



Government of Northwest Territories  
Gouvernement des Territoires du Nord-Ouest

**Government of Northwest Territories**

# **Standard Specifications for Highway Construction**

**Department of Infrastructure**





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## 2.1 SECTION 1 – DEFINITIONS

### 2.1.1 GENERAL

The definitions within the Construction Contract's General Terms and Conditions "Interpretation" (General Terms and Conditions GC1) remain the same throughout these Standard Specifications for Highway Construction. In addition, the following definitions and abbreviations shall be used unless the context requires a contrary meaning.

### 2.1.2 DEFINITIONS

#### 2.1.2.1 **Bidder or Tenderer**

"Bidder" or "Tenderer" means a single individual, partnership, corporation, or company who submitted a tender or bid for the project.

#### 2.1.2.2 **Commercial Accommodation**

"Commercial Accommodation" means a licensed hotel, motel or serviced accommodation with established rates and in proximity to the Work.

#### 2.1.2.3 **Construction Schedule**

"Construction Schedule" as defined in Division 2, Section 4.

#### 2.1.2.4 **Contract**

"Contract" means the written agreement between the Department and the Contractor for the construction of the project as defined in the General Terms and Conditions.

#### 2.1.2.5 **Contractor**

"Contractor" means the person or company who entered into the Contract with the Department for the construction of the project and executes the Work.

#### 2.1.2.6 **Department**

"Department" means the Government of the Northwest Territories, as represented by the Minister of Infrastructure and includes a person authorized by the Minister to perform, on its behalf, any of its functions under the Contract.

#### 2.1.2.7 **Department Supply Sources**

"Department Supply Sources" as defined in Division 5, Section 1 Crushed Aggregate Production.

#### 2.1.2.8 **Drawings**

"Drawings" as defined in the General Terms and Conditions.

#### 2.1.2.9 **Environmental Construction Operations Plan (ECO Plan)**

"Environmental Construction Operations Plan" as defined in Division 2, Section 6 Environmental Requirements.

#### 2.1.2.10 **Engineer**

"Engineer" as defined in the General Terms and Conditions.

#### 2.1.2.11 **Environmental Management Plan (EMP)**

"Environmental Management Plan" as defined in Division 2, Section 6 Environmental Requirements.

**2.1.2.12 Erosion and Sediment Control Manual**

“Erosion and Sediment Control Manual” is the latest edition of the Department’s publication located on the Department’s website or sourced from the Department’s representative.

**2.1.2.13 Final Completion**

“Final Completion” means when all Work specified in the Contract, has been completed by the Contractor and accepted by the Department and a Certificate of Final Completion has been issued by the Engineer, as defined in the General Terms and Conditions.

**2.1.2.14 Flagperson**

“Flagperson” is a Traffic Control Person as defined in the Workers’ Safety and Compensation Commission as a competent person who possesses the knowledge, experience and training to perform traffic control and flagging duties at the work site.

**2.1.2.15 General Terms and Conditions**

“General Terms and Conditions” refers to the Construction Contract’s General Terms and Conditions.

**2.1.2.16 Land Use Authority**

“Land Use Authority” refers to the approving authorities who manage the access, conditions and use of the lands under their control.

**2.1.2.17 Principal Contractor**

“Principal Contractor” as defined in the General Terms and Conditions (GC67).

**2.1.2.18 Professional Engineer**

“Professional Engineer” fully licensed individuals who have met the academic, experience and character requirements set out in the Engineering and Geoscience Professions Act as regulated and governed by the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists.

**2.1.2.19 Sacred Object**

“Sacred Object” means a heritage object that is identified as having spiritual significance by the local First Nations.

**2.1.2.20 Sacred Site**

“Sacred Site” means a heritage site that is identified as a place of spiritual significance by the local First Nations.

**2.1.2.21 Special Provisions**

“Special Provisions” are part of the Specifications. Special Provisions are project-specific modifications or additions to the General Terms and Conditions and the Highway Construction Specifications.

**2.1.2.22 Specifications**

“Specifications” as defined in the General Terms and Conditions.

**2.1.2.23 Standard Drawings**

“Standard Drawings” are the Department’s current standard and typical detail drawings used for highway construction.

**2.1.2.24 Subcontractor**

“Subcontractor” as defined in the General Terms and Conditions.



**2.1.2.25 Substantial Completion**

“Substantial Completion” means when all Work specified in the Contract, has been substantially completed by the Contractor and accepted by the Department and a Certificate of Substantial Completion has been issued by the Engineer, as defined in the General Terms and Conditions.

**2.1.2.26 Superintendent**

“Superintendent” as defined in the General Terms and Conditions.

**2.1.2.27 Right of Way**

“Right of Way” for the purposes of these Specifications is defined as 60 m wide, 30 m either side of the road centerline.

**2.1.2.28 Work**

“Work” as defined in the General Terms and Conditions.

**2.1.3 LIST OF COMMON ABBREVIATIONS**

- AASHTO: .....American Association of State Highway and Transportation Officials
- ARTBA: ..... American Road and Transportation Builders Association
- ASTM: ..... American Society for Testing Materials
- ATT: ..... Alberta Transportation Test Methods
- CSA: ..... Canadian Standards Association
- CSP: ..... Corrugated Steel Pipe
- ECO Plan: ..... Environmental Construction Operations Plan
- EMP: ..... Environmental Management Plan
- ENR: ..... Environment and Natural Resources
- ESC: ..... Erosion and Sediment Control
- GPS: ..... Global Positioning System
- GNWT: ..... Government of Northwest Territories
- ITP: ..... Inspection and Test Plan
- MPa: ..... Megapascal (unit of pressure based on SI units)
- m: ..... Metre (unit of length based on SI units)
- mm: ..... Millimetre (unit of length and 0.001 of a metre, the SI unit)
- N-m: ..... Newton-Metre (unit of torque based on SI units)
- NAPEG: ..... Northwest Territories and Nunavut Association of Professional Engineers and Geoscientist
- NWT: ..... Northwest Territories
- PESC: ..... Permanent Erosion and Sediment Control
- PSI: ..... Pounds per Square Inch (Imperial unit of pressure)
- QA ..... Quality Assurance
- QC: ..... Quality Control
- TAS: ..... Traffic Accommodation Strategy
- TESC: ..... Temporary Erosion and Sediment Control

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## **2.2 SECTION 2 - EXAMINATION OF WORK**

### **2.2.1 BIDDER'S INVESTIGATION**

The Bidder shall examine the Drawings, Specifications, permits, supplemented information including geotechnical information, and Contract Documents and carefully investigate and satisfy itself of every condition affecting the Work, including site conditions and the labour and materials to be provided. It is agreed that submission of a bid shall be conclusive evidence that the Contractor has made such investigation and that, whether or not they have so investigated, they are willing to assume and does assume all risk regarding conditions affecting the Work.

Where the Department has made investigations of site conditions, including subsurface conditions, in areas where the Work is to be performed under the Contract, such investigations are made only for the purpose of study and design. Where the results of such investigations, including geotechnical data, are made available to Bidders, such results and interpretations are not a part of the Contract and are shown solely for the convenience of the Bidder.

It is expressly understood and agreed that the Department assumes no responsibility whatsoever in respect to the sufficiency or accuracy of the investigations thus made, the records thereof, or of the interpretations set forth therein or made by the Department in its use thereof, and there is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations or records thereof are representative of those existing throughout such areas, or any part thereof, or that unlocked-for developments may not occur, or that materials other than, or in proportions different from those indicated, may not be encountered.

### **2.2.2 OMISSIONS**

In the event of an omission of any detail from the Drawings, Specifications or Contract Documents, the Contractor shall perform the Work using best industry practices, and materials and workmanship of high quality to the satisfaction of the Engineer.

### **2.2.3 WORK BY OTHERS**

The Department reserves the right at any time to contract for and perform other or additional work, on, near or adjacent to the Work covered by the Contract.

The Contractor shall be responsible for investigating the nature and scheduling of all work to be carried out by others on, near or adjacent to the Contract and shall cooperate fully with, and schedule and coordinate their work such, that the progress or completion of the work being performed by others on, near or adjacent to the Contract is not interfered with or unduly hindered or delayed.

The Contractor shall have no claim against the Department for any inconvenience, delay or loss arising from the presence and operations of others on, near or adjacent to the Contract except where the conditions outlined in "Cooperation With Other Contractors" (General Terms and Conditions, GC15) are met.

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## **2.3 SECTION 3 - MEASUREMENTS**

### **2.3.1 MEASUREMENT OF QUANTITIES**

#### **2.3.1.1 Linear**

All linear measurements shall be based on horizontal distances, except for the measurement of culvert installations as noted elsewhere in the Specifications.

#### **2.3.1.2 Area**

All area measurements shall be based on horizontal distances, unless noted elsewhere in the Specifications.

#### **2.3.1.3 Volume**

In computing volume of excavation and embankment, the "Average End Area Method", supported by adequate survey information as determined by the Engineer, will be used except as otherwise agreed to in writing and in advance by the Contractor and the Engineer.

When materials are to be measured in the haulage vehicle, the vehicle shall be of a size and type acceptable to the Engineer. Unless approved vehicles are of uniform capacity, each must bear a plainly legible identification mark indicating its specific approved capacity. Loads shall be measured at the point of delivery.

Material specified for measurement by the cubic metre may be weighed and such weights converted to cubic meters for payment purposes. Factors of conversion will be determined by the Engineer and must be agreed to by the Contractor before such method of measurement of pay quantities will be approved by the Engineer.

#### **2.3.1.4 Mass**

When payment by weight is specified, the Contractor is required to provide silo scales or platform scales and a scale house.

The use of a particular silo scale is subject to the approval of the Engineer. Platform scales must be of sufficient length and capacity to accommodate in a single loading any truck, including pups or trailers that are used. Scale houses must be weatherproof, heated and large enough to provide reasonable working accommodations for the scaleperson and required furnishings. The scale house must have sufficient windows to provide the scaleperson with an unobstructed view of the entire scale.

All weigh scales must be certified by Measurement Canada or its successor, an agency of Innovation, Science and Economic Development Canada. The most recent certificate for a scale must be displayed at all times. In the event a certified scale is modified in any way, it must be re-certified prior to being used.

Prior to use on this Contract and in each instance that a certified weigh scale is moved and set up, the Contractor must test the weigh scale using the procedures established by Measurement Canada. The Engineer must be given the option to be in attendance during the entire testing process. The Contractor must complete a scale accuracy inspection form to include all applicable tests and scale information and provide a copy to the Engineer.

The approach ramps must be rut free and level for a minimum distance of 3 m from each end of the scale.

Any truck, including pups or trailers, must have all wheels and axle combinations completely on the scale during tarring and final weight measurements. The Engineer may, verify the accuracy of the weigh scale at any time and the Contractor is required to provide all test weights, equipment, facilities and operating staff required to verify the weigh scale and to cooperate fully in the verification process.

The Contractor will not be permitted to use grain elevator scales or inspection station scales in lieu of testing the weigh scale. The Engineer may direct that haul trucks be weighed on inspection station scales for verification purposes.

