

Department of Transportation
and Infrastructure

Standard Specifications

for Highway
Construction

January 2019

FOREWORD

USE OF NEW BRUNSWICK PROVINCIAL STANDARDS

The standards in the DTI Standard Specifications are intended to be used as pre-printed components of a construction Contract. They are not prepared as design aids or as a manual of design procedures and they will not competently serve those purposes.

It is the responsibility of the Bidder/Contractor to ensure they have an up-to-date copy of the Standard Construction Contract including the Articles of Agreement, Terms of Payment "A", General Conditions "B", and the Standard Specifications. The Standard Specifications are compliant with the Crown Construction Contracts Act.

Bid Items in the Standard Specifications are intended to be complete units of Work and clearly identify the scope, material requirements, and specific construction provisions to produce the specified end product.

Requirements of the Notice of Tender are incorporated by reference and shall form part of the Contract as if they had appeared here in their entirety.

The Standard Specifications rely on the use of specific words and phrases as defined in the Definitions (*Item 003*).

The Standard Specifications form part of the Contract Documents and govern the performance of the Contractor even though an Item is not specifically noted as a bid Quantity. Items which are not noted as a bid Quantity are found under the following Divisions: Division 000 - Introduction; Division 800 - Payment & Adjustments; and Division 900 - Standard Conditions. It is imperative that users of these Standard Specifications understand this inter-relationship to the overall Contract and requisite behaviour of the Contractor within the context of the Contract.

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001.1 TERMINOLOGY

- .1 This document is divided into specific Items.
 - .1 Item is generally used with text that contains reference to payment and performance related to the Work.
 - .2 Article is used to reference any subsection of an Item.
- .2 Whenever in the Contract Documents and in documents resulting during the Work it is provided that anything is, done or to be done, if, as, when, or where “contemplated”, “required”, “directed”, “requested”, “deemed necessary”, “permitted”, “suitable”, “approved”, “acceptable”, “unacceptable”, “satisfactory”, “unsatisfactory”, “suspended”, “sufficient”, “authorized”, “specified”, “designated”, and such similar expressions then the expression shall have the same force as if followed by the words “by the Engineer” or “to the Engineer” as the case may be.
- .3 Unless otherwise specified in the text, all references to Specifications, Items, Tables or Figures shall refer to this document.

001.2 GENDER NOTATION

- .1 Working titles having a masculine gender, such as workman, workmen and foreman and pronouns such as he, his and him are utilized in these Specifications for the sake of brevity, are intended to refer to persons of either sex and are gender neutral.

001.3 HEADINGS, TITLES and CAPTIONS

- .1 The headings, titles and captions appearing in this document have been inserted as a matter of convenience and for the ease of reference only and in no way define, limit or enlarge the scope or meaning of the Standard Conditions, Specifications and/or the Particular Specifications.

001.4 PARTICULAR SPECIFICATIONS

- .1 Particular Specifications are defined as Specifications adopted subsequent to the publication of this document and are particular and specific to a Contract.
- .2 Particular Specifications shall prevail over those published herein whenever in conflict therewith.

001.5 CONFLICTS IN CODES AND STANDARDS

- .1 Whenever a conflict in interpretation, application or direction occurs between this document and any other referenced document, including but not limited to related codes and/or standard practice, the most stringent requirement shall apply to the Work.
- .2 In the event of a conflict the Engineer shall be the sole judge of the most stringent requirement, between the choices of action as noted to be in conflict between the documents.

001.6 CROSS-REFERENCES

- .1 Cross-references form an important role in the interpretation of the Standard Specification Items and can be categorized as follows:
 - .1 Inclusive – reference to a portion of another Specification Item, in general to the Materials (xxx.2) or Construction (xxx.4) section, indicating that the cross-referenced section forms part of the work under the Item where the reference is noted. There will be no separate payment for the adherence to or the performance of the requirements of the cross-referenced section of the Item.
 - .2 Separate Item – reference to another Specification Item (Item xxx), indicating that some portion of the work under the Item where the reference is noted is carried out “in accordance with...” or “to the requirements of...” the cross-referenced Item. The cross-reference to the full Item (Item xxx) indicates that the cross-referenced Item is a separate unit payment and appears as such in the “List of Approximate Quantities” of the tender documents.
 - .3 Standard Drawing – reference to the applicable drawing.

002.1 ABBREVIATIONS

- .1 Wherever the following abbreviations or terms are used in the Specifications, the Plans, or other Contract Documents, their intent and meaning shall be as follows:

Organizations

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APEGNB	Association of Professional Engineers and Geoscientists of New Brunswick
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BPR	Bureau of Public Works, Department of Commerce
CGSB	Canadian General Standards Board
CAN/CSA	Canadian Standards Association
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DELG	Department of Environment and Local Government (New Brunswick)
DTI	Department of Transportation and Infrastructure (New Brunswick)
DFO	Department of Fisheries and Oceans
MTO	Ministry of Transportation of Ontario
OPSS	Ontario Provincial Standard Specification
PCI	Prestressed Concrete Institute
PCA	Portland Cement Association
SSPC	Steel Structures Painting Council
TRB	Transportation Research Board
SI	International System of Units

Terms

AADT	Average Annual Daily Traffic
CHW	Creosote Hardwood
CAP	Corrugated Aluminum Alloy Pipe
CE	Common Excavation
CHBDC	Canadian Highway Bridge Design Code
CSP	Aluminum Coated Corrugated Steel Pipe
CSPA	Aluminum Corrugated Steel Pipe-Arch
DR	Dimension Ratio for plastic pipe
EMM	Environmental Management Manual (DTI)
EOS	Equivalent Opening Size
EPP	Environmental Protection Plan
ESAL	Equivalent Single Axle Load
GC	General Conditions "B" of the Contract
LOC	Limit of Contract
PCP	Pre-cast Concrete Pipe
PE	Polyethylene
PVC	Polyvinyl Chloride
RAP	Reclaimed Asphalt Pavement
RCP	Reinforced Concrete Pipe
ROW	Right of Way
SPCAP	Structural Plate Corrugated Aluminium Alloy Pipe

Terms

SPCSP	Structural Plate Aluminum Coated Corrugated Steel Pipe
SPCAPA	Structural Plate Corrugated Aluminium Alloy Pipe-Arch
SPCSPA	Structural Plate Aluminum Coated Corrugated Steel Pipe-Arch
SRE	Solid Rock Excavation
UNE	Unclassified Excavation
WATCM	Work Area Traffic Control Manual (DTI)

002.2 PUBLICATIONS AND REGULATIONS

- .1 When publications or regulations are referred to, the reference is to the latest version available at the time of the signing of the Contract.

002.3 SI TERMS

- .1 The following table of common metric terms and abbreviations shall apply to all Work carried out under the terms of the Standard Specifications.
- .2 Other terms and abbreviations may be used if they are referenced in the context in which they are used.
- .3 Where no units are indicated on the Plans for the measurement of length or distance, the unit of measure shall be millimetres unless otherwise noted.

Physical Quantity	Common SI units	SI Symbol
Area	square millimetre	mm ²
	square metre	m ²
	hectare	ha
	square kilometre	km ²
Density	gram per cubic metre	g/m ³ (mg/L)
	kilogram per cubic metre	kg/m ³
	tonne per cubic metre	t/m ³
Energy	joule (Newton metre)	J
	kilojoule	kJ
	megajoule	MJ
Force	Newton	N
	kilonewton	kN
	meganeutron	MN
Length	micron	µm

Physical Quantity	Common SI units	SI Symbol
	millimetre	mm
	metre	m
	kilometre	km
Light	lux	lx
	kilolux	klx
Mass	milligram	mg
	gram	g
	kilogram	kg
	tonne	t
Permeability	metre per second	m/s
	metre per year	m/a
Power	watt	W
	kilowatt	kW
Pressure	pascal	Pa
	kilopascal	kPa
	megapascal	MPa
Stress	newton per square metre	N/m ²
	kilonewton per square metre	kN/m ²
	meganewton per square metre	MN/m ²
Temperature	degree celsius	°C
Time	second	s
	minute	min
	hour	h
	day	d
	year	a
Torque	newton metre	N•m
Unit Weight	kilonewton per cubic metre	kN/m ³

Physical Quantity	Common SI units	SI Symbol
Velocity	metre per second	m/s
	kilometre per hour	km/h
Viscosity Dynamic	pascal second	Pa•s
	millipascal second	mPa•s
Viscosity Kinematic	square millimetre per second	mm ² /s
	square metre per second	m ² /s
Volume solid	cubic millimetre	mm ³
	cubic decimetre	dm ³
	cubic metre	m ³
Volume fluid	millilitre	mL
	litre	L
	kilolitre	kL
	cubic metre	m ³
Volume Rate of Flow	cubic metre per second	m ³ /s
	litre per minute	L/min

003.1 DESCRIPTION

- .1 The following words and phrases, wherever used in the Contract Documents, shall have the meaning ascribed to them set out below in order to provide consistency and clarity of intent.
- .2 Where it is intended that words and phrases used in the Contract Documents are to have meanings ascribed in this definitions item such words and phrases shall be designated by the use of a capital letter for the first letter of each word or each word of a phrase.
- .3 Where words and phrases are not defined in this item then reliance should be placed on a standard dictionary definition, Compilation of ASTM Standard Definitions and/or ASTM D653, and having regard to the context in which such words or phrases are used.

003.2 DEFINITIONS

Actual Basic Rate - rate per hour paid to the Contractor's employee exclusive of any allowances or mark-ups for the Contractor's overhead, profit or other administrative costs related to the employee and not directly accrued to that employee.

Addendum - see Tender Addendum

Aggregate Base - the layer of crushed aggregate placed as a distinct layer directly below the Pavement.

Aggregate Subbase - the layer of aggregate placed as a distinct layer between the Aggregate Base and the Subgrade.

Backslope - Slope between the back-of-ditch and original ground.

Bidder - a person, partnership or corporation, acting directly or through a duly authorized representative, submitting a tender for the Work.

Borrow - an excavated material used in construction; the source of which is located outside the Right-of-Way.

Bridge - any Structure in excess of 3 m in span length carrying vehicular and/or pedestrian traffic.

Bridge Length - the greater dimension of a Structure measured along the centre of the deck between backs of abutment walls or between ends of Bridge deck.

Bridge Width - the clear width of a Structure measured at right angles to the centre of the deck between the bottom of curbs or, if curbs are not used, between the inner faces of parapet or railing.

Change Order - a written order issued by the Engineer to the Contractor, covering changes in the Contract Documents or Quantities or both, within the scope of the Contract and establishing the basis of payment and time adjustments for the Work affected by the change.

Completion Date - the date specified in the Contract Documents on which the Contract is to be completed.

Conform - compliance with reasonable and customary manufacturing and construction tolerances where working tolerances are not specified. Where working tolerances are specified, Conform means compliance with such tolerances.

Contract - as per the Articles of Agreement of the Standard Construction Contract.

Contractor - the party of the first part to the Contract acting directly or indirectly through agents or employees, who is primarily liable for the acceptable performance of the Contract and also for the payment of all legal debts pertaining to the Work.

Contract Documents - the executed Articles of Agreement, the Tender, Terms of Payment "A", General Conditions "B", Standard Specifications, Particular Specifications, Plans and any Addenda incorporated into the Contract before the execution of the Articles of Agreement, and such other documents as may be listed in the Articles of Agreement and subsequent amendments to the Contract made pursuant to the provisions of the Articles of Agreement.

Culvert - any Structure, not classified as a Bridge, and/or drainage system which provides an opening for the passage of water under any Roadway or driveway.

Day - a calendar day and shall include all days without exception.

Daylight – shall refer to the hours between sunrise to sunset. Sunrise and sunset times are available on a daily basis from the Environment Canada Weather website.

Dust - the fine particles of a mass defined by the percentage passing the 75 micron size sieve as tested by standard sieve analysis methods on a sampled prepared and tested on the fraction of the whole sample passing the 100 mm sieve size.

Engineer - the Chief Engineer of the Department of Transportation and Infrastructure of the Province of New Brunswick otherwise named as the Engineer-Architect as per General Conditions "B" section 1(1) of the Contract.

This shall include any person authorized by him/her to perform on her/his behalf any function under the Contract and shall include without being limited to any persons acting either directly or through authorized assistants, such as Engineers, Technicians, Inspectors, by whom all explanations and directions necessary for the satisfactory prosecution and completion of the Work will be given.

Equipment - all machinery, and vehicles, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of the Work.

Finished Grade - the grade to indicate the finished Pavement elevation of the centre line.

Foreslope - the Slope between the Shoulder and the ditch, or between the Shoulder and the original ground in case of a fill.

Highway - the whole strip of land reserved for and secured for the use of the travelling public, being bounded by the Right of Way lines, as at present, or as said lines may be changed to include extra land which the Owner may from time to time acquire during the progress of the Contract.

Initial Work Schedule - the Work schedule submitted per Item 906.

Laboratory - any official testing facility maintained by the Owner or any other testing facility designated by the Owner.

Lane - the portion of a travelled way for the movement of a single line of vehicles.

Lump Sum Price - a Contract item for which payment will be made at a single tendered price, all inclusive for the completion of the Work defined. Payment is not based on a measured Quantity, although a Quantity may be given in the Contract Documents.

Overbreak - the portion of any rock which is excavated, displaced, or loosened outside and beyond the established payment lines regardless of whether the excess is due to the inherent character of any rock formation encountered, or to any other cause.

Overburden - any material that must be removed to access underlying suitable construction materials, exclusive of the grubbed material.

Overexcavation - all excavation beyond that specified, performed without the written order of the Engineer.

Owner - shall be as stated in the General Conditions "B" section 1(1).

Pavement - surface and/or base mixes whether Portland cement, asphalt concrete and/or chip seal.

Pavement Structure - all material placed above the Subgrade which would include Aggregate Subbase, Aggregate Base and Pavement providing support for, and the distribution of the traffic load to the Subgrade.

Plans - shall include all graphical representations including but not limited to Profiles, cross-sections and other drawings, or exact reproductions thereof, which show the location, character, dimensions and details of the Work.

Professional Engineer – shall mean a qualified Professional Engineer registered or licensed to practice in the Province of New Brunswick, and as defined and bound by the APEGNB By-Laws and Code of Ethics.

Profile - a charted line indicating grades and distances and usually depth of cut and height of fill for excavation and grading Work; taken along a centreline or other designated line. A side view, as distinct from a plan or overhead view.

Progress Estimate - shall have the same meaning as "progress claim" as attributed to it by usage in the Terms of Payment "A" and the General Conditions "B".

Public Holiday - shall include the following Days only: New Year's Day, Good Friday, Canada Day, New Brunswick Day, Labour Day, Remembrance Day, and Christmas Day.

Quantity - the amount presented on the Tender Form is to be considered as approximate only, and is to be used as an estimate of the Work. Final payment to the Contractor will be made only for the actual aggregate of Work performed or material furnished in accordance with the Contract Documents as determined by measurements made by the Engineer.

Right-of-Way - the land secured and reserved to the public for Highway purposes.

Roadbed - that portion of the Roadway between the inside edges of Slopes of ditches and fills (referenced from centreline).

DEFINITIONS

ITEM: 003

Roadway - that portion of the Right-of-Way required for construction, limited by the outside edges of the Slopes (referenced from centreline), and including ditches, channels and all Structures appertaining to the Work.

Shoulder - that portion of the Roadway from the outside edges of the Lane or Lanes to the inside edge (referenced from centreline) of the Slopes of ditches and fills.

Sidewalk - that portion of the Roadway constructed for the use of pedestrians.

Skew or Skew Angle - the acute angle formed by the intersection of a line normal to the centre line of the Roadway with a line parallel to the face of the abutments, the centre line of the piers, or in the case of Culverts with the centre line of the barrel.

Slope - run to rise expressed as a ratio.

Soil Particle Sizes - the following soil particles sizes shall apply for the terms used to describe the material;

boulder	average dimension greater than 300 mm.
cobble	average dimension between 75 and 300 mm.
gravel	particle passing a 75 mm sieve and retained on a 4.75 mm sieve.
sand	particle passing a 4.75 mm sieve and retained on a 75 µm sieve.
silt	particle passing a 75 µm sieve and is non-plastic to slightly plastic and exhibits no strength when air dried.
clay	fine grained soil or the fine grained portion of a soil that can be made to exhibit plasticity within a range of water contents and exhibits considerable strength when air dry. Also defined as particle finer than 2 µm.

Specifications - the statements, provisions and requirements contained in the Contract Documents, that define the products, materials and workmanship upon which the Contract for the Work is based.

Statutory Holiday – shall include the following Days only: New Year’s Day, Good Friday, Easter Monday, the day fixed by proclamation of the Governor in Council for the celebration of the birthday of the Sovereign, Canada Day, New Brunswick Day, Labour Day, the day fixed by proclamation of the Governor in Council as a general day of thanksgiving, Remembrance Day, Christmas Day, and Boxing Day.

Stripping - either the removal of topsoil and/or Overburden or the action of water resulting in the removal of the asphalt cement from the aggregate.

Structure(s) - Bridges, Culverts, catch basins, drop inlets, manholes, retaining walls, overhead sign structures, concrete barriers, cribbing, walls, buildings, sewers, service pipes, sub-drains, foundation drains and other features which may be encountered in the Work and not otherwise classed herein.

Subgrade - the layer, whether in cut or fill, as prepared to support the Pavement Structure; or the surface which forms the finished elevation of this layer, defined at the centreline.

Substantial Completion - The condition of the Work when the Work Site is ready for the Owner’s acceptance and occupancy, except for the performance of any cleanup and/or finishing, and the remediation of other deficiencies as defined by the Engineer.

Substructure - all that part of the Structure below the bearings of simple and continuous spans, skewback of arches and tops of footings of rigid frames; including but not limited to ; backwalls, wingwalls and wing protection railings, and for the expressed purposes of winter concreting - cast in place box culverts and cast in place concrete arches.

Superintendent - the Contractor's authorized representative of record in responsible charge of the Work.

Superstructure - all that part of the Structure supported on piers or abutments located above the bearings of simple and continuous spans, and the deck slab of rigid frames.

Tender Addendum - a change in a tender issued prior to the time and date of tender closing, which has the effect of modifying the tender. A Tender Addendum shall be considered as an integral component of the tender and shall be deemed to take precedence over those parts of the tender documents to which the Addendum refers.

Ticket - see Weight Certificate.

Unit Price - the amount stated in the Contract representing the price per unit for all labour, tools, Equipment, materials, transportation costs and expenses, and any and all other incidentals necessary to complete the Work and does not include the HST.

Utility - a facility maintained by a municipality, public authority or regulated authority and includes, but is not limited to sanitary sewer, storm sewer, water, electric, gas, steam, telephone and cable television services.

Weight Certificate - a voucher, issued by the Owner at the point of origin of a load to a truck driver and delivered to and verified by the Owner's representative at the Work Site. This voucher shall describe the Quantity of material upon which payment of the load is to be based and shall show information pertinent and necessary for the evaluation of the load by the Engineer and others.

Work - includes all labour, material and services required, as shown or described in the Contract, supplied and installed or erected complete at the place of building.

Work Area - the location in the Work Site on which Work is being carried out.

Work Site - the lands and premises owned by the Owner or in which the Owner has proprietary interest, upon which the Work is to be performed and as defined in the Contract Documents.

005.1 ORDERS OF THE ENGINEER

- .1 The Contractor shall promptly and efficiently comply with all orders, directions and instructions given at any time by the Engineer with respect to the Work or the conduct thereof.
- .2 If the Contractor disagrees with any order, direction or instruction given at any time by the Engineer, the Contractor shall perform the Work as instructed and shall serve notice in accordance with terms set out in the General Conditions.

005.2 CONSTRUCTION METHODS AND EQUIPMENT

- .1 Equipment and methods used shall be appropriate to perform the Work outlined in the Contract Documents.
- .2 The Engineer reserves the right to order the discontinuance or use of any Equipment or method which fails to consistently produce satisfactory results.

005.3 UNAUTHORIZED WORK

- .1 Any Work done or material supplied by the Contractor which is beyond the lines, grades, or descriptions detailed in the Contract Documents, or established by the Owner by written notification, shall be considered as unauthorized and may not be measured for payment.
- .2 Upon order of the Engineer, unauthorized Work or material shall be remedied, removed or replaced by the Contractor, at his/her own expense.
 - .1 If the Contractor fails to comply promptly with any order made under this Section, the Engineer may cause unauthorized Work or material to be remedied, removed or replaced in accordance with the terms of the General Conditions.

006.1 DESCRIPTION

- .1 The Contractor shall review all permits in force for the Work and the conditions as set out in Item 948 and the Contract Documents.
- .2 All other permits required, but not forming part of the Contract Documents but necessary and requisite for the carrying out of the Work shall be obtained by the Contractor, at his/her own expense, unless otherwise specified.

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NUMBER OF PAGES</u>
101	Clearing	2
102	Grubbing.....	2
103	Removal of Isolated Trees.....	1
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CLEARING

ITEM: 101

101.1 DESCRIPTION

- .1 This Item consists of cutting and salvaging Merchantable Timber, and disposing of all other trees, brush, and slash.
- .2 Merchantable Timber is defined as any timber for which the Contractor can find an established market in the general vicinity of the Contract.

101.2 MATERIALS

- .1 None identified.

101.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, a copy of any permit(s) required to carry out the Work.

101.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Engineer shall identify clearing limits and buffer zone limits with ribbons or similar means.
- .3 Merchantable timber shall be salvaged, unless otherwise approved by the Engineer. Salvaged material shall become the property of the Contractor and shall be removed from the Work Site by the Completion Date.
- .4 Before commencing clearing on any part of the Work Site that had been Crown Land under licence, the Contractor shall offer to sell to the former licensee all merchantable timber involved.
 - .1 The price shall be the current price negotiated between the former licensee and the Forest Products Marketing Board responsible for the area in which the timber is harvested.
 - .2 If the former licensee decides to purchase the cut timber, the Contractor shall perform the Work to the former licensee's specifications.
- .5 The driver of any vehicle transporting wood from the Work Area(s) shall have in the vehicle a Transportation Certificate (TC) for "Crown Land Permit Harvest" for each load.
 - .1 In filling out the TC, "Other" (in the top right corner) use "DTI ROW"; under "Harvest Block No." shall be "xx-xxxx" (the Contract number); and the place name of the clearing location shall be identified.
- .6 Trees shall be cut so that stump height is not greater than 0.3 m above average ground level, or in the event of significant snow cover, to a height as agreed with the Engineer.
- .7 Non-merchantable trees not felled by cutting may be shredded in place (to a stump height per 101.4.6) using Equipment designed for that purpose, but shall not be bulldozed down.
 - .1 No shredding, chipping, or placement of shredded or chipped material shall occur within 30 m of a watercourse or wetland.
 - .2 All other non-merchantable trees, and all brush and slash shall be shredded or chipped and evenly distributed over the ground within the clearing limits.

CLEARING

ITEM: 101

- 101.4.7 .3 Disposal by burning is prohibited.
- .4 Notwithstanding 101.4.7.1 to 101.4.7.3, all non-merchantable trees, brush and slash shall be disposed of such that the Engineer can set and grade stakes for cut and fills, set stakes for top of slope and toe of slope; and survey cross-sections.
- .8 Ornamental trees and shrubs shall not be disturbed without written permission from the Engineer.
- .9 The Contractor shall limit ground disturbance to minimize the potential for erosion and sedimentation of watercourses and wetlands.
 - .1 Directional hand felling and harvesting shall be used where ground conditions are not suitable for access by heavy Equipment. When cable skidders are used, the full range of cables shall be made to avoid rutting soft ground areas.
- .10 Clearing shall not be performed within wetland buffer zones unless such areas are frozen hard, except to provide access through the buffers, as approved by the Engineer.
- .11 The Contractor shall not use heavy Equipment for clearing within 30 m of stream banks and shall do cutting therein by hand or by Equipment able to "reach in" to cut and yard out the timber.
- .12 Initial clearing of merchantable timber within 5 m of either side of watercourses identified on the Plans, and any other watercourses identified during the course of the Work, shall be limited to removal of merchantable timber.
 - .1 Non merchantable timber shall be removed at the time of the Structure installation.
- .13 There shall be no long skids of timber on steep slopes adjacent to watercourses, and no felling or skidding trees across a watercourse.
 - .1 Where clearing of a steep slope in snow or ice conditions is suspended through a written order by the Engineer or a representative of Work Safe NB for safety reasons, the Contractor shall cease Work immediately.
 - .2 In the case of Work suspension per 101.4.13.1, the Contractor shall not be responsible to complete clearing on the affected area.
- .14 Stockpiling or loading of merchantable timber or waste materials, adjacent to the highway, shall be as approved by the Engineer.

101.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of hectares of land cleared in accordance with this Item.
 - .1 All measurements shall be made in a horizontal plane.
- .2 The areas of removal of merchantable trees within 5 m of watercourses per 101.4.12 shall be measured for payment as clearing.

101.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

102.1 DESCRIPTION

- .1 This Item consists of the removal and disposal of roots and stumps.
- .2 This Item also consists of removal of shredded and/or chipped material left behind from the clearing operation done by others.

102.2 MATERIALS

- .1 None identified.

102.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, a copy of any permit(s) required to carry out the Work.

102.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
 - .1 The Work shall include dealing with stump height over 0.3 m, and with brush, slash and pieces of timber lying on the ground, due to clearing by others.
- .2 The Contractor shall carry out the Work in accordance with Item 946 and Item 948.
- .3 Grubbing shall be carried out with root rakes or similar Equipment, such that only the roots and stumps are removed and topsoil is left for salvage under the excavation item.
 - .1 In cut sections, and in fill sections where the Subgrade is within 2.5 m of the original ground, grubbing shall be carried out to a width 2 m from the clearing line or as otherwise directed by the Engineer.
- .4 Grubbing shall not be carried out in fill sections where the Subgrade is more than 2.5 m above the original ground, except as approved by the Engineer where foundation excavation or stream diversions for Structures are to be carried out.
 - .1 Grubbing shall not be carried out in swamps and other areas where the underlying material is to be wasted, as indicated in the Contract Documents or by the Engineer.
- .5 The Contractor shall be responsible, at his/her own expense, to carry out any remedial measures necessary to redress any areas grubbed beyond the specified limits, including but not limited to extra shaping, hydroseeding and/or mulching of the exposed ground, and removal of trees which have fallen as a result of root severance due to the over-width grubbing.

GRUBBING

ITEM: 102

- 102.4 .6 Roots and stumps, with or without non-merchantable trees, brush and slash as per 101.4 shall be disposed of within the Work Site by tub-grinding, or by burial as follows:
- .1 The materials may be placed under fills over 5 m in height to Subgrade, if the materials are spread out and tramped flat in a uniform layer to a compact mass no more than 0.6 m above original ground, using a crawler tractor of 20 t or heavier.
 - .2 Where Roadbed fills exceed 6 m in height to Subgrade, the Contractor may place one layer of grubbed materials either on the existing ground, or on the first lift of compacted excavated material or Borrow, and shall tramp the materials to a 0.6 m thickness as described in 102.4.6.1.
 - .3 Burying may be permitted at other locations within the Work Site as indicated in the Contract Documents and/or as approved by the Engineer, if the materials are spread out, tramped, and covered with excavated material as directed by the Engineer, and the surface hydroseeded in accordance with 614.4.
- .7 Where the disposal measures of 102.4.6 are determined by the Engineer to be unfeasible, the roots and stumps, with or without non-merchantable timber, brush and slash as per 101.4 may be disposed of outside the Work Site in accordance with Item 947.
- .1 Burning of grubbed materials shall not be permitted.
- .8 No materials removed during grubbing shall be permitted to be placed within 30 m of a Culvert, Bridge or any other Structure.

102.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of hectares of grubbing carried out in accordance with this Item.
 - .1 All measurements shall be made in a horizontal plane.

102.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF ISOLATED TREES

ITEM: 103

103.1 DESCRIPTION

- .1 This Item consists of the removal and disposal of isolated trees complete with stumps, and/or isolated stumps.
 - .1 An isolated tree is defined as a tree having a minimum diameter of 100 mm measured at 300 mm above the existing ground surface.
 - .2 An isolated stump is defined as a stump having a minimum top diameter of 300 mm.

103.2 MATERIALS

- .1 None identified.

103.3 SUBMITTALS

- .1 None identified.

103.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Isolated trees and stumps shall be clearly identified as such in the field, by the Engineer.
- .3 Ornamental trees and shrubs shall not be disturbed without written permission from the Engineer.
- .4 The Contractor shall be responsible to repair, at her/his own expense, any damage to private property resulting from the Work.
- .5 The Contractor shall carry out the removal in accordance with 101.4 and 102.4.

103.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of isolated trees and/or isolated stumps removed and disposed of in accordance with this Item.

103.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

COMMON EXCAVATION

ITEM: 106

106.1 DESCRIPTION

- .1 This Item consists of the excavation and placement within the Work Site or disposal outside the Work Site, of soil and all other materials not classified as solid rock.

106.2 MATERIALS

- .1 For temporary stream diversion channels, clear polyethylene liners a minimum of 6 mils thick and meeting the requirements of CGSB 51.34 shall be supplied by the Contractor.

106.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

106.4 CONSTRUCTION

106.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall carry out the Work in accordance with Item 946 and Item 948.
- .3 The Contractor shall construct offtakes and stream diversion channels as identified and/or detailed in the Contract Documents.
- .4 Polyethylene liners for temporary stream diversions shall be installed transverse to the direction of flow and overlaps shall be a minimum of 300 mm in the direction of flow.
 - .1 The Contractor shall be responsible for maintenance and removal of the liners.
- .5 The Contractor shall maintain surface drainage during excavation of cuts and construction of embankments.
 - .1 Low spots and ruts that could pond water shall be removed no later than the end of each Day's Work or, if rain is imminent, as Work progresses during the Day.
- .6 If at any time during the Work the surface becomes rutted or displaced, the Contractor shall make all necessary repairs to reinstate the surface grade.
 - .1 The depth rutted and/or displaced shall be scarified, moisture conditioned, shaped and compacted to meet the requirements of this Item.
- .7 Where the Roadbed being constructed is subject to through-traffic, the Contractor shall conduct operations so that through-traffic does not travel directly on an undercut surface or Subgrade, unless approved by the Engineer.
 - .1 Any surface constructed or exposed by the Contractor and subjected to through-traffic shall be maintained in a condition such that traffic can safely travel along it at the speed limit posted for the Work Area.
- .8 Transitions in cut and fill conditions, at the ends of bedrock cuts, shall be carried out as indicated on Standard Drawing 108-1.

106.4 .2 Excavation

- .1 The Contractor shall not commence any excavation until the original cross-section survey has been completed for the Work Area involved.
- .2 The Contractor shall control the excavation and handling of the common material such that optimum usage of the excavated materials is achieved, as follows:
 - .1 Any material suitable for topsoil, from cuts, and from fill areas that shall be stripped, shall be salvaged and stockpiled at the location(s) approved by the Engineer.
 - .1 The depth of excavation of the topsoil layer shall be as determined in the field at the time of excavation, between the Contractor and the Engineer.
 - .2 Stockpile(s) shall not be located where they shall inhibit orderly construction and completion of ditches and slopes as per Item 946, block or inhibit natural drainage, or be a potential source of siltation to watercourses.
 - .3 Stockpiling shall be carried out such that the maximum recovery of the material is assured.
 - .4 Topsoil stockpiles shall be mulched in accordance with Item 616.
 - .2 The Contractor shall separately excavate or otherwise salvage materials meeting the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, for use in the top 600 mm of the Subgrade.
 - .3 The Contractor shall conduct operations such that all usable material resulting from common excavation either has been used or shall be used in the Work, prior to the placement of any material under Item 121.
 - .1 Borrow shall not be placed in areas where excavated materials could be hauled and placed at a lesser cost to the Owner, unless otherwise authorized by the Engineer.
 - .4 Common material salvaged by the Contractor for re-use other than as topsoil shall be stockpiled such that the material does not become saturated at a location approved by the Engineer.
 - .1 Stockpiling of common material shall be done on a well-drained, level base capable of supporting the entire weight and dimension of the stockpiles and in such a manner as to ensure maximum recovery of the stockpiled materials.
 - .2 Stockpiles shall not be placed near a quarry/pit face, Stripping piles or piles of other materials, nor near property lines, tree lines or drainage ditches such that retrieval of all common material is not possible or practical and access to the stockpile shall be maintained at all times.
 - .3 Stockpiles shall be built in layers not exceeding one metre in thickness and each layer shall be shaped to maintain surface drainage before the next layer is begun. Dumping over the edge of stockpiles shall not be permitted.
 - .4 Work will involve the re-handling of excavated material from stockpiles.
- .3 Where the Subgrade requires undercutting, subexcavation shall be carried out to the specified depth below Subgrade on a plane parallel to the Subgrade cross-slope.

COMMON EXCAVATION

ITEM: 106

- 106.4.2 .4 Hauling of common excavation over Aggregate Base/Subbase shall not be permitted, unless authorized by the Engineer.
- .5 The Contractor shall shape ditches to the lines and grades specified, and any grade conditions that would cause water to pond shall be removed.
- .6 In cuts, the area between the top of the Backslope and the edge of the ungrubbed surface shall be shaped to eliminate vertical or overhanging faces, exposed roots and any material which would impede natural drainage.
- .7 Where common material is underlain by a deep bedrock cut, the material at the top of the bedrock Backslopes shall be shaped as indicated on Standard Drawing 106-1.
- .8 Excavated material designated by the Engineer as surplus and useable, shall remain the property of the Owner and shall be either stockpiled or otherwise placed in the Work, as directed by the Engineer.
- .9 Excavated material designated by the Engineer as waste, shall become the property of the Contractor and shall be disposed of in accordance with Item 947.
- .10 Boulders 1 m³, or larger, that are encountered in the Work shall be handled in accordance with Item 108.

106.4 .3 Placement

- .1 The placement of excavated material shall be carried out in accordance with Item 941, to conform to lines and grades provided.
- .2 The placement of material shall be in layers, and each layer shall be shaped to maintain surface drainage.
- .3 Embankments shall be constructed such that the first lift when shaped forms the toe of the Foreslopes and each successive lift shall be completed to the full width prior to placing the next lift.
- .1 On ungrubbed areas, swamps and rough terrain the initial lift thickness shall be as approved by the Engineer.
- .4 Material placed to within 600 mm below Subgrade shall have a maximum lift thickness of 300 mm.
- .1 The lift thickness may be increased to a maximum of 600 mm if the Contractor can provide proof that the specified density can be achieved throughout the entire lift.
- .5 Material placed in the top 600 mm of the Subgrade shall meet the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, and shall be placed as specified in 106.4.3.4.
- .1 In backfilling of undercuts deeper than 600 mm, the lift thicknesses shall be as determined by the Engineer.
- .6 Where embankments are constructed against an existing earth sidehill having a Slope steeper than 3:1, for the top 2.5 m below Subgrade the spreading Equipment shall cut into the sidehill as each lift of fill is placed so that the next lift is "keyed" into the sidehill to a width not less than 1 m.

COMMON EXCAVATION

ITEM: 106

- 106.4.3 .7 Where the Work involves placement of material firstly along one side of the Roadbed and then the other side, the spreading Equipment shall cut into the edge of the previously built side of the Roadbed as each lift of material is placed, so that the next lift is “keyed” into the adjacent side of the Roadbed or the existing Roadway Slope to a width not less than 0.5 m.
- .8 Excavated material placed behind Structures or in areas where Structures are to be constructed shall be a material meeting the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, and shall have lift thicknesses as follows:
 - .1 Maximum 200 mm behind abutment breastwalls or other earth-retaining Structures, to the limits shown on the Plans; or
 - .2 Maximum 300 mm where Structures shall be constructed or through which piles shall be driven.
- 106.4 .4 Compaction
 - .1 The Contractor shall carry out moisture conditioning and compaction in accordance with Item 936.
 - .1 Any isolated soft spots, or other areas within the top 1.2 m of the Subgrade, not meeting the specified compaction criteria shall be excavated and backfilled with material of the quality matching the surrounding material, as directed by the Engineer.
 - .2 In cuts, the Subgrade surface shall be compacted to 97% of the control density as determined by a test strip.
 - .1 If the Subgrade has been undercut, the undercut surface shall be rolled with a static roller prior to being backfilled with Borrow A/A1-quality material, as indicated in the Contract Documents, to Subgrade.
 - .3 Each lift of excavated material, after placement per 106.4.3, shall be compacted to a minimum of 95% of the maximum dry density.
- 106.4 .5 Culverts
 - .1 Where excavation involves removal of Culverts, the Contractor shall take care to ensure that any existing pipe is not damaged and is salvaged for re-use.
 - .1 The Contractor shall notify the Engineer prior to exposing any existing pipe.
 - .2 Pipe determined by the Engineer to be salvageable shall remain the property of the Owner and shall be re-used in the Work Site under Item 140, or transported to the nearest DTI Maintenance Depot.
 - .1 Salvageable pipe that is damaged as a result of the Contractor’s actions, as determined by the Engineer, shall be replaced by the Contractor.
 - .3 Unsalvageable pipe and waste shall become the property of the Contractor and shall be disposed of outside the Work Site.
- 106.4 .6 Driveways
 - .1 Driveways excavated under this Item shall be replaced the same Day they are removed, utilizing material excavated from the crossing wherever possible.

COMMON EXCAVATION

ITEM: 106

- 106.4.6 .2 Where excavation involves paved driveways, parking lots or other abutting private lands the Pavement shall be cut to a neat straight line and edge, and removed in a manner so as to avoid damage to the adjacent lands and Roadbed.
- .1 The Contractor shall be responsible for damage to the Pavement and other surfaces beyond the designated limits of the excavation and for the repair or restoration, at his/her own expense, of the areas affected.
- .2 The excavated Pavement shall be broken down into pieces small enough to be suitable for use in embankment construction, unless designated by the Engineer as waste to be disposed of outside the Work Site.

106.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of common material excavated and placed, stockpiled and/or disposed of in accordance with this Item.
- .2 The volume shall be as measured in situ and computed by the average end area method, based on "original ground" cross-sections surveyed by the Engineer on the natural ground.
- .1 In the areas to be grubbed, the cross-sections shall be taken before grubbing, and the volume payable under this Item shall include material in the grubbed layer removed under Item 102.
- .3 Excavation of soft spots, deleterious materials, offtakes, stream diversion channels and driveways as defined by this Item shall be measured for payment.
- .4 Compensation payable to the Owner or the Contractor, for the difference in price of fuel between the month prior to the month of tender opening for the Contract and the month of Work under this Item, will be calculated in accordance with Item 822.

106.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of common excavation, as identified under the Contract.

107.1 DESCRIPTION

- .1 This Item consists of the excavation and placement within the Work Site or disposal outside the Work Site, of materials classified under neither common excavation nor solid rock excavation but composed of a mixture and variable and undetermined distribution of both.

107.2 MATERIALS

- .1 For temporary stream diversion channels, clear polyethylene liners a minimum of 6 mils thick and meeting the requirements of CGSB 51.34 shall be supplied by the Contractor.

107.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

107.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall carry out the Work in accordance with Item 946 and Item 948.
- .3 The Contractor shall construct offtakes and stream diversion channels as identified and/or detailed in the Contract Documents.
- .4 Polyethylene liners for temporary stream diversions shall be installed transverse to the direction of flow and overlaps shall be a minimum of 300 mm in the direction of flow.
 - .1 The Contractor shall be responsible for maintenance and removal of the liners.
- .5 The Contractor shall handle material which would otherwise be classified under common excavation in accordance with 106.4.
- .6 The Contractor shall handle material which would otherwise be classified under solid rock excavation in accordance with 108.3 and 108.4.

107.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of unclassified material excavated and either placed, stockpiled or disposed of in accordance with this Item.
- .2 The volume shall be as measured in situ and computed by the average end area method, based on "original ground" cross-sections surveyed by the Engineer on the natural ground.
 - .1 In the areas to be grubbed, the cross-sections shall be taken before grubbing, and the volume payable under this Item shall include material in the grubbed layer removed under Item 102.
- .3 Excavation, per 106.4, of offtakes, stream diversion channels, soft spots, deleterious materials, and the excavation of driveways shall be measured for payment.

107.5 .4 Compensation payable to the Owner or the Contractor, for the difference in price of fuel between the month prior to the month of tender opening for the Contract and the month of Work under this Item, will be calculated in accordance with Item 822.

107.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall include a separate Unit Price for each type of unclassified excavation, as identified under the Contract.

SOLID ROCK EXCAVATION

ITEM: 108

108.1 DESCRIPTION

- .1 This Item consists of the excavation and placement within the Work Site, or disposal outside the Work Site, of solid rock.
- .2 Solid rock is defined as in situ bedrock, and naturally occurring boulders that are 1 m³ or larger in volume.

108.2 MATERIALS

- .1 None identified.

108.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.
- .2 The Contractor shall submit to the Engineer, in advance of any drilling and blasting, the following information:
 - .1 Copy of Insurance Policy as it relates to blasting, and any pre-blast survey requirements therein.
 - .2 Copy of the blaster's certification per Regulation 97-125 under the Apprenticeship and Occupational Certification Act.
- .3 The Contractor shall submit upon request the following information:
 - .1 A letter signed by the certified blaster or a Professional Engineer, stating that drill pattern and blasting sequences and charges have been designed and performed in accordance with appropriate codes.
 - .2 A letter indicating anticipated time(s) of the Day at which blasts shall take place.

108.4 CONSTRUCTION

108.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall carry out the Work in accordance with Item 946 and Item 948.
- .3 The Contractor shall maintain surface drainage during excavation of cuts and construction of embankments.
 - .1 Low spots and ruts that could pond water shall be removed no later than the end of each Day's Work or, if rain is imminent, as Work progresses during the Day.
- .4 Any surface constructed or exposed by the Contractor, and subjected to through-traffic, shall be maintained in a condition such that traffic can safely travel along it at the speed limit posted for the Work Area.

SOLID ROCK EXCAVATION

ITEM: 108

- 108.4.1 .5 Transitions in cut and fill conditions, at the ends of the bedrock cuts, shall be carried out as indicated on Standard Drawing 108-1.
- .6 Rock cuts and fills shall be shaped in accordance with Item 941.
- .7 Blasting shall be permitted only between 30 minutes after sunrise and 30 minutes before sunset.
 - .1 Blasting within 500 m of any residence or business shall not be permitted to take place between 7:00 p.m. and 7:00 a.m. Monday to Friday, or on any weekend or Public Holiday, without prior notification to and approval by the Engineer.

108.4 .2 Blasting Near Wells or Structures

- .1 The Contractor shall carry out a pre-blast survey in accordance with the requirements of the Insurance Policy submitted per 108.3.2.
- .2 Notwithstanding 108.4.2.1, the Owner will, before and during the Work under this Item, be conducting inspections on residential wells within 500 m of area of blasting, including sampling for water quality.
 - .1 Any wells adversely affected by the Work, the Owner will provide water temporarily during the course of the Work, and/or will determine if repair or replacement by the Contractor is required for any wells found to be permanently damaged.
- .3 The Contractor shall carry out the Work such that vibrations from drilling and blasting are controlled, and do not exceed the requirements of Figure 108-A, for 2 in/s.

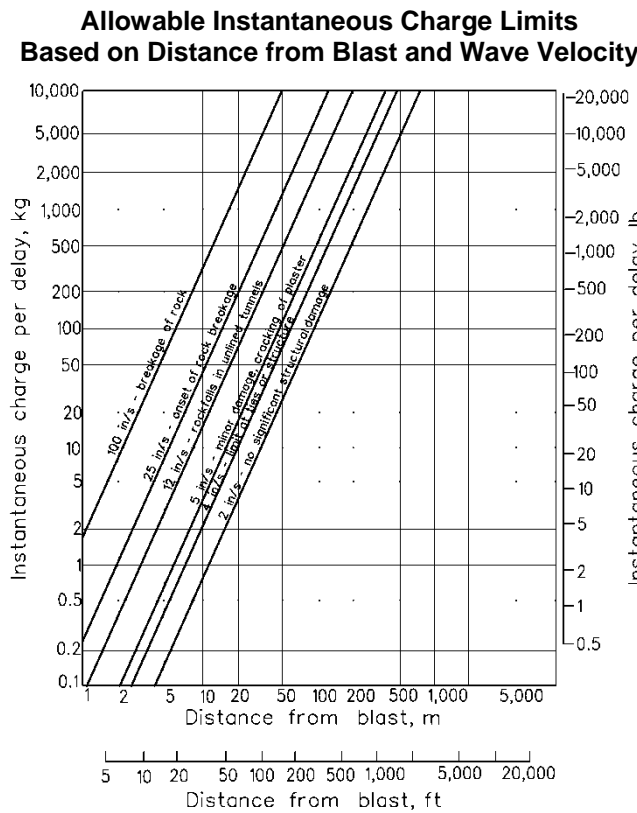


Figure 108-A

108.4 .3 Excavation

- .1 The Contractor shall notify the Engineer when material appearing to be bedrock is first encountered.
 - .1 The area identified shall be stripped of Overburden and the Engineer shall determine the top of bedrock elevation for cross-sectioning.
- .2 The Contractor shall be responsible to control the fracturing, excavation and handling the solid rock such that optimum usage of the excavated materials is achieved, as follows:
 - .1 Fracturing of bedrock shall be carried out so as to produce shattered rock for use as per 108.4.4.1.
 - .2 The Contractor shall separately excavate or otherwise salvage rock meeting the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, for use in the top 600 mm of the Subgrade.
 - .3 Where the Contract includes Borrow to be placed in the Work, the Contractor shall conduct operations such that all usable material resulting from solid rock excavation either has been used or shall be used in the Work, prior to the placement of any material under Item 121.
 - .1 Borrow shall not be placed in areas where excavated materials could be hauled at a lesser cost to the Owner, unless otherwise authorized by the Engineer.
- .3 In cuts in bedrock, the Roadbed shall be subexcavated to the specified depth below Subgrade and on a plane parallel to the Subgrade cross-Slope.
- .4 Prior to backfilling a bedrock undercut the Roadbed shall be subexcavated to the full width and depth specified, and the ditches shall be excavated to at least the same grade, over the entire length of the bedrock cut or 50 m longitudinally, whichever is the lesser.
- .5 The Contractor shall fill any overexcavated areas in the bedrock undercut with finely shattered rock to meet the tolerances specified in Item 941.
- .6 Where soil is encountered below Subgrade in a bedrock cut area, subexcavation and backfilling shall be carried out as follows:
 - .1 Isolated pockets of soil encountered below Subgrade within a bedrock cut shall be subexcavated as directed by the Engineer and backfilled with finely shattered rock.
 - .2 If the Subgrade cross-section is partly in bedrock and partly in soil and constitutes more than pockets of soil in a bedrock Subgrade, the soil shall be subexcavated to match the specified solid rock subexcavation.
 - .1 The same type of Borrow A/A1-quality material, as indicated in the Contract Documents, shall be used to backfill both the bedrock and soil undercuts.
 - .3 Where the Subgrade line (longitudinally) is in and out of solid rock and soil, subexcavation of the bedrock and the soil at the transition points shall be as indicated on Standard Drawing 108-1.
- .7 Loosened rock shall be removed from the Backslope of bedrock cuts so as to leave a neat and safe condition and the rock so removed shall be utilized in embankment construction.

SOLID ROCK EXCAVATION

ITEM: 108

- 108.4.3 .8 The Contractor shall shape the ditches, remove any rock knobs that would impede drainage and/or fill any low spots with finely shattered rock, to achieve the specified width and grade.
- .9 Naturally occurring boulders, after being measured by the Engineer, shall be placed as directed by the Engineer.
- .10 Excavated material designated by the Engineer as surplus and useable, shall remain the property of the Owner and shall be either stockpiled or otherwise placed in the Work, as directed by the Engineer.
- .11 Excavated material designated by the Engineer as waste, shall become the property of the Contractor and shall be disposed of in accordance with Item 947.

108.4 .4 Placement

- .1 Rock embankments shall be constructed in lifts not exceeding 1 m in thickness, except for friable rock, for which lift thickness shall not exceed 600 mm.
- .1 Large rocks and boulders shall not be placed in clusters or nests but shall be distributed over the surface of the layer onto which they are pushed and finer rock placed in the voids between them.
- .2 Rock placed as backfill over an undercut in soil or rock, or as the top 600 mm of the Subgrade in an embankment, shall be the rock salvaged under 108.4.3.2.2 and shall contain no fragments greater than 400 mm in any dimension, and voids in the surface shall be filled with rock spalls.
- .2 Embankments shall be constructed such that the first lift when shaped forms the toe of the Foreslopes and each successive lift shall be completed to the full width prior to placing the next lift.
- .1 On ungrubbed areas, swamps and rough terrain, the initial lift thickness shall be as approved by the Engineer.
- .3 Each lift of rock shall be compacted such that rock fragments are further broken down or repositioned to minimize voids and bridging, and to consolidate the embankment.
- .1 Rock suitable to be placed in a 1 m lift shall be compacted with a vibratory roller of at least 15 t or placed and tramped by a crawler tractor of at least 30 t mass.
- .2 Friable rock shall be compacted with a vibratory roller of a minimum 11 t mass.
- .4 Where embankments are constructed against an existing earth sidehill having a Slope steeper than 3:1, for the top 2.5 m below Subgrade, the spreading Equipment shall cut into the sidehill as each lift of fill is placed so that the next lift is "keyed" into the sidehill to a width not less than 1 m.
- .5 Where the Work involves placement of material firstly along one side of the Roadbed and then the other side, the spreading Equipment shall cut into the edge of the previously built side of the Roadbed as each lift of material is placed so that the lift is "keyed" into the adjacent side of the Roadbed to a width not less than 0.5 m.
- .6 Excavated material placed behind Structures or in areas where Structures are to be constructed shall be a material meeting the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, and shall have lift thicknesses as follows:

SOLID ROCK EXCAVATION

ITEM: 108

- 108.4.4.6
- .1 Maximum 200 mm behind abutment breastwalls or other earth-retaining Structures, to the limits identified on the Plans; or
 - .2 Maximum 300 mm where Structures shall be constructed or through which piles shall be driven.
 - .7 No excavated rock shall be placed within 4 m of either side and for the depth where an induced trench shall be constructed under Item 169.

108.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of solid rock excavated and either placed, stockpiled or disposed of in accordance with this Item.
- .2 The volume of bedrock shall be as measured in situ and computed by the average end area method, based on the top-of-rock sections surveyed by the Engineer, after the bedrock exposure noted in 108.4.3.1.
 - .1 If the Contractor fails to give notice under 108.4.3.1, then the Engineer shall determine the rock line to be used to calculate the Quantity of solid rock excavation.
 - .2 The payline for the rock undercut surface shall be the theoretical undercut line as per 108.4.3.3, to the intercept of the Foreslope as excavated.
- .3 Boulders greater than 1 m³ in volume shall be measured individually for payment.
- .4 Where, in the opinion of the Engineer, Overbreak in ditches and Backslopes has been unavoidable, the Overbreak shall be measured for payment up to but not exceeding 10% of the Quantity calculated within the lines staked by the Engineer at the stations at which the Overbreak occurs.
 - .1 This percentage may be increased at the discretion of the Engineer for stations of small cross-sectional area for which the width of Overbreak is not excessive but represents a relatively large percentage of the area of solid rock excavation staked, and if all of the Overbreak Quantity is useable material.
- .5 Compensation payable to the Owner or the Contractor, for the difference in price of fuel between the month prior to the month of tender opening for the Contract and the month of Work under this Item, will be calculated in accordance with Item 822.

108.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of solid rock excavation, as identified under the Contract.

DITCHING

ITEM: 116

116.1 DESCRIPTION

- .1 This Item consists of the excavation and disposal of material from existing ditches.

116.2 MATERIALS

- .1 None identified.

116.3 SUBMITTALS

- .1 None identified.

116.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Ditching shall consist of removing vegetal matter and up to a maximum of 300 mm of soil from an existing ditch such that the width of the bottom of the ditch is not less than 1 m and the ditch has a continuous smooth grade providing positive gravity drainage, without ponding, in the specified flow direction.
 - .1 The tendered Quantity includes cleaning ends of driveway culverts and cross culverts as directed by the Engineer.
- .3 The Contractor shall not excavate or undermine the Foreslope during the course of the Work.
- .4 The Contractor shall shape ditches to a uniform cross-section, with no gouges or ridges remaining in the finished Work.
- .5 The Contractor shall repair any damage, at his/her own expense, to adjacent property resulting from the Work.
- .6 The materials excavated from within the ditches shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .7 A driveway crossing designated to be removed and not replaced shall be excavated so that the ditch and Slopes remaining after excavation match the adjacent ditch and Slopes.
- .8 Driveways with a culvert designated for replacement shall be replaced in the same workday in accordance with Item 130 and/or Item 140 utilizing material excavated from the crossing wherever possible.
 - .1 Where excavation involves removal of driveway Culverts, the Contractor shall take care to ensure that any existing pipe is not damaged and is salvaged for re-use.
 - .1 The Contractor shall notify the Engineer prior to exposing any existing pipe.
 - .2 Any pipe determined by the Engineer to be salvageable shall remain the property of the Owner.

DITCHING

ITEM: 116

- 116.4.8.1 .3 Salvageable pipe shall be re-used in accordance with Item 130 or Item 140 in the Work Site or transported, by the Contractor, to the nearest DTI Maintenance Depot and stockpiled as directed by the Engineer.
- .4 Unsalvageable pipe and waste shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .5 If the pipe is damaged as a result of the Contractors actions, as determined by the Engineer, the Contractor shall be responsible to replace the pipe.
- .9 Ditches shall be stabilized against erosion with hay or straw mulch, in accordance with 616.2, 616.3, and 616.4, at the end of each day's ditching.

116.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of ditching carried out in accordance with this Item.

116.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

121.1 DESCRIPTION

- .1 This Item consists of supply of material from outside the Work Site, and its placement within the Work Site.

121.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Borrow shall consist of soil and/or rock free of roots, stumps, organics and/or other deleterious substances, and shall meet the following requirements:
 - .1 Dust content shall be determined in accordance with ASTM C117.
 - .2 Borrow A1 shall be pit run gravel, quarried or ripped rock, having a Micro-Deval loss not exceeding 50% when tested per MTO LS-618.
 - .1 Borrow A1 shall not contain more than 10% of particles passing the 75 µm sieve when tested in accordance with ASTM C136 and C117.
 - .2 Borrow A1 shall have a maximum Plasticity Index of 5.
 - .3 Borrow A shall have a Dust content not exceeding 25% tested at a minimum frequency of one test per 10 000 t.
 - .1 If successive test results indicate a Dust content below 15% the test frequency may be reduced at the discretion of the Engineer.
 - .1 Sedimentary rock proposed for use as Borrow A shall have a Micro-Deval loss not greater than 60% when tested in accordance with Test Method MTO LS-618, A Grading, modified as follows:
 - Para. 5.6- The Micro-Deval abrasion machine shall run 30 minutes.
 - Para. 5.7 and 5.8- A 75 µm sieve shall be added to determine Mass 'B' in the Percent Loss calculation.
 - .4 Mudstone, claystone and/or siltstone shall not be acceptable as Borrow A/A1.
 - .5 Borrow A shall have a maximum Plasticity Index of 5.
 - .6 Borrow B shall have a Dust content not exceeding 50%.
 - .3 Borrow shall be subject to the approval of the Engineer at the time of placement in the Work and the maximum particle size shall not exceed two-thirds of the lift thickness being placed.

121.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, for approval of the source of material, at least 14 Days in advance of obtaining material from the proposed Borrow source.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

121.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall carry out the Work in accordance with Item 946 and Item 948.
- .3 The Contractor shall carry out operations at the Borrow source in accordance with Item 922.
- .4 Borrow placement shall be carried out in accordance with Item 941.
- .5 If at any time during the Work the surface becomes rutted or displaced, the Contractor shall make all necessary repairs to reinstate the surface grade.
 - .1 The depth rutted and/or displaced shall be scarified, shaped and compacted to meet the requirements of this Item.
- .6 The Contractor shall conduct the Work such that all usable material resulting from excavation under Items 106, 107 and/or 108 either has been used or shall be used in the Work, prior to the placement of any material under this Item.
- .7 Oversize stones (per 121.2.3) and unsuitable materials from the Borrow placement shall be disposed of so that the Roadway is left in a neat and tidy condition.
- .8 The Contractor shall carry out moisture conditioning and compaction of soil Borrow in accordance with Item 936.
 - .1 Any isolated soft spots or other areas within the top 1.2 m of the Subgrade not meeting the specified compaction criteria shall be excavated and backfilled with material of the quality matching the surrounding material, and as directed by the Engineer.
- .9 The placement of Borrow shall be in lifts and shall conform to lines and grades provided.
 - .1 Material placed in the top 600 mm to Subgrade shall meet the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, and shall be placed, as follows:
 - .1 Soil Borrow A/A1, as indicated in the Contract Documents, shall be placed as specified in 121.4.9.2.1.
 - .2 Rock Borrow A/A1, as indicated in the Contract Documents, shall be placed in one lift using a vibratory roller of at least 11 t mass. Surface voids shall be filled with rock fragments and spalls, and compacted such that rock fragments are further broken down or repositioned to minimize voids and bridging, and to consolidate the lift.
 - .3 In backfilling of undercuts deeper than 600 mm, the lift thickness shall be as determined by the Engineer.

- 121.4.9 .2 Material placed to within 600 mm below Subgrade shall be placed as follows:
- .1 Soil Borrow shall have a maximum lift thickness of 300 mm, and each lift shall be compacted to a minimum of 95% of the maximum dry density.
 - .1 The lift thickness may be increased to a maximum of 600 mm if the Contractor can provide proof that the specified density can be achieved throughout the entire lift.
 - .2 Rock Borrow shall have a maximum lift thickness of 600 mm, and each lift shall be compacted such that rock fragments are further broken down or repositioned to minimize voids and bridging, and to consolidate the lift, using a vibratory roller of at least 11 t mass.
 - .3 Borrow placed behind Structures or in areas where Structures are to be constructed shall be soil meeting the requirements of 121.2 - Borrow A/A1, as indicated in the Contract Documents, and shall be compacted to a minimum of 95% of the maximum dry density for each layer placed as follows:
 - .1 Material behind abutment breastwalls or other earth-retaining Structures, to the limits identified in the Contract Documents, shall have a maximum lift thickness of 200 mm.
 - .2 Material over which Structures shall be constructed or through which piles shall be driven shall have a maximum lift thickness of 300 mm.
- .10 Embankments shall be constructed such that the first lift when shaped forms the toe of the Foreslopes and each successive lift shall be completed to the full width prior to placing the next lift.
- .1 On ungrubbed areas, swamps and rough terrain, the initial lift thickness may exceed the thickness in 121.4.9.2.2 as approved by the Engineer.
- .11 The Contractor shall maintain surface drainage during the placement of Borrow.
- .1 Low spots and ruts that could pond water shall be removed no later than the end of each Day's Work or, if rain is imminent, as Work progresses during the Day.
- .12 Where embankments are constructed against an existing earth sidehill having a Slope steeper than 3:1, for the top 2.5 m below Subgrade the spreading Equipment shall cut into the sidehill as each lift of fill is placed so that the next lift is "keyed" into the sidehill to a width not less than 1 m.
- .13 Where the Work involves placement of material firstly along one side of the Roadbed and then the other side, the spreading Equipment shall cut into the edge of the previously built side of the Roadbed, as each lift of material is placed so that the lift is "keyed" into the adjacent side of the Roadbed to a width not less than 0.5 m.
- .14 Any Borrow surface subjected to through-traffic shall be maintained in a condition such that traffic can safely travel along it at the speed limit posted for the Work Area.

121.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tonnes of Borrow supplied and placed in accordance with this Item.
- .2 If the Contractor places more Borrow than the tendered Quantity, thereby causing a waste of useable excavated materials under Items 106, 107 and/or 108, the volume of excavated material so wasted shall be calculated and that Quantity deducted from the total Quantity of Borrow.
 - .1 This volume of material shall be converted to tonnes using 2.0 t/m^3 .
- .3 Compensation payable to the Owner or the Contractor, for the difference in price of fuel between the month prior to the month of tender opening for the Contract and the month of Work under this Item, will be calculated in accordance with Item 822.

121.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each class of Borrow, as identified under the Contract.

METAL PIPE

ITEM: 130

130.1 DESCRIPTION

- .1 This Item consists of supply and installation of aluminum coated corrugated steel pipe (CSP) pipe-arch (CSPA) and corrugated aluminum alloy pipe (CAP), having an equivalent diameter of 1200 mm or less.

130.2 MATERIALS

- .1 All pipe materials shall be supplied by the Contractor.
- .2 All pipe and appurtenances shall be manufactured of aluminum coated steel or aluminum alloy and shall meet the requirements of Table 130-1 and Table 130-2.
 - .1 Bolts and nuts shall be of the same material as the pipe.

**Table 130-1
Material/Fabrication Standards**

Culvert/Structure Type	Material Standard	Fabrication Standard
Aluminum coated steel (pipe)	CSA G401-01 AASHTO M274-87	CSA G401-01 ASTM A929/A929M
Aluminum alloy (pipe)	ASTM B209	ASTM B790/B790M-97
Aluminum Structures (pipe & arch)	ASTM B209 ASTM B221 AASHTO M219-92	ASTM B746/B746M ASTM B789/B789M ASTM B790/B790M

**Table 130-2
Standard CSP/CSPA/CAP Dimensions**

CSP/CAP Diameter (mm)	Equivalent CSPA Span x Rise (mm)	Wall Thickness (mm)		Corrugation Profile (mm)
		Aluminum	Aluminum Coated	
150		1.6	N/A	38 x 6.5
200		1.6	N/A	38 x 6.5
250		1.6	1.6	38 x 6.5
300		1.6	1.6	68 x 13
400	450 x 340	2.0	1.6	68 x 13
500	560 x 420	2.0	1.6	68 x 13
600	680 x 500	2.8	2.0	68 x 13
700	800 x 580	2.8	2.0	68 x 13
800	910 x 660	2.8	2.0	68 x 13
900	1030 x 740	2.8	2.0	68 x 13
1000	1150 x 820	2.8	2.8	68 x 13
1200	1390 x 970	3.5	2.8	68 x 13

METAL PIPE

ITEM: 130

130.2 .3 Couplers shall be aluminum coated steel or aluminum alloy and shall have configurations and fastening systems as indicated in Table 130-3.

**Table 130-3
 CSP/CSPA/CAP Couplers**

Equivalent Diameter (mm)	Type(s) of Coupler	Minimum Thickness (mm)	Minimum Width (mm)	Types(s) of Fasteners
150 to 250	Flat, Dimple or Corrugated	1.3	150	Wedge or Bolts
300 to 1200	Annular Corrugated	1.6	300	Bolts

- .4 Helical corrugated pipe greater than 250 mm diameter shall have ends re-corrugated to annular corrugations for coupling purposes.
- .5 All cut edges and any damage to aluminum coatings shall be ground smooth and recoated in accordance with CSA G401.
- .6 Backfill material shall meet the requirements of 167.2.
 - .1 Backfill material shall be obtained from within the Work Site as approved by the Engineer.
 - .2 If sufficient quantities of suitable backfill material are not available within the Work Site, as determined by the Engineer, additional backfill shall be imported by the Contractor in accordance with Item 167 from a source approved by the Engineer.

130.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.
 - .1 If fish weirs/baffles are specified for a Culvert, the Contractor shall submit shop drawings for each Culvert in accordance with 131.3.
- .2 The Contractor shall submit, upon request, the proposed source of the supply of the backfill material from within the Work Site.
- .3 If the source of the supply of the backfill material is located outside the Work Site, the Contractor shall identify the proposed source, in writing, for the approval of the Engineer, at least 14 Days in advance of obtaining backfill material from the proposed source.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

130.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 If fish weirs/baffles are specified for a Culvert, the hook bolts shall be isolated from the reinforcement.

METAL PIPE

ITEM: 130

- 130.4 .3 The Engineer shall provide control points in the field to provide vertical and horizontal control at selected locations or as may be required.
- .4 The Contractor shall be responsible for the layout and maintenance of control for all lines and grades for the Work as shown on the Plans.
- .5 The pipe sections shall be joined in a straight line using standard industry methods.
- .6 Trench excavation shall be carried out in accordance with 161.4 and to the limits as indicated on the Standard Drawings 161-1 to 161-5.
- .7 If Over-excavation occurs, the Contractor shall, at her/his own expense, repair and fill the Over-excavation with an approved backfill material, placed in accordance with Item 936, and compacted to 95% of the maximum dry density.
- .8 Installation shall proceed upgrade.
- .9 Backfill shall be placed and shaped to lines and grades as indicated on Standard Drawings 161-1 to 161-5.
- .10 No backfill material shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of excavation and the character of foundation materials.
- .1 Material over 75 mm in size shall not be placed within 300 mm of any metal pipe.
- .2 Backfill shall be placed in lifts of not more than 200 mm in thickness for vibratory plate or rammer-type compactors and not more than 300 mm in thickness for vibratory rollers.
- .3 Backfill shall be compacted in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .11 Backfilling of metal pipes shall proceed such that the differential in elevation between the two sides is not more than one lift of backfill.
- .1 Only compactors recommended by the pipe manufacturer shall be used within 1 m of metal pipes.
- .12 No traffic or construction equipment shall be permitted to pass over the metal pipe until the limit of backfilling above the pipe has been attained as indicated on Standard Drawings 161-1 to 161-5 and/or in the Contract Documents.
- .13 Shoring, bracing, sheeting, pumps, temporary roads and/or bridges that are necessary for the Work shall be employed, maintained and removed by the Contractor.
- .14 The Contractor shall construct, maintain and remove suitable temporary construction detours in accordance with Item 918.
- 130.5 MEASUREMENT FOR PAYMENT
- .1 The Quantity to be measured for payment shall be the number of linear metres of metal pipe supplied and installed in accordance with this Item.
- .1 The measurement shall be taken along the invert of the pipe.

130.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size and type of metal pipe, as identified under the Contract.
- .2 The Owner shall make partial payment in accordance with 908.7 for metal pipe stored at the Work Site.
 - .1 Partial payment shall be made for specialized metal pipe acceptably stored at the supplier's yard.

131.1 DESCRIPTION

- .1 This Item consists of the supply and installation of aluminum coated corrugated metal pipe, including but not limited to, all CSP and CSPA having an equivalent diameter greater than 1200 mm, structural plate CSP or CSPA (SPCSP or SPCSPA), structural plate arches, aluminum alloy pipe (CAP, SPCAP, SPCAPA), and any other type of metal pipe.

131.2 MATERIALS

- .1 All pipe materials shall be supplied by the Contractor.
- .2 All pipe and appurtenances shall be manufactured of aluminum coated steel, aluminum alloy or galvanized steel and shall meet the requirements of Table 131-1.
 - .1 Bolts and nuts shall be of the same material as the pipe.

**Table 131-1
Material/Fabrication Standards**

Culvert/Structure Type	Material Standard	Fabrication Standard
Aluminum coated steel (pipe)	CSA G401 AASHTO M274	CSA G401 ASTM A929/A929M
Aluminum alloy (pipe)	ASTM B209	ASTM B790/B790M
Aluminum Structures (pipe & arch)	ASTM B209 ASTM B221 AASHTO M219	ASTM B746/B746M ASTM B789/B789M ASTM B790/B790M
Aluminum Structures (box)	ASTM B209 ASTM B221 AASHTO M219	ASTM B864/864M ASTM B746/B746M
Galvanized steel (plate arch)	CSA G401	CSA G401

- .3 Helical corrugated pipe shall have ends re-corrugated to annular corrugations for coupling purposes.
- .4 All cut edges and any damage to aluminum coatings or galvanized steel shall be ground smooth and recoated in accordance with CSA G401.
- .5 Backfill material shall be Class "A" per 167.2.
 - .1 Backfill material shall be obtained from within the Work Site as approved by the Engineer.
 - .2 If sufficient quantities of suitable backfill material are not available within the Work Site, as determined by the Engineer, additional backfill shall be imported by the Contractor in accordance with Item 167 from a source approved by the Engineer.

131.3 SUBMITTALS

- .1 The Contractor shall submit, in accordance with Item 956, shop drawings for each Culvert, containing but not limited to, the following information:
 - .1 Station(s) of pipe(s), name(s) of watercourse(s), and DTI contract number and description;
 - .2 General layout showing pipe and appurtenances;
 - .3 Length and weight (mass) of individual sections; and
 - .4 Itemized supply list.
- .2 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification that the materials to be supplied, for the fabrication, meet the specified requirements as detailed in the Contract Documents.
- .3 The Contractor shall submit, upon request, the proposed source of the supply of the backfill material from within the Work Site.
- .4 If the source of the supply of the backfill material is located outside the Work Site, the Contractor shall submit the proposed source, in writing, for the approval of the Engineer, at least 14 Days in advance of obtaining backfill material from the proposed source.
- .5 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

131.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Engineer shall provide control points in the field to provide vertical and horizontal control at selected locations or as may be required.
- .3 The Contractor shall be responsible for the layout and maintenance of control for all lines and grades for the Work as shown on the Plans.
- .4 Excavation shall be carried out in accordance with 161.4 and to the limits as indicated on Standard Drawings 161-1 to 161-5, or as specified in the Contract Documents.
 - .1 If Overexcavation occurs, the Contractor shall, at his/her own expense, repair and fill the Overexcavation with an approved backfill material, placed in accordance with Item 936, and compacted to 95% of the maximum dry density.
- .5 The pipe sections shall be joined in a straight line using standard industry methods.
- .6 Pipes shall be assembled and/or erected as shown on the manufacturer's drawings.
- .7 Backfill shall be placed and shaped to the lines and grades as indicated on Standard Drawings 161-1 to 161-5.
- .8 No backfill shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of excavation and the character of foundation materials.

METAL PIPE - LARGE

ITEM: 131

- 131.4.8 .1 Material over 75 mm in size shall not be placed within 300 mm of the Culvert.
- .2 Backfill shall be placed in lifts of not more than 200 mm in thickness for vibratory plate or rammer-type compactors and not more than 300 mm in thickness for vibratory rollers.
- .3 Backfill shall be compacted in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .9 Backfilling of metal pipe shall proceed simultaneous and evenly on both sides of the Structure and shall never exceed 600 mm in differential elevation.
- .10 No traffic or construction equipment shall be permitted to pass over the Culvert until the backfill cover indicated on Standard Drawings 161-1 to 161-5 and/or in the Contract Documents has been placed.
- .11 Shoring, bracing, sheeting, pumps, temporary roads and/or bridges that are necessary to the Work shall be employed, maintained and removed by the Contractor.
- .12 The Contractor shall construct, maintain and remove temporary construction detours around the Structure in accordance with Item 918.

131.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of metal pipe supplied and installed in accordance with this Item.
- .1 The measurement shall be taken along the invert of the pipe or the bottom edge of an arch at the connection to the foundation.

131.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of metal pipe, as identified under the Contract.
- .2 The Owner shall make partial payment for metal pipe in accordance with 908.7.

SUBDRAIN

ITEM: 136

136.1 DESCRIPTION

- .1 This Item consists of the supply and installation of subdrain pipe.

136.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Subdrain pipe shall be 150 mm and/or 200 mm diameter perforated pipe, as specified in the Contract Documents, and shall meet the following:
 - .1 Galvanized CSP and appurtenances shall be galvanized steel manufactured to meet the requirements of CAN/CSA G401; or
 - .2 PVC pipe and appurtenances shall be DR 35 conforming to CAN/CSA B182.2 and perforated as per CAN/CSA B182.1 (Clause 4.1.5); or
 - .3 Corrugated polyethylene pipe and appurtenances conforming to ASTM F405 and/or ASTM F667.
- .3 All elbows, caps and reducer sections shall match the grade and quality of the pipe supplied.
- .4 Geotextile shall be Type N2 in accordance with 601.2.
- .5 Free draining backfill shall be supplied in accordance with 366.2.

136.3 SUBMITTALS

- .1 The Contractor shall submit to the Engineer, at least 14 Days in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

136.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 A trench shall be excavated to depths as indicated in the Contract Documents and shall be lined with geotextile of a width sufficient to fit the bottom and sides and, after backfilling, the top of the free draining backfill with a minimum overlap of 200 mm.
- .3 Rock encountered within the limits of the excavation shall be excavated in accordance with Item 161.
- .4 The subdrain pipe shall be installed as indicated on Standard Drawing 136-1.
- .5 The subdrain shall be installed as a continuous line with all joints being constructed with couplers compatible with the pipe supplied and in accordance with the manufacturer's recommendations.
 - .1 The Contractor shall be responsible for all cutting and fitting of pipes in the Work.

SUBDRAIN

ITEM: 136

- 136.4.5 .2 The Contractor shall cut holes in catch basins, when required, at the required elevation and in accordance with 404.4.
- .6 The upgrade end of each continuous line of subdrain shall be capped, as required.
- .1 Where the subdrain is to be connected to a precast catch basin, the Contractor shall carefully make an opening in the catch basin at the required elevation, and make the connection as indicated on Standard Drawing 136-1.
- .7 The trench shall be backfilled to match the surrounding grade.
- .8 The material excavated from the trench shall be spread on the Foreslopes, placed in embankments, or, if it is considered by the Engineer to be unsuitable for such use, it shall become the property of the Contractor and shall be disposed of outside the Work Site.

136.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the linear metres of subdrain supplied and installed in accordance with this Item.
- .1 The measurement shall be taken along the centreline of the pipe from end to end for each continuous section of installation.

136.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size and type of pipe, as identified under the Contract.

SUBDRAIN OUTLET

ITEM: 137

137.1 DESCRIPTION

- .1 This Item consists of the supply and installation of subdrain outlets.

137.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Subdrain outlet pipe shall be non-perforated pipe of a size, type and quality to match the subdrain pipe supplied and installed under Item 136.
 - .1 Galvanized CSP and appurtenances shall be galvanized steel manufactured to meet the requirements of CAN/CSA G401; or
 - .2 PVC pipe shall be DR 35 conforming to CAN/CSA B182.2; or
 - .3 Corrugated polyethylene pipe and appurtenances conforming to ASTM F667.
- .3 Geotextile shall be Type N2 in accordance with 601.2.
- .4 Pipe zone material shall conform to the requirements of 415.2.
- .5 Free draining backfill shall be supplied in accordance to the requirements of 366.2.

137.3 SUBMITTALS

- .1 The Contractor shall submit to the Engineer, at least 14 Days in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

137.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall construct the subdrain outlet Structure in advance of any placement of Aggregate Subbase.
- .3 The subdrain outlet shall be constructed as detailed in Standard Drawing 137-1.
- .4 The subdrain outlet shall have all joints constructed with couplers and 90° elbows and/or T-sections compatible with the pipe supplied and in accordance with the manufacturer's recommendations.
 - .1 The Contractor shall be responsible for all cutting and fitting of pipes in the Work.
 - .2 Where the Subdrain outlet connects at the end of a line of subdrain pipe, the connection shall be a 90° elbow or a T-section with the lower end capped.

SUBDRAIN OUTLET**ITEM: 137**

- 137.4 .5 Material excavated from the outlet trench shall be used for backfill above the pipe zone to Subgrade.
- .1 Pipe zone and trench backfill shall be placed in 300 mm lifts in accordance with Item 936, to a minimum of 95% of its maximum dry density, from the base of the excavation up to 600 mm below Subgrade.
 - .2 Trench backfill shall be placed in 300 mm lifts in accordance with Item 936, to a minimum of 95% of its maximum dry density, within the last 600 mm below Subgrade.
 - .3 The trench shall be backfilled to match the surrounding grade.
- .6 If the material excavated from the trench is considered by the Engineer to be unsuitable for backfill, it shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .1 Replacement backfill material shall be obtained from the Work Site as directed by the Engineer.

137.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of subdrain outlets supplied and installed in accordance with this Item.

137.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size and type of pipe, as identified under the Contract.

CONCRETE PIPE

ITEM: 140

140.1 DESCRIPTION

- .1 This Item consists of supply and installation of all reinforced concrete pipe having a nominal inside diameter (ID) of 1200 mm or less.

140.2 MATERIALS

- .1 All pipe materials shall be supplied by the Contractor.
- .2 All pipe 900 mm and larger shall be supplied with gaskets (confined "O" ring with lubricant or single offset type).
- .3 All reinforced concrete pipe shall meet the requirements of CAN/CSA A257.2 and CAN/CSA A257.3.
- .4 Pipe of 1050 mm and 1200 mm nominal ID shall have a minimum 70 mm diameter lift hole at the centre of gravity, and shall be equipped with a tapered concrete or rubber plug that does not protrude beyond the inside wall of the pipe.
- .5 Pipe made with elliptical reinforcement shall have the lift hole located so as to establish the top of the pipe, and for pipe having baffles and weirs, such that it is centred over the top of the baffle or weir.
- .6 Tension rod/bar assemblies shall be supplied as indicated in Standard Drawing 140-1 for pipes specifically identified in the Contract Documents.
- .7 Tee-base sections, elbow sections and/or other appurtenances shall be supplied as indicated in the Contract Documents.
 - .1 Tee-bases shall be fabricated such that when installed at the slope indicated in the Contract Documents, the catch basin shaft on the Tee-base is vertical.
 - .2 Weirs/baffles shall be reinforced and secured to the pipe invert by a method approved by the Engineer and moist cured for a minimum of 72 hours, or until 70% of design strength has been reached.
 - .1 When drilled holes and dowels are used to attach weirs/baffles to the invert, the holes shall be drilled to a minimum depth of 75 mm, and the dowels shall be secured with an epoxy or acrylic adhesive such as Epcon A7 or approved equivalent.
 - .2 Reinforcement shall be placed in both faces of weirs, baffles and cut-off walls.
- .8 Backfill material shall meet the requirements of Table 140-1.
 - .1 Class "A" shall be used for backfilling 1050 mm and 1200 mm diameter concrete pipes.
 - .2 Class "B" shall be used for backfilling concrete pipes 900 mm or smaller in diameter.
 - .3 Backfill material shall be obtained from within the Work Site as approved by the Engineer.
 - .4 If sufficient quantities of suitable backfill material are not available within the Work Site, as determined by the Engineer, additional backfill shall be imported by the Contractor in accordance with Item 167 from a source approved by the Engineer.

140.2 .9 Rough edges at both ends of pipe shall be flush with all bleed-by removed.

Table 140-1
Backfill Classification

Class	Description
A	Class "A" backfill shall be a well graded granular material composed of clean, uncoated particles free of lumps of clay or other deleterious material, and having not more than 10% retained on the 100 mm sieve, and not more than 10% Dust.
B	Class "B" backfill shall be a well graded granular material having not more than 10% retained on the 100 mm sieve, and not more than 35% Dust.

140.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.
 - .1 If fish weirs/baffles are specified for a Culvert, the Contractor shall submit shop drawings for each Culvert in accordance with 141.3.
- .2 The Contractor shall submit, upon request, the proposed source of the supply of the backfill material from within the Work Site.
- .3 If the source of the supply of the backfill material is located outside of the Work Site, the Contractor shall submit the proposed source, in writing, for the approval of the Engineer, at least 14 Days in advance of obtaining backfill material from the proposed source.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.
- .5 Three-Edge Bearing testing, in accordance with CAN/CSA A257, shall be done a minimum of once per year for each size of pipe in the presence of the Engineer.

140.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Engineer shall provide control points in the field to provide vertical and horizontal control at selected locations or as may be required.
- .3 The Contractor shall be responsible for the layout and maintenance of all lines and grades for the Work.
- .4 Trench excavation shall be carried out in accordance with 161.4 and to the limits as indicated on Standard Drawings 161-1 to 161-5, or as specified in the Contract Documents.
 - .1 If Overexcavation occurs, the Contractor shall, at his/her own expense, repair and fill the Overexcavation with an approved backfill material, placed in accordance with Item 936, and compacted to 95% of the maximum dry density.

CONCRETE PIPE

ITEM: 140

- 140.4 .5 The pipe sections shall be joined in a straight line using standard industry methods, proceeding up grade with bell end up grade.
- .6 The maximum joint gap between any two concrete pipe sections shall be 13 mm.
- .1 Where the joint gap exceeds 13 mm, sections shall be removed and reset to meet the specified tolerance.
- .7 Tension rod/bar assemblies shall be installed as indicated in Standard Drawing 140-1 and in the Contract Documents.
- .8 All other appurtenances shall be installed as indicated in the Contract Documents.
- .1 Pipe sections with weirs or baffles shall be installed with the weir/baffle tops horizontal in the transverse direction.
- .9 Backfill shall be placed and shaped to lines and grades as indicated on Standard Drawings 161-1 to 161-5.
- .1 If the pipe shall have an induced trench constructed over it under Item 169, backfill shall be placed and shaped as noted in the Contract Documents.
- .10 No backfill material shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of excavation and the character of foundation materials.
- .1 Material over 75 mm in size shall not be placed within 300 mm of any concrete pipe.
- .2 Backfill shall be placed in lifts of not more than 200 mm in thickness for vibratory plate or rammer-type compactors and not more than 300 mm in thickness for vibratory rollers.
- .3 Backfill shall be compacted in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .11 Backfilling of concrete pipe shall proceed simultaneously and evenly on both sides of the Structure and shall never exceed 600 mm in differential elevation.
- .12 No traffic or construction equipment shall be permitted to pass over the concrete pipe until the backfill cover indicated on Standard Drawings 161-1 to 161-5 and/or in the Contract Documents has been placed.
- .13 Shoring, bracing, sheeting, pumps, temporary roads and/or bridges that are necessary for the Work shall be employed, maintained and removed by the Contractor.
- .14 The Contractor shall construct, maintain and remove suitable temporary construction detours in accordance with Item 918.
- .15 Precast cut-off walls under this Item or cast-in-place headwalls under Item 301 shall be set at the elevations and offsets shown on the Plans and/or shop drawings, or if site conditions differ from the Plans, as directed by the Engineer.
- .1 An inlet cut-off wall or headwall shall not be placed until enough culvert sections have been placed per 140.4.5 to ensure that the inlet end section line up with the wall to the satisfaction of the Engineer. If the pipe fails to line up with the wall as specified, the Contractor shall make necessary corrections at her/his expense.

CONCRETE PIPE

ITEM: 140

- 140.4.15 .2 Following placement and backfilling of a precast cut-off wall, the top pre-formed surface of the wall shall be "battered" with a 25 mm layer of non-shrink grout and the culvert end section immediately set into place on it.
- .3 With the end section in place, the Contractor shall core drill 30 mm diameter holes through the end section and to a nominal depth of 150 mm into the top of the cut-off wall.
- .4 The 25 M dowels shall be inserted and secured into place using an epoxy or acrylic adhesive such as Epcon A7 or an approved equivalent.

140.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of reinforced concrete pipe supplied and installed in accordance with this Item.
- .1 The measurement shall be taken along the invert of the pipe.

140.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of reinforced concrete pipe, as identified under the Contract.
- .2 The Owner shall make partial payment in accordance with 908.7 for reinforced concrete pipe stored at the Work Site.
- .1 Partial payment shall be made for specialized reinforced concrete pipe acceptably stored at the supplier's yard.

141.1 DESCRIPTION

- .1 This Item consists of the design, supply and installation of all reinforced concrete pipe of a nominal inside diameter (ID) greater than 1200 mm.

141.2 MATERIALS

- .1 All pipe materials shall be supplied by the Contractor.
- .2 Pipe shall meet the referenced manufacturing standards.
- .3 All pipes shall be supplied with gaskets (confined "O" ring with lubricant, or single offset type).
- .4 Appurtenances, which may include tension bar assemblies, tee-bases, cut-off walls, weirs (with or without steel inserts), baffles, and/or bevelled ends, shall be supplied as shown on the Contract Document and shop drawings.
 - .1 Tension bar assemblies shall be as shown in Standard Drawing 140-1.
 - .2 Tee-bases shall be fabricated such that when installed at the slope shown on the Plans, the catch basin shaft on the tee-base is vertical.
 - .3 Dowels for attaching cut-off walls to pipe shall be 25 M deformed reinforcing steel bars.
 - .4 The concrete for precast weirs, baffles and cut-off walls shall have an air content of 5 to 8%.
 - .5 The maximum spacing of reinforcing steel for cut-off walls, headwalls and weirs/baffles shall be 300 mm.
- .5 Non-shrink grout shall conform to ASTM C1107.
- .6 For lifting devices the following shall apply:
 - .1 Pipe up to 1800 mm diameter shall have a formed lift hole (minimum 70 mm diameter) at the centre of gravity of the pipe section, with tapered concrete or rubber plug that does not protrude beyond the inside wall of the pipe, or shall be the system described in 141.2.6.2.
 - .2 Pipe of 2100 mm diameter and larger shall use Dayton Superior Swift Lift Systems or equivalent of sufficient capacity to handle and place pipe sections.
 - .3 Pipe made with elliptical reinforcement shall have the lift hole or lift anchorage located to establish the top of the pipe, and for pipe having weirs or baffles, such that it is centered over the top of the weir or baffle.
- .7 Weirs, baffles and cut-off walls shall be made with the same concrete requirements as the pipe.
- .8 Backfill material shall be Class "A" per 167.2.
 - .1 Backfill material shall be obtained from within the Work Site as approved by the Engineer.
 - .2 If sufficient quantities of suitable backfill material are not available within the Work Site, as determined by the Engineer, additional backfill shall be imported by the Contractor in accordance with Item 167 from a source approved by the Engineer.

141.3 SUBMITTALS

- .1 For pipe with an ID of 3000mm or greater, the pipe shall be analysed in accordance with CAN/CSA-S6, CL-625-ONT, by the Direct Design Method, using the most recent software version of PIPECAR, or Eriksson Pipe version 1.1, as per the Contract Documents.
- .1 The pipe reinforcing area and spacing for pipe with an ID of 3000 mm or greater shall conform to the governing PIPECAR or Eriksson Pipe version 1.1 output.
- .2 If the area of reinforcing specified by the manufacturer is greater than the area of reinforcing specified in PIPECAR or Eriksson Pipe version 1.1, the area must be verified per CSA S6 Commentary CI.7.8.8.1.1 to ensure it is less than the maximum allowable reinforcing area.
- .3 All pipes shall be designed for actual fill plus 1 m of fill.
- .2 Pipe less than 3000 mm diameter shall be designed using the CSA A257.2 and A257.3. Special designs, outside the limits of the CSA A257 design tables, shall be designed using the PIPECAR Indirect Design Method or Eriksson Pipe Indirect Design Method.
- .3 Pipe design shall be in accordance with Table 141-1

Table 141-1
Reinforced Concrete Pipe Design Requirements

Pipe Diameter (mm)	Applicable Standards	Additional Standards / Requirements for Concrete
1350 to 2700	CSA A257.2, CSA A257.3	CSA A23.1 and A23.2, exposure class C-1; air content of 5 to 8%.
≥ 3000	CSA-S6 ASTM C1417	CSA A23.1 and A23.2, exposure class C-1; air content of 5 to 8%; calcium nitrite corrosion inhibitor at a rate of 15 L/m ³ .

- .4 The Contractor shall submit, in accordance with Item 956, shop drawings for each Culvert, containing but not limited to, the following information:
 - .1 Station(s) of pipe(s), name(s) of watercourse(s), and DTI contract number and description;
 - .2 General layout showing pipe and appurtenances;
 - .3 Length and weight (mass) of individual sections;
 - .4 Joint details;
 - .5 Details of reinforcing steel for each individual cage, including bar spacing, bar yield strength, wire sizes for cages and stirrups;
 - .6 Details of reinforcing steel for weirs, baffles and cut-off walls;
 - .7 Concrete design strength, age of test and shipping strength;
 - .8 Production schedule;
 - .9 Method of attaching concrete weir(s) and baffle(s) to pipe;
 - .10 PIPECAR or Eriksson Pipe design input and output, including printouts of outputs for load cases as indicated on the Contract Documents for pipe sizes and classes not listed in the CSA A257 design tables;
 - .1 PIPECAR or Eriksson Pipe version 1.1, design input for pipe ≥ 3000 mm ID shall be in accordance with the Supplement to Item 141 of the Contract Documents.
 - .2 PIPECAR or Eriksson Pipe, design for pipe < 3000 mm and not listed in the CSA A257 Design Tables, will require PIPECAR Three Edge Bearing input and output information.
 - .11 Lap lengths and welding procedure for pipes ≥ 3000 mm ID.

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- 141.3 .5 The Contractor shall submit, in accordance with Item 956, two sets of design calculations for the following:
- .1 All pipes 3000 mm ID and larger;
 - .2 All pipe designs that are not listed in the design tables in CAN/CSA A257.
- .6 The proposed mix proportions (design), shall be submitted to the Engineer at least 14 Days before concrete production is due to start.
- .7 The manufacturer's certification that the supplied materials meet the specified requirements of the Contract Documents shall be submitted upon request.
- .8 The Contractor shall submit, upon request, the proposed source of the supply of the backfill material from within the Work Site.
- .9 If the source of the supply of the backfill material is located outside the Work Site, the Contractor shall submit the proposed source, in writing, for the approval of the Engineer, at least 14 Days in advance of obtaining backfill material from the proposed source.
- .10 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

141.4 CONSTRUCTION

.1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Each pipe section shall be clearly labeled with "NBDTI" on the inside.
- .3 The Engineer shall have the right to inspect the manufacture of any pipes and appurtenances supplied under this Item.
- .4 The Contractor shall notify the Engineer at least 5 Days before commencing any phase of the manufacture to allow for scheduling of the Owner's inspection.
- .5 The Engineer shall have the authority to order production to stop if the Work does not conform to the Plans, shop drawings or Specifications.
- .6 The manufacturer shall provide safe working conditions for the Engineer.
- .7 The manufacturer shall provide regular and practically located office space at the fabrication plant to accommodate the Engineer.
 - .1 The office space shall be clean and furnished with a suitable standard office desk and chair, adequate lighting, and ventilation and heating to provide a room temperature of approximately 20°C.
 - .2 Convenient telephone, internet, facsimile, photocopy, mail and message handling services shall also be provided.

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141.4 .2 Pipe Fabrication

- .1 Pipe fabrication shall be in accordance with Table 141-2 and Table 141-3, and such that specified installation tolerances are attainable.
- .2 Reinforced steel cages shall extend into the bell and spigot.

Table 141-2
Reinforced Concrete Pipe Fabrication Requirements

Pipe Diameter (mm)	Applicable Standards	Additional Standards / Requirements for Concrete	Duration of Moist Curing
1350 to 2700	CSA A257.2, CSA A257.3	CSA A23.1 and A23.2, exposure class C-1; air content of 5 to 8%.	Until min. concrete strength of 20 MPa is attained.
≥ 3000	CSA-S6 ASTM C1417	CSA A23.1 and A23.2, exposure class C-1; air content of 5 to 8%; calcium nitrite corrosion inhibitor at a rate of 15 L/m ³ .	Until min. concrete strength of 35 MPa is attained.

Table 141-3
Requirements for Reinforcing Steel Cover for Reinforced Concrete Pipes & Appurtenances

Pipe Diameter	Concrete Cover Over Reinforcing Steel		
	Circumferential Steel (Pipe)	Weirs / Baffles, Cut-off Walls / Footings	Slope of Beveled Ends
< 3000 mm	25 mm; min. 19 mm	50 mm ± 10 mm	50 mm ± 10 mm
≥ 3000 mm	40 mm ± 10 mm	50 mm ± 10 mm	50 mm ± 10 mm

141.4 .3 Forms

- .1 Forms shall be a configuration to ensure compliance with the allowable tolerances.
- .2 Forms shall be clean and free of mortar prior to application of form coating.
- .3 Forms shall be complete and inspected by the Engineer before placing of concrete shall be permitted.
- .4 Permanently exposed sharp edges shall be chamfered with triangular fillets, 19 mm by 19 mm, made of steel, plastic, or clear straight-grained wood placed on the side exposed to concrete.
- .5 The minimum cover over form snap-ties shall be 50 mm and the voids shall be filled to their entire depth with an approved cement grout mix per 141.4.5.

141.4 .4 Curing and Protection of Concrete

- .1 Moist curing of the concrete sections shall be carried out in accordance with CSA A23.1, per Table 141-2.
- .2 Artificially accelerated curing of the concrete sections shall be in accordance with CSA A23.4 and the following:
 - .1 The concrete sections shall be maintained on the casting bed in an approved enclosure that ensures full circulation of thoroughly saturated air and/or steam around the concrete sections with a minimum loss of moisture and heat.

CONCRETE PIPE - LARGE

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- 141.4.4.2 .2 During the initial curing period (typically 4 to 5 hours after casting) the enclosure temperature shall be kept at approximately 20°C.
- .3 For the next stage of curing, the enclosure temperature shall be raised at a rate not to exceed 15°C per hour, to a temperature between 40 and 60°C.
- .1 The temperature differential within the enclosure shall not exceed 5°C.
- .4 Steam, radiant heat or forced air used for accelerated curing shall not be applied before the initial set; shall provide excess moisture for proper hydration of the cement; and shall not be applied directly to the concrete, forms or cylinders.
- .5 The exposed surfaces of the concrete shall have an excess of moisture during the entire curing period. Water applied for this purpose shall have a temperature that varies no more than 10°C from the concrete temperature, and in no case shall exceed 60°C.
- .6 The Contractor/Manufacturer shall provide a continuous record of curing temperatures for the entire curing period by means of approved accurate automatic recording devices; one device per length of the curing enclosure to record the temperature.
- .7 When a concrete section has reached its required strength the enclosure temperature shall be lowered, at a rate of 15°C per hour, to the ambient air temperature.
- .8 Culvert sections shall not be exposed to freezing temperatures until they have dried 48 hours in warm temperatures following curing, and cooled at not more than 5°C per hour to the outside air temperature.

141.4 .5 Finishing of Concrete Surfaces

- .1 All surfaces of the precast concrete sections shall receive an "Ordinary Surface Finish" in accordance with the following:
- .1 All surface voids larger than 12 mm in diameter and cavities, or holes visible upon the removal of the formwork, shall be filled to their entire depth with an approved cement grout mix of cement and fine sand from the same source as used in the concrete and incorporate a latex bonding agent.
- .2 All objectionable fins, projections, offsets, streaks or other surface imperfections shall be totally removed to the Engineer's satisfaction.
- .3 If the concrete surface does not adequately fulfill the requirements for Ordinary Surface Finish, the Contractor shall, as directed by the Engineer, entirely remove certain designated portions, or all of the concrete, and replace with new concrete.
- .2 Immediately after the removal of forms, any part of the Work which displays defects shall be clearly marked and the Contractor shall notify the Engineer of the location and extent of the defect.
- .1 The Contractor shall submit a repair procedure for approval.
- .1 Cement washes of any kind shall not be used.
- .2 All defects shall be finished smooth, uniformly colour matched and flush with the adjacent surface.
- .3 All ridges occurring at junctions of form panels shall be ground smooth.

141.4 .6 Pipe Less Than 3000 mm in Diameter – Fabrication & Testing

- .1 Before delivery of pipe sections, and on at least 5 Days notice to the Engineer, the manufacturer shall perform D-load testing (Three-Edge Bearing Test) in the presence of the Engineer.
- .2 The Engineer shall select at random one pipe section per size and class from among those produced for the Contract or supplied from stock. If no 0.3 mm crack has developed at the D-load specified for the size and class of pipe tested, further load shall be applied until a 0.3 mm crack develops or a load 5% greater than the specified load is reached, whichever occurs first.
- .3 The manufacturer shall clearly mark on the inside of test sections the following: on all test sections, the word "TESTED"; and on sections that failed or were tested to ultimate strength, the word "REJECT".
- .4 In the event of disagreement between the manufacturer/supplier and the Engineer in verification of the 0.3 mm crack on a culvert section being tested, that section may be tested to its ultimate strength at the Contractor's expense.
- .5 During production, quality control testing and test sampling per 302.4 shall be carried out for every 15 m³ of concrete placed.
 - .1 For concrete placements under 15 m³, a minimum of one set of cylinders and air content tests shall be carried out per half Days production.

141.4 .7 Pipe 3000 mm in Diameter and Larger- Manufacture & Testing

- .1 All Work shall be carried out in the presence of the Engineer.
- .2 Sampling, test cylinders and air content tests shall be performed by the manufacturer in accordance with CSA A23.2.
 - .1 A strength test is defined as a minimum of 2 cylinders broken at the specified age, with additional cylinders broken at earlier dates for production purposes.
 - .2 For dry-cast precast concrete sections, air content shall be tested on every section and a strength test shall be taken on every second section.
 - .3 For wet-cast precast concrete sections, air content and one strength test shall be taken on every section.
 - .4 If superplasticizers are added, the air content test shall be performed after the addition of the superplasticizer.

141.4 .8 Weirs and Baffles

- .1 Each weir/baffle shall be positioned under the lifting device so the top is horizontal in the transverse direction when the pipe is installed.
- .2 Each weir/baffle shall have two rows of reinforcement and shall be secured to the pipe invert by a method approved by the Engineer.
- .3 Concrete for weirs and baffles shall match the concrete of the pipe in colour and consistency, and shall be moist cured for a minimum of 72 hours.

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141.4.8 .4 When drilled holes and dowels are used to attach weirs/baffles to the invert, the holes shall be drilled to a minimum of 100 mm, and the dowels shall be secured with an epoxy or acrylic adhesive such as Epcon A7+ or approved equivalent.

141.4 .9 Bevelled End Sections

- .1 Bevelled ends shall be constructed as shown on the Plans or shop drawings.
- .2 The bevel shall be capped with concrete matching the colour and consistency of the pipe's concrete. Capping concrete shall be finished smooth and moist cured for a minimum of 72 hours.
- .3 Saw-cut bevels shall be roughened before being capped.
- .4 A slurry coat of Engineer-approved bonding agent shall be applied before capping concrete is placed.

141.4 .10 Placement

- .1 The Engineer shall provide control points in the field for vertical and horizontal control at selected locations or as otherwise required.
- .2 The Contractor shall be responsible for the layout and maintenance of all lines and grades for the Work as shown on the Plans.
- .3 Excavation shall be carried out in accordance with 161.4 and to the limits as indicated on Standard Drawings 161-1 to 161-5, or as specified in the Contract Documents.
 - .1 If Overexcavation occurs, the Contractor shall, at his/her own expense, repair and fill the Overexcavation with an approved backfill material, placed in accordance with Item 936, and compacted to 95% of the maximum dry density.
- .4 Pipes shall be placed as shown on the Plans and/or shop drawings.
- .5 Pipe sections shall be joined in a straight line using standard industry methods, proceeding up grade with bell end up grade. Each pipe section shall be set into place and positioned together as recommended by the lifting device manufacturer.
- .6 The maximum joint gap between pipe sections shall be 13 mm for pipes up to 1500 mm diameter, and 20 mm for pipes of 1800 mm diameter and larger.
 - .1 Where the joint gap exceeds the above tolerances, sections shall be removed and reset to meet the specified tolerance, at the Contractor's expense.
- .7 Precast cut-off walls under this Item, or cast-in-place headwalls under Item 301, shall be set at the elevations and offsets shown on the Plans and/or shop drawings, or if site conditions differ from the Plans, as directed by the Engineer.
 - .1 An inlet cut-off wall or headwall shall not be placed until enough culvert sections have been placed per 141.4.10.5 to ensure that the inlet end section line up with the wall to the satisfaction of the Engineer. If the pipe fails to line up with the wall as specified, the Contractor shall make necessary corrections at his/her expense.
 - .2 Following placement and backfilling of a precast cut-off wall, the top pre-formed surface of the wall shall be "battered" with a 25 mm layer of non-shrink grout and the culvert end section immediately set into place on it.

- 141.4.10.7 .3 With the end section in place, the Contractor shall core drill 30 mm diameter holes through the end section and to a nominal depth of 150 mm into the top of the cut-off wall.
- .4 The 25 M dowels shall be inserted and secured into place using an epoxy or acrylic adhesive such as Epcon A7+ or an approved equivalent.
- .8 Sections of concrete pipe marked as having been tested for D-loading shall be placed only at the inlet or outlet end of the installed culvert.
- .9 Gaskets shall be installed per the pipe manufacturer's instructions.
- .10 Pipe sections with weirs or baffles shall be installed with the weir or baffle top horizontal in the transverse direction, with a maximum installed tolerance of 2% vertically over the full horizontal length of the weir.
- .11 All other appurtenances shall be installed as shown on the Plans.
- .12 Lifting anchor recesses shall be entirely grouted in with non-shrink grout.
- .13 Backfill shall be placed and shaped to lines and grades as indicated on Standard Drawings 161-1 to 161-5.
- .1 If the pipe shall have an induced trench constructed over it under Item 169, backfill shall be placed and shaped as noted in the Contract Documents.
- .14 No backfill shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of excavation and the character of foundation materials.
- .1 Material over 75 mm in size shall not be placed within 300 mm of any concrete pipe.
- .2 Backfill shall be placed in lifts of not more than 200 mm in thickness for vibratory plate or rammer-type compactors and not more than 300 mm in thickness for vibratory rollers.
- .3 Backfill shall be compacted in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .15 Backfilling of concrete pipe shall proceed simultaneous and evenly on both sides of the Structure and shall never exceed 600 mm in differential elevation.
- .16 No traffic or construction equipment shall be permitted to pass over the concrete pipe until the backfill cover indicated on Standard Drawings 161-1 to 161-5 and/or in the Contract Documents has been placed.
- .17 Shoring, bracing, sheeting, pumps, temporary roads and/or bridges that are necessary for the Work shall be employed, maintained and removed by the Contractor.
- .18 The Contractor shall construct, maintain and remove temporary construction detours around the pipe and appurtenances as required in accordance with Item 918.

CONCRETE PIPE - LARGE

ITEM: 141

141.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of reinforced concrete pipe supplied and installed in accordance with this Item.
 - .1 The measurement shall be taken along the invert of the pipe.

141.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of reinforced concrete pipe, as identified under the Contract.
- .2 The Owner shall make partial payment for reinforced concrete pipe in accordance with 908.7.

PRECAST CONCRETE BOX CULVERT

ITEM: 142

142.1 DESCRIPTION

- .1 This Item consists of the supply and installation of precast concrete box Culvert section(s).

142.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Concrete shall meet the requirements of CSA A23.1 and CSA A23.2.
 - .1 Exposure Class shall be C-XL.
 - .2 Air content shall be 5 to 8%.
- .3 Interior water tight joint seal shall be Rub'r-Nek, size per joint seal manufacturer's written recommendations, or approved equivalent.
- .4 Exterior joint wrap shall be 300 mm wide Conwrap, ConSeal CS-212 or approved equivalent, with primers recommended by the manufacturer.
- .5 The calcium nitrite corrosion inhibitor shall conform to the following:
 - .1 The dosage rate shall be 15 L/m³.
 - .2 The corrosion inhibiting calcium nitrite admixture shall contain between 30% to 36% calcium nitrite by weight of solution.
 - .3 The calcium nitrite shall be added at the concrete ready mix plant and verification shall be provided to the Engineer for the quantity of the calcium nitrite added to each batch of concrete.
 - .1 Acceptable verification shall include, but is not necessarily limited to, printouts from computerized batch plants or printouts from computerized admixture dispensing units.
 - .2 Verification shall be provided on the delivery slip.
- .6 Dowels for attachment of cut-off walls to box Culverts shall be 25 M deformed reinforcing steel bars.
- .7 Reinforcing steel shall be rebar conforming to 304.2 and/or welded deformed steel wire fabric conforming to ASTM A1064.
 - .1 Welding of reinforcing steel, including tack welding, is prohibited unless otherwise indicated on the Contract Documents.
- .8 Weirs, baffles and headwalls shall be reinforced and secured to the Culvert by a method approved by the Engineer and moist cured for a minimum of 72 hours.
 - .1 When drilled holes and dowels are used to attach weirs/baffles to the invert, and headwalls to boxes, the holes shall be drilled to a minimum depth of 100 mm, and the dowels shall be secured with an epoxy or acrylic adhesive such as Epcon A7 or approved equivalent.
 - .2 Reinforcement shall be placed in both faces of weirs, baffles, headwalls and cut-off walls.
 - .1 The maximum spacing of reinforcing steel for weirs, baffles, headwalls and cut-off walls shall be 300 mm.

PRECAST CONCRETE BOX CULVERT

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- 142.2.8 .3 The concrete for precast weirs, baffles, headwalls and cut-off walls shall have an air content of 5 to 8%.
- .4 Weirs, baffles, headwalls and cut-off walls shall be made with the same concrete requirements as the Culvert.
- .9 Non-shrink grout shall conform to ASTM C1107.
- .10 Levelling sand shall be clean, non-plastic, free of deleterious materials and shall be a natural or manufactured crusher Dust obtained from crushing bedrock.
- .1 Sand (including crusher Dust) shall meet the grading limits as shown in Table 142-1, when tested in accordance with ASTM C136.

Table 142-1
Grading Requirements for Levelling Sand

ASTM Sieve Size	Percent Passing
9.5 mm	100
4.75 mm	95 to 100
2.36 mm	80 to 100
1.18 mm	50 to 90
600 µm	25 to 65
300 µm	10 to 35
75 µm	2 to 10

- .11 Lifting anchorage devices shall be Dayton Superior Swift Lift Systems or equivalent, of sufficient capacity for handling and placing the Culvert sections.
- .12 Rigid sheets (boards, plywood, sheet metal or similar) for placing under joints shall be of sufficient durability so as to allow adjacent Culvert sections to slide into place.
 - .1 The supplied rigid sheets shall be of a length to extend beyond each side of the box Culvert.
- .13 Reinforcing supports shall be made of plastic, stainless steel, or galvanized steel with a minimum of 25 mm of cover.
- .14 Side form spacers shall be made entirely of plastic or entirely of stainless steel.
- .15 Backfill material shall be Class "A" per 167.2.
 - .1 Backfill material shall be obtained from within the Work Site as approved by the Engineer.
 - .2 If sufficient quantities of suitable backfill material are not available within the Work Site, as determined by the Engineer, additional backfill shall be imported by the Contractor in accordance with Item 167 from a source approved by the Engineer.

142.3 SUBMITTALS

- .1 The Contractor shall submit, in accordance with Item 956, shop drawings for each precast concrete box Culvert, containing but not limited to, the following information:

PRECAST CONCRETE BOX CULVERT

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- 142.3.1 .1 Station of culvert, name of watercourse, and DTI Contract number and description;
.2 General layout showing all box culvert sections and appurtenances;
.3 Length and weight (mass) of individual sections;
.4 Joint details (including gap, gasket, connection plates and waterproofing);
.5 Proposed construction joints (if sections not cast monolithically);
.6 Location and type of inserts and lift devices (including location where rebar and/or mesh will be cut for lifting anchors);
.7 Location of reinforcing steel;
.8 Bar schedules for all reinforcing steel;
.9 Itemized supply list;
.10 Detail showing year of fabrication embedded in the headwalls;
.11 Concrete design strength, age of test, form removal strength and shipping strength;
.12 Two sets of design calculations; and
.13 Location of manufacturing plant.
.14 BOXCAR design input and output, including printouts of outputs for load cases as indicated on the Contract Documents.
.1 BOXCAR design input shall be in accordance with the Supplement to Item 142 of the Contract Documents.
- .2 The proposed mix proportions (design), shall be submitted to the Engineer for review at least 14 Days before concrete production is due to start.
- .1 The Contractor shall submit a production schedule to the Engineer.
- .2 The Contractor shall submit to the Engineer the proposed method and sequence to be employed for the curing and protection of the precast concrete sections.
- .3 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification that the materials to be supplied for the fabrication meet the specified requirements.
- .4 The Contractor shall submit, upon request, the proposed source of the supply of the backfill material from within the Work Site.
- .5 If the source of the supply of the backfill material is located outside the Work Site, the Contractor shall submit the proposed source, in writing, for the approval of the Engineer, at least 14 Days in advance of obtaining backfill material from the proposed source.
- .6 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

142.4 CONSTRUCTION

142.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall comply with the requirements of CSA A23.4 and ASTM C1433 with respect to fabrication, transportation, storage and delivery of the precast concrete box Culvert sections.
- .1 Reinforcing steel bars or wire mesh shall have a minimum concrete cover of 55 mm ± 10 mm.
- .2 At joints, the minimum concrete cover shall be 13 mm for all longitudinal steel from the end of the bell and spigot.

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- 142.4.1.2 .3 For circumferential steel, in the bell and spigot, the minimum concrete cover shall be 13 mm and the maximum concrete cover shall be 50 mm.
- .4 Two additional anchors shall be installed on the inside of each box at approximately one-third of the height of the inside wall, mid length and on opposite sides for jacking boxes to home the joints for a tight seal.
- .3 All aspects of precast concrete work shall comply with CSA A23.1 and CSA A23.4 and shall be to the satisfaction of the Engineer.
- .4 Manufacture of the box Culvert sections shall not commence until the Shop Drawings have been reviewed by the Engineer.
 - .1 The Engineer's written notice of review of the Shop Drawings shall in no way relieve the manufacturer of the responsibility for correctness of dimensions, size of components and details of fabrication in accordance with 142.3.1.
- .5 The Contractor shall ensure that the manufacturer notifies the Engineer at least 5 Days in advance of the commencement of any phase of the manufacture so that the DTI-assigned inspector can be scheduled.
 - .1 The Engineer shall have the right to inspect the manufacture of the precast sections, and the authority to order the Work to stop if it does not conform to the Plans, Shop Drawings or Specifications.
 - .2 The manufacturer shall ensure that safe working conditions exist for the Engineer.
- .6 The manufacturer shall provide regular and practically located office space at the fabrication plant to accommodate the Engineer.
 - .1 The office space shall be clean and furnished with a suitable office desk and chair, adequate lighting, and ventilation and heating to provide a room temperature of approximately 20°C.
 - .2 Convenient telephone, internet, facsimile, photocopy, mail and message handling services shall also be provided.
- .7 Shop drawings may show a design with wall and slab thicknesses different from those on the Plans, but the inside dimensions (ID) of the span and the rise shall not be less than those indicated on the Plans.
- .8 The cured Culvert sections shall be fitted horizontally at the plant to a gasket-free gap of 10 mm or less, and the joints so fitted shall be sequentially numbered on the outside of each unit, to ensure proper fit at the Work Site.
- .9 Waterproofing, if required, shall be carried out in accordance with Item 351.
- 142.4 .2 Culvert Design
 - .1 Box culvert design shall be in accordance with the latest editions of CAN/CSA-S6 for the worst-case loading of either 0.7 m of earth fill or finished grade plus 1.0 m of earth fill.
 - .1 Earth fill material shall have a design density of 2.15 t/m³ and a soil structure interaction factor of 1.15.
 - .2 The live loading shall conform to CL-625-ONT live loading.

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142.4.2 .3 Box culvert design shall be carried out using the "CHBDC" design option contained within the latest edition of the BOXCAR software sponsored by the American Concrete Pipe Association.

142.4 .3 Forms

- .1 Forms shall be of a configuration to ensure compliance with the allowable tolerances.
- .2 Forms shall be clean and free of mortar prior to application of form coating.
- .3 Forms shall be complete and inspected by the Engineer before placing of concrete shall be permitted.
- .4 Permanently exposed sharp edges shall be chamfered with triangular fillets, 19 mm by 19 mm, made of steel, plastic, or clear straight-grained wood placed on the side exposed to concrete.
- .5 The minimum cover over form snap-ties shall be 50 mm and the voids shall be filled to their entire depth with an approved cement grout mix per 142.4.6.

142.4 .4 Material Testing

- .1 Sampling, test cylinders and air content tests shall be performed by the manufacturer in accordance with CSA A23.2.
 - .1 A strength test is defined as a minimum of 2 cylinders broken at the specified age, with additional cylinders broken at earlier dates for production purposes.
 - .2 For dry-cast precast concrete sections, air content shall be tested on every section and a strength test shall be taken on every second section.
 - .3 For wet-cast precast concrete sections, air content and one strength test shall be taken on every section.
 - .4 If superplasticizers are added, the air content test shall be performed after the addition of the superplasticizer.

142.4 .5 Curing and Protection of Concrete

- .1 Moist curing of the concrete sections shall be carried out in accordance with CSA A23.1, until the design strength is reached.
- .2 Artificially accelerated curing of the concrete sections shall be in accordance with CSA A23.4 and the following:
 - .1 The concrete sections shall be maintained on the casting bed in an approved enclosure that ensures full circulation of thoroughly saturated air and/or steam around the concrete sections with a minimum loss of moisture and heat.
 - .2 During the initial curing period (typically 4 to 5 hours after casting) the enclosure temperature shall be kept at approximately 20°C.
 - .3 For the next stage of curing, the enclosure temperature shall be raised at a rate not to exceed 15°C per hour, to a temperature between 40 and 60°C.
 - .1 The temperature differential within the enclosure shall not exceed 5°C.

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- 142.4.5.2 .4 Steam, radiant heat or forced air used for accelerated curing shall not be applied before the initial set; shall provide excess moisture for proper hydration of the cement; and shall not be applied directly to the concrete, forms or cylinders.
- .5 The exposed surfaces of the concrete shall have an excess of moisture during the entire curing period. Water applied for this purpose shall have a temperature that varies no more than 10°C from the concrete temperature, and in no case shall exceed 60°C.
- .6 The Contractor/Manufacturer shall provide a continuous record of curing temperatures for the entire curing period by means of approved accurate automatic recording devices; one device per length of the curing enclosure to record the temperature.
- .7 When a concrete section has reached its required strength the enclosure temperature shall be lowered, at a rate of 15°C per hour, to the ambient air temperature.
- .8 Culvert section(s) shall not be exposed to freezing temperatures until they have dried 48 hours in warm temperatures following curing, and cooled at not more than 5°C per hour to the outside air temperature.

142.4 .6 Finishing of Concrete Surfaces

- .1 All surfaces of the precast concrete sections shall receive an "Ordinary Surface Finish" in accordance with the following:
- .1 All surface voids larger than 12 mm in diameter and cavities, or holes visible upon the removal of the formwork, shall be filled to their entire depth with an approved cement grout mix of cement and fine sand from the same source as used in the concrete and incorporate a latex bonding agent.
- .2 All objectionable fins, projections, offsets, streaks or other surface imperfections shall be totally removed to the Engineer's satisfaction.
- .3 If the concrete surface does not adequately fulfill the requirements for Ordinary Surface Finish, the Contractor shall, as directed by the Engineer, entirely remove certain designated portions, or all of the concrete, and replace with new concrete.
- .2 Immediately after the removal of forms, any part of the Work which displays defects shall be clearly marked and the Contractor shall notify the Engineer of the location and extent of the defect.
- .1 The Contractor shall submit a repair procedure for approval.
- .1 Cement washes of any kind shall not be used.
- .2 All defects shall be finished smooth, uniformly colour matched and flush with the adjacent surface.
- .3 All ridges occurring at junctions of form panels shall be ground smooth.
- .4 Exposed ends of lifting devices that have been cut off shall be painted with an approved coating to prevent rusting.

142.4 .7 Culvert Placement

- .1 Excavation shall be carried out in accordance with 161.4 and as specified in the Contract Documents.

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- 142.4.7.1
- .1 If Overexcavation occurs, the Contractor shall, at his/her own expense, repair and fill the Overexcavation with an approved backfill material, place in accordance with Item 936, and compacted to 95% of the maximum dry density.
 - .2 Following placement and backfilling of the cut-off wall, the top horizontal surface of the cut-off wall shall be "battered" with a 25 mm layer of non-shrink grout and the bevelled end section shall be immediately set into place on the cut-off wall.
 - .3 With the end section in place, the Contractor shall core drill 30 mm diameter holes through the end section and to a nominal depth of 150 mm into the top of the cut-off wall.
 - .4 The 25 M dowels shall be inserted and secured into place using an epoxy or acrylic adhesive such as Epcon A7 or an approved equivalent.
 - .5 The Contractor shall place a minimum thickness of 50 mm of bed levelling sand, compacted and raked or screeded to provide a uniform bedding surface, over the entire foundation area of the Culvert.
 - .6 A rigid sheet shall be installed flush with the bed levelling material surface and centred under each joint of the Culvert sections, such that when sections are joined, sand and other materials are prevented from entering and contaminating the joint.
 - .7 Precast concrete box Culvert sections shall be erected in the sequence indicated on the manufacturer's shop drawings.
 - .1 Deviation from the manufacturer's shop drawings shall not be permitted without the written authorization of the Engineer.
 - .8 Culvert sections shall be joined in a straight line using industry methods, with the bell end up grade. Each Culvert section shall be set into place and positioned together as recommended by the manufacturer of the lifting device.
 - .1 After final alignment of each box Culvert section by overhead means, homing shall be performed by jacking or winching with "come-alongs" attached to the inner anchors while the box Culvert section is still suspended.
 - .2 Boxes that are subsequently moved after the gasket joint seal has been compressed, will require re-installation with a replacement gasket.
 - .9 The maximum joint gap between any two box Culvert sections shall be 20 mm uniformly across the joint with the sections in straight alignment.
 - .1 Sections set to a joint gap greater than 20 mm shall be removed and reset to the specified gap.
 - .2 Sections which cannot be reset as 142.4.7.8 shall be rejected.
 - .10 After satisfactory placement of the Culvert sections, all anchor pockets shall be filled with non-shrink grout.
 - .11 Joint seal and exterior wrap material and appurtenances shall be installed in accordance with the manufacturer's specifications.
 - .1 Joint seal shall be placed around the entire joint.

PRECAST CONCRETE BOX CULVERT

ITEM: 142

- 142.4.7 .12 Backfill shall be carried out in accordance with 166.4 and as specified in the Contract Documents.
- .13 No backfill shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of excavation and the character of foundation materials.
- .1 .1 Material over 75 mm in size shall not be placed within 300 mm of the Culvert.
- .2 Backfill shall be placed in lifts of not more than 200 mm in thickness for vibratory plate or rammer-type compactors and not more than 300 mm in thickness for vibratory rollers.
- .3 Backfill shall be compacted in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .14 Backfilling of box Culverts shall proceed simultaneous and evenly on both sides of the box Culvert and shall never exceed 600 mm in differential elevation.
- .15 No traffic or Equipment shall be allowed to cross over the installed box Culvert until a minimum of 1000 mm of backfill material has been placed over the box Culvert in the area of crossing.
- .16 Shoring, bracing, sheeting, pumps, temporary roads and/or bridges that are necessary for the Work shall be employed, maintained and removed by the Contractor.

142.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of precast concrete box Culvert supplied and installed in accordance with this Item.
- .1 The measurement shall be taken along the inside bottom centreline of the box Culvert from end section to end section.

142.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of precast concrete box Culvert, as identified under the Contract.
- .2 The Owner shall make partial payment for precast concrete box Culvert in accordance with 908.7.

FOUNDATION EXCAVATION

ITEM: 161

161.1 DESCRIPTION

- .1 This Item consists of excavation necessary for the construction and/or removal of Structures, and placement of materials within the Work Site, or disposal outside the Work Site.
- .2 Foundation Excavation is classified by the type(s) of material encountered as indicated in Table 161-1.

**Table 161-1
Definition of Foundation Excavation by Type**

A	Foundation excavation of common material as defined by Item 106
B	Foundation excavation of unclassified material as defined by Item 107
C	Foundation excavation of solid rock as defined by Item 108

161.2 MATERIALS

- .1 None identified.

161.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

161.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Excavation shall be carried out to the dimensions as indicated on Standard Drawings 161-1 to 161-7, unless otherwise indicated in the Contract Documents.
- .3 For induced trench locations (to be completed under Item 169), the Contractor shall carry out the excavation to the dimensions indicated in the Contract Documents.
- .4 The Contractor shall not commence any excavation until the Owner's initial cross-section survey is complete for the Work Area involved.
- .5 The Contractor shall immediately notify the Engineer when bedrock or boulders are encountered.
- .6 Shoring, bracing, sheeting, pumps, temporary roads and/or Bridges that are necessary for the Work shall be employed, maintained and removed by the Contractor.
- .7 Excavated materials that meet the requirements of 167.2 shall be used as backfill.
- .8 Excavated materials not required or unsuitable for backfill shall be utilized as directed by the Engineer and as follows:
 - .1 For embankment construction within the Work Site and placed in accordance with 106.4, 107.4 and/or 108.4.
 - .2 Material identified by the Engineer as waste shall become the property of the Contractor and shall be disposed of in accordance with Item 947.

FOUNDATION EXCAVATION

ITEM: 161

- 161.4 .9 Where foundation excavation involves removal of existing Culverts, the Contractor shall take care to ensure that any existing pipe is not damaged during excavation and is salvaged for re-use.
- .1 The Contractor shall notify the Engineer prior to exposing any existing pipe.
 - .2 Any pipe determined by the Engineer to be salvageable shall remain the property of the Owner.
 - .3 Salvageable pipe shall be re-used in the Work Site or transported, by the Contractor, to the nearest DTI Maintenance Depot.
 - .4 Unsalvageable pipe and waste shall become the property of the Contractor and shall be disposed of outside the Work Site.
 - .5 The Contractor shall be responsible to replace the pipe which is damaged, where such damage is the result of the Contractor's actions, as determined by the Engineer.
- .10 Where the Finished Grade is the same as the existing Pavement surface, the Pavement shall be cut in a straight line to a straight edge on each side of the trench or hole and removed separately from the underlying material.
- .1 The Contractor shall break down the Pavement pieces to a size small enough to be suitable for use in embankment construction.
 - .2 Any existing Aggregate Base/Subbase shall be excavated and stockpiled separately from Subgrade materials for re-use under 166.2 at the Work Area.
- .11 The Contractor shall notify the Engineer after the excavation is completed.
- .12 No backfill material, formwork, pipe or other Structure(s) shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of the excavation and the nature of the foundation materials.
- .13 The bottom of the foundation excavation for footings founded on solid rock shall be cleaned of all loose rock and soil.

161.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres excavated in accordance with this Item.
- .2 The volume shall be calculated from the dimensions shown on the Standard Drawings and/or the Contract Documents.
- .3 If Foundation Excavation types "A" and "C" have been tendered, any overlying common material shall be removed sufficiently to allow the Engineer to take measurements of the bedrock surface before any blasting or excavation of the bedrock takes place.
 - .1 Boulders shall be excavated when encountered and separated for the Engineer to measure before disposal.

161.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of excavation, as identified under the Contract.

BACKFILLING AROUND STRUCTURES

ITEM: 166

166.1 DESCRIPTION

- .1 This Item consists of the placement of backfill material around a Structure.

166.2 MATERIALS

- .1 Suitable material obtained from the excavation within the Work Site and meeting the requirements of 167.2 shall be used for backfilling around Structures.
 - .1 Class "A" backfill shall be used for backfilling metal Culverts (pipes), concrete pipes over 900 mm in diameter and concrete box Culverts.
 - .2 Class "B" backfill shall be used for backfilling catch basins, footings, and concrete pipes 900 mm or smaller in diameter.
- .2 Additional backfill, if authorized by the Engineer, shall be supplied in accordance with Item 167.

166.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

166.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Backfilling to be carried out to the lines and grades as indicated on Standard Drawings 161-1 to 161-7, unless otherwise indicated in the Contract Documents.
- .3 If the Structure being backfilled is to be constructed with an induced trench design, additional specific backfilling requirements, as noted in the Contract Documents, shall apply.
- .4 No backfill material shall be placed in the excavation until the excavation has been approved by the Engineer, including but not limited to the dimensions of excavation and the nature of foundation materials.
 - .1 Material over 75 mm in size shall not be placed within 300 mm of any Structure.
 - .2 Backfill shall be placed in lifts of not more than 200 mm in thickness for vibratory plate or rammer-type compactors and not more than 300 mm in thickness for vibratory rollers.
 - .3 Backfill shall be compacted in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .5 Only compactors recommended by the pipe manufacturer shall be used within 1 m of metal pipes.
- .6 Backfilling of Structures shall proceed simultaneously and evenly on both sides of the Structure and shall never exceed 600 mm in differential elevation.

BACKFILLING AROUND STRUCTURES

ITEM: 166

- 166.4 .7 No traffic or construction Equipment shall be permitted to pass over the Structure until the backfill cover indicated on the Standard Drawings 161-1 to 161-5 and/or in the Contract Documents has been placed.
- .8 Shoring, bracing, sheeting, pumps, temporary roads and/or Bridges that are necessary for the Work shall be employed, maintained and removed by the Contractor.

166.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the volume in cubic metres of backfilling around a Structure carried out in accordance with this Item.
- .2 The volume shall be calculated from the dimensions shown on the Standard Drawings and/or the Contract Documents.

166.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 Overhaul of suitable material obtained from the excavation within the Work Site, as approved by the Engineer, shall be paid in accordance with Item(s) 806, 807, and/or 808, as applicable.

BACKFILL FOR STRUCTURES

ITEM: 167

167.1 DESCRIPTION

- .1 This Item consists of supplying backfill obtained from outside the Work Site.

167.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 It shall be the responsibility of the Contractor to provide the pit and/or quarry source for supply unless the source of the materials is specified in the Contract Documents.
- .3 Backfill for Structures shall satisfy the requirements for the material type and the gradation as indicated in Table 167-1.

Table 167-1
Backfill for Structures

Class	Description
A	Class "A" backfill shall be a well graded granular material composed of clean, uncoated particles free of lumps of clay or other deleterious material, and having not more than 10% retained on the 100 mm sieve, and not more than 10% Dust.
B	Class "B" backfill shall be a well graded granular material having not more than 10% retained on the 100 mm sieve, and not more than 35% Dust.

167.3 SUBMITTALS

- .1 The Contractor shall submit the proposed backfill source, in writing, for the approval of the Engineer, at least 14 Days in advance of obtaining material from the proposed source.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

167.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall supply the specified material(s) to the Work Area.
- .3 The Contractor shall advise the Engineer immediately of any changes in the source materials, at any time during the course of the Work.
 - .1 Random samples shall be taken and tests conducted by the Engineer to determine the effects of the change.
 - .2 No Work shall be undertaken by the Contractor in the area of the changed conditions until an approval is received from the Engineer.

BACKFILL FOR STRUCTURES

ITEM: 167

167.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tonnes of backfill supplied in accordance with this Item.

167.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each class of backfill, as identified under the Contract.

INDUCED TRENCH

ITEM: 169

169.1 DESCRIPTION

- .1 This Item consists of the construction of an induced trench.

169.2 MATERIALS

- .1 All material shall be supplied by the Contractor.
- .2 Backfill material shall be a lightweight product of a consistent nature, and supplied in a loose, dry, unconsolidated fashion.
 - .1 The Engineer has approved the backfill materials listed in Table 169-1 for use in the Work.

**Table 169-1
Approved Backfill Materials**

Product
Sawdust
Wood chips
Rubber tire chips
Expanded Polystyrene
Loose hay or straw

- .2 Baled hay or straw shall be broken up to a loose condition before placement in the trench.

169.3 SUBMITTALS

- .1 None identified.

169.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall construct the induced trench only after the installation of the pipe and the embankment construction have been completed to the specified elevation and dimensions as indicated in the Contract Documents.
- .3 The Contractor shall excavate a trench in the embankment surface along the centreline of the pipe to the specified dimensions and depth as indicated in the Contract Documents.
 - .1 The material excavated from the trench shall be incorporated into the surrounding embankment.
 - .2 The excavation shall have a tolerance of ± 20 mm in depth and a tolerance of $\pm 10\%$ in width on each side.
- .4 The Contractor shall excavate the trench such that the sides of the trench stand vertically.
 - .1 If the trench walls show signs of sloughing, it shall be the Contractor's responsibility to design, supply and install shoring to maintain the trench walls in a vertical state.

INDUCED TRENCH

ITEM: 169

- 169.4 .5 The trench shall be completely backfilled with the approved material which shall not be compacted.
- .1 The Contractor shall not leave any of the trench open at the end of any Day's operation.
 - .2 If shored, the Contractor shall remove the shoring from the trench after backfilling.
- .6 The Contractor shall place a minimum of 600 mm of embankment material (under the applicable Item) over the induced trench prior to permitting construction traffic to use the Work Area.

169.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the volume in cubic metres of induced trench constructed in accordance with this Item.
- .1 The volume shall be calculated from the dimensions shown in the Contract Documents.

169.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

WILDLIFE FENCE

ITEM: 178

178.1 DESCRIPTION

- .1 This Item consists of the supply and installation of wildlife fence.

178.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

.2 Fence Fabric

- .1 Wildlife fence fabric shall be Style 20-96-6, 2440 mm high, with 20 strands of horizontal wire and 152 mm vertical wire spacing.
- .2 Fence wire shall be 12.5-gauge high tensile steel, hot-dipped galvanized (at 240 g/m²), meeting the requirements of CAN/CGSB 138.1.
- .3 Fasteners shall be 9-gauge aluminum wire or equivalent as recommended by the fence manufacturer.

.3 Posts and Braces

- .1 Line posts shall be hot-dipped galvanized steel T-rails with minimum dimensions as shown on Standard Drawings 178-1 and 178-2, and a minimum unit mass of 1.97 kg/m (after galvanizing). Posts shall be manufactured by Franklin Industries Co. or approved equivalent.
 - .1 Line posts shall have studs for securing fence fabric; posts with holes are not acceptable.
 - .2 Terminal posts shall include straining, corner, end, and gate posts for this Item and for Items 179 and 181.
 - .1 Terminal posts and braces shall be Schedule 40 hot-dipped galvanized steel pipe, scale free and with dimensions per Standard Drawings 178-1, 178-2, 179-1, 179-2, 181-1 and 181-2.

.4 Concrete

- .1 Concrete shall be exposure class F1.
- .2 Material properties shall conform to CSA A23.1 unless otherwise specified herein.
- .3 Cementing materials shall conform to CSA A3001 as indicated in Table 178-1.

Table 178-1
Cementing Materials

Cementing Material	Type of Cement
Hydraulic cement	Type GU
Blended hydraulic cement	Type GUb
Supplementary cementing materials	Types F, S and SF

- .4 Concrete aggregated shall meet the aggregate material properties of 302.2.
- .5 Other admixtures not covered by ASTM shall require approval of the Engineer before being used, and shall conform to the manufacturer's recommendations or otherwise submitted with the design mix.

WILDLIFE FENCE**ITEM: 178**

178.2.4 .6 Curing fabrics shall be burlap or nonwoven geotextile with no holes and capable of readily absorbing and retaining water when soaked or sprayed.

.5 Other Materials

- .1 All nuts, bolts, post caps, crimping sleeves, parts, fittings and specially fabricated components shall be hot-dipped galvanized steel or aluminum alloy.
- .2 Fibre form tubes for concrete bases of terminal posts and braces shall be spiral wound and coated wood-fibreboard tubes manufactured using waterproof glue, having length and diameter per Standard Drawings 178-1 and 178-2.
- .3 Grout for grouting around post holes in rock (bedrock and boulders) shall be a non-shrink type conforming to ASTM C1107 as approved by the Engineer.

178.3 SUBMITTALS

- .1 The Contractor shall submit, prior to the Work, the manufacturer's certification that the materials supplied meet the specified requirements, and the manufacturer's recommended procedures and instructions for handling.
- .2 The Contractor shall submit the name of the proposed concrete source for approval by the Engineer before supplying any concrete to the Work.
- .3 Other submittals for approval include but are not necessarily limited to the following:
 - The name of the proposed cement supplier; and
 - Proof that the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Plant Certification Program or equivalent, in the appropriate categories in accordance with CSA A23.1.
- .1 Only concrete supplied from certified plants will be acceptable.
- .2 Plant certification shall be maintained for the duration of concrete placement until the warranty period of the Work expires.
- .4 The Contractor shall submit the mix design at least 5 Days before concrete production begins.
- .5 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

178.4 CONSTRUCTION

- .1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 General
 - .1 The Work shall meet the requirements of CAN/CGSB-138.3.
 - .2 The Work shall include removal of existing debris that would interfere with or prevent proper installation of the fence or associated gates.
 - .3 Minor ground undulations that would interfere with or prevent proper installation of the fence or associated gates shall be corrected by the Contractor.

- 178.4.2 .4 The Engineer will stake the alignment of each run of wildlife fence as shown on the Plans, to the extent practicable depending on topography, or the requirements of 178.4.2.5.
- .5 The fence line shall be at a distance from the Roadbed beyond the limit of plow-thrown snow or at the following offsets, whichever is greater:
- .1 In areas with no guide rail, as per the Contract Documents;
 - .2 In areas behind guide rail, at least 3 m beyond the toe of slope; and
 - .3 At least 3 m from the existing tree line or clearing limit.
- .6 The end of wildlife fence shall be per the details as shown on the Plans.
- .7 All waste from the Work shall become the property of the Contractor and shall be disposed of outside the Work Site.

.3 Concrete Requirements

- .1 All concrete materials shall be handled and protected in such a way as to prevent segregation, damage and contamination.
- .1 All cement, aggregate and other concrete construction materials shall be stored in accordance with CSA A3001 and CSA A23.1.
- .2 Concrete shall be proportioned in accordance with the submitted mix designs.
- .1 If it is determined during the course of the Work that any concrete has inadequate workability or does not meet the requirements under this Item, the Contractor shall submit a new mix design.
- .3 The following Work shall be in accordance with CSA A23.1:
- Concrete production;
 - Concrete delivery, to be regulated to enable continuous deposition until placement in each section of the Work is complete;
 - Formwork design and construction;
 - Concrete placement, unless otherwise specified herein; and
 - Concrete curing and protection
- .4 Cold weather requirements for concrete shall be per the requirements of 302.4.9.
- .5 Hot weather requirements for concrete shall be per the requirements of 302.4.10.

.4 Installation of Terminal Posts

- .1 Terminal posts for this Item and for Items 179 and 181 shall be installed under this Item as shown in Standard Drawings 178-1, 178-2, 179-1, 179-2, 181-1 and 181-2.
- .2 Terminal posts (straining, corner, end and gate posts) shall be installed to establish the fence line and gate locations.
- .3 A terminal post shall be installed at each change in horizontal direction so that the line posts in between terminal posts are installed only on tangents.

- 178.4.4.3 .1 The fence line around a horizontal roadway curve shall consist of tangent sections of a length dependent on the curve radius, but typically not less than 60 m and in no case more than 90 m.
- .4 The maximum length of any tangent section between two terminal posts shall be 150 m, with an intermediate terminal post at each point the ground slope changes more than 30°, and other terminal posts per 178.4.5.4.1.
- .5 To the extent possible, terminal posts shall be placed where the fence line is on level ground so that braces are similar in length.
- .6 Gate posts shall be placed on level ground so as to be the same height.
- .7 Terminal posts and braces shall be embedded in the ground in concrete-filled fibre form tubes as shown in Standard Drawings 178-1, 178-2, 179-1, 179-2, 181-1 and 181-2.
- .1 The hole for fibre form tubes shall be augered and shall have a diameter not greater than 20% of the tube diameter.
- .2 The tube shall be installed vertically in the hole, with the top projecting 25 mm above existing ground to ensure drainage away from the tube.
- .3 Any void between the tube and hole that is less than 20% of the tube diameter shall be backfilled with well compacted sand before placing concrete.
- .4 If the void is over 20% of the tube diameter the Contractor shall remove the tube, backfill the hole with well compacted excavated material, and auger a new hole that meets 178.4.4.7.1.
- .5 The post shall be supported vertically inside the tube using an Engineer-approved method such that post embedment does not exceed the specified depth and the post is no closer than 50 mm to the wall of the tube. Each brace in a fibre form tube shall be supported in a similar manner.
- .6 Concrete shall be trowel-finished to be crowned at least 25 mm at the post or brace and flush with the rim of the tube for drainage away from the post/brace.
- .1 Surface voids larger than 12 mm diameter shall be infilled with an approved grout containing a latex bonding agent, and removal of other surface defects.
- .8 Concrete bases in organic material or like ground that will not support the concrete base at 1.2 m depth of bury shall be constructed using overlength fibre form tubes, such that the base is set at least 0.8 m into sound material.
- .5 Installation of Line Posts
- .1 All line posts shall be placed vertical.
- .2 Spacing and depth of bury of line posts shall be as shown on Standard Drawings 178-1 and 178-2.
- .3 At an obstruction or major ground elevation difference the post spacing may be reduced to 2.5 m but in no case shall be more than 3.0 m.
- .4 Line posts driven in organic material or like ground that will not support the post at 1.1 m depth of bury shall be extended in length by butt-welding, such that the post can be driven at least 0.4 m into sound material.

178.4.5.4 .1 The Engineer may require intermediate terminal posts in lieu of T-posts where the fence line is in organic material for more than 100 m.

.6 Posts – Other

.1 For embedment of line posts, terminal posts and braces in rock, the drilled hole per Standard Drawings 178-1 and 178-2 shall have a diameter at least 30 mm larger than the post/brace, which shall be centered in the hole and grouted fully around.

.1 In friable rock such as weathered shale or weathered sandstone, posts shall be installed the same as posts in earth.

.2 Tops of posts placed in rock shall be cut to be uniform in height with adjacent posts placed in earth, within the tolerance allowed by 178.4.7.4.2.

.3 On the approaches to small streams the post spacing shall be adjusted per 178.4.5.3 to avoid having any posts in the streambed.

.4 At a depression such as a drainage swale the Contractor shall place short posts in the depression to secure fence fabric as described in 178.4.7.6.

.7 Installation of Fence Fabric

.1 Fence fabric installation shall proceed so that at the end of each Day's Work the installed fence on one side of the highway does not extend farther than the installed fence on the other side by more than 1 km or one Day's Work, whichever is the shorter distance.

.2 Fence fabric shall not be installed until gates within that run or section of fence have been installed, or the opening temporarily blocked at the Contractor's expense by a means acceptable to the Engineer.

.3 Fence fabric shall be erected on the tree-line side of the posts unless site conditions warrant its placement on the highway side.

.1 The fabric shall be tensioned uniformly to minimize distortion, and secured with wire fasteners at top and bottom, and at uniform intervals not exceeding 300 mm, with at least half the fasteners secured at the protruding studs either by hanging or wire fastening.

.2 The fabric shall be secured with wire fasteners that twist around the adjacent horizontal fence fabric stand a minimum of three times on each side of the post, minimizing excess unwrapped tie material.

.1 No alternate means of attachment is acceptable.

.4 The fence fabric shall be installed at a height as follows:

.1 With the bottom strand as close to the ground as practicable and in no case leaving a space more than 120 mm; and

.2 With the top strand 50 mm below the top of posts, or in areas of rough ground not addressed under 178.4.2.3, up to but not above the top of posts.

.5 Fence fabric splices shall be made by butting two vertical strands, wrapping all leading horizontal strands around the two vertical strands and back onto themselves, and tightly twisting them a minimum of three times around the trailing horizontal strands.

WILDLIFE FENCE

ITEM: 178

- 178.4.7 .6 At a depression such as a drainage swale a section of fence shall be cut to fit the depression and fastened to the bottom strand of the main fence and to posts in the stream bottom, as indicated on Standard Drawings 178-1 and 178-2.
- .8 Repairs/ Replacement
- .1 The Contractor shall be responsible, at his own expense and to the Engineer's satisfaction, for repair or replacement of any damage resulting from the Work, including the following:
- .1 Ground exposed by the Work shall be mulched per 616.4 the Day of exposure, and upon completion of fencing Work all damaged slopes shall be reshaped to match adjacent undisturbed ground and hydroseeded per 614.4.
- .2 Damaged areas and butt welds of hot-dipped galvanized materials shall be painted with two coats of similarly coloured inorganic zinc-rich paint.
- .3 All posts that are not installed vertical and/or that are bent or otherwise damaged by the Contractor's actions shall be removed and replaced with new posts at the Contractor's expense and to the satisfaction of the Engineer.

178.5 MEASUREMENT FOR PAYMENT

- .1 The Quantities of materials supplied and installed in accordance with this Item shall be measured for payment as follows:
- .1 Posts
- .1 For T-posts and terminal posts along the fence line and associated with dual ungulate gates and pedestrian gates, measurement will be the number of each type of post embedded in soil (common material) and embedded in rock.
- .2 Posts installed in friable rock per 178.4.6.1.1 will be paid as posts in soil.
- .2 Fence Fabric
- .1 For wildlife fence fabric along the fence line and associated with dual ungulate gates, the number of linear metres of such fence, measured at mid-height from terminal post to terminal post of each continuous run.

178.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of wildlife post and fence installation as identified under the Contract.
- .2 The overlength fibre form tubes and associated extra concrete for terminal post bases per 178.4.4.8 will not be measured separately for payment.
- .3 All cutting and welding Work of line posts per 178.4.5.4 shall be ordered and paid under Item 812.

DUAL ONE-WAY UNGULATE GATES

ITEM: 179

179.1 DESCRIPTION

- .1 This Item consists of the supply and installation of dual one-way ungulate gates.

179.2 MATERIALS

- .1 Posts and fence fabric shall be supplied under Item 178.
- .2 All other materials shall be supplied by the Contractor under this Item.
- .3 Gate materials shall be in accordance with Standard Drawings 179-1 to 179-5.
 - .1 The horizontal top brace of the gate posts shall be hot-dipped galvanized steel angle, 75 mm x 75 mm x 6 mm.
- .4 Low temperature lubricant (such as Chevron Arctic Grease, Irving Lubex Syn2 or approved equivalent) and rubber or neoprene hose boots shall be provided to avoid problems with gates sticking in cold temperatures.
- .5 Tines shall be painted forest green using an Engineer-approved paint suited for galvanized steel applications.
- .6 Hinges for the tines shall have nylon bushings per the Standard Drawings.

179.3 SUBMITTALS

- .1 The Contractor shall submit, prior to the Work, the manufacturer's certification that materials supplied meet the specified requirements, and the manufacturer's recommended procedures and instructions for handling.
- .2 The Contractor shall submit three copies of the shop drawings for the proposed ungulate gate and its connection to the posts.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

179.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Gates shall be fully operational before erection of fence fabric along that run or section of fence or the opening shall be temporarily blocked at the Contractor's expense by a means acceptable to the Engineer.
- .3 Dual one-way ungulate gates typically shall be located within 500 m of the beginning and end of each run of wildlife fence and at intervals of approximately 1000 m, as indicated on the Plans.
 - .1 Variances in gate location up to 100 m longitudinally may be allowed based on unforeseen field conditions, as approved by the Engineer.
- .4 Gates shall be installed as indicated on Standard Drawings 179-1 to 179-5, on 89 mm steel posts installed under Item 178.

DUAL ONE-WAY UNGULATE GATES

ITEM: 179

- 179.4 .5 Placement of gates at large fills, deep cut areas or at utility poles should be avoided as this could restrict wildlife access. The Contractor shall make every effort to install the gates on even terrain.
- .6 All waste shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .7 Repairs/ Replacement
- .1 The Contractor shall be responsible, at his/her own expense and to the Engineer's satisfaction, for repair or replacement of any damage resulting from the Work, including the following:
- .1 Repair of damaged slopes shall include placing mulch per 616.4 on ground exposed by the Work daily and, upon completion of fencing Work, reshaping of disturbed ground to match adjacent undisturbed ground, and hydroseeding per 614.4.
- .2 Damaged areas of hot-dipped galvanized materials shall be painted with two coats of similarly coloured inorganic zinc-rich paint.
- .3 Any gate or component that is bent or otherwise irreparably damaged by the Contractor's actions shall be removed and replaced with a new gate or component, at the Contractor's expense and to the satisfaction of the Engineer.

179.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of dual one-way ungulate gates supplied and installed in accordance with this Item.
- .2 Posts associated with dual ungulate gates shall be measured for payment under Item 178.

179.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

CANTILEVER SLIDE GATE

ITEM: 180

180.1 DESCRIPTION

- .1 This Item consists of supply and installation of cantilever slide gates for vehicular access through wildlife fence at locations shown on the Plans.

180.2 MATERIALS

- .1 Pedestrian gate signs or reflective signs shall be supplied by the Owner.
- .2 All other materials shall be supplied by the Contractor.
- .3 Gate frame rails, cantilever frame rails and accessories shall meet the requirements of CAN/CGSB-138.2 and CAN/CGSB-138.4.
- .4 Posts, braces and rails shall be Schedule 40 hot-dipped galvanized steel pipe, scale-free and having dimensions per Standard Drawings 180-1 to 180-4.
 - .1 The Engineer may entertain alternatives to the gate shown in Standard Drawings 180-1 to 180-4, provided that the materials, size of gate and its operation are at least equivalent to that gate.
- .5 Gate accessories, including bump stop tabs, shall be hot-dipped galvanized and shall meet the requirements of CAN/CGSB-138.4.
 - .1 Bump stop tabs shall be of suitable size and gauge to resist deformation and/or bending due to forces exerted on the gate and posts under normal opening and closing actions.
 - .2 Bump stops shall be rubber or an Engineer-approved equivalent.
- .6 Latches, latch catches and rollers shall be Shield Fence & Wire Products Inc. products as follows, or Engineer-approved equivalent:
 - Cantilever Latch Model CGL238;
 - Cantilever Latch Catch Model CLC412; and
 - Cantilever Roller Model CR412 with sealed bearings and protective cover.
 - .1 Latches shall be capable of being padlocked.
- .7 Fence fabric shall meet the requirements of 178.2.2.
- .8 Chains shall be 4.7 mm, Grade 30, hot-dipped galvanized steel having a nominal length of 450 mm and painted flat black using an Engineer-approved paint suited for galvanized steel applications.
- .9 All nuts, bolts, post caps, crimping sleeves, fittings and specially fabricated components shall be hot-dipped galvanized steel or aluminum alloy.
- .10 Concrete shall meet the requirements of 178.2.4 and 178.4.3.
- .11 Fibre form tubes for concrete bases of terminal posts and braces shall be spiral wound and coated wood-fibreboard tubes manufactured using waterproof glue, with length and diameter per Standard Drawings 180-1 and 180-2.
- .12 All joints and connections shall be shop-welded, cleaned and painted with two coats of similarly coloured inorganic zinc-rich paint.

180.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the Work, the manufacturer's certification that the materials supplied meet the specified requirements, and the manufacturer's recommended procedures and instructions for handling.
- .2 The Contractor shall submit three copies of the shop drawings for the proposed cantilever slide gate, post connections and fittings.
- .3 The Contractor shall submit the name of the proposed concrete source for approval by the Engineer before supplying any concrete to the Work.
- .4 Other submittals for approval include but are not necessarily limited to the following:
 - The name of the proposed cement supplier; and
 - Proof that the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Plant Certification Program or equivalent, in the appropriate categories in accordance with CSA A23.1.
- .1 Only concrete supplied from certified plants will be acceptable.
- .2 Plant certification shall be maintained for the duration of concrete placement until the warranty period of the Work expires.
- .5 The Contractor shall submit the mix design at least 5 Days before concrete production begins.
- .6 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

180.4 CONSTRUCTION

- .1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Gates shall be fully operational before erection of fence fabric along that run or section of fence, or the opening temporarily blocked at the Contractor's expense by a means acceptable to the Engineer.
- .3 The Work shall be performed per Standard Drawings 180-1 to 180-4.
- .4 Gate posts shall be placed on level ground to be the same height, and the cantilever frame shall be installed level.
- .5 Terminal posts and braces shall be embedded in the ground in concrete-filled fibre form tubes as shown in Standard Drawings 180-1 and 180-2.
 - .1 Installation of fibre form tubes, posts and braces shall be performed as described under 178.4.4.7.
- .6 Gate accessories shall be installed in accordance with the manufacturer's recommended procedures.
- .7 Fence fabric shall be tensioned uniformly to minimize distortion and secured to the gate frame rails using the fasteners of 178.2.2.3, or per the fence manufacturer's recommendations, as approved by the Engineer.

CANTILEVER SLIDE GATE

ITEM: 180

- 180.4 .8 Bump stop tabs shall be suitably installed for both the opening and closing action of the gate to reduce the amount of energy transfer and subsequent potential damage to the fence, posts and gate components.
- .1 Bump stops shall be suitably attached to the bump stop tabs using an Engineer-approved method.
- .9 Chains shall be site-welded or otherwise attached as approved by the Engineer, to the bottom member of the gate frame at 150 mm spacing for the full length of the gate. Chains shall be of uniform length and have a minimum of 200 mm clearance from the access road or trail surface.
- .10 All waste shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .11 Pedestrian gate signs shall be suitably attached to the gate.
- .12 Repairs/ Replacement
- .1 The Contractor shall be responsible, at his own expense and to the Engineer's satisfaction, for repair or replacement of any damage resulting from the Work, including the following:
- .1 Repair of damage to the road/trail spanned by the gate shall consist of grading the surface to pre-Work condition or better.
- .2 Damaged areas of hot-dipped galvanized materials shall be painted with two coats of similarly coloured inorganic zinc-rich paint.
- .3 Any gate or component that is bent or otherwise irreparably damaged by the Contractor's actions shall be removed and replaced with a new gate or component, at the Contractor's expense and to the satisfaction of the Engineer.

180.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cantilever slide gates supplied and installed in accordance with this Item.
- .2 Fence fabric and posts associated with the cantilever slide gates will not be measured separately for payment.

180.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

PEDESTRIAN GATE

ITEM: 181

181.1 DESCRIPTION

- .1 This Item consists of supply and installation of a single-swing pedestrian gate for access of authorized personnel through wildlife fence at locations shown on the Plans.

181.2 MATERIALS

- .1 Pedestrian gate signs shall be supplied by the Owner.
- .2 Gate posts shall be supplied under Item 178.
- .3 All other materials shall be supplied by the Contractor under this Item.
- .4 Gate materials shall be in accordance with Standard Drawings 181-1 and 181-2.
- .5 Fence fabric shall meet the requirements of 178.2.2.
- .6 The horizontal top brace of the gate posts shall be hot-dipped galvanized steel angle, 75 mm x 75 mm x 6 mm.
- .7 Frame rails shall be Schedule 40 hot-dipped galvanized steel pipe, scale-free and having dimensions as indicated on Standard Drawings 181-1 and 181-2.
- .8 Gate accessories shall be hot dipped galvanized steel and shall meet the requirements of CAN/CGSB-138.4.
 - .1 All joints and connections shall be shop-welded, cleaned, and painted with two coats of similarly coloured inorganic zinc-rich paint.
- .9 Latches and hinge assemblies (gate frame collars, post collar with heavy setscrew, and hinge bolts with nuts) shall be Shield Fence & Wire Products Inc. products as follows, or Engineer-approved equivalent:
 - Industrial Drop Latch Model DL16 (capable of being padlocked);
 - Gate Frame Collars Model GFC16;
 - Post Collars Model PC312SS; and
 - Hinge Bolts Model HB346.

181.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the Work, the manufacturer's certification that the materials supplied meet the specified requirements, and the manufacturer's recommended procedures and instructions for handling.
- .2 The Contractor shall submit three copies of the shop drawings for the proposed pedestrian gate and its post connections and fittings.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

181.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

PEDESTRIAN GATE**ITEM: 181**

- 181.4.1 .1 Gates shall be fully operational before erection of fence fabric along that run or section of fence, or the opening temporarily blocked at the Contractor's expense by a means acceptable to the Engineer.
- .2 The Work shall be performed as indicated on Standard Drawings 181-1 and 181-2.
- .3 Fence fabric shall be secured to the gate frame using the fasteners of 178.2.2.3, or per the fence manufacturer's recommendations, as approved by the Engineer.
- .4 The gate frame bottom panel and the gate hinges and latch shall be attached to the posts installed under Item 178, as indicated on Standard Drawings 181-1 and 181-2 or as directed by the Engineer, and in accordance with the manufacturer's recommended procedures.
- .5 The gate shall be installed on two hinges on one side, and shall move freely and latch properly.
- .6 The pedestrian gate sign shall be suitably attached to the gate.

181.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of pedestrian gates supplied and installed in accordance with this Item.
- .2 Fence associated with the pedestrian gates will not be measured separately for payment.
- .3 Posts associated with the gates shall be measured for payment under Item 178.

181.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

CHAIN LINK FENCE

ITEM: 182

182.1 DESCRIPTION

- .1 This Item consists of supply and installation of chain link fence and gates.

182.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Chain link fence and appurtenances shall meet the requirements of CAN/CGSB 138.1 and 138.2.
 - .1 Chain link fence gates and fittings shall meet the requirements of CAN/CGSB 138.4.
- .3 The fence fabric shall be chain link, 50 mm mesh, constructed of 3.5 mm steel wire, galvanized, Type 1, Class A, Style 2, Grade 2.
 - .1 The top selvedge of the fabric shall be twisted and the bottom selvedge shall be knuckled.
- .4 Posts and rails shall be Schedule 40, scale-free, hot-dipped galvanized tubular steel pipe as indicated on Standard Drawing 182-1, and as follows;
 - .1 Line posts shall be 60 mm OD, 4.0 mm wall thickness and a minimum 5.45 kg/m mass.
 - .2 Terminal (gate, end, corner and straining) posts shall be 89 mm OD, 5.5 mm wall thickness and a minimum 11.28 kg/m mass, supplied with stretching bands and bars for attaching the fabric to the posts, and bands for attaching the braces.
 - .3 Top rails shall be 43 mm OD, 3.6 mm wall thickness and a minimum 3.38 kg/m mass, supplied with sleeves that allow for contraction and expansion at the top rail joints.
- .5 All nuts, bolts, parts and fittings shall be hot-dipped galvanized steel, or aluminum alloy.
- .6 Concrete shall meet the requirements of Item 301.2, and CSA A23.1, exposure class F-1.
- .7 Concrete form tubes shall be coated, spiral wound, wood fibre paper board manufactured with a waterproof glue, and supplied with a minimum length of 1.22 m and of a diameter as indicated on Standard Drawing 182-1.
- .8 The Contractor shall supply all other appurtenances and miscellaneous metals as required and as indicated in the Standard Drawings 182-1 and 182-2.

182.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements, and the manufacturer's recommended procedures for installation and instructions for handling.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

182.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All Work shall be carried out in accordance with the Standard Drawings 182-1 and 182-2.
- .3 Prior to the construction of the chain link fence, the Contractor shall remove any debris and correct minor ground undulations (greater than 0.3 m vertical in a 3 m length) which would interfere with the proper construction of the fence in its required location.
- .4 All fence grades shall be subject to the approval of the Engineer.
- .5 All posts installed in soil shall be centred and vertically embedded in the concrete placed in a concrete form tube forming the boundary of the excavated hole formed by augering.
 - .1 Any void space that results between the concrete form tube and the excavated hole that is less than 20% of the OD of the concrete form tube shall be backfilled with well compacted sand backfill prior to placing the concrete.
 - .2 If the void is greater than 20% of the OD of the concrete form tube, then the concrete form tube shall be removed and the hole shall be backfilled with compacted excavated material and the post shall be repositioned to meet 182.4.5 or 182.4.5.1.
- .6 All concrete shall be placed in accordance with 301.4.
- .7 If posts are placed in solid rock, then the footings shall be constructed as indicated on Standard Drawing 182-1.
- .8 Line posts shall be placed vertically, and in line at a uniform spacing not exceeding 3 m.
 - .1 If an obstruction or major ground elevation difference prevents placing a post at 3 m from an adjacent post, the post may be placed not less than 2.4 m from the next post and in no case more than 3 m.
- .9 A corner post shall be installed wherever the fence line changes direction by more than 10°, and a straining post at changes in elevation of more than 30°.
- .10 Top rails, braces and appurtenances shall be installed in accordance with the manufacturer's recommended procedures.
- .11 Terminal posts shall be braced by a centre rail of the same material and size as the top rail, between the gate, corner or end post and the adjacent post.
- .12 The fence fabric shall be installed on the outside of the line posts and top rail, continuous between terminal posts and stretched tightly and uniformly but not to such a degree that the diamond pattern is distorted.
- .13 Lengths of fabric shall only be joined by splicing, using the manufacturer's approved splicing wire system such that a continuous diamond mesh pattern results.
 - .1 Splicing by overlap shall not be permitted.

CHAIN LINK FENCE

ITEM: 182

182.4 .14 At all end, corner and gate posts the fabric shall be broken and secured to the posts by a steel stretching bar and stretching bar bands as indicated in the manufacturer's recommended procedures.

.15 The bottom tension wire shall be strung tight on the outside of the line posts at the diamond pattern, fastened to the fabric by a twisted wire or enclosed in a fabric knuckle.

182.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of linear metres of chain link fence including gates, if any, supplied and installed in accordance with this Item.

.2 The length shall be taken along the top of the fence from terminal post to terminal post of each section of fence.

182.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF FENCE

ITEM: 186

186.1 DESCRIPTION

- .1 This Item shall consist of the removal of all types of fencing.

186.2 MATERIALS

- .1 None identified.

186.3 SUBMITTALS

- .1 None identified.

186.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All post holes shall be backfilled and tamped and graded to match the surrounding grade.
- .3 The dismantling and removal shall be carried out in a manner so as to avoid damage to the adjacent and surrounding area.
 - .1 The Contractor shall be responsible, at his/her own expense, for any repair of such damage resulting from this Work.
- .4 All materials and waste shall become the property of the Contractor and shall be disposed of outside the Work Site.

186.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of fencing dismantled and handled in accordance with this Item.

186.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

APPLICATION OF WATER

ITEM: 191

191.1 DESCRIPTION

- .1 This Item consists of the supply and application of water.

191.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Water shall be obtained from a source approved by the appropriate regulatory agency or agencies, and shall be free of any deleterious materials.
- .3 When applying for a permit for water extraction per 191.2.2, the Contractor shall ensure that the permit covers extraction of water for use under the Items of the Contract.

191.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the method of withdrawal, the method of application of the water and the certification of the approval of the source.

191.4 CONSTRUCTION

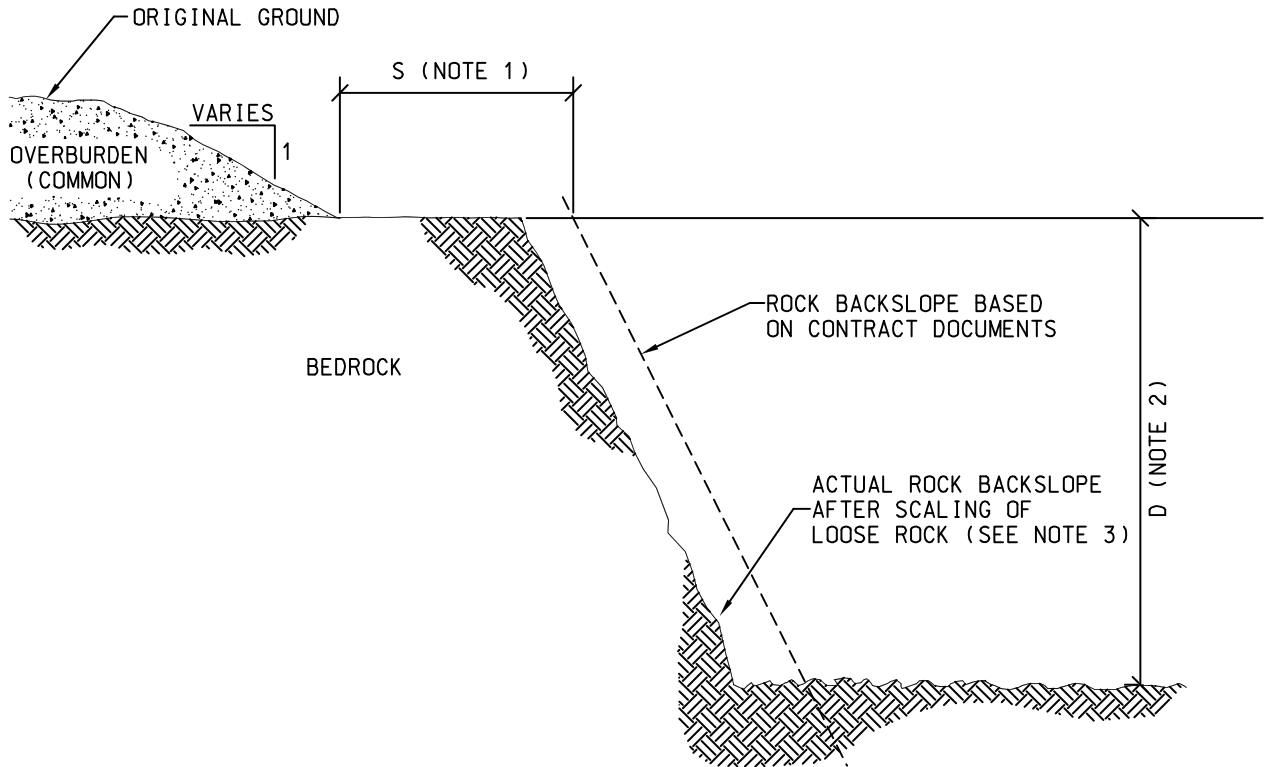
- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Water shall be applied by Equipment capable of a uniform and even rate of distribution in such amounts and at such times as required, for the following purposes:
 - .1 For dust control, any time that the Contractor is hauling within the Work Site or public traffic is directed through the Work Site over dust-prone surfaces.
 - .2 For compaction of soils or aggregates.
 - .3 To cool a newly placed asphalt concrete mat.
- .3 The Contractor shall be prepared to apply water on a seven-day-per-week basis.

191.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of water supplied and applied in accordance with this Item.
- .2 The capacity (load size) of each water tank will be determined prior to the commencement of the Work, either by weighing each load or by weighing and/or calculating a typical load and counting the loads applied, thereafter.
 - .1 For the purposes of this Item, a tonne (mass) shall be equivalent to a cubic metre.

191.6 BASIS OF PAYMENT

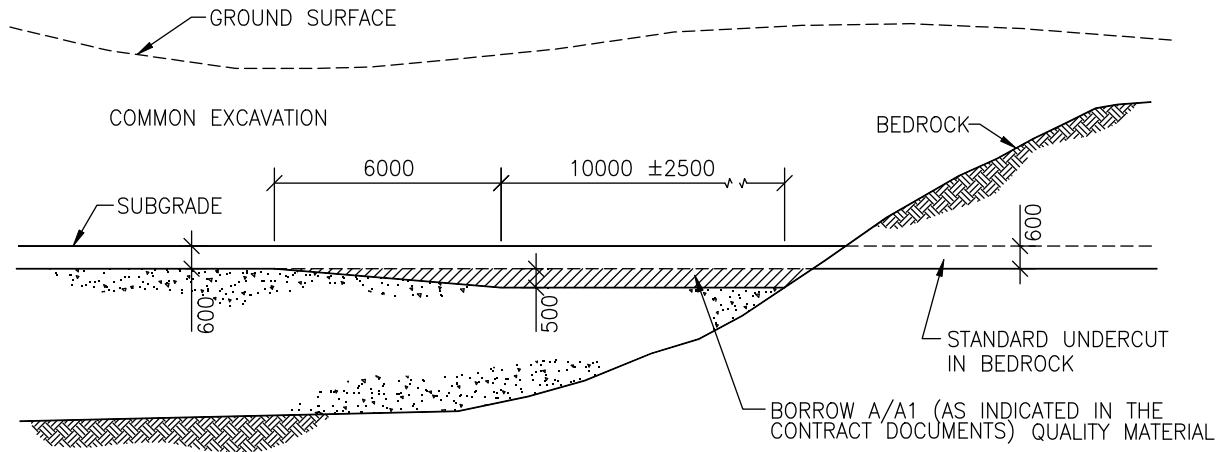
- .1 Payment for Work under this Item shall include a separate Unit Price for each type of water application, as identified under the Contract.



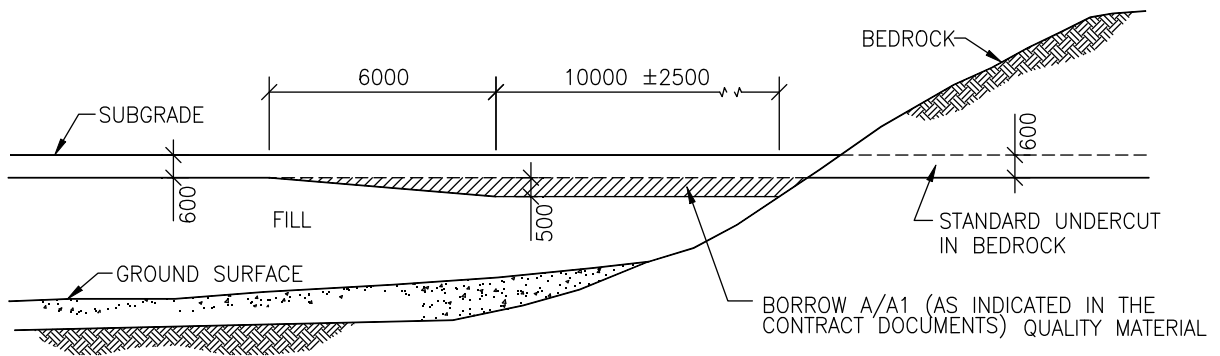
NOTES:

1. THE SLOPE SETBACK DISTANCE "S" SHALL BE 1.5 m OR AS DIRECTED BY THE ENGINEER.
2. THE EXCAVATED DEPTH "D" SHALL NOT EXCEED 3m BEFORE THE SHAPING OF THE OVERBURDEN SLOPE HAS BEEN COMPLETED.
3. SCALING OF LOOSE ROCK AND PREPARATION OF THE FINISHED BACKSLOPE INCLUDING ANY OVERBREAK SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.

Shaping of Overburden at Top of Solid Rock Backslope

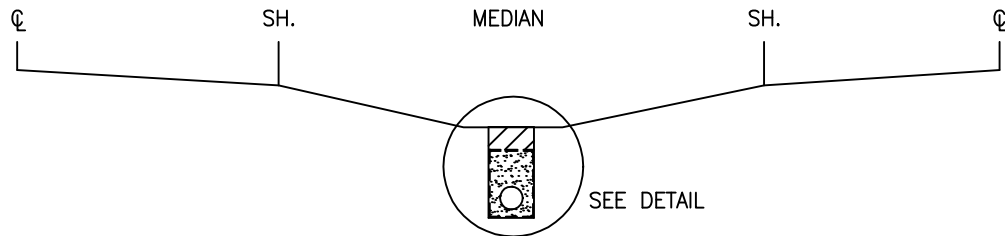


TRANSITION IN CUT CONDITION

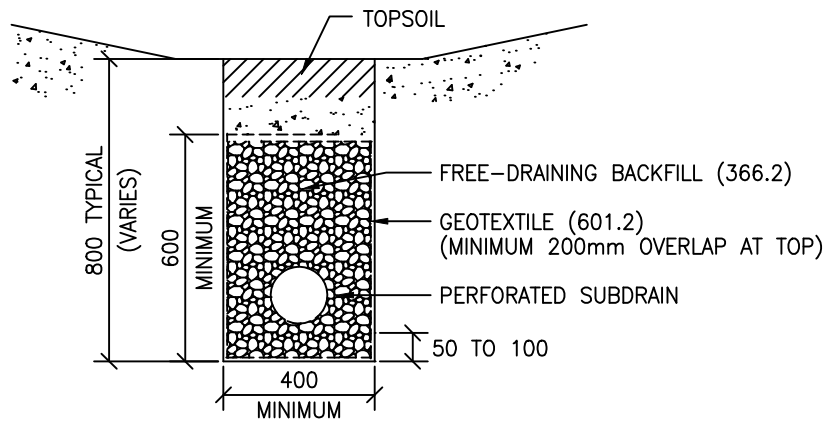


TRANSITION IN FILL CONDITION

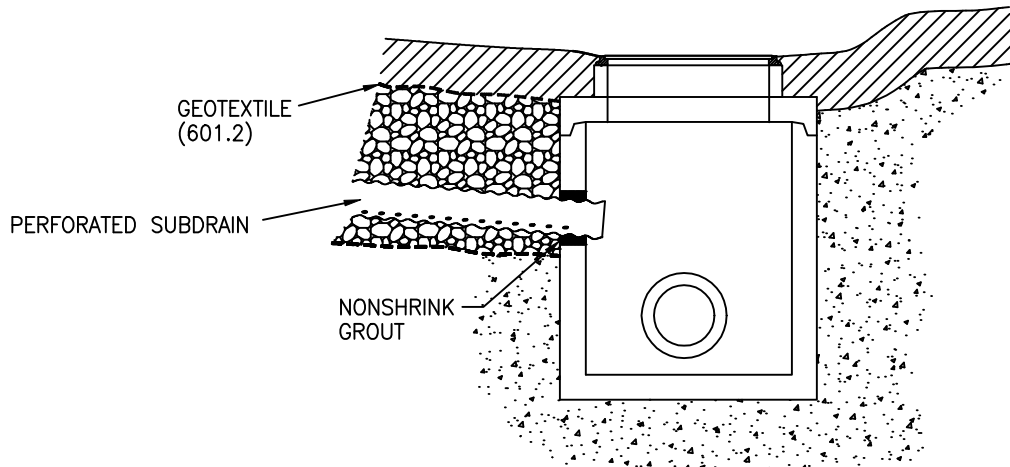
Solid Rock Transitions (longitudinal)



TYPICAL SECTION
MEDIAN SUBDRAIN INSTALLATION

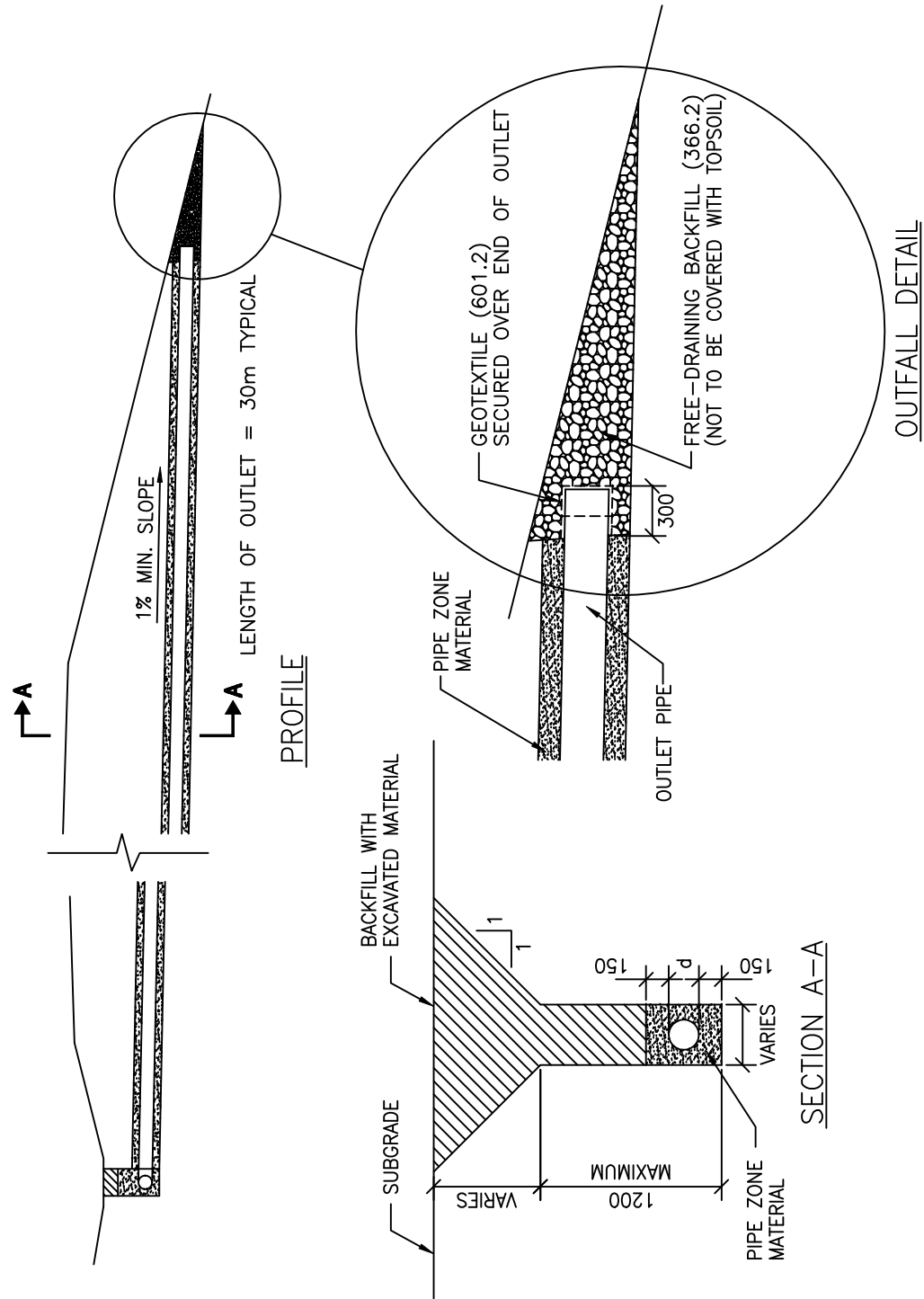


DETAIL

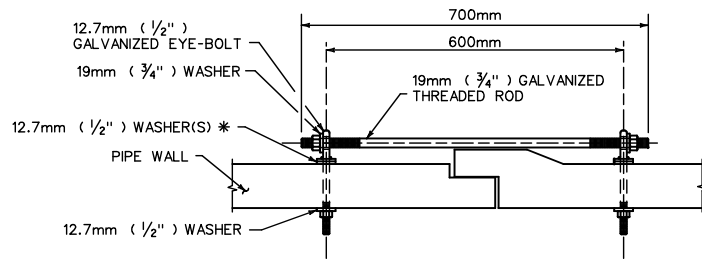
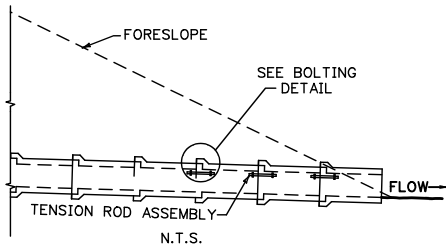


CATCH BASIN CONNECTION

Subdrain



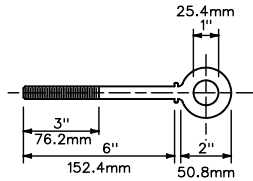
Subdrain Outlet



BOLTING DETAIL

N.T.S.

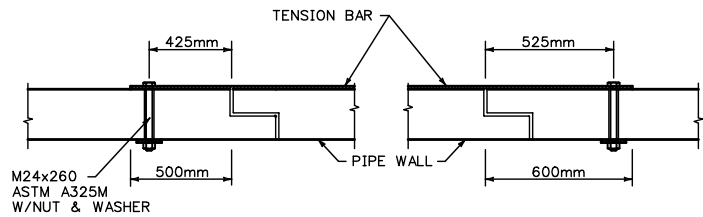
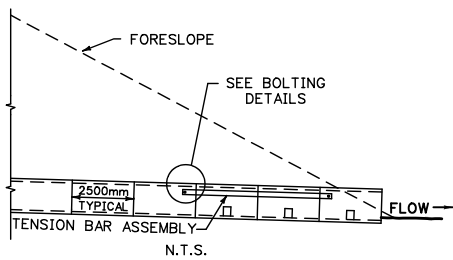
* NOTE: MINIMUM ONE WASHER REQUIRED, ADD EXTRA WASHERS TO CLEAR BELL.



12.7mm (1/2") GALVANIZED EYE-BOLT WITH SHOULDER

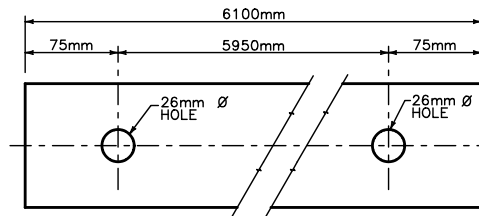
N.T.S.

TENSION ROD ASSEMBLY - RAISED BELLS



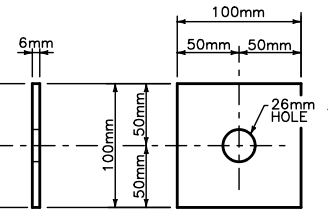
BOLTING DETAIL

N.T.S.



TENSION BAR

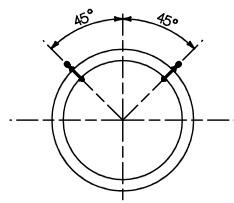
N.T.S.



WASHER

N.T.S.

TENSION BAR ASSEMBLY - FLUSH BELLS



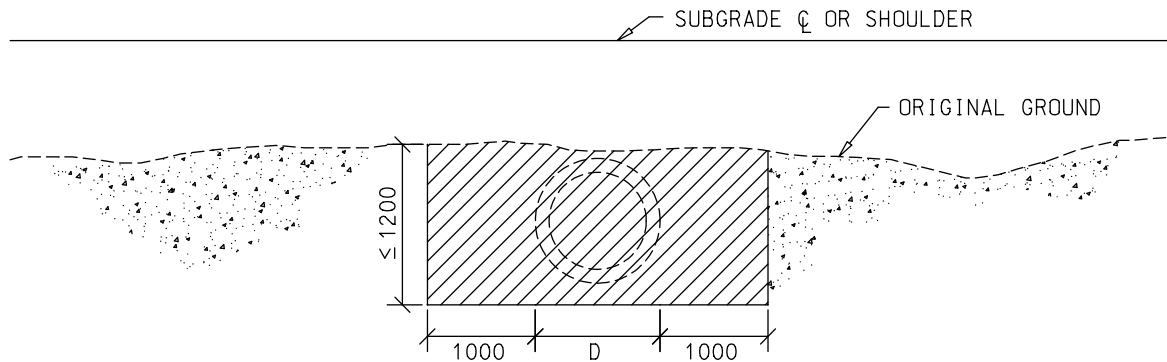
TENSION ROD / BAR PLACEMENT DETAIL

N.T.S.

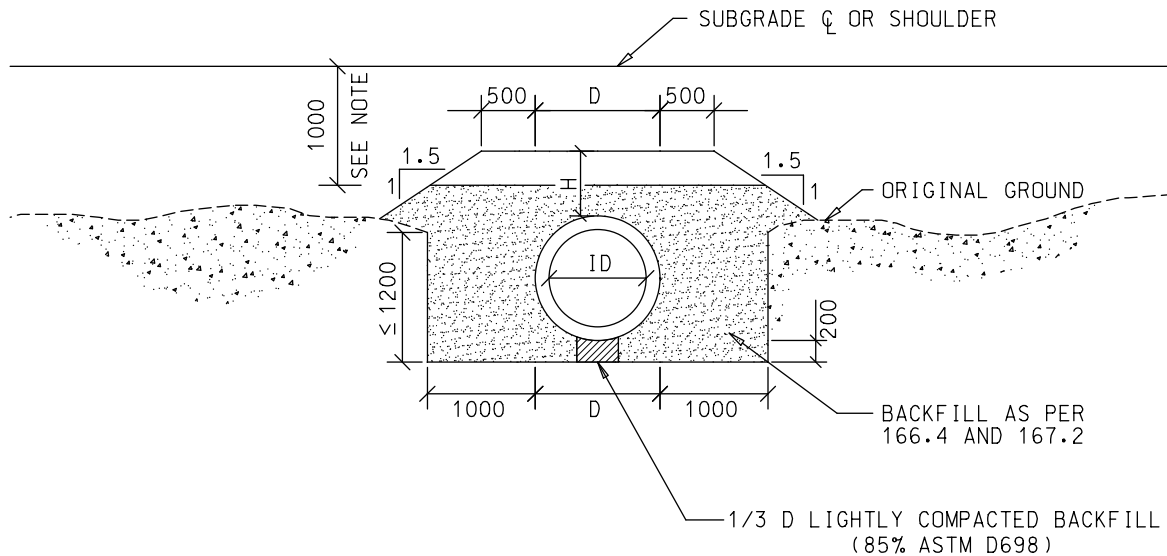
NOTES :

- (1) TENSION RODS MAY BE SHORT , AS SHOWN (ONE PER JOINT) , OR LONG , TO SPAN THREE JOINTS AS TENSION BARS DO.
- (2) STEEL SHALL BE PER CSA G40.12 300W.
- (3) TENSION RODS / BARS, NUTS AND WASHERS SHALL BE GALVANIZED PER CSA G164-M92, TO A MINIMUM MASS OF 610g/m² .
- (4) EYE-BOLTS FOR TENSION RODS SHALL BE GALVANIZED 12.7mm (1/2") SAE GRADE 5.
- (5) BOLTS FOR TENSION RODS SHALL BE GALVANIZED M24x260 (SAE GRADE 5) .
- (6) TENSION BAR SHALL BE USED AS TEMPLATE FOR CONTRACTOR TO FIELD DRILL HOLES IN INSTALLED PIPE.
- (7) NUTS SHALL NOT BE OVER TIGHTENED.
- (8) BOLT LENGTH PROTRUDING MORE THAN 25mm BEYOND TIGHTENED NUT SHALL BE CUT OFF FLUSH WITH NUT.

Tension Rod/Bar Assembly



LIMITS OF FOUNDATION EXCAVATION



LIMITS OF BACKFILLING AROUND STRUCTURES (TO HEIGHT "H")

NOTE:

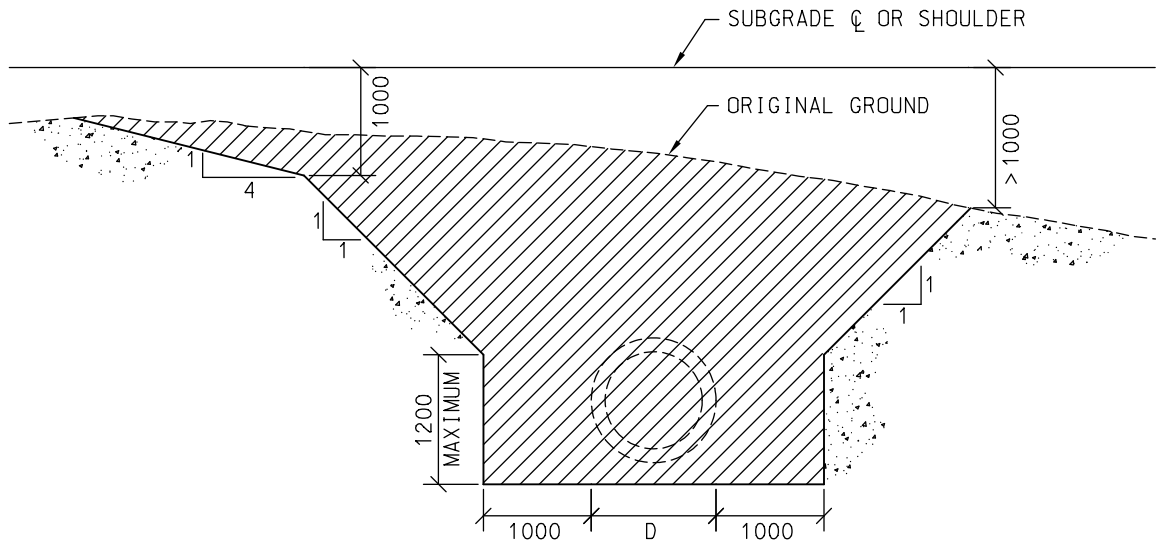
BACKFILL MATERIAL WITHIN 1000mm OF SUBGRADE SHALL BE THE SAME AS OR SIMILAR TO THAT WHICH COMPRISES THE ROADBED FILL.

D = NOMINAL PIPE DIAMETER: OUTSIDE DIAMETER OF CONCRETE PIPE, OR DIAMETER OF METAL PIPE, OR SPAN OF METAL PIPE-ARCH (ID = OD)

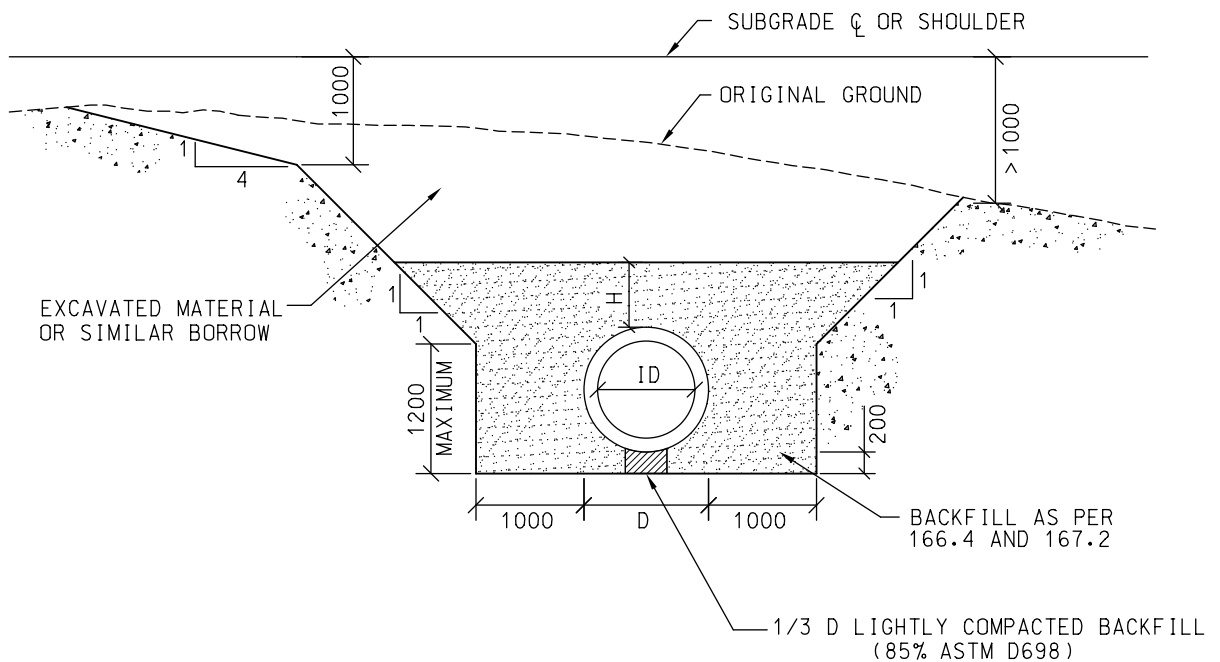
FOR CULVERTS HAVING A NOMINAL ID ≥ 2100 mm, THE LIMITS OF FOUNDATION EXCAVATION ARE INCREASED TO A 1:1 SLOPE EXTENDING OUTWARD AND UPWARD FROM THE BOTTOM OF EXCAVATION.

ID	H
≤ 1200	600
>1200 TO ≤ 2000	1000
> 2000	ID/2

Case 1.1
Cross Culvert : Subgrade Above Original Ground
Trench ≤ 1.2 m deep



LIMITS OF FOUNDATION EXCAVATION



LIMITS OF BACKFILLING AROUND STRUCTURES (TO HEIGHT "H")

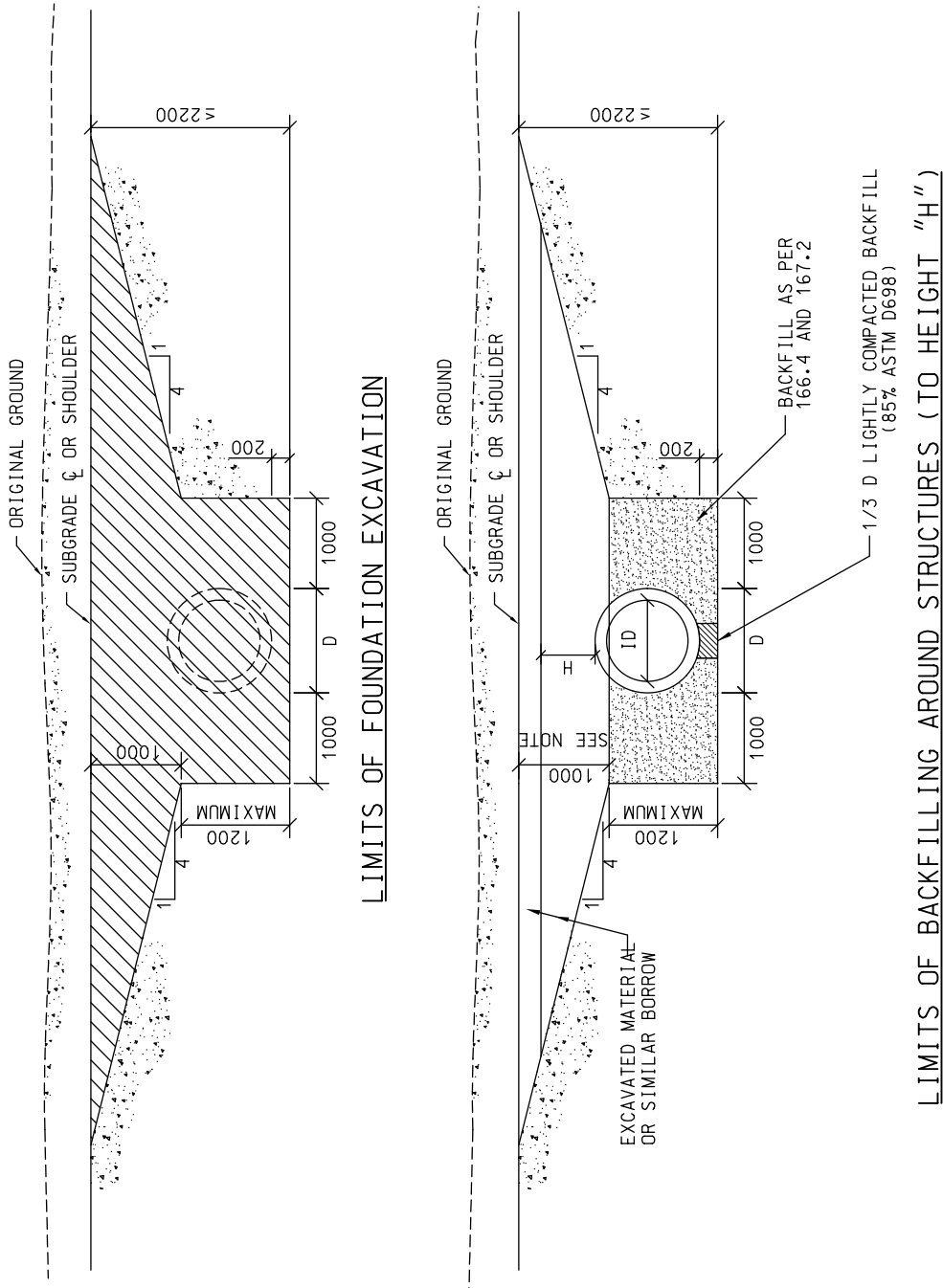
NOTE:

D = NOMINAL PIPE DIAMETER; OUTSIDE DIAMETER OF CONCRETE PIPE OR DIAMETER OF METAL PIPE, OR SPAN OF METAL PIPE-ARCH (ID = OD)

ID	H
≤1200	600
>1200 TO ≤2000	1000
>2000	ID/2

FOR CULVERTS HAVING A NOMINAL ID ≥ 2100mm, THE LIMITS OF FOUNDATION EXCAVATION ARE INCREASED TO A 1:1 SLOPE EXTENDING OUTWARD AND UPWARD FROM THE BOTTOM OF EXCAVATION.

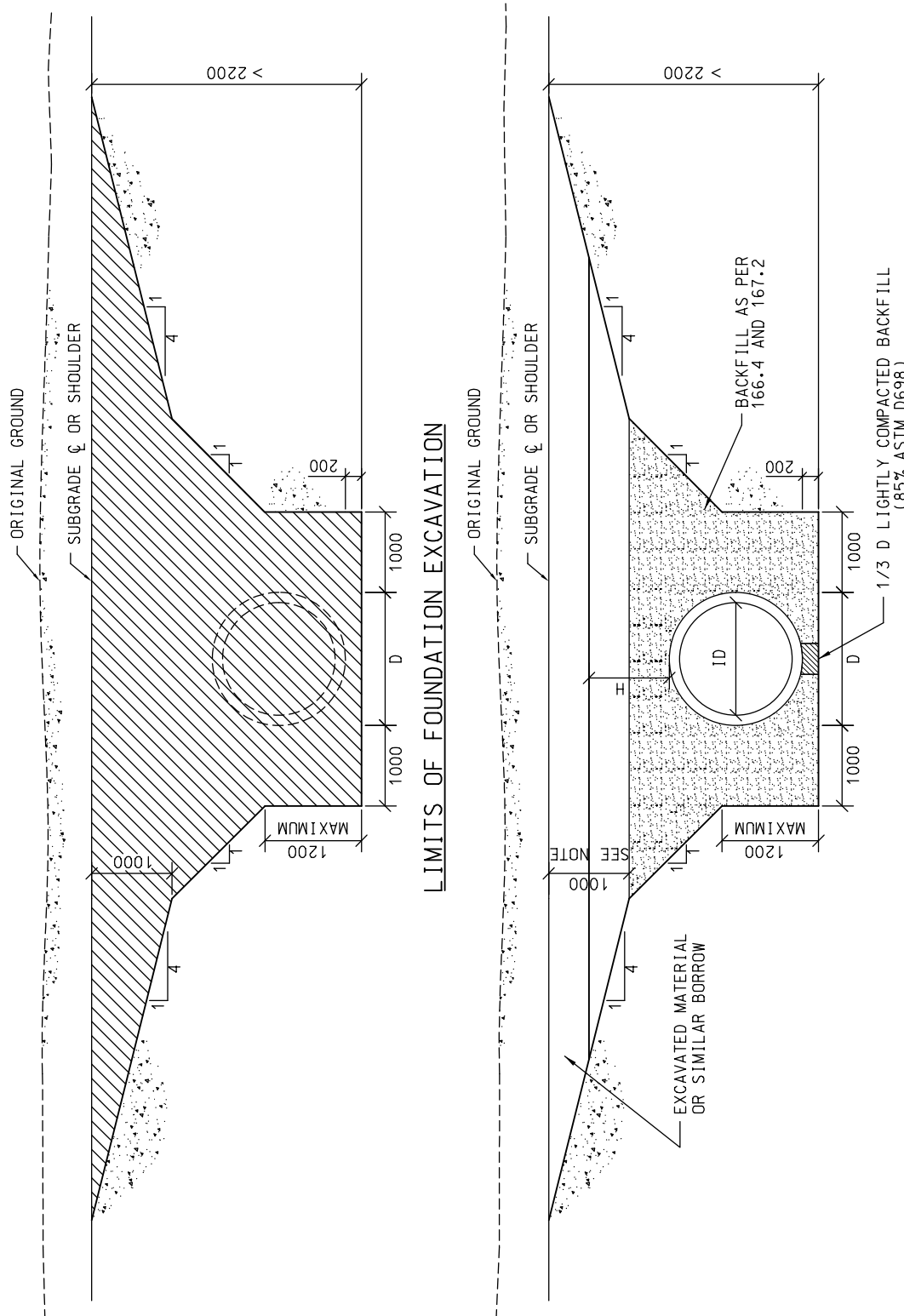
Case 1.2
Cross Culvert : Subgrade Above Original Ground
Trench > 1.2 m deep



ID	H
≤ 1200	600

NOTE:
BACKFILL MATERIAL WITHIN 1000mm OF SUBGRADE SHALL BE THE SAME AS OR SIMILAR TO THAT WHICH COMPRISES THE ADJACENT SUBGRADE MATERIAL.
D = NOMINAL PIPE DIAMETER; OUTSIDE DIAMETER OF CONCRETE PIPE, OR DIAMETER OF METAL PIPE, OR SPAN OF METAL PIPE-ARCH (ID = OD)
FOR CULVERTS HAVING A NOMINAL ID ≥ 2100 mm, THE LIMITS OF FOUNDATION EXCAVATION ARE INCREASED TO A 1:1 SLOPE EXTENDING OUTWARD AND UPWARD FROM THE BOTTOM OF EXCAVATION.

Case 2.1
Cross Culvert : Original Ground Above Subgrade
Trench ≤ 2.2 m deep

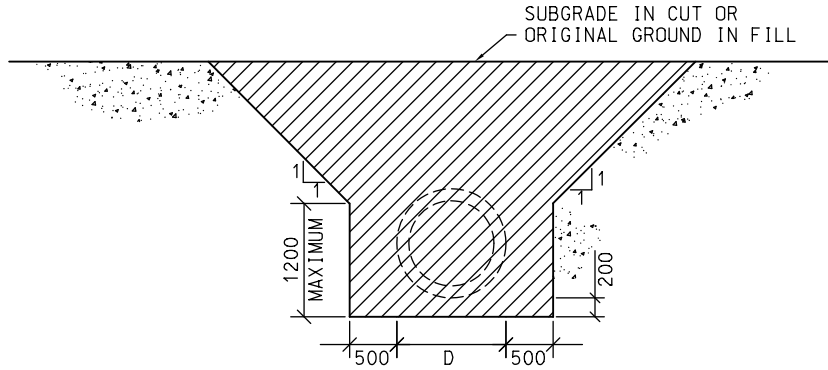


LIMITS OF BACKFILLING AROUND STRUCTURES (TO HEIGHT "H")

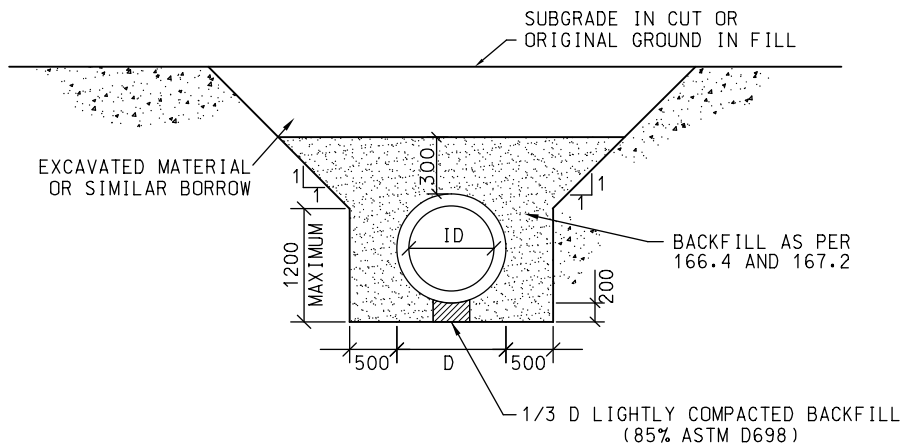
ID	H
≤ 1200	600
>1200 TO ≤2000	1000
> 2000	ID/2

NOTE:
BACKFILL MATERIAL WITHIN 1000mm OF SUBGRADE SHALL BE THE SAME AS OR SIMILAR TO THAT WHICH COMPRISES THE SUBGRADE MATERIAL.
D = NOMINAL PIPE DIAMETER; OUTSIDE DIAMETER OF CONCRETE PIPE, OR DIAMETER OF METAL PIPE, OR SPAN OF METAL PIPE-ARCH (ID = OD)
FOR CULVERTS HAVING A NOMINAL ID ≥ 2100mm, THE LIMITS OF FOUNDATION EXCAVATION ARE INCREASED TO A 1:1 SLOPE EXTENDING OUTWARD AND UPWARD FROM THE BOTTOM OF EXCAVATION.

Case 2.2
Cross Culvert : Original Ground Above Subgrade
Trench > 2.2 m deep



LIMITS OF FOUNDATION EXCAVATION

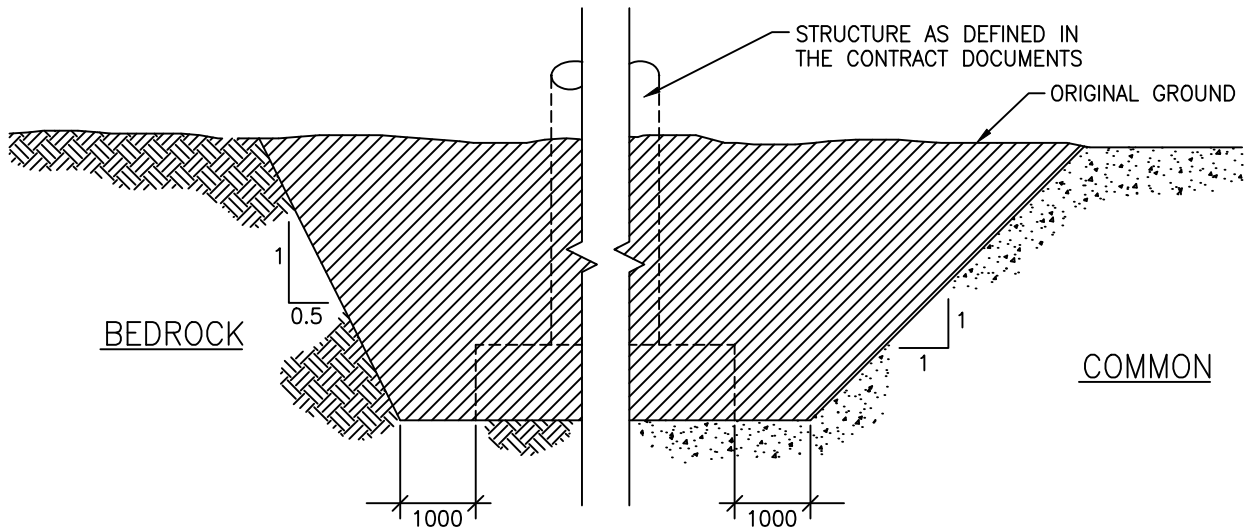


LIMITS OF BACKFILLING AROUND STRUCTURES

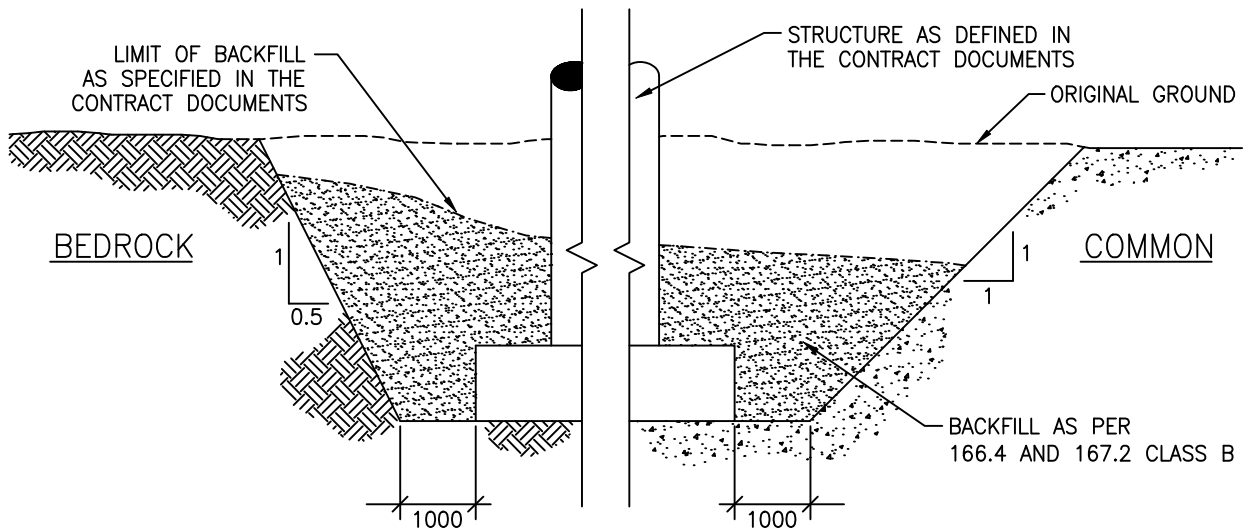
NOTE:

FOR CULVERTS HAVING A NOMINAL ID $\geq 2100\text{mm}$, THE LIMITS OF FOUNDATION EXCAVATION ARE INCREASED TO A 1:1 SLOPE EXTENDING OUTWARD AND UPWARD FROM THE BOTTOM OF EXCAVATION.

Case 3.1
Storm Drainage Culvert Longitudinal to the Centreline of Roadway

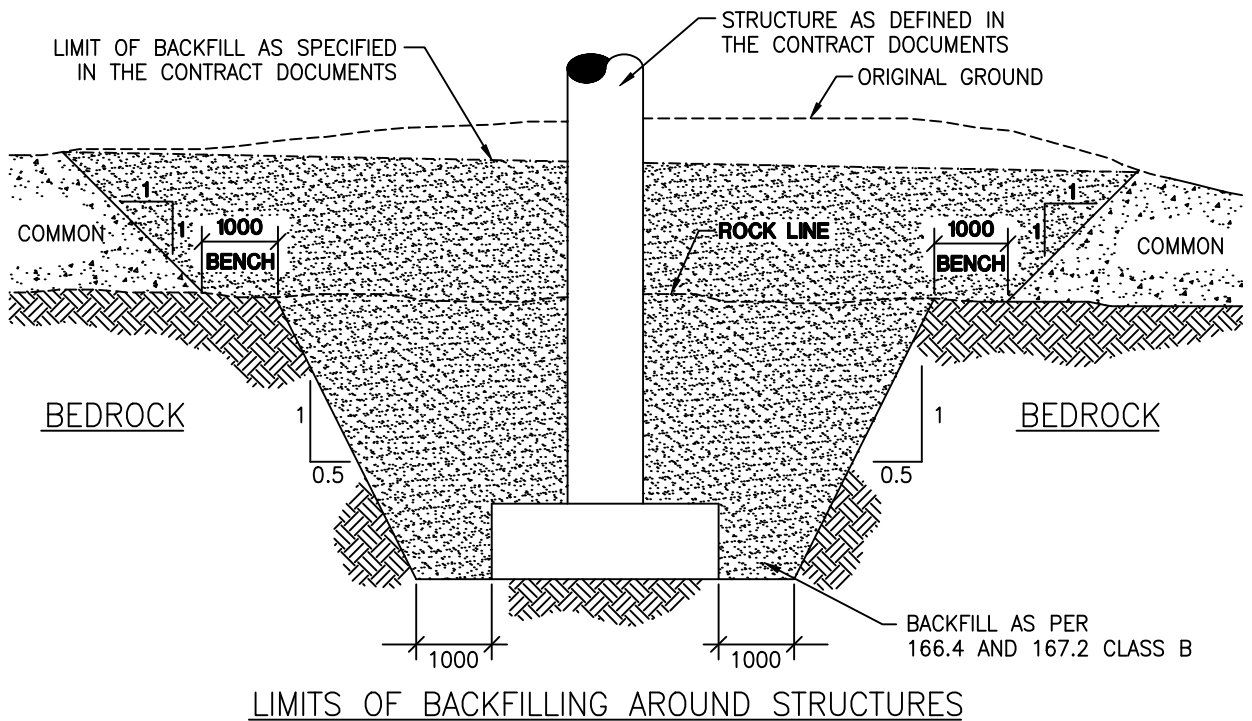
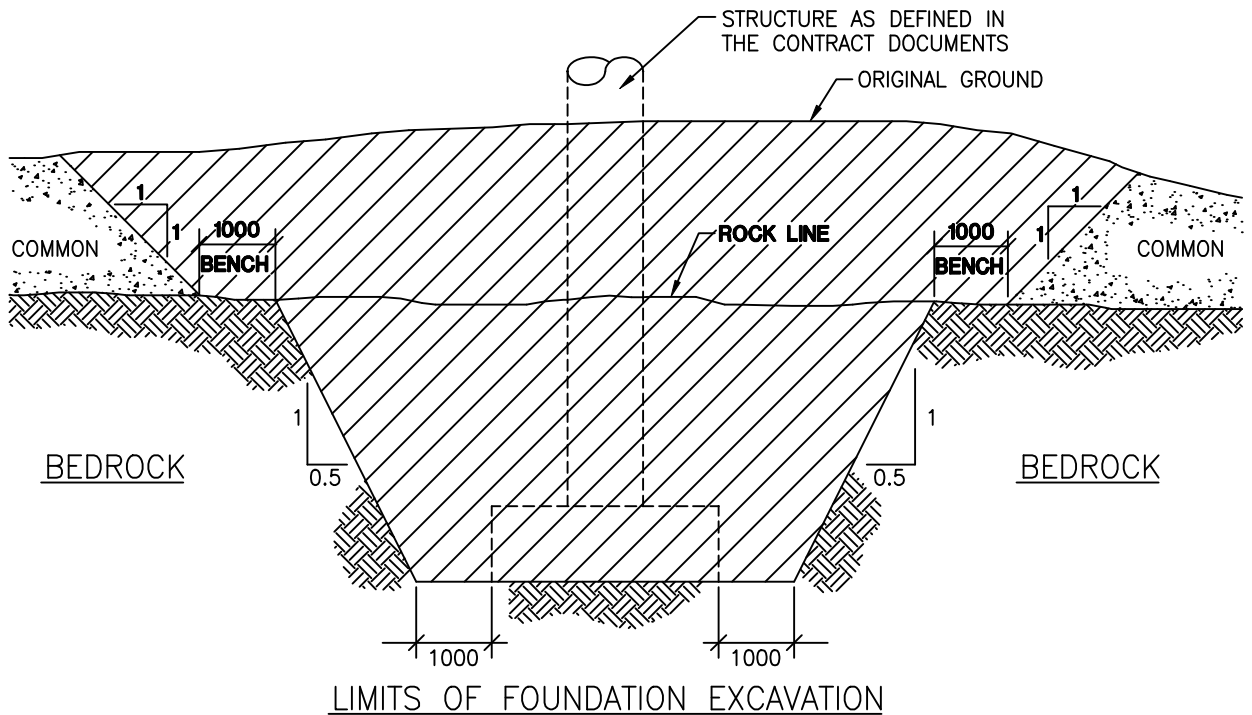


LIMITS OF FOUNDATION EXCAVATION

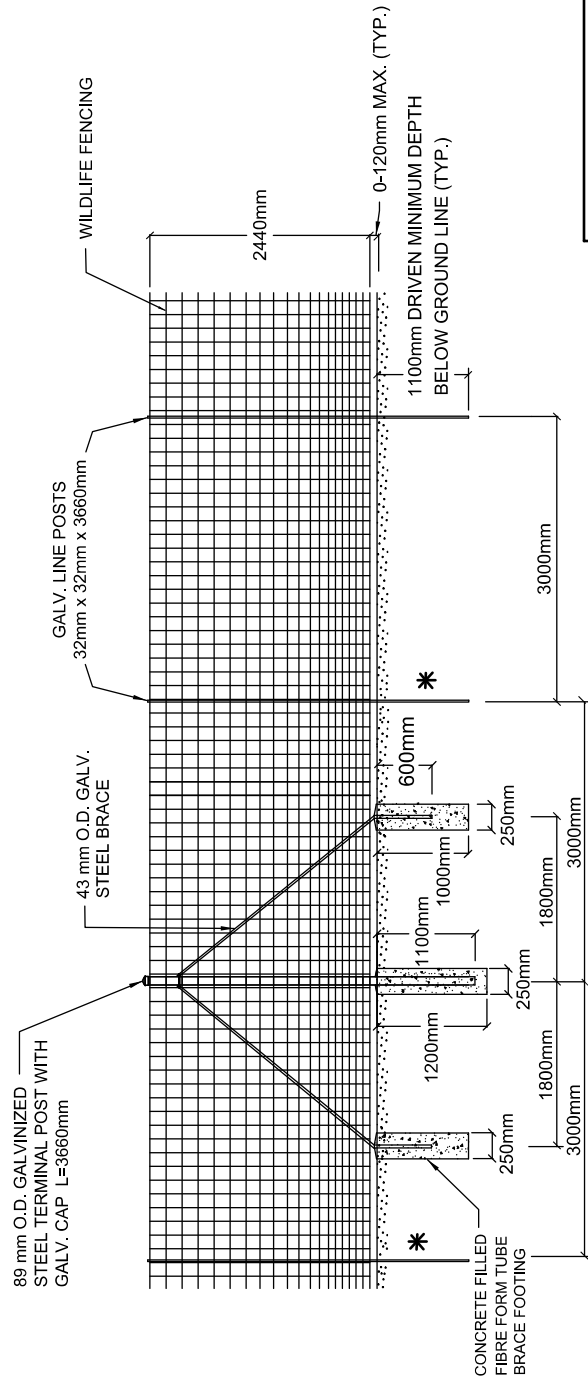


LIMITS OF BACKFILLING AROUND STRUCTURES

Foundation Excavation for Footings
Solid Rock and Common Cases



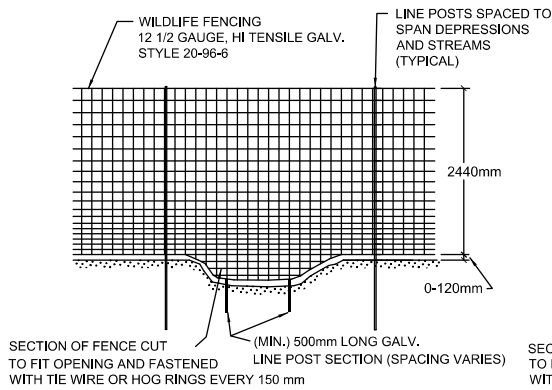
**Foundation Excavation for Footings
Common over Solid Rock Case**



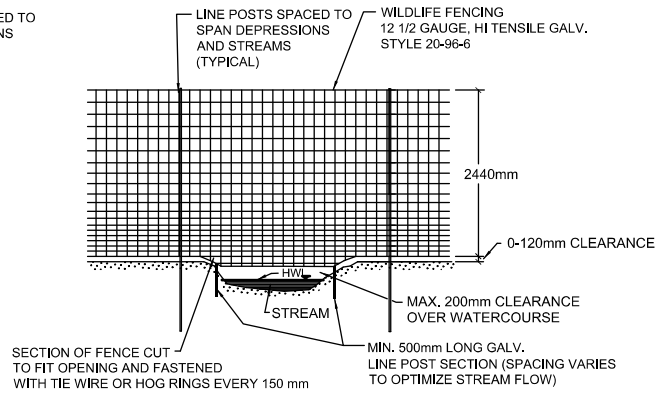
NORMAL SOIL CONDITIONS

NOT TO SCALE

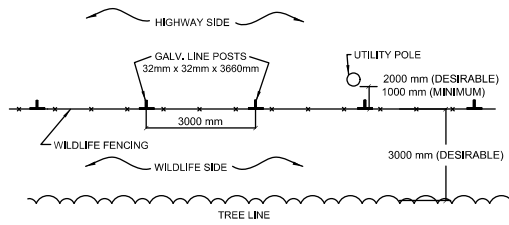
Wildlife Fence Detail - 1



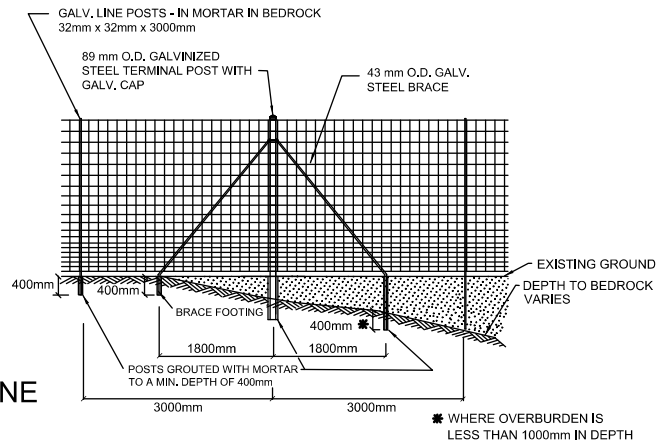
DRAINAGE DEPRESSION CONDITIONS



STREAM CROSSING CONDITIONS



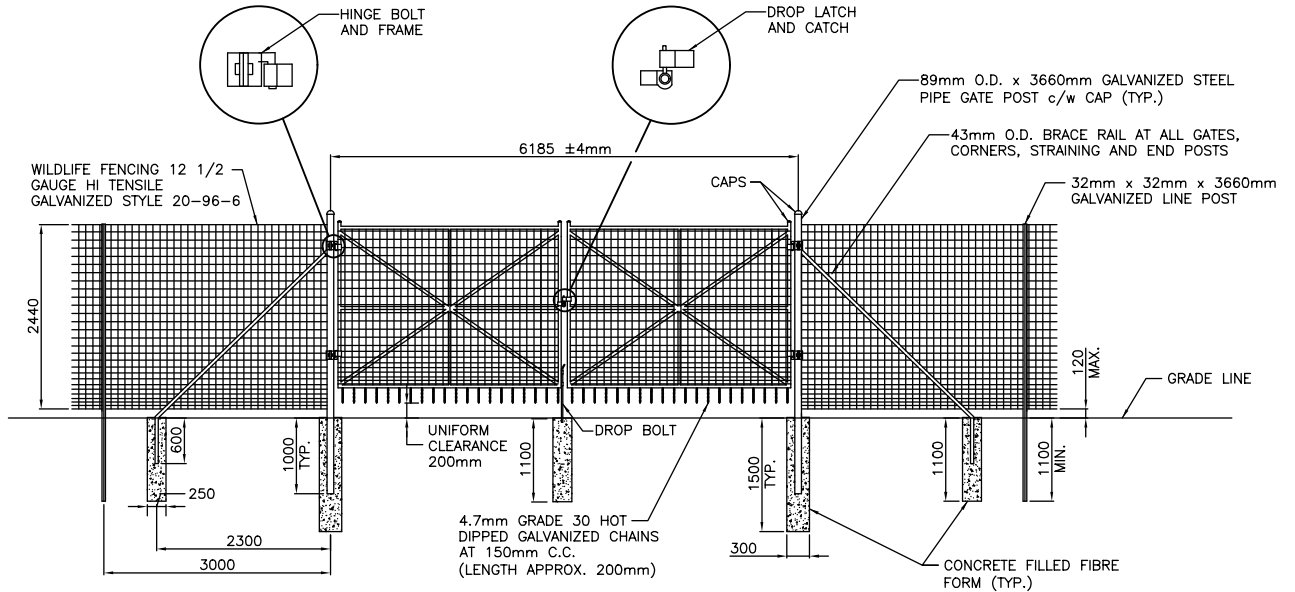
TOP VIEW OF FENCE LINE ALONG TREE LINE



BEDROCK CONDITIONS

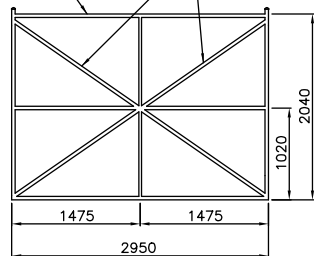
NOT TO SCALE

Wildlife Fence Detail - 2



NOT TO SCALE

43mm O.D. FENCE FRAME, TYP. SHOP WELDED



FRAME DETAIL

Double Swing Gate

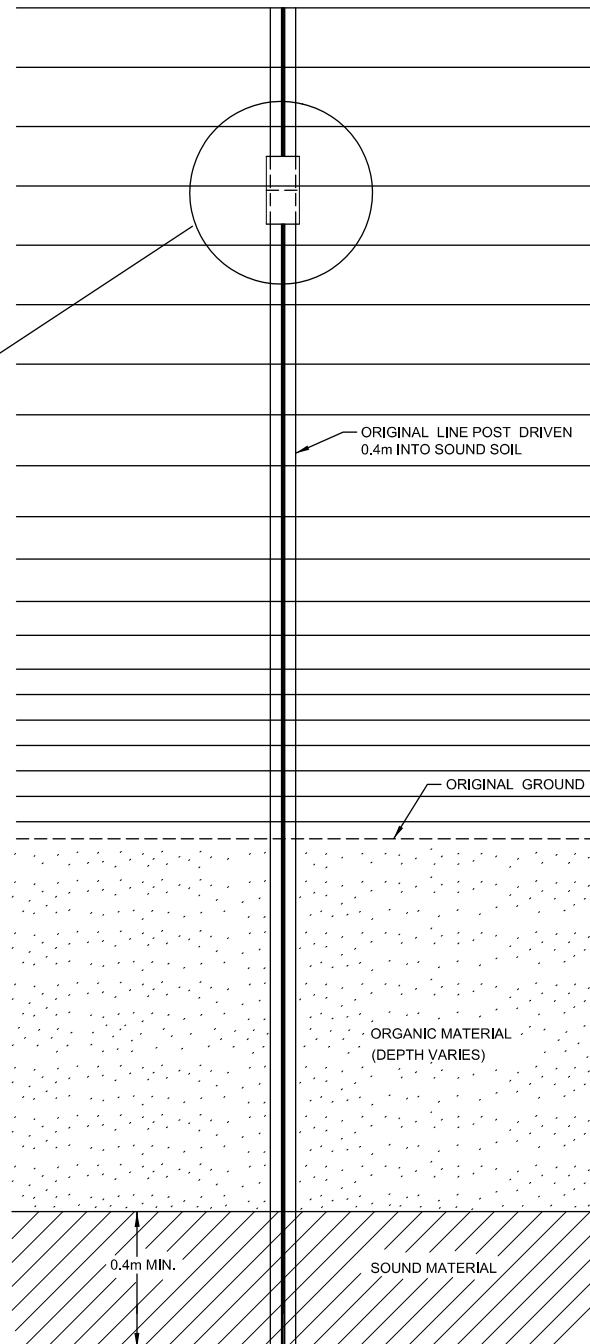
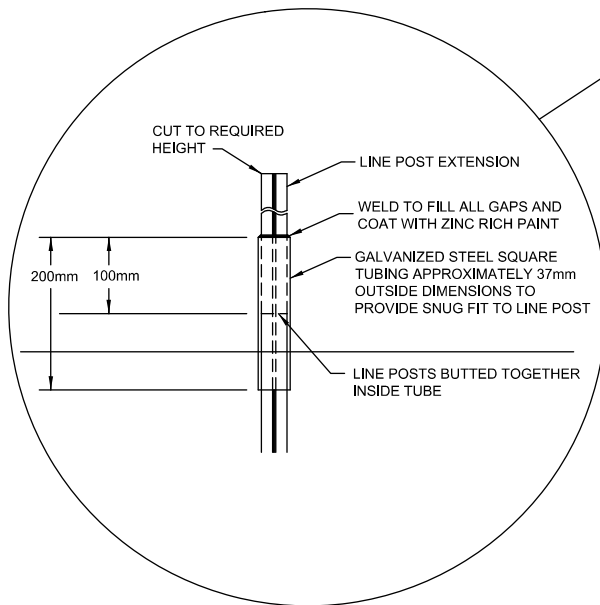
NOTES: ONLY HORIZONTAL FENCE FABRIC STRANDS SHOWN FOR DRAWING CLARITY PURPOSES.

ALL ATTEMPTS SHALL BE MADE TO PLACE THE EXTENSION IN THE FENCE FABRIC ZONE WHICH HAS A 150mm OR GREATER SPACING BETWEEN HORIZONTAL STRANDS.

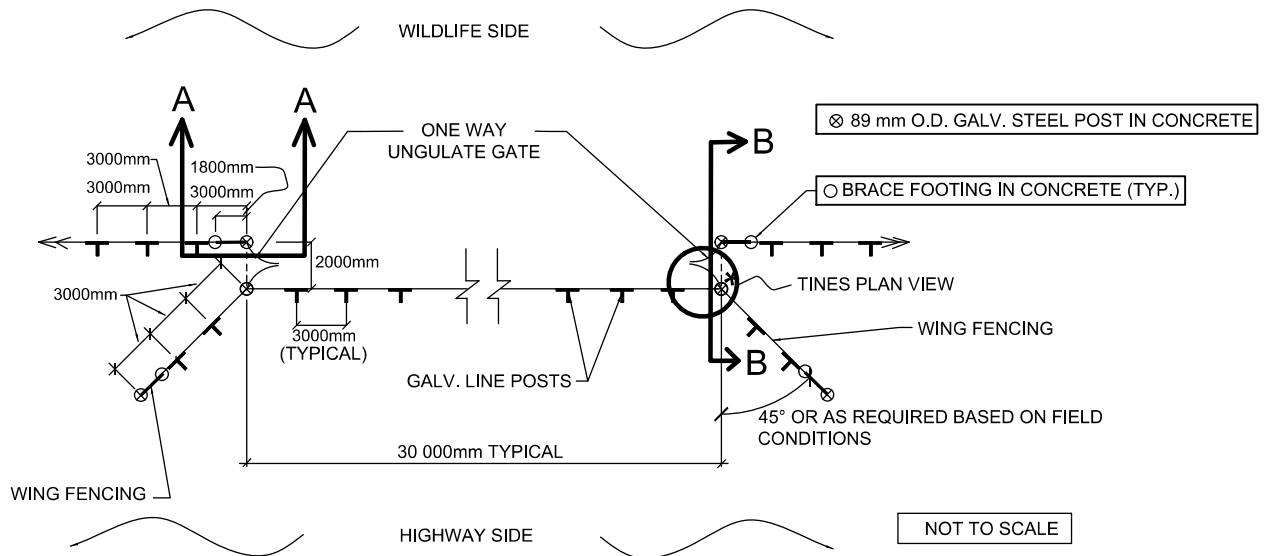
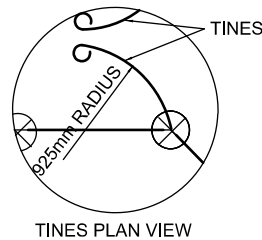
FENCE FABRIC TO BE TIED TO LINE POST AT ALL HORIZONTAL STRANDS ABOVE EXTENSION TUBING. (A MINIMUM OF THREE STRANDS AS SHOWN IN THE STANDARD DRAWING).

MAXIMUM EFFORT SHOULD BE USED TO UTILIZE AS MANY LINE POST HOLES FOR FABRIC TYING AS POSSIBLE ABOVE THE EXTENSION TUBING.

NOT TO SCALE

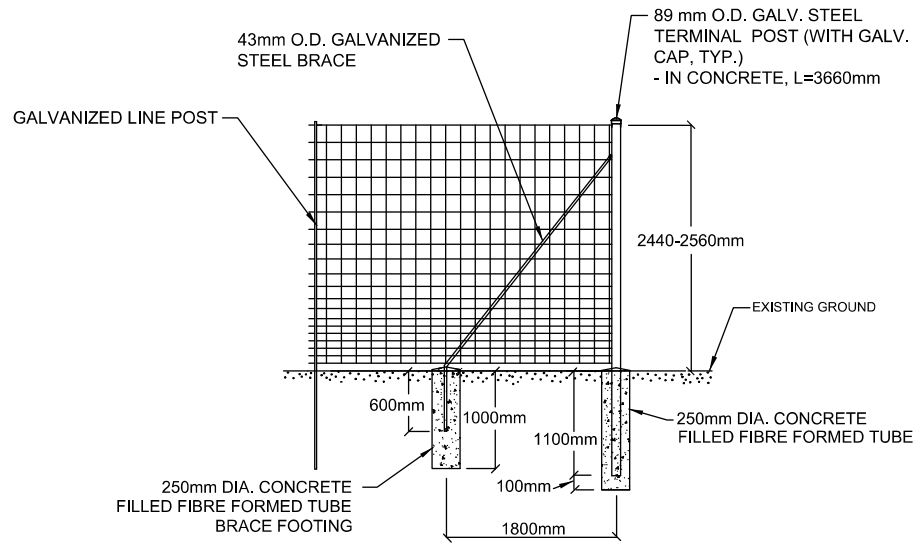


Line Post Extension Detail



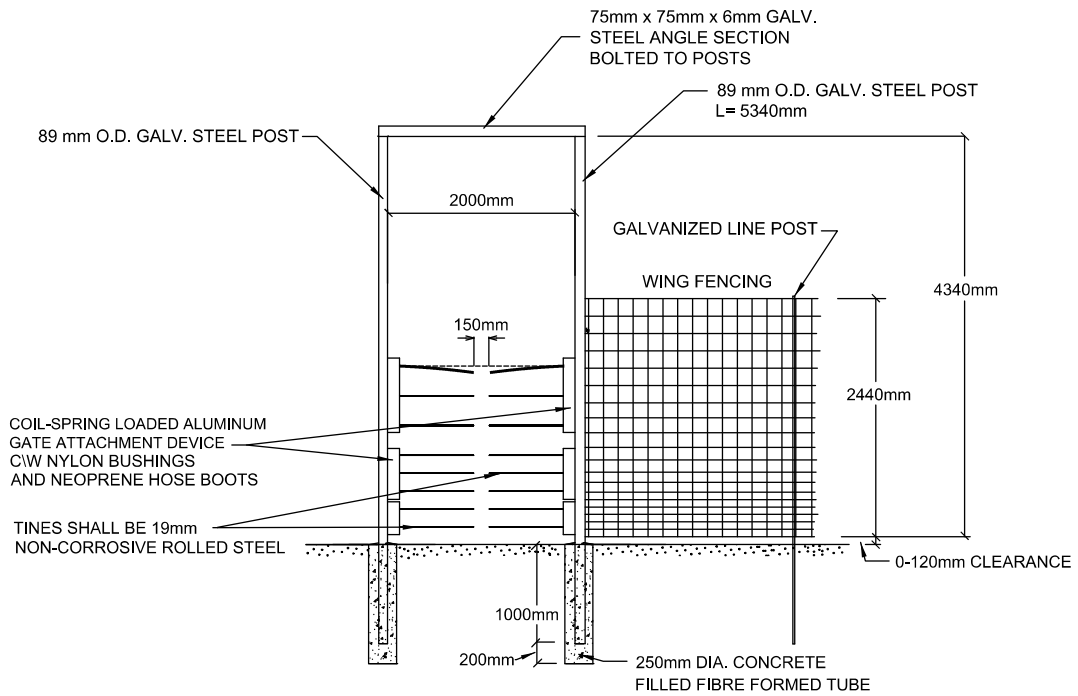
SECTION DETAILS ON STANDARD DRAWING 179-2

Dual Ungulate Gate Layout



A-A

NOT TO SCALE

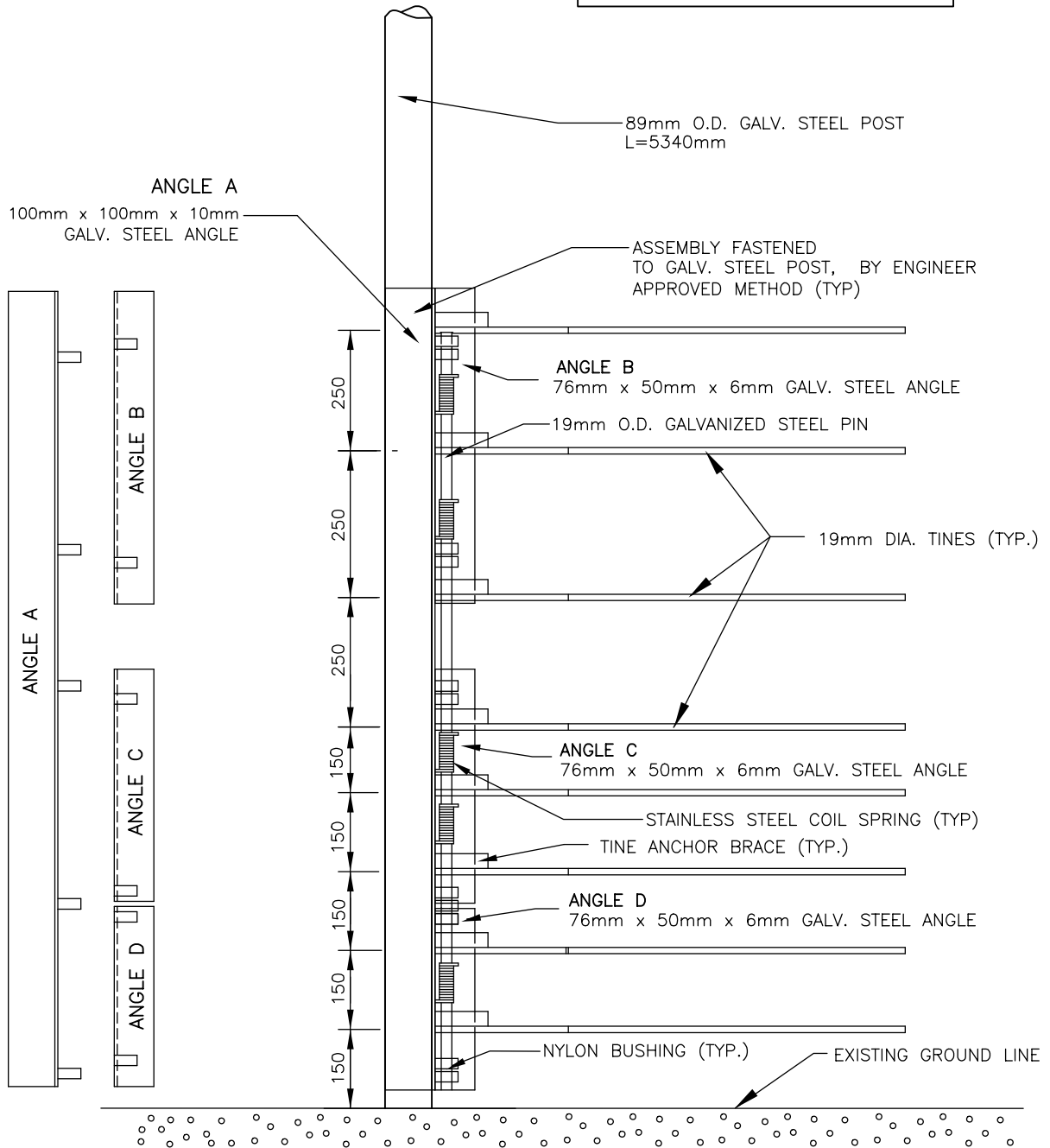


B-B

PLAN VIEW ON STANDARD DRAWING 179-1

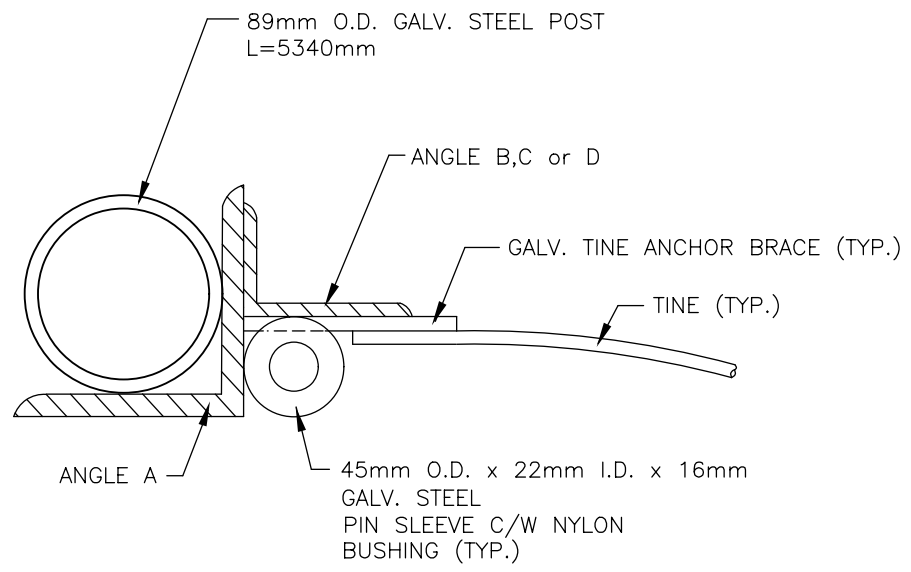
Typical Dual Ungulate Gate Details

NOTE : FOR GATE ANGLES DETAILS,
SEE STANDARD DRAWING 179-5
NOT TO SCALE



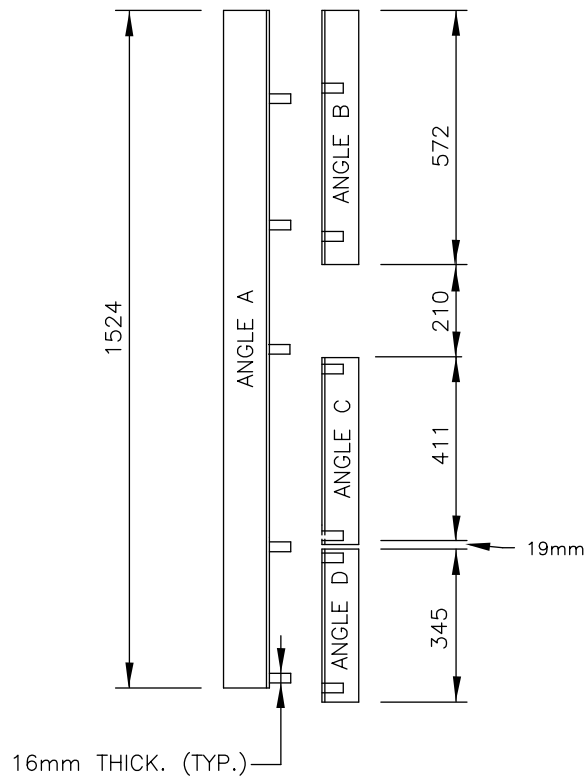
Ungulate Gate Detail
One - Side Elevation

ASSEMBLY TO BE FASTENED TO GALV. STEEL POST BY ENGINEER APPROVED METHOD (TYP)
NOT TO SCALE



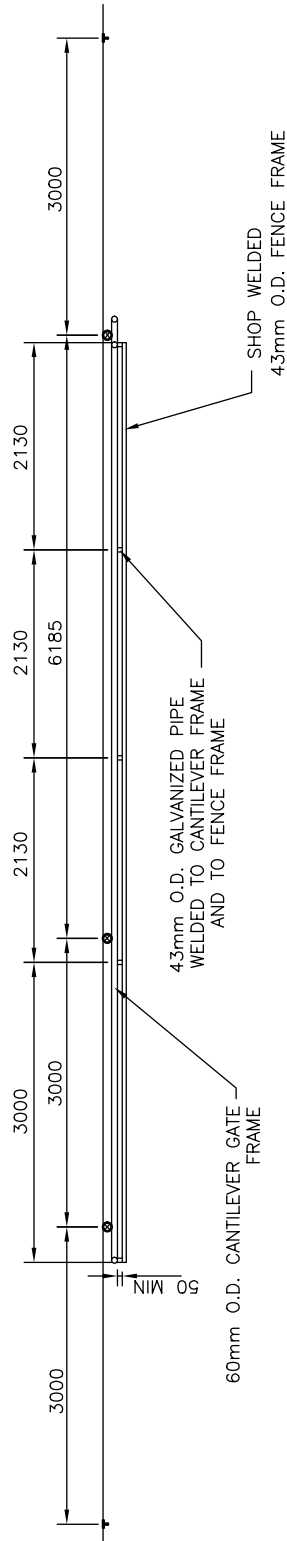
Ungulate Gate Assembly – Plan View

NOTE : ANGLE A – 100mm x 100mm x 10mm GALV. STEEL ANGLES B,C and D – 76mm x 50mm x 6mm GALV. STEEL
NOT TO SCALE

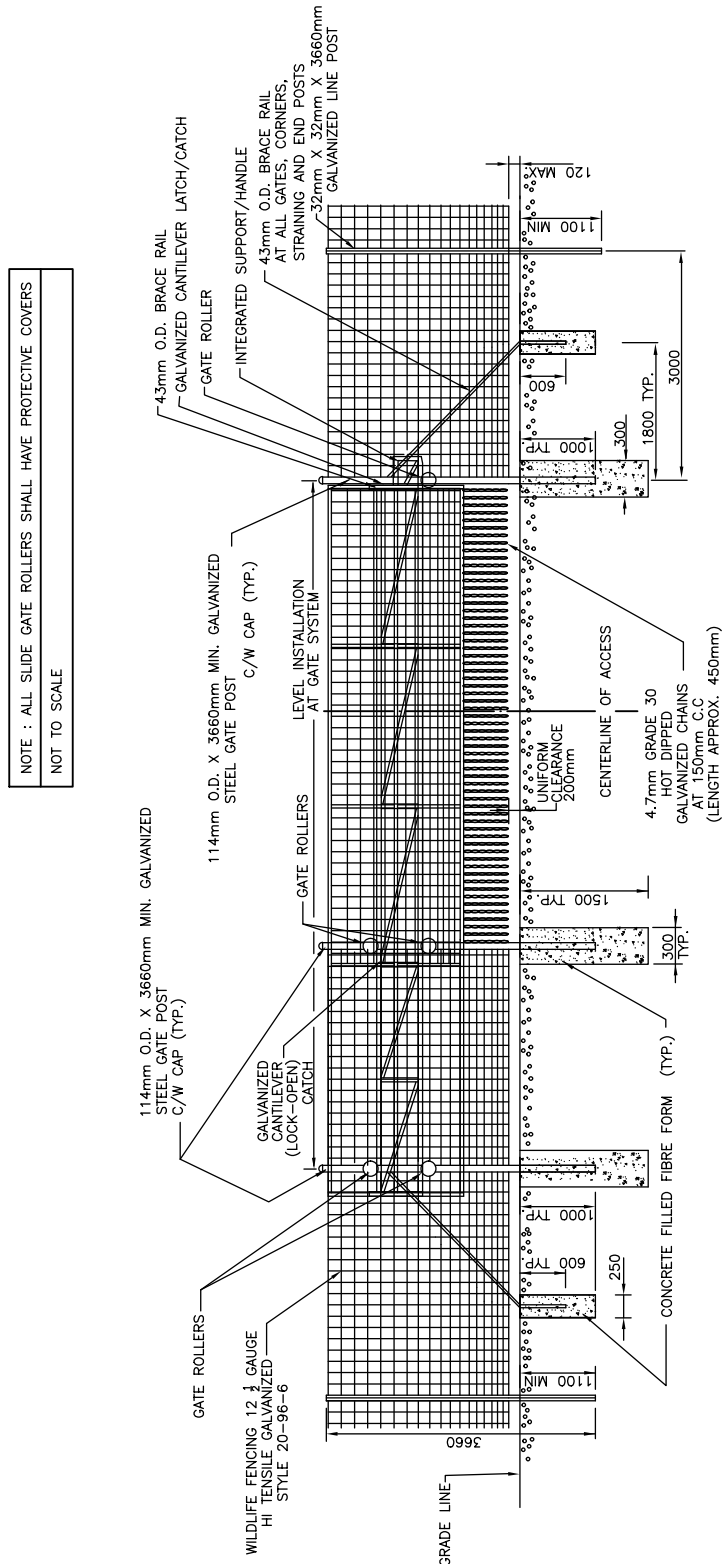


**Ungulate Gate Assembly Details
 Gate Angles**

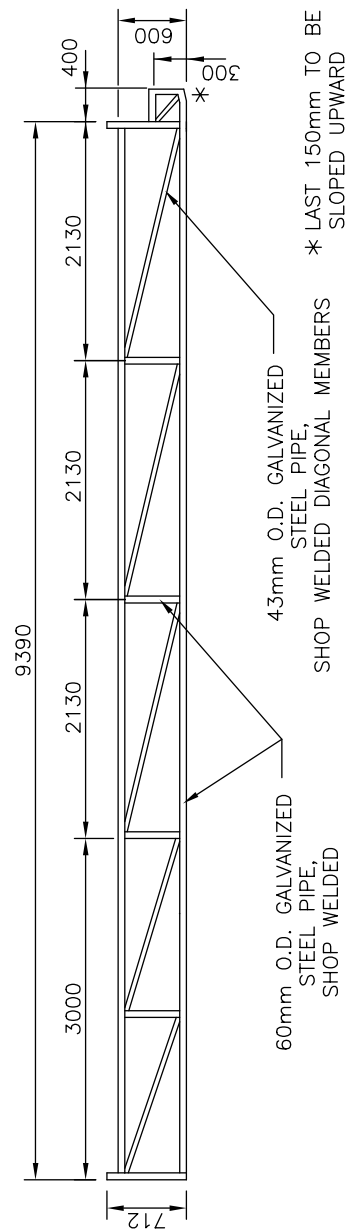
NOT TO SCALE



Cantilever Slide Gate – Plan View

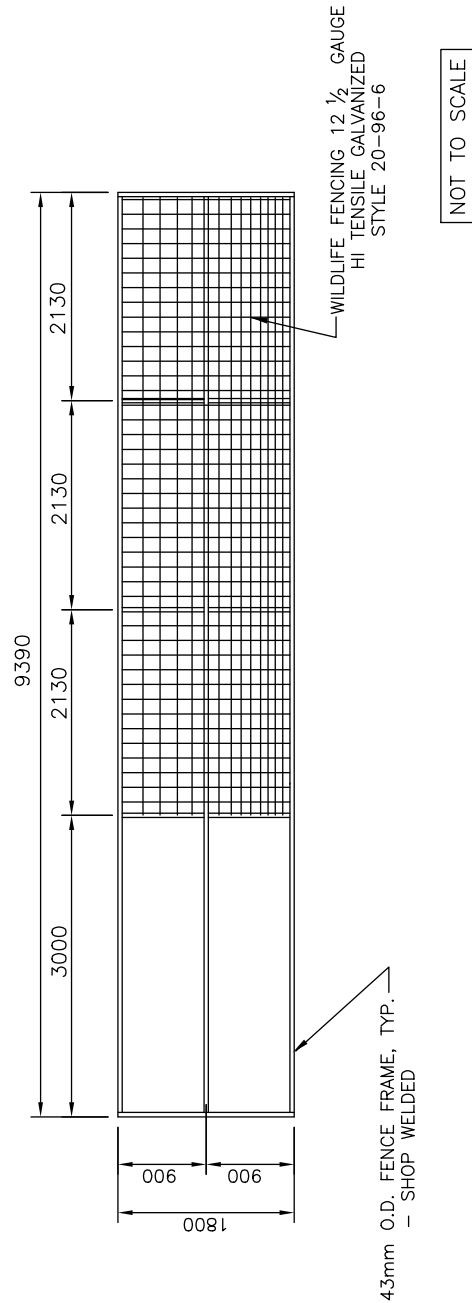


Cantilever Slide Gate – Front Elevation

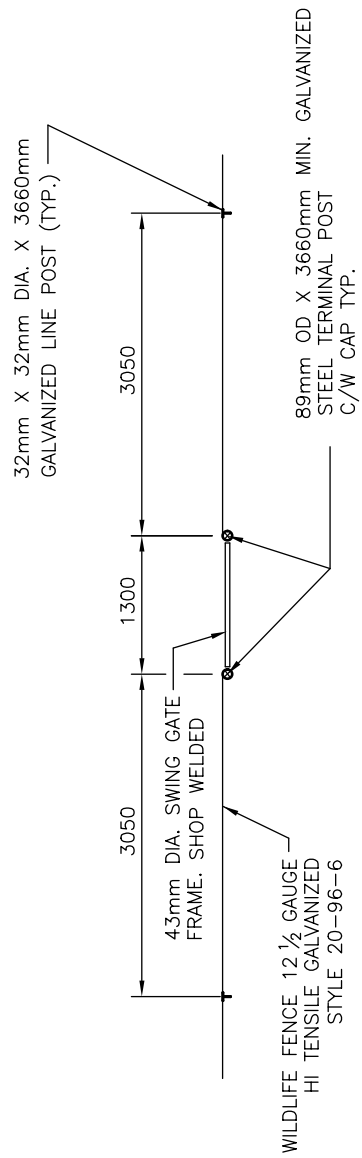


NOT TO SCALE

Cantilever Slide Gate Frame Detail

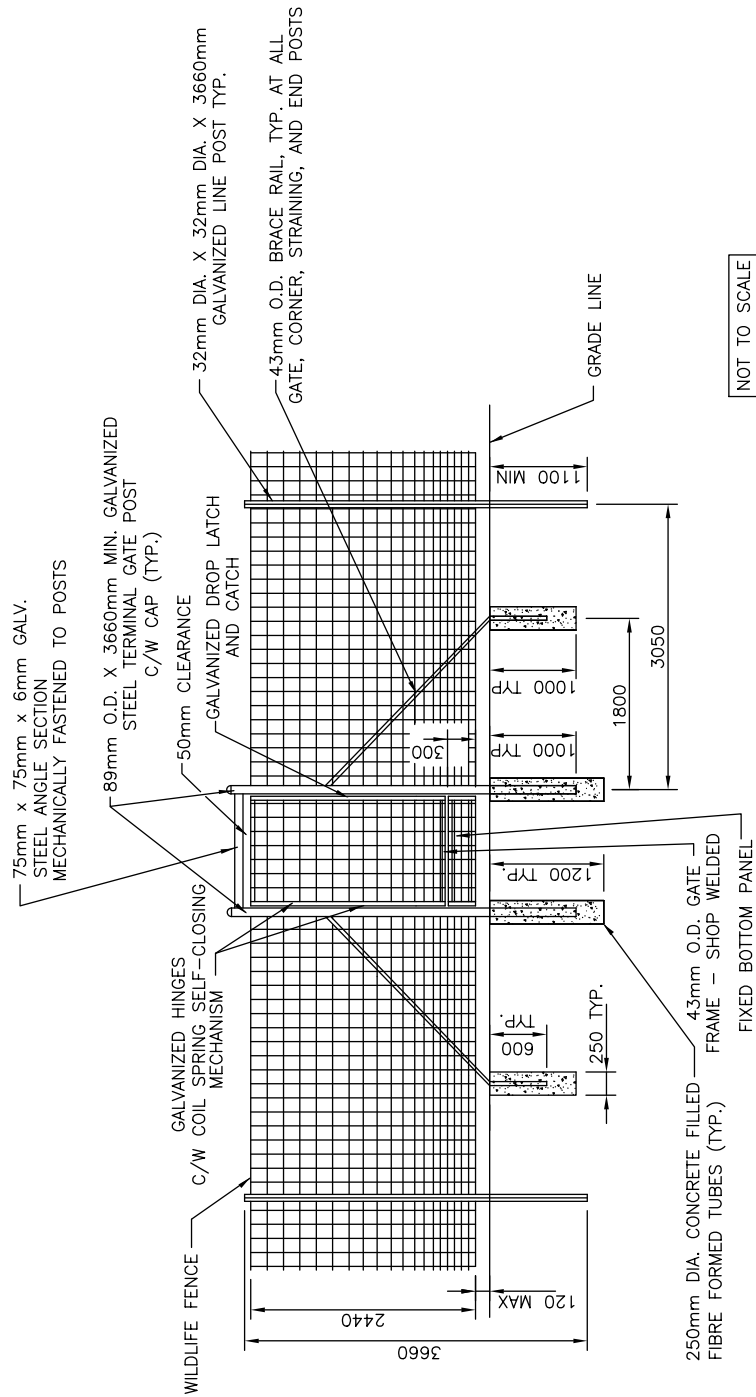


**Cantilever Slide Gate – To Be Welded
To Cantilever Slide Gate Frame**

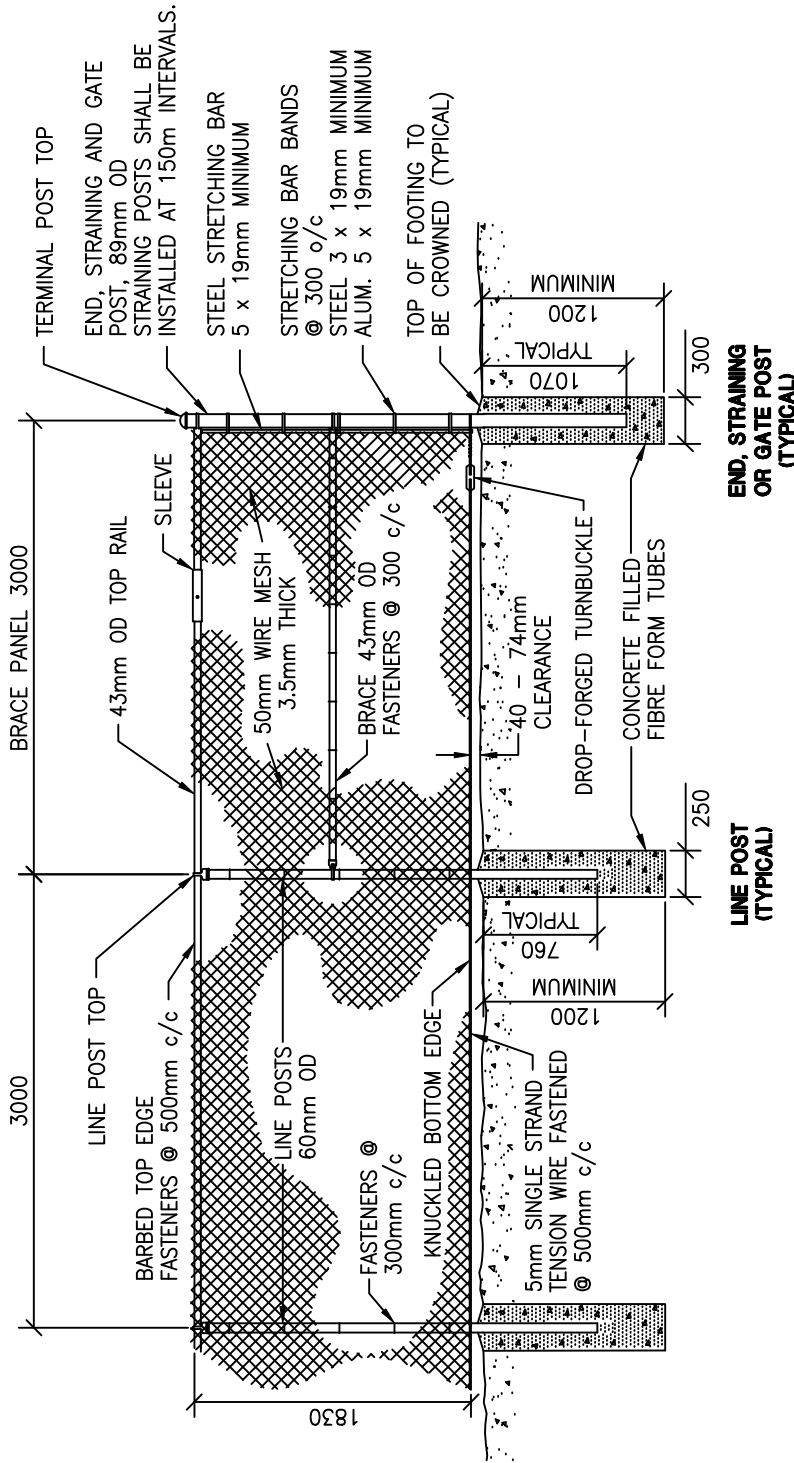


NOT TO SCALE

Pedestrian Gate – Plan View



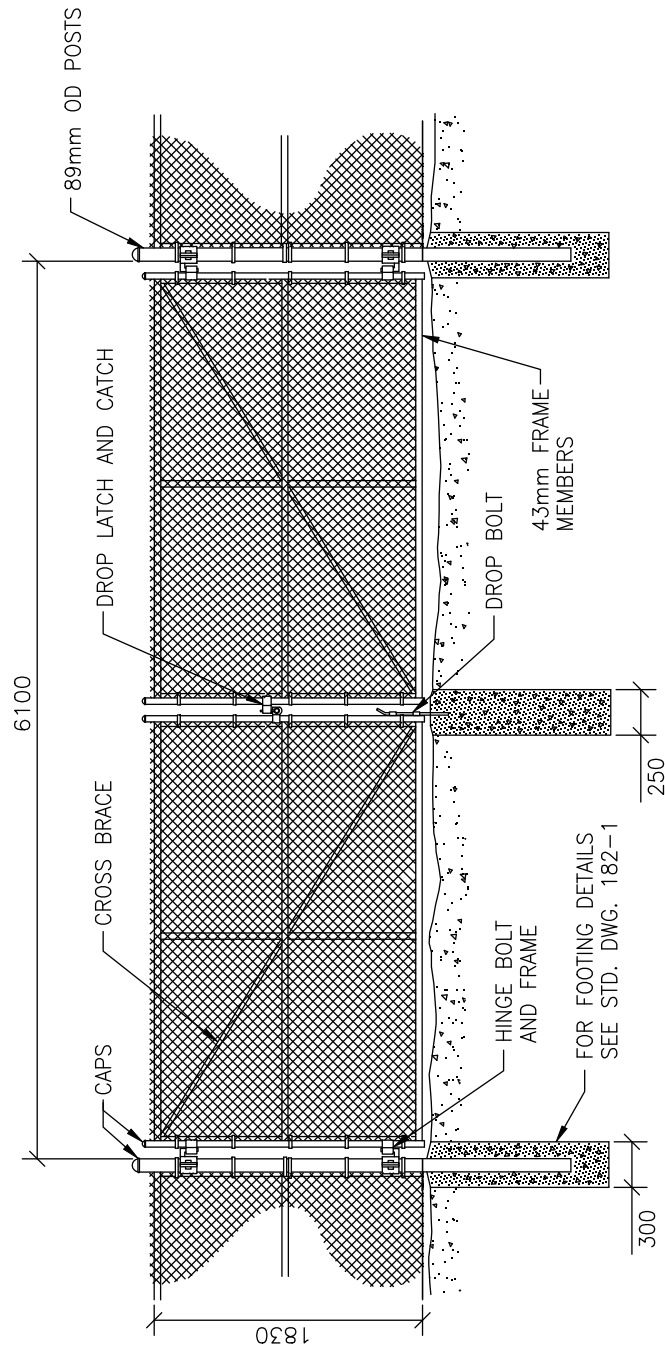
Pedestrian Gate – Front Elevation



<p>GROUND LINE</p> <p>POST</p> <p>ROCK LINE</p> <p>NON-SHRINK CEMENT GROUT</p> <p>OD+25</p> <p>450 MAX.</p>	<p>IN SOLID ROCK WITH OVERBURDEN LESS THAN 450mm</p>
<p>GROUND LINE</p> <p>POST</p> <p>ROCK LINE</p> <p>IF DRILLED USE NON-SHRINK CEMENT GROUT</p> <p>IF EXCAVATED OR BLASTED USE CONCRETE</p> <p>CONCRETE</p> <p>900</p> <p>850</p> <p>OD+25</p> <p>300</p>	<p>IN SHALE OR FRIABLE ROCK, AND IN SOLID ROCK WITH MORE THAN 450mm OVERBURDEN</p>

FASTENERS SHALL BE MINIMUM 3.5mm ALUMINUM WIRE. FASTENING OF BOTTOM EDGE OF FENCE MAY BE DONE BY USING FASTENERS OR BY BENDING A KNUCKLED MESH WIRE AROUND THE TENSION WIRE.

Chain Link Fence



DOUBLE SWING GATE

Chain Link Gate

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201.1 DESCRIPTION

- .1 This Item consists of the processing and stockpiling of Highway aggregates.
- .2 For the purposes of this Item the term "rock" does not include sandstone, which is handled as a separate material.

201.2 MATERIALS

201.2 .1 General

- .1 All materials shall be supplied by the Contractor.

PRODUCTION OF HIGHWAY AGGREGATES

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- 201.2.1 .2 The Contractor shall provide the pit and/or quarry source for supply unless the source of the materials is specified in the Contract Documents.
- .3 The Owner reserves the right to reject any source of supply of aggregates on the basis of past field performance, documented by the records and experience of the Owner and/or the Engineer with a specific material, regardless of compliance with physical requirements or grading limits.
- .4 The Owner maintains records of field and Laboratory testing results for known Highway aggregate sources located throughout the province and these records are available for viewing, in accordance with Item 926, at the Owner's offices located in the Soils and Mineral Building, 975 College Hill Road, Fredericton, NB, during normal business hours.

201.2 .2 Rock And Gravel Aggregates - Physical Requirements

- .1 Aggregate shall be composed of clean, hard, sound, durable, uncoated particles that do not contain friable, soluble or reactive minerals or other deleterious materials or conditions that would make the aggregate prone to decomposition or disintegration, or present any environmental hazard, from the presence of the parent material or its by-products, when exposed to the natural elements after placement in the Work.
- .2 Aggregate shall meet the requirements of Table 201-1.

Table 201-1
Properties of Rock and Gravel Aggregate

Test and Method	Aggregate Type	Value (Max.)
Micro-Deval (MTO LS - 618)	Cover Material	22%
	Aggregate Base	25%
	Aggregate Subbase and Shoulder Material	30%
Micro-Deval (MTO LS - 619)	Blending Material (Aggregate Base)	25%
	Blending Material (Aggregate Subbase and Shoulder Material)	30%
Freeze Thaw (MTO LS - 614)	All Highway Aggregates	20%
Flat & Elongated Particles @ 4:1 (MTO LS - 608)	Crushed Rock Aggregates	35%
Plasticity Index (AASHTO T89 and T90)	Aggregate Base and Blending Material	3
	Aggregate Subbase and Blending Material	5

201.2 .3 Blending of Aggregates

- .1 Blending of aggregates shall be permitted to meet the grading requirements, increase the percentage of crushed particles, or decrease the percentage of flat and elongated particles.
- .2 Blending shall not be permitted if required solely to improve the results of material quality tests (Micro-Deval, Freeze-Thaw and Plasticity Index).

PRODUCTION OF HIGHWAY AGGREGATES

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- 201.2.3 .3 Blending shall be permitted only at the crusher, and the method and location of introducing the blending material into the crushing process shall be submitted in writing to the Engineer for approval, prior to production of any blended product.
- .4 The blending material shall be added such that the rate of blending is controlled and measurable.
- .5 Blending materials shall be granular materials having a Dust content not exceeding 20% when tested in accordance with ASTM C117.
 - .1 The blending materials shall individually meet the Micro-Deval and Plasticity Index requirements of Table 201-1.
- .6 Natural sand or gravel used as blending material in the production of the crushed rock aggregates shall not exceed 20% by mass of the blended aggregate produced.
- .7 Blending of aggregates shall produce a consistently graded product.
- 201.2 .4 Aggregate Base/Subbase
- 201.2.4 .1 Crushed Rock Base/Subbase
 - .1 Crushed rock base/subbase shall be produced by the crushing and processing of rock to conform to the grading limits as set out in Table 201-2, when tested in accordance with ASTM C136 and C117.
 - .1 Rock shall be quarried from a source that is solid in situ.

Table 201-2
Grading Limits - Crushed Rock Base/Subbase

ASTM Sieve Size	Aggregate Base		Aggregate Subbase	
	25 mm % passing	31.5 mm % passing	50 mm % passing	75 mm % passing
90.0 mm				100
75.0 mm				95 - 100
63.0 mm			100	85 - 100
50.0 mm			95 - 100	73 - 95
37.5 mm		100	76 - 100	58 - 87
31.5 mm	100	95 - 100		
25.0 mm	95 - 100	81 - 100	60 - 84	
19.0 mm	71 - 100	66 - 90	50 - 76	35 - 69
12.5 mm	56 - 82	50 - 77		
9.5 mm	47 - 74	41 - 70	32 - 61	25 - 54
4.75 mm	31 - 59	27 - 54	21 - 49	17 - 43
2.36 mm	21 - 46	17 - 43	15 - 40	12 - 35
1.18 mm	13 - 34	11 - 32	10 - 32	8 - 28
300 µm	5 - 18	4 - 19	4 - 18	4 - 16
75 µm	0 - 7	0 - 7	0 - 8	0 - 8

PRODUCTION OF HIGHWAY AGGREGATES

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201.2.4 .2 Crushed Gravel Base/Subbase

- .1 Crushed gravel base/subbase shall be produced by the crushing and processing of gravel to conform to the grading limits of Table 201-3 when tested in accordance with ASTM C136 and C117.

Table 201-3
Grading Limits - Crushed Gravel Base/Subbase

ASTM Sieve Size	Aggregate Base		Aggregate Subbase		
	25 mm % passing	31.5 mm % passing	50 mm % passing	75 mm % passing	100 mm % passing
100.0 mm					100
90.0 mm				100	95 - 100
75.0 mm				95 - 100	80 - 100
63.0 mm			100	86 - 100	
50.0 mm			95 - 100	75 - 95	60 - 87
37.5 mm		100	79 - 100	61 - 87	50 - 81
31.5 mm	100	95 - 100			
25.0 mm	95 - 100	83 - 100	63 - 85		
19.0 mm	75 - 100	70 - 90	53 - 78	38 - 70	34 - 68
12.5 mm	60 - 82	55 - 78			
9.5 mm	52 - 75	45 - 72	35 - 62	28 - 56	25 - 58
4.75 mm	36 - 61	30 - 57	24 - 51	19 - 46	17 - 48
2.36 mm	25 - 48	20 - 46	17 - 42	13 - 37	13 - 39
1.18 mm	16 - 36	14 - 35	12 - 33	9 - 30	9 - 30
300 µm	5 - 16	5 - 19	5 - 18	4 - 16	4 - 17
75 µm	0 - 6	0 - 6	0 - 6	0 - 7	0 - 7

- 201.2.4.2 .2 Gravel Base shall have a minimum of 40% of the particles, by mass, having at least one fractured face, when tested in accordance with ASTM D5821.

201.2.4 .3 Pit Run Gravel Subbase

- .1 Pit run gravel subbase shall be gravel that conforms to the grading limits set out in Table 201-4, when tested in accordance with ASTM C136 and C117.

- .1 Oversize rocks in the pit run material shall be removed from the Work.

Table 201-4
Grading Limits - Pit Run Gravel Subbase

ASTM Sieve Size	%-Passing
125 mm	100
100 mm	95 - 100
75 mm	82 - 100
50 mm	62 - 100
37.5 mm	52 - 100
19 mm	30 - 90
9.5 mm	22 - 79
4.75 mm	16 - 66
2.36 mm	12 - 55
1.18 mm	9 - 44
300 µm	4 - 25
75 µm	0 - 7

201.2.4 .4 Crushed Sandstone Subbase

- .1 Crushed sandstone subbase shall be produced by the crushing and processing of sandstone to conform to the grading limits as set out in Table 201-5, when tested in accordance with ASTM C136 and C117.
 - .1 Sandstone shall be composed of clean uncoated particles free from clay, organic or other deleterious materials, and shall be from a source that is solid in situ.
 - .1 Sandstone rubble and highly weathered sandstone shall not be acceptable.
 - .2 Crushed sandstone shall have a maximum Plasticity Index (PI) of 5.

Table 201-5
Grading Limits - Crushed Sandstone Subbase

ASTM Sieve Size	50 mm % Passing	75 mm % Passing	100 mm % Passing
100 mm			95-100
75 mm		95 - 100	
50 mm	95 - 100		
75 µm	0 - 10	0 - 10	0 - 10

- 201.2.4.4.1 .3 Crushed Sandstone proposed for use as subbase shall have a Micro-Deval loss not greater than 60% when tested in accordance with Test Method MTO LS-618, A Grading, modified as follows:
 - Para. 5.6- The Micro-Deval abrasion machine shall run 30 minutes.
 - Para. 5.7 and 5.8- A 75 µm sieve shall be added to determine Mass 'B' in the Percent Loss calculation.

PRODUCTION OF HIGHWAY AGGREGATES

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201.2 .5 Crushed Shoulder Material

- .1 Shoulder material shall be produced by the crushing and processing of rock or gravel to conform to the grading limits set out in Table 201-6, when tested in accordance with ASTM C136 and C117.

Table 201-6
Grading Limits - Crushed Shoulder Material

ASTM Sieve Size	31.5 mm % passing
37.5 mm	100
31.5 mm	95 - 100
25.0 mm	84 - 100
19.0 mm	70 - 90
12.5 mm	55 - 78
9.5 mm	45 - 72
4.75 mm	30 - 57
2.36 mm	20 - 46
1.18 mm	14 - 35
300 µm	7 - 21
75 µm	3 - 9

201.2 .6 Cover Material

- .1 Cover material shall be produced by the crushing and processing of rock or gravel to conform to the grading limits set out in Table 201-7, when tested in accordance with ASTM C136 and C117.

Table 201-7
Grading Limits - Cover Material

ASTM Sieve Size	9.5 mm % passing	12.5 mm % passing	16 mm % passing	19 mm % passing
19.0 mm				100
16.0 mm			100	
12.5 mm		100	0 - 90	40 - 80
9.5 mm	100	40 - 90	0 - 60	20 - 62
4.75 mm	0 - 5	0 - 20	0 - 20	0 - 20
2.36 mm		0 - 8	0 - 8	0 - 10
75 µm	0 - 2	0 - 3	0 - 3	0 - 3

201.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, identifying the source of material and shall provide 7 Days' notice of the commencement date for crushing.
- .1 The Contractor shall make available all Equipment necessary for the Engineer to obtain representative samples of the material proposed for supply.
- .1 Prior to sampling for source approval, the Contractor shall crush a minimum of 500 tonnes of aggregate from the proposed material location.

201.3.1.1 .2 The frequency of sampling and testing for source approval will be carried out as indicated in Table 201-8.

Table 201 – 8
Source Approval Frequency

Initial Test Sample (8 bags required): Coarse Micro-Deval (MTO LS-618) Freeze Thaw (MTO LS-614) Flat and Elongated (MTO LS-608) - quarries only Plasticity Index (AASHTO T89 & T90) Crush Count (ASTM D5821) - gravel base only Total Sulphur/Neutralizing Potential Ratio (NPR) - quarries only		Follow up Test Sample (3 bags required): Micro-Deval (MTO LS-618) Plasticity Index (AASHTO T89 & T90)	
Total Aggregate Tonnage		Minimum Test Samples Required	
Up to 25,000		1 initial test	-
Up to 75,000		1 initial test	1 follow up
Up to 125,000		1 initial test	2 follow up
Up to 200,000		1 initial test	3 follow up
Up to 300,000		1 initial test	4 follow up
Notes: 1) When producing more than one type of aggregate, ensure that the results meet the specifications for all products or additional tests may be required. 2) Visually detected changes in aggregate will constitute immediate testing. 3) Follow up test results will be made available 5 days after submission to the lab.			

.2 The Engineer shall require up to 21 Days from the date the aggregate samples are received at the Owner's Central Laboratory in Fredericton to the date of notification of the evaluation of the material.

201.3 .2 The Contractor shall not commence any processing Work until written notification of the approval of the source is received from the Engineer.

201.4 CONSTRUCTION

201.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall advise the Engineer immediately of any changes in the source materials, at any time during the course of the Work.
 - .1 Random samples shall be taken and tests conducted by the Engineer to determine the effects of the change.
 - .2 No Work shall be undertaken by the Contractor in the area of the changed conditions until an approval is received from the Engineer.
- .3 For rock and gravel aggregates, if samples taken during the Work fail to meet the physical property requirements of Table 201-1 the Contractor shall cease production and make necessary changes in location or source to produce material meeting the requirements.

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201.4 .2 Plant

- .1 The Contractor shall provide an area for the Owner's lab trailer and shall make all necessary provisions for power and an adequate supply of water (minimum 10 L/min) that is clean and free of injurious amounts of oil, alkali, acid, organic matter or other deleterious substances, for the duration of the Work.
 - .1 The Contractor shall retain a qualified electrician to perform the electrical hook-up to conform to the requirements of the Canadian Electrical Code.
- .2 The Contractor shall provide the Engineer safe access to the stream of crushed aggregate flowing off the belt(s), or to the stockpile.
- .3 The Contractor shall crush and screen aggregates with Equipment of adequate capacity and capable of yielding a consistent and acceptable product.
- .4 Aggregates shall only be washed by a method that produces a consistent product.
 - .1 The water to be used for washing aggregate shall be clean and free of injurious amounts of oil, alkali, acid, organic matter or other deleterious substances.
 - .2 Disposal of any washing residue shall be the responsibility of the Contractor.

201.4 .3 Pits and Quarries Controlled By Owner

- .1 Processed materials not meeting the specified aggregate type and/or size shall remain the property of the Owner.
- .2 The Contractor shall be responsible for the loading, hauling and stockpiling of this material at a location within the developed pit/quarry as specified in the Contract Documents and/or as directed by the Engineer.

201.4 .4 Pits and Quarries Controlled by Others

- .1 Processed materials not meeting the specified aggregate type and/or size shall be the responsibility of the Contractor.

201.4 .5 Stockpiles

- .1 Crushed aggregate shall be stockpiled at a location as indicated in the Contract Documents and/or as approved by the Engineer.
- .2 Stockpiling of aggregate shall be done on well-drained, level base(s) capable of supporting the entire weight and dimension of the stockpile(s) and in such a manner as to ensure maximum recovery of the stockpiled material(s).
 - .1 Stockpiles shall not be placed near the quarry face, Stripping piles or piles of other aggregates, nor near property lines, tree lines or drainage ditches such that retrieval of all aggregate is not possible or practical and access to the stockpile shall be maintained at all times.
 - .2 If a potential for contamination of the aggregate exists due to ground conditions at the stockpile site, the Contractor shall evenly distribute and compact a layer of clean, fine-grained material, a minimum of 150 mm thick, to form a foundation for the stockpiles.

PRODUCTION OF HIGHWAY AGGREGATES

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- 201.4.5 .3 Stockpiles shall be built in layers not exceeding 1.5 m in depth and each layer shall be completed before the next layer is begun.
- .4 Forming of cone-shaped piles with conveyer belts, pushing up piles with a tractor and dumping over the edge of stockpiles shall not be permitted.
- .5 It is the express responsibility of the Contractor to ensure that stockpiles contain material of the specified quality and gradation and are of uniform distribution.
- .1 Aggregates that become contaminated or mixed with other aggregates or segregated shall be immediately removed from the stockpile(s).

201.4 .6 Sampling and Testing of Aggregates

- .1 The crushed product shall be monitored for gradation throughout the period of the Work and shall be accepted or rejected on the basis of the tests performed by the Engineer.
- .2 Sampling and testing shall be carried out as indicated in Table 201-9.
- .1 For gravel base, the frequency of testing for crushed particles will be a minimum of one test per 10 000 tonnes produced or a minimum of two tests per contract, whichever is greater.
- .2 If the source approval test results for crushed particles is less than 45% crushed, the frequency of testing will be increased to one test per 5 000 tonnes.

**Table 201-9
 Minimum Sampling And Testing Frequency**

Procedure	Standard(s)	Minimum Frequency Per Shift	
		≤ 50 mm	≥ 75 mm
Sampling Aggregates	ASTM D75	3	2
Reduction of Sample	ASTM C702	3	2
Sieve Analysis	ASTM C117, C136	3	2

NOTES: 1) Shift is defined as one production crew's daily work period.
 2) Where production is greater than 4000 t per shift the minimum frequency of testing shall be increased as determined by the Engineer.
 3) Frequency of testing may also be reduced during low production, as determined by the Engineer.

- 201.4.6 .3 Sample sizes smaller than those specified in ASTM D75 and C136 may be used for quality control purposes, as indicated in Table 201-10

**Table 201-10
 Minimum Sieve Analysis Sample Sizes**

Aggregate			Cover Material	
Type	Size (mm)	Mass (g)	Size (mm)	Mass (g)
Base	25	5000	9.5	1000
Base/Shoulder Material	31.5	7000	12.5	1200
Subbase	50	10000	16	1500
Subbase	75	15000	19	2000
Subbase	100	20000		
Subbase	Pit Run	20000		

NOTE: Field samples obtained under ASTM D75 shall be at least four times larger than the above sieve analysis sizes.

PRODUCTION OF HIGHWAY AGGREGATES

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201.4.6 .4 The Contractor shall be provided a copy of all test results as soon as they are available and shall be notified immediately if any test result indicates that materials are being produced outside of the specified limits.

201.4 .7 Aggregates Produced Outside the Specified Limits

.1 The Contractor shall not place any material into the production stockpile after notification under 201.4.6.4 that the material being produced is outside the specified limits.

.2 The Contractor shall “hold” the placement of material into the production stockpile or shall stockpile all material being produced in separate and clearly defined “reject” stockpile(s) once a test result indicates that the material being produced does not meet specification and shall continue to do so until such time that 2 additional consecutive sieve analyses show that material being produced is within the specified limits.

.1 Should only one test indicate material to be outside the specified limits, then following the completion of 2 acceptable consecutive test results, the material held may be placed in the production stockpile; otherwise the held material and any other production shall be rejected from the Work until 2 acceptable consecutive test results are obtained.

.3 The sequence of material acceptance/rejection into production stockpiles is indicated in Table 201-11.

Table 201-11
Schematic Representation of Handling Procedure

two consecutive tests within Specifications		place in production stockpile
one test outside Specifications	hold in separate stockpile(s)	
	next two tests within specification	place in production stockpile
one test outside Specifications	hold in separate stockpile(s)	
	following test outside Specification	reject material
		reject until two consecutive tests within specification

201.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of tonnes of aggregate processed and stockpiled, in accordance with this Item.

201.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall include a separate Unit Price for each size and type of aggregate, as identified under the Contract.

AGGREGATE BASE/SUBBASE

ITEM: 203

203.1 DESCRIPTION

- .1 This Item consists of supply and placement of Aggregate Base/Subbase.

203.2 MATERIALS

203.2 .1 General

- .1 All materials shall be supplied by the Contractor.
- .2 Aggregate Base/Subbase shall conform to the requirements of 201.2, 201.3 and 201.4, and shall be of the type and size, as indicated in the Contract Documents.

203.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

203.4 CONSTRUCTION

203.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Aggregate Base/Subbase materials shall conform to the properties and specified gradation requirements for the class of material specified, at the time of incorporation into the Work, and up to the completion of the Contract.
 - .1 If the material incorporated into the Work does not conform with the specified properties and/or gradation, the Contractor shall cease hauling from the source of supply and shall immediately rectify the problem to the satisfaction of the Engineer.
 - .2 Any material found to be non-conforming to the specified material shall be removed from the Work.
- .3 The Contractor shall advise the Engineer of any changes in the source materials, at any time during the course of the Work and sufficiently in advance so that random samples may be taken and tests conducted by the Owner to determine the effects of the change.
 - .1 No Work shall be undertaken by the Contractor in the area of the changed conditions until an approval is received from the Engineer.

203.4 .2 Placement

- .1 The Contractor shall satisfy himself that the existing grade has been constructed to the lines and grades as indicated in the Contract Documents prior to the commencement of the Work.
 - .1 Any deficiencies in grade shall be noted and submitted in writing prior to the commencement of the Work.

AGGREGATE BASE/SUBBASE

ITEM: 203

- 203.4.2 .2 Aggregate Base/Subbase materials shall not be placed on inundated, soft, muddy, potholed, rutted or frozen surfaces and Work shall progress only once the Work Area has been approved by the Engineer.
- .1 Any ruts or potholes which appear in advance of the Aggregate placement shall be eliminated by scarifying, shaping and compacting, or if necessary, by excavating the unsuitable material and placing and compacting new material of the same quality.
 - .3 Prior to the placement of Aggregate Base/Subbase, the slopes and ditches in the Work Area shall have been shaped to the satisfaction of the Engineer, including any topsoil that may be required.
 - .4 The Aggregate Base/Subbase shall be spread evenly and compacted in lifts minimizing the potential for segregation.
 - .1 The maximum Aggregate Subbase lift thickness shall be 300 mm.
 - .5 Each lift of Aggregate Base/Subbase shall be bladed, shaped and compacted to produce the required Profile and cross section.
 - .6 The final grade after shaping and compaction shall be to the specified tolerances.
 - .7 Spreading, shaping and compacting operations shall proceed simultaneously with the dumping operations and the Contractor shall, at the completion of any Day, ensure that all material placed is shaped and compacted to the specified density.
 - .8 Crawler tractors and scrapers shall not be permitted for hauling or placing of Aggregate Base/Subbase.
 - .9 The Foreslope in the Aggregate Base/Subbase layers shall be constructed to be free of ruts, ridges and/or undulations, to form a straight line Slope in cross section.
 - .10 Aggregate Base/Subbase materials shall not be bladed onto the Subgrade Foreslope.
 - .11 Any deterioration of the placement grade which appears during the course of the Work and is directly or indirectly attributable to the Contractor shall be repaired to the satisfaction of the Engineer before any Work may continue over this area.
 - .12 The Contractor shall remove, from the Work Site, excess material and oversize stones which have been bladed to the sides of the layer.
 - .13 The Contractor shall maintain the finished grade to the specified tolerances and to the specified density until the completion of the Contract.
 - .14 The Engineer may accept the Work on contiguous 1 km long sections of Roadbed or the whole length of Roadbed depending on conditions at the time of the Work.
- 203.4 .3 Segregation
- .1 If the Contractor's methods result in segregation of the materials, as defined by ASTM C125 and tested in accordance with ASTM C136, the Contractor shall cease Work immediately.
 - .1 Segregation is the separation of particles of an aggregate causing a lack of uniformity in their placement.

AGGREGATE BASE/SUBBASE

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203.4.3.1 .2 Surface segregation is discernible when there are visible patches of excessive rock or sand.

.2 If segregation of materials occurs, then the Contractor shall submit a Work plan to scarify and remedy the Work in place, or shall remove the segregated materials from the Work.

203.4 .4 Compaction

.1 The material shall be compacted in accordance with Item 936 to a minimum of 95% of the maximum dry density.

203.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of tonnes of Aggregate Base/Subbase supplied and placed, in accordance with this Item.

.2 Compensation payable to the Owner or the Contractor, for the difference in price of fuel between the month prior to the month of tender opening for the Contract and the month of Work under this Item, will be calculated in accordance with Item 822.

203.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall include a separate Unit Price for each size and type of Aggregate Base/Subbase, as identified under the Contract.

204.1 DESCRIPTION

- .1 This Item consists of supply and placement of Shoulder materials on the Roadbed Shoulder.

204.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Shoulder material shall conform to the requirements of 201.2, 201.3 and 201.4 and shall be of the type and size, as indicated in the Contract Documents.
- .3 If specified for use in the Contract, RAP shall be made available by the Owner.
 - .1 RAP may be made available under Item 208 and/or from a stockpile location, as identified in the Contract Documents.
 - .2 The Contractor shall be responsible to supply the material to the Work.
 - .3 The Contractor shall process the RAP to contain 100% passing the 50.0 mm sieve size, as determined by ASTM C136, and shall be free of all lumps or clods and soil.

204.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

204.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The placement of Shoulder material shall be carried out in a manner so as to avoid damage to the adjacent and surrounding Roadbed.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any damage to the adjacent and/or abutting finished surfaces resulting from this Work.
- .3 Shoulder material shall be placed by Equipment specifically designed for that purpose.
 - .1 Any Shoulder spreader considered for the Work shall be constructed so that it shall not place any Shoulder material on the Pavement.
 - .2 Shoulder material shall not be bladed onto the Subgrade Foreslope.
- .4 The Contractor shall spread the Shoulder material evenly in lifts not exceeding 150 mm uncompacted thickness and shall employ methods to limit segregation.
 - .1 Where surplus Aggregate Base has been windrowed along the Shoulder during the Work under Item 205, the Contractor shall spread, shape and compact the windrowed material on the Shoulder at his/her own expense, prior to placing any Shoulder material under this Item.

SHOULDER MATERIAL

ITEM: 204

- 204.4 .5 The Shoulder material shall be compacted in accordance with Item 936 to a minimum of 95% of the maximum dry density, except as follows:
- .1 RAP shall be compacted to the 97% of maximum density as determined by a test strip.
- .6 The Contractor shall not permit more than 4 km of each lift of newly laid asphalt concrete to be open to traffic without the Shoulder material operation being in progress.
- .1 Regardless of the distance paved, each new lift of newly laid asphalt concrete shall not be open to traffic for a period greater than 7 Days without Shoulder material being placed.
 - .2 Where the difference in elevation between the asphalt concrete and the Shoulder exceeds 70 mm in any portion of the Work, the Shoulder material placement operation shall commence within 48 hours of the placement of the asphalt concrete.
 - .3 Where the difference between the finished Partial Depth or Full Depth Recycling and the Shoulder exceeds 70 mm in any portion of the Work, the Shoulder material placement operation shall commence within 48 hours of the completion of Partial Depth or Full Depth Recycling.
 - .1 Low shoulders shall be immediately signed as per the Work Area Traffic Control Manual.
- .7 Shoulder material shall be placed in driveways and around guide posts as directed by the Engineer.
- .1 The Contractor shall undertake all handwork that may be necessary to complete the Work.
- .8 Final shaping of the Shoulder material shall be consistent and continuous to the grade of the abutting Pavement surface and shall extend at the specified Slope to the line of the Foreslope and shall be blended and shaped to match the Foreslope intersection.
- .9 The Contractor shall keep clean the adjacent Pavement surface and in all cases the Pavement surface shall be free of Shoulder material prior to opening the Work Area to traffic.
- .1 Excess Shoulder material remaining on the Pavement surface shall be removed by sweeping.

204.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tonnes of Shoulder material supplied and placed in accordance with this Item.

204.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size and type of Shoulder material, as identified under the Contract.
- .2 The Contractor shall be subject to a penalty of \$500.00 per Day, for each occurrence, if the Shoulder material placement operation is not carried out in the prescribed period as defined in 204.4.6.

FINE GRADING

ITEM: 205

205.1 DESCRIPTION

- .1 This Item consists of shaping and compaction of Aggregate Base to the specified lines and grades.

205.2 MATERIALS

- .1 None required.

205.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

205.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All fine grading shall be carried out in accordance with Item 941 and/or to grades, slopes, dimensions and tolerances as directed by the Engineer.
 - .1 If at any time during the Work, the surface becomes rutted or displaced, the Contractor shall make all necessary repairs to reinstate the surface grade and if necessary, the depth rutted and/or displaced shall be scarified, reshaped and compacted to meet the requirements of this Item.
- .3 The fine grading material shall be compacted in accordance with Item 936 to a minimum of 95% of the maximum dry density. If paved Shoulders are specified, the Shoulders shall be fine graded to the same elevation as the top of the adjacent surface.
- .4 On paving Contracts, materials remaining from fine grading operations shall be used to the extent possible to complete the shouldering to the line and grade of the finished Pavement.
 - .1 If surplus material still remains after completion of shouldering then these materials shall remain the property of the Owner and shall be removed from the Work Site as directed by the Engineer.
 - .2 The Contractor shall be responsible to ensure that all Shoulders and Foreslopes are left in a neat and uniform appearance.

205.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of fine grading completed in accordance with this Item.
- .2 The area to be fine graded shall be defined as 300 mm beyond the edge of the Pavement line unless otherwise noted in the Contract Documents.

205.6 BASIS OF PAYMENT

- .1 Payment for this Work shall be at the Unit Price.

208.1 DESCRIPTION

- .1 This Item consists of the removal, haulage and stockpiling of asphalt concrete from a Roadbed.

208.2 MATERIALS

- .1 None identified.

208.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer a minimum of 3 Days in advance of the commencement of the Work.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

208.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall take care in full depth removal not to contaminate the RAP with the underlying aggregate material.
- .3 The Contractor shall provide, in partial depth removal, Equipment with a ski at least 7.6 m long or approved equivalent, with automatic controls for the control of longitudinal grade.
 - .1 All loose material remaining after cold milling shall be swept to a granular shoulder or picked up from paved Shoulders, gutters, or from under guide rail before reopening the Work Area to traffic.
 - .2 If a transverse vertical cut is milled in the existing Pavement at the limit of the Work Area the Contractor shall immediately construct with hot mixed asphalt concrete a temporary smooth 1.5 m long taper, as shown in Standard Drawing 261-1.
 - .3 The Lanes shall be completed to the same location at the end of the Day's cold milling.
 - .4 There shall be no transverse slope control used.
- .4 The Contractor shall remove all asphalt concrete from the faces of gutters, catch basins or manhole frames and other Structures abutting the Work, in such a manner that the Structures are not damaged, and the area after removal matches the grade of the adjacent removal area.
- .5 The Contractor shall provide for the drainage of water from the cold milled area as determined by the Engineer.
- .6 The RAP shall remain the property of the Owner and shall be loaded and hauled to a stockpile site as indicated in the Contract Documents or as directed by the Engineer.
 - .1 If the Contractor removes the specified thickness in more than one layer, then material from each layer must be stockpiled separately, unless otherwise indicated in the Contract Documents.

COLD MILLING - ASPHALT CONCRETE

ITEM: 208

- 208.4 .7 Proper stockpiling procedures shall be used and care taken not to contaminate or consolidate the reclaimed asphalt concrete stockpile.
- .1 If a potential for contamination of the RAP exists due to ground conditions at the stockpile site a layer of clean, fine-grained material shall be evenly distributed as a base for the stockpiles.
 - .2 The height of RAP stockpiles shall be a maximum of 3 m to limit the consolidation of the stockpiled material and no loaders, crawler tractors, trucks or other Equipment shall be permitted to travel on the stockpile.
- .8 If the Contract Documents specify that the reclaimed asphalt concrete is to be used in a hot recycled asphalt mix, the RAP shall be weighed prior to placement in the stockpile.
- .9 The Contractor shall continuously maintain the Work Site free of potholes and standing water and in a condition providing for the safe and efficient flow of traffic, from the time of removal, until such time as the new asphalt concrete is placed.
- .1 Hot mixed asphalt concrete shall be placed in the potholes; cold mix or RAP are acceptable only as a temporary repair.

208.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of asphalt concrete acceptably removed, hauled and stockpiled in accordance with this Item.

208.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for either full depth or partial depth removal, as identified under the Contract.

SHOULDER RUMBLE STRIPS

ITEM: 210

210.1 DESCRIPTION

- .1 This Item consists of the cold milling of rumble strips on the paved (asphalt concrete) Shoulders.

210.2 MATERIALS

- .1 None identified.

210.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer a minimum of 5 Days prior to commencing the Work.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

210.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Rumble strips shall be cold milled on the outside paved Shoulder, right side in direction of travel, at the locations indicated in the Contract Documents.
- .3 Rumble strips shall be a series of 400 mm x 150 mm rectangular troughs milled to a depth of 10 ± 2 mm at 150 mm spacing, parallel to and 200 mm outside the solid white edge line, as shown on Standard Drawing 210-1.
- .4 To accommodate rumble strips the right Shoulder shall have a minimum 0.8 m of its width paved at least 140 mm thick, and another 1.5 m paved or chipsealed.
 - .1 The outer edge of the rumble strip shall be a minimum of 100 mm inside that portion of Shoulder that is full depth asphalt concrete.
- .5 Unless otherwise approved by the Engineer, rumble strips shall not be installed in the following locations:
 - .1 Within 300 m of residential or commercial development;
 - .2 Within 30 m of a Structure with PC concrete deck (paved or bare); or
 - .3 Within 30 m of the beginning or end of tapers of auxiliary (deceleration or acceleration) lanes, resuming beyond the gore area.
- .6 All cold-milled material resulting from the Work under this Item shall be removed from the Roadbed within one hour after milling, to the satisfaction of the Engineer.

SHOULDER RUMBLE STRIPS

ITEM: 210

210.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of Shoulder along which rumble strips have been acceptably constructed in accordance with this Item.
- .1 The measurement shall be taken parallel to the white edge line of the travelled lane.

210.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

SHOULDER SUBDRAIN

ITEM: 231

231.1 DESCRIPTION

- .1 This Item consists of the supply and installation of Shoulder subdrain and associated drain outlet Structures.

231.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Subdrain pipe shall be 100 mm diameter corrugated slotted plastic pipe, and shall meet the following:
 - .1 PVC pipe and appurtenances shall be DR 35 conforming to CAN/CSA B182.2 and perforated as per CAN/CSA B182.1 (Clause 4.1.5); or
 - .2 Corrugated polyethylene pipe and appurtenances conforming to ASTM F667.
 - .1 All subdrain pipe shall be pre-wrapped with a geotextile covering.
- .3 All outlet pipe shall be solid corrugated plastic pipe and shall conform to the requirements of CAN/CSA B182.1.
- .4 All appurtenances shall conform to the requirements of CAN/CSA B182.1.
- .5 Geotextile shall be Type N2 in accordance with 601.2.
- .6 Free draining backfill shall be supplied in accordance to the requirements of 366.2.

231.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

231.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall install the Shoulder subdrain system before paving.
- .3 The subdrain trench shall be installed in the Shoulder of the Roadbed parallel to the edge of the Pavement and shall be carried out in a manner, so as to avoid damage to the adjacent and surrounding Roadbed.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any damage to the adjacent and/or abutting finished surfaces resulting from this Work.
- .4 The subdrain shall be installed in accordance with the Standard Drawing 231-1.

SHOULDER SUBDRAIN

ITEM: 231

- 231.4 .5 The subdrain shall be installed as a continuous line with all joints being constructed with couplings compatible with the pipe supplied and in accordance with the manufacturer's recommendations.
- .6 The material excavated from the subdrain trench shall be disposed of on the Shoulder of the Roadbed and shall be uniformly graded across the width of the Shoulder prior to the placement of shouldering material.
 - .1 If the excavated material is deemed, by the Engineer, to be waste then the excavated material shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .7 All subdrain trench backfill shall be free-draining backfill and shall be placed in two equal layers and each layer shall be thoroughly tamped.
- .8 The ends of each continuous line of subdrain shall be capped.
- 231.4 .9 Subdrain Outlets
 - .1 All subdrain outlets shall be installed in accordance with the Standard Drawing 231-1.
 - .2 The Contractor shall install T-sections and the outlet Structures to the subdrain line at a maximum of 300 m intervals along the run of the line and at the lowest point along sag vertical curves and as directed by the Engineer.
 - .3 The subdrain outlets shall be installed as a continuous line from the T-section union to the outfall.
 - .4 The trench for the subdrain outlet shall be excavated from the T-section at the subdrain to the limit of the Foreslope.
 - .5 The outfall end of the subdrain outlet shall be protected in accordance with the Standard Drawing 231-1.
 - .6 All corrugated pipe used for subdrain outlet construction shall be unslotted and shall be graded to provide for positive gravity drainage from the subdrain to the outlet outfall.
 - .7 All outfall detail backfill shall be graded to match the surrounding Foreslope grade.
 - .8 The material excavated from the outlet trench shall be used for backfill of the subdrain outlet trench.
 - .1 The trench backfill shall be placed in accordance with Item 936 and compacted to a minimum of 95% of the maximum dry density.
 - .2 The trench shall be backfilled to match the surrounding grade.

231.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the linear metres of Shoulder subdrain and the linear metres of subdrain outlets supplied and installed in accordance with this Item.
- .2 The Shoulder subdrain shall be measured along the centreline of the pipe from end cap to end cap for each continuous section of installation.
- .3 The outlet Structures shall be measured separately as a unit complete from the T-section to the finished Foreslope grade.

231.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

BITUMINOUS TACK COAT

ITEM: 259

259.1 DESCRIPTION

- .1 This Item consists of supply and application of a bituminous tack coat on an asphalt concrete or Portland cement concrete surface.

259.2 MATERIALS

- .1 All material shall be supplied by the Contractor.
- .2 Tack coat shall be RS-1 or CRS-1 Grade asphalt emulsion and shall conform in all respects to the provisions of ASTM D977 and D2397, respectively.
- .3 Non-tracking emulsion shall be diluted with 40% water and shall meet the requirements of Table 259-1.
 - .1 Dilution of the emulsion shall be permitted at the terminal only.

**Table 259-1
 Non-tracking Emulsion Requirements (Prior to Dilute)**

Test Type	Specification Range	
	Minimum	Maximum
Test on Emulsion		
SF Viscosity, 25°C, SFs	20	
Sieve Test, 850µm, %		0.1
Dist. Residue, 260°C	55	
Oil Portion of Dist., %		trace
Particle Charge	(-) or (+)	
Test on Residue		
Penetration, 25°C, dmm	20	55
Ash Content, %		1.0

259.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer at least 3 Days in advance of the application of bituminous tack coat.
- .2 The Contractor shall submit, upon request, the manufacturer's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.

259.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Bituminous pressure distributors shall be capable of applying tack within ±5% of established application rates, and at a continuous and uniform rate both longitudinally and transversely.
- .3 Distributors shall be equipped with a tank gauge and measuring stick graduated in litres, and a sampling valve.

BITUMINOUS TACK COAT

ITEM: 259

- 259.4 .4 The Contractor may place the bituminous tack coat by brushing or spraying at longitudinal and transverse joint locations.
- .5 Bituminous tack coat shall be applied only when the surface to be treated is dry.
- .1 Immediately prior to the application of the bituminous tack coat, the surface to be treated shall be swept clean.
- .6 The Contractor shall protect through traffic and adjacent Highway/Structure appurtenances from any bituminous tack coat overspray.
- .1 The Contractor shall be responsible to remove any bitumen adhering to these surfaces.
- .7 Bituminous Tack Coat shall be applied in a uniform manner, without streaking at the rates indicated in the Contract Documents.
- .8 Temperature of the bituminous tack coat when applied shall be between 38°C and 66°C.
- .9 Bituminous tack coat shall be allowed to cure for such a time as approved by the Engineer, and traffic shall be diverted around freshly sprayed surfaces until the bituminous tack coat has set.
- .10 Bituminous tack coat application widths shall be such that approximately one-half the Pavement width is left open to traffic with no tack coat applied.
- .1 Bituminous tack coat applications shall be strictly limited in length, to minimize inconvenience to the public and shall be kept within the asphalt concrete Work Area.
- .2 The Work shall be planned so that tacked surfaces shall be covered with asphalt concrete to within 200 m of the tacked length before opening the Work Area to traffic and at the end of the Day's Work.
- .3 The Contractor shall be responsible to reinstate any bituminous tack-coated surface which becomes fouled due to weather and/or traffic.

259.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of bituminous tack coat supplied and applied in accordance with this Item.

259.6 BASIS OF PAYMENT

- .1 Payment for this Work shall be at the Unit Price.

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ASPHALT CONCRETE - END RESULT SPECIFICATION (ERS)

ITEM: 261

261.1 DESCRIPTION

261.1 .1 General

- .1 This Item consists of the supply and placement of hot mixed asphalt concrete, recycled asphalt concrete and warm mixed asphalt concrete.
- .2 The asphalt concrete shall be identified by the following mix designations:
 - .1 Hot mixed asphalt concrete base mix - B.
 - .2 Hot mixed asphalt concrete base/surface mix - C.
 - .3 Hot mixed asphalt concrete surface mix - D.
 - .4 Hot mixed recycled asphalt concrete base mix - HRB.
 - .5 Hot mixed recycled asphalt concrete surface mix - HRD.
 - .6 Warm mixed asphalt concrete base mix - WMA-B.
 - .7 Warm mixed asphalt concrete base/surface mix - WMA-C.
 - .8 Warm mixed asphalt concrete surface mix - WMA-D.
- .3 It shall be the Contractor's responsibility to provide an acceptable product as specified.
 - .1 The Contractor shall implement and maintain a quality control system that shall provide assurance that all components, as well as end result products, submitted to the Owner for acceptance, conform to the Contract requirements.
 - .2 This responsibility is without regard to whether the products are manufactured by the Contractor or purchased from suppliers or subcontractors.
- .4 Quality assurance tests shall be performed, by the Engineer, on random samples taken either at the job site or at the supplier's plant.

261.1 .2 Definitions

261.1.2 .1 End Result Specification (ERS)

- .1 ERS - a Specification under which the Engineer monitors the Contractor's control of the process that produces the items of construction and accepts or rejects the end product according to a specified quality assurance plan; the Contractor is entirely responsible for quality control; end product acceptance is the responsibility of the Owner and includes a statistically oriented program of quality assurance testing.
 - .1 Work Category – the work will be classified as Work Category 1 - Blended Quality Assurance/Quality Control (Blended QA/QC), Work Category 2, Work Category 3 or Work Category 4. The category defined will apply to all asphalt concrete produced. The categories are determined by the Department based on the total estimated tonnage of the Work as per the Contract Documents.

261.1.2 .2 Design Mix Formula (DMF)

- .1 DMF - the Laboratory determination of the precise proportions of asphalt binder and aggregates to be blended together to meet the specified properties for the asphalt concrete mix.

ASPHALT CONCRETE - END RESULT SPECIFICATION (ERS)

ITEM: 261

261.1.2 .3 Job Mix Formula (JMF)

- .1 JMF - the establishment of the single definite percentage passing the 4.75 mm and 75 μ m sieve fraction of aggregate and the asphalt binder content that shall produce the desired mix properties under field conditions.
- .1 Percentage of constituent materials to be listed on the JMF sheet.

261.1.2 .4 Asphalt Binder Content

- .1 Design Asphalt Binder Content - the asphalt binder content established by the DMF.
- .2 Approved Asphalt Binder Content - the asphalt binder content determined by the JMF.
- .3 Actual Asphalt Binder Content - the amount of asphalt binder in the mix as determined by ASTM D2172 or DTI Asphalt Concrete Quality Assurance Technician Certification Manual, Procedure # 9.

261.1.2 .5 Lot

- .1 Lot - a portion of the Work being considered for acceptance and is further defined by the Work Category, described in the following sections:
 - .1 Work Category 1 – a Lot will be defined as 2400 t \pm 50 t where approved changes to the Job Mix Formula have not occurred.
 - .1 For loose samples, each Lot shall be divided into 3 approximately equal segments and one sample taken from each segment.
 - .2 For core samples, each Lot shall be divided into 5 approximately equal segments and one core sample taken from each segment.
 - .3 If it is the last time the mix is produced with this criterion the following shall apply:
 - .1 If the plant production is 800 t or less the production shall be added to the Lot.
 - .1 For plant production of 800 t or less, one additional random loose sample will be obtained.
 - .2 If the plant production is more than 800 t but less than 2400 t, the production shall be designated as a Lot.
 - .2 Work Category 2 and Work Category 3 – a Lot will be defined as 1500 t \pm 50 t where approved changes to the Job Mix Formula have not occurred.
 - .1 For loose samples, each Lot shall be divided into 3 approximately equal segments and one sample taken from each segment.
 - .2 For core samples, each Lot shall be divided into 4 approximately equal segments and one core sample taken from each segment.
 - .3 If it is the last time the mix is produced with this criterion the following shall apply:

- 261.1.2.5.1.2.3 .1 If the plant production is 800 t or less the production shall be added to the Lot.
- .1 For plant production of 800 t or less, one additional random loose sample will be obtained.
- .2 If the plant production is more than 800 t but less than 1500 t, the production shall be designated as a Lot.
- .3 For Work Category 4 – a Lot will be defined as the total tonnage of each mix type placed.
- .1 One loose mix sample shall be taken from each lot.
- .1 The loose mix sample shall be obtained from the estimated Lot tonnage as directed by the Engineer.
- .2 For core samples, each Lot shall be divided into 3 approximately equal segments and one core sample taken from each segment.
- .4 A separate Lot shall be established if, in the Engineer's opinion, conditions of construction indicate that it is likely that a portion of a Lot shall be significantly different from the remainder of that Lot.
- .5 The Contractor may request to end the Lot before the Lot is completed.
- .1 The Engineer must obtain one QA sample and results of the QA sample(s) are binding.
- .1 No appeals will be allowed.
- 261.1.2 .6 Stratified Random Sample
- .1 Stratified Random Sample - the division of the Lot into 3 or more areas or segments; a random sample is taken from each area or segment in an unbiased way.
- 261.1.2 .7 Sample Mean
- .1 Sample Mean - the arithmetic mean of a set of 3 or more test results constituting the sample.
- 261.1.2 .8 Mean of the Deviations
- .1 Mean of the Deviations - the sum of the absolute values of the deviations from the JMF or the air voids (4.00%) divided by the number of tests in the Lot.
- 261.1.2 .9 Specified Thickness
- .1 Specified Thickness - the specified application rate divided by the bulk relative density obtained from the core samples.

261.2 MATERIALS261.2 .1 Material Properties261.2.1 .1 Asphalt Binder

- .1 Asphalt binder shall be supplied by the Contractor.
- .2 The asphalt binder grade shall be as specified in the Contract Documents.
- .3 Performance Grade (PG) asphalt binder shall meet the requirements of AASHTO M332, Table 1 - Performance Graded Asphalt Binder Specification.
 - .1 When the selected WMA technology requires that additives be added to the asphalt binder, acceptance of the asphalt binder shall be based on the samples that contain the WMA additive.
- .4 When anti-Stripping admixtures are required, the asphalt binder grade shall meet the specified requirements of 261.2.1.1.3, after the addition of the required admixtures.

261.2.1 .2 Coarse Aggregate

- .1 Coarse aggregate shall be supplied by the Contractor.
- .2 The coarse aggregate shall be prepared by crushing rock or gravel and shall consist of hard, sound, durable particles, free from adherent coatings, shale, clay, loam, schist and other soft or disintegrated pieces, or other deleterious substances.
- .3 Coarse aggregate is the portion retained on the 4.75 mm sieve, tested in accordance with ASTM C136, and shall meet the physical requirements of Table 261-1.
- .4 Coarse aggregate may be produced from pit run gravel by crushing the fraction retained on the 31.5 mm sieve, provided that no more than 10% of the retained material passes the 31.5 mm sieve, as determined by ASTM C136 and C117.
- .5 Coarse aggregate may also be accepted or rejected on the basis of past performance.

261.2.1 .3 Fine Aggregate

- .1 Fine aggregate shall be supplied by the Contractor.
- .2 Fine aggregate shall be prepared by crushing rock or gravel or screening a manufactured sand and shall consist of hard, sound, durable particles free from adherent coatings, shale, clay, loam, schist and other soft or disintegrated pieces, or other deleterious substances.
- .3 Fine aggregate shall be the portion passing the 4.75 mm sieve, when tested in accordance with ASTM C117 and C136, and shall meet the physical requirements of Table 261-1.

Table 261-1
Superpave Asphalt Concrete Mix Requirements

Sieve Size ASTM Designation	Type B/HRB/WMA-B	Type C/WMA-C	Type D/HRD/WMA-D	
	% (by mass) Passing Each Sieve			
Coarse Aggregate	25.0 mm	100.0	-	-
	19.0 mm	84.0-98.0	-	-
	16.0 mm	72.0-94.0	100.0	-
	12.5 mm	60.0-87.0	88.0-98.0	100.0
	9.5 mm	51.0-75.0	68.0-90.0	76.0-98.0
	6.3 mm	41.0-66.0	54.0-77.0	60.0-84.0
Fine Aggregate	4.75 mm	34.0-60.0	46.0-69.0	52.0-70.0
	2.36 mm	22.0-50.0	28.0-58.0	36.0-65.0
	1.18 mm	12.0-42.0	20.0-50.0	25.0-55.0*
	600 µm	6.0-32.0	13.0-40.0	16.0-44.0
	300 µm	3.0-20.0	7.0-27.0	8.0-26.0
	150 µm	2.0-8.0	3.0-10.0	4.0-12.0
	75 µm	2.0-6.0 (B)	2.0-6.0	2.0-6.0
		2.0-6.5 (HRB)		

*Note: For 75 gyration mix the percent passing the 1.18 mm sieve shall be 20.0 – 55.0.

Physical Requirements For Asphalt Concrete			
Air Voids %	3.0-5.0	3.0-5.0	3.0-5.0
VMA % (min) for 100 gyration mix	13.5	14.5	15.5
VMA % for 75 gyration mix	13.5 - 15.0	14.5 - 16.0	15.5 - 17.0
Voids Filled with Asphalt %	70.0-75.0	70.0-75.0	70.0-77.0
TSR (Average of Conditioned & Freeze/Thaw TSR values) % (min) ASTM D4867	80.0	80.0	80.0
Dust to Binder Ratio	0.6-1.2	0.6-1.2	0.6-1.2

Physical Requirements For Coarse Aggregate				
Freeze/Thaw % (max) DTI Method	0.3 to < 3 million Design ESALS	16.0	14.0	14.0
	≥ 3 million Design ESALS	14.0	12.0	12.0
Micro-Deval % (max) MTO LS - 618	0.3 to < 3 million Design ESALS	20.0	16.0	16.0
	≥ 3 million Design ESALS	18.0	15.0	15.0
Petrographic No. (max)* MTO LS - 609	0.3 to < 3 million Design ESALS	250	200	200
	≥ 3 million Design ESALS	230	180	180
Flat & Elongated Particle % (max @4:1) DTI Method	0.3 to < 3 million Design ESALS	25.0	20.0	20.0
	≥ 3 million Design ESALS	20.0	15.0	15.0
Crushed Particles DTI Method	0.3 to < 3 million Design ESALS	60	70	70
	≥ 3 million Design ESALS (min % by wt., one face)	95	95	95
	≥ 3 million Design ESALS (min % by wt., two face)	80	80	80
Absorption % (max) ASTM C 127	1.50	1.50	1.50	

*Note: Not mandatory, the Owner reserves the right to obtain a Petrographic No.

Table 261-1 continued

Physical Requirements For Fine Aggregate	Type B/HRB/WMA-B	Type C/WMA-C	Type D/HRD/WMA-D
Micro-Deval % (max) MTO LS - 619			
0.3 to < 3 million Design ESALs	22.0	18.0	18.0
≥ 3 million Design ESALs	20.0	17.0	17.0
Uncompacted Void Content % (min) ASTM C1252	45.0	45.0	45.0
NOTE: The allowable Micro-Deval surface Fine Aggregate shall be Max % Loss=19.0, if the Micro-Deval on Coarse Aggregate is ≤12.0, provided that the Coarse Aggregate is from the same source.			

261.2.1.3 .4 Fine aggregate may be produced from pit run gravel by crushing the fraction retained on the 6.3 mm sieve, provided that no more than 5% of the retained material passes the 31.5 mm sieve, as determined by ASTM C136 and C117.

.1 Material produced as per 261.2.1.2.4 and passing the 4.75 mm sieve, may be used as fine aggregate.

.5 Fine aggregate may also be accepted or rejected on the basis of past performance.

.6 Washed materials shall be stockpiled for at least 24 hours to allow free water to drain from the aggregate and to allow the material to attain uniform moisture content.

261.2.1 .4 Blending of Aggregates

.1 Blending of aggregates shall be allowed only to meet the grading requirements and/or to increase the percentage of crushed particles.

.2 Blending shall be performed at the asphalt plant cold feed units to produce a consistently graded product.

261.2.1 .5 RAP

.1 If applicable to the Contract:

.1 RAP shall be supplied by the Owner in designated stockpiles or obtained by the Contractor under Item 208.

.2 The Contractor shall be responsible for the incorporation of RAP into the asphalt concrete mix.

.3 The Contractor shall be responsible for collecting 6 RAP samples during the milling operation, spaced equally over the portion of the milling area needed to produce the recycled mix.

.1 The Contractor shall be responsible to deliver the RAP samples obtained for testing to the Owner's Central Laboratory in Fredericton, during normal working hours.

261.2.1 .6 Blending Sand

.1 Blending sand shall be supplied by the Contractor.

.2 Blending sand shall be used to obtain acceptable physical asphalt concrete mix properties as outlined in Table 261-1.

- 261.2.1.6 .3 The maximum mass of blending sand to be used in the total asphalt concrete mix shall not exceed 10% of the total mass.
- .4 Blending sand shall have 100% passing the 9.5 mm sieve prior to the introduction into the coldfeed at the plant.
- 261.2.1 .7 Anti-stripping Admixtures
- .1 Anti-stripping admixtures shall be supplied by the Contractor.
- .1 The requirement for an anti-stripping admixture is determined at the asphalt concrete mix design stage.
- .2 The Owner has approved the following anti-stripping admixtures listed below for use in the Work.
- | | |
|---------------------|--------------------|
| • Redicote 82-S | • Pave Bond T Lite |
| • Redicote C-3082 | • Travcor 4505 |
| • Redicote C-2914 | • Innovalt W |
| • Rediset LQ-1102 | • Evotherm M1 |
| • AD-here LOF 65-00 | • Cecabase RT 2N1 |
| • AD-here 7700 | |
- .2 The type and dosage of all asphalt binder anti-stripping admixtures shall be noted on the delivery slip.
- 261.2.1 .8 WMA Materials
- .1 The Contractor shall supply all materials required for production of WMA.
- .2 The Contractor shall obtain from the supplier all information required for the proper preparation, handling, storage and use of their materials.
- .3 The Owner has approved the following Warm Mix Technologies listed below for use in the Work:
- | | |
|-------------------------------------|--------------------------|
| • Evotherm M1 | • Sonne Warmmix |
| • Advera | • Cecabase RT |
| • Gencor Ultraform GX | • ALmix Foaming Systems |
| • Astec Double Barrel Green Foaming | • Meeker Foaming Systems |
| • Cecabase RT 2N1 | • Rediset LQ |

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261.2 .2 Composition of Asphalt Concrete Mix

261.2.2 .1 Asphalt Binder Content

.1 For the purpose of establishing the Unit Price for asphalt concrete the Bidder shall assume an asphalt binder content for the asphalt concrete mix as follows:

- .1 Asphalt Concrete "B": 4.8% of the total specified tonnage.
- .2 Asphalt Concrete "C": 5.7% of the total specified tonnage.
- .3 Asphalt Concrete "D": 6.0% of the total specified tonnage.
- .4 Asphalt Concrete "HRB": 3.1% of the total specified tonnage.
- .5 Asphalt Concrete "HRD": 5.0% of the total specified tonnage.
- .6 Asphalt Concrete "WMA-B": 4.8% of the total specified tonnage.
- .7 Asphalt Concrete "WMA-C": 5.7% of the total specified tonnage.
- .8 Asphalt Concrete "WMA-D": 6.0% of the total specified tonnage.

261.2.2 .2 Mix Design

261.2.2.2 .1 Responsibility for Design Mix Formula

.1 Preparation and submission of the asphalt DMF for the Owner's approval is the responsibility of the Contractor.

.1 The Contractor shall use Professional Engineering services and a qualified testing Laboratory, to assess the aggregate materials proposed for use and to carry out the design of the asphalt concrete mix.

261.2.2.2 .2 Requirements for Design Mix Formula

.1 The asphalt concrete mix design shall follow AASHTO R35 Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA), AASHTO R30-02 Standard Practice for Mixture Conditioning of Hot-Mix Asphalt (HMA) and AASHTO T312 Standard Method for Preparing and Determining the density of Hot-Mix Asphalt (HMA) specimens by means of Superpave Gyrotory Compactor.

.1 The asphalt concrete mix design, at the Design Asphalt Content, shall meet the requirements in Table 261-1 for the Asphalt Concrete Mix Type specified.

.2 The amount of RAP in the hot mixed recycled asphalt concrete base mix shall be 30%±5% of the total weight of the combined materials.

.3 The amount of RAP in the hot mixed recycled asphalt concrete surface mix shall be 15%±5% of the total weight of the combined materials.

261.2.2.2 .3 Approval of Design Mix Formula / Aggregate Source Approval

.1 All submissions shall include the Contract number.

.2 The material samples shall be tagged and indicate the Contract number, the location of the source, pit/quarry ID number as indicated by the Engineer, the sample location, and the type/size of the material.

- 261.2.2.2.3.2
- .1 Sampling of the aggregates for the DMF/aggregate source approval for the asphalt concrete mix production for the year shall not be undertaken until:
 - .1 At least 30% of each aggregate type is in stockpile, when the tendered Quantity for the mix designation is less than 10 000 t; or
 - .2 At least 2 000 t of each aggregate type is in stockpile, when the tendered Quantity for the mix designation exceeds 10 000 t.
 - .2 Sampling of the aggregate shall be done by the Contractor in the presence of the Engineer and delivered to the Owner's Central Laboratory in Fredericton, during normal working hours.
 - .1 The Engineer shall require up to 21 Days from the date the aggregate samples are received at the Owner's Central Laboratory in Fredericton to the date of notification of the evaluation of the material.
 - .3 The Contractor shall submit the DMF including the following information/materials to the Engineer for approval at a location(s) designated by the Engineer.
 - .1 A list of all constituent materials, including aggregate source(s), blending sand source(s), asphalt binder source, warm mix additive supplier and anti-stripping admixture supplier.
 - .2 The average gradation of each aggregate to be used in the asphalt concrete mix.
 - .3 The percentage by mass of each aggregate (including blending sand) to be used in the asphalt concrete mix.
 - .4 The asphalt concrete mix design gradation of the combined aggregate (including blending sand).
 - .5 Other characteristics of the combined aggregate specified in Table 261-1.
 - .6 All Superpave mix design characteristics, including bulk relative density specimen mass, graphs used in arriving at the final asphalt concrete mix design, the bulk relative density of each individual material and the combined aggregates, and the asphalt absorption of the combined aggregates.
 - .7 Samples of the aggregate: (8)-18 kg samples of coarse aggregate, (10)-18 kg samples of fine aggregate, (2)-18 kg samples of blending sand, and 0.5 L of anti-stripping admixture, if necessary.
 - .8 A sample of the asphalt binder (4 L/mix).
 - .9 In order to calibrate the ignition oven, additional samples are required: (3)-18 kg samples of coarse aggregate, (3)-18 kg samples of fine aggregate, (1)-18 kg sample of blending sand, and 3 L/mix of asphalt binder, shall be required to be delivered to a lab designated by the Engineer.
 - .4 The Engineer shall require up to 8 Days from the time of receipt of the DMF, for evaluation by the Owner's Laboratory.

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- 261.2.2.2.3.4
- .1 The evaluation period shall include verification of the asphalt concrete mix design, moisture sensitivity testing, and verification of the bulk relative densities of the coarse and fine aggregates and blending sand(s).
 - .1 In case of discrepancy in the bulk relative density values of the aggregates or blending sand(s), the Engineer's results shall prevail.
 - .5 If the DMF does not meet the requirements of Table 261-1 it shall be rejected.
 - .1 The Engineer shall provide a written explanation to the Contractor that details why the DMF failed.
 - .2 The Contractor shall then provide another complete DMF and re-submit it to the Engineer for approval.
 - .6 The Engineer shall not accept any asphalt concrete mix produced prior to the Contractor receiving written approval of the DMF from the Engineer.
 - .7 Once the DMF has been approved, the Engineer shall prepare samples of the combined aggregates and a sample of the asphalt binder for calibration of the ignition furnace to be used for the quality assurance.
 - .1 The Engineer shall deliver the calibration samples to the quality assurance laboratory.
 - .2 The Engineer shall complete calibration of the ignition furnace within 3 Days of approval of the DMF.
 - .8 The Contractor shall be responsible to pay the Owner's associated costs if the Contractor submits for evaluation more than one asphalt concrete mix design per Contract conventional mix designation.
 - .1 Testing costs incurred by the Owner shall be charged as per DTI Standard Laboratory Rate Schedule.
- 261.2.2.2
- .4 Approval of Job Mix Formula
 - .1 The Contractor shall submit the JMF to the Engineer prior to beginning production. The Contractor's submission shall include the following information:
 - .1 The percentage by mass of each aggregate (including blending sand) to be used in the asphalt concrete mix.
 - .2 The percentage by mass passing the 4.75 mm and the 75 µm sieves of the combined aggregates and blending sand
 - .3 The asphalt binder content as a percentage of the mass of the total mix.
 - .4 The asphalt binder grade and the asphalt binder supplier.
 - .5 The production and compaction temperature.
 - .6 The type of Warm Mix and/or anti-stripping admixture.

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261.2.2.2.4 .2 The JMF, when compared to the DMF, shall be within the following limits:

- .1 $\pm 3\%$ for material passing the 4.75 mm sieve.
- .2 $\pm 0.8\%$ for material passing the 75 μm sieve.
- .3 $\pm 0.2\%$ for asphalt binder.

261.2.2.2 .5 JMF Adjustments During Production

- .1 Adjustments to the JMF shall be submitted to the Engineer prior to the start of Lot production.
- .2 The Contractor shall submit a revised DMF in accordance with 261.2.2.2 for a change in source of aggregate used in the asphalt concrete mix.

261.3 SUBMITTALS

- .1 The Contractor shall submit, in writing, the proposed source(s) of supply of coarse aggregate and fine aggregate for approval by the Engineer.
- .2 The Contractor shall notify the Engineer 3 Days in advance of the commencement of the production of asphalt concrete mix.
- .3 The Contractor shall submit in writing, the proposed supplier of the asphalt binder.
 - .1 The Contractor shall supply, upon request, a sample of the asphalt binder (2 L/mix) and a sample of any proposed admixture(s), in a volume proportional to the asphalt binder sample.
 - .2 The Contractor shall supply, upon request, the optimum mixing and compaction temperature, for PG asphalt binders.
 - .3 The Contractor shall submit at the time of delivery to the plant the refinery certification and delivery slip for each tanker load of asphalt binder.
 - .4 If the source of supply of the asphalt binder changes during the Work, the Contractor shall submit in writing the proposed change prior to using the new asphalt binder supply in the Work.
- .4 Other submittals are required for this Item and are contained within the sections applicable to the specific phase of the Work being undertaken.
- .5 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

261.4 CONSTRUCTION

261.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

261.4 .2 Equipment261.4.2 .1 General

- .1 Equipment shall be designed and operated to produce an end product complying with the requirements of this Specification.
- .2 Equipment used shall be of adequate rated capacity and shall be in good working order.

261.4.2 .2 Mixing Plant

- .1 The asphalt mixing plant and its components shall meet the requirements of ASTM D 995 and the Contract Documents.

261.4.2 .3 Placing Equipment

- .1 Mechanical self-powered pavers shall be capable of spreading mixture true to line, grade and cross-Slope.
- .2 Pavers shall be equipped with hoppers and distributing screws to place mixture evenly in front of the screeds.
- .3 Pavers shall be equipped with vibrating screeds and shall be capable of spreading mixtures, without segregation and with a smooth and uniform textured surface, to the required thickness and in widths from 3 m to 5 m.
 - .1 Screeds shall be equipped with heaters which are capable of preheating the entire screed and screed extensions.
- .4 The Contractor shall provide a 3 m straight edge with each paver.
- .5 Pavers shall be equipped with automatic screed controls.
 - .1 The longitudinal grade control shall be equipped to operate from either side of the paver and be capable of providing longitudinal grade control as well as matching longitudinal joints.
 - .2 The Contractor shall use a minimum 12 m ski/floating beam or an approved equivalent for longitudinal grade control.
 - .1 A joint matching shoe may be used to control longitudinal grade of subsequent mats placed adjacent to the original mat.
 - .3 A calibrated Slope indicator shall be installed in a readily visible location on each paver.
- .6 Longitudinal grade control shall be used on all lifts.
- .7 Vibrating hydraulic screed extensions and vibrating bolt-on screed extensions shall be used in placing mat widths greater than 3 m.
 - .1 Hydraulic strike-off extensions are only acceptable when laying mats of irregular widths outside of the driving Lanes.
 - .2 Screed cut off shoes may be used when placing widths less than 3 m.

261.4.2 .4 Compaction Equipment

- .1 Compaction Equipment shall consist of at least one of each of the following:
 - .1 Vibratory roller having a minimum mass of 8 t.
 - .1 Paving in echelon on the driving lanes shall require the use of two vibratory breakdown rollers.
 - .2 When the rate of placement exceeds 250 tonnes per hour (tph), the Contractor shall use two vibratory rollers.
 - .2 Pneumatic-tired roller.
 - .1 A combination steel-drum vibratory/pneumatic tire roller may be used in place of the vibratory and pneumatic rollers.
 - .2 Paving in echelon on the driving lanes shall require the use of two pneumatic-tired rollers.
 - .3 Steel-drum tandem finish roller.
 - .1 Use of a steel-drum finish roller on base courses shall be optional.
- .2 All rollers with rubber tires shall be equipped with a means to prevent the asphalt mix from adhering to the rubber tires.
 - .1 Hydrocarbon fuels or solvents shall not be used.

261.4.2 .5 Material Transfer Vehicle (MTV)

- .1 Material transfer vehicles shall be used for placement of asphalt concrete, and shall be self-propelled equipment capable of transferring asphalt concrete from the hauling equipment into the paver, and shall have the following characteristics:
 - .1 Minimum storage capacity of 20 t;
 - .2 A conveyor system to transfer asphalt concrete from the hauling equipment to the paver hopper insert; and
 - .3 An auger system in the MTV or paddle mixers in the hopper insert to remix the asphalt concrete prior to discharge from the hopper insert.

261.4 .3 Production and Placement of Asphalt Concrete Mix

261.4.3 .1 Production of Mix

- .1 Asphalt concrete shall meet the requirements of Table 261-6.
- .2 For the plant mix, the TSR shall meet the requirements of Table 261-1.

261.4.3 .2 Trial Mix

- .1 Trial mixes are the property of the Contractor and shall be placed outside the Work Site, unless otherwise authorized by the Engineer for the purpose of padding or patching.

261.4.3 .3 Mixing and Temperatures

- .1 Mixing temperature for all types of plants shall be such that the temperature of the asphalt concrete mix when discharged from the mixer unit shall be controlled within $\pm 5^{\circ}\text{C}$ of the temperature requirement of the DMF, unless otherwise authorized by the Engineer.
 - .1 The maximum mixing temperature for hot mixed asphalt concrete shall be 165°C or the temperature recommended by the asphalt binder supplier.
 - .2 The maximum temperature of the WMA mix shall be as specified by the WMA additive supplier.
- .2 The heating of the asphalt mix shall be controlled to prevent the fracture of the aggregate and damage to the asphalt binder.
 - .1 The system shall be equipped with automatic burner controls and shall provide a printed record of the mix temperature at discharge.
 - .2 The asphalt binder recovered by extraction from the asphalt mix shall meet the requirements of the Pressure Aging Vessel (PAV) as specified in AASHTO M332, Table 1 - Performance Graded Asphalt Binder Specification.
- .3 Overnight storage in silos shall not be permitted.
- .4 Reclaimed asphalt concrete shall not be exposed to direct flame during and/or after introduction into the plant.
- .5 Moisture Content:
 - .1 The maximum moisture content allowed in the asphalt concrete mix as it is discharged from the mixing unit shall be 0.10%.
 - .2 The aggregate shall be dried sufficiently so that visual evidence of moisture, such as but not limited to the presence of foaming, slumping or Stripping of the mix, does not occur.
- .6 During paving operations the Contractor shall produce only the asphalt mix(es) identified in the Contract.
- .7 When producing Hot Recycled Asphalt, the Contractor shall submit the daily production summary from the plant operating system detailing the following daily mix proportions:
 - .1 The virgin combined aggregate, from the belt scale.
 - .2 The Recycled Asphalt Pavement (RAP), from the belt scale.
 - .3 The amount of virgin asphalt binder incorporated into the mix, from the AC pump.

261.4.3 .4 Transportation of Asphalt Concrete

- .1 Trucks for transporting asphalt concrete shall have tight, metal boxes free of foreign materials.

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- 261.4.3.4 .2 Loads shall be covered with tarpaulins of sufficient size to overhang the fully loaded truck boxes and be tied down on three sides and the front shall be tight to the box of the truck or shielded to prevent air infiltration.
- .3 Truck boxes may be lightly lubricated with an environmentally acceptable release agent, as required, but must be raised and drained after each application and before loading.
 - .1 Hydrocarbon fuels or solvents shall not be used.
- .4 Tarpaulins shall be rolled back and the hot asphalt concrete shall be uncovered immediately prior to dumping the load into the paver.

261.4.3 .5 Timing of Paving Operations

- .1 Paving operations shall not commence in the spring until the DTI weight restrictions are lifted or continue after the dates specified in Table 261-2 without written permission of the Engineer.

**Table 261-2
Cut-off Dates for Paving**

County	Surface mixes	Base mixes
Gloucester, Madawaska, Restigouche, Victoria	October 07	October 22
All others	October 22	October 31

- .2 Paving operations shall only be conducted during Daylight hours unless specifically altered by written approval of the Engineer.
- .3 The placement of the new asphalt concrete mix shall commence within 14 Days of the commencement of the cold milling operation and shall continue on a daily basis until the entire milled surface has received a lift of asphalt concrete.
- .4 When the RAP is being reused in a recycled asphalt concrete mix, the placement of the asphalt concrete shall commence within 21 Days of the commencement of the cold milling operation and shall continue on a daily basis until the entire milled surface has received a lift of asphalt concrete.

261.4.3 .6 Placing Asphalt Concrete

- .1 The Contractor shall place asphalt concrete on a dry surface.
 - .1 Asphalt concrete shall not be placed under adverse weather conditions of precipitation.
 - .2 When placing asphalt concrete surface mix, the surface temperature of the material to be overlaid shall be a minimum of 5°C.
- .2 When paving on Aggregate Base, the Aggregate Base must be free from standing water.
- .3 All prepared surfaces shall be cleaned of loose or foreign material prior to placing of the asphalt concrete.
 - .1 Milled and aged asphalt concrete surfaces shall be treated with bituminous tack coat in accordance with Item 259 prior to the placing of asphalt concrete.

- 261.4.3.6 .4 Existing approaches to railway crossings and Bridge Structures, or areas adjacent to paved surfaces or other Structures, shall be removed to the depths shown on the Contract Documents or as directed by the Engineer.
- .1 The removed material shall be disposed of and the exposed surfaces shall be prepared as identified in the Contract Documents or as directed by the Engineer.
- .5 Contact edges of existing mats and contact faces of curbs, gutters, manholes, Sidewalks and Bridge Structures shall receive an application of tack before placing the asphalt concrete.
- .6 The temperature prior to initial compaction shall be:
- .1 A minimum of 115°C for hot mixed asphalt concrete.
- .2 A minimum of 90°C for warm mixed asphalt concrete.
- .7 The maximum temperature of the hot mixed asphalt concrete shall be 165°C or the temperature recommended by the asphalt binder supplier.
- .8 The maximum temperature of the WMA behind the screed shall be 125°C.
- .1 The allowable maximum temperature of the WMA behind the screed may be increased for Work after October 1st, if approved by the Engineer.
- .2 The temperature shall be checked with a calibrated stem thermometer or temperature probe.
- .9 When laying base and/or surface course the alignment of the paver shall be controlled by a standard method, such as following a stringline, placed by the Contractor from an alignment designated by the Engineer.
- .10 Irregularities in alignment and grade along the outside edge of the asphalt concrete shall be corrected by the addition or removal of asphalt concrete before the edge is rolled.
- .11 The cross slope of the asphalt concrete surface shall be within $\pm 0.5\%$ (± 15 mm when measured over 3 m, perpendicular to the centreline) of the cross slope specified in the Contract Documents or provided by the Engineer.
- .12 In narrow base widening, deep or irregular sections, intersections, turn-outs or driveways where it is impractical to spread and finish asphalt concrete by machine methods, the asphalt concrete shall be spread by hand in accordance with standard hand placement practices.
- .13 Paving of intersections, extra widths and other variations from standard Lane alignment and as defined in the Contract Documents, whether by hand spreading or machine laying, shall be carried out concurrently with the machine laying operation of the regular mat, unless otherwise approved by the Engineer.
- .1 Driveway entrances and aprons shall be paved concurrently or after the machine laying operation of the regular mat.
- .14 Spreading of asphalt concrete by hand shall be kept to a minimum and shall be carried out concurrently with the machine laying operation of the regular mat, unless otherwise approved by the Engineer.

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- 261.4.3.6 .15 Adjacent asphalt concrete mats, including those placed on Shoulder(s), shall be completed to within 100 m of the same location at the end of each Day's paving.
- .1 For each occurrence that adjacent asphalt concrete mats are not completed to within 100 m per 261.4.3.6.15, the Contractor shall pay the Owner a penalty of \$1000 per occurrence.
- .1 The penalty may be waived, if the Engineer deems the occurrence to be no fault of the Contractor.
- .2 Such occurrences shall include but not necessarily limited to mechanical breakdowns and weather.
- .16 For ESAL counts equal to or greater than 3 million, no traffic shall be permitted on newly placed asphalt concrete until finish rolling is complete, and the finished mat has been permitted to cool to 60°C.
- .1 Water required to lower the mat temperature shall be supplied in accordance with Item 191.
- .17 Damage to the mat as a result of contaminant spills from the Contractor's Equipment shall be immediately repaired by the Contractor to the satisfaction of the Engineer.
- .18 All placement, spreading, compacting and rolling shall occur only during Daylight hours, and any loads arriving at the Work Site such that these requirements cannot be met shall be rejected by the Engineer.
- .19 The speed of the paver shall be matched to the production of the asphalt plant to ensure continuous operation of the paver.
- 261.4.3 .7 Padding
- .1 Padding shall not be included as part of a Lot.
- .1 Material for padding shall be the same asphalt concrete mix designation as specified in the Contract Documents.
- .2 Asphalt concrete for padding shall be placed by means of a self-powered paver or by other methods approved by the Engineer.
- .3 The compaction Equipment shall be in accordance with 261.4.2.4.
- .1 For padding, 261.4.5.5, 261.4.5.6, 261.4.5.7 and 261.4.5.9 shall not apply.
- .2 The Contractor shall establish a rolling pattern to achieve the maximum compaction of the asphalt concrete used for padding.
- .4 Padding is intended to be a separate operation and shall not be done as part of the construction of the subsequent lift of asphalt concrete.
- .5 For padding, loose mix sampling will be done at a rate of one sample per 500 tonnes of mix to determine the actual binder content.
- .1 A minimum of one sample shall be obtained for quantities less than 500 tonnes.

261.4.3 .8 Driveways and Aprons

- .1 Material placed in driveways and aprons shall only be included as part of a Lot when paved concurrently with the main lanes.
- .2 Asphalt Concrete D or WMA-D to be used for driveways shall be approved by the Engineer.
- .3 A transverse key joint or straight vertical joint shall be constructed at each paved driveway and shall meet the requirements of 261.4.3.9.3.
- .4 Asphalt placed in driveways shall match the existing thickness of the driveway or apron, as approved by the Engineer.
- .5 If required, preparation of the driveway shall be paid under Item 812, with the exception of the work identified in 261.4.3.8.3.
- .6 For asphalt placed in driveways and aprons, the requirements of 261.4.3.6.1.2 shall not apply.

261.4.3 .9 Joints261.4.3.9 .1 General

- .1 Joints shall be constructed to ensure thorough and continuous bond, and to provide a smooth riding surface.
- .2 Dirt or other foreign and loose material shall be removed from the faces against which joints are to be made.
- .3 The Contractor shall remove and dispose of waste materials, resulting from joint construction or other Work activity, outside the Work Site before the end of each week.

261.4.3.9 .2 Transverse Construction Joint

- .1 A Transverse Construction Joint shall be constructed at the end of each Day's Work and at other times when paving is halted for a period of time which shall permit the asphalt concrete to cool.
 - .1 Below 115°C for hot mixed asphalt concrete.
 - .2 Below 90°C for warm mixed asphalt concrete.
- .2 Where the asphalt concrete surface and/or base course has been terminated due to the conditions noted in 261.4.3.9.2.1, a smooth 1.5 m long taper shall be paved.
- .3 When paving resumes, tapers from surface courses previously laid shall be cut back to full mat thickness to expose fresh, straight vertical surfaces, free from broken or loose material and tacked in accordance with 259.2, 259.3 and 259.4.

261.4.3.9 .3 Transverse Key Joint

- .1 When the elevation of the new asphalt concrete pavement is higher than the existing pavement, a transverse key joint shall be constructed per Standard Drawing 261-1 between the existing and new asphalt concrete pavement, at the beginning and at the paving limits and other locations, as determined by the Engineer.
 - .1 If a transverse key is cut in advance of paving the joint area, the Contractor shall immediately construct with hot mixed asphalt concrete a smooth long taper at the joint area, as shown in Standard Drawing 261-1.
 - .2 Prior to the placement of the asphalt concrete, all transverse key joint surfaces shall be cleaned of loose foreign material and a tack coat applied in accordance with 259.2, 259.3, and 259.4.
- .2 When the elevation of the new asphalt concrete Pavement is at the same elevation as the existing pavement, a straight vertical surface equal to the thickness of the new asphalt Pavement shall be constructed between the new lift of Pavement at the beginning and at the end of the project and other locations where the new pavement terminates against an existing pavement.
- .3 When the entire thickness of asphalt is removed, a transverse key joint shall be constructed in accordance with Standard Drawing 261-2.

261.4.3.9 .4 Longitudinal Joint

- .1 The following requirements shall apply when constructing longitudinal joints.
 - .1 Widths of succeeding individual courses shall be offset by 50-100 mm.
 - .2 All longitudinal joints shall receive an application of tack coat in accordance with 259.2, 259.3 and 259.4.
 - .3 Longitudinal joints shall not be permitted between the edges of driving Lanes in the final lift of asphalt concrete.
 - .4 Longitudinal joints shall be constructed to ensure that maximum compression under rolling is achieved.
 - .5 On surface courses, the method of making joints shall be such that excess material is not scattered on the surface of the freshly laid mat and all excess material shall be carefully removed.

261.4.3 .10 Compaction of Asphalt Concrete

- .1 If damage to Highway components and/or adjacent property is occurring while using vibratory compaction Equipment, the Contractor shall immediately cease using this Equipment and proceed with the Work using static rolling Equipment.
- .2 Along curbs, manholes and similar Structures and places not accessible to full size rollers, the mixture shall be compacted with either smaller compactive Equipment, such as vibrating plate tampers, or by hand tampers.

261.4.3 .11 Additional Requirements for Bridge Deck Paving

- .1 The Contractor shall place asphalt concrete on the deck waterproofing system in accordance with the waterproofing manufacturer's recommendation and/or procedures.
- .2 The Contractor shall be responsible for all damage to the waterproofing membrane resulting from any aspect of the paving operation.
 - .1 Should the membrane become damaged, paving operations shall be immediately stopped and repairs made, in accordance with the manufacturer's instructions, before paving recommences.
- .3 Expansion joints and deck drains shall be protected from damage from Equipment passing over them.
 - .1 The placing of the asphalt concrete at expansion joints shall be completed as indicated on Standard Drawing 261-3.
- .4 The Contractor shall submit a rolling pattern for the approval of the Engineer.
- .5 A steel-drum tandem roller, operating in the non-vibratory mode and exerting a contact pressure on compression roll of at least 3.0 kg/mm of drum width shall be the breakdown roller required for Bridge deck paving.
- .6 The breakdown roller shall be required to run off the deck to stop and turn.
- .7 After breakdown rolling, the mat shall be rolled with a pneumatic tired roller, taking care not to displace the mat when stopping or turning.
- .8 The mat shall be finish rolled to remove any marks.
- .9 For Bridge decks, 261.4.5.5, 261.4.5.7 and 261.4.5.9 shall not apply.

261.4 .4 Quality Control Testing261.4.4 .1 General

- .1 The Contractor shall be totally responsible for quality control testing throughout every stage of the Work from the crushing and production of aggregates to the final accepted product, to ensure materials and workmanship conform with the requirements of this Specification.

261.4.4 .2 Inspection Testing Plan (ITP)

- .1 The Contractor shall submit, upon request, in writing to the Engineer, an ITP covering all phases of the Contract performance and the name of the party retained to conduct the ITP, within 10 Days after the Contract award.
- .2 The ITP shall include, but not be limited to, identification and description of inspection and required test procedures to be used during the entire life of the Contract.
- .3 The ITP shall be sufficiently comprehensive and detailed to assure the Engineer of the Contractor's willingness and ability to control the construction production and processes.

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- 261.4.4.2 .4 Once accepted by the Engineer the plan becomes a part of the Contract and shall be enforced accordingly.
- .5 The ITP may have to be updated and revised, by the Contractor, as conditions warrant.
- 261.4.4 .3 Sampling and Test Results
- .1 Where specified, random sampling procedures shall be followed, and where no specific random sampling procedure is specified the sampling procedure shall be as identified by the Contractor.
- .2 The Contractor shall be responsible for the interpretation of the test results and the determination of any action to be taken to ensure that all materials and Work conform to the requirements of the Contract.
- .3 The Contractor shall maintain records of all inspection and tests.
- .1 Results of all quality control tests shall be available for examination by the Engineer at all times and copies shall be provided if requested by the Engineer.
- 261.4.4 .4 Asphalt Compaction Rolling Pattern
- .1 For each asphalt concrete mix type the Contractor shall establish a rolling pattern using a nuclear gauge or equivalent. Upon completion of the rolling pattern the Contractor shall immediately submit a copy to the Engineer.
- 261.4 .5 Quality Assurance Testing and Adjustments
- 261.4.5 .1 General
- .1 The Contractor shall provide an end product conforming in quality and accuracy of detail to the dimensional and tolerance requirements of the Plans and Specifications.
- .1 While the Contractor shall be fully and exclusively responsible for producing the end product, acceptance testing is the responsibility of the Engineer.
- .2 For Work Category 1 acceptance testing is the responsibility of the Engineer and shall incorporate the quality control test results from the Contractor with the quality assurance test results from the Engineer in accordance with this Item.
- .3 For Work Category 1 the Engineer shall perform the quality assurance testing and the Contractor shall perform the quality control testing.
- .2 Certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied.
- .1 The Engineer and the Contractor shall test for compliance with these requirements as described in 261.4.5.
- .2 The test methods indicated in Table 261-3 shall be used to determine material characteristics.

**Table 261-3
Test Methods**

Test Description		Test Method
Sampling Mixes		ASTM D 979
Coring		ASTM D 5361
Ignition Method		DTI Asphalt Concrete Quality Assurance Technician Certification Manual, Procedure # 9
Percent Fracture		DTI Method
Sieve Analysis		ASTM C 136/ASTM C 117
Bulk Relative Density		ASTM D 2726
Theoretical Maximum Relative Density		AASHTO T209
Voids Calculations, Asphalt Concrete Specimens		ASTM D 3203
Forming Superpave Specimens, Field Method		AASHTO T 312
Moisture Content, Oven Method Asphalt Concrete Mix		ASTM D 2172
Smoothness of Pavements, Profiler Method		ASTM E 950
Stratified Random Test Sites for A.C.P. Projects		ASTM D 3665
Appeal Testing		as outlined in Specifications
Asphalt Binder:	Flash and Fire Points Viscosity Rheological Properties Rolling Thin Film Oven Accelerated Aging (PAV) Flexible Creep Stiffness	AASHTO T 48 or ASTM D 92 AASHTO T316 or ASTM D 4402 AASHTO T315 AASHTO T 240 AASHTO R28 AASHTO T313
TSR (Average of Conditioned & Freeze/Thaw TSR values)		ASTM D 4867
In all test methods used as reference in this specification, metric sieves as specified in ASTM E11 shall be substituted for any other specified wire cloth sieves.		

- 261.4.5.1 .3 The Engineer reserves the right to inspect and/or test any of the Contractor's operations or materials and those of subcontractors and suppliers, regardless of location.
- .1 Such inspections and tests shall not relieve the Contractor of his/her responsibilities to control quality.
 - .2 The Engineer's approval of any materials or mixture shall in no way relieve the Contractor from her/his obligation to provide materials, mixtures and workmanship in accordance with the Specifications.
- 261.4.5.1 .4 The loose mix and core samples shall be taken by the Contractor in the presence of the Engineer.
- .1 The random locations shall be determined by the Engineer.
 - .2 The Contractor shall be notified of the random location when the truck containing the target tonnage has arrived on-site.
 - .1 The Engineer shall notify the Contractor of the upcoming loose mix sample approximately 30 minutes prior to the target tonnage arriving on site.
 - .2 If the Contractor is not available to obtain the sample, the truck shall be parked at the paving site until it can be sampled.
 - .3 Once the truck has been identified for sampling the mixture from the identified truck shall become part of the Lot.

- 261.4.5.1.4.2
- .4 Failure to provide a loose mix sample at the target tonnage will result in rejection of the segment.
 - .1 The samples collected from the remaining segments will be combined to evaluate the remainder of the Lot.
 - .3 The Engineer shall be responsible for labelling the loose mix and core samples.
 - .4 The Contractor shall be responsible for the storage and transportation of the loose mix and core samples to the designated QA laboratory, within 36 hours of the completion of the Lot.
 - .1 The maximum may be extended to include Saturdays, Sundays and holidays when applicable.
 - .2 For each occurrence that the loose mix and core samples are not delivered per 261.4.5.1.4.4, the Contractor shall pay the Owner a penalty of \$1000 per Day.
 - .5 The Contractor shall reinstate the Pavement at each core sample location in conjunction with removal of the core by dewatering the core hole and filling it with hot mixed asphalt concrete in 50 mm lifts to the Pavement surface elevation, compacting each lift with 25 blows using a standard compaction device.
 - .5 The Engineer shall provide the Contractor with a copy of the results of acceptance tests within one working Day of their availability.
 - .6 The QA results for the loose mix samples shall not be reported to the Contractor until the QC results for that Lot have been reported to the Engineer.
 - .1 For Work Category 1, the quality control testing shall be performed by a technician who has successfully completed the NBDTI certification program.
 - .2 For Work Category 1, the quality control testing equipment shall be verified and approved by the Engineer before plant production begins.
 - .7 Tests performed by the Engineer shall not be considered to be quality control tests.
 - .8 Random sampling methods shall not be applied to the following areas:
 - .1 Areas of obvious surface defects shall be marked and repaired in accordance with 261.4.5.12.2.
 - .2 Small areas such as tapers, aprons, Bridge approaches, gores and areas of handwork, and asphalt mix used for isolated levelling and repair of failed areas.
 - .9 The procedure for dealing with an outlier test result shall be as follows:
 - .1 When an individual test result from a Lot is questionable, the validity of the test result in question shall be determined in accordance with ASTM E 178, Standard Practice for Dealing with Outlying Observations using a "t" test at a 5 percent significance level.
 - .1 An appeal is required before the Outlier Test applies.
 - .2 If the outlier test procedure shows that the challenged test result is valid then the test result shall be used in the calculations.

261.4.5 .2 Work Category 1

- .1 For Work Category 1, quality assurance testing shall be done on a delayed basis for every Lot on the Contract.
- .2 If the results for a given Lot are within the tolerances stated in Table 261-4, the quality control and quality assurance mean of deviations, established from the test results, shall be combined together to establish the mean of deviation for payment adjustment.
- .3 The tolerance referred to in Table 261-4 is the sample mean difference for each mix characteristic between the quality control and quality assurance test results. The sample mean is defined in 261.1.2.7.

Table 261-4
Acceptance Tolerance for Combining QA and QC Lot Test Results

Mix Characteristics	Acceptance Tolerance Between QA and QC Test Results	
	Base Mix	Surface Mix
Air Voids	± 0.70	± 0.60
Binder Content	± 0.30	± 0.20
4.75 mm	± 5.0	± 3.0
75 µm	± 0.5	± 0.4
Note: The Mix Characteristics in Table 261-4 are based on the sample mean of the Lot test results.		

- .4 If any of the mix characteristics are outside the acceptable tolerance in Table 261-4, the acceptance test results for that mix characteristic shall be calculated using only the quality assurance test results.
- .5 If any of the control characteristics of a Lot is outside the acceptance limits as listed in Table 261-6 then the Lot shall be rejected automatically regardless of the values of the other control characteristics.

261.4.5 .3 Work Category 2 and Work Category 3

- .1 For Work Category 2 and Work Category 3, quality assurance testing shall be done on a delayed basis for every Lot on the Contract
- .2 For Work Category 2 and Work Category 3, one sample will be selected from each Lot using random numbers and it will be tested for quality assurance.
 - .1 If the test results from the selected sample meet the criteria in Table 261-5, no further testing will be required and the Lot will be paid at 100%.

Table 261-5
Acceptance Criteria

Test Properties	Criteria
Air Voids	2.50% - 5.00%
Asphalt Binder Content	JMF ± 0.40
Percent Passing 4.75 mm Sieve	JMF ± 6.0
Percent Passing 75 µm Sieve	JMF ± 1.0
Maximum Percent Passing 75 µm	6.5%

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- 261.4.5.3.2 .2 If the test results from the selected sample do not meet the above criteria, the Owner will test the remaining samples from the Lot. The Owner will test all mix characteristics per Tables 261-8, 261-9 and 261-13.
- .3 A Sample Mean or the Mean of Deviations for the combined test results will be determined, and this value will be used for acceptance and Unit Price Adjustment per Tables 261-8, 261-9 and 261-13.
- 261.4.5 .4 Work Category 4
- .1 For Work Category 4, the QA results for the loose mix samples will be reported to the Contractor once they are available.
- .2 The Lot sample shall meet the criteria in Table 261-5.
- .3 If the test results from the Lot sample do not meet the criteria in Table 261-5, the Unit Price Adjustments per Tables 261-8, 261-9 and 261-13 shall apply.
- .4 The maximum percent passing the 75 μm from Table 261-5 shall not apply.
- 261.4.5 .5 Asphalt Density
- .1 Density testing shall be based on a Lot average method.
- .2 Pavement samples shall be taken on the road by coring using stratified random sampling procedures.
- .1 For Work Category 1, five samples per Lot shall be selected, one from each of five segments of approximately equal length.
- .2 For Work Category 2 and Work Category 3, four samples per Lot shall be selected, one from each of four segments of approximately equal length.
- .3 For Work Category 4, three samples per Lot shall be selected, one from each of the three segments of approximately equal length.
- .4 In each segment a test site shall be located by using random numbers to determine the longitudinal distance from the end of the segment and the lateral distance from the edge of the segment.
- .5 In no case shall a lateral distance be less than 0.3 m from the edge of a mat.
- .6 Cores shall not be taken in the Shoulder area where only a single lift of asphalt concrete surface mix is placed, for which the Contractor shall establish a rolling pattern to achieve the maximum compaction of the asphalt concrete.
- .7 Cores shall not be taken within 25 m of a loose sample location.
- .8 Cores shall be obtained in accordance with ASTM D5361, within 24 hours after the placement of the Lot.
- .1 The maximum may be extended to include Saturdays, Sundays and holidays when applicable.
- .2 The Engineer may allow cores to be obtained within 12 hours after asphalt concrete placement.

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261.4.5.5.2.8 .3 The percent density of a Lot shall be determined by comparing the average of the core densities with the average of the Theoretical Maximum Relative Density of the loose samples.

261.4.5 .6 Asphalt Content, Gradation and Air Voids

.1 Loose samples shall be taken on the road behind the paver before compaction, or from the MTV discharge using an approved hopper, with 3 samples per Lot selected as follows:

- .1 A Lot shall be divided into 3 segments of approximately equal quantity.
- .2 For each segment random numbers shall be used to determine the tonnage at which to obtain the sample.
- .3 Each sample shall be split in two equal portions, one portion shall be tested, and the other shall be set aside in the event that an appeal is requested by the Contractor.

.2 If the plant production is 800 t or less, one additional random loose sample shall be obtained, and the production shall be added to the previous Lot.

261.4.5 .7 Smoothness

261.4.5.7 .1 General

.1 The smoothness requirements shall be specified in the Contract Documents.

261.4.5.7 .2 IRI Smoothness

.1 Definitions

.1 Roadway Smoothness Category

.1 The smoothness category that applies for a particular section of roadway will be classified as either Category A or Category B. Roadway categories are determined solely at the Owner's discretion based on a number of factors, including but not necessarily limited to: roadway classification, geometry, access points (intersections, driveways), rehabilitation strategies and the presence of other physical features that may impact the ability to achieve pavement smoothness.

.2 International Roughness Index (IRI)

.1 IRI is a statistical measurement used to determine the amount of roughness in a measured longitudinal profile. IRI shall be measured in mm/m and reported to two (2) decimal places for all procedures relating to this specification.

.3 Reporting Interval

.1 The reporting interval for this specification shall be 100 metres for overall IRI, and 10 metres for localized roughness.

261.4.5.7.2.1

.4 Localized Roughness

- .1 Localized roughness is reported in 10 metre intervals where the IRI exceeds an established value as set out in Table 261-11, for a particular roadway category.

.5 Segment

- .1 A segment of roadway shall be defined by the full lane width over a defined length. The segment length shall be 10 metres for localized roughness. The segment length shall be 100 metres for overall IRI, however, shorter segment lengths may exist as outlined in 261.4.5.7.2.4.3.

.6 Project Chainage

- .1 The distance as measured by the High Speed Profiler will be referenced to the Contract stake chainage but will be the only chainage deemed accurate and acceptable for the smoothness specification.

.2 References

- .1 This specification refers to the following standards, specifications or publications:
- ASTM E 950 Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

.3 Equipment

- .1 A Class 1 Inertial Laser Profiler, with moving average filter (high pass 90 m and low pass 0.3 m), shall be used for all smoothness measurements. The equipment shall be installed and operated in accordance with the manufacturer's recommendations and ASTM E 950.

.4 Smoothness Testing Procedures

- .1 The Owner will conduct smoothness testing in accordance with ASTM E 950. The Owner's smoothness testing results will be used in determining payment adjustments and areas requiring corrective work.

- .1 Smoothness testing will be carried out as soon as possible upon completion of the paving operation.

.2 Profile Measurements

- .1 The profiler will record the right and left wheel path IRI values simultaneously at 10 metre intervals. The final IRI readings will be reported at 10 metre intervals. The 100 metre interval averages will then be computed from the 10 metre interval average IRI values.

261.4.5.7.2.4

.3 Exclusions

- .1 The 10 metre segments at both ends of the section under contract shall be excluded from smoothness calculations. Bridges, underpass and overpass structures located within any 10 metre segment, including the 10 metre segments immediately before and after the structure shall be excluded from payment adjustments.
- .2 Areas requiring hand work, tapers, intersections, gore areas, aprons, etc. shall be excluded.
- .3 Individual 10 metre segments exhibiting roughness, which can be directly attributed to physical features of the roadway including iron works or curb/gutter match-ins, will be excluded from payment adjustments.

261.4.5.7

.3 Bump/Dip Profile Requirement

- .1 Individual bumps/dips exceeding 8.4 mm as detected by the profiler shall be subject to payment adjustment as described in 261.5.3.
- .2 The Bump/Dip profile requirements shall apply to all ramps.

261.4.5

.8 Asphalt Binder

- .1 Asphalt binder samples shall be obtained and packaged as follows:
 - .1 Samples shall be a minimum size of one litre and shall be taken from the Contractor's storage tank in accordance with ASTM D 140.
 - .1 The sample containers shall be supplied by the Engineer.
 - .2 For Work Category 1, the Contractor shall obtain one asphalt binder sample per 8000 t of asphalt concrete mix production.
 - .3 For Work Category 2, Work Category 3 and Work Category 4, the Contractor shall obtain one asphalt binder sample per Contract.
 - .4 The Engineer shall label the samples with the Contract number, date, time, grade and type of asphalt binder, supplier, refinery, and the name and the proportions of any additives added to the asphalt binder.
 - .5 If a sample test result falls outside of the material requirements specified in 261.2.1.1, the Engineer may require that the Contractor suspend the asphalt concrete mix production.
 - .1 Compliance shall be verified by the Engineer before the asphalt concrete mix production is allowed to continue.

261.4.5

.9 Thickness

- .1 The Contractor shall place the asphalt concrete in lifts at the thickness indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 For Work Category 1, thickness shall be evaluated on a Lot by Lot basis.

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- 261.4.5.9 .3 For Work Category 1, the Pavement thickness shall be determined from the test results of the cores obtained according to 261.4.5.5.
- .1 If the thickness does not meet the requirements of Table 261-6 then the deficient area shall be repaired as indicated in 261.4.5.12.
- .4 For Work Category 2, Work Category 3 and Work Category 4, the asphalt concrete thickness shall be controlled by the Owner.
- 261.4.5 .10 Surface Defects
- .1 The finished surface of any Pavement course shall have a uniform texture and be free of visible signs of poor workmanship and bumps and/or dips exceeding 3mm as measured with a 3 m straight edge.
- .2 Any obvious defects, as determined by the Engineer, shall be cause for rejection of the Pavement course.
- .1 Multiple defects within a 10 metre section shall be considered as one defect.
- .1 If a defect is continuous beyond 10 metres it shall be considered as one defect.
- .3 Such defects shall include but not necessarily be limited to the following:
- .1 Segregated areas;
 - .2 Ravelling;
 - .3 Roller marks;
 - .4 Cracking or tearing;
 - .5 Improper matching of longitudinal and transverse joints;
 - .6 Tire marks;
 - .7 Sampling locations not properly reinstated;
 - .8 Improperly constructed patches;
 - .9 Contaminant spills on the mat;
 - .10 Flushed Areas; and
 - .11 Pneumatic-tired roller pickup.

Table 261-6
Acceptance/Rejection Requirements by Lot

Measurement	Types of Mix (& Sieve Size)	Lot Payment			Repair / Replace Reject
		Increased	Full	Reduced	
Bulk Relative Density as (%) of Theoretical Maximum Relative Density (%)	All	> 92.5	92.5	92.4 – 89.5	< 89.5
Asphalt Content (%) (Mean of Deviations of Lot from JMF)	All	N.A. N.A.	0.00 – 0.40 0.00 – 0.30	0.41 – 0.65 0.31 – 0.50	> 0.65 > 0.50
Gradation (%) (Mean of Deviations of Lot from JMF) (See Note 1)	B, HRB, WMA-B: (4.75 mm) (75 µm)	N.A. N.A.	0.0 – 6.0 0.0 – 0.8	6.1 – 10.0 0.9 – 1.5	> 10.0 > 1.5
	C, D, HRD, WMA-C, WMA-D: (4.75 mm) (75 µm)	N.A. N.A.	0.0 – 5.0 0.0 – 0.5	5.1 – 9.0 0.6 – 1.2	> 9.0 > 1.2
Cores with Thickness Within Tolerance (#) (See Note 2)	All	N.A.	4 of 5	N.A.	3 of 5
Air Voids (%) (Mean of Deviations from Target Value of 4.0%)	All	N.A.	1.00	1.01 - 2.00	> 2.00

NOTES:

- 1) Additional Requirements for Gradation for Work Category 1, Work Category 2 and Work Category 3:
 - a) If the average of Lot test results for the 4.75 mm sieve size falls outside the gradation limits of Table 261-1, the Lot shall be rejected.
 - b) If the average of Lot test results for the 75 µm sieve size exceeds 6.5%, the following shall apply:
 - 6.6% to 7.5% the Lot Payment shall be reduced by \$5.00/t;
 - >7.5%, the Lot shall be rejected.
 - c) For Work Category 2 and Work Category 3, when the 75 µm sieve size exceeds 6.5% for the selected sample, the remaining samples shall be tested for percent passing the 75 µm sieve size. If the average for all samples exceeds 6.5% refer to Note 1b.
- 2) Specified Thickness for Work Category 1:
 - a) Specified Thickness = specified application rate ÷ bulk relative density obtained from core samples.
 - b) Lift Thickness Tolerance by Type of Mix
 - Tolerance = 0.80 x Specified Thickness (HRB)
 - Tolerance = 0.85 x Specified Thickness (B, C, D)
 - c) If the thickness of either lift of base mix is less than the tolerance, the Contractor shall place the next lift of asphalt concrete to achieve a thickness equivalent to the total thickness of the two lifts as specified in the Contract. The total thickness of the two lifts for the deficient Lot shall be verified by coring the two lifts in the area of the deficient Lot.
 - d) If the thickness of the surface lift is less than the tolerance, the total thickness of all lifts for the deficient Lot shall be verified by coring all the lifts in the area of the deficient Lot.

261.4.5 .11 Appeal of Lot Test Results

- .1 The Contractor may appeal the results of acceptance testing of the density, asphalt content, gradation, air voids and thickness for any rejected or penalized Lot only once.
 - .1 Appeals on density test results shall only be permitted if the original density of the Lot is less than 91.5%.
 - .2 For Work Category 4, the Contractor shall not be permitted to appeal, and the results shall be binding on both the Contractor and the Owner.
- .2 For Work Category 1, the Contractor may appeal the results of any quality assurance mix characteristic(s) from Table 261-4, if the difference between the quality control and quality assurance test results are outside the tolerance listed in Table 261-4, or if the calculated mean of deviation indicates that the Lot will be rejected.
- .3 Appeals shall only be considered for all tests within the Lot.
- .4 Any attempt to improve density on the appealed Lot after the Engineer has tested the Lot for acceptance shall void the appeal and the original test results shall apply.
- .5 The following procedures shall apply for an appeal:
 - .1 The Contractor shall serve notice of appeal to the Engineer, in writing, within 48 hours of receipt of the test results.
 - .2 The Contractor and the Engineer shall agree on a time at which the cores for the appeal of the Lot shall be taken.
 - .1 The cores for the appeal of the Lot shall be taken within 48 hours of the submission of the notice for the appeal.
 - .2 Appeal cores shall be taken at the center of the travelling lane.
 - .3 For Work Category 1, if the density or thickness of the Lot is appealed the Contractor shall take 5 more cores at random locations as determined by the Engineer. These cores shall be tested by the Owner.
 - .4 For Work Category 2 and Work Category 3, if the density of the Lot is appealed the Contractor shall take 4 more cores at random locations as determined by the Engineer. These cores shall be tested by the Owner.
 - .5 If the asphalt content, gradation or air voids is appealed the Engineer shall take the remaining portion of the samples obtained in 261.4.5.6 and test them at the Owner's Central Laboratory in Fredericton.
 - .1 The Contractor shall deliver the appeal samples to the Owner's Central Laboratory in Fredericton.
 - .6 The Contractor may have a representative present during the period of the testing; the Contractor's representative shall comment on anything concerning the testing which he does not consider to be valid and the Engineer shall respond to all comments in order to resolve them.
 - .1 Prior to leaving the testing Laboratory any unresolved comments regarding the testing procedures are to be given to the Engineer in writing.

- 261.4.5.11.5.6
- .2 Any comments, with respect to the testing procedures, which are made subsequent to the Contractor's representative leaving the Laboratory, shall not be considered.
 - .7 For Work Category 1, when the results of the mix characteristics in Table 261-4 are appealed, the following procedures shall apply.
 - .1 The sample mean of the mix characteristic being appealed shall be calculated for quality assurance, quality control and appeal test results.
 - .2 If the sample mean appeal test result is closer to the quality assurance sample mean result, they shall be combined together to establish the mean of deviation for payment adjustment and the Contractor shall be charged the Owners lab testing fees to cover the cost of the appeal testing as set out in Table 810-1.
 - .3 If the sample mean appeal test result is closer to the quality control sample mean result they shall be combined together to establish the mean of deviation for payment adjustment at no cost to the Contractor for the appeal testing.
 - .4 If the sample mean appeal test result is spaced equally between the quality assurance and quality control sample mean test results, all sample mean test results shall be combined together to establish the mean of deviation for payment adjustment at no cost to the Contractor for the appeal testing.
 - .5 For thickness appeals, 7 out of 10 test results must meet or exceed the lift thickness tolerance specified in Table 261-6.
 - .6 The new Lot test results so obtained shall be binding on both the Contractor and the Owner.
 - .8 For Work Category 2 and Work Category 3, only the test results from the Owners Central Laboratory shall be used to determine a new mean of deviations for acceptance and Unit Price Adjustment.
 - .1 The new Lot test results so obtained shall be binding on both the Contractor and the Owner.
 - .9 Analysis of Rejected Lots
 - .1 Following an appeal of the entire Lot, in accordance with 261.4.5.11, if the new test results continue to indicate rejection, the new test results will be analyzed, at the discretion of the Engineer, to determine whether or not a portion of the Lot is acceptable.
 - .2 An analysis, as determined by the Engineer, will be carried out to determine which segments may be acceptable.
 - .3 If the analysis indicates partial Lot acceptance, only those areas corresponding to the sample segment(s) in which rejected material placement occurred shall be subject to 261.4.5.12.2 or 261.4.5.12.3, as determined by the Engineer.
 - .4 Any and all price adjustments corresponding to the recalculated test results shall apply.

261.4.5 .12 Repairs

261.4.5.12 .1 General

- .1 Repairs to correct surface defects shall be carried out by removal and replacement as per 261.4.5.12.2 or routing and crack sealing. The method of repair shall be determined by the Engineer.
- .2 The asphalt concrete used for replacement to correct surface defects shall be the same asphalt concrete mix designation as that which is removed.
 - .1 Any asphalt concrete which does not conform to the requirements of this Item shall not be incorporated in the Work.
- .3 Clause 261.6.7 shall also apply.

261.4.5.12 .2 Removal and Replacement

- .1 The full thickness of the appropriate lift of Pavement in the rejected Lot shall be removed by cold milling or other means as approved by the Engineer.
- .2 All joints shall be tack-coated.
- .3 Repaired areas shall be retested for acceptance; those failing shall be rejected and shall require further repair.
- .4 Material removed shall become the property of the Contractor, who shall dispose of the material outside the Work Site.

261.4.5.12 .3 Overlaying

- .1 The overlay shall extend the full width of the underlying Pavement surface and have a finished compacted thickness of not less than 50 mm for a base course and 34 mm for a surface course.
- .2 A key shall be constructed at each end of the overlaid section as per Standard Drawing 261-1.
- .3 If an overlay results in the need for repairs or adjustments to the adjacent materials within the Work Area, the Contractor shall carry out the repairs and adjustments at his/her own expense and to the satisfaction of the Engineer.
- .4 Repaired areas shall be retested for acceptance.
 - .1 Those failing will be rejected and a second overlay shall not be permitted.
 - .2 The Contractor shall then carry out repairs in accordance with 261.4.5.12.2.
 - .3 Removal depth shall be sufficient to remove the full thickness of the overlay lift and the original unsatisfactory surface lift.

261.5 MEASUREMENT FOR PAYMENT

261.5 .1 General

.1 The Quantity to be measured for payment shall be the number of tonnes of asphalt concrete placed, in accordance with this Item, subject to payment adjustments.

.1 For Work Category 1, the Quantity of asphalt concrete for a Lot shall not exceed that calculated as follows:

$$[1.10 \times (\text{application rate}) \times (\text{length}) \times (\text{specified width})] \div 1000$$

261.5 .2 Unit Price Adjustment (UPA) of the Lot

.1 The UPAs for asphalt concrete are shown in Tables 261-7, 261-8, 261-9 and 261-13.

.1 For Work Category 1, the UPAs for asphalt concrete are as shown in Tables 261-7, 261-8, 261-9 and 261-13.

.2 For Work Category 2, the UPAs for asphalt concrete as shown in Table 261-8, 261-9 and 261-13 will be subjected to 75% of the values listed and the UPAs in Table 261-7 will be subjected to 100% of the values listed.

.3 For Work Category 3, the UPAs for asphalt concrete as shown in Table 261-8, 261-9 and 261-13 will be subjected to 50% of the values listed and the UPAs in Table 261-7 will be subjected to 100% of the values listed.

.4 For Work Category 4, the UPAs for asphalt concrete as shown in Table 261-8, 261-9 and 261-13 will be subjected to 25% of the values listed. The positive values in Table 261-7 will be subjected to 100% of the values listed. The negative values in Table 261-7 will be subjected to 50% of the values listed.

.1 For Work Category 4, the UPAs for asphalt concrete as shown in Tables 261-7, 261-8, 261-9 and 261-13 shall be limited to the maximum penalty. The rejection criteria shall not apply.

.2 For asphalt concrete placed on Shoulder areas where a single lift of asphalt concrete surface mix over granulars is specified and on Bridge decks, the UPA as shown in Table 261-7 shall not apply.

.3 For asphalt concrete placed as padding, driveways and aprons, the UPA as shown in Table 261-7, 261-8, 261-9 and 261-13 shall not apply.

.4 If repairs are carried out by removal and replacement or overlay of the asphalt concrete, the UPA for the Lot shall be based on quality assurance testing carried out on the repaired Lot.

.5 The Unit Price (UP) for asphalt concrete base or surface mixes shall be adjusted for each Lot as follows:

$$UP_{\text{Lot}} = UP + \Sigma (UPA_{\text{Density}} + UPA_{\text{Asphalt Content}} + UPA_{\text{Gradation}} + UPA_{\text{Air Voids}})$$

261.5 .3 Payment Adjustment for Smoothness

- .1 The Engineer will provide the Contractor with a copy of the smoothness test results, including detailed payment adjustment summaries and mandatory repair requirements.
- .2 Individual bumps and dips shall be assessed in accordance with the schedule set out in Table 261-12.
- .3 For asphalt concrete placed on Bridge decks, the payment adjustments as shown in Tables 261-10, 261-11 and 261-12 shall not apply.
- .4 100 Metre Segments
 - .1 Payment adjustment for 100 metre segments shall be calculated based on the overall average IRI in mm/m for each 100 metre segment in each lane in accordance with Table 261-10.
- .5 Localized Roughness
 - .1 With the exception of areas described in 261.4.5.7.2.4.3, each 10 metre segment with an IRI value greater than those shown in Table 261-11 shall be defined as localized roughness, resulting in negative payment adjustments. The total localized roughness payment adjustment shall be the numerical summation of all the individual localized roughness payments adjustments for the defined section of roadway.
- .6 Total Payment Adjustments
 - .1 The total payment adjustment shall be the summation of all the individual payment adjustments for each 100 metre segment in each lane, including localized roughness payment adjustments. If the total 100 metre segment payment adjustment is a positive value, the Contractor shall be assessed the total 100 metre segment payment adjustment, and the total localized roughness payment adjustment for the defined section of roadway.
 - .2 If the total 100 metre segment payment adjustment is a negative value, the Contractor shall be assessed either the total 100 metre segment payment adjustment or the total localized roughness payment adjustment, whichever is numerically less (i.e. whichever results in a greater penalty to the Contractor). The two penalties shall not be applied in summation.
- .7 Segments Less Than 100 Metres
 - .1 For segments less than 100 metres in length, price adjustments shall be determined from 10 metre segments that are not subject to exclusions as described in 261.4.5.7.2.4.3. Payment adjustments under 261.5.3.4 and 261.5.3.5 shall apply to these areas based on the actual number of 10 metre segments that are not excluded. Price adjustments shall be prorated based on the number of non-excluded 10 metre segments in the 100 metre segment, as detailed in Table 261-10.