The Contractor shall provide a scale person at the Contractor's weigh scales for the purpose of weighing materials. The weight so determined will be the basis for payment subject to periodic verification by the Engineer.

The Contractor is required to operate controls for loading material into trucks. All costs associated with providing and installing the truck weigh scales and scale house and the testing or certification of the weigh scales, is the responsibility of the Contractor and no separate payment will be made.

The Engineer reserves the right to suspend weighing operations if at any time the scale fails to operate within the standard allowable tolerance of 0.2% or does not meet Measurement Canada specifications.

#### **2.3.1.5 Materials**

Asphaltic material may be measured by the litre or by mass in each railroad tank car, tank distributor tank or drum delivered for the project.

The volumetric measurement of asphaltic material shall be based upon a temperature of 15.6°C and shall be taken when the material is of uniform temperature and free from air bubbles.

#### **2.3.1.6 Time**

Unless otherwise provided for in the Special Provisions or by written authority of the Engineer, hourly rental of equipment will be measured in actual working time and necessary traveling time of the equipment within the limits of the project at an all-inclusive rate and each unit of mobile equipment shall be equipped with an approved device to register the hours of operation.

Payment for equipment engaged at monthly rates will begin when such equipment is actively engaged and will continue for as many months or fractions thereof, in the opinion of the Engineer, such equipment is required on the Work.

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## **2.4 SECTION 4 – EXECUTION OF WORK**

### **2.4.1 PRE-CONSTRUCTION MEETING**

Prior to the Contractor's mobilization to the site, the Contractor must attend a pre-construction meeting that will be conducted by the Engineer. The Contractor must notify the Engineer when they plan to commence the Work so a pre-construction meeting can be scheduled. The Contractor must provide a list of all planned sub-contractors for the Work and identify which ones they believe should attend the meeting. The Engineer may review the list and may require the Contractor to ensure certain key sub-contractors attend. In addition to the sub-contractors, the Contractor must ensure that its Site Superintendent, and its designated safety and traffic representatives, are in attendance. In addition, the Contractor cannot mobilize to site until after the Contract is executed.

#### **2.4.1.1 Pre-Construction Meeting Documents**

Unless otherwise directed by the Engineer, a minimum of fourteen (14) calendar days prior to the pre-construction meeting, the Contractor is required to submit to the Engineer the following:

- a) A detailed construction schedule showing commencement and completion dates for each phase or major element of the Work and other key milestone dates identified in the Contract. The schedule must be in a Gantt chart format and must include production rates and working hours ("Construction Schedule").
- b) A Health and Safety Plan in accordance with Section 5, Health and Safety.
- c) An ECO Plan in accordance with Section 6, Environmental Requirements.
- d) Traffic Accommodation Strategy (TAS) in accordance with Section 7 Traffic Accommodation and Temporary Signing.
- e) A detailed plan showing the total involvement of Local/Northern employment and Northern business for the Work.
- f) A list of supervisory and engineering staff, including corresponding positions and contact phone/mobile radio numbers, and an organizational chart showing clear lines of reporting.
- g) A detailed sketch showing the layout of the construction camp.
- h) A detailed development plan for all granular deposit, pit and quarry sites.
- i) An Operation Plan detailing the production rates for crushing and stockpiling of the granular material, program and schedule of testing for quality control and production and stockpiling methods.
- j) A Quality Control Plan in accordance with this Section 4 Execution of the Work.
- k) A fuel spill contingency plan related to the worst-case scenario, taking into consideration the volumes and types of fuel involved. The plan must indicate equipment and methods to be used to control and clean up a possible fuel spill.

Within one (1) week from date of receipt, the Engineer will inform the Contractor if the documents provide sufficient detail with respect to the project and appear to be compliant. The Engineer may require the Contractor to resubmit documents and will postpone the pre-construction meeting until sufficient documents are received. The Contractor is responsible for providing compliant documents. Any delay or cost associated with or resulting from providing insufficient or non-compliant documents is the responsibility of the Contractor and will not be compensated in any way by the Department.

### **2.4.2 CONSTRUCTION PROGRESS MEETINGS**

The Contractor is responsible for hosting construction progress and milestone meetings at its site office or at a location determined by the Engineer. All attendees identified as necessary by the Engineer must be in attendance. The frequency, date and agendas for the meetings will be determined by the Engineer. At a

minimum, the Contractor must ensure all supervisory personnel directly involved in the Work are in attendance.

The Contractor shall arrange daily safety meetings prior to commencing the Work and this meeting will be attended by all on-site personnel, including Subcontractor's personnel. The Engineer's representative may attend these meetings.

The Contractor shall conduct weekly on-site safety meetings with all on-site personnel, including Subcontractor's personnel. The Engineer must be invited to attend all Contractor safety meetings. Minutes of the meetings shall be recorded by the Contractor and a copy submitted to the Engineer on a weekly basis.

The Engineer may request a meeting with the Contractor as and when required during the performance of the Work.

Each month the Contractor shall prepare a monthly progress report and submit it to the Engineer. The monthly progress report shall report on the Contractor's progress as well as any other items requested by the Engineer.

#### 2.4.3 COMPLIANCE WITH SCHEDULE

The Contractor must commence the Work in accordance with the dates set out in the Construction Schedule and proceed with diligence to prosecute the Work in accordance with this schedule to complete the Work on or before the specified completion date.

The Contractor must immediately notify the Department and the Engineer of any proposed changes to the Construction Schedule and provide a copy of the updated Construction Schedule and, if applicable or requested by the Engineer, an updated TAS and ECO Plan.

#### 2.4.4 MOBILIZATION AND DEMOBILIZATION

This item includes all mobilizations and demobilizations to and from all of the work sites from beginning to end of the project.

##### **2.4.4.1 Mobilization**

This item shall be considered full payment for mobilization of all buildings, equipment, personnel and materials required to complete the Work for all of the work sites, also including all start-up costs, insurance, contract security, and any other costs related to completion of the Work and which are not specifically measured under any other item contained in the Unit Price Table.

No additional payment will be made for additional mobilization required by the Contractor's schedule or made necessary as a result of changes to the Contractor's schedule for whatever reason, or in the event of unforeseen work interruptions resulting from seasonal, environmental or any other factors. No extra payment will be made to the Contractor for mobilizing their equipment using alternative routes due to road bans in place.

A payment of sixty (60) percent of the total Lump Sum Bid Price indicated in the Tender Forms for Mobilization and Demobilization will be made after the Contractor has mobilized to the site and started conducting effective work as determined by the Engineer.

##### **2.4.4.2 Demobilization**

Demobilization shall include the general clean-up and removal of all buildings, equipment, personnel and surplus materials from all of the work sites. The sites shall be left in a condition satisfactory to the Engineer.

No additional payment will be made for additional demobilization required by the Contractor's schedule or made necessary as a result of changes to the Contractor's schedule for whatever reason, or in the event of unforeseen work interruptions resulting from seasonal, environmental or any other factors. No extra payment will be made to the contractor for mobilizing their equipment using alternative route due to road bans in place.

A final payment of forty (40) percent of the total Lump Sum Bid Price indicated in the Tender Forms for Mobilization and Demobilization will be paid after the Contractor has cleaned the site and removed all buildings, equipment, personnel and surplus materials to the satisfaction of the Engineer.

#### 2.4.5 PROJECT SIGNS

The Contractor, at their own expense, shall supply and erect two (2) signs each as per Standard Drawings SD-200-02-52 (Construction Warning Signs), SD-200-02-53 (End of Construction Signs), and SD-200-02-51 (Project Signs). Signage will be 4.0 m from the edge of travel lane and shall be installed such that the mounting posts and signs are vertical. The Contractor is advised that mounting posts must be augered, pinned or otherwise secured in place such that cross-bracing is not required.

The Contractor shall also supply and install two (2) "Fines Doubled in Construction Project Zone" signs at both ends of the construction zone as per Standard Drawing SD-200-02-52A.

The cost of signage, standard white painted 100 mm x 100 mm wooden mounting posts, hardware, installation, maintenance, relocation and removal of the signs and mounting posts after completion of the Work will not be measured separately for payment and will be considered incidental to the Work.

#### 2.4.6 CONTRACTOR'S ACCESS TO THE SITE

The Contractor is responsible for hauling of materials and equipment to the site. In addition, they must ensure that adequate access for all activities is provided and maintained until Final Completion. The Contractor will identify the haul roads they propose to use and must obtain the necessary approvals, in writing, from the road authority, landowner or license holder, as applicable. Hauling of equipment and materials to the job site will be in accordance with Division 5, Section 3, Hauling.

No claims for extra costs or time extensions will be considered on account of access conditions, or imposed road bans or load restrictions.

#### 2.4.7 ENGINEER'S ACCESS TO THE WORK

The Contractor shall always provide the Engineer with suitable and safe access to the Work for the purposes of inspection and measurement, and when such work is being carried out at night, suitable lighting shall be provided so that all operations are plainly and safely visible. The Contractor shall provide all labour, staging, ladders and other equipment, information and assistance required by the Engineer and their staff for inspecting, measuring and monitoring of the Work. The Engineer may arrange for a photographic record of the progress of the Work by taking photographs at regular intervals or at such other times as the Engineer shall deem appropriate. The Contractor shall provide access and all reasonable facilities for the Engineer to carry out the Work. No additional payment will be made on this account and shall be considered incidental to the execution of the works. See also "Performance of Work Under Direction of Engineer" (General Terms and Conditions, GC14).

#### 2.4.8 LAYOUT OF WORK

##### 2.4.8.1 **Engineer Responsibilities**

The Engineer will provide the following regarding the location and alignment of the Work, for grading and

combined grading and surfacing projects, where applicable:

- a) A list of horizontal control points
- b) A list of subgrade design grades and ditch grades
- c) Culvert installation locations and design grades
- d) Geodetic benchmark locations, descriptions and elevations.

#### **2.4.8.2 Contractor Responsibilities**

The Contractor shall provide all other surveying, layout, staking, grading and referencing required to complete the Work in accordance with the Specifications. This will not be measured separately for payment and shall be considered incidental to the Work.

The Contractor shall provide all surveying, layout, staking, grading and referencing required for the establishment of the centreline, the preparation of the existing roadway surface, and the accurate placement and control of all granular and asphalt surfacing operations.

Any restaking or remarking resulting from careless operations of the Contractor shall be at the Contractor's expense. The Contractor must satisfy itself before commencing with the Work as to the meaning and accuracy of all stakes, measurements, marks and information provided by the Engineer.

Prior to commencing construction, the Contractor may perform a topographic survey of the right-of-way to confirm the original ground survey provided by the Engineer. This survey work shall not be measured separately and will be considered incidental to the Work. If the Contractor fails to perform cross-sectional surveys, measurements for payments will be made as per the design cross-sections, attached in the Drawings.

A hard copy of the Drawings is attached with the Contract Documents. Electronic copies of the design/data can be provided to the Contractor upon request after signing a release waiver. The Contractor may choose to reproduce the survey to verify the Contract Drawings or operate GPS-assisted equipment on their own software. The Contractor's work to reproduce data, control points, or verification of inconsistent survey coordinates shall not be measured separately and will be considered incidental to the Work.