Table 261-7
Unit Price Adjustment For Density (UPAd)

% of Theoretical Maximum Relative Density (Lot Average)	Unit Price Adjustment (\$ per Tonne)	% of Theoretical Maximum Relative Density (Lot Average)	Unit Price Adjustment (\$ per Tonne)
93.0	+1.00	91.1	-2.80
92.9	+0.80	91.0	-3.00
92.8	+0.60	90.9	-3.40
92.7	+0.40	90.8	-3.80
92.6	+0.20	90.7	-4.20
92.5	0.00	90.6	-4.60
92.4	-0.20	90.5	-5.00
92.3	-0.40	90.4	-5.40
92.2	-0.60	90.3	-5.80
92.1	-0.80	90.2	-6.20
92.0	-1.00	90.1	-6.60
91.9	-1.20	90.0	-7.00
91.8	-1.40	89.9	-8.00
91.7	-1.60	89.8	-9.00
91.6	-1.80	89.7	-10.00
91.5	-2.00	89.6	-11.00
91.4	-2.20	89.5	-12.00
91.3	-2.40	<89.5	reject
91.2	-2.60		

continued next column

Table 261-8
Unit Price Adjustment For Asphalt Content (UPAa)

Mean of the Deviations of Actual Asphalt Content From the Approved Asphalt Content		Unit Price adjustment for Asphalt Content (\$ per Tonne)
Type B/HRB/WMA-B	0.00 to 0.40	0.00
	0.41 to 0.45	-1.00
	0.46 to 0.50	-2.00
	0.51 to 0.55	-3.00
	0.56 to 0.60	-4.00
	0.61 to 0.65	-5.00
	> 0.65	reject
Type C/D/HRD/ WMA-C/WMA-D	0.00 to 0.30	0.00
	0.31 to 0.35	-1.00
	0.36 to 0.40	-2.00
	0.41 to 0.45	-3.00
	0.46 to 0.50	-4.00
	> 0.50	reject

Table 261-9
Unit Price Adjustment For Gradation (UPAg)

Sieve Size ASTM Designation	Mean of the Deviations of the Gradation from the JMF		Unit Price Adjustment for Gradation
	Type B/HRB/WMA-B	Type C/D/HRD WMA-C/WMA-D	\$ per Tonne
4.75 mm	0.0 to 6.0	0.0 to 5.0	0.00
	6.1 to 6.2	5.1 to 5.2	-0.50
	6.3 to 6.4	5.3 to 5.4	-1.00
	6.5 to 6.6	5.5 to 5.6	-1.50
	6.7 to 6.8	5.7 to 5.8	-2.00
	6.9 to 7.0	5.9 to 6.0	-2.50
	7.1 to 7.2	6.1 to 6.2	-3.00
	7.3 to 7.4	6.3 to 6.4	-3.50
	7.5 to 7.6	6.5 to 6.6	-4.00
	7.7 to 7.8	6.7 to 6.8	-4.50
	7.9 to 8.0	6.9 to 7.0	-5.00
	8.1 to 9.0	7.1 to 8.0	-10.00
	9.1 to 10.0	8.1 to 9.0	-15.00
	> 10.0	> 9.0	reject
75 µm	0.0 to 0.8	0.0 to 0.5	0.00
	0.9	0.6	-0.50
	1.0	0.7	-1.50
	1.1	0.8	-3.00
	1.2	0.9	-5.00
	1.3	1.0	-7.50
	1.4 to 1.5	1.1 to 1.2	-12.00
	> 1.5	> 1.2	reject
<p>For Work Category 1, Work Category 2 and Work Category 3, in addition to the above acceptance/rejection requirements for gradation, the following shall apply:</p> <p>(a) If the average of Lot test results for the 4.75 mm sieve size falls outside the gradation limits of Table 261-1, the Lot shall be rejected.</p> <p>(b) If the average of Lot test results for the 75 µm sieve size exceeds 6.5%, the following shall apply:</p> <ul style="list-style-type: none"> • 6.6% to 7.5% the Lot Payment shall be reduced by \$5.00/t; • >7.5%, the Lot will be rejected. 			

Table 261-10
Payment Adjustment 100 Metre Segments

IRI (mm/m)	Payment Adjustment for each 100 metre Segment in each Lane	
	Category A	Category B
0.00 – 0.10	+\$750.00	+\$950.00
0.11 – 0.20	+\$670.00	+\$860.00
0.21 – 0.30	+\$580.00	+\$770.00
0.31 – 0.40	+\$490.00	+\$670.00
0.41 – 0.50	+\$400.00	+\$570.00
0.51 – 0.60	+\$305.00	+\$470.00
0.61 – 0.70	+\$205.00	+\$370.00
0.71 – 0.80	+\$100.00	+\$270.00
0.81 – 0.90	-\$20.00	+\$160.00
0.91 – 1.00	-\$250.00	+\$50.00
1.01 – 1.10	-\$490.00	-\$70.00
1.11 – 1.20	-\$760.00	-\$190.00
1.21 – 1.30	-\$1040.00	-\$320.00
1.31 – 1.40	-\$1350.00	-\$450.00
1.41 – 1.50	-\$1700.00	-\$590.00
1.51 – 1.60	-\$2110.00	-\$740.00
1.61 – 1.70	-\$2630.00	-\$900.00
1.71 – 1.80	-\$3800.00	-\$1070.00
1.81 – 1.90	-\$4690.00	-\$1260.00
1.91 – 2.00	-\$4700.00	-\$1480.00
2.01 – 2.10	-\$4700.00	-\$1720.00
2.11 – 2.20	-\$4700.00	-\$2040.00
2.21 – 2.30	-\$4700.00	-\$2750.00
2.31 – 2.40	-\$4700.00	-\$3290.00
2.41 – 2.50	-\$4700.00	-\$3300.00
2.51 – 3.00	-\$4700.00	-\$3300.00

Table 261-11
Payment Adjustment 10 Metre Segments

Roadway Classification	Localized Roughness IRI (mm/m) for 10 metre Segments	Payment Adjustment (for each occurrence)
Category A	> 1.10	-\$250.00
Category B	> 1.40	-\$250.00

**Table 261-12
Bump And Dip Penalty Schedule**

Bump/Dip	Penalty
8.5 to 9.4 mm	\$ 100.00
9.5 to 10.4 mm	\$ 200.00
10.5 to 11.4 mm	\$ 400.00
11.5 to 12.4 mm	\$ 600.00
12.5 to 13.4 mm	\$ 800.00
13.5 to 14.4 mm	\$1000.00
14.5 to 15.4 mm	\$1200.00
15.5 to 16.4 mm	\$1400.00
16.5 to 17.4 mm	\$1600.00
17.5 to 18.4 mm	\$1800.00
≥ 18.5 mm	\$2000.00

**Table 261-13
Unit Price Adjustment for Air Voids (UPA_{AV})**

Mean of Deviations of Air Voids from Target Value Air Voids (4.00%)	Unit Price Adjustment (\$/t)
0.00 to 1.00	0.00
1.01 to 1.10	- 0.50
1.11 to 1.20	- 1.00
1.21 to 1.30	- 2.00
1.31 to 1.40	- 4.00
1.41 to 1.50	- 6.00
1.51 to 1.60	- 8.00
1.61 to 1.70	- 10.00
1.71 to 1.80	- 12.00
1.81 to 1.90	- 14.00
1.91 to 2.00	- 16.00
> 2.00	Reject

261.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of asphalt concrete, as identified under the Contract.
- .2 Compensation to the Contractor or the Owner for differences between the asphalt binder content as determined by QA ignition furnace results, and the assumed asphalt binder content specified in 261.2.2.1 for the total payable tonnage, shall be as follows:
 - .1 Payment to the Contractor shall be made for asphalt content in excess of the assumed asphalt binder content specified in 261.2.2.1 for the total payable tonnage, subject to the following limitations:
 - .1 The maximum amount of asphalt content used in the above calculation will be the "Approved Asphalt Binder Content", from the JMF and subsequent approved adjustments, plus 0.65 % for Type B/HRB mix and 0.5 % for Type C/D mix.

ASPHALT CONCRETE - END RESULT SPECIFICATION (ERS)

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- 261.6.2.1 .2 If the actual asphalt binder content is less than the assumed asphalt binder content, the Contractor shall reimburse the Owner using the MTO's PG asphalt binder price index for the month preceding the month of the tender opening.
- .3 If the actual asphalt binder content is higher than the assumed asphalt binder content, the Owner shall reimburse the Contractor at the actual invoiced amount supplied by the Contractor.
- .4 Payments and credits shall be determined on a Lot by Lot basis.
- .5 This determination is independent from and has no relationship to calculations for determining Unit Price adjustments as determined under 261.6.3.
- .6 The asphalt binder content for each mix type will be calculated by averaging all the ignition furnace results obtained throughout the contract.
 - .1 For RAP mixes, the actual asphalt binder content in the RAP will be subtracted from the ignition furnace results obtained throughout the contract.
 - .2 For padding, the actual asphalt binder content will be calculated by averaging the ignition furnace results obtained under 261.4.3.7.1.5.
 - .3 No binder adjustment shall be required for material placed in driveways and aprons.
- .3 Payment adjustment for change in the PG asphalt binder price shall be calculated in accordance with Item 821.
- .4 In the case that the Contractor initiates an appeal under 261.4.5.11, the following shall apply:
 - .1 If the new test results after the appeal process indicates that a penalty no longer applies, then the testing costs incurred by the Owner during the appeal procedures for that Lot will be borne by the Owner.
 - .1 Payment to the Contractor shall be made for the sampling costs.
 - .2 If the new test results after the appeal process verify that a penalty still applies or rejection remains valid for that Lot, the testing costs incurred by the Owner during the appeal procedure shall be charged, in accordance with Item 810, to the Contractor.
 - .3 When the binder content is appealed, an additional \$1,300 will be charged to cover the cost of calibrating the ignition furnace.
- .5 If the Contractor carries out IRI Compulsory Work per 261.6.8 or carried out work to repair Surface Defects per 261.4.5.10, the smoothness shall be retested.
 - .1 The Contractor shall be charged for the smoothness retesting in accordance with Item 810.
- .6 For each occurrence that paving is not performed per 261.4.3.5.3 or 261.4.3.5.4, the Contractor shall pay the Owner a penalty of \$1000 for each Day after the 14th Day or 21st Day, respectively, until paving commences; and \$1000 for each Day that paving is not continuous (stopped on any Day for more than 40% of the Contractor's normal Work hours), until paving resumes.
- .7 For each surface defect as per 261.4.5.10, the Contractor shall pay the Owner a penalty of \$500.00 per defect.

261.6 .8 Mandatory Penalty for IRI Category A

- .1 The Contractor shall be subjected to a mandatory penalty of -\$2500 for each 10 metre segment with an IRI > 3.00 mm/m, with exceptions of areas defined in 261.4.5.7.2.4.3.
- .2 The Owner reserves the right to require Compulsory Corrective Work on any of the sections with an IRI > 3.00 mm/m. In sections where Compulsory Corrective Work is required the Owner will waive the -\$2500 penalty.
 - .1 The Owner shall notify the Contractor if Compulsory Corrective Work is required.

.9 Compulsory Corrective Work Procedures

- .1 Corrective work shall consist of "removal and replacement" of the surface course of asphalt concrete. The minimum length of any repair area shall be 10 metres.
- .2 On each of the 10 metre segments affected, the Contractor shall remove (by cold milling) and replace the full width of the driving lane and the full depth of the surface course of asphalt concrete affected.
- .3 The asphalt concrete repair shall conform to 261.4.5.12.

.10 Retesting Following Corrective Work

- .1 After corrective work has been completed, each of the 100 metre segments containing corrective work shall be retested, using the same profiler used in the original testing. The new IRI values shall be used and recalculated results shall be binding. Should the new IRI results indicate further Mandatory Penalty, the Contractor shall be subject to the Mandatory Penalty as stated in 261.6.8 and as per 261.6.11.1

.11 Cost for Corrective Work

- .1 All costs associated with corrective work, including retesting, shall be the responsibility of the Contractor.

PARTIAL DEPTH RECYCLING

ITEM: 262

262.1 DESCRIPTION

- .1 This Item consists of in-place partial depth reclamation of the existing asphalt Pavement, recycling the reclaimed asphalt Pavement (RAP) using Mobile Recycling Equipment, and placement of a recycled cold bituminous mixture.
 - .1 Alternative A – Using Emulsified Asphalt.
 - .2 Alternative B – Using Expanded Asphalt.

262.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The Contractor shall process the RAP to contain 100% passing the 31.5 mm sieve.

262.2 .3 Alternative A- Emulsified Asphalt

- .1 The emulsified asphalt shall be a CSS-1 or CSS-1H or an Engineer approved equivalent.
- .2 The emulsified asphalt may be cationic or anionic, based on the performance in the coating tests conducted in the initial phase of the Design Mix Formula (DMF).
- .3 The emulsified asphalt shall meet the requirements of ASTM D2397 for cationic, and ASTM D977 for anionic.

262.2 .4 Alternative B- Asphalt Binder

- .1 The asphalt binder grade shall be PG 58–28.
- .2 Performance Grade (PG) asphalt binder shall meet the requirements of AASHTO MP1, Table 1 – Performance Graded Asphalt Binder Specification, and shall contain no anti-foaming agents.

262.2 .5 Water

- .1 Water shall be obtained from a source approved by the appropriate regulatory agencies, and shall be free of any deleterious materials.

262.2 .6 Mix Design

.1 Preliminary Sampling

- .1 Prior to commencing the Work, the Contractor shall obtain representative samples of the material to be produced during the reclaiming operation, and shall carry out the laboratory testing necessary to establish the DMF.
- .2 The samples shall be taken from the Roadbed, at a minimum rate of one per 500 metres of lane kilometer, which shall be restored with either asphalt concrete or cold mix the same Day as sampling, to the satisfaction of the Engineer.
 - .1 The Contractor shall be responsible to maintain and repair all sample locations.
 - .2 The Contractor shall notify the Engineer of sampling at least 3 Days prior to sampling from the Roadbed.

262.2.6 .2 Design Mix Formula (DMF)

.1 The Contractor shall use Professional Engineering services and a qualified testing Laboratory to assess the aggregate materials proposed for use in, and to carry out the design of, the expanded asphalt mix.

.2 Alternative A

.1 The emulsified asphalt DMF shall be in accordance with the procedures outlined in *A Basic Asphalt Emulsion Manual – Manual Series No. 19, 4th Ed.* from the Asphalt Institute and the Asphalt Emulsion Manufacturer's Association (AEMA).

.2 The emulsified asphalt by mass of RAP shall have a minimum residual asphalt content of 0.8%.

.3 The DMF shall identify the maximum allowable field adjustment to the design rate without adverse effects on mix properties. A new DMF shall be submitted when the emulsified asphalt design rate is adjusted by 0.5% or greater.

.4 If the composition of the existing Pavement changes significantly, the Contractor shall submit a separate DMF.

.5 The DMF report shall contain all information on the type, manufacturer and supplier of the asphalt emulsion, and its technical specifications.

.6 A minimum of 0.5% by mass of Portland cement shall be incorporated into all DMF.

.1 For the purpose of establishing the Unit Price for Alternative A, the amount of Portland cement required shall be calculated using a mix design of 2100 kg/m³.

.2 The maximum amount of Portland cement allowable for incorporation into the mix shall be 1.0% if the minimum requirements of Table 262-2 cannot be met.

.7 Corrective aggregate by mass shall be supplied for incorporation into the mix if the DMF fails to conform to the grading limits of Table 262-1 and/or if the minimum requirements of Table 262-2 cannot be met using Portland cement.

.1 Corrective aggregate shall meet the physical requirements of Table 201-1 for aggregate base.

.3 Alternative B

.1 An expanded asphalt mix design shall be conducted in accordance with the procedures outlined in the *Wirtgen Cold Recycling Manual*. Preparation of the DMF shall be the Contractor's responsibility.

.2 The DMF shall identify total asphalt binder content, aggregate gradation, compacted bulk density, target dry density of the mixture, dry tensile strength, wet tensile strength, and tensile strength ratio.

.1 For the purpose of establishing the Unit Price for Alternative B expanded asphalt, an asphalt binder content of 1.2% and a mix density of 2100 kg/m³ shall be assumed for the expanded asphalt mix.

PARTIAL DEPTH RECYCLING

ITEM: 262

- 262.2.6.2.3
- .3 The DMF shall identify the maximum allowable field adjustment to the design rate without adverse effects on mix properties. A new DMF shall be submitted when the asphalt binder design rate is adjusted by 0.5% or greater.
 - .4 If the composition of the existing Pavement changes significantly, the Contractor shall submit a separate DMF.
 - .5 The total asphalt binder content of the DMF includes the existing aged binder and virgin asphalt binder.
 - .1 The design rate of expanded asphalt by mass of RAP shall have a minimum asphalt content of 0.8%, unless otherwise approved by the Engineer.
 - .6 The water content of the expanded asphalt shall be established so as to provide the maximum expansion ratio and maximum half-life.
 - .1 The expansion ratio and half-life shall be determined at a minimum of five different water contents, with a minimum of two trials for each water content. The average values obtained shall be used in the final analysis.
 - .2 The rate of water injection into the expanded asphalt shall be selected to provide a minimum half-life of 6 seconds.
 - .7 The combined aggregate shall comprise a mix conforming to the grading limits of Table 262-1.

**Table 262-1
 Final Grading Limits for Combined Aggregate**

Sieve Size (mm)	% Passing
31.5	100
4.75	45-70
0.075	5-20

- .8 The mix shall conform to the strength requirements of Table 262-2.

**Table 262-2
 Strength Requirements**

Test	Minimum Requirement (kPa)
ITS (Soaked) / MTO LS-297	100
ITS (Dry) / MTO LS-297	225
TSR	50

- .9 A minimum of 0.5% by mass of Portland cement shall be incorporated into all DMF.
 - .1 For the purpose of establishing the Unit Price for Alternative B expanded asphalt, a mix density of 2100 kg/m³ shall be assumed.
 - .2 The maximum amount of Portland cement allowable for incorporation into the mix shall be 1.0% if the minimum requirements of Table 262-2 cannot be met.
- .10 Corrective aggregate by mass shall be supplied for incorporation into the mix if the DMF fails to conform to the grading limits of Table 262-1 and/or if the minimum requirements of Table 262-2 cannot be met using Portland cement.

PARTIAL DEPTH RECYCLING

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262.2.6.2.3.10 .1 Corrective aggregate shall meet the physical properties of Table 201-1 for aggregate base.

262.2.6 .3 Mix Design Report

- .1 A mix design report shall include:
 - .1 NBDTI contract number and description;
 - .2 A cover letter summarizing the DMF and identifying the recommended mix proportions;
 - .3 A copy of all calculations performed to determine the design percentage by mass of new binder or emulsion to be added to the unstabilized material;
 - .4 The name of the proposed emulsified asphalt or asphalt binder supplier;
 - .1 For Alternative B, the recommended PGAC temperature for foaming;
 - .5 The dry and wet tensile strength and tensile strength ratio;
 - .6 The mix design bulk relative density and the theoretical maximum density;
 - .7 The optimum moisture content;
 - .8 The gradation of the RAP;
 - .9 The type, source and quantity of Portland cement and/or corrective aggregate;
 - .10 The maximum allowable field adjustment to the design rate without adverse effects on the mix properties.

262.3 SUBMITTALS

- .1 The Contractor shall submit, at least 10 Days prior to commencing the Work, a list of all pieces of Equipment intended for use in the Work.
- .2 The Contractor shall submit, at least 10 Days prior to commencing the Work, a detailed report outlining the DMF as established on the basis of the preliminary sampling of the material to be recycled.
- .3 The Contractor shall submit, at least 7 Days prior to commencing the Work, recent calibration certificates of all metering, weighing and other controlling devices to be used in controlling and monitoring the mix production.
 - .1 Certificates must be dated within the same calendar year or prior to the start of construction season.
- .4 The Contractor shall submit in writing, prior to the Work, the application rate for Portland cement in kg/m² and/or the application rate for corrective aggregate in kg/m², if required.
- .5 Prior to the Work, the source and location of the proposed water supply shall be submitted in writing.
 - .1 Upon request, the method proposed for withdrawal and application of water, and certification of approval of the water source.
- .6 Prior to the Work, the Contractor shall identify cross-slope on tangents and super elevation on curves of the existing Pavement and shall submit the values to the Engineer.
 - .1 The Contractor shall also submit the expected cross-slope and super elevation on curves of the completed PDR surface demonstrating the requirements of 262.4.5.5.
 - .2 If pre-milling is required under Item 208, the Contractor shall submit the expected cross-slope and super elevation on curves for each phase of the Work.

PARTIAL DEPTH RECYCLING

ITEM: 262

- 262.3 .7 Upon completion of the Work, the daily reports indicating the amount of emulsified asphalt or asphalt binder used shall be submitted.
- .8 Delivery slips for each tanker load of emulsified asphalt or asphalt binder shall be submitted.
- .1 Partial tanker loads shall be weighed at an approved location and have the weigh slip accompany the delivery slip.
- .2 If temporary onsite asphalt binder storage is used, the temporary storage shall be weighed prior to commencement of the Contract and after PDR is complete.
- .1 Any remaining binder shall be subtracted from the total binder delivered to site.
- .9 No later than 6 months after completion of the Work, a final written report containing mix design reports and results of all field and laboratory tests shall be submitted to the Paving Engineer.
- .10 Delivery slips or weigh tickets indicating the amount of Portland cement incorporated into the Work.
- .11 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

262.4 CONSTRUCTION

262.4 .1 Details of Work

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 In-place partial depth reclaiming of existing asphalt concrete Pavement, sizing, and mixing with binder and water (if required) shall be completed to a depth sufficient to achieve 262.4.1.3 and to the average width specified in the Contract Documents.
- .3 The recycled cold bituminous mixture shall be spread and compacted to an average depth of 100 mm \pm 10 mm and width specified in the Contract Documents.
- .4 The Work shall be carried out in-place on the Roadbed in a manner that does not disturb the underlying Aggregate Base and that ensures the in-place partial depth recycled material contains a negligible amount of granular material.
- .5 Portland cement and/or corrective aggregate shall be added to the existing road surface prior to stabilization.

262.4 .2 Equipment

- .1 The cold milling machine shall be self-propelled with a cutting drum capable of reclaiming the asphalt Pavement to the required depth and automatically controlled for grade and slope.
- .2 The screening and sizing equipment shall be capable of reducing the RAP to the maximum size specified and consistently producing the gradation required for the approved mix design.
- .1 Single-Unit Recycling Equipment must be capable of sizing the RAP material to the required gradation.

- 262.4.2 .3 The stabilizing unit shall produce a uniform, thoroughly mixed cold-mix product, which shall be deposited directly into the placing Equipment and not windrowed.
- .4 The stabilizing unit shall have an emulsion/expanded asphalt injection system capable of injecting and blending emulsion or expanded asphalt uniformly throughout the unstabilized material, and the following additional features:
- .1 A system to control and monitor the percentage of emulsion or asphalt binder added and the percentage of water for optimum compaction;
 - .2 A system of nozzles that uniformly applies emulsion or expanded asphalt across the full width of treatment and is adjustable for varying widths of treatment;
 - .3 A system to control and regulate the application of emulsion or expanded asphalt in relation to travel speed and mass of material;
 - .4 A heating system to maintain operating temperature.
- .5 Placing Equipment shall evenly distribute the stabilized mix in front of a tamper bar / vibratory screed, and shall be capable of spreading the mix, without segregation, and with a smooth and uniform textured surface, to the required thickness in one continuous pass.
- .1 Placing Equipment shall be equipped with automatic grade and slope control.
 - .2 The Contractor shall provide a 3 m straight edge with each paver.
- .6 Compaction Equipment shall consist of a vibratory drum roller of at least 15 t mass, a pneumatic-tired roller of at least 10 t mass, and for areas inaccessible to full size rollers, smaller compactors as required.
- .7 Asphalt Binder tankers shall have all-round heat retention cladding and shall be equipped with a working thermometer to show binder temperature in the bottom third of the tank and a rear feed valve that is capable of draining the contents of the tank.
- .1 The Contractor shall determine the number and size of tankers delivering to the Work Area so as to provide a continuous mixing operation and minimal disruption to traffic.
- .8 Water tankers shall be equipped with pumps of a minimum capacity of 500 L/min, and flexible, non-collapsing supply hoses and quick-release couplings.
- .1 The Contractor shall determine the number and size of tankers delivering to the Work Area so as to provide a continuous supply of water to the mixing operation and minimal disruption to traffic.
- .9 Portland cement spreader/distributor shall have the means to control the rate of application of cement and distribute the Portland cement evenly and uniformly across the entire mat to be recycled.
- .10 The corrective aggregate delivery system shall have the means to control the rate of application of corrective aggregate and distribute the corrective aggregate evenly and uniformly across the entire mat to be recycled.

262.4 .3 Test Strip

- .1 The Contractor shall initially stabilize a test strip 0.5 km in length and one lane in width, to demonstrate the ability to produce a stabilized Roadbed in conformance with this Item.
 - .1 The Contractor must demonstrate that the required application rates for Portland cement and/or corrective aggregate can be achieved, including uniform distribution across the entire mat to be stabilized.
- .2 The test strip shall be free of surface defects after placement and compaction, such as segregation, raveling, rutting, checking, etc.
- .3 If the test strip is not acceptable, as determined by the Engineer, the Contractor shall rework the test strip.
 - .1 A second test strip might be required if the first is deemed not acceptable as determined by the Engineer.

262.4 .4 Operational Constraints

- .1 The Contractor shall not conduct and/or continue the emulsified asphalt or expanded asphalt process during rain; when there is free-standing water on the surface to be stabilized; or when the ambient temperature is below 10°C.
- .2 Prior to termination of operations each Day, the length of Roadbed on which Work under this Item has begun shall have all mixing, placing and compacting completed, for the specified widths.
- .3 Traffic including construction vehicles shall be kept off the freshly placed and compacted recycled cold bituminous mixture until the Contractor has determined that the mat is able to carry traffic without damage.
 - .1 The Contractor shall supply any pilot vehicles with operator and all other labour, Equipment and material required to convoy traffic through or around the Work Area, at a maximum convoy speed of 30 km/h.
 - .2 The Contractor shall be responsible for ensuring that the recycled cold bituminous mixture is not damaged by traffic while curing.
- .4 If cold milling is required, partial depth recycling shall commence within 14 Days of the commencement of the cold milling operation, and shall continue on a daily basis until the entire milled surface has received a lift of recycled cold bituminous mixture.

262.4.4 .5 Alternative A

- .1 The recycled cold bituminous mixture has been allowed to cure for a minimum of 7 Days of good curing weather (sunny, warm, low humidity).
- .2 The in-situ mean moisture content of the recycled cold bituminous mixture is 3% or less with no single test greater than 3.5%.

262.4.4 .6 Alternative B

- .1 The recycled cold bituminous mixture has cured for a minimum of 7 Days.

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262.4.4.6 .2 The placement of new asphalt concrete shall commence within 14 Days of the completion of partial depth recycling and shall continue on a daily basis until the entire partial depth recycling surface has received a lift of asphalt.

262.4 .5 Placement of Cold Bituminous Mixture

- .1 Emulsified asphalt, or asphalt binder shall be added to the RAP at the design rate.
- .2 The emulsified asphalt or asphalt binder rate shall be adjusted by the Contractor as required, to produce a uniform, thoroughly coated, recycled cold bituminous mixture of the specified density.
- .3 For Alternative B, the minimum binder temperature shall be 145°C.
- .4 Water may be required to be added to the RAP prior to or concurrently with addition of the emulsified asphalt to facilitate uniform mixing.
- .5 The stabilized mat shall be shaped and compacted to the pre-existing rates of cross-slope and super elevation or, where existing cross-slope was less than 0.01 m/m or more than 0.035 m/m, it shall be shaped and compacted to a value not less than 0.01 m/m or more than 0.035 m/m, respectively.
 - .1 All alignment and grade transitions shall be smooth, including tangent to curve, curve to tangent, and where cross-slope varies per 262.4.5.5.
 - .2 If the Engineer determines that the Contractor has not met the requirements specified under 262.4.5.5, the Contractor will be required to reprocess or pad the entire section.
- .6 The finished surface shall be uniform in texture and free of surface defects, including but not limited to raveling, segregation, flushing, pot-holing, cracking, deflections, rutting and contamination.
 - .1 Soft spots or areas exhibiting surface defects prior to paving shall be cold milled and paved with asphalt concrete as directed by the Engineer.
- .7 Overlapped joints and repaired areas in the recycled cold bituminous mixture, and processed areas outside the specified areas of stabilization, shall be considered as part of the Work.
- .8 If the Engineer determines that 40% or more of the area in a section of the Work is defective the Contractor shall be required to reprocess the entire section of the Work under this Item.
- .9 If the asphalt content being added to the field mix varies by $\pm 0.5\%$ from the DMF target value, the Contractor shall suspend Work and submit a revised DMF for approval.
- .10 The recycled cold bituminous mixture shall be compacted smooth, to a minimum of 83% of the mix design Theoretical Maximum Relative Density as determined by AASHTO T209.
 - .1 Secondary rolling, if necessary to achieve the required density, shall be permitted within 10 Days after placing.

262.4 .6 Quality Control (QC)

- .1 The Contractor shall implement a comprehensive quality control (QC) program to ensure the quality of Work.

- 262.4.6 .2 The Contractor shall submit, upon request, in writing to the Engineer an Inspection Testing Plan (ITP) covering all phases of the contract performance and the name of the party retained to conduct the ITP.
- .1 The ITP shall include, but not limited to, identification and description of inspection and required test procedures to be used during the entire life of the contract.
 - .2 The ITP shall be sufficiently comprehensive and detailed to assure the Engineer of the Contractor's willingness and ability to control the construction production and processes.
 - .3 Once accepted by the Engineer the plan becomes a part of the Contract and shall be enforced accordingly.
 - .4 The ITP may have to be updated and revised by the Contractor as conditions warrant.
- .3 The Contractor shall be responsible for calibration of measuring equipment and regular verification of their accuracy during the course of the Work.
- .1 The accuracy of the metering devices controlling the emulsified asphalt or asphalt binder rate shall be verified by the Contractor by checking the quantities on the delivery slip that accompanies each tanker delivered at the Work Site.
- .4 For Alternative A, the RAP shall be sampled by the Contractor from behind the paver at a rate of 1 sample per lane-km.
- .1 Samples shall be tested by the Contractor if requested by the Engineer for Gradation (ASTM C136) and moisture content. A composite sample of each Day's samples shall be tested for residual asphalt content (ASTM D2172).
- .5 For Alternative B, QC sampling and testing shall ensure that the recycled cold bituminous mixture meets the requirements of Table 262-2. Samples shall be taken at a minimum frequency of 1 per lane-km. QC test results shall be submitted to the Engineer within 10 Days of sampling.
- .1 Indirect Tensile Strength testing shall be completed in accordance with the *Wirtgen Cold Recycling Manual*.
 - .2 Samples shall be tested by the Contractor for Gradation (ASTM C136) and moisture content.
 - .3 The Contractor shall, in the presence of the Engineer, obtain and provide the Engineer with a duplicate set of briquettes (six in total) for the Owner to perform quality assurance testing.
 - .1 One location per Contract will be randomly chosen by the Engineer.
 - .2 Briquettes shall be compacted within four hours of sampling.
- .6 QC testing shall ensure that the depth of recycled cold bituminous mixture meets the thickness requirements specified under 262.4.1.3.
- .7 QC testing shall ensure that density of the compacted recycled cold bituminous mixture meets the requirements of 262.4.5.10.

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262.4.6 .8 QC tests for 262.4.6.6 and 262.4.6.7 shall be performed at a minimum frequency of 10 per lane-km. QC test results shall be submitted to the Engineer prior to placing asphalt concrete.

262.4 .7 Quality Assurance (QA)

.1 Thickness measurements shall be taken by the Engineer by means of excavating along the edge of the stabilized mat with a shovel, at a minimum frequency of 5 per lane-km.

.1 Thickness requirements are met when at least 90% of all measurements are equal to or greater than the specified thickness, and no individual measurement is 30 mm less than the specified thickness.

.2 For Alternative A, prior to the planned overlay of the recycled cold bituminous mixture, the Contractor shall obtain two 150mm x 150mm slab samples per kilometre at random locations as directed by the Engineer.

.1 The slab samples will be tested for moisture content.

.2 Each slab sample shall be dry cut, removed from the recycled cold bituminous mixture, packaged in non-absorptive materials to protect the sample integrity, sealed in appropriately labelled waterproof containers and delivered by the Contractor in good condition to the Engineer within four hours of sampling.

.3 Emulsified asphalt or asphalt binder samples shall be taken at the Work Site at a rate of 1 per 10 lane-km or a minimum of 1 per contract, to be tested by the Owner, with containers supplied by the Owner. Each sample shall be a minimum of 1 L and identified with a completed label.

.1 Samples shall be taken from a sampling spigot on the transfer line or from the end of the transfer line, after at least 4000 kg has been drawn from the tanker.

262.4 .8 Acceptance Criteria

.1 Asphalt concrete may be placed once all of the following requirements have been met upon approval of the Engineer.

.1 The Owner shall perform a visual assessment of the surface to be overlaid and all soft spots and areas exhibiting surface defects have been repaired.

.2 The recycled cold bituminous mixture shall be compacted smooth and showing minimal deflection, cracking or showing under the weight of a loaded tandem truck.

.1 Compaction shall meet the requirements of 262.4.5.10.

.3 The finished surface shall have a uniform texture, free of visible signs of poor workmanship and bumps and/or dips exceeding 8 mm as measured with a 3 m straight edge.

.4 Thickness requirements are met when at least 90% of all measurements are equal to or greater than the specified thickness, and no individual measurement is 30 mm less than the specified thickness.

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262.4 .9 Guarantee

- .1 The Contractor shall, for a period of two years after completion of the Work, guarantee the Work against failure and defects, including surface defects per 262.4.5.6, and shall hold the Owner blameless in all claims arising from the Work, whether resulting from poor workmanship, poor or incompatible materials, improper design of application rates, inadequate traffic control, failure to practice proven partial depth recycling procedures, or other factors.
- .2 Structural failure of the mat, and areas of rutting or other depressions, shall generally be construed as failure; however, the Engineer shall decide as to what areas must be reprocessed in accordance with Work under this Item.
- .3 Reprocessing, consisting of full-lane reprocessing at specified depth, shall be carried out promptly and efficiently as directed by the Engineer. The Contractor shall, for a period of two years after its completion, guarantee the reprocessing against defects and failure per 262.4.9.1 and 262.4.9.2.
- .4 For the purposes of this Item and at the discretion of the Engineer, failure of intermittent areas that comprise 40% or more of the area processed or reprocesses on this Contract shall be considered a complete failure, and the Contractor shall be required to redo the entire Work under this Item.

262.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of recycled cold bituminous mixture reclaimed, recycled and stabilized in accordance with this Item.
 - .1 If the stabilized mat is wider than the existing asphalt concrete to be reclaimed, the quantity for payment shall be the number of square metres of stabilized recycled cold bituminous mixture.
- .2 Overlapped joints and repaired areas in the stabilized surface, and pulverized areas outside the areas of stabilization shall not be measured separately for payment.

262.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each alternative, as identified under the Contract.
- .2 The Owner shall reimburse the Contractor at a fixed rate under Item 810 for corrective aggregate supplied and incorporated into the mix per 262.2.6.2.2.7 & 262.2.6.2.3.10.
 - .1 Haulage for corrective aggregate shall be paid under Item 801.
- .3 Payment adjustment for a change in the PG asphalt binder price shall be calculated in accordance with Item 821.
 - .1 Adjustments for a change in the PG asphalt binder price payment quantity shall be made at the end of each month based on the weigh slips received during that month. When emulsified asphalt is used, the percent residue and specific gravity of the emulsion will be averaged for the volume received during that month to calculate the monthly adjustment.

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- 262.6 .4 For each occurrence that partial depth recycling is not performed per 262.4.4.4, the Contractor shall pay the Owner a penalty of \$1000 for each Day until partial depth recycling commences; and \$1000 for each Day that partial depth recycling is not continuous (stopped on any Day for more than 40% of the Contractor's normal work hours), until partial depth recycling resumes.
- .5 For each occurrence that paving is not performed per 262.4.4.6.2, the Contractor shall pay the Owner a penalty of \$1000 for each Day until paving commences; and \$1000 for each Day that paving is not continuous (stopped on any Day for more than 40% of the Contractor's normal work hours), until paving resumes.
- .6 Compensation to the Contractor or the Owner for the difference in the actual amount of Portland cement supplied and incorporated into the mix, as verified by the Contractors daily delivery slips or weigh tickets, and required 0.5% minimum Portland cement content, shall be paid in accordance with Item 810.
- .7 For Alternative B, compensation to the Contractor or the Owner for difference between actual binder content, as verified by the Contractor's daily weigh slips plus appropriate documentation from the supplier to verify the amount in the last tanker and assumed asphalt binder content per 262.2.6.2.3.2.1, for the total payable tonnage, shall be as follows:
- .1 If the actual binder content is less than the assumed asphalt binder content, the Contractor shall reimburse the Owner using the MTO's PG asphalt binder price index for the month preceding the month of the tender opening.
- .2 If the actual asphalt binder content exceeds the assumed asphalt binder content, the Owner shall reimburse the Contractor at the actual invoiced amount supplied by the Contractor.

FULL DEPTH RECYCLING

ITEM: 263

263.1 DESCRIPTION

- .1 This Item consists of in-place full depth reclamation of the existing Pavement incorporating the underlying granular material, and placement of an expanded asphalt mix.

263.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

263.2 .2 Asphalt Binder

- .1 The asphalt binder grade shall be PG 58-28.
- .2 Performance Grade (PG) asphalt binder shall meet the requirements of AASHTO MP1, Table 1 - Performance Graded Asphalt Binder Specification, and shall contain no anti-foaming agents.

263.2 .3 Water

- .1 Water shall be obtained from a source approved by the appropriate regulatory agency/agencies, and shall be free of any deleterious materials.

263.2 .4 Mix Design

.1 Preliminary Sampling

- .1 Prior to commencing the Work, the Contractor shall obtain representative samples of the material to be produced during the reclaiming operation, and shall carry out the laboratory testing necessary to establish the DMF.
- .2 The samples shall be taken from the Roadbed, at a minimum rate of one per 500 metres of lane kilometer, which shall be restored with either asphalt concrete or cold mix the same Day as sampling, to the satisfaction of the Engineer.
 - .1 The Contractor shall be responsible to maintain and repair all sample locations.
 - .2 The Contractor shall notify the Engineer of sampling at least 3 Days prior to sampling from the Roadbed.

.2 Design Mix Formula (DMF)

- .1 The Contractor shall use Professional Engineering services and a qualified testing Laboratory to assess the aggregate materials proposed for use in, and to carry out the design of, the expanded asphalt mix.
- .2 An expanded asphalt mix design shall be conducted in accordance with the procedures outlined in the *Wirtgen Cold Recycling Manual*. Preparation of the Design Mix Formula (DMF) shall be the Contractor's responsibility.
- .3 The DMF shall identify total asphalt binder content, aggregate gradation, compacted bulk density, target dry density of the mixture, dry tensile strength, wet tensile strength, and the tensile strength ratio.

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- 263.2.4.2.3
- .1 For the purpose of establishing the Unit Price for expanded asphalt, an asphalt binder content of 2.5% and a mix density of 2200 kg/m³ for expanded asphalt mix, shall be assumed.
 - .4 The DMF shall identify the maximum allowable field adjustment to the design rate without adverse effects on mix properties. A new DMF shall be submitted when the emulsified asphalt design rate is adjusted by 0.5% or greater.
 - .5 If the composition of the existing Pavement changes significantly, the Contractor shall submit a separate DMF.
 - .6 The total asphalt binder content of the DMF includes the existing aged binder and virgin asphalt binder.
 - .7 The water content of the expanded asphalt shall be established so as to provide the maximum expansion ratio and maximum half-life.
 - .1 The expansion ratio and half-life shall be determined at a minimum of five different water contents, with a minimum of two trials for each water content. The average values obtained shall be used in the final analysis.
 - .2 The rate of water injection into the expanded asphalt shall be selected to provide a minimum half-life of 6 seconds.
 - .8 The combined aggregates shall comprise a mix conforming to the grading limits of Table 263-1.

Table 263-1
Final Grading Limits for Combined Aggregate

Sieve Size (mm)	% Passing
50	100
4.75	45-70
0.075	5-20

- .9 The mix shall conform to the strength requirements of Table 263-2.

Table 263-2
Strength Requirements

Test	Minimum Requirement (kPa)
ITS (Soaked) / MTO LS-297	100
ITS (Dry) / MTO LS-297	225
TSR	50

- .10 A minimum of 0.5% by mass of Portland cement shall be incorporated into all DMF.
 - .1 For the purpose of establishing the Unit Price, a mix density of 2200 kg/m³ shall be assumed.
 - .2 The maximum amount of Portland cement allowable for incorporation into the mix shall be 1.0% if the minimum requirements of Table 263-2 cannot be met.

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- 263.2.4.2 .11 Corrective aggregate by mass shall be supplied for incorporation into the mix if the DMF fails to conform to the grading limits of Table 263-1, and/or if the minimum requirements of Table 263-2 cannot be met using Portland cement.
- .1 Corrective aggregate shall meet the physical properties of Table 201-1 for aggregate base.
- 263.2.4 .3 Mix Design Report
- .1 A mix design report shall include:
- .1 NBDTI contract number and description;
 - .2 A cover letter summarizing the DMF and identifying the recommended mix proportions;
 - .3 A copy of all calculations performed to determine the design percentage by mass of new binder to be added to the unstabilized material;
 - .4 The name of the proposed asphalt binder supplier;
 - .1 The recommended PGAC temperature for foaming;
 - .5 The dry and wet tensile strength and tensile strength ratio;
 - .6 The mix design bulk relative density and the theoretical maximum density;
 - .7 The optimum moisture content;
 - .8 The gradation of the RAP;
 - .9 The type, source and quantity of Portland cement and/or corrective aggregate;
 - .10 The maximum allowable field adjustment to the design rate without adverse effects on the mix properties.

263.3 SUBMITTALS

- .1 The Contractor shall submit, at least 10 Days prior to commencing the Work, a list of all pieces of Equipment intended for use in the Work.
- .2 The Contractor shall submit, at least 10 Days prior to commencing the Work, a detailed report outlining the DMF as established on the basis of the preliminary sampling of the material to be recycled.
- .3 The Contractor shall submit, at least 7 Days prior to commencing the Work, recent calibration certificates of all metering, weighing and other controlling devices to be used in controlling and monitoring the mix production.
 - .1 Certificates must be dated within the same calendar year or prior to the start of construction season.
- .4 The Contractor shall submit in writing, prior to the Work, the application rate for Portland cement in kg/m² and/or the application rate for corrective aggregate in kg/m², if required.
- .5 Prior to the Work, the source and location of the proposed water supply shall be submitted in writing.
 - .1 Upon request, the method proposed for withdrawal and application of water, and certification of approval of the water source.
- .6 Prior to the Work, the Contractor shall identify cross-slope on tangents and super elevation on curves of the existing Pavement and shall submit the values to the Engineer.

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- 263.3.6 .1 The Contractor shall also submit the expected cross-slope and super elevation on curves of the completed FDR surface demonstrating the requirements of 263.4.5.4.
- .2 If pre-milling is required under Item 208, the Contractor shall submit the expected cross-slope and super elevation on curves for each phase of the Work.
- .7 Upon completion of the Work, the daily reports indicating the amount of asphalt binder used shall be submitted.
- .8 Delivery slips for each tanker load of asphalt binder shall be submitted.
- .1 Partial tanker loads shall be weighed at an approved location and have the weigh slip accompany the delivery slip.
- .2 If temporary onsite asphalt binder storage is used, the temporary storage shall be weighed prior to commencement of the Contract and after FDR is complete.
- .1 Any remaining binder shall be subtracted from the total binder delivered to site.
- .9 No later than 6 months after completion of the Work, a final written report containing mix design reports and results of all field and laboratory tests shall be submitted to the Paving Engineer.
- .10 Delivery slips or weigh tickets indicating the amount of Portland cement incorporated into the Work.
- .11 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

263.4 CONSTRUCTION

263.4 .1 Details of Work

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The existing asphalt concrete and underlying Aggregate Base shall be pulverized to the width and depth as indicated in the Contract Documents.
- .1 The Contractor shall be responsible for, in areas where the existing Pavement is thicker than anticipated, all Work including milling to reduce Pavement thickness prior to pulverizing, adjustment of the DMF, provision of additional Equipment, provision of additional material to maintain grade and all related Work.
- .3 Pulverized but unstabilized material particles exceeding 50 mm in any dimension shall be removed from the surface of the Work.
- .4 Portland cement and/or corrective aggregate, if required to satisfy the DMF, shall be added to the pulverized surface prior to stabilization.
- .5 If successive passes of the stabilizer are required, the restabilized mat shall be a minimum depth of 100 mm.

263.4 .2 Equipment

- .1 The pulverizer shall be capable of pulverizing and reclaiming the existing Pavement and underlying aggregate to the depth specified in 263.4.1; incorporating corrective aggregate or Portland cement into the mix, if required.

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- 263.4.2.1
- .1 The pulverizer-stabilizer shall have a cutting drum at least 2 m wide and an automatic sensor to accurately maintain a preset depth of cut.
 - .2 The grader used to shape the pulverized material shall be equipped with automatic slope control.
 - .3 The stabilizing unit shall have an expanded asphalt injection system capable of injecting and blending expanded asphalt uniformly throughout the unstabilized material, and the following additional features:
 - .1 A system to control and monitor the percentage of asphalt binder added and the percentage of water for optimum compaction;
 - .2 A system of nozzles that uniformly applies expanded asphalt across the full width of treatment and is adjustable for varying widths of treatment;
 - .3 A system to control and regulate the application of expanded asphalt in relation to travel speed and mass of material; and
 - .4 A heating system to maintain operating temperature.
 - .4 Placing Equipment shall evenly distribute the stabilized mix in front of a tamper bar / vibratory screed, and shall be capable of spreading the mix, without segregation, and with a smooth and uniform textured surface, to the required thickness in one continuous pass.
 - .1 Placing Equipment shall be equipped with automatic grade and slope control.
 - .2 The Contractor shall provide a 3 m straight edge with each paver.
 - .5 Compaction Equipment shall consist of a vibratory drum roller of at least 15 t mass, a pneumatic-tired roller of at least 10 t mass, and for areas inaccessible to full size rollers, smaller compactors as required.
 - .6 Asphalt Binder tankers shall have all-round heat retention cladding and shall be equipped with a working thermometer to show binder temperature in the bottom third of the tank and a rear feed valve that is capable of draining the contents of the tank.
 - .1 The Contractor shall determine the number and size of tankers delivering to the Work Area so as to provide a continuous mixing operation and minimal disruption to traffic.
 - .7 Water tankers shall be equipped with pumps of a minimum capacity of 500 L/min, and flexible, non-collapsing supply hoses and quick-release couplings.
 - .1 The Contractor shall determine the number and size of tankers delivering to the Work Area so as to provide a continuous supply of water to the mixing operation and minimal disruption to traffic.
 - .8 Portland cement spreader/distributor shall have the means to control the rate of application of cement and distribute the Portland cement evenly and uniformly across the entire mat to be recycled.
 - .9 The corrective aggregate delivery system shall have the means to control the rate of application of corrective aggregate and distribute the corrective aggregate evenly and uniformly across the entire mat to be recycled.

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ITEM: 263263.4 .3 Test Strip

- .1 The Contractor shall initially stabilize a test strip 0.5 km in length and one lane in width, to demonstrate the ability to produce a stabilized Roadbed in conformance with this Item.
 - .1 The Contractor must demonstrate that the required application rates for Portland cement and/or corrective aggregate can be achieved, including uniform distribution across the entire mat to be stabilized.
- .2 The test strip must be free of surface defects after placement and compaction, such as segregation, raveling, rutting, checking, etc.
- .3 If the test strip is not acceptable, as determined by the Engineer, the Contractor shall rework the test strip.
 - .1 A second test strip might be required if the first is deemed not acceptable as determined by the Engineer.

263.4 .4 Operational Constraints

- .1 The Contractor shall not conduct and/or continue the expanded asphalt process during rain; when there is free-standing water on the surface to be stabilized; or when the ambient temperature is below 10 °C.
- .2 Prior to termination of operations each Day, the length of Roadbed on which Work under this Item has begun shall have all pulverizing, shaping and compacting, and/or mixing, placing and compacting completed, for the specified widths.
- .3 If cold milling is required, pulverizing shall commence within 14 Days of the commencement of the cold milling operation and shall continue on a daily basis until the entire milled surface has received a lift of recycled expanded asphalt mixture.
- .4 Expanded asphalt stabilization shall commence within 14 Days of the commencement of the pulverizing and shall continue on a daily basis until the entire pulverized surface has received the expanded asphalt stabilization.
- .5 The recycled expanded asphalt mixture has cured for a minimum of 7 Days.
 - .1 The placement of new asphalt concrete shall commence within 14 Days of the completion of full depth recycling and shall continue on a daily basis until the entire full depth recycling surface has received a lift of asphalt.
- .6 Traffic including construction vehicles shall be kept off the freshly placed and compacted expanded asphalt surface until the Contractor has determined that the mat is able to carry traffic without damage.
 - .1 The Contractor shall supply any pilot vehicles with operator and all other labour, Equipment and material required to convoy traffic through or around the Work Area, at a maximum convoy speed of 30 km/h.
 - .2 The Contractor shall be responsible for ensuring that the recycled cold bituminous mixture is not damaged by traffic while curing.

263.4 .5 Placement of Expanded Asphalt Mixture

- .1 The asphalt binder shall be added to the RAP at the design rate.
- .2 The asphalt binder rate shall be adjusted by the Contractor as required, to produce a uniform, thoroughly coated, recycled expanded asphalt mixture of the specified density.
- .3 The minimum binder temperature shall be 145°C.
- .4 The stabilized mat shall be shaped and compacted to the pre-existing rates of cross-slope and super elevation or, where existing cross-slope was less than 0.01 m/m or more than 0.035 m/m, it shall be shaped and compacted to a value not less than 0.01 m/m or more than 0.035 m/m, respectively.
 - .1 All alignment and grade transitions shall be smooth, including tangent to curve, curve to tangent, and where cross-slope varies per 263.4.5.4.
 - .2 If the Engineer determines that the Contractor has not met the requirements specified under 263.4.5.4, the Contractor will be required to reprocess or pad the entire section.
- .5 The finished surface shall be uniform in texture and free of surface defects, including but not limited to raveling, segregation, flushing, pot-holing, cracking, deflections, rutting and contamination.
 - .1 Soft spots or areas exhibiting surface defects prior to paving shall be cold milled and paved with asphalt concrete as directed by the Engineer.
- .6 Overlapped joints and repaired areas in the recycled expanded asphalt mixture, and processed areas outside the specified areas of stabilization, shall be considered as part of the Work.
- .7 If the Engineer determines that 40% or more of the area in a section of the Work is defective the Contractor shall be required to reprocess the entire section of the Work under this Item.
- .8 If the asphalt content being added to the field mix varies by $\pm 0.5\%$ from the DMF target value, the Contractor shall suspend Work and submit a revised DMF for approval.
- .9 The recycled expanded asphalt mixture shall be compacted smooth, to a minimum of 83% of the mix design Theoretical Maximum Relative Density as determined by AASHTO T209.
 - .1 Secondary rolling, if necessary to achieve the required density, shall be permitted within 10 Days after placing.

263.4 .6 Quality Control (QC)

- .1 The Contractor shall be responsible for all QC sampling and testing to ensure conformance to the requirements of this Item. Sampling and testing shall be carried out by Lot.
- .2 The Contractor shall submit, upon request, in writing to the Engineer an Inspection Testing Plan (ITP) covering all phases of the contract performance and the name of the party retained to conduct the ITP.
 - .1 The ITP shall include, but not limited to, identification and description of inspection and required test procedures to be used during the entire life of the contract.

FULL DEPTH RECYCLING

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- 263.4.6.2 .2 The ITP shall be sufficiently comprehensive and detailed to assure the Engineer of the Contractor's willingness and ability to control the construction production and processes.
- .3 Once accepted by the Engineer the plan becomes a part of the Contract and shall be enforced accordingly.
- .4 The ITP may have to be updated and revised by the Contractor as conditions warrant.
- .3 The Contractor shall be responsible for calibration of measuring equipment and regular verification of their accuracy during the course of the Work.
- .1 The accuracy of the metering devices controlling the asphalt binder rate shall be verified by the Contractor by checking the quantities on the delivery slip that accompanies each tanker delivered at the Work Site.
- .4 QC sampling and testing shall ensure that the recycled expanded asphalt mixture meets the requirements of Table 263-2. Samples shall be taken at a minimum frequency of 1 per lane-km. QC test results shall be submitted to the Engineer within 10 Days of sampling.
- .1 Indirect Tensile Strength testing shall be completed in accordance with the *Wirtgen Cold Recycling Manual*.
- .2 Samples shall be tested by the Contractor for Gradation (ASTM C136) and moisture content.
- .3 The Contractor shall, in the presence of the Engineer, obtain and provide the Engineer with a duplicate set of briquettes (six in total) for the Owner to perform quality assurance testing.
- .1 One location per Contract will be randomly chosen by the Engineer.
- .2 Briquettes shall be compacted within four hours of sampling.
- .5 QC testing shall ensure that the depth of expanded asphalt mixture meets the thickness requirements specified under 263.4.1.2.
- .6 QC testing shall ensure that density of the compacted recycled expanded asphalt mixture meets the requirements of 263.4.5.9.
- .7 QC tests for 263.4.6.5 and 263.4.6.6 shall be performed at a minimum frequency of 10 per lane-km. QC test results shall be submitted to the Engineer prior to placing asphalt concrete.
- 263.4 .7 Quality Assurance (QA)
- .1 Thickness measurements shall be taken by the Engineer by means of excavating along the edge of the stabilized mat with a shovel, at a minimum frequency of 5 per lane-km.
- .1 Thickness requirements are met when at least 90% of all measurements are equal to or greater than the specified thickness, and no individual measurement is 30 mm less than the specified thickness.

263.4.7 .2 Asphalt binder samples shall be taken at the Work Site at a rate of 1 per 10 lane-km or a minimum of 1 per contract, to be tested by the Owner, with containers supplied by the Owner. Each sample shall be a minimum of 1 L and identified with a completed label.

.1 Samples shall be taken from a sampling spigot on the transfer line or from the end of the transfer line, after at least 4000 kg has been drawn from the tanker.

263.4 .8 Acceptance Criteria

.1 Asphalt concrete may be placed once all of the following requirements have been met upon approval of the Engineer.

.1 The Owner shall perform a visual assessment of the surface to be overlaid and all soft spots and areas exhibiting surface defects have been repaired.

.2 The recycled expanded asphalt mixture shall be compacted smooth and showing minimal deflection, cracking or shoving under the weight of a loaded tandem truck.

.1 Compaction shall meet the requirements of 263.4.5.9.

.3 The finished surface shall have a uniform texture, free of visible signs of poor workmanship and bumps and/or dips exceeding 8 mm as measured with a 3 m straight edge.

.4 Thickness requirements are met when at least 90% of all measurements are equal to or greater than the specified thickness, and no individual measurement is 30 mm less than the specified thickness.

263.4 .9 Guarantee

.1 The Contractor shall, for a period of two years after completion of the Work, guarantee the Work against failure and defects, including surface defects as described in 263.4.5.5, and shall hold the Owner blameless in all claims arising from Work, whether resulting from poor workmanship; poor or incompatible materials; improper design of application rates; inadequate traffic control; failure to practice proven expanded asphalt stabilization procedures; and/or other factors.

.2 Structural failure of the mat, and areas of rutting or other depressions, shall generally be construed as failure; however, the Engineer shall decide as to what areas must be reprocessed in accordance with Work under this Item.

.3 Reprocessing, consisting of full-lane pulverizing and stabilization, shall be carried out promptly and efficiently as directed by the Engineer. The Contractor shall, for a period of two years after its completion, guarantee the reprocessing against defects and failure per 263.4.9.1 and 263.4.9.2.

.4 For the purposes of this Item and at the discretion of the Engineer, failure of intermittent areas that comprise 40% or more of the area processed or reprocesses on this Contract shall be considered a complete failure, and the Contractor shall be required to redo the entire Work under this Item.

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ITEM: 263**263.5 MEASUREMENT FOR PAYMENT**

- .1 The Quantity to be measured for payment shall be the number of square metres of expanded asphalt mix placed in accordance with this Item.
- .2 Overlapped joints and repaired areas in the stabilized surface, and pulverized areas outside the areas of stabilization, shall not be measured separately for payment.

263.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 The Owner shall reimburse the Contractor at a fixed rate under Item 810 for corrective aggregate supplied and incorporated into the mix per 263.2.4.2.11.
 - .1 Haulage for corrective aggregate shall be paid under Item 801.
- .3 Payment adjustment for a change in the PG asphalt binder price shall be calculated in accordance with Item 821.
 - .1 Adjustments for a change in the PG asphalt binder price payment quantity shall be made at the end of each month based on the weigh slips received during that month.
- .4 For each occurrence that pulverizing is not performed per 263.4.4.3, the Contractor shall pay the Owner a penalty of \$1000 for each Day until pulverizing commences, and \$1000 for each Day that pulverizing is not continuous (stopped on any Day for more than 40% of the Contractor's normal work hours), until pulverizing resumes.
- .5 For each occurrence that full depth recycling is not performed per 263.4.4.4, the Contractor shall pay the Owner a penalty of \$1000 for each Day until full depth recycling commences, and \$1000 for each Day that full depth recycling is not continuous (stopped on any Day for more than 40% of the Contractor's normal work hours), until full depth recycling resumes.
- .6 For each occurrence that paving is not performed per 263.4.4.5.1, the Contractor shall pay the Owner a penalty of \$1000 for each Day until paving commences, and \$1000 for each Day that paving is not continuous (stopped on any Day for more than 40% of the Contractor's normal work hours), until paving resumes.
- .7 Compensation to the Contractor or the Owner for the difference in the actual amount of Portland cement supplied and incorporated into the mix, as verified by the Contractors daily delivery slips or weigh tickets, and required 0.5% minimum Portland cement content, shall be paid in accordance with Item 810.
- .8 Compensation to the Contractor or the Owner for difference between actual binder content, as verified by the Contractor's daily weigh slips plus appropriate documentation from the supplier to verify the amount in the last tanker and assumed asphalt binder content per 263.2.4.2.3.1, for the total payable tonnage, shall be as follows:
 - .1 If the actual binder content is less than the assumed asphalt binder content, the Contractor shall reimburse the Owner using the MTO's PG asphalt binder price index for the month preceding the month of the tender opening.
 - .2 If the actual asphalt binder content exceeds the assumed asphalt binder content, the Owner shall reimburse the Contractor at the actual invoiced amount supplied by the Contractor.

MICROSURFACING

ITEM: 264

264.1 DESCRIPTION

- .1 This Item consists of supply, production and placement of polymer-modified microsurfacing to seal the existing Pavement surface, improve skid resistance, and correct rutting.

264.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

264.2 .2 Polymer Modified Emulsified Asphalt (Binder)

- .1 The binder shall be a quick-set polymer modified cationic type CSS-1H emulsion or approved equivalent conforming to the requirements indicated in Table 264-1.
- .2 Emulsified asphalt and polymer modified asphalt shall be homogeneous after mixing and show no signs of separation within 14 Days after delivery.
- .3 The addition of polymers or other additives after the manufacture of the emulsified asphalt will not be permitted.

**Table 264-1
Binder Requirements**

Test	Property	Requirement
ASTM D244	Residue by Distillation % by Mass (Test Temperature should be < 138 °C)	62% min.
Tests on Residue		
ASTM D36	Softening Point	57° C min
ASTM D5	Penetration at (25 °C, 100 g, 5 s) 0.1 mm	40 – 90
ASTM D2170	Kinematic Viscosity at 135 °C	650 mm ² /s min.

264.2 .3 Aggregate

- .1 Aggregate shall consist of 100% crushed rock having a Micro-Deval loss not greater than 17% when tested in accordance with MTO LS-618.
- .2 Gradation of aggregate shall be within the grading limits of Table 264-2 and shall not vary by more than the specified grading limits.

**Table 264-2
Aggregate Grading Limits and Gradation Tolerances**

ASTM Sieve Size	Percent Passing	Tolerance Limits
9.5 mm	100	± 5 %
4.75 mm	70 - 90	± 5 %
2.36 mm	45 - 70	± 5 %
1.18 mm	28 - 50	± 5 %
600 µm	19 - 34	± 5 %
300 µm	12 - 25	± 4 %
150 µm	7 - 18	± 3 %
75 µm	5 - 15	± 2 %

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264.2 .4 Other Materials

- .1 Mineral filler shall be Portland cement, hydrated lime or approved equivalent, and shall be free of lumps.
- .2 Water shall be clean and free of harmful salts, oil, acid and other deleterious materials.
- .3 Polymer modifiers shall consist of a minimum of 3% polymer solids by mass of the asphalt residue. The polymer solids, along with special quick-setting emulsifier agents, shall be incorporated into the emulsified asphalt at the colloid mill.
- .4 Additives may be added to the emulsion mix during construction to provide control of the quick-set properties and to increase adhesion, only if they have been included as part of the mix design and are compatible with the other components of the microsurfacing mix.

264.2 .5 Mix Design

- .1 The Contractor shall designate mix proportions and prepare the job mix formula. The final mix design shall conform to the requirements listed in Table 264-3.
- .2 All component materials used in the mix design shall be representative of the materials proposed by the Contractor for use in the Work.

Table 264-3
Microsurfacing Mix Properties

Test	Property	Requirements
ISSA TB-139	Wet Cohesion: At 30 minutes min. (set) At 60 minutes min. (traffic)	12 kg-cm min. 20 kg-cm min.
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	538 g/m ² max.
ISSA TB-114	Wet Stripping	Pass (90% min.)
ISSA TB-100	Wet Track Abrasion Loss: - One-Hour Soak - Six-Day Soak	538 g/m ² 807 g/m ²
ISSA TB-147A	Lateral Displacement	5% max.
	Specific Gravity after 1000 cycles of 57 kg	2.1 max.
ISSA TB-144	Classification Compatibility (AAA, BAA)	11 grade points min.
ISSA TB-113	Mix Time at 25 °C	Controllable to 120 s min.

264.3 SUBMITTALS

- .1 The Contractor shall submit, at least 7 Days prior to placing any material in the Work, the aggregate gradation, final mix design, and results of the Micro-Deval test and the tests listed in Table 264-3.
- .2 The Contractor shall submit, at the beginning of each Day of Work, a written summary of the total quantity and distribution rate of microsurfacing placed the previous Day, including a list of the quantities used for each component: aggregate, emulsion, mineral filler and additive(s).

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264.4 CONSTRUCTION

264.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Microsurfacing shall be placed to a width as specified in the Contract Documents.
- .3 The application shall consist of a minimum of a scratch coat and a final coat with a combined minimum rate of application of 14 kg/m².
- .4 Microsurfacing shall not be applied before June 1st or after August 31st.
- .5 The Contractor shall, upon no less than 24 hours notice to the Engineer, calibrate the proportioning devices to the satisfaction of the Engineer, and shall submit a copy of the calibration results prior to beginning any microsurfacing operation.
- .6 The proportioning devices shall be recalibrated to the satisfaction of the Engineer after every 2000 t of microsurfacing placement, and also when either of the following occurs over the duration of the Work:
 - .1 A change in aggregate source since the previous calibration; or
 - .2 A mechanical failure to the application system and/or proportioning devices for which repair is required.
- .7 The Contractor shall be responsible to ensure that traffic, including construction traffic, is kept off the freshly placed mixture for the time required to prevent damage to the surface.
- .8 On two-lane, two-way highways the Contractor shall supply any pilot vehicles, with operator, and other labour, equipment and/or materials required to convoy traffic through or around the construction.

264.4 .2 Equipment

- .1 Equipment for the Work shall be designed, operated, and maintained to produce an end product complying with the requirements of this Item.
- .2 Rotary power brooms shall be capable of cleaning gravel, sand, dirt and other debris from bituminous surfaces.
- .3 Mixing Equipment shall be an automatic-sequenced, self-propelled microsurfacing mixing machine specifically designed and manufactured to lay microsurfacing.
 - .1 The machine shall be a continuous-flow mixing unit capable of accurately proportioning and delivering aggregate, emulsified asphalt, mineral filler, control-setting additive and water to a revolving multi-blade double-shaft mixer, and discharging the mixed product on a continuous flow basis.
 - .2 The machine shall have sufficient storage capacity to maintain an adequate supply of materials to the proportioning controls.

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- 264.4.2.3 .3 Individual volume or weight controls for proportioning each material to be added to the mix shall be provided and properly marked. Proportioning devices are usually revolution counters or similar devices used in material calibration and to determine material output at any time.
 - .4 A 3 m metal or wood straight edge shall be provided for checking surface deviations.
 - .5 The spreading machine shall be equipped with paddles to agitate and spread the material evenly throughout the box, with an attached conventional augered surfacing spreader box attached to the mixing machine, and shall be used to spread the mixture uniformly.
 - .1 There shall be a front seal to ensure no loss of mixture at the Pavement contact point, and an adjustable rear seal for final strike-off.
 - .2 The spreader box and rear strike-off shall be so designed and operated to achieve a uniform consistency and a free flow of material to the rear strike-off.
 - .3 The spreader box shall have suitable means provided to maneuver the box to compensate for variations in the Pavement surface.
 - .6 The rut-filling spreader box shall be specifically designed for rut-filling applications. The use of a rut box is at the discretion of the Contractor.
 - .7 A stringline or other device must be provided to ensure the longitudinal edges are straight and meet the existing pavement edge.
- 264.4 .3 Stockpiling
- .1 The Contractor shall be fully responsible for stockpile sites.
 - .2 Stockpiles shall be placed on a level well-drained base, in such a manner so as to prevent contamination of the stockpiled material.
 - .3 Throughout the duration of the Contract, the Contractor shall be sufficient aggregate in stockpile to cover 3 Days of production of microsurfacing Work.
 - .4 Aggregates from different sources shall be stockpiled separately.
- 264.4 .4 Quality Control and Quality Assurance Testing
- .1 Quality control testing shall be the responsibility of the Contractor throughout every stage of the Work, from and including the production of the aggregates and polymer modified asphalt emulsion to the design and placement of the final product.
 - .2 The Contractor shall provide the Engineer with a copy of all quality control test results within 24 hours of testing.
 - .3 Quality assurance testing may be conducted by the Owner during the Work. The results of these tests shall be made available to the Contractor, upon request, but will not relieve the Contractor of, or replace the specified quality control testing.

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264.4 .5 Guarantee

- .1 The warranty period for rutting shall be 60 Days after initial placement, and for repaired areas, 60 Days after the repairs.
- .2 The Contractor shall guarantee for two years after the completion of the Work performed against factors that may include but may not be limited to the following:
 - .1 Poor workmanship and failing to practice proven microsurfacing procedures;
 - .2 Poor or incompatible materials, including incompatibility of the bituminous binder with the cover aggregate supplied by the Owner;
 - .3 Improper design of application rates; and
 - .4 Inadequate traffic control.
- .3 Generally, areas of delamination and flushing or bleeding surfaces shall be construed as failure; however, the Engineer shall be the sole judge as to areas that must be re-treated.
- .4 Retreatment is defined as a full lane application and shall be carried out promptly and efficiently as directed by the Engineer. The Contractor shall, for a period of two years after its completion, guarantee the retreatment against failure and defects as noted in 264.4.6.6.1 and 264.4.6.6.2.
- .5 For the purposes of this Item and at the discretion of the Engineer, failure of intermittent areas that constitute 40% or more of the area treated or retreated on the Contract shall be deemed a complete failure, and the Contractor shall be required to redo the entire Work Area under this Item.

264.4 .6 Placement of Microsurfacing

264.4.6 .1 General

- .1 The Contractor shall demonstrate the ability to produce and place microsurfacing by successfully placing a trial mix over an area 100 m long and one wide prior to full production of the Work.
- .2 The microsurfacing shall not be applied if either the Pavement or air temperature is below 10°C and falling, but may be applied when both Pavement and air temperatures are above 7°C and rising.
- .3 The microsurfacing shall not be applied when there is danger that the finished product will freeze within 24 hours after placement, or when weather conditions would prolong opening the Work to traffic.
- .4 The Work Area shall be thoroughly cleaned of all vegetation, loose material, sand, dirt and other debris. Dried mud or other foreign matter not removed with the rotary power broom shall be removed by hand blade or other approved method.
- .5 Water shall be applied to pre-wet the surface, if required, immediately ahead of the spreader at a rate to dampen the surface without allowing any free-standing or free-flowing water.

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- 264.4.6.1 .6 Manholes, valve boxes, drop inlets and other service entrances shall be protected from the microsurfacing.

- 264.4.6 .2 Application Using a Mechanical Spreader
 - .1 The mixture shall be spread to fill ruts, minor cracks and shallow potholes and leave a uniform surface.
 - .2 Any oversized aggregate or foreign materials shall be screened from the aggregate prior to delivery to the mixing machine.
 - .3 A sufficient amount of mixture shall be carried in all parts of the spreader box at all times, so that complete coverage is obtained.
 - .4 Water for spraying the spreader box to facilitate spreading shall not harm the mix.
 - .5 Ruts shall be filled to have no depression after the final coat of microsurfacing, but shall not be overfilled more than 3 mm per 25 mm of rut depth as measured with a 3 m straight edge.
 - .6 Edges of the microsurfacing scratch coat shall have a uniform neat appearance along the Roadway centerline, lane lines and edges (white edge line, pavement edge, curb line or shoulder), with a maximum horizontal variance of ± 50 mm in any 30 m section.

- 264.4.6 .3 Handwork
 - .1 In restricted areas where hand spreading is necessary, slight adjustments to the mix formula may be used to retard the setting time.
 - .2 The mixture shall be deposited in a small windrow along one edge of the surface to be covered, and spread uniformly over the surface with squeegees or other suitable hand tools.

- 264.4.6 .4 Joints
 - .1 Longitudinal and transverse joints shall be neat in appearance and uniform.
 - .2 No excessive build-up, uncovered areas, non-homogeneous mixture or unsightly appearance will be permitted at joints.
 - .3 Longitudinal joints in the scratch coat shall be constructed as butt joints.
 - .4 Longitudinal joints in the surface coat shall be placed on lane lines. Adjacent passes shall not overlap more than 100 mm, except where Pavement width varies (as in ramps and tapers), and shall not have more than 6 mm difference in elevation as measured with a 3 m straight edge.
 - .5 Transverse joints shall be constructed so as to have no more than 6 mm difference in elevation across the joint, as measured with a 3 m straight edge.

- 264.4.6 .5 Rolling
 - .1 The microsurfacing shall be rolled at the discretion of the Contractor.

264.4.6 .6 Requirements for Finished Surface

- .1 The finished microsurfacing shall have a uniform texture and be free from visible signs of surface defects. No lumping, balling or unmixed aggregate will be permitted in the finished surface.
- .2 Any surface defects, as determined by the Engineer, will be cause for rejection of the microsurfacing. Such defects shall include but are not necessarily limited to those noted in Table 264-4.
 - .1 The bleeding defects as defined in 6) and 7) in Table 264-4 shall also apply to the rut/fill operation.

Table 264-4
Unacceptable Defects in Finished Surface

1) Tear marks: in any 12 m ² per lane, four or more marks \geq 12 mm wide x100 mm long, or any marks \geq 25 mm x 25 mm.
2) Total ruts > 6 mm deep, as measured with a 3 m straight edge, exceeding 2% based on 10 random samples per lane-km.
3) Longitudinal ripples (raking) or wash-boarding (chatter) \geq 5 mm deep, as measured with a 3 m straight edge.
4) Total areas exhibiting raking and chatter exceeding 2% in any 100 m ² area.
5) Total areas exhibiting loss of surface (debonding, delamination, potholing) exceeding 2% in any 100 m ² area.
6) Bleeding and flushing exceeding 2% in any 100 m ² area.
7) Bleeding and/or flushing at joints.

- 264.4.6.6 .3 Any 400 m lane segment with repairs or defects exceeding 5% of the area shall require re-application of microsurfacing over the entire segment.
- .1 All Work required for reconstruction of unacceptable areas shall be at the Contractor's expense.
 - .4 Any part of completed microsurfacing rejected for surface defects shall be repaired within 20 Days from the time the Contractor receives notification of rejection, but in no case later than August 31st of the current year.
 - .1 If the 20-Day period extends past August 31st of the current year, the Contractor shall complete the repairs between June 1st and June 15th of the following year.

264.4.6 .7 Clean-Up

- .1 Any microsurfacing mix on areas outside the specified limits of microsurfacing, such as Shoulders and gutters, shall be removed as specified by the Engineer.
- .2 The Contractor shall, on a daily basis, remove from the Work Site any debris associated with the performance of the Work.

264.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of microsurfacing supplied, produced and placed in accordance with this Item.
- .2 In areas where rutting has been corrected, the Engineer may withhold payment for the rutting warranty period.

264.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 Payment adjustment for a change in the PG asphalt binder price shall be calculated in accordance with Item 821.

265.1 DESCRIPTION

- .1 This Item consists of the supply and placement of single chip seal and double seal.
- .2 Chip seal shall be identified by the following mix designations:
 - .1 Single chip seal – S.
 - .2 Double chip seal – D.
- .3 Single chip seal shall consist of a single application of bituminous binder followed by a single application of 9.5 or 12.5 mm cover aggregate.
- .4 Double seal shall consist of an application of bituminous binder followed by a single application of 16.0 mm or 19.0 mm cover aggregate, a second application of bituminous binder, and an application of 12.5 or 16.0 mm cover aggregate, as indicated in the Contract Documents.
 - .1 Under certain conditions and at the discretion of the Engineer, the application of an approved penetration primer plus a single chip seal may be an acceptable substitute for a double seal.

265.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Aggregates shall meet the requirements of 201.2.
 - .1 Each project shall exhibit consistency of cover aggregate colour; switching from one aggregate source to another on the final coat of a project shall not be accepted.
- .3 The bituminous binder shall be selected from the following and shall meet the requirements as set out in the tables as follows:
 - .1 Emulsified Asphalt - HF-100S, HF-100S(P), HF-150S, HF-150S(P), HF-250S, HF-250S(P), HP200, HP200(P), HFMS2 or MS-2 per Tables 265-1, 265-2, 265-3 and Figure 265-1.

Table 265-1
Requirements for Emulsified Asphalt Binder

Grade		HF-100S		HF-150S		HF-250S		HP200		HFMS-2		MS-2	
Requirements	ASTM Test Method	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
Test on Emulsion Asphalt Residue by Distillation, %	D244	62		62		62		65		62		65	
Oil Distillate % by Volume;	D244	0.5	4	0.5	4	1	6	N/A		0.5	3	-	10
Saybolt Viscosity Furol Seconds at 50°C	D244	50	150	50	150	50	150	100	250	50	300	100	400
Sieve Test % Retained 1000 µm Sieve	D244		0.10		0.10		0.10		0.10		0.10		0.10
Coating Test % Coated	D244	80		80		80		80		80		80	
Settlement in 1 day, % Settlement in 5 day, %	D244		1.5 -		1.5 -		1.5 -		- 3		- 1		- 3
Demulsibility-50 ml of 0.1 N CaCl ₂ , %	D244	75		75		N/A		N/A		N/A		N/A	
Test on Residue Penetration at 25°C, 100g 5 s	D5	100-175		150-250		250-500		100-250		100-250		100-250	
Viscosity at 60°C, Pa·s		See Note		See Note		See Note		N/A		N/A		N/A	
Float Test at 60°C, s	D139	1200		1200		1200		N/A		N/A		N/A	
Solubility in Trichloroethylene, %	D2042	97.5		97.5		97.5		97.5		97.5		97.5	
NOTE: Viscosity @ 60°C and Penetration @ 25°C shall fall within the area described in Table 265-1													

Table 265-2
Viscosity and Penetration Requirements
For High Float Emulsified Asphalt Binder

High Float Emulsified Asphalt Binder					
GRADE OF HIGH FLOAT EMULSIFIED ASPHALT	HF-250 S	HF-150 S	HF-100 S	HF-150 P	HF-100 P
Viscosity and Penetration shall be within graphic regions described by the lettered co-ordinates	E, F, G, C	A, B, C, D	L, M, N, O	A, B, C, D	L, M, N, O
NOTE: Viscosity and Penetration shall be within graphic regions described by the lettered co-ordinates in the Figure 265-1.					

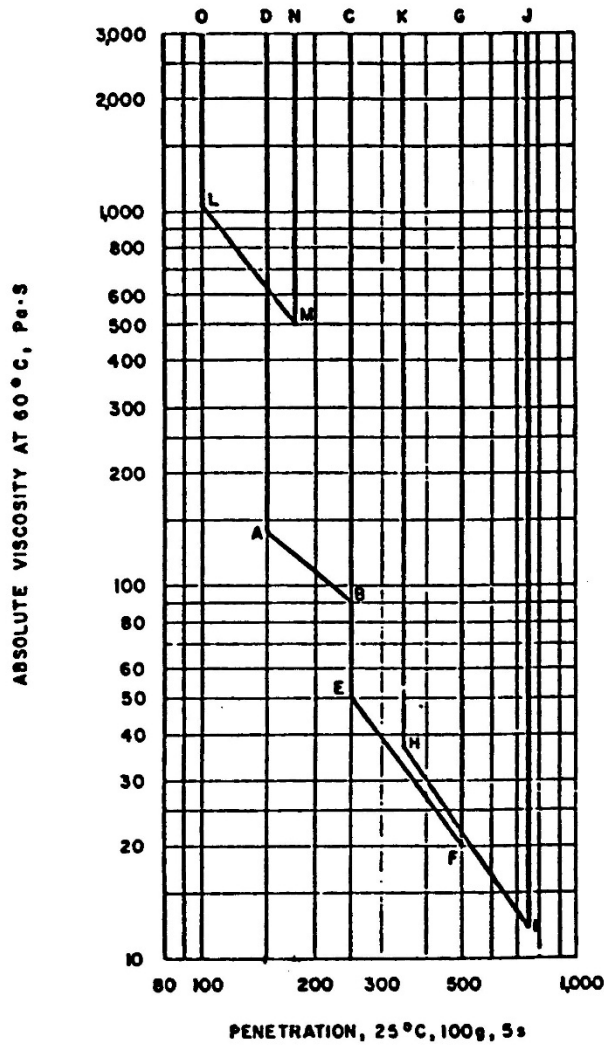


Figure 265-1

265.3 SUBMITTALS

- .1 The Contractor shall submit, for approval by the Engineer, a copy of the design application rates prior to commencing the Work.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.
- .3 The Contractor shall submit to the Engineer a copy of the delivery slip for each load of Emulsion delivered on the contract. The total litres of Emulsion used shall be summed and the payment adjustment for change in PG asphalt binder price shall be calculated, if necessary, per 265.6.2.

265.4 CONSTRUCTION265.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall be responsible for loading and hauling cover aggregate from the designated stockpile(s) when material is supplied by the Owner.
- .3 The placement of single and double chip seals shall be carried out in such a manner as to avoid damage to the adjacent and surrounding Roadbed.
 - .1 The Contractor shall, at his/her own expense, repair any damage to the adjacent and/or abutting finished surfaces as a result of the Work.
 - .2 The Contractor shall be responsible, at her/his own expense, for any damage suffered to the environment through the performance of the Work, and shall hold the Owner blameless in all claims arising from such damage.
 - .3 All other damage claims related to this Work shall be the responsibility of the Contractor, and the Owner shall be held blameless.
- .4 The Contractor shall design the bituminous binder and cover aggregate application rates. For emulsified asphalt binder the minimum application rate shall be 2.20 L/m², unless otherwise directed by the Engineer.
- .5 Unless otherwise directed by the Engineer, single chip seals and double chip seals shall be constructed 7.3 m wide.
- .6 For a double seal, all excess aggregate shall be swept off the first binder and aggregate application before commencing the second application.
- .7 Intersections shall be deemed to be a normal part of the Work and shall be chip sealed at the discretion of the Engineer.
- .8 The Contractor shall be responsible for the protection of newly constructed chip seals against damage from inclement weather, high ambient temperatures and high humidity, for a period of two weeks after the Work.
- .9 The Contractor shall be responsible for the removal of all excess cover aggregate from the Work Site, for a period of 3 weeks, after completion of the Work.

265.4 .2 Equipment

.1 Equipment for placing chip seals shall be specifically designed for that purpose and shall be in proper working order.

.1 Grader shall be equipped with automatic slope control.

265.4.2 .2 Distributors

.1 Bituminous pressure distributors shall be self-propelled, and shall have a capacity of not less than 5000 L.

.2 Distributors shall provide application rates that are within $\pm 5\%$ of the established application rates, and shall be capable of applying material at a continuous and uniform rate both longitudinally and transversely.

.3 Distributors shall be equipped with at least the following devices and appliances:

.1 A positive displacement asphalt pump developing uniform pressure within the spray bars;

.2 An electronic device to measure ground and pump speed or a tachometer to measure pump speed, and a fifth wheel-driven speedometer and odometer, each of which shall be visible to the driver;

.3 A thermometer well and accurate thermometer;

.4 Heating coils and burners capable of applying even heat to the bitumen so as to maintain spraying temperature;

.5 An adjustable length and height spray bar, and hand spray attachment;

.6 A strainer in the circulating system and in the filling line;

.7 A tank gauge and a measuring stick graduated in litres; and

.8 A sampling cock.

.4 The rear chassis shall be modified to prevent increasing bar height as the tank empties.

.5 All nozzles shall be of the same manufacture type and size; meeting the manufacturer's recommendation for volume being sprayed; arranged in the spray bar so that the nozzle slots are at a 30° angle with the longitudinal axis of the spray bar; and free of any obstructions.

.6 The spray bar shall be equipped with a positive shut-off mechanism to prevent leaking or dripping and the spray bar height shall be adjusted for double or triple coverage so as to prevent streaking.

265.4.2 .3 Brooms

.1 Rotary power brooms shall be capable of removing gravel, sand, dirt and other debris from bituminous surfaces to the satisfaction of the Engineer.

265.4.2 .4 Spreaders

- .1 Aggregate spreaders shall be self-propelled and shall be capable of continuously and uniformly placing aggregate over the full width of the applied binder (1.0 m to 3.7 m per pass).
- .2 Spreaders shall be equipped with a rear hopper capable of accepting aggregate from towed trucks, and a front hopper fitted with adjustable discharge gates and a screen for rejecting oversize aggregate.
- .3 Both front and rear hoppers shall be designed and equipped so that metering, opening and closing can be controlled by the operator.

265.4.2 .5 Rollers

- .1 All rollers shall be self-propelled and capable of reversing without backlash.
- .2 Tandem steel rollers shall have a minimum mass of 7 t and a minimum drum width of 1300 mm. Three-wheel steel rollers shall not be used.
- .3 Vibratory rollers shall have a minimum mass of 7 t and a minimum drum width of 1500 mm. Three-wheeled vibratory rollers shall not be used unless the rear drive wheels are smooth-tread rubber tires.
- .4 Pneumatic-tired rollers shall have a minimum of seven smooth-tread rubber tires uniformly inflated to a minimum pressure of 350 kPa.
- .5 Combination tandem rollers equivalent to the Bomag BW161AC and Dynapac CC421C are acceptable alternatives to the compaction devices described in 265.4.2.5.2 through 265.4.2.5.4, subject to the approval of the Engineer.

265.4 .3 Preparation

- .1 Leveling with hot mix asphalt concrete and crack filling ahead of single chip seals shall be the responsibility of the Owner.
- .2 All other surface preparations shall be the responsibility of the Contractor, and shall include but not be limited to the following:
 - .1 The road shall be shaped with a grader to meet an acceptable crown and super elevation, and shall be compacted in accordance with 936, and shall commence 1 Day prior to chip sealing and continue on a daily basis until the entire granular surface has received the first application of a double chip seal.
 - .1 Any ruts or potholes which appear in advance of the chip seal placement shall be eliminated by scarifying, shaping and compacting.
 - .2 Sweeping excess sand, aggregate and other debris from the first mat of a double seal before the second application is placed;
 - .3 Repairing irregularities in the first mat of a double seal before the second application is placed; and
 - .4 Sweeping existing Pavement clean of sand, aggregate and other debris prior to applying a single chip seal.

265.4 .4 Placement

- .1 Chip seals shall not be placed when the ambient temperature is below 10 °C, when humidity is high, when rain is threatening, or on damp surfaces.
- .2 Binder application shall be at a uniform rate determined by the Contractor.
 - .1 There shall be a minimum of overlap and no missed areas at longitudinal and transverse joints. The Contractor shall repair unacceptable joints as directed by the Engineer.
 - .2 No more than 30 m of road surface shall be sprayed ahead of the cover aggregate spreading operation.
- .3 The temperature of the binder when sprayed shall be within the ranges specified in Table 265-3.

**Table 265-3
 Binder Spraying Temperature Ranges**

Type of Bituminous Binder	Temperature Range (°C)	
	Minimum	Maximum
HFMS-2	65	80
HP200 / HP200(P)	65	80
HF-100S / HF-100S(P)	65	80
HF-150S / HF-150S(P)	65	80
HF-250S / HF-250S(P)	65	80
MS-2	65	80

- .4 Cover aggregates shall be applied uniformly over the full width of the sprayed surface immediately following the application of bitumen.
- .5 Rolling shall commence immediately behind the aggregate placing operation and shall be continuous until all cover aggregate placed has received a minimum of two passes with a pneumatic-tired roller and one pass with a steel-wheeled roller, or three passes with compaction devices described in 265.4.2.5.3 and 265.4.2.5.5.
 - .1 Roller speed shall not exceed 10 km/h.
- .6 The Contractor shall ensure that no bituminous binder, fuel or solvents are spilled, sprayed or tacked onto completed sections of chip seals.

265.4 .5 Guarantee

- .1 The Contractor shall guarantee the Work performed in accordance with GC 34 against factors that may include but may not be limited to the following:
 - .1 Poor workmanship and failing to practice proven chip seal procedures;
 - .2 Poor or incompatible materials, including incompatibility of the bituminous binder with the cover aggregate;
 - .3 Improper design of application rates; and
- .2 Generally, loss of cover aggregate, flushing and bleeding surfaces shall be construed as failure; however, the Owner shall be the sole judge as to areas that shall be re-treated.
 - .1 A re-treatment shall consist of an application of emulsion binder placed with a distributor truck, a layer of 12.5 mm cover aggregate placed with a chip spreader and compacted with rollers. All equipment shall meet the minimum requirements under section 265.4.2.
 - .3 Re-treatment shall be carried out promptly and efficiently as directed by the Engineer. The Contractor shall guarantee the re-treatment against failure and defects in accordance with GC 34.
 - .4 For the purpose of the Contract and at the discretion of the Owner, failure of intermittent or individual areas that comprise 40% or more of the entire area treated or re-treated shall be deemed a complete failure, and the Contractor shall be required to re-surface the entire area of the Work.

265.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of chip seal and double seal designed, supplied and placed in accordance with this Item.

265.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 Payment adjustment for a change in the PG asphalt binder price shall be calculated in accordance with Item 821.
- .3 For each occurrence that Work is not performed per 265.4.1.9, the Contractor shall pay the Owner a penalty of \$500 for each Day until the Work is completed, and \$500 for each Day that Work is not continuous (stopped on any Day for more than 40% of the Contractor's normal work hours), until the Work resumes.

PULVERIZING

ITEM: 267

267.1 DESCRIPTION

- .1 This Item consists of the pulverizing, shaping and compaction of a Roadbed surface.

267.2 MATERIALS

- .1 None identified.

267.3 SUBMITTALS

- .1 None identified.

267.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
 - .1 Work under this Item shall also include excavating and moving of pulverized material in the transitions to match into the existing conditions, as directed by the Engineer.
- .2 All Work shall be carried out to the full Roadbed width to intercept the existing Foreslopes.
- .3 The Contractor shall carry out the Work such that the pulverizing extends to a minimum depth of 100 mm into the Aggregate Base/Subbase layer.
- .4 The Contractor shall ensure that this pulverized region is in a completely mixed and loosened condition, with all material sized such that 100% of the material passes the 75 mm sieve, when measured in accordance with ASTM C136.
- .5 Oversize pieces remaining after pulverizing shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .6 The re-graded surface material shall be compacted in accordance with Item 936 to a minimum of 95% of the maximum dry density as established by a test strip.
- .7 The Contractor shall shape the road with a grader to meet an acceptable crown and super elevation.
- .8 Grader shall be equipped with automatic slope control.

267.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of pulverizing completed in accordance with this Item.

267.6 BASIS OF PAYMENT

- .1 Payment for this Work shall be at the Unit Price.

SHOULDER PROCESSING

ITEM: 284

284.1 DESCRIPTION

- .1 This Item consists of the processing, shaping and compaction of material on the Shoulder.

284.2 MATERIALS

- .1 None identified.

284.3 SUBMITTALS

- .1 None identified.

284.4 CONSTRUCTION

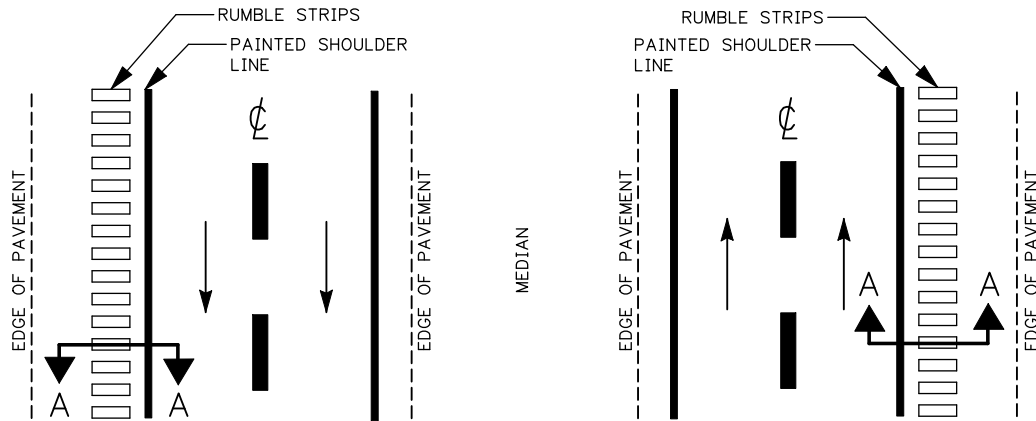
- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
 - .1 This Work shall be carried out before paving.
- .2 A longitudinal cut between the edge of the existing asphalt concrete mat and the Shoulder Work shall be formed having a straight vertical face.
- .3 The in-situ material shall be processed, to a minimum depth of 150 mm and/or to the full depth of the abutting asphalt concrete, so that the material is in a completely mixed and loosened condition with all material sized so that 100% of the material passes the 75 mm sieve.
- .4 Oversize pieces remaining after processing shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .5 The Contractor shall not permit more than 4 km to be open to traffic where the Shoulder processing operation is in progress.
 - .1 Regardless of the length of the Work Area, the Shoulder processing shall be completed within 7 Days for any portion of the Work open to traffic.
 - .2 Where the difference in elevation between the asphalt concrete and the Shoulder exceeds 70 mm in any portion of the Work, the Shoulder processing operation shall be completed within 48 hours of the commencement.
- .6 The material shall be compacted to the maximum density as determined by a rolling pattern.
- .7 Final shaping of the processed Shoulder material shall be consistent and continuous to the grade of the abutting asphalt concrete surface and shall extend at the specified Slope to the line of the Foreslope and shall be blended and shaped to match the Foreslope intersection.
- .8 The Contractor shall keep clean the adjacent Pavement surface and in all cases the Pavement surface shall be free of Shoulder material prior to opening the Work Area to traffic.

284.5 MEASUREMENT FOR PAYMENT

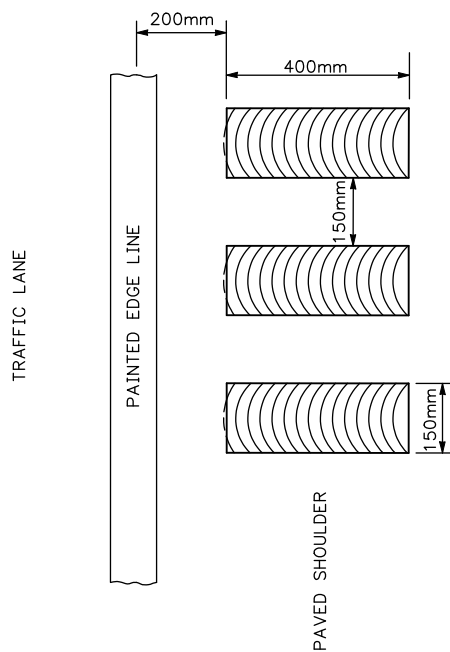
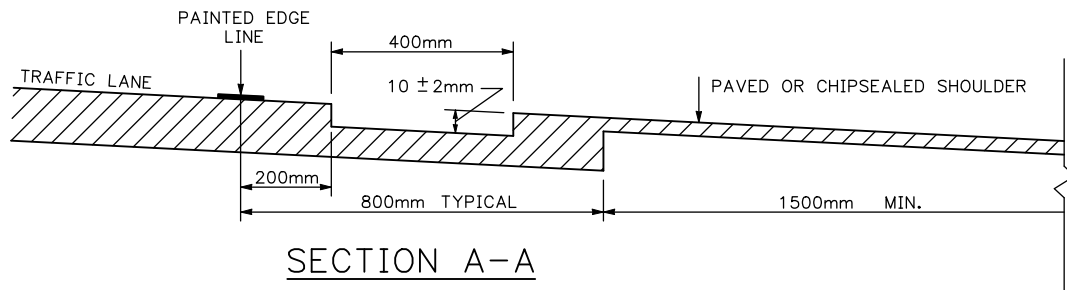
- .1 The Quantity to be measured for payment shall be the number of square metres of Shoulder processing completed in accordance with this Item.

284.6 BASIS OF PAYMENT

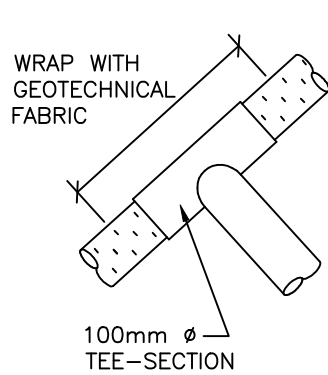
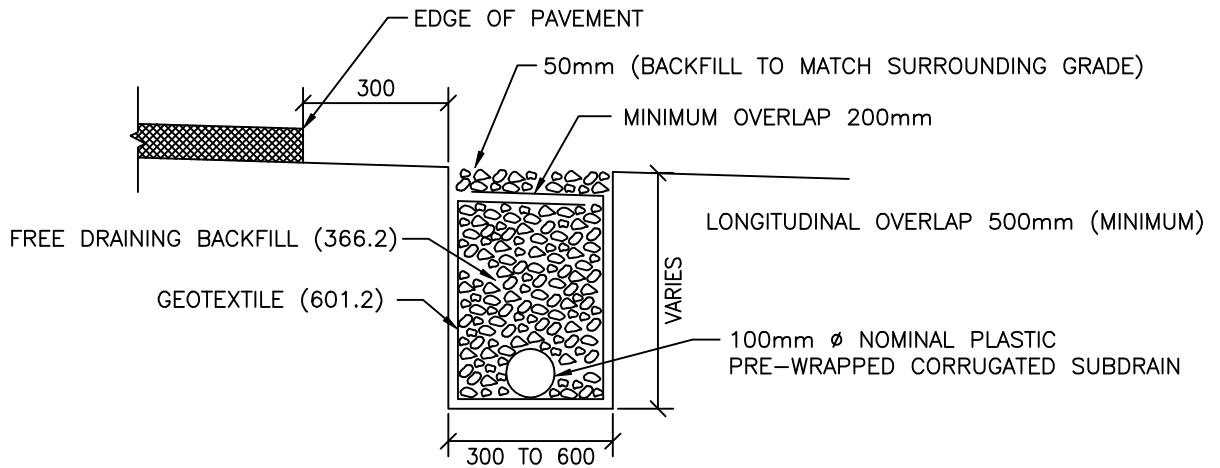
- .1 Payment for this Work shall be at the Unit Price.
- .2 The Contractor shall be subject to a penalty of \$500.00 per Day, for each occurrence, if the Shoulder processing operation is not carried out in the prescribed period as defined in 284.4.5.



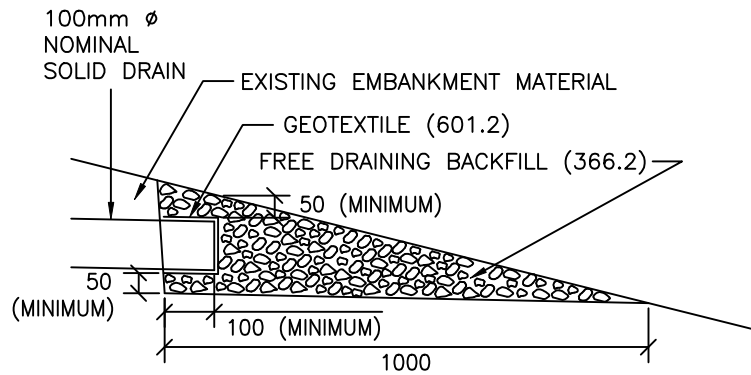
FOUR LANE DIVIDED HIGHWAY – TYPICAL



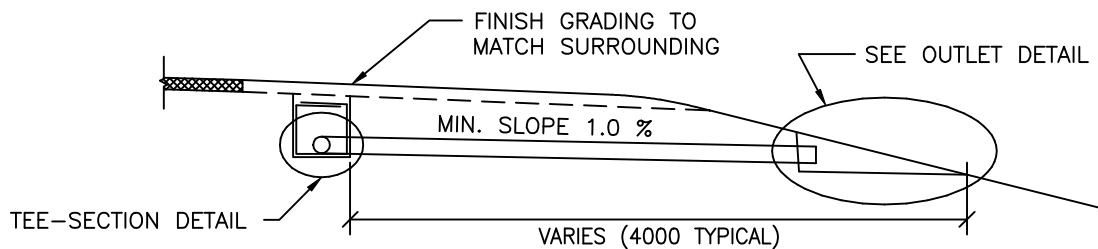
Shoulder Rumble Strip Installation



TEE SECTION DETAIL



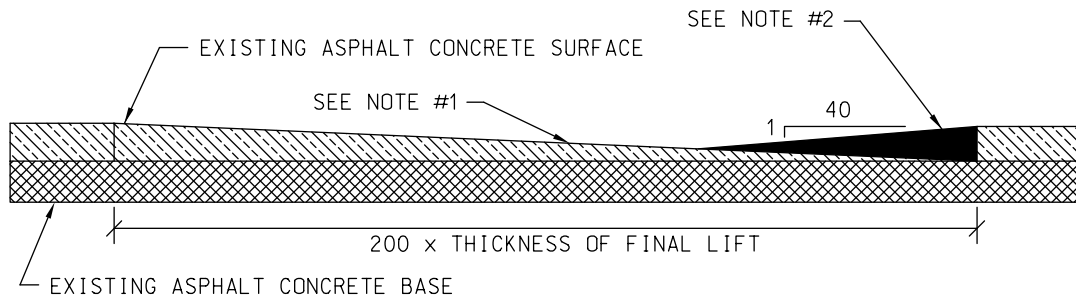
OUTLET DETAIL



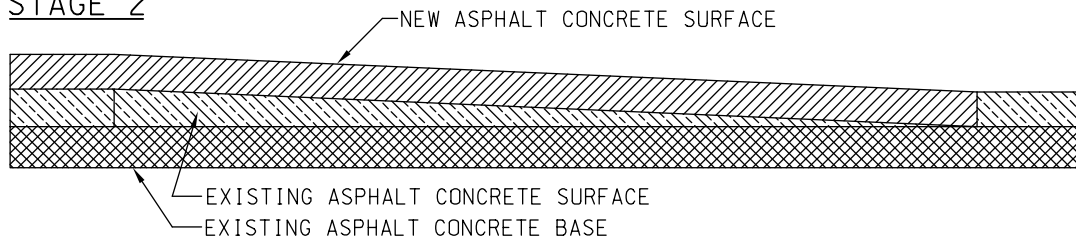
TEE-SECTION DETAIL

Shoulder Subdrain and Outlet Details

STAGE 1



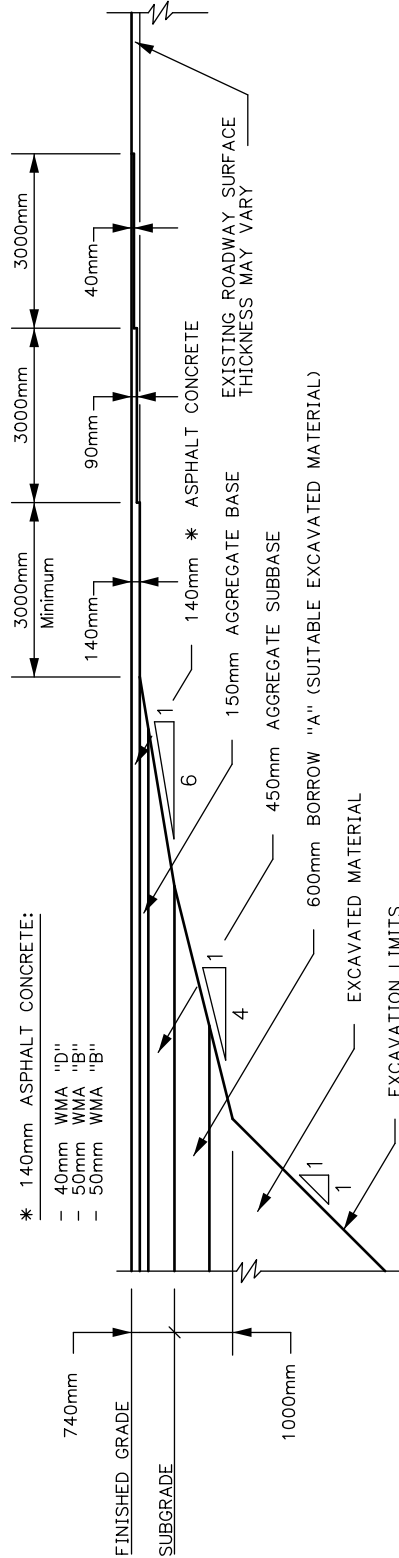
STAGE 2



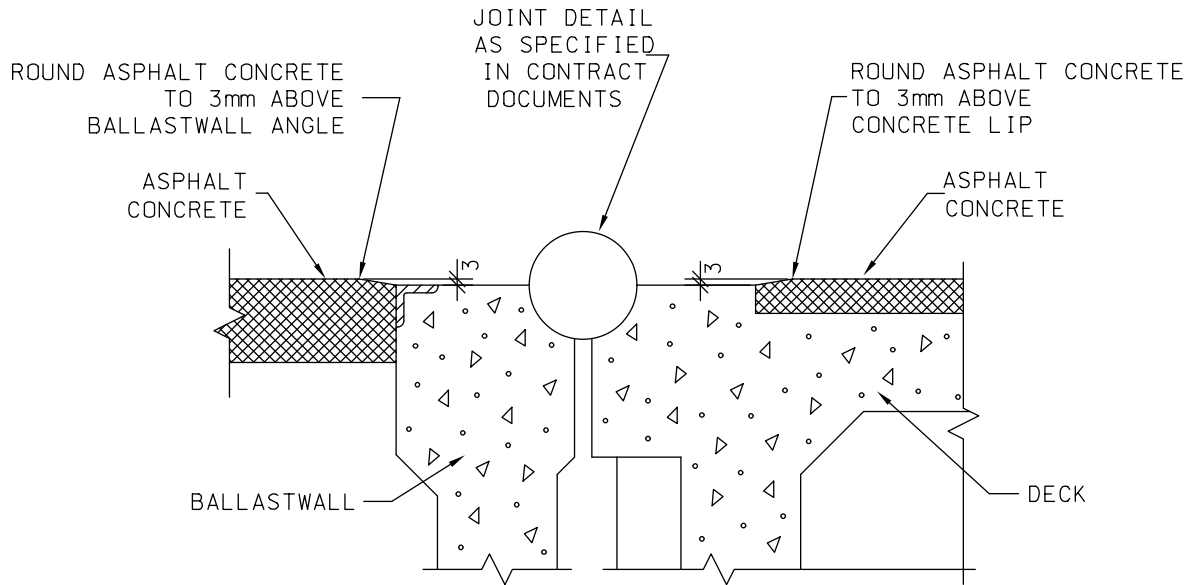
NOTE #1: THE EXISTING ASPHALT CONCRETE SHALL BE COLD MILLED TO THE SHAPE INDICATED.

NOTE #2: WHEN THE EXISTING PAVEMENT HAS BEEN REMOVED IN ADVANCE OF PAVING THE JOINT AREA, THE CONTRACTOR SHALL CONSTRUCT A SMOOTH LONG TAPER. THE TAPER MAY BE PLACED ON TAR PAPER AND SHALL BE REMOVED WHEN PAVING IS RESUMED. THE TRANSVERSE JOINT SHALL BE STRAIGHT AND HAVE A VERTICAL FACE WHEN THE TAR PAPER IS REMOVED.

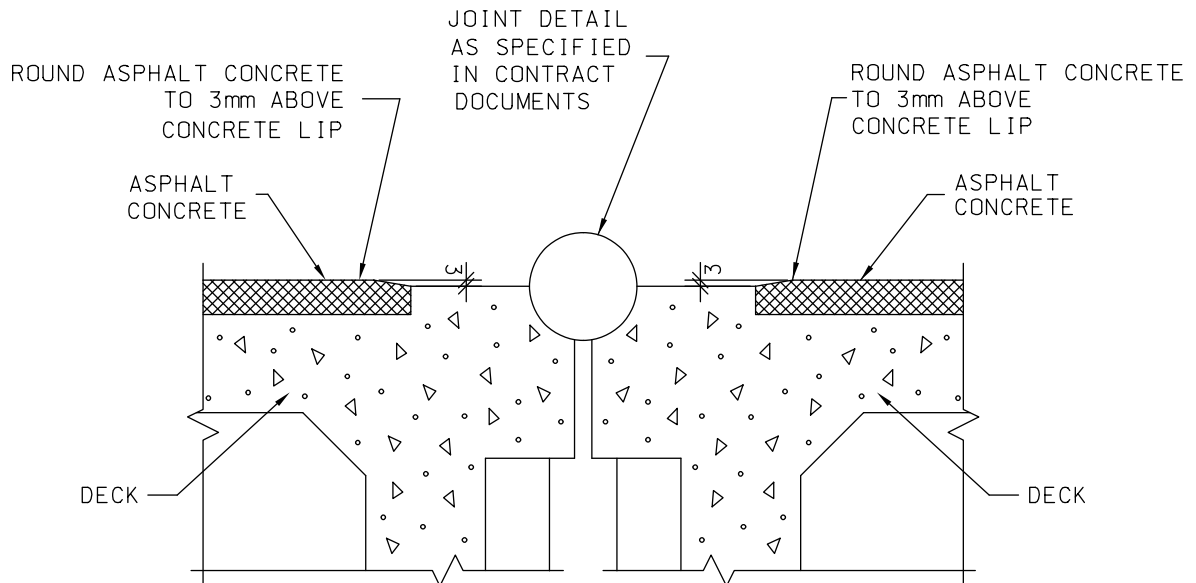
Construction Detail of a Transverse Key Joint



Typical Asphalt Transverse Joint Cold Milling Detail



ABUTMENT



EXPANSION PIER

Construction Details at a Structure

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PORTLAND CEMENT CONCRETE

ITEM: 301

301.1 DESCRIPTION

- .1 This Item consists of the proportioning, supply and placement of Portland cement concrete.

301.2 MATERIALS

301.2 .1 General

- .1 All materials shall be supplied by the Contractor.
- .2 Material properties shall conform to CSA A23.1, if not otherwise specified herein.

301.2 .2 Cements and Supplementary Cementing Materials

- .1 The following words and phrases, wherever used in this Item, shall have the meaning ascribed to them in CSA A3001:
 - .1 Blended Hydraulic Cement;
 - .2 Supplementary Cementing Materials;
 - .3 Blast- furnace slag;
 - .4 Blended Supplementary Cementing Materials;
 - .5 Fly Ash.

301.2 .3 Aggregates

- .1 Aggregates used in concrete shall meet the material properties specified in accordance with 302.2.

301.2 .4 Other Admixtures Not Covered By ASTM

- .1 A written statement shall be provided to the Engineer from the manufacturer stating that the admixture contains no purposely added calcium chloride.

301.2 .5 Curing Materials

- .1 Burlap, absorptive mat, or non-woven geotextile shall be used for curing horizontal surfaces.
- .2 For vertical surfaces, curing shall be carried out by using burlap.
- .3 Curing materials shall, at any time of use, be in good condition free from holes, dirt, clay or other substance which would have a deleterious effect upon concrete.
- .4 Burlap shall be of a quality which will absorb water readily when dipped or sprayed and shall have a mass of not less than 237 g/m² when clean and dry.
- .5 Curing water shall be free of chlorides, oils, dirt and other deleterious materials.

301.3 SUBMITTALS

- .1 The Contractor shall have the source of supply of Portland cement concrete approved by the Engineer in advance of the supply of the concrete to the Work, and this approval shall consist of but not be limited to :
 - .1 The Contractor shall provide the Engineer with the name of the proposed cement supplier.
 - .2 The Contractor shall submit certification that the concrete supplier is certified in accordance with Atlantic Provinces Ready Mix Concrete Association, Plant Certification Program or equivalent.
 - .1 The concrete supplier shall submit proof of certification in the appropriate categories in accordance with CSA A23.1.
 - .2 Only concrete supplied from such certified plants shall be acceptable to the Owner and plant certification shall be maintained for the duration of the fabrication and erection until the warranty period expires.
- .2 The proposed mix proportions (design), certified by the Contractor or his/her agent, shall be submitted at least 5 Days before concrete production is due to start.

301.4 CONSTRUCTION**301.4 .1 General**

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Concrete shall meet the requirements of CSA A23.1, if not otherwise specified herein.
- .3 No loads shall be applied to new concrete including vibration until the concrete has attained a minimum compressive strength of 10 MPa.

301.4 .2 Care and Storage of Materials

- .1 All concrete materials shall be handled and protected in such a way as to prevent segregation, damage and contamination.
- .2 All cement, aggregate and other concrete construction materials shall be stored in accordance with the requirements of CSA A3001, and CSA A23.1.

301.4 .3 Proportioning and Composition of Concrete

- .1 The Contractor shall be responsible for providing concrete mix designs for each Exposure Class of concrete specified and proposed for use.
 - .1 Concrete shall meet the requirements of CSA A23.1 Exposure Class C-1.
- .2 If during the progress of the Work, it is determined that the concrete has inadequate workability or does not meet the requirements of the Specifications, the Contractor shall submit a new mix design to the Engineer, in accordance with the 301.3.2.
- .3 All concrete shall be proportioned in accordance with the submitted mix designs.

PORTLAND CEMENT CONCRETE

ITEM: 301

301.4 .4 Concrete Production

- .1 Portland cement concrete shall be produced in accordance with the requirements of CSA A23.1.

301.4 .5 Delivery

- .1 Delivery of concrete shall be in accordance with CSA A23.1 and shall be regulated so as to enable continuous deposition until the placement of each concrete section is completed.
- .2 The batch delivery ticket meeting the requirements of CSA A23.1 shall accompany each batch of concrete delivered to site.
 - .1 The batch ticket shall include quantities of materials batched.

301.4.5 .3 Addition of Water

- .1 Water shall not be added after batching for any purpose without the approval of the Engineer.
 - .1 Slump adjustment of superplasticized concrete shall be with admixture only.

301.4 .6 Placement

- .1 The Contractor shall be responsible for all formwork design and construction in accordance with CSA A23.1.
- .2 All concrete placement shall be in accordance with CSA A23.1, unless otherwise noted.
- .3 Floats shall be wood or magnesium. Steel floats shall not be permitted.
- .4 All concrete shall be placed in a space free of standing water, clean of all dirt and debris, unless otherwise specified in the Contract Documents. Water infiltration shall be controlled for a minimum of 24 hours prior to ordering and placing concrete.
- .5 Form ties shall be of such type that they can be entirely removed or cut back 25 mm or more below the finished surface of the concrete leaving no metal within 25 mm of the surface.
- .6 Concrete shall receive an Ordinary Surface Finish in accordance with 302.4.

301.4 .7 Curing and Protection

- .1 Curing shall be carried out in accordance with CSA A23.1 and this Item.
 - .1 Curing compound may be used where specifically referenced by another Item.
- .2 For vertical surfaces, curing shall be carried out by securing wet burlap against the vertical surface, supplying a continuous source of moisture to the burlap, and sealing with plastic, or by keeping formwork in place for the specified curing period.

PORTLAND CEMENT CONCRETE

ITEM: 301

301.4 .8 Testing

- .1 The Contractor is responsible for supplying concrete which shall have, at the point of final discharge, the characteristics specified in the Contract Documents.
- .2 The Owner shall carry out Quality Assurance Testing.

301.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of Portland cement concrete proportioned, supplied and placed in accordance with this Item.

301.6 BASIS FOR PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each class of concrete, as identified under the Contract.

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CONCRETE IN STRUCTURES

ITEM: 302

302.1 DESCRIPTION

- .1 This Item consists of the supply, placement and finishing of concrete in Structures.
- .2 This Item is subdivided into, but not limited to, the following types:
 - .1 Concrete In Structures "A":
 - .1 Concrete for use in Bridge abutments including but not limited to, abutment barrierwalls, safety-curbs, sidewalks and independent curb and gutter at the end of wingwalls.
 - .1 Concrete for use in integral bridge abutment, as indicated in the Contract Documents.
 - .2 Concrete In Structures "B":
 - .1 Concrete for use in buried Bridge abutment approach slabs.
 - .3 Concrete In Structures "C":
 - .1 Concrete for use in Bridge piers.
 - .4 Concrete In Structures "D":
 - .1 Concrete for use in Bridge deck slabs including but not limited to, diaphragms, barrierwalls, safety-curbs, sidewalks, at grade approach slabs, and other integral deck components.
 - .1 Concrete for use in decks in integral abutment bridges, as indicated in the Contract Documents.
 - .5 Concrete In Structures "E":
 - .1 Concrete for use as tremie concrete in footings.
- .3 A continuous structure is defined as the complete deck slab between the expansion joints.

302.1 .4 Definitions

- .1 The following words and phrases, wherever used in this Item, shall have the meaning ascribed to them in CSA A3001:
 - .1 Blended Hydraulic Cement;
 - .2 Supplementary Cementing Materials;
 - .3 Blast- furnace slag;
 - .4 Blended Supplementary Cementing Materials; and
 - .5 Fly Ash.

302.2 MATERIALS

302.2 .1 General

- .1 All materials shall be supplied by the Contractor.
- .2 Material properties shall conform to CSA A23.1, if not otherwise specified herein.

302.2 .2 Material Properties.1 Aggregates

- .1 The coarse aggregate and fine aggregate shall each be stockpiled separately.
- .2 Stockpiles shall be placed on a level well drained base and constructed in such a manner that segregation and contamination does not occur.
 - .1 Stockpiles shall be checked during the normal course of the Work, for conformance to the grading limits specified.
 - .2 Segregated or contaminated stockpiles shall not be incorporated into the Work.
 - .3 Stockpiles shall be maintained so that there is a sufficient supply of aggregates for the production of concrete to be placed in the following 14 Days.
- .3 Fine and coarse aggregates shall only be combined in the specified proportions at the time of batching.
- .4 Petrographic examination of the aggregates shall be made on an annual basis in accordance with CSA A23.2-15A and as described below.
 - .1 A Petrographic examination of the aggregates shall be initiated where there is an observed change in the material at the pit or quarry.
 - .2 When the size of the crushing operation or the usage of material from that operation is such that more than two years supply is stockpiled, the Contractor may submit a request for an extension to the time requirement for the petrographic test. The request for extension shall include details of inventory management and time period requested as a minimum.
 - .3 The petrographic examination shall detect the presence of deleterious shale, mica, coated grains, soft flaky particles, chert, and all deleterious substances which are known to cause harmful reactions in Portland cement concrete mixtures. The maximum PN for coarse aggregate shall be reported.
 - .4 The aggregate petrographer shall be responsible to describe each rock type present in an aggregate sample and to comment on the unfavourable effects of any material which is known to be deleterious.
 - .5 When the sample has been found to possess properties or constituents that are known to have specific unfavourable effects on concrete, those properties or constituents shall be described qualitatively and, to the extent practicable, quantitatively.
 - .1 Additional testing shall be necessary to prove the aggregate shall have no deleterious effect on concrete.
- .5 Blending of aggregates shall only be permitted to meet the grading requirements.
 - .1 The blending materials shall individually meet the requirements of this Item with the exception of the grading requirements.

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302.2.2 .2 Fine Aggregate

- .1 Fine aggregate shall consist of uncoated natural sand, manufactured sand or an approved combination.
- .2 The amounts of deleterious substances in fine aggregate, each determined on independent samples complying with the grading requirements indicated in CSA A23.1, shall not exceed the limits specified in Table 302-1.

Table 302-1
Limits for Deleterious Substances and Physical Properties of Fine Aggregate

Deleterious Substances and Physical Properties	Test Procedures	Test Limits (%)
Coal and Lignite	Note ¹	0.25
Micro Deval	CSA A23.2-23A	16.0
Alkali Aggregate Reaction ²	CSA A23.2-14A Modified ³	0.035 @ 2 years
NOTES: 1) The sample shall first be tested for low density material in accordance with CSA A23.2-4A. The material retained on the liquid with a specific gravity of 2.0 shall be dried and the portion which is coal or lignite shall be determined by petrographic examination. 2) Test runs for a period of two years. There shall be no testing on the third year. Following the year of no testing the cycle shall begin again. New results required within 3 years of previous results. 3) Testing period shall be 2 years. Job mix aggregate combination shall contain 430 kg/m ³ cement content.		

302.2.2 .3 Coarse Aggregate

- .1 The amount of deleterious substances in coarse aggregate, determined on independent samples complying with the grading requirements in CSA A23.1, shall not exceed the limits prescribed in Table 302-2.

Table 302-2
Limits for Deleterious Substances and Physical Properties of Coarse Aggregates

Deleterious Substances	Test Procedures	Test Limits (%)
Coal and Lignite	Note ¹	0.5
Micro Deval	CSA A23.2-29A	14.0
Particle Shape	CSA A23.2-13A	15
Unconfined Freeze Thaw	CSA A23.2-24A	6
Alkali Aggregate Reaction ²	CSA A23.2-14A Modified ³	0.035 @ 2 years
NOTES: 1) The sample shall first be tested for low density material in accordance with CSA A23.2-4A. The material retained on the liquid with a specific gravity of 2.0 shall be dried and the portion which is coal or lignite shall be determined by petrographic examination. 2) Test runs for a period of two years. There shall be no testing on the third year. Following the year of no testing the cycle shall begin again. New results required within 3 years of previous results. 3) Testing period shall be 2 years. Job mix aggregate combination shall contain 430 kg/m ³ cement content.		

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302.2.2 .4 Water

- .1 The source of supply shall be the responsibility of the Contractor.
- .2 Water-to-cementing materials ratio shall be computed using the weight of cementing materials that is equal to the total weight of cement plus fly ash, silica fume, and slag.

302.2.2 .5 Admixtures

- .1 A written statement from the manufacturer stating that the admixture contains no purposefully added calcium chloride shall be provided to the Engineer.
- .2 Any admixtures which increase the water-to-cementing materials ratio by 0.01 or greater shall be accounted for in the mix design to meet the specified water-to-cementing ratios.

302.2.2 .6 Curing Materials

- .1 Burlap, absorptive mat, or non-woven geotextile shall be used for curing horizontal surfaces.
- .2 Curing materials shall, at any time of use, be in good condition free from holes, dirt, clay or other substance which would have a deleterious effect upon concrete.
- .3 Burlap shall be of a quality which will absorb water readily when dipped or sprayed and shall have a mass of not less than 237 g/m² when clean and dry.
- .4 Curing water shall be free of chlorides, oils, dirt and other deleterious materials.
 - .1 Curing water shall have a minimum temperature of 10°C.

302.2.2 .7 Cement And Supplementary Cementing Materials

- .1 Fly ash, slag, and silica fume may be used:
 - .1 On flatwork concrete exposed to chlorides and freezing and thawing, the proportions shall be limited to 20%, 35%, and 8% respectively. Total replacement shall not exceed 35%.
 - .2 On formwork concrete exposed to chlorides and freezing and thawing, the proportions shall be limited to 30%, 50%, and 8% respectively. Total replacement shall not exceed 50%.
 - .3 Higher replacement proportions may be permitted at the discretion of the Engineer.

302.2 .3 Composition of Concrete Mix

302.2.3 .1 General

- .1 It shall be the responsibility of the Contractor to ensure that the mixture proportions submitted to the Engineer are properly batched, mixed, placed and cured such that the concrete conforms to the Specification.
- .2 Concrete types A, B, C, and D shall be exposure Class C-XL and type E shall be F-1.
 - .1 Concrete for footings shall be exposure class C-1.

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- 302.2.3.1 .3 A calcium nitrite corrosion inhibitor shall be added to all concrete in the abutments above the elevation of the Bridge seat, bearing blocks, approach slabs overlaid directly with asphalt concrete (excluding approach slabs buried below grade), and to concrete in the Superstructure.
- .1 The dosage rate shall be 15 L/m³.
 - .2 The corrosion inhibiting calcium nitrite admixture shall contain between 30% to 36% calcium nitrite by weight of solution.
 - .3 The calcium nitrite shall be added at the concrete ready mix plant and verification shall be provided to the Engineer for the quantity of the calcium nitrite added to each batch of concrete.
 - .1 Acceptable verification shall include, but is not necessarily limited to, printouts from computerized batch plants or printouts from computerized admixture dispensing units.
 - .2 Verification shall be provided on the delivery slip.
 - .4 For C-XL and C-1 concrete, the range of air content shall be 6% to 9% regardless of the nominal size of the coarse aggregate used in the concrete mix.

302.2 .4 Associated Materials

- .1 The Contractor shall supply any associated materials necessary for construction, as shown on the Contract Documents.
- .2 Safety anchor assemblies shall be available from the Owner.
- .3 Materials shall be stored at least 100 mm off the ground.

302.3 SUBMITTALS

- .1 The Contractor shall submit the source of supply of Portland cement concrete to the Engineer 14 Days in advance of the supply of the concrete to the Work, and this submittal shall consist of but not be limited to:
 - .1 Certification that the concrete supplier is certified in accordance with Atlantic Concrete Association (ACA), Plant Certification Program or the equivalent as follows:
 - .1 The concrete supplier shall submit proof of conformance to the requirements for the production of the concrete in accordance with CSA A23.1.
 - .2 Only concrete supplied from such certified plants shall be acceptable to the Owner and plant certification shall be maintained for the duration of the Work.
 - .2 Proposed sources of aggregates and test results shall be submitted to the Engineer, in writing, a minimum of 14 Days prior to the proposed use of such materials. This notification period shall be increased to a minimum of 35 Days if the aggregates proposed for use have not been previously approved for use in the Owner's projects.
 - .3 The proposed design mix proportions, certified by the Contractor or his/her agent, and stamped and signed by the Professional Engineer, who reviewed the concrete mix, and shall include:

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- 302.3.1.3 .1 Specified hardened properties and age of testing for strength, air, and permeability.
- .2 The Contractor shall submit, at least 14 Days prior to commencement of the Work, the proposed method and sequencing of the placing of the concrete for approval by the Engineer.
- .3 Other submittals are required for this Item and are contained within the sections applicable to the specific phase of the Work being undertaken.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

302.4 CONSTRUCTION**302.4 .1 General**

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Concrete materials and methods of concrete construction and methods of test for concrete shall conform to CSA A23.1 and CSA A23.2, if not otherwise specified herein.
- .3 The Contractor shall notify the Engineer at least two Days in advance of the commencement of each concrete placement.
- .4 When detailed in the Contract Documents the Contractor shall install the associated materials described in 302.2.4 in accordance with the Contract Documents.

302.4 .2 Equipment and Production**302.4.2 .1 Batching**

- .1 The Contractor has the responsibility to ensure that the concrete mix proportions are being accurately and consistently batched to produce the specified mix and concrete properties.
- .1 The moisture content for aggregates shall be determined and adjustments made prior to the batching of concrete.

302.4.2 .2 Mixing

- .1 Mixers and agitators used for transporting concrete shall deliver their load to the Work Site and discharge shall be completed within 2 hours of initial mixing unless a longer time is specifically authorized in writing by the Engineer.
- .1 Under conditions contributing to rapid stiffening of concrete the Engineer may specify a time of less than 2 hours.

302.4.2 .3 Delivery

- .1 The batch delivery ticket meeting the requirements of CSA A23.1 shall accompany each batch of concrete delivered to site.
- .1 The batch ticket shall include quantities of materials batched.

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302.4.2.3 .2 Addition of Water

- .1 Water shall not be added after batching for any purpose without the approval of the Engineer.
- .1 Slump adjustment of superplasticized concrete shall be with admixture only.

302.4 .3 Falsework and Formwork

- .1 The Contractor shall be responsible for all falsework design and construction in accordance with Item 957.
- .2 The Contractor shall be responsible for all formwork design and construction in accordance with Item 958.
- .3 All submissions with respect to falsework and formwork shall be in accordance with Item 956.

302.4 .4 Placement

302.4.4 .1 General

- .1 All concrete shall be placed in a space free of standing water, unless otherwise specified in the Contract Documents.
- .2 New concrete shall be defined as concrete that has not attained its minimum specified compressive strength.
 - .1 All loads to be applied on new concrete shall be subject to the approval of the Engineer, including vibration.
- .3 Bonding of new concrete on hardened concrete shall be carried out as follows:
 - .1 Before depositing new concrete on concrete that has set, the forms shall be re-tightened and the surface of the hardened concrete shall have all foreign matter and laitance removed.
 - .2 Hardened concrete surfaces shall be thoroughly saturated with water, for 24 hours in advance of placing concrete.
 - .3 Methods of obtaining an adequate bond between the hardened and fresh concrete shall be subject to the approval of the Engineer.
- .4 The Contractor shall determine required delivery temperature of concrete to satisfy the selected construction method and temperature control, but concrete temperatures from the time of batching until final placing shall be maintained between 10 °C and 25 °C, unless otherwise authorized in writing.
- .5 Concrete shall be placed while still plastic and workable.
 - .1 Concrete at the advancing face of the concrete placement must be plastic and cold joints within a concrete placing operation shall not be permitted.
 - .2 Re-tempering any partially hardened concrete with additional water shall not be permitted.

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- 302.4.4.1 .6 Concrete placement advancement shall be up-grade unless otherwise noted in the Contract Documents and/or authorized by the Engineer.
- .7 If the concrete details are such that a feather edge or thin section might be created by the sequence of placing, a bulkhead shall be introduced to maintain an edge thickness of at least 100 mm.

- 302.4.4 .2 Footings and Working Slabs
 - .1 Where Overexcavation occurs in the solid rock excavation for footings, concrete shall be placed in accordance with Standard Drawing 302-3 and as follows:
 - .1 Down to an elevation of 150 mm below the specified elevation of the bottom of the footing, the Contractor shall place the concrete specified for the footing.
 - .2 If the Overexcavation is in excess of 150 mm below the specified elevation of the bottom of the footing, the Contractor shall place working slab concrete from the bottom of the excavation up to the bottom of the specified footing elevation.
 - .1 The working slab shall have a minimum specified compressive strength of 20 MPa at 28 Days.
 - .2 Prior to the placement of footings, the working slab concrete shall have a minimum compressive strength of 5 MPa.
 - .3 For stepped footings and similar stepped formwork details, where concrete has to be placed in two or more stages and where the monolithic nature has to be maintained, the upper portion shall be placed as soon as stiffening of the concrete in the lower portion shall permit.
 - .1 The concrete in the lower portion shall be designed so as to minimize bleeding; any free water or laitance shall be removed before the next layer of concrete is placed.

- 302.4.4 .3 Columns
 - .1 Concrete in columns shall be placed in one continuous operation unless otherwise noted in the Contract Documents and/or as directed by the Engineer.
 - .2 Prior to the placement of walls or column formwork all concrete in footings must have attained a minimum compressive strength of 20 MPa and the footing curing and protection requirements must be satisfied in accordance with 302.4.8.
 - .3 Concrete in columns shall be allowed to cure a minimum of 36 hours and to a minimum compressive strength of 20 MPa before adjacent formwork is placed.
 - .4 Falsework supported by brackets on columns shall not be placed until concrete has attained 60% of its minimum specified compressive strength.
 - .5 Unless specifically permitted by the Engineer, in writing, concrete shall not be placed in the Superstructure until column forms have been stripped sufficiently to determine the character of concrete in the columns.

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302.4.4 .4 T-Beam Spans

- .1 Concrete in girder webs shall be deposited uniformly in horizontal layers.
- .2 Concrete in a T-Beam span shall be placed in one continuous operation.

302.4.4 .5 Box Girders

- .1 Concrete in box girders shall be placed in two or three separate operations.
 - .1 The bottom slab shall be placed first with a construction joint between the bottom slab and the webs.

302.4.4 .6 Decks and Diaphragms

- .1 All diaphragm concrete, with the exception of continuous pier diaphragms for Bridges with prestressed girders that are made continuous for live load and integral abutment diaphragms, must have attained 60% of its minimum specified compressive strength, prior to placing the concrete for the deck slab or any other superimposed dead loads.
 - .1 Pier diaphragms in prestressed concrete girder Bridges that are made continuous for live load shall be placed concurrently with the portion of the deck over the same pier, as shown on the concrete placement diagram in the Contract Documents.
- .2 Deck concrete shall be placed uniformly and symmetrically with respect to the width of the Structure.
- .3 The deck slab concrete must have attained 80% of its minimum specified compressive strength prior to the placement of curb, barrierwalls or Sidewalk concrete or any other superimposed dead load on the deck slab.
 - .1 Bulkheads for the deck slab placement shall remain in place for at least 36 hours and until the deck slab concrete reaches a minimum compressive strength of 20 MPa following the initial set of the deck slab concrete.
 - .1 No disturbance of the embedded reinforcing shall occur until a minimum compressive strength of 20 MPa is achieved.
- .4 The deck slab concrete and continuous pier diaphragms must have attained 80% of its minimum specified compressive strength prior to the placement of any vehicles on the deck slab.

302.4.4 .7 Superstructure Reactions on Bents, Piers, or Abutments

- .1 The load of the Superstructure shall not be allowed to come upon the bents, piers or abutments until concrete in the bents piers or abutments has reached the minimum specified compressive strength.

302.4.4 .8 Profile of Bridge Superstructure Components

- .1 Longitudinal girders, transverse floor beams and stringers shall be profiled by the Engineer.
 - .1 The Contractor shall notify the Engineer of the availability of his/her safety support system a minimum of 7 Days in advance of the placement of any falsework, formwork or other additional loads on the Superstructure to allow for the profiling.

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- 302.4.4.8.1 .2 When the Contractor carries out the surveying under Item 941, longitudinal girders, transverse floor beams and stringers shall be profiled by the Contractor.
- .1 The Contractor shall submit the profiles to the Engineer a minimum of 7 Days in advance of the placement of any falsework, formwork or other additional loads on the Superstructure.
- .2 Where excessive camber of precast pre-stressed beams occurs, the Contractor shall carry out grade adjustments, as directed by the Engineer.

302.4.4 .9 Bridge Decks

- .1 The deck slab concrete for a simple span shall be placed in one continuous operation, starting at one end of a span and proceeding to the other end, unless otherwise noted in the Contract Documents.
- .2 Concrete in continuous slab and slab-on-girder Bridges shall be placed as shown in the Contract Documents.
- .1 Placing of concrete in deck slabs shall be continuous between construction joints.
- .2 Vehicles or any superimposed dead load shall not be allowed on any portion of a continuous structure until all concrete has attained 80% of its minimum specified compressive strength.
- .3 Deck slab, safety curb, parapet, barrier wall and Sidewalk concrete shall not be placed between November 1st and May 1st, unless authorized by the Engineer, in writing.
- .4 During the concreting of the deck slab and barrier walls the Contractor shall ensure, at no cost to the Owner, that cement paste or other leakage from the forms is removed from the exposed portions of a steel superstructure employing an Engineer approved pressurized water spray.

302.4.4 .10 Multi-span Steel Girder Bridges

- .1 Before deck slab concrete is placed on steel spans, the falsework supporting Bridge girders shall be removed.
- .2 The placement of deck concrete for any single placement on a continuous Structure shall not proceed until the minimum specified compressive strength has been attained for the preceding concrete deck placement(s) as detailed in the Contract Documents.

302.4 .5 Tremie Concrete

- .1 The Contractor, in conjunction with the concrete supplier, shall plan all aspects of underwater concrete placement including mix design, contingencies, monitoring and test placements, in accordance with ACI 304, CSA A23.1, and the following minimum requirements:
- .1 Tremie pipes shall be kept filled with concrete while depositing and shall have a maximum spacing of 3.0 m. All pipes shall be used in continuous rotation to maintain concrete level.
- .1 A concrete pump may be used to charge tremie pipes as part of an approved tremie placement plan.

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- 302.4.5.1
- .2 During placing, the upper surface of the concrete must be kept as level as possible and particular care must be taken to ensure that the tremie concrete has a reasonably smooth and level upper surface +200 mm or -100 mm of the elevation designated in the Contract Documents.
 - .1 Concrete in excess of 300 mm of the upper designated surface shall be removed.
 - .3 Prior to any placing of the tremie concrete, vertical shaft reinforcing bars in the tremie area shall be securely held in proper alignment by steel templates.
 - .1 The lower template shall be located a maximum of 1 m above the top of the tremie.
 - .2 The upper template is to be positioned near the top of the cofferdam.
 - .4 During placing of the structural tremie, the Contractor must satisfy, as a minimum, the following conditions:
 - .1 The Contractor shall only begin the tremie placement, for the footings of any pier, once the Contractor warrants the capability of supplying and placing the concrete at a rate of not less than 40 cubic metres per hour throughout the entire placement.
 - .1 For a plan area greater than 100 square metres, concrete shall be supplied and placed at a rate of not less than 50 cubic metres per hour, unless otherwise approved in writing by the Engineer.
 - .2 The concrete must contain enough retarder to ensure a minimum depth of 1 m of fluid concrete at any time during the placement.
 - .3 A maximum centre to centre spacing of tremie pipes shall be 3 m in any footing concrete placement and the outside rows of tremie pipes shall be spaced a maximum of 1.5 m from the inside face of the sheet piling cofferdam walls.
 - .2 In the area of pier shafts, at the top of the structural tremie footing, the laitance shall be removed and the top of the footing shall be chipped down to sound concrete.
 - .1 All laitance and concreting residue shall become the property of the Contractor and shall be disposed of outside the Work Area.
 - .3 The Owner shall arrange to have one or more cores drilled from the structural tremie concrete of each pier for the purpose of checking the quality and strength of the concrete placement.
 - .1 The Contractor shall, as part of the Work, provide access, platforms and any other assistance that may be necessary to enable the drilling to be carried out efficiently.
 - .2 The Contractor shall suspend all of her/his construction operations on the pier during the tremie coring operation.
 - .3 Should such cores identify defects or fail to meet the Specifications, the Contractor shall at his/her own expense, carry out corrective measures, subject to the approval of the Engineer, to remedy the deficiencies identified in the structural tremie concrete.
 - .1 The Contractor shall be responsible, at her/his own expense, for the cost of any additional coring to determine the full extent of the defects and to develop a remediation plan satisfactory to the Engineer.

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302.4 .6 Construction Joints

302.4.6 .1 Limitation in Use of Construction Joints

- .1 Construction joints shall not be permitted except those shown in the Contract Documents or as approved in writing by the Engineer, unless occasioned by the breakdown of the Equipment, or other unforeseen reasons, in which case the Contractor shall provide bulkheads parallel to the principal lines of stress.
- .2 Vertical construction joints in deck slabs shall not be allowed parallel to the centreline of the Roadway.

302.4.6 .2 Use of Keys

- .1 Suitable keys shall be formed at the top of the upper layer of each day's Work and at other levels where Work is interrupted.
- .2 Keys or construction joints shall be of the type and detail as shown in the Contract Documents, unless otherwise permitted by the Engineer.
- .3 If a key constructed by the Contractor is deemed deficient by the Engineer, the key shall be removed and an alternate key configuration proposed for the approval of the Engineer.

302.4 .7 Placing and Finishing Plastic Concrete

302.4.7 .1 Tolerances

- .1 Unless otherwise required in the Contract Documents, the maximum deviations from line, grade and dimension shall be as shown in Table 302-3.

Table 302-3
Placing and Finishing Tolerance Limits

Position in Structure	Tolerance
Finished Bridge Deck	Grades Surface variation
	± 8 mm 8 mm over 3 m
Approach Slab directly overlaid with asphalt concrete	Grades Surface variation
	± 8 mm 8 mm over 3 m
Approach Slab buried below grade	Grades Surface variation
	± 8 mm 12 mm over 3 m
Concrete Bridge Bearing Block or Seat	Grades Surface variation from level or specified slope
	+1 to -5 mm ± 0.1°
Footings	
Columns, Walls, Cap Beams and High Quality Surface Areas and exposed Wingwalls	Surface variation from true line
	≤ 5 mm
Misplacement or eccentricity in Pier, Cap Beam & Bridge Seat	
	± 10 mm
Columns, Piers, Walls, Beams and High Quality Surface Areas and exposed Wingwalls	Cross sectional dimensions
	- 5 mm/+ 10 mm
Footings	Plan dimensions width/length Misplacement or eccentricity
	- 10 mm ± 1% of footing dimension in direction of misplacement but < 50 mm
Variation in sizes and location of Slab and Wall openings	
	± 10 mm

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302.4.7 .2 Upper Horizontal Surfaces

- .1 The concrete shall be placed in the forms in such a way that the final elevation of the upper horizontal surfaces shall be as indicated in the Contract Documents and/or as directed by the Engineer.
 - .1 Use of mortar topping shall not be permitted.
 - .2 Steel floats shall not be permitted.

302.4.7 .3 Bearing Surfaces

- .1 Where bearing pads (other than steel) are shown in the Contract Documents, concrete surfaces on which pads are to be placed shall be wood or magnesium floated to a level plane.
 - .1 If bearing block surfaces are ground to meet tolerances, the surface shall be artificially roughened as required to produce a surface texture similar to coarse sandpaper.

302.4.7 .4 Bridge Curbs and Sidewalks

- .1 Sidewalks and curbs shall be constructed by placing concrete continuously to the elevations shown in the Contract Documents.
- .2 The concrete shall be worked with a magnesium float to give a uniform surface.
- .3 Floating shall be kept to a minimum consistent with the desired finish.
- .4 Before this finish has set, the surface shall be lightly roughened, perpendicular to the centre line of the Roadway, with a fine dry broom.

302.4.7 .5 Bridge Decks

- .1 Concrete Bridge decks shall be finished by power machine method as specified in the following sections.
- .2 Continuous access to the Bridge deck surface during finishing operations shall be provided by the Contractor.
 - .1 Access shall be provided by means of suitable transverse Bridges.
 - .2 The access Bridges shall be positioned as required by the Engineer.
- .3 Placing of concrete in Bridge decks shall not be permitted until the Engineer is satisfied that:
 - .1 The rate of producing and placing concrete shall be sufficient to complete finishing operations within the scheduled time.
 - .2 The necessary tools and Equipment are at the site and in satisfactory condition for use.
 - .3 Proper protection measures are in place to prevent drying and/or the concrete is to be placed at night.

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- 302.4.7.5 .4 The finishing operations for silica fume modified concrete shall be limited to screeding.
 - .1 Bull floats or magnesium trowels shall be used to remove defects.
- .5 Falsework and wedges shall be checked immediately prior to placing Bridge deck concrete, and the Contractor shall make necessary adjustments.
 - .1 Care shall be exercised to ensure that settlement and deflection due to the added weight of the Bridge deck concrete is minimal.
 - .2 Suitable means shall be provided by the Contractor to permit immediate measurement by the Engineer of settlement and deflection.
- .6 Screed bars or pipes shall be set to the correct elevation, to form the surface of the Bridge deck to the line and grade as shown in the Contract Documents, with allowances, as required, for any anticipated settlement and/or cambered deflection of the Structure.
 - .1 Screed bars and pipes shall be of such type and be installed so that they shall not deflect appreciably under the applied loads.
 - .2 Screed pipes or bars for deck pours shall be firmly secured prior to placing concrete.
 - .3 Supports for screed pipes or bars shall not be carried upon reinforcing steel.
 - .1 If the supports for the rails are located in the concrete, the supports shall be the type which can be removed without disturbing the concrete, or partially removed so that no part remains less than 70 mm below the finished concrete surface.
 - .1 The supports shall be removed and the resulting holes entirely filled with deck concrete before the deck concrete has hardened, or once concrete has hardened, the holes shall be entirely filled and finished, subject to the approval of the Engineer.
 - .4 The Contractor shall be responsible for the design of deck hangers and form brackets to support the additional loads imposed by the power-driven screeding machine.
 - .1 For steel girder Bridges, screed rails shall be supported on the top girder flange; or the Contractor shall submit an analysis, stamped and signed by a Professional Engineer acceptable to the Owner, demonstrating there will be no excessive deformations or permanent loads imparted to the girders, for approval by the Engineer.
- 302.4.7 .6 Deck Surface Repairs to Meet Tolerances
 - .1 Areas outside of tolerances identified in Table 302-3 shall be repaired as directed by the Engineer.
 - .1 It shall not be acceptable to achieve this repair by placing grout or concrete over deck concrete that has hardened.
- 302.4.7 .7 Screed Machines
 - .1 Screeding of Bridge decks shall be accomplished by power-driven Bridge deck screeding machines, approved by the Engineer.

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- 302.4.7.7 .2 Prior to beginning concrete placing operations, the screeding machine shall be operated over the full length of the Bridge segment to be placed.
- .1 This test run shall be made with the screed in its finishing position.
 - .2 While operating the screeding machine in this test, the screed rails shall be checked for deflection and proper adjustment, the cover on slab reinforcement measured and the controlling dimensions of slab reinforcement and forms checked.
 - .3 Necessary corrections shall be made before starting the placement of concrete.
- .3 After the concrete has been placed, spread, and consolidated to provide a uniformly dense slab, the surface shall be struck off immediately by the passage of the screeding machine.
- .1 The screeding machine shall carry sufficient concrete in front of the screed to fill low porous places.
 - .2 The Contractor shall verify the top cover on the reinforcing steel and the thickness of the deck slab across the deck within 3 m of the screeding operation at a maximum of 2 m intervals.
 - .1 If the top cover or the thickness of deck slab does not meet tolerances the screeding operation shall be repeated.
 - .3 The screeding operation shall be repeated as may be necessary to produce a uniformly consolidated, dense, and smooth surface true to the lines and grade.
 - .4 The final deck finish shall be obtained by methods approved by the Engineer.

302.4 .8 Curing and Protection

- .1 The Contractor shall submit to the Engineer for approval, 3 Days prior to the concrete placement, the proposed method and sequence to be employed in the Work for the curing and protection of the concrete, including but not limited to, cold weather protection method, temperatures expected during curing, the number of field cured cylinders required and the desired testing schedule.
- .2 Concrete shall be protected against plastic or dry shrinkage cracking by methods such as placing concrete at night or erecting wind protection and the use of sun shades. This is especially important when placing flatwork.
- .3 All exposed concrete surfaces, mortar and grout shall be continuously wet cured.
 - .1 The curing period for concrete shall be for a minimum of 7 Days from the completion of concrete placement, at a minimum ambient temperature of 10°C, and until 70% of the minimum specified compressive strength is attained (90% for concrete placed between November 1st and May 1st).
 - .1 Wet curing shall be carried out by means of ponding, continuous sprinkling, absorptive mat, or fabric kept continuously wet.
 - .2 Compressive strength test specimens, used for the purpose of determining when wet curing can cease, shall be cured entirely under field conditions.
- .2 The curing period for mortar or grout shall be 3 Days from the completion of mortar or grout placement or as recommended by the manufacturer.

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- 302.4.8.3 .3 A burlap, absorptive mat, or non-woven geotextile fabric shall be applied immediately after finishing of the concrete surface.
- .4 A fog mist system shall be applied continuously to bridge decks from the time of screeding until concrete is covered with burlap or non-woven geotextile fabric, in such a way as to maintain high relative humidity above the concrete and prevent drying of the concrete surface.
- .1 Water shall not be allowed to drip, flow or puddle on the concrete surface during fog misting, when placing the burlap or non-woven fabric or at any time before the concrete has achieved final set.
- .4 Equipment and materials necessary for curing and protection of concrete shall be available on the Worksite and ready for use before placement of concrete commences.
- .5 Freshly finished concrete shall be protected from the elements and from defacement due to construction operations.
- .1 The Contractor shall repair or replace, subject to the approval of the Engineer, any concrete damaged by the elements or defacement.
- .6 It shall be the responsibility of the Contractor to ensure that the system of curing and protection is properly constructed and maintained for the period of time required.
- .7 Material or Equipment, other than that required for actual curing operations, shall not be placed on either the concrete deck being cured or portions of decks on adjacent spans of continuous Structures, without the approval of the Engineer.
- .8 Bridge decks shall be barricaded from traffic until completely cured.
- .9 Formwork shall not be removed before 7 Days without the approval of the Engineer.
- .1 When formwork is removed prior to the completion of curing, the newly exposed concrete surfaces shall be kept wet until the curing period is completed.
- .2 For vertical surfaces, curing shall be carried out by securing wet burlap against the vertical surface, supplying a continuous source of moisture to the burlap, and sealing with plastic.

302.4 .9 Cold Weather Requirements

302.4.9 .1 General

- .1 For the purpose of this specification cold weather curing and protection shall be in effect between November 1st and May 1st.
- .1 Cold weather curing and protection shall be required outside of these dates if the ambient temperature is at or below 5 °C, or in the Engineer’s opinion, is likely to fall below 5 °C within the next 24 hour period.
- .2 The Contractor shall ensure that all boilers used for heating, materials, and housing, shall meet the inspection requirements and operating conditions of all applicable Provincial Acts and Regulations.

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- 302.4.9.1 .3 Curing and protection shall continue for 7 days and until 90% of the minimum specified compressive strength is obtained on field cured cylinders.
- .4 During periods of freezing temperatures the protection shall continue for 12 hours after cessation of moist curing and then be gradually withdrawn in accordance with 302.4.9.7.
- .5 Contractor shall plan his/her Work such that after completion of curing, a minimum of 28 Days is allowed prior to being subjected to application of de-icing chemicals.
- 302.4.9 .2 Materials
- .1 The temperature of material charged in the mixer shall be such that the temperature of the mixed concrete, at the time of placement does not exceed 25°C nor shall it be less than 10°C, unless otherwise approved as part of a comprehensive temperature control plan for mass concrete elements.
- .1 The Contractor may heat water, or water and aggregate, to ensure that these temperature limits shall be met.
- .2 Frozen lumps of aggregate shall be excluded from the mix.
- .3 Water over 35°C shall not be brought in direct contact with the cement.
- 302.4.9 .3 Placing
- .1 Concrete shall not be placed against frozen surfaces.
- .2 Formwork, existing concrete at a construction joint, and reinforcing steel shall be free of ice and snow and shall be preheated to and maintained at a temperature of not less than 5°C for a minimum period of 24 hours prior to placement.
- 302.4.9 .4 Enclosed Protective Housing
- .1 Protective housing shall be wind and weather tight, constructed of suitable materials on a substantial framework.
- .1 Housing shall be of adequate size so proper placing and finishing procedures can proceed unhampered.
- .2 Provisions shall be made for access, to carry out inspection of curing adequacy, by the Contractor and the Engineer.
- .2 Use of "roll back" sheeting or tarpaulins supported from screed rails, or other means, is permitted on horizontal surfaces, provided:
- .1 their use does not preclude the attaining of the required surface finish;
- .2 the concrete is covered progressively as placed; and
- .3 the resulting housing satisfies all the specified provisions of this Item.
- 302.4.9 .5 Heating Within A Housing
- .1 Housing shall be constructed so that it is clear of concrete and formwork by a minimum of 300 mm at all points.

- 302.4.9.5.1 .1 This minimum shall include the underside of Bridge beams, slabs, cap beams, columns and walls unless the Engineer has authorized the protection of these areas by insulated formwork.
- .2 The heating system shall provide at all times, an air temperature throughout the housing of not less than 15°C nor more than 40°C.
- .3 These conditions shall be maintained for a minimum of seven continuous Days and until the minimum specified compressive strength is obtained.
- .1 Written permission shall be obtained from the Engineer prior to cessation of curing and protection.
- .4 Unvented heaters shall be removed from the placement area prior to the placement of concrete.
- .1 All concrete surfaces shall be checked prior to acceptance into the Work with phenolphthalein (carbonation indicator) to ensure that surfaces are not damaged by combustion products.
- .5 At the time of placing and during curing, concrete surfaces shall be protected by formwork or an impermeable membrane from direct exposure to combustion gases or drying from heaters.
- .1 When dry heat is used the products of combustion shall be vented to the outside air and concrete surfaces shall be kept continuously wet.
- .6 The housing shall be completed and the heating system shall be in operation for a sufficient period prior to placing concrete to prove the adequacy of the Equipment to establish and maintain the specified curing conditions during the placing and throughout the specified curing period.
- 302.4.9 .6 Insulation
- .1 Insulation may be used to protect concrete providing weather conditions and insulation procedures are such that the temperature of the surface of the concrete is maintained at a minimum of 15°C and a maximum of 50°C for a period of 7 continuous Days and until the minimum specified compressive strength is obtained.
- .2 When the ambient temperatures are anticipated to be -15°C, or lower, then insulation providing an R value of not less than 20 may be used to protect concrete, providing weather conditions and insulation procedures are such that the temperature of the surface of the concrete is maintained at a minimum of 15°C and a maximum of 50°C for a period of 7 continuous Days and until the minimum specified compressive strength is obtained.
- .3 The proposed method of insulation shall be submitted to the Engineer for approval at least two weeks in advance of use.
- .4 Insulating materials shall be kept dry.

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302.4.9 .7 Withdrawal of Protection

- .1 After completion of the specified curing period the temperature of the concrete shall be gradually reduced, at a rate not to exceed 5°C per hour, to that of the surrounding air. The temperature differential between ambient air temperature and the concrete shall not exceed 20°C.

302.4 .10 Hot Weather Requirements

- .1 For the purpose of this Specification hot weather shall be considered to be when the ambient temperature is at or above 25°C, is likely to rise above 25°C within the next 24 hours, or when the sun, wind and humidity create moderate or severe drying conditions.
- .2 Hot weather placing of concrete shall not proceed without the approval of the Engineer.
- .3 The Contractor must demonstrate that he can provide adequate hot weather protection and agree to provide this protection before any approval can be given to start placing concrete.
- .4 When the drying conditions meet moderate drying conditions or severe drying conditions as defined by CAN/CSA - A23.1, the drying protection must meet with the approval of the Engineer.
- .5 The temperature of the formwork, reinforcing steel, and material against which new concrete is to be placed, shall not exceed 30°C.
- .6 The mixing water and/or aggregates shall be cooled when the temperature of the mix exceeds 25°C.
- .7 Exposed surfaces of concrete shall be shaded from the direct rays of the sun and sheltered from direct wind.

302.4 .11 Finishing Hardened Concrete

302.4.11 .1 General

- .1 The following concrete surfaces shall receive a "High Quality Surface Finish":
 - .1 Abutment endposts, barrierwalls, and outside edges of the deck;
 - .2 Columns and cap beams;
 - .3 Vertical faces and bottom side of rigid frame grade separation Structures; and
 - .4 Safety curbs and sidewalks with exposed concrete surfaces.
- .2 All other concrete surfaces shall receive an "Ordinary Surface Finish" unless otherwise directed by the Engineer.
- .3 The Contractor shall cast, for a barrierwall, a site reference panel 3 m in length.
 - .1 The reference panel shall be cast separate from the Structure.
 - .1 With the approval of the Engineer this 3 m reference panel may be cast in place on the Structure. No further barrier walls shall be placed until this is accepted. If this reference panel is not accepted it shall be removed and replaced at the Contractor's own expense.

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- 302.4.11.1.3 .2 The panel shall be cast in the same orientation, with the same formwork material and reinforcing that shall be incorporated into the Work.
- .3 The panel shall be cast with the same concrete mix and method of placement, curing and protection that shall be applied for the barrierwalls.
 - .1 The surface finish shall be reviewed for approval by the Engineer.
- .4 Once the reference panel is accepted, it shall remain on-site for the purpose of comparison in assessing compliance of the high quality finish for the barrierwalls.
- .5 The Contractor shall be responsible for the removal and disposal of the site reference panel, outside of the Work Site.
- .4 For components other than barrierwalls, the Contractor and the Engineer shall jointly select an area of the component and the Contractor shall finish the area such that the area is acceptable to the Engineer.
 - .1 The selected finished area shall be used for comparison purposes in assessing compliance with the finish required for the component.
- 302.4.11 .2 Defects Formed Surfaces
 - .1 Immediately after the removal of forms any part of the Work which displays defects shall be clearly marked and the Contractor shall notify the Engineer of the location and extent of the defect for her/his review.
 - .1 The Contractor shall submit a repair procedure for approval.
 - .1 Cement washes of any kind shall not be used.
 - .2 All defects shall be finished smooth, uniformly colour matched and flush with the adjacent surface.
- 302.4.11. .3 Defects Bridge Deck
 - .1 Immediately after cessation of curing, the Contractor shall uncover, clean and allow the entire deck surface to dry, to facilitate inspection by the Engineer. The Engineer will determine if the deck slab surface fulfils the requirements of the contract. If the deck slab surface is generally acceptable, the Engineer may require repairs to isolated local defects which shall begin within 14 Days after placement of concrete. Repairs shall be in accordance with the following guidelines.
 - .1 Isolated local depressions/defects less than 5 mm deep shall be removed by grinding the adjacent area, provided the specified cover is maintained within tolerance.
 - .1 If removal of the depression/defect by means of grinding cannot be carried out while maintaining specified cover then the affected area shall be repaired per 302.4.11.3.2.
 - .2 Isolated local depressions/defects more than 5 mm deep shall be removed and replaced as follows:
 - .1 If the depression/defect has an area less than 0.03 m² then the perimeter of the affected area shall be cut to a depth of 19 mm, chipped to a depth of 25 mm, and patched with an Engineer approved repair material.

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- 302.4.11.3.2 .2 If the depression/defect has an area greater than 0.03 m² then the affected concrete shall be removed in accordance with the provisions of Item 372.4 as a Partial Depth Removal and replaced with concrete of the same mix proportions as the parent deck concrete.
- .3 Individual isolated local defects less than 25 mm in diameter and less than 5 mm deep may be filled with an Engineer approved product compatible with the waterproofing system.
- .4 All repairs are subject to the approval of the Engineer, and groupings or large numbers of defects will not be considered isolated.
- 302.4.11 .4 Ordinary Surface Finish
- .1 All surface voids larger than 12 mm in diameter and cavities or holes visible upon the removal of the formwork, shall be filled to their entire depth, with an approved cement grout mix of cement and fine sand from the same source as used in the concrete and incorporate a latex bonding agent.
- .2 All objectionable fins, projections, offsets, streaks or other surface imperfections shall be totally removed to the Engineer's satisfaction.
- .3 If the concrete surface does not adequately fulfill the requirements for Ordinary Surface Finish, the Contractor shall, as directed by the Engineer, entirely remove certain designated portions, or all of the concrete, and replace with new concrete.
- 302.4.11 .5 High Quality Surface Finish
- .1 Prior to finishing, and without defacing the surface, the Contractor shall pressure wash the surface to identify all air voids.
- .2 The surface shall first be given an Ordinary Surface Finish as specified in 302.4.11.4.
- .3 Small surface voids due to entrapped air shall be cleaned to remove surface laitance and filled, to their entire depth, with an approved cement grout mix of cement and fine sand from the same source as used in the concrete and incorporating a latex bonding agent.
- .4 The entire surface shall be finished to produce a sack-rubbed finish as defined by CSA A23.1.
- 302.4.11 .6 Bridge Deck Surface Preparation
- .1 The entire deck shall be shot blasted, and/or using equivalent means, achieve an anchor profile which is clean of all foreign materials, such as asphalt, oil, grease, and is free of any sharp protrusions and of laitance.
- .2 The final concrete surface profile shall range between a CSP 1 and a CSP 5 as defined by the International Concrete Repair Institute (ICRI) Technical Guideline No. 03732.
- .1 Surface profile shall not interfere with the adhesion of the waterproofing membrane to the concrete deck.
- .1 Contractor shall submit a repair procedure to the Engineer for approval of areas that are noncompliant.

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- 302.4.11.6 .3 Areas where rapid setting patching materials have been approved for use by the Engineer shall be cured for minimum of 72 hours, or longer when recommended by the product manufacturer's written specifications, prior to applying primer or installing membrane.
- .4 The entire surface shall then be swept and cleaned by pressure washing and oil-free compressed air, to the satisfaction of the Engineer.
- .5 Deck surface shall be allowed to dry for a minimum of 7 Days after cessation of curing and in accordance with the waterproofing manufacturer's written specifications, prior to applying membrane.

302.4 .12 Quality Testing

302.4.12 .1 General

- .1 The Contractor shall provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the initial curing period. The storage facilities shall be furnished with a temperature monitoring device capable of measuring the minimum and maximum temperature range within the unit over a 24 hour period. Storage of test specimens shall conform to the latest version of CSA A23.2-3C.
- .2 Suitable facilities shall be provided by the Contractor, for the Engineer to inspect all ingredients and processes used in the manufacture and delivery of concrete, adjacent to the placing location.
- .3 Samples shall be obtained at final point of discharge unless otherwise specified by the Engineer.
- .4 The Contractor is responsible for supplying concrete which shall have, at the point of final discharge, the characteristics specified in the Contract Documents.

302.4.12 .2 Quality Control Testing

- .1 The Contractor shall carry out Quality Control sampling/testing during the concrete placement, including air, temperature, slump and density testing.
- .1 Results of Quality Control tests shall be recorded and made available to the Engineer.
- .2 Tests shall be conducted by personnel certified under ACI Concrete Field Testing Technician Grade 1, or CSA A283.
- .2 Test specimens shall be sampled in accordance with CSA A23.2-1C.
- .3 The air content of each load, or batch, of concrete shall be tested until consistent and acceptable air content is established, at which point testing frequency may be reduced, at the discretion of the Engineer. Should a test fail to meet the requirements, the frequency of testing shall return to one test per load, or batch, until acceptable air content consistency is re-established.

302.4.12 .3 Quality Assurance Testing

- .1 The Owner shall carry out Quality Assurance testing on samples obtained, as per 302.4.12.1.3, by the Contractor.

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- 302.4.12.3.1 .1 If the measured slump or air content falls outside the limits specified a check test shall be made immediately on another portion of the same sample.
- .1 This concrete load, in the event of a second failure, shall be considered to have failed to meet the requirements of this specification, and shall be rejected.
- .2 Density and Yield tests shall be made, as required by the Engineer, to meet the requirements of CSA A23.2-6C.

302.4.12 .4 Age of Compressive Strength Testing

- .1 The Contractor shall determine the age of test and shall be indicated on the submitted concrete mix design.
- .1 In the absence of a Contractor initiated request, the age requirements stipulated in CSA A23.1 for the specified exposure class shall apply.
- .2 Strength tests shall be performed at 7 days, 28 days, and 56 days.
- .1 The 56 day strength test may be omitted if the submitted age of test request is less.

302.4.12 .5 Frequency of Compressive Strength Testing

- .1 Frequency of compressive strength testing shall conform to the schedule indicated in Table 302-4 and per 302.4.12.4.
- .2 For each age of compressive strength test (7, 28, & 56 Days) two tests, as defined in 302.4.12.4.1, shall be required, unless otherwise indicated on the concrete mix submittal.
- .1 A test, as defined in 302.4.12.8.1 to be broken at the specified age submitted with the mix design.

Table 302-4
Frequency of Compressive Strength Testing (Concrete)

Number of Cubic Metres in Placing Operation	Minimum No. of Trucks to be Tested
up to 50	2
51 - 100	3
101 - 200	4
over 200	See Note 1
NOTE: 1. An additional test shall be taken for each additional 100 cubic metres of concrete placed. 2. Only one test will be performed for concrete placements consisting of one truck load.	

302.4.12 .6 Hardened Air Void Testing Frequency

- .1 A minimum of two cylinders shall be taken for hardened air void testing from each placement and cured for a minimum of 7 Days.
- .1 Concrete placements consisting of only one truck load of concrete will have only one cylinder tested.

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- 302.4.12.6 .2 The hardened air void testing shall be carried out by the Owner.
- .3 All tests must be performed as per ASTM C457. Regardless of water to cementing material ratios, the hardened air void system shall meet the following:
 - .1 The average of all tests shall have a spacing factor not exceeding 0.230 mm, with no single test greater than 0.260 mm.
 - .4 In the event the hardened air void system does not meet these requirements, production of concrete shall cease until it can be shown that these requirements can be met on a consistent basis.
 - .1 Subsequent testing to achieve a satisfactory hardened air void system shall be carried out by the Contractor at his own expense.
 - .5 Concrete cast with a noncompliant hardened air void system shall be evaluated by the Engineer and may be subject to removal and replacement at the Contractor's own expense.
- 302.4.12 .7 Permeability Testing Frequency
 - .1 A minimum of two cylinders shall be taken for permeability testing from each placement and shall be cured for 56 Days. Testing shall be carried out in accordance with ASTM C1202. Concrete placements consisting of only one truck load of concrete will have only one cylinder tested.
 - .1 The cylinders shall be prepared for testing immediately after the 56 days of curing.
 - .1 Where sample preparation or testing falls on a weekend, testing shall be conducted at an age not to exceed 60 Days.
 - .1 The age of cure and the age at test date shall be reported.
 - .2 The permeability testing shall be carried out by the Owner.
 - .1 Results are to be provided to the Contractor within 3 Days of the test being completed.
 - .2 The average must fall within the pay range established in Table 302-6, with no single result greater than 200 Coulombs above the pay range.
 - .1 A single result greater than 200 Coulombs above the pay range will result in the payment being reduced to the next lower level.
 - .3 A value of 200 Coulombs shall be subtracted from test results for concrete containing calcium nitrite corrosion inhibitor calculation payment adjustment.
 - .4 In the event that testing results in a reduction in payment, referee testing may be requested and conducted by the Contractor.
 - .1 A minimum of two cores shall be taken from the component in question and shall be tested within 7 Days of the original test date.
 - .2 If referee testing indicates the original test results are not representative then the referee testing will prevail.

302.4.12 .8 Compressive Strength Testing

- .1 Strength tests shall mean the average strength of two-companion 150 mm by 300 mm or three companion 100 mm by 200 mm test cylinder specimens taken from the same batch and tested at the same age.
- .2 Test specimens shall be tested at the age of test submitted with concrete mix design, unless otherwise approved by the Engineer, and shall meet the requirements of CSA A23.2-9C.
- .3 To meet the strength requirements of this Item, the average of all tests shall exceed the specified strength.
 - .1 When three or more tests of the same type of concrete are available, the average of any three consecutive tests shall be equal to or greater than the specified strength, and no individual test shall be less than 90% of the specified strength.
 - .2 Concrete that does not meet specified strength shall be subject to Payment Adjustment per 302.5.7.
- .4 If tests indicate that concrete in a placement does not meet the specified strength, the concrete in that placement shall be deemed noncompliant.
 - .1 Depending upon the severity of the noncompliant concrete, the Engineer may require complete removal, or:
 - .1 The Contractor may submit a proposal for repair of the noncompliant concrete to the Engineer for consideration.
 - .2 Any additional testing requested by the Contractor shall be subject to approval of the Engineer.
 - .1 Additional testing shall be conducted at the Contractors own expense.
 - .3 If the remedial measures are accepted by the Owner and the noncompliant concrete is allowed to remain, the concrete in the placement shall be paid according to Table 302-5.
 - .2 If the noncompliant concrete is removed and replaced, the concrete incorporated into the placement shall be paid according to 302.6.5.
- .5 Additional tests of cylinders, cured entirely under field conditions, shall be required to check the adequacy of curing, cold weather protection or to facilitate the removal of formwork. The Contractor shall provide the quantity of test specimens to be cast and the schedule for testing to the Engineer prior to each concrete placement.
 - .1 Test cylinders shall be stored as near as possible to the point in the Structure that the test cylinders represent, and shall be afforded the same temperature protection and moisture environment as the Structure.
 - .2 At the end of the curing period the test cylinders shall be left in place, exposed to the weather in the same manner as the Structure.

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302.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the specified volume, measured in cubic metres, of concrete supplied, placed and finished in accordance with this Item.
 - .1 The volume shall be the lesser of the computed volume of concrete as determined from the design dimensions presented in the Contract Documents or the actual volume of concrete placed.
- .2 For beam supported concrete deck slabs the computed volume of concrete in Structures "D" shall include the concrete calculated based on the actual beam camber profile.
- .3 On partial depth concrete removal and replacement under Item 372, the volume shall be the actual quantity of concrete placed.
- .4 For footing and working slab concrete where Overexcavation in solid rock occurs payment shall be handled as follows:
 - .1 For Overexcavation down to a maximum of 150 mm below the specified elevation of the bottom of the footing the computed volume of the footing concrete shall be determined from design plan footing dimensions presented in the Contract Documents and the average depth of the footing.
 - .2 For Overexcavation in excess of 150 mm below the specified elevation of the bottom of the footing, the width and length of the working slab concrete will be as shown on Standard Drawing 302-3, and the average depth of the working slab shall be determined from the bottom of the excavation up to the specified elevation of the bottom of the footing.
 - .1 Concrete required to provide a working slab under footings shall be paid at the Contractor's invoice price from the supplier.
- .5 The specified volume of tremie concrete for which payment shall be made shall be the volume contained within cofferdams assuming the theoretical horizontal dimensions as shown in the Contract Documents and the base and upper surface elevations as measured in the field and in accordance with 302.4.5.1.2.
- .6 Measurement of concrete in Structures, calculated on the dimensions shown in the Contract Documents, shall not be affected by the formwork tolerances listed in Item 958.
- .7 The Price Adjustment for Control of Strength shall be paid in accordance with Table 302-5, based on the Owner's Quality Assurance testing.

Table 302-5
Price adjustment for Control of Strength

For Concrete in Structures A, B , C and D				
Strength	50 MPa+	45-49 MPa	40-44 MPa	Less than 40MPa- To be reviewed by Engineer
Payment per cubic metre component	100%	-\$50	-\$100	Removal or -\$200 (per 302.4.12.8.4)

- .8 The price adjustment for Resistance to Chloride Ion Penetration shall be paid in accordance with Table 302- 6.
 - .1 A bonus is not applied to footing concrete.

Table 302-6
Price Adjustment for Resistance to Chloride Ion Penetration

For Exposure Class C-XL in CSA A23.1					
Coulombs after corrosion inhibitor correction (ASTM C1202)	0-500	500-1000	1000-1500	1500-2000	> 2000
Payment per cubic metre for component (\$/m ³)	\$25	\$0	-\$25	-\$50	-\$200

302.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of concrete, as identified under the Contract.
- .2 The Owner shall make partial payment in accordance with 908.7 for associated materials identified in 302.2.4.1.
- .3 For failure to maintain wet curing on all concrete surfaces of a placement, in accordance with 302.4.8, the Contractor shall be subject to a penalty of \$1000 for the first occurrence, \$2000 for the second occurrence and \$5000 for each occurrence thereafter. If there are more than two occurrences on the same section of concrete, the concrete shall be removed and replaced at the Contractors expense.
 - .1 An occurrence shall be when an inspection reveals that the concrete surface is not visibly wet. If proper curing is not reinstated within 2 hours of notification to the Contractor, this shall be considered a separate occurrence.
- .4 Where noncompliant concrete is removed and replaced in accordance with 302.4.12.8.4.2, the concrete incorporated into the component shall be paid in accordance with Table 302-5.
- .5 Where concrete does not meet the requirements for strength or hardened air voids or is otherwise rejected, but is allowed to remain in place, there will be no positive payment adjustments for any of the properties.

REINFORCING STEEL

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304.1 DESCRIPTION

- .1 This Item consists of supplying and placing of reinforcing steel.

304.2 MATERIALS

- .1 All material shall be supplied by the Contractor.
- .2 Reinforcing steel shall be designated as follows:
 - .1 Reinforcing Steel "A" for non-coated reinforcing steel.
 - .2 Reinforcing Steel "SS" for Solid Stainless Steel reinforcing bars.
- .3 All Reinforcing Steel "A" shall be new billet steel conforming to current CAN/CSA G30.18, "Carbon Steel Bars for Concrete Reinforcement", Grade 400W.
- .4 All Reinforcing Steel "SS" shall be Solid Stainless Steel Reinforcing Bars conforming to the requirements of A955/A955M-07A and CSA-S6 "Deformed and Plain Stainless Steel Bars for Concrete Reinforcement" and shall be Type 316LN. The minimum yield strength shall be 400 MPa. The design of the reinforcing bars, including hooks, development lengths and bar splices shall be based on a yield strength of 400 MPa.
- .5 Reinforcing steel shall be in the form of deformed round bars unless otherwise noted in the Contract Documents.
- .6 Reinforcing steel shall be free of physical defects.
- .7 Reinforcing steel shall be bent to proper shape in a plant having suitable devices for bending reinforcing steel as recommended in The Reinforcing Steel Institute of Canada, (RSIC), Manual of Standard Practice, unless otherwise noted in Contract Documents.
- .8 Heating shall not be used as an aid in bending steel, unless specifically authorized by the Engineer.
- .9 Welding or splicing shorter bars as a substitute for supplying bars of the specified lengths shall not be permitted.
 - .1 For stainless steel reinforcing, splicing of shorter bars as a substitute for supplying bars of the specified length will be considered for approval. The additional quantity required by this substitution will not be considered for payment.
- .10 Bars are subject to rejection if their actual weight varies from their theoretical weight, as specified in CAN/CSA G30.18, Grade 400W, by more than 5%.
- .11 All Structures are designed using Metric (SI) reinforcing steel bar sizes and the Contractor shall supply accordingly.
- .12 Bar splice couplers shall be supplied in accordance with the Contract Plans.
- .13 No field bending of reinforcing will be allowed unless authorized by the Engineer.

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304.2 .14 Stainless steel reinforcing bars at the time the concrete is placed shall be free of mud, oil, or other contaminants that adversely affect bonding strength and deposits of iron and non-stainless steels, as well as other physical defects. If mill scale is present, it shall be removed by pickling or abrasive blasting.

.15 Tie wire used to tie stainless steel reinforcing bars to stainless steel reinforcing bars and to Type "A" reinforcing bars shall be Type 316LN or Type 316L stainless steel wire, 1.2 or 1.6 mm in diameter.

304.3 SUBMITTALS

.1 The Contractor shall submit the manufacturer's certification that the materials supplied meet the specified requirements, at least 14 Days in advance of the commencement of the Work.

.2 The Contractor shall submit proof of certification for the welders conducting the Work, prior to commencing the Work.

.1 All welders shall be certified by the CWB in accordance with CSA W186, and/or to a certification level of Qualified Welder as issued by the Province of New Brunswick.

.3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

304.4 CONSTRUCTION

304.4 .1 General

.1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

.1 Stainless steel rebar shall be used in the barrier walls and top mat deck reinforcing as shown on the Plans.

.2 The Work shall be in accordance with CSA A23.1, and Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

.3 The Contractor shall handle and store the reinforcing steel in a manner that ensures it is not damaged or contaminated with dirt or other materials.

.4 Prior to delivery of reinforcing steel, bars or groups of bars shall be tagged in a durable fashion.

.1 Tags shall indicate designation letters and number assigned to bars on the Plans.

.5 Reinforcing steel shall be stored on skids at least 150 mm above ground.

.6 Stainless steel reinforcing bars shall be stored separately from reinforcing steel bars.

.7 Stainless steel reinforcing shall be protected from direct contact with chlorides prior to embedment in concrete.

.8 Nylon or polypropylene slings are to be used when lifting stainless steel reinforcing.

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304.4.1 .9 When stainless steel reinforcing bars are to be lifted by machinery or mechanical equipment, the reinforcing bars must be protected such that no damage or scratching will occur to the reinforcing bars.

304.4 .2 Placing and Fastening

.1 Immediately before placing, reinforcing steel shall be free of oil, dirt, mill scale, loose or excessive rust or other coatings that would reduce bond to concrete.

.1 Reinforcing steel shall be maintained in this clean condition until embedded in concrete and reinforcing steel about to be embedded in concrete shall be free of loose hardened concrete.

.2 Reinforcement shall be accurately positioned, secured and supported, using bar supports and side form spacers, to ensure proper concrete cover and spacing within allowable tolerances before and during placement of concrete.

.3 Bars shall be fastened together at all intersections, except where the spacing is less than 300 mm in each direction in which case fastening at alternate intersections of each bar with other bars shall be permitted provided the Contractor can demonstrate to the Engineer that this shall hold all the bars securely in position.

.4 In deck slabs, the top bar on the top mat shall be tied securely to the stirrups of the precast prestressed concrete beam or the connectors on the steel beam.

.1 Spacing of the ties shall not exceed 900 mm centre along the entire length of the beams.

.5 The Contractor shall ensure flexing of the reinforcing steel partially embedded in the Work shall not occur until the concrete has attained a minimum compressive strength of 20 MPa.

.6 Work on partially embedded reinforcing steel shall continue only when the previously placed concrete has attained a minimum compressive strength of 20 MPa.

.7 Prior to the deposition of concrete the positioning and securing of the reinforcing steel shall be inspected and approved by the Engineer.

304.4 .3 Support of Reinforcement

304.4.3 .1 Bar Supports

.1 Bar supports shall have sufficient strength and stiffness to carry the loads from the reinforcement, construction crew and concrete pressures without failure, displacement or significant deformation.

.2 Bar supports shall be spaced such that any sagging between supports shall not reduce the specified concrete cover.

.3 Bar supports shall be made of plastic or stainless steel.

.1 Commercially available precast concrete bar supports, or Engineer approved equivalent, shall be used for bar supports that are in contact with soil.

.1 Precast concrete bar supports shall be made of concrete with a quality at least equal to that specified for the member into which the bar supports are integrated.

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- 304.4.3.1.3.1.1 .1 Geometry of bar support or embedded tie wires shall keep rebar securely fastened.
- .2 Stacking of bar supports shall not be permitted.
- .4 Bar chairs for supporting stainless steel reinforcing bars shall be non-metallic. Concrete chairs shall not be used to support stainless steel reinforcing bars.
- .5 Bar supports shall be nonconductive and have a geometry and bond characteristics that deter the movement of moisture from the surface to the reinforcement.
- .6 Bar supports in contact with the soil shall have a base area of less than 10,000 mm².

- 304.4.3 .2 Side Form Spacers
- .1 Side form spacers shall have provisions to enable them to be firmly secured to the reinforcement.
- .2 Side form spacers shall meet the requirements of 304.4.3.1, Bar Supports.
 - .1 Wheel spacers shall be used when prefabricated cages are inserted into formwork.

- 304.4.3 .3 Internal Spacers
- .1 Spacers for maintaining the specified distance between layers of reinforcement shall be made from reinforcing bars or steel rods.
 - .1 Spacers shall be positioned and securely fixed between the layers of reinforcement and shall not protrude in the cover concrete.

- 304.4 .4 Welding
- .1 Column spirals shall be lap welded, when so specified, using E49 Series low hydrogen electrodes and in accordance with the requirements of CSA W186.
- .2 The welding of reinforcement, including tack welding, is prohibited unless otherwise indicated in the Contract Documents.

- 304.4 .5 Testing
- .1 Additional reinforcing steel, required to replace that altered by testing, shall be provided by the Owner under the terms of this Item, unless the reinforcing steel is shown, by testing, to be in non-conformance with the Specifications, then the reinforcing steel shall be provided by the Contractor.

- 304.4 .6 Tolerances
- .1 Unless otherwise specified in the Contract Documents, reinforcing steel shall be constructed within tolerances listed in Table 304-1.
- .2 The tolerances listed in Table 304-1 and those presented in Table 958-1 for formwork are not cumulative.

Table 304-1
Reinforcing Steel Tolerances

Fabrication Tolerances	Cutting to length		(+) 10 mm, (-) 25 mm	
	Hooked bars	out-to-out of hooks	for 25M bars or smaller	± 10 mm
			for bars larger than 25M	+10 mm/ - 40 mm
	Spirals or circular ties	out-to-out dimension	± 5 mm	
Column ties or stirrups	out-to-out dimension	± 5 mm		
Placing Tolerances	Reinforcing steel shall be placed in specified positions within the following tolerances unless otherwise noted in the Contract Documents:			
	Where the depth (d) of a flexural member, the thickness of a wall or slab or the smallest dimension of a column is:			
	200 mm or less	± 3 mm		
	200 mm to 750 mm	± 6 mm		
	more than 750 mm	± 10 mm		
	Longitudinal locations of bends and ends of bars	± 25 mm *		
*Note: Cover may not be reduced by more than 10 mm or increased by more than 20 mm at the end of a member.				
Spacing Tolerances	Reinforcing steel shall be spaced at the specified spacing within the following tolerances unless otherwise noted in the Contract Documents			
	Footings		± 10 mm	
	Columns	notwithstanding the stated tolerance, all column bars must be in contact with spirals in round columns, and must be in contact with stirrups and in corners of stirrups for rectangular columns	± 10 mm	
	Deck bars and walls		± 10 mm	
	Tee beams	notwithstanding the stated tolerance, all bars must be in contact with stirrups and in the corners and hooks	± 10 mm	
Bar Cover Tolerances		± 10 mm		

304.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of kilograms of reinforcing steel supplied and placed in accordance with this Item.

304.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of reinforcing steel, as identified under the Contract.
- .2 The Owner shall make partial payment for reinforcing steel in accordance with 908.7.

- 304.6 .3 The cost of the provision of materials, labour and Equipment to test the reinforcing steel to resolve disagreement between the Owner and the Contractor shall be borne by the Contractor if the test results show that the material does not meet the Specifications, otherwise the Owner shall bear the cost of the test.
- .1 The cost of any retesting to resolve the supply of the specified reinforcing steel shall be borne by the Contractor.

TENSION SPLICES

ITEM: 305

305.1 DESCRIPTION

- .1 This Item consists of the splicing of reinforcing steel bars 25M and larger.

305.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Tension reinforcing bar connections shall be able to develop a minimum of 125% of the yield stress of the bars being spliced.
- .3 Materials shall be stored in a weatherproof enclosure.

305.3 SUBMITTALS

- .1 The Contractor shall submit the name of the supplier and the manufacturer/supplier's technical data information, including yield stress, at least 14 Days in advance of the Work.
- .2 The Contractor shall submit the manufacturer's instructions and recommended procedures for installation.

305.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The preparation and installation of the splice shall be in accordance with the manufacturer's instructions.
 - .1 The Contractor, upon request, shall make available, at the site, a representative of the supplier to ensure that preparations and installation procedures are as recommended by the manufacturer.
- .3 The Engineer reserves the right to test any or all splices.

305.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tension splices constructed in accordance with this Item.

305.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 The Owner shall make partial payment for tension splices in accordance with 908.7.
- .3 The cost of the provision of materials, labour and Equipment to test the tension splices to resolve disagreement between the Owner and the Contractor shall be borne by the Contractor if the test results show that the splice does not meet the Specifications, otherwise the Owner shall bear the cost of the test.
 - .1 The cost of any retesting to resolve the adequacy of the tension splice shall be borne by the Contractor.

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311.1 DESCRIPTION

- .1 This Item consists of the installation of steel H piles and the supply and installation of cap plates and pile points.
- .2 This Item includes the supply and installation of 800 mm diameter by 3000 mm long corrugated galvanized steel pipe, the EPS Type 4 insulation board, the uniformly graded aggregate, and the excavation and any required measures to install the corrugated pipe, when shown on the Plans.

311.2 MATERIALS

- .1 The steel H piles shall be made available by the Owner from stock at the DTI Bridge Yard on Currie Avenue in Fredericton, NB, FOB during normal working hours.
 - .1 Steel H piles shall be in accordance with the requirements of CAN/CSA G40.20/G40.21, Grade 350W and the stock lengths may vary from 6 to 18 metres depending on available stock at the time of the Contract.
- .2 All other materials shall be supplied by the Contractor.
- .3 Steel used for pile cap plates shall meet the requirements of CAN/CSA G40.21, Grade 300W.

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311.2 .4 Cap plates and pile points for HP 310x79, HP 310x132 and HP 360x132 piles shall be supplied as shown on Standard Drawing 311-1 and 311-2.

.1 Where there is another pile size indicated in the Contract Document, the Contractor shall supply the pile points and the respective pile cap plates fabricated in accordance with the details presented in the Contract Documents.

.5 Piles shall be stored in an organized, straight and horizontal fashion to avoid permanent distortion. Caps and points shall be acceptably stored on pallets or blocked at least 150 mm off the ground.

.6 Electrodes for the Shielded Metal Arc Welding (SMAW) process shall be certified by the Canadian Welding Bureau (CWB), conform to CSA W48, "Filler Metals and allied materials for metal arc welding", and be classified as E4918 or E4918-1.

.7 Electrodes for the Flux Cored Arc Welding (FCAW) process shall be certified by the Canadian Welding Bureau (CWB), conform to CSA W48, and be classified as gas shielded, E49XT-XX or E49C-XX with a specified minimum Charpy V-Notch Impact Property equal to 27 Joules at -30 °C.

.1 Electrodes shall have a diffusible hydrogen designator of -H16 or less.

311.3 SUBMITTALS

.1 The Contractor shall submit, at least 7 Days in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements.

.2 The Contractor shall submit proof of certification for the welders conducting the Work, prior to commencing the Work.

.1 All welders shall be certified by the CWB to CAN/CSA W47.1, and/or to a certification level of Qualified Welder as issued by the Province of New Brunswick.

.3 The Contractor shall submit, for approval by the Engineer, the proposed electrodes for the FCAW process.

.4 The Contractor shall submit, for approval, at least 14 Days in advance of any pile installation, a detailed description and drawing of the proposed driving system(s) including, the manufacturer's specifications for the hammer and driving system including the leads proposed.

.1 The submission shall provide the full details of characteristics necessary to evaluate performance, including but not limited to: the manufacturer's name, type of hammer, rated energy per blow at the normal working rate, the mass of the striking parts of the hammer, the mass of the driving cap and the type and elastic properties of the hammer and pile cushion materials.

.2 The submission shall also include, but not be limited to, the following minimum requirements:

.1 The leads employed shall be supported independent of the pile;

.2 Impact of the pile driving hammer shall be axial and square with respect to pile axis; and

.3 Leads shall be immobile during hammer operation but shall be capable of adjustment to accommodate changing the centre of gravity of the driving system during driving.

.5 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

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311.4 CONSTRUCTION

311.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall carry out the Work with a pile driving system(s) capable of developing the capacity as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .3 The Contractor shall install all cap plates and pile points, in accordance with the details presented on Standard Drawings 311-1 and 311-2.
- .4 The Contractor shall splice the pile sections in accordance with the Standard Drawings 311-3, 311-4 and 311-5 and at the approved locations to meet the Work requirements in accordance with this Item.

311.4 .2 Pile Installation

- .1 The installation of each pile shall be subject to the approval of the Engineer who shall be the sole judge of the acceptability of each pile with respect to the final driving resistance, depth of penetration or other criteria used to determine the capacity of the pile.
- .2 The Contractor shall ensure that the piles are installed in accordance with the specified criteria, provided by the Engineer and based on the Contractor's approved driving system(s).
 - .1 During driving, pile heads showing evidence of damage such as curled flange tips which indicate that the pile stiffness is compromised, shall be trimmed immediately prior to finalizing, and immediately prior to each retapping sequence.
 - .1 When the pile damage is evident only after removal of the hammer from the pile, the pile head shall be trimmed and the pile redriven to the specified capacity.
 - .2 If, in the opinion of the Engineer, the pile head damage results in unnecessary loss of Owner supplied material, or causes excessive uncertainty in estimating pile capacity; and is a result of misaligned, worn, or poorly fitting driving equipment, or improper pile driving technique; the Contractor shall adjust, modify or replace the driving equipment or methods so that further damage does not occur.
 - .3 Followers shall only be used with the expressed written consent of the Engineer.
 - .4 The first pile driven at any pile group location shall be driven to finalization, prior to commencing the driving of other pile(s) within the same group.
 - .1 This pile shall be used to determine pile length and minimize splices and material waste.
 - .5 Any piles which become displaced as the result of the driving of adjacent piles shall be retapped to re-establish the finalization criteria and the specified capacity.

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- 311.4.2 .6 Piles which are subject to relaxation shall be retapped and/or driven until it can be demonstrated that the permanent pile capacity meets or exceeds the specified capacity.
- .1 All retaps shall be conducted with a hammer warmed by applying a minimum of 20 blows on a pile other than the pile to be tested or any adjacent piles.
 - .2 Retaps shall not be carried out within 24 hours of the end of the previous driving of that pile or any adjacent pile(s) within a clear distance of 3 m and forming part of the group.
 - .3 Retaps shall, as a minimum, advance the pile a distance of 150 mm or reach a total of 50 blows whichever occurs first.
 - .4 Retaps shall continue until 120% of the specified pile capacity has been achieved and upon retap this value does not fall below 100% of the specified pile capacity.
 - .5 The Contractor shall keep detailed field notes on all retapping tests to confirm that the above provisions have been met, prior to cutting the piles to final grade.
 - .7 The Contractor shall ensure that a minimum of 500 mm of pile length remains above the specified cut-off elevation after finalization and the Contractor shall cut all piles at the specified grade in a horizontal plane only after finalization of the pile has been approved by the Engineer.