Where the Contractor finds any errors, inconsistencies, or omissions relating to the Contract, the Contractor shall promptly report the foregoing to the Engineer and shall not proceed with the activity affected until receiving direction from the Engineer.

The Contractor shall, at no additional cost to the Department, furnish all reasonable aid, facilities and assistance required by the Engineer for the proper inspection and examination of the Work, and the taking of measurements for specifications compliance or payment purposes.

#### **2.4.9 QUALITY CONTROL**

Quality control, quality control testing and inspections are the sole responsibility of the Contractor. The Contractor shall prepare and maintain a Quality Control Plan (QC Plan) that outlines the quality control planned for the Work that complies with the Specifications and Drawings. The QC Plan will include an Inspection and Test Plan (ITP) which outlines the critical hold points at the various stages or processes of the Work.

Unless otherwise specified, the Contractor shall submit the QC Plan to the Engineer a minimum of fourteen (14) days prior to the pre-construction meeting for the project. The Engineer will review the QC Plan and communicate any concerns to the Contractor within seven (7) days of the pre-construction meeting. Any issues or concerns regarding the Contractor's proposed QC Plan shall be addressed to the satisfaction of the Engineer



prior to the commencement of the Work.

The Contractor shall retain and utilize Professional Engineering Services provided by a Professional Engineer and/or Professional Geoscientist registered with NAPEG to carry out all quality control and quality control testing to ensure the end use meets the Specification requirements.

The Contractor shall not retain or utilize the Professional Engineer and/or Geoscientist or personnel retained by the Department with respect to the Contract, for any work on or associated with the Contract.

All quality control tests, and test results shall be calculated, recorded and submitted in a form acceptable to the Engineer. The tests and test results shall be certified for correctness by the Contractor's Professional Engineering services company employed by the Contractor to perform the tests and shall be signed by the Contractor's representative. Quality control records, including calculations, shall be submitted to the Engineer daily. All records shall be reviewed and certified for correctness by the Contractor's Professional Engineer.

The Contractor shall interpret quality control test results and alter their operation if necessary, so that the product meets all required Specifications.

The quality assurance, testing and inspections by the Engineer shall not in any way relieve the Contractor of their responsibility for quality control and testing.

No separate payment will be made for the cost of all quantity control, quality control testing, reporting, certification and will be considered incidental to the Work.

#### 2.4.10 MAINTENANCE OF WORK AND DUST CONTROL DURING CONSTRUCTION

The Contractor shall maintain all work diligently throughout the project, including haul roads, to ensure that all traffic is always safely accommodated, including times of inclement weather. The maintenance shall constitute continuous and effective work, prosecuted day-by-day, with adequate equipment and forces, so that the roadway, including haul roads and/or structures, are always kept in a condition satisfactory to the Engineer.

On projects where grading, granular or asphalt surfacing or hauling over an existing unpaved roadway is required, the Contractor shall carry out dust control diligently throughout the project, to ensure that all traffic is always safely accommodated, including times of inclement weather.

The Contractor shall commence road maintenance and dust control immediately upon commencement of roadway construction operations.

A minimum of one (1), or frequency determined by the Engineer, complete wet blading of the entire roadway shall be carried out per week on unpaved roadways, excluding sections not open to public traffic.

If at any time any section of the roadway within the project is considered unsafe by the Engineer due to inadequate road maintenance or dust control, construction operations will be suspended until such time that safe driving conditions are obtained.

Any costs incurred by the Department in carrying out adequate road maintenance and dust control due to the Contractor's failure to do so, will be recovered from the Contractor.

Road maintenance and dust control will not be measured separately for payment and shall be considered

incidental to the Work.

In the event that a Contract extends over more than one construction season, the Department may assume responsibility for the maintenance of the roadway surface for the duration of the winter shut down. The Department shall not be held liable for any damages caused to the roadway surface while performing the necessary maintenance operations during this period.

#### 2.4.11 LAWS TO BE OBSERVED

The Contractor shall at all times, observe and comply with the latest edition of all Federal and Territorial Laws, all local bylaws, acts and regulations, and all orders and decrees of bodies or tribunals having any jurisdiction or authority which in any manner affect those engaged or employed on the Work, or which in any way affect the conduct of the Work.

Special attention is called to the following:

- a) Before any camp, material deposit, borrow pit, storage or detour bypass site is opened or operated on Government property, permission shall be obtained from the Federal or Territorial Department or other agency having jurisdiction.

#### Territorial

- The provisions of the *Commissioner's Land Act*.
- The provisions of the *Environmental Protection Act*.
- The provisions of the *Explosives Use Act*.
- The provisions of the *Fire Prevention Act*.
- The provisions of the *Forest Protection Act*.
- The provisions of the *Insurance Act*.
- The provisions of the *Mackenzie Valley Resource Management Act*.
- The provisions of the *Motor Vehicle Safety Act*.
- The provisions of the *Engineering and Geoscience Professions Act* and *Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (NAPEG)*.
- The provisions of the *Northwest Territories Lands Act*.
- The provisions of the *NWT Navigable Waters Protection Act*.
- The provisions of the *Public Health Act*.
- The provisions of the *Public Highways Act*.
- The provisions of the *Safety Act*.
- The provisions of the *Territorial Parks Act*.
- The provisions of the *Motor Vehicles Act*.
- The provisions of the *Mine Health and Safety Act*.
- The provisions of the *Transportation and Dangerous Goods Act*.
- The provisions of the *Waters Act*.
- The provisions of the *Wildlife Act*.
- The provisions of the *Worker's Safety and Compensation Commission*.

#### Federal

- The provisions of the *Canadian Environmental Protection Act*.
- The provisions of the *Canada National Park Act*.
- The provisions of the *Canadian Navigable Waters Act*.

- The provisions of the *Explosives Act*.
- The provisions of the *Fisheries Act*.
- The provisions of the *Migratory Birds Convention Act*.
- The provisions of the *National Building Code*.
- The provisions of the *National Fire Code*.
- The provisions of the *Species at Risk Act*.

On projects where specific Land Use and Quarry Permits have been issued to the Department by the Federal or Territorial or other agency having jurisdiction, such permits shall also form an integral part of the Contract and the Contractor shall at all times, observe, comply with and carry out all Work in accordance with the conditions and regulations of such permits.

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**2.5 SECTION 5 – HEALTH AND SAFETY****2.5.1 PRINCIPAL CONTRACTOR**

The Department assigns Principal Contractor responsibilities to the Contractor from the date the Contractor mobilizes to the site until the Certificate of Final Completion has been issued and all Contractor's obligations other than warranty have been fulfilled. The Contractor designation and responsibilities are identified in "Principal Contractor Designation & Responsibilities" (General Terms and Conditions, GC67).

The Contractor shall refer to the Department's "Contractor Safety Orientation and Information Guideline" with information and guidelines required to work safely on the Department's worksites. This publication may be sourced from the Department's website or Department's representative.

**2.5.2 HEALTH AND SAFETY PLAN**

The Contractor shall submit a site-specific Health and Safety Plan fourteen (14) calendar days prior to the pre-construction meeting. The Engineer will review the Health and Safety Plan and communicate any concerns to the Contractor within seven (7) days of the pre-construction meeting. The Contractor shall revise the plan as appropriate and resubmit the plan prior to the commencement of the Work. The Engineer's review of the Contractor's final Health and Safety Plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety. The Contractor must ensure that each worker and Subcontractor engaged in relation to the project, complies with the safety requirements and the Health and Safety Plan.

**2.5.3 PAYMENT**

No separate payment will be made for the provision of health and safety requirements and will be considered incidental to the Work.

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## 2.6 SECTION 6 - ENVIRONMENTAL REQUIREMENTS

### 2.6.1 ENVIRONMENTAL MANAGEMENT

#### 2.6.1.1 **Environmental Legislation, Regulations, Approvals, and Permits**

The Contractor shall reference all applicable federal and territorial legislation and regulations concerning environmental protection and shall conduct their activities in accordance with such legislation and regulations, including, but not necessarily limited to the *Northwest Territories Lands Act*, the territorial *Mackenzie Valley Resource Management Act*, the territorial *Waters Act*, and the territorial *Environmental Protection Act*, the federal *Fisheries Act*, the federal *Canadian Navigable Waters Act*, the federal *Migratory Birds Convention Act* and the federal *Species at Risk Act*.

The Contractor shall comply with the conditions and requirements of all environmental approvals, permits, licenses and authorizations (Permits) issued for the project. If available at the time of bidding, Permits will be provided within the bid document. The Contractor shall obtain any further environmental Permits for their temporary works as may be required. The Contractor shall ensure that all workers on site are aware of conditions and requirements all Permits issued for the project. Copies of Permits, and associated conditions and requirements, shall be posted on site for viewing by workers at the location that is visible and frequented by all workers.

The Contractor shall provide the Department with written confirmation of their full compliance with all approvals, permits, licenses, written authorizations and management plans before the full amount of holdback will be released.

In the event of conflicting statements between the various Acts, Authorizations, Permits, and Codes of Practice, the more stringent requirement shall apply.

#### 2.6.1.2 **Environmental Construction Operations Plan (ECO Plan)**

The Contractor shall prepare and implement an Environmental Construction Operations Plan (ECO Plan) for the project, otherwise known as an Environmental Management Plan (EMP). The ECO Plans shall consist of written procedures and drawings (if required) that address the environmental protection issues relevant to the specific activities being performed and shall detail temporary environmental control measures that the Contractor proposes to undertake to comply with all applicable legislation, regulations and approvals during the course of construction and during seasonal work interruptions.

The Contractor's ECO Plan shall be specific to the project. The Contractor shall ensure effective implementation of the ECO Plan by assigning responsibility for the implementation, and maintenance of temporary erosion control measures, wildlife monitor etc. to one individual. The individual responsible shall be identified at the pre-construction meeting.

The Environmental Construction Operations Plan shall not cover any permanent or long-term environmental or erosion control devices or work specified in the Contract.

The Contractor shall submit their ECO Plan to the Engineer at least fourteen (14) calendar days prior to beginning of the work in each phase of the project. The Engineer will review the ECO Plan and communicate any concerns to the Contractor within seven (7) calendar days after submission. The Contractor shall address any issues or concerns regarding the proposed ECO Plan to the satisfaction of the Engineer prior to the commencement of the Work.

The finalization of the ECO Plan to the mutual satisfaction of the Engineer and the Contractor does not

constitute an approval or assurance from the Engineer that the "temporary environmental control measures" detailed in the ECO Plan are sufficient to ensure compliance with all applicable legislation, regulations or conditions of approval. The Contractor is ultimately responsible to ensure all measures, used on the project, are sufficient to ensure compliance with all applicable authorities. This may mean increasing the number of installations, providing alternate devices or modifying procedures.

If at any time during the project it is determined that the devices or procedures detailed in the ECO Plan (any specific measures, locations or quantities proposed) are inappropriate or insufficient, the Engineer will notify the Contractor in writing and Contractor shall modify the ECO Plan accordingly.