311.4 .3 Pile Installation Tolerances

- .1 The Contractor shall ensure that the pile remains within the specified tolerances throughout the entire length of the driven pile.
- .2 All piles shall be driven with a variation of not more than 10 mm/m from vertical or from the batter specified in the Contract Documents.
- .3 In no case shall the total variation exceed 100 mm from the specified location.
- .4 Pile tolerances shall be measured at the ground line and at the cut-off elevation and in no cases shall piles be loaded horizontally to move the pile within the specified tolerances.
- .5 For piles outside the specified tolerances, the Contractor shall submit a report, for the approval of the Engineer, stamped and signed by a Professional Engineer, detailing the findings and, if required, any corrective measure(s) to remedy the Work.
 - .1 The Contractor shall carry out all remedial Work.

311.4 .4 H Pile Splices, Cap Plate and Pile Point Connections, and Welds

- .1 Welding of field and shop splices for steel H piles, cap plate and pile point connections shall be by the SMAW or FCAW process.
- .2 The Engineer may request to have the welder tested or approved on the welding procedures outlined in the Specifications.
- .3 Basic electrodes of E480 classification that are not used within 4 hours after removal from ovens shall be dried for at least one hour at a temperature between 370 °C and 430 °C before being used.

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- 311.4.4 .4 Roughness of oxygen cut surfaces shall not be greater than that defined by the ANSI Surfaces Roughness Value of 1000.
- .1 Roughness exceeding this value and occasional notches or gouges, not more than 5 mm deep on otherwise satisfactory surfaces, shall be removed by machining or grinding.
 - .2 Oxygen cut surfaces and edges shall be left free of adhering slag.
 - .3 Corrections of defects shall be flared to the oxygen cut surface with a Slope not exceeding 1 in 10.
- .5 Defects of oxygen cut surfaces shall not be repaired by welding except with the express approval of the Engineer for correction of occasional notches or gouges less than 10 mm deep.
- .1 These weld repairs shall be made by suitably preparing non-conforming surfaces, welding with basic electrodes not exceeding 4 mm in diameter, observing applicable SMAW requirements of 311.4.5 and grinding the completed weld smooth and flush with adjacent surface to produce a satisfactory finish.
- .6 Joint Profiles shall be as detailed on Standard Drawings 311-3, 311-4 and 311-5.
- .7 The workmanship of the assembly shall meet the standards of CAN/CSA W59.
- .8 Welding of steel made of CAN/CSA G40.21, Grade 300W of 20 mm thickness and under, shall not require preheating when base metal temperature is above 0°C.
- .1 When base metal temperature is 0°C or lower, the base metal shall be preheated to at least 10°C and maintained at a minimum temperature of 10°C during welding.
- .9 Steel over 20 mm shall be preheated to 10°C before any welding is done.
- .10 No welding shall be done when the ambient temperature is lower than -18°C.
- .11 The preheating zone shall be a minimum of 75 mm on each side of the joint.
- .12 Protection shall be provided for welding under adverse weather conditions of wind and/or precipitation.
- .1 All methods of protection shall be subject to the approval of the Engineer prior to any welding being carried out.
- .13 No pile shall be driven until the welded joint has been inspected and approved by the Engineer.
- .14 When piles have been welded within a heated enclosure during cold weather, the pile shall not be removed from this enclosure until the welded joint has cooled so that it is warm to the bare hand.

311.4 .5 Procedures for Shielded Metal Arc Welding And Flux Cored Arc Welding

311.4.5 .1 General

- .1 The details of welding procedure, workmanship and technique shall conform to CAN/CSA W59.
 - .1 The design and construction provisions for Cyclically Loaded Structures of Clause 12 of CAN/CSA W59 shall apply.
- .2 The Work shall be positioned for flat position welding whenever practical.
- .3 When welding in vertical positions progression for all passes shall be upward.
- .4 Before welding over previously deposited metal, slag shall be removed, and welds and adjacent base metal shall be brushed clean.
 - .1 This requirement shall apply not only to successive layers but also to successive beads and to the crater area when welding is resumed after interruption.
- .5 Classification and size of electrodes, arc length, voltage and amperage shall be suitable for thickness of material, type of groove, welding positions and other circumstances pertaining to the Work.
 - .1 Welding current shall be within the range recommended by the electrode manufacturer.
- .6 For SMAW, the maximum size of electrode, the maximum thickness of layers and the maximum size of one-pass fillets shall be as indicated in Table 311-1.

Table 311-1
Criteria for Prequalified Joints using the SMAW Process

Maximum size of Electrode	4 mm ϕ	All passes in vertical fillet and groove welds
	5 mm ϕ	All passes in overhead fillet and groove welds
		All passes in horizontal groove welds
		Root passes in grooves with backing where the root opening is less than 6 mm in flat position
	6 mm ϕ	Root passes in grooves without backing in flat position
		All passes for horizontal fillet welds
		Root passes for fillets in flat position
	8 mm ϕ	Root passes in grooves with backing where the root opening is greater than 6 mm in flat position
All passes subsequent to root passes for fillet and groove welds made in the flat position		
Maximum Thickness of Layers	6 mm	For root passes of groove welds with the minimum size being such as to prevent cracking
	5 mm	For subsequent layers of welds made in any position
Maximum One-pass Fillet	10 mm	In the flat position
	8 mm	In the horizontal or overhead positions
	12 mm	In the vertical position

- 311.4.5.1 .7 For FCAW the maximum size of electrode, the maximum thickness of layers and the maximum size of one-pass fillets shall be as indicated in Table 311-2.

Table 311-2
Criteria for Prequalified Joints using the FCAW Process

Maximum size of Electrode	4 mm ϕ	All passes in flat and horizontal positions
	2.4 mm ϕ	For the vertical position
	2.0 mm ϕ	For the overhead position
Maximum Thickness of Layers	6 mm	All weld layers except for root and surface layers A multiple pass, split-layer technique shall be used in making all multiple pass welds when the width of the layer exceeds 22 mm
Maximum One-pass Fillet weld	12 mm	In the flat and vertical positions
	10 mm	In the horizontal position
	8 mm	In the overhead position

311.4.5 .2 Details

- .1 Butt joint groove welds, except those produced with the aid of backing, shall have the root of the initial weld air carbon-arc gouged, chipped or ground to sound metal before welding is started from the second side.
 - .1 Particular care shall be taken in the gouging, chipping or grinding operation so that the remaining weld metal or base metal is not nicked or undercut.
 - .2 Defective portions of the weld shall be removed without substantial removal of the base metal.
- .2 Groove welds made with the use of backing shall have the weld metal thoroughly fused with the backing.
- .3 Steel H pile splice groove welds shall be terminated at ends of a joint in a manner to ensure sound welds by use of extension bars or runoff tabs.
 - .1 Extensions shall be removed upon completion and cooling of the weld, and the ends of the weld made smooth and flush with the edges of the abutting parts.
- .4 When tack welds are used for alignment, care shall be exercised by properly grinding or preparing stops and starts to make continuous welding satisfactory.
- .5 Flux, pin holes, craters, visual surface defects and excessive crown shall be removed before depositing the next layer of weld.
- .6 Stringer beads shall be used for horizontal welds.

311.4 .6 Inspection of Welds311.4.6 .1 Inspection and Testing of Welds

- .1 The procedure and technique for visual and non-destructive testing shall be in accordance with CAN/CSA W59, Clauses 7 and 8.
- .2 Inspection and Testing Organizations shall demonstrate to the Engineer that the methods they propose to use for non-destructive testing are suitable, and meet one of the following requirements:
 - .1 The methods for non-destructive testing shall be as approved by the Province of New Brunswick.
 - .2 The Welding Inspection Organization shall be certified to CSA W178.1, Certification of Welding Inspection Organizations.
- .3 Guided bend tests shall be carried out on coupons in accordance with CAN/CSA W47.1 Section 8.5 and shall be tested by the Engineer.
 - .1 Runoff tabs required for bend tests shall be made of the same material and thickness as the H pile.
 - .2 Guided bend test coupons may be taken from the actual pile splice by removing the coupon from a steel H pile splice.
 - .3 If the Engineer determines that a guided bend test coupon fails to meet the standard, he/she may then test sufficient coupons as she/he feels are necessary to provide assurance that the balance of the welding is satisfactory.
 - .4 The preparation of these test coupons shall be done by the Contractor before the pile splice is driven below the ground.
 - .5 The Contractor shall restore the pile to its original condition, if the weld is acceptable.
 - .6 The length of the weld on 75 mm long runoff tabs shall be a minimum of 65 mm.

311.4.6 .2 Frequency of Inspection and Testing

- .1 All welds shall be inspected visually.
- .2 Testing shall be carried out by the Engineer as follows:
 - .1 A minimum of 25% of full penetration groove welds and steel H pile splices shall be tested by non-destructive testing methods (radiographic and/or ultrasonic test methods and supplemented by magnetic particle or liquid penetrant test methods as required) to assure the soundness and quality level of the welds.
 - .2 A minimum of 25% of fillet welds shall be tested by non-destructive testing methods (magnetic particle and/or liquid penetrant test methods) to assure the soundness and quality level of the welds.

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- 311.4.6.2.2 .3 Welds in steel H pile splices may also be tested by guided bend tests on specimens made from a portion of field spliced material removed from the H pile.
- .1 These specimens shall have the backing removed by mechanical means or by flame cutting to within 3 mm of its thickness followed by grinding or machining.
 - .2 All guided bend test coupons shall be stamped by the welder.
 - .3 Non-destructive testing may be performed on coupons instead of guided bend tests.
 - .4 If defects are identified that are outside the criteria specified in 311.4.6.3, the Engineer shall determine the additional percentage of testing that shall be carried out to ensure the soundness and quality level of all the welds.
 - .5 All corrected welds are to be retested.

- 311.4.6 .3 Quality of Welds
- .1 The quality of welds in steel H pile splices shall be in accordance with CAN/CSA W59, Section 12, clause 12.5.4.
 - .2 The acceptance criteria for defects shall be in accordance with CAN/CSA W59 clause 12.5.4 and shall meet the limits described in this clause for tension welds.
 - .3 The quality of weld required for guided bend tests shall be in accordance with CAN/CSA W47.1, clauses 8.5 and 8.6.

311.4 .7 Dynamic Pile Testing

- .1 Piles, as identified in the Contract Documents and/or as specifically directed by the Engineer, shall be dynamically tested during driving for measurement and estimation of mobilized resistance, hammer performance, pile stress and soil dynamic properties at the end of initial driving and during all retaps.
- .2 The Engineer, based on the results of dynamic testing and analysis, shall determine the pile acceptance criteria.
- .3 The Contractor shall notify the Engineer at least 7 Days in advance of the pile driving operations.
- .4 The Contractor shall assist the Engineer in carrying out the testing.
- .5 The testing procedure shall be carried out in accordance with AASHTO T298-99.
- .6 The Contractor shall provide the Engineer with reasonable means of access to the pile for attaching instruments, with the pile in the leads.
 - .1 The Contractor shall provide a work platform, minimum size of 1.2 m by 1.2 m, capable of being raised to the top of the pile.
 - .2 The Engineer shall require approximately one hour per pile, per test, to attach the instruments.

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- 311.4.7 .7 The Contractor shall supply an electrical power supply of 20 Ampere, 115 Volts, 60 Hz, AC, for use by the Engineer during the tests.
- .1 Field generators shall be equipped with functioning voltage and frequency meters, and shall only supply electrical power for the pile testing.
- .8 The Contractor shall provide the Engineer with access for a motor vehicle (van) within 15 m of the pile test or a shelter within the same distance.
- .1 The shelter shall have a minimum floor size of 2.5 m by 2 m, a minimum ceiling height of 2 m, and the interior temperature shall be maintained above 10°C.
- .9 With the dynamic testing equipment attached to the pile, the Contractor shall drive to end of initial driving and retap the pile with a hammer of the specified size, as directed by the Engineer.
- .10 Stresses in the pile shall be monitored during driving to ensure that the stresses do not exceed 90% of the pile steel yield stress.
- .1 If directed by the Engineer, the Contractor shall reduce the driving energy delivered to the pile by means of cushion or helmet modifications, or by reducing the energy output of the hammer.
- .2 If non-axial driving is indicated by the measurements, the Contractor shall immediately realign the driving system.

311.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of piles, installed in accordance with this Item.
- .2 All piles shall be measured for payment only after all piles in any group or in close proximity to any other pile have been finalized and no further driving in the pile group shall be required.
- .3 The length to be measured for payment shall be the difference between the design cut-off elevation and the actual field toe elevation measured along the centreline axis of the pile.
- .4 The Quantity of splices to be measured for payment shall be the number of approved splices fabricated in accordance with this Item.
- .1 The Owner reserves the right to specify the number of splices to ensure the economical use of materials as well as to limit the amount of waste in pile cut-offs.

311.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of steel H pile, as identified under the Contract.
- .2 The Owner shall make partial payment in accordance with 908.7 for steel H pile stored at the Work Site.
- .3 Splices, approved by the Engineer, shall be paid in accordance with Item 810.
- .4 The cost of the provision of materials, labour and Equipment to test the welds shall be borne by the Contractor if the test results show that the material does not meet the specified requirements, otherwise the Owner shall bear the cost of the test.
 - .1 The cost of any testing to resolve the quality of welds shall be borne by the Contractor.
- .5 Retapping in excess of four operations, if required, shall be paid for in accordance with Item 812.

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312.1 DESCRIPTION

- .1 This Item consists of the supply and installation of steel pipe piles, including splicing as required, and the supply and installation of pile points.

312.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Steel pipe piles shall be nominal 500 mm OD with 13 mm wall thickness conforming to ASTM A252, Grade 3 or as otherwise indicated in the Contract Documents.

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- 312.2 .3 Pile points shall be supplied as shown on Standard Drawing 312-1 and the steel used for pile points shall meet the requirements of CAN/CSA G40.21 Grade 300W.
- .4 Piles shall be stored in an organized, straight and horizontal fashion with the bottom tier being blocked at least 150 mm off the ground and stickers placed between the tiers. Points shall be acceptably stored on pallets or stored at least 150 mm off the ground. Nylon or canvas slings shall be used to handle the pipe piles.
- .5 Electrodes for Shielded Metal Arc Welding (SMAW) process shall be certified by the Canadian Welding Bureau (CWB), conform to CSA W48, "Filler Metals and allied materials for metal arc welding", and be classified as E4918 or E4918-1.
- .6 Electrodes for the Flux Cored Arc Welding (FCAW) process shall be certified by the Canadian Welding Bureau (CWB), conform to CSA W48, and be classified as gas shielded, E49XT-XX or E49C-XX with a specified minimum Charpy V-Notch Impact Property equal to 27 Joules at -30 °C.
- .1 Electrodes shall have a diffusible hydrogen designator of H16 or less.
- .7 The protective coating shall meet the requirements of CAN/CGSB-1.171 for inorganic zinc coatings and CAN/CGSB-1.184 for coal tar epoxy coatings.
- .8 The coal tar epoxy coating shall be compatible with the inorganic zinc coating.

312.3 SUBMITTALS

- .1 The Contractor shall submit, at least 7 Days in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements.
- .2 The Contractor shall submit proof of certification for the welders conducting the Work, prior to commencing the Work.
- .1 All welders shall be certified by the CWB to CAN/CSA W47.1 and/or to a certification level of Qualified Welder as issued by the Province of New Brunswick.
- .3 The Contractor shall submit, for approval by the Engineer, the proposed electrodes for the FCAW process.
- .4 The Contractor shall submit, prior to the commencement of the inorganic zinc coating Work, certification from the manufacturer of the inorganic zinc coating stating that the proposed method, Equipment, and materials used in the blast cleaning are acceptable.
- .5 The Contractor shall submit, for approval, at least 14 Days in advance of any coating application, the applicator's name and schedule of Work.
- .1 The method of repair of a coating shall be submitted for approval 7 Days in advance of the repair.

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- 312.3 .6 The Contractor shall submit, for approval, at least 14 Days in advance of any pile installation, a detailed description and drawing of the proposed driving system(s) including, the manufacturer's specifications for the hammer and driving system including the leads proposed.
- .1 The submission shall provide the full details of characteristics necessary to evaluate performance, including but not limited to the manufacturer's name, type of hammer, rated energy per blow at the normal working rate, the mass of the striking parts of the hammer, the mass of the driving cap and the type and elastic properties of the hammer and pile cushion materials.
 - .2 The submission shall also include, but not be limited to, the following minimum requirements:
 - .1 The leads employed shall be supported independent of the pile.
 - .2 Impact of the pile driving hammer shall be axial and square with respect to pile axis.
 - .3 Leads shall be immobile during hammer operation but shall be capable of adjustment to accommodate changing the centre of gravity of the driving system during driving.
 - .7 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

312.4 CONSTRUCTION

312.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall carry out the Work with a pile driving system(s) capable of developing the capacity as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .3 The Contractor shall fabricate and install all pile points, in accordance with the details presented on Standard Drawing 312-1.
- .4 The Contractor shall splice the pile sections in accordance with Standard Drawing 312-2 and at the approved locations to meet the Work requirements in accordance with this Item.
- .5 The Contractor must take special care during handling and driving operations to minimize damage to the pile protective coatings.
 - .1 Any damage done to the coatings of the pipe pile casings shall be repaired to the satisfaction of the Engineer prior to driving the pile.

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- .1 Steel pipe piles shall be supplied with a protective coating system, consisting of an application of inorganic zinc coating, and coal tar epoxy coating.
- .1 All Work shall be performed in a heated weatherproof enclosure.
- .2 Each coating shall be cured in accordance with the manufacturer's recommendations prior to transport.

312.4.2 .2 Surface Preparation

- .1 The exterior of all steel pipe piles shall be blast cleaned to conform to SSPC - SP5 - No. 5, White Metal Blast Cleaning.
- .2 The blasting medium (silica sand, grit or shot) used shall be of a size that produces a surface profile acceptable to the manufacturer of the inorganic zinc coating being used.
 - .1 No cleaning shall be carried out when the surface of the steel pipe pile casings are damp.
 - .2 The blasted surfaces must be coated with inorganic zinc coating before any rusting occurs.
 - .3 Under no circumstances are blast cleaned surfaces to be left uncoated overnight.
 - .4 If the blast cleaned areas become damp, these surfaces shall be re-blasted to white metal after drying.
- .3 All surfaces shall be free of dust, dirt, moisture, oil and grease prior to the application of a coating.

312.4.2 .3 Inorganic Zinc Coating

- .1 The inorganic zinc coating shall be mixed and applied to the white metal surface with airless spray equipment and cured at the proper temperature for the minimum curing period, in accordance with the manufacturer's recommendations.
- .2 The inorganic zinc coating shall be applied to obtain a dry film thickness of 60 μm (one coat) with tolerance of $\pm 5 \mu\text{m}$.
- .3 Before applying the inorganic zinc coating, the coating applicator shall be required to tape 75 mm on each end of the steel piles to facilitate pile splicing in the field.
 - .1 The inorganic zinc coating shall be applied to the splice and the taped area in accordance with this Item.

312.4.2 .4 Coal Tar Epoxy Coating

- .1 A coal tar epoxy coating shall be applied over the inorganic zinc coating on the steel pipe piles.
- .2 The coal tar epoxy shall have dry film thickness of 400 µm and shall be applied and cured in accordance with the coal tar epoxy manufacturer's recommendations.
- .3 Before applying the coal tar epoxy coating, the coating applicator shall be required to tape 150 mm on each end of the steel piles to facilitate pile splicing in the field.
 - .1 The coal tar epoxy coating shall be applied to the splice and the taped area in accordance with this Item.
- .4 If a post-cured inorganic zinc coating is used, no coal tar epoxy shall be applied to the inorganic zinc coated pipe pile until all curing solution has been removed in accordance with the recommendations of the manufacturer of the coatings.

312.4.2 .5 Inspection of Coatings

- .1 Each Day's Work shall be inspected by the Engineer not later than the Day following application of the coatings.
- .2 Blast cleaned surfaces are to be approved by the Engineer before the commencement of the inorganic zinc coating application.
- .3 Inspection of the completed coatings shall be based upon Elcometer or other magnetic detector readings.
 - .1 Inadequately coated sections and areas requiring re-coating shall be identified by the Engineer.
 - .2 If such areas are close together, the Engineer may require re-coating of the entire zone.
 - .3 The re-coated zone shall be re-inspected and shall meet the approval of the Engineer.
- .4 Where rejection of a coating is due to poor workmanship or similar deficiency in the quality of the Work or materials, the Contractor shall remove the entire defective section of all previously applied material prior to re-application.
- .5 At the discretion of the Engineer, an occasional spot test may be made using a sharp chisel (or other means) to remove a small section of the coating to physically gauge the coating thickness as a "proof test".
 - .1 Where such tests are made, the areas shall be recoated.

312.4 .3 Pile Installation

- .1 The installation of each pile shall be subject to the approval of the Engineer who shall be the sole judge of the acceptability of each pile with respect to the final driving resistance, depth of penetration or other criteria used to determine the capacity of the pile.
- .2 The Contractor shall ensure that the piles are installed in accordance with the specified criteria, provided by the Engineer and based on the Contractor's approved driving system(s).
 - .1 During driving with an external hammer, pile heads showing evidence of damage such as curled pipe wall which indicate that the pile stiffness is compromised, shall be trimmed immediately prior to finalizing, and immediately prior to each retapping sequence.
 - .1 When the pile damage is evident only after removal of the hammer from the pile, the pile head shall be trimmed and the pile redriven to the specified capacity.
 - .2 If in the opinion of the Engineer, the pile head damage causes excessive uncertainty in estimating pile capacity; and is a result of misaligned, worn, or poorly fitting driving equipment, or improper pile driving technique; the Contractor shall adjust, modify or replace the driving equipment or methods so that further damage does not occur.
 - .2 Immediately prior to internal driving a plug of dry concrete having a compacted height of 2.5 times the pile diameter shall be deposited in the base of the pile.
 - .1 The ratio of cement:stone:sand shall be 1:2:4, with a water-to-cementing materials ratio of 0.25.
 - .2 Driving shall be discontinued on a plug after 90 minutes from the time of mixing.
 - .1 After 90 minutes a smaller charge (50% of initial volume) of fresh concrete shall be added.
- .3 Followers shall only be used with the express consent of the Engineer.
- .4 The first pile driven at any pile group location shall be driven to finalization, prior to commencing the driving of other pile(s) within the same group.
- .5 Any piles which become displaced as the result of the driving of adjacent piles shall be retapped to re-establish the finalization criteria and the specified capacity.
- .6 Piles which are subject to relaxation shall be retapped and/or driven until it can be demonstrated that the permanent pile capacity meets or exceeds the specified capacity.
 - .1 All retaps shall be conducted with a hammer warmed by applying a minimum of 20 blows on a pile other than the pile to be tested or any adjacent piles.
 - .2 Retaps shall not be carried out within 24 hours of the end of the previous driving of that pile or any adjacent pile(s) within a clear distance of 3 m and forming part of the group.
 - .3 Retaps shall, as a minimum, advance the pile a distance of 150 mm or reach a total of 50 blows whichever occurs first.

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- 312.4.3.6 .4 Retaps shall continue until 120% of the specified pile capacity has been achieved and upon retap this value does not fall below 100% of the specified pile capacity.
- .5 The Contractor shall keep detailed field notes on all retapping tests to confirm that the above provisions have been met, prior to cutting the piles to final grade.
- .7 The Contractor shall ensure that a minimum of 500 mm of pile length remains above the specified cut-off elevation after finalization and the Contractor shall cut all piles at the specified grade in a horizontal plane only after finalization of the pile has been approved by the Engineer.

312.4 .4 Pile Installation Tolerances

- .1 The Contractor shall ensure that the pile remains within the specified tolerances throughout the entire length of the driven pile.
- .2 The Contractor shall be responsible to remove all foreign materials and water from within the entire length of the pile.
- .3 All piles shall be driven with a variation of not more than 10 mm/m from vertical or from the batter specified in the Contract Documents.
- .4 In no case shall the total variation exceed 100 mm from the specified location.
- .5 Pile tolerances shall be measured at the ground line and at the cut-off elevation and in no cases shall piles be loaded horizontally to move the pile within the specified tolerances.
- .6 For piles outside the specified tolerances, the Contractor shall submit a report, for the approval of the Engineer, stamped and signed by a Professional Engineer, detailing the findings and, if required, any corrective measures to remedy the Work.
- .1 The Contractor shall carry out all remedial Work.

312.4 .5 Pipe Pile Splices, Pile Point Connections, and Welds

- .1 Welding of field and shop splices for steel pipe piles and pile point connections shall be by the SMAW or FCAW process.
- .2 The Engineer may request to test or otherwise have the welder approved on the procedures outlined in the Specifications.
- .3 Basic electrodes of E480 classification that are not used within 4 hours after removal from ovens shall be dried for at least one hour at a temperature between 370°C and 430°C before being used.
- .4 Roughness of oxygen cut surfaces shall not be greater than that defined by the ANSI Surfaces Roughness Value of 1000.
- .1 Roughness exceeding this value and occasional notches or gouges, not more than 5 mm deep on otherwise satisfactory surfaces, shall be removed by machining or grinding.
- .2 Oxygen cut surfaces and edges shall be left free of adhering slag.
- .3 Corrections of defects shall be flared to the oxygen cut surface with a Slope not exceeding 1 in 10.

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- 312.4.5 .5 Defects of oxygen cut surfaces shall not be repaired by welding except with the express approval of the Engineer for correction of occasional notches or gouges less than 10 mm deep.
- .1 These weld repairs shall be made by suitably preparing non-conforming surfaces, welding with basic electrodes not exceeding 4 mm in diameter, observing applicable SMAW requirements of 312.4.6 and grinding the completed weld smooth and flush with adjacent surface to produce a satisfactory finish.
- .6 The joint detail of the complete penetration groove weld for the butt joint in pipe piles shall be that shown on Standard Drawing 312-2.
- .7 The workmanship of the assembly shall meet the standards of CAN/CSA W59.
- .8 Welding of steel pipe piles shall not require preheating when base metal temperature is above 0°C.
- .1 When base metal temperature is 0°C or lower, the base metal shall be preheated to at least 10°C and maintained at this minimum temperature during welding.
- .9 No welding shall be done when the ambient temperature is lower than -18°C.
- .10 The preheating zone shall be a minimum of 75 mm on each side of the joint.
- .11 No welding shall be done when there is a wind and/or when it is raining unless proper protection is provided.
- .1 All methods of protection shall be subject to the approval of the Engineer prior to any welding being carried out.
- .12 No pile shall be driven until the welded joint has been inspected and approved by the Engineer.
- .13 When piles have been welded within a heated enclosure during cold weather, the pile shall not be removed from this enclosure until the welded joint has cooled so that it is warm to the bare hand.

312.4 .6 Procedure for Shielded Metal Arc Welding and Flux Cored Arc Welding

312.4.6 .1 General

- .1 The details of welding procedure, workmanship and technique shall conform to CAN/CSA W59.
 - .1 The design and construction provisions for Cyclically Loaded Structures of Clause 12 of CAN/CSA W59 shall apply.
 - .2 The Work shall be positioned for flat position welding whenever practical.
 - .3 When welding in vertical positions progression for all passes shall be upward.
 - .4 Before welding over previously deposited metal, slag shall be removed and welds and adjacent base metal shall be brushed clean.
 - .1 This requirement shall apply not only to successive layers but also to successive beads and to the crater area when welding is resumed after interruption.

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- 312.4.6.1.1 .5 Classification and size of electrodes, arc length, voltage and amperage shall be suitable for thickness of material, type of groove, welding positions and other circumstances pertaining to the Work.
- .1 Welding current shall be within the range recommended by the electrode manufacturer.
- .6 For SMAW, the maximum size of electrode, the maximum thickness of layers and the maximum size of one-pass fillets shall be as indicated in Table 312-1.
- .7 For FCAW the maximum size of electrode, the maximum thickness of layers and the maximum size of one-pass fillets shall be as indicated in Table 312-2.

Table 312-1
Criteria for Prequalified Joints using the SMAW Process

Maximum size of Electrode	4 mm ϕ	All passes in vertical fillet and groove welds
	5 mm ϕ	All passes in overhead fillet and groove welds
		All passes in horizontal groove welds
		Root passes in grooves with backing where the root opening is less than 6 mm in flat position
		Root passes in grooves without backing in flat position
	6 mm ϕ	All passes for horizontal fillet welds
		Root passes for fillets in flat position
		Root passes in grooves with backing where the root opening is greater than 6 mm in flat position
	8 mm ϕ	All passes subsequent to root passes for fillet and groove welds made in the flat position
	Maximum Thickness of Layers	6 mm
5 mm		For subsequent layers of welds made in any position
Maximum One-pass Fillet	10 mm	In the flat position
	8 mm	In the horizontal or overhead positions
	12 mm	In the vertical position

Table 312-2
Criteria for Prequalified Joints using the FCAW Process

Maximum size of Electrode	4 mm ϕ	All passes in flat and horizontal positions
	2.4 mm ϕ	For the vertical position
	2.0 mm ϕ	For the overhead position
Maximum Thickness of Layers	6 mm	All weld layers except for root and surface layers A multiple pass, split-layer technique shall be used in making all multiple pass welds when the width of the layer exceeds 22 mm
Maximum One-pass Fillet weld	12 mm	In the flat and vertical positions
	10 mm	In the horizontal position
	8 mm	In the overhead position

312.4.6 .2 Details

- .1 Butt joint groove welds except those produced with the aid of backing shall have the root of the initial weld air carbon-arc gouged, chipped or ground to sound metal before welding is started from the second side.
 - .1 Particular care shall be taken in the gouging, chipping or grinding operation so that the remaining weld metal or base metal is not nicked or undercut.
 - .2 Defective portions of the weld shall be removed without substantial removal of the base metal.
- .2 Groove welds made with the use of backing shall have the weld metal thoroughly fused with the backing.
- .3 When tack welds are used for alignment, care shall be exercised by properly grinding or preparing stops and starts to make continuous welding satisfactory.
- .4 Flux, pin holes, craters, visual surface defects and excessive crown shall be removed before depositing the next layer of weld.
- .5 Stringer beads shall be used for horizontal welds.

312.4 .7 Inspection of Welds

312.4.7 .1 Inspection and Testing of Welds

- .1 The procedure and technique for visual and non-destructive testing shall be in accordance with CAN/CSA W59, Clauses 7 and 8.
- .2 Inspection and Testing Organizations shall demonstrate to the Engineer that the methods they propose to use for non-destructive testing are suitable, and meet one of the following requirements:
 - .1 The methods for non-destructive testing shall be as approved by the Province of New Brunswick.
 - .2 The Welding Inspection Organization shall be certified to CSA W178.1, Certification of Welding Inspection Organizations.
- .3 Guided bend tests shall be carried out on coupons in accordance with CAN/CSA W47.1 Section 8.5 and shall be tested by the Engineer.
 - .1 Guided bend test coupons may be taken from the actual pile splice by removing the coupon from a steel pipe pile splice.
 - .2 If the Engineer determines that a guided bend test coupon fails to meet the standard, he/she may then test sufficient coupons as she/he feels are necessary to provide assurance that the balance of the welding is satisfactory.
 - .3 The preparation of these test coupons shall be done by the Contractor before the pile splice is driven below the ground.
 - .4 The Contractor shall restore the pile to its original condition, if the weld is acceptable.

312.4.7 .2 Frequency of Inspection and Testing

- .1 All welds shall be inspected visually.
- .2 Testing shall be carried out by the Engineer as follows:
 - .1 A minimum of 25% of full penetration groove welds and steel pipe pile splices shall be tested by non-destructive testing methods (radiographic and/or ultrasonic test methods and supplemented by magnetic particle or liquid penetrant test methods as required) to assure the soundness and quality level of the welds.
 - .2 A minimum of 25% fillet welds may be tested by non-destructive testing methods (magnetic particle and/or liquid penetrant test methods) to assure the soundness and quality level of the welds.
 - .3 Welds in steel pipe pile splices may also be tested by guided bend tests on specimens made from a portion of field spliced material removed from the pipe pile.
 - .1 These specimens shall have the backing removed by mechanical means or by flame cutting to within 3 mm of its thickness followed by grinding or machining.
 - .2 All guided bend test coupons shall be stamped by the welder.
 - .3 Non-destructive testing may be performed on coupons in lieu of guided bend tests.
 - .4 If defects are identified that are outside the criteria specified in 312.4.7.3, the Engineer shall determine the additional percentage of testing that shall be carried out to ensure the soundness and quality level of all the welds.
 - .5 All corrected welds are to be retested.

312.4.7 .3 Quality of Welds

- .1 The quality of welds in steel pipe pile splices shall be in accordance with CAN/CSA W59, Section 12, clause 12.5.4.
- .2 The acceptance criteria for defects shall be in accordance with CAN/CSA W59 clause 12.5.4 and shall meet the limits described in this clause for tension welds.
- .3 The quality of weld required for guided bend tests shall be in accordance with CAN/CSA W47.1, clauses 8.5 and 8.6.

312.4 .8 Dynamic Pile Testing

- .1 Piles, as identified in the Contract Documents and/or as specifically directed by the Engineer, shall be dynamically tested during driving for measurement and estimation of mobilized resistance, hammer performance, pile stress and soil dynamic properties at the end of initial driving and during all retaps.
 - .1 Piles to be tested shall be driven with an external hammer.
- .2 The Engineer, based on the results of dynamic testing and analysis, shall determine the pile acceptance criteria.

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- 312.4.8 .3 The Contractor shall notify the Engineer at least 7 Days in advance of the pile driving operations.
- .4 The Contractor shall assist the Engineer in carrying out the testing.
- .5 The testing procedure shall be carried out in accordance with AASHTO T298-99.
- .6 The Contractor shall provide the Engineer with reasonable means of access to the pile for attaching instruments, with the pile in the leads.
- .1 The Contractor shall provide a work platform, minimum size of 1.2 m by 1.2 m, capable of being raised to the top of the pile.
- .2 The Engineer shall require approximately one hour per pile, per test, to attach the instruments.
- .7 The Contractor shall supply an electrical power supply of 20 Ampere, 115 Volts, 60 Hz, AC, for use by the Engineer during the tests.
- .1 Field generators shall be equipped with functioning voltage and frequency meters, and shall only supply electrical power for the pile testing.
- .8 The Contractor shall provide the Engineer with access for a motor vehicle (van) within 15 m of the pile test or a shelter within the same distance.
- .1 The shelter shall have a minimum floor size of 2.5 m by 2 m, a minimum ceiling height of 2 m, and the interior temperature shall be maintained above 10°C.
- .9 With the dynamic testing equipment attached to the pile, the Contractor shall drive to end of initial driving and retap the pile with a hammer of the specified size, as directed by the Engineer.
- .10 Stresses in the pile shall be monitored during driving to ensure that the stresses do not exceed 90% of the pile steel yield stress.
- .1 If directed by the Engineer, the Contractor shall reduce the driving energy delivered to the pile by means of cushion or helmet modifications, or by reducing the energy output of the hammer.
- .2 If non-axial driving is indicated by the measurements, the Contractor shall immediately realign the driving system.

312.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of piles supplied and installed in accordance with this Item.
- .2 All piles shall be measured for payment only after all piles in any group or in close proximity to any other pile have been finalized and no further driving in the pile group shall be required.
- .3 The length to be measured for payment shall be the difference between the design cut-off elevation and the actual field toe elevation measured along the centreline axis of the pile.

312.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of steel pipe pile, as identified under the Contract.
- .2 The Owner shall make partial payment in accordance with 908.7 for steel pipe pile stored at the Work Site.
- .3 The cost of the provision of materials, labour and Equipment to test the welds shall be borne by the Contractor if the test results show that the material does not meet the specified requirements, otherwise the Owner shall bear the cost of the test.
 - .1 The cost of any testing to resolve the quality of welds shall be borne by the Contractor.
- .4 Retapping in excess of four operations, if required, shall be paid for in accordance with Item 812.

STEEL SHEET PILE COFFERDAMS

ITEM: 321

321.1 DESCRIPTION

- .1 This Item consists of the design, supply, construction and removal of all steel sheet pile cofferdam(s) required in the Contract.

321.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 All steel sheet pile shall conform to CAN/CSA G40.20 and G40.21 and, as a minimum, shall be Grade 300W steel.
- .3 The Contractor shall supply the sheet pile in lengths such that the toe elevation specified in the Contract Documents is achieved and an undamaged pile is provided up to the specified cofferdam flooding elevation with due consideration given to driving.
- .4 The Contractor may use welded steel sheet pile section(s) provided that:
 - .1 Welded splices in steel sheet pile shall conform to the requirements of CAN/CSA W59.
 - .2 Welded steel sheet pile splices shall be prequalified full penetration groove welds.
 - .3 Upon the request of the Engineer, the Contractor shall test a minimum of 25% of welded steel sheet pile splices by radiographic inspection.
 - .4 The acceptance for welded steel sheet pile splices shall be as specified in Clause 12 of CAN/CSA W59 for tension welds in dynamically loaded Structures.
 - .1 If unacceptable weld defects are found in welded steel sheet pile splices, the Engineer shall reject the pile section, or
 - .2 Subject to the approval of the Engineer, the Contractor may undertake to have the weld defects corrected and the splices retested.
- .5 The Contractor shall supply the corners for the cofferdam, in lengths as long as the sheet pile supplied.
- .6 Materials shall be stored in an organized, straight and horizontal fashion to avoid permanent deformation.

321.3 SUBMITTALS

- .1 The Contractor shall be responsible for the design of the cofferdam and associated bracing and shall submit the design, in accordance with Item 956.
 - .1 The Contractor shall ensure that the dimensions of the cofferdam shall remain at least as large as that shown in the Contract Documents.
 - .1 The sheet piling sections and corner details shown on the drawings are based on one commercially available product selected to determine the minimum size of the footing and to determine the specified volume of the tremie concrete in accordance with 302.5.5.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

321.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall design and construct all cofferdams to be adequately braced to withstand the anticipated design loadings and to be as watertight as practically possible.
- .3 Steel sheet piles in cofferdams constructed before or during the winter months of any year shall be pulled or cut off to final elevation before March 1st of the following year, unless otherwise approved in writing.
- .4 Work on cofferdams may not start until the June 15th of each year unless otherwise approved in writing.
- .5 Steel sheet piles shall be driven to conform with the limits as shown in the Contract Documents and as defined by 321.3.1 and are subject to the tolerances indicated in Table 321-1.

Table 321-1
Cofferdam Sheet Pile Tolerances

Horizontal alignment of walls	± 8 mm per metre of plan length of wall
Vertical Alignment of walls	± 10 mm per metre of vertical length of wall
Misplacement or Eccentricity	± 50 mm parallel to building line, or centreline of Bridge
	± 75 mm perpendicular to building line or centreline of Bridge

- .6 Cofferdams tilted or moved out of position as per 321.4.5, during driving shall be righted or enlarged to provide necessary clearance and proper location.
- .7 Cofferdam walls shall be vented to permit cofferdam flooding at an elevation not higher than the specified cofferdam high water design elevation.
- .8 Cross struts or bracing may extend through foundation concrete when indicated on the cofferdam design and having been approved by the Engineer.
- .9 Excavation shall not be made outside of cofferdams, and the existing stream bed adjacent to the structure shall not be disturbed, unless specifically permitted in the Contract Documents or in writing by the Engineer.
- .10 Steel sheet piles may remain in place as a part of the permanent structure or they may be removed at the option of the Contractor.
 - .1 When the steel sheet piles are to remain in place and form part of the permanent structure, the Contractor shall cut off the steel sheet piles evenly at the elevation indicated in the Contract Documents.
- .11 Superimposed loads shall not be placed on the surrounding soil immediately adjacent to cofferdam, unless specifically permitted in the Contract Documents, in writing by the Engineer or having been submitted as part of 321.3.1.

STEEL SHEET PILE COFFERDAMS

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- 321.4 .12 The Contractor shall wait a minimum of 72 hours following the completion of the placing of underwater (tremie) concrete before dewatering the cofferdam unless otherwise altered and approved in writing by the Engineer.
- .13 The Contractor shall ensure that adequate dewatering is provided so that all concrete to be placed on top of the tremie concrete is placed in the dry.
- .14 The Contractor shall familiarize himself with all permits, Item 948 and any environmental conditions at the site prior to the commencement of the dewatering which may, at the discretion of others, influence the chosen style of operations.
- .1 The Contractor shall be solely responsible for all compliance and undertakings relating to the dewatering discharge and shall maintain records of all pertinent dewatering discharge data required to verify and confirm continuous compliance with the permit parameters throughout the period of the Work.
- .2 The Contractor shall submit a Work plan outlining the scope of the proposed monitoring program and this program shall be of a form acceptable to DELG prior to the commencement of the Work.
- .3 A copy of all records shall be submitted to the Engineer on a weekly basis however the submission of this data does not relieve the Contractor of any responsibility with respect to the dewatering discharge.

321.5 MEASUREMENT FOR PAYMENT

- .1 The design, supply, construction and removal of all steel sheet pile cofferdam(s) in accordance with this Item shall be on a lump sum basis.

321.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 The Owner shall make partial payment for steel sheet pile in accordance with 908.7.
- .1 Partial payment for used steel sheet pile shall be calculated on 30% of the estimated purchase price for new steel sheet pile.
- .3 The cost of carrying out the radiographic testing under 321.2.4.3 shall be shared equally by the Owner and the Contractor.
- .4 In the event that welded steel sheet pile splices are deficient under 321.2.4, all additional testing and repair and retesting of these splices shall be at the Contractor's own expense.
- .5 If the Contractor's cofferdam design, submitted under 321.3.1, results in cofferdam dimensions which are larger than the dimensions specified in the Contract Documents, the Contractor shall be responsible, at her/his own expense, to supply and place the additional concrete, in excess of the specified dimension, to complete the Work.

EXCAVATION WITHIN COFFERDAMS

ITEM: 322

322.1 DESCRIPTION

- .1 This Item consists of the excavation of all materials within cofferdams.

322.2 MATERIALS

- .1 None identified.

322.3 SUBMITTALS

- .1 None identified.

322.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All material shall be excavated to the full dimension of the cofferdam.
- .3 All excavated materials from inside the cofferdam, shall become the property of the Contractor and shall be disposed of outside of the Work Site.
- .4 Pre-excavation of the riverbed material shall not be permitted unless specifically noted as a requirement in the Contract Documents.

322.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the volume in cubic metres of material excavated within cofferdams in accordance with this Item.

322.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

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331.1 DESCRIPTION

- .1 This Item consists of the supply and installation of the precast prestressed concrete beams.
- .2 Prestressing Method - This specification refers to Bulb-Tee's, I-beams, box girders, slabs, hollow core slabs, single and double T-sections and similar Bridge products manufactured by the pretensioning method and in accordance with CAN/CSA S6.
- .3 All precast prestressed concrete Bridge elements under this Item shall be referred to as beams.

331.2 MATERIALS

.1 General

- .1 All materials and procedures shall be supplied by the Contractor.
- .2 Material properties shall conform to CSA A23.1, if not otherwise specified herein.

331.2 .2 Material Properties

331.2.2 .1 Aggregates

- .1 Aggregates used in concrete shall meet the material properties specified in accordance with 302.2.

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331.2.2 .2 Admixtures

- .1 A written statement shall be provided to the Engineer from the manufacturer stating that the admixture contains no purposely added calcium chloride.
- .2 The calcium nitrite corrosion inhibiting admixture shall contain between 30% to 36% calcium nitrite by weight of solution.

331.2.2 .3 Water

- .1 Water used in production and curing shall be clean and free from any materials which shall cause discoloration or harmful effects to the concrete.

331.2.2 .4 Composition of Mix

- .1 Concrete shall meet the requirements of CSA A23.1, exposure class C-XL.
- .2 Concrete shall have a slump not greater than 210 mm.
- .3 No materials shall be used in the mix design that contain purposefully added chloride compounds in any quantity.
- .4 A calcium nitrite corrosion inhibitor shall be added to the concrete at a dosage rate of 15 L/m³.
 - .1 The calcium nitrite shall be added at the concrete ready mix plant and verification shall be provided to the Engineer for the Quantity of the calcium nitrite added, to each batch of concrete.
 - .1 Acceptable verification shall include, but is not necessarily limited to, printouts from computerized batch plants or printouts from computerized admixture dispensing units.

331.2.2 .5 Stranded Wire

- .1 Prestressing strands shall be of the 7 wire stress-relieved stabilized type and shall meet the requirements of ASTM A416M and have an ultimate tensile strength of 1860 MPa unless otherwise specified in the Contract Documents.
 - .1 Wire welds, breaks, nicks, bends or any other defect shall not be permitted in any prestressing cable.
 - .2 All prestressing steel must be free of deleterious materials such as oil, grease, frost, paint, mill scale, loose rust, corrosion and any foreign material, which may prevent bond between steel and concrete.
 - .3 In pretensioning strands one approved splice per strand shall be permitted, provided the splice is not located within the concrete member. Welded strand joints or wire splices shall not be permitted in any reel or coil of strand.

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- 331.2.2.5 .2 All stranded wire shall be delivered in coils with a metal tag attached to each coil showing:
- .1 The manufacturer's name;
 - .2 The heat number;
 - .3 The coil number; and
 - .4 Each coil shall be accompanied by a stress-strain curve, showing:
 - .1 the corresponding information of the metal tag,
 - .2 ultimate strength,
 - .3 the date of manufacture, and
 - .4 the stress-strain curve from zero stress to ultimate.
 - .3 The shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel, and the care to be used in handling.
- 331.2.2 .6 Reinforcing Steel
- .1 Reinforcing steel shall be supplied in accordance with 304.2.
 - .2 Welding of reinforcing steel, including tack welding, is prohibited without the written permission of the Engineer.
- 331.2.2 .7 Inserts
- .1 Inserts shall be of sufficient capacity and of an approved type as specified and shall be placed in the location(s) as indicated by location in the Contract Documents.

331.3 SUBMITTALS

- .1 The Contractor shall submit shop drawings for the prestressing system in accordance with Item 956.
 - .1 The submission shall show the proposed arrangement, location and details, indicating inserts; manufacture, size, type and ultimate strength of tendons, sequence and rate of tensioning in order to provide prestressing forces and eccentricities as detailed in the Contract Documents.
- .2 All prestressing Work shall be carried out by a qualified Contractor or subcontractor, pre-qualified in accordance with Item 907.
- .3 The Contractor shall provide the following informational items, for review, a minimum of 21 Days prior to commencing prestressing Work:
 - .1 Standard test data certifying that all components of the stressing system conform to minimum specification requirements indicated for these components.
 - .2 The manufacturer shall provide quality control procedures for review.
- .4 The prestressing system is subject to approval by the Engineer and samples of material such as, but not limited to: pre-stress steel, hold-down/hold-up devices, anchors and couplings shall be submitted for approval, when requested by the Engineer.
 - .1 Samples submitted shall be accompanied by all necessary certificates, source of supply, date of manufacture and technical information, to enable the Engineer to carry out a full investigation.

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- 331.3.4 .2 Sufficient test specimens may be taken from each coil of prestressing steel and tested by the Owner to determine compliance with the requirements of this specification.
- .1 With each prestressing steel sample a certificate shall be submitted stating the manufacturer's minimum guaranteed ultimate tensile strength, the corresponding reel number and the date of manufacture.
- .5 The beam manufacturer shall provide the Engineer, in writing, the safety procedures that shall be in force during the period of beam manufacture, prior to the commencement of the manufacture of the beams.
- .6 The Contractor at the conclusion of the prestressing shall provide a copy of following records:
- .1 Date of tensioning;
- .2 Beam mark numbers and identification and location in the Structure;
- .3 Identification of jacking Equipment;
- .4 Required total load per strand;
- .5 Initial tension;
- .6 Anticipated and actual gauge pressure for each strand or strand group;
- .7 Anticipated and actual elongation; and
- .8 Any problems encountered.
- .7 Submittals are required in accordance with any cross-referenced Item and referred to as forming part of this Item.

331.4 CONSTRUCTION

.1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer and in accordance with CSA A23.4.
- .2 The Contractor shall provide certified copies of quality control tests related to this Contract as specified in CSA A23.4, and ASTM A416M.
- .3 The Contractor shall inspect prestressed concrete tendons in accordance with Canadian Precast Concrete Quality Assurance (CPCQA).
- .4 The Contractor shall provide records from in-house quality control programs based upon plant certification requirements to the Engineer for inspection and review.
- .5 The Contractor shall, upon request of the Engineer, provide certified copies of the mill test report(s) of the reinforcing steel supplied, showing physical and chemical analyses.
- .6 Precast plants shall keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and shall provide this information to the Engineer.
- .7 The prestressing plant shall conform to the following minimum requirements:
- .1 Only steel side forms and steel or concrete bottom forms shall be used for standard members.
- .2 Forms shall be clean, and of a configuration to ensure compliance with the tolerances outlined under this item and the Contract Documents.

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- 331.4.1.7 .3 Hydraulic jacks and pumps of sufficient capacity shall be used for tensioning cables and only accurately calibrated gauges for registering the stressing forces shall be used.
- .4 All chucks used for stressing, depressing or lifting pretensioning cables shall be an approved type of sufficient capacity and in good working order.
- .5 Safety devices shall be installed near the stressing bed to provide an adequate safety shield for the protection of workmen during stressing operations.
- .6 Cold weather facilities to enable complete fabrication out of the elements shall be provided between October 31st to May 1st.
- .8 Concrete shall not be placed until all forms, inserts, reinforcing steel and prestressing steel have been checked and approved for compliance with the Contract Documents and any drawings submitted under Item 956.
- .9 The concrete placement operation shall be in one continuous operation, without the formation of partially hardened layers of concrete.
- .1 For multiple beam set-ups, the mix design shall be adjusted so that the concrete remains plastic throughout the entire placement.
- .10 The Contractor shall provide regular and practically located office space at his/her prestressing plant to accommodate the Engineer or the Owner's representative.
- .1 The office space so provided shall be ventilated, heated, lighted and clean, and shall be furnished with a suitable standard office desk and chair.
- .1 The office room temperature shall be maintained at 20°C.
- .2 Convenient telephone, facsimile, photocopy, mail and message handling services shall also be provided.
- .11 The Contractor shall provide 7 Days written notice prior to commencement of any fabrication or change in fabrication schedule.
- 331.4 .2 Curing of Concrete
- .1 When the ambient temperature in the plant does not fall below 5°C and where the manufacturing facilities are protected from the wind and direct rays from the sun, curing and protection may be performed in accordance with CSA A23.1 and A23.4 and per 302.4.
- .2 Accelerated strength development may be attained by accelerated curing or heated concrete as defined in CSA A23.4.
- .3 When heated concrete method is used for accelerated strength development:
- .1 Heated concrete shall have a maximum plastic concrete temperature of 33°C.
- .2 The maximum temperature of the hardened concrete shall not exceed 60°C.
- .3 The maximum cooling rate of the concrete shall not exceed 15°C per hour.
- .4 When accelerated curing method is used for accelerated strength development:

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- 331.4.2.4
- .1 The accelerated curing shall not begin before the initial set.
 - .2 The accelerated curing shall provide excess moisture for proper hydration of the cement.
 - .3 In no instance shall the steam, radiant heat or forced air be directly applied to the concrete, forms or test cylinders.
 - .4 The beams shall be maintained on the casting bed in an approved enclosure, designed to ensure full circulation of thoroughly saturated air and/or steam around the beams with a minimum loss of moisture and heat.
 - .5 During the initial curing period (typically 4 to 5 hours after completion of casting) the temperature within the enclosure shall be maintained at approximately 20°C.
 - .6 For the next stage of curing, the temperature within the enclosure shall be raised at a rate not to exceed 15°C per hour to a minimum of 40°C and a maximum of 60°C.
 - .7 This temperature shall be maintained until the required strength for the transfer of prestress is reached.
- .5 The exposed surfaces of the concrete shall have an excess of moisture during the entire curing period.
- .1 If water is applied for this purpose, then this water temperature shall not vary from the concrete temperature by more than 10°C nor shall this temperature exceed 60°C.
- .6 Stress transfer shall take place when the concrete temperature is above 30°C.
- .1 Maximum temperature differential between the girder and the surrounding environment shall be 20°C.
 - .2 Additional measures may be required to prevent thermal shock. This may include insulated tarps, with or without an additional heating source, draped over the girders and stressing cables.
- .7 After transfer of stress the temperature shall be lowered at a maximum rate of 15°C per hour until the beam is at the ambient air temperature.
- .1 The beams shall not be exposed to temperatures below freezing until they have undergone two Days of drying in warm temperatures after the transfer of stress.
- .8 The Contractor/manufacturer shall provide a continuous record of curing temperatures for the entire curing period by means of approved accurate automatic recording devices, spaced one per beam to record the temperature throughout the length of the curing enclosure(s).
- .1 The maximum permissible temperature variation within the enclosure shall not exceed 5°C.
 - .2 Shop, girder and enclosure temperature records shall be submitted to the Engineer on a daily basis during production.
- .9 Forms shall not be removed until the concrete has obtained the specified release strength.

331.4 .3 Finishing of Concrete Surfaces

- .1 The top surface of precast beams shall be rough, clean, and free of laitance with a full amplitude of approximately 6 mm.
- .2 Immediately after the stripping of forms, the Engineer shall be informed of all cases where beams require patching.
 - .1 Proposed patching materials and methods for non-structural repairs shall be submitted for approval of the Engineer.
 - .2 The Engineer shall determine whether patching shall be done before or after the transfer of prestressing force.
 - .3 Beams with structural defects including cracks and honeycomb are subject to rejection if the load carrying capacity or durability are reduced.
 - .1 Repairs of a structural nature shall not be undertaken until the manufacturer's engineer has carried out and obtained the following:
 - .1 Investigated the structural implications of the defect or the damage.
 - .2 Established the cause of the defect or the damage.
 - .3 Received approval of the proposed repair from the Owner.
- .3 The permanently exposed surfaces of all beams shall be smooth and free from honeycomb, stain and laitance.
- .4 The Contractor shall pressure wash the surface to identify all air voids prior to final finishing.
- .5 Small surface voids shall be filled with an approved cement grout mix of cement and fine sand from the same source as used in the concrete and incorporating a latex bonding agent.
 - .1 The beams shall remain in a controlled temperature environment for a minimum time period of 48 hours after completion of the repair.
- .6 All bearing surfaces must be constructed in such a manner to give a smooth surface, true to lines and grades.
- .7 The prestressing steel shall be ground off with an inset at the ends of the beam and the end surfaces of the beam shall then be finished flush in an approved manner.
 - .1 Holddown devices in the bottom of the beam shall be finished similarly.
- .8 The end surfaces of all beams, except as specifically noted in the Contract Documents shall be coated with an approved asphalt or bituminous coating.
- .9 Concrete repairs shall be carried out and allowed to cure for a minimum time in a controlled temperature environment as recommended by the manufacturer of the repair material and approved by the Engineer.
- .10 Concrete surfaces not meeting the approval of the Engineer may be cause for rejection of the beam.

331.4 .4 Testing and Inspection

- .1 Concrete strength at transfer shall be determined by the Contractor in accordance with CSA A23.1 and as follows:
 - .1 In the presence of the Engineer, the Contractor shall cast cylinders and subsequently carry out a minimum of one transfer strength test and one 28-day strength test for each beam containing less than 10 m³ concrete, and not less than two transfer strength tests and two 28-day strength tests for each beam containing more than 10 m³ concrete.
 - .2 Each transfer strength test shall consist of two cylinders from the same batch and each 28-day strength test shall consist of two cylinders from the same batch and tests shall be conducted in pairs; that is, transfer strength tests and 28-day strength tests shall be from the same portions of the same batches.
 - .3 Stress transfer shall not take place until at least one cylinder from each transfer strength test has reached a strength not less than 1 MPa below the specified release strength as indicated in the Contract Documents.
 - .1 Stress transfer shall not take place until the average strength of all release test cylinders meets or exceeds the specified release strength.
 - .4 The initial curing of the stress release cylinders shall take place in an area representative of the mean temperature of the enclosure.
 - .5 The average of all cylinders, of any one beam, tested to determine the 28-day strength shall be equal to or greater than the specified minimum 28-day strength.
 - .1 The allowable strength for each individual cylinder shall not be more than 2 MPa below the specified minimum.
 - .2 The average strength for each test of two cylinders shall not be more than 1 MPa below the specified minimum.

331.4 .5 Reinforcing Steel

- .1 The Contractor shall be responsible to position the reinforcing steel within the specified tolerances in accordance with 331.4.8 and 304.4.
- .2 All reinforcing steel protruding from the precast member shall be free from oil, grease, any loose or foreign material and excessive concrete.
- .3 Supporting chairs for reinforcing steel and prestressing cable shall be heavy plastic tipped and subject to the approval of the Engineer.

331.4 .6 Tensioning and Stress Transfer

- .1 The tensioning and stress transfer shall be carried out by the Contractor in accordance with CSA A23.4 and as follows:
 - .1 When stressing is done by jacking the strands from one end of the stressing bed, the prestress force shall be additionally measured on at least two strands at the far end.
 - .1 The theoretical jacking force may be increased by a maximum of 5% to attain the required prestress force at the far end of the prestress bed.

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- 331.4.6.1.1.1
- .1 If the required prestress force is still not achieved, the strands shall be jacked from the far end of the bed to give the required prestress.
 - .2 If the measured elongation is not within 5% of the theoretical elongation when the specified prestress force is applied, the strand may be temporarily overstressed to overcome friction.
 - .1 Such overstressing shall not induce a stress before anchoring exceeding 78% of the specified tensile strength of the strand.
 - .2 Anchorage set shall not result in prestress losses exceeding five percent of the theoretical jacking force.
 - .2 The tensioning procedure and sequence shall be approved by the Engineer and as a minimum shall be in accordance with the following:
 - .1 Each strand may be seated by application of an initial tension of 5 kN, and all further tensioning shall be measured by elongation and verified by jack-pressure.
 - .2 If the difference between the stressing force measured by the gauges and that determined from elongation exceeds 5%, the source of error shall be found and corrected before continuing with the stressing operation.
 - .3 Gauges shall be calibrated to read directly in kN or accompanied by a chart from which the dial reading can be converted to kN.
 - .1 The hydraulic pressure system activating the gauges shall have appropriate by-pass piping, valves and fittings to enable the gauge pointer to move steadily and without fluctuations.
 - .2 Gauging devices shall be calibrated by an approved authority and re-calibrated as requested by the Engineer and, in all cases, at intervals of not more than one year.
 - .4 Before each prestressing operation, all chucks and jaws shall be inspected, cleaned, lubricated and reassembled.
 - .1 Chucks and jaws with hammer marks and/or nicks on their internal working parts shall not be used.
 - .5 After the concrete in the beam has reached the specified minimum compressive strength for stress transfer, the strands shall be released in such a manner and sequence that the stresses in the concrete at no time exceed those provided for in the design.
 - .6 Stress transfer is to be performed simultaneously at both ends of the bed and between beam ends and while all beams are warm and moist.
- 331.4 .7 Identification of Prefabricated Beams
- .1 The Contractor shall adopt and show a beam identification system on the beam layout drawing of the shop drawings, whereby identical beams have identical numbers.
 - .2 During construction, the date of fabrication shall be indicated on each beam.
 - .3 Identification and fabrication numbers shall be painted on the side of the upper flange of each beam.

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331.4.7 .4 Each beam end shall be identified by painting on the approximate compass direction.

331.4 .8 Tolerances

Beam Dimensions	Depth (flange, web and fillets)	± 6 mm
	Depth (overall)	+ 12 mm, - 6 mm
	Depth (flanges plus fillet)	+ 10 mm, - 6 mm
	Width (web)	+ 6 mm, - 3 mm
	Length of Beam	± 1 mm per m but not greater than 20 mm
Exposed Beam Ends Deviation (from square or designated skew)	Horizontal	+ 6 mm
	Vertical	± 10 mm per m of beam height
Side Inserts	spacing between centres of insert and from centres of inserts to the end of the beam	± 12 mm
Skew Angle Variation		± 3°
Bearing Plates	spacing between the centres of bearing plates to the ends of the beams	± 6 mm
Bearing Plates	spacing between the centres of bearing plates	± 1 mm per m of spacing but not greater than 20 mm
Bearing Plate or Bearing Area	deviation from plane	± 2 mm
Stirrup Bars	projection above theoretical top of the beam	± 20 mm
Horizontal Alignment	deviation from a straight line parallel to the centre line of beam	1 mm per m of span
Camber	differential between adjacent beams	1 mm per m of span to maximum of 25 mm
Centre of Gravity of Strand Group and Individual Tendons		± 6 mm
Position of Deflection Points for Deflected Strands	Deflection points are to be concentric with respect to the middle of the beam	± 100 mm
Position of Lifting Device		± 150 mm
Position of Temporary Bracing Insert	longitudinal	± 25 mm

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331.4 .9 Handling, Storage and Shipping

331.4.9 .1 General

- .1 Beams shall not be shipped until the concrete in the beams has reached the specified 28-day strength.
- .2 The beams shall be handled and stored so that the points of support shall be the same as when the beams are in their final position, except that for transporting they may be supported at a distance equal to the depth of the beam measured along its centreline from the end of the beam, or as indicated on the shop drawings.
- .3 If the finished beam is to be stored on concrete supports then a softer material such as wood or rubber shall be used between the beam and the support.
- .4 Beams damaged by improper handling, storage, transportation or erection are subject to rejection if their load carrying capacity or service life has been reduced.
- .5 Beams shall be handled/erected by two or more cranes.
- .6 The use of slings which result in a horizontal force component into the beam is prohibited.
- .7 Where beams are proposed to be handled/erected by a single crane, the Contractor shall submit the detailed Work plan and shall obtain written approval prior to conducting the Work.
- .8 Should the bearing surfaces of the prestressed beams or finishing of the concrete bearing blocks leave a gap between the surface of the bearing pad and bottom of the beam, the Contractor shall grind to fit.

331.4.9 .2 Lifting Devices

- .1 Lifting devices shall be supplied in the beam as indicated in Standard Drawing 331-1 and/or as specified in the Contract Documents, and;
 - .1 Beams having a mass of more than 23 tonnes and less than 43 tonnes shall have a steel plate, as indicated on the Standard Drawing 331-1, typical for the DTI type I- and AASHTO type IV-Beams.
 - .2 Beams having a mass of more than 43 tonnes and less than 60 tonnes shall have a steel plate, as indicated on the Standard Drawing 331-1, typical for the Bulb-Tee type Beams.
 - .3 Lifting devices for beams having a mass of more than 60 tonnes must be approved by the Engineer and shall be submitted for approval as part of 331.3.1.
 - .4 Beams shall be stored on blocks at least 150 mm off solid level ground and adequately braced and secured to prevent overturning.

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331.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of beams supplied and installed in accordance with this Item.

331.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of precast prestressed concrete beam, as identified under the Contract.
- .2 The Owner shall make partial payment for beams in accordance with 908.7.

POST-TENSIONING SYSTEM

ITEM: 332

332.1 DESCRIPTION

- .1 This Item consists of the supply and installation of the complete post-tensioning system.

332.2 MATERIALS

- .1 All materials and procedures shall be supplied by the Contractor.
- .2 Concrete shall be supplied in accordance with Item 302.2 and shall match the specified concrete requirements of the Structure into which it is being incorporated and/or as specified in the Contract Documents.
- .3 Grout shall be a pre-packaged natural aggregate grout, mixed, placed and cured as recommended by the manufacturer.
 - .1 Grout shall conform to ASTM C1107 Grade B or Grade C when tested at a fluid consistency of 25 - 30 seconds as per ASTM C939, at temperature extremes of 5 °C and 25 °C, and an extended working time of 30 minutes.
 - .2 Grout shall not contain chlorides or other chemicals known to be deleterious to the post-tensioning steel.
 - .1 Chlorides shall be determined in accordance with CSA A23.2-4B.
 - .2 When testing for nitrates the sampling procedure shall be in accordance with CSA A23.2-4B, Clauses 5, 6.1, 6.2 and 6.3, then the nitrates in water, so extracted, shall be determined in accordance with ASTM D4327.
- .4 Grout shall also be supplied in accordance with CSA A23.1 and shall be proportioned to provide the specified properties as indicated in the Contract Documents and as a minimum shall have the following properties:
 - .1 An approved expanding agent additive or approved pre-manufactured non-shrink grout formulation;
 - .2 A water cement ratio between 0.40 and 0.45; and
 - .3 A minimum compressive strength of 20 MPa at 1 Day, 40 MPa at 7 Days and 60 MPa when tested at 28 Days in accordance with CSA A23.2 when cured at 23°C and shall also meet the 7- and 28-day requirements when tested and cured at the 5°C and 25°C limits.
- .5 Reinforcing steel shall be supplied in accordance with Item 304.2.
- .6 Post-tensioning strands shall be of the 7-wire stress-relieved type and shall meet the requirements of ASTM A416 and have an ultimate tensile strength of 1860 MPa, unless otherwise specified in the Contract Documents.
- .7 Post-tensioning wire shall be a high tensile strength wire specifically manufactured for use in prestressed concrete and shall meet the requirements ASTM A421 and shall be of a type BA where cold-end deformation is used for anchoring purposes, or type WA where ends are anchored by wedges.

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- 332.2 .8 Post-tensioning tendons shall also be supplied in accordance with CAN/CSA G279 and CAN/CSA S6.
- .9 Anchorages and couplings shall be supplied in accordance with CSA A23.1.
- .10 The Contractor shall supply bright or galvanized sheet steel sheaths fabricated and placed to be grout tight.

332.3 SUBMITTALS

- .1 The Contractor shall be responsible for the design of the post-tensioning system and shall submit the design, in accordance with Item 956.
- .2 All post-tensioning Work shall be carried out by a qualified Contractor, or subcontractor pre-qualified in accordance with Item 907.
 - .1 The Contractor shall provide the Engineer with the name of the proposed post-tensioning firm.
 - .2 The post-tensioning firm shall show to the Engineer's satisfaction that he has the Equipment, materials and suitably trained and experienced staff to supply and supervise the installation of the required post-tensioning system.
- .3 The Contractor shall provide the following informational items, for review, a minimum of 40 Days prior to commencing post-tensioning Work:
 - .1 A load-strain curve certifying physical properties for each mill heat of bar steel and/or wire steel;
 - .2 The physical properties and chemical composition for bar steel and/or wire steel verifying that the materials conform to the minimum specification requirements indicated;
 - .3 A mill certificate for anchorages and X-rays of each multi-strand single wire anchorage;
 - .4 Hardness test result(s) for heat treated anchorages;
 - .5 Any other standard test data required to certify that all components of system conforms to minimum specification requirements indicated for these components; and
 - .1 The manufacturer shall provide quality control procedures for review.
- .4 The submission shall also show the proposed arrangement, location and details, indicating wobble coefficients and belt friction, for sheathing and couplings; manufacture, size, type and ultimate strength of tendons, sequence and rate of tensioning in order to provide post-tensioning forces and eccentricities as detailed in the Contract Documents.
- .5 The post-tensioning system is subject to approval by the Engineer and samples of material such as post-tensioning steel, anchors, couplings, sheath and grout components shall be submitted for approval, when requested by the Engineer.
 - .1 Samples submitted shall be accompanied by all necessary certificates, source of supply, date of manufacture and technical information, to enable the Engineer to carry out a full investigation.

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- 332.3.5 .2 Sufficient test specimens may be taken from each coil of post-tensioning steel and tested by the Owner to determine compliance with the requirements of this specification.
- .1 With each sample of post-tensioning cable for testing, there shall be submitted a certificate stating the manufacturer's minimum guaranteed ultimate tensile strength, the corresponding reel number and the date of manufacture.
- .6 All stranded wire shall be delivered in coils with a metal tag attached to each coil showing, the manufacturer's name, the heat number and the coil number.
- .7 Each coil shall be accompanied by a stress-strain curve, showing, the corresponding information of the metal tag, the ultimate strength, the date of manufacture and the stress-strain curve from zero stress to ultimate.
- .8 The shipping package or form shall be clearly marked with a statement that the package contains high-strength post-tensioning cable; the type of care to be used in handling; and the type, kind and amount of corrosion inhibitor used, including the date when placed, safety orders and instructions for use.
- .9 The Contractor at the conclusion of the post-tensioning shall provide a copy of the following records:
- .1 Date of tensioning;
.2 Identification and number of elements;
.3 Identification of jacking Equipment;
.4 Required total load per strand;
.5 Initial tension;
.6 Anticipated and actual gauge pressure for each strand or strand group;
.7 Anticipated and actual elongation; and
.8 Any problems encountered.
- .10 Submittals are required in accordance with any cross referenced Item forming part of this Item.

332.4 CONSTRUCTION

332.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All concrete Work shall be carried out in accordance with Item 302.

332.4 .2 Post-tensioning Steel

- .1 All post-tensioning steel must be free of deleterious materials such as oil, grease, frost, paint, mill scale, loose rust, corrosion or any foreign material which may prevent bonding between steel and concrete.
- .2 The use of post-tensioning steel having kinks, bends, nicks or other defects is not permitted.
- .3 During all stages of transport, handling, storage and construction, all post-tensioning materials shall be thoroughly protected against corrosion, crushing or other damage.

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- 332.4.2 .4 All water used for flushing ducts shall contain either quick lime (calcium oxide) or slaked lime (calcium hydroxide) in the amount of 10 kg/m³.
- .1 All compressed air used to blow out ducts shall be oil free.
- .5 When wires are to be button-headed, the buttons shall be cold formed symmetrically about the axis of the wire.
- .1 The buttons shall develop the minimum guaranteed ultimate tensile strength of the wire.
 - .2 No cold forming process shall be used that causes indentations in the wire.
- .6 Post-tensioning steel which is installed in members prior to placing and curing of the concrete shall be continuously protected against rust or other corrosion, by means of a corrosion inhibitor placed in the ducts or applied to the steel in the duct, until grouted.
- .7 When post-tensioning steel is installed in the ducts after completion of concrete curing, and if stressing and grouting are completed within 10 Days after the installation of the post-tensioning steel, rust which may form shall not be cause for rejection of the steel.
- .1 Post-tensioning steel installed, tensioned and grouted within 10 Days, shall not require the use of a corrosion inhibitor in the duct following installation of the post-tensioning steel.
 - .1 Post-tensioning steel installed but not grouted within 10 Days shall be subject to all the requirements pertaining to corrosion protection and rust.
- .8 In tensioning strands, one approved splice per strand shall be permitted provided the splice is not located within the concrete member.
- .1 Welded strand joints or wire splices shall not be permitted in any reel or coil of strand.
- 332.4 .3 Placement of Cables
- .1 Post-tensioning cables shall be placed within a tolerance of ± 5 mm of their theoretical position and all kinks and undulations shall be avoided.
 - .2 Cables shall be supported on rigid metal supports not exceeding a spacing of 1 m and attached to the vertical stirrups without welding.
 - .3 The Contractor shall repair the sheath to the satisfaction of the Engineer should the sheath become punctured or crushed at any time during the placement of cables and prior to or during the placement of concrete.
 - .4 Where the end of a post-tensioned assembly will not be covered by concrete, the anchoring devices shall be recessed so that the ends of the post-tensioning steel and all parts of the anchoring devices will be at least 50 mm inside of the end surface of the members, unless otherwise indicated in the Contract Documents.
 - .1 Following post-tensioning, the recesses shall be filled with an approved type of dry pack material and finished flush.

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332.4 .4 Anchorage and Couplings

- .1 All post-tensioning steel shall be secured at the ends by means of an approved permanent type anchoring device.
- .2 Anchorages shall be capable of transferring the maximum post-tensioning force to the concrete without distress to the concrete.
- .3 The final unit compressive stress on the concrete directly underneath the anchorage assembly shall not exceed 21 MPa.
- .4 Bending stresses in the plates or assemblies induced by the pull of the post-tensioning steel shall not exceed the yield point of the material nor cause visible distortion in the anchorage plate when 100% of the ultimate load is applied.
- .5 Anchorages shall be provided with suitable ports for the injection of grout.

332.4 .5 Sheath

- .1 The sheath shall be provided with air vents at all high points in the cables.

332.4 .6 Tensioning Equipment

- .1 Hydraulic jacks and pumps of sufficient capacity shall be used for tensioning of cables.
- .2 All gauges or load cells used for registering the stressing forces shall be calibrated and certified within the previous 12 months of the time of the Work.
 - .1 If a pressure gauge is used it shall have an accurate reading dial at least 150 mm in diameter and each jack and its corresponding gauge shall be calibrated as a unit and shall be accompanied in the field by a certified calibration chart.
 - .2 If a load cell is used it shall be calibrated and shall have an indicator by means of which the post-tensioning force in the cables may be determined.

332.4 .7 Cold Weather Requirements

- .1 Cold weather requirements for grout shall be the same as for concrete as outlined in 302.4.
- .2 The temperature of the concrete surrounding the sheath shall not be less than 5°C during grouting and the temperature of the surrounding concrete shall be maintained at a minimum of 5°C for not less than 7 Days after grouting.

332.4 .8 Supervision

- .1 The Contractor shall retain personnel on site with extensive experience in post-tensioned/prestressed concrete construction and who is thoroughly familiar with the post-tensioning system being used, and this person(s) shall be present at all times during cable placing, stressing and grouting.

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332.4 .9 Post-Tensioning

- .1 No stressing by post-tensioning shall be undertaken until all concrete in the Structure has reached the strength specified in the Contract Documents.
- .2 Prior to post-tensioning any member, the Contractor shall demonstrate that the post-tensioning steel is free and unbonded in the duct.
- .3 Stress in the cables shall be measured with a dynamometer accurate to $\pm 0.5\%$ and verified by elongation based on the stress-strain characteristics of the wire.

332.4 .10 Grout

- .1 All cable ducts shall be filled with grout in one continuous operation after the completion of stressing.
- .2 During freezing weather, the grout shall be kept at a minimum of 5°C for not less than 7 Days.
- .3 The grouting Equipment shall be capable of grouting at a minimum pressure of 0.7 MPa and the grouting Equipment shall be furnished with a pressure gauge having a full-scale reading of not more than 2 MPa.
- .4 Standby flushing Equipment capable of developing a pumping pressure of 1.7 MPa and of sufficient capacity to flush out any partially grouted cable ducts shall be provided.
- .5 All grout shall pass through a screen with 1.8 mm maximum clear opening size prior to being introduced into the grout pump.
- .6 If a breakdown of the grout pump occurs during the grouting operation, the cable duct shall be flushed out and the entire cable duct regouted.

332.5 MEASUREMENT FOR PAYMENT

- .1 The supply and installation of the complete post-tensioning system in accordance with this Item shall be on a lump sum basis.

332.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.

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335.1 DESCRIPTION

- .1 This Item consists of the supply including but not limited to, the fabrication, surface preparation, delivery and erection of steel Superstructure to the Work Site.
- .2 The Bridge Superstructure has been designed according to CAN/CSA-S6, with a CL625-ONT live loading and all Work shall conform to this, except as noted in the Contract Documents.

335.2 MATERIALS

335.2 .1 General

- .1 All materials shall be supplied by the Contractor.
- .2 The supply of any additional structural steel not shown on the Contract Documents, deemed necessary for the erection condition, including falsework and guys that may be required to maintain stability, shall be at the Contractor's own expense.

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335.2 .2 Structural Steel

- .1 All structural steel with the exception of secondary members comprised of rolled shapes shall meet the requirements of CAN/CSA G40.21 Grade 350 AT - Category 3, "Atmospheric Corrosion Resistant Structural Steel" with "Improved Low Temperature Properties" or ASTM A588 when Charpy Impact Energy test demonstrates adequate toughness.
- .1 This material shall possess a minimum Charpy V Notch impact energy of 27 Joules when tested at minus 30°C, on a per plate basis, as evidenced by rolling mill certificates.
- .2 All tee sections, channels, rolled beam and angle shapes and pintles shall conform to CAN/CSA G40.21 M Grade 350A or ASTM A588.
- .3 Sample preparation and testing shall be in accordance with the requirements of CAN/CSA G40.20.
- .4 All steel shall be delivered in accordance with CAN/CSA G40.20.
- .5 Structural shapes and angles shall be individually colour marked in accordance with CAN/CSA G40.21 or CAN/CSA G40.20, when shapes under 150 mm in cross sectional dimension are shipped in bundles and tagged in bundles.
- .6 All anchor and anchor bolt assemblies including fabricated sections, nuts and washers shall conform to CAN/CSA G40.21 Grade 350A.

335.2 .3 High Tensile Bolts

- .1 High tensile bolts, nuts and washers shall conform to ASTM A325M or A490M, as specified in the Contract Documents. ASTM A325M bolts shall be galvanized Type I for painted steel or Type 3 for unpainted corrosion-resistant steel.
- .2 Nuts shall be Grade A563 DH for galvanized applications and C3 (recommended) or DH3 (suitable) for unpainted applications.
- .3 A325 nuts and bolts shall be shipped together as an assembly.

335.2 .4 Welding Electrodes

- .1 Electrodes shall conform to CAN/CSA W48.
- .2 Filler metal shall be in accordance with CAN/CSA W59, Table 5-1.
- .3 Deposited weld metal shall have a minimum Charpy Impact Energy of 27 Joules at minus 30°C.
- .4 The selection, supply and storage of electrodes and fluxes shall be in accordance with Clause 5 of CAN/CSA W59-M.

335.2 .5 Stud Shear Connectors

- .1 Stud shear connectors shall be of a headed stud type, in accordance with the requirements of CAN/CSA W59.

335.2 .6 Formwork

- .1 All formwork shall be carried out in accordance with Item 958.

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.1 Within 12 Days after Tender Closing and prior to Award of the Contract, the Contractor shall submit the following:

.1 Documentation from the Canadian Institute of Steel Construction indicating the steel fabricator has been certified with the CISC Steel Bridge Certification.

.2 Documentation from the Canadian Welding Bureau indicating the fabrication shop is fully certified to the requirements of CAN/CSA W47.1, Division 1 or 2.

335.3 .2 Shop Drawings

.1 The Contractor shall submit shop drawings in accordance with Item 956 and with, but not limited to, the following additional requirements:

.1 The Contractor shall provide shop drawings of all metal Work and shall submit six (6) copies of the shop drawings and three (3) copies of certified mill reports to the Engineer for review.

.1 For steel delivered to the fabrication shop during production Work, the Contractor must submit certified mill test reports and nesting/cutting bills to the Engineer for review 48 hours prior to cutting steel or using the steel in production.

.2 The Contractor shall arrange to have the shop drawings in the hands of the Engineer five (5) weeks prior to the start of fabrication.

.3 After the Engineer's review, the Contractor shall submit one complete set of plastic transparencies to the Engineer for his/her records of the as-built drawings, after all revisions have been made.

.4 No fabrication shall be undertaken until the Engineer has returned the shop drawings to the Contractor.

.5 The review of the Contractor's shop drawings by the Engineer, shall not relieve the Contractor of her/his responsibility for the correctness of his/her drawings.

.6 All shop drawings, erection drawings, welding procedures, design briefs, and all other such documents shall be stamped and signed by a Professional Engineer.

.2 Shop drawings shall provide shop details, which includes:

.1 Full detail dimensions and sizes of all components and parts of the Structure;

.1 These dimensions shall make allowance for changes in shape due to weld shrinkage, camber and any other effects which cause finished dimensions to differ from initial dimensions.

.2 All necessary specifications for the materials to be used;

.3 Identification of areas requiring special surface treatment;

.4 Identification of fracture critical and primary tension members and component parts;

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- 335.3.2.2 .5 Bolt installation requirements; and
- .6 Details of all welds.
- 335.3.2 .3 Symbols for welding and non-destructive test on shop drawings shall be in accordance with the provisions of CAN/CSA W59.
- 335.3 .3 Welding Procedures
- .1 The Contractor shall submit the welding procedure specifications and welding procedure data sheets, conforming to CAN/CSA W59 and CAN/CSA W47-1, to the Engineer at least two weeks in advance of fabrication and review must be obtained before commencing the Work.
- .1 The following shall be included, but not limited to;
- .1 The welding process to be used, the position of welding, filler metal, flux, shielding gas if required, joint configurations, number and size of passes, preheat and inter-pass temperatures if required, sequence of passes, current, rate of pass, electrode size, electrical stick-out and polarity, and methods of storing consumables.
- .1 All groove welds shall be considered as primary tension members and shall be certified by the Canadian Welding Bureau to provide a minimum Charpy Impact Energy of 27 Joules at minus 30°C, in accordance with the testing requirements of CAN/CSA W47.1, Annex E.
- .1 This shall include the testing of five subsurface weld metal Charpy V Notch (CVN) impact test specimens and five subsurface HAZ CVN test impact specimens.
- .2 The methods that shall be used for the preparation of the edges.
- .3 Measures which shall be taken to control the effects of distortion, shrinkage and residual stresses.
- .4 The proposed methods and sequence of assembling.
- .5 The welding Equipment used shall be calibrated as stated in section AWS D1.5.
- 335.3 .4 Conformance
- .1 The Contractor shall submit to the Engineer, at least two (2) weeks in advance of the steel fabrication, three (3) copies of a letter certifying that the stud shear connectors conform to 335.2.5.1.
- 335.3 .5 Erection
- .1 The Contractor shall, prior to commencing the Work of erection, furnish the Engineer with erection procedure drawings, together with complete calculations of stresses in the steelworks in the various stages of erection and shall inform the Engineer fully as to the method of erection he proposes to use.
- .2 The whole of this information shall be submitted to the Engineer for review, at least four weeks before the Work of erection is to commence and shall be stamped by a Professional Engineer.
- .6 Submittals are required for this Item that are contained within the sections applicable to the specific phase of the Work being undertaken, separate and distinct to those listed here.

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335.4 CONSTRUCTION335.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall notify the Engineer a minimum of 48 hours prior to any plate being used in production to allow for the scheduling of QA testing.

335.4 .2 Fabrication335.4.2 .1 Fabrication Standards

- .1 The fabrication of all structural steel shall conform to the AASHTO Construction Specification, AWS D1.5 Bridge Welding Code and to CAN/CSA W59, except that all welding shall conform to CAN/CSA W59 and CAN/CSA W47.1.

335.4.2 .2 Workmanship and Finish

- .1 All edges of all members and plates, whether rolled, cut or sheared, that are exposed to view or weather in the finished assembly, and are to be coated, shall be rounded to a 1.5 mm minimum radius by grinding, prior to blast cleaning and/or fit up.

335.4.2 .3 Storage and Handling of Material

- .1 Structural materials, either plain or fabricated, shall be stored at the fabricator's shop or elsewhere above the ground upon platforms, skips or other suitable supports and shall be kept free from dirt and other foreign matter.
- .2 Structural materials, either plain or fabricated, shall be protected as far as practicable from corrosion.
- .3 Long members shall be supported to prevent yielding of the material.
- .4 Plates damaged due to handling techniques or devices may be subject to rejection.

335.4.2 .4 Shipping of Material

- .1 Damaged members shall be repaired or replaced as required by the Engineer.

335.4.2 .5 Camber

- .1 All plate girders shall be cambered to compensate for full dead load deflections and the vertical curve as may be required by the profile grade as shown in the Contract Documents.
 - .1 The maximum error in girder camber shall conform to Clause 5.8 of CAN/CSA W59, except that the error shall not exceed ± 20 mm.
 - .2 Rolled sections may be heat cambered using an approved procedure, while plate girders shall have the required camber cut into the web with suitable allowance for camber loss due to cutting, welding, and heat-curving.

335.4.2 .6 Girder Splices

- .1 The locations of the field bolted main girder splices are shown in the Contract Documents.
 - .1 Additional field splices or the relocation of the main bolted field splices shall not be allowed.
- .2 The locations of the shop-welded splices are shown in the Contract Documents.
 - .1 No other shop-welded splices shall be permitted without prior written approval of the Engineer.
 - .2 Welded field splices of the main girders shall not be allowed.
 - .3 The locations of the main girder shop welded splices for the flanges are shown on the Contract Documents.
 - .4 Should the Contractor require additional shop welded complete penetration groove weld splices in the flanges, these shall only be permitted with the written approval of the Engineer.
 - .5 The location of complete penetration shop welded groove welds for the web plate shall be subject to the approval of the Engineer.

335.4.2 .7 Re-entrant Cuts

- .1 A fillet of not less than 25 mm radius shall be provided at the junctions of all re-entrant cuts, and the fillet shall be formed before the cuts are made.

335.4.2 .8 Thermal Cutting

- .1 Steel may be flame-cut, provided a smooth surface is secured by the use of a mechanical guide.
- .2 Flame cutting by hand shall be done only when approved by the Engineer, and the surface shall be made smooth by planing, chipping or grinding.
- .3 The quality and repair of the cut edges shall conform to Clause 5 of CAN/CSA W59.

335.4.2 .9 Fabrication Tolerances

335.4.2.9 .1 Structural Members

- .1 Structural members consisting of a single rolled shape shall meet the straightness tolerances of CAN/CSA G40.20, except that columns shall not deviate from straight by more than 1/1000 of the length between points of lateral support.
- .2 A variation of not more than 1 mm from the detailed length is permissible in the length of members which have both ends finished for contact bearing.
- .3 Other members without finished ends may have a variation from the detailed length of not more than 2 mm for members 10 m or less in length, or not more than 4 mm for members over 10 m in length.

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- 335.4.2.9 .2 Abutting Joints
 - .1 When compression members are butted together to transmit loads in bearing, the contact faces shall be milled or saw-cut.
 - .1 The completed joint shall have at least 75% of the entire contact area in full bearing, defined as not more than 0.5 mm separation, and the separation of the remainder shall not exceed 1 mm.
 - .2 At joints where loads are not transferred in bearing, the nominal dimension of the gap between main members shall not exceed 10 mm.

- 335.4.2.9 .3 Bearing Plates
 - .1 Bearing plates shall meet the following requirements:
 - .1 Rolled steel bearing plates 50 mm or less in thickness may be used without planing provided that a satisfactory contact bearing is obtained.
 - .2 Rolled steel bearing plates over 50 mm but not over 100 mm may be straightened by pressing or by planing on all bearing surface to obtain a satisfactory contact bearing.
 - .3 Rolled steel bearing plates over 100 mm in thickness shall be planed on all bearing surfaces, except for those surfaces which are in contact with concrete foundations and are grouted to ensure full bearing.

- 335.4.2.9 .4 Fabricated Components
 - .1 Tolerances for welded components shall conform to Clause 5.4 of CAN/CSA W59.
 - .2 Dimensional tolerances of welded structural members shall conform to those prescribed in Clauses 5.8 and 12.5.3 of CAN/CSA W59.
 - .3 Built-up, bolted structural members shall satisfy the straightness tolerances of CAN/CSA G40.20 for rolled wide flanged shapes.
 - .4 Bearing stiffeners fitted to bear shall have a minimum bearing contact area of 75%, with a maximum separation of 1 mm over the remaining area.
 - .1 Contact is defined as a gap less than 0.25 mm.
 - .5 All intermediate stiffeners shall be fitted having a minimum bearing contact area of 25%, and a maximum separation of 1 mm.
 - .1 Contact is defined as a gap less than 0.25 mm.
 - .6 Use of force to move flanges inward to achieve fit up tolerance shall be as approved by the Engineer.

335.4.2 .10 Pre-assembly of Field Connections

335.4.2.10 .1 Shop Trial Assembly

- .1 Girders and other main components shall be pre-assembled in the shop to prepare or verify the field-splices.
- .2 Components shall be supported in a manner consistent with the finished geometry of the Bridge, as defined in the Contract Documents, with allowance for any camber required to offset the effects of dead-load deflection.
- .3 Holes in the webs and flanges of main components shall be reamed or drilled to final size while in assembly.
 - .1 The components shall be pinned and firmly drawn together by bolts before reaming or drilling.
 - .2 Drifting done during assembly shall only be sufficient to align the holes and not to distort the steel.
 - .3 If required, reaming shall be used to enlarge holes.
- .4 Where a number of sequential assemblies are required because of the length of the Bridge, the second and subsequent assemblies shall include at least one section from the preceding assembly to provide continuity of alignment.
- .5 Trial assemblies are required when the field-splices are bolted.
 - .1 Each assembly shall be checked by the fabricator for camber, alignment, accuracy of holes, and fit-up of welded joints and milled surfaces.
 - .2 The Engineer shall be given the opportunity to verify alignment and dimensions prior to drilling, reaming or cutting.
 - .1 Corrective Work, if necessary, shall be carried out in a manner acceptable to the Engineer.

335.4.2 .11 Hole Drilled using Numerically Controlled Machines

- .1 As an alternative to the above trial assembly, when the bolt holes have been prepared by numerically controlled drilling or using a suitable template, the accuracy of the drilling may be demonstrated by a check assembly consisting of the first components of each type to be made.
- .2 If the check assembly is satisfactory, further assemblies of like components are not required.
- .3 If the check assembly is unsatisfactory for any reason, the Work shall be redone or repaired in a manner acceptable to the Engineer.
 - .1 Further check assemblies shall be required as specified by the Engineer to demonstrate that the required accuracy of fit-up has been achieved.

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- .1 All welding, including Workmanship, technique, qualification, etc., shall conform to the requirements of CAN/CSA W59, except where modified by the following conditions;
 - .1 The electroslag and electrogas welding processes (see Clause 5 of CAN/CSA W59) shall not be used for welding quenched and tempered steels nor for welding components of members subject to tension stress or stress reversal.
 - .2 Groove weld procedures shall be pre-qualified welds in accordance with CAN/CSA W59 and CWB certified to provide a minimum Charpy Impact Energy of 27 Joules when tested at minus 30°C per CAN/CSA W47.1 Annex E.
 - .3 All groove welds in web and flange plates shall be done to the individual plates prior to the welding of flanges to the web plates.
 - .4 No field groove welds shall be allowed.

335.4.2 .13 Repair Welding

- .1 All welding corrections and repairs shall be performed according to CAN/CSA S6, clause 10.23, pertaining to fracture critical members.
- .2 Repair of base metal by welding, at the producing mill shall not be permitted.

335.4.2 .14 Blast Cleaning - Painted Areas

- .1 All steel that is to be painted shall be blast cleaned to conform to "The Steel Structures Painting Council" specification SSPC SP10 No. 10 "Near-White Blast Cleaning".
- .2 All oil and grease and any other surface contamination shall be removed according to the requirements of SSPC SP1 "Solvent Cleaning", before any other surface preparation is started.
- .3 The blasting medium (silica sand, grit or shot) used shall be of a size that produces a surface profile acceptable to the manufacturer of the inorganic zinc coating being used.
- .4 The Contractor shall supply the Owner with a letter from the inorganic zinc coating manufacturer stating that the proposed method, Equipment and materials used in the blast cleaning is acceptable.
 - .1 No blast cleaning shall commence until the Owner is in possession of this letter.
- .5 No blast cleaning shall be carried out when the surfaces of the steel are damp.
- .6 The blast cleaned surfaces shall be coated with inorganic zinc before any rusting occurs.
- .7 Under no circumstances are blast cleaned surfaces to be left uncoated overnight.
- .8 If the blast cleaned areas become damp and/or rusted, these areas shall be re-blasted after the steel has dried.
- .9 The Contractor shall ensure that all applicable safety precautions are taken during the blast cleaning operation.
- .10 All surfaces to be painted shall be free from any or all contaminants.

335.4.2 .15 Blast Cleaning - Unpainted Areas

- .1 All exposed steel surfaces shall be blast cleaned to conform to "The Steel Structures Painting Council" specification SSPC SP6 "Commercial Blast Cleaning".
- .2 The blast cleaning shall preferably be carried out after the complete erection of the structural steel, but may be carried out in the shop after all fabrication work has been completed, provided the Contractor cleans the steel work of all cutting oil, dirt, erection marks or other foreign material after the completion of the erection.

335.4.2 .16 Surface Condition of Bolted Parts

- .1 All bolted connections are friction type connections and are designed for standard size bolts.
- .2 The surface condition for bolted friction connections for painted Structures with coated joints shall be blast cleaned and coated with Class B inorganic zinc silicate coating.

335.4.2 .17 Facing of Bearing Surfaces

- .1 The surface finish of bearing and base plates shall be in accordance with CAN/CSA S6.
- .2 Surfaces of flanges which are in contact with bearing sole plates shall be in accordance with CAN/CSA W59.
 - .1 Outside this area 2 mm deviation from flat is acceptable.
 - .2 The bearing surface shall be perpendicular to the web and bearing stiffeners.

335.4 .3 Fracture Control

335.4.3 .1 General

- .1 All bridge members with the exception of secondary members comprised of rolled shapes, shall be treated as fracture critical in accordance with CAN/CSA S6, clause 10.23.
- .2 Attachments having a length of more than 100 mm in the direction of tension and welded to the members shall be treated as part of the member.

335.4.3 .2 Identification

- .1 For each component of a fracture critical member, records are to be kept to identify the heat number of the material and its corresponding mill test certificate.

335.4 .4 Transportation

- .1 A shipping plan shall be provided by the Contractor indicating support, lateral bracing, and tie-down points for primary members during transportation to the Work Site.
- .2 Primary members shall be shipped upright, unless otherwise approved by the Engineer.
- .3 Primary members shall be loaded, supported, and unloaded in a manner that will not damage or place excessive stress on the member.

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335.4.4 .4 Any damaged members shall be repaired or replaced by the Contractor as required by the Engineer.

.5 All fastener components shall be shipped and stored in sealed, watertight containers with the content clearly labelled on the outside.

335.4 .5 Storage

.1 Fabricated material shall be stored above ground on platforms, blocking or other suitable supports and shall be kept clean from dirt and other foreign matter.

.2 Primary members shall be stored upright and braced to ensure stability.

.3 All members shall be stored in a manner to prevent permanent damage.

335.4 .6 Erection

335.4.6 .1 General

.1 The erection procedure drawings and calculations shall fully illustrate the proposed method of erection including the sequence of erection, the weights and lifting points of the members, and the location and lifting capacities of the cranes used to lift them.

.1 Details of temporary bracing and bents to be used during construction shall be shown.

.2 Calculations shall be provided to show the members and supports are not overloaded during erection.

.2 The Contractor shall erect the whole of the fabricated structural steel Work which he supplies under the Contract.

.3 The Contractor shall erect the structural steel in accordance with the requirements of the AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, the AASHTO Bridge Construction Specifications, and CAN/CSA S6.

.4 Components shall be lifted and placed, using appropriate lifting Equipment, temporary bracing, guys or stiffening devices so that they are at no time overloaded or unstable.

.5 Additional permanent material may be provided, if approved, to ensure that the member capacities are not exceeded during erection.

.6 All falsework, including necessary foundations, required for the safe construction of the Bridge shall be designed, furnished, maintained and removed by the Contractor.

.1 The Contractor shall not use any of the material intended for use in the finished Bridge for temporary purposes during erection, unless such use is approved.

.7 All temporary falsework towers, cables, dampers, etc., shall be removed from the erected steelworks following complete erection of the steelworks.

.8 Any additional bracing or guys required, other than those shown in the Contract Documents, to maintain the stability for the construction stage shall only be removed by the Contractor at a time that is mutually suitable to the Engineer and the Contractor.

.9 The company undertaking field-welding shall be certified to Division 1 or 2 of CAN/CSA W47.1.

- 335.4.6.1 .10 Tack welds used for attachments, or for any other purpose, are expressly forbidden unless they subsequently become part of welds detailed in the Contract Documents.
- .11 The use of tack welds which are not part of the welds detailed in the Contract Documents, shall not be made on any portion of the girders.
- .12 The Substructure shall be protected prior to erection, under a separate Item as specified in the Contract Documents, against rust-staining by water run off from the Bridge.
- 335.4.6 .2 Erection and Construction Stresses
- .1 The Contractor shall assume full responsibility to verify all Bridge components for erection stresses and shall provide any additional steel and/or bracing, if required, for his/her erection procedure.
- .2 The Contractor shall not commence erection until the Engineer has received and reviewed these calculations, along with erection stresses and erection methods.
- .1 Review of these calculations shall not relieve the Contractor of her/his responsibility to maintain overall stability of the steel in the construction phase.
- .3 Under no circumstances may stresses occurring in the members of the Structure exceed the basic allowable stresses, except with the express permission of the Engineer.
- .1 All allowable stresses shall be based upon CAN/CSA S6 Canadian Highway Bridge Design Code or the AASHTO LRFD Bridge Design Specifications.
- .4 Release of temporary supports or temporary members, etc. must be gradual, and under no circumstances shall a sudden release be permissible.
- .5 The method of erection proposed to be used shall be subject to the authorization of the Engineer, but such authorization shall not relieve the Contractor of any responsibility for the safety of the proposed method of erection, or of the Equipment, or from carrying out the Work in full accordance with the Contract.
- .1 The Contractor shall not start any erection operation before this authorization is obtained.
- 335.4.6 .3 Erection Methods and Equipment
- .1 The Contractor shall ensure that all cranes, rigging and Equipment are in good condition and properly maintained at all times during the period of the Work.
- .2 The Contractor shall ensure that all cranes, rigging and Equipment is of adequate capacity to carry out the required steel erection.
- .3 The Engineer shall have the right to inspect all Equipment to be used for the erection to satisfy himself that such Equipment is of good quality, and he may forbid the use of any Equipment that is, in his/her opinion, in any way faulty.
- .1 The inspection of the erection Equipment by the Engineer shall in no way relieve the Contractor of her/his primary responsibility for the safety and adequacy of all erection methods and Equipment.
- .4 All structural steelworks shall be handled in such a manner, so as to prevent shock or impact loadings to any steel member or Substructure component.

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- 335.4.6.3 .5 Slings and other lifting apparatus used in the handling of structural steelworks shall be of a type which will not damage shop primed or painted surfaces of fabricated steelworks.

- 335.4.6 .4 Falsework and Guys
 - .1 The Contractor shall construct, erect, maintain and subsequently remove and dispose of all falsework and guys required for the erection of the Work.
 - .2 Falsework shall include all temporary supports and foundations and shall be properly designed and substantially constructed and maintained to sustain the loads which shall come upon it.
 - .3 Falsework shall be carried out in accordance with Item 957.

- 335.4.6 .5 Field Assembling of Steel
 - .1 Insofar as the cantilever method of erection is followed, the splice or splices which connect a member to the part of the Structure already erected shall be fully bolted before any further members are put in place.
 - .2 Cylindrical erection pins for use in shop-reamed holes shall be machined to a push fit so as to obtain an accurate matching of corresponding holes.
 - .3 Shop reamed holes shall not be re-reamed on the site.

- 335.4.6 .6 High Strength Bolts
 - .1 High strength bolts shall be installed and inspected in accordance to "Specification for Structural Joints using ASTM A325 or ASTM A490 bolts" approved by the Research Council on Bolted Structural Joints of the Engineering Foundation and AASHTO specifications with latest revisions.
 - .2 The "turn-of-the-nut" method, per CAN/CSA S6 shall be used for tightening bolts.
 - .1 The Contractor shall supply personnel to assist in inspecting all high strength bolted connections for conformance to the job inspection torque and the Contract Documents.
 - .3 The Contractor shall pay particular attention to the lubricant required for the nuts and additional test requirements required for galvanized bolts.

- 335.4 .7 Quality Control

- 335.4.7 .1 Responsibility
 - .1 It is the Contractor's responsibility to supply the material and execute, complete and maintain the Work in strict accordance with the terms of the Contract, and inspection and testing by the Engineer shall not be deemed to relieve the Contractor of any of his/her obligations.

- 335.4.7 .2 Inspection
 - .1 Inspection by the Engineer may extend to all or any part of the Work and to the preparation, fabrication or manufacture of any of the materials.

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- 335.4.7.2 .2 The Engineer shall be furnished by the Contractor with such information as is required to make a complete and detailed inspection and shall be allowed access to all parts and phases of the Work.
- .3 Any Work done or materials used without supervision or inspection by the Engineer may be ordered to be removed and replaced at the Contractor's own expense.
- 335.4.7 .3 Owner's Representative
- .1 An Owner's representative shall be assigned to the project to report to the Engineer on the progress of the Work as a whole and the manner in which they are being performed, to secure adherence to the requirements of the Contract, to report on any noted failure by the Contractor to fulfill the requirements of the Contract and to direct the Contractor's attention to such failure.
- .2 Testing engineers and inspectors may be appointed by the Engineer to fulfill duties similar to those of the Engineer in connection with various aspects of the Work and to carry out the testing of materials and Work.
- .3 The Engineer's representative(s) shall, within the limits of the written authorization given to them by the Engineer, have authority to reject material or Work that is not in conformity with the requirements of the Contract, but no representative of the Engineer shall have authority to revoke, alter, enlarge, relax or release any requirement of the Contract.
- .4 No representative of the Engineer shall perform any duty or management on the Contractor's behalf.
- .5 The Contractor shall provide regular and practically located office space at her/his steel fabrication plant to accommodate the Engineer or the Owner's representative.
- .1 The office space so provided shall be ventilated, heated, lighted and clean and shall be furnished with a suitable standard office desk and chair.
- .1 The office room temperature shall be maintained at 20°C.
- .2 Convenient telephone, internet, facsimile, photocopy, mail and message handling services shall also be provided.
- 335.4.7 .4 Samples and Testing
- .1 The Engineer shall have the right to call for any additional samples, specimens and tests that are, in his/her opinion, necessary to secure proper quality control of the material and the Work.
- .2 The Contractor shall bear all costs for the provision, preparation and testing of samples and specimens, including the costs of re-inspection and retesting as associated with Work not meeting the requirements of the Contract Documents.
- .3 The Owner shall bear the costs and fees of the testing engineer and other representatives of the Engineer.
- 335.4.7 .5 Transfer of Heat Numbers
- .1 The Contractor shall transfer heat numbers on plates for flanges, webs, stiffeners, splice plates and diaphragm plates in the presence of the Engineers representative.

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- 335.4.7.5 .2 Heat numbers or any other identification numbers are not to be stamped on individual pieces or plates unless authorized in writing by the Engineer. Heat numbers shall be marked with chalk or crayon in the presence of the Engineers representative.
- .1 Chalk or crayon shall be a non-oil based product.
- .3 The Contractor shall prepare a drawing indicating the heat number of steel used for all components of the steel Superstructure.

335.4.7 .6 Inspection of Welds

- .1 The Engineer reserves the right to submit welds, chosen at random, to non-destructive testing.
- .1 If faults in the welds are discovered, the Engineer may order such additional testing as she/he may consider necessary to satisfy himself as to the overall quality and Workmanship of the welded construction.
- .2 Any welds found to be faulty shall be removed, re-welded and retested at the Contractor's own expense.
- .3 The amount and location of non-destructive testing shall be determined by the Engineer.
- .4 In general, the following minimum testing shall be conducted.
- .1 All welds shall be visually inspected.
- .2 Groove welds in flanges and webs of built-up members shall be tested by magnetic particle, radio-graphically and/or ultrasonically as follows:
- .1 All flange tension splices and flange splices subject to stress reversal shall receive 100% radiographic and/or ultrasonic inspection.
- .2 Web splices shall receive 100% radiographic and/or ultrasonic inspection for a minimum of half of the depth beginning at the point or points of maximum tension and 25% of the remainder of the web splice shall be so tested.
- .3 Flange compression splices shall receive 25% radiographic and/or ultrasonic inspection.
- .4 All groove welds shall receive 100% magnetic particle inspection.
- .3 Web to flange fillet welds shall be subject to magnetic particle inspection in accordance with Table 335-1.

Table 335-1
Magnetic Particle Inspection Sequence

Submerged arc welds	25 percent of length
Semiautomatic welds	50 percent of length
Manual welds	100 percent of length

- .4 Fillet welds for attaching gusset plates, diaphragm welds and stiffeners shall have 25% of the total tested by magnetic particle inspection.

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- 335.4.7.6.4 .5 All transverse welds on flanges shall receive 100% magnetic particle inspection.
- .6 All gusset plates and stiffeners for attaching diaphragm bracing shall be tested for 100% of the length from the mid depth of the web to the tension flange.
- .5 Radiographic and/or ultrasonic testing shall be performed prior to assembly of the flanges to the web.
- .6 In the event that defects are found, all welds shall be tested and all inferior welding shall be corrected and retested, at the Contractor's own expense.
- 335.4.7 .7 Repair of Welds
- .1 Any welds which do not meet the acceptance standards shall be removed, re-welded and re-tested at the Contractors expense.
- .2 The repair and non-destructive testing of fracture-critical and primary-tension members shall be in accordance with 335.4.2.
- 335.4.7 .8 Standards of Acceptance of Defects
- .1 The standards of acceptance of defects shall be in accordance with CAN/CSA W59 "Welded Steel Construction (Metal Arc Welding) Clause 12 - Cyclically Loaded Structures".

335.5 MEASUREMENT FOR PAYMENT

- .1 The labour, Equipment and materials required for, but not limited to, the loading, shipping, supply, fabrication, surface preparation, delivery and erection of the complete steel Superstructure in accordance with this Item shall be on a lump sum basis.

335.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 The Contractor may be granted progress payments in accordance with the Terms of Payment A section 4 and;
- .1 The Contractor shall provide the Engineer, at the time of signing of the Contract, a breakdown of the Lump Sum Price, including but not necessarily limited to, identifying the portion of the price attributable to the supply of materials to the fabricator's shop (structural plate and rolled shapes), steel fabrication, shop painting preparation, material transportation and erection excluding temporary access Structures, temporary erection supports and fasteners.
- .2 The Owner shall take ownership of the materials and Work covered by the progress payment, however the Contractor shall assume the full responsibility for the care and maintenance for all such materials until placed and accepted in the Structure.
- .1 The Contractor shall be solely responsible to repair or replace, at his/her own expense, any materials or components of the Work which become damaged or lost between the period of the progress payment and the inclusion of the materials or components into the Work.

STEEL LAMINATED BEARINGS

ITEM: 341

341.1 DESCRIPTION

- .1 This Item consists of the supply and installation of steel reinforced bearings.

341.2 MATERIALS

341.2 .1 General

- .1 All materials shall be supplied by the Contractor and shall conform to the requirements of CAN/CSA S6.
- .2 The bearings shall be of an approved type sufficient to provide as a minimum, the loading and movement capacities indicated in the Contract Documents.
- .3 The elastomer used in the bearings shall be 100% virgin natural polyisoprene of nominal 55 \pm 5 durometer hardness having properties conforming to the requirements of CAN/CSA S6.
- .4 The elastomer compound used in the bearings shall conform to Grade 5 low temperature behaviour.
- .5 The steel laminations incorporated into the bearings shall be rolled mild steel sheets, with a minimum yield strength of 230 MPa and not less than 3 mm nor more than 5 mm in thickness.
- .6 The rubber/steel bearings must be moulded as complete units.
- .1 Vulcanizing or otherwise bonding rubber sheet to bearings cut from larger moldings shall not be accepted.
- .7 Bearing pressures, compressive deflections, rotation and shear deformations shall conform to the limits as specified in CAN/CSA S6.
- .8 Where indicated on reference bearings, all bearings shall be supplied complete with locating dowels and PVC caps.
- .1 The minimum effective rubber thickness shall take into consideration the effect of dowel penetration.
- .9 The effective rubber thickness, denoted as T in CSA Standard CSA S6 and T_e in Table 341-2, shall be the sum of the thicknesses of all laminates with a shape factor less than or equal to 12.
- .10 Bearings shall be stored at least 100 mm off the ground in a weatherproof enclosure.

341.2 .2 Elastomers

- .1 The elastomers shall conform to the following:
- .1 Virgin natural polyisoprene shall be the only raw polymer permitted; and
- .2 The physical properties of the polyisoprene used shall conform to the requirements of Table 341-1.

Table 341-1
Physical Properties of Polyisoprene

Property	Test	Requirements
Hardness, °Shore A	ASTM D2240	55 ± 5
Tensile Strength, MPa	ASTM D412	min. 17.0
Ultimate Elongation, %	ASTM D412	min. 400
Heat Resistance	ASTM D573	70h at 70°C
Change in hardness, °Shore A		max. +10
Change in tensile strength, %		max. -25
Change in ultimate elongation, %		max. -25
Compression Set, %	ASTM D395 Method B	22h at 70°C max. 25
Ozone	ASTM D518 Mounting Procedure A 20% strain 40 ± 2°C	25 pphm, 48 h no cracks
Bond between steel and Elastomer laminates, N. mm ⁻¹	ASTM D429 Method B	min. 7.0
Brittleness at - 40°C	ASTM D746 Procedure B	no failure
Low temperature crystallization increase in hardness, °Shore A	ASTM D2240	168 h at -25°C max. +15

341.3 SUBMITTALS

- .1 Only bearings which comply with the Contract Documents and have previously been approved by the Engineer, in writing, shall be considered acceptable for supply.
 - .1 The Contractor shall submit in writing, a minimum of 30 Days in advance of the installation, the name of the pre-approved manufacturer supplying the bearings, the manufacturer's part number and the physical dimensions of the bearing to be supplied.

- .2 The Contractor shall submit shop drawings for the bearings in accordance with Item 956 and the manufacturer shall provide the full data for the bearings including as a minimum the following:
 - .1 Individual laminate and total bearing dimension;
 - .2 Part numbers for bearings;
 - .3 Maximum load capacity in compression;
 - .4 Compression stiffness;
 - .5 Maximum movement capacity in shear;
 - .6 Installation details;
 - .7 Load capacity at serviceability limit states Combination 1, including:
 - .1 maximum compressive permanent and total loads,
 - .2 compressive stiffness, and
 - .3 shear stiffness;
 - .8 Number of steel plates in each bearing;
 - .9 Rotational capacity of each bearing under maximum and minimum load; and
 - .10 Material properties of the bearing components and test procedures employed to determine the properties.

- .3 The Contractor shall submit to the Engineer, in advance of the installation, the manufacturer's certification, as a written affidavit, that the materials supplied meet the specified requirements as detailed in the Contract Documents.

STEEL LAMINATED BEARINGS

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341.3 .4 All bearings being supplied for the Work shall be approved in writing by the Engineer prior to the placement of the bearing into the structure.

341.4 CONSTRUCTION

341.4 .1 General

.1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

341.4 .2 Fabrication

- .1 The fabrication of the steel laminated bearings shall conform to CAN/CSA S6.
- .2 Where pintles are specified, the depth of the pindle holes shall be such as to fully engage only one steel plate.
- .3 Each laminated bearing shall be marked with the date of manufacture and an individual alphanumeric identification. The latter shall consist of the designated identification letter of the supplier and source followed by the letter "I" for polyisoprene and a sequential five digit number.
 - .1 The characters shall be not less than 10 mm high, stamped or engraved into two adjacent sides, with the indentations or protrusions not less than 1 mm in width and 1 mm in depth.
- .4 The tolerances shall be as indicated in Table 341-2.

**Table 341-2
Bearing Tolerances**

Bearing thickness	≤ 40 mm	-0 mm to +3 mm
	> 40 mm	-0 mm to +6 mm
Bearing plan dimension		-0 mm to +6 mm
Thickness of individual layers of elastomer		± 20%
Deviation from plane parallel to theoretical surface		
	Top	1 in 200
	Sides	1 in 100
	Steel Laminates	0.25 T _e (Note 1)
Cover to embedded steel		±2 mm
Pindle hole diameter		-0 mm to + 2 mm
Relative position of pindle holes to each other		± 2 mm
Note 1: The tolerance of steel laminates shall be determined as follows: <ul style="list-style-type: none"> (a) The distance from the base of the bearing to the bottom of every plate shall be measured. Measurements shall be taken at each corner of rectangular bearings and at the extremities of two perpendicular diameters of circular bearings. (b) The difference between the highest and lowest measurements for every plate shall be recorded. (c) The cumulative total of the differences recorded, expressed as a fraction of the effective rubber thickness of the bearing, shall be recorded. 		

STEEL LAMINATED BEARINGS

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341.4 .3 Installation

- .1 The Contractor shall place bearings accurately with respect to the location and elevation, on level and smooth bearing surfaces, as indicated in the Contract Documents.
- .2 Bearing block elevations shall be adjusted when bearing thickness varies from the reference bearing thickness shown in the Contract Documents.
- .3 The tolerances shall be as indicated in Table 341-3.

Table 341-3
Tolerance For Top Of Bearing Elevations

Structure Type	Top Of Bearing Elevation
Concrete Structures	± 2.5 mm
Steel Structures	+ 3 mm
Box Girders	+ 2 mm
Deviation from level	± 0.1°

341.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of steel laminated bearings supplied and installed in accordance with this Item.

341.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 The Owner shall make partial payment for steel laminated bearings in accordance with 908.7.

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342.1 DESCRIPTION

- .1 This Item consists of the fabrication, supply and installation of all confined elastomer (pot) Bridge bearings required in the Contract.

342.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Bearings shall possess the minimum horizontal and vertical load capacity, and shall be constructed for the movement capacities, as indicated in the Contract Documents.
 - .1 The rotational bearings and sliding surfaces shall consist of components arranged so as to transmit all loads (including uplift) and accommodate the rotations and, where necessary, translations of the Structure.
 - .2 At serviceability limit state, the design shall be such that the bearings will not suffer damage which would affect their performance.
 - .3 At ultimate limit states, the strength and stability of the bearings shall be adequate to resist the factored loads and accommodate movements of the Structure.
- .3 Bearing material and workmanship shall comply with CAN/CSA S6.
- .4 The allowable bearing pressures on the confined elastomer and bonded confined polytetrafluoroethylene polymer (TFE) elements are to be as stipulated in clause 11 of CAN/CSA S6.
- .5 Steel components of the bearings (other than stainless steel sliding surfaces) shall conform to the requirements of CAN/CSA G40.21M, Grade 350A.
- .6 Stainless steel for sliding surfaces shall have a minimum corrosion resistance conforming to ASTM A167 Type 304.
- .7 Steel fasteners shall conform to ASTM A325 and shall be galvanized to conform to CAN/CSA G164.
 - .1 For centre guide bars alternative steel fasteners may be approved.
- .8 Brass sealing rings for confined elastomer bearings shall conform to ASTM B36 Half-hard.
- .9 Polyisoprene (natural rubber) shall conform to 341.2 except that the hardness may be 50 ± 5 .
- .10 TFE resin for use in sliding surfaces shall be virgin material and shall conform to ASTM D1457.
 - .1 It shall be unfilled and conform to the physical requirements indicated in Table 342-1.

Table 342-1
Physical Requirements for TFE Resin

Physical Property	ASTM Test Method	Requirement
Tensile Strength, MPa	D 638	minimum 20
Elongation, %	D 638	minimum 200
Relative Density	D 792	2.16 ± 0.03

342.2 .11 Material used as mating surface for guides for lateral restraint may be:

- .1 Unfilled TFE;
 - .2 TFE filled with up to 25% by mass of glass fibres; or
 - .3 Lead filled TFE in a bronze matrix.
- .12 Lubricant shall be silicone grease and shall conform to OPSS 1203.05.06.
- .13 Adhesives for bonding TFE to metal shall produce a bond with a minimum peel strength of 4 N/mm width when tested in accordance with ASTM D429 Method B and shall not degrade in the service environment.
- .14 All steel bearing components, other than the stainless steel sliding surfaces, shall be painted with a primer coat of inorganic zinc silicate paint with a dry film thickness of 75 microns (-10 microns or +15 microns) of Carbo Zinc 11, manufactured by Corrosion Service Company Limited, or approved equivalent in accordance with 335.2 and 335.4.
- .15 All surfaces, with the exception of the faying surface between the top of the top plate and the underside of the tapered shoe plate attached to the bottom flange of the girders (supplied under Item 335), shall be top coated with two coats of high build, modified aluminum epoxy mastic paint (Carbomastic 15) in accordance with 335.2 and 335.4.
- .1 Each of these top coats shall have a film thickness of 125 microns ± 20 microns.
- .16 The organic zinc primer shall be applied to a surface that is blast cleaned to conform to "The Steel Structures Painting Council" specification SSPC-SP10 - No. 10 "Near White Blast Cleaning".
- .17 All surface preparation and painting shall conform to 335.2 and 335.4.
- .18 The bolts for attaching the bearing top plate to the girder shoe plate shall be A325-Type I galvanized.
- .19 At full design load, the maximum rotation and/or the eccentricity of the axial load shall not exceed 3% of the diameter of the elastomeric disc.
- .20 Grout shall be In-Pakt Nonshrink Premix Grout or approved equivalent and shall have a minimum 28-day strength of 40 MPa.

BRIDGE POT BEARINGS

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342.2 .21 The entire bearing assembly, except for the top plate used to attach it to the Superstructure and the base plate used to anchor it to the Substructure but including both contact surfaces of the sliding interface, shall be replaceable without damage to the Structure and without removal of the concrete, welds or anchorages permanently attached to the Structure and without lifting the Superstructure more than 5 mm.

.1 Bearings shall not be recessed into plates that are permanently attached to the Structure.

.22 Bearings shall be stored at least 100 mm off the ground in a weatherproof enclosure.

342.3 SUBMITTALS

342.3 .1 General

.1 The Contractor shall submit the design for the bearings, designed for the specified translation and load capacities, in accordance with Item 956.

.1 Notwithstanding the requirements in 342.3.1.1, the submission shall include but not be limited to:

.1 Bearing layout and orientation;

.2 The top and bottom plate details including anchorages;

.3 Installation details;

.4 Method of attachment of bearings to the top and bottom plates;

.5 Load capacity at serviceability limit states Combination 1, including:

.1 maximum vertical permanent and total load,

.2 maximum lateral load and corresponding vertical load, and

.3 maximum rotational capacity about any horizontal axis and about the vertical axis through the centre of the bearing;

.6 The bearing ID letter and numbers.

.2 The Contractor shall have a stamped copy of these drawings at the site before and during site installation.

.2 Upon request, the Contractor shall submit certification that the fabrication is being performed by a recognized bearing manufacturer having experience in the manufacture of "pot" bearings.

.3 The Contractor shall submit to the Engineer a copy of the manufacturer's recommended procedures for handling, storing and installation of the bearings.

.4 The Contractor shall submit the manufacturer's signed written guarantee for the bearings, guaranteeing as a minimum:

.1 Each bearing is to perform satisfactorily, in the opinion of the designer/manufacturer, for a period of five years after the Bridge has been opened to regular vehicular traffic.

BRIDGE POT BEARINGS

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- 342.3.1.4 .2 If, during the five year guarantee period, the bearings do not perform satisfactorily, the manufacturer of the bearings shall replace the bearings.
- .1 All costs related to repairs, replacements, jacking of the Bridge, installation and any other Work necessary to complete the Work of replacing the bearings shall be incidental to this guarantee and shall be borne by the manufacturer of the bearings.
 - .2 All required repairs shall be carried out in accordance with this Item and shall be approved by the Engineer.
- .5 All grouting procedures shall be submitted for approval prior to commencement of the Work.
- .6 Submittals are required in accordance with any cross referenced Item forming part of this Item.
- 342.3 .2 Approval of Supplier
- .1 The Engineer may request for the supplier to be approved, in which case the supplier may be required to submit the following data for each class and type of bearing:
 - .1 Typical drawings showing all materials, tolerances, details of construction including uplift restraint devices, if applicable, and methods of installation.
 - .2 Load range (minimum and maximum).
 - .3 Maximum rotational capacity about any horizontal axis and the vertical axis through the centre of the bearing.
 - .4 Maximum translational capacity.
 - .5 Lateral Load capacity of rotational bearings.
 - .6 Capacity of lateral restraints of translational elements.
 - .7 Corrosion protection.
 - .8 A TFE sample of at least 200 mm in diameter.
 - .9 A typical sample of elastomeric disc.
 - .10 A sample of the smallest production size unidirectional bearing with a translational capacity of at least ± 50 mm, the shop drawings and the design calculations for the bearing.
 - .11 The design calculations shall be stamped and signed by a Professional Engineer.
 - .12 Final approval of the source of supply shall be based on compliance of the sample bearing, and the shop drawings with the specified requirements noted in the Contract Documents.
 - .1 Any deviation from the materials and details indicated on the typical drawings and the typical sample shall be cause for cancellation of approval and necessitate application for approval.

342.4 CONSTRUCTION

342.4 .1 Design Requirements

342.4.1 .1 General

- .1 The bearings shall be proportioned to function satisfactorily under the critical combinations of the maximum and minimum factored loads and the factored translations and rotations at the serviceability limit state and the ultimate limit states as shown on the Contract Documents.
- .2 Bearings subject to uplift shall limit the separation of the bearing components to the value specified.
- .3 All steel components of the bearings, including fasteners, shall be proportioned in conformance with the requirements of CAN/CSA S6.
- .4 The average stress in the elastomer at serviceability limit state Combination 1 loads shall conform to the requirements of 342.2.4.

342.4.1 .2 Translation Rotation

- .1 Provision for translation shall be through sliding of a stainless steel surface against a mating TFE element.
- .2 The translational capacity in the unrestrained direction or directions shall be as specified, or ± 50 mm, whichever is greater.
- .3 Translational elements with lateral restraints shall be capable of resisting the greater of the lateral loads as specified or either of the following:
 - .1 For bearings with a capacity of 5000 kN or less at serviceability limit state Combination 1, 10% of the vertical load capacity.
 - .2 For bearings with a capacity over 5000 kN at serviceability limit state Type II plus 5% of the vertical load in excess of 5000 kN.
- .4 Provision for rotation about any horizontal axis shall be by means of a single disc of confined elastomer for pot bearings.
- .5 The rotational capacity about the vertical axis through the centre of the bearing shall be as specified or $\pm 1^\circ$, whichever is greater.
- .6 Uplift restraint devices shall not restrict rotations.
- .7 At serviceability limit state Combination 1 loads and maximum rotation, the shift in the axial load from the centre of bearing shall not exceed the following values:
 - .1 3% of the diameter of the confined elastomer for pot bearings.
- .8 Rotational bearings shall be capable of resisting, in any direction, the lateral loads as specified in combination with the applicable vertical loads.

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- 342.4.1.2 .9 The rotation of confined elastomeric bearings about a horizontal axis shall be limited so that the vertical strain at the perimeter of the elastomer, at serviceability limit state Combination 1 loads does not exceed 0.15 of the elastomer thickness.
- .10 Brass sealing rings at least 6 mm wide shall be provided at the perimeter of the elastomer to prevent the elastomer from extruding between the piston and the pot wall.
- .11 A minimum of two layers of flat sealing rings shall be used with the split ends equally positioned around the circumference of the elastomer and shall fit snugly against the surface of the inside perimeter of the pot wall.
- .12 The sealing rings shall be flat and smooth on all surfaces.
- .13 The upper edge of the elastomer shall be recessed to accommodate the sealing rings.
- .14 The depth of the pot wall shall be such that a minimum vertical distance of 2.5 mm remains between the top of the pot wall and the closest point of contact of the sealing rings with the pot wall upon rotating the piston and amount equal to the required rotation plus 1°.
- .15 The pot and piston surfaces in contact with the confined elastomer shall be lubricated with silicone grease.
- .16 The bearing shall be sealed by a one piece continuous performed closed-cell compressible ring against entry of dirt, Dust and moisture between the elastomer and the pot and piston contact surfaces.
- .17 Any joint in the ring shall be bonded and the strength shall be at least equal to the strength of the ring.
- 342.4.1 .3 Sliding Surfaces
- 342.4.1.3 .1 General
- .1 Sliding surfaces shall allow translation or rotation by sliding of a metal surface against a mating TFE element.
- .1 For plane surfaces, the metal surface shall be stainless steel; and for spherical surfaces, the metal surface shall be stainless steel or anodized aluminum alloy.
- .2 The metal surface shall overlap the TFE by at least 5 mm at extremes of movement and except for guides for lateral restraint, shall be positioned above the TFE element so that the sliding movements will cause the accumulations of Dust and dirt to fall off.
- 342.4.1.3 .2 TFE Element
- .1 Except when used as mating surfaces for guides for lateral restraint, the TFE resin shall be virgin material and shall be used as unfilled sheets and shall contain spherical reservoirs for lubricant pressed into its surface.
- .2 The diameter of the reservoirs shall not exceed 8 mm, measured at the surface of the TFE, and the depth shall not be less than 2 mm nor more than half the thickness of the TFE.

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- 342.4.1.3.2 .3 The reservoirs shall be evenly distributed across the surface of the TFE and shall occupy not less than 20% nor more than 30% of the surface.
- .4 Material used as mating surface for guides for lateral restraint shall conform to 342.2.12 and 342.2.13 and shall not be dimpled or lubricated.

342.4.1.3 .3 Stainless Steel

- .1 The thickness of the stainless steel sheet shall not be less than that given in Table 342-2 for dimensional differences between stainless steel and the TFE in the direction of movement.

Table 342-2
Thickness Of Stainless Steel

Dimensional Difference between Stainless Steel and TFE mm	Minimum Thickness of Stainless Steel mm
≤ 300	1.5
> 300 and ≤ 500	2.0
> 500 and ≥ 1500	3.0

342.4.1.3 .4 Lubrication

- .1 All TFE surfaces except those which act as mating surfaces for guides or are subject to a contact pressure of less than 5 MPa, shall be permanently lubricated with silicone grease.

342.4.1.3 .5 Thickness of TFE and Depth of Recess

- .1 The TFE element shall be fully bonded in the manufacturer’s plant and recessed in a rigid backing material.
- .2 Thickness of the TFE element and the depth of recess shall be as given in Table 342-3.

Table 342-3
Thickness of TFE Elements and Depth of Recess

Maximum Plan Dimension, mm	≤ 1200	> 1200
Thickness, mm	5.0	5.5
Depth of Recess, mm	2.5	3.0

342.4.1.3 .6 Contact Pressure

- .1 The average contact pressure for unfilled TFE elements based on the gross area of the TFE, shall not exceed the values given in Table 342-4.

Table 342-4
Average Contact Pressure For TFE Elements

Limit State	Dead Load MPa	Total Load MPa
Serviceability - Combination 1	30	45
Ultimate	45	65

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- 342.4.1.3.6 .2 The maximum contact pressures at the extreme edges of flat and curved TFE elements shall not exceed 1.2 times the values given in Table 342-4.
- .3 The average contact pressure at serviceability limit state Combination 1 loads for filled TFE elements used to face mating surfaces for guides for lateral restraint shall not exceed the following:
 - .1 TFE filled with up to 25% by mass of glass fibres 45 MPa.
 - .2 Lead filled TFE in a bronze matrix 60 MPa.

342.4.1.3 .7 Coefficient Of Friction

- .1 The coefficient of friction between stainless steel and lubricated virgin TFE shall not exceed the values given in Table 342-5 and shall be interpolated linearly for contact pressures within the range given.

Table 342-5
Coefficient Of Friction

Contact Pressure MPa	Coefficient of Friction
10	0.06
25 and above	0.03

342.4.1 .4 Guide For Lateral Restraint

- .1 The guides for lateral restraint shall be arranged to permit the required rotations about both the horizontal and the vertical axis.
- .2 Unless the guide bars are machined from the solid they shall be bolted and recessed not less than 5 mm into the plate to which they are attached.
- .3 The translational elements of guides for lateral restraint shall be faced with stainless steel and shall provide lateral restraint by sliding against mating surfaces faced with TFE conforming to 342.2.12 and 342.2.13.
- .4 Lead filled TFE shall be at least 2 mm thick and shall be mechanically fastened and bonded to the substrate.
- .5 Glass fill or virgin TFE shall be recessed and bonded to the substrate to conform to 342.4.1.3.5.

342.4.1 .5 Shoe and Base Plates

- .1 The shoe plate and base plate which are permanently attached to the Structure shall be provided with the bearings and shall conform to the requirements of the bearing and the Structure.

342.4.1 .6 Fasteners and Anchorage

- .1 Fasteners, used to attach the bearing to the top and base plates, and anchorage devices shall be capable of resisting the greater of the lateral loads as specified or either of the following:

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- 342.4.1.6.1 .1 For bearings with a capacity of 5000 kN or less at serviceability limit state Combination 1, 10% of the vertical load capacity.
- .2 For bearings with capacity over 5000 kN at serviceability limit state Combination 1, 500 kN plus 5% of the vertical load capacity in excess of 5000 kN.
- .2 The beneficial effect of friction shall be neglected in proportioning the fasteners and anchors.

- 342.4.1 .7 Replaceability
 - .1 The entire bearing assembly, except for the top plate used to attach it to the Superstructure and the base plate used to anchor it to the Substructure but including both contact surfaces of the sliding interface, shall be replaceable without damage to the Structure and without removal of any concrete, welds or anchorages permanently attached to the Structure and without lifting the Superstructure more than 5 mm.
 - .2 Bearings shall not be recessed into plates that are permanently attached to the Structure.

- 342.4.1 .8 Durability
 - .1 The bearings shall be fabricated from materials which are durable and are protected against corrosion so to perform their intended function.
 - .2 Bearings shall be designed to prevent moisture and dirt from entering the internal surfaces.

- 342.4.1 .9 Concrete Bearing Pressure
 - .1 At serviceability limit state Combination 1 loads the average concrete bearing pressure shall not exceed 17 MPa.
 - .2 At ultimate limit states, the average concrete bearing pressure shall not exceed 24 MPa.
 - .3 The top and base plates of the bearing shall be proportioned to ensure that the permissible bearing pressures are not exceeded.
 - .4 The effective area for distributing the bearing load shall be taken as the contact area of the elastomer or TFE transferring the load to the plate plus the area within the uninterrupted dispersal lines drawn at 45° to the line of application of the load from the contact area.

- 342.4 .2 Fabrication

- 342.4.2 .1 Welding
 - .1 Welding of structural quality steels shall conform to 335.4.
 - .2 Welding of stainless steel shall be done with appropriate electrodes conforming to CAN/CSA W48.2 or AWS A5.22.
 - .3 The welding procedure shall be approved by the Canadian Welding Bureau.

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- 342.4.2.1 .4 The stainless steel sheets which will be in contact with TFE shall be one piece continuously welded around the perimeter to its backing plate to prevent ingress of moisture.
- .5 The weld shall be clean, uniform and without overlaps and shall be located outside the area in contact with TFE.
- 342.4.2 .2 Fasteners
- .1 The threaded portion of the bolts shall be coated with silicone grease prior to installation.
- 342.4.2 .3 Anchors
- .1 When the Contract Documents specify that bearings shall be supplied from a listed source, the top and base plate anchorage to concrete may be provided by studs, using the fusion welding process, unless otherwise indicated in the Contract Documents.
- .1 The anchorage for steel structures shall be provided with bolts and anchor bolts as indicated on Standard Drawing 342-1 and in the Contract Documents.
- .2 Alternative methods of anchoring these plates may be approved.
- 342.4.2 .4 Machining
- .1 Machining shall be carried out after welding wherever possible.
- .2 Metal to metal contact surfaces shall be machined or fine ground.
- .3 The pots and pistons for confined elastomer bearings shall be machined from solid metal plate or castings.
- .4 There shall be no openings or discontinuities in the metal surfaces in contact with the elastomer or TFE.
- 342.4.2 .5 Roughness Of Metal Surface
- .1 The roughness of metal surface in contact with TFE, measured to conform to CAN/CSA B95, shall not be greater than 0.25 μm arithmetic average for plane surfaces.
- .2 The roughness of metal surfaces in contact with elastomers measured to conform to CAN/CSA B95, shall not be greater than 3.0 μm arithmetic average.
- 342.4.2 .6 Attachment of TFE
- .1 Virgin or glass filled TFE elements shall be recessed in a rigid backing material and shall be bonded over the entire area with an adhesive.
- .2 The rigid backing material shall be grit blasted prior to applying the adhesive.
- .3 Lead filled TFE shall be mechanically fastened, and bonded to the backing plates.

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342.4.2 .7 Corrosion Protection

- .1 All exposed metal surfaces except stainless steel, and components permanently attached to steel Superstructures shall be protected against corrosion by an inorganic/aluminum epoxy mastic system conforming to 335.2 and 335.4.
- .2 Steel fasteners shall be galvanized or protected by other approved methods.
- .3 For corrosion protection purposes, bearing components permanently attached to steel Superstructures shall be considered part of the structural steel.

342.4.2 .8 Identification

- .1 The bearings shall be supplied with each bearing marked with the date of manufacture and an individual alphanumeric identification.
- .2 The latter shall consist of the designated identification letter of the supplier and source followed by a sequential five digit number.
- .3 The characters shall be stamped or engraved into two adjacent sides and shall be clearly legible after installation.
- .4 The characters shall not be less than 10 mm high with the indentations not less than 1 mm in width and 0.5 mm in depth.

342.4.2 .9 Tolerances

342.4.2.9 .1 General

- .1 The deviation from flatness of stainless steel or aluminum alloy surfaces in contact with TFE for plane surfaces and from the theoretical surface for spherical surfaces shall not exceed 0.0003 LH mm for rectangular bearing nor 0.0006 RH mm for circular TFE elements, where L is the greater plan dimension for a rectangular bearing, R is the radius of a circular bearing and H is the free height of TFE element.
- .2 For confined elastomer bearings, the tolerance of fit between the piston and the pot shall be +0.75 mm to +1.25 mm.
- .3 The inside diameter of the pot cylinder shall be the same as the nominal diameter of the elastomer and shall be machined to a tolerance of -0, +0.125 mm for diameters up to and including 500 mm and -0, +0.175 mm for diameters over 500 mm.
- .4 The plan dimensions of the recess for the TFE shall be the same as the nominal plan dimensions of the TFE and shall be machined to a tolerance of 0, +0.2% of diameter or diagonal.
- .5 Overall bearing plan dimension ± 3 mm.
- .6 Overall bearing height ± 3 mm.
- .7 Machined surfaces except where otherwise specified ± 0.4 mm.

- 342.4.2.9 .2 Elastomer
- .1 Diameter +0.0 / -1.5 mm for diameters \leq 500 mm
+0.0 / -2.0 mm for diameters $>$ 500 mm
 - .2 Thickness -0.0 / +1.0 mm
 - .3 Brass rings
 - .1 Difference between internal diameter of brass ring and diameter of recess in the moulded elastomer shall be -0 / + 0.5 mm.
 - .2 Difference between sum of thickness of brass rings and recess depth in the moulded elastomer shall be -0 / + 0.25 mm.
 - .4 Recessed Guide Bars - American Standard Clearance Locational Fit Class LC3.
 - .5 Guides for Lateral - Gap between metal surfaces Restraints and mating TFE elements shall be 0.50 mm \pm 0.25 mm.
 - .6 TFE plan dimension + 0 / - 0.2% of diameter or diagonal
 - .7 TFE thickness - 0 / + 10.0% of thickness
 - .8 Depth of recess for TFE - 0 / + 0.3 mm
- 342.4 .3 Installation
- 342.4.3 .1 General
- .1 The Contractor shall carry out the Work at the locations as indicated in the Contract Documents.
 - .2 The Contractor shall ensure that all materials, workmanship, construction and inspection shall conform to the requirements of 335.2 and 335.4, except as further modified and expanded upon by this Item and/or submission under 342.3.1.1.
 - .3 All steel plates shall be pressed or machined flat prior to manufacture of the bearings.
 - .4 The bottom portion of the bearing (the pot), which contains the elastomer, shall be machined from a solid piece of steel.
 - .5 Tabs for bolting the pot to the masonry plate shall be machined from the same plate as the pot.
 - .1 Welding of the tabs for attachment of the tabs to the pot will not be permitted.
 - .6 Structural steel components of the bearings shall have a minimum dimension in any direction of 25 mm.
 - .7 The Contractor shall ensure that all bearings shall be installed in the Bridge under the direct supervision of a Qualified Technical Representative of the bearing manufacturer.

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- 342.4.3.1 .8 The bearings shall be shipped and stored in accordance with the manufacturers recommendations.
- .1 As a minimum the bearings shall be stored at the site in weatherproof shelters and kept out of direct sunlight.
- 342.4.3 .2 Grouting of Bearings
- .1 Prior to the grouting, the bearing base plates shall be carefully levelled within a tolerance of 1 in 200 and locked by means of the levelling and top nuts provided on the anchor bolts.
- .1 All concrete surfaces to be grouted are to be roughened to an amplitude of ± 5 mm and all dirt, rust, oil, grease, and other such contaminants are to be removed from the grout area prior to the commencement of grouting.
- .2 The annular space between the anchor bolts and sleeves shall be grouted with grout of flowable consistency mixed and placed in accordance with the manufacturer's instruction.
- .3 The space between the bearing base plates and top of concrete shall be filled with the "dry pack" grout mixed in accordance with the manufacturer's instructions.
- .1 Following dry packing, the grout shall be covered for 4 Days with wet burlap.
- .2 Grout shall be maintained at a temperature of at least 10°C during the curing period.
- .1 No grouting shall be done when the concrete or steel is below freezing.
- .4 Superstructure components shall not be placed on the bearings until the grout has obtained a minimum strength of 80% of the specified 28-day strength.

342.5 MEASUREMENT FOR PAYMENT

- .1 The fabrication, supply and installation of all confined elastomer (pot) Bridge bearings in accordance with this Item shall be on a lump sum basis.

342.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 The Owner will make partial payment for confined elastomer (pot) Bridge bearings in accordance with 908.7.

343.1 DESCRIPTION

- .1 This Item consists of the supply and installation of sealed expansion joint assemblies including modular assemblies.

343.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The approved expansion joint assemblies to be supplied shall be as noted in the Contract Documents.
- .3 Cast-in-place type anchors or inserts, steel cover plates and cap screws shall be supplied with the expansion joint assemblies.
- .4 All steel surfaces, with the exception of anchor studs, shall be sandblasted to a white metal finish and coated with an approved inorganic zinc coating conforming to CGSB 1-GP-171B Type 1 (100 $\mu\text{m} \pm 12 \mu\text{m}$ thick) or zinc metalized in accordance with CAN/CSA G189 (125 μm thick).
- .5 The support boxes for the sliding plates in modular expansion joints shall be designed such that the bottom plate transfers the load to the side plates, assuming no support from the thin layer of concrete beneath the support boxes.
- .6 All centre beams (separation beams) and edge beams shall be solid or voided steel extrusions or machined shapes and shall not be built-up welded members.
- .7 The design loading for sealed expansion joint assemblies and for centre beams shall be CL-625-ONT plus the dynamic load allowance, and all stresses shall be within the limits specified in CAN/CSA S6.
- .8 The round bar anchorages and cover plates shall conform to CAN/CSA G40.21 - Grade 260 W.
- .9 All steel used for extrusions, edge beams and support bars shall conform to the minimum requirements of CAN/CSA G40.21 - Grade 350A or ASTM A588, unless grades of higher yield strength are required to satisfy the stresses resulting from the loading specified.
 - .1 All other steel components shall conform to the minimum requirements of CAN/CSA G40.21 - Grade 300 W.
- .10 Welded anchor studs, when required, shall be the size indicated in the Contract Documents and shall be made from steel meeting the requirements of ASTM A-108.
- .11 Cover plates are to be galvanized by hot dipping in accordance with CAN/CSA G-164, to a minimum thickness of 175 μm and/or a minimum application of 1 kg/m^2 .
- .12 Anchors for cover plates shall be Richmond Insert Type LFW (closed ferrule) or approved equivalent, a minimum of 70 mm long sized for 13 mm diameter x 32 mm long threaded cap screws with Allen socket head or approved equivalent.

SEALED EXPANSION JOINT ASSEMBLIES**ITEM: 343**

343.2 .13 Sealed expansion joint assemblies shall be stored at least 150 mm off the ground in a manner to maintain the cross slope and avoid permanent distortion.

343.3 SUBMITTALS

- .1 The Contractor shall submit the shop drawings for the sealed expansion joint assembly in accordance with Item 956.
- .2 The Contractor shall submit proof of certification for the welders conducting the Work, prior to commencing the Work.
 - .1 All welders shall be certified by the CWB to CAN/CSA W47.1 specifications, and/or to a certification level of Qualified Welder as issued by the Province of New Brunswick.

343.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 A representative from the expansion joint assembly(s) manufacturer or supplier shall be present when modular expansion joints are installed.
 - .1 All materials, anchor bolt spacing and the recesses formed to receive the assemblies shall meet the representative's approval before the Contractor may place the assemblies.
- .3 The inserts for attaching the steel cover plates at curb(s), Sidewalk(s) and/or barrier wall(s), are to be cast in the concrete and the steel plates are to be fastened for final installation after the concrete has attained a minimum 24 hour set.
- .4 All welding shall conform to the requirements of CAN/CSA W59.
- .5 Cover plates are to be anchored on the approaching traffic side of the joint.
- .6 The steel portions of the expansion joint assemblies shall be fabricated in one piece in the fabricating shop, unless otherwise specified.
- .7 Portions of inorganic zinc coating, damaged in the field, shall be mechanically cleaned and recoated in the field.
- .8 Spacing hardware shall be released within 2 hours maximum of the placing of the adjacent concrete.
- .9 The steel portions of the expansion joint assemblies shall be fabricated to the dimensions indicated in the Contract Documents and are subject to the tolerances indicated in Table 343-1.

**Table 343-1
Expansion Joint Fabrication Tolerances**

Dimensions	Face of curb to back of curb	± 6 mm
	Face to face of curbs	± 6 mm
Crown		± 1 mm in 1 m

- 343.4 .10 The expansion joint assemblies shall be installed in the position indicated in the Contract Documents and are subject to the tolerances indicated in Table 343-2.

**Table 343-2
Expansion Joint Installation Tolerances**

Elevation	- 3 mm
This tolerance shall not be considered additive with the tolerances presented in Table 343-1	
Joint Opening	± 3 mm

343.5 MEASUREMENT FOR PAYMENT

- .1 The supply and installation of the complete sealed expansion joint assemblies in accordance with this Item shall be on a lump sum basis.

343.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price for each type of sealed expansion joint assembly, as identified under the Contract.
- .2 The Owner shall make partial payment for sealed expansion joint assemblies in accordance with 908.7.

344.1 DESCRIPTION

- .1 This Item consists of the supply and installation of steel finger joint assemblies.

344.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 All steel surfaces, with the exception of anchor studs, shall be sandblasted to a white metal finish and coated with an approved inorganic zinc coating.
 - .1 Carbo Zinc 11 and Dimecote 9 are approved coatings.
 - .2 Sandblasting shall not be used on stainless steel.
- .3 The round bar anchorages and cover plates shall conform to CAN/CSA G40.21 - Grade 260 W.
- .4 Welded anchor studs, when required, shall be the size indicated in the Contract Documents and shall be made from steel meeting the requirements of ASTM A-108.
- .5 Cover plates are to be galvanized by hot dipping in accordance with CAN/CSA G-164, to a minimum thickness of 100 µm and/or a minimum application of 1 kg/m².
- .6 Anchors for cover plates shall be Richmond Insert Type LFW (closed ferrule) or approved equivalent, a minimum of 75 mm long sized for 13 mm diameter x 50 mm long threaded cap screws with Allen socket head.
- .7 Structural steel in finger plate assemblies shall meet the requirements of CAN/CSA G40.21M Grade 350WT Category 3 or with a certified Charpy V-notch impact energy of 27 joules when tested at minus 30°C.
- .8 Stainless steel shall conform to the requirements of ASTM A240 :AISI Type 316.
- .9 Steel finger joint assemblies shall be stored at least 150 mm off the ground in a manner to maintain the cross slope and avoid permanent distortion.

344.3 SUBMITTALS

- .1 The Contractor shall submit the shop drawings for the finger joint assemblies in accordance with Item 956.
- .2 The Contractor shall submit proof of certification for the welders conducting the Work, prior to commencing the Work.
 - .1 All welders shall be certified by the CWB to CAN/CSA W47.2 specifications, and/or to a certification level of Qualified Welder as issued by the Province of New Brunswick.

344.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The inserts for attaching the steel cover plates at curb(s), Sidewalk(s) and/or barrier wall(s), are to be cast in the concrete and the steel plates are to be fastened for final installation after the concrete has attained a minimum 24 hour set.
- .3 All welding shall conform to the requirements of CAN/CSA W59.
- .4 Cover plates are to be anchored on the approaching traffic side of the joint.
- .5 The steel trough shall be sealed to the finger joint assembly to construct a durable watertight joint.
- .6 Steel finger joint assemblies shall be fabricated in one piece in the fabricating shop, unless otherwise specified.
 - .1 All expansion joint assemblies field welded shall be ground flush.
 - .2 Portions of inorganic zinc coating, damaged by field welding, shall be mechanically cleaned and recoated in the field.
 - .3 Inorganic zinc shall have all curing solution and residue removed by water and bristle brush, prior to installation of assemblies.
 - .4 Stud anchors on steel expansion joint assemblies shall conform to the requirements of CAN/CSA W59.
- .7 Steel finger joint assemblies shall be fabricated to the dimensions indicated in the Contract Documents and are subject to the tolerances indicated in Table 344-1.
 - .1 After fabrication and before application of coatings, finger joint assemblies shall be test fitted to verify operation.
 - .1 Test fitting shall be carried out in the presence of the Engineer with the joint compressed to a maximum gap of 25 mm, from end of fingers to root of opening, across the entire joint.
 - .1 Joints not meeting this tolerance shall be reworked until acceptable.

Table 344-1
Finger Joint Fabrication Tolerances

Dimensions	Face of curb to back of curb	± 6 mm
	Face to face of curbs	± 6 mm
Crown		± 1 mm in 1 m

- 344.4 .8 Steel finger joint assemblies shall be installed in the position indicated in the Contract Documents and are subject to the tolerances indicated in Table 344-2.

Table 344-2
Finger Joint Installation Tolerances

Elevation	- 3 mm
This tolerance shall not be considered additive with the tolerances presented in Table 344-1	
Joint Opening	± 3 mm

344.5 MEASUREMENT FOR PAYMENT

- .1 The supply and installation of the complete steel finger joint assemblies in accordance with this Item shall be on a lump sum basis.

344.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 The Owner shall make partial payment for steel finger joint assemblies in accordance with 908.7.

STEEL BALLASTWALL ANGLE

ITEM: 345

345.1 DESCRIPTION

- .1 This Item consists of the supply and installation of the steel angle on the top of each abutment ballastwall.

345.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 All steel surfaces, with the exception of anchor studs, shall be sandblasted to a white metal finish and coated with an approved inorganic zinc coating.
 - .1 Carbo Zinc 11 and Dimecote 9 are approved coatings.
- .3 The round bar anchorages and cover plates shall conform to CAN/CSA G40.21 - Grade 260 W.
- .4 Welded anchor studs, when required, shall be the size indicated in the Contract Documents and shall be made from steel meeting the requirements of ASTM A108.
- .5 Structural steel in the ballastwall angle shall meet the requirements of CAN/CSA G40.21M-300W.
- .6 Steel ballastwall angle shall be stored at least 100 mm off the ground in a manner to maintain the cross slope and avoid permanent distortion.

345.3 SUBMITTALS

- .1 The Contractor shall submit the shop drawings for the steel ballastwall angle in accordance with Item 956.
- .2 The Contractor shall submit proof of certification for the welders conducting the Work, prior to commencing the Work.
 - .1 All welders shall be certified by the CWB to CAN/CSA W47.1 specifications, and/or to a certification level of Qualified Welder as issued by the Province of New Brunswick.

345.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All welding shall conform to the requirements of CAN/CSA W59.

STEEL BALLASTWALL ANGLE

ITEM: 345

345.4 .3 Steel ballastwall assemblies shall be fabricated in one piece in the fabricating shop, unless otherwise specified.

.1 Portions of inorganic zinc coating, damaged by field welding, shall be mechanically cleaned and recoated in the field.

.2 Inorganic zinc shall have all curing solution and residue removed by water and bristle brush, prior to installation of assemblies.

.3 Stud anchors on steel ballastwall assemblies shall conform to the requirements of CAN/CSA W59.

.4 Ballastwall assemblies shall be fabricated to the dimensions and installed in the position indicated in the Contract Documents and Standard Drawing 345-1.

345.5 MEASUREMENT FOR PAYMENT

.1 The supply and installation of the complete steel ballastwall angle assemblies in accordance with this Item shall be on a lump sum basis.

345.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall be at the Lump Sum Price.

.2 The Owner will make partial payment for steel ballastwall angle assemblies in accordance with 908.7.

GUIDE RAIL SYSTEM - STRUCTURES

ITEM: 346

346.1 DESCRIPTION

- .1 This Item consists of the supply and installation of an aluminum guide rail system on a Highway Structure.

346.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

346.3 SUBMITTALS

- .1 The Contractor shall submit shop drawings for the aluminium guide rail system in accordance with Item 956.

346.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall be responsible for the placing and alignment of the anchor bolts in the formwork and concrete at the stage of the Work when this placement must occur.
- .3 The Contractor shall install all posts and railing(s) and these shall be secured firmly in place.
- .4 All contacting aluminum and concrete surfaces shall be separated by a fabric pad.
- .5 Aluminum posts shall be separated from steel bolts by nylon or plastic bushings.
- .6 Rail posts bases bearing unevenly on concrete surfaces shall be brought to bear in alignment as specified by grouting under the base plate of the rail post with an approved epoxy grout, as approved by the Engineer.
 - .1 The grout shall provide a smooth bearing surface under the full base plate area and shall form a waterproof seal.

346.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of aluminum guide rail system on a Highway Structure supplied and installed in accordance with this Item.
- .2 The measured Quantity shall be the direct straight line measurement along the centerline of the guide rail system, measured from end cap to end cap of each section and on both sides of the Structure.

346.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of aluminum guide rail system on a Highway Structure, as identified under the Contract.

SERVICE DUCT - STRUCTURES

ITEM: 348

348.1 DESCRIPTION

- .1 This Item consists of the supply and installation of all service ducts in Structures.

348.2 MATERIALS

348.2 .1 General

- .1 All materials shall be supplied by the Contractor.

348.2 .2 Fibreglass Duct

- .1 Fibreglass duct, couplings, bends and end caps shall be made of fibreglass reinforced epoxy (FRE) and shall conform to CAN/CSA C22.2.

348.2 .3 Polyvinyl Chloride Duct

- .1 All PVC duct, bends, couplings and caps shall conform to Bell Canada's Specifications - "Semi-Rigid Plastic Duct" - CT20-286 and shall be Type II (Thick Wall).
- .2 Each section of PVC duct shall have the following information printed on the duct surface and at intervals not exceeding 1.5 m:
 - .1 Manufacturer's name and trademark;
 - .2 Inside diameter in millimetres; and
 - .3 Type designation.

348.2 .4 Steel Supports

- .1 Steel in supports and sleeves shall conform to CAN/CSA G40.21-300.
- .2 All steelworks shall be galvanized in accordance with CAN/CSA G-164.

348.2 .5 Fish Rope

- .1 The fish rope shall be polypropylene not less than 5 mm in diameter and shall be one piece in each duct.

348.2 .6 Storage

- .1 Materials are to be stored in an organized fashion at least 100 mm off the ground with individual pieces contained or strapped.

348.3 SUBMITTALS

- .1 The Contractor shall submit to the Engineer, upon request, the manufacturer's certification that the materials meet or exceed the specified grade.

348.4 CONSTRUCTION**348.4 .1 General**

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall ensure that an inspection of the Work has been completed and the Work is accepted, in writing by the Engineer, prior to the placement of any concrete surrounding and encasing the Work.

348.4 .2 FRE Duct

- .1 The duct shall be of the bell and spigot type with all joints fully seated together.
- .2 The duct shall be tied with wire to the reinforcing steel at intervals not exceeding 1.5 m.
- .3 Where external supporting steelworks is detailed in the Contract Documents, the Contractor shall supply and install this Structure at the stage of the Contract most beneficial to complete the Work.
- .4 A minimum of 3 Days notice prior to placing concrete on the duct shall be given to the Engineer to allow inspection of the FRE service ducts.
- .5 Expansion sleeves shall be provided at each expansion joint in the Bridge Superstructure and shall be of the type indicated in the Contract Documents.

348.4 .3 PVC Duct

- .1 Joints shall be fitted with push-fit type couplings and the duct shall be fully seated into the coupling.
- .2 The duct shall be tied with wire to the reinforcing steel at intervals not exceeding 1.5 m.
- .3 Expansion sleeves shall be provided at each expansion joint in the Bridge Superstructure and shall be of the type as indicated on the Contract Documents.
- .4 Each duct run shall be equipped with two (1 m) 45° bends in each abutment and shall be as shown in the Contract Documents or as directed by the Engineer.
- .5 A 300 mm long galvanized steel pipe sleeve shall be provided on each PVC duct where it leaves the end of the abutment wingwalls or Sidewalks.
 - .1 The galvanized steel sleeve shall be embedded 200 mm in the abutment wingwall or Sidewalk and shall extend 100 mm beyond the concrete surfaces.
 - .2 The exposed 100 mm of the galvanized steel pipe sleeve shall be threaded on the outside.

SERVICE DUCT - STRUCTURES

ITEM: 348

348.4 .4 Testing

348.4.4 .1 General

- .1 After the installation is complete, a mandrel with a diameter of at least 90% of the diameter of the installed duct and a minimum length of 250 mm, shall be passed through the length of the duct system in the presence of the Engineer.
- .2 The Contractor shall be responsible to clear and/or replace any ducts that do not pass the mandrel test.
- .2 After completion of testing, the Contractor shall thread each duct with a fish rope and terminate at each end in a "screw-eye" inserted in the recess provided in the duct cap.
 - .1 A surplus of approximately 1 m of fish rope shall be provided at each duct end.
 - .3 Caps shall be affixed to each end of the duct with an appropriate solvent welding cement to the galvanized steel pipe sleeves at the ends of abutment wingwalls or Sidewalks.

348.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of duct supplied and installed in accordance with this Item.
- .2 The linear measurement shall be taken from end to end on each duct and shall be measured along the continuous direct run of the duct.

348.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of duct, as identified under the Contract.
- .2 The Owner shall make partial payment for duct in accordance with 908.7

WATERPROOFING

ITEM: 351

351.1 DESCRIPTION

- .1 This Item consists of the supply and installation of waterproofing systems on Structures.

351.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
 - .1 The waterproofing system "A" shall be a manufactured waterproofing membrane system consisting of a primer, a membrane and a mastic and shall be used on the decks of Structures.
 - .2 The waterproofing system "B" shall be a manufactured waterproofing membrane system consisting of a primer, a membrane, a mastic and a protection board and shall be used on the ballastwalls of Structures and on concrete box Culverts.
 - .1 Protection board shall be Vibraflex Type 70 or IKO 1/8" Protecto Board or approved equivalent and having a maximum absorption of 3%.
 - .3 The approved waterproofing system shall be selected from the list provided in the Contract Documents.
- .2 Materials shall be stored at least 100 mm off the ground in a weatherproof enclosure.

351.3 SUBMITTALS

- .1 The Contractor shall submit to the Engineer, 7 Days in advance of the commencement of the Work, the proposed type of waterproofing system including the following:
 - .1 The manufacturer's recommended procedures for installation and instructions for handling the waterproofing system and its components.
 - .2 The manufacturer's specified minimum temperature for asphalt concrete during placement on the waterproofing system.
 - .3 The Contractor shall select a product appropriate for the application and field conditions in accordance with the manufacturer's specifications.
 - .4 The waterproofing and asphalt concrete shall perform as a waterproofing system.

351.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All concrete surfaces shall be dry and free of foreign materials prior to priming.
 - .1 Any primed surfaces left overnight shall be re-primed prior to membrane application.
- .3 The Contractor shall prepare the area and install the waterproofing system in accordance with the manufacturer's installation specifications and instructions.
- .4 For all waterproofing applications the following shall apply:
 - .1 The membrane shall be protected, when so noted in the Contract Documents, with the specified protection board, adhered to the waterproofed surface.

WATERPROOFING

ITEM: 351

- 351.4.4 .2 Any protection board which is to be left exposed for more than 48 hours shall be protected from sunlight exposure in accordance with the manufacturer's instructions.
- .3 All exposed edge terminations shall receive a trowelled bead of mastic.
- .5 For Bridge decks, the edge details shall be constructed as shown on Standard Drawing 351-1 or 351-4.
- .1 Solvent based materials shall be cured for appropriate time period prior to the placing of the waterproofing membrane.
- .6 For ballast walls the membrane shall be applied in vertical strips starting at the mid-depth of the downward angle of the ballast wall angle.
- .1 The membrane shall cover the entire back face of the ballast wall with a minimum 150 mm overlapping onto the approach slab and wingwalls.
- .2 The details for installation are shown on Standard Drawing 351-2.
- .7 For concrete box Culverts, the following conditions shall apply:
- .1 The membrane shall be applied in strips perpendicular to the long axis of the Culvert.
- .2 The membrane shall be installed in accordance with Standard Drawing 351-3.
- .3 The protection board shall be applied over the top of the waterproofing system, on both the top and sides and adhered to the membrane by placing gobs of the mastic at 600 mm centres between the two surfaces.
- .4 The protection boards shall be butted tightly and shall be orientated vertically when coverage of the sides is specified and in all cases shall completely cover the applied waterproofing system.
- .8 The Contractor shall pave a Bridge deck within 3 Days of the installation of the deck slab waterproofing.
- .9 Prior to placement of asphalt concrete, the Contractor shall survey the entire waterproofed surface using the chain drag method to identify any unbonded areas.
- .1 Unbonded areas shall be repaired according to the Manufacturers recommendations and to the satisfaction of the Engineer prior to proceeding.

351.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of waterproofing system supplied and installed in accordance with this Item.
- .1 Starter strips, flashing, overlapped joints, double plied areas, patches and seams shall be measured as a single layer of the waterproofing system.

351.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of waterproofing system, as identified under the Contract.
- .2 The Owner shall make partial payment for the waterproofing system in accordance with 908.7.

SHORING

ITEM: 361

361.1 DESCRIPTION

- .1 This Item consists of the design, supply, construction and removal of the materials necessary to shore excavations.

361.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Timber and lumber used in the construction of shoring shall be graded and stamped with the grade mark used by the Canadian Lumber Manufacturing Association and agencies authorized to mark lumber in Canada and/or lumber approved by the Engineer.
- .3 Timber piles used in shoring shall meet the requirements of CAN/CSA 056.
- .4 Steel sheeting shall be free from kinks and bends.
- .5 Steel members with reduced cross-sectional areas due to holes, cuts, and other discontinuities differing from those shown in the design submission and/or in the Contract Documents which reduce the design capacity of the members shall not be used.
- .6 When the grade of the steel members is not known and/or certified, the Engineer will assume that the yield point of the steel is 200 MPa.

361.3 SUBMITTALS

- .1 The Contractor shall be responsible for the design of the shoring and associated bracing and shall submit the design, in accordance with Item 956.
 - .1 Shoring shall also be designed by the Contractor to meet the requirements of Section 21 of the Industrial Safety Code.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

361.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer and/or as may be required due to Work Site conditions as the Work progresses.
- .2 The Contractor shall design and construct all shoring to withstand the anticipated design loadings.
- .3 The Contractor shall be responsible for the adequacy of the shoring and the safety of the workmen and the Work Area, continuously from the time of placement of the shoring until such time as the shoring is removed.
- .4 The Contractor shall remove the shoring and all materials shall remain the property of the Contractor and he shall dispose of them outside the Work Site.

361.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of shoring designed, constructed and removed in accordance with this Item.
- .2 The area to be measured for payment shall be the extent of the shoring exposed from the base of the excavation to a point vertically upward 300 mm below the surrounding natural grade and horizontally along the edge of the base of the excavation.

361.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

ENGINEERED FILL

ITEM: 365

365.1 DESCRIPTION

- .1 This Item consists of the supply and placement of engineered fill.

365.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Engineered fill shall consist of clean hard sound durable crushed rock, crushed gravel or pit run gravel, composed of clean, uncoated particles, free of mud, mudstone, siltstone or other unconsolidated rock material, organic materials and other deleterious material, and when tested in accordance with ASTM C117 and/or C136, shall conform to the grading limits of 31.5 mm crushed rock base or 31.5 mm crushed gravel base per 201.2.
- .3 Engineered fill shall not contain any friable, soluble or reactive minerals or other deleterious materials or conditions that would make the aggregate prone to decomposition or disintegration.
- .4 Engineered fill shall not present any environmental hazard, from the presence of the parent material or its by-products, when exposed to the natural elements after placement in the Work.
- .5 The material, when tested by the Micro-Deval test method in accordance with MTO LS-618, shall have a Micro-Deval loss not greater than 30%.
- .6 The Owner reserves the right to reject any source of supply of engineered fill solely on the basis of past field performance, documented by the records and experience of the Owner and/or the Engineer, regardless of compliance with gradation or physical requirements.

365.3 SUBMITTALS

- .1 The Contractor shall advise the Engineer a minimum of 7 Days prior to start of placing of any engineered fill.
- .2 Where engineered fill placement occurs between November 1st and May 1st, the Contractor shall submit, for approval, the proposed method of protection to prevent freezing of the engineered fill.

365.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The excavation for; and the placement of; the engineered fill must be one continuous operation, from commencement of the Work up to and until the engineered fill placement is completed up to the specified elevation.
- .3 The in-situ material, on which the engineered fill is to be founded, shall be compacted to a depth of 300 mm below the placement grade in accordance with Item 936 and to a minimum of 98% of the maximum dry density.
- .4 The engineered fill shall be placed on a firm, dry base and shall be placed in lifts not exceeding 200 mm and compacted in accordance with Item 936, to a minimum of 95% of the ASTM D1557 (modified Proctor) maximum dry density.

- 365.4.4 .1 Adjacent fill material shall be placed simultaneously and maintained at the same elevation as the engineered fill.
- .5 Neither the excavation below existing grade, nor the engineered fill as supplied or after placement, shall be permitted to freeze until after the bearing concrete has been cast.
- .6 The tolerances in elevation for the placement of the engineered fill shall meet the requirements of Table 365-2.

Table 365-2
Tolerances For Placement Of Engineered Fill

Surface	Tolerance in Elevation
Base of Engineered Fill	± 5% of the nominal thickness of the engineered fill specified in the Contract Documents
Top of Engineered Fill	± 25 mm

365.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of engineered fill supplied and placed in accordance with this Item.
- .2 The measurement shall be calculated based on the payment lines as indicated in the Contract Documents.

365.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 Haulage for engineered fill shall be paid for in accordance with Item 801.

FREE-DRAINING BACKFILL

ITEM: 366

366.1 DESCRIPTION

- .1 This Item consists of supply and placement of free-draining backfill.

366.2 MATERIALS

- .1 The Contractor shall supply all materials.
- .2 Free-draining backfill shall be clean, sound durable crushed rock, crushed gravel or pit run gravel.
- .3 Free-draining backfill shall meet the grading requirements shown in Table 366-1, when tested in accordance with ASTM C136.
 - .1 Concrete aggregates meeting the requirements of Item 302.2 may be approved for supply under this Item.

**Table 366-1
Free-Draining Backfill Gradation**

ASTM Sieve Size	Percent Passing
63 mm	100
50 mm	90 - 100
25 mm	35 - 100
19 mm	15 - 85
12.5 mm	0 - 53
9.5 mm	0 - 30
4.75 mm	0 - 4
1.18 mm	0 - 2

366.3 SUBMITTALS

- .1 The Contractor shall submit the source of material for approval in advance of obtaining the free-draining backfill.
- .2 The Contractor shall submit a request in writing for approval of the use of concrete aggregates as a source of supply for this Item.

366.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 When the water table is below the bottom of the free-draining backfill, positive drainage of the free-draining backfill shall be provided as indicated in the Contract Documents and/or on the Standard Drawing 366-1.
- .3 Free-draining backfill shall be placed simultaneously with the placing of adjacent embankment material.
- .4 The free-draining backfill shall be placed to the dimensions as indicated in the Contract Documents and/or on the Standard Drawing 366-1.

366.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of cubic metres of free-draining backfill supplied and placed in accordance with this Item.
- .2 The measurement shall be calculated based on the payment lines as indicated in the Contract Documents.

366.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF ASPHALT CONCRETE - STRUCTURES

ITEM: 371

371.1 DESCRIPTION

- .1 This Item consists of the removal and disposal of the existing asphalt concrete, including the waterproofing system, from a Bridge deck.

371.2 MATERIALS

- .1 None identified.

371.3 SUBMITTALS

- .1 None identified.

371.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All removed materials shall become the property of the Contractor and shall be disposed of outside of the Work Site.
- .3 The Contractor must take care when removing the existing asphalt concrete so as not to damage the concrete Bridge deck, steel orthotropic Bridge deck, Roadway drains, joints, curbs and other abutting components of the Structure.
 - .1 The Contractor shall be responsible, at his/her own expense, for the repair and/or replacement of such damage resulting from the Work.
- .4 All asphalt concrete shall be completely removed, including any deck waterproofing system which may be in place, to expose and leave bare the Portland cement concrete surface or steel orthotropic Bridge deck.
- .5 The Contractor shall not be allowed to remove the existing asphalt from the Bridge deck by cold milling.
- .6 The approach asphalt shall be removed in a stepped fashion to avoid a vertical face full depth of the asphalt at the interface of new and old asphalt.

371.5 MEASUREMENT FOR PAYMENT

- .1 The removal and disposal of the asphalt concrete carried out in accordance with this Item shall be on a lump sum basis.

371.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.

REMOVAL OF CONCRETE

ITEM: 372

372.1 DESCRIPTION

- .1 This Item consists of the removal and disposal of concrete from a Structure.

372.2 MATERIALS

- .1 None identified.

372.3 SUBMITTALS

- .1 The Contractor shall submit the proposed method and sequencing of the removal at least 14 Days prior to the commencement of the Work.

372.4 CONSTRUCTION

.1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The removal of the asphalt concrete to bare exposed concrete surface shall be carried out under Item 371.
- .3 All removed materials generated as a result of the Work shall be the property of the Contractor and shall be disposed of outside the Work Site.
- .4 Unless otherwise specified the railing and rail posts are to remain in place during the construction operations and the Contractor shall ensure that no damage to these articles occurs during the Work.
- .5 The Contractor shall take all care not to damage any portion of the Superstructure and supports during the Work.
- .6 The Contractor shall pay particular attention to the flow of traffic through the construction zone and any damage incurred to vehicles or their cargo or injury sustained to their occupants as direct or indirect result of the Contractor's action, procedures or negligence, shall be the sole responsibility of the Contractor.
 - .1 The Contractor shall indemnify and save harmless the Owner with regards to claims arising from damages or injuries.
- .7 The Contractor shall be responsible to ensure the security of the fall area below the Structure.
- .8 The Contractor shall be required to remove all concrete rubble and other waste from piers and abutments and from the Work Site before the Contract is completed.
- .9 The Contractor shall be responsible, at his/her own expense, for any damage or loss of adjacent and abutting features.

REMOVAL OF CONCRETE

ITEM: 372

372.4 .2 Equipment

- .1 All Equipment used to remove concrete from the repair areas shall be subject to the approval of the Engineer.

372.4.2 .2 Chipping hammers

- .1 Chipping hammers shall weigh less than less than 15 kg.
- .2 Chipping hammers shall be permitted in all areas of concrete removal.

372.4.2 .3 Jackhammers

- .1 Jackhammers shall weigh less than 40 kg.
- .2 Concrete removal utilizing a jackhammer shall not be permitted in the following areas:
 - .1 Within 100 mm of concrete that is to remain in place;
 - .2 Within 100 mm of the edges and faces of structural steel members that are to remain in place; and
 - .3 Within 25 mm of reinforcing steel that is to remain in place.

372.4.2 .4 Rig-Mounted Breakers

- .1 Utilizing a rig-mounted breaker for concrete removal shall not be permitted in the following areas:
 - .1 For barrier walls, parapet walls and deck slabs supported by concrete girders, unless the girders are to be removed;
 - .2 For barrier walls and parapet walls supported by steel beams, unless the deck slab is to be removed;
 - .3 Within deck joint assembly;
 - .4 Located within a distance from concrete to remain in place equal to the sum of 600mm and the lap length of steel reinforcement to remain in place as specified in the Contract Documents; and
 - .5 Within 600 mm from the edge and faces of structural steel members including shear studs to remain in place.

372.4 .3 Type A - Partial Depth Removal

- .1 This section consists of the partial depth removal and disposal of loose and unsound concrete.
- .2 The actual locations, area and extent of removal shall be determined on the site by the Engineer.
- .3 Partial depth removal shall apply to but is not limited to:
 - .1 Sidewalks and curbs;
 - .2 The top surface of decks; and
 - .3 Barrier walls, endposts and ballastwalls.

REMOVAL OF CONCRETE

ITEM: 372

- 372.4.3 .4 Concrete shall be removed in such a manner as to prevent damage to adjacent concrete, other components and utilities that are to remain in place.
- .5 Reinforcing steel, prestressing tendons, shear connectors, structural steel and other components to remain in place shall not be damaged or loosened.
- .6 Hammers shall not come in contact with reinforcing bars in a manner which will cause debonding of bars in adjacent concrete areas not being repaired.
- .7 Concrete removal shall not be permitted within 1 m of newly placed concrete for a period of 72 hours and to a minimum compressive strength of 20 MPa.
- .8 The unsound and delaminated areas of the concrete deck slab, curbs and endposts, as determined by the Engineer, shall be saw cut along all edges to a depth of approximately 15 mm orientated perpendicular to the original concrete surface.
- .1 Concrete shall be removed to a minimum of 20 mm below the bottom bar of the top mat of reinforcing steel.
- .1 Any additional unsound concrete, beyond the minimum specified, shall also be removed from these areas.
- .2 Removal of concrete beyond the specified limit shall only be carried out when directed by the Engineer.
- .9 All of the exposed reinforcing steel within these repair areas shall be cleaned by sandblasting (or Engineer approved alternate method) such that it is free of scale, rust and concrete.
- .10 The maximum size of the air hammer to be used when removing concrete around reinforcing steel shall be 156 N.
- .11 In areas where the top mat of reinforcing steel is completely exposed, the bars shall be retied at each intersection point.
- 372.4 .4 Type B - Full Depth Removal
- .1 This section consists of the full depth removal and disposal of concrete.
- .2 The actual locations, area and extent of removal shall be determined on the site by the Engineer.
- .3 Full depth removal areas shall be saw cut along all edges, perpendicular to the existing concrete surface to a depth of 25 mm or to the top layer of reinforcing steel, whichever is less.
- .4 All of the exposed reinforcing steel within these repair areas shall be cleaned by sandblasting (or Engineer approved alternate method) such that they are free of scale, rust and concrete.
- .5 Care shall be taken not to damage, cut or loosen the reinforcing steel.
- .6 Exposed reinforcing steel shall be retied at each intersection point.

REMOVAL OF CONCRETE

ITEM: 372

372.4.4 .7 The Contractor must take care during the removal of deck concrete in the curb areas so as not to damage the existing reinforcing steel, granite curbing, railposts and railing in any way.

.8 The Contractor shall employ methods approved by the Engineer to protect the steel Superstructure from falling concrete debris.

372.4 .5 Type C - Complete Removal

.1 This section consists of the complete removal and disposal of concrete above the girders/floor stringers of a Structure.

.2 The use of explosives shall not be permitted.

.3 The Contractor shall not drop any materials from the Bridge deck area.

.4 The Contractor shall clearly mark, on the surface of the Bridge deck, the locations of the supporting members in advance to performing saw cutting and/or jack hammering operations in order to prevent cutting, nicking or spalling of the supporting members.

.5 Where supporting members have shear connections or stirrups embedded in the deck slab, the Contractor shall employ concrete removal methods that will not result in damage to those embedded elements nor the supporting members.

372.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of square metres of deck concrete removed and disposed of in accordance with this Item.

372.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall include a separate Unit Price for each type of removal, as identified under the Contract.

REMOVAL OF STRUCTURES

ITEM: 381

381.1 DESCRIPTION

- .1 This Item consists of the removal of Structure(s) including the disposal of all debris.

381.2 MATERIALS

- .1 None identified.

381.3 SUBMITTALS

- .1 The Contractor shall submit drawings and design calculations in accordance with Item 956.
- .2 The Contractor shall submit to the Engineer, upon request, at least 14 Days prior to the commencement of the Work, the proposed method and sequencing of the removal of the Structure for approval by the Engineer and the Department of Environment and Local Government.
 - .1 The submittal shall include the proposed method for the capture and removal of the debris from the Structure, the proposed retention system for preventing the material from falling into the wetted portion of the watercourse and techniques to be used for the removal of any material which inadvertently falls into the watercourse.

381.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 For Structures in or over watercourses, the Contractor shall carry out the Work in accordance with Item 948 and the following:
 - .1 The Structure shall be removed without releasing harmful materials or contaminants into the watercourse.
 - .2 The removal of material which falls into the river shall be accomplished without stationing equipment in the wetted portion of the watercourse or disturbing the riverbed.
- .3 The Contractor shall protect public traffic from the dust and debris resulting from the Work.
- .4 Explosives will not be permitted for demolition.
- .5 All Work shall be carried out in accordance with CAN/CSA S350 - "Code of Practice for Safety in Demolition of Structures".
 - .1 The Structure shall be removed in such a manner to eliminate contact with the riverbed.
- .6 The following conditions shall apply for buried portions of the Structures:
 - .1 Foundation excavation for the Work shall be carried out in accordance with 161.4.
 - .2 Backfilling of the Work Area shall be carried out in accordance with 106.4 or 108.4, depending on the backfill material to be placed.

REMOVAL OF STRUCTURES

ITEM: 381

381.4 .7 All waste and demolition debris shall become the property of the Contractor and shall be disposed of outside the Work Site at an approved Construction and Demolition Material Disposal Site.

.1 Waste and demolition debris shall be recycled where possible.

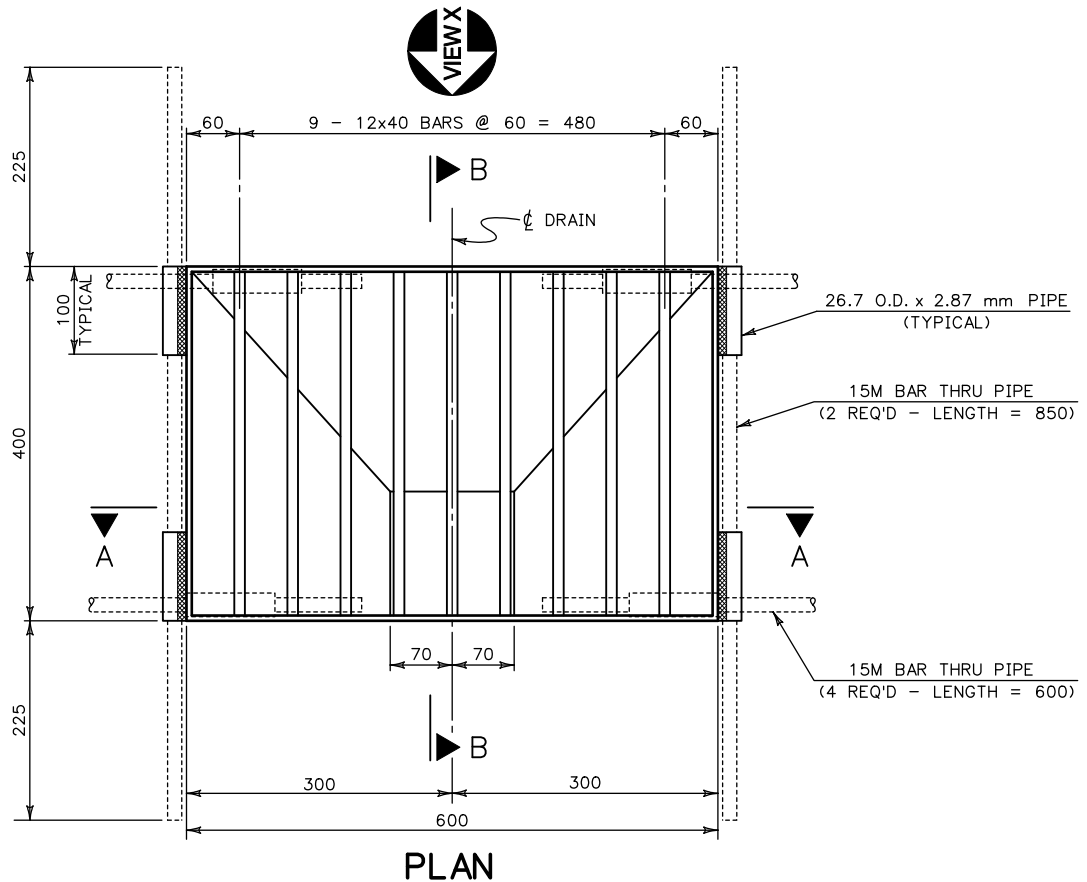
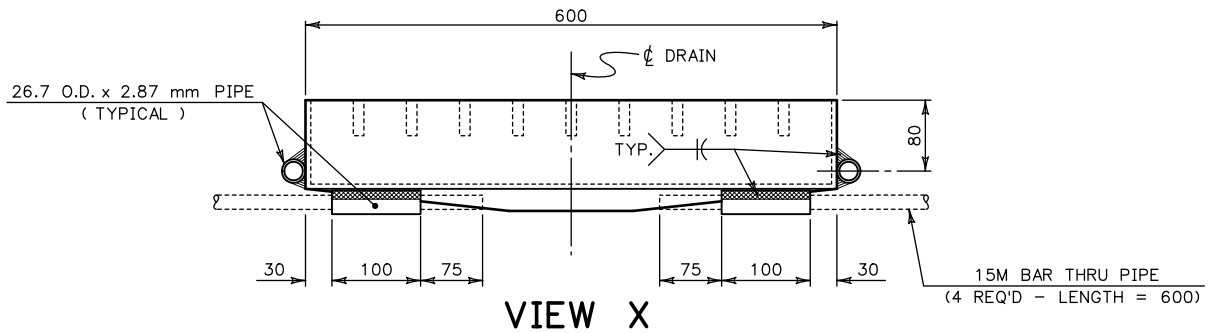
.8 Any damage to the riverbed or to portions of the Structure which are to remain in place shall be repaired by the Contractor at his/her own expense.

381.5 MEASUREMENT FOR PAYMENT

.1 The removal of a Structure(s) in accordance with this Item shall be on a lump sum basis.

381.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall be at the Lump Sum Price.

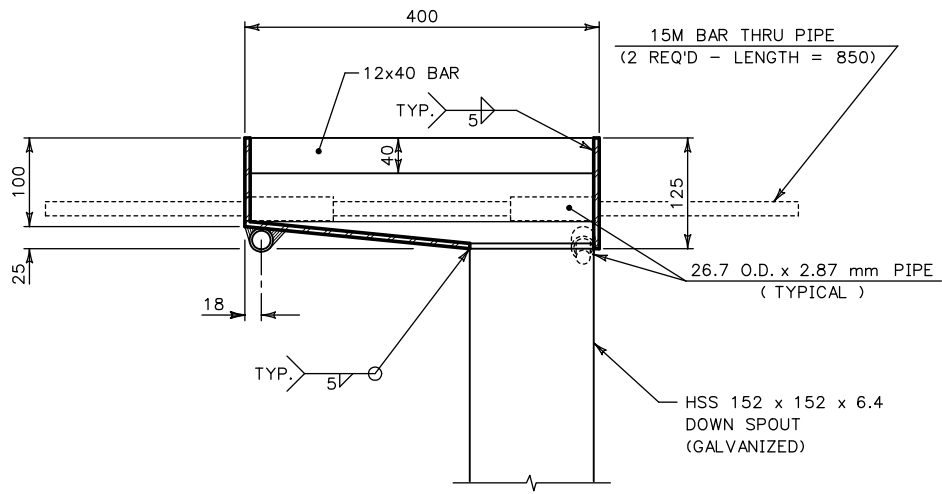


NOTES:

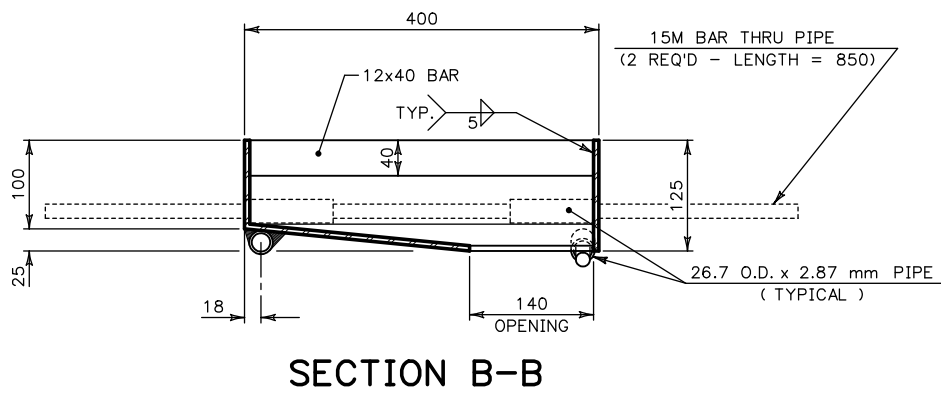
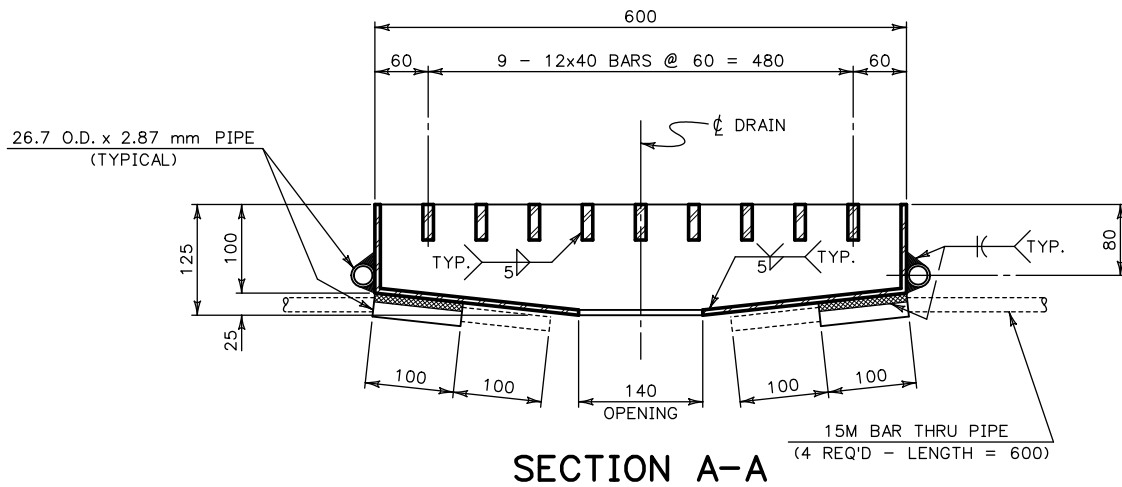
- MATERIALS = STEEL: CAN/CSA - G40.20/G40.21 - M92 - TYPE 300W
REINFORCING: CSA G30.12, GRADE 400
- WELDING = CSA W47.1 - 1983 AND CSA W59 - M1989
- ALL STEEL PLATES ARE TO BE 6mm THICK UNLESS OTHERWISE NOTED.
- ALL WELDERS SHALL BE CERTIFIED BY THE CWB TO CAN/CSA W47.1 SPECIFICATIONS, AND/OR TO A CERTIFICATION LEVEL OF QUALIFIED WELDER AS ISSUED BY THE PROVINCE OF NEW BRUNSWICK.
- DECK DRAIN ASSEMBLIES TO BE GALVANIZED BY HOT DIPPING IN ACCORDANCE WITH CAN/CSA G-164, TO A MINIMUM THICKNESS OF 175 μ m AND/OR A MINIMUM APPLICATION RATE OF 1 kg/m^2 .
- 15M REINFORCING BARS SHALL BE SUPPLIED WITH DRAINS.

DOWN SPOUT/ SECTION DETAILS ON STANDARD DRAWING 302-2

Roadway Drain For Structures

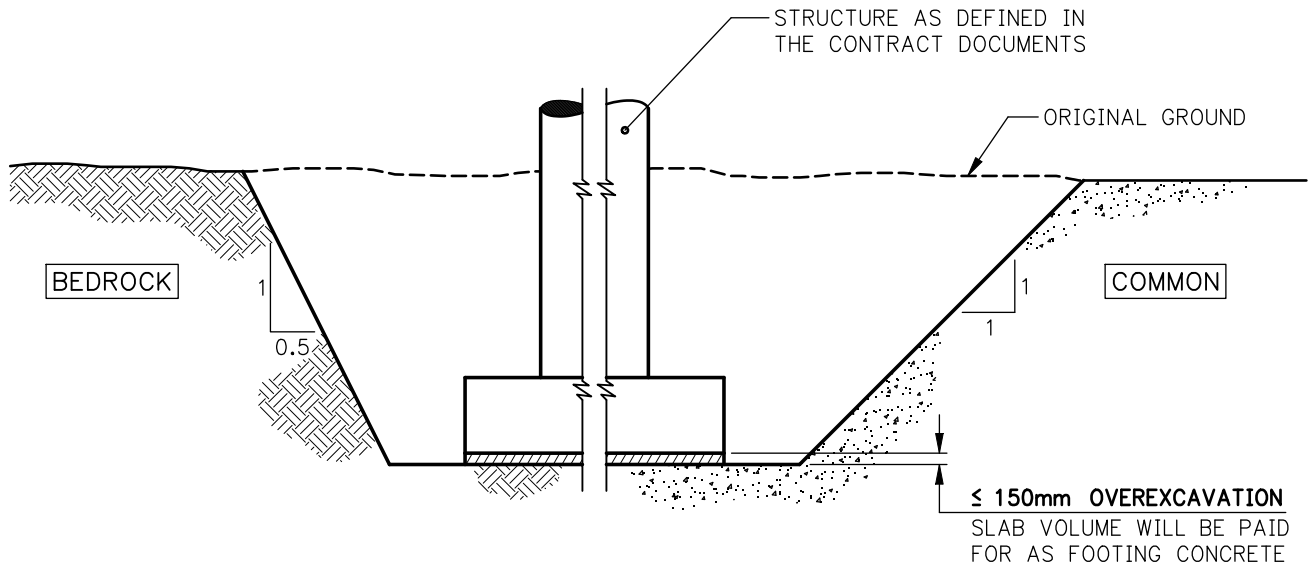


DOWN SPOUT DETAIL

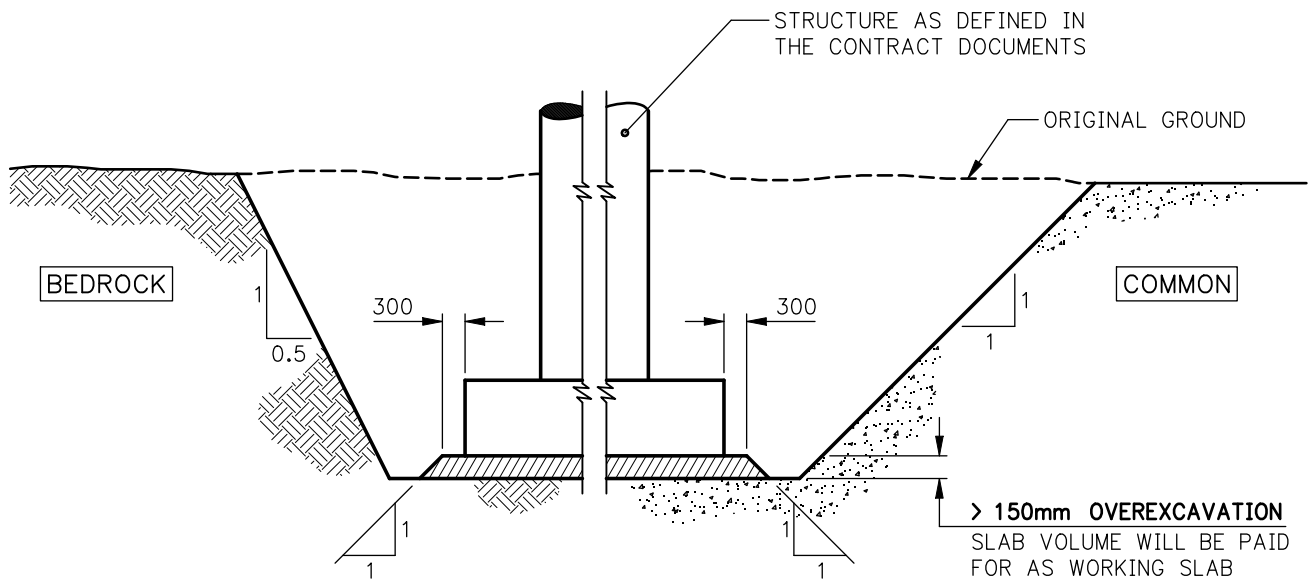


PLAN / VIEW X ON STANDARD DRAWING 302-1

Roadway Drain Details

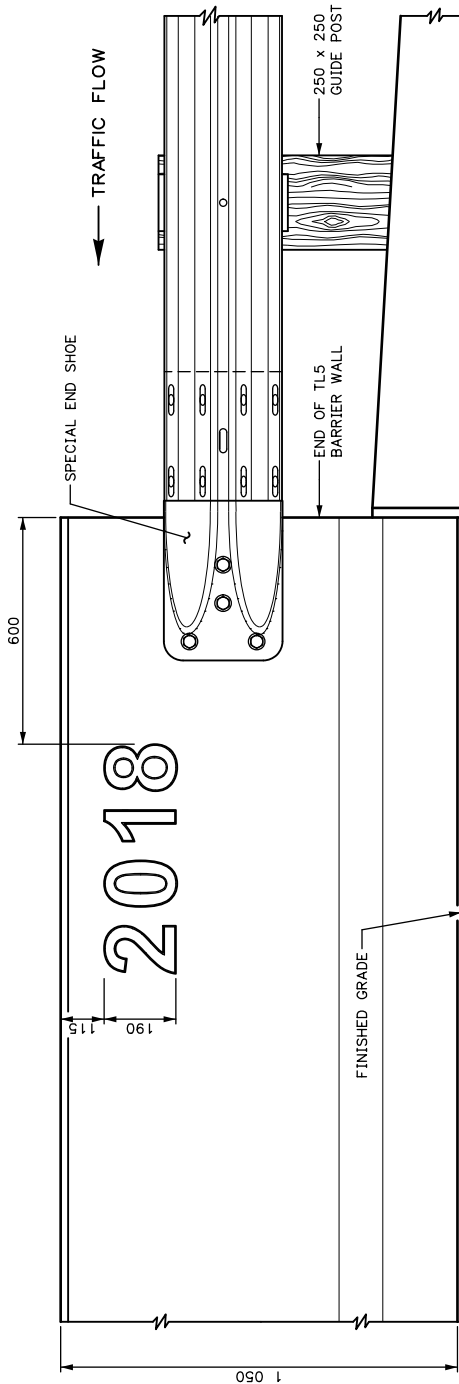


LIMITS OF FOOTING CONCRETE



LIMITS OF WORKING SLAB CONCRETE

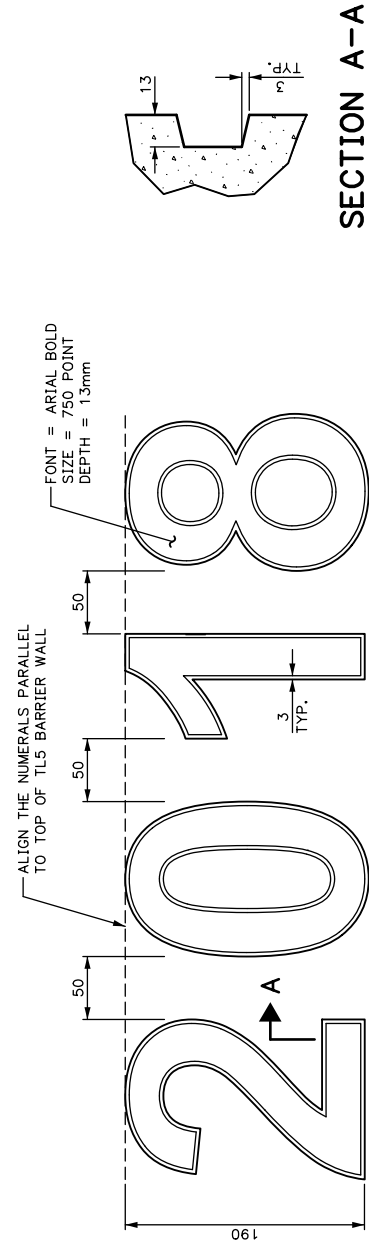
Concrete Limits For Foundation Overexcavation



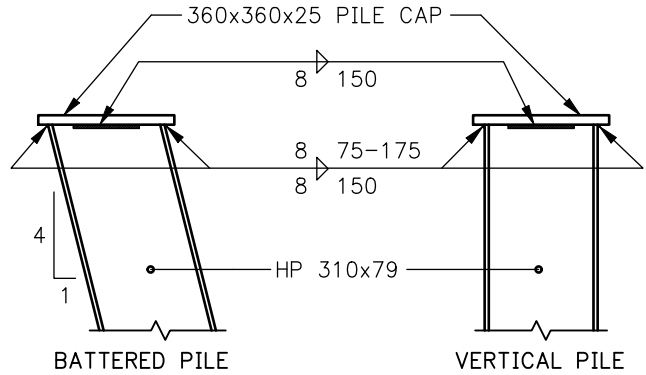
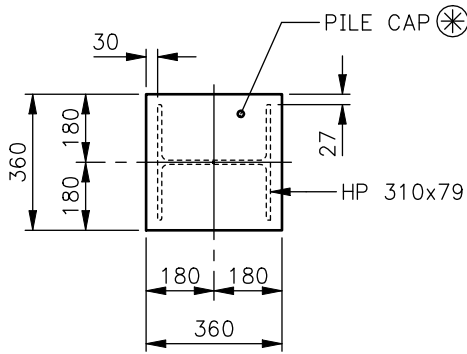
DATE LOCATION ELEVATION

NOTES:

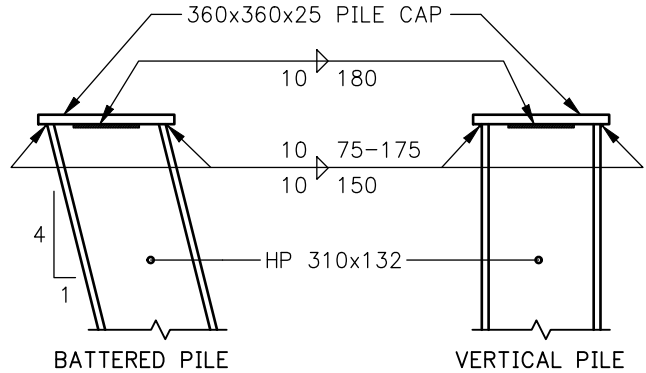
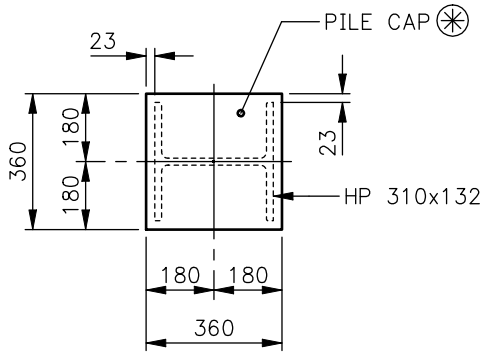
- BRIDGE DATES ARE TO BE LOCATED AT START OF BARRIER WALL. (TO THE RIGHT OF APPROACHING TRAFFIC)
- DATE SHOWN IS FOR ILLUSTRATED PURPOSES ONLY, ACTUAL DATE SHALL BE USED.



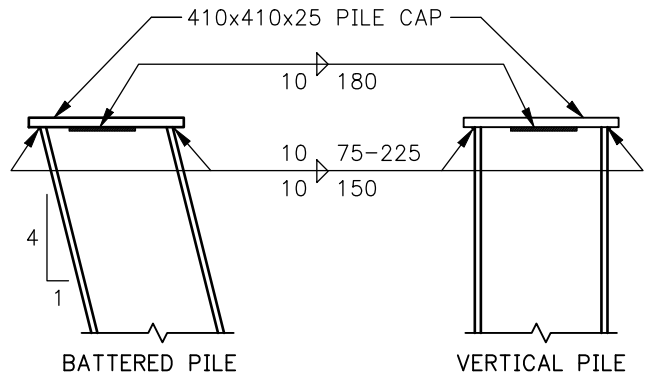
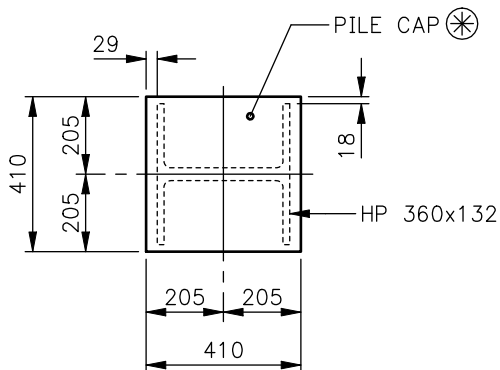
TYPICAL DATE NUMERALS



PILE CAP DETAILS FOR HP 310x79



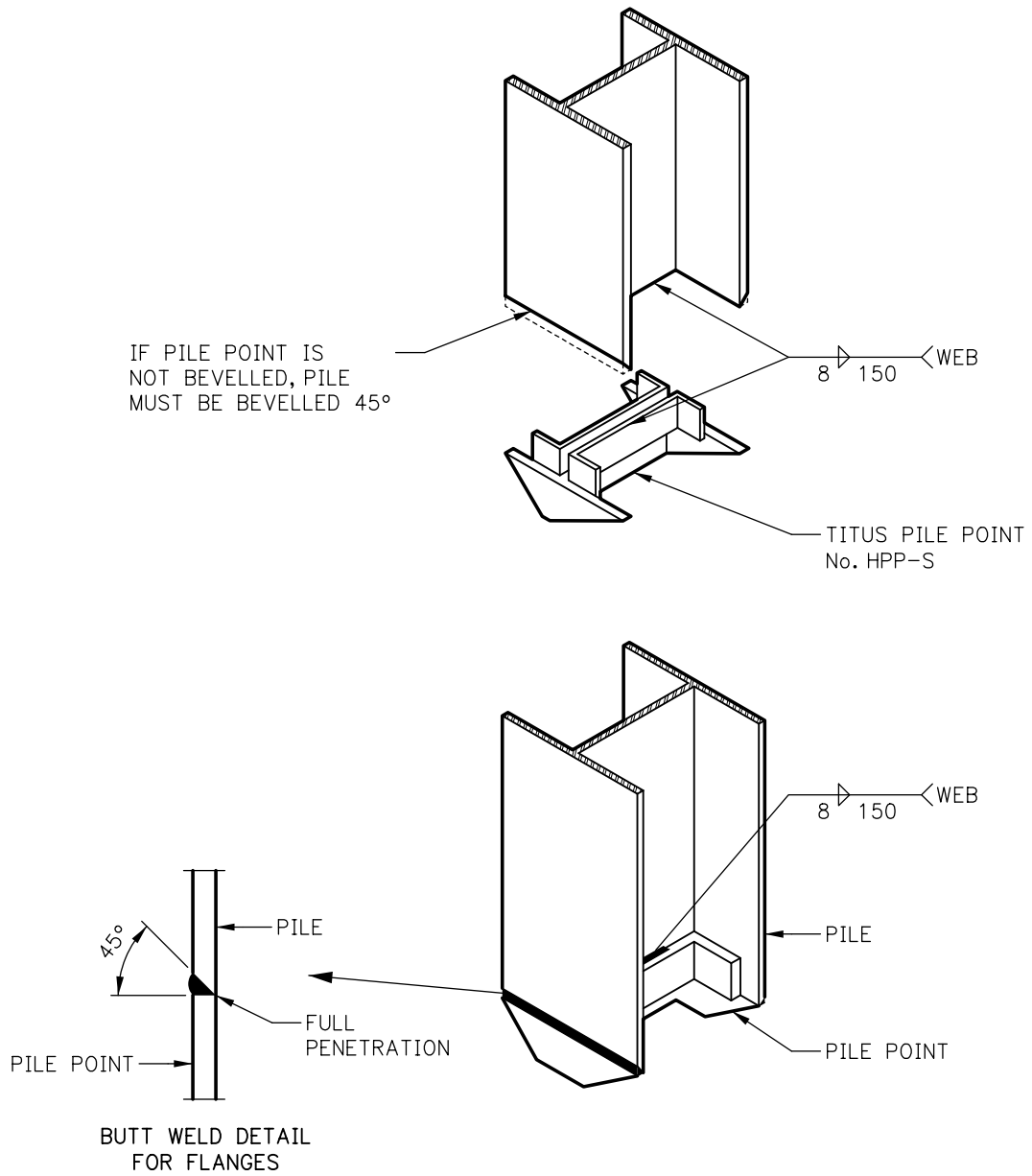
PILE CAP DETAILS FOR HP 310x132



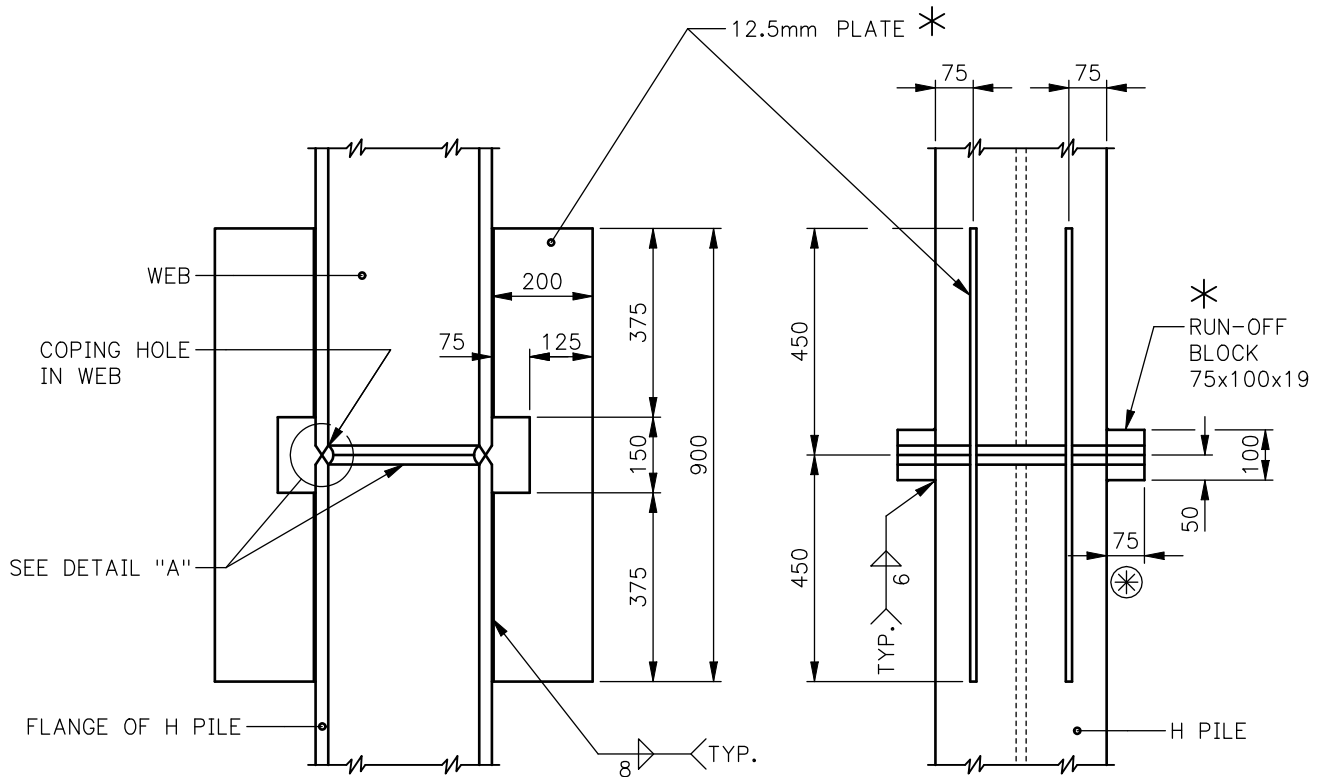
PILE CAP DETAILS FOR HP 360x132

⊗ PILE CAP PLATE SIZE BASED ON NOMINAL PILE DIMENSIONS

Steel H Piles
Pile Cap Details

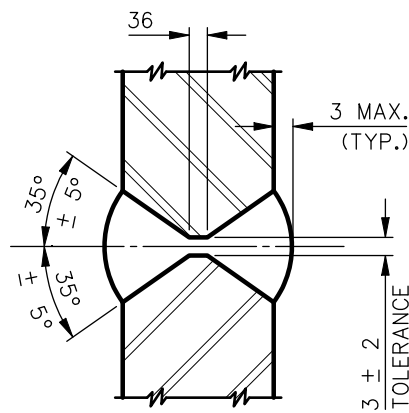


**Steel H Piles
Pile Point Details**



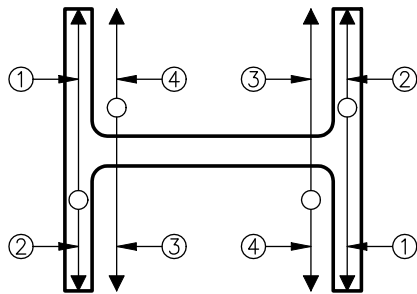
⊗ MAY BE REDUCED TO 50 WHEN SPLICES ARE CHECKED BY NON-DESTRUCTIVE TEST METHOD.
* REMOVE AFTER SPLICE IS FINISHED AND GRIND FLUSH.

VERTICAL ALIGNMENT FOR H PILE SPLICING



DETAIL "A"

Steel H Piles
Splice Details

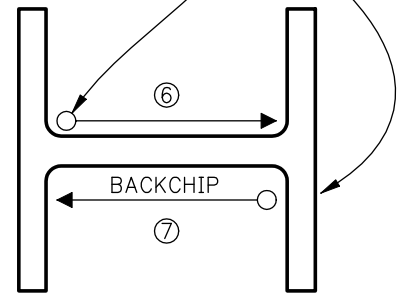


SEQUENCE OF
WELDING FLANGES

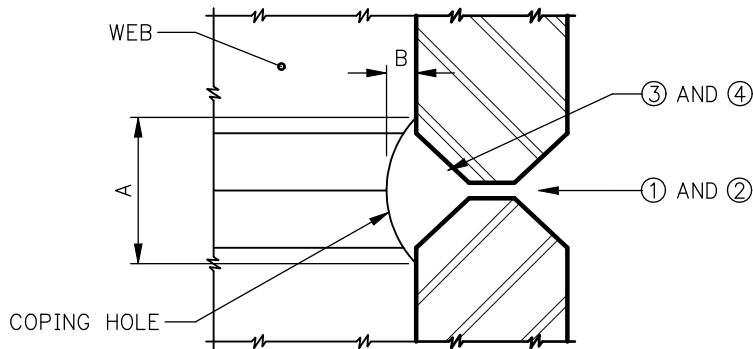
NOTE:

WELD PASSES ① AND ② ARE AT THE CENTER LINE OF THE FLANGES AND WELD PASSES ③ AND ④ ARE ON THE INSIDE OF THE FLANGES

CORNER FILLED FIRST ON ALTERNATE SIDES



SEQUENCE OF
WELDING WEB



COPING HOLE DETAIL

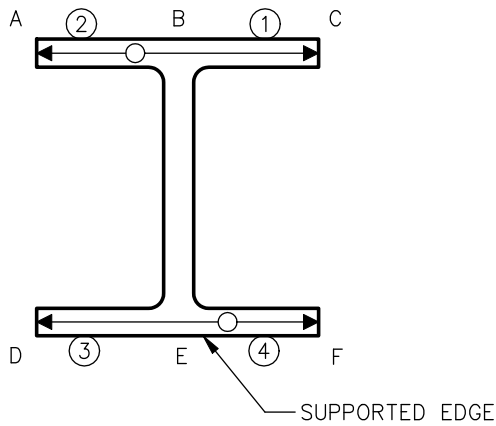
"A" APPROX. 4mm LARGER THAN EDGE OF GROOVE

"B" LARGE ENOUGH TO ALLOW THE WELD TO START BEYOND THE WEB WITH A MAX. TIP OF 7° OF THE ELECTRODE

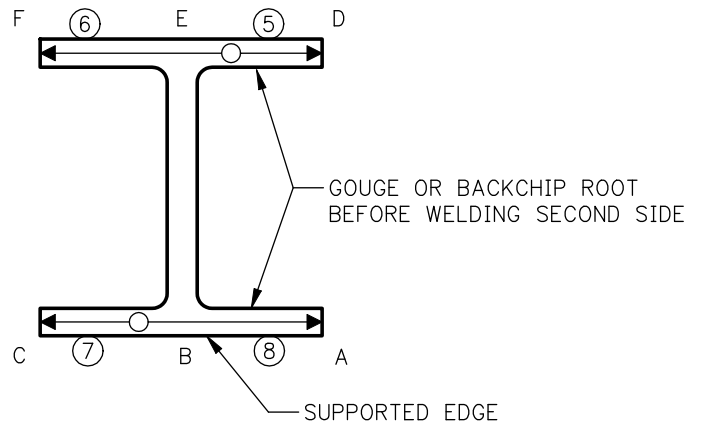
BACKCHIP ① AND ② TO SOUND METAL BEFORE DEPOSITION OF PASSES ③ AND ④

Steel H Piles
Sequences for Welds for Horizontal Position

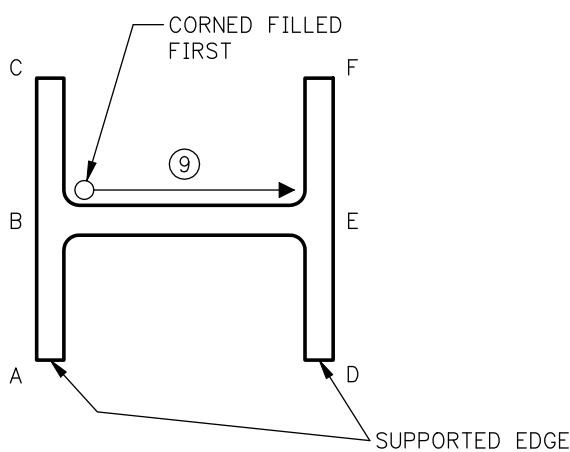
NOTE:
WELD TO BE COMPLETE AS SHOWN
BY THE NUMBERED SEQUENCE



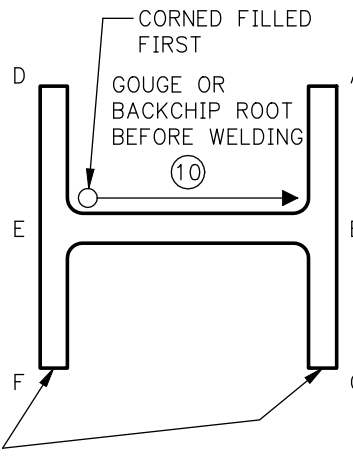
POSITION No. 1



POSITION No. 2

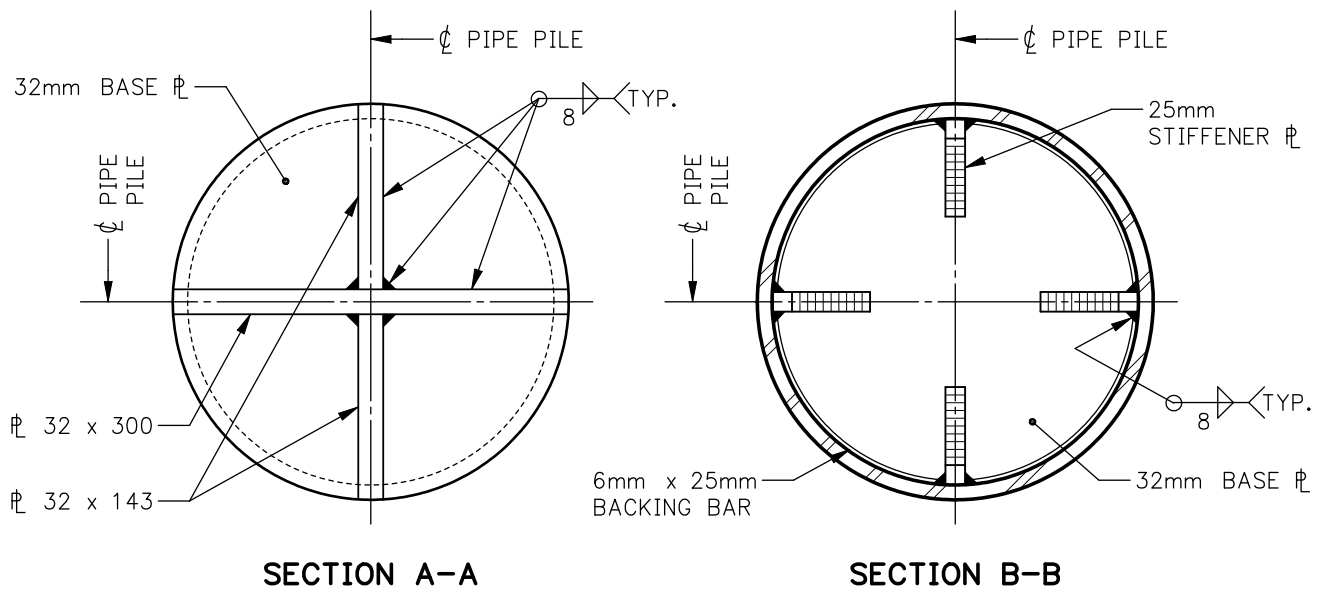
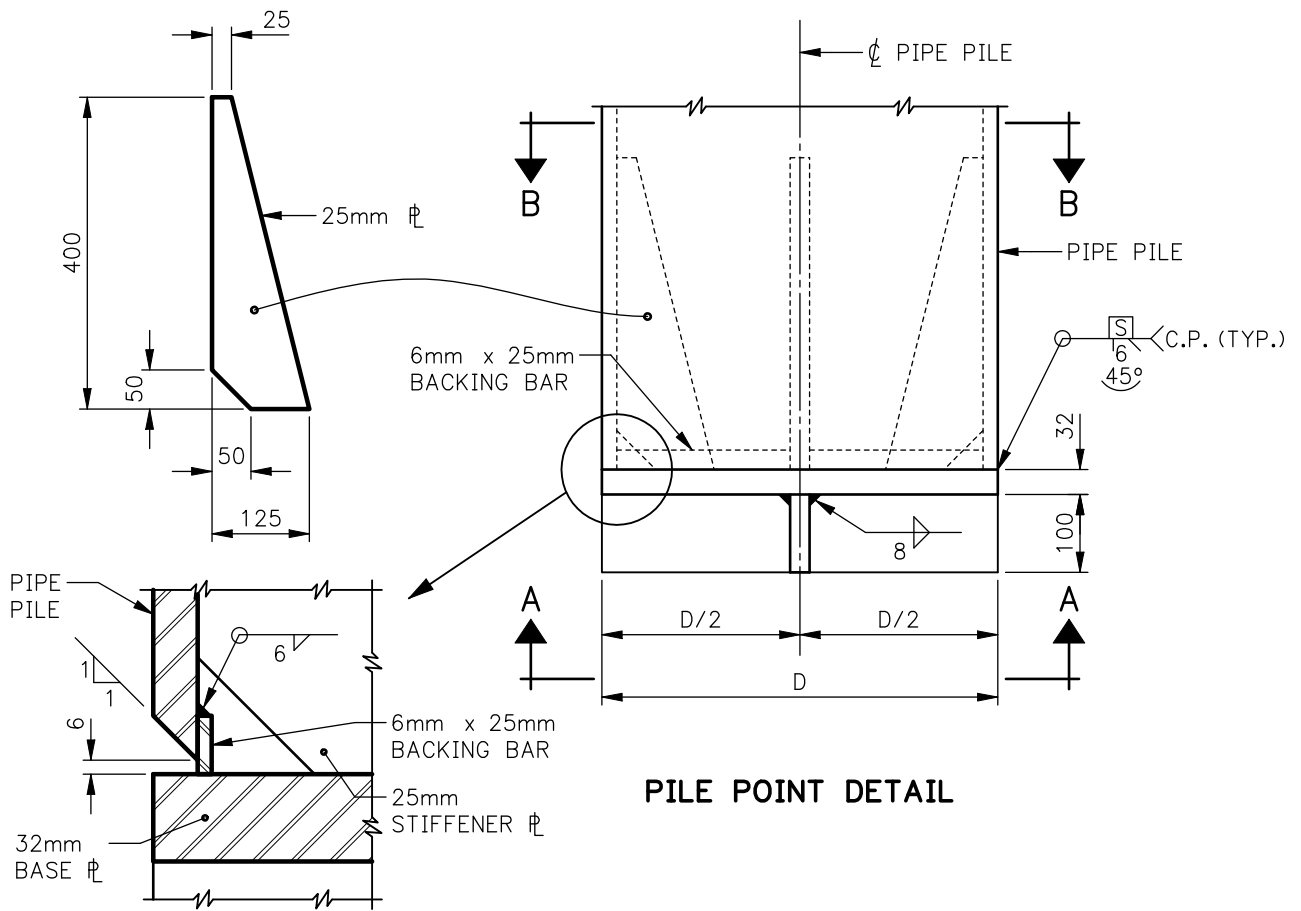


POSITION No. 3

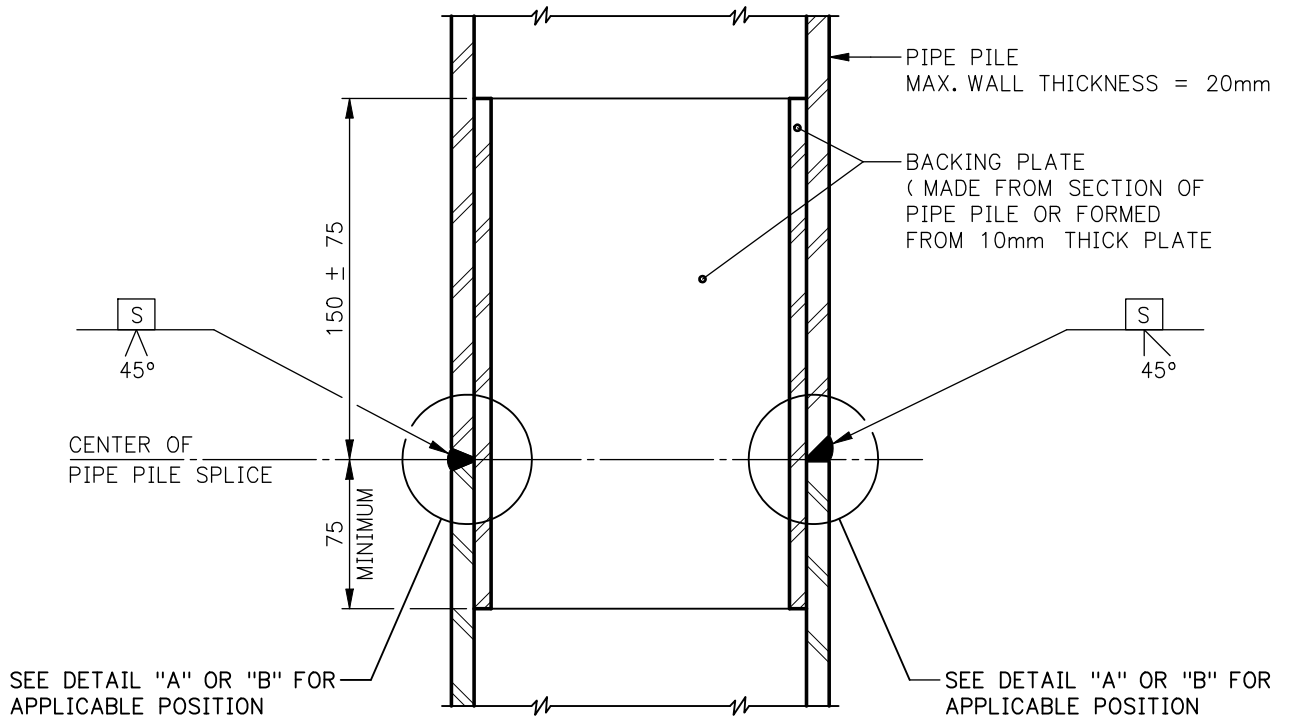


POSITION No. 4

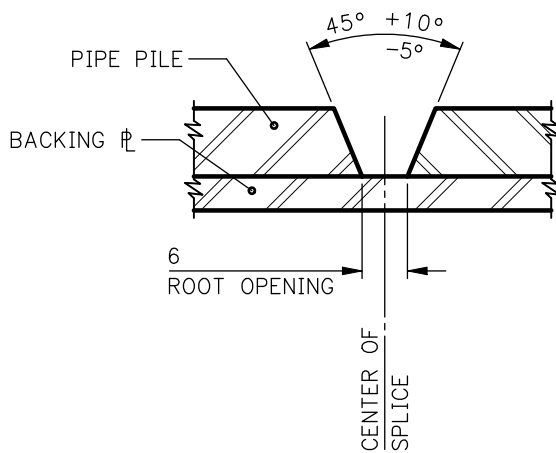
Steel H Piles
Sequences for Welds for Flat Position



Steel Pipe Piles
Pile Point Details

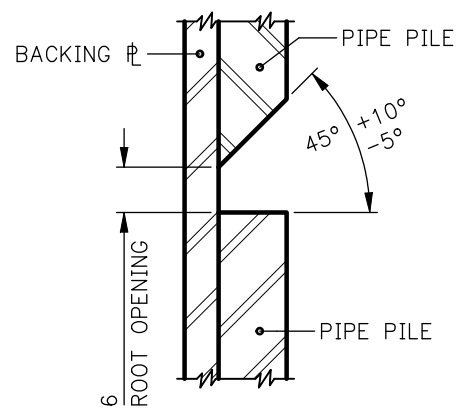


SECTION OF PILE



DETAIL "A"

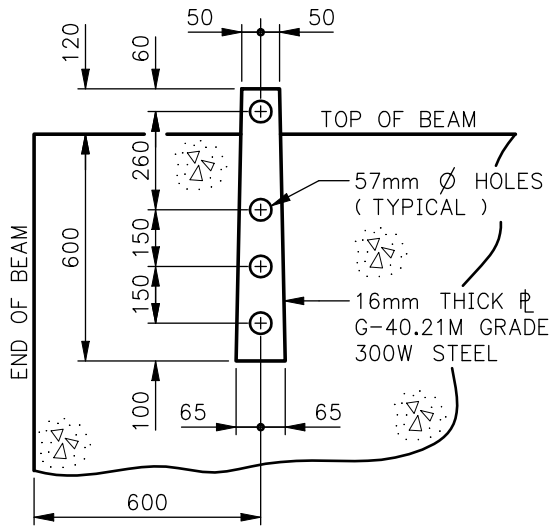
FLAT, VERTICAL OR OVERHEAD
POSITION



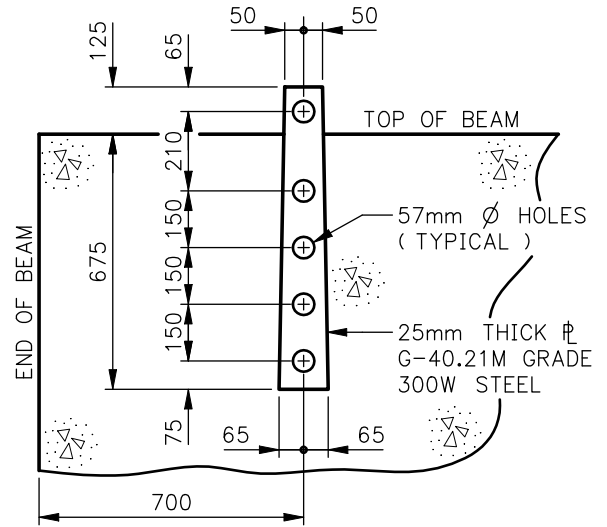
DETAIL "B"

HORIZONTAL POSITION

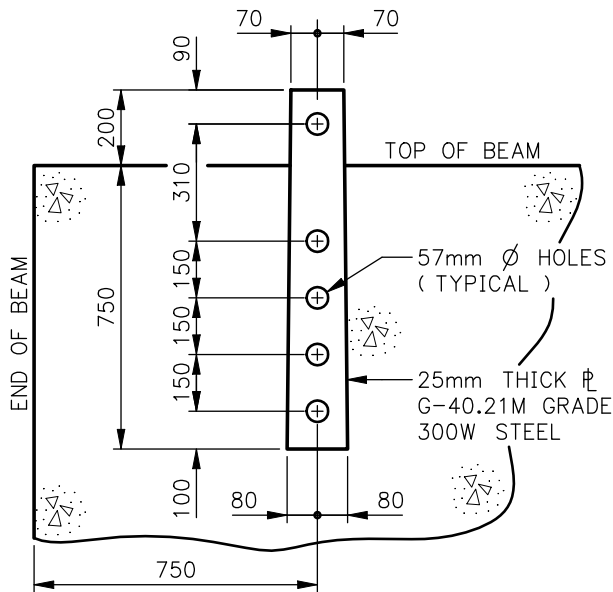
Steel Pipe Piles
Splice Details



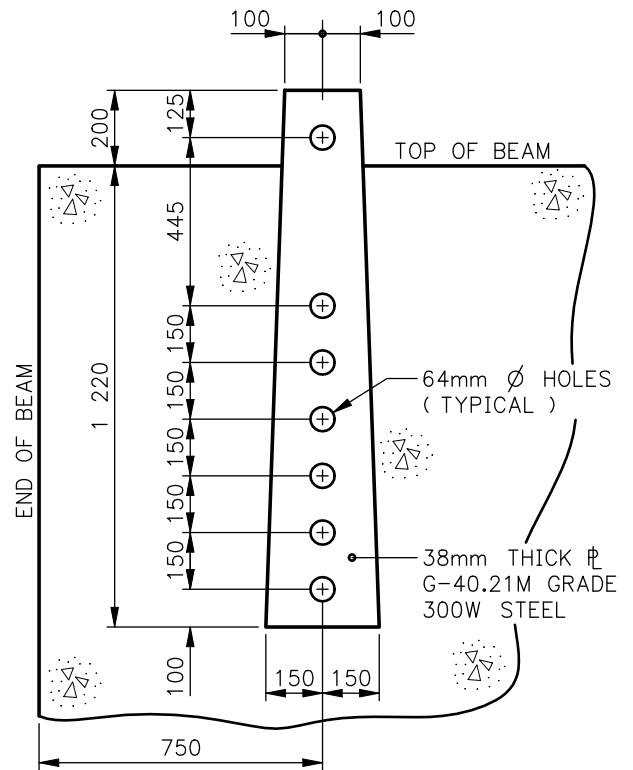
AASHTO TYPE II BEAM



AASHTO TYPE III BEAM

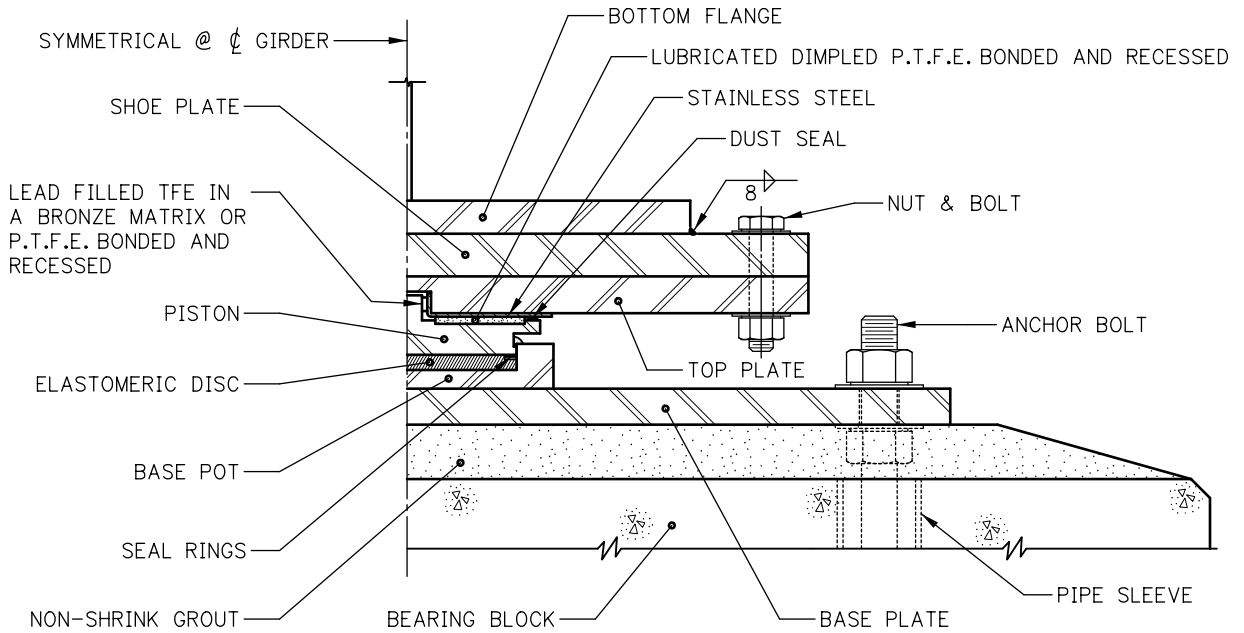


AASHTO TYPE IV BEAM
NBDOT TYPE I BEAM

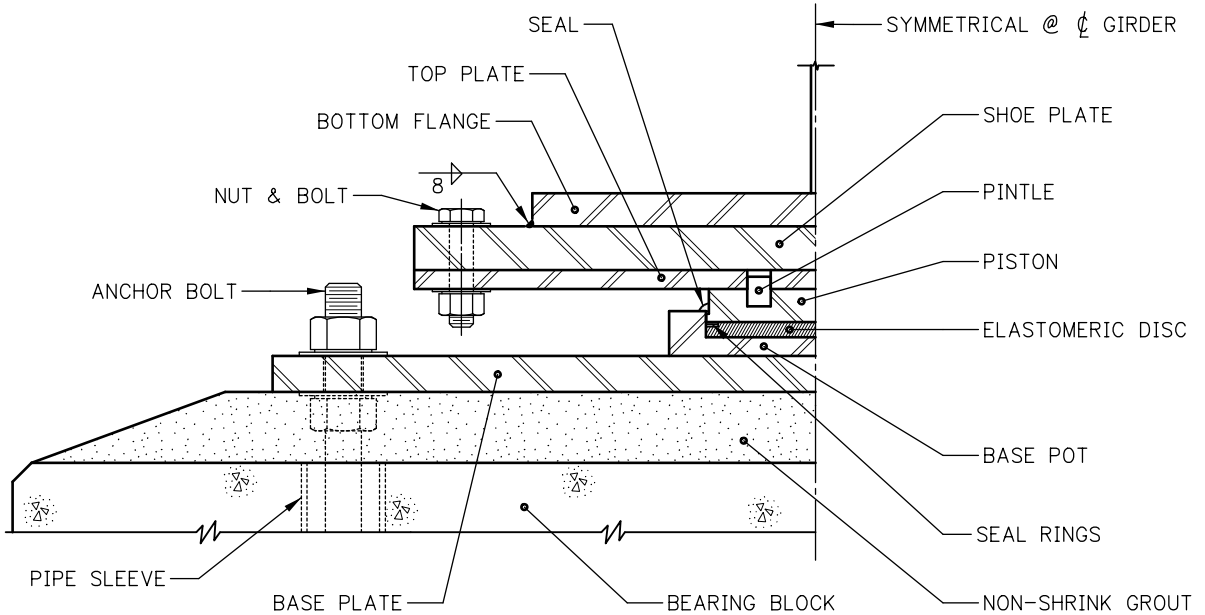


BULB-TEE BEAM

Prestressed Beam Lifting Device Details
Vertical Only

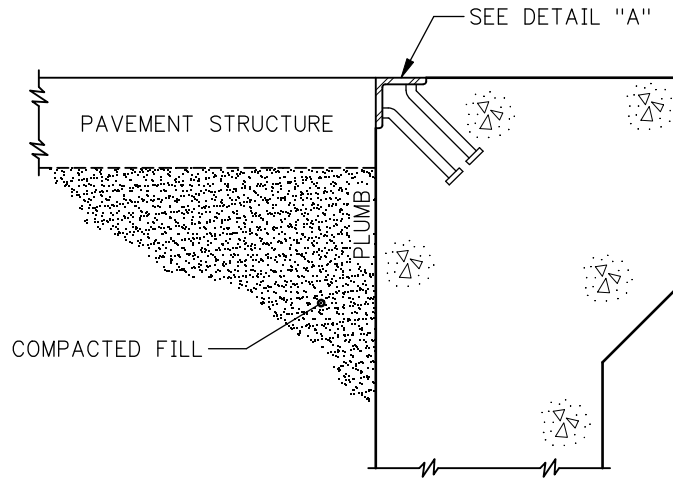


CONSTRAINED SLIDING BEARING

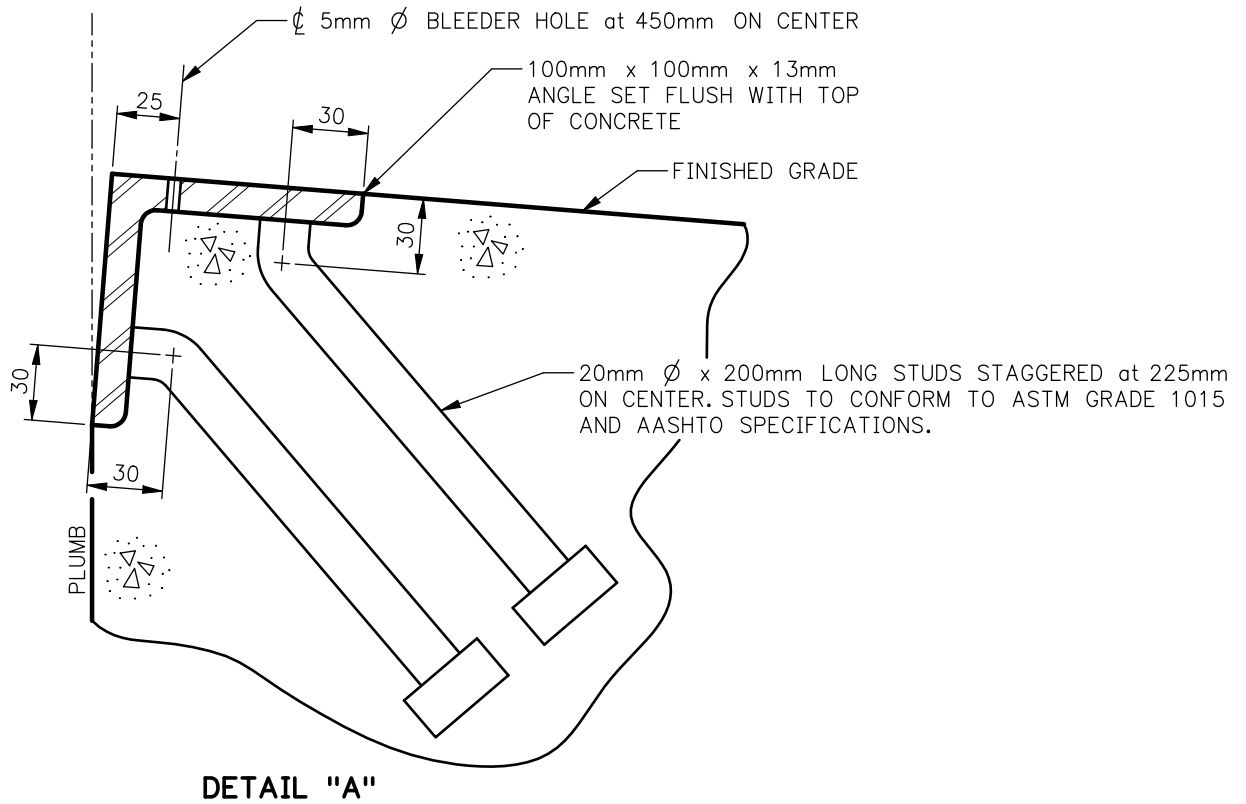


FIXED BEARING

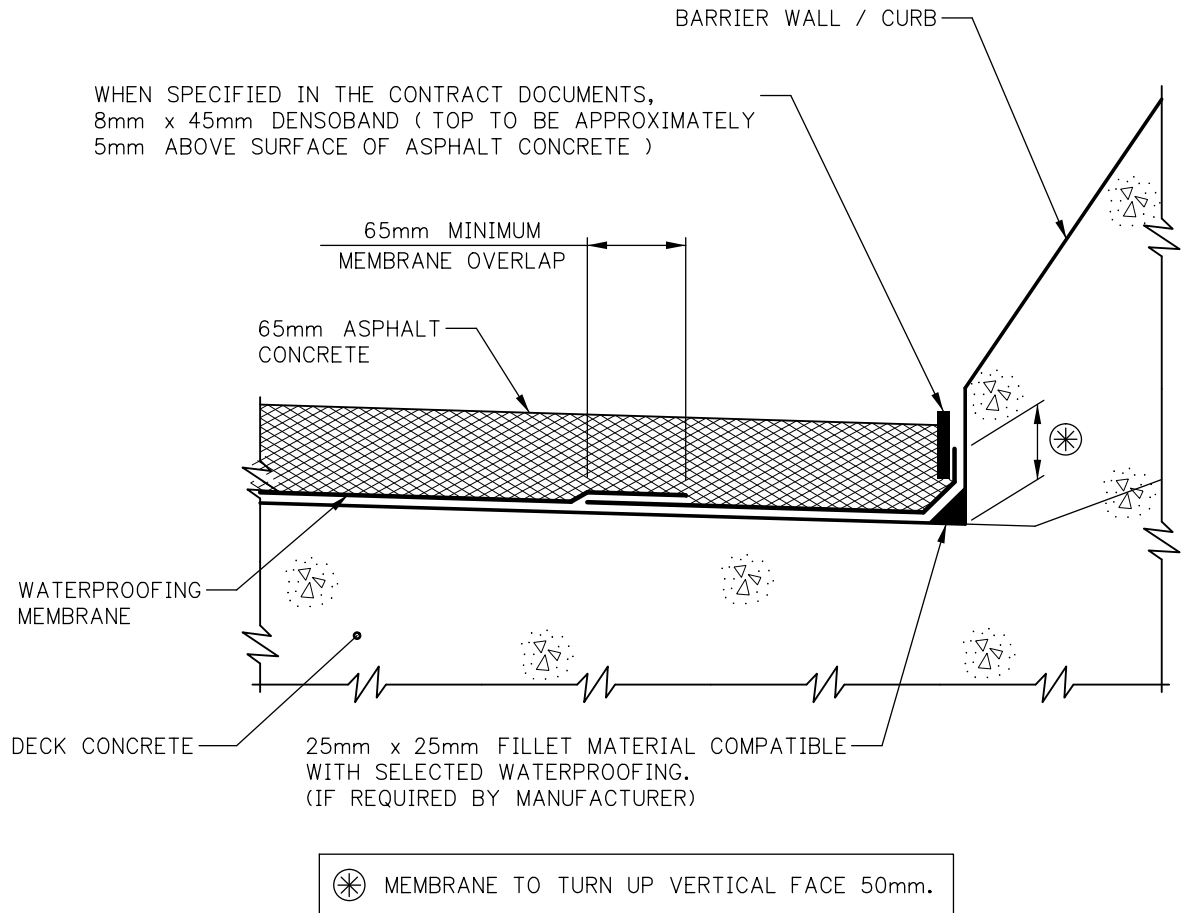
Bridge Pot Bearing
Nomenclature



BALLASTWALL SECTION



Ballastwall Protection Details

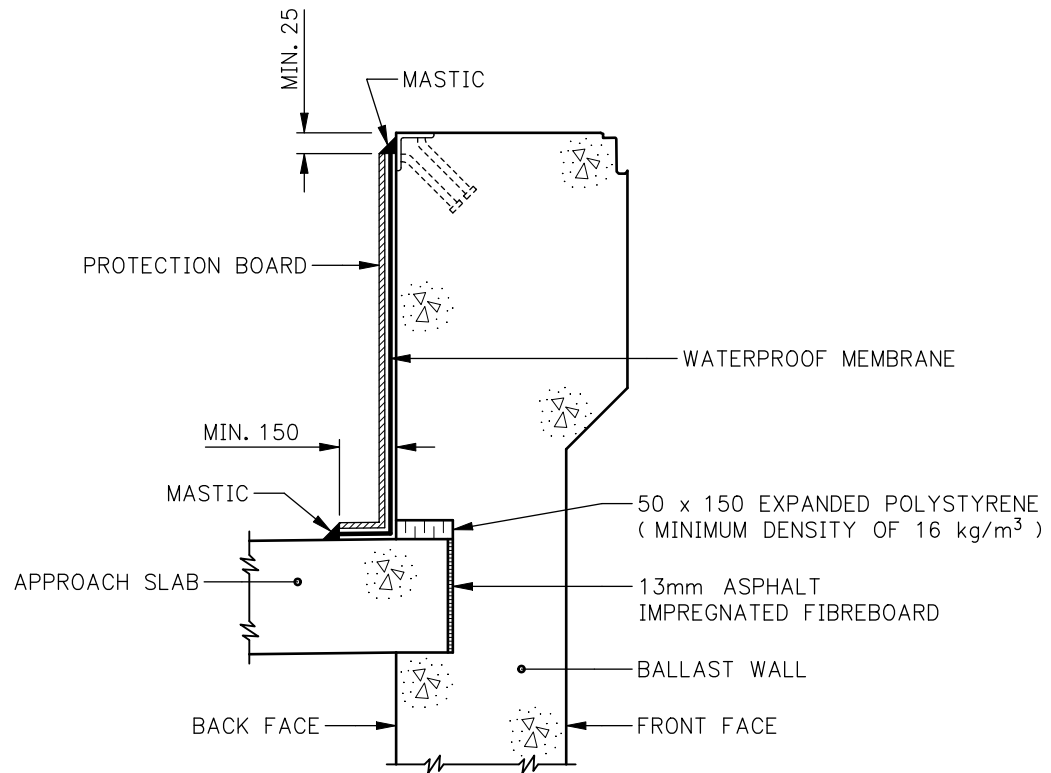


**SECTION THROUGH DECK AT BARRIER WALL / CURB
SHOWING WATERPROOFING SYSTEM**

NOTES:

- OVERLAP MEMBRANE IN PRINCIPLE DIRECTION OF WATER FLOW AND IN DIRECTION OF ASPHALT CONCRETE PLACEMENT.
- FOR NORMAL CROWN - INSTALL STARTER STRIP FIRST.
FOR SUPERELEVATION - INSTALL STARTER STRIP ON HIGH SIDE LAST.

Deck at Barrier Wall/Curb Waterproofing Details



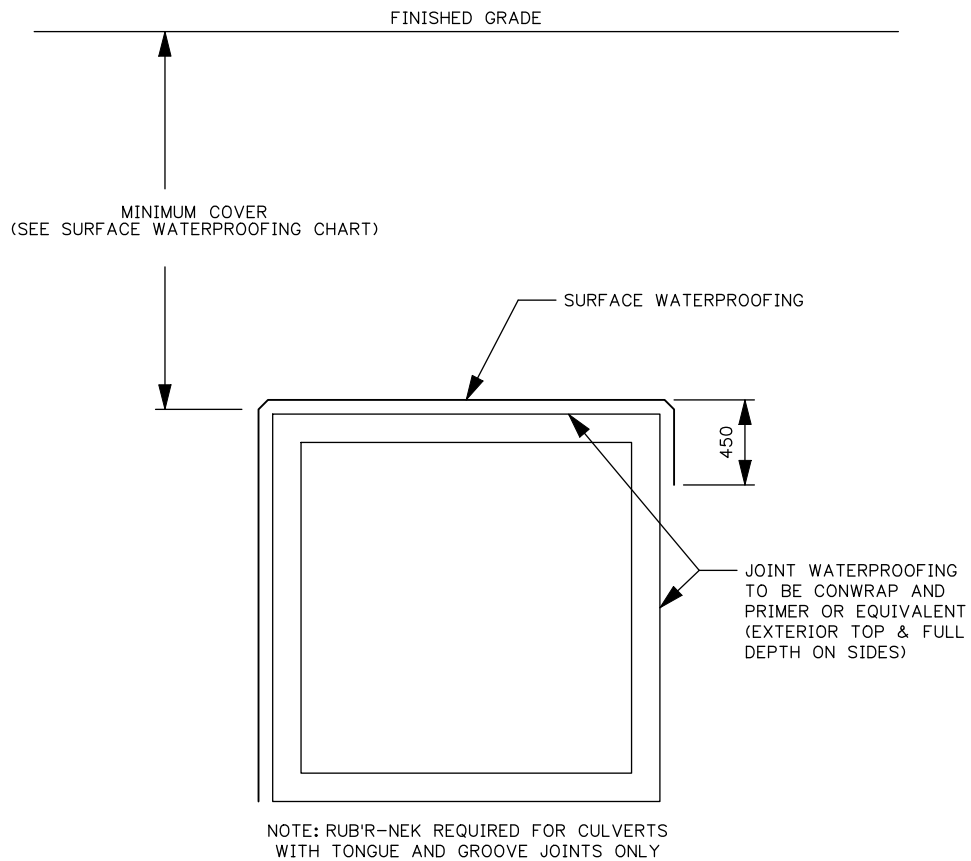
SECTION THROUGH BALLAST WALL SHOWING
WATERPROOFING SYSTEM

NOTES:

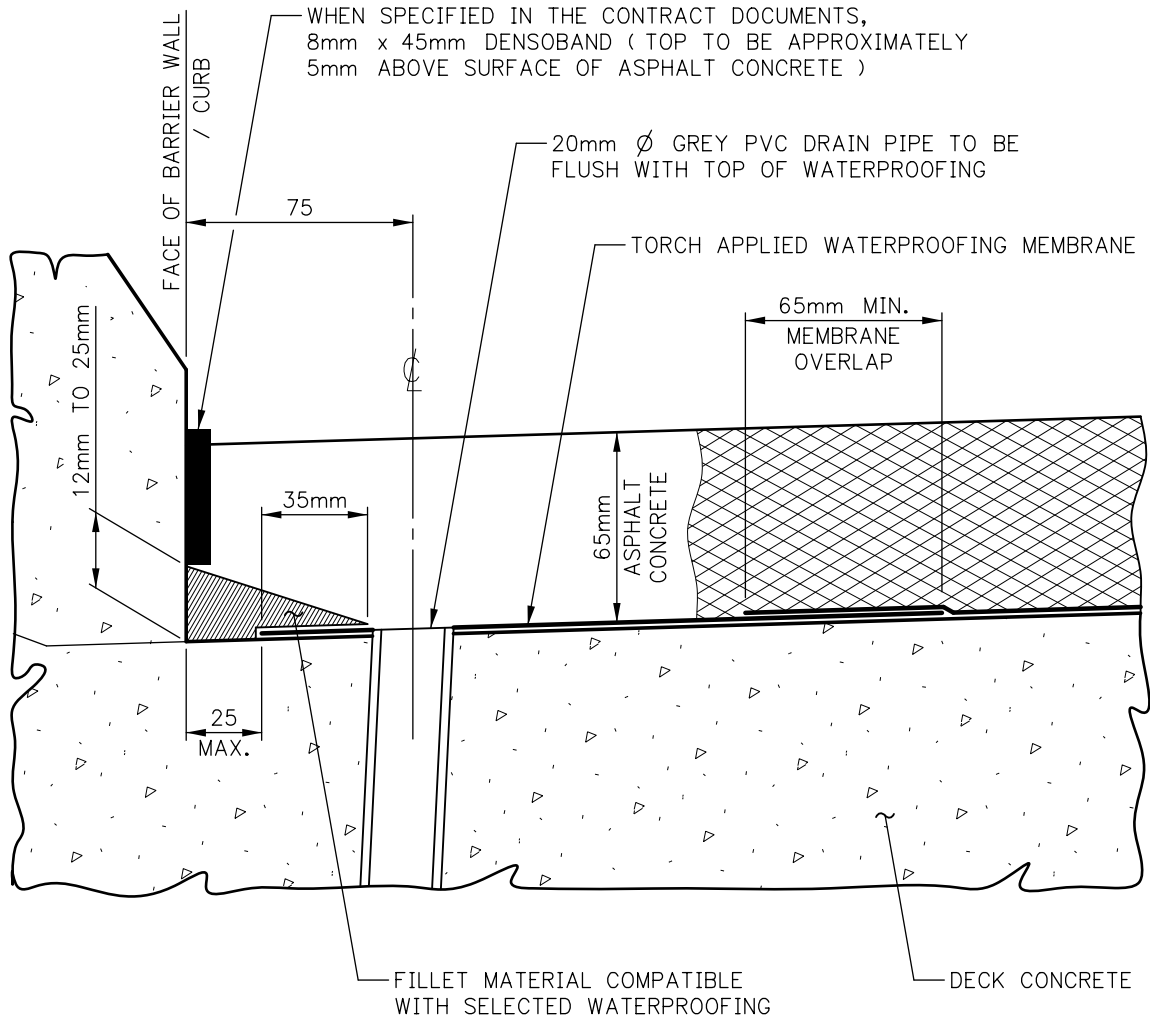
- ALL PROTECTION BOARD TO BE APPLIED ON TOP OF THE WATERPROOFING SYSTEM AND ADHERED TO THE MEMBRANE WITH THE SPECIFIED MASTIC PLACED AS GOBS ON 600mm CENTERS BETWEEN THE TWO SURFACES.
- ALL PROTECTION BOARD TO BE BUTTED TIGHTLY.
- ALL TERMINATIONS TO BE SEALED BY AN EDGE BEAD OF MASTIC.
- ALL MEMBRANE SHALL BE PLACED VERTICALLY AND OVERLAPPED A MINIMUM OF 65mm WITH ADJACENT SHEETS..

Ballast Wall Waterproofing System Details

SURFACE WATERPROOFING CHART			
CASE	MINIMUM COVER	REQUIRED WATERPROOFING	TYPE
1	0m to 150mm	TOP AND FULL DEPTH ON SIDES	A
2	150mm to 1.5m	TOP AND FULL DEPTH ON SIDES	B
3	1.5m to 3.5m	TOP AND DOWN 450mm ON SIDES	B
4	OVER 3.5m	NO WATERPROOFING	-



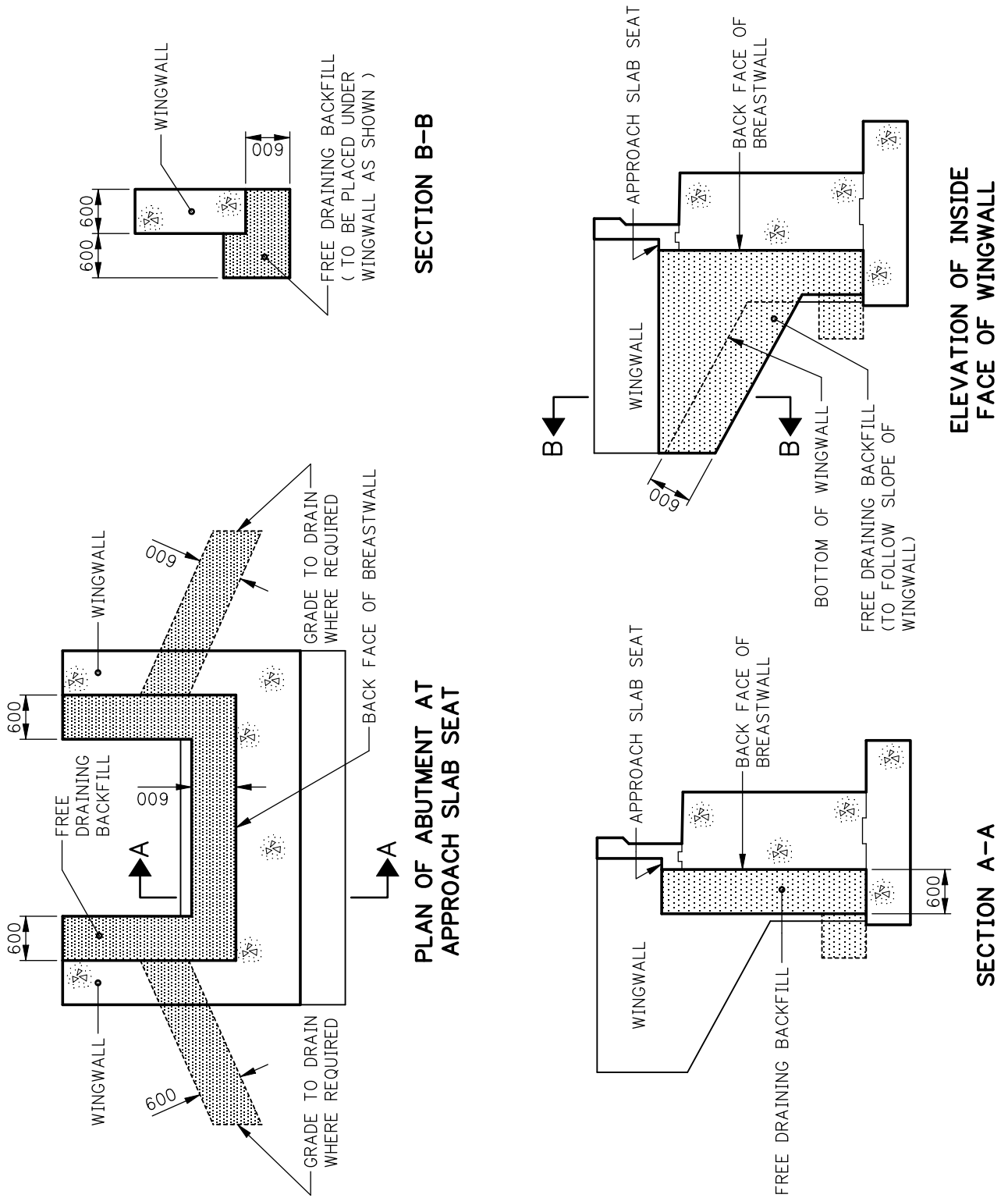
**Waterproofing Requirements on
Box Culvert or Rigid Frame**



**SECTION THROUGH DECK AT BARRIER WALL / CURB
SHOWING TORCH APPLIED WATERPROOFING SYSTEM**

NOTE:
OVERLAP MEMBRANE IN PRINCIPLE DIRECTION OF WATER FLOW AND IN DIRECTION
OF ASPHALT CONCRETE PLACEMENT.

Deck at Barrier Wall/Curb – Torch Applied Waterproofing Detail



Free Draining Backfill Placement Details

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NUMBER OF PAGES</u>
401	Storm Sewer Pipe	5
404	Precast Catch Basin	2
406	Sluice Box	2
407	Frame With Grate or Cover	1
408	Adjustment of Catch Basins and Manholes	1
409	Relocation of Catch Basin	2
410	Paving Catch Basin Apron	1
415	Pipe Zone Material	2
416	Curb and Gutter	4
419	Concrete Sidewalk	4
420	Asphalt Sidewalk	2
423	Removal of Curb and Gutter	1
424	Removal of Sidewalk	1
425	Removal of Underground Services	2
499	Standard Drawings	
	401 - 1 Typical Trench Cross Sections	
	404 - 1 Precast Catch Basin Details	
	404 - 2 Typical Catch Basin Excavation	
	406 - 1 Typical Sluice Box and Pipe Detail	
	406 - 2 Typical Sluice Box Installation Behind the Curb and Gutter	
	406 - 3 Typical Sluice Box Installation Into the Curb and Gutter	
	407 - 1 Typical Frame With Grate - Square	
	407 - 2 Typical Frame With Cover - Round	
	410 - 1 Paving Catch Basin Apron	
	416 - 1 Curb and Gutter Details	
	416 - 2 Curb and Gutter Details	
	416 - 3 Curb and Gutter Details	
	419 - 1 Concrete Sidewalk Details	
	419 - 2 Joint Layout	
	419 - 3 Joint and Isolation Details	
	420 - 1 Asphalt Sidewalk Details	

STORM SEWER PIPE

ITEM: 401

401.1 DESCRIPTION

- .1 This Item consists of the supply and installation of storm sewer pipe.

401.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

401.2 .2 Concrete Pipe

- .1 All pipe shall conform to CAN/CSA-A257.2, Class 65-D.
- .2 All pipe wrap for the pipe joints shall be a geotextile conforming to 601.2, Type N1.

401.2 .3 Metal Pipe

- .1 All pipe shall be corrugated steel pipe, as specified by CAN/CSA-G401.
- .2 All pipe wrap for the pipe joints shall be a geotextile conforming to 601.2, Type N1.

401.2 .4 Plastic Pipe

- .1 All plastic pipe shall conform to CAN/CSA-B182.1.
- .2 PVC pipe:
 - .1 Smooth wall PVC pipe shall conform to CAN/CSA-B182.2, ASTM D3034, and/or ASTM F679.
 - .2 Profile/ribbed PVC pipe shall conform to CAN/CSA-B182.4 and ASTM F794.
- .3 PE pipe:
 - .1 PE pipe shall conform to ASTM F405 and/or F667.
 - .2 Profile PE pipe and fittings shall conform to CAN/CSA-B182.6.
- .4 Specialized Bends:
 - .1 Specialized bends as indicated in the Contract Documents shall conform to the requirements of the adjoining pipe.

401.2 .5 Pipe Zone Materials

- .1 Pipe zone materials shall conform to the limits established in 415.2 or as detailed in the manufacturer's installation instructions.

401.2 .6 Backfill

- .1 Backfill material shall be selected material, from the excavation, as approved by the Engineer.
- .2 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer and in accordance with Item 167.

401.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.
- .2 The Contractor shall notify the Engineer, in writing, for approval of the source(s) of supply of backfill and pipe zone materials, at least 14 Days in advance of obtaining material from the source(s) proposed.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

401.4 CONSTRUCTION

401.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Engineer shall provide control points in the field to provide vertical and horizontal control at selected locations or as may be required.
- .3 The Contractor shall be responsible for the layout and maintenance of control for all lines and grades for the Work as shown on the Plans.
- .4 The Contractor shall schedule all Work to minimize interruptions to existing services.
- .5 The Contractor shall notify the Engineer at least 24 hours before inspection of any phase of the Work is anticipated.

401.4 .2 Excavation

- .1 Trench excavation for pipe laying shall be carried out in accordance with the limits indicated in the Contract Documents and Standard Drawing 401-1.
- .2 The Contractor shall be responsible for the design and construction of all temporary shoring, bracing and underpinning necessary to complete the Work.
- .3 The Contractor shall, insofar as is practical, confine the operations and storage of products to the property, rights-of-way or easements provided by the Owner for the Work.
 - .1 Any damage resulting from the Work on adjacent property shall be repaired by the Contractor, at her/his own expense, with reasonable promptness.
 - .2 Paved driveways, Culverts, hedges, lawns, etc. which are likely to be affected by the Work are shown on the Plans, and the Contractor shall make the repairs to the affected areas identified as part of this Item.
- .4 The Contractor shall neatly cut Pavement in a straight line, so that the excavation does not disturb the surface beyond the limits of the excavation.

STORM SEWER PIPE

ITEM: 401

- 401.4.2.4 .1 The Contractor shall be responsible, at his/her own expense, for all removal of, and/or damage to, the Pavement and other surfaces beyond the designated limits of the excavation and for the repair or otherwise restoration of the areas affected.
- .2 The Pavement shall be excavated separately.
- .5 All other materials shall be excavated by material type and stockpiled separately. Selected stockpiled material shall be reused to backfill the excavation to Subgrade, as directed by the Engineer.
- .6 The Contractor shall dispose of water resulting from the Work in accordance with Item 948 and in a manner not detrimental to public and private property.
- .7 The Contractor may be required to excavate existing pipe and/or catch basin(s) in the location of the new pipe alignment.
- .1 The Contractor shall notify the Engineer prior to breaking into existing pipe and catch basins and shall verify that the existing pipe and catch basins are out of service and approved for removal.
- .2 Any pipe determined to be salvageable by the Engineer shall remain the property of the Owner and the Contractor shall take all precaution to preserve the pipe sections intact and undamaged.
- .1 If the pipe is damaged as a result of the Contractor's actions, as determined by the Engineer, the Contractor shall be responsible to replace the pipe.
- .3 All pipe removed and salvaged from the Work shall be transported to the nearest DTI Maintenance Depot.
- .4 All unsalvageable pipe and/or catch basins shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .8 The Contractor shall not excavate more than 30 metres in advance of installation operations, without the prior approval of the Engineer.
- .9 The Contractor shall not leave open more than 15 metres of trench at the end of any day's operation, without prior approval of the Engineer.
- .10 If Overexcavation occurs, the Contractor shall, at her/his own expense, repair the Overexcavation and shall fill the Overexcavation with an approved backfill material, placed in accordance with Item 936, and compacted to 95% of the maximum dry density.
- .11 Rock encountered within the limits of the excavation shall be excavated in accordance with Item 161.
- 401.4 .3 Pipe Zone Material
- .1 Pipe zone material shall be placed as indicated on Standard Drawing 401-1 and in accordance with the pipe manufacturer's instructions.
- .2 Pipe zone material shall not be placed in trenches having soft and unstable bottom conditions.
- .3 All pipe zone material shall be placed, in accordance with Item 936, in lifts of not more than 150 mm in thickness and compacted to a minimum of 95% of its maximum dry density.

STORM SEWER PIPE

ITEM: 401

- 401.4.3 .4 Compaction Equipment for pipe bedding shall be sized so as not to cause damage to the pipe or cause movement of the pipes due to impact and/or vibration.
- .5 The Contractor shall shape the pipe bed true to grade and the grade shall provide a continuous, uniform bearing surface for the barrel of the pipe.
- .6 All placement of pipe zone material shall be carried out such that the pipe is backfilled equally on both sides at the same time.

401.4 .4 Pipe Laying

- .1 All pipe shall be installed on a prepared bed as indicated on Standard Drawing 401-1 and in accordance with 401.4.2.
- .1 In all cases the installation shall proceed upgrade, with the bell ends placed upgrade for concrete and PVC pipe.
- .2 Connections between catch basins and pipe shall be mortared to provide a tight and secure fit.
- .1 Precast inserts shall be acceptable for PVC connections.

401.4 .5 Joints

- .1 Joints for concrete and metal pipe storm sewers shall be gasket-free.
- .1 Joints for concrete and metal pipe shall be wrapped with Type - N1 geotextile for a minimum of 150 mm on each side of the joint and the geotextile shall overlap a minimum of 300 mm at the crown of the pipe.
- .2 Gaskets shall be used in joints for plastic pipe.
- .3 Joints shall be maintained free of mud, silt, gravel and other foreign materials.

401.4 .6 Backfilling

- .1 Backfill material shall be placed from the top of the pipe zone material to the defined Subgrade, as indicated on the Standard Drawing 401-1, and/or as indicated in the Contract Documents.
- .2 All backfill material shall be placed, in accordance with Item 936, in lifts of not more than 300 mm in thickness and compacted to a minimum of 95% of its maximum dry density.
- .3 Excavated material, suitable for and surplus to backfilling, shall be placed or disposed of by the Contractor as directed by the Engineer.
- .4 Stockpiled material not reused per 401.4.2.5 and excavated material not suitable for backfill, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.

401.4 .7 Detours

- .1 Detours required for the Work shall be carried out in accordance with Item 918.

401.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of storm sewer pipe supplied and installed in accordance with this Item.
- .2 The measurement shall be taken continuously, from end to end, along the centreline of the pipe, starting and ending at the centre of a precast structure (if any), and including in the length any intermediate precast concrete Structures and fittings.

401.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each specified size and type of pipe, as identified under the Contract.
- .2 The Owner shall make partial payment in accordance with 908.7 for storm sewer pipe stored at the Work Site.
 - .1 Partial payment shall be made for specialized storm sewer pipe stored at the supplier's yard.

404.1 DESCRIPTION

- .1 This Item consists of the supply and installation of precast catch basins.

404.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 All materials shall conform to CSA A257.4, ASTM C139 and/or ASTM C478M.
- .3 Pipe zone materials shall conform to the limits established in 415.2.
- .4 Backfill material shall be selected material from the excavation, as approved by the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer and in accordance with Item 167.

404.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.
- .2 The Contractor shall submit, in accordance with Item 956, shop drawings for each precast catch basins, containing but not limited to, the following information:
 - .1 Station of catch basin, DTI Contract number and description;
 - .2 General layout showing catch basin and appurtenances;
 - .3 Length and weight (mass) of individual sections;
 - .4 Joint details;
 - .5 Location of reinforcing steel (including additional reinforcement around large openings); and
 - .6 Concrete design strength, age of test and shipping strength.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

404.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall be responsible for the design and construction of all temporary shoring, bracing and underpinning necessary to complete the Work.
- .3 The Contractor shall schedule all Work so as to minimize interruptions to existing services.
- .4 The height of the precast catch basins, the final grade of the frame and grate, and the location in the Work for each catch basin, shall be as indicated in the Contract Documents.
- .5 The Contractor shall be responsible to construct all units in accordance with Standard Drawing 404-1, and all units shall be constructed plumb and true to alignment and grade.

PRECAST CATCH BASIN**ITEM: 404**

- 404.4 .6 All joints are to be made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.
- .7 The Contractor shall maintain the interior of the unit in a clean condition as the Work progresses.
- .8 Holes shall be cut in the precast sections by means of drilling or other methods approved by the Engineer.
- .1 Holes shall not be more than 50 mm greater in diameter than the outside diameter of the connecting pipe for connecting pipe diameters less than 900 mm, and shall not be more than 100 mm greater in diameter than the outside diameter of the connecting pipe for connecting pipe diameters equal to or greater than 900 mm.
- .2 Holes may be made at the time of the manufacturing of the precast sections; however, it shall be the responsibility of the Contractor to make any adjustments in the field necessary to make the proper connections.
- .9 Height adjustments to meet the required elevation shall only be made with precast riser sections and/or metal or concrete grade rings as per Standard Drawing 404-1.
- .1 Precast riser sections shall be used if the adjustment to be made is greater than 300 mm.
- .10 Excavation, pipe zone material, backfilling around the catch basin installation and any detours required, shall be carried out in accordance with 401.4 and as indicated on the Standard Drawing 404-2.

404.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of precast catch basin, exclusive of frames and grates, supplied and installed in accordance with this Item.
- .1 The height of individual catch basins shall be measured from the underside of the precast concrete base to the underside of the frame or grate seat.

404.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size (diameter) of precast catch basin, as identified under the Contract.
- .2 The Owner shall make partial payment for precast catch basins in accordance with 908.7.

406.1 DESCRIPTION

- .1 This Item consists of the supply and installation of a storm sewer sluice box and drain pipe to the storm sewer pipe, and/or catch basin.

406.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The sluice box shall be precast concrete fabricated and supplied to the dimensions indicated on Standard Drawing 406-1, complete with drain pipe, steel frame, a square cast iron grate and a pre-cut opening for the drain pipe.
- .3 The drain pipe shall be 200 mm diameter PVC pipe meeting the requirements of DR35, typically up to 4.0 m in length.
- .4 Pipe zone materials shall conform to the limits established in 415.2.
- .5 Backfill material shall be selected material from the excavation, as approved by the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer and in accordance with Item 167.

406.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

406.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The sluice box and drain pipe shall be constructed as indicated on Standard Drawing 406-1.
- .3 The drain pipe shall be laid on a prepared bed.
- .4 The drain pipe from the sluice box shall be connected to the drainage Structure with the end placed flush with the inside surface of the Structure and secured with mortar or a rubber gasket to provide a tight and secure fit.
- .5 Excavation, pipe zone material, backfilling around the sluice box installation shall be carried out in accordance with 401.4.
- .6 For installations behind curb and gutter, the sluice box shall be installed with the top grade set at 50 mm below the surrounding ground level as per Standard Drawing 406-2.

SLUICE BOX

ITEM: 406

- 406.4.6 .1 The area defined by extending a distance of 600 mm from all sides of the sluice box shall be sloped down from the surrounding grade to the sluice box top grade at a constant Slope.
- .7 For installations in the gutter, the sluice box shall be installed with the top grade set at 15 mm below the lowest point of the gutter as per Standard Drawing 406-3.
- .1 The area defined by extending a distance of 300 mm from all sides (excluding curbside) of the sluice box, shall be sloped down from the surrounding grade to the sluice box top grade at a constant Slope.

406.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of sluice box units supplied and installed in accordance with this Item.

406.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

407.1 DESCRIPTION

- .1 This Item consists of the supply and installation of a catch basin frame with grate or cover.

407.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Frame with grate or cover shall be supplied in accordance with Standard Drawings 407-1 and 407-2 respectively.

407.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.

407.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Frames shall be rigidly fitted onto the drainage Structure.
- .3 Frames shall be placed as shown on Standard Drawing 404-1.
- .4 Grates or covers shall be set to a tolerance of +0 mm to -12 mm of the adjacent finished elevation.

407.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of catch basin frames with grates or covers supplied and installed in accordance with this Item.

407.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of frame with grate or cover, as identified under the Contract.

ADJUSTMENT OF CATCH BASINS AND MANHOLES

ITEM: 408

408.1 DESCRIPTION

- .1 This Item covers the adjustment of catch basins and manholes to the final specified grade.

408.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 All adjusting rings supplied shall be concrete conforming to ASTM C478, high density polyethylene conforming to ASTM D1248 or metal.

408.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.

408.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Existing catch basins and manholes shall be adjusted to suit the final grade and cross slope using grade rings and/or precast riser sections.
- .3 Existing cast iron frames shall be removed and cleaned, and prepared for re-use in the Work.
- .4 The height of adjustments required shall be set out in the Contract Documents.
- .5 The grates or covers shall be set to a tolerance of +0 mm to -12 mm of the adjacent finished elevation.

408.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of catch basins and/or manholes adjusted in accordance with this Item.

408.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

409.1 DESCRIPTION

- .1 This Item consists of the relocation of catch basin.

409.2 MATERIALS

- .1 Existing catch basin shall be reused.
- .2 All materials shall be supplied by the Contractor.
- .3 Pipe zone materials shall conform to the limits established in 415.2 or as detailed in the manufacturer's installation instructions.
- .4 Backfill material shall be selected material, from the excavation, as approved by the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer and in accordance with Item 167.

409.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

409.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall relocate the existing structure such that it may be reused in the Work.
 - .1 The Contractor shall take all precaution to preserve the catch basin intact and undamaged.
 - .2 If the catch basin is damaged as a result of the Contractors actions, as determined by the Engineer, the Contractor shall be responsible to replace the catch basin.
- .3 Excavation and backfilling of a trench from the catch basin location to the relocation position shall be carried out in accordance with 401.4.
- .4 All other Work shall be carried out in accordance with 404.4.
- .5 Drain pipe from the existing catch basin shall be relocated by addition or removal of pipe connecting the catch basin and the storm sewer system.
- .6 Drain pipe shall be reconnected to the relocated catch basin and the connection shall be secured with cement mortar.
- .7 Relocated catch basins shall be adjusted to suit the specified final grade.
- .8 Wall heights shall be adjusted solely by the removal of existing spacer materials and/or by the addition of new or replacement grade rings and/or precast riser sections.

RELOCATION OF CATCH BASINS

ITEM: 409

409.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of catch basins relocated in accordance with this Item.

409.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

PAVING CATCH BASIN APRON

ITEM: 410

410.1 DESCRIPTION

- .1 This Item consists of the supply and placement of Aggregate Base and asphalt concrete for the construction of an apron around a catch basin grate.

410.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Aggregate Base shall meet the requirements of 201.2.
- .3 Asphalt Concrete C and D shall meet the requirements of 261.2.

410.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

410.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Aggregate Base shall be placed and compacted in accordance with 203.4.
- .3 The Contractor shall place Asphalt Concrete, over the prepared area surrounding the catch basin, in accordance with 261.4.
- .4 The apron shall be shaped as shown on Standard Drawing 410-1.

410.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of catch basin aprons constructed in accordance with this Item.

410.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

PIPE ZONE MATERIAL

ITEM: 415

415.1 DESCRIPTION

.1 This Item consists of the supply of pipe zone material for all underground services.

415.2 MATERIALS

.1 Pipe zone material shall be clean, hard, sound, durable crushed or pit run gravel or stone, free of shale, clay, friable materials, organic matter and other deleterious substances and shall meet the grading limits indicated in Table 415-1, when tested in accordance with ASTM C136 and ASTM C117.

**Table 415-1
 Gradation Limits for Pipe Zone Materials**

ASTM sieve size	Coarse Material - Type A percent passing see note 1	Fine material - Type B percent passing see note 2
37.5 mm	100	100
31.5 mm	95 - 100	
25 mm	83 - 100	95 - 100
19 mm	70 - 100	90 - 100
12.5 mm	55 - 90	
9.5 mm	45 - 80	60 - 100
4.75 mm	30 - 65	35 - 80
2.36 mm	20 - 50	15 - 60
300 µm	5 - 20	0 - 30
75 µm	0 - 8	0 - 10

Notes: 1) Use Type A material for PVC pipe larger than 600 mm in diameter, and for all other pipe larger than 450 mm in diameter.
 2) Use Type B for PVC pipe 600 mm or smaller in diameter, and for all other pipe 450 mm or smaller in diameter.

415.3 SUBMITTALS

.1 The Contractor shall submit to the Engineer for approval, at least 14 Days prior to the delivery of the material to the Work Site, the proposed source of supply and certification of the pipe zone material.

415.4 CONSTRUCTION

.1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

415.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of tonnes of pipe zone material supplied in accordance with this Item.

415.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall include a separate Unit Price for each type of pipe zone material, as identified under the Contract.

CURB AND GUTTER

ITEM: 416

416.1 DESCRIPTION

- .1 This Item consists of the construction of Portland cement concrete curb and gutter.

416.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Concrete shall be supplied in accordance with 301.2, and CSA A23.1 exposure class C-2.
- .3 Joint filler shall consist of an approved 12 mm thick asphalt impregnated fibreboard of good quality cut to fit the required cross sections of the joints formed.
 - .1 Alternate materials shall be submitted to the Engineer for approval.
- .4 Pigmented membrane curing compounds shall conform to ASTM C309.
- .5 Aggregate Base shall meet the requirements of 201.2.

416.3 SUBMITTALS

- .1 Submittals are required in accordance with 301.3 and with any other cross-referenced Item forming part of this Item.

416.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Engineer shall provide control points in the field for vertical and horizontal control, at selected locations or as may be required.
- .3 The Contractor shall be responsible for the layout for all lines and grades for the Work as indicated in the Contract Documents.
- .4 Excavation for the foundation preparation for the curb and gutter shall be to the depth and width as shown in the Contract Documents and/or on Standard Drawing 416-1.
 - .1 The Contractor shall neatly cut the existing Pavement in a straight line so that the Work does not disturb the surface beyond the limits of excavation.
- .5 Material disturbed in the bottom of the excavation shall be compacted to the maximum density as determined by a test strip or other standard industry methods, and approved by the Engineer prior to the placement of the backfill.
- .6 Excavated material may be used as backfill behind and under the new concrete curb and gutter along the limits of the Work subject to the approval of the Engineer.
 - .1 Excavated material, suitable for and surplus to backfilling, shall be disposed of as directed by the Engineer.

CURB AND GUTTER

ITEM: 416

- 416.4.6 .2 Excavated material not suitable for backfill, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .7 Aggregate Base shall be placed as indicated on Standard Drawings 416-1 and 416-2, and in accordance with 203.4.
- .1 Water shall be uniformly applied to the Aggregate Base immediately ahead of concrete placement so as to thoroughly wet the Aggregate Base surface without the pooling of water.
- .8 Curb and gutter shall be constructed in accordance with the dimensions shown in the Contract Documents and/or Standard Drawings 416-2 and 416-3.
- .1 Joint layout and joint details shall be laid out and constructed in accordance with Standard Drawings 419-2 and 419-3.
- .1 Control joints are partial depth and are used to create a plane of weakness in the concrete to control the location of drying shrinkage cracks.
- .2 Isolation joints are full depth and are used to prevent cracking due to differential movement.
- .3 Construction joints are full depth and are used at the end of a Day's construction or when the placement of concrete is interrupted by more than 30 minutes.
- .4 Dummy joints are tooled partial depth joints and are positioned for aesthetics.
- .9 Concrete shall be placed in accordance with 301.4.
- .1 The Contractor shall notify the Engineer at least 24 hours prior to the planned placement of any concrete.
- .2 Concrete placed in the Work shall be consolidated to ensure uniformity of the concrete density so that a minimum of voids remain in the placed concrete.
- .10 Curb and gutter shall be cast in place in sections of 6 m in length, except in slipforming operations, and/or where local conditions dictate otherwise.
- .1 Curb and gutter shall be formed and placed monolithically, without kinks.
- .2 Curvatures in the alignment of the curb and gutter for parking areas and at street intersections and transitions for driveways, crosswalks and other transition areas shall be constructed as indicated in the Contract Documents and/or directed by the Engineer.
- .3 Where the curb and gutter are formed against a building or other fixed structure, a 12 mm prefabricated joint filler shall be placed between the curb and the adjacent structure, to form an isolation joint as indicated in the Standard Drawing 419-3.
- .1 Spacing of the control joints should vary to coincide with the centre of manholes or other box-outs.
- .4 Curb and Gutter shall have a control joint formed by cutting a slot to a depth of 50 mm and spaced as indicated on Standard Drawing 419-2.
- .5 Joints shall be cut before uncontrolled shrinkage takes place (which can occur between 4 and 24 hours after placement) and the timing shall be the responsibility of the Contractor.

CURB AND GUTTER

ITEM: 416

416.4 .11 Metal Forms

- .1 The Contractor shall erect all forms to the full depth of the curb and gutter and these shall be securely positioned to the required lines and grade as indicated in the Contract Documents.
- .2 Formwork shall be thoroughly coated with a commercial quality form coating, which shall permit the ready release of the forms and will not discolour the concrete.
- .3 Forms shall remain in place for a minimum of 24 hours after concrete is placed if the danger of any disturbance to the placed and partially set concrete exists.
- .4 Top surfaces of the curb and gutter shall be "struck" with a straight edge and floated with a wooden or magnesium float for finish.

416.4 .12 Slipforming

- .1 Slipform machines must be capable of placing the concrete as indicated on Standard Drawings 416-1, 416-2 and 416-3.
 - .1 After slipforming, joints shall be saw cut; insert bars shall not be permitted.

416.4 .13 Finishing, Curing and Protection

- .1 Finished surfaces of the curb and gutter shall be roughened by brooming lightly or other method, subject to the approval of the Engineer.
- .2 Pigmented membrane curing compounds may be used, upon request, subject to the prior approval of the Engineer.
 - .1 Pigmented membrane curing compounds shall be applied in two applications immediately after the final finishing.
 - .1 One application shall be placed in a direction perpendicular to the previous application.
- .3 Voids or surface irregularities shall be repaired using concrete grout from the same concrete load and a float shall be used on the repaired area prior to texturing.
- .4 Edges of concrete shall be rounded with an approved edging tool while the concrete is still plastic and shall leave a true smooth surface.
- .5 The Contractor shall be responsible for the maintenance of the curb and gutter until completion and acceptance of the Work.

416.4 .14 Repair and Replacement

- .1 Curb and gutter which does not conform to the Specifications shall be repaired and/or replaced as directed by the Engineer.
- .2 If the repair and replacement results in the need for repairs and adjustments to the materials adjacent to the curb and gutter, the Contractor shall carry out the repairs and adjustments at his/her own expense and to the satisfaction of the Engineer.
- .3 Materials removed shall become the property of the Contractor and shall be disposed of outside the Work Site.

416.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of curb and gutter constructed in accordance with this Item.

416.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of curb and gutter, as identified under the Contract.

CONCRETE SIDEWALK

ITEM: 419

419.1 DESCRIPTION

- .1 This Item consists of the construction of Portland cement concrete Sidewalk.

419.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Concrete shall be supplied in accordance with 301.2, and CSA A23.1 exposure class C-2.
- .3 The joint filler shall consist of an approved 12 mm thick asphalt impregnated fibreboard of good quality cut to fit the required cross sections of the joints formed.
 - .1 Alternate materials shall be submitted to the Engineer for approval.
- .4 Pigmented membrane curing compounds shall conform to ASTM C309.
- .5 Aggregate Base shall meet the requirements of 201.2.

419.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

419.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Engineer shall provide control points in the field for vertical and horizontal control at selected locations or as may be required.
- .3 The Contractor shall be responsible for the layout for all lines and grades for the Work as indicated in the Contract Documents.
- .4 Excavation for the foundation preparation for the Sidewalk shall be to the depth and width as shown in the Contract Documents and/or on Standard Drawing 419-1.
- .5 Material disturbed in the bottom of the excavation shall be compacted to the maximum density as determined by a test strip or other standard industry methods, and shall be approved by the Engineer prior to the placement of the backfill.
- .6 Excavated material may be used as backfill behind and under the new concrete Sidewalk along the limits of the Work subject to the approval of the Engineer.
 - .1 Excavated material, suitable for and surplus to backfilling, shall be disposed of by the Contractor as directed by the Engineer.
 - .2 Excavated material not suitable for backfill, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.

- 419.4 .7 Aggregate Base shall be placed as indicated on Standard Drawing 419-1 and in accordance with 203.4.
- .1 Water shall be uniformly applied to the Aggregate Base immediately ahead of concrete placement so as to thoroughly wet the Aggregate Base surface without the pooling of water.
- .8 A cross Slope of 20 mm per metre shall be formed and the direction of the Slope shall, in general, be towards the curb, however local conditions may result in the necessity to vary this Slope and the Contractor is to advise the Engineer if this Slope condition must be altered.
- .9 Concrete Sidewalk shall be constructed in accordance with the dimensions shown in the Contract Documents and/or Standard Drawing 419-1.
- .1 Joint layout and joint details shall be constructed in accordance with Standard Drawings 419-2 and 419-3.
 - .1 Control joints are partial depth and are used to create a plane of weakness in the concrete to control the location of drying shrinkage cracks.
 - .2 Isolation joints are full depth and are used to prevent cracking due to differential movement.
 - .3 Construction joints are full depth and are used at the end of a Day's construction or when the placement of concrete is interrupted by more than 30 minutes.
 - .4 Dummy joints are tooled partial depth joints and are positioned for aesthetics.
- .10 Concrete shall be placed in accordance with 301.4.
- .1 The Contractor shall notify the Engineer at least 24 hours prior to the planned placement of any concrete.
 - .2 Concrete placed in the Work shall be consolidated to ensure uniformity of the concrete density so that a minimum of voids shall remain in the placed concrete.
- .11 Concrete Sidewalk shall be cast-in-place in 6 m sections in length, except in slipforming operations, and/or where local conditions dictate otherwise.
- .1 Sidewalk shall be formed and placed in a single operation.
 - .2 Curvatures in the alignment of the concrete Sidewalk for parking areas and at street intersections and depressions for driveways, crosswalks and other transition areas shall be constructed as indicated in the Contract Documents and/or as directed by the Engineer.
 - .3 Where the concrete Sidewalk is formed adjacent to a building or other fixed structure, a 12 mm prefabricated joint filler shall be placed between the curb and the adjacent structure, to form an isolation joint as indicated in the Standard Drawing 419-3.
 - .1 Spacing of the control joints should vary to coincide with the centre of manholes or other box-outs.
 - .4 Concrete Sidewalk shall have a control joint formed by cutting a slot to a depth of 50 mm and spaced as indicated on Standard Drawings 419-2 and 419-3.

- 419.4.11 .5 Dummy joints shall be formed in concrete at intervals equal to the width of the Sidewalk, by cutting a slot in the slab 25 mm deep with a T-bar.
- .6 Every fourth joint shall be to the full depth of the concrete.
- .7 Joints shall be cut before uncontrolled shrinkage takes place (which can occur between 4 and 24 hours after placement) and the timing shall be the responsibility of the Contractor.

419.4 .12 Metal Forms

- .1 The Contractor shall erect all forms to the full depth of the concrete Sidewalk and these shall be securely positioned to the required lines and grade.
- .2 Formwork shall be thoroughly coated with a commercial quality form coating, which shall permit the ready release of the forms and will not discolour the concrete.
- .3 Forms shall remain in place for a minimum of 24 hours after concrete is placed if the danger of any disturbance to the placed and partially set concrete exists.

419.4 .13 Slipforming

- .1 Slipform machines must be capable of placing the concrete as indicated on the Standard Drawing 419-1.
- .1 After slipforming, the joints shall be saw cut; insert bars shall not be permitted.

419.4 .14 Finishing, Curing and Protection

- .1 The top surface of the Sidewalk shall be "struck" with a straight edge and floated with a wooden or magnesium float for finish.
- .2 Finished surfaces of the concrete Sidewalk shall be roughened by brooming lightly or other method, subject to the approval of the Engineer.
- .3 Pigmented membrane curing compounds may be used, upon request, subject to the prior approval of the Engineer.
- .1 Pigmented membrane curing compounds shall be applied in two applications immediately after the final finishing.
- .1 One application shall be placed in a direction perpendicular to the previous application.
- .4 Voids or surface irregularities shall be repaired using concrete grout from the same concrete load and a float shall be used on the repaired area prior to texturing.
- .5 A margin of 50 mm in width shall be defined and finished smooth along the perimeter of each slab and the edges shall be rounded to a radius of 6 mm with an approved edging tool.
- .6 The Contractor shall be responsible for the maintenance of the concrete Sidewalk until completion and acceptance of the Work.

419.4 .15 Repair and Replacement

- .1 Concrete Sidewalk which does not conform to the Specifications shall be repaired and/or replaced as directed by the Engineer.
- .2 If the repair and replacement results in the need for repairs and adjustments to the materials adjacent to the Sidewalk, the Contractor shall carry out the repairs and adjustments at his/her own expense and to the satisfaction of the Engineer.
 - .1 Materials removed shall become the property of the Contractor and shall be disposed of outside the Work Site.

419.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of Sidewalk constructed in accordance with this Item.
- .2 Measurements shall be taken as the dimension of the Work, as indicated on Standard Drawing 419-1 and no deductions shall be made for areas occupied by light standards, manhole covers, poles or other similar objects.

419.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

ASPHALT SIDEWALK

ITEM: 420

420.1 DESCRIPTION

- .1 This Item consists of the construction of asphalt concrete Sidewalk.

420.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Aggregate Base shall meet to the requirements of 201.2.
- .3 Asphalt Concrete D or Warm Mix D shall conform to the requirements of 261.2.

420.3 SUBMITTALS

- .1 The Contractor shall submit the asphalt concrete mix design as set out in 261.2 for approval by the Engineer.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

420.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Asphalt sidewalk shall be constructed as shown on Standard Drawing 420-1.
- .3 Material disturbed in the bottom of the excavation shall be compacted to 97% of the maximum density as determined by a test strip, per 936, or other standard industry methods, and approved by the Engineer prior to the placement of the backfill.
- .4 Surplus excavated material not required for backfill, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .5 Aggregate Base shall be placed as indicated on Standard Drawing 420-1, and in accordance with 203.4.
- .6 A cross slope of 20 to 30 mm per metre shall be placed and the direction of the Slope shall, in general, be towards the curb, however local conditions may result in the necessity to vary this Slope and the Contractor is to advise the Engineer if this Slope condition must be altered.
- .7 The Contractor shall place the sidewalk using an asphalt spreader in accordance with 261.4.
- .8 Asphalt concrete shall be compacted to a density not less than 91% of the theoretical maximum relative density, as determined in accordance with ASTM D2041.
- .9 The Contractor shall maintain barricades or other suitable measures to ensure that the finished Sidewalk is protected from traffic until the heat of the asphalt concrete mixture has dissipated.

420.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of asphalt Sidewalk constructed in accordance with this Item.
- .2 Measurements shall be taken as the dimension of the Work, as indicated on Standard Drawing 420-1 and no deductions shall be made for areas occupied by light standards, manhole covers, poles or other similar objects.

420.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF CURB AND GUTTER

ITEM: 423

423.1 DESCRIPTION

- .1 This Item consists of the removal of curb and gutter.

423.2 MATERIALS

- .1 None identified.

423.3 SUBMITTALS

- .1 None identified.

423.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Excavated curb and gutter materials shall become the property of the Contractor and shall be disposed of outside the Work Site.

423.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity measured for payment shall be the number of linear metres of curb and gutter removed in accordance with this Item.

423.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF SIDEWALK

ITEM: 424

424.1 DESCRIPTION

- .1 This Item consists of the removal of Sidewalk.

424.2 MATERIALS

- .1 None identified.

424.3 SUBMITTALS

- .1 None identified.

424.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Excavated sidewalk materials shall become the property of the Contractor and shall be disposed of outside the Work Site.

424.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity measured for payment shall be the number of square metres of Sidewalk removed in accordance with this Item.

424.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF UNDERGROUND SERVICES

ITEM: 425

425.1 DESCRIPTION

- .1 This Item consists of the removal of underground services.

425.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Backfill material shall be selected material from the excavation as approved by the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the site from a source and of a type approved by the Engineer and in accordance with the appropriate Item.

425.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

425.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall notify the Engineer prior to breaking into the existing underground services and shall verify that they are out of service and approved for removal.
- .3 The Contractor shall be responsible for the design and construction of all temporary shoring, bracing and underpinning found necessary to complete the Work.
- .4 The Contractor shall ensure, to the extent practicable, that no contents of any sewer or sewer connection flows into the excavation during the Work.
- .5 The Contractor shall confine his/her operations and storage of products to the properties, rights-of-way or easements provided by the Owner for the Work.
 - .1 The Contractor shall repair and restore the properties, rights-of-way or easements provided by the Owner to the satisfaction of the Engineer.
 - .2 Any other damage to adjacent property, resulting from the Work, shall be repaired by the Contractor at her/his own expense.
- .6 Excavation shall be carried out in accordance with 401.4 and Standard Drawings 401-1 and 404-2.
- .7 Materials from the Work, unless otherwise determined by the Engineer, shall remain the property of the Owner.
- .8 Materials that are determined by the Engineer to be unsalvageable shall become the property of the Contractor and shall be disposed of outside the Work Site.

REMOVAL OF UNDERGROUND SERVICES

ITEM: 425

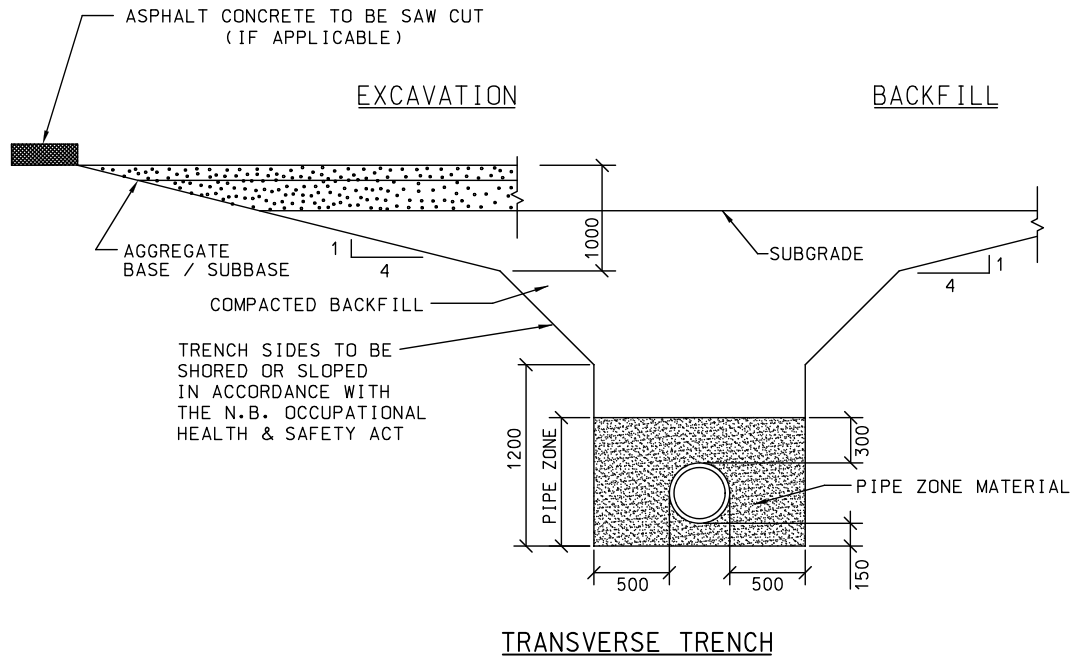
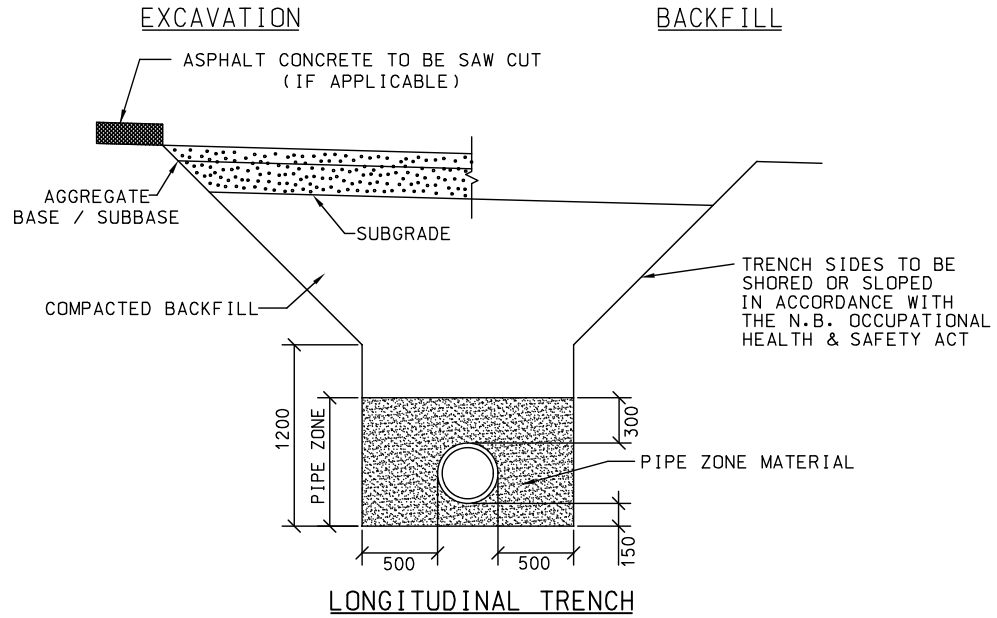
- 425.4 .9 The Contractor shall completely backfill the excavation resulting from the removal of underground services, with an approved material of the quality matching the surrounding material, and shall finish the backfilled area to match the surrounding grade.
- .10 Backfill shall be placed in accordance with Item 936 in lifts of not more than 300 mm in thickness, and compacted to a minimum of 95% of its maximum dry density.

425.5 MEASUREMENT FOR PAYMENT

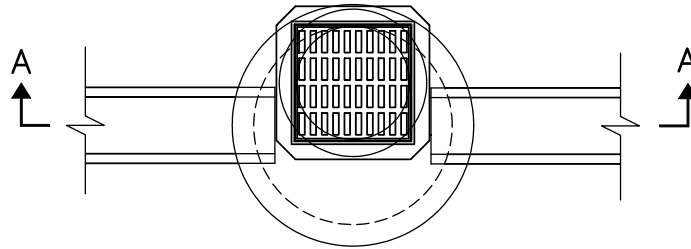
- .1 The Quantity to be measured for payment shall be the number of linear metres of underground services removed in accordance with this Item.
- .2 If more than one service exists in a given trench the length shall only be measured once and the combination of services shall be treated as one unit.

425.6 BASIS OF PAYMENT

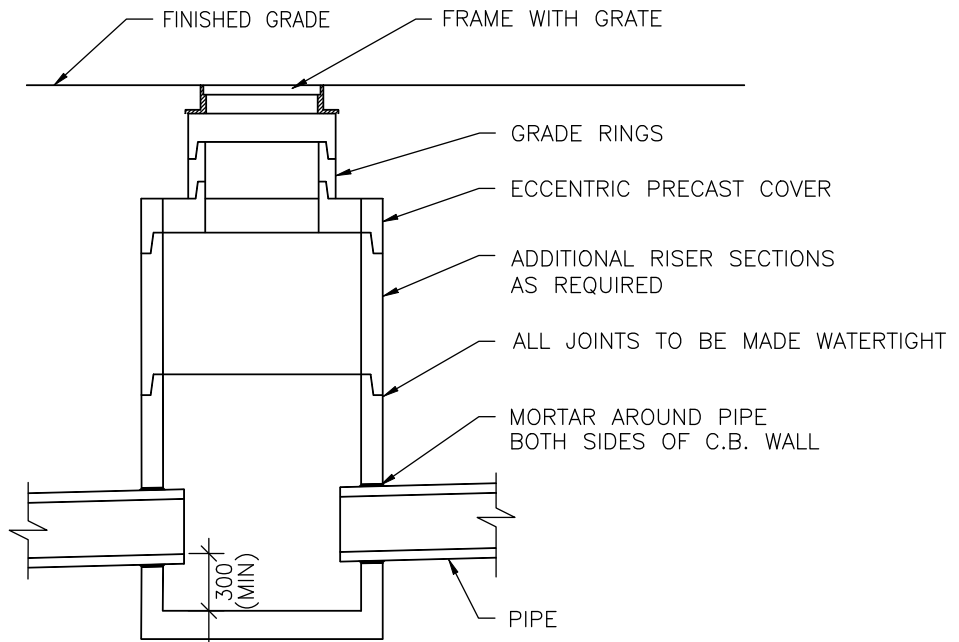
- .1 Payment for Work under this Item shall include a separate Unit Price for each type of underground service removed, as identified under the Contract.



Typical Trench Cross Sections

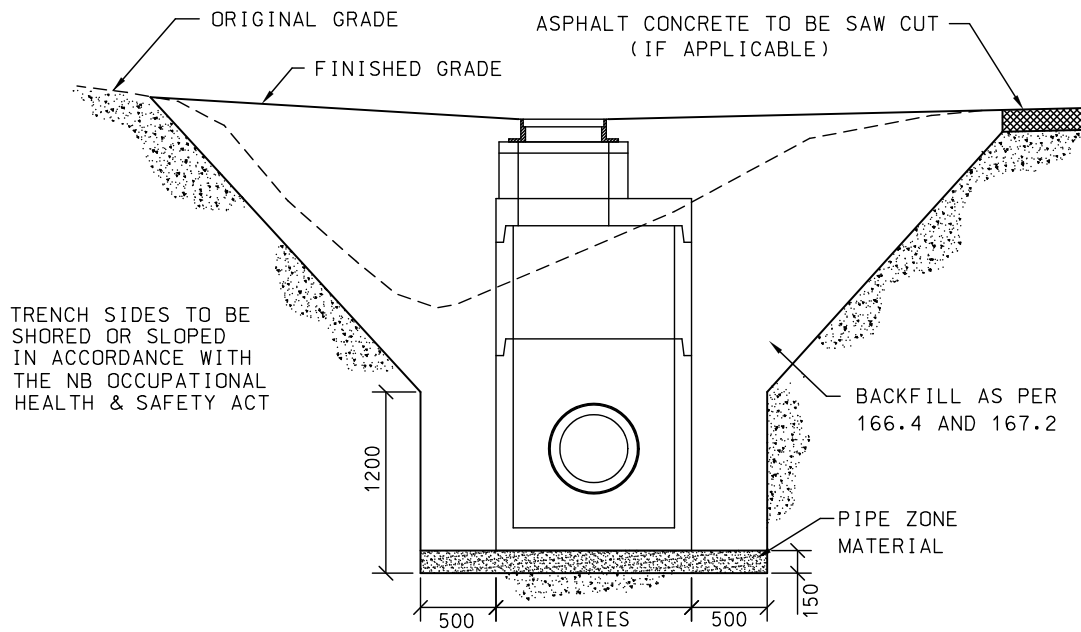


TOP VIEW

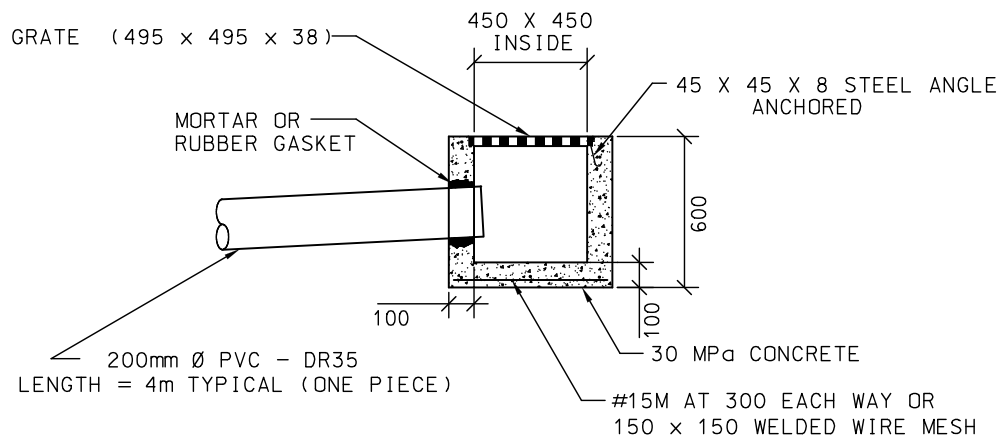
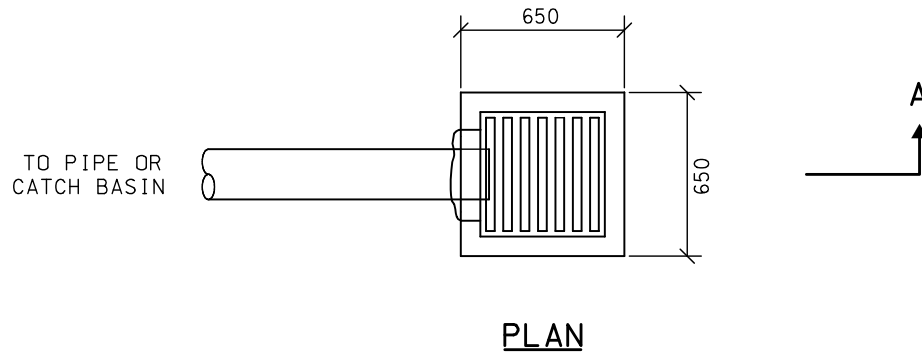


SECTION A-A

Precast Catch Basin Details

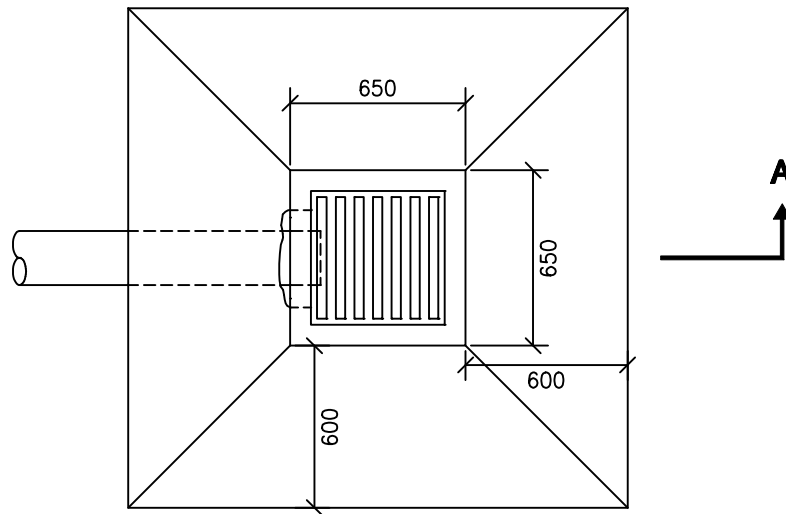


Typical Catch Basin Excavation

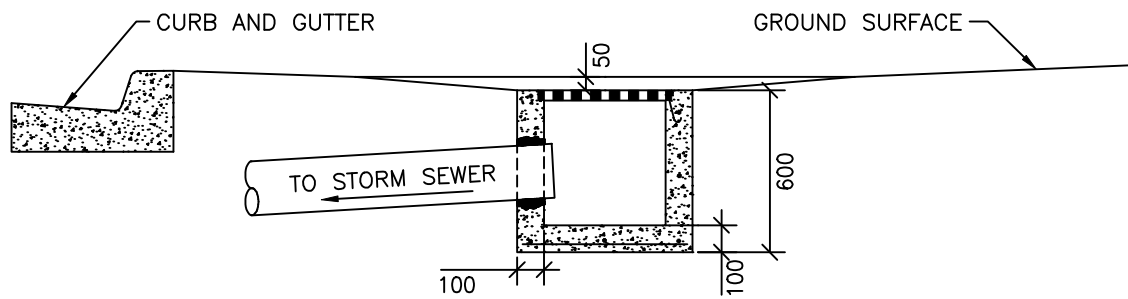


SECTION A

Typical Sluice Box And Pipe Detail



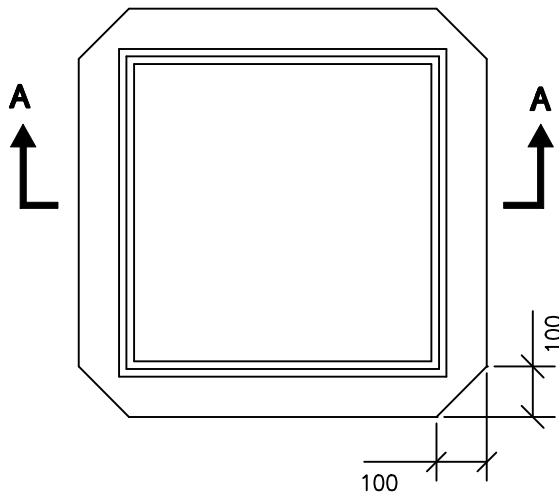
PLAN



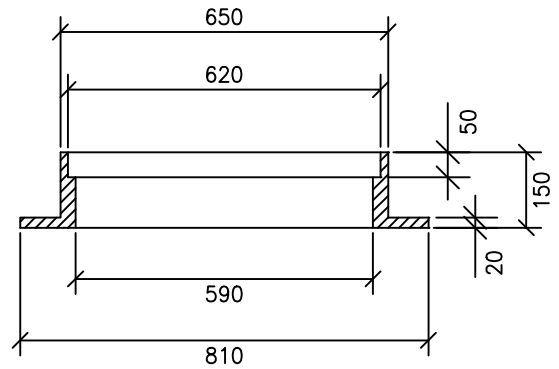
SECTION A

**Typical Sluce Box Installation
Behind the Curb and Gutter**

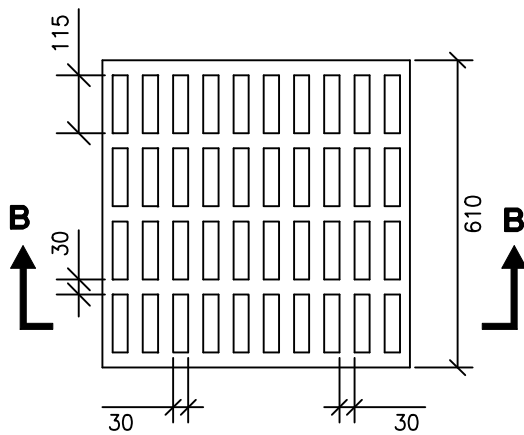
NOTES: - MATERIAL CAST IRON TO
ASTM A48, CLASS 30
- MINIMUM MASS: FRAME 110 kg
GRATE 85 kg



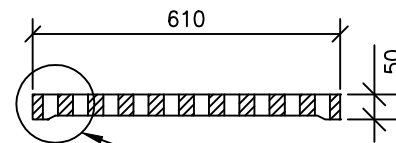
FRAME



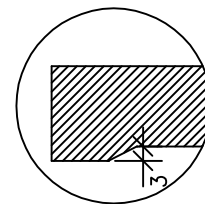
SECTION A-A



GRATE



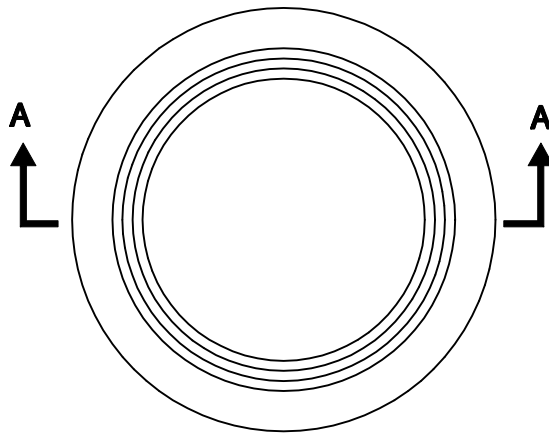
SECTION B-B



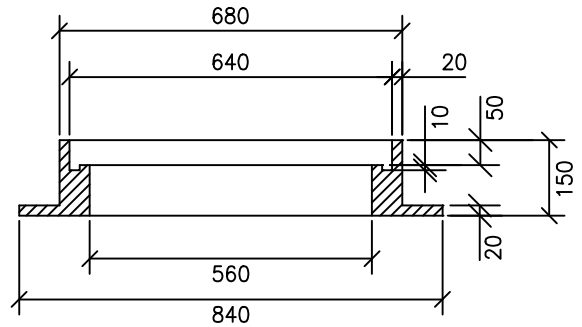
DETAIL A

Typical Frame With Grate
Square

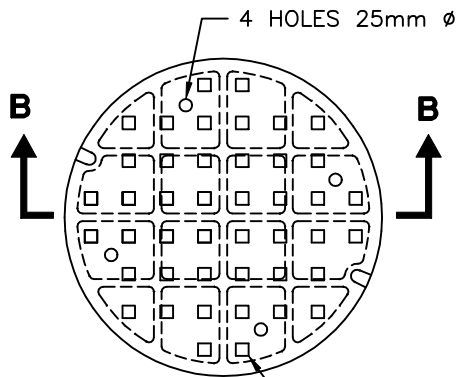
NOTES: - MATERIAL CAST IRON TO
 ASTM A48, CLASS 30
 - MINIMUM MASS: FRAME 125 kg
 COVER 63 kg



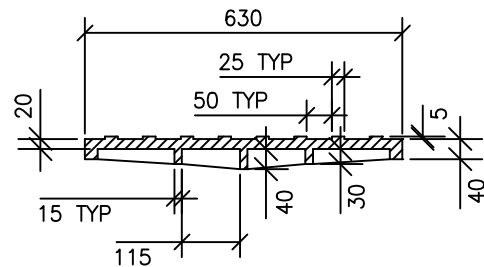
FRAME



SECTION A-A

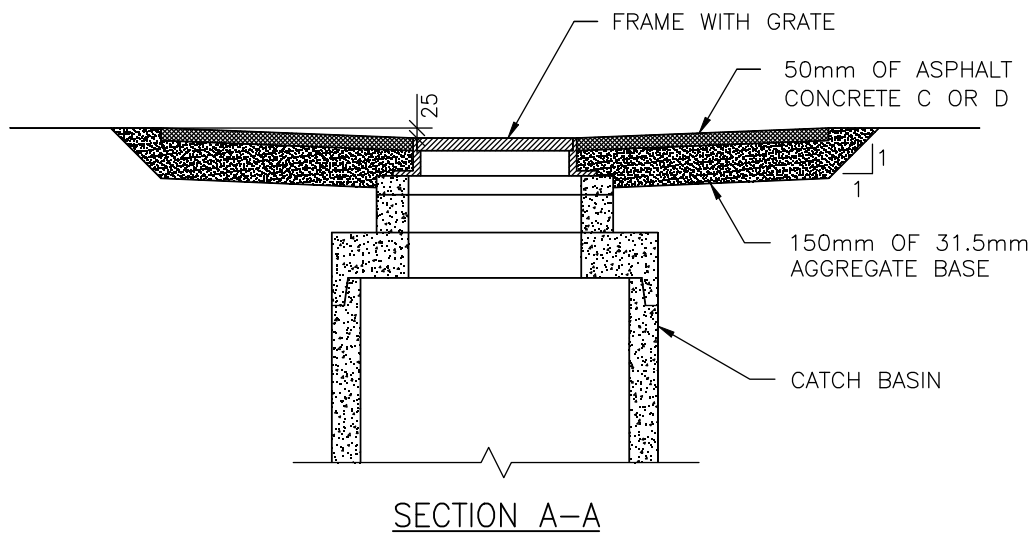
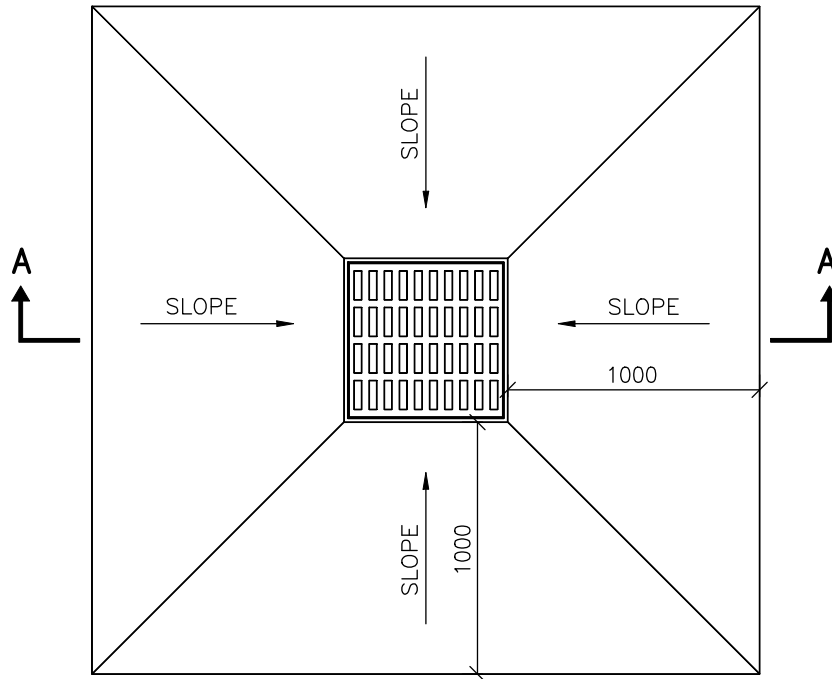


COVER

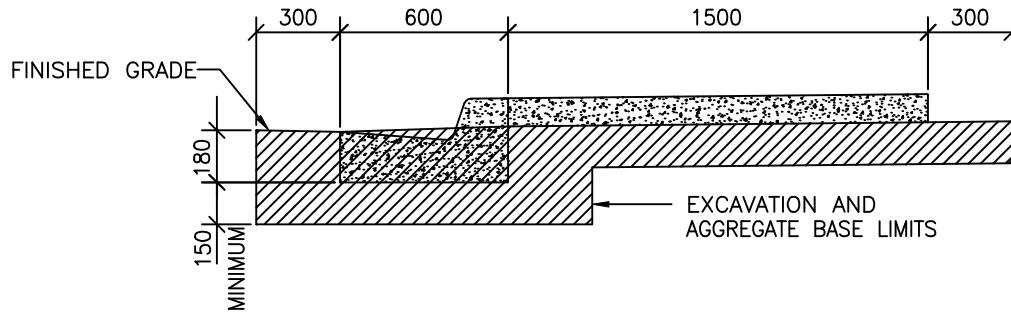


SECTION B-B

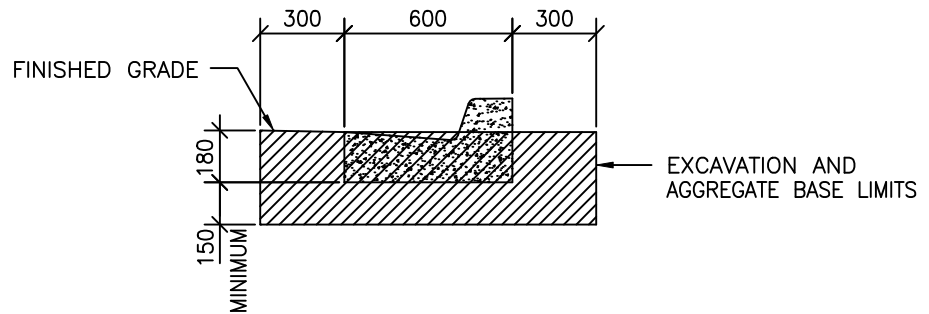
**Typical Frame With Cover
 Round**



Paving Catch Basin Apron

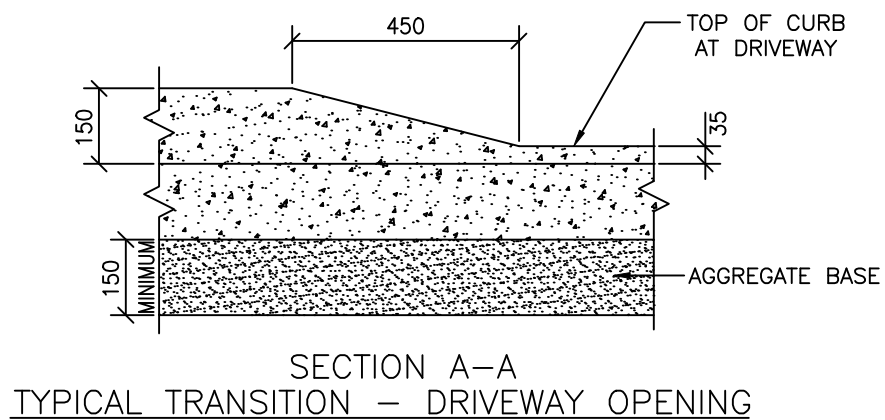
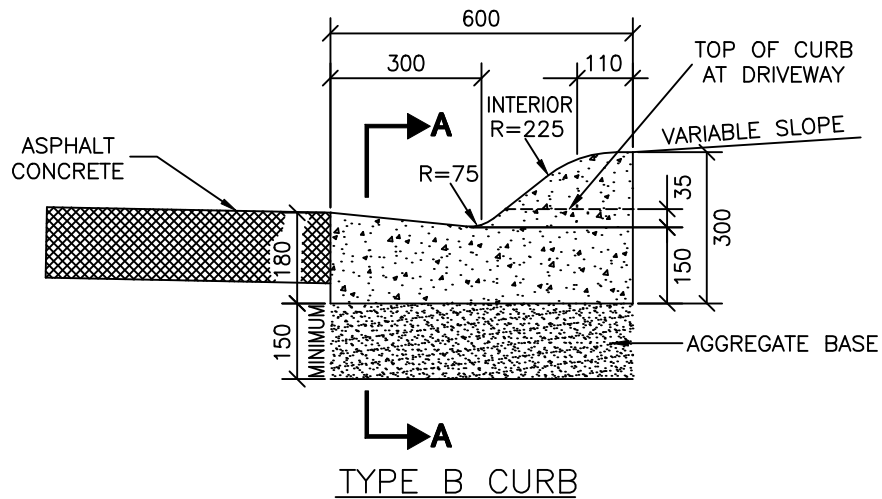
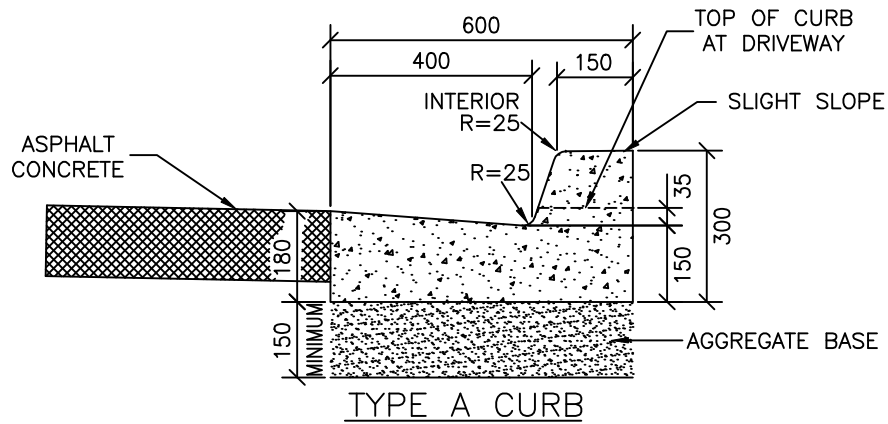


CURB AND GUTTER WITH SIDEWALK

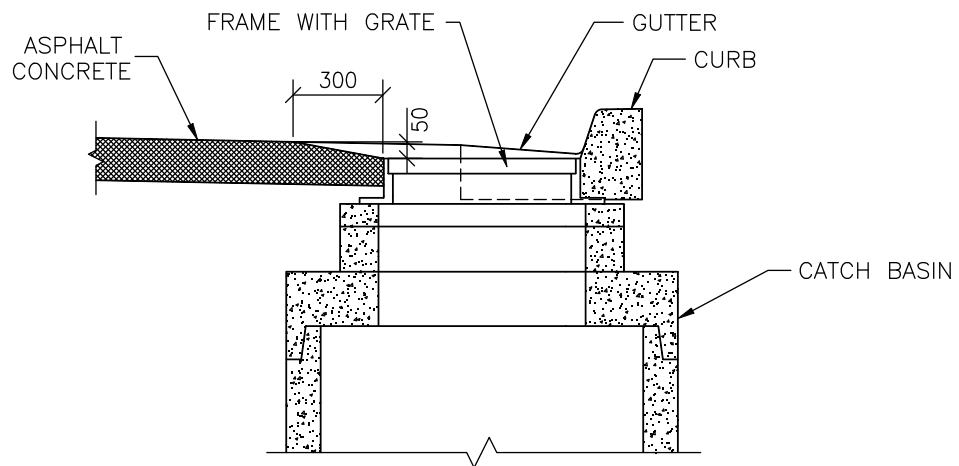
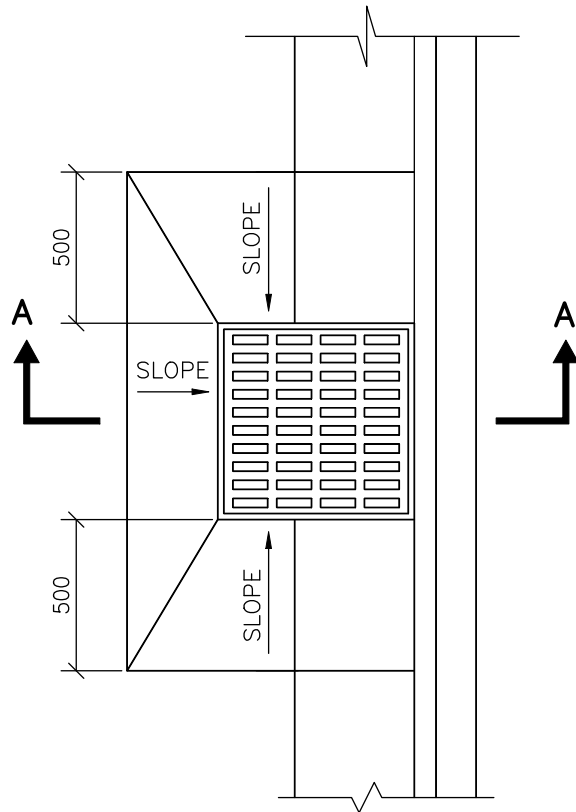


CURB AND GUTTER ONLY

Curb And Gutter Details

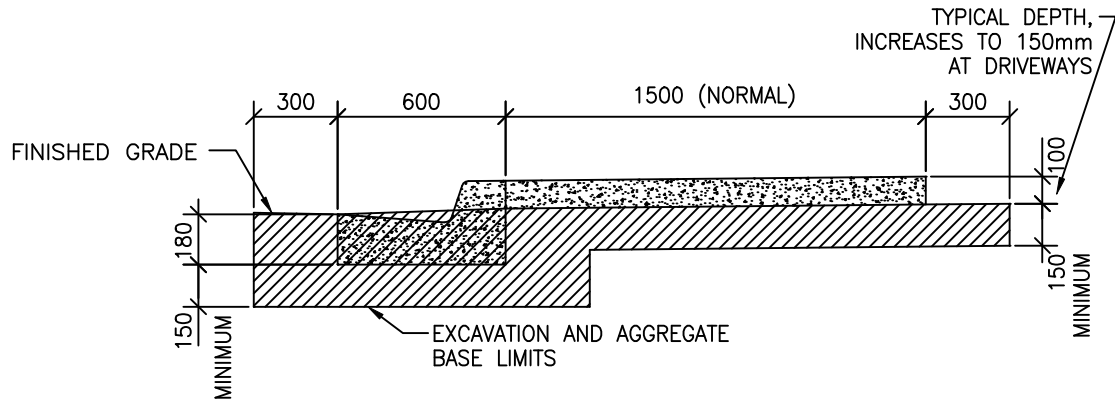


Curb And Gutter Details

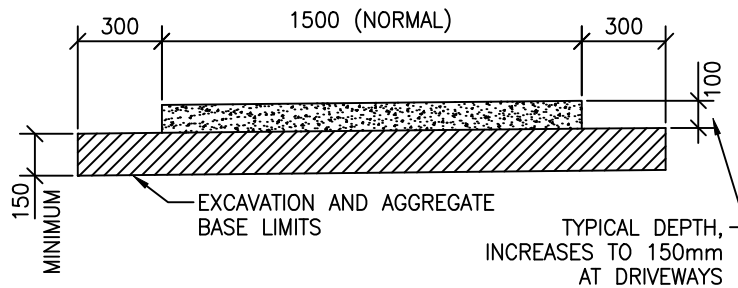


SECTION A-A

Curb And Gutter Details

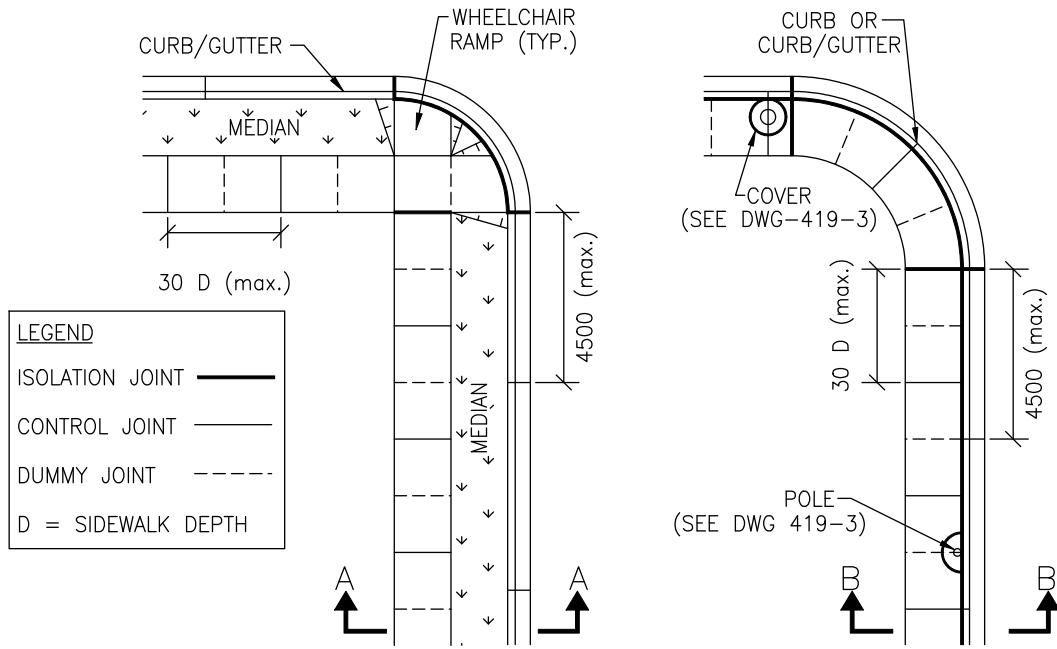


SIDEWALK WITH CURB AND GUTTER



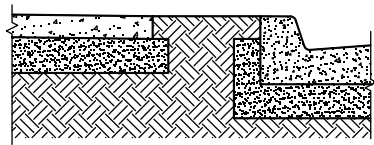
SIDEWALK ONLY

Concrete Sidewalk Details

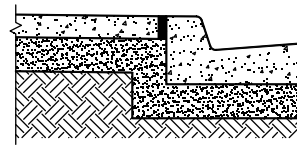


SEPARATE SIDEWALK
AND CURB/GUTTER

SIDEWALK WITH
CURB/GUTTER

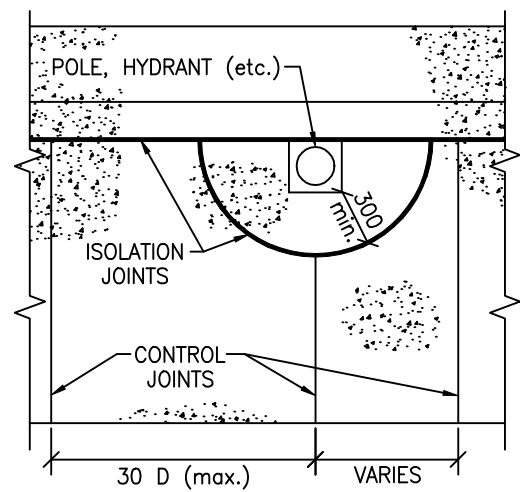
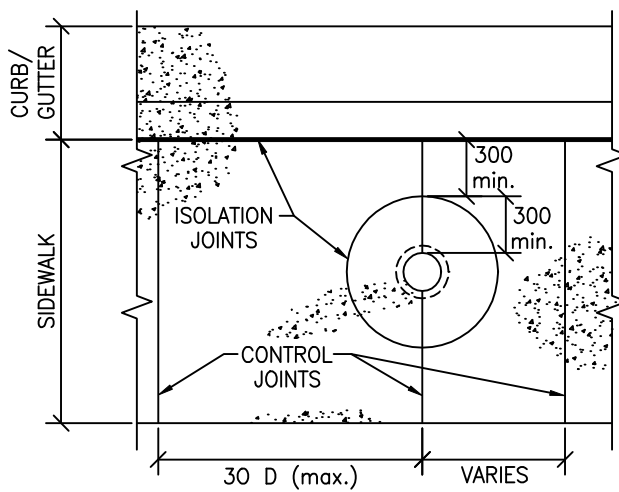
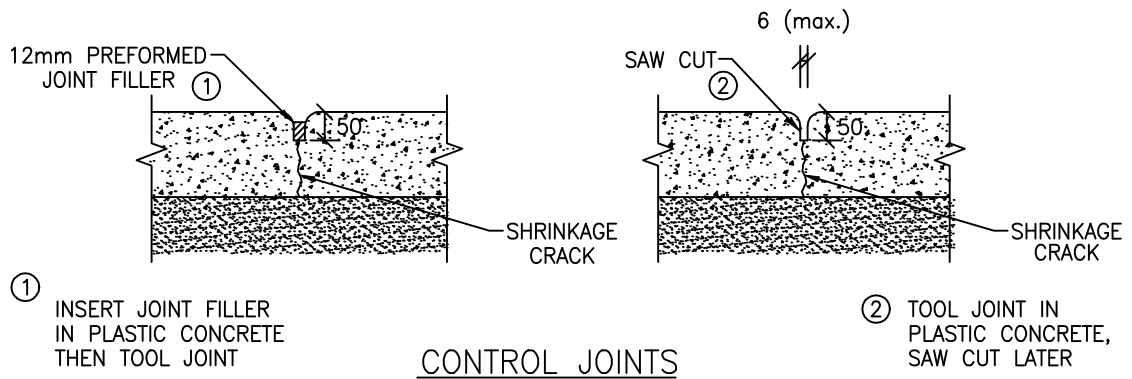
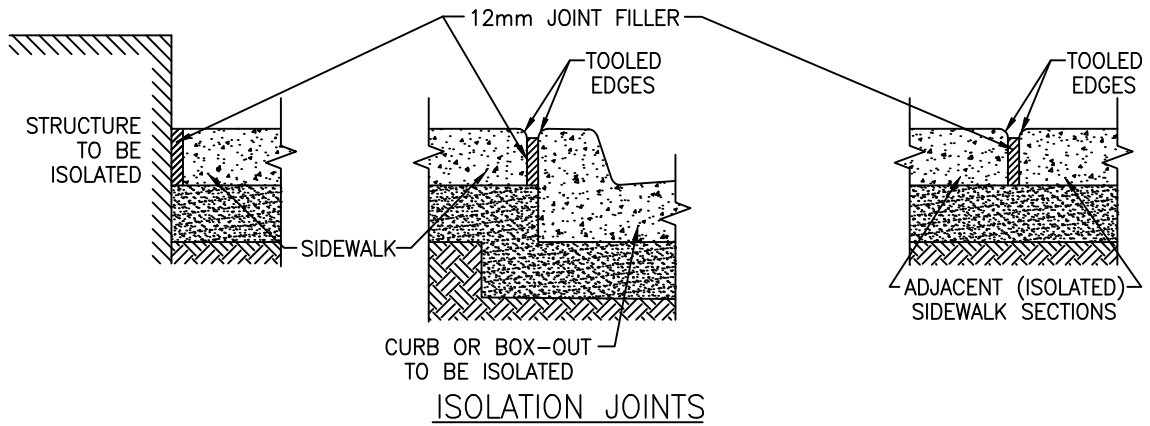


SECTION A-A



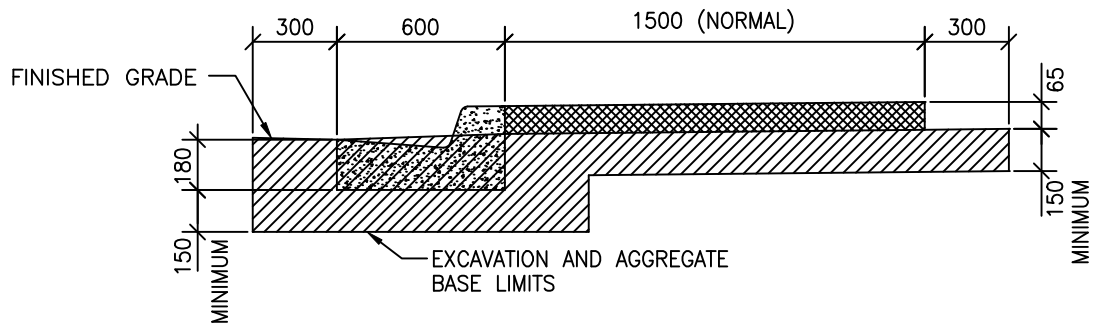
SECTION B-B

Joint Layout

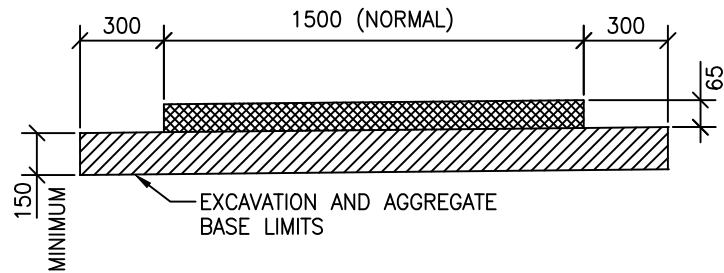


D=SIDEWALK DEPTH

Joint and Isolation Details



SIDEWALK WITH CURB AND GUTTER



SIDEWALK ONLY

Asphalt Sidewalk Details

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553	Removal of Roadside Sign	1

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554 - 2	Overhead Sign Structure Foundation - Base Plate and Template Details	

GUIDE POSTS

ITEM: 510

510.1 DESCRIPTION

- .1 This Item consists of the supply and installation of preservative treated hardwood guide posts.

510.2 MATERIALS

- .1 All material shall be supplied by the Contractor.
- .2 Guide posts shall be of the maple, birch or beech species of hardwood.
- .3 The posts shall be sound and rot-free, and shall meet or exceed the requirements for No. 1 Structural Posts and Timbers, graded in accordance with the National Lumber Grading Authority (NLGA) Standard Grading Rules for Canadian Lumber.
- .4 Preparation, handling and treatment of posts shall be in accordance with CAN/CSA-080 and the American Wood Preservers' Association (AWPA) standards.
- .5 Prior to pressure treating, posts shall be incised on all four sides and dried to their fibre saturation point of 25 to 30% at 25 mm depth.
 - .1 Guide posts may be pre-cut and drilled prior to pressure treating.
- .6 The preservative shall be as follows: for pressure treating, chromated copper arsenate (CCA); and for field-cut surfaces, Wolman End Cut Preservative (Green) or equivalent applied in two coats.
- .7 Preservation and wood products supplied shall be in accordance with CAN/CSA 080.
- .8 Guide posts shall be sized as indicated on Standard Drawing 510-1.
- .9 Backfill materials used shall be selected material from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Site from a source and of a type approved by the Engineer and supplied in accordance with 167.2 - Class A.
- .10 Offset blocks shall conform with 510.2 and shall be sized in accordance with the details indicated on Standard Drawing 510-1.
 - .1 Salvaged rail may require the length of the offset block to be greater than the 342 mm shown in the Standard Drawing 510-1 in order to achieve the minimum 15.5 mm above and below the rail.

510.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, prior to incorporating the material in the Work, the product name and manufacturer's specifications for the preservative to be applied to the post field cuts.
- .2 The Contractor shall submit, upon request and in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.

510.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Guide posts shall be installed in accordance with Standard Drawings 510-1, 510-2, 510-3, 512-2, 512-3, 512-4, 512-5, and 512-6.
 - .1 If Energy-Absorbing Guide Rail Terminal (EAGRT) systems are specified in the Contract Documents, the flared buried end treatments shown in Standard Drawings 510-2, 510-3, 512-2 and 512-3 shall be replaced with EAGRT systems installed in accordance with Item 515.
- .3 Alignment of guide posts shall be established by the Engineer.
- .4 Installation shall be carried out in a manner so as to avoid damage to the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any such damage resulting from the Work.
- .5 Areas around guide posts shall be backfilled with approved material, compacted during placement and shall be finished to match the surrounding grade.
- .6 Cut surfaces of all wood products shall be treated with an approved preservative, as detailed in the manufacturer's application instructions.
- .7 Waste materials shall become the property of the Contractor and shall be disposed of outside the Work Site.

510.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity measured for payment shall be the number of guide posts supplied and installed in accordance with this Item.

510.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each size of guide post, as identified under the Contract.

REMOVAL OF GUIDE POSTS

ITEM: 511

511.1 DESCRIPTION

- .1 This Item consists of the removal of guide posts.

511.2 MATERIALS

- .1 None identified.

511.3 SUBMITTALS

- .1 None identified.

511.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The removal shall be carried out in a manner so as to avoid damage to the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any such damage resulting from the Work.
- .3 All materials shall remain the property of the Owner, until such time as the materials are directed for disposal.
 - .1 Salvageable guide posts, as determined by the Engineer, shall be used as offset blocks under 512.2, unless otherwise specified in the Contract Documents.
 - .2 Salvageable guide posts not used for offset blocks shall be transported to the nearest DTI Maintenance Depot.
 - .3 All unsalvageable guide posts and waste shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .4 The Contractor shall be responsible to completely backfill the hole resulting from the guide post removal, with an approved material, compacted during placement and shall finish the backfilled area to match the surrounding grade.
- .5 The Contractor shall shape and grade the Shoulder by removing the excess materials that have accumulated over time and shall leave the Work Site in a uniform and consistent grade matching the adjacent surface.

511.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity measured for payment shall be the number of guide posts removed in accordance with this Item.

511.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

512.1 DESCRIPTION

- .1 This Item consists of the supply and installation of steel beam guide rail.

512.2 MATERIALS

- .1 All material shall be supplied by the Contractor.
- .2 If specified for use on the Contract, salvaged/straightened rail shall be made available by the Owner under Item 513 from DTI, Fredericton, NB.
 - .1 The Contractor shall be responsible to transport the salvaged rail to the Work Site.
- .3 Guide rail delineators shall be 50 mm x 50 mm x 3 mm 6061-T6 aluminum angle stock cut to 50 mm lengths.
 - .1 Delineators shall have a centered 19 mm slot cut in one leg from the outer edge a total of 19 mm inward. The slot shall end with a 9 mm radius.
 - .2 The material shall be degreased and etched to ensure adhesion of reflective materials.
 - .3 The solid leg of each delineator must have both the outside edge and both faces completely covered with 3M high-intensity silver sheeting No. 3870 or yellow sheeting No. 3871.
 - .4 Reflective materials shall conform to CGSB 62-GP-11 and a written warranty covering the field performance of the product shall be submitted.
- .4 Guide rail shall be Class A, Type II, W-section steel beams conforming to AASHTO M180.
 - .1 Each section of guide rail, in accordance with AASHTO M180, requires markings as follows:
 - Name or brand of manufacturer;
 - Identification symbols or code for heat;
 - Number and coating lot;
 - AASHTO Spec #; and
 - Class and Type.
- .5 Guide rail end marker posts shall be W-shaped thermoplastic extrusion comprised of a double-curve profile, a minimum of 95 mm wide with 4 mm walls and shall be 1.5 m long.
 - .1 Approach guide rail marker shall be a red post with a 75 mm x 150 mm red reflector. Termination guide rail marker shall be a green post with a 75 mm x 150 mm green reflector.
 - .1 Retro-reflective sheeting shall be ASTM Type IV or higher grade, factory applied by the manufacturer.
 - .2 Guide rail end marker posts shall be capable of sustaining a minimum of ten direct wheel-over impacts at 100 km/hr, without damage to the post or the reflective sheeting applied to the post.
 - .3 Lag screws to attach end markers to guide posts shall be 8 mm x 50 mm galvanized and shall include an 8 mm galvanized flat washer.

512.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, prior to incorporating the material in the Work, the product name and manufacturer's specifications for the guide rail.
- .2 The Contractor shall submit, upon request, in advance of the commencement of the Work, the manufacturer's certification, for all galvanized metals, that the materials supplied meet the specified requirements as detailed on the Contract Documents.

512.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Guide rail shall be installed in accordance with Standard Drawings 510-1, 510-2, 510-3, 512-1, 512-2, 512-3, 512-4, 512-5 and 512-6.
 - .1 If Energy-Absorbing Guide Rail Terminal (EAGRT) systems are specified in the Contract Documents, the flared buried end treatments shown in Standard Drawings 510-2, 510-3, 512-2 and 512-3 shall be replaced with EAGRT systems installed in accordance with Item 515.
- .3 Guide rail sections shall be installed to produce a smooth continuous rail, paralleling the line and grade of the finished Highway surface.
- .4 Salvaged guide rail shall not be intermixed or alternated with new guide rail in the same installation.
 - .1 The Contractor shall allow for a two week turn around for straightened rail.
- .5 Guide rail sections shall be lapped in direction of the traffic.
 - .1 Each section of salvaged rail shall be installed such that the end that had been overlapped before dismantling is overlapped upon reinstallation.
 - .2 Additional 63 mm x 19 mm slots required in the guide rail shall meet the requirements of AASHTO M180.
- .6 Cut surfaces of all wood products shall be treated with an approved preservative, as detailed in the manufacturer's application instructions.
- .7 Offset blocks and delineators shall be installed on the guide rail as specified and indicated on Standard Drawing 510-1.
 - .1 The colour of the delineator shall be consistent with the colour of the adjacent Pavement line marking.
- .8 Guide rail sections with a typical buried-end treatment, the red approach guide rail marker shall be installed 200 mm onto the second guide post from the end using two lag screws spaced 100 mm apart.
 - .1 Guide rail sections with an energy-absorbing guide rail treatment (EAGRT) shall have approach end markers per Item 515.
- .9 The green termination guide rail marker shall be installed 200 mm onto the second last guide rail post using two galvanized lag screws spaced 100 mm apart.

512.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of guide rail supplied and installed in accordance with this Item.
 - .1 The Quantity shall be calculated by multiplying the total number of guide rail pieces in the Work by 3.81 m.

512.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

513.1 DESCRIPTION

- .1 This Item consists of the removal of steel beam guide rail.

513.2 MATERIALS

- .1 None identified.

513.3 SUBMITTALS

- .1 When salvaged guide rail is delivered to DTI, Fredericton, NB in accordance with 513.4.4 for straightening, the Contractor shall submit a document identifying the quantity of guide rail being delivered and the Contract number of the project under which it was salvaged.

513.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Guide rail, offset blocks, hardware and delineators shall be dismantled to individual components.
- .3 The dismantling shall be carried out in a manner so as to avoid damage to the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any such damage resulting from the Work.
- .4 Dismantled guide rail, hardware and delineators shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he/she shall replace any materials damaged or lost.
 - .2 Unsalvageable guide rail, hardware and delineators, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .5 Dismantled offset blocks shall be stored at a location selected by the Contractor, until reused in the Work and shall be the responsibility of the Contractor.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be the Contractor's responsibility and he shall replace any materials damaged or lost.
 - .2 Unsalvageable offset blocks, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.

513.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of guide rail removed in accordance with this Item.
- .2 The Quantity shall be calculated by multiplying the total number of guide rail pieces in the Work by 3.81 m.

513.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

515.1 DESCRIPTION

- .1 This Item consists of the supply and installation of an Energy-Absorbing Guide Rail Terminal (EAGRT).

515.2 MATERIALS

- .1 All material shall be supplied by the Contractor.
- .2 EAGRTs shall meet the requirements of National Cooperative Highway Research Program (NCHRP) Report 350 Test Level 3 or Test Level 3 standards of the AASHTO Manual for Assessing Safety Hardware (MASH), for the finished installed height specified.
- .3 EAGRTs shall be the straight/flared type and shall be installed to a finished height of 685/785 mm at the top of rail.
- .4 Only proprietary EAGRTs will be acceptable, including those made by the following:
 - .1 Energy Absorption Systems Inc., Chicago, Illinois.
 - .2 Road System Inc., Big Spring, Texas.
 - .3 Trinity Industries Inc., Dallas, Texas.
 - .4 Lindsay Corporation, Omaha, Nebraska.
- .5 A yellow and black hazard marker, minimum 300 mm x 600 mm and made from 3M Hi-Intensity reflective sheeting or equivalent, shall be supplied with each EAGRT.
- .6 Backfill material shall be the material excavated from the Roadbed for the installation of the EAGRT, or the material otherwise specified by the manufacturer.
- .7 End marker posts shall be W-shaped thermoplastic extrusion comprised of a double-curve profile, a minimum of 95 mm wide with 4 mm walls and shall be 1.5m long.
 - .1 Markers shall be a red post with two 75 mm x 150 mm red reflectors spaced 75 mm apart.
 - .1 Retro-reflective sheeting shall be ASTM Type IV or higher grade, factory applied by the manufacturer.
 - .2 Guide rail end marker posts shall be capable of sustaining a minimum of ten direct wheel-over impacts at 100 km/hr, without damage to the post or the reflective sheeting applied to the post.
 - .3 Bolts to attach end marker to a steel post shall be 8 mm x 38 mm galvanized and shall include 8 mm galvanized nuts and washers.
 - .4 Lag screws to attach end markers to wooden post shall be 8 mm x 50 mm galvanized and shall include an 8 mm galvanized flat washer.

515.3 SUBMITTALS

- .1 The Contractor shall submit, at least 14 Days in advance of the Work, the type of EAGRT system proposed for the Work, the name of the manufacturer, and at least three copies of Shop Drawings clearly showing in detail the components and installation of the EAGRT.
- .2 Prior to delivery of the EAGRT systems to the Work Site, the Contractor shall submit written certification that the EAGRT has been designed to meet the requirements of NCHRP Report 350 Test Level 3 or MASH Test Level 3 standards; have been fabricated of materials consistent with the design; and will function as designed.
- .3 Submittals shall be made as required for any cross-referenced Item forming part of this Item.

515.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Work shall be carried out as indicated in the Shop Drawings.
- .3 Grading for flared EAGRT's shall be carried out to the dimensions as indicated on Standard Drawing 515-1.
- .4 The Contractor shall be prepared to arrange for a technical representative of the supplier/manufacturer of the EAGRT to be on site for the initial installation on the Contract to ensure that correct procedures are established.
- .5 The impact head of each EAGRT shall be cleaned thoroughly as recommended by the manufacturer of the reflective sheeting hazard marker.
- .6 Hazard markers shall be secured squarely to the impact head.
- .7 On a straight or flared EAGRT, a red end marker shall be installed 200 mm onto the first steel post using two bolts, nuts and washers spaced 100 mm apart.
 - .1 On a flared EAGRT, an additional red marker shall be installed 200 mm onto the first guide post following the flared section of the EAGRT using two lag screws spaced 100 mm apart.
- .8 Backfilling of posts and other underground units of the EAGRT shall be completed in accordance with 510.4.
- .9 Installation of any EAGRT shall be performed concurrently with the completion of the guide rail installation to which it will be attached.

515.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment will be the number of EAGRTs installed in accordance with this Item.

515.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

516.1 DESCRIPTION

- .1 This Item consists of the removal of an Energy-Absorbing Guide Rail Terminal (EAGRT).

516.2 MATERIALS

- .1 None identified.

516.3 SUBMITTALS

- .1 None identified.

516.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work in accordance with the Contract Documents and/or specifically directed by the Engineer.
- .2 Guide rail, offset blocks, steel guide posts, bearing plates, anchors, impact head and all related hardware shall be salvaged and dismantled into individual components.
- .3 Dismantling shall be carried out in a manner so as to avoid damage to the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any such damage resulting from the Work.
- .4 Dismantled components shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to components during removal, transporting and/or storage shall be Contractor's responsibility and she/he shall replace any components damaged or lost.
 - .2 Unsalvageable components, as determined by the Engineer, shall become the property of the Contractor and shall be disposed of outside the Work Site.

516.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment will be the number of EAGRTs removed in accordance with this Item.

516.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

CAST-IN-PLACE CONCRETE BARRIER

ITEM: 520

520.1 DESCRIPTION

- .1 This Item consists of the construction of cast-in-place concrete barrier using the slipforming method.

520.2 MATERIALS

- .1 Delineators shall be available from the Owner from stock at DTI, Fredericton, NB.
- .2 All other materials shall be supplied by the Contractor.
- .3 Steel restraining dowels shall meet the requirements of 304.2.
 - .1 Dowels shall be of the size and length, as per Standard Drawing 520-1.
- .4 Concrete shall be supplied in accordance with CSA A23.1, class of exposure C-XL.
- .5 Membrane curing compounds shall meet the requirements of ASTM C309 and shall restrict the loss of water to not more than 0.31 kg/m².

520.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

520.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Concrete barrier shall be constructed in accordance with Standard Drawing 520-1.
- .3 Concrete shall be placed in accordance with 301.4.
- .4 When slipforming concrete barrier on Aggregate Base, the base shall be fine graded, in accordance with Item 205.
 - .1 Water shall be uniformly applied to the Aggregate Base immediately ahead of concrete placement so as to thoroughly wet the Aggregate Base surface without the pooling of water.
- .5 When slipforming concrete barrier on Pavement surfaces, the steel dowels shall be installed to the line established by the Engineer.
 - .1 Dowels shall be embedded to the depth and at the spacing indicated on Standard Drawing 520-1.
- .6 The Contractor shall schedule the Work sequence so as to ensure uniform placement of the concrete with a minimum of interruption.
- .7 The Contractor shall take all precaution to avoid damage to the Roadway surface (Pavement or Aggregate Base) by the slipform paver, truck mixers or other Equipment.
 - .1 Concrete spilled on the Highway shall be removed and the Highway cleaned to the satisfaction of the Engineer.

CAST-IN-PLACE CONCRETE BARRIER

ITEM: 520

- 520.4 .8 Hand finishing will be permitted only on a minimal basis and shall be conducted with a magnesium or wood float.
- .1 Textured broom or brush finish shall be applied to the approved surface.
 - .2 Air holes 15 mm in diameter or larger shall be repaired.
- .9 Surfaces of the median barrier shall not vary by more than 5 mm when measured with a 3 m straight edge.
- .10 Curing shall consist of two spray applications of the membrane curing compound immediately after finishing with the second application applied in a direction perpendicular to the first.
- .11 Contraction joints shall be saw cut, as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling and before shrinkage cracking takes place.
- .1 Contraction joints shall be cut neatly in a vertical plane to a minimum depth of 50 mm and at a uniform spacing not exceeding 6 m.
- .12 Work which experiences uncontrolled shrinkage cracking shall be clearly marked and the Contractor shall notify the Engineer of the location and extent of cracking for his/her review.
- .1 For those parts deemed not acceptable, the Contractor shall remove and replace a section of concrete of not less than 1 m surrounding the crack.
 - .2 The Contractor may submit, for consideration, alternate repair methods.
- .13 Vertical construction joints shall include a vertical key in the joint surface.
- .14 The Contractor shall undertake formwork and hand placement of the Work where slipforming methods cannot be employed.
- .1 Formwork shall be in accordance with 301.4.
 - .2 Form and style of the formed barrier shall match the slipformed abutting section.
- .15 Delineators shall be installed on the median barrier every 15 m on tangents and every 7.5 m on curves.

520.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of cast-in-place concrete barrier constructed in accordance with this Item.
- .2 Measurement of the barrier shall be along the bottom of the barrier, between the end section limits.

520.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

522.1 DESCRIPTION

- .1 This Item consists of the supply, delivery to the Work Site and installation of F-shape precast concrete barrier sections.
- .2 The concrete barriers sections shall be supplied in size and type as required in strict conformity with this Item as shown on Contract Document.
- .3 Precast F-shape concrete barriers shall be based on the design that has been crash tested and meets the requirements of NCHRP 350 Test Level 3 or Test Level 3 standards of the AASHTO Manual for Assessing Safety Hardware (MASH).
 - .1 F-shape barriers shall have a 570 mm base width, 810 mm height, 200 mm top width, 2440 mm section length.
 - .2 The barriers shall have a 255 mm distance from the ground to the slope break point, that is, the barrier shall begin with 75 mm vertical face at the pavement level, and then breaks a slope face of 55 degree that rises to a vertical height of 180 mm, before changing to 84 degree vertical face to the top of the barrier.
- .4 The length of any installed barriers system shall be at least three times the length in which impact deformation is predicted but shall not be less than 23 metres.
 - .1 Length of the barrier system shall be such that (1) terminals or end anchorage devices do not influence in an abnormal manner the dynamic behavior of the barrier and (2) the ability of the barrier to contain and redirect the impact vehicle into a path parallel to the barriers alignment.
 - .2 Exceptions to the recommended lengths per 522.1.4 can be made provided the installation satisfies 522.1.4.1 requirements.

522.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Concrete shall meet the requirements of CSA A23.1 and CSA A23.2. The Concrete shall have a minimum strength of 40MPa at 28 day compressive cylinder breaks test.
 - .1 Exposure Class shall be C-XL.
- .3 Steel reinforcement bars shall be grade 400W and shall conform to the requirements of 304.2.
- .4 The welded plain wire fabric shall conform to ASTM A186 for Specifications for Welded Steel Wire Fabric for Concrete Reinforcement.
- .5 Loop bars shall conform to the requirements of 304.2 with minimum yield strength of 420MPa and minimum tensile strength of 550MPa.
 - .1 After bending, loop bars shall be hot-dipped galvanized in accordance with CSA-G164-M92, with a minimum coating thickness of 610 g/m².
 - .2 Damaged areas of hot-dipped galvanized materials shall be painted with two coats of similarly coloured inorganic zinc-rich paint in accordance with A780/A780M.
- .6 The connection pin assemblies shall be at least 32 mm in diameter conforming to ASTM A36 and shall be hot-dipped galvanized in accordance with 522.2.5.1.

PRECAST CONCRETE BARRIERS

ITEM: 522

- 522.2 .7 The ground anchor bolts shall conform to the requirements of 304.2 and not exceed 750 mm in total length.
- .8 Lifting devices shall not interfere with the placement, drainage, or final appearance of the elements.
- .9 Form coating shall be a commercial quality form varnish or equivalent that permits ready release of the forms and does not discolour the concrete.
- .10 Retro-reflective markings shall conform to ASTM Type III, or Engineer approved equivalent.

522.3 SUBMITTALS

- .1 The Contractor shall submit shop drawings in accordance with Item 956.
- .1 The shop drawings shall show concrete barrier shape, steel reinforcement size and placement details, bar bending schedule, barriers' connection system, anchorages of concrete barriers to the ground, and details of the lifting devices for removing the precast barrier element from the form and for installation of the precast concrete barriers.
- .2 The precast concrete sections shall be produced in accordance with the approved shop drawings.
- .3 Drawings shall be prepared and stamped by a licensed Professional Engineer registered in the Province of New Brunswick.
- .1 Upon request, the Contractor shall submit precast concrete barrier design calculations stamped by a licensed Professional Engineer registered in the Province of New Brunswick.
- .2 The Contractor shall submit for approval, in advance of the work, the type of form coating proposed.
- .3 The Contractor shall submit, in advance of the work, the manufacturer's certification that the materials supplied meet the specified requirements.
- .4 The Contractor shall submit concrete mix design proportions and appropriate mix design test data.
- .5 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

522.4 CONSTRUCTION

- .1 General
- .1 The Contractor shall perform the Work as indicated in the Plans and/or as directed by the Engineer.
- .2 All barrier sections shall be delivered by the Contractor and installed under this Item.
- .3 Fabrication, transportation, storage and delivery of the barriers shall be in compliance with CSA A23.4 and CSA A251.
- .4 All aspects of precast concrete work shall comply with CSA A23.1 and CSA A23.4, and shall be to the approval of the Engineer.

522.4 .2 Concrete

- .1 Concrete quality shall conform to CSA Standard CAN3-A23.1M.
- .2 A compressive strength test is defined as the average of the strengths of three 28 day compressive test cylinder breaks with a standard cylinder size of 150 mm diameter and height of 300 mm.
- .3 Concrete shall meet the following requirements:
 - .1 Minimum cement content of 400 kg per cubic metres.
 - .2 Maximum water/cement ratio of 0.45.
 - .3 Course aggregate of a nominal maximum size not exceeding 20 mm.
 - .4 Slump of 50 mm \pm 20 mm.
 - .5 Entrained air of 5 to 8%.

.3 Reinforcing Steel

- .1 Reinforcing steel for bent and hooked connections shall conform to CSA CAN3-G40.21-M Grade 260W and shall be carefully bent to the radii detailed and installed as will be shown on the approved Shop Drawings.
- .2 The minimum lap for all longitudinal reinforcing bars shall be 300mm.
- .3 The reinforcing steel bars shall be tack welded to the welded wire mesh.
- .4 Supporting chairs for welded steel wire mesh shall be heavy-duty and plastic-tipped, as approved by the Engineer.

.4 Forms

- .1 The forms used in the manufacture of barrier sections shall be sufficiently rigid to maintain production within the permissible tolerance per 522.4.8.1.
- .2 Side and bottom forms shall be steel, of a configuration to ensure compliance with the specified tolerances.
 - .1 Cover over reinforcement steel shall be a minimum of 50 mm.
- .3 Forms shall be cleaned and made free of mortar and hardened concrete before application of form coating.
- .4 Exposed corners shall be chamfered 25 mm x 25 mm either by the shape of the form or by using triangular fillets made of steel, plastic, or clear, straight-grained wood planed on the side exposed to concrete.
- .5 The Engineer will inspect the completed forms before concrete placement.

.5 Curing and Protection of Concrete

- .1 Curing shall be carried out naturally or artificially accelerated by heat.

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- 522.4.5 .2 Natural curing shall be performed per 302.4, but membrane curing compounds will not be permitted. Forms may be removed and curing ceased when the concrete has obtained 80% of its specified 28-Day compressive strength.
- .1 Curing shall be considered complete when test cylinders reach the specified 28 Day compressive strength provided such strength is reached not later than 28 Days after the barriers are cast.
- .3 Artificially accelerated curing shall be performed per CSA A23.4 and as follows:
- .1 The elements shall be kept on the casting bed in an approved enclosure that ensures full circulation of thoroughly saturated air and/or steam around the elements with a minimum loss of moisture and heat.
- .2 For the initial curing period (typically 4 to 5 hours after casting), the enclosure temperature shall be kept at approximately 20°C.
- .3 For the next stage of curing, the enclosure temperature shall be raised at a rate not exceeding 15°C per hour, to a temperature between 40° and 60°C that varies less than 5°C.
- .4 Steam, radiant heat or forced air used for accelerated curing shall not be applied before the initial set or directly to the concrete, forms or cylinders, and shall provide excess moisture for proper hydration of the cement.
- .5 Exposed concrete surfaces shall have an excess of moisture while being cured. The temperature of water applied for this purpose shall be within 10°C of the concrete temperature, and shall not exceed 60°C.
- .6 The Contractor/manufacturer shall provide a continuous record of curing temperatures for the entire curing period by means of approved accurate automatic recording devices, spaced one per element to record the temperature throughout the length of the curing enclosure(s).
- .7 When a barrier has reached its required strength the temperature shall be lowered at a rate of 15°C per hour to the ambient air temperature.
- .8 Barriers shall not be exposed to freezing temperatures until they have dried two days in warm temperatures following curing, and cooled at not more than 5°C per hour to the outside air temperature.
- .6 Barrier Connections
- .1 The precast concrete barrier connections shall be pin and loop system.
- .1 The maximum joint gap between barrier sections shall be 25 mm.
- .2 Where the joint gap exceeds the above tolerances, barrier sections shall be removed and reset to meet the specified tolerance, at the Contractor's expense.
- .2 There shall be six connection loops (from both barrier, each three) in each barriers connection that the connection pin shall go through.
- .3 The connection loop shall be embedded to the concrete (coming out of the precast concrete barrier 50 mm) and tied to the barrier's reinforcement.

522.4 .7 Finishing of Concrete Surfaces

- .1 The top of the precast section shall have a smooth wood float finish, and all permanently exposed surfaces shall be true and smooth.
- .2 Small surface voids due to entrapped air shall be filled with an approved cement mixture. All ridges at junctions of form panels and all bottom edges shall be ground smooth.
- .3 No patching of defects other than minor surface imperfections shall occur without the Engineer's permission.

.8 Tolerances

- .1 Allowable tolerances for the concrete dimensions of the barriers shall be ± 3 mm except as otherwise indicate in the Contract Documents.

.9 Handling, Storage and Shipping

- .1 Precast concrete units shall be handled and transported in a manner to minimize damage. Lifting devices or holes shall be consistent with industry standards. Lifting shall be accomplished with methods or devices intended for this purpose as indicated on shop drawings.
 - .1 Upon request, the Contractor shall provide documentation on acceptable handling methods for the barriers.
- .2 Precast concrete sections shall be stored in a manner that will minimize potential damage.
- .3 Transportation and delivery of the barriers shall be in compliance with CSA A23.4 and CSA A251.
 - .1 The barriers shall be stored and transported in an upright position at all times and be lifted by the inserts or other approved devices
 - .2 Barriers shall not be shipped until the specified 28-Day compressive strength has been reached.
 - .3 During transportation, the barriers shall be supported on a dry firm base with truck bolsters or battens no less than 100 mm wide and padded with 50 mm of rubber to prevent chipping of the concrete.

.10 Barrier Installations

- .1 The Contractor shall install the barrier sections as indicated in the plans and/or as directed by the Engineer.
- .2 Barrier sections in association with connection pins shall be supplied by the Contractor.
- .3 Barriers shall be joined together by pin and loop connections system. Connections shall be tight as practicable to limit deformation and rotation of the barriers.
- .4 Barrier sections shall be installed level in the transverse direction to the specified alignments and joined together to form a continuous structure in accordance with 522.4.10.3.
- .5 Each precast concrete barrier sections shall be anchored to the roadway, on traffic side, by three anchor bolts to prevent lateral movement of the barrier.

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- 522.4.10.5 .1 Precast concrete barrier used in the median less than 200 mm in width (as measured between nearest fog lines) shall be anchored to the roadway on both sides to resist impacts from both sides.
- .1 Barriers may not need to be anchored to the roadway if there is at least 900 mm of flat area behind the barrier for deflection.
- .2 Precast concrete barriers anchor stake shall be driven into predrilled holes through the appropriate blockout holes in the barrier sections to a depth of approximately 585 mm.
- .3 All bolts and dowels shall be hot-dip galvanized after fabrication.
- .6 Installed precast concrete barriers shall be supplemented with appropriate retro-reflective markings such as construction markers or other device meeting, as minimum, ASTM Type III.

522.5 MEASUREMENT FOR PAYMENT

- .1 The quantity to be measured for payment shall be the number of linear metres of precast concrete barrier supplied, delivered to the Work Site, and installed accordance with this Item.
- .1 Measurement shall be taken by multiplying the number of barriers by their section length.

522.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

TEMPORARY BARRIER

ITEM: 524

524.1 DESCRIPTION

- .1 This Item consists of the supply, delivery to the Work Site, installation, maintenance, relocation within the Work and removal of 2.44 m long temporary precast concrete traffic barriers, together with appurtenances.

524.2 MATERIALS

- .1 The barriers shall consist of interlocking concrete median barriers as per the Contract Documents.
- .2 All materials shall be supplied by the Contractor.
- .3 Key plate connectors shall be CAN/CSA G40.21M Grade 300W steel.
 - .1 Key plate connectors shall have a thickness of 12 mm.
- .4 Retro-reflective markings shall conform to ASTM Type III, or Engineer approved equivalent.

524.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer a minimum of 7 Days in advance of the installation of barriers.

524.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work in accordance with the Contract Documents and/or as specifically directed by the Engineer.
 - .1 The Contractor shall place the interlocked barriers as shown on the Plans.
 - .2 Barriers deemed by the Engineer to be damaged shall not be used in the Work.
- .2 The Contractor shall maintain the barriers and relocate them as necessary to complete the Work.
- .3 After completion of the Work and upon written approval from the Engineer, the Contractor shall remove the barriers from the Work within 3 Days.

524.5 MEASUREMENT FOR PAYMENT

- .1 The supply, delivery to the Work Site, installation, maintenance, relocation within the Work and removal of the barriers, carried out in accordance with this Item shall be on a Lump Sum basis.

524.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.

529.1 DESCRIPTION

- .1 This Item consists of the supply and installation of concrete-encased Polyvinyl Chloride (PVC) duct under the Roadbed.

529.2 MATERIALS

- .1 All materials shall be supplied by the Contractor unless otherwise indicated on the Plans.
- .2 Electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.
- .3 Duct and underground service warning tape shall be of the type and size as indicated on Standard Drawing 529-1 and/or as indicated in the Contract Documents.
- .4 Backfill material shall be selected materials from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer.
- .5 Bedding material shall be sand having a Dust content not more than 15%.
- .6 All concrete-encased PVC duct, bends, couplings and caps shall be as specified in the Contract Documents.
- .7 Each section of PVC duct shall have printed on its surface, at intervals not exceeding 1.5 metres, the manufacturer's name and trademark; inside diameter (mm); and type designation.
- .8 Concrete shall meet the requirements of 301.2, exposure class C-2.
- .9 Rebar shall be 15M bar meeting the requirements of 304.2.
- .10 The Contractor shall supply all other appurtenances as required and as indicated on the Plans.

529.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification, and/or mill certificates for the duct, that the materials supplied meet the specified requirements as detailed on the Contract Documents.
- .2 When requested, the Contractor shall submit the manufacturer's recommended procedures for installation and instructions for handling of the duct.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

529.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

- 529.4 .2 Construction of the trench and the installation of the duct shall be in accordance with Standard Drawing 529-1, and/or as indicated in the Contract Documents.
- .1 For excavation depths greater than 1.5 m, the Contractor shall notify the Engineer of the schedule of the Work.
 - .3 Bottom of the excavated trenches shall be uniformly graded and shall be free of sharp rocks, soft spots or disturbed ground prior to placement of the bedding material.
 - .1 If Overexcavation is carried out, the Contractor shall, at his/her own expense, repair the area of Overexcavation and shall fill this area with an approved backfill material placed in accordance with Item 936, and compacted to a minimum of 95% of the maximum dry density.
 - .4 The Contractor shall install the duct in the formwork and in accordance with the manufacturer's recommended procedures such that the duct is free of sharp bends, kinks and breaks.
 - .1 Joints shall be watertight.
 - .5 The Engineer shall be notified at least 3 Days in advance of the concrete Work so that inspection of the concrete-encased duct bank system can be carried out.
 - .6 Formwork and concrete placement shall conform to the requirements of 301.2, 301.3 and 301.4. Exposed concrete shall be moist-cured. Forms shall be left in place for at least 3 Days or as specified by the Engineer.
 - .7 Duct installation shall be inspected and approved by the Engineer prior to backfilling.
 - .8 Trenches shall be completely backfilled to Subgrade elevation.
 - .1 Backfill shall be placed in such a manner so as to minimize damage to the installed duct.
 - .2 Backfill for the area immediately surrounding the duct and to a height of 75 mm above the conduit shall be non-organic and free of lumps and stones larger than 50 mm in the greatest dimension.
 - .3 Backfill from 75 mm above the duct to Subgrade shall be material of the quality matching the surrounding material.
 - .4 Bedding and backfill shall be compacted to the degree of compaction of the existing surrounding material or, as a minimum, in lieu of other direction, in accordance with Item 936, to a minimum of 95% of the maximum dry density.
 - .9 Backfill and materials above Subgrade elevation shall match the surrounding existing Pavement Structure.
 - .10 Underground service warning tape shall be installed to conform to the details shown on Standard Drawing 529-1.
 - .11 After the backfilling is complete, a flexible steel mandrel at least 230 mm long and of a diameter 5 mm less than the duct ID shall be passed through the length of each duct in the concrete-encased duct bank system in the presence of the Engineer and a representative of each utility company.

CONCRETE-ENCASED DUCT BANK SYSTEM

ITEM: 529

- 529.4.11 .1 Each duct shall be threaded with a polypropylene fish rope (minimum 6 mm) and terminated at each end in a "screw-eye" insert in the end cap or plug. A surplus of 1 m of fish rope shall be provided at each end.
- .2 The Contractor shall be responsible to clear and/or replace any ducts that do not pass the mandrel test.
- .12 Immediately after the mandrel inspection and approval, the Contractor shall securely block the open ends of the duct with a watertight plug.
- .13 The Contractor shall install a visible marker at each end (termination point) of the concrete-encased duct bank system.

529.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of concrete-encased duct bank system supplied and installed in accordance with this Item.

529.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

530.1 DESCRIPTION

- .1 This Item consists of the supply and installation of duct under the Roadbed.

530.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.
- .3 Duct and underground service warning tape shall be of the type and size as indicated on Standard Drawing 530-1.
- .4 Backfill material shall be selected materials from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer.