The Engineer may suspend work in cases where in their opinion the Contractor fails to comply with procedures stated in the ECO Plan or does not comply with permit conditions or applicable legislation. In cases where the Contractor is not in conformance with its ECO Plan or is causing a significant adverse environmental impact, the Engineer has the authority to order the immediate suspension of Work until the infraction is corrected in compliance with the applicable legislation and to the satisfaction of the Engineer. Such orders will be made in writing. The costs of correcting an infraction of the ECO Plan as well as any costs associated with a Work suspension are the responsibility of the Contractor; and the Contractor will not have any claim for standby costs or a completion date extension resulting from such cases.

The cost of preparing the ECO Plan and the performance of all work necessary to ensure compliance with the applicable legislation will be incidental to the Work and will not be paid separately.

Complying with all other licenses and permits shall be incidental to the contract and will not be measured separately for payment.

#### **2.6.1.3 Fish Capture and Release**

If the project involves work in a watercourse that is deemed to be fish-bearing and likely to contain fish at the time of construction, the Contractor will be responsible for retaining a Qualified Professional to determine fish presence in the watercourse and, if necessary, capture, salvage, and release fish that are trapped or stranded as a result of the Contractor's authorized operations in the watercourse. The Contractor will be responsible for obtaining fish salvage permits and submitting any reports or management plans required by regulators pursuant to the salvage permits. All materials required for fish capture, salvage and release shall be supplied by the Contractor.

All costs associated with determining the presence of fish will be considered incidental to the Work, and no separate or additional payment will be made. Fish capture, salvage and release, if required, will be considered incidental and no separate or additional payment will be made.

#### **2.6.1.4 Environmental Protection Devices or Procedures**

##### Permanent Environmental Protection Devices

The Contract Documents may specify the use of various erosion and sediment control (ESC) or other environmental protection devices, at specific locations throughout the project. The Department's Erosion and Sediment Control Manual specifies that a permanent erosion and sediment control (PESC) plan will be prepared as part of the detailed planning and design phase of a project. These are items that are considered necessary for environmental protection following the completion of construction, once a project is operational. The timing of the installation, construction and maintenance of these devices, and the quantities required, will be specified in the Contract or determined by the Engineer. These devices will be paid for at the applicable unit price bid for the specific device used.

### Temporary Environmental Protection Devices or Procedures

All other environmental protection or ESC devices or procedures required to ensure compliance with the Specifications, applicable legislation or regulations, and/or environmental approvals, permits, licenses and authorizations during construction are deemed to be necessary only as temporary environmental protection measures and must be the direct responsibility of the Contractor. This must include the responsibility for determining the quantities, nature and locations of such devices or procedures and the timing of each event. To ensure that erosion is controlled during construction, the PESC will be provided to the Contractor to guide them in designing a Temporary Erosion and Sediment Control (TESC), in accordance with the Department's Erosion and Sediment Control Manual. The Contractor will incorporate their proposed temporary environmental protection devices or procedures, including their TESC plan in their ECO Plan.

No separate or additional payment will be made for any temporary environmental protection measures undertaken by the Contractor, with the exception that payment will be made for any temporary ESC device which the Engineer directs to remain in place following the completion of construction.

### Maintenance of Environmental Protection Devices

The Contractor must maintain all permanent ESC devices to the extent required for the Project and as directed by the Engineer, up to completion of construction, including during periods of shutdown. This is particularly critical prior to adverse weather conditions or spring thaw. All costs associated with maintaining temporary and permanent environmental protection devices until the completion of construction will be considered incidental to the Work, and no separate or additional payment will be made.

#### **2.6.1.5 Environmental Inspections**

Unless the Engineer approves otherwise, the Contractor shall retain the services of a Qualified Professional, defined as an applied scientist or technologist who is registered and in good standing with an appropriate professional organization relevant to the specific project task (e.g., Professional Biologist) to conduct environmental inspections of the Work to evaluate compliance with the ECO Plan. The inspections will be conducted in conjunction with the Department's field staff on a weekly basis, at a minimum, during construction and at the completion of the Work. The Contractor shall submit to the Department, within three working days of each inspection, a report that includes the date, attendance, scope, observations, incidents of non-compliance, and actions taken as a result of the inspection to achieve compliance with the ECO Plan. The Contractor shall ensure that the reports are signed by the Contractor's and Department's representatives, and that copies of the reports are retained. No separate or additional payment will be made for providing Qualified Professional services.

#### **2.6.1.6 Waste Disposal**

The Contractor shall not release, dump, spill or dispose of any substance(s) into the environment that causes or could cause impairment of or damage to the environment or human health or safety. The Contractor shall mitigate to ensure compliance with all regulatory legislation, any wastes arising from the Work and any other substance(s) that causes or could cause impairment of or damage to the environment or human health or safety, and should they fail to do so, the Engineer may, without further notice, arrange the clean-up of such wastes and/or other substance(s) at the expense of the Contractor.

The Contractor shall remove and dispose of any inert solid waste materials resulting from the Work, prior to completion of the Work. The Contractor may temporarily store such material in interim stockpiles on the disturbed land, only if approved by the Engineer. The Contractor shall not burn any waste oil or solid waste products, unless authorized in writing by an appropriate authority.

**2.6.1.7 Reporting Procedures for Spills**

In the event of the release of silt or other deleterious substance to the environment, the Contractor shall take all reasonable measures to contain the release and repair any damage. Any such Work shall be performed in accordance with the applicable legislation and regulations at the Contractor's expense. All the Work regarding the waste disposal and spill cleanup will not be measured separately for payment and shall be considered incidental to the Work. All Work shall be completed to the satisfaction of the Engineer and meet the applicable regulatory requirements.

Spills or releases of deleterious substance, hazardous materials and/or any other substances that cause or could cause impairment of or damage to the environment or human health or safety shall also be immediately reported to the Engineer and to the NWT 24-hour Spill Report Line (1-867-920-8130). The Contractor shall also complete a Spill Report Form and submit a copy to the appropriate regulatory bodies within twelve (12) hours of a reported incident (Email: [spills@gov.nt.ca](mailto:spills@gov.nt.ca); Fax: 1-867-873-6924).

**2.6.1.8 Work Subject to the Migratory Bird Convention Act and the Species at Risk Act**

In order to comply with the federal *Migratory Birds Convention Act* and the federal *Species at Risk Act* in the event that vegetation clearing and/or other disturbances are necessary or likely to be required to carry out the Work, the Contractor must retain a Qualified Professional to assess the area requiring disturbance prior to clearing to determine the presence of nesting birds and sensitive or at-risk species. If the survey reveals the presence of any active nests, sensitive or at-risk species, the Contractor must incorporate into its ECO Plan any mitigation measures deemed necessary to ensure the Work is completed in a compliant manner. All costs associated with the survey will be considered incidental to the Work, and no separate or additional payment will be made.

**2.6.1.9 Archaeological or Paleontological Remains**

The Contractor's ECO Plan shall include a protocol for the encountering of archaeological or paleontological remains and materials. The Contractor shall be alert to archaeological or paleontological remains and materials that may be uncovered, which may be of significance in recording the historic and prehistoric past to preserve the culture and heritage of the NWT. When archaeological or paleontological remains are uncovered, the Contractor must immediately halt operations in the discovery location and notify the Engineer. Every effort must be made to preserve archaeological or paleontological remains intact in their original positions in order to preserve the archaeological or paleontological importance of materials in relation to one another and to the enclosing soil.

**2.6.1.10 Climatic Conditions**

The Contractor's attention is drawn to the possible adverse climatic conditions at the location of the project. Information regarding climate conditions can be obtained from Environment Canada. The Department will not be liable for any delays caused by adverse weather and no claims will be entertained for any increased costs whatsoever.

**2.6.1.11 Other Environmental Management Considerations**

The Contractor shall conduct operations in such a manner that construction equipment does not leave the confines of flagged or designated right-of-way and pit limits without prior approval of the Engineer. Environmentally sensitive areas adjacent to rights-of-way and pit limits shall be physically avoided.

The Contractor shall not operate heavy construction equipment in environmentally sensitive areas (e.g., streams, wetlands, muskeg) without prior written approval of the Engineer.

The Contractor shall note and avoid any Aboriginal settlement areas and asserted territories located in the vicinity of the work.

#### 2.6.2 LAND USE REGULATIONS

Land Use and Quarry Permits issued to the Department grant it the authority to carry out the Work described in the Specifications and Drawings subject to the *Northwest Territorial Lands Act*. The Land Use and Quarry Permits and their operating conditions shall be considered part of the Contract Specifications. The Contractor shall abide by all Terms and Conditions associated with these permits.

The Contractor shall ensure that all workers on site are aware of all Terms and Conditions of Land Use and Quarry Permits. Copies of these Permits and the associated Terms and Conditions shall be posted on site for viewing by workers, at the location, that is accessible and frequented by all workers.

The Contractor's attention is directed to "No Implied Obligations" (General Terms and Conditions, GC6) and is hereby advised they will be held fully responsible for all fines and penalties issued against the Department as Permittee under the Land Use Permit, and which resulted directly or indirectly from the Contractor's activities on the project.

The Contractor's representative shall meet with the Engineer and the Department of Lands' Resource Management Officer prior to commencement of any work under this Contract. The purpose of the meeting will be to review the Terms and Conditions of Land Use Permits, to identify areas of environmental concern, and to establish special procedures and precautions because of such concern.

#### 2.6.3 FOREST PROTECTION AND FIRE FIGHTING EQUIPMENT

The Contractor shall comply with the requirements for forest protection and firefighting equipment regulations as outlined in the Land Use Permit and the latest edition of the *Forest Protection Act*, Chapter 38 of the Revised Acts of the Northwest Territories.

Firefighting equipment shall be stored in a conspicuous place in the camp and used exclusively for fire control. Caches should be appropriately signed.

The supply of firefighting equipment and personnel will not be measured separately for payment and shall be considered incidental to the Work under the Contract.

#### 2.6.4 CONSTRUCTION CAMP

The Contractor shall make all efforts necessary to use local Commercial Accommodation. If local Commercial Accommodation is not available, the Contractor shall request permission from the Engineer for the installation of a temporary construction camp. The Contractor shall not mobilize a construction camp before receiving approval from the Engineer. The Contractor's camp and services shall be set-up and operated in accordance with Northern Land Use Guidelines: Camp and Support Facilities published by the Government of the Northwest Territories Department of Lands (2015) and comply with all terms and conditions of the applicable permits/licences. Prior to applications for authorization for the camp and related services, a plan of the layout shall be submitted to the Engineer for approval.

##### **2.6.4.1 Authorizations**

Prior to establishing a construction camp, the Contractor must receive authorizations from responsible authorities, which vary depending on the proposed camp location.

For the use and occupation of the camp site, a Land Use Permit must be obtained from the Department of Lands

(in the Inuvialuit Settlement Region) or the Land and Water Boards (in the Mackenzie Valley).