530.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification, and/or mill certificates for the duct, that the materials supplied meet the specified requirements as detailed on the Contract Documents.
- .2 When requested, the Contractor shall submit the manufacturer's recommended procedures for installation and instructions for handling of the duct.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

530.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Construction of the trench and the installation of the duct shall be in accordance with Standard Drawing 530-1, and/or as indicated in the Contract Documents.
 - .1 For excavation depths greater than 1.5 m, the Contractor shall notify the Engineer of the schedule of the Work.
- .3 Bottom of the excavated trenches shall be uniformly graded and shall be free of sharp rocks or disturbed ground.
 - .1 If Overexcavation is carried out, the Contractor shall, at his/her own expense, repair the area of Overexcavation and shall fill this area with an approved backfill material placed in accordance with Item 936, and compacted to a minimum of 95% of the maximum dry density.

UNDER ROADBED DUCT**ITEM: 530**

- 530.4 .4 The Contractor shall install the duct in the prepared trench such that the duct is free of sharp bends, kinks and breaks.
- .1 Joints shall be watertight.
- .5 Duct installation shall be inspected and approved by the Engineer prior to backfilling.
- .6 Trenches shall be completely backfilled to Subgrade elevation.
- .1 Backfill shall be placed in such a manner so as to minimize damage to the installed duct.
 - .2 Backfill for the area immediately surrounding the duct and to a height of 75 mm above the conduit shall be non-organic and free of lumps and stones larger than 50 mm in the greatest dimension.
 - .3 Backfill from 75 mm above the duct to Subgrade shall be material of the quality matching the surrounding material.
 - .4 Backfill shall be compacted to the degree of compaction of the existing surrounding material or, as a minimum, in lieu of other direction, in accordance with Item 936, to a minimum of 95% of the maximum dry density.
- .7 Backfill and materials above Subgrade elevation shall match the surrounding existing Pavement Structure.
- .8 Underground service warning tape shall be installed to conform to the details shown on Standard Drawing 530-1.
- .9 After the backfilling is complete, a mandrel with a diameter of at least 90% of the diameter of the installed duct shall be passed through the length of the duct system in the presence of the Engineer.
- .1 The Contractor shall be responsible to clear and/or replace any ducts that do not pass the mandrel test.
- .10 Immediately after the mandrel inspection and approval, the Contractor shall securely block the open ends of the duct with a watertight plug.
- .11 The Contractor shall install a visible marker at each end (termination point) of the under Roadbed duct crossing.

530.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of duct supplied and installed in accordance with this Item.

530.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

UNDERGROUND DUCT

ITEM: 531

531.1 DESCRIPTION

- .1 This Item consists of the supply and installation of duct and wires.

531.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.
- .3 Duct, secondary wires, ground wires, ground rods, underground service warning tape and connections shall be of the type and size as indicated on Standard Drawing 531-1.
- .4 Backfill materials shall be selected material from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer.

531.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.
- .2 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.
- .3 When requested, the Contractor shall submit the manufacturer's recommended procedures for installation and instructions for handling of the duct.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

531.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Electrical Work shall be in accordance with the Canadian Electrical Code.
 - .1 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
- .3 On new construction the Work under this Item shall be completed before Aggregate Subbase placement.

UNDERGROUND DUCT

ITEM: 531

- 531.4 .4 Construction of the trench and the installation of the duct and the wiring shall be in accordance with Standard Drawing 531-1.
- .1 Bottom of the excavated trenches shall be undisturbed insitu soil and shall have a uniform grade, free of sharp rocks.
 - .2 If Overexcavation is carried out, the Contractor shall, at his own expense, repair the area of Overexcavation and shall fill this area with an approved backfill material placed in accordance with Item 936, and compacted to a minimum of 95% of the maximum dry density.
- .5 Duct placed under a Roadbed shall be encased in Under Roadbed Duct.
- .6 The Contractor shall install the duct in the prepared trench such that the duct is free of sharp bends, kinks and breaks.
- .7 Duct shall be inspected and approved by the Engineer prior to backfilling.
- .8 Backfill shall be placed in such a manner so as to minimize damage to the installed duct.
- .9 Trenches shall be completely backfilled and finished level with the surrounding adjacent surface.
- .1 For trenches outside the Roadbed, backfill shall be tamped during placement.
 - .1 Backfill in the area immediately surrounding the duct, and to a height of 75 mm above the conduit, and also in the top 300 mm of the trench, shall be in-organic and free of lumps and stones larger than 50 mm in the greatest dimension.
 - .2 For trenches within the Roadbed, backfilling shall be carried out as follows:
 - .1 Backfill for the area immediately surrounding the duct and to a height of 75 mm above the conduit shall be in-organic and free of lumps and stones larger than 50 mm in the greatest dimension.
 - .2 Backfill from 75 mm above the duct to Subgrade shall be material of the quality matching the surrounding material.
 - .3 Backfill shall be compacted to the degree of compaction of the existing surrounding material or, as a minimum, unless otherwise directed by the Engineer, in accordance with Item 936, to a minimum of 95% of the maximum dry density.
 - .4 Backfill and materials above Subgrade shall match the surrounding existing Pavement Structure.
- .10 Underground service warning tape shall be installed to conform to the details shown on Standard Drawing 531-1.
- .11 After the backfilling is complete, a mandrel with a diameter of at least 90% of the diameter of the installed duct shall be passed through the length of the duct system in the presence of the Engineer.
- .1 The Contractor shall be responsible, to clear and/or replace any ducts that do not pass the mandrel test.

UNDERGROUND DUCT

ITEM: 531

- 531.4 .12 Immediately after the mandrel inspection and approval, the Contractor shall securely block the open ends of the duct with a watertight plug.
- .13 Secondary wires shall be of a size and number indicated on the Plans.
- .1 The Contractor shall pull the wires through the duct in such a manner that no damage will occur to the wire as a result of installation.
- .14 A minimum of 1 m of secondary and ground wire shall be left coiled at all pole bases, junction boxes and power points in order to accommodate the making of connections.
- .15 Splicing of wire will only be permitted in junction boxes.
- .16 Electrical Work shall be tested for satisfactory operation by the Contractor and the results of the tests shall be submitted to the Engineer.
- .17 The Contractor shall perform megger tests on all feeders and branch circuits before energizing any portion of the electrical system.

531.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of duct and wires supplied and installed in accordance with this Item.
- .2 Linear measurement shall be taken from end to end on the duct and shall be measured along the direct run of the duct.
- .1 Duct encased in Under Roadbed Duct shall be measured as one unit of length.

531.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of installation, as identified under the Contract.

532.1 DESCRIPTION

- .1 This Item consists of the supply and installation of an underground electrical junction box.

532.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The underground electrical junction box shall be of the type and size as indicated on Standard Drawing 532-1.
- .3 All electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.
- .4 Free-draining backfill shall be supplied in accordance with 366.2.
- .5 Backfill material shall be selected materials from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Site from a source and of a type approved by the Engineer and in accordance with 167.2.

532.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the commencement of the Work, the manufacturer's certification that the materials supplied meet the specified requirements as detailed on the Contract Documents.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

532.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All electrical Work shall be in accordance with the Canadian Electrical Code.
 - .1 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
- .3 The junction box shall be installed in accordance with Standard Drawing 532-1.
 - .1 All wire splices inside the junction box shall be made with a CSA-approved direct buried splice kit.
- .4 The Work shall be carried out in a manner so as to avoid damage to the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any such damage resulting from the Work.

UNDERGROUND JUNCTION BOX**ITEM: 532**

532.4 .5 The junction box shall be installed above the water table on a 400 mm thick foundation layer of free draining backfill.

.1 The foundation layer shall be constructed such that the area is maintained free-draining and the area of the junction box installation shall be provided with positive drainage to ensure that water cannot pond or saturate the foundation zone.

.6 The top of the junction box shall be placed flush with the surrounding grade, either existing or adjusted to accommodate 532.4.5.

.7 All backfill shall be placed in accordance with 166.4.

532.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of underground junction boxes supplied and installed in accordance with this Item.

532.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall be at the Unit Price.

533.1 DESCRIPTION

- .1 This Item consists of the installation of a power point.

533.2 MATERIALS

- .1 The control box and service box shall be supplied by the Owner from stock at DTI Fredericton, NB.
- .2 All other materials shall be supplied by the Contractor.
- .3 All electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.

533.3 SUBMITTALS

- .1 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.

533.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All electrical Work shall be in accordance with the Canadian Electrical Code.
 - .1 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
- .3 The power point shall be installed in accordance with Standard Drawing 533-1.
- .4 The Contractor shall be responsible for transporting, unloading, storing and distributing materials from DTI, Fredericton, NB, to the Work Area(s).
- .5 The Contractor shall be responsible for all materials and for any damage or loss from the time of receipt of the materials until such time that the materials have been accepted in the Work.
- .6 All electrical wiring shall be connected as shown on the Plans.
 - .1 All portions of the electrical Work shall be tested for satisfactory operation and the results of the tests shall be submitted to the Engineer.
 - .2 The Contractor shall perform megger tests on all feeders and branch circuits before energizing any portion of the electrical system.
- .7 The control box and service box shall be locked immediately after installation and the keys shall be delivered to the Engineer.

533.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of power points installed in accordance with this Item.

533.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF POWER POINT

ITEM: 534

534.1 DESCRIPTION

- .1 This Item consists of the removal of a power point.

534.2 MATERIALS

- .1 None identified.

534.3 SUBMITTALS

- .1 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.

534.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All electrical Work shall be in accordance with the Canadian Electrical Code.
 - .1 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
 - .2 All electrical equipment shall be removed in accordance with New Brunswick Regulation 84-165 of the Electrical installation and Inspection Act for the Province of New Brunswick.
- .3 A power point shall consist of all components as identified and detailed on Standard Drawing 533-1.
- .4 The Contractor shall remove the above ground conduit, wire, control box, service box and photo control unit from the Utility pole and the wire from the Utility pole to the next junction point(s).
 - .1 The Utility pole shall only be removed if the electrical supply feeds only the DTI control box.
- .5 Power point and all components shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he shall replace any materials damaged or lost.

534.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of power points removed in accordance with this Item.

534.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

SCREW BASE

ITEM: 538

538.1 DESCRIPTION

- .1 This Item consists of the installation of a screw base.

538.2 MATERIALS

- .1 Screw bases, bolts and washers shall be available from the Owner from stock at DTI, Fredericton, NB.
- .2 All other materials shall be supplied by the Contractor.

538.3 SUBMITTALS

- .1 None identified.

538.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Screw bases shall be installed at the locations indicated on the Plans.
- .3 Screw bases shall be aligned to be within ± 25 mm in horizontal offset from the centrelines as shown on Standard Drawing 538-1.
- .4 The top surface of the screw bases shall be within the following tolerances:
 - .1 ± 3 mm of a level line when measured across the top surface of the base.
 - .2 ± 25 mm of the elevation provided by the Engineer.

538.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of screw bases installed in accordance with this Item.

538.6 BASIS OF PAYMENT

- .1 Payment for work under this Item shall be at the Unit Price.

REMOVAL OF SCREW BASE

ITEM: 539

539.1 DESCRIPTION

- .1 This Item consists of the removal of a screw base.

539.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The backfill materials shall be selected materials from the Work Site, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfill, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer.

539.3 SUBMITTALS

- .1 None identified.

539.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Work shall be carried out in such a manner so as to avoid damage to the screw base and its components.
- .3 Screw base, bolts and washers shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be the Contractor's responsibility and he shall replace any materials lost or damaged.
 - .2 All material that is not a component of the screw base shall be removed from the screw base.
- .4 The Contractor shall be responsible to completely backfill the hole resulting from the removal of the screw base with an approved material, compacted during placement, and finished to match the surrounding grade.

539.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of screw bases removed in accordance with this Item.

539.6 BASIS OF PAYMENT

- .1 Payment for work under this Item shall be at the Unit Price.

540.1 DESCRIPTION

- .1 This Item consists of the construction of a cast-in-place reinforced concrete sign or light base.

540.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.
- .3 Concrete shall be designed, produced, supplied and placed in accordance with 301.2, 301.3 and 301.4.
 - .1 Concrete shall meet the requirements of CSA A23.1 exposure class C-1.
- .4 Reinforcing steel shall meet the requirements of 304.2.
- .5 Other materials are detailed on Standard Drawings 540-1, 540-2, 540-3 and 540-4.
- .6 Backfill material shall be selected materials from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfilling, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer and supplied in accordance with 167.2.

540.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

540.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All electrical Work shall be in accordance with the Canadian Electrical Code,
 - .1 An electrical Contractor holding a valid electrical contractor's license issued by the Province of New Brunswick shall perform all electrical Work.
- .3 Construction of all sign and light bases shall be in accordance with the details indicated on Standard Drawings 540-1, 540-2, 540-3 and 540-4.
- .4 Bases shall not have a diameter variation greater than 20 mm in the cross sectional dimensions.
- .5 The anchor bolt assembly shall be aligned to be within 12.5 mm in horizontal offset from the centrelines as shown on Standard Drawing 540-5.
- .6 Concrete and reinforcing steel shall be placed to meet the requirements of 301.4 and 304.4, respectively.

- 540.4 .7 Backfilling shall be carried out in accordance with 166.4.
- .8 Bases shall have the top surface finished level, smooth and within the following tolerances:
- .1 ± 3 mm of a level line when measured across the base;
 - .1 Areas in excess of the 3 mm tolerance may be removed by abrasive means, provided the minimum cover requirements specified in the Contract Documents are met.
 - .1 It will not be acceptable to achieve this repair by placing grout or concrete over base concrete that has hardened.
 - .2 If the concrete surface, upon removal areas in excess of the 3 mm permissible tolerance, is not to the Engineer's satisfaction, the Contractor shall, as directed by the Engineer, entirely remove designated portions or all of the concrete, and replace with new concrete.
 - .2 ± 25 mm of the elevation provided by the Engineer.
 - .9 The Contractor shall restore the Work Area to its original condition. This may include shaping, topsoiling, and/or hydroseeding to the satisfaction of the Engineer.

540.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of bases constructed in accordance with this Item.

540.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of base, as identified under the Contract.

541.1 DESCRIPTION

- .1 This Item consists of the removal of a concrete sign or light base.

541.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Backfill materials shall be selected materials from the excavation, subject to the approval of the Engineer.
 - .1 If additional materials are required for backfill, the Contractor shall import materials to the Work Area from a source and of a type approved by the Engineer.

541.3 SUBMITTALS

- .1 None identified.

541.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Work shall be carried out in such a manner so as to avoid damage to the sign or light base and its components.
 - .1 Any salvageable bases not reused on the Contract shall be transported to the nearest DTI District Maintenance Depot.
 - .2 Unsalvageable bases shall become the property of the Contractor and shall be disposed of outside the Work Site.
- .3 The Contractor shall be responsible to completely backfill the hole resulting from the removal of the base with an approved material, compacted during placement, and finished to match the surrounding grade.

541.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of bases removed in accordance with this Item.

541.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of base, as identified under the Contract.

LIGHT STANDARD

ITEM: 542

542.1 DESCRIPTION

- .1 This Item consists of the installation and/or reinstallation of a light standard and luminaires.

542.2 MATERIALS

- .1 Light standard (pole and davit), frangible bases, luminaires, lamps, complete panel boards, fuse kits and pole hardware and frangible bases, will be available from the Owner's stock at DTI, Fredericton, NB.
- .2 All other materials required shall be supplied by the Contractor.
- .3 All electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.

542.3 SUBMITTALS

- .1 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.

542.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All electrical installations shall be in accordance with the Canadian Electrical Code.
 - .1 An electrical Contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
- .3 The Contractor shall be responsible for transporting, unloading, storing and distributing materials from DTI, Fredericton, NB, to the Work Area(s).
- .4 The Contractor shall be responsible for all materials and for any damage or loss from the time of receipt of any materials until such time that the materials have been accepted in the Work.
- .5 The wiring shall be installed and the complete structure erected, plumbed and connected to the underground wiring, in accordance with Standard Drawings 542-1, 542-2, 542-3 and 542-4.
 - .1 Wire splices will not be permitted between the handhole connections and the luminaire.
- .6 The Contractor shall perform megger tests on all feeders and branch circuits before energizing any portion of the electrical system.
- .7 Luminaires with lamps shall be attached to the light standard and the unit shall be made operational.
- .8 The luminaires once operable shall be adjusted by the Contractor under the direction of the Engineer.
- .9 All portions of the electrical Work shall be tested for satisfactory operation and the results shall be submitted to the Engineer.

542.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity measured for payment shall be the number of light standards installed and/or reinstalled in accordance with this Item.

542.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

543.1 DESCRIPTION

- .1 This item consists of disconnecting and removing light standard(s) and luminaires.

543.2 MATERIALS

- .1 None identified.

543.3 SUBMITTALS

- .1 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.

543.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Electrical Work shall be in accordance with the Canadian Electrical Code.
 - .1 Electrical equipment shall be removed in accordance with New Brunswick Regulation 84-165 (Electrical Installation and Inspection Act).
 - .2 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
- .3 Work shall be carried out in such a manner so as to avoid damage to the light standard and its components.
 - .1 The Contractor shall be responsible, at his/her own expense, for any repair of such damage resulting from this Work.
- .4 Light standards and components shall be handled with a non-metallic sling.
- .5 Light standards shall be removed from the concrete base and disassembled into davit, pole and luminaire(s).
- .6 Wire shall be rolled and labelled by length.
- .7 Light standards, luminaires and wire shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he shall replace any materials damaged or lost.

543.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of light standards removed in accordance with this Item.

543.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

MEDIAN FLASHING LIGHT

ITEM: 544

544.1 DESCRIPTION

- .1 This Item consists of the installation of a median flashing light with post.

544.2 MATERIALS

- .1 The median flashing light, post, frangible base and mounting hardware shall be available from the Owner from stock at DTI, Fredericton, NB.
- .2 All other materials shall be supplied by the Contractor.
- .3 All electrical equipment shall be certified in accordance with New Brunswick Regulation 84-165 under the Electrical Installation and Inspection Act.

544.3 SUBMITTALS

- .1 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.

544.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 All electrical installations shall be in accordance with the Canadian Electrical Code.
 - .1 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical work.
- .3 The median flashing light and post shall be installed on the concrete median barrier or screw foundation as shown on Standard Drawing 544-1.
- .4 The Contractor shall be responsible for transporting, unloading, storing and distributing materials from DTI, Fredericton, NB, to the Work Area(s).
- .5 The Contractor shall be responsible for all materials and for any damage or loss from the time of receipt of the materials until such time that the materials have been accepted in the Work.
- .6 All wiring connections shall be carried out, by the Contractor, to make the light operational.
 - .1 Wire splices will not be permitted.
- .7 All portions of the electrical Work shall be tested for satisfactory operation by the Contractor and the results shall be submitted to the Engineer.
- .8 The Contractor shall perform megger tests on all feeders and branch circuits before energizing any portion of the electrical system.

544.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of median flashing lights with posts installed in accordance with this Item.

544.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of installation, as identified under the Contract.

REMOVAL OF MEDIAN FLASHING LIGHT

ITEM: 545

545.1 DESCRIPTION

- .1 This Item consists of the removal of a median flashing light with post and wire.

545.2 MATERIALS

- .1 None Identified.

545.3 SUBMITTALS

- .1 Prior to commencing the Work, the Contractor shall submit a copy of the wiring permit to the Engineer.

545.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Electrical Work shall be in accordance with the Canadian Electrical Code.
 - .1 Electrical equipment shall be removed in accordance with New Brunswick Regulation 84-165 (Electrical Installation and Inspection Act).
 - .2 An electrical contractor holding a valid electrical contractor's licence issued by the Province of New Brunswick shall perform all electrical Work.
- .3 Median flashing light, post and hardware shall be removed from the concrete median barrier or screw foundation, in such a manner so as to minimize damage to the unit.
- .4 Median flashing light and post shall be handled with a non-metallic sling.
- .5 Wire shall be disconnected and removed from the underground duct between the median light and power point.
 - .1 Wire shall be rolled and labelled to indicate the length.
- .6 Materials shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he shall replace any materials damaged or lost.

545.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity measured for payment shall be the number of median flashing lights removed in accordance with this Item.

545.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

550.1 DESCRIPTION

- .1 This Item consists of the installation of a sign post.

550.2 MATERIALS

- .1 The sign post, frangible base and hardware shall be available from the Owner from stock at DTI, Fredericton, NB.

550.3 SUBMITTALS

- .1 None identified.

550.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall be responsible for transporting, unloading, storing and distributing materials from DTI, Fredericton, NB, to the Work Area(s).
- .3 The Contractor shall be responsible for all materials and for any damage or loss from the time of receipt of the materials until such time that the materials have been accepted in the Work.
- .4 The sign post shall be handled by a non-metallic sling.
- .5 The sign post shall be plumbed and fastened to the sign base with the anchor bolts provided with a minimum torque of 400 N•m and in accordance with Standard Drawing 550-1.
- .6 After installation, the sign posts shall be clean.
- .7 The installation of sign posts shall be immediately followed by the installation of the sign installed under Item 552.

550.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of sign posts installed in accordance with this Item.

550.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF SIGN POST

ITEM: 551

551.1 DESCRIPTION

- .1 This Item consists of the removal of a sign post.

551.2 MATERIALS

- .1 None identified.

551.3 SUBMITTALS

- .1 None identified.

551.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Work shall be carried out in such a manner so as to avoid damage to the post.
- .3 The post shall be handled with a non-metallic sling.
- .4 All materials shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he/she shall replace any materials damaged or lost.
 - .2 The Contractor shall identify all sign posts by marking the sign number on the cap with a permanent black marker.

551.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of sign posts removed in accordance with this Item.

551.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

ROADSIDE SIGN

ITEM: 552

552.1 DESCRIPTION

- .1 This Item shall consist of the assembly and installation and/or reinstallation of an extruded aluminum roadside sign on one or more sign posts.

552.2 MATERIALS

- .1 Roadside sign materials shall be available from the Owner from stock at DTI, Fredericton, NB.

552.3 SUBMITTALS

- .1 None identified.

552.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Work shall be carried out in such a manner so as to avoid damage to the roadside sign, post and the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible for any damage to, or loss of materials, from the time possession of these materials is taken until such time as they have been accepted in the Work.
 - .2 The repair of any damage resulting from this Work shall be carried out by the Contractor at his/her own expense.
- .3 Sign panels shall be transported and stored in a vertical position with the sign faces protected, with no more than ten sign sections in one row.
- .4 Direct contact with the sign faces shall be avoided at all times.
- .5 Sign panels shall be handled with a non-metallic sling.
- .6 Sign panels shall be installed as shown in the Contract Documents and Standard Drawing 552-1 through 552-6.
- .7 Sign panels shall be immediately installed following the installation of the sign post.
- .8 After installation, the signs shall be clean.

552.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of roadside signs assembled and installed and/or reinstalled in accordance with this Item.

552.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

553.1 DESCRIPTION

- .1 This Item consists of the removal of an extruded aluminum sign mounted on one or more posts.

553.2 MATERIALS

- .1 None identified.

553.3 SUBMITTALS

- .1 None identified.

553.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Work shall be carried out in such a manner so as to avoid damage to the roadside sign, post and the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, for any repair of such damage resulting from this Work.
- .3 Signs shall be handled with a non-metallic sling.
- .4 Signs shall be removed from the sign post(s) and disassembled into 300 mm sign panels.
- .5 Panels for each sign shall be packaged and labelled, with permanent ink, indicating the sign number as specified on the Plans.
- .6 Materials shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he/she shall replace any materials damaged or lost.

553.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of signs removed in accordance with this Item.

553.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

554.1 DESCRIPTION

- .1 This Item consists of the excavation, shoring, construction and backfilling of a reinforced concrete foundation for an overhead sign Structure.

554.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Concrete shall be designed, produced and supplied in accordance with CSA A23.1-04, and the concrete shall meet the requirements of Table 2, Exposure Class C-XL.
- .3 Reinforcing steel shall be supplied in accordance with 304.2 and shall be of the size and shape as indicated on the Plans.
- .4 Material for anchor bolts shall conform to the requirements of ASTM Specification A325 Type 1.
 - .1 Anchor bolts, nuts and washers shall be hot-dip galvanized to ASTM A153 Class C.
- .5 Backfill shall be supplied in accordance with 167.2.

554.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross referenced Item and referred to as forming part of this Item.
- .2 Submittals are required in accordance with 302.3 and 302.4.
 - .1 Certification that the concrete supplier is certified in accordance with Atlantic Provinces Ready Mix Concrete Association, Plant Certification Program or the equivalent as follows:
 - .1 The concrete supplier shall submit proof of conformance to the requirements for the production of the concrete in accordance with CSA A23.1.
 - .2 Only concrete supplied from such certified plants shall be acceptable to the Owner and plant certification shall be maintained for the duration of the Work.
 - .2 Proposed sources of aggregates and test results shall be submitted to the Engineer, in writing, a minimum of 14 Days prior to the proposed use of such materials.
 - .1 This notification period shall be increased to a minimum of 35 Days if the aggregates proposed for use have not been previously approved for use in the Owner's projects.
 - .3 The proposed design mix proportions, certified by the Contractor or his/her agent, and stamped and signed by a Professional Engineer, shall be submitted at least 14 Days before concrete production is due to commence.
- .4 All submittals for shoring shall be in accordance with 361.3.

OVERHEAD SIGN STRUCTURE FOUNDATION**ITEM: 554**

554.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
 - .1 Concrete construction methods shall be in accordance with CSA A23.1.
- .2 Construction of the foundation shall be as indicated in the Contract Documents.
- .3 Excavation shall conform to the requirements of 161.4.
 - .1 Shoring shall be installed in accordance with 361.4
- .4 Placement of reinforcing steel shall conform to the requirements of 304.4.
- .5 Concrete construction methods shall be in accordance with 302.4.
- .6 Anchor bolts shall be installed to conform with the requirements noted on the Plans, on Standard Drawings 554-1 and 554-2, and Item 555.
- .7 The Contractor may supply either:
 - .1 Anchor System "A" - Embedded Anchor Bolts
 - .2 Anchor System "B" - Structural Inserts
 - .1 The Contractor shall submit shop drawings in accordance with Item 956.
 - .2 Systems shall be designed for a safe working load of 139 kN per anchor rod/bolt, with a factor of safety against failure equal to at least 3, and a statement to this effect shall be included on the submitted shop drawings.
- .8 The Contractor shall supply a plywood template, made to suit the bolt size and spacing, to the tolerances specified for each group of anchor bolts.
- .9 Top surfaces of the foundation shall have a level, smooth, trowelled finish.
- .10 Overhead sign Structures shall not be erected until at least 7 Days after placing of the concrete foundation.
- .11 Backfilling shall be carried out in accordance with 166.4.
- .12 The Contractor shall restore the Work Area to its original condition. This may include shaping, topsoiling, seeding and/or mulching to the satisfaction of the Engineer.

554.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of reinforced concrete foundations for overhead sign Structures constructed in accordance with this Item.

554.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

555.1 DESCRIPTION

- .1 This Item consists of the erection of an overhead sign Structure.

555.2 MATERIALS

- .1 All materials, including the overhead sign Structure shall be available from the Owner from stock at DTI, Fredericton, NB.

555.3 SUBMITTALS

- .1 The Contractor shall submit the erection procedure, stamped and signed by a Professional Engineer, a minimum of 14 Days before the scheduled start of erection.

555.4 CONSTRUCTION

555.4 .1 General

- .1 The Contractor shall erect the overhead sign Structure as described in the Contract Documents.
- .2 The Contractor shall ensure that dimensional tolerances and indicated dimensions are compatible and congruent with aspects of the Work supplied under Item 554 and/or Item 557.

555.4 .2 Surface Finishing

- .1 After erection, the Structure shall have any blemishes or marks removed and restored to match the fabrication finish.

555.4 .3 Dimensional Tolerances

- .1 Prior to tightening bolts, any gaps between plates are to be filled with shims matching the plates in diameter and hole location.

555.4 .4 Inspection and Testing

- .1 A visual inspection shall be carried out before erection to ensure there are no cracked welds as a result of the transportation of the overhead sign Structure to the Work Site.
 - .1 The inspection shall be carried out by an independent inspector certified in accordance with CAN/CSA W178.2.
- .2 The inspector's report shall be submitted to the Engineer before erection of the Structure.
- .3 Faulty welds shall be corrected as specified in CAN/CSA W59.2, clause 5.12.
- .4 Corrected welds shall be re-inspected.

OVERHEAD SIGN STRUCTURE

ITEM: 555**555.4 .5 Erection**

- .1 The Contractor shall deliver the overhead sign Structure to the Work Site and shall supply a storage facility for the overhead sign Structure if it cannot be installed immediately.
 - .1 Storage areas shall be at least 10 m from the edge of the travel Lane of the Highway with the overhead sign Structure raised a minimum of 300 mm above grade on blocking.
- .2 The Contractor shall be responsible for the safe storage of the Structure and adequate support, including sufficient and satisfactory blocking to ensure that the members are not distorted, overstressed or otherwise damaged.
- .3 Following erection and plumbing of the Structure, where drawings indicate for the base plate to be grouted, a non-shrink, non-metallic grout, shall be placed in accordance with the manufacturer's instructions, under the base plate.
 - .1 Central holes in the base plate shall be blocked to prevent escape of grout.
- .4 A minimum of 20 m² of sign panel (or equivalent weight in sand filled bags or approved equivalent, which must be securely attached until the sign panels are installed), shall be installed upon the Structure on the same Day it is erected.
- .5 Structures shall be cleaned to a bright new condition to the satisfaction of the Engineer before final inspection.
- .6 If the galvanized coating on the bolts is damaged during installation of the Structure, or if the bolts have rusted, the bolts shall be wire brushed to remove the loose coating or rust and washed clean using a non-organic solvent. When the surface is dry it shall be coated with a zinc-rich paint in accordance with CGSB Specification 1-GP-178M or equivalent system as identified in CGSB 85-GP-16M.
- .7 The Contractor shall notify the Engineer, 14 Days in advance of the erection of the overhead sign Structure.

555.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of overhead sign Structure(s) erected in accordance with this Item.

555.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of overhead sign Structure, as identified under the Contract.

REMOVAL OF OVERHEAD SIGN STRUCTURE

ITEM: 556

556.1 DESCRIPTION

- .1 This Item consists of dismantling and removing an overhead sign Structure.

556.2 MATERIALS

- .1 None identified.

556.3 SUBMITTALS

- .1 None identified.

556.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The removal shall be carried out in a manner so as to avoid damage to the overhead sign Structure and the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at his/her own expense, to repair any such damage resulting from the Work.
- .3 The overhead sign Structure shall be handled with a non-metallic sling.
- .4 The overhead sign Structure shall be dismantled in one Day.
- .5 All materials shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and she/he shall replace any materials damaged or lost.

556.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of overhead sign Structures dismantled and removed in accordance with this Item.

556.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of overhead sign Structure, as identified under the Contract.

OVERHEAD SIGN

ITEM: 557

557.1 DESCRIPTION

- .1 This Item consists of the assembly and installation of an extruded aluminum sign on an overhead sign Structure.

557.2 MATERIALS

- .1 All materials shall be available from the Owner from stock at DTI, Fredericton, NB.

557.3 SUBMITTALS

- .1 None identified.

557.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall be responsible for transporting, unloading, storing and distributing materials from DTI, Fredericton, NB, to the Work Area(s).
- .3 The Contractor shall be responsible for all materials and for any damage or loss from the time of receipt of the materials until such time that the materials have been accepted in the Work.
- .4 Sign panels shall be transported and stored in a vertical position with the sign faces protected, and with no more than ten signs in one row.
- .5 Direct contact with the sign faces shall be avoided at all times.
- .6 Sign panels shall be handled with a non-metallic sling.
- .7 Sign panels shall be secured to the Structure in accordance with the Plans.
- .8 After installation, the signs shall be clean.

557.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of overhead signs assembled and installed in accordance with this Item.

557.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

REMOVAL OF OVERHEAD SIGN

ITEM: 558

558.1 DESCRIPTION

- .1 This Item consists of the dismantling and removal of a sign from an overhead sign Structure.

558.2 MATERIALS

- .1 None identified.

558.3 SUBMITTALS

- .1 None identified.

558.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Work shall be carried out in such a manner so as to avoid damage to the overhead sign and the overhead sign Structure and the adjacent and surrounding Roadway.
 - .1 The Contractor shall be responsible, at her/his own expense, to repair any such damage resulting from the Work.
- .3 Signs shall be handled with a non-metallic sling.
- .4 Signs shall be removed from the sign Structure and disassembled into 300 mm sign panels.
- .5 Panels for each sign shall be packaged and labelled with permanent ink, indicating the sign number as specified on the Plans.
- .6 Materials shall remain the property of the Owner and shall be transported to DTI, Fredericton, NB.
 - .1 Any loss or damage to materials during removal, transporting and/or storage shall be Contractor's responsibility and he shall replace any materials damaged or lost.

558.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of overhead signs dismantled and removed in accordance with this Item.

558.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

PAVEMENT MARKINGS

ITEM: 571

571.1 DESCRIPTION

- .1 This Item consists of supply and application of yellow and white paint materials for traffic markings on roadway Pavement.
 - .1 Either oil-based or waterborne paint may be used in the Work.
 - .2 Only traffic markings coatings containing 150 g/L of volatile organic compound (VOC) or less will be allowed for use between May 1 and October 15.

571.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

571.2 .2 Traffic Paint

571.2.2 .1 Oil-Based Traffic Paint

- .1 The paint shall meet CGSB Specification 1.206-M, but with paragraphs of that specification modified as shown in Table 571-1.

**Table 571-1
 Modifications to CGSB 1.206-M-89**

Para.	Modifications for this Item									
3.3	"... and shall meet the requirements for consistency (para. 4.1) and no-pick-up time (para. 4.2):									
4.1	Minimum changed from 80 to 85									
4.2	Maximum changed from 6 to 8									
4.3	Maximum changed from 60 to 90									
4.7	Minimum changed from 34 to 37									
4.10	Pigment composition (minimums in kg/L): <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td align="left"><u>Pigment Description</u></td> <td align="center"><u>Yellow</u></td> <td align="center"><u>White</u></td> </tr> <tr> <td>Silicon dioxide (as SiO₂)</td> <td align="center">0.20</td> <td align="center">0.20</td> </tr> <tr> <td>Titanium dioxide</td> <td align="center">0.075</td> <td align="center">0.15</td> </tr> </table>	<u>Pigment Description</u>	<u>Yellow</u>	<u>White</u>	Silicon dioxide (as SiO ₂)	0.20	0.20	Titanium dioxide	0.075	0.15
<u>Pigment Description</u>	<u>Yellow</u>	<u>White</u>								
Silicon dioxide (as SiO ₂)	0.20	0.20								
Titanium dioxide	0.075	0.15								
4.14	Change ASTM E97 to ASTM E1347. Add: yellow not less than 60%									
4.15	The colour of the paint shall conform to: White: standard number 37925 of the standard U.S. FED-STD 595 B Yellow: standard number 33507 of the standard U.S. FED-STD 595 B									
6.2.1	Change 60 seconds to 90 seconds									
6.2.2	Add: SiO ₂ shall be determined using classical gravimetric method on insoluble portion of paint									
NOTE: Lead Content (if present) not to exceed 600 mg/kg										

PAVEMENT MARKINGS

ITEM: 571

571.2.2 .2 Waterborne Traffic Paint

- .1 The paint shall be a homogeneous water-based mixture of particles well ground to a uniform smooth consistency, free of skin, dirt and other foreign matter, capable of being sprayed evenly and smoothly at its intended temperature and covering solidly when applied to the Pavement.
- .2 The paint shall be supplied ready-mixed for use without adding water.
- .3 Handling and storage qualities shall provide an acceptable degree of settling, uniformity, consistency, and absence of skinning and thixotropic properties. The paint shall be capable of being sufficiently atomized to produce a uniformly applied paint stripe without side splatter and overspray within the limitations of conventional striping equipment.
- .4 The paint materials shall be of a quality and consistency such that the paint's colour will not change in service to impair the visibility of the markings. The paint film shall be flat in finish. White and yellow markings shall be visible in Daylight and under artificial light after the addition of overlay glass beads.
- .5 The chemical composition shall be determined by the paint manufacturer but shall comply with the requirements of Table 571-2.
- .6 The physical properties shall comply with Table 571-3.

Table 571-2
Chemical Properties of Waterborne Traffic Paint

Property	Min	Max	Test Method
Pigment Content (% by mass) ¹	56	62	ASTM D3723
Volatile matter (% by mass)		24	ASTM D2369
Non-Volatile Vehicle (% by mass)	16.75		CGSB 1-GP-71, Method 19.1
Coalescing Agent (2,2,4-trimethyl – 1,3 pentanediol monoisobutyrate) (% by mass of solid polymer)	10		
Type of Binder	Rohm & Haas Rhoplex Fastrack 3427 Emulsion, Dow Chemical DT-250NA Emulsion, or Engineer-approved equivalent		
White Paint			
Titanium Dioxide (g/L) ²	150		
Yellow Paint			
Titanium Dioxide (g/L) ²	150		
NOTES: 1) To be 20% talc that meets ASTM D605 with a photovolt green filter reflectance of 90% minimum 2) Titanium Dioxide pigment shall meet ASTM D476 type II 3) Lead Content (if present) not to exceed 600 mg/kg 4) Volatile Organic Compound (VOC) Max 150			

Table 571-3
Physical Properties of Waterborne Traffic Paint

Property	Min	Max	Test Method
No-Pickup Time, minutes		1	ASTM D711
Non-tracking Time, seconds ¹		8	ASTM D711
Volatile Organic Compound (VOC) Content excluding water, g/L		150	ASTM D3960
Freeze-Thaw Resistance	Pass		ASTM D2243
Viscosity, Krebs Unit (KU) @ 25 °C	85	95	ASTM D562
Viscosity Change (KU) after heat-shear Stability Test @ 25 °C		10	Caltrans 8010-61G-30
Skinning Properties	Nil	Nil	CGSB 1-GP-71, Method 10.1
Coarse Particles (% by mass): 250 µm 150 µm	Nil	Nil 0.01	ASTM D185 & D2205
Settling Rate (Up to 6 months)	8.0 6.0		ASTM D869 ASTM D1309
Bleeding	4		ASTM D868 & D969
Hiding Power (m ² /L)	8.4 4.0		Pfund cryptometer w/#3.5 wedge CGSB 1-GP-71 Method 14.2
Reflectance (colour difference)% Yellow White	50 80	60	ASTM E1347
NOTE: Non-tracking time for Regular Water Based striping paint based on 375 µm (15 mils) wet film thickness applied on dry pavement having temperature > 10 °C, under humidity conditions ≥ 80%.			

571.2 .3 Overlay Glass Beads

571.2.3 .1 General

- .1 Beads shall be true smooth, lustrous spheres manufactured from glass of a composition designed to be resistant to the effects of traffic wear and weathering. No foreign material shall be contained in or among the beads.
- .2 Glass beads shall meet the gradation requirements of Table 571-4 when tested in accordance with ASTM D1214 on sample sizes of 50 to 100g.

Table 571-4
Grading Limits for Glass Beads

ASTM Sieve Size (µm)	Percent Passing
850	100
600	80 - 100
300	20 - 35
150	0 - 8
75	0 - 2

- .3 Glass beads shall be colourless to the extent that they do not impart a noticeable hue to the paint.
- .4 The refraction index of the glass beads shall not be less than 1.50 when tested in accordance with CGSB Specification 1-GP-71, Method 49.1.

PAVEMENT MARKINGS**ITEM: 571**

571.2.3 .2 Roundness

- .1 A minimum of 75% by mass of the glass beads shall be true spheres.
- .2 The percentage of true spheres shall be determined by ASTM D 1155, or, on a sample of approximately 1000 beads in a culture dish, by counting the number of true spheres under reflected light and magnification as follows:
 - Retained on the 300 um sieve size, under 50x magnification;
 - Passing the 300 um sieve size, under 100x magnification.
- .3 Failure to meet roundness requirements will be cause for rejection.

571.2.3 .3 Imperfections

- .1 The surface of the beads shall be smooth, lustrous and free of film, cavities, pits or scratches. Not more than 25% of the true spheres shall have imperfections in the form of milkiness, air inclusions, dark specks and incipient fractures.
- .2 Testing for imperfections will be performed in accordance with CGSB Specification 1-GP-71, Method 149.1.

571.2.3 .4 Moisture Resistance

- .1 Beads shall be treated so as to overcome the effect of water (vapour or liquid) on the beads before the beads are added to the painted marking.
- .2 Beads shall not agglomerate during storage and application, and shall flow freely from dispensing equipment whenever surface and atmospheric conditions are satisfactory for painting.
- .3 Moisture resistance will be tested on a 100g sample of beads placed in a 500 mL beaker, to which an equivalent volume of distilled water shall be added. After standing for 5 minutes the water shall be decanted and the glass beads transferred to a clean dry beaker.
 - .1 After standing for 5 minutes the beads shall be poured slowly via a funnel into a standard stem of 125 mm length and 10 mm inside diameter.
 - .2 The beads shall flow through the stem without stoppage. Slight initial agitation to start the flow at the beginning of the test is permissible.

571.2.3 .5 Chemical Stability

- .1 Exposure of glass beads to paint film constituents, humidity, atmospheric conditions or diluted acid or alkali solutions shall not result in dulling of the surface that would adversely affect reflective properties of the beads.
- .2 Glass beads shall be resistant to deterioration by calcium chloride, as determined on a 10 g sample of beads placed in a 1000 mL beaker, covered with 500 mL of a calcium chloride solution (1.0 normal solution), left to soak for three hours, rinsed with 100 mL of distilled water three times, and air dried.
 - .1 The beads will be examined under a microscope and compared with an untreated sample. Dulling of the surface of the beads or other detrimental effects shall constitute failure of this test.

PAVEMENT MARKINGS

ITEM: 571

571.2.3 .6 Dual Coating of Glass Beads

- .1 The beads shall have both a moisture-resistant silicone coating, and an adhesion-promoting silane coating. The beads shall pass the moisture resistance test (per 571.2.3.4), and the adherence coating test.
- .2 The adherence coating test shall use a solution of 0.2 grams of dansyl chloride dissolved in 25 mL of acetone. This solution may be used for several tests during the day if kept refrigerated in a closed dark container between uses. A fresh solution shall be made daily.
- .3 The adherence coating test shall be performed as follows:
 - Weigh 10 grams of beads and place in aluminium trays.
 - Saturate the beads with dansyl chloride solution using an eyedropper.
 - Dry the beads in an oven at 60 °C for 15 minutes. (Beads will be yellow and agglomerated.)
 - Rinse the beads in a funnel lined with new filter paper and pour 100 mL of acetone over them. Use suction during this step.
 - Remove the beads from the funnel and place in aluminium trays.
 - Over-dry the beads until free flowing.
 - Place the glass beads on filter paper and inspect colour under ultra-violet light in a dark room. A yellow-green fluorescence will be observed if adherence coating is present.
- .4 If all beads have a yellow-green fluorescence, the adherence coating is properly applied and the beads are acceptable. If only some of the beads have a yellow-green fluorescence, the beads are not properly coated and this is a cause for rejection. If no yellow-green fluorescence is seen adherence coating was not applied and this is a cause for rejection.

571.3 SUBMITTALS

- .1 The Contractor shall submit, in writing before work commences, the names of the suppliers of paint and glass beads.
- .2 The Contractor shall submit, as received from each supplier, certification that the materials supplied conform to the requirements of this Item; and instructions on the proper storage and use of the materials.
- .3 The Contractor shall submit, in writing, certification that the Equipment proposed for the Work is capable of applying the Pavement markings as outlined in the Contract Documents.

571.4 CONSTRUCTION

571.4 .1 General

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Work shall be performed in accordance with the Transportation Association of Canada (TAC) Manual of Uniform Traffic Control Devices for Canada (MUTDC), Part C; and the Owner's Work Area Traffic Control Manual (WATCM).

PAVEMENT MARKINGS

ITEM: 571

571.4.1 .3 Traffic paint shall be transported in accordance with the Transportation of Dangerous Goods Act. Drivers certified under the Act may be employed by the Contractor to transport traffic paint under the authority of the Owner's permit, provided that the conditions of the permit are adhered to.

571.4 .2 Equipment

571.4.2 .1 General

.1 The Contractor shall supply all Equipment needed for applying Pavement markings, as recommended by the manufacturer of the Pavement marking paint products. Equipment shall not contaminate the paint or other Pavement marking materials or cause damage to the Pavement.

571.4.2 .2 Line Painting Equipment

- .1 Line painting Equipment shall be capable of applying centre, lane and edge line markings to the required thickness and at widths of 100 or 200 mm, as a uniform stripe with sharp edges.
- .2 The Equipment shall have a glass bead dispenser and shall be capable of applying the beads to the wet painted line uniformly at the recommended rate by means of a pressurized overlay glass bead gun.
- .3 The Equipment shall have a heater capable of heating the paint to any temperature up to 80°C and maintaining a constant temperature during the spraying operation.
- .4 The Equipment shall have a metering device to measure the number of litres of paint applied.
- .5 The Contractor shall supply one or more shadow vehicles mounted with an arrow board and signs to adequately warn and advise the driving public of the slow moving striping vehicle and wet Pavement marking paint ahead.

571.4.2 .3 Equipment for Other Pavement Markings

- .1 Equipment for applying other Pavement markings shall be capable of applying paint at the required thickness and dispensing glass beads to the wet paint uniformly at the required rates.
- .2 Equipment shall be capable of painting the longitudinal lines outlining cross-hatched islands at a width of 100 mm or 200 mm, and cross-hatching bars at a width of 450 mm and "Stop" bars at a width of 600 mm.
- .3 Equipment shall be capable of painting arrows and similar markings, using templates with dimensions as per the Manual of Uniform Traffic Control Devices for Canada, Part C1.

571.4.2 .4 Paint Removal Equipment

- .1 Equipment shall be made available for removal of Pavement markings as ordered by the Engineer, or as required to correct markings applied in error or non-conformance per 571.4.6.10. The Equipment shall be capable of removing markings with minimal damage to the Pavement surface.

PAVEMENT MARKINGS

ITEM: 571

571.4 .3 Timing of the Work

- .1 Pavement markings shall be applied within the following time frames after completion of paving under the Contract:
 - .1 No sooner than 7 Days (to allow the new asphalt concrete to cure), and for white edge lines no sooner than completion of Item 204; and
 - .2 No later than 14 Days for arterial highways and 21 Days for other classes of highway.
 - .3 For each occurrence that Pavement markings are not applied per 571.4.3.1.2, the Contractor shall pay the Owner a penalty of \$1000 for each Day after the 14th Day or 21st Day, respectively, until application of Pavement markings is complete.

571.4 .4 Pre-marking

- .1 The Engineer shall provide the measurements and pre-markings on the Pavement to establish the position of Pavement markings, as follows:
 - .1 Painted symbols at the beginning of each type of centreline marking identified in Table 571-5, and painted dots along the centreline;
 - .2 Painted dots to mark edgelines that are not parallel to centreline, as on tapers to auxiliary lanes; otherwise the Contractor shall paint edgelines using the pre-marked or painted centreline as the control line;
 - .3 Outline of each cross-hatched island; and
 - .4 Location of each type of arrow.
- .2 The Contractor shall notify the Engineer at least two weeks prior to the Work under this Item, to allow the Engineer to schedule the pre-marking crew.
- .3 Should the Contractor's line-painting Equipment be unable to paint parallel edgelines using the centerline as control per 571.4.4.1.2, the Contractor shall premark the edge lines or otherwise ensure they are painted parallel to the centerline.

571.4 .5 Surface Preparation

- .1 Pavement markings shall be applied only on clean and dry surfaces. Any contaminants such as dirt, loose particles and oily residue shall be removed before painting.

571.4 .6 Application

- .1 All Pavement markings shall be accurately placed based on pre-markings, and shall present a crisp, uniform appearance in Daylight and darkness.
- .2 The applied markings shall be to the satisfaction of the Engineer with respect to paint thickness, retro-reflectivity, the straightness and spacing of lines, the accuracy of dimensions and positioning of other markings, and absence of overspray and tracking.
- .3 The Contractor shall be responsible for control of the paint spray during application so that it does not get on vehicles or other private property. In the event that this occurs, the Contractor shall be responsible for the costs of removing the paint off the private property and the repair of any damage that occurs as a result of the paint or its removal.

571.4.6 .4 Longitudinal lines shall be of the types and widths shown in Table 571-5.

Table 571-5
Types and Widths of Longitudinal Painted Lines

Line Type	Colour	Width (mm)
Single Solid	Yellow White	100 100/200
Single Broken	Yellow White	100 100/200
Combination (Solid Beside Broken)	Yellow	100
Double Solid	Yellow	2 lines x 100

- .1 Single broken 100 mm-wide lines between traffic lanes shall have a "skip" pattern of 1:3 (3 m line and 9 m space).
- .2 Single broken 200 mm-wide lines that mark the edge of travelled lane through a taper, auxiliary lane or intersection shall have a skip pattern of 1:1 (3 m line and 3 m space).
- .5 Cross-hatching lines shall be 450 mm wide, uniformly spaced at 6 m and at an angle of 2:1 in the direction of travel (2 units along the direction of travel to 1 unit perpendicular to it), and/or as directed by the Engineer.
- .6 Stop bars shall be 600 mm wide, applied at 90° to the edge of the travelled lane across the lane(s) as indicated in the Contract Documents or as directed by the Engineer.
- .7 Pavement marking shall be applied only on dry Pavement having a surface temperature as follows:
 - For Oil-based Paint, 5°C and rising; or
 - For Waterborne Paint, 10°C and rising.
- .1 Paint shall be applied to the Pavement surface to a minimum dry thickness of 255 µm ± 25 µm.
- .2 Overlay glass beads shall be applied at a rate of 0.7 kg/L of paint for Oil Based paint and 0.8 kg/L of paint for Water Based paint.
- .8 Retroreflectivity shall meet the following requirements when tested no sooner than two weeks and no later than four weeks after application of markings.
 - Yellow Paint 200 mcd/m²/lx
 - White Paint 250 mcd/m²/lx
- .9 Pavement markings shall be applied in a manner that reduces tracking by the wheels of vehicles that cross over the painted markings.
 - .1 Tracking of longitudinal centre, lane and edge lines shall not exceed 3% of line length as determined by the Engineer.
- .10 Pavement markings that do not conform to the requirements of this Item Documents and/or as specified by the Engineer shall be removed and/or replaced as directed by the Engineer.

PAVEMENT MARKINGS

ITEM: 571

571.4 .7 Sampling and Testing of Materials

- .1 The Contractor shall arrange for the Engineer to take samples of paint, 1 L minimum for each colour, from the paint truck on site.
- .2 The Engineer shall take on-site random samples of glass beads, 15 kg minimum.
- .3 Testing costs shall be borne by the Owner if test results are satisfactory, and by the Contractor if test results fail. In the latter case, samples from another batch of paint and/or glass beads shall be taken for new tests.
- .4 Should the Contractor wish to appeal any test results, such appeal may be made only once and in writing within 48 hours of his receipt of test results.
 - .1 The Contractor shall make provision for the Engineer to obtain additional samples for the appeal testing, the results of which shall be binding on both the Owner and the Contractor.
 - .2 Testing costs from the appeal shall be borne by the Owner if test results are satisfactory and by the Contractor if test results fail.

571.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be for Pavement markings supplied and applied in accordance with this Item:
 - .1 For longitudinal lines, the number of linear metres of each type, colour and width of line per Table 571-5, measured from beginning to end of each line type, including the gap between line types;
 - .2 For cross-hatching, the number of square metres of yellow or white crosshatched island, defined as the area enclosed by edge of Pavement, curb and gutter, and/or longitudinal lines (which shall not be measured as lines under 571.5.1 but shall be considered as part of the island);
 - .3 For painted arrows, the total number of all types of arrows painted; and
 - .4 For painted stop bars, the number of stop bars in each lane.

571.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of Pavement marking as identified under the Contract.

CONSTRUCTION TRAFFIC CONTROL

ITEM: 576

576.1 DESCRIPTION

- .1 This Item consists of the supply, installation, operation, maintenance, relocation, and removal of Work Area Traffic Control Devices (TCDs) and the provision of Traffic Control Persons (TCPs), in accordance with the Work Area Traffic Control Manual (WATCM).

576.2 MATERIALS

576.2 .1 General

- .1 All materials shall be supplied by the Contractor, including all TCDs and sign supports, and all required safety equipment and apparel for TCPs.
- .2 References to signs shall include barricades with respect to the materials used in their fabrication.
- .3 Delineation TCD's shall be as shown in Standard Drawing 576-1 attached.

576.2 .2 Traffic Control Signs

- .1 Sign sizes, letters, symbols and colours shall conform to requirements outlined in the Work Traffic Control Manual (WATCM), or to custom details shown in the Contract Documents or as approved by the Engineer.
- .2 Sign letter and symbol sizes are based upon posted speed limit and location per the TAC Manual of Uniform Traffic Control Devices for Canada (MUTCDC) Sign Pattern Manual using Modified-E font.
- .3 Letters and borders shall be constructed of black non-reflective vinyl sheeting or black screen-processing ink.
- .4 Sign substrates shall be either aluminium alloy or plywood that provides a smooth surface for the sign sheeting.
- .5 Sign sheeting shall be securely adhered to the sign substrate so that the finish is smooth and the sign message or symbol is legible to motorists.

576.2 .3 Temporary Pavement Markings

576.2.3 .1 Pavement Marking Tape

- .1 Marking tape shall be composed of high quality polymeric materials, pigments and glass beads, and shall be manufactured in rolls 10.2 cm wide with pressure sensitive adhesive backing.
- .2 Marking tape shall ensure reflectivity for at least 6 months, and shall have minimum retroreflectivity requirements as follows, when measured per ASTM E1710 using a 30 m viewing distance:
 - Entrance angle of 88.76° (yellow and white tape)
 - Observation angle of 1.05° (yellow and white tape)
 - Retroreflected Luminance of 200 and 250 millicandelas for yellow and white tape, respectively.
- .3 Minimum skid resistance of tape shall be 45 BPN per ASTM E 303.

CONSTRUCTION TRAFFIC CONTROL

ITEM: 576576.2.3 .2 Pavement Marking Paint

- .1 When pavement is treated by cold milling, microsurfacing, Partial Depth Recycling, or Full Depth Recycling, traffic paint and associated reflectorization material shall ensure retroreflectivity of temporary traffic markings as follows:
 - Yellow Paint 200 mcd/m²/lx
 - White Paint 250 mcd/m²/lx

576.2 .4 Lighting Devices

- .1 Lighting devices include Flashing Arrow Boards (FAB's), Flashing Beacons and Temporary Traffic Control Signals, and shall conform to the requirements outlined in the WATCM.
- .2 All lighting devices must conform to manufacturers specifications and be approved for use on New Brunswick roadways.
- .3 The Contractor is responsible to provide temporary power to the lighting devices.
 - .1 Lighting devices may be hard wired, solar or battery powered.
- .4 The Contractor shall indicated the type of lighting devices in conjunction with the Traffic Control Plan(s) at the first job meeting for review by the Engineer.

576.3 SUBMITTALS

- .1 Within 7 Days of the commencement of Work the Contractor shall submit a declaration stating that all retro-reflective materials to be used on the Contract shall meet the requirements of this Item.
- .2 Submittals are required in accordance with any cross-referenced Items forming part of this Item.

576.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall be responsible for all Work associated with TCDs, TCPs and all related Equipment on the Contract, in accordance with the requirements of the WATCM for the various types of Work and conditions at the Work Site.

576.4 .3 Traffic Control Plans

- .1 The Contractor shall determine the appropriate site specific traffic control requirements for the type and sequence of Work under the Contract, taking into consideration all points identified in Section 1.3 of the WATCM.
- .2 Any of the Contractor's signing plans that are different from the WATCM typical layouts shall be stamped by a Professional Engineer.
- .3 The Contractor shall present the Traffic Control Plan(s) at the first Job Meeting for review and acceptance by the Engineer.

CONSTRUCTION TRAFFIC CONTROL

ITEM: 576

576.4 .4 Traffic Control Persons

- .1 Further to Chapter 5 of the WATCM, the Contractor shall provide as many TCPs as required based on roadway geometry, traffic patterns and volumes, size or length of Work Area, and other pertinent factors.

576.4 .5 Traffic Control Agent

- .1 The Contractor shall provide a Traffic Control Agent with overall authority to make operational decisions on behalf of the Contractor and other subcontractors with regard to Work Area traffic control on the Contract.
- .2 The Contractor shall identify the Traffic Control Agent at the first Job Meeting for the Contract.
- .3 The Traffic Control Agent shall ensure that at least one traffic lane is kept open during the day and two lanes at night.
- .4 The Traffic Control Agent shall perform inspections and prepare related documentation as prescribed in Section 4.3 of the WATCM.

576.4 .6 Application of Temporary Pavement Marking

- .1 Temporary Pavement markings shall be placed on the same Day as the Work is carried out, as per Section 3.8 of WATCM, for operations as follows:
 - .1 Paving;
 - .2 Milling (Painted markings only);
 - .3 Partial or Full Depth Recycling; and
 - .4 Microsurfacing.
- .2 Temporary Pavement markings shall not be placed on a chip seal surface unless otherwise directed by the Engineer.
- .3 Damaged or missing markings shall be replaced at the end of each Day.

576.4 .7 Work Stoppage

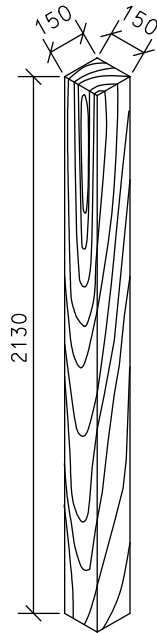
- .1 Upon written order of the Engineer the Contractor shall stop Work in any Work Area for which the Engineer has identified that TCDs and/or TCPs are not in accordance with this Item or the WATCM, and the deficiencies are of a serious nature and/or previously ordered to be corrected.
- .2 Work shall not resume until the Contractor has corrected all deficiencies to the satisfaction of the Engineer.
- .3 Any Work time lost due to Work stoppage per 576.4.7.1 and GC 18 for non-compliance, and the time taken by the Contractor to be in compliance, shall not be considered for any adjustment of the Specified Work / Limited Funds / Completion Date, and shall not be a basis of claim.

576.5 MEASUREMENT FOR PAYMENT

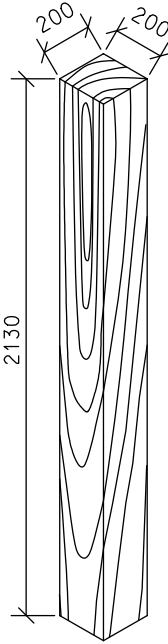
- .1 The supply, installation, operation, maintenance, relocation and removal of Traffic Control Devices and the provision of Traffic Control Persons, in accordance with this Item, shall be on a lump sum basis.

576.6 BASIS OF PAYMENT

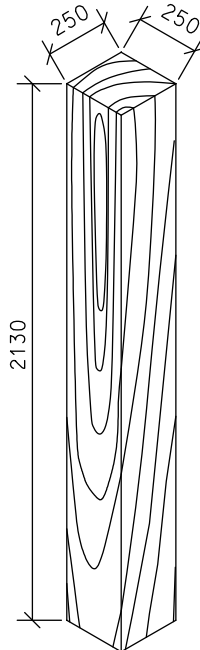
- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 Notwithstanding 576.6.1, separate payment shall be made by the Owner for TCPs approved by the Engineer for the following types of Work:
 - .1 Force Account Work performed as identified under Item 811 in the Contract Documents; and/or
 - .2 Extra Work (Work of a nature or style not identified in the Contract Documents) performed under Item 812.



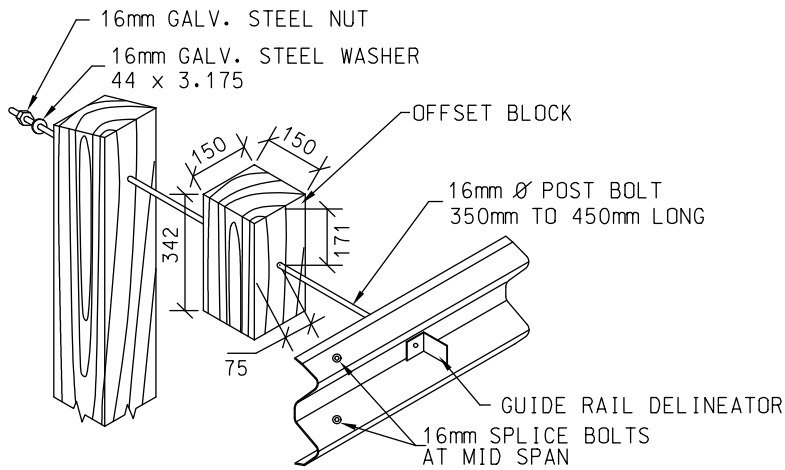
TYPICAL
GUIDE POST



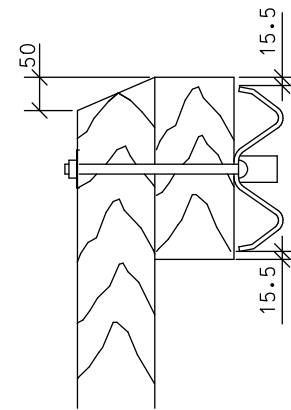
GUIDE POST AT
INTERMEDIATE
LOCATIONS



GUIDE POST
ADJACENT TO
STRUCTURE



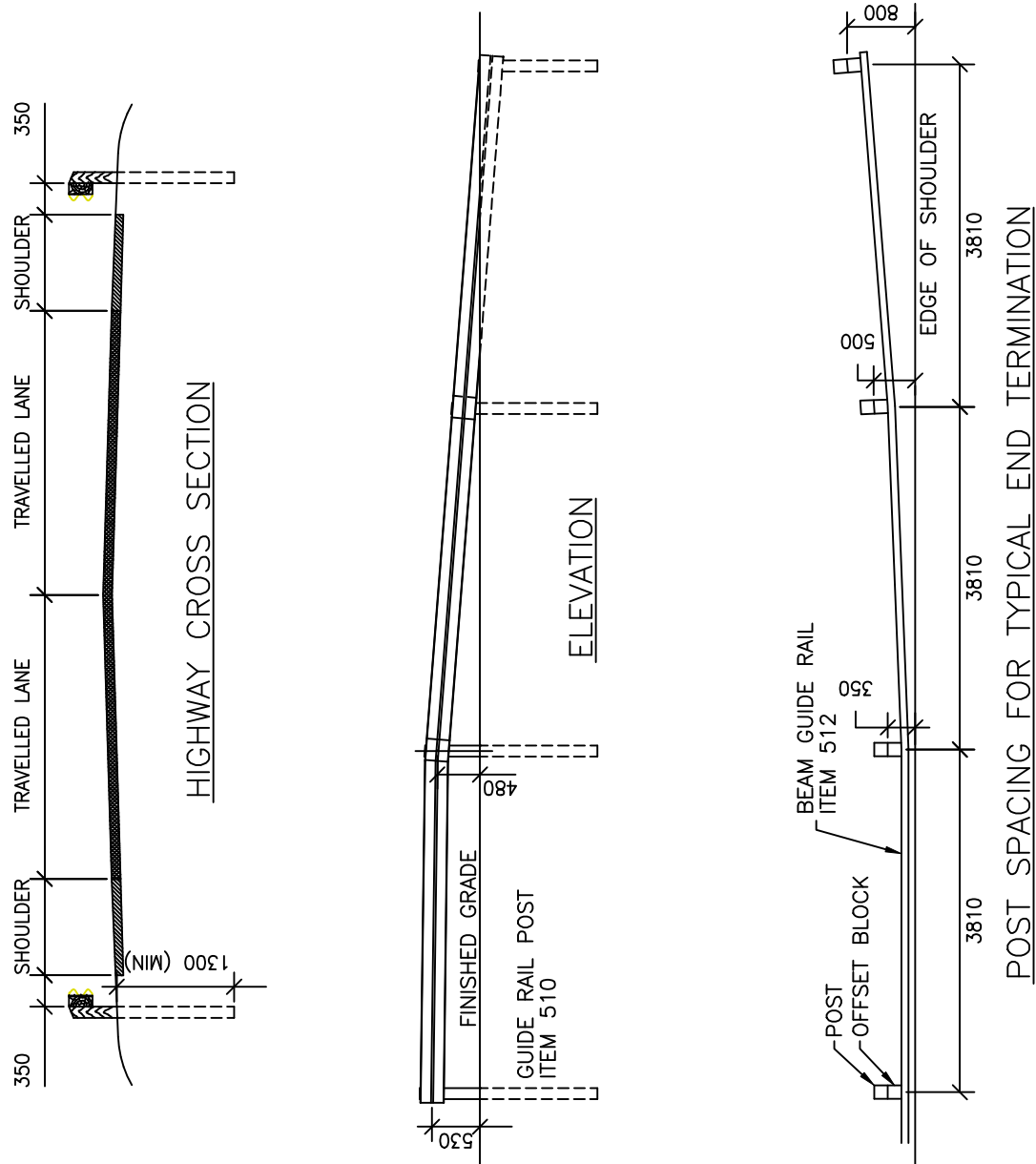
POST DETAIL



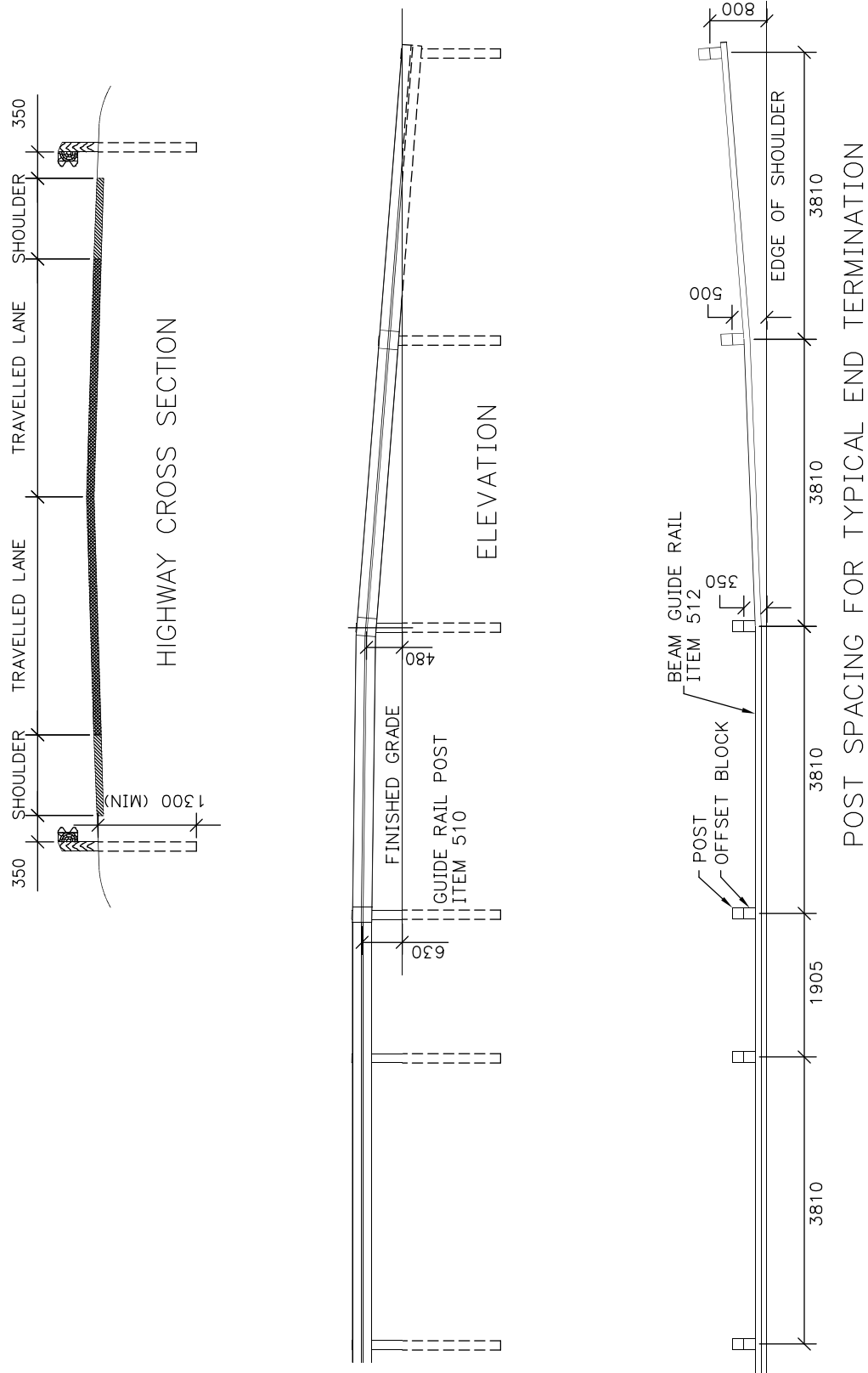
NOT TO SCALE

SPACING OF GUIDE RAIL DELINEATOR	
ON TANGENTS	15 m
ON CURVES	7.5 m

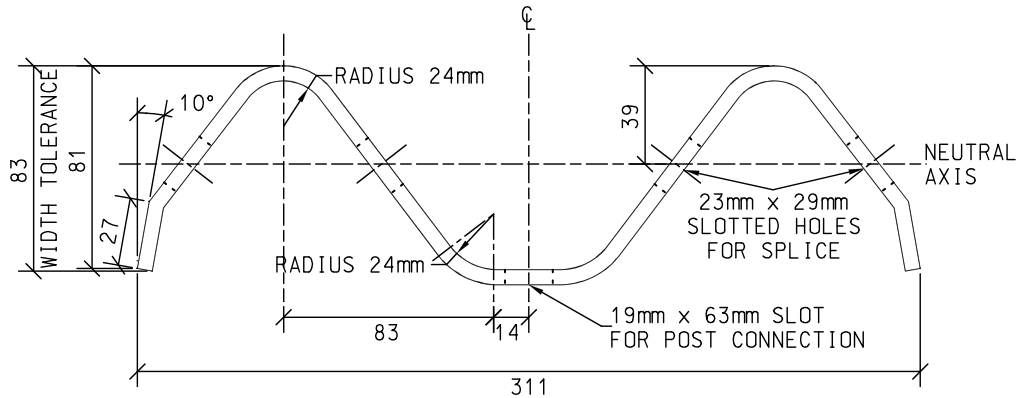
Guide Post Details



Guide Post and Guide Rail Details – 530 Height

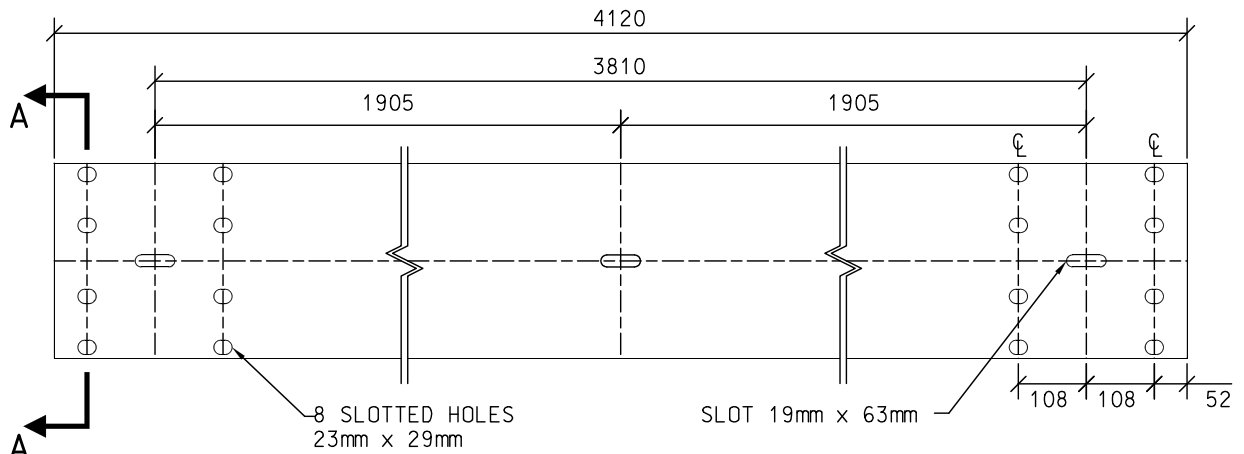


Guide Post and Guide Rail Details – 630 Height



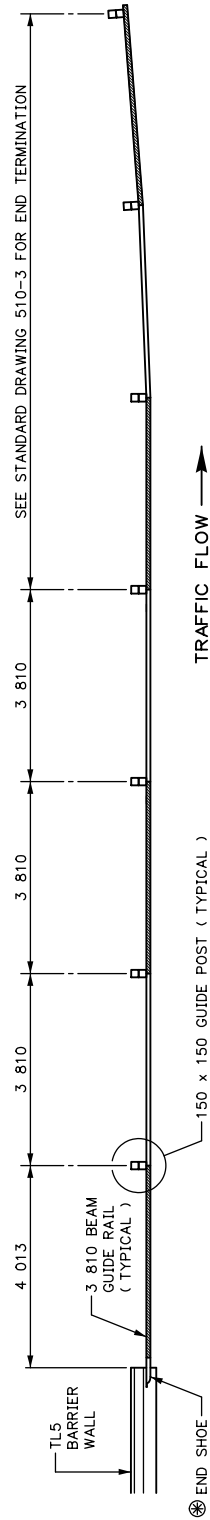
AS PER AASHTO M180

SECTION A-A



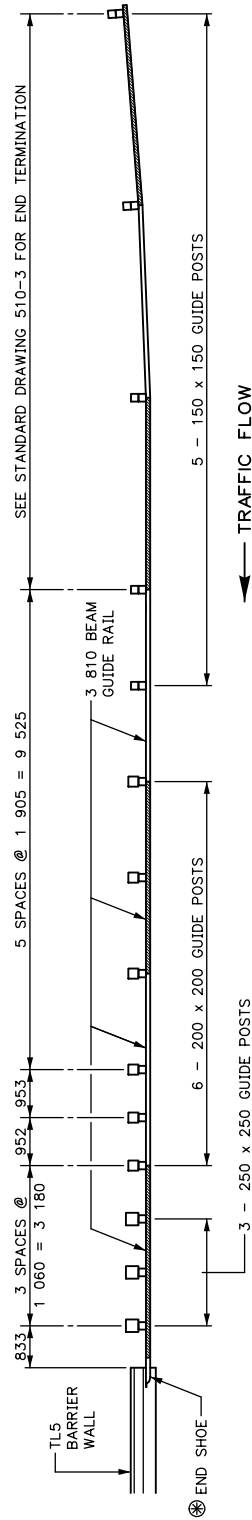
FRONT ELEVATION

Beam Guide Rail Details



TYPICAL GUIDE POST SPACING: DEPARTING END OF A BRIDGE
MINIMUM LENGTH
(ONE-WAY TRAFFIC ONLY)

⊗ "ARMTEC" SPECIAL END SHOE, SEE STANDARD DRAWING 512-4.

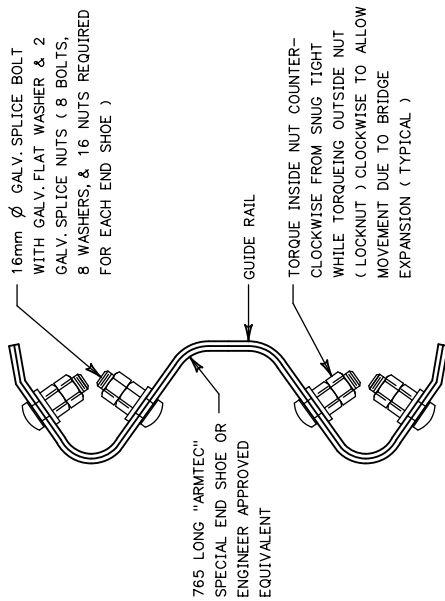


TYPICAL GUIDE POST SPACING: APPROACHING END OF A BRIDGE
MINIMUM LENGTH
(ONE-WAY AND TWO-WAY TRAFFIC)

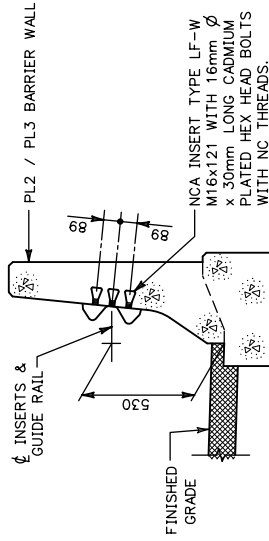
Guide Rail / Structure Details

N.O.T.E.S.:

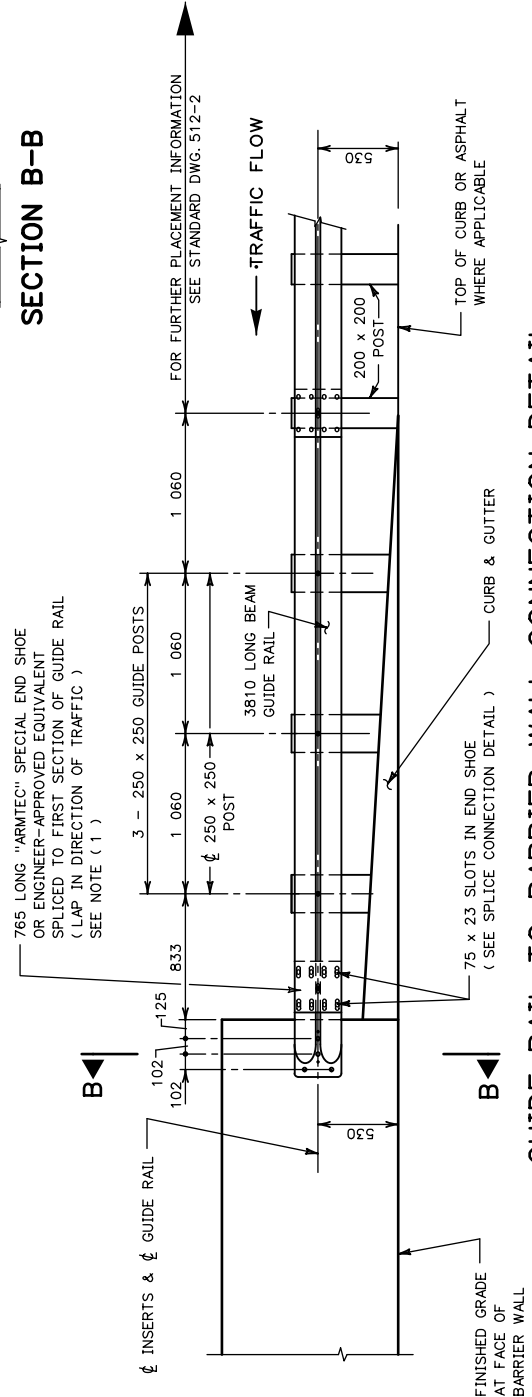
- (1) SPECIAL END SHOE TO BE HOT-DIPPED GALVANIZED, WITH 75 x 23 mm SLOTS AS SHOWN. 16 mm ϕ GALVANIZED SPLICE BOLTS TO BE CENTERED IN SLOTS BEFORE TIGHTENING. ALL MATERIALS SUPPLIED & INSTALLED BY CONTRACTOR. SEE SPLICE CONNECTION DETAIL FOR MORE INFORMATION.



SPLICE CONNECTION DETAIL



SECTION B-B

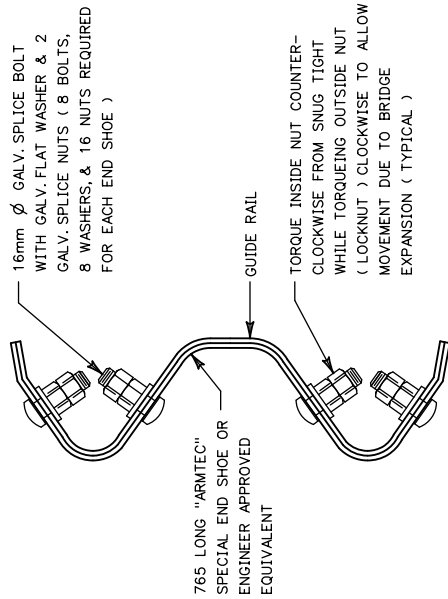


GUIDE RAIL TO BARRIER WALL CONNECTION DETAIL

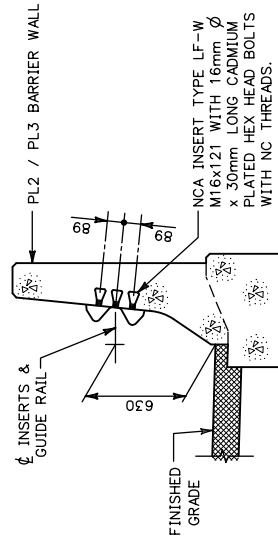
Guide Rail / Structure Details – 530 Height

N O T E S :

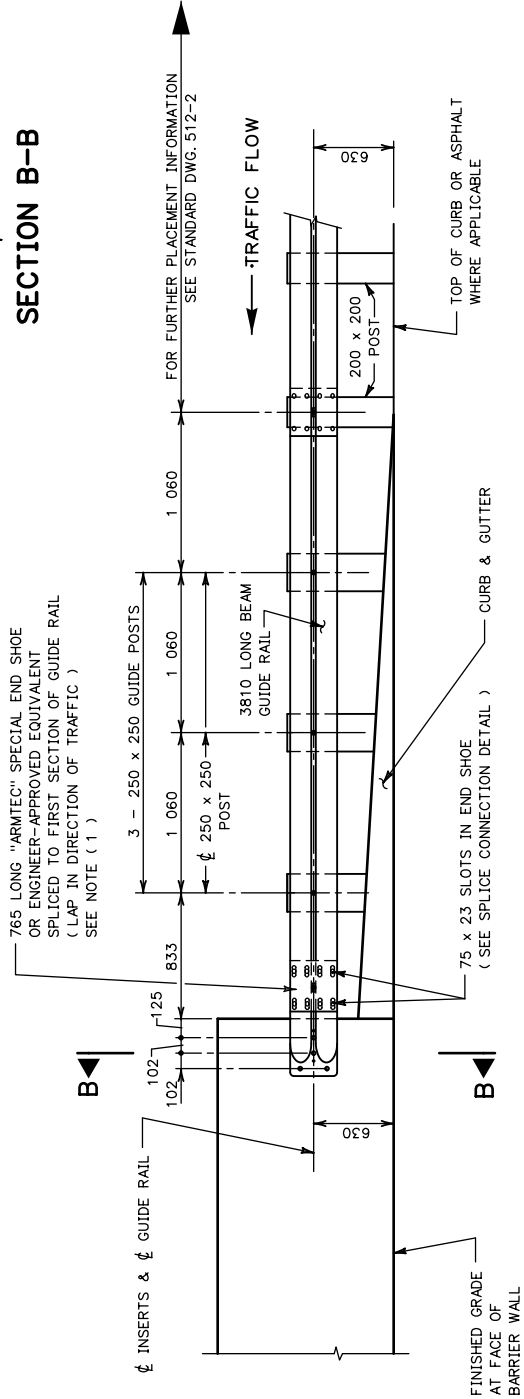
- (1) SPECIAL END SHOE TO BE HOT-DIPPED GALVANIZED, WITH 75 x 23 mm SLOTS AS SHOWN. 16 mm ϕ GALVANIZED SPLICE BOLTS TO BE CENTERED IN SLOTS BEFORE TIGHTENING. ALL MATERIALS SUPPLIED & INSTALLED BY CONTRACTOR. SEE SPLICE CONNECTION DETAIL FOR MORE INFORMATION.



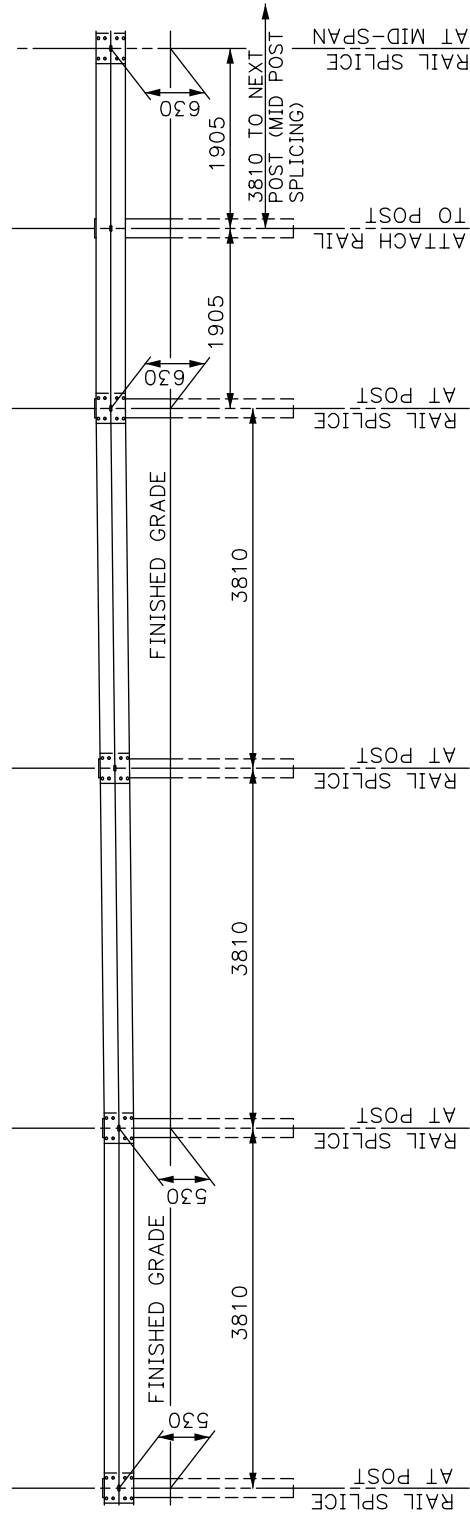
SPLICE CONNECTION DETAIL



SECTION B-B



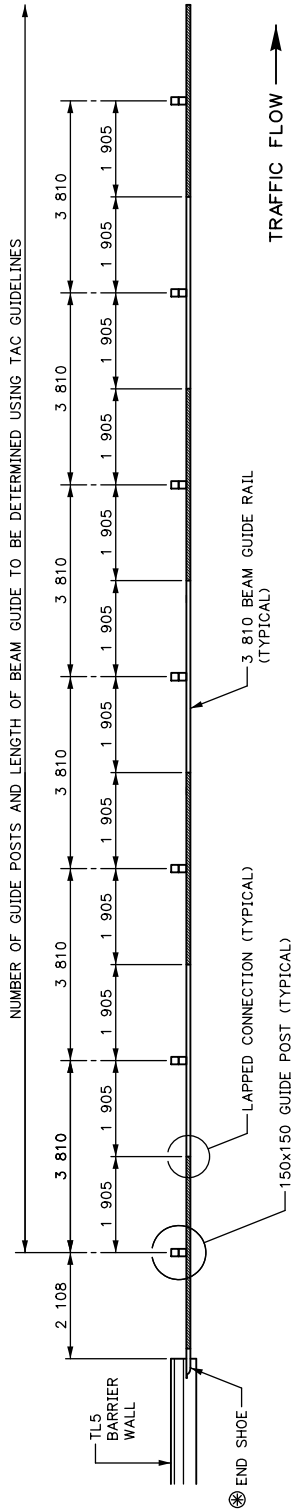
Guide Rail / Structure Details – 630 Height



NOTES:

1. SEE APPROPRIATE GUIDE RAIL STANDARD DRAWING(S) FOR DETAIL NOT SHOWN.
2. LAP GUIDE RAIL IN DIRECTION OF ADJACENT TRAFFIC.
3. GUIDE RAIL HEIGHT MEASURED FROM FINISHED GRADE TO CENTER OF BEAM GUIDE RAIL.

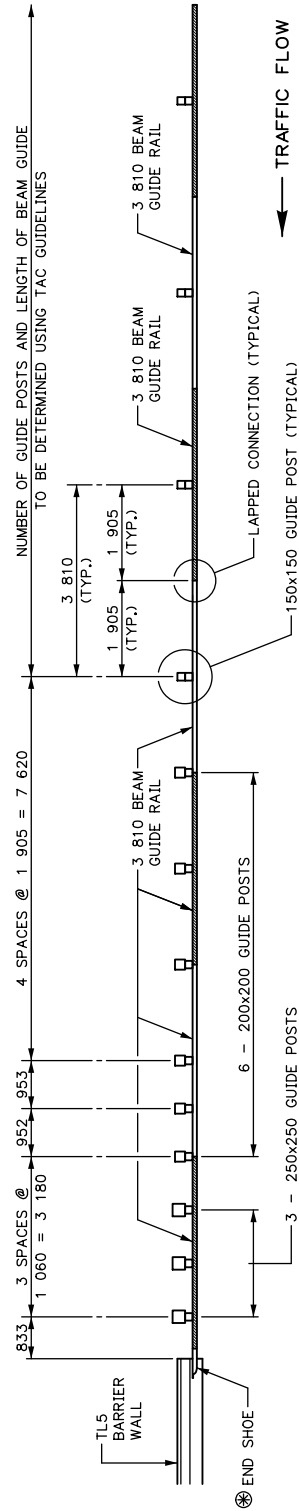
Guide Rail Height Conversion



TYPICAL GUIDE POST SPACING: DEPARTING END OF A BRIDGE
(ONE-WAY TRAFFIC ONLY)

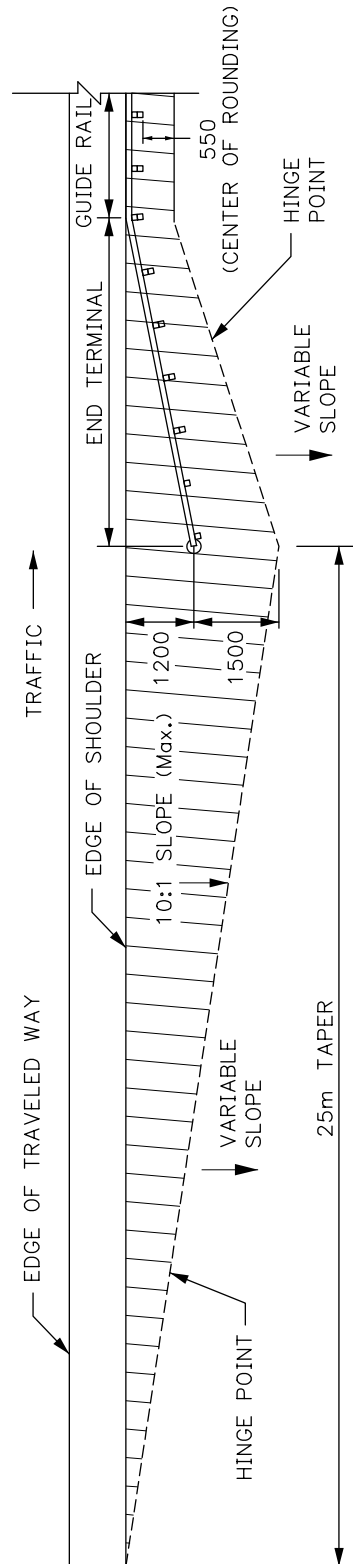
NOTE:
SEE STANDARD DRAWING 510-3
FOR END TERMINATION.

⊗ "ARMEC" SPECIAL END SHOE, SEE STANDARD DRAWING 512-4.

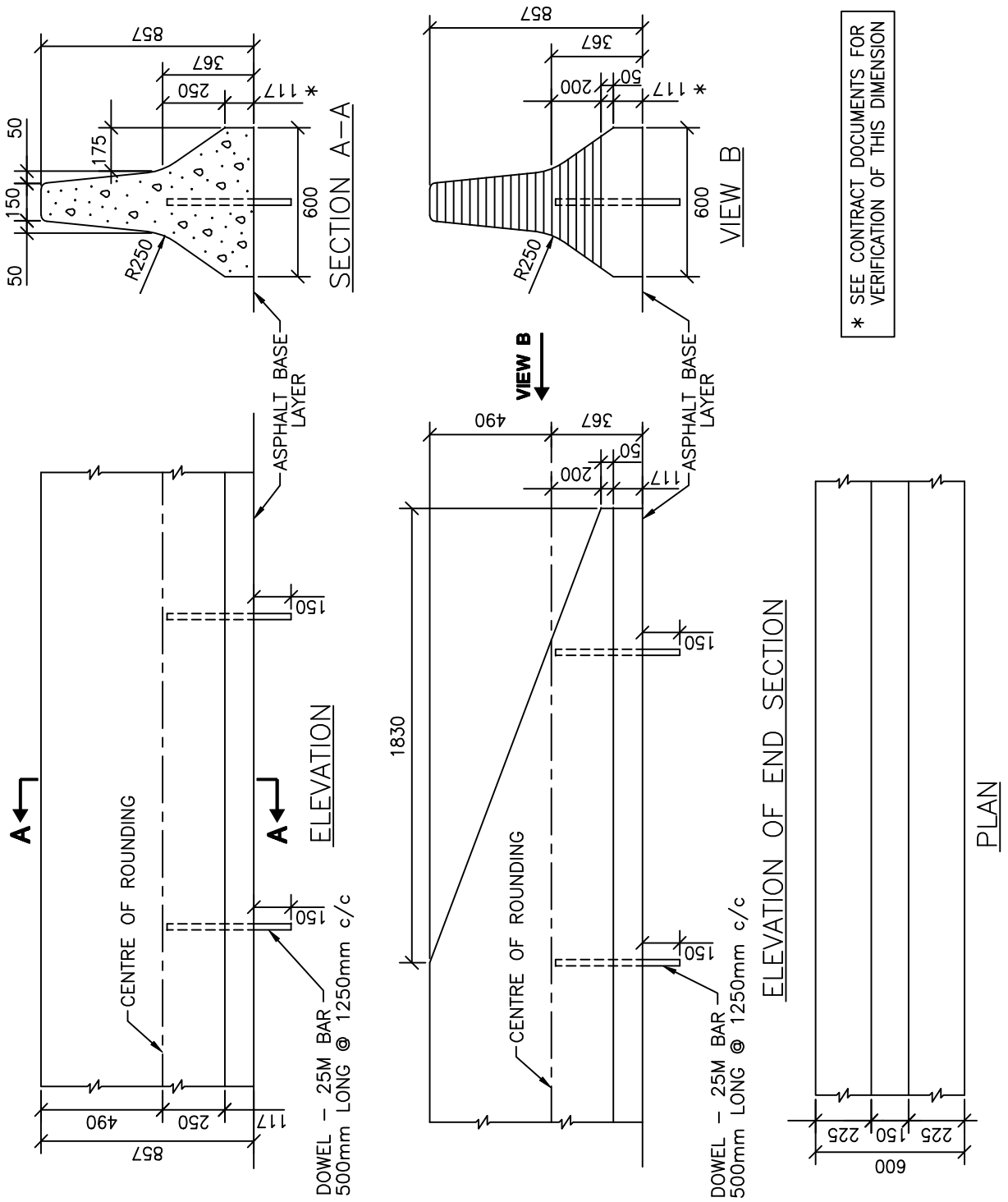


TYPICAL GUIDE POST SPACING: APPROACHING END OF A BRIDGE
(ONE-WAY AND TWO-WAY TRAFFIC)

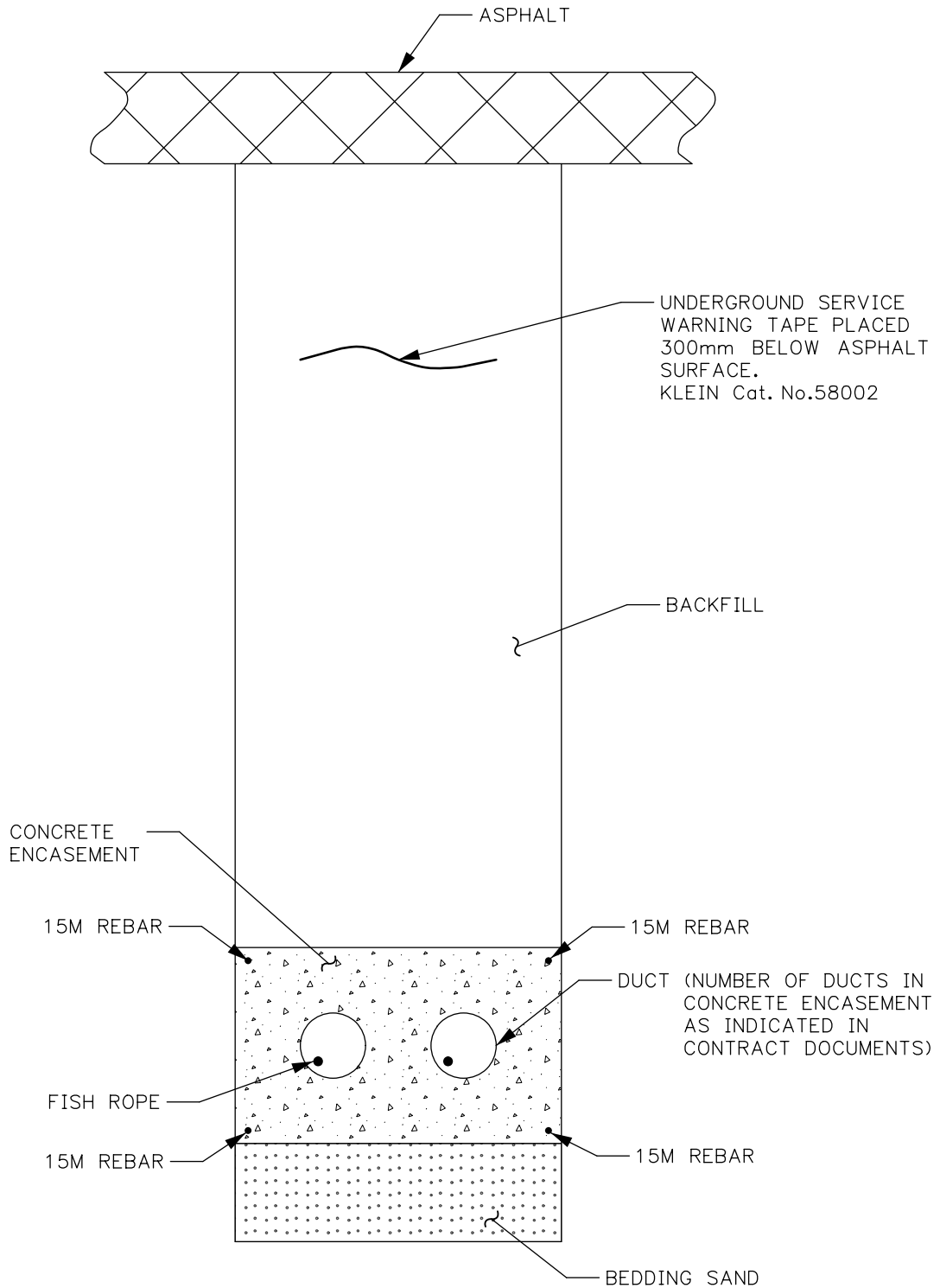
Typical Guide Post Spacing At Structure



Grading For Flared Energy-Absorbing Guide Rail Terminal (EAGRT) Installation

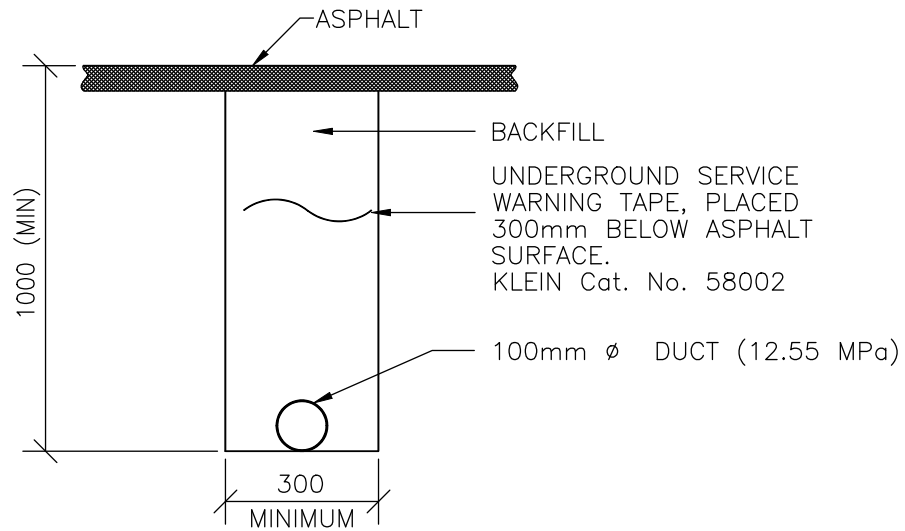
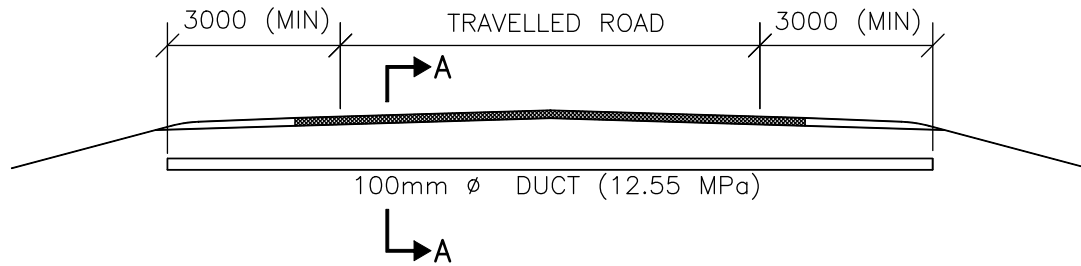


Cast-in-Place Concrete Barrier Details



NOTE:
DIMENSIONS SHOWN ON CONTRACT DOCUMENTS.

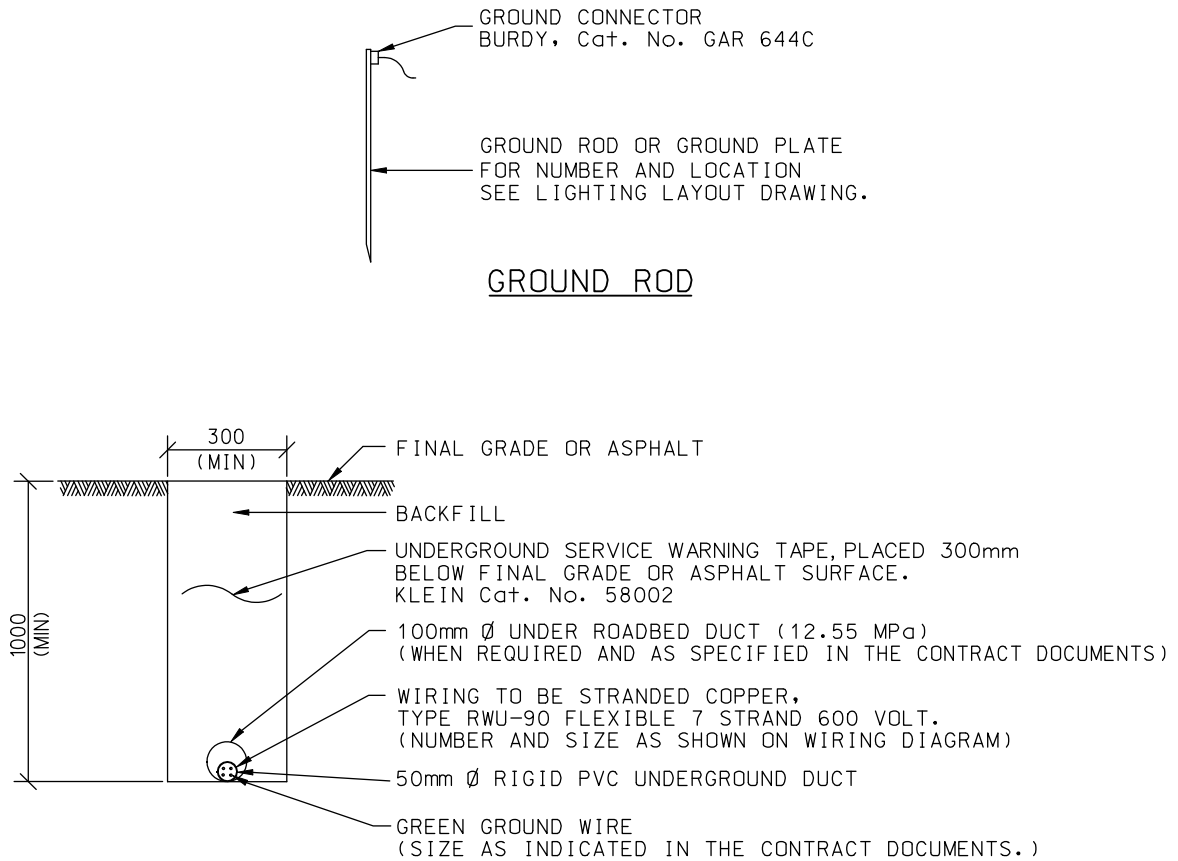
Concrete Encased Duct Bank System



SECTION A-A

NOTE
WIRING INSTALLED UNDER ITEM 531

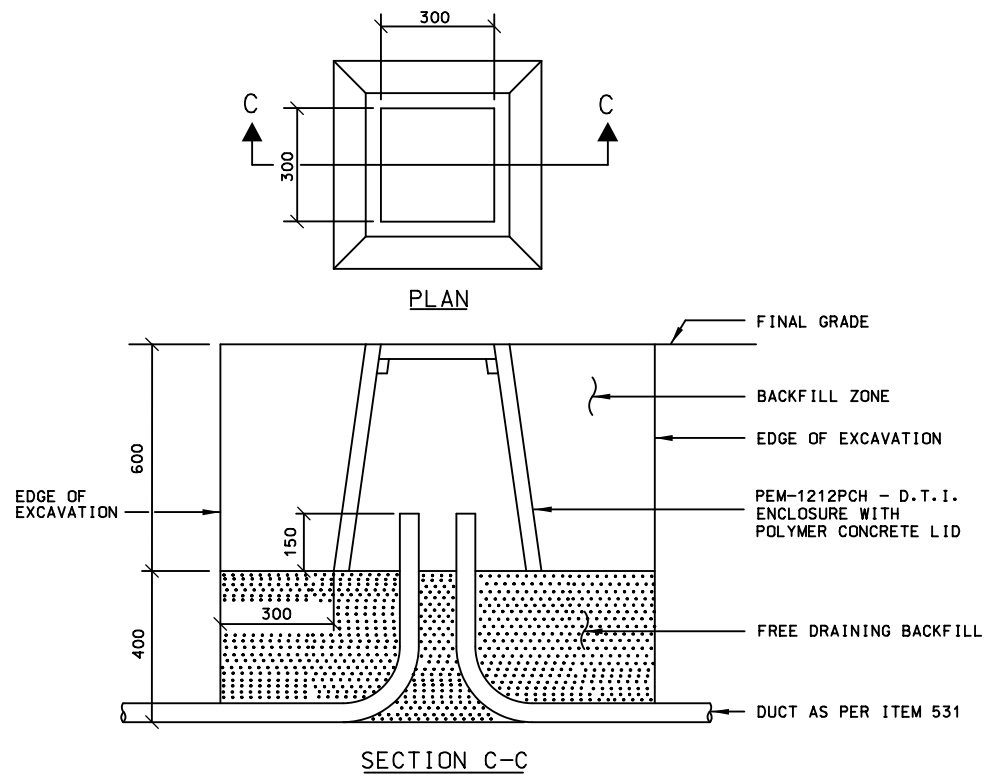
Under Roadbed Duct Details



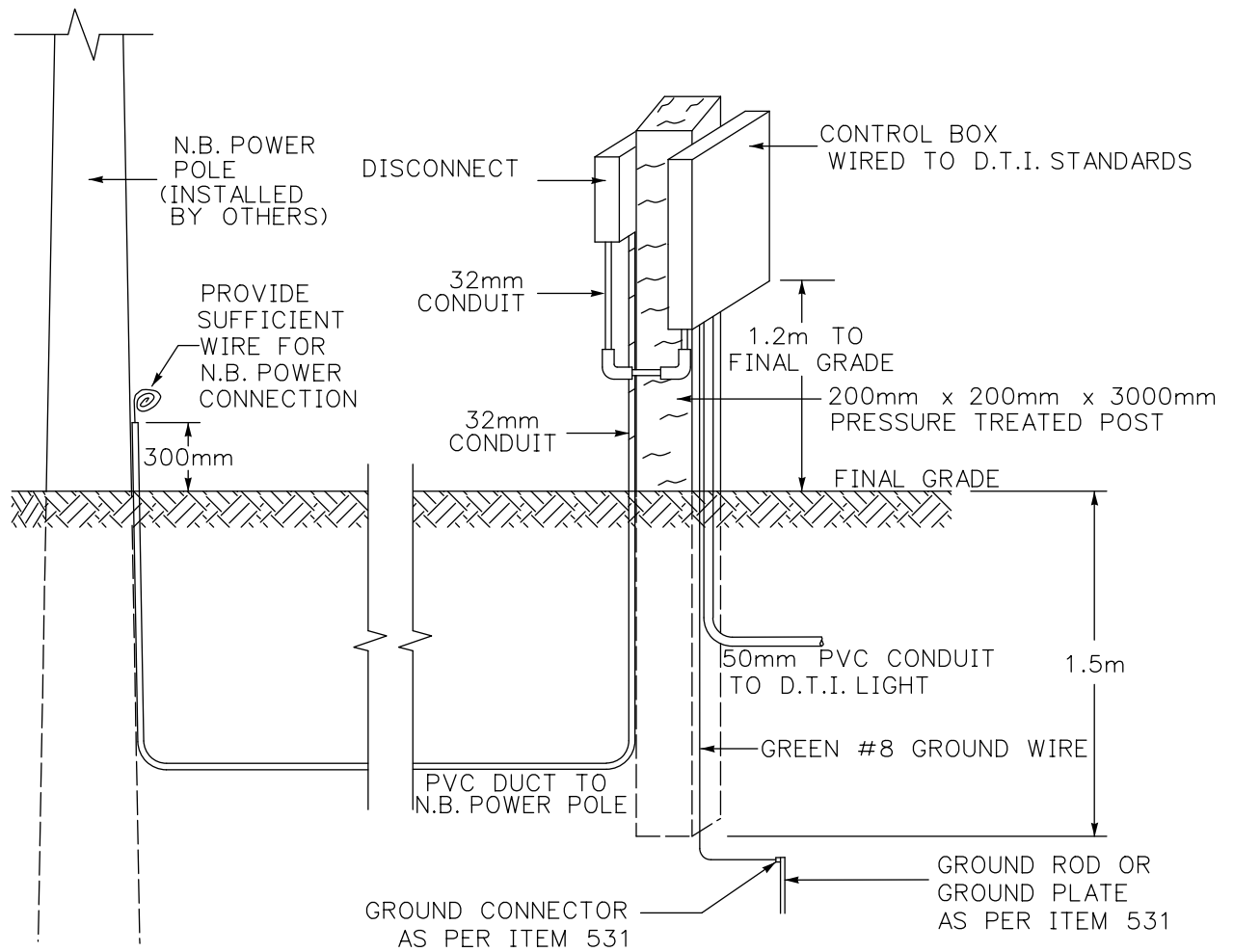
NOTES:

1. CHECK EXISTING AND FUTURE UTILITIES BEFORE COMMENCING EXCAVATION WORK.
2. BEFORE ANY TRENCHING TO POWER POLES, CHECK WITH NB POWER AND ALIANT FOR EXACT LOCATION.
3. CHECK WITH ALIANT FOR FIBRE-OPTIC CABLE LOCATION.
CALL 1-800-332-3333 BEFORE DIGGING.

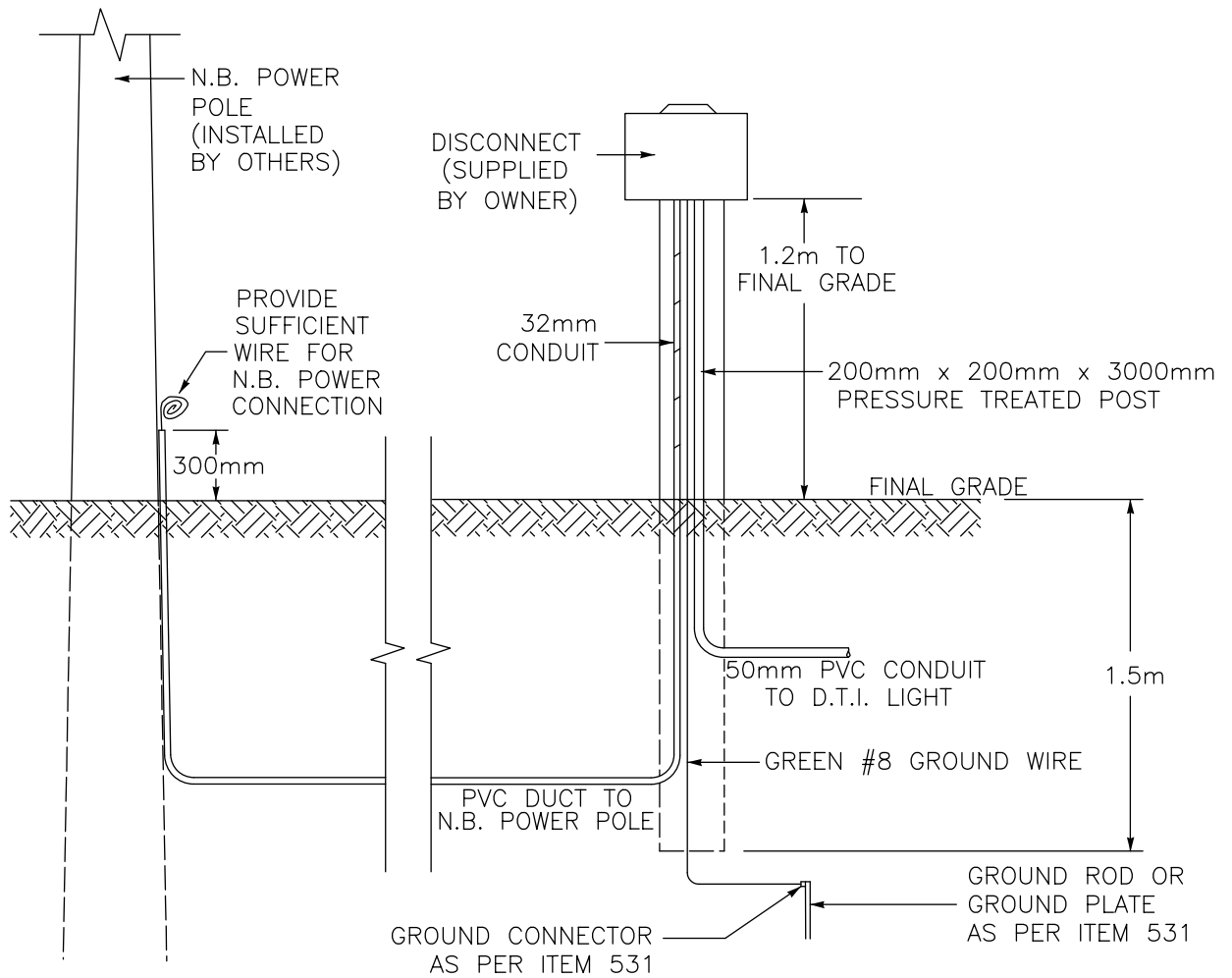
Underground Duct Details



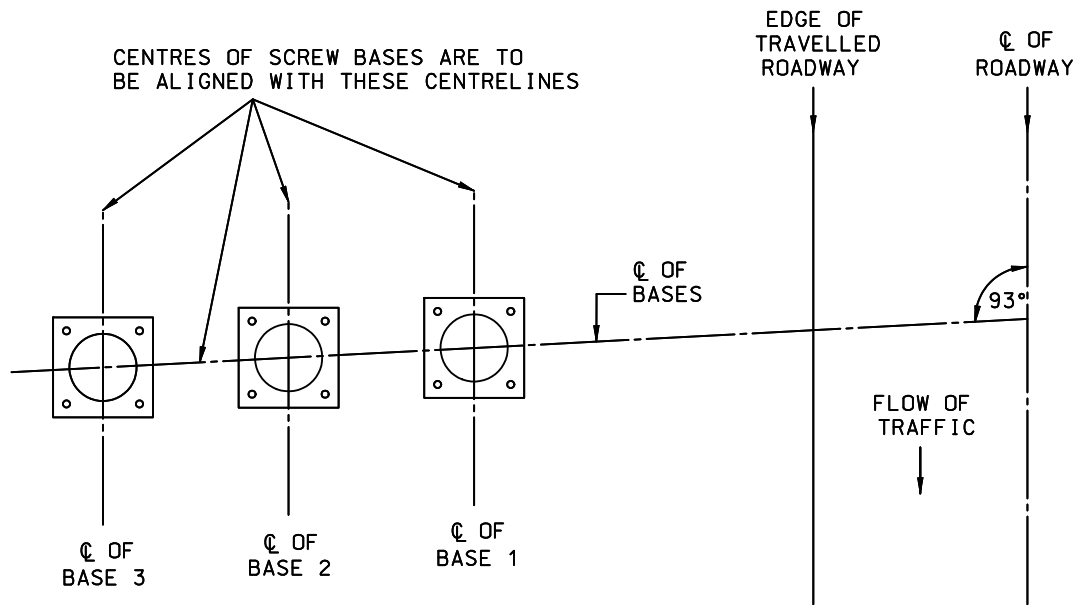
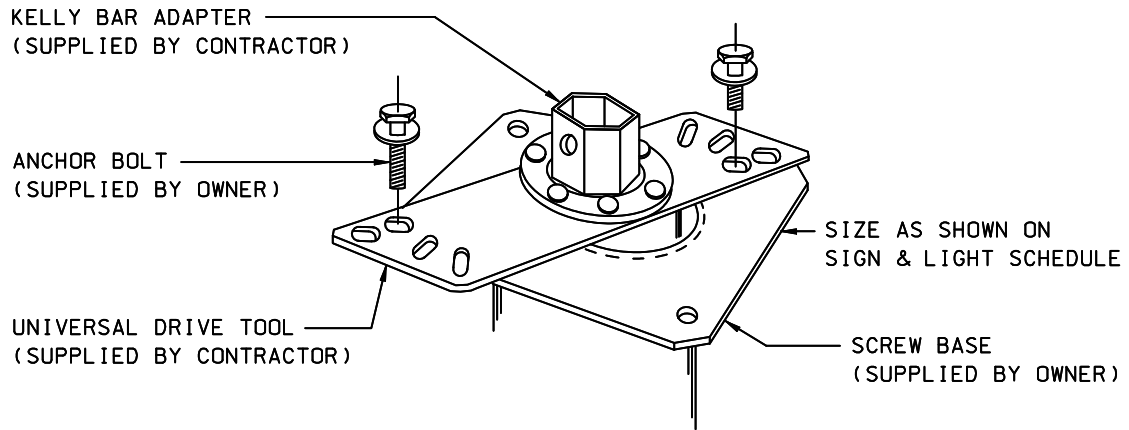
Underground Junction Box Detail



Power Point, Multiple Lights

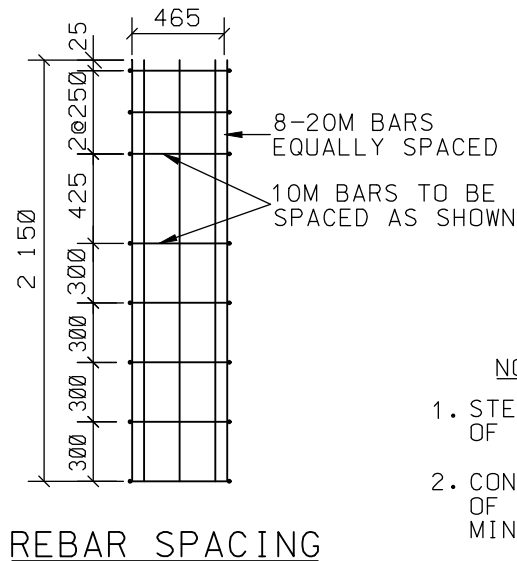
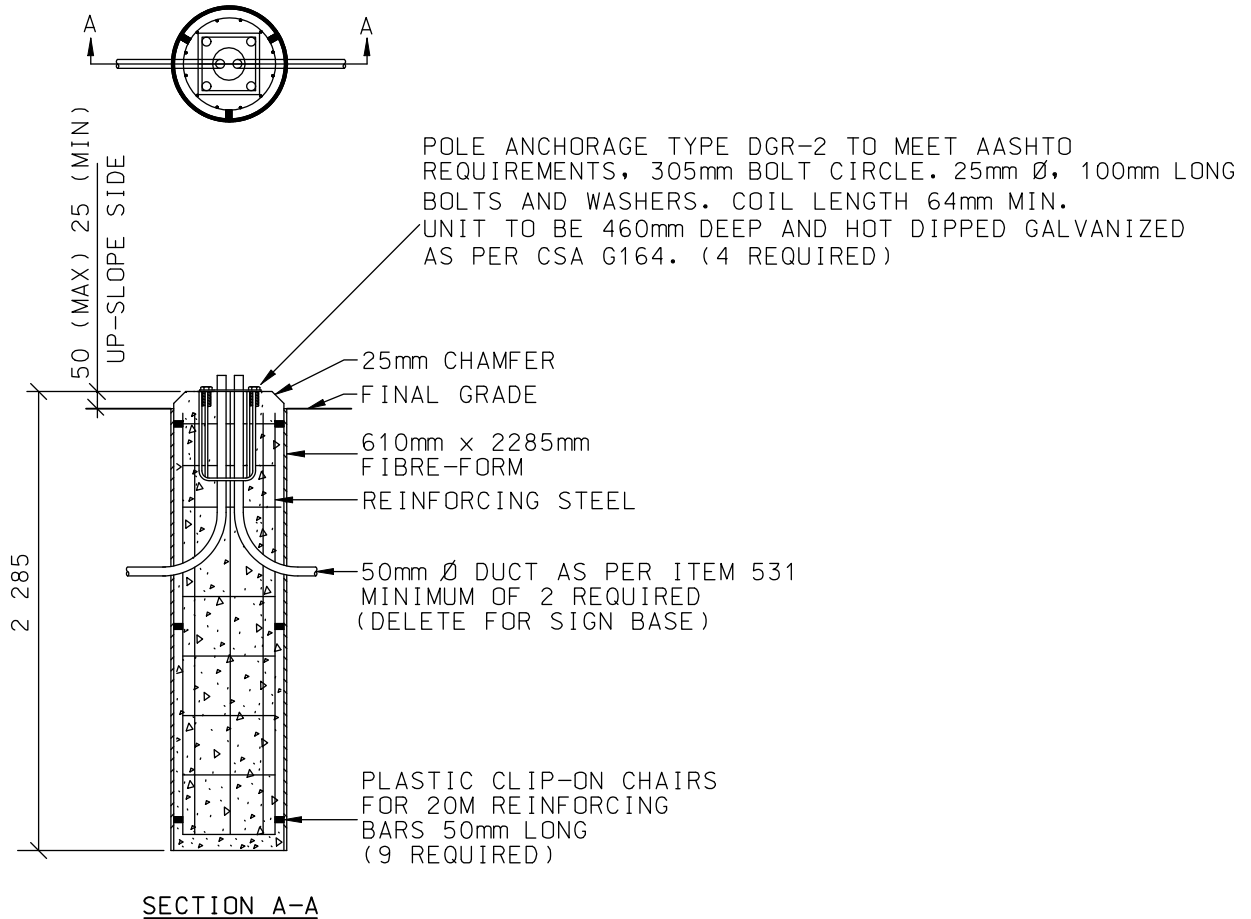


Power Point, Single Light



NOTE:
REQUIRED NUMBER OF BASES
INDICATED ON SIGN SCHEDULE

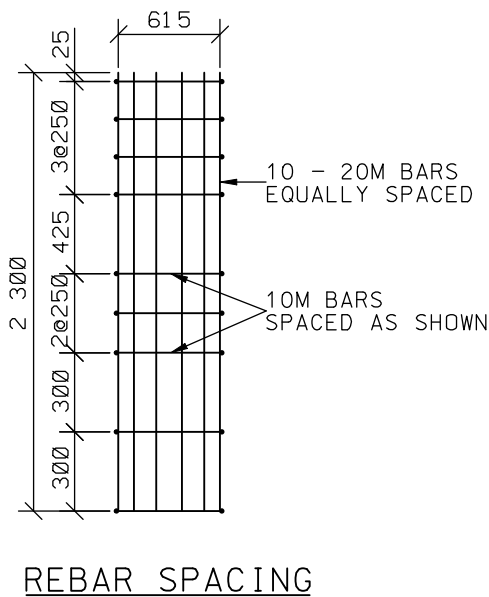
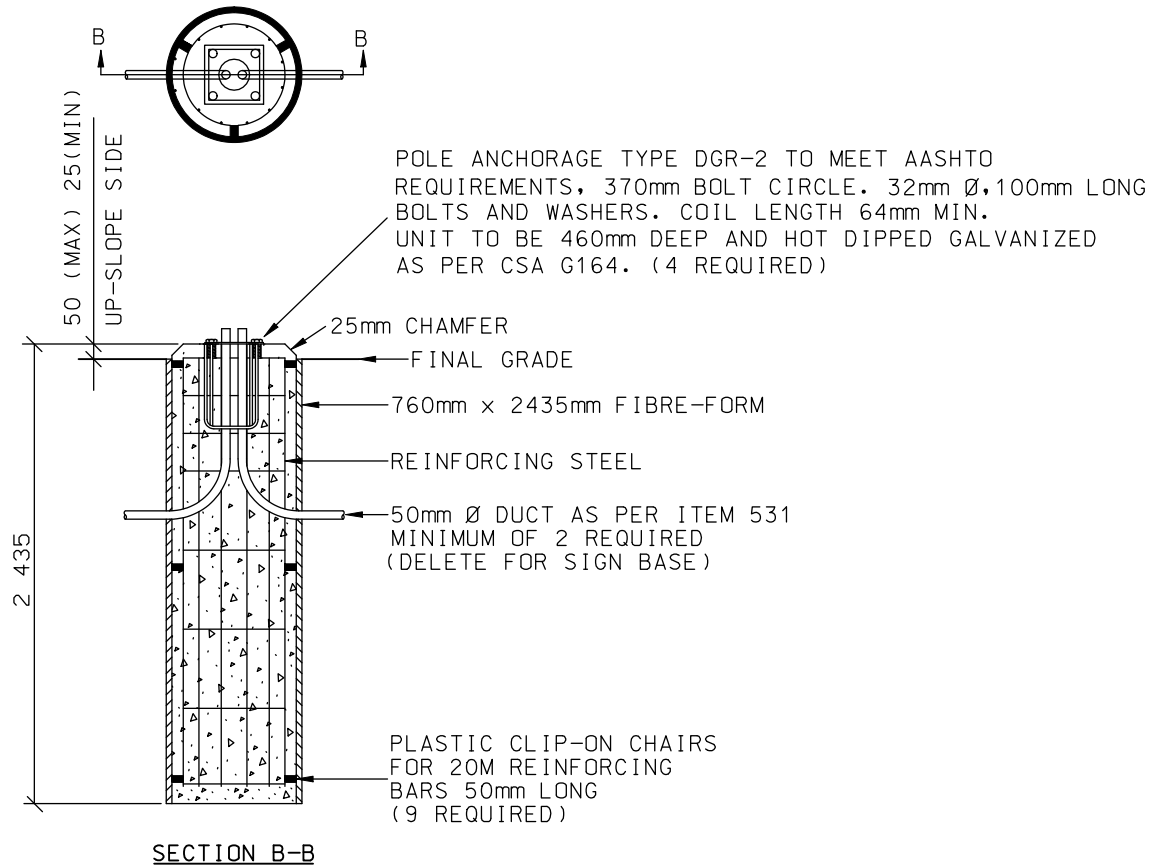
Screw Base Detail



NOTE:

1. STEEL SHALL BE LAPPED MIN. OF 350mm.
2. CONCRETE COVER SHALL BE A MINIMUM OF 40mm ON SIDES & TOP, AND A MINIMUM OF 75mm ON THE BOTTOM.

Type "E" Sign or Light Base Details
Soil Foundation

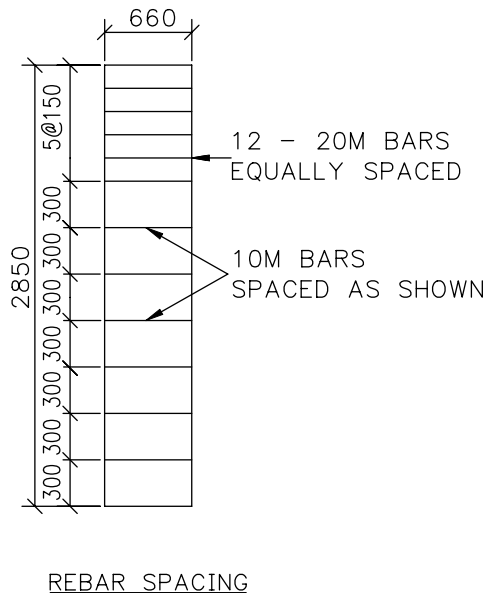
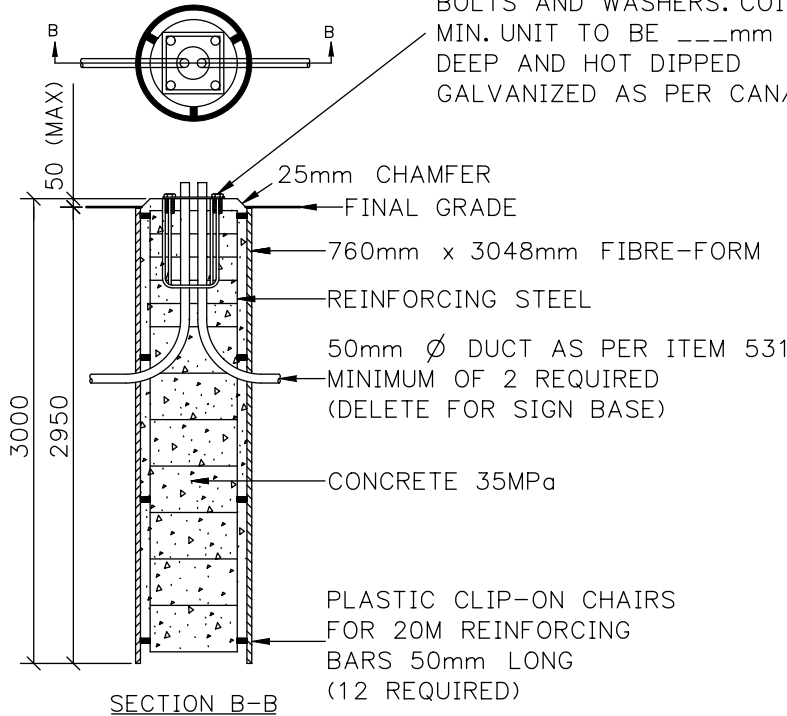


NOTE:

1. STEEL SHALL BE LAPPED MIN. OF 350mm.
2. CONCRETE COVER SHALL BE A MINIMUM OF 40mm ON SIDES & TOP, AND A MINIMUM OF 75mm ON THE BOTTOM.

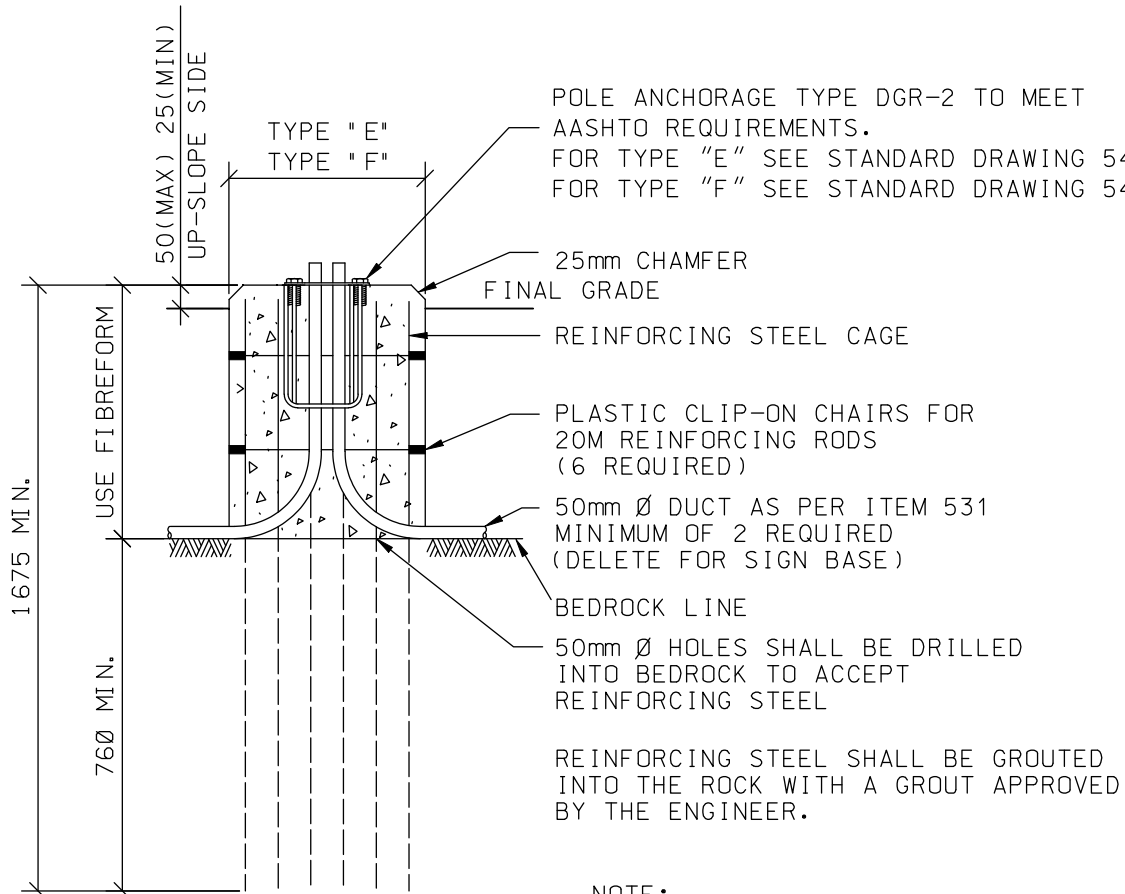
Type "F" Sign or Light Base Details
Soil Foundation

POLE ANCHORAGE NATIONAL CONCRETE
ACCESSORIES (NCA) TYPE DGR-__ __mm
BOLTS CIRCLE. __mm ϕ , __mm LONG
BOLTS AND WASHERS. COIL LENGTH __mm
MIN. UNIT TO BE __mm
DEEP AND HOT DIPPED
GALVANIZED AS PER CAN/CSA G164. (4 REQUIRED)



- NOTE:**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
 2. STEEL SHALL BE LAPPED MIN. OF 325mm FOR 10M BARS AND 550mm FOR 20M BARS.
 3. STEEL SHALL MEET CAN/CSA G30.18-M GRADE 400 AND SHALL BE IN THE FORM OF DEFORMED ROUND BARS
 4. CONCRETE COVER FOR REINFORCING STEEL SHALL BE A MINIMUM OF 40mm FOR THE SIDES AND TOP AND 75mm FOR THE BOTTOM.

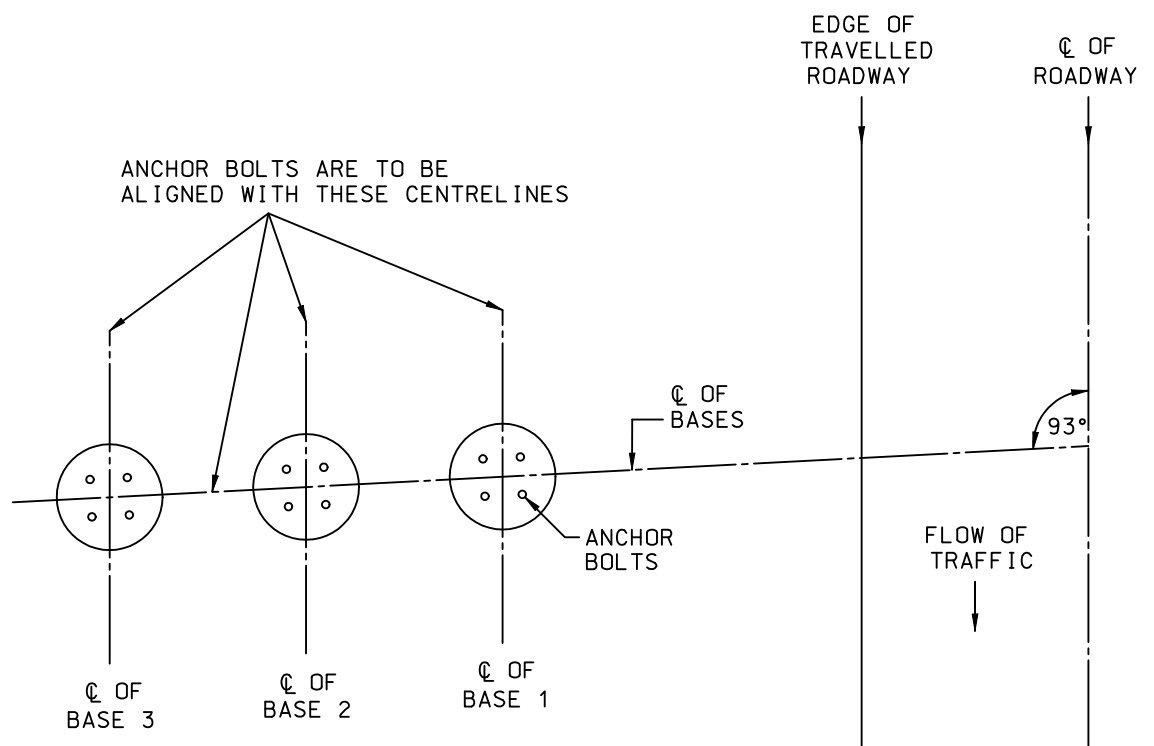
**Type "G" Sign or Light Base Details
Soil Foundation**



NOTE:

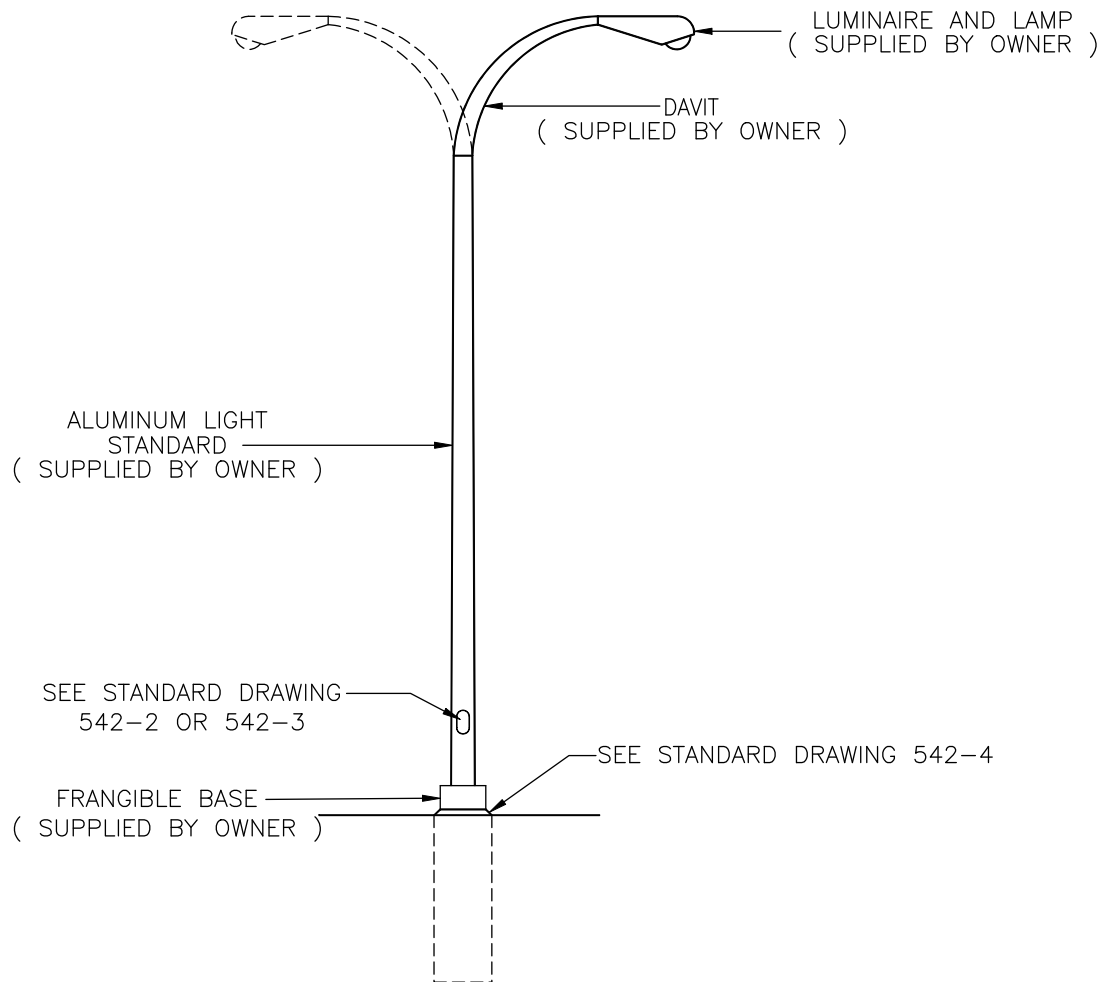
1. STEEL SHALL BE LAPPED MIN. OF 350mm.
2. CONCRETE COVER SHALL BE A MINIMUM OF 40mm ON SIDES & TOP.

**Sign or Light Base Detail
Bedrock Foundation**

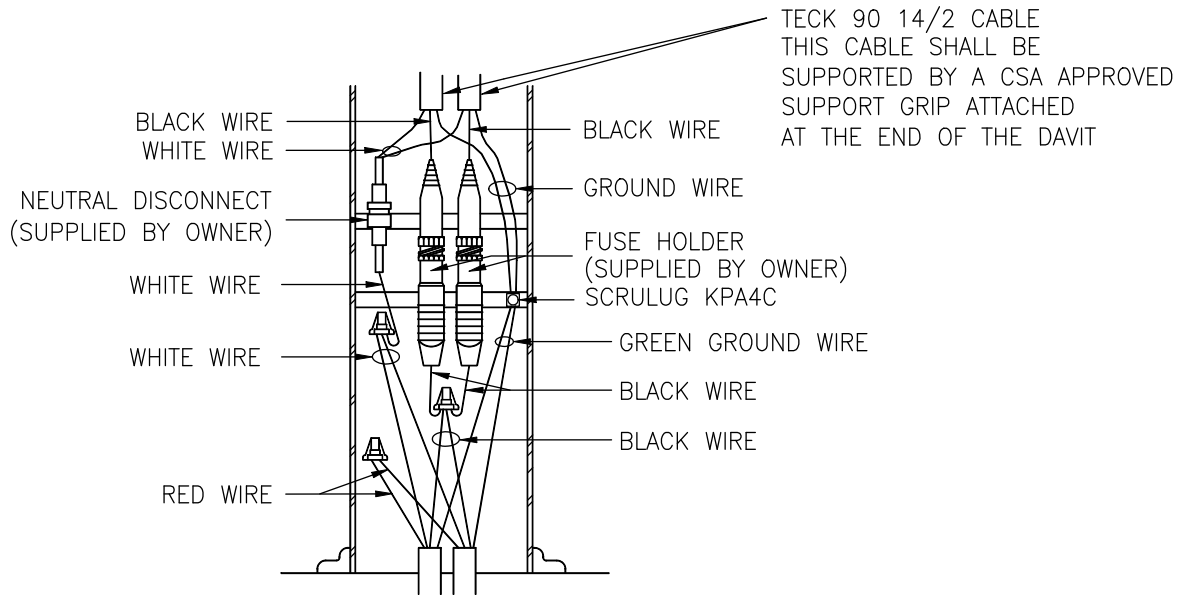


NOTE:
REQUIRED NUMBER OF BASES
INDICATED ON SIGN SCHEDULE

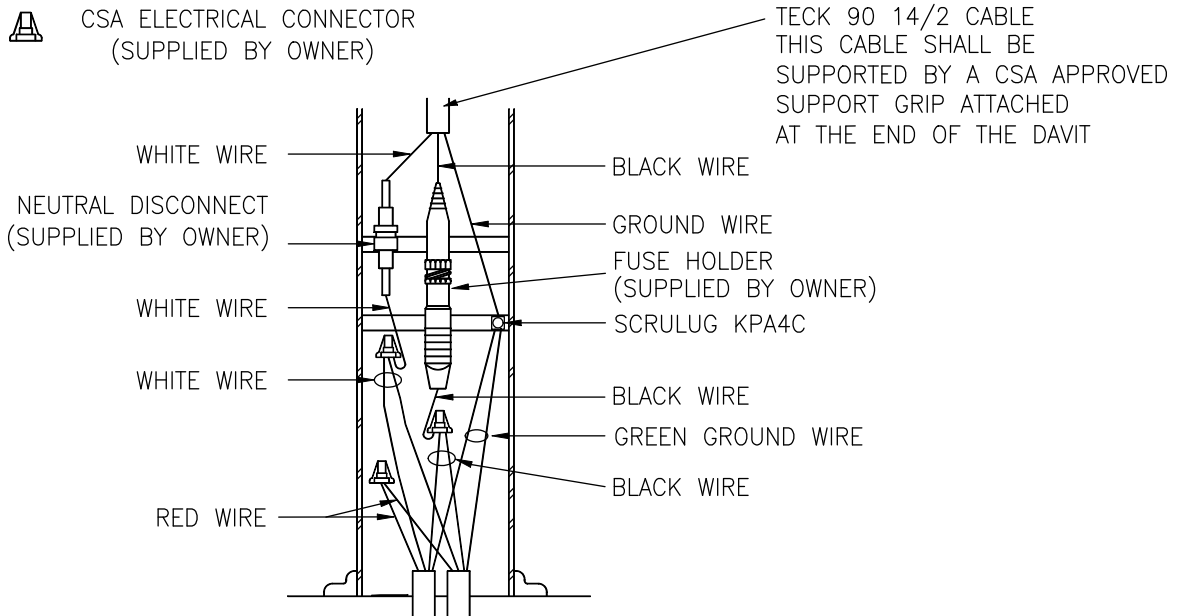
Angulation of Sign Foundations



**Light Standard Detail
Single and Double Davit**

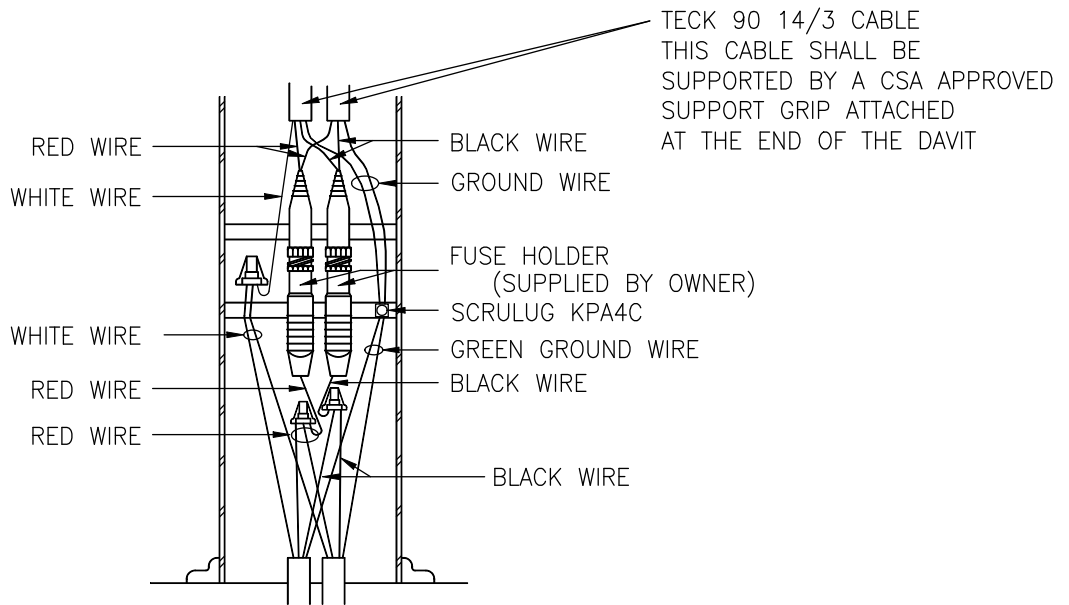


120V
TYPICAL CONNECTION FOR
DOUBLE DAVIT ALUMINUM LIGHT STANDARD



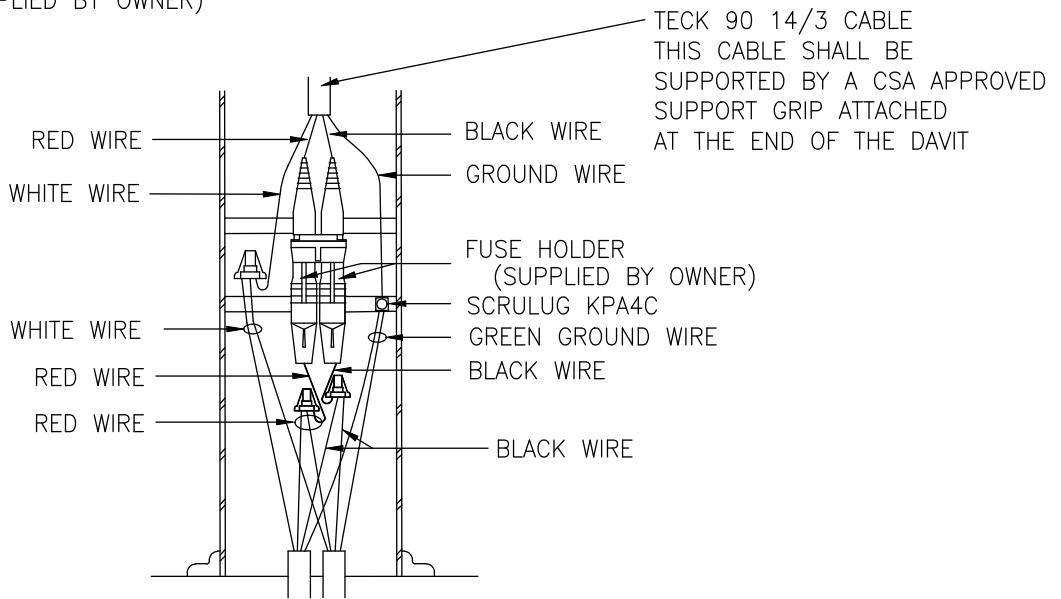
120V
TYPICAL CONNECTION FOR
SINGLE DAVIT ALUMINUM LIGHT STANDARD

Light Standard Wiring Details
120 volt



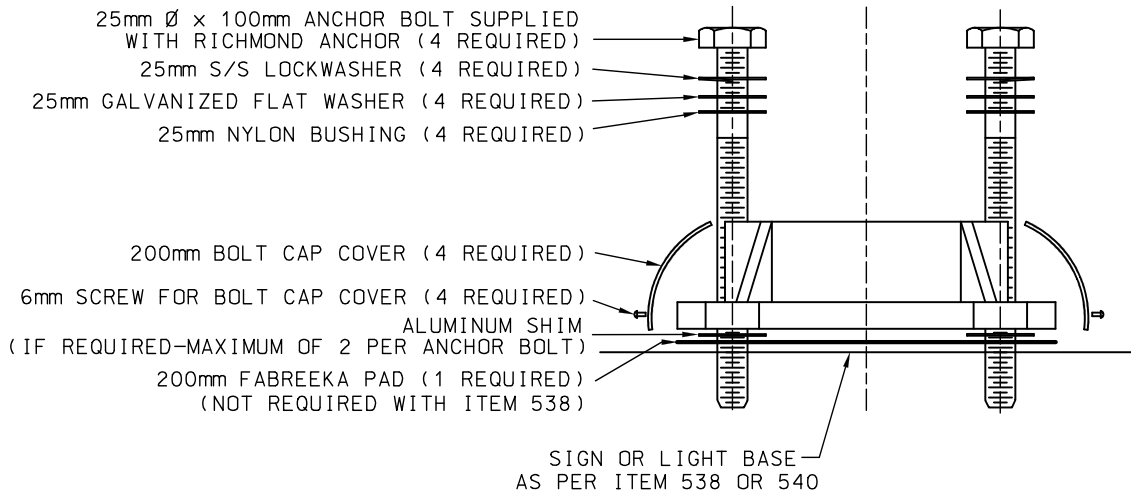
240V
TYPICAL CONNECTION FOR
DOUBLE DAVIT ALUMINUM LIGHT STANDARD

 CSA ELECTRICAL CONNECTOR
(SUPPLIED BY OWNER)

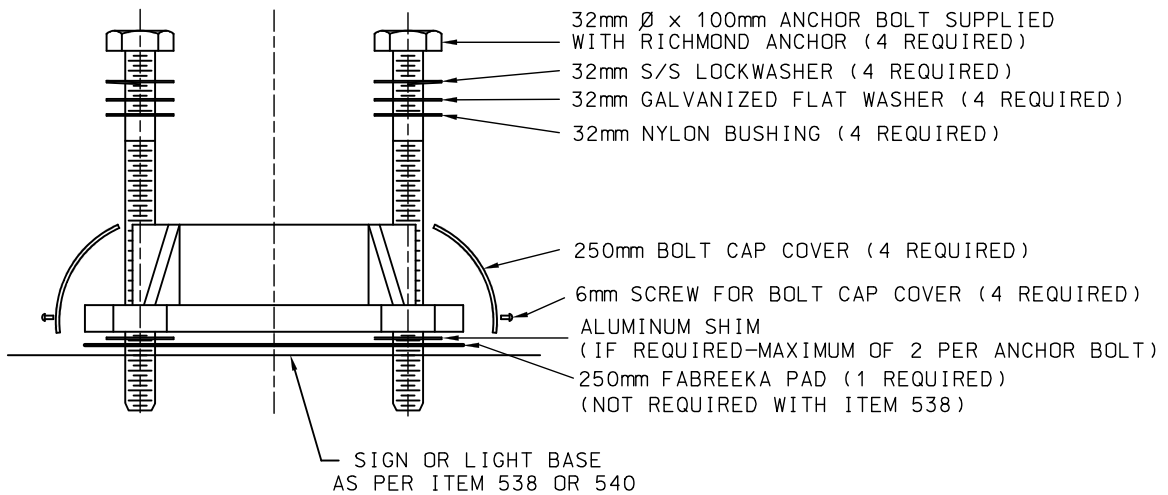


240V
TYPICAL CONNECTION FOR
SINGLE DAVIT ALUMINUM LIGHT STANDARD

Light Standard Wiring Details
240 volt

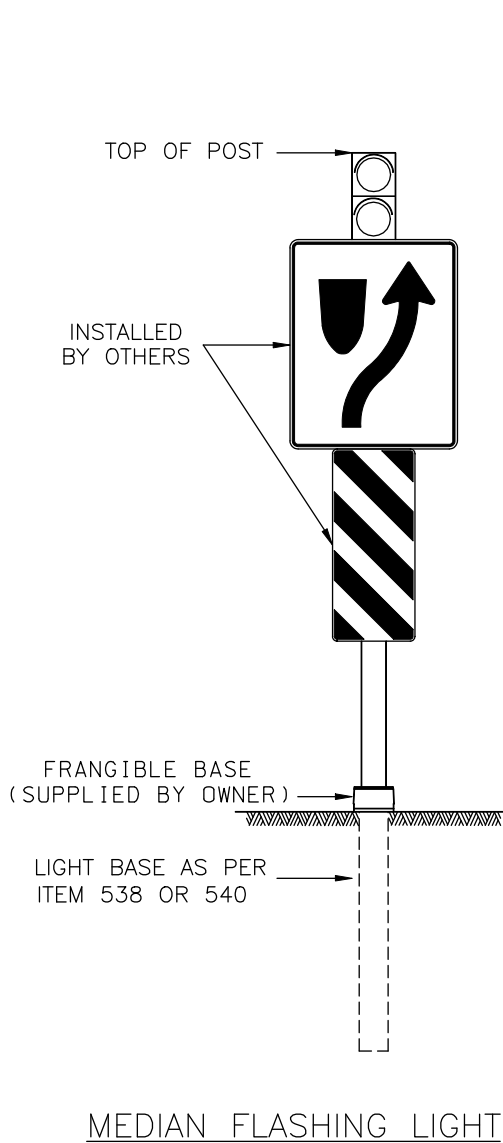


MATERIAL FOR A
9.1m AND 10.7m LIGHT STANDARD

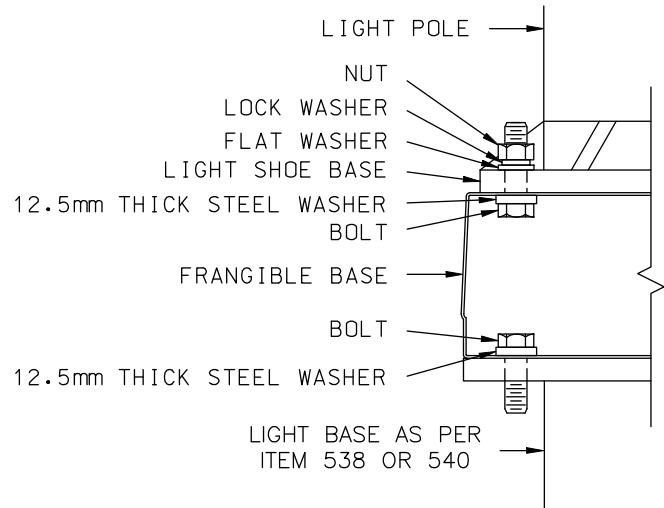


MATERIAL FOR A
12.2m AND 13.7m LIGHT STANDARD

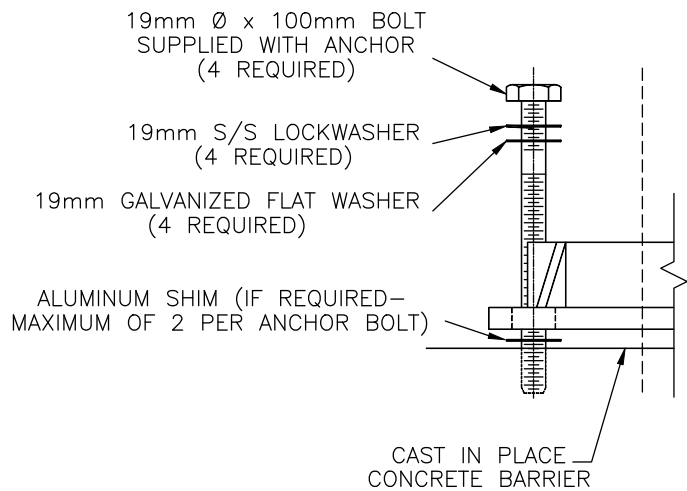
Light Standard Anchor Details



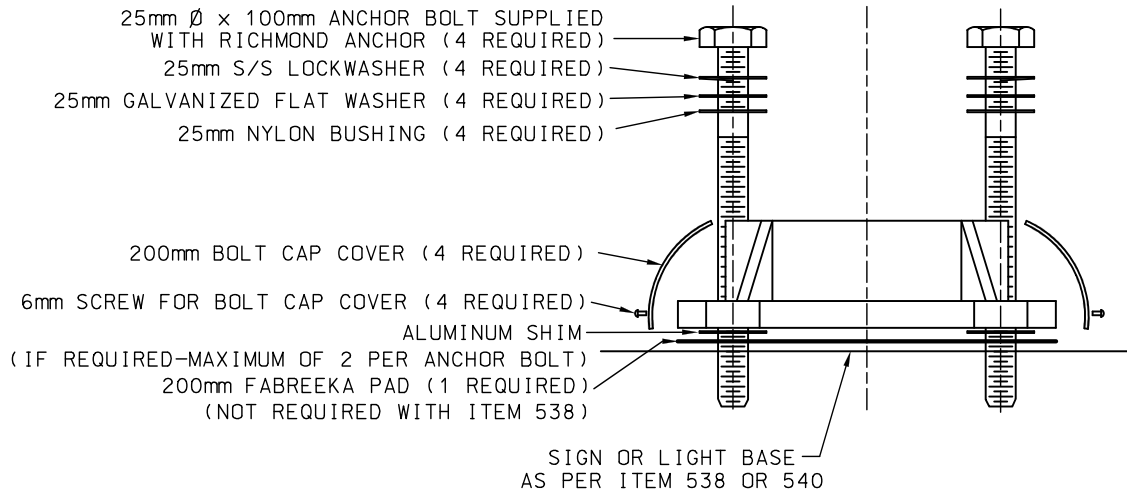
LIGHT BASE



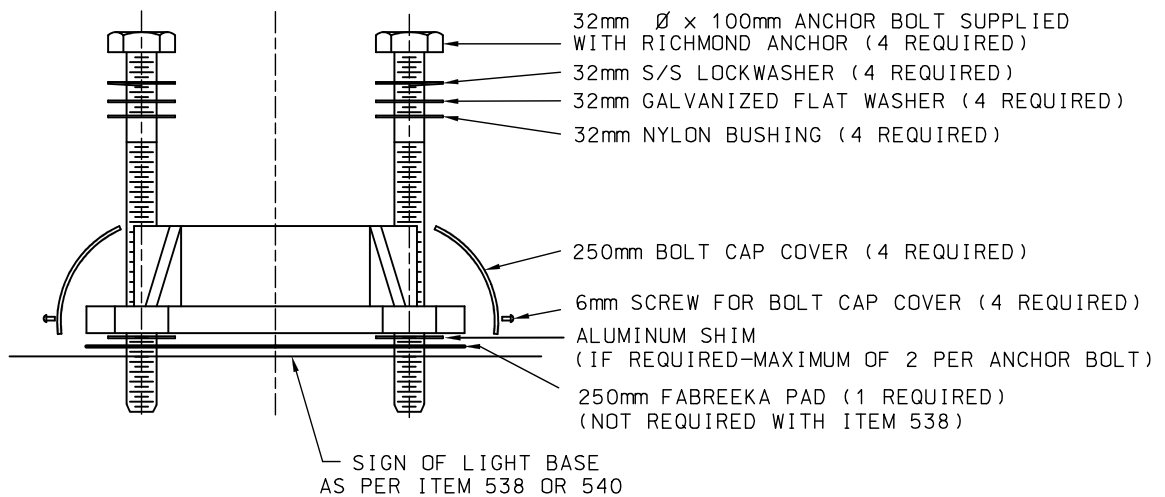
MEDIAN BARRIER



Median Flashing Light Details

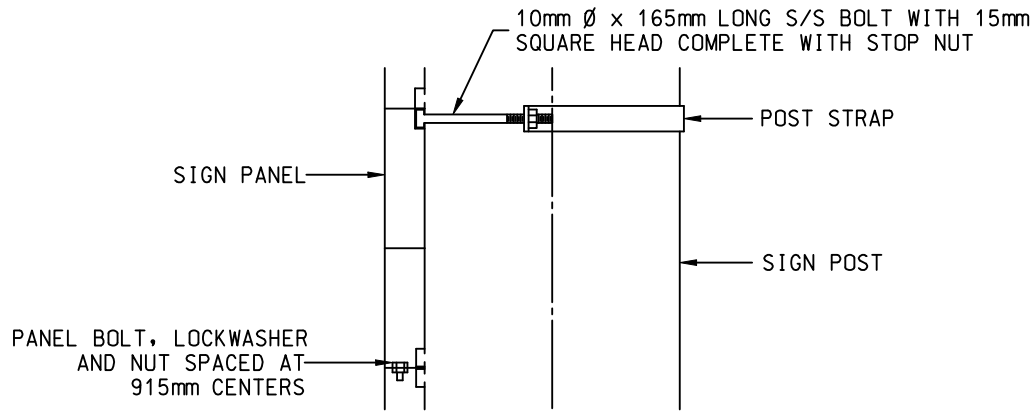


MATERIAL FOR A
200mm ALUMINUM SIGN POST

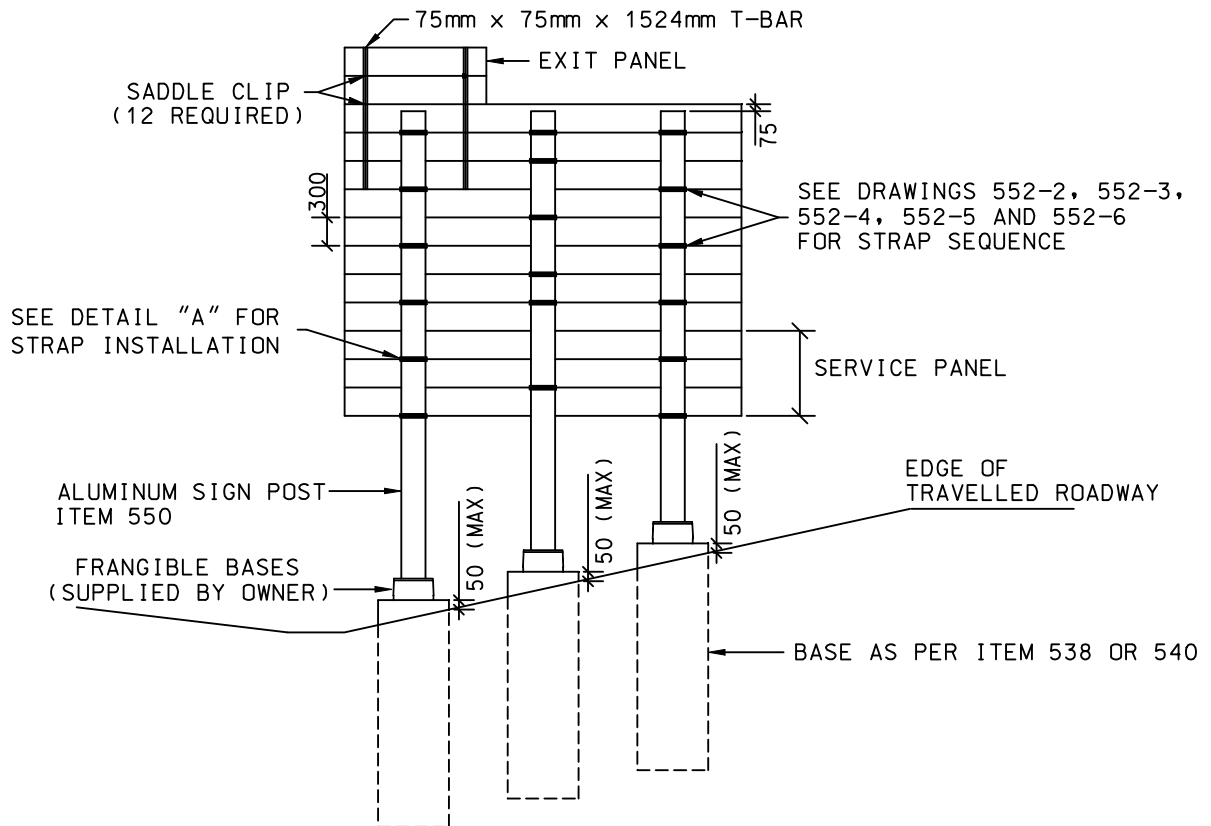


MATERIAL FOR A
250mm ALUMINUM SIGN POST

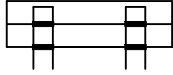
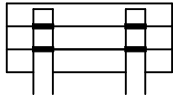
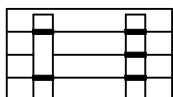

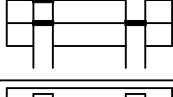
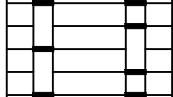

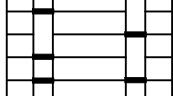

Roadside Sign Post Anchor Details



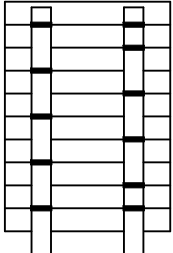
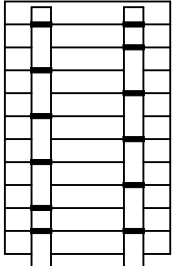
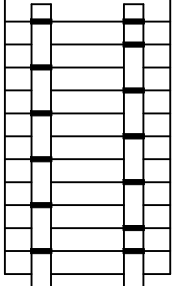
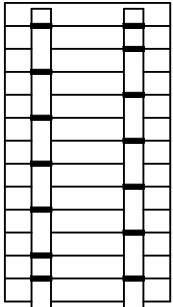
DETAIL "A"



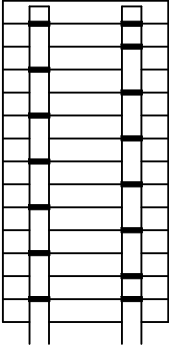
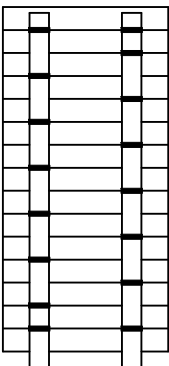
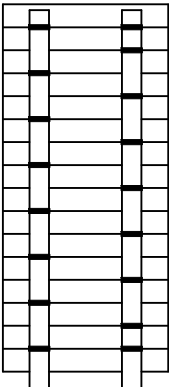
Roadside Sign Details

Number of Sign Panels	Number of Straps on First Post	Number of Straps on Second Post	Strap Sequence for Two-Post Signs	Strap Sequence for Third and Fourth Post
2	2	2		<p>Regardless of the number of panels, the strap sequence of the third post shall be the same as that of the first post and the strap sequence of the fourth post shall be the same as that of the second post.</p>
3	2	2		
4	3	2		
5	3	3		
6	4	3		
7	4	4		
8	5	4		
9	5	5		
				

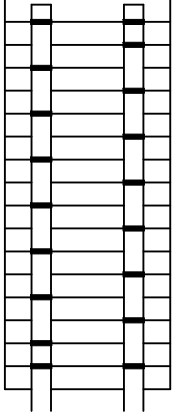
Roadside Sign Strap Sequence

Number of Sign Panels	Number of Straps on First Post	Number of Straps on Second Post	Strap Sequence for Two-Post Signs	Strap Sequence for Third and Fourth Post
10	6	5		<p>Regardless of the number of panels, the strap sequence of the third post shall be the same as that of the first post and the strap sequence of the fourth post shall be the same as that of the second post.</p>
11	6	6		
12	7	6		
13	7	7		

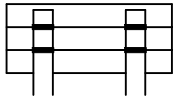
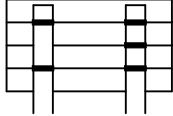
Roadside Sign Strap Sequence

Number of Sign Panels	Number of Straps on First Post	Number of Straps on Second Post	Strap Sequence for Two-Post Signs	Strap Sequence for Third and Fourth Post
14	8	7		
15	8	8		<p>Regardless of the number of panels, the strap sequence of the third post shall be the same as that of the first post and the strap sequence of the fourth post shall be the same as that of the second post.</p>
16	9	8		

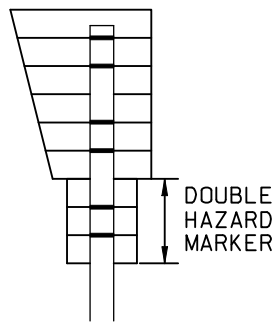
Roadside Sign Strap Sequence

Number of Sign Panels	Number of Straps on First Post	Number of Straps on Second Post	Strap Sequence for Two-Post Signs	Strap Sequence for Third and Fourth Post
17	9	9		<p>Regardless of the number of panels, the strap sequence of the third post shall be the same as that of the first post and the strap sequence of the fourth post shall be the same as that of the second post.</p>

Roadside Sign Strap Sequence

Number of Sign Panels	Number of Straps on First Post	Number of Straps on Second Post	Strap Sequence for Two-Post Signs	Strap Sequence for Third and Fourth Post
3	2	2		Regardless of the number of panels, the strap sequence of the third post shall be the same as that of the first post and the strap sequence of the fourth post shall be the same as that of the second post.
4	3	2		

ROADSIDE SIGN SERVICE PANEL STRAP SEQUENCE

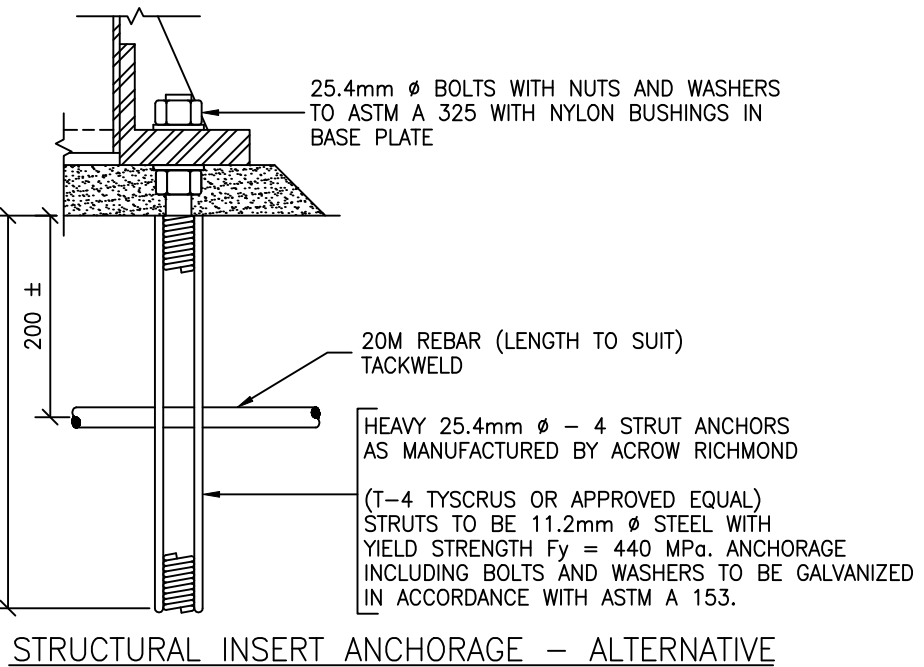
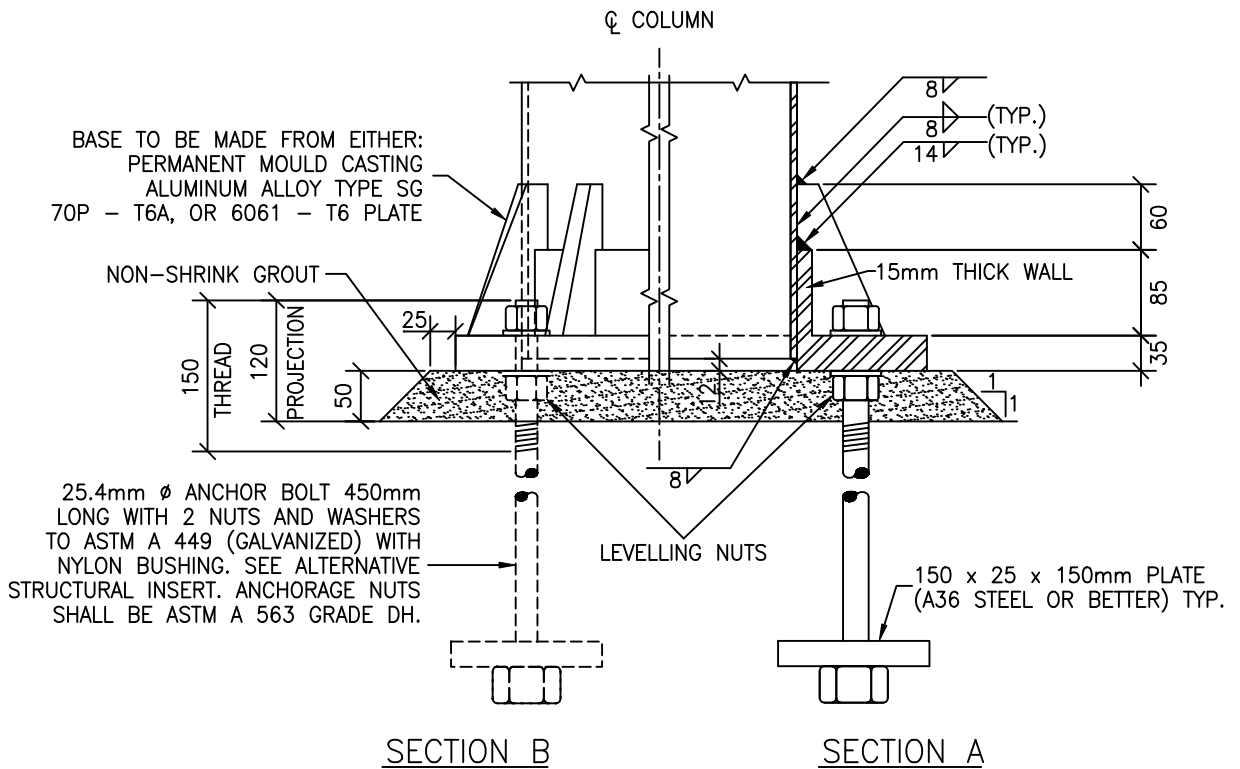


NOTE:

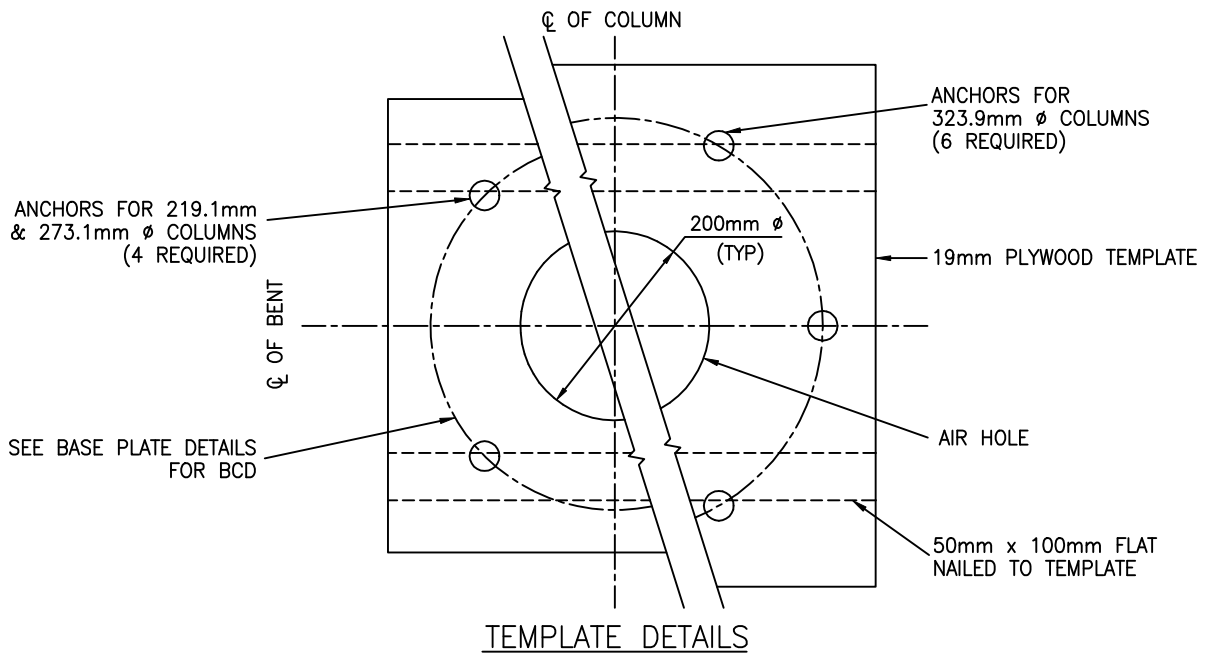
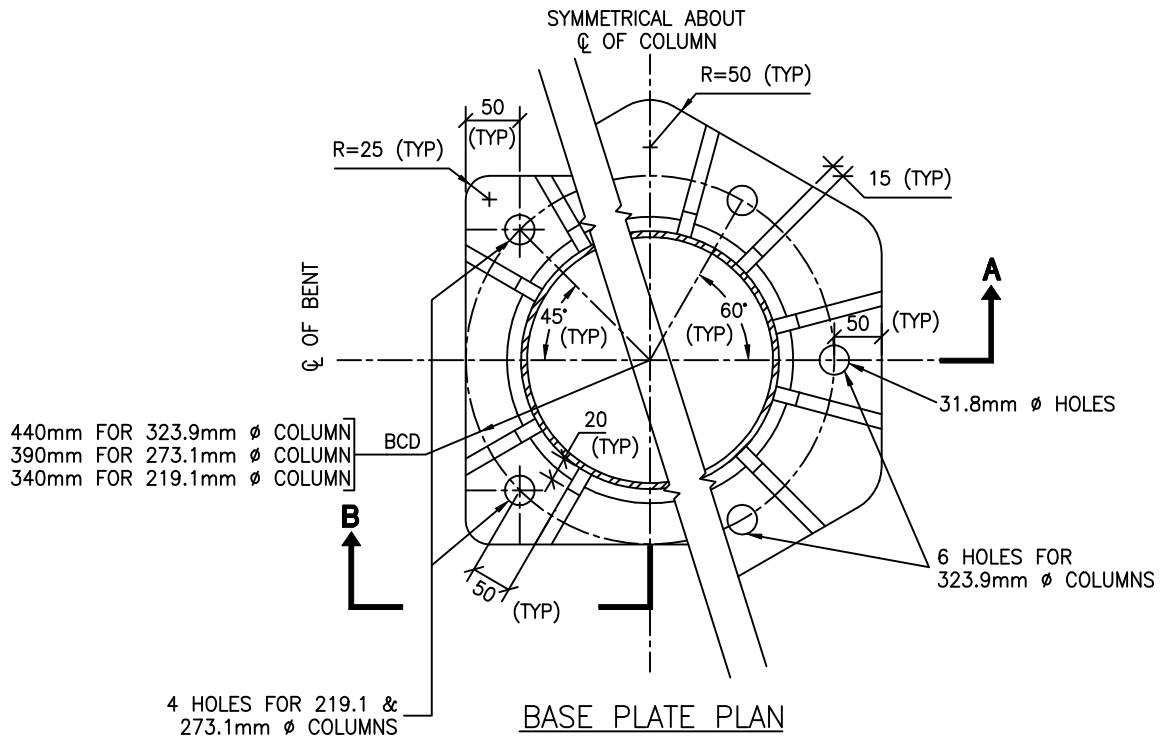
OTHER THAN THE GORE EXIT SIGN, ALL SIGNS INSTALLED ON SINGLE POSTS SHALL FOLLOW THE STRAP INSTALLATION OF THE FIRST POST FOR THE SPECIFIED NUMBER OF SIGN PANELS INSTALLED.

GORE EXIT SIGN STRAP SEQUENCE (SINGLE POST)

Roadside Sign Strap Sequence



Overhead Sign Structure Foundation
Anchorage Details



**Overhead Sign Structure Foundation
Base Plate and Template Details**

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NUMBER OF PAGES</u>
601	Geotextile	2
602	Sediment Control Fence	2
603	Filter Screen	2
604	Jute Mats	1
605	Erosion Control Structure	3
606	Removal of Erosion Control Structure	2
607	Gabions	2
608	Random Riprap	3
609	Rock Weir	1
610	Armour Stone Protection	2
611	Individual Rock Placement	1
612	Gravel for Fish Habitat	2
613	Topsoil	2
614	Hydroseeding	4
615	Fertilizing	2
616	Mulching	2
617	Root Wads	1
618	Trees and Shrubs	2
620	Temporary Water Barrier	1
621	Temporary Water Control Works	3
622	Fish Rescue	2
623	Culvert Erosion Protection	1
630	Soil Reinforcement	2
631	Sodding	2
632	Hydraulic Ground Cover	4
633	Turf Reinforcement Mat	2
699	Standard Drawings:	
	602 - 1 Sediment Control Fence	
	604 - 1 Jute Mat Details	
	605 - 1 Type A - Spillway Structure for Sediment Pond	
	605 - 2 Type A - Spillway Structure Details	
	605 - 3 Type B - Erosion Control Structure for Ditches	
	605 - 4 Type B - Erosion Control Structure Details	
	605 - 5 Type C - Erosion Control Structure for Ditches	
	605 - 6 Type C - Erosion Control Structure Details	
	605 - 7 Type D - Erosion Control Structure for Ditches	
	607 - 1 Gabion Backfilling Details	
	609 - 1 Rock Weir Details	
	610 - 1 Armour Stone Protection System Details	
	617 - 1 Root Wad Detail in Pool	
	621 - 1 Temporary Working Pad	
	623 - 1 End Treatment for Culverts ≤ 1500mm ID – Roadway Foreslope 3:1 or Steeper	
	623 - 2 End Treatment for Culverts ≤ 1500mm ID – Roadway Foreslope Flatter Than 3:1	

601.1 DESCRIPTION

- .1 This Item consists of the supply and installation of geotextile.