For the use of water, a Water License must be obtained from the Inuvialuit Water Board (in the Inuvialuit Settlement Region) or the Land and Water Boards (in the Mackenzie Valley) in accordance with the latest edition of the *Waters Act*.

To obtain granular materials, a Quarrying Permit must be obtained from the Department of Lands.

To clear timber prior to camp construction, a Timber Permit must be obtained from the Department of Environment and Natural Resources (ENR).

#### **2.6.4.2 Measurement and Payment**

The development, maintenance and restoration of the construction camp and service area will not be measured separately for payment and shall be considered incidental to the Work under the Contract.

Upon being vacated, the construction camp and service areas shall be left in a condition acceptable to the Engineer and Land Use Officer.

#### **2.6.5 PRESERVATION OF POTENTIAL PICNIC SITES AND SACRED SITES**

Some areas along the highway route may be designated as potential picnic sites and Sacred Sites and Sacred Objects. The Contractor shall not enter designated areas for any purpose whatsoever.



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## **2.7 SECTION 7 – TRAFFIC ACCOMMODATION AND TEMPORARY SIGNING**

### **2.7.1 GENERAL**

This specification details the requirements for traffic accommodation, including the preparation of the Traffic Accommodation Strategy and the supply, installation, maintenance and removal of temporary construction signing and traffic control devices that are specifically related to construction, repair or emergency situations and are generally removed when the Work is completed or the situation returns to normal.

Permanent signing requirements for normal use of the roadway are detailed in Division 7.

### **2.7.2 TRAFFIC ACCOMMODATION STRATEGY**

The Contractor shall prepare a Traffic Accommodation Strategy (TAS) detailing their proposed methods for accommodating traffic throughout the work zone. All construction zone signing shall be carried out in accordance with the Department's Standard Drawings. Any project specific requirements, in excess of these minimum requirements, will be identified in the Special Provisions.

The Traffic Accommodation Strategy shall consist of drawings detailing the configuration of temporary construction signs and other traffic control devices in the work area(s) and, written confirmation of the methods or procedures being used by the Contractor to address specific traffic safety related issues or situations at the work zone.

When localized detours are required that do not follow a Standard Drawing, the Contractor's Traffic Accommodation Strategy shall include detailed drawings of the proposed traffic accommodation measures, signed and stamped by a Professional Engineer. The detour plans shall be drawn to scale and shall include the proposed vertical and horizontal alignments.

Unless otherwise specified, the Contractor shall submit the Traffic Accommodation Strategy to the Engineer a minimum of fourteen (14) days prior to the pre-construction meeting for the project. The Engineer will review the Traffic Accommodation Strategy and communicate any concerns to the Contractor within seven (7) days of the pre-construction meeting. Any issues or concerns regarding the Contractor's proposed Traffic Accommodation Strategy shall be addressed to the mutual satisfaction of the Contractor and the Engineer prior to the commencement of the Work.

The Contractor shall have no claim against the Department resulting from the Engineer's failure to accept the Contractor's Traffic Accommodation Strategy submission, nor any costs incurred by the Contractor to address concerns raised by either the Engineer or the Department during the review of the Contractor's Traffic Accommodation Strategy submission.

The preparation of the Traffic Accommodation Strategy (TAS) and maintaining and controlling of the traffic as per that Strategy throughout all phases of the work will not be measured separately for payment and shall be considered incidental to the execution of the Work.

### **2.7.3 BARRICADES AND WARNING SIGNS**

- a) All traffic signs used on construction projects are designed and erected for the safety and convenience of the traveling public, and for the safety of on-site personnel. The Contractor shall make suitable provisions to accommodate all traffic over and around any part of the roadway upon which the Work is being performed. Unless otherwise specified, the Contractor shall accommodate the public through the Work zone on a twenty-four (24)-hour per day basis.
- b) The Contractor shall, at their own expense, provide, erect, and maintain all necessary signals and

other signs, provide a sufficient number of flagpersons and watchmen, and take all necessary precautions for the safety of the public. Highways closed to the traffic shall be protected by effective barricades and obstructions shall be illuminated at night. Suitable warning signals illuminated at night by lanterns or flares, shall be provided to mark the places where surfacing ends or is not compacted. All lights for this purpose shall remain illuminated from sunset to sunrise.

- c) All signs and traffic control devices, barricades, etc. shall conform with the latest edition of the *Manual of Uniform Traffic Control Devices for Canada*, except where specified or otherwise directed by the Engineer.
- d) All construction signs shall have fully reflectorized backgrounds.
- e) Poorly maintained, defaced, damaged or dirty construction signs are ineffective and shall be replaced, repaired or cleaned without delay.
- f) Before any construction Work is started or equipment mobilized, all necessary construction signs must be in place.
- g) Objects within the roadway or immediately adjacent to the traveled lanes, which constitute a hazard to traffic, shall be marked with delineation devices.
- h) Construction speed zones shall be implemented only with the approval of the Engineer.
- i) Signs designating construction work shall not be displayed unless that particular portion of the Work is in progress at the time. The Contractor shall promptly cover or remove signage that is not required for, or contradicts with, the Work.
- j) Existing highway signs which conflict with the required construction zone signing shown on the Standard Drawings shall be covered. An existing highway signs that interfere with construction operations shall be removed, stored at a site approved by the Engineer and reinstalled after construction is completed.
- k) The covering, removal, storing, assembling and reinstallation of the signs will not be measured separately for payment and shall be considered incidental to the Work.
- l) The cost of supply, installation and maintenance of project signs will not be measured separately for payment and shall be considered incidental to the execution of the Work.
- m) If signing is at any time deemed inadequate by the Engineer, all construction activities being carried out by the Contractor may be suspended until such time that the required signing is established by the Contractor.
- n) Any costs incurred by the Engineer in discharging the responsibilities required under this section shall be recovered from the Contractor.

#### 2.7.4 FLAGPERSONS

An adequate number of Flagpersons shall be provided for the purpose of warning and directing traffic while construction operations are being carried out. Flagpersons shall be provided and instructed by the Contractor at their own expense. The number of Flagpersons required on any phase of the Work shall be as directed by the Engineer. Flagpersons shall be trained, instructed and posted on the Work to meet the following requirements:

- a) Flagpersons shall be maintained continuously on all sections of the roadway upon which the Work is being performed.
- b) Flagpersons shall conform to, and be instructed by, the Contractor in the proper traffic control procedures for the Work as described in the latest edition of the Northwest Territories Traffic Control Person Code of Practice published by the Workers' Safety and Compensation Commission.
- c) Flagpersons shall also be maintained continuously on any work undertaken during hours of darkness,

where the work area is open to public travel, and for this work shall be equipped with reflectorized vests and paddles.

- d) Flagpersons shall be located far enough in advance of the Work so that vehicles will have sufficient distance to slow down or stop but shall not be that far away that traffic will tend to speed up into the work area.
- e) Flagpersons shall be clearly visible for a distance of 160 m. For this reason, they must stand alone and never permit a group of workers to congregate around them. Parked motor vehicles and/or construction equipment shall not be located within 100 m of a Flagperson.
- f) Flagpersons shall be on the alert for emergency vehicles and for motorists who seem to be confused. They shall make all signals clearly and calmly.
- g) Flagpersons shall never leave their posts unless authorized or replaced.
- h) Flagpersons shall be trained and meet the requirements of the latest addition of the Traffic Control Person Code of Practice, and shall be reliable, physically active, mentally alert, able to speak fluent English and shall maintain a courteous, cooperative attitude towards the traveling public at all times.
- i) Flagpersons shall be preceded by the proper advance warning signs.
- j) During hours of darkness, flagging stations shall be illuminated by overhead lighting; and signs indicating hazardous conditions and signs requiring increased attention shall be marked with flashers.

#### 2.7.5 ACCOMMODATION OF TRAFFIC

Public traffic shall always be safely accommodated, including times of inclement weather. Delays to public traffic are to be minimized. Normal construction shall not delay traffic for periods longer than ten (10) minutes. The Contractor shall obtain approval from the Engineer prior to changing or disrupting existing accesses and road crossings.

The Engineer may direct that construction activities impacting public traffic, including hauling operations, will not be permitted if excessive damage to highways or public roads will occur or when construction activities impacting public traffic cause serious hazards or difficulties to the travelling public. The conditions when this may occur will generally be:

- a) When spring thaw is taking place
- b) During or after heavy rainfall
- c) During periods of exceptionally heavy traffic

Overweight and over dimension public traffic operating under specially issued permits must be accommodated.

When the movement of vehicular traffic constitutes a hazard to workers and/or the traveling public, as determined by the Engineer, the Contractor shall provide pilot vehicle(s). Unless stated otherwise, the provision of pilot vehicle(s) shall be considered incidental to the Work and will not be measured separately for payment.

Failure to comply with the signing and traffic control requirements or the Contractor's TAS, will result in the Work being stopped until all necessary personnel and signage are in place and the safety of the traveling public and employees is not in jeopardy. Any cost incurred to the Department due to the Contractor failure to address signage and safety issues, shall be assessed and sent to the Contractor for payment.

**2.7.6 ACCOMMODATING PEDESTRIANS AND CYCLISTS**

Pedestrians and cyclists shall be provided with safe passage through or around Work areas. When pedestrian and cyclist traffic cannot be accommodated through the Work area, an alternate route shall be made available.

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**2.8 SECTION 8 - LABOUR REQUIREMENTS****2.8.1 EMPLOYMENT OF LOCAL RESIDENTS**

Notwithstanding all terms of "Labour and Material" (General Terms and Conditions, GC 22), special arrangements are required for the employment of local residents on this Contract. The Contractor, prior to recruiting their work force, shall meet with the Manager of the Local/Regional Canada Employment Centre and/or Outreach Office/Band Offices covering the area of the project and advise them of the labour requirements for the project.

Where available, the Canada Employment Centre and local Band Offices will identify, for the Contractor, local residents in the area of the project who appear to be qualified to perform the duties as outlined by the Contractor and the Contractor must show just cause, in writing, in the event these qualified local people are not offered employment before alternative sources of manpower are utilized. The Canada Employment Centre will act as the employment referral agency.

During the process of the Work, the Department of Education, Culture and Employment may make a Liaison Officer available on-site to assist the Contractor with any employment arrangements with the local people. The Contractor shall maintain contact with the Liaison Officer, who will provide counseling services as required for employees and their families.

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## **2.9 SECTION 9 - UTILITIES**

### **2.9.1 GENERAL**

The Contractor is responsible to ensure that all utility installations are located and clearly marked on the ground before commencing its construction operations. The Department or Engineer may provide information respecting the existence of known utility installations, such as power, telephone, pipeline, coaxial or fibre-optic cables, water, gas or other utilities. However, the Contractor is responsible for contacting all affected utility companies to determine the existence and location of all utility installations, maintaining liaison with the utility companies concerning the adjustment of all utilities and coordinating its operations. The Contractor assumes full responsibility for safeguarding all existing and relocated utilities and railways during the progress of the Work. While the Department and Engineer make every effort to collect and present complete details concerning utility installations and railways, no responsibility will be assumed by the Department or Engineer for the correctness and completeness of its information, and the Contractor has no claim on this account. The Contractor is responsible for confirming the accuracy of this information and investigating if there are any other utility installations or railways in, on or near the Work.