601.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The plastic yarn of the geotextile and the threads used in sewing operations shall consist of a long chain synthetic polymer composed of at least 85% by mass of propylene, ethylene, ester, amide or vinylidene-chloride, and shall contain stabilizers or inhibitors added to the base plastic to make the filaments resistant to deterioration by ultraviolet and heat exposure.
- .3 Type N1, N2, N3 and N4 geotextile shall be a pervious sheet of non-woven plastic yarn.
- .4 Type W1, W2 and W3 geotextile shall be a sheet of woven plastic yarn.
- .5 The geotextile shall conform to the requirements as indicated in Table 601-1.
- .6 The material shall be handled and protected as per the manufacturer's instructions and recommendations until incorporated into the Work.
- .7 Thread for the seams shall be equal to or better than the geotextile in resistance to chemical and biological degradation and both factory and field sewn or sealed seams shall have a grab tensile strength equal to 90% of that of the geotextile.

601.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the Work, a mill certificate for the geotextile to be supplied.
- .2 The Contractor shall submit, upon request, the manufacturer's recommended procedures for installation and instructions for handling of the selected geotextile.

601.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The areas to be covered with geotextile shall be prepared by shaping the ground to present a uniform and regular surface free from bumps and depressions.
 - .1 Geotextile shall not be placed on stumps, brush, limbs, ice or other material that may tear or puncture the fabric.
 - .2 The geotextile shall be placed so as to create a surface that is smooth and free of tension stress, folds, wrinkles and creases.

Table 601-1
Requirements Of Non-Woven And Woven Geotextiles

Property (Note 1)	Unit	ASTM	Type Of Fabric						
			N1	N2	N3	N4	W1	W2	W3
Tearing Strength (Trapezoid Method)	N	D4533	160	250	310	500	200	500	625
Grab Tensile Strength (Both Directions)	N	D4632	400	600	790	1200	400	1200	1500
Elongation At Break	%	D4632	50	50	50	50	25 max.	25 max.	25 max.
Apparent Opening Size	µm	D4751	50 to 250	50 to 250	50 to 250	50 to 250	840 max.	Note 2	Note 2
UV Degradation	% Ret.	D4355					70 min	Note 2	Note 2
Permittivity	Sec ⁻¹	D4491	1.75 to 3.50	1.25 to 2.75	1.00 to 2.50	1.00 to 2.50	0.01 min.	Note 2	Note 2
Thickness	mm								

NOTES: 1) Values above the heavy line are Minimum Average Roll Values (MARV) and unless otherwise noted, values are minimum requirements.
2) Special requirement defined in the Contract Documents.

601.4 .3 The manufacturer's installation procedures shall be the standard of installation that shall be applied except as follows:

- .1 Where more than one width of fabric is used, the fabric shall be joined by sewing or by an overlap of at least 500 mm and all overlap joints shall be securely held in place.
- .4 For Roadbed construction, at least 300 mm of fill material shall be kept between Equipment and fabric.
 - .1 In no case shall Equipment travel on uncovered fabric.
- .5 The Contractor shall immediately repair damaged geotextile.
 - .1 The damaged area shall be covered with a patch of the same fabric type extending a minimum of one metre beyond the perimeter of the damaged area.

601.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of area covered with geotextile in accordance with this Item.
- .2 Overlapped joints, patches and seams shall be measured as a single layer of fabric.

601.6 BASIS FOR PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of geotextile, as identified under the Contract.

SEDIMENT CONTROL FENCE

ITEM: 602

602.1 DESCRIPTION

- .1 This Item consists of the supply, installation, maintenance and removal of a sediment control fence.

602.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The fence may be prefabricated or constructed on site from the specified individual components.
- .3 The fabric shall conform to the requirements of 601.2, Type W1, geotextile.
- .4 Support posts are to be supplied as indicated on Standard Drawing 602-1.

602.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

602.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall install additional sediment control fence as directed by the Contractor's on-site environmental representative, as defined in 948.2, when necessary to comply with Item 948, as well as applicable permits and regulations.
- .3 The sediment control fence shall be installed as indicated on the Standard Drawing 602-1 and prefabricated sediment control fence shall be installed as per the manufacturer's instructions.
 - .1 In areas of potential sheet flow runoff where construction activity may cause the drainage run-off to transport sediment(s), and the Contract Documents do not provide for sediment control fences in these areas, the Contractor shall ensure that sediment control fences are properly located for effective runoff control.
- .4 The Contractor shall maintain the sediment control fence in a functional condition continuously from the time of installation until the completion of the Contract or removal.
- .5 The Contractor shall inspect all sediment control fences after each rainfall and at least daily during periods of prolonged rainfall.
- .6 The Contractor shall immediately repair any damage to sediment control fences or parts thereof.
- .7 The Contractor shall remove retained sediment prior to it having accumulated to a level approximately but not exceeding one-half the height of the fence, and this sediment shall be disposed of at a location at least 30 m away from any watercourse, and in such a manner that the sediment will not be returned to the Work Area or the watercourse;
 - .1 Subject to the approval of the Engineer, the Contractor may install a second, back-up sediment control fence, at his/her own expense.

SEDIMENT CONTROL FENCE

ITEM: 602

602.4 .8 The Contractor shall remove all sediment control fence and the time of such removal shall be subject to the Engineer's approval but in all cases shall occur prior to the completion of the Contract.

.1 Sediment control fence removed shall become the property of the Contractor and shall be disposed of outside the Work Site.

.2 If the Engineer notifies the Contractor in writing, prior to the completion of the Contract, that all or any part of the sediment control fence is to remain in place, the Contractor shall be deemed to have completed her/his obligations for that portion of the sediment control fence under this Item and the sediment control fence shall become the property of the Owner.

.9 At the time of removal, the Contractor shall excavate any remaining sediment and dispose of it at a location at least 30 m from any watercourse, and in such a manner that the sediment will not be returned to the Work Area or the watercourse and shall dress and seed the area of the removed fence and sedimentation, to the satisfaction of the Engineer.

602.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the number of linear metres of sediment control fence supplied, installed, maintained and removed in accordance with this Item.

602.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall be at the Unit Price.

603.1 DESCRIPTION

- .1 This Item consists of the design, supply, installation, maintenance and removal of a filter screen.

603.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The filter screen shall utilize, as a minimum requirement, geotextile meeting the requirements of 601.2, Type N4.
- .3 The material shall be handled and protected as per the manufacturer's instructions and recommendations until incorporated into the Work.

603.3 SUBMITTALS

- .1 The Contractor shall submit a detailed design in accordance with Item 956.
 - .1 The purpose of the filter screen is to provide an effective barrier to sediment (silt and other fine particulate matter) from migration off site and is to be constructed in such a manner so as to be effective over the entire water depth.
 - .2 The barrier must be able to withstand all natural forces and the predictable weather conditions specific to the site where installed.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

603.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall construct the filter screen as per the design submitted under 603.3.1.
- .3 The portion of the geotextile located along the bottom of the watercourse shall be held in place in such a manner that water cannot pass between the bottom line of the geotextile and the bed of the watercourse.
- .4 The geotextile is to form a continuous sheet and the seams are to be constructed with materials and in a manner that conforms with the manufacturer's instructions.
- .5 The Contractor shall maintain the filter screen in a functional manner throughout the period applicable.
- .6 The Contractor shall remove from the watercourse all materials and associated Structures or related items, pertaining to the filter screen, following notification to and approval from the Engineer.

603.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of linear metres of filter screen designed, supplied, installed, maintained and removed in accordance with this Item.

603.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

JUTE MATS

ITEM: 604

604.1 DESCRIPTION

- .1 This Item consists of the supply and installation of jute mats as a ditch liner.

604.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Jute mats shall be made of unbleached, loosely twisted jute yarn 3 to 5 mm in diameter, woven to mesh openings of approximately 20 mm.
- .3 Mats shall be a minimum of 1.2 m in width and shall have an average unit shipping weight of 500 g/m².
- .4 Staples shall have the approximate dimensions as indicated on Standard Drawing 604-1.

604.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's certification that the materials being supplied meet the specified requirements.
- .2 The Contractor shall submit the manufacturer's recommended procedures for installation of the materials.
- .3 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

604.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Jute Mats shall be installed as indicated on Standard Drawing 604-1 and in accordance with the manufacturer's procedures.
- .3 Jute mats shall be installed along the full length of all CE ditches and all topsoiled ditches the same day as removal of erosion structures, after final shaping of the ditches, and prior to hydroseeding.
- .4 Staples shall be driven perpendicular to the ground in an approved pattern and finished flush with the ground, such that the mats are secured in uniform contact with the ground.

604.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of jute mats supplied and installed in accordance with this Item.
- .2 Overlapped joints, patches and seams shall be measured as a single layer.

604.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

605.1 DESCRIPTION

- .1 This Item consists of the supply, construction and maintenance of an erosion control structure.

605.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Geotextile shall be supplied in accordance with the requirements of 601.2, Type N1.
- .3 Random riprap shall be supplied in accordance with the requirements of 608.2 and may consist of rock from the Work Site.
- .4 Fill material shall be obtained from within the limits of the excavation and shall be of a gradation capable of forming an impermeable dike when compacted, unless otherwise directed by the Engineer.

605.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

605.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall install additional erosion control structures as directed by the Contractor's on-site environmental representative, as defined in 948.2 when necessary to comply with Item 948, as well as applicable permits and regulations.
- .3 Erosion control structures shall be constructed, to the dimensions as indicated on Standard Drawings 605-1 through 605-7.
- .4 Erosion control structures may be installed in natural swales prior to ditch construction, in temporary or partially constructed ditches, and/or in completed ditches.
 - .1 In areas of potential sheet flow runoff where construction activity may cause the drainage run-off to transport sediment, and the Contract Documents do not provide for erosion control structures in these areas, the Contractor shall ensure that erosion control structures are properly located for effective runoff control.
- .5 The Contractor shall carry out the Work in accordance with Item 946 and Item 948.
- .6 The application, construction details and clean-out requirements for the different types of erosion control structures shall be carried out as indicated in Table 605-1 and 605.4.7.

Table 605-1
Erosion Control Structures

Type	Application	Construction Details	Clean-Out Requirements
"A"	Type A structures shall be installed as spillways of dykes that are built to pond runoff from ditches or from grubbed areas, or at the end of a cut where runoff leaves the ditch to flow down a natural slope.	Standard Drawings 605-1 and 605-2	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point within 300 mm of the crest of the spillway.
"B"	Type B structures are typically installed in rock ditches where stakes required for Type C and D structures cannot be driven.	Standard Drawings 605-3 and 605-4	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point within 100 mm of the crest of the notch.
"C"	Type C structures are typically installed in earth ditches or swales.	Standard Drawings 605-5 and 605-6	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point within 100 mm of the crest of the notch.
"D"	Type D structures are typically installed in earth ditches or swales.	Standard Drawing 605-7	The Contractor shall remove the sediment deposits prior to the level of sedimentation reaching a point within 100 mm of the crest of the notch.

- 605.4 .7 Clean-out consists of removal of sediment deposits retained by the structure and disposal of the removed materials in accordance with 605.4.11.
- .1 Sediment removal shall be performed so as to cause minimal disturbance to the ground or any part of the erosion control structure, and in the case of Type A structures, to the sediment pond dyke.
 - .8 The Contractor shall maintain erosion control structure(s) in a functional condition from the time of installation until their removal.
 - .1 All erosion control structures shall be kept in place until the grass on hydroseeded slopes and ditches is established as an effective erosion deterrent, or as directed by the Engineer.
 - .1 In Work Areas that are hydroseeded up to but no later than September 15th, erosion control structures Types B, C, and D shall be kept in place until the day on which the ground is prepared for hydroseeding, as approved by the Engineer.
 - .2 All erosion control structures(s) shall be removed under Item 606.
 - .9 The Contractor shall inspect all erosion control structure(s) prior, during and after each rainfall and at least daily during periods of prolonged rainfall.
 - .10 The Contractor shall immediately repair any damage to erosion control structure(s) or parts thereof.

EROSION CONTROL STRUCTURE

ITEM: 605

- 605.4 .11 The Contractor shall dispose of the excavated sediment at a location, at least 30 m away from any watercourse, and in such a manner that the sediment will not be returned to the Work Area or watercourse.
- .12 The Contractor shall not remove any erosion control structure without the authorization of the Engineer.

605.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of erosion control structure(s) that are supplied, constructed and maintained in accordance with this Item.
- .2 The Quantity to be measured for payment for clean-out of retained sediment deposits will be the number of such clean-outs performed in accordance with 605.4.6 as approved by the Engineer.

605.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of erosion control structure, as identified under the Contract.
- .2 Payment for Work under this Item shall include a separate Unit Price for the clean-out of each type of erosion control structure, as identified under the Contract.

REMOVAL OF EROSION CONTROL STRUCTURE

ITEM: 606

606.1 DESCRIPTION

- .1 This Item consists of the removal of an erosion control structure.

606.2 MATERIALS

- .1 None identified.

606.3 SUBMITTALS

- .1 None identified.

606.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Scheduling of the removal of the erosion control structures shall be subject to the approval of the Engineer.
 - .1 Erosion control structures removed shall become the property of the Contractor and shall be disposed of outside the Work Site.
 - .2 If the Engineer notifies the Contractor in writing, prior to the completion of the Contract, that all or any of the erosion control structure(s) are to remain in place, the Contractor shall be deemed to have completed his/her obligations for that portion of the Work under this Item and the erosion control structure(s) indicated shall become the property of the Owner.
- .3 At the time of removal, the Contractor shall excavate any remaining sediment and dispose of it at a location at least 30 m from any watercourse, and in such a manner that the sediment will not be returned to the Work Area or the watercourse.
- .4 The Contractor is to ensure that all possible care is taken to ensure that ground disturbance is maintained at a minimum during the erosion control structure removal operation and that all necessary precaution is taken to ensure that no sediment release occurs as a result of this removal activity.
- .5 The Contractor shall be responsible to match the affected ditches and Slopes with the Slopes and ditch grades of the adjacent Work Area(s).
- .6 The Contractor shall restore the area of the removed erosion control structure, deposited sedimentation and other disturbed ground within the Work Area, in accordance with Items 614 and/or 616, and to the satisfaction of the Engineer within 48 hours following the removal of the erosion control structure.

REMOVAL OF EROSION CONTROL STRUCTURE

ITEM: 606

606.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of erosion control structure(s) removed in accordance with this Item.

606.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of erosion control structure, as identified under the Contract.

GABIONS

ITEM: 607

607.1 DESCRIPTION

- .1 This Item consists of the supply and installation of gabion baskets fabricated from wire mesh and filled with rock.

607.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Gabion baskets shall be fabricated of galvanized wire mesh.
 - .1 Fasteners to secure the baskets shall be supplied in a material compatible with the material type and properties of the basket.
- .3 Rocks used in the construction of gabions shall be clean, hard, sound and durable, with the least dimension of any rock equal to or greater than one and one-half times the mesh size, and shall not exceed 300 mm in greatest dimension.
 - .1 Rock used for basket fill material, when tested by Los Angeles Abrasion test method in accordance with ASTM C131 and/or C535, shall have an abrasion loss not greater than 40%.
 - .2 Rocks shall be of a size that at least two layers of overlapping rock are required to fill the gabion.
- .4 Geotextile shall be supplied in accordance with the requirements of 601.2, Type N1.
- .5 Gabion baskets shall conform to the following minimum standards:
 - .1 Factory fabricated so that the sides, ends, lid and internal diaphragms can be readily assembled at the Work Area into rectangular baskets of the sizes indicated in the Contract Documents.
 - .2 When the length exceeds horizontal width, diaphragms of the same mesh as the gabion basket walls shall be used to divide the basket into equal cells of a length not in excess of the horizontal width.
 - .3 Wire mesh shall be a uniform regular pattern, with a maximum nominal opening size of 80 by 100 mm, and fabricated to be non-ravelling.
 - .4 Selvedge edges of the mesh shall be securely fastened together so that the joints, which are formed, are as strong as the body of the mesh.
 - .5 Hot dip galvanized wire shall have a minimum coverage of 260 g/m² and shall conform to ASTM Tests: A641, A90, and A764.
 - .6 Wire shall be dimensioned, as a minimum, as indicated in Table 607-1.
- .6 The Contractor shall supply free draining backfill behind the gabion Structure in accordance with 366.2.

**Table 607-1
 Minimum Twisted Galvanized Wire Dimensions**

Application	Diameter
Mesh	2.95 mm
Selvedges	3.80 mm
Binding	2.20 mm
Interlocking Wire Fasteners	3.17 mm

GABIONS

ITEM: 607

607.3 SUBMITTALS

- .1 The Contractor shall submit, in advance of the Work, a mill certificate for the gabion materials to be supplied.
- .2 The Contractor shall submit, upon request, the manufacturer's recommended procedures for installation and instructions for handling of the selected gabion.
- .3 The Contractor shall notify the Engineer, in writing, for approval of the source of supply of rock, at least 14 Days in advance of obtaining material from the source proposed.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

607.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall prepare the area to receive the gabions in accordance with 161.4 and the Contract Documents.
- .3 The Contractor shall place the gabions on a prepared rock and/or compacted soil foundation grade and shall assemble the gabions according to the manufacturer's instructions and recommendations.
- .4 The gabion baskets in any row shall be filled in stages to minimize void spaces and so that local deformations are avoided.
- .5 The rock for the exposed rock face(s) of the gabion basket shall be hand placed to ensure proper alignment and a neat, compact, square appearance.
- .6 Bulges in the gabions shall not exceed 40 mm at the most extreme point measured in any cell.
- .7 The geotextile shall be placed in accordance with 601.4.
- .8 The Contractor shall backfill the areas behind gabion Structure in accordance with 366.4 and to the lines indicated on the Standard Drawing 607-1.

607.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the volume in cubic metres of gabions, supplied and installed in accordance with this Item.

607.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

RANDOM RIPRAP

ITEM: 608

608.1 DESCRIPTION

- .1 This Item consists of supply and placing of random riprap.

608.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Random riprap materials shall be a well-graded mixture and shall conform to the grading limits shown in Table 608-1.
- .3 Random riprap for each rock shall have both thickness and breadth greater than or equal to one-third of its length.
- .4 Random riprap shall consist of clean, hard, sound, durable rock, having a density of not less than 2.6 t/m³ and angular surfaces such that the rocks interlock when placed.
 - .1 Rock when tested by the Micro-Deval test method in accordance with MTO LS - 618, shall have a Micro-Deval loss not greater than 35%.
 - .2 Rock when tested by the Freeze/Thaw test method in accordance with MTO LS - 614, shall have a Freeze/Thaw loss not greater than 15%.
- .5 Random riprap used for Backslope stabilization or in erosion control structures may have a Micro-Deval loss not greater than 70% and a Freeze/Thaw loss not greater than 30%.
- .6 Acceptability of the rock will be determined by the Owner's service records and/or by laboratory and/or field testing procedures carried out by qualified personnel.

608.2 .7 Random Riprap Mixed

- .1 Random riprap mixed shall be noted in the Contract Documents as R-# mixed and shall consist of a random riprap material of the designated size (R-#) thoroughly mixed with a pitrun gravel subbase which shall conform to the requirements of 201.2.
 - .1 Finely shattered rock which conforms to the requirements of 608.2.4, 608.2.4.1, and 608.2.4.2 may be substituted for gravel, subject to the approval of the Engineer.
- .2 The Contractor shall produce a consistent mixed homogeneous blended supply of the specified mixture mixed at the proportion of approximately 20% by weight to the random riprap material indicated, to form a very dense material.

608.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, for approval of the source of supply of rock or gravel/finely shattered rock materials, at least 14 Days in advance of obtaining material from the proposed source.

Table 608 - 1
Random Riprap Grading Limits

Mass	Size (Note 1)	Finer by Mass (%)								
		R-A (Note 2)	R-5	R-25	R-50	R-100	R-250	R-500	R-1000	R-2000
(kg)	(mm)									
6000	1600									100
4000	1400									70 - 90
3000	1300								100	
2000	1100								70 - 90	40 - 55
1500	1000							100		
1000	900							70 - 90	40 - 55	
750	820						100			
500	710						70 - 90	40 - 55		
300	600					100				
250	570						40 - 55			
200	530					70 - 90				0 - 15
150	480				100					
100	420				70 - 90	40 - 55			0 - 15	
75	380			100						
50	330			70 - 90	40 - 55			0 - 15		
25	260			40 - 55			0 - 15			
15	220	100	100							
10	190		70 - 90			0 - 15				
5	150		40 - 55		0 - 15					
2.5	120	0		0 - 15						
0.5	70		0 - 15							
Thickness (mm) (Note 3)		300	300	500	600	800	1100	1400	1600	2200
NOTES: 1) Approximate diameter (for information only) 2) Random riprap for abutment and slope protection 3) Measured perpendicular to the prepared surface										

RANDOM RIPRAP

ITEM: 608

608.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall clear the Work Area of all driftwood, debris, snow, ice, and other objectionable materials.
- .3 Control of the gradation shall be by visual examination.
 - .1 Differences in opinion between the Engineer and the Contractor shall be resolved by testing in accordance with ASTM D5519.
 - .2 The Contractor shall provide the Equipment, a sorting site and the labour required to undertake the testing required.
- .4 The Contractor shall place random riprap material such that the underlying materials and any abutting Structures are not damaged.
 - .1 The Contractor shall be responsible, at his/her own expense to repair any such damage to the Work.
- .5 The Contractor shall tamp random riprap mixed during placement.

608.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tonnes of random riprap supplied and placed in accordance with this Item.

608.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each gradation of random riprap, as identified under the Contract.
- .2 Cost of the provision of materials, labour and Equipment to test the random riprap to resolve disagreement between the Owner and the Contractor shall be borne by the Contractor if the test results show that the material does not meet the specified gradation, otherwise the Owner shall bear the cost of the test.
 - .1 Cost of any retesting to resolve the supply of the specified material gradation shall be borne by the Contractor.

ROCK WEIR

ITEM: 609

609.1 DESCRIPTION

- .1 This Item consists of the supply and installation of a Rock Weir.

609.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Individual rocks shall have approximate dimensions as indicated on Standard Drawing 609-1.
 - .1 Rocks shall be clean, hard, sound and durable and shall meet the following test requirements:
 - .1 Micro-Deval loss not greater than 35% (MTO LS618).
 - .2 Freeze-Thaw loss not greater than 25% (MTO LS614).
 - .2 Rocks with visible planes of weakness and/or marked deterioration by water or weather will not be accepted.
- .3 Random Riprap R-50 Mixed shall conform to Item 608.2.

609.3 SUBMITTALS

- .1 The Contractor shall submit upon request to the Engineer for approval of the source of supply of rock, at least 14 Days in advance of obtaining material from the source proposed.
- .2 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

609.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Rock Weirs shall be constructed in accordance with Standard Drawing 609-1.

609.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of Rock Weirs constructed in accordance with this Item.

609.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

ARMOUR STONE PROTECTION

ITEM: 610

610.1 DESCRIPTION

- .1 This Item consists of supply and placing of the armour stone protection system.

610.2 MATERIALS

- .1 All materials shall be supplied by the Contractor for both armour stone and filter blanket, in the specified size range by mass of individual rock or gradation limit, as indicated in the Contract Documents.
- .2 The armour stone protection shall be rock that is clean hard, sound, durable, resistant to weathering and degradation in water, free of Overburden, spoil, shale and organic material and having a density of not less than 2.6 t/m³.
 - .1 The rock, when tested by the Micro-Deval test method in accordance with MTO LS - 618, shall have a Micro-Deval loss not greater than 35%.
 - .2 When tested by the Freeze/Thaw test method in accordance with MTO LS - 614, the rock material shall have a Freeze/Thaw loss not greater than 15%.
- .3 Individual rock shall be angular and each rock shall have both thickness and breadth greater than or equal to one-half of its length.
- .4 Rock with visible planes of weakness and/or subject to marked deterioration by water or weather will not be accepted.
- .5 The acceptability of the rock shall be determined by the Owner's service records and/or by laboratory and/or field testing procedures carried out by qualified personnel.
- .6 The approval of some rock fragments does not convey the Engineer's approval of all rock fragments to be obtained at that quarry.

610.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, for approval of the source of supply of rock, at least 14 Days in advance of obtaining material from the source proposed.

610.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall place armour stone protection system (comprised of the composite of armour stone and filter blanket material) as indicated in the Contract Documents and/or in accordance with the Standard Drawing 610-1.
- .3 The Contractor shall verify the existing grades and shall notify the Engineer if reshaping is required.
- .4 The Contractor shall maintain the grades and Slopes of the underlying material to ensure that the Work Area is cleared of all driftwood, debris, snow, ice and all other objectionable materials in the area of the Work.

ARMOUR STONE PROTECTION

ITEM: 610

- 610.4.4 .1 The armour stone protection shall be placed in conjunction with the construction of the embankment, so that the embankment is fully protected as soon after placement as practical.
- .5 Control of the gradation shall be by visual examination.
- .1 Any difference in opinion between the Engineer and the Contractor shall be resolved by testing in accordance with ASTM D5519.
- .2 The Contractor shall provide the Equipment, a sorting site and the labour required to undertake the testing required.
- .6 The Contractor shall place the armour stone protection such that the underlying materials and any abutting Structures are not damaged.
- .1 The Contractor shall be responsible at his/her own expense to repair any such damage to the Work.
- .7 Armour stone protection shall be placed such that each rock is stable, secure and supported by rocks below and the placement shall be controlled to ensure that a uniform and continuous cover results.
- .1 The Contractor shall ensure that during placement the larger rocks shall be dispersed throughout the entire armour stone protection mass.
- .2 The Contractor shall place the individual rock in such a manner that the whole structure shall be bound and consolidated to as great an extent as the nature of the rock will allow.
- .8 No pushing or dumping of armour stone protection shall be permitted during placement.
- .9 The Contractor shall be responsible for any Work or materials required to repair damage which is a result of water level variations, waves or weather conditions.

610.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tonnes of the armour stone protection system supplied and placed in accordance with this Item.

610.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item include a separate Unit Price for each armour stone protection system, as identified under the Contract.
- .2 The cost of the provision of materials, labour and Equipment to test the armour stone protection to resolve disagreement between the Owner and the Contractor shall be borne by the Contractor if the test results show that the material does not meet the specified gradation, otherwise the Owner shall bear the cost of the test.
- .1 The cost of any retesting to resolve the supply of the specified material gradation shall be borne by the Contractor.

INDIVIDUAL ROCK PLACEMENT

ITEM: 611

611.1 DESCRIPTION

- .1 This Item consists of the supply and placing of individual rocks.

611.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
 - .1 The rocks may be made available from the Work Site at the location(s) of their origin or production.
 - .2 The material shall be rocks that are hard, sound, durable, resistant to weathering and degradation in water and free of deleterious materials.
 - .3 Individual rocks shall be typically 600 mm \pm 100 mm long and shall have both the thickness and breadth greater than or equal to one-half of their length.

611.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, for approval, of the source(s) of supply, prior to the supplying of any material from the source(s) identified.

611.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall ensure that the placement of individual rocks does not disturb the underlying or surrounding material.

611.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of individual rocks placed in accordance with this Item.

611.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

612.1 DESCRIPTION

- .1 This Item consists of the supply and placement of gravel for fish habitat.

612.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Gravel for fish habitat shall consist of a well graded granular material composed of clean, uncoated particles free of clay, silt or other deleterious materials when tested in accordance with ASTM C136 it shall conform to the gradation limits presented in Table 612-1.

Table 612-1
Gradation Limits for Gravel for Fish Habitat

ASTM Sieve Size	Percent Passing
125 mm	100
100 mm	85 - 90
50 mm	60 - 75
16 mm	20 - 45
9.5 mm	15 - 35
1.18 mm	0 - 3

- .3 Gravel for fish habitat shall show a Micro-Deval loss of not greater than 35%, when tested in accordance with MTO LS - 618.
- .4 Gravel from the existing streambed may be used in the Work, if identified in the Contract Documents as being available.

612.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, for approval of the source of gravel, at least 14 Days in advance of obtaining material from the source proposed.
- .2 The Contractor shall submit verification that the material meets the specified requirements prior to the commencement of the Work.

612.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

GRAVEL FOR FISH HABITAT

ITEM: 612

612.4 .2 The Contractor shall adhere to the following construction practices, as a minimum standard, when conducting salvage of existing streambed materials:

- .1 Streambed material shall only be taken from areas of the existing watercourse which are being abandoned and are identified in the Contract Documents.
- .2 All salvage activity shall occur in the dry and in areas separated from the existing stream flow by environmentally accepted and approved techniques.
- .3 The Contractor shall be responsible for the salvage area and shall leave the salvage area in a clean, neat and environmentally acceptable condition.

612.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of tonnes of gravel for fish habitat supplied and placed in accordance with this Item.

612.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

613.1 DESCRIPTION

- .1 This Item consists of the placement of topsoil, either available on site or including the supply from an off site source, and/or the supply and application of a soil amendment.

613.2 MATERIALS

- .1 Topsoil shall be material salvaged and stockpiled under Item 106 and 107.
 - .1 If additional material is required beyond that available on the Work Site, the Contractor shall obtain that material from outside the Work Site.
- .2 Topsoil composition shall consist of 20 to 70% sand and contain 2 to 10% organic matter by weight.
- .3 Topsoil shall be free of debris and stones larger than 75 mm in greatest dimension and large clods, roots and any other coarse vegetative material, of a size equal to or greater than the thickness of the layer of topsoil to be placed.
 - .1 In areas of lawn restoration, topsoil shall be free of debris and stones larger than 25 mm in greatest dimension.
- .4 All soil amendment materials shall be supplied by the Contractor.
 - .1 Accepted soil amendment products are shown in Table 613-1. Alternatives must be approved by the Engineer.

**Table 613-1
Soil Amendment Products**

Manufacturer	Product
ECB Verdyol	Biotic Earth (Black)
Profile Products LLC	ProGanics Biotic Soil Media

- .2 Soil stabilizing tackifier shall be supplied by the Contractor in accordance with the manufacturers recommendations.

613.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer of the source(s) of topsoil to be obtained from outside the Work Site, at least 7 Days prior to importing material from off site.
- .2 The Contractor shall submit the manufacturer's recommended procedures for application of soil amendment, at least 7 Days in advance of the commencement of the Work.

613.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Areas to be topsoiled shall be scarified or otherwise loosened to a depth of at least 50 mm within 1 Day preceding the placement of topsoil.

- 613.4 .3 Soil amendment shall be applied in the locations identified in the Contract Documents.
- .1 Areas requiring soil amendment will not require topsoil.
 - .2 Application rate shall be a minimum of 5600 kg/ha.
 - .3 Soil amendment shall be applied in accordance with the manufacturers recommendations.
- .4 Topsoil and soil amendment placement in the Work Area shall be completed prior to the placement of any Roadbed materials above Subgrade, unless otherwise approved by the Engineer.
- .5 Topsoil shall be spread on the prepared area(s) to a depth of 100 mm \pm 25 mm and shall be brought to a true and even surface meeting the required grade.
- .1 Hand placement and raking shall be required in areas adjacent to finished lawns or in areas of restricted access.
 - .2 In areas of lawn restoration, topsoil shall be rolled using a lawn roller or approved equivalent.
 - .3 Topsoil shall be placed on Foreslopes from Subgrade shoulder down in cuts and fills, including the slopes of the layer of Borrow A/A1- quality material as identified in the Contract Documents; and on Backslopes or as directed by the Engineer.
- .6 Placing of topsoil and soil amendment shall not be carried out on frozen materials or when materials are wetted to such a degree that balling and clumping results.
- .7 Topsoil and soil amendment shall not be placed after the end of the week in which September 30th occurs without prior approval of the Engineer.
- .8 Topsoil that is contained within the Work Site that can be or has been salvaged shall be used prior to importing topsoil.
- .1 The Contractor shall incorporate imported topsoil into the Work only after receiving written authorization from the Engineer.
- .9 If excess topsoil material exists after completion of the Work, this material shall remain the property of the Owner.

613.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of topsoil and/or soil amendment placed in accordance with this Item.
- .2 The area shall be measured along the slope of the ground.

613.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for topsoil and soil amendment, as identified under the Contract.

HYDROSEEDING

ITEM: 614

614.1 DESCRIPTION

- .1 This Item consists of supply and application of hydroseeding on Foreslopes, Backslopes, ditches and other prepared areas.
- .2 Hydroseeding shall be identified by the following mix designations:
 - .1 Roadside Mix with Mulch per 616.4 - Hydroseeding "B"
 - .2 Municipal Mix with Mulch per 616.4 - Hydroseeding "BM"

614.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Seed mix shall be as indicated in Table 614-1, except that for lawns and other areas identified by the Engineer, the seed mix shall be as indicated in Table 614-2.
 - .1 Additional alternatives to the municipal seed mix may be approved by the Engineer.
 - .2 The seed mixes for Tables 614-1 and 614-2 shall meet or exceed the requirements of the Canada Seeds Act for Canada No. 1 Ground Cover Mixture and Canada No. 1 Lawn Grass Mixture, respectively.

**Table 614-1
Composition of Roadside Mix**

Species	Seed Mix % By Mass
Creeping Red Fescue	40
Hard Fescue	20
Canada Bluegrass	15
Alsike or White Clover	5
Annual Ryegrass	15
Red Top	5

**Table 614-2
Composition of Municipal Mix**

Species	Seed Mix % By Mass	
	Alternative 1	Alternative 2
Kentucky Bluegrass	50	40
Creeping Red Fescue (Turf Type)	30	40
Annual Ryegrass	20	20

HYDROSEEDING

ITEM: 614

- 614.2 .3 Fertilizer shall be a 15-25-15 (N-P-K) mix for seeding done May 1st to Labour Day and 10-20-20 (N-P-K) thereafter.
- .4 Bags of seed and fertilizer shall be labelled, identifying mass (kg), mix components and percentages, date of bagging and supplier's name.
- .1 Bags of seed shall also be marked with lot number.
- .5 Seed and fertilizer shall be kept dry and protected from direct sunlight and other detrimental conditions.
- .1 Seed and fertilizer that have been subjected to moisture shall not be used.
- .6 Binder may be supplied in liquid, flake or powder form.
- .7 Water shall be free of any impurities which would inhibit germination of the seed.
- .8 Hydraulic mulch for hydroseeding as specified in Table 614-3 shall be a product made primarily for use in hydroseeding, and shall consist of shredded wood fibres, shredded newsprint coloured green with an environmentally acceptable dye, or shredded straw mixed with raw cotton fibres and/or shredded newsprint.
- .1 Hydraulic mulch shall form a homogeneous slurry when agitated or mixed in water with the other specified materials and shall contain no growth-inhibiting chemicals or compounds.
- .9 When applied, the hydroseeding mix shall be capable of forming an absorptive mat, which will allow moisture to percolate into the underlying soil.

614.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's and/or supplier's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.
- .2 The Contractor shall submit, upon request, a Certificate of Analysis for the seed mix identifying the component species and percentages, including weed and inert material content. This submission shall include the location(s) where the lot(s) of seed to be used on the Contract may be sampled by the Engineer.
- .3 The Contractor shall submit the proposed binder application rate in conjunction with 614.3.1.

614.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Areas to be hydroseeded shall be free of ruts, ridges and deleterious materials such as weeds, sticks, roots and large rocks which would impede growth of the seed mix and mowing.
- .1 Stones greater than 75 mm in the least dimension shall be removed and disposed of outside the Work Area.

HYDROSEEDING

ITEM: 614

- 614.4 .3 Final shaping of Slopes and other exposed earth surfaces shall be done in areas of cut and fill, as portions of the Work are completed, to enable hydroseeding to be done in stages in accordance with Item 946.
- .4 The Contractor shall ensure all such areas are prepared to a loosened condition to a minimum depth of 25 mm no sooner than 2 Days prior to hydroseeding.
 - .1 Hydroseeding will not be permitted on hardened, crusted or rutted soil.
- .5 Hydraulic mulch, seed, fertilizer and binder shall be thoroughly mixed with water in a hydroseeding tank capable of continually agitating the mixture during the hydroseeding operation to ensure that a homogeneous slurry is produced.

614.4 .6 Application Rates

- .1 Application rates shall be as shown in Table 614-3 and may vary by $\pm 15\%$, depending on ground conditions.
- .2 Binder is required with both the hydroseeding and mulching operations of Hydroseeding B and BM.
- .3 Hydroseeding B includes mulching applied after hydroseed, in accordance with 616.2.

Table 614-3
Application Rates for Hydroseed

Type of Material	"B" (kg/ha)	"BM" (kg/ha)
Seed	125	200
Fertilizer	375	375
Hydraulic Mulch: All	500	500
Binder (tackifier): Application rate per manufacturer's specifications.		
Mulch: Hay/straw bales/rolls/processed straw	Per 616.4	Straw only per 616.4

614.4 .7 Timing of Application

- .1 Hydroseeding shall be carried out in all cases within 2 Days after completion of the surface preparation, as defined by 614.4.4.
 - .1 The Engineer shall approve and pre-measure all areas to be hydroseeded, in advance of the commencement of the hydroseeding of any area.
 - .2 The Engineer shall be notified at least 24 hours in advance of the application of the hydroseeding.
- .2 Hydroseeding should not be performed during windy conditions or periods of rainfall.
- .3 Hydroseeding done between May 1st and Labour Day must produce a satisfactory growth over at least 95% of the area hydroseeded in the growing season of that year.
 - .1 Areas of poor or no growth shall be reseeded as determined by the Engineer.
- .4 After Labour Day, and up to the end of the week in which September 30th occurs, only Hydroseed B (BM), incorporating a 10-20-20 fertilizer mix as per 614.2.3 shall be used.

HYDROSEEDING

ITEM: 614

- 614.4.7.4
- .1 The hay/straw mulching operation, which forms part of Hydroseed B (BM), shall be carried out within 48 hours of the hydroseeding operation in accordance with 616.4.
 - .2 Growth will be based on the performance during the next growing season as per the conditions of 614.4.7.3.
 - .5 No hydroseeding shall be carried out after the week of September 30th without the prior approval of the Engineer.
 - .6 The Contractor shall take all reasonable care to prevent overspray onto Structures, signs, and all other installations and, where such overspray occurs, the Contractor shall remove it by a method approved by the Engineer.
- .1 Where overspray comes in contact with the foliage of any trees, shrubs or other susceptible vegetation, the Contractor shall immediately spray the affected vegetation with water to remove such overspray.

614.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the area in square metres of hydroseeding supplied and applied in accordance with this Item.
- .2 The area shall be measured along the slope of the ground.

614.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of hydroseeding, as identified under the Contract.

615.1 DESCRIPTION

- .1 This Item consists of supplying and applying fertilizer.

615.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Fertilizer shall have a composition of 20-10-10 (N-P-K) with 50% of the nitrogen being derived from sulphur-coated urea and/or polymer-coated urea.
- .3 Hydraulic mulch shall be shredded wood fibres or shredded newsprint coloured green with an environmentally acceptable dye.
 - .1 Hydraulic mulch shall contain no growth-inhibiting chemicals or compounds.
 - .2 Hydraulic mulch material shall form a homogeneous slurry when agitated or mixed in water with the other specified materials.
- .4 Water shall be free of any impurities which would inhibit the effect of the fertilizer.

615.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's and/or supplier's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.
- .2 The Contractor shall submit the proposed proportioning of the ingredients and coverage per tankful for the selected Equipment to be employed in the Work and in conjunction with 615.3.1.

615.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Application shall be by hydroseeding methods and no direct access to the areas with Equipment will be permitted.
- .3 Fertilizing shall be carried out between mid-April and Victoria Day.
 - .1 The Engineer shall be notified at least 24 hours in advance of the application of the fertilizer.
- .4 The Contractor shall not perform the Work under adverse field conditions.
- .5 Hydraulic mulch, at the rate of 150 kg/ha, shall be mixed with water in the fertilizer tank.
- .6 Fertilizer, at the rate of 250 kg/ha, shall be introduced immediately prior to spraying, with agitation sufficient to distribute the mix uniformly in the tank.
- .7 Application rates shall not vary by more than 15%.

FERTILIZING**ITEM: 615**

615.4 .8 The Contractor shall take all reasonable care to prevent overspray onto Structures, signs, and all other installations and, where such overspray occurs, the Contractor shall remove it by a method approved by the Engineer.

.1 Where overspray comes in contact with the foliage of any trees, shrubs or other susceptible vegetation, the Contractor shall immediately spray the affected vegetation with water to remove such overspray.

615.5 MEASUREMENT FOR PAYMENT

.1 The Quantity to be measured for payment shall be the area in square metres of fertilizer supplied and applied in accordance with this Item.

.2 Areas shall be measured along the slope of the ground.

615.6 BASIS OF PAYMENT

.1 Payment for Work under this Item shall be at the Unit Price.

MULCHING

ITEM: 616

616.1 DESCRIPTION

- .1 This Item consists of the supply and application of mulch on exposed ground.

616.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Mulch shall be hay or straw and supplied in either of the following forms:
 - .1 Unprocessed form such as bales or rolls, free of noxious weeds and other undesirable material, and not so wet, decayed or compacted so as to inhibit even and uniform spreading; or
 - .2 Approved equivalent.
- .3 When applied the mulch shall form an absorptive mat, which will allow moisture to percolate into the underlying soil.
- .4 Binder must be capable of joining together the mulch particles to secure the mulch to the ground and shall remain effective for 60 Days from the time of application.
- .5 Binder shall not form an impervious seal which would prevent the penetration of moisture to the underlying soil.
- .6 Binder may be supplied in liquid, flake or powder form.
- .7 Water shall be contaminant-free and obtained from a source approved by the appropriate regulatory agency.

616.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's and/or supplier's certification that the materials supplied meet the specified requirements as detailed in the Contract Documents.

616.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall apply additional mulch as directed by the Contractor's on-site environmental representative, as defined in 948.2, when necessary to comply with Item 948, as well as applicable permits and regulations
- .3 Mulch shall be applied with binder at the manufacturer's recommended application rate.

MULCHING

ITEM: 616

616.4 .4 Approved unprocessed hay or straw mulch shall be spread evenly and uniformly at a rate of 4500 kg/ha \pm 15%.

- .1 Lumps and thick clumps of mulch shall be broken apart and dispersed.
- .2 Binder shall be mixed in a solution of water with sufficient green dye or green-coloured wood-fibre or paper mulch and sprayed uniformly over the mulched ground.
- .3 Binder application shall be completed within 48 hours after the unprocessed hay or straw has been placed.
- .5 The Contractor shall maintain the mulched areas until mulch is no longer required during the Contract period.
 - .1 The Contractor shall apply additional mulch as required, to restore the area(s) exposed after the initial application of mulch.
- .6 The Contractor shall take all reasonable care to prevent overspray onto Structures, signs, and all other installations and, where such overspray occurs, the Contractor shall remove it by a method approved by the Engineer.
- .7 Ditches carried out in accordance with 116.4, and areas requiring the hand placement of mulch may, subject to the approval of the Engineer, be placed without binder.

616.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the area in square metres of mulch supplied and applied in accordance with this Item.
- .2 Areas shall be measured along the slope of the ground.

616.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

ROOT WADS

ITEM: 617

617.1 DESCRIPTION

- .1 This Item consists of the supply and installation of root wads.

617.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 The trees to be used as root wads, and header and footer logs shall be deciduous trees and native to the Work Site.
 - .1 Trees may be salvaged on-site from areas being cleared to be used as root wads or header and footer logs, as directed by the Engineer.
- .3 The trees to be used for root wads shall be 300 to 400 mm in diameter at 1.3 m above the ground and shall be removed from the ground complete with roots, such that the intact root mass is at least 1 m in diameter. The trees shall be cut to a length of 5 m above the roots as indicated in the Contract Documents.
- .4 The trees shall be of sound wood and free of decay, breakage or other damage.
- .5 Reinforcing steel used to secure the header and footer logs shall be 15M rebar.
- .6 Header and footer logs shall be a minimum of 300 mm in diameter and have a minimum length of 2 m.

617.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, for approval of the source of supply of material, at least 14 Days in advance of obtaining material from the proposed source.

617.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The root wads shall be embedded into the side of the outlet pool facing the flow, as shown in Standard Drawing 617-1 or as directed by the Engineer.
- .3 Header and footer logs shall be installed horizontally and anchored using 15M rebar, as shown in Standard Drawing 617-1.
- .4 The tree root mass shall be washed and free of soil prior to installation.

617.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of root wads supplied and installed in accordance with this Item.

617.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

TREES AND SHRUBS

ITEM: 618

618.1 DESCRIPTION

- .1 This Item consists of the supply, planting and maintenance of trees and shrubs.

618.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Trees and shrubs shall be of the species indicated below or as indicated in the Contract Documents:
 - .1 Trees shall be White Ash, Hybrid Poplar and/or Yellow Birch.
 - .2 Shrubs shall be Speckled Alder and/or Red Osier Dogwood.
- .3 Trees and shrubs shall be free of disease, insects, defects or injuries and shall be structurally sound with a strong fibrous root system.
- .4 Plants, if supplied from the vicinity of the Work Site, shall have adequate root systems, in excess of 750 mm for trees and 450 mm for shrubs.
- .5 Nursery stock shall have a root ball at least 200 mm in diameter including the roots and surrounding soil.
- .6 Topsoil shall meet the requirements of 613.2.
- .7 Stakes for supporting trees shall be steel T-bar, 32 x 32 x 5 mm, or wood, 38 x 38 mm, each a minimum of 2130 mm long.
- .8 Trees shall be tied to stakes using trunk collars which neither pinch nor are abrasive to the tree trunks.

618.3 SUBMITTALS

- .1 The Contractor shall notify the Engineer, in writing, for approval of the source of supply of material, at least 14 Days in advance of obtaining material from the source proposed.

618.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 Roots of the trees and shrubs shall be kept moist until planting by the use of wet burlap bags or other approved means.
- .3 Excavation for planting shall be to a depth of 150 mm below and around the root system or root ball.
- .4 Each tree and shrub shall be placed on a bedding of topsoil of 150 mm loose thickness, and topsoil shall be placed around the root system in 150 mm lifts, tamped to eliminate voids.

TREES AND SHRUBS

ITEM: 618

- 618.4 .5 When two-thirds backfilled, the planting hole shall be filled with water. After the water has penetrated into soil, the remaining depth of hole shall be backfilled to finish grade.
- .6 A berm shall be built around the rim of the hole and the plant watered again.
- .7 Trees large enough to require staking shall be staked and tied at the time of planting, as approved by the Engineer.
- .8 The Contractor shall be responsible to water each plant daily for at least two weeks after planting and as necessary thereafter, so as to maintain soil moisture conditions required for plant growth without causing erosion of the surrounding berm.
- .9 The Contractor shall guarantee the trees and shrubs for both the year of planting and the following growing season, and shall replace at his cost all trees and shrubs not sustaining growth within the warranty period, except those damaged by vandalism or flooding or other natural disasters.

618.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment will be the number of trees and shrubs supplied, planted and maintained in accordance with this Item.

618.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of tree or shrub, as identified under the Contract.
- .2 Holdback in the amount of 20% of the value of the Work under this Item will be held until the expiration of the warranty period or until released by the Engineer, whichever is the least time.

TEMPORARY WATER BARRIER

ITEM: 620

620.1 DESCRIPTION

- .1 This Item consists of the supply, installation, maintenance and removal of a temporary water barrier.

620.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Plastic liners shall be clear polyethylene a minimum of 6 mils thick, and shall meet the requirements of CGSB 51.34.

620.3 SUBMITTALS

- .1 The Contractor shall submit for approval, at least 14 Days prior to starting Work under this Item, plans and details of the proposed temporary water barrier.

620.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall maintain the temporary water barrier in a functional condition continuously throughout the period of use.
- .3 The Contractor shall inspect and document the temporary water barrier after each rainfall and at least daily during periods of prolonged rainfall.
- .4 The Contractor shall immediately repair any damage to the temporary water barrier or parts thereof.
- .5 When the temporary barrier is no longer required, the Contractor shall remove from the watercourse all materials pertaining to the temporary water barrier.
 - .1 Temporary water barrier located within the limits of an embankment to be constructed may be left in place and incorporated into the final embankment as approved by the Engineer.

620.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment will be the number of linear metres of temporary water barrier supplied, installed, maintained and removed in accordance with this Item.

620.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

TEMPORARY WATER CONTROL WORKS

ITEM: 621

621.1 DESCRIPTION

- .1 This Item consists of the design, supply, construction, operation, maintenance and removal of temporary water control works, herein after called "TWCW".
- .2 This Item applies to Culverts with a nominal inside diameter (ID) greater than 1200 mm, unless otherwise indicated in the Contract Documents.

621.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Supply of materials shall include sediment control fence per 602.2 that is additional to such fence shown on the Plans and fence directed to be installed by the Engineer, and required solely as part of the TWCW.
- .3 Materials for Temporary Working Pads for Work access in wetlands shall be supplied per Standard Drawing 621-1.

621.3 SUBMITTALS

- .1 Two copies of design drawings and design calculations for the TWCW, stamped and signed by a Professional Engineer, shall be submitted a minimum of 14 Days before commencing Work.
- .2 The design of each TWCW plan shall include, but are not limited to:
 - .1 The flow capacity of the TWCW;
 - .2 The proposed method, description and drawings of the TWCW designed to accommodate or exceed the minimum specified flow capacity of the TWCW;
 - .3 The proposed method of monitoring stream flows and weather forecasts at the Work Area to anticipate stream flow increases; and
 - .4 A precautionary Work Area clean-up procedure and mitigation measures to be implemented in advance of any stream flow increase anticipated to exceed the flow capacity of the TWCW, or when directed by the Engineer.

621.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
 - .1 The Contractor shall not weld or attach any part of the TWCW to an existing structure without the written approval of the Engineer.
- .2 The following information is provided on the drawings for each watercourse crossing:
 - .1 Drainage Area
Time of Concentration
Runoff Coefficient
Design Flow (Q100)
Minimum Specified Flow Capacity

TEMPORARY WATER CONTROL WORKS

ITEM: 621

- 621.4.2 .2 The Contractor shall consider these factors in designing a TWCW plan which balances cost of installation with the risk of delay due to weather events. The submitted plan must detail the measures taken to minimize damage to the site and the environment in the event that flows exceed the design capacity of the TWCW.
- .3 Notwithstanding the above the Contractor must provide TWCWs which accommodate the minimum specified flow to satisfy the commitments to the regulatory agencies necessary to obtain the required permits.
- .3 The TWCW shall separate the Work Area from the flow of the watercourse, and shall keep the Work Area dry. The TWCW shall also control the introduction of sediment and debris from the Work Area to the flow of the watercourse.
- .4 The Contractor is responsible for control and/or removal of any water entering the Work Area due to infiltration. Methods to remove infiltrated water may include the construction of sumps and pumping.
- .1 If pumping is used as the method of temporary water control through the Work Area, the Contractor shall supply and maintain, ready on site, a second pumping system capable of accommodating the flow capacity of the TWCW.
- .1 The second pumping system shall include, but not limited to, pumps and backup power supply.
- .5 The Contractor shall inspect the TWCW after each rainfall and at least daily during periods of prolonged rainfall.
- .6 The Contractor shall monitor and ensure that the TWCW operate in a functional condition continuously throughout the entire period of use, including evenings and weekends, and shall repair any damage to the TWCW or parts thereof.
- .1 Failure to maintain a properly functioning TWCW or properly implement the TWCW plan, as identified by the Engineer or a representative of DFO or DELG, shall result in penalties per 621.6.2.
- .2 This penalty will not apply during periods of flow exceeding the flow capacity provided the TWCW plan was followed and the Contractor submits documentation, such as actual flow (m³/sec) measurements that verifies that flows exceeded the flow capacity of the TWCW.
- .7 The Work under this Item shall include installation, replacement and maintenance of additional sediment control fence as described in 621.2.2.
- .8 When TWCW is no longer required, the Contractor shall remove from the watercourse all materials pertaining to the TWCW.
- .1 Any parts of the TWCW within the limits of an embankment and/or fill to be constructed under the Contract may be left in place and incorporated into the final embankment as approved by the Engineer.

621.5 MEASUREMENT FOR PAYMENT

- .1 The design, supply, placement, maintenance, operation and removal of Temporary Water Control Works (TWCW) in accordance with this Item shall be paid for on a Lump Sum basis.

621.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 The Contractor shall be subject to a penalty of \$1000 per Day for each Day that the TWCW are not functioning properly per 621.4.6.1.

FISH RESCUE

ITEM: 622

622.1 DESCRIPTION

- .1 This Item consists of rescuing and salvaging fish from natural watercourses and/or temporary stream diversions where construction activities or compromised habitat conditions pose a risk of death or injury to the fish.
- .2 For the purpose of this Item the person(s) carrying out the fish rescue will be known as the biologist.

622.2 MATERIALS

- .1 None identified.

622.3 SUBMITTALS

- .1 The Contractor shall submit the biologist's fish rescue report within one week of receiving it from the biologist.

622.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall arrange to have the biologist at the Work Area at the time of any in-stream activities that pose a risk to fish.
- .3 The Contractor shall install the biologist's barrier nets or structures as directed by the biologist to prevent fish from migrating into the Work Area.
 - .1 Brush, logs and debris shall be removed from the Work Area as required so that cover that would obscure fish is reduced or eliminated.
 - .2 After completion of the Work in 622.4.3 and 622.4.3.1, stream flow may be cut off from the Work Area to facilitate capturing the fish.
- .4 All species of fish shall be captured from the Work Area and promptly placed alive in permanent water flows above or below the Work Area.
- .5 A fish rescue will be considered complete when deemed by the biologist.
- .6 After a fish rescue the biologist may leave his/her barrier nets in place if he/she deems that fish might re-enter the Work Area and there is no other suitable option to prevent fish from returning. The Contractor shall be responsible for the care of the nets and for replacement or repair of any lost or damaged nets.
- .7 For each fish rescue the biologist shall submit a written summary of the results to the Contractor within three weeks of completing the Work.
 - .1 The summary shall describe the efforts taken to isolate the Work Area, the species captured, the approximate numbers and sizes of each fish species salvaged and relocated.

622.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of fish rescues carried out in accordance with this Item.

622.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.
- .2 Payment will not be made for fish rescues other than those identified in the Sequence of Construction for each Culvert installation as shown on the Plans, or those pre-approved by the Engineer under an alternative sequence.

CULVERT EROSION PROTECTION

ITEM: 623

623.1 DESCRIPTION

- .1 This Item consists of the excavation for, and supply and installation of geotextile and random riprap for erosion protection of the ends of concrete Culverts.

623.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Geotextile shall be Type N2 meeting the requirements of 601.2.
- .3 Random riprap shall be Type R-25 meeting the requirements of 608.2.

623.3 SUBMITTALS

- .1 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

623.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Work shall be performed before stream flow is diverted into the culvert.
- .3 The Contractor shall excavate and shape the existing ground beyond each end of the Culvert, and excavate and shape the excess backfill and Roadbed embankment materials from the invert to the height, slope and width specified in Standard Drawings 623-1 and/or 623-2.
 - .1 Standard Drawing 623-1 applies where the Roadbed foreslope is 3:1 or steeper, and the slope of the riprap is the same as, and flush with, the Roadbed slope.
 - .2 Standard Drawing 623-2 applies where the Roadbed foreslope is flatter than 3:1, and the slope of the riprap is 2:1 with the end of the pipe recessed into the Roadbed slope.
- .4 After shaping per 623.4.3, the Contractor shall place geotextile per 601.4 on the prepared slopes, including the faces of the sides of the excavation. The geotextile shall be cut to fit closely around the Culvert perimeter.
- .5 The Contractor shall carefully place riprap in accordance with 608.4 on the prepared slope, and for Standard Drawing 623-2, in the outlet pool.

623.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of Culvert ends protected in accordance with this Item.

623.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

SOIL REINFORCEMENT

ITEM: 630

630.1 DESCRIPTION

- .1 This Item consists of the supply and installation of geogrid soil reinforcement.

630.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Soil reinforcement shall be geogrid manufactured from a polypropylene polymer.
 - .1 Soil reinforcement shall be a biaxial geogrid.
- .3 Soil reinforcement shall be Tensar BX1100 or Titan 1515, or an approved equivalent.

630.3 SUBMITTALS

- .1 The Contractor shall submit, at least 14 Days in advance of the Work, the name of the supplier, the product specifications and a mill certificate for the geogrid to be supplied.
- .2 The Contractor shall submit, before incorporating the material into the Work, the manufacturer's instructions for handling and recommended procedures for installing the selected geogrid.
- .3 The Contractor shall, upon request, make available at the Work Site a representative of the supplier to ensure that Work Area preparation and geogrid installation procedures are as recommended by the manufacturer.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

630.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The manufacturer's installation procedures shall be observed along with the following:
 - .1 Geogrid shall be oriented such that the roll length runs parallel to the Roadway centerline.
 - .2 Geogrid material shall be tensioned by hand. Overlaps and securing of outside edges shall be as recommended by the manufacturer.
 - .3 The Contractor shall ensure that geogrid sections do not separate at overlaps during construction as recommended by the manufacturer.
 - .4 Equipment shall not travel over unprotected geogrid or over backfilled geogrid with less than 150 mm of cover, which shall be placed the same Day as geogrid placement.
 - .5 The Contractor shall immediately repair damaged geogrid in accordance with the manufacturer's recommendations. All repaired sections shall meet the performance standard of the intact geogrid and shall be subject to the approval of the Engineer.

630.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of geogrid soil reinforcement supplied and installed in accordance with this Item.
- .2 Overlapped joints, patches and seams shall be measured as a single layer of soil reinforcement.

630.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

SODDING

ITEM: 631

631.1 DESCRIPTION

- .1 This Item consists of the supply and placement of sod.

631.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Sod shall be cut from living, thickly matted nursery turf which includes grass species that are dormant during cold or dry seasons and capable of renewing growth after the dormant period. Sod shall be relatively free of woody or other undesirable foreign plants, stones or roots.
- .3 Topsoil shall meet the requirements of 613.2.
- .4 Fertilizer shall be 6-12-12 composition, free flowing and uniform, having at least 50% of components derived from organic sources, and supplied in unopened, properly labelled, waterproof bags.

631.3 SUBMITTALS

- .1 The Contractor shall submit, for the Engineer's approval, the proposed sources of materials.
- .2 The Contractor shall submit, in advance of the Work, certification from the suppliers that the materials meet the specified requirements.
- .3 The Contractor shall submit the supplier's instructions for handling and installing the sod.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

631.4 CONSTRUCTION

- .1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 The Contractor shall deliver the sod to the site within 24 hours after being cut, and shall lay the sod within 24 hours after being delivered.
- .3 Sod shall be handled and protected in accordance with the supplier's instructions and recommendations until incorporated into the Work.
- .4 Topsoil shall be spread and shaped in accordance with 613.4.
- .5 Sod shall be laid as recommended by the supplier, ensuring close contact with the topsoil.
- .6 Immediately after placement, the sodded area shall be evenly fertilized at the manufacturer's recommended application rate, and watered sufficiently to obtain moisture penetration into the top 100 mm of topsoil.
 - .1 Watering shall continue daily for a week after placement or as otherwise required such that the roots have established into the topsoil.
- .7 Sodded areas shall be accepted by the Engineer if, at 30 Days after being placed, the sod exhibits healthy growth and is free of disease, insects, weeds, fungal organisms, and bare or dead spots.
- .8 Areas of unhealthy or dead sod shall be replaced at the Contractor's expense.

631.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of sod supplied and placed in accordance with this Item.

631.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Unit Price.

HYDRAULIC GROUND COVER

ITEM: 632

632.1 DESCRIPTION

- .1 This Item consists of the supply and application of a flexible reinforced matrix (FRM) and a hydroseeding mix, to comprise a hydraulic ground cover on slopes, ditches and other areas for erosion and sedimentation control.

632.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Flexible Reinforced Matrix (FRM)
 - .1 Approved FRMs for the Work are shown in Table 632-1.

**Table 632-1
Approved FRM Systems**

Manufacturer	Product
Profile Products	Flexterra (FGM)
Mat Inc.	Flex Guard (FRM)

- .3 Hydroseeding Mix
 - .1 The seed mix shall be in accordance with Table 614-1 and the requirements of the Canada Seeds Act for Canada No. 1 Ground Cover Mixture.
 - .2 Fertilizer shall be a 15-25-15 (N-P-K) mix for seeding done May 1st to Labour Day, and 10-20-20 (N-P-K) thereafter.
 - .3 Bags of seed and fertilizer shall be labelled with mass (kg), mix components and percentages, lot number, date of bagging and supplier's name.
 - .4 Seed and fertilizer shall be kept dry and away from direct sunlight and other detrimental conditions. Materials subjected to moisture will be rejected.

632.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's certification that supplied materials meet the requirements specified in the Contract Documents.
- .2 The Contractor shall submit, prior to the Work, the manufacturer's recommended procedures for application of the materials.
- .3 The Contractor shall submit, at least one week prior to the Work, the area of coverage anticipated for each tank load of FRM mix for the application rates indicated in Table 632-2 and/or Table 632-3.
- .4 For FRM applied into turf reinforcement mat (TRM), the Contractor shall submit prior to the Work, documentation from the FRM and TRM manufacturers that their products are compatible and guaranteed as a system for turf protection and erosion and sediment control.
- .5 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

632.4 CONSTRUCTION

.1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

.2 Ground Preparation

.1 The Contractor shall prepare the ground (or topsoiled surface) for application of FRM by removing all ruts, ridges and deleterious materials such as sticks, roots and stones that would impede growth of the seed mix and mowing.

.2 During or after the Work of 632.4.2.1, but no sooner than 2 Days before FRM application, the surface shall be loosened to a minimum depth of 25 mm, to ensure that FRM is not placed on hardened soil.

.3 Application Rates

.1 The FRM mix for application on bare ground shall be as shown in Table 632-2.

**Table 632-2
 Application Rates for FRM Mix on Bare Ground**

Application Rates (kg/ha)			
FRM	Seed	Fertilizer	Total Mix
4200	125	375	4700
Rates may vary by ±5%, depending on ground conditions			

.2 The FRM mix for application on TRM shall be as shown in Table 632-3, and the FRM shall be applied into and completely filling the mesh of the installed TRM.

**Table 632-3
 Application Rates for FRM Mix on TRM**

Application Rates (kg/ha)			
FRM	Seed	Fertilizer	Total Mix
3900	125	375	4400
Rates may vary by ±5%, depending on ground conditions			

.4 Areas of Application

- .1 The Work shall be performed at the locations as indicated in the Contract Documents.
- .2 The Engineer will pre-measure the limits of coverage of each tank load of mix based on estimated coverage per 632.3.3.

.5 Conditions for Application

- .1 The Contractor shall notify the Engineer at least 48 hours prior to any application of FRM.
- .2 FRM shall be applied within 2 Days after ground preparation per 632.4.2, and within 1 Day of placement of TRM per 632.4.3.2.
- .3 FRM shall not be applied during windy conditions or periods of rainfall, or on unprepared slopes or slopes that are leaching water.

632.4 .6 Application of FRM

- .1 Application of FRM shall be performed in accordance with the manufacturer's recommended procedures and as specified herein.
- .2 FRM shall be applied only on slopes and other areas that have been pre-approved per 632.4.2 and pre-measured per 632.4.4.2.
- .3 The applied FRM shall form a continuous blanket completely covering and in full contact with all exposed ground, with no voids or shadowing, including the top of slopes to ensure runoff from above the cut does not flow under the FRM.
- .4 FRM shall be built up in successive layers from opposite directions onto each measured area until the prescribed application rate per 632.3.3 and complete and uniform coverage per 632.4.6.3 are achieved.
 - .1 Complete coverage of slopes requires spraying from top and bottom of the slope, and the use of a manually held hose.
 - .2 Areas of voids or shadowing shall be redone, at the Contractor's expense, to attain the prescribed application rate.
- .5 After drying, the applied FRM shall not dissolve or disperse when rewetted, or form a crust that inhibits water infiltration.
- .6 The Contractor shall take care to prevent overspray onto Structures, signs, and all other installations and, where such overspray occurs, the Contractor shall remove it by a method approved by the Engineer.
- .7 Overspray that comes in contact with the foliage of any trees, shrubs or similar vegetation shall be immediately washed off with water.

.7 Success of the Work

- .1 For FRM applied as a ground cover without seed mix, success shall mean complete coverage of the measured areas with no voids, and no washouts due to precipitation or runoff for a period of one year from the date of application.
- .2 For FRM applied with a seed mix, success shall mean that the FRM remains intact and the seed mix produces satisfactory growth on at least 95% of the areas of application, based on the time of year as follows:
 - .1 May 1st to Labour Day – based on growth in that year's growing season;
 - .2 Labour Day to the end of the week of September 30th – based on growth in the next growing season; and
 - .3 After the week of September 30th until freeze-up, as for 632.4.7.2.2.
 - .1 Work during this period will require prior approval by the Engineer.
- .3 Areas of poor or no growth that exceed 5% (measured cumulatively) of the total area of the Work shall be redone at the Contractor's expense.

632.5 MEASUREMENT FOR PAYMENT

- .1 The Quantity to be measured for payment shall be the number of square metres of FRM, and/or FRM with seed mix, supplied and applied in accordance with this Item.
- .2 The area shall be measured along the slope of the ground.

632.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall include a separate Unit Price for each type of FRM application, as identified under the Contract.

TURF REINFORCEMENT MAT

ITEM: 633

633.1 DESCRIPTION

- .1 This Item consists of supply and installation of a Turf Reinforcement Mat (TRM) as a ditch liner or slope protection.

633.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 TRM shall be supplied rolls of a width or varying widths, such as 1 m and 2 m, that will minimize the number of longitudinal seams for the application.
- .3 Approved TRMs for the Work are shown in Table 633-1, along with approved flexible reinforced matrix (FRMs) applied under Item 632. The two products comprise an approved turf reinforcement system.

**Table 633-1
 Approved Turf Reinforcement Systems**

Manufacturer	TRM	FRM	System
Colbond Geosynthetics	Enkamat 7020	Flexterra	Green Armor
Mat Inc.	Multimat	Flex Guard	Green Guard

- .4 Staples for securing TRM to the ground shall be U-shaped steel wire, No. 11 gauge or heavier, and at least 150 mm long for cohesive soils and 200 mm long for granular soils.
- .5 Pins for securing the up-grade edge of the TRM shall be staples per 633.2.4, or hook-shaped steel rods or equivalent at least 450 mm long.

633.3 SUBMITTALS

- .1 The Contractor shall submit, upon request, the manufacturer's certification that the supplied materials meet the requirements specified in the Contract Documents.
- .2 The Contractor shall submit the manufacturer's recommended procedures for installation of the materials.
- .3 In cases where FRM will be applied to infill the TRM installed under this Item, the Contractor shall submit, prior to the Work, documentation from the FRM and TRM manufacturers that their products are compatible and guaranteed as a system for turf protection and sediment control, as indicated in Table 633-1.
- .4 Submittals are required in accordance with any cross-referenced Item forming part of this Item.

633.4 CONSTRUCTION

- .1 The Contractor shall perform the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- .2 TRMs shall be installed in accordance with the manufacturer's recommended procedures and as described herein.

TURF REINFORCEMENT MAT

ITEM: 633

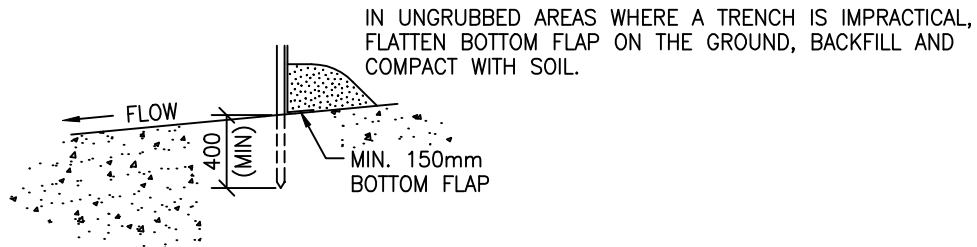
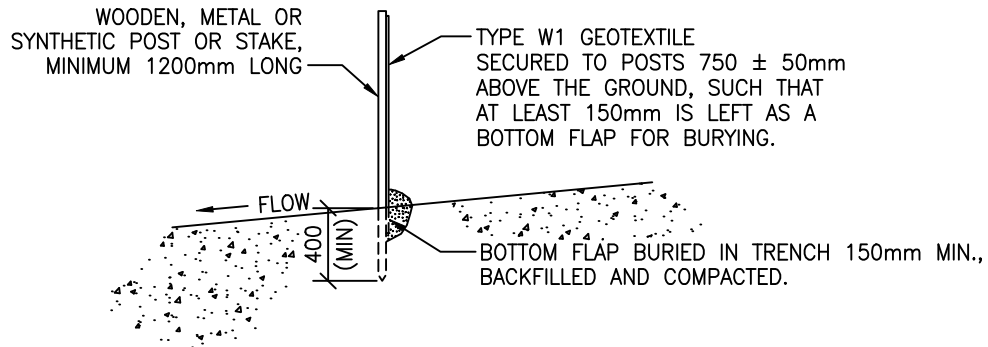
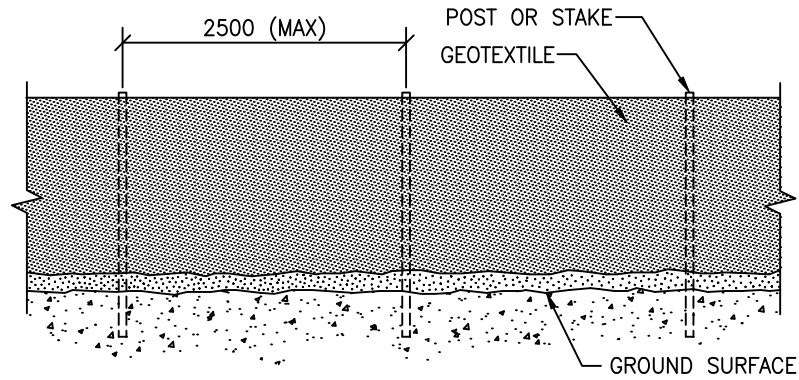
- 633.4 .3 After placement per 633.4.5 or 633.4.6, the TRM shall be held in place with staples driven perpendicularly through the mat in a pattern recommended by the TRM manufacturer, and finished flush with the ground such that the TRM is secured in full and uniform contact with the ground.
- .4 The up-grade edge of the TRM shall be embedded in a trench perpendicular to the slope or ditch, and anchored in place with staples or steel J-pegs driven flush with the ground.
- .5 Slope Protection
- .1 TRMs used for slope protection shall be installed at the locations shown on the Plans and/or as directed by the Engineer.
- .6 Ditch Liner
- .1 TRMs shall be installed longitudinally in ditches as shown on the Plans and/or at locations as directed by the Engineer, extending up the foreslope and backslope to have the edges at least 0.3 m vertically above the ditch.
- .2 The Contractor shall schedule the Work so that on the same day that the ditch is prepared (removal of erosion control structures and retained sediment, final shaping and topsoil placement), the TRM is placed and then covered with FRM under Item 632.

633.5 MEASUREMENT FOR PAYMENT

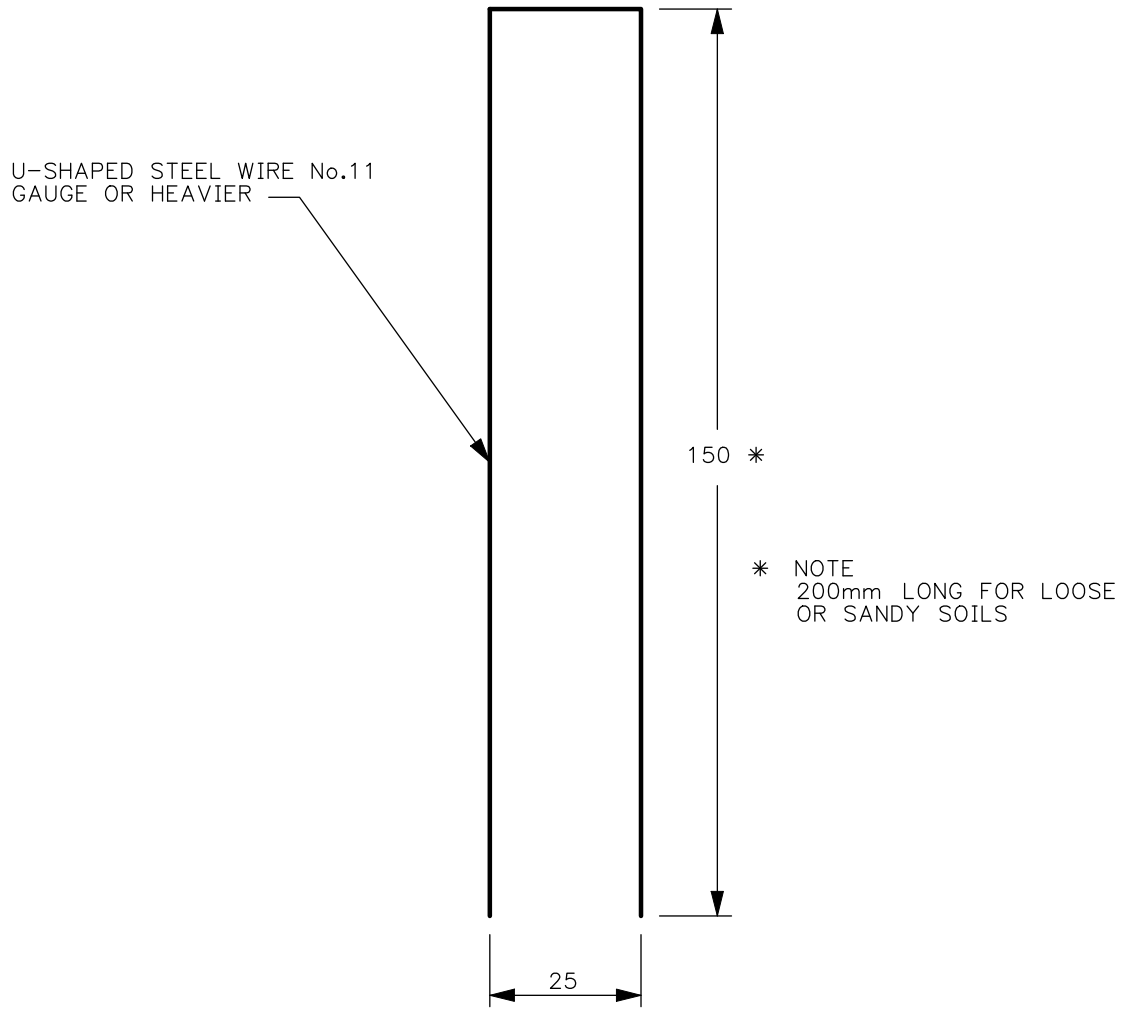
- .1 The Quantity to be measured for payment shall be the number of square metres of turf reinforcement mat supplied and installed in accordance with this Item.
- .2 Overlapped joints, patches and seams will be measured as a single layer.

633.6 BASIS OF PAYMENT

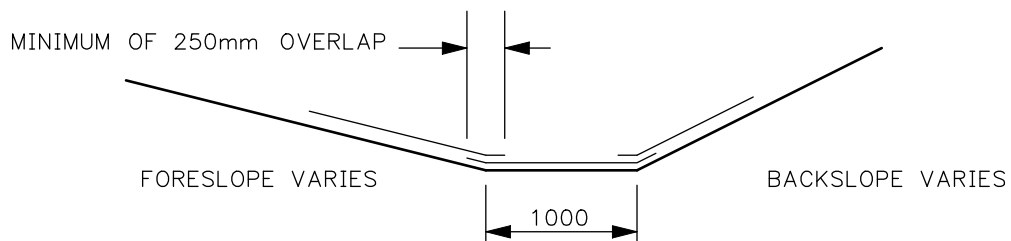
- .1 Payment for Work under this Item shall be at the Unit Price.



Sediment Control Fence

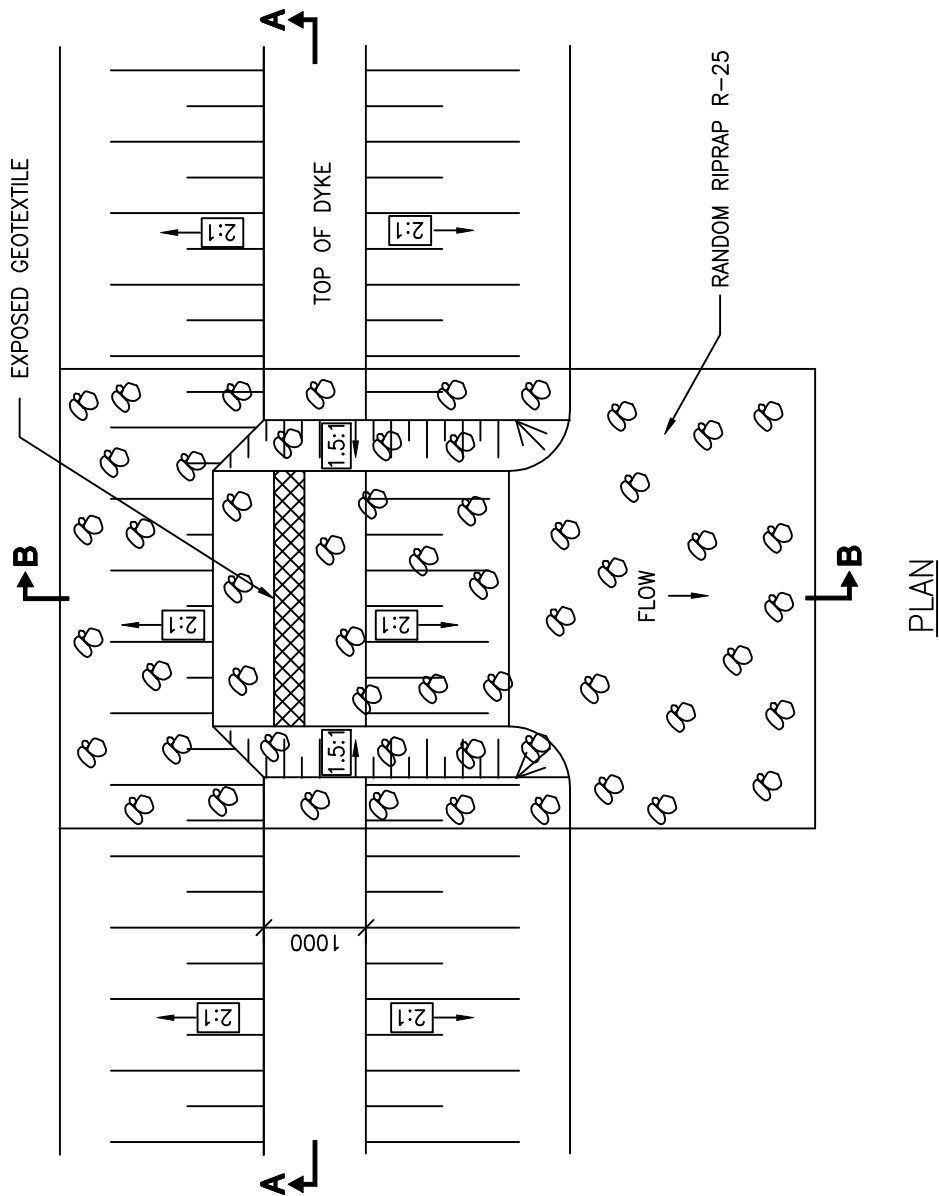


STAPLE DETAIL

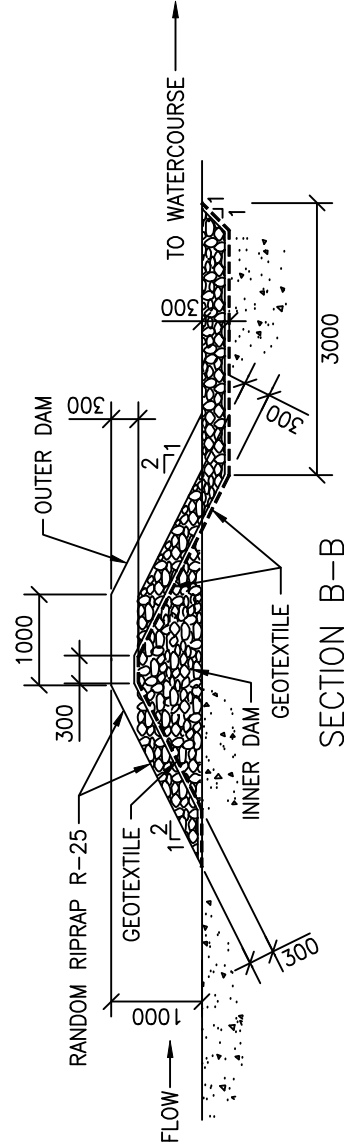
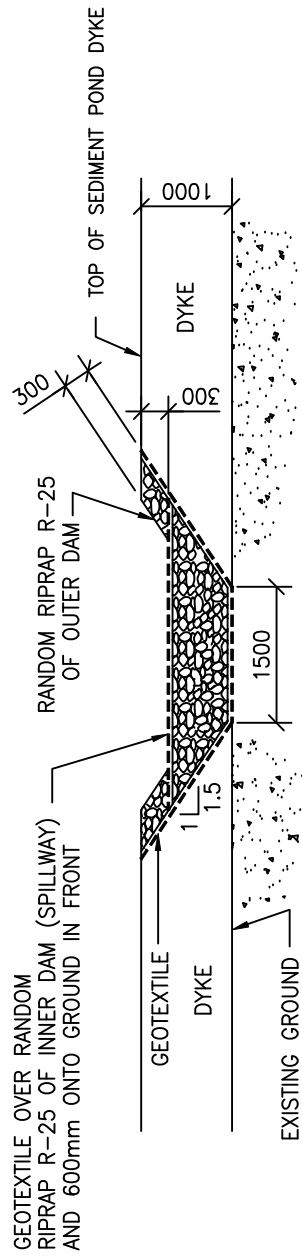


- NOTES
1. ALWAYS USE THREE STRIPS OF JUTE MATS
 2. JUTE MATS ARE TO BE INSTALLED LONGITUDINALLY IN THE DITCH
 3. LAY FIRST STRIP IN DITCH BOTTOM

Jute Mat Details

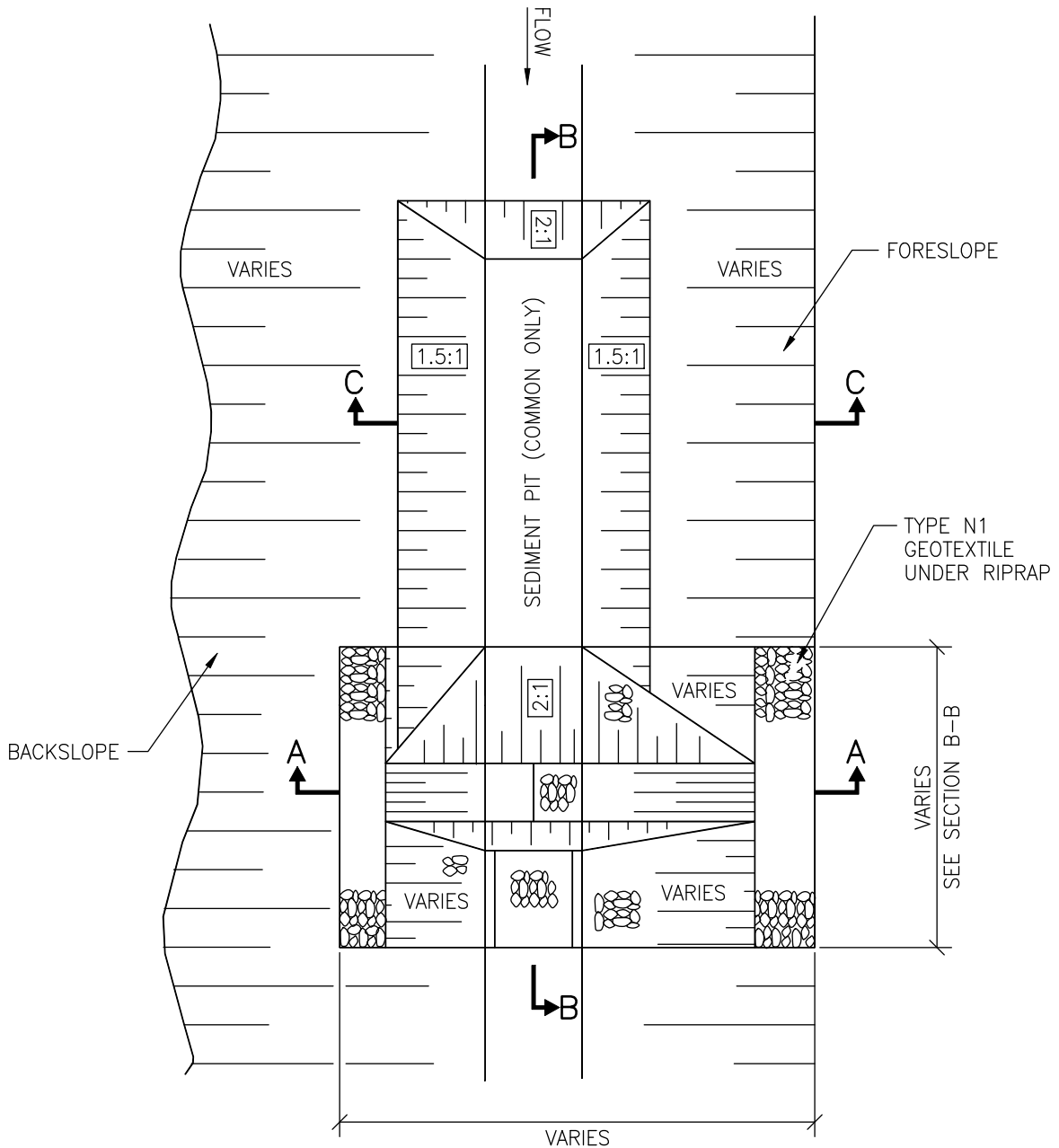


Type A - Spillway Structure for Sediment Pond



PLAN / SECTION LINES ON STANDARD DRAWING 605-1

Type A - Spillway Structure Details

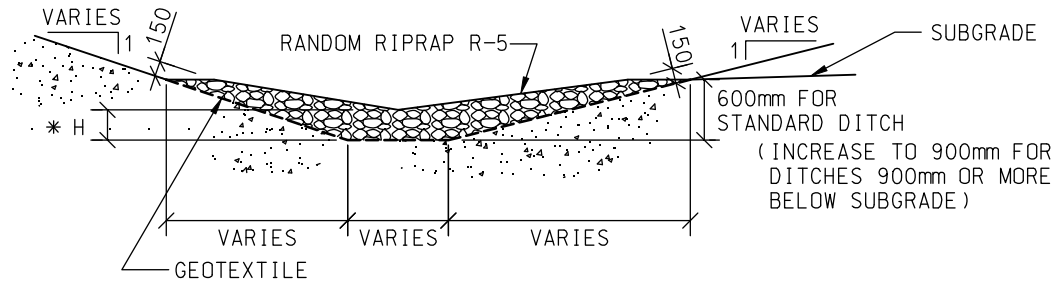


NOTES:

1. DEPTH, WIDTH AND SIDE SLOPES OF SEDIMENT PIT MAY VARY WITH SOIL CONDITIONS AS DIRECTED BY THE ENGINEER
2. ALL RIPRAP SHOWN IS R-5 SIZE

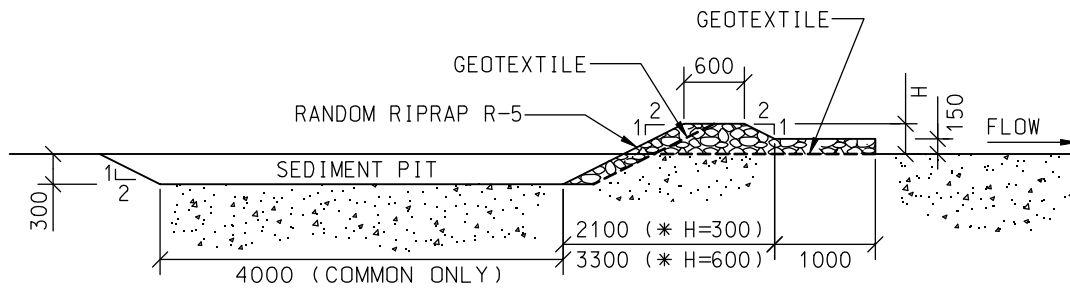
SECTION DETAILS ON STANDARD DRAWING 605-4

Type B - Erosion Control Structure for Ditches

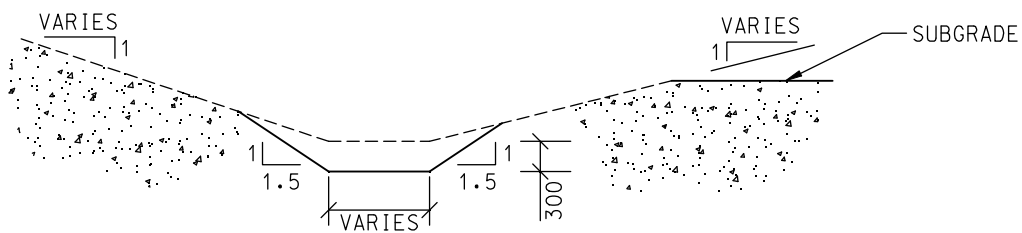


SECTION A-A

* H = 300mm FOR STANDARD
DITCH DEPTH OF 600mm
OR
600mm FOR DITCHES 900mm
OR MORE BELOW SUBGRADE



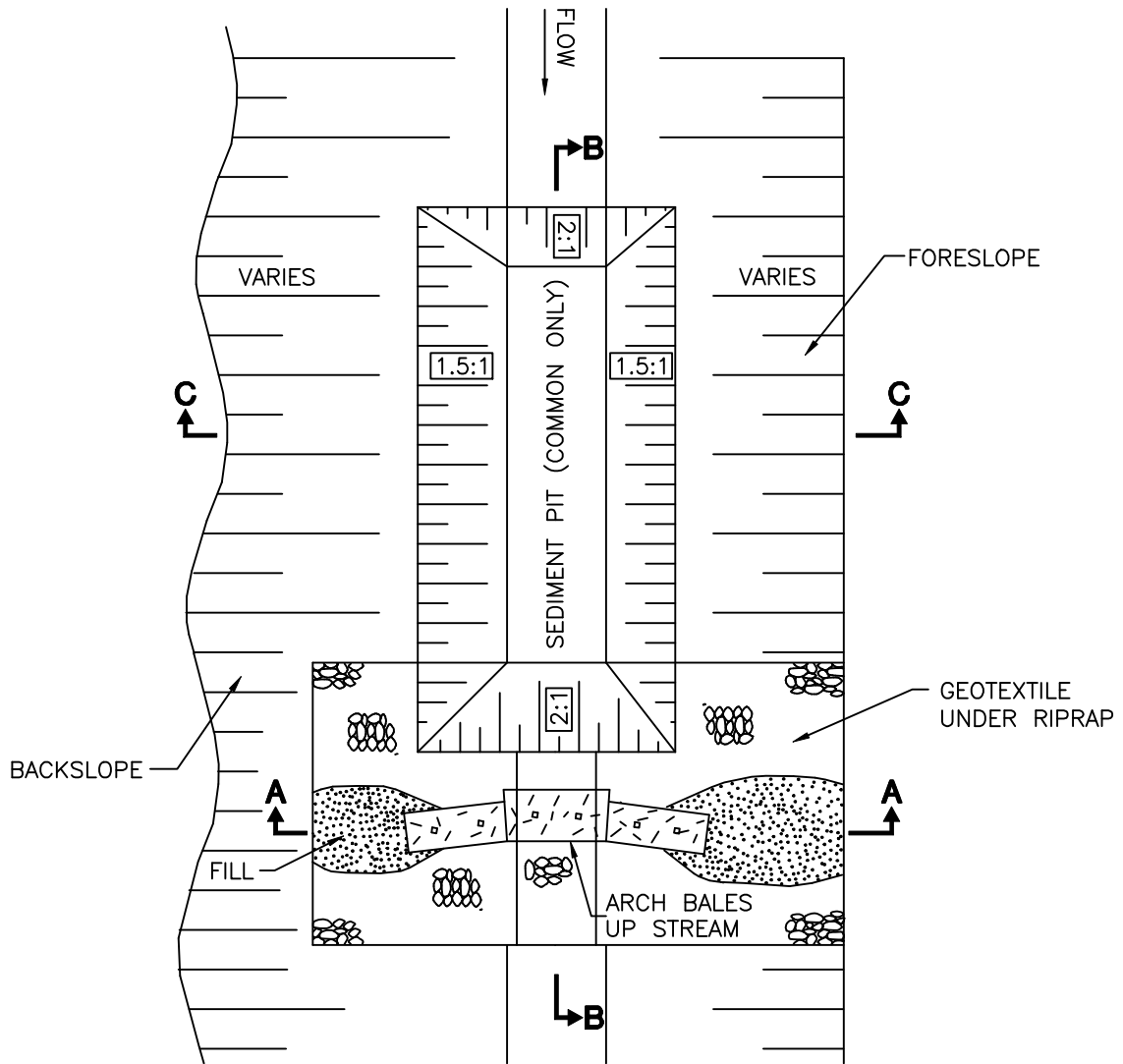
SECTION B-B



SECTION C-C
(COMMON ONLY)

PLAN/SECTION LINES ON STANDARD DRAWING 605-3

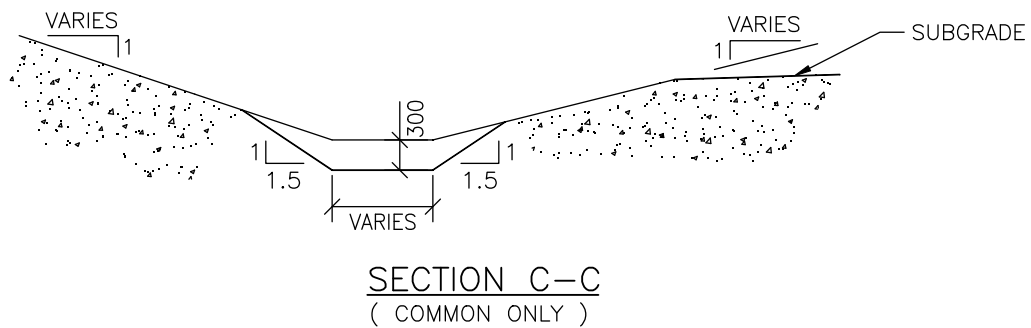
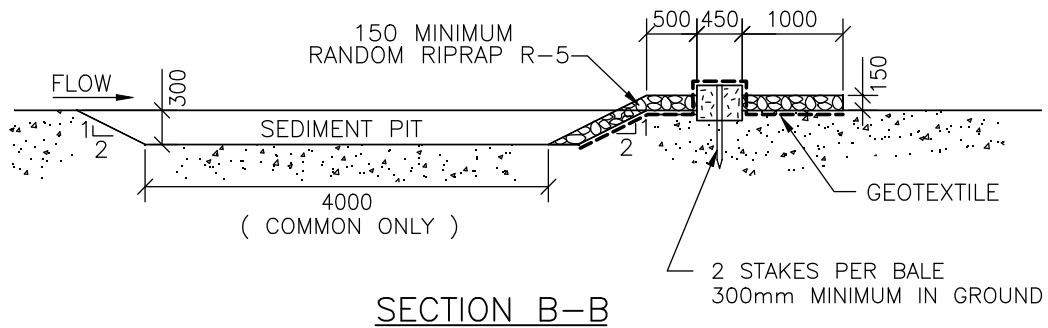
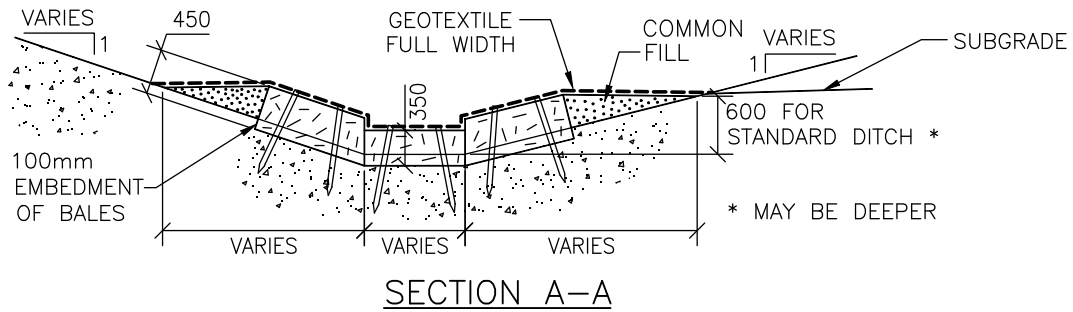
Type B - Erosion Control Structure Details



- NOTES: 1. NUMBER OF HAY/STRAW BALES REQUIRED VARIES DEPENDING ON BACKSLOPE AND FORESLOPE, AND DITCH WIDTH AND DEPTH.
2. DEPTH, WIDTH AND SIDE SLOPES OF SEDIMENT PIT MAY VARY WITH SOIL CONDITIONS AS DIRECTED BY THE ENGINEER.
3. THE GEOTEXTILE MUST BE PLACED OVER THE BALES AND DYKES AND EXTEND ALONG THE GROUND IN FRONT AND BACK OF THIS DAM, AND BE HELD IN PLACE BY THE RIPRAP R-5.

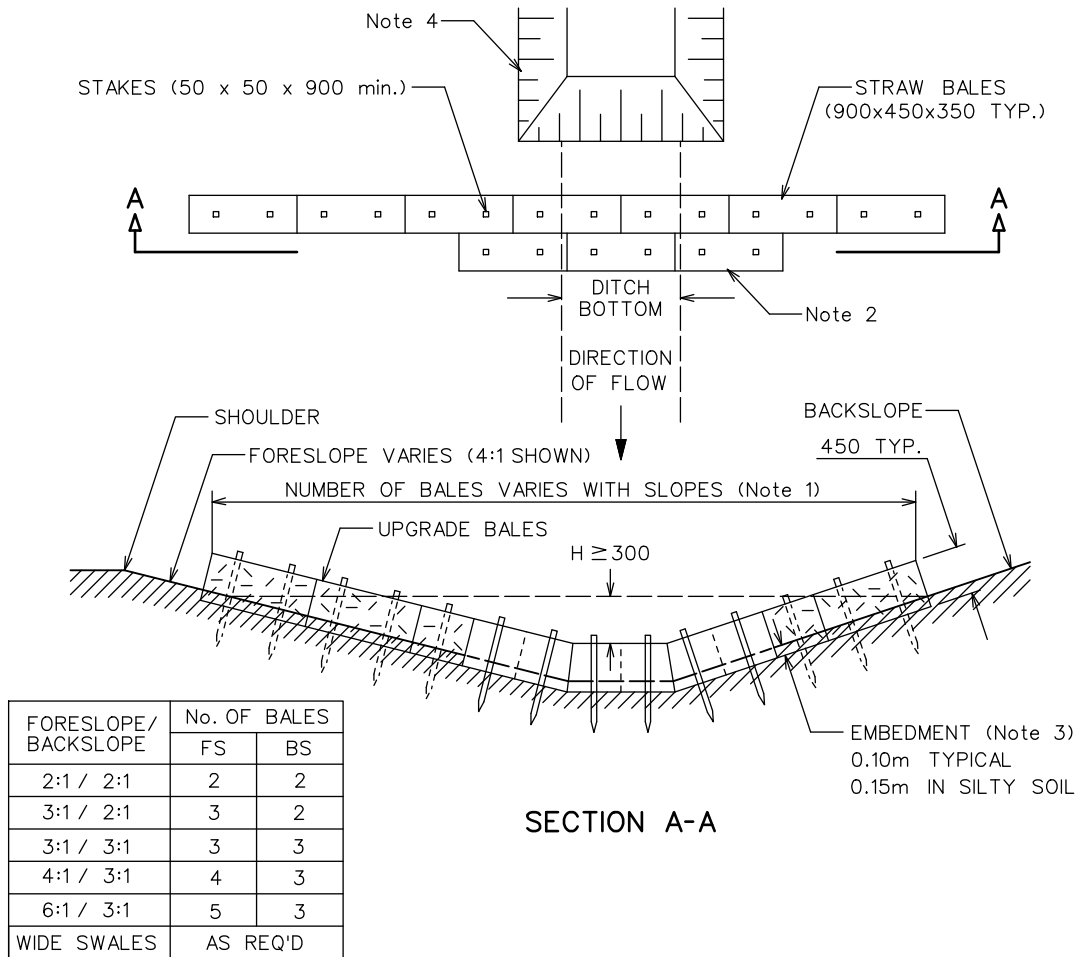
SECTION DETAILS ON STANDARD DRAWING 605-6

Type C - Erosion Control Structure for Ditches



PLAN / SECTION LINES ON STANDARD DRAWING 605-5

Type C - Erosion Control Structure Details



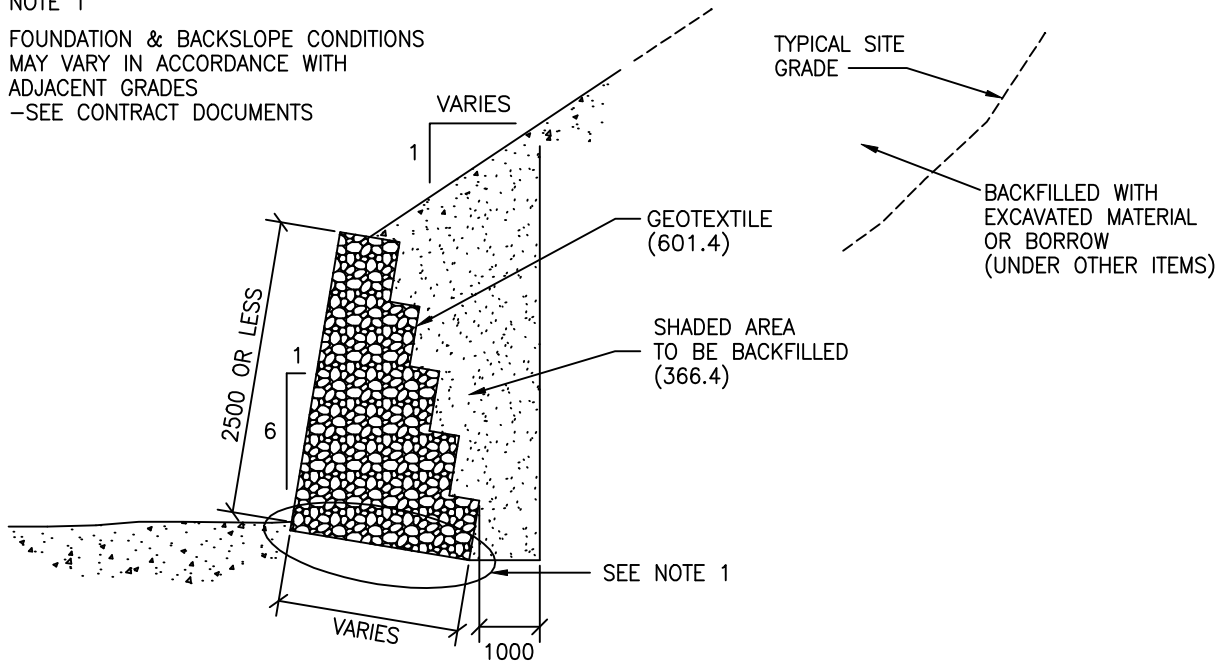
NOTES:

- 1) SEE TABLE FOR TYPICAL NUMBER OF UPSTREAM BALES WHICH ARE REQUIRED TO ENSURE MIN. 300mm FOR HEIGHT 'H' (FROM TOP OF BALES AT DITCH CENTRE TO POINT WHERE HIGHEST BALES INTERCEPT SLOPES.)
- 2) INSTALL MINIMUM OF 3 BALES DOWNGRADE AS REINFORCEMENT. JOINTS OF DOWNGRADE BALES SHOULD BE STAGGERED FROM UPSTREAM BALES.
- 3) IF TRENCH FOR BALE EMBEDMENT IS EXCAVATED WIDER THAN BALES, BACKFILL WITH EXCAVATED MATERIAL.
- 4) THE SEDIMENT PIT OF STANDARD DWGS 605-5 AND 605-6 IS REQUIRED FOR TYPE 'D' STRUCTURE.

Type D - Erosion Control Structure for Ditches

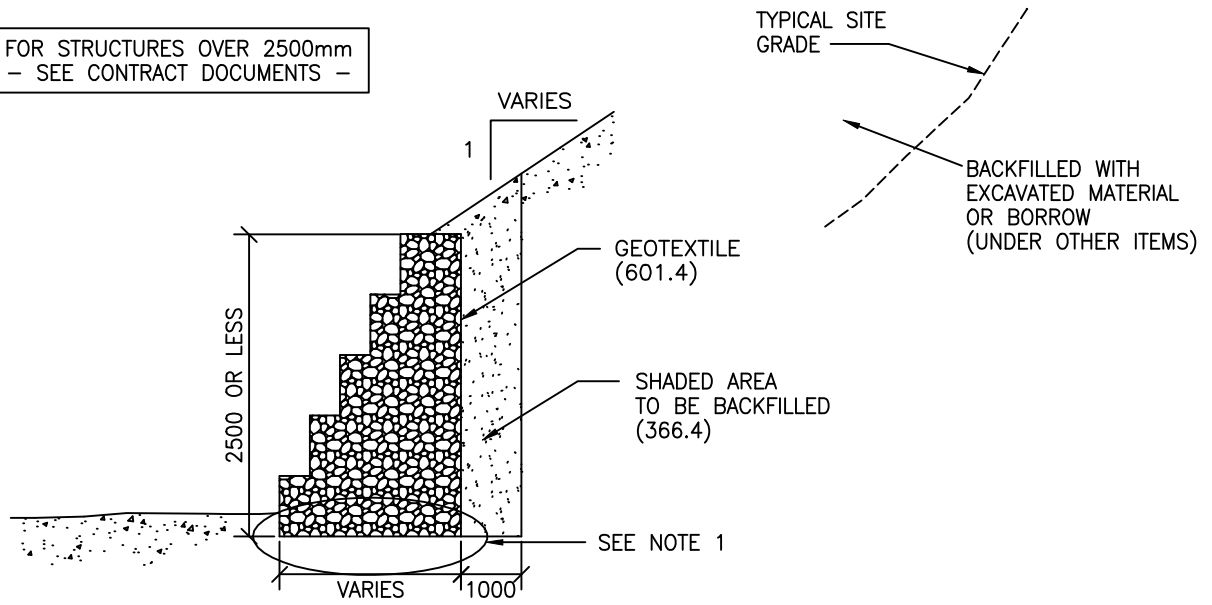
NOTE 1

FOUNDATION & BACKSLOPE CONDITIONS
MAY VARY IN ACCORDANCE WITH
ADJACENT GRADES
-SEE CONTRACT DOCUMENTS



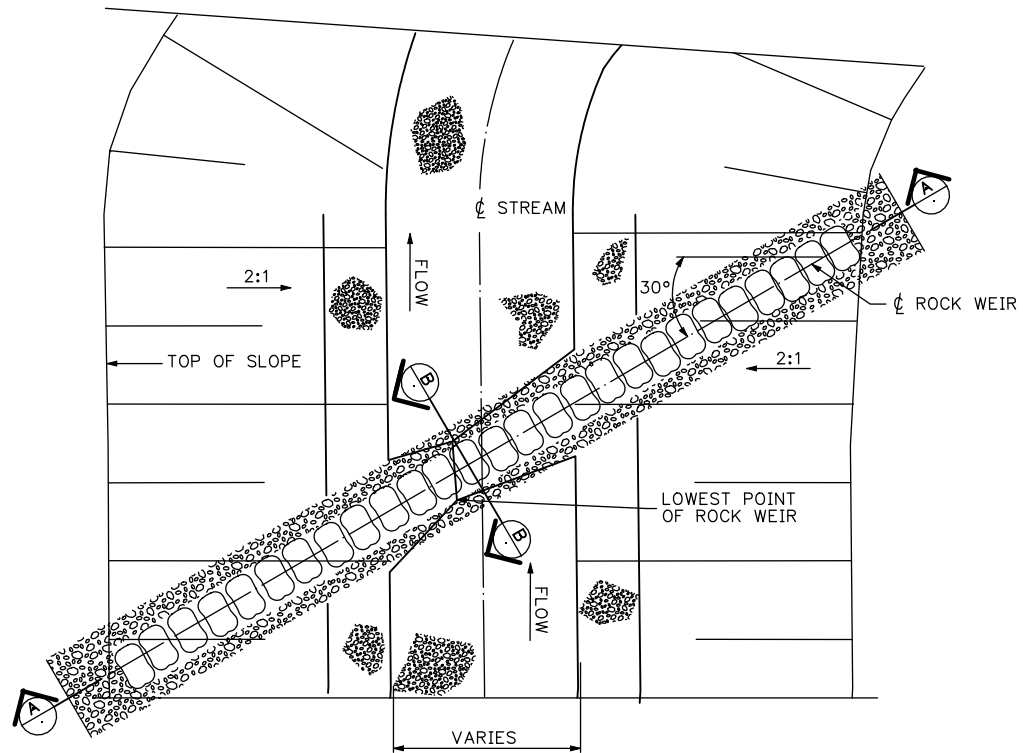
SLOPING FRONT

FOR STRUCTURES OVER 2500mm
- SEE CONTRACT DOCUMENTS -

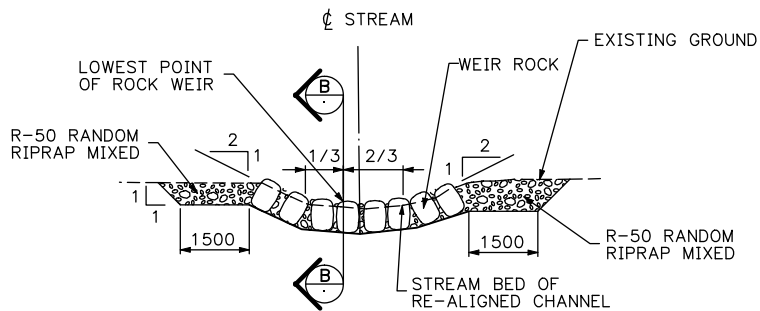


STEPPED FRONT

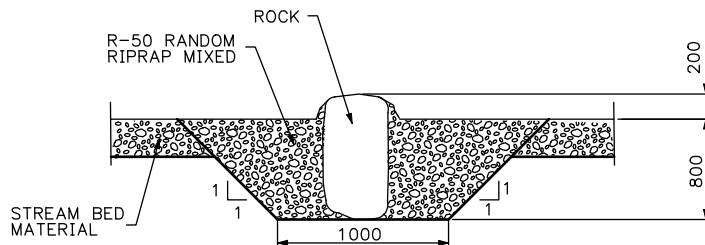
Gabion Backfilling Details



PLAN
N.T.S.

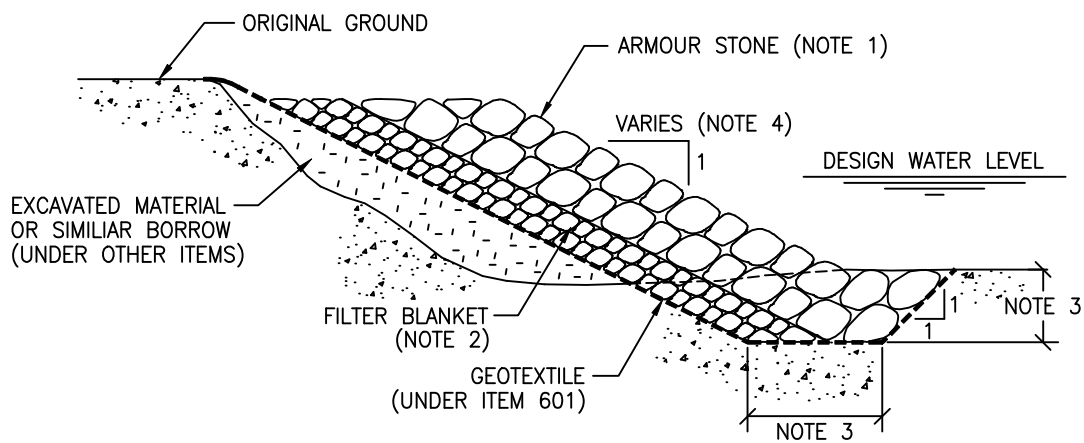


SECTION A-A
N.T.S.



SECTION B-B
N.T.S.

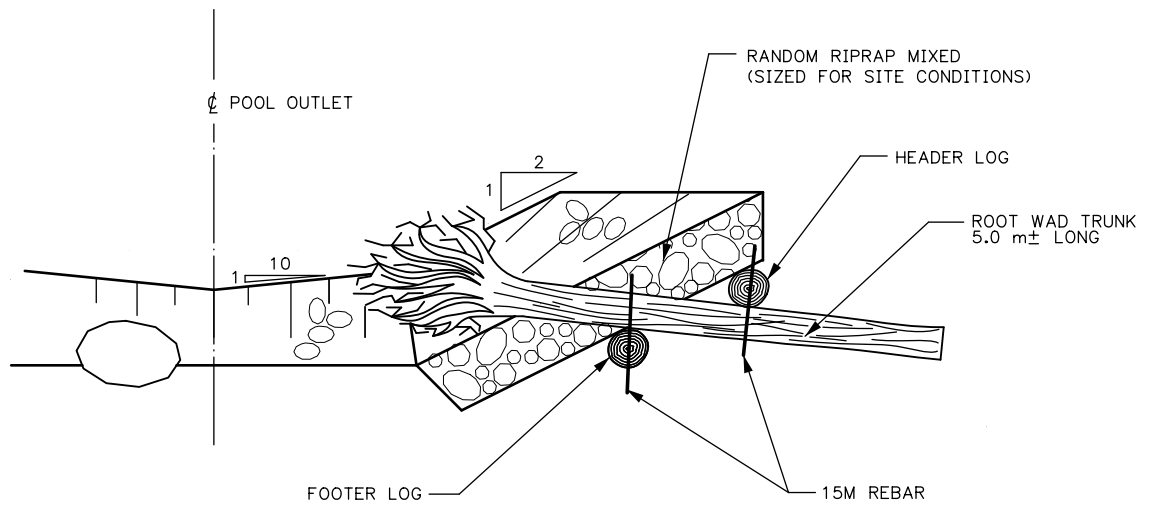
Rock Weir Details



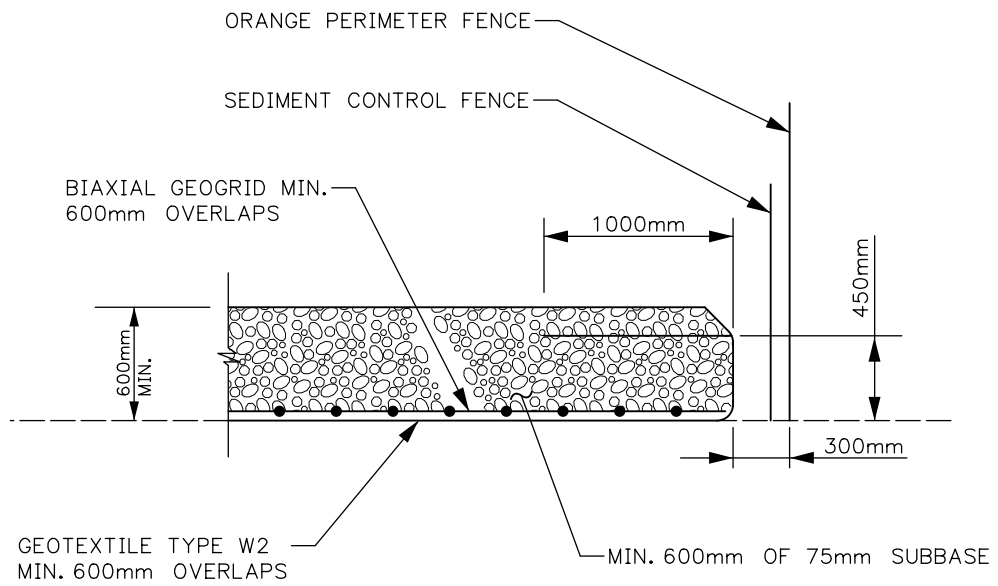
NOTES:

1. ARMOUR STONE – SIZE AND THICKNESS AS SPECIFIED IN THE CONTRACT DOCUMENTS. APPROXIMATELY 2 ROCKS THICK.
2. FILTER BLANKET – SIZE AND THICKNESS AS SPECIFIED IN THE CONTRACT DOCUMENTS. APPROXIMATELY 2 ROCKS THICK.
3. TOE DEPTH AS SPECIFIED IN THE CONTRACT DOCUMENTS.
4. SLOPE AS SPECIFIED IN THE CONTRACT DOCUMENTS.

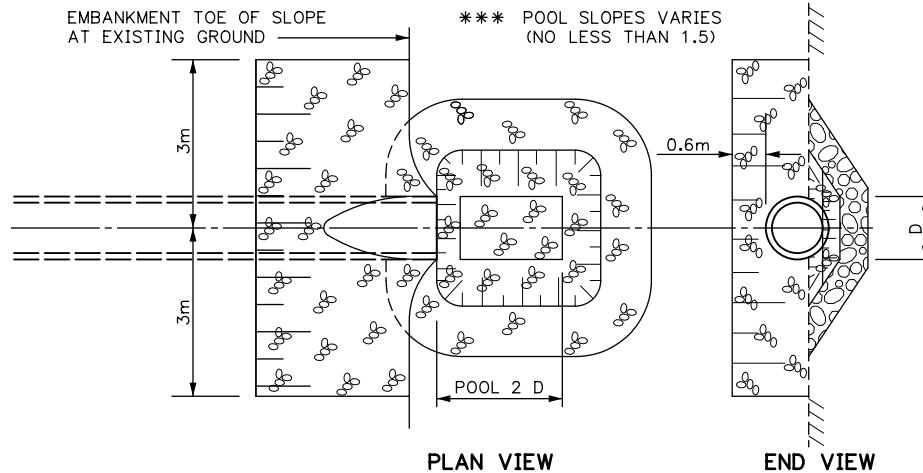
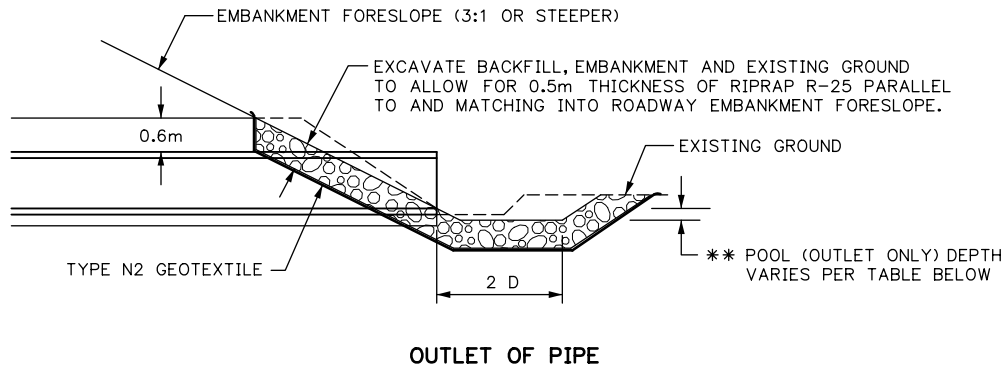
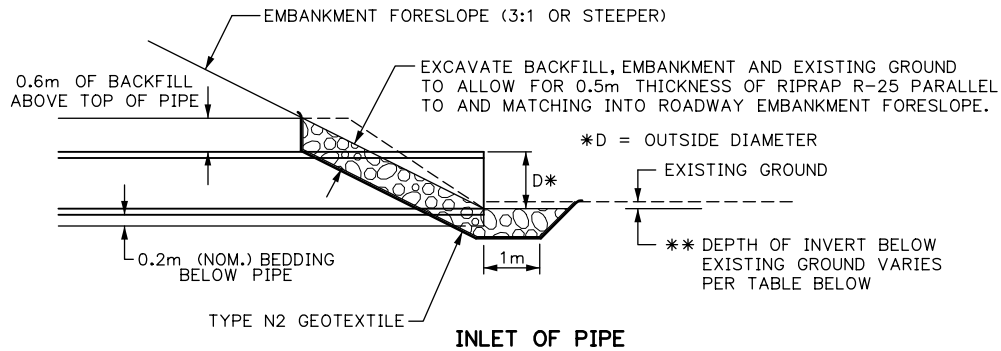
Armour Stone Protection System Details



Root Wad Detail in Pool



Temporary Working Pad

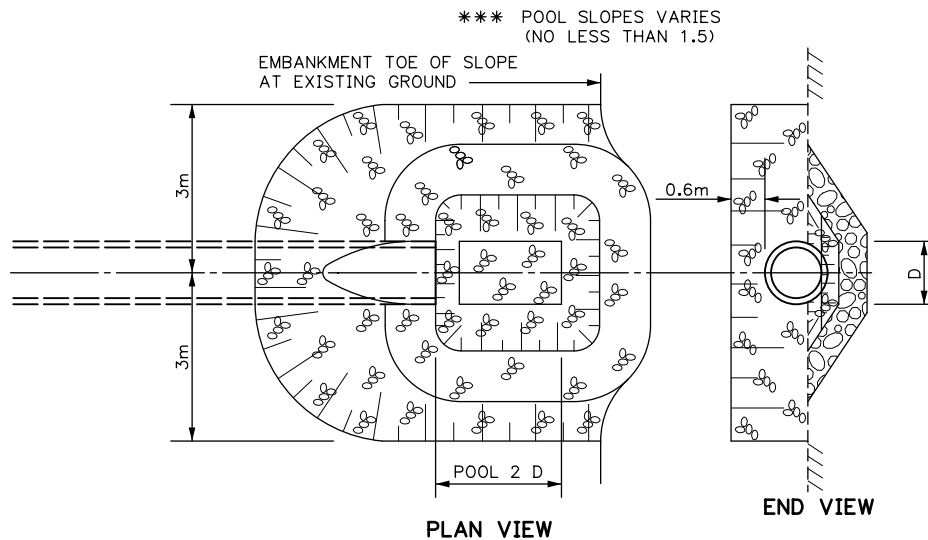
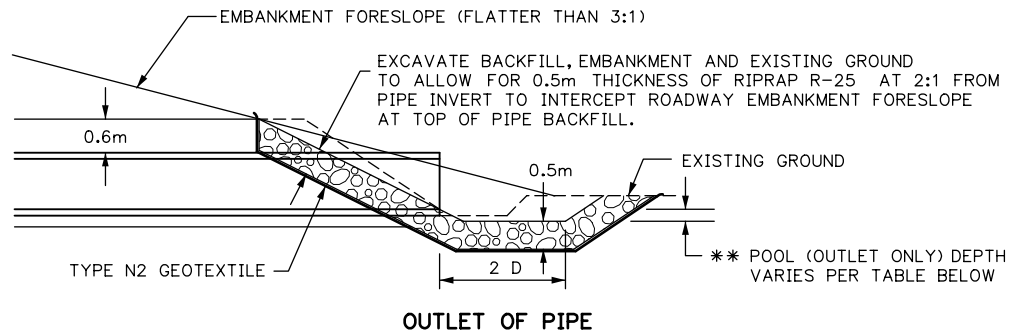
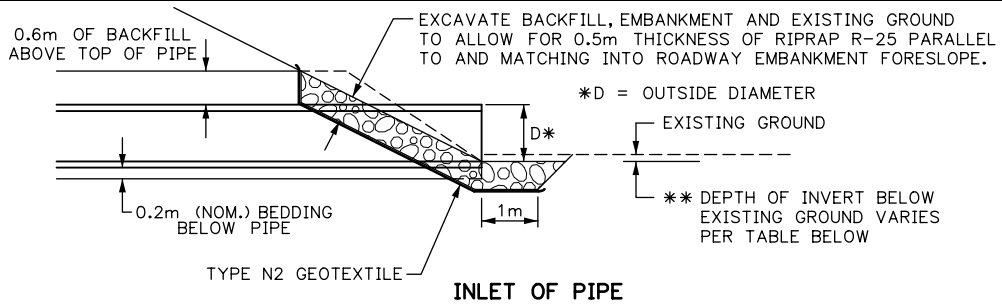


DETAILS OF CULVERT AFTER PLACEMENT OF RIPRAP R-25 ON SLOPE

** CULVERT OUTLET FEATURES

SUM OF SLOPES (PIPE + OFFTAKE)	MIN. DEPTH OF INVERT BELOW EXISTING GROUND	MIN. DEPTH OF POOL BELOW EXISTING GROUND
0 - 3%	0.1m	0.0m
> 3 - 6%	0.2m	0.0m
> 6 - 10%	0.3m	0.2m
> 10%	0.3m	0.3m

**End Treatment for Culverts ≤ 1500mm ID
- Roadway Foreslope 3:1 or Steeper**



DETAILS OF CULVERT AFTER PLACEMENT OF RIPRAP R-25

** CULVERT OUTLET FEATURES

SUM OF SLOPES (PIPE + OFFTAKE)	MIN. DEPTH OF INVERT BELOW EXISTING GROUND	MIN. DEPTH OF POOL BELOW PIPE INVERT
0 - 3%	0.1m	0.0m
> 3 - 6%	0.2m	0.0m
> 6 - 10%	0.3m	0.2m
> 10%	0.3m	0.3m

**End Treatment for Culverts ≤ 1500mm ID
- Roadway Foreslope Flatter Than 3:1**

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NUMBER OF PAGES</u>
801	Haulage -Soil, Rock and Aggregate.....	1
802	Haulage - Asphalt Concrete	1
806	Overhaul - Common Excavation	1
807	Overhaul - Unclassified Excavation	1
808	Overhaul - Solid Rock Excavation	1
810	Fixed Rates	1
811	Force Account	1
812	Extra Work	5
820	Payment Adjustments	1
821	Adjustment for Asphalt Binder Price.....	1
822	Payment Adjustment for Fuel Cost.....	1
825	Mobilization.....	1

801.1 DESCRIPTION

- .1 Haulage rates for the haulage of specified soil, rock and aggregate materials shall be as identified in Table 801-1 on a tonne-kilometre basis.
 - .1 Current haulage rates, including Table 801-1, are available from the following web address:
<http://www2.gnb.ca/content/gnb/en/departments/dti/trucking.html>

801.2 APPLICATION

- .1 The provision for payment of haulage on any Item shall be specifically and clearly stated in the Item or in the Contract Documents.
 - .1 If no specific reference to the provision of payment is made under the Item or in the Contract Documents then the haulage shall be included in the Unit Price for the Item.
- .2 Where the Contractor is required to include haulage of materials in the Unit Price, no separate payment for haulage and no mark-up on haulage shall be made by the Owner to the Contractor.
- .3 Where the Owner provides for payment of the haulage of materials in the Item, the Owner shall pay the Contractor the haulage rates as set out in Table 801-1 plus a 5% mark-up.
 - .1 If the Owner revises the haulage rates during the term of the Contract, the Owner shall pay the Contractor the revised rates plus the 5% mark-up from the date of the revision.
- .4 Extra haulage to and from the weigh scale location shall not be paid when the weigh scale is not along the most direct route permissible by law between the material source and the location of placement of the material at the Work Site.

801.3 PRIVATE TRUCKS

- .1 Notwithstanding 801.1 and 801.2, the Contractor shall pay to the owner of Private Trucks haulage rates not less than the haulage rates as set out in Table 801-1 for materials governed under Item 932.
- .2 Revisions made to haulage rates by the Owner, during the term of the Contract, shall from the date of the revision result in the following:
 - .1 An adjustment shall be made to cover the increase or decrease in rates and the Contractor shall pay the revised rates to the owners of Private Trucks.
 - .2 A 5% mark-up will be applied only to the amount of the increase or decrease in rates.

802.1 DESCRIPTION

- .1 Haulage rates in Table 802-1 are applicable, for the haulage of asphalt concrete, on a tonne-kilometre basis.
 - .1 Current haulage rates, including Table 802-1, are available from the following web address:
<http://www2.gnb.ca/content/gnb/en/departments/dti/trucking.html>
 - .2 Revisions made to haulage rates by the Owner, during the term of the Contract, shall from the date of the revision result in the following:
 - .1 An adjustment shall be made to cover the increase or decrease in rates and the Contractor shall pay the revised rates to the owners of Private Trucks.
 - .2 A 5% mark-up will be applied only to the amount of the increase or decrease in rates.

806.1 DESCRIPTION

- .1 Overhaul rates, when required under an Item, shall be paid to the Contractor by the Owner as set out in Table 806-1.
 - .1 Current overhaul rates, including Table 806-1, are available from the following web address:
<http://www2.gnb.ca/content/gnb/en/departments/dti/trucking.html>
 - .2 The overhaul rates are paid for the volume in cubic metres of excavated material measured in its original position; i.e. bank measure, and hauled more than 300 metres.
 - .3 If the overhaul rates are revised by the Owner during the term of the Contract, the Owner shall pay the Contractor the revised overhaul rates from the date of the revision.

807.1 DESCRIPTION

- .1 Overhaul rates, when required under an Item, shall be paid to the Contractor by the Owner as set out in Table 807-1.
 - .1 Current overhaul rates, including Table 807-1, are available from the following web address:
<http://www2.gnb.ca/content/gnb/en/departments/dti/trucking.html>
 - .2 The overhaul rates are paid for the volume in cubic metres of excavated material measured in its original position; i.e. bank measure, and hauled more than 300 metres.
 - .3 If the overhaul rates are revised by the Owner during the term of the Contract, the Owner shall pay the Contractor the revised overhaul rates from the date of the revision.

808.1 DESCRIPTION

- .1 Overhaul rates, when required under an Item, shall be paid to the Contractor by the Owner as set out in Table 808-1.
 - .1 Current overhaul rates, including Table 808-1, are available from the following web address:
<http://www2.gnb.ca/content/gnb/en/departments/dti/trucking.html>
 - .2 The overhaul rates are paid for the volume in cubic metres of excavated material measured in its original position; i.e. bank measure, and hauled more than 300 metres.
 - .3 If the overhaul rates are revised by the Owner during the term of the Contract, the Owner shall pay the Contractor the revised overhaul rates from the date of the revision.

FIXED RATES

ITEM: 810

810.1 DESCRIPTION

- .1 Fixed rates shall apply for Work performed in the Contract for which there is a defined and finite task.
- .2 The rates shall be in accordance with Table 810-1 and no overheads or mark-ups shall be added to the fixed rates units.
- .3 Fixed rates shall only be applied with the approval of the Engineer.

810.2 TERMS and CONDITIONS

- .1 The rates as set out in Table 810-1 shall apply to the administration of fixed rate Work.

**Table 810-1
Fixed Rates**

Item Reference	Description	Unit	Fixed Rate
261	Smoothness Retesting	per hour see 810.2.2	\$100.00
261	Approval of 2 nd and Subsequent Mix Design(s)	per mix design	DTI Standard Laboratory Rate
261	Payment of Appeal Testing Costs		
	Density	per appeal test	\$500.00
	Asphalt Content (See Note)		\$400.00
	Asphalt Content and Gradation		\$500.00
	Thickness		\$200.00
	Air Voids		\$500.00
262 263	Portland Cement	per tonne	\$300.00
262 263	Corrective Aggregate	per tonne	\$37.50
311	Steel H Pile Splices	per splice	\$800.00
NOTE:	An additional \$1300 will be charged to cover the cost of calibrating the ignition furnace.		

- 810.2 .2 The Fixed Rate shall include all time and Equipment required to complete the retesting.
- .1 Time required for retesting shall include all travel time, including return, from the DTI office in Fredericton or the site of origin for the crew whichever is the least amount, all standby time and all profiling Work required to test the Work.

811.1 DESCRIPTION

- .1 Force Account is defined as foreseen Work that is necessary to be performed on the Contract but for which there is not a Lump Sum or Unit Price in the Contract.
- .2 The Force Account Work shall be defined in the Contract Documents and shall be carried out under a provisional sum.
 - .1 The Contractor may submit in writing, for the Engineer's approval and in accordance with GC 44, a Lump Sum or Unit Price for each or any number of the Work activities described under Force Account.
 - .2 If the Contractor chooses not to submit a price, or if the Engineer and the Contractor cannot agree on a price for the Work, the Engineer shall prepare a written Work Order for each such Work activity and the Work shall be performed as cost plus in accordance with GC 45.

811.2 TERMS and CONDITIONS

- .1 The terms and conditions as set out in Item 812 shall apply to the administration of Force Account Work.

EXTRA WORK

ITEM: 812

812.1 DESCRIPTION

- .1 Extra Work is defined as Work that is necessary to be performed on the Contract but for which there is not a lump sum or Unit Bid Price in the Contract.
- .2 Foreseen Work - Force Account - is described in Item 811.
- .3 Unforeseen Extra Work is Work ordered by the Engineer under GC 37.
 - .1 Where the determination of the cost of the Extra Work cannot be made under GC 43, and if the Engineer and the Contractor cannot agree on a price under GC 44, the Work shall be performed as cost plus in accordance with GC 45.
- .4 The phrase "Extra Work" and the statements referring to it hereinafter shall apply to both Foreseen Work (Item 811) and Unforeseen Extra Work.

812.2 CLARIFICATIONS OF GC 44

- .1 The following clarifications are made for the administration of Extra Work performed at lump sum or in-place Unit Price under GC 44.
 - .1 Extra Work proposed to be performed by the Contractor on a lump sum or in-place Unit Price basis shall require approval of such price in writing, prior to commencing the Work.
 - .2 The Contractor's invoice for the Work shall show only the approved lump sum or the in-place Unit Price times the units accepted in the Work; no detailed breakdown shall be required and no mark-up is allowed.
 - .3 If the price submitted for approval is for Work to be carried out by an approved subcontractor (as per 812.3.10), the subcontractor shall submit an invoice to the Contractor as per 812.2.1.2.

812.3 CLARIFICATIONS OF GC 45

- .1 Clarifications are made for the administration of Extra Work performed as cost plus under GC 45.

812.3 .2 Work Orders

- .1 Extra Work must be authorized by the Engineer in writing in the form of a Work Order. The Owner shall not pay for any such Work unless a written Work Order has been issued to the Contractor.
- .2 The Work Order shall describe the nature of the Work to be done, the Equipment, labour and materials anticipated to be used, and the Engineer's estimate of the value of the Work.
 - .1 This estimate shall be the sole determination of the rate of mark-up to be applied on all invoices for that Work Order.

812.3 .3 Reports

- .1 The Engineer shall record daily, on a "Daily Equipment Report", the Equipment and labour hours expended and materials supplied by the Contractor, subcontractor or Hired Equipment owner on the Extra Work, as agreed to by the Engineer and the Contractor at the end of each Day or shift.
- .2 The Engineer and Contractor shall each sign and retain a copy of these reports. Only the information on these reports shall be considered for payment by the Owner.

812.3 .4 Labour

- .1 The Contractor shall show the Actual Basic and Overtime Rates paid for each individual engaged in the Extra Work, plus the various levies paid by the Contractor on the employees' wages.
 - .1 The Contractor shall submit, to the Administrative Services Branch of the Owner for approval, a list of the various levies paid for his/her employees. This list shall initially be submitted upon award of a Contract and shall be verified annually or whenever there is a change in any levies paid or as otherwise requested by the Owner.
 - .2 The various levies paid by the Contractor must be shown individually, if different from those previously submitted as per 812.3.4.1.1.
 - .1 The Contractor must be prepared to substantiate wage rates and all levies shown on the Extra Work Invoices.
 - .3 Overtime accumulated by the Contractor's employees within the established normal work hours of a calendar week, during which they have worked on Work Order(s) and on other Work for the Contractor, shall be prorated in the ratio of "total hours on each Work Order" to "total hours that week".
 - .1 The distributed overtime as calculated in 812.3.4.3 shall be rounded to the nearest half hour.
 - .2 In the case where the Contractor extends her/his normal work hours to Work solely on Work Order(s), the overtime worked during that extended period shall be charged entirely to the Work Order(s).
 - .3 The overtime distributed to each Work Order shall be deducted from the total number of hours worked on that Work Order that week to determine the number of regular hours to be paid in each case.
 - .4 Where the overtime is paid on daily rather than weekly Work hours, the principle for distributing overtime to each Work Order shall apply, but on a daily basis.
- .4 A mark-up shall be added to the total of the Actual Basic and Overtime wages plus levies paid by the Contractor.
 - .1 The mark-up shall be 20% if the value of the Work Order is \$2,500 or less, and 15% if over \$2,500, as estimated by the Engineer under 812.3.2.2.
- .5 The number of hours to be paid for the Superintendent and/or foreman, shall be paid for commensurate with the time supervising on the Extra Work.

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812.3 .5 Board

- .1 The Owner shall pay board allowance to the Contractor, at a daily rate set by the Engineer, for the Contractor's personnel working on Extra Work and boarded in the Contractor's site facilities.
- .2 The Owner shall pay board allowance to the Contractor, at a daily rate set by the Engineer, for the Contractor's personnel working on Extra Work and boarded off site at a location not supplied by the Contractor.
- .3 A mark-up, as described under 812.3.4.4, shall be paid on board and/or other approved allowances.
- .4 For Extra Work which is completed in less than 10 hours per Day, board or other allowances noted in 812.3.5.1 and 812.3.5.2 shall be paid at an hourly rate determined by dividing the daily rate by 10 hours/Day.
- .5 For Extra Work requiring more than 10 hours per Day, the daily rate shall apply.

812.3 .6 Materials

- .1 Any materials supplied for and utilized in the Extra Work, at the request of the Engineer, shall be invoiced by the Contractor at his/her supplier's invoice price (excluding the HST), plus a mark-up as described in 812.3.4.4.1.
- .2 A copy of the supplier's invoice shall accompany the Contractor's invoice for each separate material item submitted for payment, including materials from the Contractor's stock.

812.3 .7 Equipment

- .1 Rates for Equipment shall be as set out in the Machine Rental Regulation (82-113) under the Crown Construction Contracts Act of the Province of New Brunswick.
 - .1 Rates for Equipment not listed in the Machine Rental Regulation will be determined by the Engineer upon application, in writing, by the Contractor.
- .2 The number of hours to be paid for machine and operator shall be the actual number of hours worked by each machine (rounded to the nearest half hour) and in accordance with Section 2(7) of the Machine Rental Regulation.
 - .1 A service allowance of one-half hour service time per Day shall be paid at the full approved rates for machine and operator, provided the machine works 6 hours or more per Day on Extra Work.
 - .2 The service allowance does not apply to trucks, floats and other Equipment not normally serviced daily.
- .3 Transportation costs of Equipment brought to the Work Site and used exclusively on Extra Work shall be paid if the time spent on Extra Work is 16 hours or less, in accordance with Section 2(8) of the Machine Rental Regulation.
 - .1 Travel and/or float costs shall be paid to transport Equipment from another area of the Work Site to and from the Extra Work area if the Extra Work is of 16 hours or less.

EXTRA WORK

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- 812.3.7 .4 Standby time shall be paid at half the applicable rental rate for the Equipment brought onto the Work Site specifically for Extra Work.
- .1 Standby time shall not be paid for Equipment that was on the Work Site at the time the Extra Work was ordered.
- .5 The number of hours to be paid for vehicles used by the Superintendent and/or foreman, shall be paid for commensurate with the time supervising on the Extra Work.
- 812.3 .8 Hired Equipment
- .1 If Extra Work requires Equipment the Contractor does not own or have at her/his disposal, such Equipment may be hired by the Contractor from some other source. Equipment so hired will be classified as Hired Equipment and not as a subcontractor.
- .2 Rates for Hired Equipment shall be established as per 812.3.7, before the Hired Equipment is used on Extra Work.
- .1 The number of hours to be paid for machine and operator shall be in accordance with 812.3.7.2.
- .2 The rate may include the Equipment's operator cost if that was the basis of hire.
- .1 If the rate includes the operator's cost, the rate shall be considered a flat rate that is full compensation for the wages (regular and overtime), levies and overhead.
- .3 When the Engineer authorizes Equipment to be rented from a rental agency, to be used solely on Extra Work, the Equipment shall be paid for at the rental agency's rate.
- .1 Equipment which rents out at a daily rather than hourly rate shall be paid at the daily rate provided it is utilized solely on Extra Work.
- .2 The Contractor shall provide proof of the amount of fuel, for Equipment utilized solely on Extra Work, in order to be reimbursed.
- .3 The Contractor shall invoice the Owner the total amount of the Hired Equipment owner's substantiated invoice plus a mark-up defined as follows:
- .1 The mark-up shall be 10% if the value of the Extra Work is \$2500 or less, or 5% if greater than \$2500, as estimated by the Engineer under 812.3.2.2.
- .2 The Contractor shall clearly mark on his/her invoice that the Work was carried out by Hired Equipment.
- 812.3 .9 Private Trucks Hired By The Hour
- .1 A 5% mark-up shall be paid on Private Trucks hired by the hour to do Extra Work. This mark-up shall apply to the rate for the truck and the operator's wages.
- .2 The Contractor shall not be entitled to reimbursement for the cost of any public liability and property damage insurance in relation to the Private Trucks.

EXTRA WORK

ITEM: 812

812.3 .10 Subcontracting

- .1 The Contractor may have Extra Work performed by a subcontractor approved as per Item 907.
- .2 The subcontractor shall invoice the Contractor for labour, board, materials, Equipment and mark-ups as specified in 812.3.4, 812.3.5, 812.3.6 and 812.3.7.
- .3 The Contractor shall invoice the Owner the total amount of the subcontractor's substantiated invoice plus a mark-up, as follows:
 - .1 The mark-up shall be 10% if the value of the Extra Work is \$2500 or less, or 5% if greater than \$2500, as estimated by the Engineer under 812.3.2.2.
 - .2 The Contractor shall mark on her/his invoice that the Work was carried out by a subcontractor.

812.3 .11 Public Holidays

- .1 The Contractor shall be entitled to payment on Extra Work for wage costs expended on individuals for Public Holidays which fall within the time period of the Extra Work.
- .2 The amount paid to the Contractor shall be the Actual Basic Rate paid the individual, plus any Workers' Compensation levy and plus a mark-up as per 812.3.4.
 - .1 No other levies shall be paid to the Contractor.

812.3 .12 Invoicing

- .1 Invoices for Extra Work must be submitted on a monthly basis unless otherwise agreed to between the Contractor and Engineer.
- .2 Each invoice shall denote the Work Order number, the location, description and date(s) of Work done, and the invoice date.
- .3 Each Work Order shall be invoiced separately. A copy of the Work Order shall accompany the Contractor's invoice. In the case where all or a portion of the Work was performed by subcontractors or Hired Equipment and invoiced to the Contractor, the Contractor shall also attach a copy of the subcontractor's or Hired Equipment invoice(s) to the Contractor's invoice submission.

812.3 .13 Delays

- .1 The Contractor shall have no claim for hindrances or delays that may be caused by carrying out the Extra Work.
- .2 The Contractor may, however, in accordance with GC 15(1) and in accordance with Item 998, submit a request in writing for an adjustment to the Completion Date if it can be demonstrated that the Extra Work has delayed completion of his/her normal operations.

820.1 DESCRIPTION

- .1 Payment Adjustments are amounts added to or deducted from payments due the Contractor, as allowed for Work carried out under other Items.
- .2 Some Payment Adjustments may be identified in the Contract Documents under an Item, with a Provisional Sum provided. The quality of the Work performed under the specific Item will determine whether the Payment Adjustment will be paid as a bonus or deducted as a penalty.
 - .1 Such Payment Adjustments may be for Mat Density and Smoothness under Item 261.
- .3 Some Payment Adjustments may be added to the Contract for Work not identified in the Contract Documents, to be paid as a plus or minus adjustment based on quality or quantity of the Work.
 - .1 Such a Payment Adjustment may be for Asphalt Binder Content under Item 261.

821.1 DESCRIPTION

- .1 Compensation payable to the Contractor or the Owner, for the difference in price of Asphalt Binder between the time of tender opening for the Contract and the time of the Work under this Item, shall be calculated in accordance with the following:
 - .1 The Owner shall adjust payments to the Contractor under the applicable Item in the Contract Document based on changes to MTO's PG asphalt binder price index. The price index is published monthly and is available on the Ontario Asphalt Pavement Council (OAPC) website.
 - .2 The price index is based on the price (excluding taxes, FOB depots in the Toronto area) of asphalt binder grade PG 58-28. One index shall be used to establish and calculate the payment adjustment for all grades.
 - .3 The payment adjustment shall be in dollars per tonne of asphalt binder. A payment adjustment shall be established for each month of paving/surface treatment in which the price index differs by more than 5% for the price index for the month preceding the month that tenders for the Contract were opened. When the price index differential is less than 5%, there shall be no payment adjustment established for that month of paving/ surface treatment.
 - .4 The payment adjustment shall apply to the quantity of asphalt binder accepted into the Work during the month for which it is established.
 - .5 The payment adjustment for the month shall be calculated as follows, where:
 - PA= Payment Adjustment for asphalt binder in dollars
 - T= PG asphalt binder price index for month prior to tender opening
 - P= PG asphalt binder price index for month of paving/ surface treatment
 - Q= Quantity of Asphalt Binder in tonnesWhen $P > 1.05T$, the Contractor receives additional payment from the Owner as follows:
$$PA = (P - 1.05T) \times Q$$
When $P < 0.95T$, the Owner deducts from payments due the Contractor as follows:
$$PA = (0.95T - P) \times Q$$
 - .6 The quantity of asphalt binder is the total for all grades of asphalt binder supplied by the Contractor. For each month in which a payment adjustment is established, the quantity of asphalt binder shall be calculated using the tonnage of asphalt concrete accepted into the Work. The asphalt binder content shall be calculated in accordance with 261.6.2.1.6.
 - .1 For emulsified asphalt each month in which a payment adjustment is established, the quantity of litres shall be converted into tonnes of asphalt binder using the % of residue asphalt and the specific gravity of the asphalt emulsion in use.

822.1 DESCRIPTION

- .1 Compensation payable to the Owner or the Contractor, for the difference in price of fuel between the month prior to the month of tender opening for the Contract and the month of Work under this Item, shall be calculated in accordance with the following:
 - .1 The Owner shall adjust payments to the Contractor under the applicable Item in the Contract Document based on a monthly average of the New Brunswick Energy and Utilities Board's (NBEUB) weekly Ultra-Low-Sulphur Diesel Benchmark Price (New York). The price is published weekly and is available on the NBEUB website.
 - .2 The Benchmark Price will be set per the Petroleum Products Pricing Act and Regulation 2006-41.
 - .3 The payment adjustment will be established for each month that Work is performed on any of the identified Items and the Monthly Average Benchmark Price (MABP) differed from the Tender Fuel Price (TFP) by more than 5%.
 - .4 The adjustments will be in Canadian dollars calculated using the Nominal Fuel Consumption Rates (NFCR) in Table 822-1 and the formulae in 822.1.5. The Contractor shall submit a statement identifying, by Item, the Monthly Fuel Adjustment (MFA), the associated NFCA, and the Material Quantity (MQ) as identified on the previous month's Progress Estimate.

**Table 822-1
 Nominal Fuel Consumption Rates (NFCRs) by Item**

Item #	Description	NFCR
106	Common Excavation	1.0 L/m ³
107	Unclassified Excavation	1.0 L/m ³
108	Solid Rock Excavation	1.5 L/m ³
121	Borrow	0.5 L/t or 1.0 L/m ³
203	Aggregate Base/Subbase	0.6 L/t

- .5 The payment adjustment shall be calculated as follows, where:
 MFA = Monthly Fuel Adjustment
 MABP = Monthly Average Benchmark Price
 TFP = Tender Fuel Price
 NFCR = Nominal Fuel Consumption Rate
 MQ = Material Quantity

When MABP > 1.05 TFP, the MFA is an additional payment to the Contractor as follows:

$$MFA = (MABP - 1.05TFP) \times NFCR \times MQ$$

When MABP < 0.95 TFP, the MFA is a deduction from payments due to the Contractor as follows:

$$MFA = (0.95TFP - MABP) \times NFCR \times MQ$$

MOBILIZATION

ITEM: 825

825.1 DESCRIPTION

- .1 This Item consists of the mobilization necessary for the execution of the Work on the Contract.
- .2 The Lump Sum Price bid for this Item shall not be greater than ten percent of the Total Contract bid, including this Item.
 - .1 Notwithstanding 825.1.2, the maximum Lump Sum Price shall be \$500,000.

825.2 MATERIALS

- .1 All materials shall be supplied by the Contractor.

825.3 SUBMITTALS

- .1 None identified.

825.4 CONSTRUCTION

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

825.5 MEASUREMENT FOR PAYMENT

- .1 Mobilization in accordance with this Item shall be on a lump sum basis.

825.6 BASIS OF PAYMENT

- .1 Payment for Work under this Item shall be at the Lump Sum Price.
- .2 The total of this Item will be paid on the first Progress Estimate, provided that the value of the Work completed in the Work Area on Items other than this Item is greater than five percent of the Total Contract bid or greater than \$250,000.
- .3 There shall be no change in the Lump Sum Price of this Item due to a change in Contract scope or an extension to the Contract Completion Date.
- .4 The payments from the Lump Sum Price shall be full compensation for the Work under this Item regardless of the number of times the Contractor mobilizes.
- .5 At no time shall the total of the amounts paid to the Contractor under this Item be greater than the Contractor's Lump Sum Price.

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NUMBER OF PAGES</u>
905	Scheduling	1
906	Work Schedule	3
907	Subcontractors	1
908	Supply of Materials	4
912	Hiring Practices	1
913	Insurance Schedule	1
916	Signs	1
917	Traffic Control Persons	1
918	Detours	1
919	Maintenance of Traffic Flow	1
921	Construction Roads	2
922	Pits and Quarries	2
926	Examination of Soils Information	1
927	Asphalt Concrete Core Data	1
928	Geotechnical Instrumentation	1
931	Scales and Weighing Procedures	5
932	Private Trucks	3
933	Heavy Equipment	2
934	Back - Up Alarms	1
936	Compaction	2
941	Lines and Grades	4
946	Work Progression	2
947	Disposal Areas	2

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>NUMBER OF PAGES</u>
948	Environmental Requirements	6
951	Working Conditions	1
952	Safety Support Systems	2
953	Audited Safety Program	1
956	Construction Drawings and Calculations	4
957	Falsework	3
958	Formwork	5
961	Partnering	2
962	Value Engineering	2
971	Advisements	2
996	Limited Funds	2
997	Specified Work	2
998	Completion Date	1
999	Standard Drawings	
	941 - 1 Standard Stake Markings	
	952 - 1 Safety Net Support System - Abutments	
	952 - 2 Safety Net Support System - Piers	
	958 - 1 Deck Overhang Bracket - Steel Girder	

905.1 GENERAL

- .1 Notification of the start date may be provided in the Contract Documents at the time of Tender.
 - .1 In no case shall any Work be performed prior to the date specified.
 - .2 The Owner reserves the right to limit the start date of the Work.

906.1 DESCRIPTION

- .1 This Item details the Contractor's responsibilities in the preparation and submission of construction Work Schedules and the format and requirements for periodic revisions.
- .2 The Initial Work Schedule shall be the Work schedule submitted within 30 Days of the formal notice of award of the Contract and not later than 4 Days prior to the first job meeting, for approval by the Engineer.
 - .1 Acceptance of the Initial Work Schedule will not alter the Contract requirements.
- .3 The Initial Work Schedule shall be reviewed for approval at the first job meeting as follows:
 - .1 If the schedule is satisfactory, the Engineer shall indicate approval by signing it.
 - .2 If the schedule is not satisfactory, the Engineer shall advise the Contractor of the reasons and identify the required modifications.
 - .1 If the identified modifications are made at the meeting, each modification shall be initialed by both the Contractor and the Engineer, and the Engineer shall approve the schedule by signing it.
 - .2 If the identified modifications are not made at the meeting, then within 3 Days following the meeting the Contractor shall submit a new Initial Work Schedule modified in accordance with the Engineer's comments.
 - .3 The Engineer will distribute copies of the approved schedule, which shall be the Initial Work Schedule for the purposes of 906.1.5 and GC 48(1).
 - .4 Pursuant to GC 48(2), no progress claims will be paid by the Owner during the time the Contractor is in default under 906.1.2 or 906.1.3.2.2.
- .4 The Contractor shall attach an updated and revised Work Schedule to the monthly Progress Estimate at time of signing of the estimate.
 - .1 If an updated and revised Work Schedule is not attached to the monthly Progress Estimate, then the Progress Estimate will be considered incomplete and, pursuant to GC 48(2), payment of the Progress Estimate will be withheld.
- .5 The monthly updated and revised Work Schedule will include information in relation to progress of Work and proposed revisions to the previous schedule and shall include the unaltered Initial Work Schedule information for each Item or task.

906.2 FORMAT

- .1 Prepare the Work Schedule in the form of a horizontal bar chart.
- .2 Provide a separate bar for each trade or operation or Item.
- .3 Provide a horizontal time scale identifying each week by the date of the Monday of that week.

WORK SCHEDULE**ITEM: 906**

- 906.2 .4 Identification of the schedule descriptions may be by Item number, or any other logical descriptor that may be applicable to the Work and the schedule.
- .5 The format for the schedule descriptions may be by the numerical sequence of the Contract Items or by the chronological order of the start of each Item or any other logical progression that may be applicable to the Work and the schedule.
- .1 The critical path of the Work shall be indicated.
- .6 Several computer scheduling programs are readily available and the Owner advises that these formats are generally acceptable, however the Contractor is advised to resolve the format and presentation issues with the Engineer prior to the time of submission of the Initial Work Schedule.

906.3 CONTENT

- .1 Include the sequence of construction from initiation to completion of the Work.
- .2 Include the dates for the commencement and completion of each major element or Item of construction.
- .3 Show the percentage of completion of each schedule description as of the last Day of the month for which a Progress Estimate is completed.
- .4 Show changes which have occurred in the Work since the previous submission of the Work Schedule, including but not limited to:
- .1 major changes in scope,
 - .2 activities modified since the previous submission,
 - .3 revised projections of progress and completion, and
 - .4 other identifiable changes.
- .5 Provide a narrative report to define the following topics, if applicable:
- .1 problem areas, anticipated delays and the impact on the Work Schedule, and
 - .2 corrective action proposed and its effect.
- .6 Include the dates for submitting shop drawings, product data, samples, if applicable.
- .7 Include the dates when free issue materials, as defined in Item 908, will be required.

906.4 SPECIFIC REQUIREMENTS**906.4 .1 On Grading Contracts**

- .1 The Work Schedule information shall include, but is not limited to: commencement dates, designated areas of excavation and embankment Work, expected production and the time required for completion.

906.4 .2 On Paving Contracts

- .1 The Work Schedule shall outline the sequence of Work with estimated time limits for the various stages or parts of the Work.
- .2 For asphalt concrete this outline should include commencement dates, scheduling of aggregate production, asphalt concrete production rate and placing sequence.

906.4 .3 On Structures Contracts

- .1 The Work Schedule shall outline the sequence of Work along with estimated time limits for the various stages or portions of the Work.
- .2 The Work Schedule shall clearly indicate the commencement and completion dates of each phase, stage or portion of the Work.

906.4 .4 On Crushing Contracts

- .1 The Work Schedule shall include the planned sequence of crushing for the different sizes of crushed material along with expected production and time limits.

907.1 DESCRIPTION

- .1 The Contractor may apply to have portions of the Contract carried out by an approved subcontractor(s).
- .2 The Contractor shall apply in writing to the Engineer with the name of the company to be considered for approval as a subcontractor for the Work.
 - .1 This submission shall also include a description of the Item(s), estimated Quantities and approximate value of the Work (the approximate Quantity multiplied by the Unit Price for the Item(s)) to be subcontracted.
- .3 The Engineer may approve the subcontractor, by response in writing, to the Contractor prior to the commencement of the Work proposed under 907.1.2.
- .4 The Contractor shall ensure that the approved subcontractor is entirely familiar with the Contract Documents and has a copy of the Contract Documents.
- .5 The approval for use of any subcontractor shall be exclusive to the Contract under which the application is made.
- .6 The Superintendent shall be on-site at all times when the subcontractor is working on the Contract.

SUPPLY OF MATERIALS

ITEM: 908

908.1 DESCRIPTION

- .1 All material necessary for the proper completion of the Work, except that listed specifically as being supplied by the Owner, shall be supplied by the Contractor.

908.2 QUALITY OF MATERIAL

- .1 All material provided by the Contractor shall be new, unless otherwise approved.
- .2 Material supplied by the Contractor shall conform to the requirements of the Contract.
- .3 As specified or as requested by the Engineer, the Contractor shall make available for inspection or testing sample(s) of any material to be provided by the Contractor.
- .4 The Contractor shall obtain for the Engineer the right to enter upon the premises of the material manufacturer or supplier to carry out such inspection, sampling and testing as specified or as requested by the Engineer.
- .5 The Contractor shall notify the Engineer in writing of the sources of supply sufficiently in advance of the material supply dates to enable the Engineer to perform the required inspection, sampling and testing.
 - .1 The Owner will not be responsible for any delays to the Contractor's operations where the Contractor fails to give sufficient advance notice to the Engineer in writing to enable the Engineer to carry out the required inspection, sampling and testing before the scheduled supply dates.
- .6 The Contractor shall not change the source of supply of any material without the written authorization of the Engineer.
- .7 Material which is not specifically identified in the tender but subsequently required in the Work, shall be of a quality best suited for its intended use.

908.3 REJECTED MATERIAL

- .1 Rejected material shall be expeditiously removed from the Work Site after notification from the Engineer.
- .2 Where the Contractor fails to comply with such notice, the Engineer may require that the rejected material be removed and disposed of outside the Work Site and the Contractor shall pay the costs of removal and disposal of the rejected materials.

SUPPLY OF MATERIALS

ITEM: 908

908.4 SUBSTITUTIONS

- .1 Where the Specifications require the Contractor to supply a specified material/product, the Unit/Lump Sum Price shall be based upon the supply of the material/product so specified, which shall be regarded as the standard of quality required by the Item.
- .2 After the award of the Contract, the Contractor may apply, in writing, to the Engineer to substitute another material/product other than the material/product specified in the Contract Documents.
 - .1 The submission shall be complete including all technical data and case history applications for the proposed material/product.
 - .2 The Engineer may decide not to entertain substitution during the period of the Contract.
- .3 Substitution of material(s)/product(s) shall not be made without the prior written approval of the Engineer.
- .4 No proposed substitution(s) will be approved prior to the award of the Contract.

908.5 FREE ISSUE OF MATERIAL

- .1 The Owner shall make available specific materials, as identified in the Contract Documents, for the Work as free issue.
- .2 The Contractor shall be responsible for loading, transporting, unloading, storing and distributing materials from DTI, Fredericton to the Work Area.
- .3 The Contractor shall be responsible for all materials and for any damage or loss that may occur from the time of receipt of the materials from the Owner's stock until such time that the materials have been accepted in the Work by the Engineer.
 - .1 Any replacement due to loss or damage shall be the responsibility of the Contractor, at his/her own expense.

908.5 .4 Care of Material

- .1 The Contractor shall, in advance of receipt of shipments of material supplied by the Owner, provide adequate and proper storage facilities acceptable to the Engineer; and on the receipt of such material shall promptly place the material in storage except where it is to be incorporated forthwith into the Work.
- .2 The Contractor shall provide the Engineer, immediately upon receipt of such shipment, copies of bills of lading, or such other documentation the Engineer may require to substantiate and reconcile the quantities of material received.
- .3 The Contractor shall be responsible for acceptance of free issue material at the specified delivery point and for its safe handling and storage.
 - .1 If such material is damaged while under the control of the Contractor it shall be replaced or repaired by the Contractor, at no cost to the Owner.
 - .2 If such material is rejected by the Engineer due to the quality of material as a result of the manufacture of the material, the material shall remain the responsibility of the Contractor until its disposition has been determined by the Engineer.

SUPPLY OF MATERIALS

ITEM: 908

- 908.5.4 .4 Where material supplied and delivered to the Work Area by the Owner arrives at the delivery point in a damaged condition or where there are discrepancies between the quantities received and the quantities shown on the bills of lading, the Contractor shall immediately report in writing such damage or discrepancies to the Engineer who shall arrange for an inspection of the shipment and provide the Contractor with a written release from responsibility for such damage or deficiencies.
- .1 Where any damage or deficiencies are reported thereafter it shall be the responsibility of the Contractor to repair or replace the materials, at her/his own expense.
- .5 The Contractor shall account for the full amount of material supplied by the Owner in each shipment and the Contractor shall be responsible and liable for such free issue material after taking delivery.
- .1 Such material shall not, except with the written permission of the Engineer, be used by the Contractor for purposes other than the performance of the Work under the Contract.
- .6 When containers, reels, crates and other types of packaging from free issue material are no longer required for their original purpose, they shall become the property of the Contractor, who shall dispose of them, outside the Work Site, unless otherwise specified in the Contract Documents.
- .7 Where material supplied by the Owner is ordered and stockpiled prior to the award of the Contract, the Contractor shall, immediately upon commencement of operations, check the material, report any damage or deficiencies to the Engineer and take charge of the material at the stockpile site.
- .1 Where any damage or deficiencies are reported thereafter it shall be the responsibility of the Contractor to repair or replace the materials, at his/her own expense.

908.5 .5 Return of Excess Material

- .1 Where material is made available to the Contractor in excess of the amount required to complete the Work, such excess material shall remain the property of the Owner on completion of the Work.

908.6 DEMURRAGE AND DAMAGES

- .1 The Contractor shall be responsible for the prompt loading, unloading and delivery of all materials for the Work and shall be responsible for any demurrage and storage charges.
- .2 In the event of demurrage or damage charges being paid by the Owner, that amount shall be deducted from money owing to the Contractor.

908.7 PARTIAL PAYMENT FOR MATERIALS

- .1 Upon written request by the Contractor and in accordance with section 4(2) of the Terms of Payment, the Owner will make partial payment to the Contractor for materials identified in the Basis of Payment of an Item and manufactured specifically for the Contract, delivered to the Work Site and stored in an condition, location and manner acceptable to the Engineer.
 - .1 The Owner may make partial payment for the materials prior to delivery, if the materials are acceptably stored at the supplier's yard.
- .2 The partial payment will be a provisional unit price for the materials determined by dividing the purchase price (materials and freight per the supplier's invoice as provided to the Engineer) by the unit of measure for the Item or by calculating the percentage of the lump sum price of the Item equivalent to the purchase price. In the case of payment for materials stored per 908.7.1.1, the calculation would exclude the freight cost.
- .3 In accordance with section 13(3) of the General Conditions, the Contractor shall be fully responsible for the care of the materials until placed and accepted in the Work, including repair or replacement at her/his own expense of any materials damaged or lost between the period of the partial payment and the incorporation of the materials into the Work.
- .4 Partial payment may only be made in the fiscal year the material is to be incorporated in the Work for the specified Items as follows:
 - .1 Items 302, 304, 341, 342, 343, 344, 345, 348, 351, and 555.

912.1 DESCRIPTION

- .1 In the employment of persons on a project, there shall be no discrimination by reason of race, sex, age, marital status, national origin, colour, religion, or political affiliation; it being agreed, however, that the foregoing shall not prevent the implementation of special measures designed to benefit groups such as those defined in the Human Rights Act of the Province of New Brunswick.
- .2 Regulation 2007-34 of The Employment Standards Act for the Province of New Brunswick shall apply to this contract.
- .3 For jobs with participation by the Government of Canada, as identified in the Contract Documents, recruiting of labour shall be conducted through Canada Employment Centres.

913.1 GENERAL

- .1 The Contract award shall require the successful Bidder to comply with terms and conditions as set out in the Insurance Schedule, attached to and forming part of the Contract.
- .2 The Insurance Schedule is marked "E" and is attached in the Articles of Agreement.

916.1 DESCRIPTION

- .1 The procurement of all signs required pursuant to the Contract shall be the responsibility of the Contractor and shall be in accordance with the requirements of the NBDTI "Work Area Traffic Control Manual" (WATCM) with respect to the Work conditions prevailing at the site.
 - .1 Signs shall be made available at DTI, Fredericton, NB.
 - .2 Signs shall be charged out at the Owner's current listed price for these materials and this amount shall be deducted from the first Progress Estimate.
- .2 Signs used in the Contract shall remain the property of the Owner and shall be returned to the DTI District office after completion of the Contract.
 - .1 Credit shall be given on the final Progress Estimate for signs returned in good condition, as per 916.1.1.2.
- .3 Signs shall be located, erected and maintained by the Contractor in accordance with the NBDTI's WATCM.
- .4 All Work associated with the signage of the Contract shall be the sole responsibility of the Contractor.
- .5 The Engineer shall issue an immediate cease Work order for any Work not in compliance with the terms set out in the NBDTI WATCM and the Contractor shall immediately comply with such an order.
 - .1 The Contractor shall immediately make whatever adjustments are necessary in order to comply with the terms set out for the particular style of Work as defined in the NBDTI WATCM.
 - .2 Any lost time resulting from non-compliance shall not be considered, by the Owner, for any extension in the Contract Completion Date.

917.1 DESCRIPTION

- .1 This Item details the Contractor's responsibility to provide any and all Traffic Control Persons (TCPs) as may be required for various types of Work performed under the Contract.
- .2 For the purposes of this Item, Work Area may encompass more than one Work operation, as approved by the Engineer.

917.2 REQUIREMENTS

- .1 The Contractor shall carry out the Work in accordance with the latest edition of the WATCM.
 - .1 Further to Chapter 5 of the WATCM, the Contractor shall be responsible to provide as many TCPs as required, based on Roadway geometry, traffic patterns, traffic volumes, size or length of Work Area and other pertinent factors.
 - .2 Supply of all necessary safety equipment and apparel for TCPs shall be the responsibility of the Contractor.
 - .3 The Stop/Slow paddle will be available from the Owner in accordance with Item 916.

917.3 OTHER

- .1 Notwithstanding 917.1 and 917.2, separate payment will be made by the Owner for TCPs approved by the Engineer for the following types of Work:
 - .1 Force Account Work identified under Item 811 in the Contract Documents; and/or
 - .2 Extra Work (of a nature or style not identified in the Contract Documents) carried out under Item 812.

918.1 DESCRIPTION

- .1 The Contractor shall construct detours at the location(s) and to a standard as indicated in the Contract Documents.
 - .1 Such detours have been incorporated in the Contract estimated Quantities and will be paid for in accordance with the applicable Items.
- .2 Traffic control devices required for detours shall be in accordance with the requirements of Item 916 and the WATCM.
- .3 No Work shall begin on a detour until approval is received from the Engineer.
- .4 The Contractor shall ensure that all required traffic control devices are in place and operational 24 hours a Day from the time immediately preceding the opening of the detour and shall remain operational for the duration of the detour operation.
- .5 Temporary construction detours, other than those indicated in the Contract Documents, must be approved by the Engineer prior to construction.
 - .1 Construction, maintenance, and removal of such detours shall be the responsibility of the Contractor.

919.1 GENERAL

- .1 The Contractor is advised that any existing traffic pattern(s) or alternate traffic pattern(s) must be maintained and kept open, at a minimum of one traffic Lane throughout the work Day and must be open to two-way traffic at the end of the work Day.
- .2 The Contractor shall schedule the Work to provide for the safe and efficient flow of traffic throughout the Work Site in accordance with the WATCM.
- .3 Surfaces subject to through traffic shall be maintained in a condition such that traffic can safely travel along it at the speed limit posted for the Work Area.

CONSTRUCTION ROADS

ITEM: 921

921.1 HAUL ROADS

- .1 Haul roads are off-Highway access to material sources required for Highway construction.
- .2 Haul roads shall be constructed in a location as approved by the Engineer, and in a manner to provide safe and reasonable access for the Engineer.
- .3 Construction, dust control and maintenance of all haul road(s) shall be the Contractor's responsibility except:
 - .1 Construction of haul roads on lands controlled by the Owner, and as indicated in the Contract Documents or as directed by the Engineer.

921.2 WORK AREA ACCESS ROADS

- .1 The Contractor shall be responsible for procuring access to and from the Work Site, and for getting permission from landowners to build access roads or to use existing woods roads or trails on private property.
 - .1 Vehicles and Equipment used during construction activities shall utilize only approved roadways and access areas.
- .2 Access roads shall be constructed in a location as approved by the Engineer, and in a manner to provide safe and reasonable access for the Engineer.
- .3 Construction, dust control, maintenance, removal and reinstatement of the access road shall be the Contractor's responsibility.
 - .1 The Contractor shall submit a maintenance plan for the access roads on the Contract for review and acceptance by the Engineer 5 Days prior to construction of the access roads. The Contractor shall implement the access road maintenance plan as reviewed and acceptance by the Engineer.

921.3 ENVIRONMENTAL PROTECTION

- .1 The Contractor shall ensure that the use of any existing private or public access roads does not cause sedimentation of any watercourses that cross such roads.
- .2 On any new access roads constructed by or for the Contractor, natural water flows shall not be impeded, ditches shall not drain directly into watercourses, and erosion shall be controlled.
- .3 A vegetated buffer zone shall be maintained between an access road and any watercourse, to the extent possible.
- .4 The cost of supply and application of hydroseeding and/or mulching for the access roads within 30 metres of the shoulders of the watercourse shall be paid for under Item 614 and 616 respectively, otherwise it shall be the Contractor's responsibility.
- .5 The cost, installation, maintenance and removal of all sediment control fencing required for any access roads within 30 metres of the shoulder of the watercourse shall be paid for under Item 602, otherwise it shall be the Contractor's responsibility.

921.4 ACCESS TO PUBLIC ROADS

- .1 The Contractor shall make every effort to avoid tracking mud, snow, and debris onto public roads. Any such materials that are tracked onto a public road shall be scraped or swept off no later than sunset each Day, and during the Day if so needed, to the satisfaction of the Engineer.

922.1 DESCRIPTION

- .1 Notwithstanding the Ownership of the property the Contractor shall operate all pit and quarry sources in such a manner that the Work places are maintained in a neat and safe condition at all times during the period of the Contract and in accordance with the laws of municipalities, the Province of New Brunswick and the Government of Canada.
- .2 The Contractor shall be responsible to ensure he/she has obtained all permits, leases and other regulatory requirements pursuant to the laws of municipalities, the Province of New Brunswick and the Government of Canada for the operation of the Work, and copies of the relevant documents shall be provided to the Engineer before commencing the Work.
 - .1 Any new pit or quarry, or the expansion of an existing pit or quarry shall be developed and operated in accordance with all applicable federal and provincial guidelines, policies, acts and regulations, including (where applicable on Crown Lands) the Crown Lands Use Policy for Pits and Quarries and the Quarriable Substances Act.
- .3 Where the source of supplies for pits and quarries is located on land controlled by the Owner, a royalty fee of 25 cents per tonne shall be paid by the Contractor to the Owner.
 - .1 Where materials are made available from excavation within the Work Site, the royalty fee of 25 cents per tonne will not apply.
- .4 The Contractor shall be responsible, at his/her own expense, for the development and maintenance of the source.
 - .1 Where the source is located on land controlled by the Owner, and is specified in the Contract Documents, the Owner shall compensate the Contractor, in accordance with the specific requirements outlined in the Contract Documents, for the development of the pit or quarry.
 - .2 Where the source is identified in the Contract Documents as being within the Work Site, it will be considered a pit or quarry in accordance with this Item, except that the Work described under 922.1.7 shall be carried out under the appropriate bid Items.
- .5 The Contractor shall operate the source in such a manner so as not to limit the ability to mine additional areas of the source in the future, by either her/his own forces or others.
 - .1 Sources within the Work Site shall be operated as specified in the Contract Documents.
- .6 The Contractor shall make every effort to optimize the use of the resource and shall adjust the Work to achieve the minimum of waste from the mined materials.
 - .1 Where the source is owned or controlled by the Owner the Contractor shall, in the case of a quarry, process all oversize material produced during the course of the Work and in the case of a pit, process all naturally occurring rocks up to 400 mm in greatest dimension.
- .7 The Contractor shall clear, grub and strip the Overburden from the source over an area sufficiently large enough to ensure that no contamination of the source materials will occur during drilling, blasting and excavation.
 - .1 Consolidated Overburden shall be stripped back a minimum distance of 2 m from the face; unconsolidated Overburden shall be stripped back a minimum distance of 7 m from the face.

PITS AND QUARRIES

ITEM: 922

- 922.1.7 .2 The waste material shall be removed from the Work Area and disposed of in accordance with the laws of municipalities, the Province of New Brunswick and the Government of Canada.
- .3 The location of the waste disposal site shall be such that any runoff or sediment-laden water draining from this area cannot impact on any stockpile area(s) or future use of the site.
- .8 The Contractor shall be responsible to restore the areas affected by the Work and in accordance with the permits, leases and other requirements identified in 922.1.2.

922.2 SULPHIDE-BEARING ROCK

- .1 Aggregate Base/Subbase, Shoulder Material and Random Riprap made from quarried rock shall have a total sulphur content of less than 0.3%; or a Neutralization Potential (NP) at least three times the Acid-generating Potential (AP), as represented by the Neutralization Potential Ratio, where $NPR = NP/AP \geq 3$.
- .2 The NPR shall be determined by the Modified Sobec procedure (acid-base accounting), based on total sulphur.

926.1 DESCRIPTION

- .1 Prior to submitting a Tender quotation, the Bidder shall have access to and may examine, at the Owner's normal place of business, the record of all borings, test excavations, and other subsurface investigations and soil analyses, if any, made for design of the Work, the records of which may or may not be shown on the Plans.
- .2 Any subsurface information available is based on the investigation made at the specific locations indicated. The Owner makes no guarantees, representations, warranties, either expressed or implied, with respect to any such information, and cautions the Bidder that these conditions are not necessarily typical and may have changed since the field data were collected.
- .3 The Owner makes no guarantees, representations or warranties, either expressed or implied, that the presence or absence of water on the site and any subsurface explorations when made, will be representative of the actual conditions at the time of construction.

927.1 GENERAL

- .1 Asphalt Concrete Core Data are provided by the Owner solely for the Bidder's/Contractor's information.
- .2 Any Asphalt Concrete Core information available is based on the investigation made at the specific locations indicated and the Owner makes no guarantees, representations, warranties, either expressed or implied, with respect to any such information, and cautions the Bidder/Contractor that these conditions are not necessarily typical and may have changed since the field data were collected.
- .3 Responsibility for interpretation and use of Asphalt Concrete Core Data in preparing a bid shall be that of the Bidder.

928.1 GENERAL

- .1 The Owner may require that geotechnical instrumentation be installed, by the Engineer or by others, within the Work Area and during the period of Work under the Contract.
 - .1 Installation and other pertinent details relating to the geotechnical instrumentation shall be as listed in the Contract Documents.
 - .1 Where the need for geotechnical instrumentation, of an emergent nature, occurs during construction, locations and installation details will be determined by the Engineer, in consultation with the Contractor.
 - .2 To expedite the installation and reading of the geotechnical instrumentation, the Contractor shall provide access and other assistance, as deemed necessary and appropriate by the Engineer.
 - .2 In the immediate area of the geotechnical instrumentation, where normal methods of fill placement and compaction do not ensure the integrity of the instrumentation, the Contractor shall supply fill material with a maximum particle size of 75 mm, and this material shall be placed and compacted by hand around the instruments.
 - .1 The placement of hand placed material shall be concurrent with the surrounding fill, which is to say that the fill elevation immediately surrounding the instruments shall be at the same elevation, within 0.5 m, of the surrounding work.
 - .2 The extent of the hand placement of fill will be determined by the Engineer, based on the material, equipment and methods used by the Contractor which have been deemed to endanger the integrity of the geotechnical instruments.
 - .3 It is imperative that this instrumentation remain intact and serviceable throughout the project.
 - .4 The Contractor shall organize his activities to ensure that the geotechnical instrumentation is not damaged, or rendered inaccessible or unusable.
 - .5 Geotechnical instrumentation damaged by the Contractor's operations shall be repaired or replaced by the Engineer, at the Contractor's own expense.
 - .1 The Engineer will endeavour to effect the repairs or replacement as soon as possible, however any additional cost due to delays will be the responsibility of the Contractor.
 - .6 Continuity of records is essential.
 - .1 If instrumentation is damaged or destroyed, the Engineer may impose limitations or restrictions on the Work within the area subject to monitoring.

931.1 WEIGHING DEVICES

- .1 The Contractor shall supply the scales necessary for determining the quantities for Contract Items that specify measurement for payment by the tonne or other mass unit.
- .2 All weighing devices shall be of a size to safely and legally weigh loads as described herein and shall be installed at a location that has been approved by the Engineer for the scale placement.
- .3 Belt scales and loader scales shall not be used unless inspected and approved by Measurement Canada (MC).
 - .1 The Engineer reserves the right to request periodic checks to be made by weighing loads on approved truck platform scales.
 - .2 All costs associated with the periodic checks shall be borne by the Contractor.
- .4 Truck platform scales will be subject to the requirements of 931.4.
- .5 The cost of supplying, setting up, any adjustments or repairs as required, and dismantling of weighing devices shall be borne by the Contractor.
- .6 If the Owner requires that the Contractor move his/her scales after the initial set-up, the Owner will pay for the cost of the move.

931.2 WEIGHING PROCEDURES

- .1 The weighing procedure to be followed by the Owner's weighers on Contract Work or other Work for the Owner will be carried out for determining payment quantities only.
- .2 The truck driver shall be responsible to ensure that the legal axle limits are not exceeded.
- .3 Any material hauled in excess of the maximum weights provisions of Regulation 2001-67, Vehicle Dimensions and Mass Regulation under the NB Motor Vehicle Act, will not be paid for or considered eligible for payment as part of the Work under any Item of the Contract.
- .4 The Contractor must ensure all trucks and other hauling units are properly registered to legally carry the gross weights they intend to haul on the Highway.
- .5 All hauling units used in the Work shall be tared at the start of the Work and at least once during every week in which they haul material weighed under the Contract, and more frequently if requested by the Engineer.
- .6 Tare and gross weights of hauling units shall be recorded typically to the nearest 10 kg, or in the case of a beam scale, to a maximum of the nearest 50 kg.

931.3 LOADER SCALES POLICY

- .1 The following policy shall apply to the Contractor's loader scales used on the Contract.
- .2 Measurement Canada is the only company that may inspect and certify loader scales.
- .3 Measurement Canada will perform periodic marketplace monitoring inspections to ensure that Contractors are abiding by the provisions of the Weights and Measures Act and Regulations.
- .4 Loader scales will be acceptable for weighing of raw materials used in road construction, such as materials under Item 121, 167, 201, 203, 204, and 608.
- .5 Loader scales will not be acceptable for weighing manufactured road materials including asphalt concrete, concrete, and any other material consisting of binder combined with aggregates.
- .6 Loader scales will not be acceptable for weighing winter sand or salt.
- .7 Loader scales will not be acceptable for weighing topsoil, ornamental rocks and gravels, or any other material primarily used for landscaping purposes.
- .8 Loader scales that do not comply with the equipment restrictions on the certificate of inspection will not be accepted for use on the Owner's Work.
- .9 The Contractor shall be responsible for the mechanical condition and proper operation of the loader scales to correctly weigh, within designated tolerances, materials used on the Contract, whether the scales are owned by his/her company, subcontractor, a supplier, or other.
- .10 The Contractor, at his/her own expense, shall ensure that Measurement Canada has inspected and certified the loader scales.

931.4 TRUCK PLATFORM SCALES POLICY

- .1 The following policy shall apply to the Contractor's truck platform scales used on the Contract.
- .2 The term "scales" used hereinafter shall mean permanent and portable truck platform scales.
- .3 Measurement Canada does not perform request inspections of the Contractor's scales for the first set-up of the calendar year nor annual inspections of scales left in place over twelve months.
- .4 Measurement Canada will perform periodic marketplace monitoring inspections to ensure that Contractors are abiding by the provisions of the Weights and Measures Act and Regulations.
 - .1 As a result of a routine inspection, if a Measurement Canada Inspector determines that a Contractor's scale is non-compliant, a notice of non-compliance will be issued and the Contractor will be required to have their device repaired.
 - .1 A report of the alteration or repair shall be sent to the nearest Measurement Canada office within 7 Days.
 - .2 If the Contractor's scale is placed under seizure, repairs must be completed and the scale released from seizure by Measurement Canada prior to the scale being put back into services. Once the scale has been brought back into compliance, Measurement Canada may schedule a re-inspection.

SCALES AND WEIGHING PROCEDURES

ITEM: 931

- 931.4 .5 Upon the request of the Engineer, the Contractor shall engage a Private Scale Company to do random checks in order to verify calibration of certain scales.
- .1 The term "Private Scale Company" shall mean any of the companies listed in Table 931-1 having standard test weights meeting the requirements of 931.6.
 - .2 After being given notice by the Engineer that the scales are to be checked, the Contractor may continue using the scales but shall make no adjustments to the scales until the testing is carried out.
 - .3 The Contractor shall have the testing carried out by a Private Scale Company within 7 Days of the Engineer's notice.
 - .4 If the testing proves the scales are accurate without adjustments or repairs, the Owner shall pay the Private Scale Company's charge for the testing.
 - .5 If the testing proves the scales are not accurate, the Contractor shall pay the Private Scale Company's charge for the testing.
 - .1 The scales shall not be used again until necessary adjustments or repairs have been carried out and the scales have been determined to be accurately calibrated, all at the Contractor's expense.
 - .6 The cost associated with any delay to the Contractor for the time the scales are out of operation as a result of the testing requested by the Engineer shall not be paid by the Owner, nor will it form the basis of any claim.
 - .6 The Contractor shall be responsible for the mechanical condition and proper operation of the scales to correctly weigh, within designated tolerances, materials used on the Contract, whether the scales are owned by his/her company, a subcontractor, a supplier or other.
 - .7 The Contractor shall ensure that a Private Scale Company has verified that the scales have been properly installed and calibrated as per 931.4.7.1 and have affixed thereon a test sticker bearing the Private Scale Company's name or logo, the date of testing, the technician's signature, and any pertinent remarks.
 - .1 Testing shall be carried out for each set of scales in the following cases:
 - .1 For the first set-up of the calendar year.
 - .2 For each subsequent set-up that same year if moved.
 - .3 Prior to the first use in the following year if not moved.
 - .4 Every twelve months if the scales are a permanent installation.
 - .2 Testing per 931.4.7.1 will be at the Contractor's expense.
 - .3 The Private Scale Company's test sticker shall not be removed until superseded at the next time testing is performed as per 931.4.7.1.
 - .8 Scales that do not have a dated sticker stating that they are in proper calibration will not be accepted for use on the Owner's Work.
 - .9 A report (statement of accuracy) shall be completed by the Private Scale Company for each time testing is performed per 931.4.7.1 and distributed as follows: the original to Measurement Canada, and a copy to the Engineer or posted in the scales.

931.5 OPERATION OF TRUCK PLATFORM SCALES

- .1 While it is acceptable to affix guiderail, curbing or other edge barriers, to the scale deck to prevent vehicles from running off the edges, the use of timbers or other means to extend the width of a scale deck beyond the width specified in the Measurement Canada Notice of Approval issued for the particular device type, is not permitted.
- .2 Extra-wide vehicles (off-road trucks, scrapers or loaders) must be weighed on extra-wide scales, designed and built to weigh such vehicles.
- .3 Scales with a deck having no guiderail or curb on the scale house side, or so narrow that the wheels of Equipment being weighed protrude over the edge(s), will be subject to closure under Section 32.1 of the Occupational Health and Safety Act.
- .4 The Contractor shall not "split-weigh" vehicles to determine the weight of a load for payment. Scales must be provided which are long enough to fully support all axles of the vehicle being weighed.
 - .1 Split weighing is acceptable only as a means of estimating the axle weights.
- .5 Each approach to the scales shall be maintained level at the same plane as the scale deck for a distance of at least 3 m from the end of the deck.
- .6 Scales shall not be used at any time which are poorly set up, damaged and/or inaccurate or otherwise improperly installed. Scales which have been struck or jarred or are jamming or reading erratically shall be shut down immediately, notwithstanding 931.4.5.

931.6 TEST WEIGHTS AND TOLERANCES FOR SCALES

- .1 Testing of scales, regardless of type of scale or type or value of material weighed on them, shall require a minimum of 10 000 kg (20 000 lb) of test weights that have been certified by Measurement Canada within the previous twelve months. Test results shall be within the applicable limit of error as specified by the Non-Automatic Weighing Device (NAWD) Specification.

931.7 SCALE HOUSE

- .1 The Contractor shall provide a scale house meeting the following minimum requirements:
 - .1 A minimum work area of 2.5 m by 1.8 m with a minimum height clearance of 2.1 m, containing a functional desk and chair.
 - .2 Heating or cooling to provide a room temperature between 20°C and 25°C, with adequate ventilation.
 - .3 Sufficient lighting to the level of intensity and of the quality defined by the standards for the type of Structure defined and the Work being performed.
 - .4 An approved and maintained first-aid kit mounted on the wall at an accessible location on the interior of the house.
- .2 The Contractor shall provide a safe means of access to and egress from the scale house.