### **2.9.2 PROTECTION MEASURES**

The Contractor must take all necessary precautionary measures when working over or adjacent to utility installations or railways whether above or below ground and operate its equipment and develop a method of construction and ensure its workers take steps to prevent damage to any utility and its appurtenances.

Under no circumstances will the Contractor carry out any Work over or adjacent to any utility or railway until the precautionary measures have been developed and implemented.

Additionally, the Contractor must provide at least forty-eight (48) hours notice to the applicable utility companies and railway companies in advance of commencing its Work in that area. After the utility owner or operator completes its utility work, the Contractor will continue to liaise with all applicable utility companies and railway companies. If any utility company or railway company requires its representative to be present the Contractor will ensure such representative is present. The Contractor will work in close cooperation with all applicable utility companies and railway companies in the execution of the Work and must ensure that no equipment crosses or operates over or under any utility installation other than where required protection has specifically been provided.

When construction is involved in the vicinity of any unprotected utilities or railway, the Contractor must exercise extreme caution to ensure that the utilities or railway is not damaged by the Work.

### **2.9.3 POWER AND TELECOMMUNICATION POLES AND CABLES**

Generally, arrangements will be made to have the poles and aerial or buried cables, which are within the embankment and excavation areas, moved to a cleared portion of the right-of-way; however, the Contractor may have to carry out operations with the poles and cables in their present location. No claims will be entertained for delay of work occasioned by such poles or cables being present in the work area.

The Contractor shall advise the Engineer in writing, a minimum of two (2) weeks in advance of commencing clearing and/or grading operations in areas where the power and/or telecommunication poles or cables are within the area of Work.

The Contractor shall be responsible for any damage, caused by their forces or Subcontractor forces, to the power and/or telecommunication poles and cables both in, and outside, of the areas of excavation and embankment.

The Contractor's attention is directed to "Precautions Against Damage, Infringements of Rights, Fire and Other Hazards" (General Terms and Conditions, GC 25).

2.9.4 RAILWAY CROSSINGS

In the case the Contractor is required to haul materials across the tracks of any railway, or elects to do so, they shall make their own arrangements with the railways for any private crossings required or for the use of any existing private crossings.

2.9.5 PAYMENT

Unless a separate bid item is identified, all work to obtain and abide by agreements, coordinate, locating, marking, relocating temporarily or permanently, protecting and repairing damaged utilities shall be considered incidental.

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### 3.1 SECTION 1 - CLEARING

#### 3.1.1 DESCRIPTION

Clearing consists of the removing or the cutting off, at the heights described herein or at such heights as approved by the Engineer, trees, stumps and brush, the removal of all fallen timber, fallen branches and other surface litter from within the right-of-way, borrow pits, gravel pits, haul roads, disposal areas and other areas shown on the Drawings or designated by the Engineer and shall include the disposal of all in accordance with this Specification. Shrubs and other vegetation that can be cut with a brush scythe or mowing machine will not be considered as clearing.

Clearing must be carried out in accordance with the regulations and requirements of the Northwest Territories *Forest Protection Act*, where applicable.

#### 3.1.2 MATERIALS

Not applicable.

#### 3.1.3 CONSTRUCTION

##### 3.1.3.1 **General**

- a) Clearing shall consist of the removal and disposal of all trees, stumps and brush, fallen timber, fallen branches and other surface litter, except for trees and shrubs that are designated for preservation. These trees and shrubs shall be protected from scarring, barking or other injury during the construction operations.
- b) Comply with the federal *Migratory Birds Convention Act* and the federal *Species at Risk Act*, as outlined in Division 2.
- c) The Contractor shall provide the survey for clearing limit markers for the clearing operations. The Contractor shall provide notice to the Engineer to review the clearing limit markers in advance of the clearing operation.
- d) The right-of-way clearing operation shall be completed at least 2 km ahead of the earth moving operation. Except as may otherwise be approved or directed by the Engineer in advance and in writing, borrow pit areas shall not be cleared in advance of excavation by more than one week.
- e) Where designated by the Engineer, all merchantable timber shall be salvaged. Merchantable timber is defined as any tree having a stump diameter 130 mm or greater measured at breast height. The diameter will be calculated to the nearest 10 mm, from the measured circumference of the tree. The merchantable timber shall be trimmed, cut to 2.5 m lengths and neatly stockpiled at locations designated by the Engineer.

##### 3.1.3.2 **Clearing Methods**

Machine clearing will generally be permitted for clearing of the right-of-way, borrow pits, gravel pits, haul roads and where roadway excavations are proposed. Hand clearing shall be performed in areas designated by the Engineer and may be required for the salvage of merchantable timber and in areas where machine clearing may cause damage to culverts, signs, survey monuments, utility lines and fences. All necessary precautions shall be taken to protect such items from damage. Clearing shall consist of cutting all trees and brush to within 100 mm of original ground surface and shall be carried out in a manner that will not damage the existing insulation of organic material. Unless otherwise specified, the use of machinery to pile and dispose of the clearing debris will be permitted.

##### 3.1.3.3 **Minimal Disturbance Clearing**

Minimal Disturbance Clearing shall be performed in specific areas designated by the Engineer. Minimal

Disturbance Clearing shall consist of cutting to within 200 mm of the original ground surface all trees, brush and existing stumps and placing this material, together with deadfalls and other surface debris in a flattened uniform layer over the embankment areas as directed. Cutting and placing operations along embankment sections must be performed in such a manner that the existing insulation of fibrous material is not damaged.

#### **3.1.3.4 Disposal**

- a) Debris piles consisting of trees, rubbish and/or organic material existing from previous clearing operations shall be removed and disposed of by the Contractor.
- b) Unless otherwise specified, all clearing and associated debris shall be disposed of by piling and burning. Generally, the disposal of right-of-way debris shall consist of chipping or piling and burning within the limits of the right-of-way and the placing of any unburned debris in disposal pits or disposal areas designated and/or approved by the Engineer. Surplus material from disposal pits shall be disposed of as directed by the Engineer. A minimum of 600 mm of mineral soil is required over the buried debris. The ground surface shall be restored and leveled.
- c) Burning of clearing debris shall be carried out at such times and in such a manner as to comply with the Territorial Land Use Regulations. If burning is prohibited at the time of the clearing, the material shall be placed in disposal areas which are not visible from the right-of-way, for burning at a later date. The disposal area shall be large enough to accommodate the pile of clearing debris and a fire guard with a minimum of 12 m between the cleared debris pile and the standing trees.
- d) Burning operations shall be under the Contractor's constant supervision and shall be completed in accordance with the regulations and requirements of the Northwest Territories *Forest Protection Act*. All precautions shall be taken to prevent the spreading of fire to adjacent forests. This shall include the maintaining of a safe distance between the forest edge and the fire to act as a fire guard.
- e) The Contractor shall obtain the necessary burning permit and carry out all burning as soon as possible. Any restrictions caused by changes in the conditions of the burning permit and any effect this may have on construction operations and scheduling shall be the responsibility of the Contractor.
- f) The disposal of clearing debris into "push-off" or "push-out" areas will not be permitted.
- g) Deadfalls, windfalls, overhanging trees, limbs or snags which lie partially within the right-of-way shall be removed and burned. The pushing of these outside of the right-of-way will not be permitted.
- h) Unless otherwise specified, for the clearing of borrow pits, the Contractor will generally be permitted to place the clearing debris into a section of the pit where excavation is completed or along the outside edge of the pit and trim such debris to a condition acceptable to the Engineer.

#### **3.1.3.5 Land Use**

All clearing Work shall be carried out in accordance with the *Northwest Territories Lands Act*. It shall be the Contractor's responsibility to familiarize itself with these regulations and conditions. The Contractor is responsible for all Work required to comply with these regulations. No extra payment will be made to the Contractor for any clean-up Work required.

#### **3.1.4 MEASUREMENT**

- a) The quantity of Clearing to be measured for payment shall be the number of hectares computed to the nearest 0.1 hectares determined from horizontal measurements, acceptably cleared in accordance with the Specifications. Measurements for Clearing will be based upon the full overhang of the timber or brush. Unless otherwise specified, cleared lines, ponds, lakes and rock outcrops having a surface area of 0.1 hectares or more without trees, stumps and brush, fallen timber, fallen branches and other surface litter which are within the area flagged for clearing, which shall not be included in the measurement for clearing. The removal of stumps and remaining clearing debris on areas cleared by

others will not be measured separately for payment and shall be considered incidental to the clearing operation; or,

- b) The quantity of Clearing to be measured for payment shall be the kilometres of right-of-way along the centreline computed to the nearest 0.1 kilometres. Unless noted in the Special Provisions, the highway right-of-way is 60 m wide for the purposes of Clearing.
- c) Shrubs and other similar vegetation that can be cut with a brush scythe or mowing machine will not be measured separately for payment and shall be considered incidental to the Work.
- d) Earth material removed along with the clearing debris during the clearing operations will not be measured separately for payment and shall be considered incidental to the clearing operation.
- e) The construction of disposal pits will not be measured separately for payment and shall be considered incidental to the clearing operation.

### 3.1.5 BASIS OF PAYMENT

- a) Payment for Clearing will be at the Contract unit price per hectare; or,
- b) Payment for Clearing will be at the Contract unit price per kilometre of highway right of way.
- c) The unit price shall be compensation in full for clearing, removing, cutting, windrowing, piling, salvaging if required, burning permit, burning, disposal, removal of all trees, stumps, brush, fallen timber, fallen branches and other surface litter, construction of disposal pits and restoring and leveling the ground surface over the buried debris and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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## 3.2 SECTION 2 - GRUBBING

### 3.2.1 DESCRIPTION

Grubbing consists of the removal of all stumps, roots, embedded logs, duff, surface boulders and other objectionable material from the areas designated to be grubbed. Duff is defined as the partly decayed and accumulated vegetable growth on the forest floor.

### 3.2.2 MATERIALS

Not applicable.