SCALES AND WEIGHING PROCEDURES

ITEM: 931

- 931.7 .3 All roads leading to the scale house shall be maintained so as to provide a safe passage for vehicles, and dust control shall be maintained within 30 metres of the scale house.
- .4 The Contractor shall provide toilet facilities in close proximity to the scale house for the weigher.

931.8 PRIVATE SCALE COMPANIES

- .1 Table 931-1 lists the Private Scale Companies which have test standard weights which Measurement Canada have certified for calibrating and checking contractors' truck platform scales. The listed accredited Private Scale Companies are authorized to perform testing pursuant to the Weights and Measures Act.

**Table 931-1
Accredited Private Scale Companies**

Advatek Systems Inc.	Moncton, NB	506-857-0909
Aggregate Equipment (Atlantic) Limited	Truro, NS	902-896-8943
All Weigh Systems (2002) Inc.	Fredericton, NB	800-563-9344
Fleetway Inc.	Saint John, NB	506-648-2226
Mettler-Toledo Inc.	Canada	800-663-5456
Weigh-Tronix Canada	Atlantic Canada Fredericton, NB Quebec, QC	800-565-7889 506-454-4010 888-496-9019

- .2 This list may be expanded as additional scale companies acquire test standard weights that are certified by Measurement Canada.
- .3 Any of the Private Scale Companies listed above who are found by Measurement Canada to be no longer capable of providing inspection services will be struck from the list.
- .4 Contractors are advised to verify the acceptability by the Owner of any company either appearing or not appearing on this list prior to tendering on the basis of that company.
- .5 The Owner shall maintain a current listing of all qualified firms and that list may vary from the one included in this section. This list will be made available to any Contractor who wishes to review this information for tendering or Contract purposes.
- .6 The Contractor's own standard test weights may be used for the testing or inspection of scales, provided these weights have been certified within the previous twelve months by Measurement Canada and the testing or inspection is performed by a Private Scale Company technician.
- .7 Measurement Canada may be contacted as follows:

Measurement Canada Atlantic District
50 Brown Avenue
Dartmouth, NS
B3B 1X8
phone: 902-426-9982

932.1 GENERAL

- .1 The purpose of this Item is to specify the Contractual provisions which will be followed by the Contractor to ensure that the owners of "Private Trucks" receive a reasonable distribution of the available Work and that they are paid for that Work in a timely manner and at rates as specified in Division 800 of the Contract Documents.
- .2 The Contractor shall do all that is necessary to ensure that the purpose of this Item is achieved.

932.2 DEFINITIONS

- .1 For the purpose of this Item, the following definitions shall apply:
 - .1 "Truck" means a straight truck, or a truck-tractor with or without a trailer.
 - .2 "Company Trucks" means a truck legally owned or leased by the Contractor or Subcontractor and includes:
 - .1 any truck, legally owned or registered in the name of an officer or the name of the spouse of an officer of the Contractor,
 - .2 any truck leased by the Contractor for or on behalf of a "Local Resident",
 - .3 any truck leased by the Contractor to a "Local Resident", and
 - .4 any truck, the registration of which has been transferred from the Contractor to a "Local Resident" (this includes franchise transfers).
 - .3 "Private Truck" means a truck legally owned or leased by a "Local Resident", other than a lease arrangement within the definition of "Company Truck".
 - .1 In the case that the "Private Truck" is registered with a trucker's agent that requires direct payment, the payments shall be made to the trucker's agent.
 - .4 "Local Resident" means a person having residence or a corporation having its principal place of business, in the area in proximity to the limits of the Contract for a period of three months or more prior to the date of the Contract.
 - .5 "Pay Period" means each two week period, during the term of the Contract, commencing on the Monday of the week in which the first Private Truck worked on the Contract, and continuing in two-week periods thereafter.

932.3 APPLICATION

- .1 This Item applies to the hauling of filter material, Aggregate Base/Subbase, shouldering material, blending sand, topsoil and asphalt concrete both within and outside the limits of the Contract.
- .2 This Item also applies if the Contractor chooses to haul any of the above-noted materials to a stockpile, to be reloaded for incorporation into the Work at a later date.
- .3 This Item does not apply to the movement or hauling of any other type of material including but not limited to excavation, Borrow, backfill, riprap, or reclaimed asphalt concrete.

PRIVATE TRUCKS

ITEM: 932

932.3 .4 The Contractor shall carry out the Work in such a way that no more than 25% by weight of the tendered Quantity of each material to which this clause applies is hauled by “Company Trucks”.

.1 The remainder (75%) of each material to which this clause applies is to be hauled by “Private Trucks”, regardless of the tendered or actual Quantity of material.

.5 The Contractor shall stop using “Company Trucks” to haul a material to which this clause applies when 25% by weight of the tendered Quantity of that material has been hauled by “Company Trucks”.

.6 The Owner shall refuse to weigh and pay for any material hauled by “Company Trucks” in violation of this clause.

932.4 CONDITIONS

.1 When “Private Trucks” are hired the following conditions shall apply:

.1 The Contractor shall be responsible for the hiring of “Private Trucks” required on the Contract.

.2 The Contractor shall give Private Truck owners at least 24 hours notice of the requirements for trucks on the Contract.

.3 “Private Trucks” must be properly equipped, registered, and insured for the Work for which they are hired.

.4 The Contractor shall ensure that operators of “Private Trucks” have met the following requirements:

.1 Operator has successfully completed the following safety training:

- Occupational Health and Safety (OHS) Awareness;
- Workplace Hazardous Material Information System (WHMIS) training; and
- Work Area Traffic Control Manual (WATCM) Awareness.

.1 OHS and WHMIS training courses shall be provided by the New Brunswick Construction Safety Association (NBCSA); Safety Services New Brunswick (SSNB); or a member of the Association of Safety and Health Consultants and Trainers (ASHCAT).

.2 WATCM awareness training is available on the NBDTI website.

.2 Operator has met the required driver’s licence for the type of “Truck” being used to haul material.

.3 Operator has carried out a pre-trip inspection each Day that the “Truck” is used.

.5 “Private Trucks” not available at the time of request by the Contractor, or who leave this Contract for other work, do not later have the right to “bump” “Private Trucks” already hired or “Company Trucks” hauling the 25% allotted to the Contractor.

.6 “Private Trucks” shall be hired in a fair and reasonable manner and without regard to membership in any organization. In the event the Owner determines that the Contractor is not distributing the Work under this Item in a fair and reasonable manner, the Owner may direct the Contractor to hire “Private Trucks” in accordance with this clause.

PRIVATE TRUCKS

ITEM: 932

- 932.4.1 .7 One Private Truck shall, if available, be hired from each "Local Resident" before a second Private Truck is hired from the same "Local Resident".
- .8 The Contractor shall, within one week after each "Pay Period", pay the owner of each Private Truck, in full, for the Work done, by the Private Truck on the Contract during the "Pay Period".
- .9 The Contractor shall pay the owner of each Private Truck haulage rates not less than the haulage rates set out in Items 801 and 802. There shall be no deductions of any kind whatsoever from the amount paid to the owner of the Private Truck by the Contractor save and except deductions for overweight material in accordance with the provisions under Item 931, fuel supplied by the Contractor and/or Workers Compensation deductions. The amount to be deducted by the Contractor from the owner of the Private Truck for materials hauled overweight must be posted in a visible location at the Scale House at all times during the period that "Private Trucks" are hauling any materials on this Contract.
- .10 In the event the Contractor does not pay the owner of the Private Truck in full and in a timely manner as stated above, the Owner may pay the owner directly pursuant to the provisions of GC 20. In the event of direct payment by the Owner to the owner of the Private Truck, the Owner shall deduct from any amount due and payable to the Contractor under the Contract, the amount paid to the owner of the Private Truck plus an administration cost of 20% of that amount, which is to the extent of the deduction, a discharge of the Owner's liability under the Contract to the Contractor.
- .11 The Contractor shall not enter into an agreement with the owner of any Private Truck to haul material on the Contract at a rate less than the haulage rates set out in Items 801 and 802. In the event that the Owner determines that the Contractor has entered into such agreement, the Owner may pay the owner of the Private Truck in accordance with 932.4.1.9, notwithstanding the terms of the agreement between the Contractor and the owner of the Private Truck.
- .12 The Owner may at any time or on a regular basis require the Contractor to provide proof of payment by the Contractor to the owner of any Private Truck. The proof of payment shall include but not be limited to:
- .1 the amount and type of material hauled by the Private Truck,
 - .2 the date(s) the material was hauled,
 - .3 the distance of the haul or hours of Work, if hired on an hourly basis,
 - .4 the total amount paid by the Contractor to the owner of the Private Truck, and
 - .5 the amount of any deductions made by the Contractor from the payment to the owner of the Private Truck.
- .13 The Owner may at any time carry out an audit on the records of the Contractor pursuant to GC 47 to verify payment to the owner of a Private Truck.

HEAVY EQUIPMENT

ITEM: 933

933.1 DESCRIPTION

- .1 The purpose of this Item is to identify under what conditions Heavy Equipment may be used in highway and bridge construction.

933.2 DEFINITIONS

- .1 For the purposes of this Item the following definitions apply:
 - .1 Heavy Equipment means scrapers, rock trucks, overweight straight or trailer dump trucks, front-end loaders and like Equipment used to transport materials.
 - .2 Rock means fractured rock produced from any type of bedrock suitable for Roadbed construction, whether excavated under Item 108 or 161 or imported under Item 121.
 - .3 Common material means any type of soil suitable for Roadbed construction, whether excavated under Item 106, 107 or 161, or imported under Item 121. It can also mean a mixture of soil and rock, either naturally occurring as in the zone of weathered rock above more competent bedrock, or mixed by the Contractor's method of excavation and loading.
 - .4 Sub-subgrade means the surface at a specified depth below Subgrade in undercuts and the top of embankments. The specified depth is usually 600 mm but may be a lesser or greater depth depending on the nature of the underlying material.
 - .5 Backfill means the layer of Borrow A/A1-quality material, as indicated in the Contract Documents, placed on the sub-subgrade surface to Subgrade elevation in cuts or embankments.

933.3 USAGE OF HEAVY EQUIPMENT

- .1 Heavy Equipment may be used to build and/or haul materials on rock Subgrade, as in a solid rock cut, or any fill that has rock comprising at least the top 1 m of Subgrade.
- .2 Heavy Equipment may be used to build and/or haul on common material Subgrade provided such usage does not damage the Roadbed.
 - .1 Damage to the Roadbed is defined as, but is not limited to, rutting that gets progressively worse, or contamination such as waste material spilling from the hauling units.
- .3 Heavy Equipment may haul over backfill material that forms the top layer of a common material embankment as long as there is no rutting or pumping of the underlying material. If such rutting or pumping occurs, hauling with Heavy Equipment shall cease immediately.
 - .1 After completing repairs, if any, in accordance with 933.3.3.1, the Contractor may resume hauling if using trucks that meet the axle mass requirements of Regulation 2001-67, or if the subgrade is surcharged to allow hauling with Heavy Equipment.
 - .1 The surcharge shall consist of the same material as used for backfill, and shall be placed along the Subgrade Shoulder to provide at least 1 m of cover over the sub-subgrade and sufficient width for at least one-way travel for a loaded vehicle.

HEAVY EQUIPMENT

ITEM: 933

- 933.3.3.1 .2 When hauling over the surcharge is finished, the surcharge material shall be incorporated as backfill to Subgrade elevation by means other than with Heavy Equipment.
- .3 The surcharge material will be measured for payment under the appropriate bid Item when incorporated as backfill. The operation of removing and incorporating the surcharge as the backfill layer will not be measured for payment.
- .4 Heavy Equipment is prohibited from hauling over common material undercuts during and after placement of backfill material, unless a surcharge is constructed as described in 933.3.3.1.1 through 933.3.3.1.3.
- .5 Heavy Equipment is prohibited from hauling along any Roadbed surface constructed above Subgrade elevation, including Aggregate Subbase, Aggregate Base and Pavement.
 - .1 If the Contract consists of upgrading an existing Highway, hauling with Heavy Equipment above Subgrade may be allowed, as follows:
 - .1 Only on sections of the existing road that will be excavated or built up within the same calendar year to form a new Subgrade; and
 - .2 Only if the existing Roadbed does not start to deteriorate and/or the hauling operation does not become unsafe.
- .6 The approval of the Engineer is required prior to Heavy Equipment hauling over Culverts with less than 3 m of fill.
 - .1 The Contractor shall submit detailed calculations stamped and signed by a Professional Engineer, in support of such request at least 7 Days before hauling is due to commence.

933.4 OTHER

- .1 The Contractor shall make all necessary repairs to the Roadbed damaged by hauling operations, and complete such repairs to the satisfaction of the Engineer.
- .2 Failure of the Contractor to stop hauling when so ordered may result in suspension of his operations in accordance with GC 18.
- .3 Any delays and costs to the Contractor resulting from performing repairs or suspension will not be considered as a basis of claim for extra costs or extension of the Limited Funds date, Specified Work Date or Completion Date, as the case may be.

934.1 GENERAL

- .1 All trucks Working on the Contract and having a registered vehicle mass greater than 4535 kilograms are to be equipped with a properly functioning, audible, automatic back-up alarm.

936.1 DESCRIPTION

- .1 This Item details the general requirements to be carried out with respect to compaction of soil, aggregate and RAP construction materials, by the Contractor.

936.2 SOIL and AGGREGATE

- .1 All Roadbed materials shall be placed in lifts of a loose thickness not greater than that specified in the Item under which the material is excavated or supplied, and compacted to at least the specified percentage of maximum dry density uniformly throughout the lift.
 - .1 Frozen materials shall not be incorporated into the Roadbed, and Roadbed materials shall not be placed on a frozen Roadbed surface without prior approval of the Engineer.
- .2 For most soils, and for Aggregate Base and Shoulder Material, the maximum dry density will be determined by ASTM D698.
 - .1 If the sample used in carrying out ASTM D698 has greater than 5% but less than 30% of oversize particles (retained on the 19 mm sieve), the maximum dry density will be the corrected value determined as per ASTM D4718.
 - .2 If the material being placed in the Work has a percentage of oversize particles more than 5% higher or lower than the percentage in the sample of 936.2.2.1, the maximum dry density will be the value calculated using the actual field percentage of oversize, as per ASTM D4718.
 - .3 For coarse granular materials and Aggregate Subbase the maximum dry density will be determined as per ASTM D4253.
- .3 For Aggregate Base/Subbase and soil, the Contractor shall take all necessary measures to ensure that the moisture content is such that compaction is achieved in accordance with 936.2.1 and the following:
 - .1 For Aggregate Base/Subbase, the moisture content shall be such that compaction is achieved without adversely breaking down or segregating the aggregate (such that its gradation falls outside the specified grading limits, as determined by sieve analyses on random samples of the compacted in-place material).
 - .1 The average moisture content of Aggregate Base/Subbase shall not be less than 3% or greater than the optimum moisture content at time of compaction.
 - .2 For soils placed in the top 1.2 m to Subgrade in embankments, the moisture content shall be a value not greater than the optimum moisture content as defined by ASTM D698 or the saturated moisture content as defined by ASTM D4253, and such that no rutting damage, as defined in 933.3, occurs upon completion of compaction.

- 936.2 .4 The Contractor shall note that the moisture density relationship (maximum dry density - optimum moisture content), and more precisely the moisture density relationship at a specified compactive effort, is a unique parameter for each soil and/or aggregate matrix considered, and the Contractor shall be responsible for the placement of the material at the appropriate moisture content for compaction efficiency.
- .1 In the event material is too dry for compaction as specified herein, the Contractor shall apply water to the area to be compacted in order to increase the moisture content of the soil or aggregate.
 - .2 In the event material is too wet for compaction, as specified herein, the Contractor shall decrease the moisture content of the soil or aggregate.
- .5 The energy imparted to the soil shall be sufficient to achieve the specified density, as determined by one of the following ASTM tests: D1556, D2167 or D2922.
- .6 No subsequent lifts shall be placed until the preceding lift has been verified as meeting the minimum compaction criteria defined.
- .7 A test strip may also be used to determine a control density and the number of passes of compaction equipment required to achieve this result.
- .1 The test strip shall be performed on a lift of placed material with density tests taken after each pass of a compactor until an insitu maximum dry density (control density) is achieved. This procedure will continue until the density result remains constant or decreases. The test strip determines the maximum number of passes, control density and field moisture content.
 - .2 The compaction equipment to be used for test strips shall be able to produce a uniform density throughout the lift and have a minimum mass of 9 tonne and a vibratory capacity of at least 1500 vpm.
 - .1 Smaller compactors will be allowed for test strips at Culverts.
 - .3 Lifts shall be compacted to a minimum of 97% of the control density.

936.3 RAP

- .1 Compaction of RAP placed as Aggregate Subbase, Aggregate Base or shoulder material will be considered to be achieved upon completing the roller pattern approved by the Engineer.

936.4 APPLICATION of WATER

- .1 All application of water shall be carried out in accordance with Item 191.

941.1 DESCRIPTION

- .1 Unless otherwise noted, the Engineer shall furnish and set stakes, marks and furnish data as deemed necessary to establish lines and grades required for the Work.
- .2 Before commencing the Work, the Contractor shall satisfy himself/herself as to the meaning of all stakes, marks and measurements.
- .3 Claims will not be considered because of alleged inaccuracies unless the Contractor notifies the Engineer, in writing, in sufficient time to allow for the verification or checking of stakes, marks or measurements by the Engineer.
- .4 The Contractor shall notify the Engineer of the requirements for stakes and/or marks, at least 3 Days in advance of starting each operation requiring staking or marks.
- .5 The preservation of stakes and marks that have been set by the Engineer for the convenience and/or the guidance of the Engineer and the Contractor, shall be the responsibility of the Contractor.
- .6 Construction stakes or marks carelessly or wilfully destroyed or disturbed by the Contractor, will be replaced by the Engineer.
 - .1 The cost of replacing or restoring such stakes and/or marks shall be at the Contractor's own expense.
- .7 The Contractor shall furnish, set and paint barricades around stakes and marks when and as required.
- .8 The Contractor shall furnish and set all batter boards.
- .9 The Contractor shall ensure access for the Engineer for the checking and control of lines and grades.
- .10 If, during the construction operation, the Contractor finds that the location of the Engineer's control point stakes or marks would interfere with the Work, the Contractor shall notify the Engineer, in writing, at least 7 Days in advance of starting the operations which are in conflict with the control point locations.
 - .1 If it is determined by the Engineer that these stakes or marks are in conflict, the Engineer shall relocate these stakes and /or marks as identified by the Contractor.
- .11 Standard stake markings shall be as indicated on Standard Drawing 941-1.

941.2 EMBANKMENT CONSTRUCTION

- .1 In embankment construction the Engineer shall supply stakes for toe of Slope and Subgrade centreline and Shoulder elevations.
- .2 The Contractor shall supply all other stakes, marks and grades necessary to maintain the specified Foreslope up to Subgrade.

LINES AND GRADES**ITEM: 941**

941.3 HIGHWAY CUTS

- .1 The Engineer shall supply stakes for the Subgrade centreline and Shoulders, back of ditch and the top of Backslope.
- .2 The Engineer shall provide for the Contractor's use, offset stakes on each side of the alignment with grades indicated for the Shoulder (on front) and the back of ditch (on back).

941.4 DEEP FILLS OR CUTS

- .1 The Engineer shall set intermediate stakes at approximately every 3 metres of change in elevation as a check on the inclination of the Slopes excavated or constructed at the point of measurement and staking.
- .2 These stakes shall be set as follows:
 - .1 Cuts: a back of ditch stake will be set to ensure that the Backslope is not overexcavated at the point of measurement.
 - .2 Fills: a stake will be set in such a location as to be representative of the elevation of the lift of fill being placed and at the extreme edge boundary of the standard lift so as to ensure that the Foreslope is maintaining the specified line and grade.

941.5 STRUCTURES

- .1 The Engineer shall provide pile layout, centreline of Roadway, centreline of bearings, and building line or working points as designated on the Plans for each major component of the Structure.
 - .1 The Contractor shall reference and maintain these marks and carry out additional layout as required.
- .2 The Engineer shall provide benchmarks for grades which will be transferred to the concrete as construction progresses.
- .3 The Engineer shall provide layout for foundation excavation, approach Roadway cuts and fills, and other Contract Items in accordance with this Item.

941.6 TOLERANCES

- .1 The graded surface of material placed shall be checked with a 3 m straight edge, by stringline method or other method approved by the Engineer and shall be conducted at selected locations in the presence of the Engineer.
- .2 This measurement shall be taken along the centreline and Shoulder of the Work, as well as at cross Slope locations.
- .3 Areas which are determined to be outside the specified tolerances will be spray painted directly on the ground with the words "cut" or "fill", whichever is applicable.

- 941.6 .4 For Aggregate Base/Subbase checking shall be conducted by stringlining on a random basis.
- .1 The criterion for acceptable placement shall be that 90% or greater of the results, based on a minimum sample size of 20 locations, shall be equal to or within the specified tolerances.
 - .2 Should the requirements of 941.6.4.1 not be met, the Contractor shall repair the Work to meet the specified tolerances and shall conduct a new stringline survey of the Work as per 941.6, at his/her own expense.
- .5 For fine grading, checking shall be performed by stringlining between every stake location.
- .1 Fine grading of Shoulders or other restricted or narrow areas to be paved shall be carried out to the grades, slopes, dimensions and tolerances as directed by the Engineer.
- .6 The Contractor shall meet the design lines and grades within the tolerances as shown in Table 941-1. The variance at any point checked to any other point shall not exceed the stated tolerance.
- .7 The location of the checking shall be longitudinally from centreline point to centreline point, from Shoulder point to Shoulder point and based on the specified material and reference distance specified in Table 941-1.
- .8 Transverse checking shall be performed from the centreline point toward the Shoulder at the same location point (station) based on the specified material type and reference distance specified in Table 941-1.
- .9 The location of the checking diagonally, when requested, shall be from the centreline point toward the Shoulder at the next location point as defined by the reference distance, based on the specified material, specified in Table 941-1.
- .10 All lines and grades intermediate to the points of measurement shall be such that a smooth and continuous transition for any one point to another shall exist and shall be within the prescribed tolerances over the entire reference distance length.
- .11 The finished surface at any place shall not deviate from the lines and grades specified in the Contract Documents by more than the tolerances specified in Table 941-1.
- .12 All humps or depressions exceeding the specified tolerances shall be corrected by the Contractor by reshaping or removing the defective area(s) and/or replacing the area with new material as required.
- .13 When the material is to be placed adjacent to a Pavement the finished surface elevation shall be referenced to the edge of Pavement.
- .14 The Contractor shall be responsible to maintain the lines and grades of the Roadway surface until such time as the Work is accepted by the Engineer or the area is paved.

Table 941-1
Grade Tolerances

Surface Being Graded	Material Type	Tolerance
Subgrade or undercut	rock (except friable rock)	+75 mm/-50 mm
Subgrade or undercut	friable rock (sandstone, shale, etc.)	50 mm
Subgrade or undercut	soils	30 mm
Aggregate Subbase (top lift)	Aggregate Subbase	25 mm
Aggregate Base (placement)	Aggregate Base	20 mm
Aggregate Base (fine grading)	Aggregate Base	12 mm

NOTE: Grade stakes shall be placed at stations (longitudinal reference distances) of 25 m spacing, except for fine grading, for which the stations shall be at 12.5 m spacing.

Undercut means the surface at the specified depth below Subgrade in a cut or fill.

WORK PROGRESSION

ITEM: 946

946.1 DESCRIPTION

- .1 This Item describes the procedures and timeframes the Contractor shall follow to ensure effective protection of the environment and orderly progression of the excavation and embankment Work in erodible materials, by performing the Work diligently and in accordance with approved Work Schedule(s) submitted per Item 906.
- .2 Erodible material includes any material that has the potential to release sediment.

946.2 WORK AREAS

- .1 For the purpose of this Item, a Work Area is an area of the Work Site which has been grubbed or otherwise unstabilized on a given Day, it is date specific.
 - .1 A Work Area may encompass several small cuts and fills if they all can be completed within the 30-Day period; or
 - .2 A Work Area may be part or all of a large cut and fill; one large cut that satisfies several fills; or one large fill requiring material from several cuts and/or borrow to complete. For each such large Work Area in which the cut/fill Work is not able to be completed within 30 Days, 946.3.3 applies.
- .2 The extent of each Work Area (station limits, estimated quantities and duration of cut/fill Work therein) shall be as indicated on the approved initial and subsequent Work schedules.
- .3 The Contractor may work on more than one Work Area at a time, but each Work Area shall have its own 30-Day period.
- .4 The 30-Day period shall begin the day that grubbing, stripping, cut, fill construction begins.

946.3 STABILIZATION

- .1 Stabilization shall mean hydroseeding of all erodible materials, or, when the Engineer deems it is not practicable to do hydroseeding, mulching of such materials.
- .2 For Work Areas that can be completed within the 30-Day period, all ditches, slopes and other exposed areas shall be acceptably shaped, topsoiled where specified, and hydroseeded under Item 614.
 - .1 Such Work Areas shall be mulched under Item 616 if the 30-Day period extends beyond the cut-off date for hydroseeding per 614.4. Placement of topsoil in such cases will be at the discretion of the Engineer.
- .3 Work Areas that cannot be completed within the 30-Day period because cut/fill quantities are too large (per 946.2.1.2), shall have all erodible materials mulched under Item 616 as directed by the Engineer.
- .4 Stabilization is not required on the top surface of a fill or on the floor of a cut however the Contractor shall address the release of suspended solids through the installation of applicable erosion control measures.
- .5 Stockpiles, including topsoil piles, shall be mulched under Item 616.

WORK PROGRESSION

ITEM: 946**946.4 UNCOMPLETED WORK AREAS**

- .1 Work Areas that have been under continuous construction but are not completed by the end of the 30-Day period shall be stabilized per 946.3.3. Work shall continue on the cuts and fills, and shall be stabilized as directed by the Engineer per Item 616, until final shaping and hydroseeding are completed.
- .2 Work Areas that have not been under continuous construction, or that have been abandoned with cuts/fills uncompleted shall be mulched per 616.2 and 616.4 at the Contractor's expense by the end of the 30-Day period or by the 7th Day after abandonment, whichever is sooner.
 - .1 Abandonment shall mean ceasing construction on the cuts and fills in a Work Area without valid cause. Valid cause would include unworkable site conditions due to precipitation, or an order by the Engineer or officials from DFO, DELG or other regulatory agency to cease Work for reasons not attributable to the Contractor's actions or failure to act.
- .3 Work Areas that are not completed at the time of winter shutdown shall be mulched under Item 616, except any Work Areas the Contractor failed to mulch under 946.4.2 shall be mulched per 616.2 and 616.4 at the Contractor's expense.

946.5 OTHER

- .1 Erosion-prone embankments constructed within 30 m of natural watercourses shall be stabilized in accordance with Item 948 and as elsewhere specified in the Contract Documents.
- .2 Erosion-prone cuts shall be excavated such that runoff is directed to one or more exit points and controlled by Sediment Control Fence and/or Erosion Control Structures per Item 602 and Item 605, respectively or as otherwise directed by the Engineer.
- .3 Areas that have been acceptably shaped but are damaged by precipitation, runoff or slope failure before hydroseeding has been done, shall be acceptably repaired and reshaped at the Contractor's expense and then hydroseeded under Item 614.
- .4 Areas that have been acceptably shaped and hydroseeded, but are subsequently damaged by precipitation, runoff or slope failure, shall be repaired, reshaped under the provisions of Item 812 and hydroseeded under Item 614.
- .5 If stabilization of erodible materials has not been performed by the 30th Day as described in this Item, the Contractor shall pay to the Owner a penalty of \$ 1000.00 for each Day (except Sundays and Statutory Holidays) that the required Work remains unstabilized.
- .6 The "Item 946 Work Progression Tracking Report" is considered as official documentation of work progression.
- .7 Rock cuts shall be subject to the Work Area and 30-Day requirements of 946.2 unless the Engineer agrees that some of the in situ rock and/or blasted but unexcavated rock may be left in place for use at a later date. The stabilization requirements of 946.3 do not apply unless the rock cut foreslopes and ditches are to be topsoiled or are deemed to be an erodible material under 946.1.2 or otherwise release sediment.
 - .1 Rock fills shall be subject to the Work Area and 30-Day requirements of 946.2, including stabilization if the slopes are to be topsoiled or are deemed to be an erodible material under 946.1.2 or otherwise release sediment.

947.1 DESCRIPTION

- .1 Disposal areas are for the disposal of waste from clearing, grubbing and/or excavation and for all other surplus excavation materials not identified for stockpiling.
- .2 In cases where soil or rock is suspected of being contaminated, the Contractor shall call the Impact Management Branch of DELG at (506) 453-7945 for advice.
- .3 For disposal of known contaminated soil or rock and construction or demolition waste produced during the Work, the Contractor shall apply to DELG for an "Approval To Operate".
- .4 Disposal areas shall be located outside the Right-of-Way or as specified in the Contract Documents, where the materials placed in them shall not block or impede natural drainage and shall not be within 30 metres of any watercourse or be allowed to cause siltation of any watercourse.
- .5 Contractors shall be responsible to obtain permission from property owners to use their land as disposal areas, and are responsible for all costs thereof.
 - .1 If the Contractor places a disposal area on private property, the Owner shall in no way be responsible for any damages to septic tanks, wells, ornamental trees or shrubs, driveways, lawns, buildings or any other part of the property, whether such damage is alleged or proven to have been caused by placement of the disposal area material.
 - .2 The Contractor shall be responsible for all costs associated with the supply, maintenance and rehabilitation of disposal areas.
 - .1 Stabilization of disposal areas shall be carried out in accordance with 947.1.10.
- .6 Disposal areas shall be cleared of all Merchantable Timber in accordance with 101.1, 101.3 and 101.4, prior to the placement of any waste.
- .7 The minimum distance between the entrances of two disposal areas on the same side of the Highway shall be 150 metres unless specifically altered by the Engineer, in writing.
- .8 Entrances to disposal areas shall be at right angles to the centreline of two-way Highways and at an angle opposing the flow of traffic on divided Highways.
- .9 Entrances shall not exceed 10 metres in opening width and shall extend back along a line perpendicular to, or at the angle defined in 947.1.8 from the Right-of-Way for a minimum distance of 15 metres. All materials being pushed or otherwise deposited in the disposal area shall be placed at least 15 metres beyond the Right-of Way, i.e. beyond the entrance. Boulders and other debris shall not be left in the disposal area entrance.
- .10 Disposal areas shall be constructed such that the slopes are stable and left in a neat and finished appearance, and shall be hydroseeded, mulched or otherwise stabilized against erosion, obtaining guidance from the described work progression details as noted in Item 946 and to the satisfaction of the Engineer. Windrows of earth or debris on either side of the entrance shall be either removed or shaped to a uniform and level condition.

947.2 LICENCE OF OCCUPATION

- .1 For waste disposal areas on Crown Land the Contractor shall apply to the NB Department of Energy and Resource Development (DERD) for a Licence of Occupation.
- .2 The licence will be issued for all Crown Land adjacent to the Work Site. DNR district staff shall be responsible for approving the locations of individual waste disposal sites on the Crown Land.
- .3 Inquiries should be made to the Crown Lands Branch at (506) 453-3826.

948.1 DESCRIPTION

- .1 The Contractor shall carry out the Work on the Contract according to the Plans and Specifications and in such a manner so as to be in compliance with various Acts and Regulations of the Province of New Brunswick and/or the Government of Canada which concern the protection of the environment, and any approvals or permits issued to the Owner or the Contractor in accordance therewith.
 - .1 References to "Watercourse" in this Item mean "Watercourse/Wetlands".
- .2 Measures determined by the appropriate regulatory authorities as necessary for the protection of watercourses affected directly or indirectly by the Work will be detailed, to the degree practical and not necessarily all inclusive, on the Plans and in the Specifications under the appropriate bid Items.
- .3 Environmental protection measures shall be installed whenever possible prior to the commencement of the Work.
 - .1 If not possible to provide the environmental protection prior to the commencement of the Work, the Contractor shall as a minimum have all materials required for the environmental protection available on site prior to the commencement of any Work and shall install the environmental measures as soon as practical in the Work progression.
- .4 If any suspected artifacts of historical or archaeological value are uncovered or any endangered plant or animal species or any contaminated soil(s) are identified during the Work, the Contractor shall cease Work, in accordance with GC 18, until the site has been reviewed by representatives of the appropriate agencies and the Engineer has approved resumption of the Work.
- .5 The Contractor shall follow sound environmental construction practices.
 - .1 Guidance to the Contractor in applying these practices to his/her Work shall be derived from, but not limited to the Environmental Management Manual, the recommendations, conditions of approval and mitigation specified in the applicable Environmental Assessment (EA).

948.2 ENVIRONMENTAL INSPECTION

- .1 The Contractor shall be responsible for designating an on-site environmental representative who has completed Environmental Management Manual (EMM) training, and has the ability to address environmental issues, acquire staff, and procure materials when there is the potential for water and runoff issues, including holidays and weekends.
- .2 The Contractor's representative shall monitor the weather forecasts and prior, during, and after rainfall events the entire site shall be inspected for environmental mitigation deficiencies, and any deficiencies immediately addressed.
- .3 The Owner may retain an environmental inspector who, along with the Engineer and construction technicians, will monitor the Work with regard to compliance with environmental requirements of the Plans and Specifications as well as any applicable acts and regulations.

948.3 ENVIRONMENTAL MITIGATION

- .1 The Contractor shall complete the Work in accordance with the measures identified in 948.1.2 and the following conditions:
 - .1 Sediment and erosion control measures shall be carried out as detailed on the Plans and included in the Specifications.
 - .1 Sediment and erosion control measures shall be inspected, maintained, and repaired prior to and after rainfall events to the satisfaction of the Engineer.
 - .2 Debris and excavated material within the Work Area shall be removed from the watercourse and adjacent areas for disposal or placement in a manner such that it cannot be returned to the watercourse.
 - .3 Precautions shall be taken by the Contractor to prevent discharge or loss of any harmful material into a watercourse including but not limited to creosote, hydrocarbons, biocides, fertilizers, cement, lime, paint or fresh concrete.
 - .4 Machinery and pollutants shall be located or stored in areas not in danger of floodwaters.
 - .5 No grubbing, excavation, embankment construction or installation of drainage Structures shall take place within the buffer zones on both sides of each natural watercourse, as indicated in the Contract Documents, until the appropriate sediment and erosion control measures are installed in order to ensure that run-off, by the time it reaches a watercourse, does not have a suspended solids level in excess of:
 - 25 mg/L over background levels during any short term exposure, less than 24 hours.
 - 5 mg/L from background levels for longer term exposure, 24 hours to 30 Days; or
 - Other level approved by DELG.
 - .1 Installation, inspection, maintenance and repair of these structures shall be in accordance with the applicable Items from the Contract Documents.
 - .6 Within a buffer zone, any temporary Work Area access roads, haul roads and/or areas constructed for the installation of a drainage Structure, shall be surfaced with at least 100 mm of clean gravel or rock placed the same day they are built, to provide sufficient cover to the soil exposed so as to provide environmental protection to the watercourse from runoff.
 - .7 No blasting shall take place in or near a watercourse without prior written consent from DFO.
 - .8 In dewatering an excavation, whether a Roadway cut, foundation excavation, a pit or a quarry, the Contractor shall ensure that any turbid water pumped out or released has a suspended solids level, by the time it reaches a watercourse, of no more than 25 mg/L over background levels during any short term exposure (less than 24 hours) and 5 mg/L from background levels for longer term exposure (24 hours to 30 Days) or other level approved by DELG.
 - .1 Erosion and sediment control measures required to achieve this level of compliance when dewatering is conducted for Roadway or foundation excavations shall be constructed, inspected, maintained and repaired in accordance with and measured for payment under the appropriate Item(s) pertaining to the Work.

- 948.3.1.8
- .2 It shall be the Contractor's responsibility to install, inspect, and maintain, at his/her own expense, to the satisfaction of DELG any erosion control measures for pits and quarries that may be required, and to obtain permission to pump or release any turbid water onto properties abutting and beyond.
 - .3 The Contractor shall be responsible to repair, at her/his own expense, any and all damage resulting from the dewatering.
 - .9 The Contractor shall not place an earth or rock causeway in the watercourse for the purpose of creating a temporary access Structure, without specific approval of the Engineer and the appropriate regulatory authority(ies), in writing.
 - .10 Instream Work shall be carried out between June 1st and September 30th. The Contractor shall notify the Engineer, in writing, at least 7 Days in advance of the anticipated date of commencement of instream Work.
 - .11 Water control for all Culvert installations in natural watercourses, other than those for which a site-specific method and/or sequence is indicated in the Plans, or Item 621 is specified, shall be accomplished using one of the following methods:
 - .1 Installing the new Culvert in the dry and diverting the watercourse through it upon completion;
 - .2 Constructing a temporary clear/light coloured plastic-lined diversion channel in the dry; or
 - .3 Stemming the flow upstream and pumping the flow around the Work Area, ensuring the pump runs whenever there is sufficient water, and having the discharge back into the stream immediately below the Work Area.
 - .12 If it is necessary to isolate the stream from the Work Area, the Contractor shall construct cofferdams consisting of, as a minimum, a layer of 6-mil clear polyethylene sandwiched between an outer (stream-side) wall of sandbags and an inner wall of earth fill.
 - .13 The Engineer, upon receiving notice from the Contractor as to when construction shall actually commence, will arrange an on-site meeting with representatives from DELG, DFO and the Contractor, prior to commencement of the instream Work.
 - .1 No Work shall commence until the Engineer verifies with the regulatory agencies having jurisdiction that the Work Site is approved for the commencement of instream Work.
 - .14 Earthwork shall be carried out in accordance with Item 946. Erosion control measures shall be as detailed in the Contract Documents and if additional measures are required in addition to those indicated, the Engineer or the Contractor's on-site environmental representative shall order such Work under the appropriate Items.
 - .15 Natural materials produced and/or supplied by excavation or from pits and quarries shall not contain any friable, soluble or reactive minerals, or other deleterious materials or conditions that would make the material prone to decomposition or disintegration, or present any environmental hazard, from the presence of the parent material or its by-products, when exposed to the natural elements after placement in the Work.

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- 948.3.1 .16 Additional conditions of approval as detailed in the Contract Documents, shall be carried out by the Contractor.
- .17 A copy of the Watercourse and Wetland Alteration Permit shall be kept on the Work Site for the duration of the Contract, and shall be made available upon request of an inspector designated to act on behalf of DELG or an employee of DFO.
- .18 Any ruts created by Equipment within 30 m of a watercourse shall be immediately graded smooth and blanketed with hay/straw mulch.
- .19 In order to prevent the spread of invasive plants, no washing of tools or machinery shall occur within 30 m of a watercourse or wetland.
- .20 Equipment shall not be stationed and materials shall not be stored in a wetland at any time, and Equipment operations shall be limited to the footprint of the existing Roadbed or the new Roadbed being constructed.
- .21 All exposed erodible material within 30 m of a watercourse or wetland shall be stabilized with hay mulch at the end of each work Day.
- .22 Temporary Bridges
 - .1 Wherever crossing a stream is necessary, a prefabricated temporary bridge shall be installed so as to clear-span the watercourse.
 - .2 The bridge shall have foundations of skids or logs placed on undisturbed ground far enough landward of the stream bank shoulders and high enough such that the clearance below the underside of the stringers meets the following criteria:
 - .1 At least 0.75 m above the bed of the watercourse;
 - .2 At least 0.45 m above the ice or water surface the day of installation; and
 - .3 Sufficiently high above the ground at both ends to have Daylight visible.
 - .3 Approved types of temporary bridges include the following:
 - .1 A flatbed trailer body frame decked with steel or squared timbers; and
 - .2 Two or more prefabricated laminated squared-timber swamp mats of girders, the outer two of which are aligned collinear with the wheels of the Equipment that will be travelling over them.
 - .4 Temporary bridges shall be installed over a section of the watercourse where the channel is straight and narrow and the banks are high and steep.
 - .5 Approach ramps shall consist of rock or clean, coarse, free draining gravel, or evergreen boughs that are trampled in place.
 - .6 Felled timber shall not be skidded or dragged across any temporary bridge.
 - .7 Temporary bridges shall be removed as the Work progresses and they are no longer required. All exposed erodible soil shall be stabilized immediately after removal.

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- 948.3.1.22 .8 Unless temporary bridges are designed to accommodate a 1:100-year flood event, the weather forecast and the water level beneath each bridge shall be closely monitored. As soon as the integrity of any bridge is threatened by increased runoff due to snow melt and/or rain events, the bridge shall be immediately removed.
- .9 All temporary bridges shall be removed prior to the dates specified in the Contract Documents.

948.4 COMPLIANCE AND DELAYS

- .1 Failure by the Contractor to carry out the Work in accordance with the requirements of this Item will result in the Contractor being liable for any fines, levies or penalties made under environment-related Acts or Regulations of the Province of New Brunswick and the Government of Canada, and may result in suspension of Work, under GC 18, until the Contractor commences the Work as specified and/or takes remedial measures to repair or compensate for any environmental damage resulting from his/her inaction or improper actions in carrying out the Work.
- .2 Delays to the Contractor's Work operation resulting from suspension of Work for failure to follow the requirements of this Item will not be considered as a basis of claim for extra costs, nor for any extension of the Contract Completion Date.
- .3 In order to comply with this Item and applicable permits and regulations, Contractor's on-site environmental representative may direct that additional environmental mitigation be carried out, and paid according to the applicable Items in the Contract Documents.

948.5 POLLUTION CONTROL

- .1 The Contractor shall not dump, spill or dispose of any Overburden, trees, brush, petroleum products, camp refuse or other debris into any watercourse, reservoir, or other natural water basin, or into any area which may ultimately cause pollution to water drainage or storage systems and/or groundwater.
- .2 It shall be the Contractor's responsibility to familiarize her/himself with the applicable legislation and regulations and to obtain all necessary permits and approvals for the operations.

948.6 WATER AND RUNOFF CONTROL

- .1 The Contractor shall perform the Work in a manner so as to not obstruct the flow of surface drainage or natural watercourses.
- .2 The Contractor shall dispose of water resulting from the Work in a manner not detrimental to public and private property, or any portion of the Work completed or under construction.
- .1 The Contractor shall comply with all requirements of DELG, municipal codes and other regulatory agencies having jurisdiction regarding the disposal of water from excavations.

948.7 RELEASE OF FUEL AND OTHER HAZARDOUS SUBSTANCES

- .1 The Contractor, including any subcontractors and/or any agent(s) of the Contractor involved in any aspect of the Contract, shall be responsible for all containment and cleanup of any release of fuel and/or other hazardous materials, regardless of the cause of the release.
- .1 This shall apply to the Work Site, all lands being used by the Contractor and under the control of the Owner, and/or any Crown Land being utilized for the Work under the Contract.

948.8 FUEL STORAGE AND HANDLING

- .1 The Contractor shall take proper environmental protection measures, such as having spill clean up and absorption materials at the Work Area, during fuelling and maintenance of the Equipment.
- .2 Equipment shall not be fuelled within 30 m of a watercourse, wetland or groundwater source (private well).
- .3 Fuel and other hazardous materials shall not be stored within 100 m of a watercourse, wetland or groundwater source (private well).

948.9 WETLANDS

- .1 To minimize the spread of invasive plant species such as purple loosestrife, the Contractor shall ensure that all Equipment entering areas near, or in, wetland habitat is cleaned of mud and vegetation, and again before the Equipment leaves such areas.
 - .1 The cleaning shall consist of digging or scraping off the vegetation and mud by means of shovels or similar tools, to the extent practicable.
- .2 In wetland areas there shall be no grubbing or ditching, except for culvert installations, and all construction-related activities shall be confined to the clearing limits.
- .3 Vehicles and equipment used during construction activities in wetlands shall use only approved roadways and access areas.

951.1 CLEAN PREMISES

- .1 During the course of the Work the Contractor shall keep the Work Area in a neat and tidy condition satisfactory to the Engineer.
- .2 The Contractor shall upon the completion of the Work, remove all temporary Structures and clear away all rubbish, surplus and waste material remaining on or about the Work Site and leave the premises in a neat and tidy condition satisfactory to the Engineer.
 - .1 If these requirements are not met, the Engineer may give written notice to the Contractor requiring him to remedy the situation.
 - .2 If the Contractor fails to remedy the situation within 14 Days of receipt of the notice, the Engineer may cause the situation to be remedied and may deduct the cost thereof from any money owing to the Contractor.

951.2 DAMAGE TO WORK

- .1 The Work shall be at the risk of the Contractor arising from any cause, which may occur to the Work until the Work is accepted by the Owner.
- .2 If any such loss or damage occurs before the final acceptance, the Contractor shall immediately repair, restore and re-execute the lost or damaged Work, so that the Work, or the portions thereof, shall be completed within the specified time.

952.1 GENERAL

- .1 The Contractor shall observe construction safety measures as referenced in but not limited to, the National Building Code, the provincial regulations pertaining to workplace safety and/or any municipal or local regulations having authority provided that in any case of conflict or discrepancy the more stringent requirements shall apply.
- .2 The Contractor shall Work specifically in reference to CAN/CSA S269.1 and CAN/CSA S269.2.
- .3 The Contractor shall ensure at all times that no part of the Work shall be subjected to loading that will cause permanent deformation.

952.2 PLATFORMS

- .1 Construction safety platforms shall be provided by the Contractor at the locations indicated in the Contract Documents.
- .2 The Contractor shall be responsible for the design and the construction of the platforms in accordance with Item 956.
- .3 Safety platforms shall be designed and constructed to provide a continuous and unbroken working surface at the level of the girder bottom flange.
- .4 Construction platforms shall be adequately fastened and secured to prevent accidental displacement.
- .5 All workers employed in the installation or removal of slab overhang brackets or any other construction activity on or outside of the spandrel girders shall be properly secured to static safety lines at all times.

952.3 SAFETY NET SUPPORT SYSTEM

- .1 A safety net support system shall be provided by the Contractor at the locations indicated in the Contract Documents.
- .2 In order to provide support for safety nets, the Contractor shall supply all materials and construct the support system for safety net lines as indicated on the Standard Drawings 952-1 and 952-2.
 - .1 The anchor assemblies shall be made available by the Owner from stock at DTI Fredericton, NB.
- .3 Where the Contractor chooses to employ safety nets as a means to satisfy the safety requirements for the Work; the Contractor shall supply and install the HP310x132 steel sections, the 10 tonne clevises and the 16 mm steel cable indicated on the Standard Drawings 952-1 and 952-2.
 - .1 All structural steel fabrication shall conform to CAN/CSA S6 and S16.1.
 - .2 The safety net support system and the safety nets must be in place before the deck slab and the diaphragm forming shall commence.

- 952.3 .4 Once the safety net system is no longer required in the Work, the Contractor shall remove the net, cables, clevises and the HP310x132 steel sections.
- .1 With the exception of the anchor bolts, all removable portions of the safety net system shall remain the property of the Contractor.
 - .2 The anchor bolts shall be installed in the anchor bolt assembly and shall remain in place at the end of the Work.
 - .5 Where the Contractor chooses to employ a system other than safety nets as a means to satisfy the safety requirements for the Work, the anchor bolts shall be installed in the anchor bolt assembly and shall remain in place at the end of the Work.

953.1 DESCRIPTION

- .1 This Item outlines the Contractor's responsibilities with respect to an audited safety program for Work performed on this Contract.

953.2 DETAILS

- .1 The Bidder shall submit, as part of their tender, a Certificate of Recognition (COR) issued under the Certificate of Recognition Program by the New Brunswick Construction Safety Association (NBCSA), or a Safety Certified Certificate issued under the Safety Certified Program by Safety Services New Brunswick, or approved alternative.
 - .1 Tenders without certification at tender opening will be rejected.
- .2 The Contractor shall maintain a valid COR, as evidenced by a Letter of Good Standing or a "Letter of Good Standing – In Process" certified by NBCSA. Alternatively, the Contractor may provide the following:
 - .1 Evidence of COR status from other member associations of the Canadian Federation of Construction Safety Associations using the NBCSA Reciprocal Process; or
 - .2 Evidence of an audited safety program certified by an independent agency, which will be evaluated by the Engineer using the NBCSA Safety Audit Instrument. Acceptance of an audited safety program will be at the discretion of the Engineer.
 - .1 Alternate audited safety program shall be submitted 7 Days prior to the tender closing date.
 - .2 Bidders are responsible to obtain approval for their alternate audited safety program prior to placing their bid.
- .3 The Contractor shall maintain a valid COR until final completion of all Work under the Contract.

956.1 GENERAL

- .1 The Contractor shall supply the Engineer with drawings and design calculations for items including, but not limited to, the following:
 - .1 Bridge bearings;
 - .2 Bridge expansion joints;
 - .3 Cofferdam including bracing;
 - .4 Removal of Obsolete Bridge Structures;
 - .5 Falsework;
 - .6 Formwork;
 - .7 Shop Drawings of all metalwork;
 - .8 Shop Drawings for prestressed concrete beams;
 - .9 Shoring;
 - .10 Temporary detour Structures;
 - .11 Filter Screen;
 - .12 Shop Drawings for Culverts per 130.3, 131.3 and 140.3;
 - .13 Overhead sign structures;
 - .14 Large Concrete Pipes; and
 - .15 Precast Concrete Box Culverts.
- .2 Six copies of the drawings and two copies of the design calculations, stamped and signed by a Professional Engineer, shall be submitted to the Engineer at least 14 Days in advance of the scheduled construction, demolition and/or fabrication of any of, but not exclusively limited to, the above-listed items.
 - .1 The Engineer shall, in writing to the Contractor, acknowledge receipt of drawings and design calculations.
- .3 Drawings and design calculations shall be specific to the project for which they are submitted.
- .4 The Contractor shall review all shop drawings prior to submission to the Engineer.
 - .1 The Contractor represents by this review that:
 - .1 The Contractor has determined and verified all field measurements and field construction conditions, or will do so;
 - .2 The product requirements, catalogue numbers and similar data meet or exceed the specified requirements; and
 - .3 That the Contractor has checked and co-ordinated each shop drawing with the requirements of the Work and the Contract Documents.
 - .2 The Contractor shall confirm this review of each shop drawing by date, and signature of the person responsible.
 - .3 At the time of submission, the Contractor shall notify the Engineer in writing of any deviations in the shop drawings from the requirements of the Contract Documents.
- .5 No fabrication and/or construction shall commence on any aspect of the Work for which drawings and design calculations are required until drawings are received and returned by the Engineer, as per 956.1.2, 956.1.3 and 956.1.4 unless approved otherwise by the Engineer.

CONSTRUCTION DRAWINGS AND CALCULATIONS

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- 956.1 .6 In addition to the above noted drawings, Contractors supplying precast prestressed concrete beams shall supply the Engineer with two sets of beam layout drawings.
- .7 The Contractor shall not be relieved of responsibility for results obtained by the use of these drawings.
- .1 The Owner makes no commitment to review the submitted shop drawings or calculations for conformance to the Contract Documents, either in part or in whole.
- .2 Identification of any discrepancies from the requirements of the Contract Documents does not imply that the Owner is providing a comprehensive identification of such discrepancies.
- .8 Drawings shall show clearly the size and spacing of all members and their connections as well as the grades and/or species of all materials.
- .9 Welding done on any of the above items shall conform to the requirements of CSA W59.
- .1 Welding within the Province of New Brunswick shall be performed by a welder holding a valid Qualified Welder's Certificate issued by the Province of New Brunswick or by a welder certified in accordance with CSA W59.
- .2 Welding outside the Province of New Brunswick shall be performed by a welder certified in accordance with CSA W59.
- .3 Welding to the permanent Structure shall only be carried out if specifically indicated in the Contract Documents or authorized, in writing, by the Engineer.
- .10 The provisions defined under 956.2.6, 956.2.7 and 956.2.8 relating to the Owner's soils information are also applicable to 956.1.1.
- .11 Drawings bearing the seal and signature of a Professional Engineer, as defined under 956.1.2, and being those submitted and received by the Engineer, shall be made available at the site, by the Contractor, prior to the commencement of the Work detailed, and shall be maintained at the site until the completion of the Work.

956.2 TEMPORARY ACCESS STRUCTURES

- .1 The Contractor's drawings for temporary access Structures shall be prepared by a Professional Engineer.
- .2 The Contractor shall notify the Engineer in writing of the name and licence or registration number of the Professional Engineer(s) who will be responsible for the design and construction of the Work, at least one month in advance of the construction of the temporary access Structure.
- .3 The Contractor shall submit drawings, upon request, for temporary access Structures.
- .4 The Contractor shall have the sole responsibility for the design, erection, operation, maintenance, and removal of temporary supports, Structures, and facilities and the design and execution of construction methods required in their use.
- .5 The Contractor shall also be responsible to the Owner to make good any damage which befalls any property of the Owner due to the design, construction, maintenance, suitability and/or adequacy of any temporary access Structure.

- 956.2 .6 The Contractor shall be permitted access to the Owner's soil boring data and any applicable further soils studies or reports which may have been prepared by the Owner or its consultants on the express understanding that these data and information have been prepared and used by the Owner in connection with the design of the permanent Structure(s) only, and for no other purpose.
- .1 The data and information may not be applicable to the precise locations where the Contractor may erect temporary access Structures, and the Contractor shall be solely responsible for obtaining any further data and information required for his/her purposes.
 - .2 The Contractor hereby waives any claim she/he may have against the Owner with respect to the suitability, adequacy and/or accuracy for the purposes of the Contractor of any soil boring data, studies, reports, or other information available from the Owner and used by the Contractor.
 - .3 The use of the Owner's soil boring data and information by the Contractor, shall in no way diminish or derogate in any way from the responsibilities of the Contractor noted in 956.2.3, 956.2.4 and 956.2.5.
 - .4 Item 926 shall apply to the Work.
- .7 Any subsurface information available is based on the investigation made at the specific locations indicated. The Owner makes no guarantees, representations, warranties, either expressed or implied, with respect to any such information, and further cautions the Bidder/Contractor that these conditions are not necessarily typical and may have changed since the field data were collected.
- .8 The Owner further makes no guarantees, representations or warranties, either expressed or implied, that the presence or absence of water on the site and any subsurface explorations when made, will be representative of the actual conditions at the time of construction.
- .9 The Contractor, prior to the loading of the temporary access Structures, shall provide to the Engineer written certification signed by the designated Professional Engineer, identified in 956.2.2, that:
- .1 The Structure has been constructed in accordance with the Contractor's Plans;
 - .2 The Structure has been constructed of sound materials consistent with the design parameters; and
 - .3 The Structure is ready to support the loads for which it was designed.

956.3 DESIGN REQUIREMENTS

- .1 Structural members incorporated into temporary detour Structures shall be designed to meet the requirements of CSA S6.

CONSTRUCTION DRAWINGS AND CALCULATIONS

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- 956.3 .2 Timber, lumber and timber piles incorporated into temporary works other than temporary detour Structures shall be designed to meet the requirements of CSA S269.1.
- .1 Where timber and lumber do not bear a valid and legible grading stamp, permissible design stresses for Joint and Plank Grades shall not exceed those permitted for S-P-F Grade No. 2.
 - .2 Where timber and lumber do not bear a valid and legible grading stamp, permissible design stresses for Beam and Stringer Grades shall not exceed those permitted for S-P-F Grade No. 1.
- .3 Structural steel members incorporated into temporary works other than temporary detour Structures may be designed to meet the requirements of one of the following:
- .1 CSA S16 for members subject to static loads;
 - .2 CSA Standard S16 for moving loads, such as cranes, trucks, etc. provided an impact allowance of 30% on live loading is used and the distribution of wheel loads to stringers and floor beams is as specified in CSA S6; or
 - .3 CSA S6.
 - .4 Temporary concrete footings or piers supporting falsework or other such elements shall be designed to meet the requirements of CSA S6 or ACI Standard 318.
 - .5 Any damaged or deteriorated components will not be permitted for use and shall be immediately removed from site when identified by the Engineer.

956.4 GRADING and MATERIAL REQUIREMENTS

- .1 Timber and lumber used in the construction of falsework, formwork, shall be graded and stamped with the grade mark used by the Canadian Lumber Manufacturing association or agencies authorized to mark lumber in Canada and/or lumber approved by the Engineer.
- .2 Timber piles used in the falsework shall meet the requirements of CSA 056.
- .3 Structural steel shall meet the requirements of ASTM A36 or CSA G40.21M Grade 260W.
 - .1 Steel shall be free of kinks and bends and shall have no welds across the tension flanges.
 - .2 Steel members with reduced cross-sectional areas, due to holes, cuts, which reduces the design capacity of the members shall not be used.
 - .3 Where the grade of the steel members is not specified, the Engineer shall assume that the yield point of the steel is 200 MPa.

956.5 PROPRIETARY SHORING, FORMS AND ACCESSORIES

- .1 At the time of the construction drawing submission, the manufacturer's technical literature presenting allowable loads, shall be submitted for any proprietary element or component proposed to be incorporated into the Work.
- .2 All elements or components shall be in like new condition or certified by the Manufacturer to perform as designed.

957.1 GENERAL

- .1 The Contractor shall be responsible for all falsework design and construction and shall carry out the Work in accordance with Item 956.
- .2 The Contractor shall furnish, construct, erect, maintain and subsequently remove and dispose of all falsework required for the erection of the Work.
 - .1 The Contractor shall have total control of the Work and shall effectively direct and supervise the Work so as to ensure it conforms to the falsework requirements.
 - .2 The Contractor shall be solely responsible for the design, construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the Work.
- .3 Falsework shall include all temporary supports and foundations and shall be properly designed and substantially constructed and maintained to sustain the loads which will come upon it.
- .4 The Contractor shall certify that no permanent stresses or other detrimental effects on the completed Structure result from the falsework design.
- .5 The Contractor shall carry out the Work such that no permanent stresses or other detrimental effects on the completed Structure result from the falsework.
- .6 Falsework design shall be in conformance with CAN/CSA S269.1 and as specified herein.
- .7 The following conditions are the minimum requirements for all falsework design and construction:
 - .1 Falsework shall be designed and constructed to provide the necessary rigidity and to support dead, live, wind and stability loads.
 - .2 Bracing required to maintain the rigidity of the falsework under all loading conditions shall be shown clearly on all drawings.
 - .3 Connection points of bracing members shall be designed to develop the strength required by the computed design load but not less than 50% of the effective strength of the members.
 - .4 Timber cap beams shall be connected to timber piles by drift pins or equivalent.
 - .5 The minimum size of bolts used in the connection points of bracing members shall be 19.0 mm in diameter.
 - .6 Falsework for support of the Superstructure shall be designed and constructed to support loads that would be imposed were the entire Superstructure (except portions above the deck slab) placed at one time.
 - .7 Falsework shall be constructed to produce a finished Structure true to the lines and grades as indicated in the Contract Documents.
 - .8 The falsework drawings shall clearly show the amount of calculated deflection of bending members under total dead loads.
 - .9 Suitable methods shall be used to set the forms to the required grade or camber and to take up any settlement in the falsework which may occur before or during placement and until initial set of the concrete has been achieved.

FALSEWORK

ITEM: 957

- 957.1.7 .10 Anticipated total settlements of falsework and forms shall be indicated by the Contractor on the falsework drawings.
- .1 These shall include falsework footing settlement and joint take-up.
 - .2 Anticipated settlements over 15 mm will not be allowed unless otherwise permitted by the Engineer.
 - .1 Deck slab forms between girders shall be constructed with no allowance for settlement relative to the girders.
- .11 Pre-manufactured bridge overhang brackets shall be used for the construction of the deck overhang.
- .1 Overhang brackets shall be configured such that a portion of the construction loads are distributed to the web or bottom flange of the prestressed beams.
- .12 Plywood, for constructing deck slab soffits, may be placed with the grain of the outer plies parallel to the joists provided it is clearly noted on the drawings and reflected in the design calculations.
- .1 Plywood must be continuous over 3 joists.

957.2 PILES AND FOUNDATIONS

- .1 Falsework shall be founded on solid rock or supported on driven timber or steel piles.
- .2 Mudsills shall only be permitted if approved, in writing, by the Engineer.
 - .1 Mudsills shall only be supported on a compacted foundation grade.
 - .2 The soil bearing pressure under mudsills shall not exceed 150 kPa, however the Contractor may submit an alternate bearing pressure value supported by engineering analysis and based on soil design parameters determined by field testing methods, subject to the approval of the Engineer.
 - .3 Soil bearing pressure shall be uniformly distributed over the entire mudsill area.
- .3 Piles shall be driven to the bearing capacity as submitted in the falsework design.
 - .1 The Contractor shall provide verification of the capacity to the Engineer. The maximum calculated service load on a timber pile shall not exceed 225 kN.
- .4 When steel scaffolding type falsework is used by the Contractor, the base plates on all jack screws shall provide full and even force against mudsills and ledger beams.

957.3 REMOVAL

- .1 The release and/or removal of temporary supports, bracing, temporary members and guys must be carried out in a staged manner and under no circumstances will a sudden release of support be permissible.

FALSEWORK

ITEM: 957

- 957.3 .2 Falsework shall not be removed until the compressive strength of the last placed concrete, including concrete above the Bridge deck reaches 80% of the specified 28-day compressive strength.
- .3 Falsework supporting a continuous or rigid frame Structure shall not be removed from any span until the concrete in all the spans of the continuous unit has reached 80% of the specified 28-day compressive strength.
- .4 Falsework shall be removed uniformly and gradually beginning at the centre of the span and working towards the supports.
- .5 Falsework for cast-in-place prestressed portions of Structures shall not be released until after the prestressing steel has been tensioned.
- .6 Falsework piling shall be removed.
- .1 Falsework piling for the support of Structures over land shall be removed to a minimum of 600 mm below the surface of the original ground or the finished Slopes, whichever is lower.

957.4 FALSEWORK CERTIFICATION

- .1 The Contractor shall provide, prior to the placement of concrete or the application of any loading, certification by either a Professional Engineer or a person designated by a Professional Engineer, in writing and bearing the seal and signature of a Professional Engineer, to be competent to certify that the falsework has been constructed:
- .1 In accordance with the falsework design submitted in accordance with 957.1.6 and 957.1.7; and
- .2 Of sound materials consistent with the design parameters.

958.1 GENERAL

- .1 The Contractor shall be responsible for all formwork design and construction and shall provide submittals in accordance with Item 956.
- .2 The Contractor shall furnish, construct, erect, maintain and subsequently remove and dispose of all formwork required for the erection of the Work.
 - .1 The Contractor shall have total control of the Work and shall effectively direct and supervise the Work so as to ensure it conforms to the formwork requirements.
 - .2 The Contractor shall be solely responsible for the design, construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the Work.
- .3 The Contractor shall certify that no permanent stresses or other detrimental effects on the completed Structure result from the formwork design.
- .4 The Contractor shall carry out the Work such that no permanent stresses or other detrimental effects on the completed Structure result from the formwork.
 - .1 The Contractor shall not weld any form hangers, chairs, bar supports, etc. to the flanges or webs of steel girders.
- .5 Formwork design (with the exception of formwork lateral pressure) shall be in conformance with CSA S269.1 and as specified herein.
 - .1 Formwork lateral pressure shall be calculated in accordance with the formulas in ACI 347R-14 Clause 4.2.2.
- .6 The following conditions are the minimum requirement for all formwork design and construction:
 - .1 Formwork shall be designed and constructed to provide the necessary rigidity and to support all dead and live loads.
 - .2 Bracing required to maintain the rigidity of the formwork under all loading conditions shall be clearly shown on the formwork drawings.
 - .3 Fluid pressure as lateral thrust on vertical forms shall be correlated to the capacity and type of placing Equipment, the planned rate of placing concrete and the slump and temperature of the concrete.
 - .4 In no case, shall wall forms, over 1200 mm in height, be designed for less than 1200 mm fluid head of concrete and in no case shall column forms over 2000 mm in height be designed for less than a 2000 mm head.
 - .5 Forms for exposed concrete surfaces shall be designed and constructed so that the formed surface of the concrete does not undulate excessively in any direction between studs, joists, form stiffeners, form fasteners or wales.
 - .1 Undulations shall not exceed 1/270 of the centre to centre distance between studs, joists, form fasteners, form stiffeners or wales, or 2 mm, whichever is smaller.
 - .2 Should any form or forming system, even though previously approved for use, produce a concrete surface with excessive undulations, its use shall be discontinued until modifications, satisfactory to the Engineer have been made.

FORMWORK

ITEM: 958

958.1.6 .6 On steel girder Structures, timber or steel posts shall be used at each overhang bracket to distribute the load to the top and bottom flanges as detailed on Standard Drawing 958-1.

958.2 FORMS

- .1 Forms shall be smooth, mortar-tight, true to the required lines and grades and of sufficient strength to resist springing out of shape during placing of concrete.
- .2 Materials to be used for forms shall be thoroughly cleaned of all mortar and foreign material before being used.
- .3 Surfaces of and within forms shall be cleaned of dirt, chips, sawdust, nails and other foreign materials before concrete is placed.
- .4 Formwork shall be thoroughly coated with a commercial quality form coating, which will permit the ready release of the forms and will not discolour the concrete.
 - .1 The type of form coating to be used shall be submitted to the Engineer for written approval and shall be applied in accordance with the manufacturer's instructions.
- .5 Plywood or steel forms shall be used for exposed concrete surfaces except where the Engineer permits the use of lumber in small and intricate portions of the Work.
- .6 Plywood shall be of a grade and quality satisfactory to the Engineer.
 - .1 Plywood shall be placed with the grain of the outer plies perpendicular to the studding or joists.
 - .2 Form panels shall be placed in a neat and symmetrical pattern.
 - .3 Horizontal joints shall be level and continuous and vertical joints shall be staggered.
 - .4 Plywood must be continuous over 3 joists or studs.
- .7 Forms for concrete columns, capbeams and all portions of abutments on overpass and underpass Structures exposed to view shall be either faced with an exterior grade plywood (G1S) with the sanded face placed against the concrete or shall be a commercial grade steel form capable of giving a true and high quality surface finish free of rust, pitting, holes or other defects..
 - .1 Plywood forms for rectangular columns shall be made up of the full 2400 mm long sheets placed vertically. All columns with the side dimensions equal to or less than 1200 mm shall be formed with no vertical joints within the face width.
 - .2 Rectangular columns with the side dimensions greater than 1200 mm shall be formed with equal width pieces of plywood.
- .8 The Contractor may use boards to construct the forms for concealed surfaces subject to the approval of the Engineer.
 - .1 Edge contact between boards shall be sufficient to make forms impervious to mortar.
- .9 Forms shall be constructed so that form marks will conform to the general lines of the Structure.
 - .1 Column form marks shall be symmetrically spaced.

- 958.2 .10 Exposed sharp edges shall be chamfered with 20 mm by 20 mm triangular fillets.
- .1 Where wood triangular fillets or chamfer strips are employed, they shall be milled from clear, straight grain lumber and shall be planed on the side exposed to concrete.
- .11 Anchor devices, of a type approved by the Engineer, may be cast into the concrete for use in supporting forms or for lifting precast members.
- .1 The use of driven types of anchorages for fastening form or form supports to concrete will not be permitted.
- .12 Anchoring devices, cast-in-place or drilled, shall be approved by the Engineer.
- .1 Specified cover over embedded metal anchors shall be maintained.
 - .2 Removable anchoring devices shall be removed without causing damage to the adjacent/surrounding hardened or partially hardened concrete.
- .13 No forms shall be left in place.

958.3 FORM TIES AND BRACING

- .1 Internal form ties shall be proprietary and designed to provide a specified cover.
- .2 Rods, bolts or prefabricated units shall be capable of maintaining the correct concrete thickness and so arranged that the slack or spring in the form framing will be eliminated when tightened.
- .3 Ties consisting of twisted wire loops shall not be permitted.
- .4 Forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and form ties shall extend through and fasten these wales.
- .5 Bracing shall be capable of maintaining the correct form alignment and stability.

958.4 CORROSION PREVENTION

- .1 Tie wires, bolts, hardware and other embedded metal items shall extend to within less than the specified cover minus 10 mm from the concrete surface.
- .2 Form ties shall be of such a type that they can be entirely removed or cut back 50 mm or more below the finished surface of the concrete leaving no metal within 50 mm of the surface.

958.5 DECK FORMWORK HANGERS

- .1 Hangers for deck formwork shall be of a type which can be completely removed or removed a minimum of 50 mm below the surface. Galvanized hangers must be removed a minimum of 19 mm below the surface.
- .2 In the event that the Contractor's formwork design does not provide the above indicated minimum cover over the hangers, a concrete haunch extension may be utilized provided it extends continuously from one end of the span to the other. No payment will be made for the concrete required.

FORMWORK

ITEM: 958

958.5 .3 If hanger removal leaves a hole of 13 mm or more it shall be cleaned and patched utilizing concrete mortar consistent with the parent concrete and containing latex.

.1 Holes less than 13 mm may be filled with an Engineer approved sealant, such as Vulkem 116.

958.6 INSPECTION OPENINGS

.1 Temporary openings shall be provided at the bottom of deep units, such as columns and walls, to facilitate cleaning and inspection.

.1 In restrictive areas, openings shall be located so that water can be used to wash out the debris.

.2 Openings shall be closed with patches, flush with the inside surface of adjacent panels.

.2 Where deep sections of concrete are reduced in cross section, as in stepped footings, and where concrete is to be placed continuously, the effect of fluid pressure on the lower portions of the step or Slope shall be addressed by providing partial form tops that will contain the concrete and prevent upward bulge or flow.

.1 Where top forms are complete or large enough to trap air, slots or holes shall be provided to vent air or to permit vibrating of concrete.

958.7 LINES AND GRADES

.1 Forms for girders and slabs shall be cambered to achieve the final lines and grades.

.2 Freely suspended check wires shall be stretched at reasonable intervals from which form alignment can be verified.

.3 Checking and corrective wedging or shoring shall be carried out horizontally and vertically as required before concrete is in place.

.1 All wedges shall be hardwood.

958.8 FORMWORK TOLERANCES

.1 Unless otherwise required in the Contract Documents, the maximum deviations from line, grade and dimension shall be as shown in Table 958-1.

.2 Measurement of concrete in Structures, calculated on the dimensions shown in the Contract Documents, will not be affected by the formwork tolerances listed in Table 958-1.

Table 958-1
Formwork Tolerance Limits

Position in Structure	Tolerance
Finished Bridge Deck Grades Variation from tolerance	± 3 mm ≤ 3 mm in any 3 m section
Concrete Bridge Bearing Block or Seat Grades Variation from tolerance	± 3 mm ± 2 mm in any direction
Columns, piers, walls, beams and similar parts Variations from true line Variation in cross sectional dimensions	≤ 5 mm in any 3m section - 5 mm, + 10 mm
Misplacement or eccentricity in piers, cap beam and Bridge seats	± 10 mm
Variation in slab thickness	- 3 mm, + 5 mm
Footings plan dimensions misplacement or eccentricity	- 10 mm, + 50 mm $\pm 1\%$ of footing dimension in direction of misplacement but < 50 mm
Variation in sizes and location of slab and wall openings	± 10 mm

958.9 FORMWORK CERTIFICATION

- .1 The Contractor shall provide, prior to the placement of concrete or the application of any loading, certification by either a Professional Engineer or a person designated by a Professional Engineer, in writing and bearing the seal and signature of a Professional Engineer, to be competent to certify that the formwork has been constructed:
- .1 In accordance with the formwork design submitted in accordance with 958.1.5 and 958.1.6; and
 - .2 Of sound materials consistent with the design parameters.

PARTNERING

ITEM: 961

961.1 DESCRIPTION

- .1 The concept of Partnering is to develop a proactive effort and spirit of respect, trust and cooperation among all key players in a Contractual relationship. It utilizes a structured systematic methodology for developing a spirit of teamwork and cooperation through shared goals, open communication, problem identification and resolution, conflict escalation procedures and the monitoring of team performance.

961.2 PARTNERING

- .1 The Owner encourages partnership with the Contractor and its principal subcontractors and suppliers.
 - .1 The Owner anticipates considerable mutual benefit can be achieved on the Contract through Partnering and strongly recommends entering into a voluntary agreement.
- .2 This partnership shall be structured to draw on the strengths of each organization to identify and achieve reciprocal goals.
- .3 The objectives are effective and efficient Contract performance and completion of the Contract within budget, on schedule, and in accordance with Plans and Specifications.
- .4 This partnership shall be bilateral in makeup, and participation shall be totally voluntary.
- .5 A representative of the Contractor and a representative of the Owner shall initiate a partnering development seminar/team building workshop which should be held before Work commences on the Contract. These representatives shall make arrangements to determine attendees at the workshop and the agenda, duration and location.
 - .1 Persons required to be in attendance should include, but are not limited to: key NB-DTI District personnel, the Contract design Engineer(s) and the Contractor's on-site project manager and supervisor(s) as well as key subcontractors.
 - .2 Where appropriate, representatives of major suppliers, Department of Environment and Local Government (DELG), Worksafe NB, Department of Energy and Resource Development (DERD), Canada Department of Fisheries and Oceans (DFO), utilities and municipal governments shall also be invited to attend.
 - .3 The Contractor and the Owner shall also be required to have Head Office and/or District managers on the project team.
- .6 Costs associated with partnering including the facilitator and facilities for a partnering development seminar/team building workshop shall be agreed to by the Owner and the Contractor and shall be shared equally.
 - .1 Each party shall be responsible for their own staff's wages and expenses during the partnering workshop sessions.
- .7 Follow-up workshops may be held periodically throughout the duration of the Contract as agreed to by the Contractor and Owner.

961.3 OBJECTIVES OF THE PARTNERING PROCESS

- .1 In order for the partnering process to succeed, the Contractor and the Owner, with a positive commitment to honesty and integrity, agree to the following mutual objectives:
- .1 Each shall function within the laws and statutes applicable to their duties and responsibilities.
 - .2 Each shall assist in the other's performance.
 - .3 Each shall avoid hindering the other's performance.
 - .4 Each shall proceed to fulfil its obligation diligently.
 - .5 Each shall cooperate in the common endeavour of the Contract.

961.4 STATEMENT OF INTENT

- .1 The Contractor is requested to indicate to the Owner no later than the time of submission of the Initial Work schedule under Item 906, any intentions regarding entering into a voluntary partnership agreement.

962.1 DESCRIPTION

- .1 The Contractor may submit to the Engineer, in writing, a Value Engineering Proposal (VEP) for modifying the Plans, Specifications or other requirements of the Contract for the purpose of reducing the total cost of construction without reducing design capacity or quality of the finished product. If accepted, by the Engineer, the net savings resulting from the Value Engineering Proposal shall be shared by the Contractor and the Owner (on behalf of the Crown) on a fifty-fifty basis.
- .2 This Item applies to all Value Engineering Proposals initiated and developed by the Contractor and which are identified as such by the Contractor at the time of their submission to the Engineer; however, nothing herein shall be construed as requiring the Engineer to approve a Value Engineering Proposal submitted hereunder.
- .3 The following information as a minimum shall be provided in the written submission of each Value Engineering Proposal:
 - .1 A statement that this proposal is submitted as a Value Engineering Proposal;
 - .2 A description of the difference between the existing Contract requirements and the proposed Value Engineering Proposal change;
 - .3 A statement concerning the basis for the Value Engineering Proposal and benefits to the Owner together with an itemization of the Contract Items and requirements affected by the Value Engineering Proposal;
 - .4 Separate detailed cost estimates for both the existing Contract requirements and the proposed Value Engineering Proposal change;
 - .5 An itemization of plan details, design standards or Specifications to be changed if the Value Engineering Proposal is adopted; and
 - .6 A statement of the date by which approval must be issued to obtain the total cost reduction of the Value Engineering Proposal during the remainder of Contract, noting any effect on Contract Completion Date.
- .4 The Owner shall process the Value Engineering Proposal in the same manner as prescribed for any other proposal which would necessitate issuance of a Contract Change Order.
 - .1 The Owner may accept in whole or in part any Value Engineering Proposal by issuing a Change Order which shall identify the Value Engineering Proposal on which it is based.
 - .2 The Owner shall not be liable to the Contractor for failure to accept or act upon any Value Engineering Proposal submitted pursuant to this provision nor for any delays to the Work attributable to any such proposal.
 - .3 Until a proposal is effected by Change Order, the Contractor shall remain obligated to the terms and conditions of the existing Contract.

- 962.1.4 .4 When an executed Change Order has not been issued by the date upon which the Contractor's proposal specifies that a decision thereon should be made, or such other date as the Contractor may subsequently have specified in writing, evaluation of the proposal shall be terminated unless the Contractor further extends the approval date.
- .5 The Change Order effecting the necessary Contract modification shall establish the estimated net savings agreed upon, provide for adjustment in the Contract prices and indicate that the net savings be equally divided between the Contractor and the Owner.
- .5 The Contractor shall absorb all costs incurred in preparing a Value Engineering Proposal for submission to the Owner. Costs incurred by the Owner in evaluating, approving or rejecting, and administering a Value Engineering Proposal shall be borne by the Owner.
- .6 The cost of any redesign resulting from the Value Engineering Proposal shall be shared equally between the Contractor and the Owner.
- .7 The Owner reserves the right to include in the Change Order any conditions it deems appropriate for implementation of the proposal.
- .8 The Contractor's fifty percent share of the net savings shall constitute full compensation for effecting all changes pursuant to the Value Engineering Proposal Change Order.
- .9 Acceptance of the Value Engineering Proposal and performance of the Work thereunder shall not change the Contract Completion Date unless specifically provided for in the Change Order authorizing the Value Engineering Proposal.
- .10 The Owner expressly reserves the right to adopt a Value Engineering Proposal for general use in Contracts administered by the Owner when it determines the Value Engineering Proposal is suitable for application to other Contracts without obligation or compensation of any kind to the Contractor.
- .11 Proposed changes in the basic design of a Bridge or Pavement type, or changes which require different Right-of-Way limits or proposals involving Work outside the scope of the Contract, shall not normally be considered as an acceptable Value Engineering Proposal.
- .12 When a Value Engineering Proposal is accepted by the Owner, the provisions of Sections 2(3) and 2(4) of Article II of the Articles of Agreement pertaining to adjustment of Contract Unit Price due to alterations of Contract quantities shall not apply to the Items adjusted or deleted as a result of effecting the Value Engineering Proposal by Change Order.
- .13 The cost of the revised Work, as determined in the Value Engineering Proposal Change Order, shall be paid by the standard monthly Progress Estimates.
- .14 In addition to such payment, the Contractor shall be paid, on a Lump Sum basis by a separate Item, one half of the difference (net savings) between the cost of the original Contract Work and the final cost of the revised Work listed in the Change Order.
- .15 One half of the Contractor's share of the estimated net savings shall be paid to the Contractor upon approval of the Value Engineering Proposal Change Order. The remainder due to the Contractor shall be paid upon completion of all Items of Work included in the Value Engineering Proposal Change Order. The final payment shall be determined by the actual quantities for Items paid by the unit or by the Change Order amount for the lump sum Items.

ADVISEMENTS

ITEM: 971

971.1 DESCRIPTION

- .1 This Item defines other activities and circumstances, which may influence the Contractor's Work.
- .2 The following advisements may not apply to all Contracts and the Contractor should become familiar with the conditions of the Contract in order to note what other activities may limit his/her Work schedule or progression of Work.

971.2 UTILITIES AND INSTALLATIONS

- .1 Utility poles, lines and/or cables within the Work Site shall be moved by the appropriate Utility company.
- .2 Underground services including but not limited to water, sewer and/or drainage pipes may be relocated by others during the period of the Contract.
- .3 Delays due to Work performed by others related to Utility moves shall not be considered as a basis of claim.
- .4 Although the Owner makes every reasonable effort to collect and present complete details concerning Utility installations, the Owner makes no guarantees, representations, warranties, either expressed or implied, with respect to any such information, and the Contractor shall have no claim on that account.
- .5 The Contractor shall assume full responsibility for determining exact locations of, as well as safeguarding, all existing and relocated Utility installations during the progress of the Work.
- .6 The Contractor shall be responsible, at his own expense, for any damage to existing or relocated Utility installations and shall be responsible for any repairs resulting from damage to these installations.

971.3 RAILWAYS

- .1 Any railway crossing existing within the Work Site may require adjustment and this Work shall be done by the appropriate authority and shall be completed to conform with the new Pavement level.
- .2 The Contractor shall notify the Engineer at least 14 Days prior to the confirmed commencement of the Work in the proximity of the railway lands, so that the appropriate railways authorities may be notified.
- .3 The Contractor shall be responsible, at his/her own expense, for any injury or death to any persons whatsoever and for any damage to the property of the railway, having jurisdiction, or otherwise or indirectly results from, is caused by, or is attributable to, the performance of the Work within the railway ROW.
- .4 Delays due to the adjustment of the crossing, by others, shall not be considered as a basis of claim.
- .5 Delays due to work by the railway or scheduling requirements shall not be considered as a basis of claim.
- .6 Notification shall be provided in the Contract at the time of Tender, if applicable.

971.4 CONTROLLED ACCESS HIGHWAY

- .1 The Contractor should note that for Highways in the area of the Contract which have controlled access, the following shall apply:
 - .1 In areas outside the Work Site, regulations pertaining to a controlled access Highway shall not be waived to facilitate construction.
 - .2 Within the Work Site, any access to the existing Highway shall be only by prior approval of the Engineer in order to ensure the safe handling of traffic.
- .2 Notification as to the location and extent of controlled access portions of Highway shall be provided in the Contract at the time of Tender, if applicable.

971.5 RIGHT-OF-WAY

- .1 Right-of-Way for the Contract may not be available before a specific date.
- .2 Delays resulting from the unavailability of Right-of-Way shall not be considered as a basis of claim.
- .3 Notification shall be provided in the Contract at the time of Tender, if applicable.

971.6 OTHER CONTRACT(S)

- .1 Other contract(s) and/or the Owner's forces may be conducting work that may be in progress at the commencement of the Contract or may commence during the period of the Contract and shall have separate and distinct completion dates.
- .2 Work on this Contract must be scheduled so as not to interfere with or cause delays to any such work by others.
- .3 Delays due to conflicts between other contracts and/or the Owner's forces and this Contract shall not be a basis for claim.
- .4 Notification shall be provided in the Contract at the time of Tender, if applicable.

LIMITED FUNDS

ITEM: 996

996.1 DESCRIPTION

- .1 The provisions under this Item are an amendment of, supplementary to and not in substitution for the provisions of the Contract and provide for the completion of a portion of the Work by the Limited Funds Date.
- .2 The type of Work is not specified, rather the value of the Work carried out shall be used to determine successful performance.
- .3 Under this Item, and as designated in the Contract Documents, the following phrases shall have the meaning ascribed to them as follows:
 - .1 "Limited Funds" means the designated sum of money which sum is exclusive of the engineering and materials costs of the Owner;
 - .2 "Limited Funds Date" means the specified date (year, month and Day); and
 - .3 "Present Fiscal Year" means the fiscal year of the Owner commencing with April 1, of the year in which the Contract was signed, and ending with March 31 of the year immediately following.
- .4 In carrying out the Work to be performed on the Contract, the Contractor shall, on or before the Limited Funds Date, perform Work having a value calculated in accordance with the Contract, equal to not less than 95%, and not more than 105% of the Limited Funds.
- .5 Request for an extension to the Limited Funds Date shall be made as detailed in 996.3.

996.2 PROVISIONS

- .1 The following provisions apply to the Work to be done with respect to the Limited Funds Date and the payment therefor:
 - .1 The value of the Work performed, in compliance with this Item, shall be determined by reference to progress claims, approved by the Engineer;
 - .2 The Contractor shall cease Work on the Contract in the Present Fiscal Year on the Day on which Work of a value equal to not less than 95%, and not more than 105% of the Limited Funds has been completed.
 - .3 The Owner shall not be obligated to pay to the Contractor an amount exceeding the lesser of the actual value of the Work done or 105% of the Limited Funds, for Work done on the Contract during the Present Fiscal Year.
 - .4 The Contractor shall not again commence Work on the Contract until after the last Day of the Present Fiscal Year, once the Limited Funds obligation has been completed.
- .2 In the event the Contractor does not perform Work having a value equal to or greater than 95% of the Limited Funds on or before the Limited Funds Date, the Contractor shall pay a penalty to the Owner, at a prescribed daily rate as set out in the Contract Documents, for each Day, except Sunday(s) and Statutory Holidays, that such shortfall continues beyond the Limited Funds Date.
 - .1 The penalty shall continue to be paid until the value of Work completed is equal to 95% or greater of the Limited Funds.

996.2 .3 Without exception, nothing in these provisions with respect to Limited Funds and the Limited Funds Date shall alter the Contract Completion Date specified in Article I of the Articles of Agreement of the Contract.

996.3 CONSIDERATIONS FOR ADJUSTMENT

- .1 Requests for consideration of extension of the Limited Funds Date shall be submitted by the Contractor in accordance with General Conditions "B".
- .2 The Owner may consider a request for adjustment to the Limited Funds Date if the Work is delayed through no fault of the Contractor.
 - .1 Additional Days may be granted for Extra Work performed, provided the Contractor can show that the Extra Work could not be carried out without interfering with his Work Schedule.
 - .2 Additional Days may be granted for increases in Work or material in greater amounts or Quantities than those set forth in the Contract in the same proportion of time as the additional Work and/or materials bears to the Initial Work Schedule.
 - .3 An additional Day may be granted for each Day that the number of hours lost, due to weather conditions, exceeds 40% of the Contractor's normal working hours.
 - .1 The "Work Time Lost Due to Weather" form is considered as official documentation of work time lost due to weather conditions.

997.1 DESCRIPTION

- .1 The provisions under this Item specify that certain Work under the Contract, hereinafter described as Specified Work, shall be completed by the Specified Work Date, as designated in the Contract Documents.
- .2 Under this Item, and as designated in the Contract Documents, the following phrases shall have the meaning ascribed to them as follows:
 - .1 "Specified Work" means a defined task having a finite and measurable scope and the definition of the scope of the Work shall be fully described in the Contract Documents.
 - .2 "Specified Work Date" means the designated date (year, month, Day) as specified in the Contract Documents.
- .3 The Contractor shall note that there may be more than one instance of Specified Work and Specified Work Date within the terms of the Contract, depending on the requirements of the Owner.
- .4 In carrying out the Work to be performed on the Contract, the Contractor shall, on or before each Specified Work Date, perform the Specified Work, in each case.
- .5 Request for an extension to the Specified Work Date shall be made as detailed in 997.3

997.2 PROVISIONS

- .1 When more than one instance of Specified Work is identified in the Contract Documents, then these provisions shall apply for each case exclusively.
- .2 The noted provisions following shall apply to Specified Work to be done and the payment therefor.
 - .1 The Specified Work performed and completed in compliance with this Item shall be determined by reference to progress estimates approved by the Engineer.
 - .2 In the event the Contractor does not perform the Specified Work on or before the Specified Work Date, the Contractor shall pay a penalty to the Owner, at a prescribed daily rate as set out in the Contract Documents, for each Day, except Sunday(s) and Statutory Holidays, that such shortfall continues beyond the Specified Work Date, and this shall continue to be paid until the Specified Work is completed.
 - .3 Without exception, nothing in these provisions with respect to Specified Work and the Specified Work Date shall alter the Contract Completion Date as specified in Article I of the Articles of Agreement of the Contract.

997.3 CONSIDERATIONS FOR ADJUSTMENT

- .1 Requests for consideration of extension of the Specified Work Date shall be submitted by the Contractor in accordance with General Conditions "B".
- .2 The Owner may consider a request for adjustment to the Specified Work Date if the Work is delayed through no fault of the Contractor.
 - .1 Additional Days may be granted for Extra Work performed, provided the Contractor can show that the Extra Work could not be carried out without interfering with his/her Work Schedule.
 - .2 Additional Days may be granted for increases in Work or material in greater amounts or Quantities than those set forth in the Contract in the same proportion of time as the additional Work and/or materials bears to the Initial Work Schedule.
 - .3 An additional Day may be granted for each Day that the number of hours lost, due to weather conditions, exceeds 40% of the Contractor's normal working hours.
 - .1 The "Work Time Lost Due to Weather" form is considered as official documentation of Work time lost due to weather conditions.

998.1 DESCRIPTION

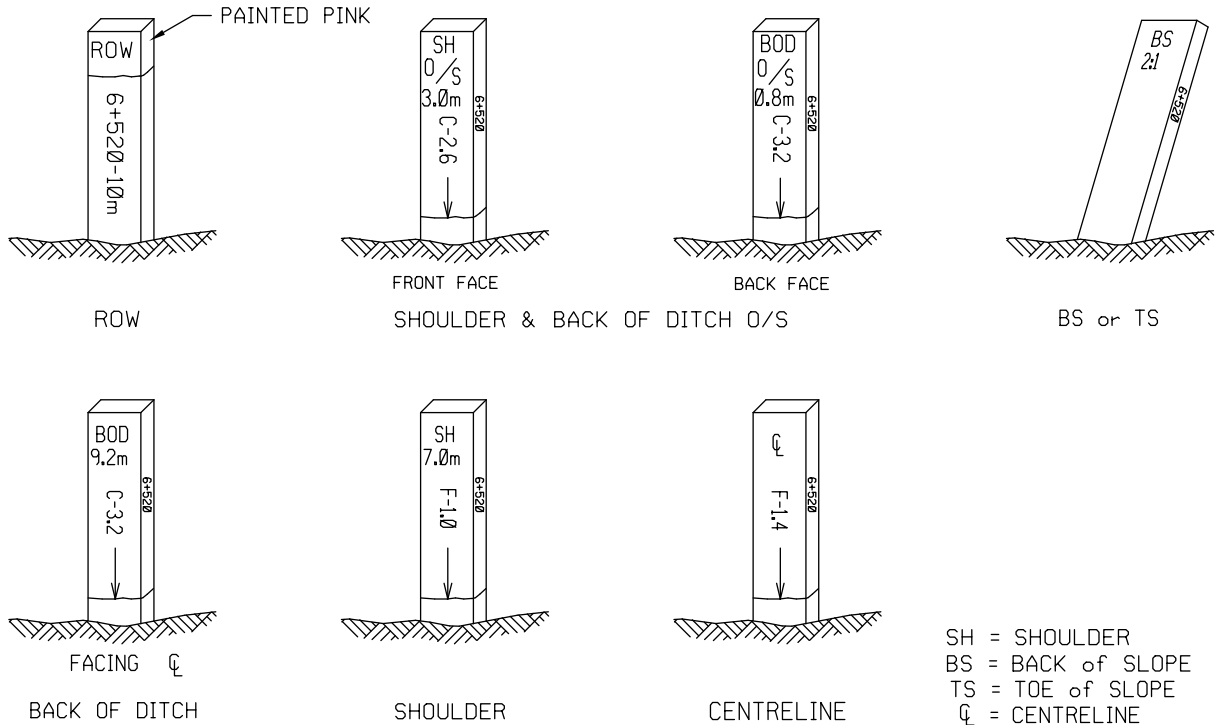
- .1 The Completion Date shall be as stated in the Articles of Agreement and/or as specified in the Contract Documents.
- .2 In the event the Contractor does not complete the Work on or before the Completion Date specified, the Contractor shall pay a penalty to the Owner, at a prescribed daily rate as set out in the Contract Documents, for each Day, except Sunday(s) and Statutory Holidays, that such shortfall continues beyond the specified Completion Date, and this shall continue to be paid until the Work is completed.
- .3 Request for an extension to the Completion Date shall be made as detailed in 998.2.

998.2 CONSIDERATIONS FOR ADJUSTMENT

- .1 Requests for consideration of extension of the Completion Date shall be submitted by the Contractor in accordance with General Conditions "B".
- .2 The Owner may consider a request for adjustment to the Completion Date if the Work is delayed through no fault of the Contractor.
 - .1 Additional Days may be granted for Extra Work performed, provided the Contractor can show that the Extra Work could not be carried out without interfering with his/her Work Schedule.
 - .2 Additional Days may be granted for increases in Work or material in greater amounts or Quantities than those set forth in the Contract in the same proportion of time as the additional Work and/or materials bears to the Initial Work Schedule.
 - .3 An additional Day may be granted for each Day that the number of hours lost, due to weather conditions, exceeds 40% of the Contractor's normal working hours.
 - .1 The "Work Time Lost Due to Weather" form is considered as official documentation of work time lost due to weather conditions.

Staking for Back of Ditch and Shoulder Offsets at Right of Way

As Shoulder and BOD staking is done, reference stakes should be set next to the Right of Way. As the Shoulder and BOD stakes are graded, the reference stakes should also be graded. This will enable the Contractor, the Engineer and/or others to check the grades without having to set up, stake, and grade.



SH = SHOULDER
BS = BACK of SLOPE
TS = TOE of SLOPE
CL = CENTRELINE
C = CUT
F = FILL
ROW = RIGHT OF WAY
BOD = BACK OF DITCH
O/S = OFFSET
GR = GRADE

NOTE:

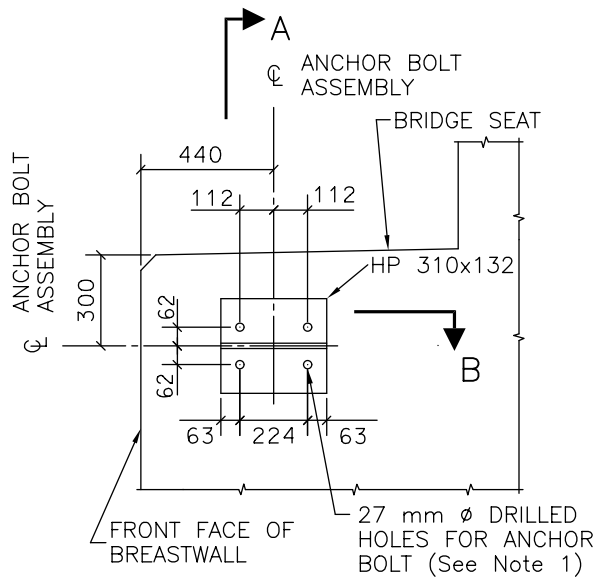
- SHOULDER AND CL STAKES ARE PLACED FACING IN DIRECTION OF CHAINAGE.
- STAKES ARE GRADED ON BOTH SIDES.
- STATIONING IS MARKED ON EDGE OF STAKES.

The front face of the reference stake should indicate the offset distance to the Shoulder as well as the grade.

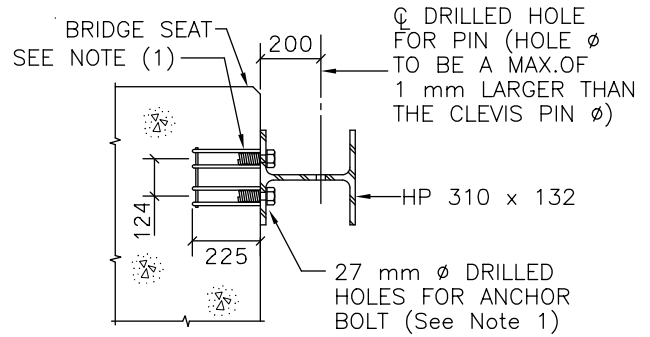
The back face of the reference stake should indicate the offset distance to the back of ditch as well as the grade.

The edge of the reference stake can be used to reference the stationing.

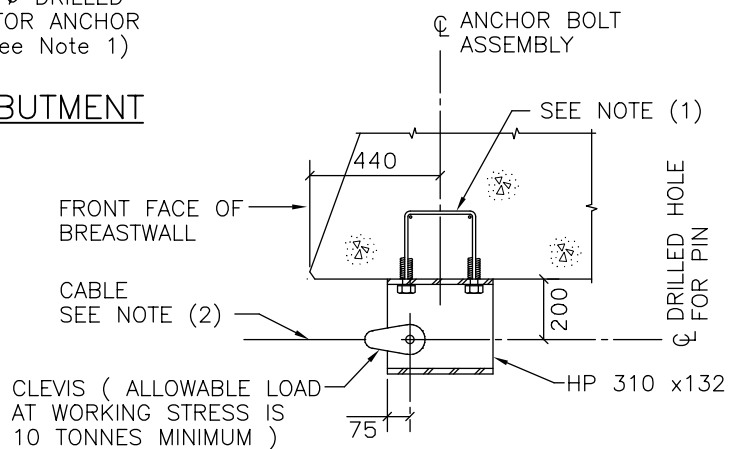
Standard Stake Markings



SIDE ELEVATION OF ABUTMENT



SECTION A



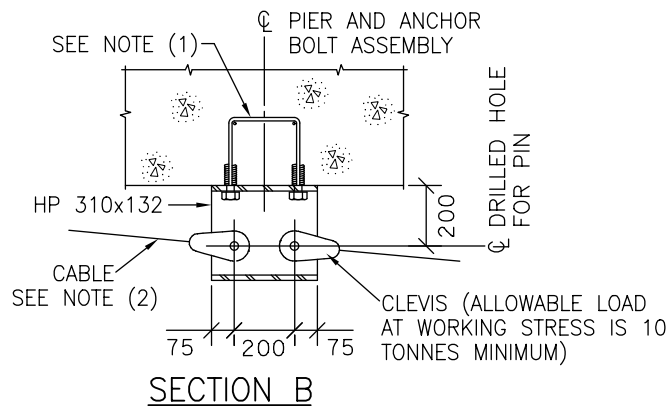
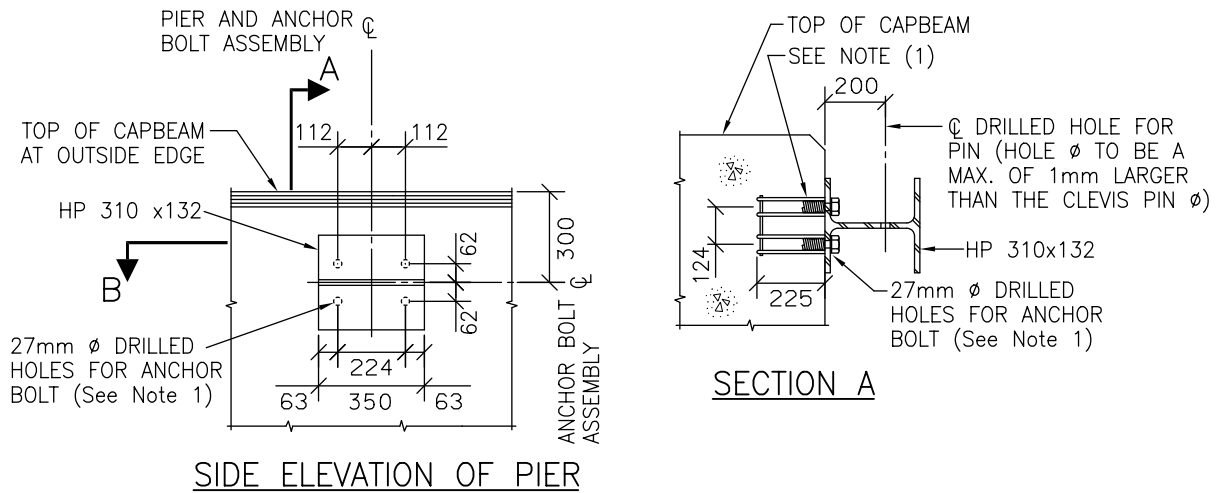
SECTION B

NOTES:

- (1) ANCHOR BOLT ASSEMBLY TO BE ACROW RICHMOND WITH FOUR 25mm ϕ x 100mm ANCHOR BOLTS CONFORMING TO ASTM A325. ANCHOR ASSEMBLIES TO BE SUPPLIED BY D.T.I. AND INSTALLED BY BRIDGE CONTRACTOR.
- (2) CABLE TO BE 16mm CABLE, 6x19 SEALE, IMPROVED PLOW STEEL PREFORMED, LANG LAY, I.W.R.C.

DETAILS OF SUPPORT SYSTEM FOR
SAFETY NET LINES AT ABUTMENTS

Safety Net Support System
Abutments

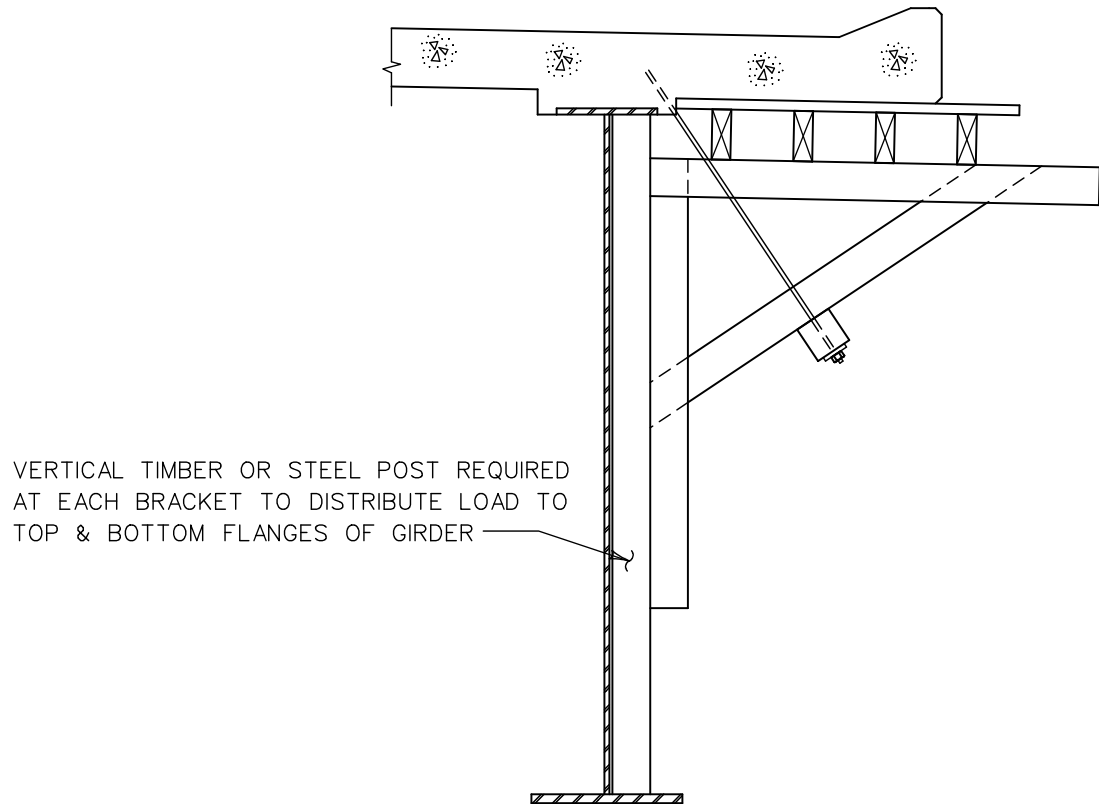


NOTES:

- (1) ANCHOR BOLT ASSEMBLY TO BE ACROW RICHMOND WITH FOUR 25mm ϕ x 100mm ANCHOR BOLTS CONFORMING TO ASTM A325. ANCHOR ASSEMBLIES TO BE SUPPLIED BY D.T.I. AND INSTALLED BY BRIDGE CONTRACTOR.
- (2) CABLE TO BE 16mm CABLE, 6x19 SEALE, IMPROVED PLOW STEEL PREFORMED, LANG LAY, I.W.R.C.

DETAILS OF SUPPORT SYSTEM FOR SAFETY NET LINES AT PIERS

**Safety Net Support System
Piers**



NOTE :
VERTICAL STIFFENER PLATES CANNOT
BE USED FOR THIS PURPOSE

**Deck Overhang Bracket
Steel Girder**

APPENDIX

PROVINCE OF NEW BRUNSWICK
SHORT FORM CONTRACT
CROWN CONSTRUCTION CONTRACTS ACT

THIS CONTRACT MADE IN DUPLICATE THIS DAY OF..... 20 BETWEEN:
HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF NEW BRUNSWICK REPRESENTED HEREIN BY THE MINISTER OF TRANSPORTATION AND
INFRASTRUCTURE
HEREIN AFTER REFERRED TO AS THE "OWNER "OF THE FIRST PART
AND.....HEREINAFTER REFERRED
TO AS THE "CONTRACTOR" OF THE SECOND PART.

WITNESSETH THAT IN CONSIDERATION OF THE MUTUAL COVENANTS AND AGREEMENTS HEREIN CONTAINED, AND SUBJECT TO THE TERMS AND CONDITIONS
HEREINAFTER SET OUT, THE PARTIES COVENANT AND AGREE AS FOLLOWS:

1. THE OWNER SHALL
(a) PAY TO THE CONTRACTOR IN CONSIDERATION OF THE WORK TO BE PERFORMED BY THE CONTRACTOR THE SUM OF
WHICH SUM SHALL BE SUBJECT TO
(I) A FIVE PERCENT HOLDBACK WHERE A PERFORMANCE BOND, A LABOUR AND MATERIALS PAYMENT BOND OR A SECURITY DEPOSIT IS APPLICABLE TO THE CONTRACT.
(II) A FIFTEEN PERCENT HOLDBACK WHERE NO SUCH BONDS OR SECURITY DEPOSIT IS APPLICABLE, AND THE CONTRACT VALUE IS GREATER THAN FIVE THOUSAND DOLLARS OR
(III) A FIFTEEN PERCENT HOLDBACK WHERE NO SUCH BONDS OR SECURITY DEPOSIT IS APPLICABLE, THE CONTRACT VALUE IS FIVE THOUSAND DOLLARS OR LESS AND THE OWNER HAS IN SECTION 6 ELECTED TO RETAIN A HOLDBACK.
(b) PAY THE HOLDBACK MONIES TO THE CONTRACTOR LESS ANY PORTION THEREOF OR PROPERLY RETAIN BY THE OWNER UPON THE EXPIRATION OF SIXTY DAYS FROM COMPLETION OF THE WORK, AND
(c) MAKE THE PAYMENT SET OUT IN PARAGRAPH (a) LESS HOLDBACK UPON COMPLETION OF THE WORK

2. THE CONTRACTOR SHALL
(a) PERFORM THE WORK DESCRIBED IN SECTION 5(2) IN ACCORDANCE WITH THE TERMS OF THIS CONTRACT, THE TENDER DOCUMENTS AND THE SPECIFICATIONS ATTACHED HERETO, IF ANY,
(b) FURNISH ALL PLANT, LABOUR, EQUIPMENT, TOOLS AND MATERIALS, OTHER THAN THOSE SUPPLIED BY THE OWNER IN ACCORDANCE WITH SECTION 4, NECESSARY TO COMPLETE THE WORK, AND
(c) COMPLETE THE WORK TO THE SATISFACTION OF THE ENGINEER-ARCHITECT ON OR BEFORE THE DAY OF..... 20

3. THIS CONTRACT IS SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS: (a) TIME IS OF THE ESSENCE, (b) AS FAR AS PRACTICABLE, NEW BRUNSWICK LABOUR AND MATERIAL SHALL BE UTILIZED BY THE CONTRACTOR, (c) THE CONTRACTOR SHALL NOT, WITHOUT THE PRIOR WRITTEN CONSENT OF THE OWNER, ASSIGN OR SUBLET ALL OR ANY PORTION OF THIS CONTRACT, (d) NO CLAIM FOR EXTRA WORK SHALL BE RECOGNIZED BY THE OWNER UNLESS APPROVED IN WRITING BY THE ENGINEER-ARCHITECT, (e) THE CONTRACTOR SHALL ALLOW OFFICERS OF THE OWNER FREE ACCESS TO THE WORK, AND (f) THE ENGINEER-ARCHITECT MAY IN WRITING DESIGNATE PERSONS TO ACT ON HIS BEHALF.

4. THE OWNER WILL SUPPLY THE FOLLOWING MATERIALS FREE ON BOARD THE LOCATION INDICATED (IF NONE INDICATE N/A)
N/A OR AS PER THE DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE STANDARD SPECIFICATIONS AND PARTICULAR SPECIFICATIONS

5. (1) THIS CONTRACT IS A LUMP SUM UNIT PRICE
(2) THE CONTRACTOR SHALL COMPLETE THE FOLLOWING DESCRIBED WORK IN ACCORDANCE WITH THE TERMS OF THIS CONTRACT, AND, IF A UNIT PRICE CONTRACT, CARRY OUT THAT WORK AT THE PRICES SET OUT HEREIN.

THE ATTACHED TENDER SUBMISSION AND MARKED "F" FORMS PART OF THIS CONTRACT

THE FOLLOWING ATTACHED ARTICLES OF AGREEMENT FORM PART OF THIS CONTRACT

- 1. GENERAL CONDITIONS FOR BUILDING MOVES AND MARKED "B"
- 2. ADDENDUM NO. AND MARKED "C"
- 3. INSURANCE SCHEDULE AND MARKED "E"
- 4. TENDER SUBMISSION AND MARKED "F"
- 5. PARTICULAR SPECIFICATIONS AND MARKED "G"
- 6. PLANS AND SPECIFICATIONS AND MARKED "G"
- 7. AFFIDAVIT AND MARKED "I"

ALL WORK SHALL BE CARRIED OUT ACCORDING TO THE DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE STANDARD SPECIFICATIONS AND UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE DISTRICT TRANSPORTATION ENGINEER,OR HIS/HER REPRESENTATIVE.

ALL WORK SHALL BE CARRIED OUT UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE DISTRICT TRANSPORTATION ENGINEER, N.B. OR HIS/HER REPRESENTATIVE.

ALL WORK SHALL BE CARRIED OUT UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE DIRECTOR OF, FREDERICTON, N.B., OR HIS/HER REPRESENTATIVE.

6. IF THIS SECTION IS INITIALLED BY THE OWNER, IT SIGNIFIES THAT THE OWNER HAS ELECTED TO RETAIN A HOLDBACK AND IF NOT INITIALLED, THAT HE HAS ELECTED NOT TO RETAIN A HOLDBACK(INITIALS)

7. THE CONTRACTOR CERTIFIES THAT HE NOW HAS AND WILL KEEP IN FORCE DURING THE TERM OF THE CONTRACT LIABILITY INSURANCE PER THE ATTACHED CONFIRMATION OF COVERAGE.

8. THE CONTRACTOR HEREBY AGREES TO INDEMNIFY AND SAVE HARMLESS THE OWNER FROM AND AGAINST ALL CLAIMS, DEMANDS, SUITS, ACTIONS OR PROCEEDINGS WHICH MAY NOW OR HEREAFTER BE BROUGHT, MAINTAINED OR INSTITUTED AGAINST THE OWNER BY ANY PERSON ARISING OUT OF IN RELATING TO OCCASIONED BY OR IN ANY WAY ATTRIBUTABLE TO THE CARRYING OUT OF THE WORK HEREUNDER BY THE CONTRACTOR, HIS SUBCONTRACTORS, SUPPLIERS, SERVANTS OR AGENTS OR IN ANY WAY RELATING TO THE INFRINGEMENT OF ANY PATENT OR COPYRIGHT BY ANY OF THEM IN RELATION TO THE WORK.

IN WITNESS WHEREOF THE RESPECTIVE PARTIES HAVE EXECUTED THIS CONTRACT ON THE DAY AND YEAR FIRST ABOVE WRITTEN

OWNER
SIGNATURE **MINISTER OF TRANSPORTATION AND
INFRASTRUCTURE**

.....
WITNESS

CONTRACTOR
SIGNATURE

.....
WITNESS

CONTRACT NO	PROJECT NO	FILE
PROJECT NAME		
ISSUED BY THE DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE	ISSUED TO	
AWARD OF CONTRACT RECOMMENDED		

**PROVINCE OF NEW BRUNSWICK
STANDARD CONSTRUCTION CONTRACT
CROWN CONSTRUCTION CONTRACTS ACT**

PROJECT:

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- 2 Detail of Paragraph 1(a)
- 3 Detail of Paragraph 1(b)
- 4 Progress Payments
- 5 Claim Payment Not Acceptance
- 6 Owner's Delay in Payment
- 7 Owner's Right of Set-off
- 8 Payment When Contract Terminated
- 9 Interim Release of Holdback

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ARTICLES OF AGREEMENT

THESE ARTICLES OF AGREEMENT made in duplicate this day of 20 :

BETWEEN: HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF NEW BRUNSWICK
REPRESENTED HEREIN BY THE MINISTER OF TRANSPORTATION AND INFRASTRUCTURE

(referred to in the documents forming the contract as the "Owner")

AND: _____, A DULY INCORPORATED COMPANY UNDER THE LAWS OF THE
PROVINCE OF NEW BRUNSWICK

(referred to in the documents forming the contract as the "Contractor")

WITNESS that the Owner and the Contractor covenant and agree as follows:

ARTICLE I

The Contractor shall in a careful and workmanlike manner execute the following work within the time herein limited:

which work is more particularly described in the documents that are attached hereto, entitled "Plans and Specifications" marked "G" (referred to in the documents forming the contract as the "Plans and Specifications") at the place and in the manner therein set out.

ARTICLE II

- 1 The Owner shall pay to the Contractor as consideration for the execution of the portion of the work to which the fixed price arrangement is applicable the sum of \$ (subject to any additions or deductions provided for in these Articles, the General Conditions, the Terms of Payment or the Labour Conditions, except any addition or deduction which is expressly stated to be applicable only to a unit price arrangement), at the times and in the manner set out or referred to in the document that is attached hereto entitled "Terms of Payment" and marked "A" (referred to in the documents forming the contract as the "Terms of Payment").
- 2(1) The Owner shall pay to the Contractor as consideration for the execution of the portion of the work to which the unit price arrangement is applicable a sum equal to the number of units of measurement of each class of labour, plant or material actually performed, used or supplied by the Contractor in the execution of the work as measured by the Engineer-Architect and set out in the Engineer-Architect's Final Certificate multiplied by the price of each such unit of measurement as set out in the Unit Price Table as added to or amended in accordance with subsections (2), (3) and (4) (such sum being subject to any additions or deductions provided for in the General Conditions, Terms of Payment, Labour Conditions, except any addition or deduction which is expressly stated to be applicable only to a fixed price arrangement) at the times and in the manner set out or referred to in the document that is attached hereto entitled "Terms of Payment" and marked "A" (referred to in the documents forming the contract as the "Terms of Payment").
- 2(2) The Engineer-Architect and the Contractor may by agreement in writing add to the Unit Price Table, as set out in the contract documents, classes of labour, plant or material together with units of measurement, prices per unit and estimated quantities therefor where any labour, plant or material which will be included in the Engineer-Architect's Final Certificate is not included in any class of labour, plant or material set out in the Unit Price Table.

- 2(3) The Engineer-Architect and the Contractor may by agreement in writing amend the price per unit set out in the Unit Price Table for any class of labour, plant or material included therein where an estimated quantity is set out therein for that class of labour, plant or material, if the Engineer-Architect's Final Certificate shows or will show that the total quantity of that class of labour, plant or material performed, used or supplied by the Contractor in executing the work is less than seventy-five percent of that estimated quantity, and the price per unit agreed under this subsection shall apply to the number of units supplied.
- 2(4) The Engineer-Architect and the Contractor may by agreement in writing amend the price per unit set out in the Unit Price Table for any class of labour, plant or material included therein where an estimated quantity is set out therein for that class of labour, plant or material, by establishing a price per unit for units of that class of labour, plant or material performed, used or supplied by the Contractor in executing the work which are in excess of one hundred and twenty-five percent of that estimated quantity, and the price per unit agreed to under this subsection shall be applicable only to those units which are in excess of one hundred and twenty-five percent of the estimated quantity.
- 2(5) For the information and guidance of the Contractor and the persons administering the contract on behalf of the Owner, but not so as to constitute a warranty, representation or undertaking of any nature, either by the Owner to the Contractor or by the Contractor to the Owner, it is estimated that the total amount payable by the Owner to the Contractor for the portion of the work to which the unit price arrangement is applicable
- is. _____.
- 3 Section 1 is not applicable where the unit price arrangement applies to the whole of the work.
- 4 Section 2 is not applicable where the fixed price arrangement applies to the whole of the work.

ARTICLE III

- 1 Subject to sections 2 and 3 of this Article, bound documents (A) and (B) in addition to attached documents (C), (D), (E), (F), (G) and (H) hereto entitled
- (A) "Terms of Payment" and marked "A";
- (B) "General Conditions" and marked "B";
- N/A** (C) "Supplementary General Conditions" and marked "C" (if none, insert not applicable);
- N/A** (D) "Labour Conditions" and marked "D";
- (E) "Insurance Schedule" and marked "E";
- (F) "Tender Submission" and marked "F";
- (G) "Plans and Specifications" and marked "G";
- N/A** (H) "Post-tender Documents" and marked "H"; and
- (I) "Affidavit" and marked "I"
- all form part of the contract between the Owner and the Contractor.
- 2 Any provisions of these Articles, the Terms of Payment and the General Conditions which are expressly stated to be applicable only to a unit price arrangement are not applicable to the whole or to the portion of the work to which the fixed price arrangement is applicable.
- 3 Any provisions of these Articles, the Terms of Payment and the General Conditions which are expressly stated to be applicable only to a fixed price arrangement are not applicable to the whole or to the portion of the work to which the unit price arrangement is applicable.

ARTICLE IV

- 1 With respect to the execution of the work by the Contractor,
 - (a) the security deposit having a current market value of \$ _____ that has been deposited with the Owner by the Contractor for the due fulfilment of the contract shall be dealt with in accordance with the provisions concerning security deposit in the General Conditions, or
 - (b) a surety company has furnished or has undertaken to furnish a Performance Bond, (insert details - name of company, amount, date, etc.)

and a Labour and Material Payment Bond, (insert details - name of company, amount, date, etc.)

which bond or bonds shall operate according to their tenor.
- 2 Where bonds are provided under paragraph 1(b), the Contractor shall post on the site of the work a notice that a Labour and Material Payment Bond is in force together with the name and address of the surety company thereunder, a definition of those persons protected thereunder and outline of the procedure for submitting a claim thereunder.

ARTICLE V

For all purposes of or incidental to the contract, the Contractor's address shall be deemed to be:

ARTICLE VI

The Unit Price Table is the Unit Price Table contained in the Tender.

SIGNED, SEALED AND DELIVERED

In the Presence of:

Witness

"The Owner"

MINISTER OF TRANSPORTATION AND
INFRASTRUCTURE

<hr/>	<hr/>
<hr/>	<hr/>

Witness

"The Contractor"

<hr/>	<hr/>
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TERMS OF PAYMENT “A”

A

TOTAL PAYMENT

- 1 Subject to the provisions of sections 16 and 19 of the General Conditions, the Owner shall pay to the Contractor at the times and in the manner hereinafter set out the amount by which
 - (a) the aggregate of the amounts described in section 2 exceeds
 - (b) the aggregate of the amounts described in section 3and the Contractor shall accept the payment as full consideration for everything furnished and done by him in respect of the work.

DETAIL OF PARAGRAPH 1(a)

- 2 The amounts referred to in paragraph 1(a) are:
 - (a) the amount payable to the Contractor pursuant to Article II of the Articles of Agreement;
 - (b) the amount, if any, payable to the Contractor pursuant to section 12 of the General Conditions relating to soil conditions, neglect or delay;
 - (c) the amount, if any, payable to the Contractor on account of a suspension of work pursuant to section 18 of the General Conditions;
 - (d) the amount, if any, payable to the Contractor pursuant to section 36 of the General Conditions relating to work not required to be done under the contract but done by the Contractor under a disputed decision or direction of the Engineer-Architect; and
 - (e) the amount, if any, payable to the Contractor by reason of an order or change pursuant to section 37 of the General Conditions.

DETAIL OF PARAGRAPH 1(b)

- 3 The amounts referred to in paragraph 1(b) are:
 - (a) the amount, if any, payable to the Owner pursuant to section 12 of the General Conditions relating to soil conditions;
 - (b) the amount, if any, which the Contractor is liable to pay to the Owner pursuant to section 14 of the General Conditions relating to damage to the Owner's material, plant and real property;
 - (c) in the event of a delay in completing the work, the amount payable to the Owner pursuant to section 15 of the General Conditions;
 - (d) the amount, if any, paid by the Owner in satisfaction of obligations of the Contractor or a subcontractor pursuant to section 20 of the General Conditions or pursuant to the Labour Conditions;

- (e) the amount, if any, payable by the Contractor to the Owner pursuant to section 35 of the General Conditions relating to matters done by the Owner which the Contractor refused or failed to do; and
- (f) the amount, if any, by which the cost of the work to the Contractor was decreased by reason of dispensations or changes pursuant to section 37 of the General Conditions.

PROGRESS PAYMENTS

- 4(1) For the purposes of this section, "Payment Period" means an interval of thirty days or such other interval as the Contractor and Engineer-Architect agree upon.
- 4(2) The Contractor and Engineer-Architect shall, either before or immediately after the signing of the Articles of Agreement, agree on a schedule of provisional unit prices to be used in the preparation of progress claims.
- 4(3) On or after the end of each Payment Period, a progress claim in writing showing the amount of each class of work performed and materials furnished during such Payment Period, with the value thereof computed in accordance with the schedule of provisional unit prices where applicable or the table of unit prices where applicable, shall be prepared by the Contractor and submitted in triplicate to the Engineer-Architect for approval.
- 4(4) The Engineer-Architect shall within ten days endorse his approval or amended approval on the copies of the progress claim, after making such alterations therein as he may deem proper, and shall forward one copy to the Owner, return one copy to the Contractor, and retain one copy in his possession and the progress claim so approved shall be the basis of the payment by the Owner under subsection (6).
- 4(5) In respect of each progress claim, the Contractor shall deliver to the Owner
 - (a) a Statutory Declaration deposing, or
 - (b) if required by the Owner, documentary proof verifying,

the fact that all his lawful obligations to subcontractors, workmen and suppliers of material in respect of the work as at a date not greater than forty-five days prior to the date of the progress claim have been fully discharged.
- 4(6) The Owner shall, within twenty days after receipt of the approved progress claim from the Engineer-Architect and receipt of the statutory declaration or proof of payment required under subsection (5), pay to the Contractor an amount equal
 - (a) when a Labour and Material Payment Bond was required of and furnished by him, to ninety-five percent of the amount of progress claim, or
 - (b) when a security deposit was required of and furnished by him, to eighty-five percent of the amount of the progress claim.
- 4(7) Upon the expiration of sixty days from the date of issuance of an Interim Certificate of Completion under subsection 39(1) of the General Conditions or thirty days after the Contractor has delivered to the Owner an invoice approved by the Engineer-Architect, showing the method by which the amount claimed therein was calculated, whichever is the later date, and if the Contractor has made and delivered to the Owner his Statutory Declaration deposing or proof of payment, if required by the Owner, verifying the fact that all his lawful obligations to subcontractors, workmen and suppliers of material in respect of the work are fully discharged and that all other lawful claims against him in respect of the work including Workers' Compensation assessments have been satisfied or provided for, the amount described in section 1 as estimated by the Engineer-Architect less the aggregate of
 - (a) all payments made pursuant to subsection (6),

- (b) an amount equal to double the estimated cost to the Owner of completing the items and doing the things described in the Interim Certificate of Completion which, in the opinion of the Engineer-Architect, are brought about by defects and faults in the work,
 - (c) an amount equal to double the cost to the Owner of completing the items and doing the things described in the Interim Certificate of Completion other than items or things to which paragraph (b) applies,
 - (d) all payments made pursuant to section 9, and
 - (e) all amounts retained pursuant to a maintenance and guarantee provision, if any, contained in the contract shall become due and be payable by the Owner to the Contractor.
- 4(8) Upon the expiration of sixty days from the date of issuance of the Final Certificate of Completion under subsection 39(2) of the General Conditions or thirty days after the Contractor has delivered to the Owner an invoice approved by the Engineer-Architect, showing the method by which the amount claimed therein was calculated, whichever is the later date, and if the Contractor has made and delivered to the Owner his Statutory Declaration or proof of payment, if required by the Owner, verifying the fact that all his lawful obligations and lawful claims against him, arising out of the work, have been discharged and satisfied, the amounts described in section 1 less the aggregate of
- (a) all payments made pursuant to subsection (6),
 - (b) all payments made pursuant to subsection (7),
 - (c) all payments made pursuant to section 9, and
 - (d) all amounts retained pursuant to a maintenance and guarantee provision, if any, contained in the contract
- shall become due and be payable by the Owner to the Contractor.
- 4(9) Where the Contractor does not provide the Owner with a Statutory Declaration or proof of payment required by subsection (5), (7) or (8) within the time limited therein, the Owner may withhold payment of the monies which would otherwise have become due until such time as the Statutory Declaration or proof of payment is provided by the Contractor to the Owner and the Owner during this period of time shall not be required to pay interest as provided for in section 6.

CLAIM PAYMENT NOT ACCEPTANCE

- 5 Neither a Progress Claim nor a payment by the Owner pursuant thereto shall be construed as evidence that the work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

OWNER'S DELAY IN PAYMENT

- 6 Delay by the owner in making a payment when it becomes due and is payable shall, if the delay continues for more than fifteen days, entitle the Contractor to interest on the overdue payment and the Owner shall pay to the Contractor interest thereon from the said fifteenth day until paid at the rate being charged by the Canadian chartered banks in Fredericton on prime commercial accounts as of the date from which such interest was payable.

OWNER'S RIGHT OF SET - OFF

- 7(1) Without restricting any right of set-off given or implied by law, the Owner may set-off against any amount payable to the Contractor under the contract, any amount payable to the Owner by the Contractor under this contract or under any current contract and, without restricting the

generality of the foregoing, the Owner may when making payment pursuant to section 4 deduct from the amount payable any amount which is then payable to the Owner or the Province of New Brunswick by the Contractor under the contract or which, by virtue of the right of set-off, may be retained by the Owner.

7(2) For the purposes of this section "current contract" means

- (a) a contract between the Owner and the Contractor under which the Contractor has an undischarged obligation to perform or supply work, labour or materials, or
- (b) a contract between the Owner and the Contractor in respect of which the Owner has since the date on which this contract was entered into exercised the right to take the work, the subject of that contract, out of the Contractor's hands.

PAYMENT WHEN CONTRACT TERMINATED

- 8 In the event that the contract is terminated pursuant to section 19 of the General Conditions, the Owner shall as soon as is practicable under the circumstances pay to the Contractor the amount, if any, payable to the Contractor pursuant to that section.

INTERIM RELEASE OF HOLDBACK

- 9(1) The Owner may at any time, but not more than twice during the term of the contract, on the written application of the Contractor and with the approval of the surety, pay to the Contractor all, or a portion of, the percentage amounts retained up to that time in respect of payments on Progress Claims under subsection 4(6).
- 9(2) Subject to the approval of the surety, the making of any such payment, and the amount thereof, are wholly in the discretion of the Owner.

GENERAL CONDITIONS “B”

B

DEFINITION OF TERMS

1(1) In the documents forming the contract, unless the context otherwise requires:

“Engineer-Architect” means the
.....of.....
.....and includes a
person authorized by him to perform on his behalf any function under the contract;

“herein,” “hereby,” “hereof,” “hereunder” and similar expressions refer to the contract as a whole and not to any particular subdivision or part thereof;

“material” includes all materials, commodities, articles and things required to be furnished under the contract for incorporation in the work;

“Owner” means that Minister, agency or corporation set forth in the Articles of Agreement as the Owner;

“plant” includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment, articles and things required for the execution of the work;

“security deposit” means the security given by the Contractor to the Owner in accordance with the contract;

“subcontractor” means a person, firm or corporation having a contract with the Contractor

(a) for the execution of a part or parts of the work included in this contract, or

(b) for the furnishing of material called for in this contract and worked to a special design according to the Plans and Specifications

provided such contract is made pursuant to section 4;

“superintendent” means the employee of the Contractor who is designated by the Contractor as being in full charge of the field operations of the Contractor for the purposes of the contract;

“work” includes all labour, material and services required, as shown or described in the contract, supplied and installed or erected complete at the place of building.

1(2) The marginal notes, if any, in the contract documents form no part of the contract but shall be deemed to be inserted for the convenience of reference only.

REFERENCES

1(3) Unless the context otherwise requires, where in a contract document reference is made to a section, subsection or paragraph, the reference is deemed to be a reference

(a) in the case of section, to a section in the contract document,

(b) in the case of a subsection, to a subsection of the section, and

- (c) in the case of a paragraph, to a paragraph in the section or subsection,
in which the reference appears.

INTERPRETING DOCUMENTS

- 1(4) In interpreting the contract in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions shall govern.
- 1(5) In interpreting the Plans and Specifications:
 - (a) in the event of discrepancies or conflicts between the Plans and Specifications, the Specifications shall govern;
 - (b) in the event of discrepancies or conflicts between the Plans, the Plans drawn with the largest scale shall govern; and
 - (c) in the event of discrepancies or conflicts between figured dimensions and scaled dimensions, the figured dimensions shall govern.

CONTRACT BINDING

- 2 The contract shall inure to the benefit of and be binding upon the parties hereto and their heirs, executors, administrators, successors, and assigns.

ASSIGNMENT

- 3 The contract may not be assigned without the written consent of the Owner and until sections 51 and 52 of the Financial Administration Act, chapter F-11 of the Revised Statutes of New Brunswick, 1973, have been complied with where applicable.

SUBCONTRACTING

- 4(1) Except for the subcontracting proposed by the Contractor in his accepted tender, neither the whole nor any part of the work may be subcontracted by the Contractor without the consent of the Engineer-Architect.
- 4(2) Every subcontract by the Contractor, whether as proposed in the approved tender or as approved by the Engineer-Architect under subsection (1), shall provide that the subcontractor shall comply with all terms and conditions of this contract which can reasonably be applied to his undertaking including, without limiting the generality of the foregoing, the provisions of section 52.

SCOPE OF WORK

- 5(1) The description of the work and material set out in the contract includes not only the particular kind of work and material mentioned but also all labour, plant and material necessary for the full execution, completion and delivery ready for use of the work and material.
- 5(2) The Contractor shall provide everything necessary for execution of the work except things in respect of which the contract expressly provides otherwise and except the site of work if the work when completed is to remain permanently affixed thereon.

NO IMPLIED OBLIGATION

- 6 No implied obligation of any kind by or on behalf of the Owner shall arise from anything in the contract, and the express covenants and agreements herein contained and made by the Owner are and shall be the only covenants and agreements upon which any right against the Owner are to be founded, and, without limiting the generality of the foregoing, the contract

supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the contract.

TIME OF THE ESSENCE

7 Time is of the essence of the contract.

INDEMNITY BY CONTRACTOR

8(1) Except as provided in section 9, the Contractor shall indemnify and save harmless the Owner from and against all claims, demands, losses, costs, damage, actions, suits, or proceedings by whomsoever made, brought or prosecuted in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor in executing the work under the contract or to an infringement or an alleged infringement by the Contractor of a patent of invention.

8(2) For the purposes of subsection (1), "activities" includes an act improperly carried out, an omission to carry out an act and delay in carrying out an act.

INDEMNITY BY OWNER

9 The Owner shall indemnify and save harmless the Contractor from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract which are directly attributable to

(a) a lack of title, a defect in title or an alleged lack of title or defect in title to the site of the work, or

(b) an infringement or an alleged infringement of any patent of invention in executing anything for the purposes of the contract, the model, plan or design of which was supplied by the Owner to the Contractor.

ELECTED MEMBERS

10(1) No member of the Legislative Assembly of the Province of New Brunswick shall be admitted to any share or part of the contract or to any benefit arising therefrom.

10(2) No member of the House of Commons of Canada shall be admitted to any share or part of the contract or to any benefit arising therefrom if Government of Canada funds are involved, whether directly or indirectly, in the payment for or financing of such contract.

SERVING NOTICES

11(1) Notices for the purposes of paragraph 16(1)(a), section 18 and section 19 shall be in writing and shall

(a) be delivered to the Contractor in person, or, if the Contractor is a corporation or partnership, be delivered to the superintendent or to a senior administrative officer of the corporation or partnership, or

(b) be sent by mail to the Contractor or his superintendent addressed to the address mentioned in the contract,

and if any question arises as to when any such notice was given to or received by the Contractor it shall be deemed to have been sufficiently given to and received by him,

(c) if it was delivered pursuant to paragraph (a), on the day it was delivered, or

(d) if it was sent by mail pursuant to paragraph (b), on the day it was received by the Contractor or on the sixth day after it was mailed, whichever is the earlier.

- 11(2) Any notice, order, direction, decision or communication, other than a notice to which subsection (1) refers, which may be given to the Contractor pursuant to the contract may be given in any manner, but it shall be deemed to have been sufficiently given to the Contractor if it was put in writing and the writing was
- (a) delivered to the Contractor in person, or, if the Contractor is a corporation or partnership, was delivered to the superintendent or to a senior administrative officer of the corporation or partnership,
 - (b) left at the Contractor's office, or, if he has more than one office, at one of them, or
 - (c) sent by mail to the Contractor or his superintendent addressed to the address mentioned in the contract or to the Contractor's last known place of business or residence.

ADJUSTMENTS DUE TO SOIL CONDITIONS, NEGLIGENCE OR DELAY

- 12(1) No payment, in addition to the payment expressly promised by the contract, shall be made by the Owner to the Contractor on account of any extra expense, loss or damage incurred or sustained by the Contractor including a misunderstanding on the part of the Contractor as to any fact, whether or not such misunderstanding is attributable directly or indirectly to the Owner or any of the Owner's agents or servants, and whether or not any negligence or fraud on the part of the Owner's agents or servants is involved, unless, in the opinion of the Engineer-Architect the extra expense, loss or damage is directly attributable to
- (a) a substantial difference between information relating to soil conditions at the site of the work, or a reasonable assumption of fact based thereon, in the Plans and Specifications or other documents or material communicated by the Owner to the Contractor for his use in preparing his tender and the real soil conditions encountered at the site of the work by the Contractor when executing the work, or
 - (b) neglect or delay occurring after the date of the contract on the part of the Owner in providing any information or in doing any act which the contract either expressly requires the Owner to do or which would be done by an Owner in accordance with the usage of the trade to enable his Contractor to carry out an undertaking similar to the work being executed under the contract for the Owner,

in which case, if as a condition precedent the Contractor has given to the Engineer-Architect written notice of his claim before the expiration of thirty days from the encountering of the soil conditions giving rise to the claim or from the day on which the neglect occurs or the delay commences, as the case may be, the Owner shall pay to the Contractor, in respect of the additional expense, loss or damage incurred or sustained by reason of that difference, neglect or delay, an amount equal to the cost of the additional plant, labour and material necessarily involved.

- 12(2) If, in the opinion of the Engineer-Architect, the Contractor has effected a saving of expenditure by reason of the execution of the work by the Contractor being rendered less difficult and less costly because the soil conditions actually encountered by the Contractor at the site if the work when executing the work are substantially different from soil conditions indicated in information, or a reasonable assumption of fact based thereon, in the Plans and Specifications or other documents or material communicated by the Owner to the Contractor for his use in preparing his tender, the amount set out in Article II of the Articles of Agreement shall be reduced by an amount equal to the saving effected by the Contractor.

- 12(3) Paragraph (1)(a) and subsection (2) are applicable only to a fixed price arrangement.

- 12(4) If information relating to soil conditions at the site of the work appeared in the Plans and Specifications or in other documents or material communicated by the Owner to the Contractor for his use in preparing his tender and if the real soil conditions encountered at the site of the work by the Contractor when executing the work are substantially different from such information, or a reasonable assumption of fact based thereon, so that the cost to the

Contractor of executing the work is directly and substantially increased or decreased by reason of such difference, the Engineer-Architect and the Contractor may by agreement in writing amend the price per unit for any class of plant, labour or material involved therein, so that the benefit of a substantial decrease in cost shall accrue to the Owner and the burden of a substantial increase in cost shall not be borne by the Contractor.

12(5) Subsection (4) is applicable only to a unit price arrangement.

12(6) No claim by the Contractor shall be valid in situations where subsection (4) is applicable unless he has given written notice thereof to the Owner within thirty days from the encountering of the soil conditions giving rise to such claim.

OWNER'S TITLE TO PLANT, ETC.

13(1) All material and plant and the interest of the Contractor in all real property, licences, powers and privileges acquired, used or provided by the Contractor for the work shall from the time of being so acquired, used or provided, become and they are the property of the Owner for the purposes of the work and they shall continue to be the property of the Owner

(a) in the case of material, until incorporated in the work or until the Engineer-Architect certifies that he is satisfied that it will not be required for the work, and

(b) in the case of plant, real property, licences, powers and privileges, until the Engineer-Architect certifies that he is satisfied that the interest vested in the Owner therein is no longer required for the purposes of the work.

13(2) Material or plant that is the property of the Owner by virtue of this section shall not be taken away from the site of the work, or used or disposed of, except for the purposes of the work, without the consent in writing of the Engineer-Architect.

13(3) The Owner is not liable for loss or damage to material or plant that is the property of the Owner by virtue of this section and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of the Owner.

CONTRACTOR'S LIABILITY FOR DAMAGE TO OWNER'S PLANT

14(1) The Contractor is liable to the Owner for loss of or damage to material, plant or real property, whether attributable to causes beyond his control or not, supplied or made available by the Owner to the Contractor for use in connection with the work other than loss or damage resulting from and directly attributable to reasonable wear and tear.

14(2) The Contractor shall not use material, plant or real property to which this section applies except for the purpose of carrying out this contract.

14(3) When the Contractor has failed to make good any loss or damage for which he is liable under this section within a reasonable time after being required by the Engineer-Architect to do so, the Engineer-Architect may cause the loss of damage to be made good, and the Contractor shall thereupon be liable to the Owner for the cost thereof and shall on demand pay to the Owner an amount equal to such cost.

14(4) The Contractor shall keep such records of material, plant and real property to which this section applies as the Engineer-Architect from time to time requires and shall, from time to time as the Engineer-Architect requires, satisfy the Engineer-Architect that such material, plant and real property are at the place and in the condition that they ought to be.

EXTENSION OF TIME AND PENALTY FOR DELAY IN COMPLETION

15(1) The Engineer-Architect may, on the application of the Contractor if made in accordance with the time limits in subsection 33(2) and made before the day fixed by Article I of the Articles of Agreement for completion of the work or any specified portion thereof or before any new date

for completion previously fixed under this subsection, if in his opinion it is in the public interest, extend the time for completion of the work or any specified portion or portions thereof by fixing a new day for such completion.

15(2) Where the Contractor does not complete the work or any specified portion thereof by the day fixed by Article I of the Articles of Agreement for such completion or by such subsequent day, if any, to which the time for completion has been extended under subsection (1), but does complete the work or portion thereafter, the Contractor shall pay to the Owner

- (a) where no statutory penalty is provided by subsection (3),
 - (i) an amount equal to all salaries, wages and travelling expenses paid by the Owner to persons superintending the work during the period of delay, which would not otherwise have been payable,
 - (ii) an amount equal to the value to the Owner of the use of the completed work for the period of delay, and
 - (iii) an amount equal to all other expenses and damages incurred or sustained by the Owner as a result of the work or specified portion thereof not being completed during the period of delay, or
- (b) where a statutory penalty is provided for by subsection (3), the amount prescribed therein for each day the work or specified portion therefor was not complete during the period of delay.

15(3) (a) The Contractor shall pay to the Owner

- (i) for each day of the period of delay during which the work in its entirety is not complete, the sum of, and
- (ii) for each day of the period of delay during which the following specified portions of the work are not complete, the sum stated for such portion
 - (A)
 - (B)
 - (C)

(b) Where no penalty is stipulated in paragraph (a), the Contractor is not bound by this subsection.

15(4) For the purposes of this section,

- (a) the work is deemed to be completed on the day specified by the Engineer-Architect in his Interim Certificate of Completion, and
- (b) "period of delay" means the period commencing on the day fixed by Article I of the Articles of Agreement for completion of the work or any portion thereof or such subsequent day, if any, to which the time for completion has been extended under subsection (1) and ending on the day immediately preceding the day on which the work or portion thereof is completed.

15(5) The Engineer-Architect may waive the right of the Owner to the whole or any part of a payment payable pursuant to subsection (2).

DEFAULT OR REMOVAL OF WORK FROM CONTRACTOR

16(1) In any of the following cases, namely,

- (a) where the Contractor has made default or delayed in commencing or in diligently executing the work or any portion thereof to the satisfaction of the Engineer-Architect and the Engineer-Architect has given notice thereof to the Contractor and has by such notice required the Contractor to put an end to such default or delay and such default or delay continues for six days after such notice was given,
- (b) where the Contractor has made default in the completion of the work, or any portion thereof, within the time limited for such completion by the contract,
- (c) where the Contractor has become insolvent,
- (d) where the Contractor has committed an act of bankruptcy,
- (e) where the Contractor has abandoned the work,
- (f) where the Contractor has made an assignment of the contract without the required consent, or
- (g) where the Contractor has otherwise failed to observe or perform any of the provisions of the contract,

the Owner may, without any other authorization, take all or any portion of the work out of the Contractor's hands and may employ such means as he may see fit to complete the work.

16(2) Where the work or any portion thereof has been taken out of the Contractor's hands under subsection (1), the Contractor shall not, except as provided in subsection (3), be entitled to any further payment in respect of the work so affected including payments then due and payable but not paid, and the obligation of the Owner to make payments in respect thereof as provided for in the Terms of Payment shall be at an end with respect to that portion of the work taken out of his hands, and the Contractor shall be liable to and upon demand therefor shall pay to the Owner an amount equal to all loss and damage suffered by the Owner by reason of the non-completion of the work by the Contractor.

16(3) Where the work or any portion thereof has been taken out of the Contractor's hands under subsection (1) and is subsequently completed by the Owner, the Engineer-Architect shall thereafter determine the amount, if any, of holdback and progress claims of the Contractor in respect thereof unpaid at the time of taking the work out of the Contractor's hands that in his opinion are not required by the Owner for the purposes of the contract and the Engineer-Architect shall, if he is of the opinion that no financial prejudice to the Owner will result, authorise payment of the amount to the Contractor.

CONTRACTOR'S CONTINUING OBLIGATION

17(1) The taking of the work, or any portion thereof, out of the Contractor's hands pursuant to section 16 does not relieve or discharge the Contractor from any obligation under the contract or imposed upon him by law except the obligation under the contract to complete the physical execution of that portion of the work so taken out of his hands.

17(2) If the work or any portion thereof is taken out of the Contractor's hands pursuant to section 16, all material and plant and the interest of the Contractor in all real property, licences, powers and privileges acquired, used or provided by the Contractor for the purpose of the work shall, notwithstanding subsection 13(1), be the property of the Owner without compensation to the Contractor.

- 17(3) If the Engineer-Architect certifies that any property interest of the Owner by virtue of subsection (2) is no longer required for the purposes of the work and that it is not in the interests of the Owner to retain the interest, it shall revert to the Contractor subject to the provisions of subsection 13(3).

SUSPENSION OF WORK

- 18(1) The Engineer-Architect may require the Contractor to suspend execution of the work either for a specified or unspecified period by giving notice to that effect to the Contractor.
- 18(2) The Contractor upon receiving notice of the Owner's requirement pursuant to subsection (1) shall suspend all operations except those which, in the Engineer-Architect's opinion, are necessary for the care and preservation of the work, material and plant.
- 18(3) During the period of suspension the Contractor shall not remove from the site any part of the work, any material or any plant without the consent of the Engineer-Architect.
- 18(4) If the period of suspension is thirty days or less, the Contractor, upon the expiration of the period of suspension, shall resume the execution of the work and except where the suspension order was due to the Contractor not diligently prosecuting the work or failing to prosecute the work in a good and workmanlike manner he is entitled to be paid the cost of any plant, labour and material necessary involved in complying with the suspension.
- 18(5) If the period of suspension is more than thirty days and if, upon the expiration of the period of suspension, the Engineer-Architect and the Contractor agree that the execution of the work be completed by the Contractor, the Contractor shall resume operations and complete the execution of the work in accordance with any terms and conditions agreed upon by the Engineer-Architect and the Contractor.
- 18(6) If upon the expiration of a period of suspension of more than thirty days, the Engineer-Architect and the Contractor do not agree that the work will be completed by the Contractor or they are unable to agree upon the terms and conditions under which the Contractor will complete the work, the notice of suspension shall be deemed to be a notice of termination pursuant to section 19.

TERMINATION OF CONTRACT

- 19(1) The Owner may at any time by giving notice to that effect terminate the contract.
- 19(2) The Contractor shall upon receipt of a notice pursuant to subsection (1) cease all operations forthwith.
- 19(3) If the contract is terminated pursuant to subsection (1), the Owner shall pay to the Contractor an amount equal to the lesser of
- (a) the value as agreed upon by the Contractor and the Engineer-Architect of all work performed by the Contractor as of the date of termination or, if the Contractor and the Engineer-Architect cannot agree, as calculated in accordance with the formula set out in section 45, less all amounts already paid to the Contractor by the Owner and less all amounts which the Contractor is liable to pay to the Owner, and
 - (b) the amount calculated in accordance with the terms of payment which would have been payable to the Contractor had he completed the work.
- 19(4) If the contract is terminated pursuant to subsection (1), the Owner shall pay to the Contractor an amount equal to the value as agreed upon by the Contractor and the Engineer-Architect of all work performed by the Contractor as of the date of termination or, if the Contractor and the Engineer-Architect cannot agree, as calculated in accordance with the formula set out in section 45, less all amounts already paid to the Contractor by the Owner and less all the amounts which the Contractor is liable to pay to the Owner.

- 19(5) Subsection (3) is applicable only to a fixed price arrangement and subsection (4) is applicable only to a unit price arrangement.

PAYMENT BY OWNER OF CONTRACTING OBLIGATIONS

- 20(1) The Owner may, in order to discharge lawful obligations of and satisfy lawful claims against the Contractor or a subcontractor arising out of the execution of the work, pay an amount which is due and payable to the Contractor, under any provision of the contract, directly to the obligees of and the claimants against the Contractor or the subcontractor.
- 20(2) A payment made pursuant to subsection (1) is to the extent of the payment a discharge of the Owner's liability under the contract to the Contractor.
- 20(3) The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the execution of the work as the same become due.
- 20(4) The Contractor shall, whenever so requested by the Engineer-Architect, make a statutory declaration deposing to the existence and condition of the obligations and claims referred to in subsection (3).

ACCESS TO WORK BY OWNER

- 21 The Contractor shall permit the Engineer-Architect to have access to the work and to all areas where portions of the work are being fabricated or manufactured at all times during the execution of the work, shall provide the Engineer-Architect with full information concerning what is being done to execute the work and shall give the Engineer-Architect every possible assistance in respect of the performance of his duty to see that the work is executed in accordance with the contract and also in respect of the performance and exercise of the duties and powers specially imposed or conferred on him by the contract.

CLEAN UP

- 22 The Contractor shall upon completion of the work clear and clean the work and its site to the satisfaction of and in accordance with any directions of the Engineer-Architect.

CONTRACTOR'S SUPERINTENDENT

- 23(1) The Contractor shall, during working hours, until the work has been completed, keep on the site of the work a competent superintendent who has authority to receive on behalf of the Contractor any order, direction or other communication that may be given under the contract.
- 23(2) The Contractor shall, upon the request of the Engineer-Architect, remove any superintendent who, in the opinion of the Engineer-Architect, is incompetent or has been conducting himself improperly and shall replace a superintendent so removed with another superintendent as described in subsection (1).

REMOVAL OF CONTRACTOR'S EMPLOYEES

- 24 The Contractor shall, at the request of the Engineer-Architect, remove from the work any person employed on the work who, in the opinion of the Engineer-Architect, is incompetent or has been conducting himself improperly and the Contractor shall not permit a person so removed to remain on the site of the work.

ESCALATION - LABOUR - MATERIAL

- 25(1) Except where the Labour Conditions contain an escalation clause, the amount payable to the Contractor under the contract shall not be increased or decreased by reason of any increase or decrease in the cost of the work brought about by an increase or decrease pursuant to the Labour Conditions.

25(2) Notwithstanding section 12 and subsection (1) of this section, the amount set out in Article II of the Articles of Agreement shall be adjusted, in the manner provided in subsection (3), in the event of any change in any tax imposed under the Social Services and Education Tax Act, chapter S-10 of the Revised Statutes of New Brunswick, 1973, or the Excise Tax Act, chapter E-13 of the Revised Statutes of Canada, 1970,

(a) after the date of the submission by the Contractor of the tender for the contract, and

(b) that applies to the material incorporated or to be incorporated in the work and that affects the cost to the Contractor of such material.

25(3) In the event of any change after the date of submission of the tender for the contract by the Contractor in any tax described in subsection (2) that applies to the material incorporated or to be incorporated in the work and that affects the cost to the Contractor of such material, the amount set out in Article II of the Articles of Agreement shall

(a) be increased where the cost to the Contractor of any material has been increased by virtue of the change, or

(b) be decreased where the cost to the Contractor of any material has been decreased by virtue of the change.

by an amount equal to such amount as it is established upon examination of the relevant records of the Contractor referred to in section 47, represents the increase or decrease, as the case may be, in the cost to the Contractor of the material involved that is directly attributable to the change in the tax levied on or in respect of such material.

25(4) For the purpose of determining the adjustment in the amount set out in Article II of the Articles of Agreement by virtue of any change in any tax described in subsection (2), where such tax is changed after the date of submission of the tender by the Contractor but public notice of such change has been given by the Minister of Finance of the Province or the Federal Government, as the case may be, before the date of submission of the tender, the change of such tax shall, for the purposes of this section, be deemed to have occurred before the date of submission of the tender.

25(5) The Contractor is not entitled to any part of a rebate of taxes obtained by the Owner.

USE OF LOCAL LABOUR AND MATERIAL

26(1) The Contractor shall use Canadian labour and material in carrying out the work, to the full extent to which they are procurable, consistent with proper economy and the expeditious carrying out of the work.

26(2) Subject to subsection (1), the Contractor shall employ labour and obtain material from the locality where the work is being executed to the extent to which it is available and shall use the offices of the Canada Employment Centre in the recruitment of workmen wherever practicable.

26(3) Subject to subsections (1) and (2), the Contractor shall employ a reasonable proportion of persons who have served on active service with the armed forces of Canada and have been honourably discharged therefrom.

SAFETY

27(1) If, in the opinion of the Engineer-Architect, the Contractor is not conducting construction of the work with proper safety precautions for workmen as prescribed by the Occupational Health and Safety Regulation - Occupational Health and Safety Act, the Engineer-Architect may, by giving notice in writing to the Contractor, stop the work.

27(2) Where under subsection (1) the Engineer-Architect has stopped the work, the Contractor shall immediately cease his operations until the provisions of the Occupational Health and Safety Regulation - Occupational Health and Safety Act have been complied with to the satisfaction of the Engineer-Architect.

27(3) No extension of time or monetary allowances shall be made to the Contractor for loss or delay arising from any stoppages in work under this section.

PROTECTION OF WORK

28 The Contractor shall guard or otherwise protect the work and shall protect the specifications, plans, drawings, information, material, plant and real property provided by the Owner to the Contractor against loss or damage from any cause.

PUBLIC CEREMONIES

29(1) The Contractor shall not allow or permit any public ceremony in connection with the work without the permission of the Owner.

29(2) The Contractor shall not erect or permit the erection of any sign or advertising on the work without the approval of the Engineer-Architect.

INSURANCE

30(1) The Contractor shall at his own expense maintain such insurance policies, if any, as are required under this contract in a form and with companies approved by the Owner and of the nature, in the amounts, for the periods and containing the terms and conditions, if any, set out in the Insurance Schedule.

30(2) All insurance policies covering the work and maintained by the Contractor pursuant to subsection (1) shall provide that the proceeds thereof are payable to the Owner, except where the Insurance Schedule otherwise provides.

30(3) The Contractor shall deposit with the Engineer-Architect the originals of all policies of insurance maintained by the Contractor pursuant to subsection (1) and the Contractor shall, when required by the Engineer-Architect, submit to him proof that such policies are in force.

30(4) Upon application by the Contractor, the Engineer-Architect may waive compliance with subsections (2) and (3).

FIRE LOSS

31(1) If the work or any portion thereof is lost or destroyed and monies are paid to the Owner in respects of the loss or damage under a policy of insurance maintained by the Contractor pursuant to section 30, the monies shall be held by the Owner for the purposes of the contract.

31(2) The Owner may elect to retain absolutely the monies held under subsection (1) and, in such event, the monies belong absolutely to the Owner and

(a) the Contractor is liable to the Owner in an amount equal to the amount by which the insurance monies payable is less than the loss and damages suffered and sustained by the Owner, including costs associated with clearing and cleaning the site of the work, and

(b) there shall be a financial accounting between the Owner and the Contractor in respect of the portion of the work which was lost or damaged and respect of which monies have been retained absolutely by the Owner and there shall be included in the financial accounting all amounts paid or payable by the Owner under the contract to the Contractor, together with all amounts paid or payable by the Contractor under the contract to the Owner and the Owner shall pay to the Contractor any balance.

- 31(3) Upon payment as required by subsection (2) by the Owner or the Contractor as the case may be, the Owner and the Contractor are discharged from all rights and obligations under the Contract in respect of the portion of the work which was lost or damaged and in respect of which monies have been retained absolutely by the Owner as though such portion of the work had been fully completed and executed by the Contractor in accordance with the contract.
- 31(4) If an election is not made under subsection (2), the Contractor shall restore and replace the portion of the work lost or damaged and the insurance monies shall be disbursed by the Owner to the Contractor in the manner and subject to the terms and conditions governing monies payable under the contract to the Contractor by the Owner, except that for the purpose of this subsection "one hundred percent" shall be substituted in subsection 4(6) of the Terms of Payment for "ninety-five percent" and "eighty-five percent".

CONTRACTOR'S RESPONSIBILITIES

- 32(1) The Contractor shall at his own expense do whatever is necessary to ensure that
- (a) no person, property, right, easement or privilege is injured, damaged or infringed by reason of the Contractor's activities under this contract,
 - (b) pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the execution or existence of the work and plant,
 - (c) fire hazards are eliminated and in the case of a fire in or about the work that it is promptly extinguished,
 - (d) the health of all persons employed on the work is not endangered,
 - (e) adequate medical supervision of all persons employed on the work is maintained,
 - (f) adequate sanitation measures in respect of the work are taken, and
 - (g) all stakes, buoys, lines, levels, and marks placed on or about the works by or under the authority of the Engineer-Architect are protected and are not removed, defaced or altered.
- 32(2) The Engineer-Architect may direct the Contractor to do such things and to construct such works which the Engineer-Architect considers reasonable and necessary to ensure compliance with or to remedy a breach of subsection (1).
- 32(3) The Contractor shall at his own expense comply with a direction of the Engineer-Architect made pursuant to subsection (2).

INTERPRETATIONS OF CONTRACT DOCUMENTS - CLAIMS ARISING

- 33(1) If at any time before the work has been completed and the Engineer-Architect has issued his Final Certificate of Completion, any question arises as to whether anything has been done as required by the contract or as to what the Contractor is required by the contract to do, and in particular, and without limiting the generality of the foregoing, as to
- (a) the meaning of anything in the Plans and Specifications,
 - (b) the meaning to be given to the Plans and Specifications in case of any error therein, an omission therefrom, or an obscurity or discrepancy in the wording or intention thereof,
 - (c) whether the quality or quantity of any material or workmanship meets the requirements of the contract,
 - (d) whether the plant, material or workmen provided by the Contractor for executing the work and carrying out the contract are adequate to ensure that the work will be executed in

accordance with the contract and that the contract will be carried out in accordance with its terms,

- (e) what quantity of any kind of work has been completed by the Contractor, or
- (f) the timing and scheduling of the various phases of the execution of the work,

the question shall be decided by the Engineer-Architect whose decision is final and binding.

33(2) In matters arising other than under section 12, the Contractor shall, where he intends to submit a claim for additional time or money arising out of the construction of the work, give written notice of his intention to claim

- (a) in the case of changes or alterations of the work ordered by the Engineer-Architect, within fourteen days of receipt of the notice of change, and
- (b) in the case of a dispute arising out of interpretation of the contract, within thirty days of the first occurrence of the circumstances giving rise to the dispute.

33(3) In matters arising other than under section 12, the Contractor may submit a claim for additional time or money only on those matters covered by the notice of intention to claim given under subsection (2) and such claim if not submitted within thirty days of the occurrence of the portion of the work out of which the claim arises shall be barred.

33(4) The Engineer-Architect shall within thirty days of receipt of a notice of claim under this section render his decision in writing to the Contractor.

33(5) The Contractor shall construct the work in accordance with the decisions and directions of the Engineer-Architect given under this section and in accordance with any consequential decisions and directions given by the Engineer-Architect.

DEFECTS AND OMISSIONS

34(1) Without restricting any warranty or guarantee implied or stipulated by law, the Contractor shall at his own expense rectify and make good any defect or fault or omission that appears in the work within twelve months or within such additional period of time stipulated in the Specifications concerning particular portions of the work from the date of the Engineer-Architect's Final Certificate of Completion, or where an Interim Certificate of Completion has been issued under section 39, from the date of such Interim Certificate.

34(2) If any defect, fault or omission appears in the work and the Engineer-Architect is of the opinion that it is one which the Contractor, either under subsection (1) or under a warranty or guarantee implied or stipulated by law, is obliged to remedy and make good, the Engineer-Architect may direct the Contractor to remedy and make good the defect, fault or omission by giving notice to the Contractor of the existence of the defect, fault or omission and the notice shall specify the time within which the defect, fault, or omission is to be rectified and made good.

34(3) The Contractor shall rectify and make good the defect, fault or omission described in a notice given pursuant to subsection (2) within the time specified in the notice.

OWNER'S RIGHT TO COMPLETE WORK

35(1) Where the Contractor has failed to comply with any decision or direction given by the Engineer-Architect under section 22, 32, 33, or 34, the Engineer-Architect may employ such methods as he may deem expedient to do that which the Contractor failed to do.

35(2) The Contractor shall on demand pay to the Owner all costs, expenses and damages incurred or sustained by the Owner by reason of the Contractor's non-compliance with any decision or

direction given by the Engineer-Architect under this section 22, 32, 33, or 34 and by the action taken by the Engineer-Architect pursuant to subsection (1).

CONTRACTOR'S RIGHTS ON DISPUTED DECISION

- 36 If the Contractor has, within ten days of communication to him by the Engineer-Architect of any decision or direction of the Engineer-Architect under section 22, 32, 33, or 34, given notice to the Engineer-Architect in writing disputing such decision or direction and stating the ground or grounds which form the basis of such dispute, the Owner shall pay to the Contractor the cost of the additional labour, material and plant necessarily involved in carrying out the decision or direction beyond what the Contract, correctly understood and interpreted, would have required the Contractor to do.

CHANGES IN THE WORK

- 37(1) The Engineer-Architect may at any time before he issues his Final Certificate of Completion, in writing,
- (a) order work or material in addition to that provided for in the Plans and Specifications, and
 - (b) delete work or change the dimensions, nature, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or as ordered pursuant to paragraph (a),
- and the Contractor shall execute the work in accordance with such orders, deletions, and changes as if the same had appeared in and been part of the Plans and Specifications.
- 37(2) The Engineer-Architect shall determine whether anything done or not done by the Contractor pursuant to an order, deletion or change made by the Engineer-Architect pursuant to subsection (1) increased or decreased the cost of the work to the Contractor.
- 37(3) If the Engineer-Architect determines under subsection (2) that the cost has been increased, the Owner shall pay to the Contractor the cost of the additional labour, material and plant necessarily involved.
- 37(4) If the Engineer-Architect determines under subsection (2), that the cost has been decreased, the Owner may reduce the amount payable to the Contractor under the contract by the amount equal to the reduction in cost of the labour, material and plant involved.
- 37(5) Where provision for the calculation of increased and decreased cost under subsections (3) and (4) is contained in the Contract Documents, such cost shall be calculated in accordance therewith.

RELATIONS WITH OTHER CONTRACTORS

- 38(1) Wherever work being done by the Owner's forces or by other contractors is contiguous to work covered by this contract, the respective rights of the various interests involved shall be established by the Engineer-Architect to secure the completion of the various portions of the work in general harmony.
- 38(2) The Owner reserves the right to let other contracts in connection with this project and the Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their material and the execution of their work and shall properly connect and co-ordinate his work with theirs.
- 38(3) If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer-Architect any defects in such work that render it unsuitable for such proper execution or results and his failure so to inspect and report shall constitute an acceptance of the other

contractor's work as fit and proper for the reception of his work except as to defects which may develop in the other contractor's work after the execution of this work.

- 38(4) To insure the proper execution of his subsequent work, the Contractor shall measure work already in place and shall at once report to the Engineer-Architect any discrepancy between the executed work and the drawings.

INTERIM CERTIFICATE OF COMPLETION

- 39(1) If the Engineer-Architect is satisfied that the work is substantially completed and is acceptable for use by the Owner, he may at any time before issuance of a Final Certificate of Completion issue to the Contractor an Interim Certificate of Completion, and shall describe therein the portions of the work not completed to his satisfaction, state those quantities which require additional measurements and all things which must be done by the Contractor before a Final Certificate of Completion can be issued.

- 39(2) As soon as reasonably possible after

(a) the work has been completed, and

(b) the Contractor has complied with the contract and all orders and directions made pursuant thereto,

to the satisfaction of the Engineer-Architect, he shall issue to the Contractor a Final Certificate of Completion.

- 39(3) The Engineer-Architect, before issuing a Final Certificate of Completion, may, in addition to the matter described in the Interim Certificate of Completion, require the Contractor to rectify any other portions of the work not completed to the satisfaction of the Engineer-Architect and to do any other things necessary for the completion of the work.

- 39(4) The Engineer-Architect shall measure and keep records of his measurements of the quantities of labour, material and plant performed, used and supplied by the Contractor in executing the work and shall, at the request of the Contractor, inform him of his measurements and the Contractor shall assist and co-operate with the Engineer-Architect in such measuring and is entitled to inspect the records of measurements kept by the Engineer-Architect.

- 39(5) On the day that the Engineer-Architect issues his Final Certificate of Completion under subsection (2), he shall issue a Final Certificate of Measurement showing the quantity of labour, plant and material performed, used and supplied by the Contractor in executing the work and all measurements included therein shall be binding upon the Owner and the Contractor and are exclusive between them as to the quantity of any labour, plant or material performed, used or supplied by the Contractor in executing the work.

- 39(6) Subsections (4) and (5) are applicable only to a unit price arrangement.

CONVERSION OF SECURITY DEPOSIT

- 40(1) If the work is taken out of the Contractor's hands pursuant to section 16 or if the contract is terminated pursuant to section 19 or if the Contractor is in breach of or in default under the contract, the Owner may negotiate the security deposit, in the case of bonds, or convert the security deposit to the Owner's own use, in the case of money, and the amount realized by the Owner shall be deemed to be a debt by the Owner to the Contractor and the Owner shall have the right of set-off and may set-off against the debt any sum or amount which the Contractor may be liable to pay to the Owner and the balance of the debt, if any, after the right of set-off has been exercised, shall if such balance, in the opinion of the Engineer-Architect, is not required for the purpose of the contract and subject always to the provisions of section 20 be paid by the Owner to the Contractor.

40(2) The Owner may retain for the purpose of the contract any balance of moneys, otherwise payable to the Contractor under subsection (1).

RETURN OF SECURITY DEPOSIT

41(1) Upon the Engineer-Architect's Interim Certificate of Completion being issued, the Owner shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor that part of the security deposit covering performance of the work which, in the opinion of the Engineer-Architect, is not required for the purposes of the contract.

41(2) Where the security deposit was converted to cash, the Owner shall pay to the Contractor the interest accrued thereon to the date of payment to the Contractor, but in no case shall the interest payable by the Owner exceed the amount paid to the owner thereon as a result of the Owner complying with subsection 20(2) of the General Regulation - Crown Construction Contracts Act and in no case shall interest be paid by the Owner to the Contractor on that portion of the security deposit taken or used by the Owner in accordance with the provisions of this Agreement.

PERMITS AND LICENCES

42(1) The Owner shall furnish all surveys unless otherwise specified.

42(2) Permits and licences of a temporary nature normally required for the prosecution of the work shall be secured and paid for by the Contractor.

42(3) Easements or other authorizations for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner unless otherwise specified.

42(4) No extension of time for completion of the work shall be allowed due to delay for any cause in the obtaining by the Contractor of the licences and permits described in subsection (1), (2), or (3) except where such delay is the direct result of actions of the Owner.

DETERMINATION OF COST - UNIT PRICE

43 Whenever it is necessary for the purposes of sections 12, 18, 36 and 37 to determine the cost of labour, plant or material, the Unit Price Table shall be used, that is, the cost shall be equal to the product of the agreed quantity of such labour, plant or material expressed in the appropriate unit of measurement multiplied by the price in respect of such unit.

DETERMINATION OF COST - AGREEMENT

44 If the method of determination in section 43 cannot be used because the labour, plant or material involved is not included in the Unit Price Table, the cost of the labour, plant or material for the purposes of sections 12, 18, 36 and 37 shall be the amount agreed upon from time to time by the Contractor and the Engineer-Architect.

DETERMINATION OF COST - COST PLUS

45(1) Where the method of determination provided for in section 43 cannot be used and the Engineer-Architect and Contractor do not agree as provided in section 44, the Owner and the Contractor may, by an agreement in writing, agree to determine the cost of labour, plant or material for the purposes of section 12, 18, 36 and 37 to be equal to the aggregate of

- (a) all reasonable and proper amounts actually expended by or legally payable by the Contractor in respect of the labour, plant or material which fall within any of the classes of expenditure described in subsection (2) (being costs which are directly attributable to the execution of the work and are not costs in respect of which the allowance in paragraph (b) is made), and

- (b) fifteen percent of the total of the expenditures of the Contractor that meet the test in paragraph (a), as an allowance for all other expenditures by the Contractor and for profit, and without limiting the generality of the foregoing, being also an allowance for payments and charges relating to overhead, head office expenses and general administration costs of the Contractor, including finance and interest charges, or, five percent of such expenditures where the Contractor has the work done by a subcontractor: provided that such allowance shall not be applied to any portion of the expenditures identified under paragraph (2)(h) in which the Machine Rental Regulation - Crown Construction Contracts Act is used to calculate such expenditure; but where the cost determination arises solely out of a change order issued pursuant to section 37 and the value of that change order, as estimated by the Engineer-Architect at the time of its issue, is \$2,500 or less, then twenty percent of the total of the expenditures of the Contractor that meet the test in paragraph (a), as an allowance for all other expenditures by the Contractor and for profit, and without limiting the generality of the foregoing, being also an allowance for payments and charges relating to overhead, head office expenses and general administration costs of the Contractor, including finance and interest charges, or, ten percent of such expenditures where the Contractor has the work done by a subcontractor: provided that such allowance shall not be applied to any portion of the expenditures identified under paragraph (2)(h) in which the Machine Rental Regulation - Crown Construction Contracts Act is used to calculate such expenditure.

45(2) Classes of expenditure that are allowable are:

- (a) payments to subcontractors, agreed to by the Owner;
- (b) wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living and travelling expenses, of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless such personnel is engaged at the site of the work with the approval of the Engineer-Architect;
- (c) payments for material necessary for and incorporated in the work, or necessary for and consumed in the execution of the work;
- (d) payments for consumable tools, other than tools customarily provided by tradesmen, necessary for and used in the execution of the work;
- (e) payments for preparation, inspection, delivery, installation and removal of material necessary for the execution of the work;
- (f) payments for renting, erecting, maintaining, and removing temporary offices, sheds and similar structures necessary for and used by the Contractor in executing the work;
- (g) assessments in respect to the work payable under any statutory requirement or other agreements relating to payroll burdens;
- (h) payments for renting plant and allowances for plant owned by the Contractor necessarily for the execution of the work providing that such payments or allowances are reasonable and do not exceed the equipment rental rate set out in the Machine Rental Regulation - Crown Construction Contracts Act;
- (i) payments for inspection, delivery, installation and removal of plant necessary for the execution of the work; and
- (j) other payments made with the approval of the Engineer-Architect that are necessary for the execution of the work.

DEFINITION OR DETERMINATION OF COST

46(1) For the purposes of sections 44 and 45 and except as in those sections specifically provided, plant does not include tools.

46(2) For the purposes of sections 43, 44 and 45, "Unit Price Table" means the table referred to in Article VI of the Articles of Agreement.

MAINTAIN RECORDS BY CONTRACTOR

47(1) The Contractor and each subcontractor shall maintain

(a) the detail of the compilation of his estimate showing labour, material, plant, overhead and all other elements entering into his unit or lump sum prices as prepared for the purpose of tender, and

(b) full records of the actual cost to him of the work together with all proper tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto,

and shall make them available to audit and inspection by the Owner, the Comptroller of the Province of New Brunswick, or by persons acting on their behalf, shall allow them to make copies thereof and to take extracts therefrom, and shall furnish them with any information which they may require from time to time in connection with such records.

47(2) The records maintained by the Contractor and each subcontractor pursuant to this section shall be kept intact until the expiration of two years from the date of issuance of the Final Certificate of Completion under subsection 39(2) or until the expiration of such other period as the Owner may direct.

47(3) The Contractor shall require all subcontractors and all firms, corporations and persons directly or indirectly controlled by or affiliated with the Contractor and all firms, corporations and persons directly or indirectly having control of the Contractor to comply with subsections (1) and (2) as if they were the Contractor.

WORK SCHEDULE

48(1) Except as otherwise provided in the Contract Documents, the Contractor shall submit to the Engineer-Architect within thirty days of the formal notice of award of contract a work schedule satisfactory to the Engineer-Architect showing therein the time, rate, and order of construction he proposes for the various portions of the work.

48(2) No progress claims shall be paid by the Owner during the time while the Contractor is in default under subsection (1).

COST BREAKDOWN OF LUMP SUM WORK

49 The Contractor shall, on contracts which are wholly lump sum or partly lump sum and partly unit price, submit a schedule to the Owner showing the cost breakdown of the lump sum work to assist the Engineer-Architect in assessing progress claims.

CONTRACTOR'S JOB OFFICE

50(1) The Contractor shall provide a temporary weather tight job office, located in an area approved by the Engineer-Architect, for his own use complete with facilities for filing drawings, specifications, correspondence, purchase orders and such other appurtenances as are necessary for the proper conduct of the work and shall remove same upon completion of the work.

50(2) The Contractor shall provide a telephone in the job office described in subsection (1) where practicable.

- 50(3) The Contractor shall at all times during construction of the work maintain in the job office required by subsection (1) a complete and current set of plans, specifications and change orders for this contract.

RECORD OF IMPORTED PLANT

- 51 The Contractor shall deliver to the Engineer-Architect each time a Progress Claim is submitted a statement, signed by a responsible person on behalf of the Contractor, setting forth an accurate record of the serial number, type and date of arrival in the Province of all construction equipment brought into the Province and used during the immediately preceding Payment Period in performance of the work, the arrival of which had not been previously reported, together with the date of departure from the Province of any such equipment which had been so used.

COPY PURCHASE ORDERS

- 52(1) Where the accepted tender for the construction of the work exceeds fifty thousand dollars, the Contractor shall maintain on the construction site one copy of every purchase order used in acquiring services and material for incorporation into the work of this contract and allow the Engineer-Architect or his authorized representative access thereto.
- 52(2) A copy of each purchase order shall be made available to the Engineer-Architect at the job site prior to incorporation of the material purchased thereby into the work.

ARBITRATION

- 53(1) Any claim or dispute involving the Owner and the Contractor may, by mutual agreement of the parties, be submitted to arbitration.
- 53(2) Should the Owner in accordance with this section agree to enter into an Agreement to Arbitrate, the Agreement shall be limited to matters contained in the claim submitted by the Contractor and shall stipulate that the arbitration is not binding on either party.

This document is the document referred to as "Insurance Schedule" and marked "E" in the Articles of Agreement entered into on the day of 20..... between the Owner and the Contractor.

	{	DEPARTMENT OF TRANSPORTATION
	{	AND INFRASTRUCTURE
	{	
	{	
Signed	{	_____
	{	Owner
	{	
	{	
	{	_____
	{	Contractor

INSURANCE SCHEDULE

General Items

- 1) The Contractor shall at his own expense, procure and maintain insurance policies which shall include the endorsements and extensions as detailed below.
- 2) The Contractor shall provide the Department with proof of coverage in the form of a certificate issued by WorkSafeNB identifying the contractor as registered and in good standing with WorkSafeNB. Such proof of coverage will be provided to the Department in conjunction with the execution of the contract as well as is stipulated under the Terms of Payment A of the contract.
- 3) The Contractor shall provide to the Department of Transportation a Confirmation of Coverage as required by the Department which shall be signed by an authorized representative of the Insurer.

Part A - Course of Construction

The Insurance Policy required under this Part A shall include:

- a) a limit of coverage equal to 100% of the value of the Structure(s)
- b) Broad Form coverage including Flood and Earthquake
- c) a Replacement Cost basis of settlement
- d) all designated parties as Loss Payees
- e) a Waiver of Subrogation
- f) coverage for "By-laws"
- g) a 30 day notice provision
- h) resultant damage coverage

All as detailed on the Department's Confirmation of Coverage form.

continued ...

Part B - Commercial General Liability

The Insurance policy required under this Part B shall include:

- a) an "occurrence" definition of "accident"
- b) the Province as an Additional Insured
- c) Owners and Contractors Protective Liability
- d) a Cross Liability clause
- e) a waiver of subrogation
- f) Blanket Contractual Liability
- g) Products/Completed Operations Liability
- h) Broad Form Property Damage
- i) Non-owned Automobile Liability
- j) Contingent Employers Liability
- k) Personal Injury extension of Bodily Injury
- l) coverage for machinery attached to vehicles
- m) a 30 day notice provision
- n) coverage for operations involving explosives, pile driving, support of any property (XCU) performed by sub-contractors. Where the Contractor performs such operations himself he shall obtain suitable coverage and shall provide the Department with a Confirmation of Coverage signed by an Authorized Representative of the Insurer signifying the validity of the Coverage. Such Confirmation shall be provided to the Department prior to the commencement of any XCU work and shall include all Schedule E requirements for Liability Insurance (Items a to o inclusive)
- o) Liability Limits of not less than \$2,000,000 or as currently carried by the Contractor whichever is greater

and such policy shall not be on a "Claims Made" Form.

All as detailed on the Department's
Confirmation of Coverage form

Part C - Automobile Liability

The Insurance policy required under this Part C shall include:

- a) coverage for the liability for all vehicles owned, hired, or leased in the performance of the Project
- b) Limits of Liability of not less than \$2,000,000 or as currently carried by the Contractor whichever is greater

continued ...

Part D - Special Items

- a) The Department reserves the right to require the Contractor to insure his property, plant and equipment, for such amounts as the Department deems adequate, and to require the Contractor to file with the Department evidence of such insurance in a format acceptable to the Department.
- b) The Department further reserves the right to require the Contractor to carry such other insurances as are deemed appropriate by the Department having regard to the nature of the project undertaken.
- c) The insurance requirements as set out in this Schedule E and supporting forms shall not in any way limit the Contractor's liability arising out of the project, contract or otherwise.
- d) All insurances required to be provided and maintained by the Contractor shall be negotiated for, procured from, and the premium paid to a resident agent of an Insurance Company licensed to do business in the Province of New Brunswick.
- e) The requirement of the Contractor to provide Confirmations of Coverage to the Department shall survive the completion of the project. The Department reserves the right to ask for and the Contractor specifically agrees to provide evidence of insurance covering the period subsequent to the term of the project contract for such eventualities as warranty periods, maintenance periods, the completion of deficiency lists, etc.

Revised January 01, 2006

CONFIRMATION OF COVERAGE

The Insurance coverages procured and maintained by the Contractor for this contract are understood and agreed to include the following:

COURSE OF CONSTRUCTION (BUILDERS RISK)

- Broad Form coverage (IBC 4042 or better) including Flood and Earthquake in an amount equal to 100% of the value of the structure(s) (Schedule E items a and b)

- Replacement Cost basis (Item c)

- Policy written in the name of Her Majesty the Queen in Right of Province of New Brunswick, Represented by the Minister of Transportation and Infrastructure ("Owner"), the Contractor and the sub-contractors as their interests may appear (Item d)

- Insurer's Waiver of Subrogation against Her Majesty the Queen et al (Item e)

- Deletion of "By-laws" exclusion (Item f)

- Thirty days prior written notice to the Department of Transportation and Infrastructure of any change to, cancellation or lapse of the Insurance coverage (Item g)

- Coverage for resultant damage of faulty or improper material, workmanship and/or design (Item h)

Name of Insurance Company: _____

Policy Number: _____

Date

Signature of Authorized Representative
of Insurance Company

Revised January 01, 2005

CONFIRMATION OF COVERAGE

The Insurance coverages procured and maintained by the Contractor for this contract are understood and agreed to include the following:

COMMERCIAL GENERAL LIABILITY

- "Occurrence" definition of "accident" (Schedule E, Item a)
- Her Majesty the Queen in Right of the Province of New Brunswick Represented by the Minister of Transportation and Infrastructure included as Additional Insured

The addition of the Province as Additional Insured shall not prevent recovery in any situation in which recovery would have been available had the Province not been so named (Item b)
- Owners and Contractors Protective Liability (Item c)
- Cross Liability Clause respecting All Insureds (Item d)
- Insurer's Waiver of Subrogation against Her Majesty the Queen et al (Item e)
- Blanket Contractual Liability (Item f)
- Products/Completed Operations Liability (Item g)
- Broad Form Property Damage (Item h)
- Non-owned Automobile Liability (Item i)
- Contingent Employers Liability (Item j)
- Personal Injury (Item k)
- Coverage extended to include machinery attached to automobiles (Item l)
- Thirty days prior written notice to the Department of Transportation and Infrastructure of any change to, cancellation or lapse of the Insurance coverage (Item m)
- Coverage for
 - a) Property Damage arising out of operations involving explosives, pile driving, or removal or weakening of support of any property, (XCU) where the work is performed by sub-contractors and
 - b) for Property Damage arising out of the same perils (XCU) included within the Products or Completed Operations coverage whether performed by the Contractor or sub-contractors. (Item n)
- Limit of Liability of not less than \$2,000,000 or as currently carried by the contractor whichever is greater (Item o)

- Occurrence Policy Form (not Claims Made)

Name of Insurance Company: _____

Policy Number: _____

Date

Signature of Authorized Representative
of Insurance Company

Revised January 01, 2005

CONFIRMATION OF COVERAGE

The Insurance coverages procured and maintained by the Contractor for this contract are understood and agreed to include the following:

AUTOMOBILE LIABILITY

- Covering all motor vehicles owned, hired or leased in the performance of the Project
- Limit of Liability of not less than \$2,000,000 or as currently carried by the contractor whichever is greater

Name of Insurance Company: _____

Policy Number: _____

Date

Signature of Authorized Representative
of Insurance Company

Revised January 01, 2005

CONFIRMATION OF COVERAGE

The Insurance coverages procured and maintained by the Contractor for this contract are understood and agreed to include the following:

GENERAL LIABILITY FOR BLASTING OPERATIONS

- "Occurrence" definition of "accident" (Schedule E, Item a)

- Her Majesty the Queen in Right of the Province of New Brunswick Represented by the Minister of Transportation and Infrastructure included as Additional Insured

The addition of the Province as Additional Insured shall not prevent recovery in any situation in which recovery would have been available had the Province not been so named (Item b)

- Owners and Contractors Protective Liability (Item c)

- Cross Liability Clause respecting All Insureds (Item d)

- Insurer's Waiver of Subrogation against Her Majesty the Queen et al (Item e)

- Blanket Contractual Liability (Item f)

- Products/Completed Operations Liability (Item g)

- Broad Form Property Damage (Item h)

- Non-owned Automobile Liability (Item i)

- Contingent Employers Liability (Item j)

- Coverage extended to include machinery attached to automobiles (Item l)

- Thirty days prior written notice to the Department of Transportation and Infrastructure of any change to, cancellation or lapse of the Insurance coverage (Item m)

- Limit of Liability of not less than \$2,000,000 or as currently carried by the contractor whichever is greater (Item o)
- Occurrence Policy Form (not Claims Made)

Name of Insurance Company: _____

Policy Number: _____

Date

Signature of Authorized Representative
of Insurance Company

Revised January 01, 2005



PROVINCE OF NEW BRUNSWICK

DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE

FORM OF TENDER

FOR

CONTRACT No.

ITEM No.	ITEM UNIT PRICE, LUMP SUM PRICE (FIXED PRICE), AS THE CASE MAY BE, SHALL BE EITHER TYPEWRITTEN, PRINTED OR WRITTEN IN INK IN WORDS IN THE SPACE PROVIDED FOR EACH ITEM IN THIS COLUMN	MEASURE	APPROXIMATE QUANTITIES	UNIT PRICE (IN FIGS)	TOTAL	
					\$	¢
Dollars andcents					
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Carried Forward

ITEM No.	ITEM UNIT PRICE, LUMP SUM PRICE (FIXED PRICE), AS THE CASE MAY BE, SHALL BE EITHER TYPEWRITTEN, PRINTED OR WRITTEN IN INK IN WORDS IN THE SPACE PROVIDED FOR EACH ITEM IN THIS COLUMN	MEASURE	APPROXIMATE QUANTITIES	UNIT PRICE (IN FIGS)	TOTAL	
					\$	¢
Dollars andcents					
Dollars andcents					
Dollars andcents					
Dollars andcents					
Dollars andcents					
Dollars andcents					
Dollars andcents					
Dollars andcents					
Dollars andcents					

Total Bid

TOTAL CONTRACT NO.	\$	¢
TOTAL HST CONTRACT NO.	\$	¢

We/I,.....

do hereby offer to furnish all and every kind of labour, tools, machinery, implements, and other plant, services, and materials, whatsoever necessary to perform the undermentioned Work within the limits of the time specified; namely:

PROVINCE OF NEW BRUNSWICK
DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE
CONTRACT NO.

Name of Project

In accordance with the Contract Documents, specifications, plans, profiles, and drawings, prepared, or to be prepared, for the purpose of such Work and upon the terms and conditions set out in the printed form of Contract to be furnished, and in every respect to the satisfaction of the Chief Engineer, all the Work of the different kinds hereinafter mentioned in the said specifications so far as the same are applicable to the class of Work hereby tendered for and required in the construction of the Work tendered.

At and for the prices set opposite the different Items.

Accompanying this tender is one of the following:

1) A Bid Security Deposit in the form of a Certified Cheque payable to the Minister of Finance in the amount of

OR

2) A Bid Bond with HER MAJESTY THE QUEEN in right of the Province of New Brunswick as represented by the Minister of Transportation and Infrastructure as obligee in the amount of

..... in accordance with the terms of the advertisement calling for this tender. We/I do hereby declare and agree that in the case of our/my refusal to execute a formal Contract with the Department within 14 days after the notification of acceptance of this tender, the said bid bond shall be forfeited in accordance with Section 24 of Regulation 82-109 under the Crown Construction Contracts Act to the Department as liquidated damages for the said refusal.

We/I, the undersigned have examined the Contract Documents, plans, and specifications for (including all revisions thereto), and have visited and examined the location of the above described Work and are fully informed as to the nature of the Work and the condition relating to its performance, and understand the quantities shown in the estimate are approximate only and are subject to either increase or decrease, and hereby agree to conform to all respects to the terms and conditions of this tender, and to sign a formal Contract therefore upon demand.

Dated at this day of20.....

Contractor

Signature of Authorized Representative

Address

.....

TO: THE MINISTER OF TRANSPORTATION AND INFRASTRUCTURE
DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE
PROVINCE OF NEW BRUNSWICK
FREDERICTON, NEW BRUNSWICK

G

This document is the document referred to as "Plans and Standard Specifications" and marked "G" in the Articles of Agreement entered into on the _____ day of _____ 20_____, between the Owner and the Contractor.

signed

(
(
(
(
(

(OWNER

(
(
(
(
(

(CONTRACTOR

**PROVINCE OF NEW BRUNSWICK
DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE
STANDARD SPECIFICATIONS**

PROJECT:

This document is the document referred to as "Affidavit" and marked "I" in the Articles of Agreement entered into on the day of 20..... between the Owner and the Contractor.

Signed {
{
{

Owner
{
{

Contractor

I, of the
in the County of and the Province of
make oath and say:

1. That I am secretary-Treasurer of
....., a body corporate under and by virtue of the laws of the Province
of having its Head Office at
.....in the County of
and the Province of and I have custody of the Corporate Seal of
the said Company.

2. That the Corporate Seal affixed to the foregoing Indenture is the Corporate Seal of the said
..... and was affixed thereto by me by authority of the Board
of Directors thereof.

3. That the signature "....." set and subscribed to the said Indenture
as President of is in true and proper handwriting of
..... who is the President of the said Company and
the signature "....." set and subscribed thereto as Secretary-
Treasurer of the said Company is in true and proper handwriting of me, this deponent.

SWORN to me at the City of
..... in the
County of
and the Province of
this day of 20..... .

.....
Secretary-Treasurer

.....
Commissioner of Oaths

40-1280

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