### 3.2.3 CONSTRUCTION

- a) Debris from the grubbing operation shall not be used in the construction of embankments.
- b) Generally, the area to be grubbed shall extend to a width of 1.5 m outside excavations and embankment slope lines. Unless otherwise approved by the Engineer in advance and in writing, grubbing will not be required under embankment thickness of 1.5 m or more.
- c) The grubbed material shall be piled and burned. The portion of the debris which cannot be burned may be buried in disposal pits at locations approved by the Engineer. Surplus material from disposal pits shall be disposed of as approved by the Engineer. A minimum of 600 mm of mineral soil is required over the buried debris. The ground surface shall be restored and levelled.
- d) Debris piles consisting of trees, surface boulders, rubbish and/or organic materials existing from previous grubbing operations shall be removed and disposed of by the Contractor.
- e) For the grubbing of borrow pit areas, the Contractor will generally be permitted to place the grubbing debris into a section of the pit where excavation is completed or along the outside edge of the pit and to flatten, cover with waste excavation and trim such debris to a condition acceptable to the Engineer. Generally, the Contractor may perform clearing and grubbing in one operation, subject to the prior approval of the Engineer.
- f) Except as may otherwise be approved by the Engineer in advance and in writing, borrow pit areas shall not be cleared and grubbed in advance of excavation by more than one week.
- g) Burning of grubbing debris shall be carried out at such times and in such a manner as to comply with the Territorial Land Use Regulations. If burning is prohibited at the time of grubbing, the material shall be placed in disposal areas which are not visible from the right-of-way for burning at a later date. The disposal area shall be large enough to accommodate the pile of grubbing debris and fireguard with a minimum of 12 m between the grubbing debris pile and the standing trees. The Contractor shall obtain the necessary burning permits and carry out all burning as soon as possible.
- h) Disposal of the grubbing debris into "push-off" and "push-out" areas will not be permitted.
- i) All grubbing Work shall be carried out in accordance with the *Northwest Territories Lands Act*, and the *Northwest Territories Forest Protection Act* where applicable. It shall be the Contractor's responsibility to familiarize itself with these regulations and conditions. The Contractor is responsible for all Work required to comply with these regulations. No extra payment will be made to the Contractor for any clean-up Work required.

### 3.2.4 MEASUREMENT AND PAYMENT

Payment for Grubbing will be incidental unless there is a separate bid item in the Unit Price Table. Payment for Grubbing will be at the Contract lump sum price bid. The unit price shall be compensation in full for piling, windrowing, burning, removing, disposing, construction of disposal pits, burying, backfilling, compacting and levelling of disposal pits and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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### 3.3 SECTION 3 – ROADWAY EXCAVATION

#### 3.3.1 DESCRIPTION

Roadway Excavation consists of excavating the roadway and satisfactorily removing and disposing of all materials taken from within the limits of the Work except borrow and other excavation not included in this Specification section. The Work shall include all excavation necessary to construct or alter side ditches, offtake ditches, interceptor ditches and inlet and outlet ditches to drainage structures. The Work shall also include sloping and shaping necessary to prepare, alter, construct and complete embankments, shoulders, gutters, ditches, roadway and driveway intersections all strictly to the proposed alignment, grade, and typical cross-sections shown on the Drawings or plans, or as designated by the Engineer.

#### 3.3.2 MATERIALS

Roadway Excavation will be paid for under one of the following two classes:

##### 3.3.2.1 Roadway Excavation Common

Roadway Excavation Common shall consist of all other material of whatever nature, including dense tills, hardpan and frozen materials (including permafrost) that do not come under the classification of Roadway Excavation Rock.

Material excavated from stockpiles within the right-of-way and redistributed over disturbed areas will also be classified as Roadway Excavation Common.

##### 3.3.2.2 Roadway Excavation Rock

Roadway Excavation Rock is defined as:

- a) Material in solid beds or masses consisting of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting.
- b) Boulders or rock fragments having a volume of 2 m<sup>3</sup> or greater.

##### 3.3.2.3 Geotextile

Geotextile shall be placed directly upon the subgrade surface prior to the placement of any subbase materials as per the Drawings and/or Engineer's direction. The requirement for use of geotextile will be determined by the Engineer on-site and it should be noted that the Engineer will limit the use of geotextile when and where possible. The geotextile material shall conform to the requirements as described below, or as specified on the Drawings.

#### Minimum Woven Geotextile Properties

Test Parameter	Required Specification	ASTM Test Method (Or Approved Equal)
Grab Tensile (N)	1300 min	D4632
Elongation (%)	15 max	D4632
Tear (N)	500 min	D4533
CBR Puncture (N)	4400 min	D6241
UV Resistance (%)	70 min	D4355
Flow Rate (l/m/m <sup>2</sup> )	160 (min)	D4491
Permittivity (sec <sup>-1</sup> )	0.05	D4491

Minimum Non-Woven Geotextile Properties

Test Parameter	Required Specification	ASTM Test Method (Or Approved Equal)
Grab Tensile (N)	1300 min	D4632
Elongation (%)	50 max	D4632
Tear (N)	500min	D4533
CBR Puncture (N)	2200 min	D6241
UV Resistance (%)	70 min	D4355
Flow Rate (l/m/m <sup>2</sup> )	3000 min	D4491
Permittivity (sec <sup>-1</sup> )	1.0 min	D4491

**3.3.2.4 Geogrid**

The Contractor shall supply and install geo-grid material in accordance with the Drawings for the roadway on the area identified by Engineer. The supply shall clearly show labeling of the shipment, and materials storage shall follow ASTM D4873. Each roll of the supplied product labeling shall clearly show the manufacturer or supplier's name, style, roll number and manufacturing date. The Contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition, SDS data sheet and others pertinent information and documents to fully describe geosynthetic and MARV requirements (Minimum Average Roll Value) of the Specifications evaluated under the manufacturer's quality control program. This certification and product labeling shall bind the manufacturer for environmental, safety requirements, and warranty obligation for their product.

The geogrid shall be made of Polypropylene Geosynthetics and meet following specific requirements detailed in the table below.

Properties	Verifying test method	Units	Typical Value
Grid Aperture (min-max)	Nominal Dimension Measured	mm	25mm - 40mm
Roll Dimension	Nominal Dimension Measured	m	(3-4) x (50-75)
Roll Area (minimum)	Effective Square area	m <sup>2</sup>	200
Rib Thickness (minimum)	Average	mm	1.7
Resistance to Long Term Damage	ASTM D5818 and D6637	%	100
Tensile strength (minimum)@ 5% strain	ASTM D6637	kN/m	11.0
Ultimate Tensile (minimum) Strength	ASTM D6637	kN/m	16
Flexural Stiffness (minimum)	ASTM D7748	mg-cm	250000
Installation Damage resistance		%SC/%SW/%GP	95/93/90

**3.3.3 CONSTRUCTION****3.3.3.1 General**

- a) Roadway Excavation shall include all excavation required for construction of contiguous roadway ditches, embankments and the removal and disposal of unsuitable materials.

- b) All suitable materials excavated shall be placed in roadway embankments except as otherwise directed by the Engineer. Embankment construction shall be carried out in accordance with "Embankment Construction" (Division 3, Section 6).
- c) All materials, which in the opinion of the Engineer are unsuitable for embankments shall be disposed of at locations and in a manner approved by the Engineer. Generally, all surplus excavated and waste material shall be used to uniformly widen embankments or flatten slopes or deposited in such other places and for such purposes as the Engineer may direct. No excavation material shall be wasted without the Engineer's permission, and when such material is to be wasted, it shall not be left in an unsightly pile but shall be so placed that it will present a neat appearance and not be an injury to abutting property. In no case shall material be deposited above the grade of the adjacent roadway unless directed in writing by the Engineer, nor shall the edge of the waste bank be less than 3 m from the top of the cut slope.
- d) All roadway excavation shall be carried out in a manner so as to minimize disturbance to the natural ground cover on adjacent areas. In permafrost and/or swampy areas, construction shall be performed in a manner that the existing natural insulation of fibrous material over the adjacent areas is not damaged.
- e) Where the subgrade is in transition from excavation to embankment, sub-excavation shall be carried out in the transition area in accordance with the Drawings or as designated by the Engineer.
- f) Where unsuitable material is encountered at the grade level of a cut, the subgrade shall be sub-excavated to the depth determined by the Engineer.
- g) When unsuitable material is encountered below the natural ground surface in embankment areas, the material shall be excavated and disposed of as indicated on the Drawings, the Special Provisions or as designated by the Engineer.
- h) Where suitable material is encountered at the grade level of a cut, except where the cut is in an existing road surface, the subgrade shall be excavated to a depth of 500 mm below the design subgrade surface. The exposed surface shall be thoroughly compacted by means of tamping rollers or other approved equipment and the excavated material utilized or disposed of as directed by the Engineer. Where utilized, the material shall be shaped to conform with the lines, grades and cross-sections as designated by the Engineer. The material shall be compacted in accordance with "Embankment Construction" (Division 3, Section 6).

When directed by the Engineer, approved material shall be added to restore true grade and cross-section.

When material varies from optimum moisture content, it shall be treated in the following manner: When a deficiency in moisture content exists, the material shall be watered and thoroughly mixed until the optimum moisture content is attained. When an excess in moisture content exists, the material shall be worked and aerated until the optimum moisture content is attained.

Shaping and compacting shall be done with blade graders and tamping rollers, or other such equipment as designated or approved by the Engineer. The finished surface shall be firm and uniform, true to grade and cross-section and shall be approved by the Engineer prior to the placement of subsequent layer material thereon. Subgrade that does not conform to the requirements as to grade, cross-section or density shall be reworked until such requirements are met.

Where required, the subgrade shall be prepared to a depth exceeding 500 mm on sections of the roadway as designated by the Engineer. When such work has been ordered, it shall be carried out in

layers not exceeding 150 mm in depth and requirements for density and optimum moisture content as specified above will apply to each layer.

Subgrade ramps, of whatever nature, at approaches to railway crossings, bridge structures or adjacent to fixed obstructions, shall be removed to the lines, grades and cross-sections as designated by the Engineer.

- i) The subgrade surface in excavations shall be shaped and finished by means of a blade grader. The surface and slopes of all excavations shall be shaped to a uniform smooth surface and graded, if required, to ensure positive drainage. Roadway excavation shall not vary from the grades shown on the Drawings or as designated by the Engineer by more than 60 mm. In addition, the difference between the constructed grade and the designated grade shall not vary by more than 30 mm.

### 3.3.3.2 Solid Rock Excavation

- a) Where material conforming to the classification of Roadway Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and take such measurements and cross-sections, at the Engineer's discretion, to compare with the Contractor's measurements and surveys. No allowance will be made for Roadway Excavation Rock before such measurements or cross-sections have been made.
- b) Rock shall be drilled and blasted in such a manner that material excavated will be usable for embankment construction.
- c) Where solid rock is encountered at the grade level of a cut, the subgrade shall be sub-excavated as shown on the Drawings or as designated by the Engineer and backfilled with material approved by the Engineer.
- d) The Contractor shall notify the Engineer a minimum of 24 hours in advance of their blasting operations.
- e) The Contractor shall notify all applicable Airport Offices and/or Air Carriers, Utility Companies, RCMP Detachments, Hospital/Health Centres and vicinity residents a minimum of 24 hours in advance of their blasting operations.
- f) The Contractor shall at all times observe and comply with the provisions and regulations of the Northwest Territories *Explosives Use Act* and the Federal *Explosives Act*.
- g) All overburden shall be removed prior to drilling and blasting. This Work shall be carried out sufficiently in advance of drilling and blasting operations to allow rock cross-sections to be taken by the Contractor's surveyor.
- h) The Contractor shall provide the Engineer with a pre-blast survey, post-blast survey and the final quarry excavation surveys along with a copy of the drill hole survey stating the quarried quantities within 10 days of the blast and a copy of the final topographic survey of the quarry shall be provided within 21 days of the removal or final mucking of the quarried materials. Final topographic survey will have contours lines drawn at least 20 m past the final edge/face of blast. All survey records shall reference the North American Datum of 1983 (NAD 83). The elevation reference datum shall be Mean Sea Level. Final survey submission shall be in a digital (AutoCAD or ASCII text file) and hardcopy format. Pre-blast and post-blast surveys will be considered incidental to the Work and will not be measured separately for payment.
- i) Bedrock shall be blasted in such a manner as to reduce oversize rock and to minimize fly-rock. Where fly-rock may result in personal injury or damage to property or work, the rock to be blasted shall be covered with approved blasting mats, soil or equally serviceable material, to prevent fly-rock. The requirement for and method of blast suppression shall be the responsibility of the Contractor.
- j) Rock fragments littering the areas surrounding a blast site shall be removed to the satisfaction of the



Engineer. All natural timber damaged as a result of the blast (e.g. leaners, broken trees etc.) shall be cut down and disposed in accordance with the land use requirements and to the satisfaction of the Engineer.

- k) Where specified, the Contractor shall pre-shear rock faces to produce a smooth, solid and stable face.
- l) The Contractor shall slope the excavated quarry walls and faces in accordance with the appropriate regulatory authorities during the operational phases and upon final clean up and site abandonment.
- m) All rock slopes and cuts shall be excavated to the lines and grades designated by the Engineer, with no rock projecting within the true slopes. The rock slopes shall be carefully scaled down, to the satisfaction of the Engineer, during or immediately after the excavation operations so that rock so obtained may be incorporated within the embankment. Scaling shall consist of the removal of all loose rock and debris by scaling bar or other means. All rock, boulders and fragments, either on or outside the excavated area, liable to slide or roll down the slope shall be removed to the satisfaction of the Engineer.
- n) A minimum of 300 mm of rock shatter below the design rock grade for the full width of the rock-cut, including ditch bottoms, is required.
- o) All finished rock embankments, including sideslopes, shall be surface dense and chinked with small rock fragments. The chinked rock embankment shall conform to the lines and grades shown on the Drawings or as designated by the Engineer and shall be uniform and free from any ruts or irregularities. Trimming and chinking of rock embankments will not be measured separately for payment and shall be considered incidental to the Work.
- p) Surplus blast-rocks shall be removed from the active rock face and stockpiled in a location directed by the Engineer. Surplus blast rock shall become the property of the Department.
- q) In solid rock cuts, where pockets which will not drain are formed below the design roadway elevation by blasting, the Contractor shall, at their own expense, provide drainage by ditching to a free outlet as determined by the Engineer, and backfill both the pockets and the trench to an elevation 300 mm below embankment grade with broken rock or coarse gravel.
- r) Detour construction, dewatering and the clean-up of rock drilling and blasting sites will not be measured separately for payment and shall be considered incidental to the Work.

#### **3.3.3.3 Geotextile Installation**

- a) The surface onto which the geotextile is placed shall be graded smooth and free from angular rocks, debris, and protrusions.
- b) Do not begin installation of the geotextile until the surface on which the geotextile is to be placed has been approved by the Engineer.
- c) Place geotextile smooth and free of tension stress, folds, wrinkles, and creases.
- d) Overlap each successive strip of geotextile a minimum 600 mm lap length over previously-laid strip. Overlap will be not measured separately for payment.
- e) Employ sufficient temporary anchorage to hold geotextile in place during backfilling.
- f) Protect installed geotextile material from displacement and damage until, during, and after placement of additional material layers.
- g) Repair rips or tears with a patch that covers a minimum of 1 meter on each side of the rip or tear.
- h) Place fill material immediately after laying geotextile.
- i) Place fill material so as to avoid damage to the geotextile.
- j) Maximum drop height for fill directly onto geotextile is 0.6 meter.
- k) No vehicle shall be permitted to pass directly on top of the geotextile at any time.

**3.3.3.4 Geogrid Installation**

Once subgrade or subbase preparation is complete and prior to geogrid installation, the Contractor shall perform a proof rolling test over the subgrade or subbase surface in order to select areas for geogrid to be installed as per the direction of the Engineer. This proof rolling will not be measured separately for payment and shall be considered to be incidental to the line item of geogrid work. The requirement for use of geogrid will be determined by the Engineer onsite and it should be noted that the Engineer will limit the use of geogrid when and where possible.

- a) Contractor's installation shall not contradict the procedure recommended by the manufacturer.
- b) The surface onto which the geogrid is placed shall be graded smooth and free from angular rocks, debris and protrusions.
- c) Do not begin installation of the geogrid until the surface on which the geogrid is to be placed has been approved by engineer.
- d) Place geogrid smooth and free of tension stress, folds, wrinkles, and creases.
- e) Overlap each successive strip of geogrid a minimum of 300 mm overlap previously-laid strip and all overlapping part must be anchored to keep Geogrid in place. Overlap will not be measured separately for payment.
- f) Employ sufficient anchorage to hold geogrid in place during backfilling materials on top.
- g) Protect installed geogrid material from displacement and damage until, during, and after placement of additional materials layers.
- h) Repair rips or tears with a patch that covers a minimum of 1 m on each side of rip or tear.
- i) Place fill materials immediately after laying geogrid.
- j) Place fill materials so as to avoid damage to geogrid.
- k) No vehicle shall be permitted to pass directly on top of the geogrid at any time.

Prior to backfilling the Contractor must handle the geogrid and material with care. Geogrid laid on the road must be anchored in every square meter (m<sup>2</sup>) using only the manufacturer's supplied anchors and as directed by the Engineer.

Backfill material shall be placed in lifts and compacted as per the Specifications. Fill material shall be compacted in such a manner as to minimize the development of wrinkles in and / or movement of the geogrid. During the operation of any tracked vehicles on the fill material over the geogrid, the vehicle must move at low speeds below 10 km/hour. Sudden braking and turning of vehicles shall be avoided. Damages to the geogrid or deficient installations shall be replaced and corrected by the Contractor prior to proceeding at no additional material or cost to Owner.

**3.3.3.5 Survey, Layout, Staking and Grading Requirements**

- a) The Contractor shall provide and pay for qualified personnel to carry out all surveying required for the accurate control of roadway excavation operations. Surveying shall include the provision of an adequate number of stakes and grades every 20 metres along the roadway to ensure construction of roadway excavation areas and any adjacent embankments in accordance with the Specifications, unless otherwise specified in the Special Provisions or directed by the Engineer in advance and in writing.  
The Contractor's survey requirements may also include, but are not limited to, establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, trim staking and referencing.
- b) The Contractor shall carry out the grading of roadway excavation areas as required to ensure that the

roadway excavation areas, including contiguous ditches and backslopes and any adjacent embankments and sideslopes are constructed to the lines, grades and cross-sections indicated on the Drawings. Grading shall include the surveying, staking and setting of grades every 20 metres along the roadway, or other such length as specified in the Special Provisions.

The Contractor shall blade and shape the roadway excavation areas such that the finished surfaces are smooth, uniform and true to design grade and cross-sections on the Drawings.

The finished surfaces shall not deviate by more than 30 mm from the Engineer's specified grade and cross-sections.

- c) The Contractor shall notify the Engineer when the roadway excavation areas have been completed in accordance with the Specifications and shall provide ample opportunity for the Engineer to take cross-sections of the completed roadway excavation areas and any adjacent embankments.

The Engineer will not take cross-sections of roadway excavation areas at any time prior to notification by the Contractor that these areas have been completed in accordance with the Specifications, nor will the Engineer be obliged to notify the Contractor of any deficiencies after the cross-sections have been completed. The completion of roadway excavation area cross-sections by the Engineer shall in no way constitute acceptance of these areas by the Engineer.

- d) As soon as any section of subgrade/embankment, subbase and base courses is constructed, the Contractor shall perform as-built cross-sectional surveys for these surfaces at 20 m interval and provide to Engineer for verification with the specifications and drawings prior to placing subsequent layer thereon. Production and supply of as built data will be incidental to the Work and will not be measured separately for payment. The topographic survey data shall include the Elevation (m) (left shoulder, center line, the right shoulder of the roadway), Cross Fall % (left side and right side of the center line of the roadway), Side Slope % (left side and right side) and Road Width (m).

- e) The Contractor shall prepare as-built info for every 20 metres along the roadway for the completed subgrade/embankment, subbase and base course and send to the Engineer for verification in the following format:

- a. Electronic ASCII text file on the standard USB in the format Point Number, Northing, Easting, Elevation, Description (Point descriptions shall be self-explanatory)
- b. File names shall refer to as-built item and date of survey,
- c. Hard copy (paper) showing station, offset, and elevation derived at 20 metre intervals and referenced to design centerline shall be made available to the Engineer upon request,
- d. Survey data shall reference the same datum as the design layout information, which normally would be North American Datum 1983 (horizontal) and Mean Sea Level (vertical).
- e. The electronic cross-section file shall be industry-standard ASCII Civil Cad cross-section data capable of being uploaded into Softree RoadEng.

### 3.3.4 MEASUREMENT

#### 3.3.4.1 **Roadway Excavation Common**

- a) The quantity of Roadway Excavation Common to be measured for payment will be the number of cubic metres of material in its original position, acceptably excavated and placed in accordance with these Specifications. The volume will be determined using the "Average End Area Method", except that culvert, ditch block and approach excavations may be determined from the average length, width, and depth, unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance. There will be no measurement for payment of material excavated beyond the lines shown on the Drawings or plans or as stated by the Engineer.

- b) In areas cleared and/or grubbed, original cross-sections for excavation measurements will be taken after the clearing and/or grubbing operations are complete.
- c) If material is excavated as unacceptable foundation material as specified in Sections 3.3.3.1 e), f), g), the volume of excavated material will be determined from the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance.

#### **3.3.4.2 Roadway Excavation Rock**

- a) The quantity of Roadway Excavation Rock to be measured for payment will be the number of cubic metres of material in its original position acceptably excavated and placed in accordance with these Specifications. Original cross-sections will be taken on top of the exposed rock surface. Volume will be determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance.
- b) There will be no measurement for payment of material excavated beyond the lines shown on the Drawings or plans or as stated by the Engineer. Drilling and shattering below subgrade will not be measured for payment. Measurement for payment will be made for the actual quantity involved within the lines and grades as staked by the Engineer. Excess material from overbreak, when placed in the embankment, will be measured for payment as Roadway Excavation Common. Excess material from overbreak, when not placed in the embankment, will not be measured for payment.

#### **3.3.4.3 Geotextile/Geogrid**

Measurement of geotextile/geogrid shall be by in place area in square meters, (excluding the quantity used for the installation of culverts).

#### **3.3.5 BASIS OF PAYMENT**

##### **3.3.5.1 Roadway Excavation Common**

Payment for Roadway Excavation Common will be at the Contract unit price per cubic metre.

The unit price shall be compensation in full for removing and disposing of unsuitable materials, unclassified rubbish, shrubs and vegetation, excavating, loading, hauling, dumping, spreading and blading Roadway Excavation Common, scarification and disposal of boulders, shaping and trimming of slopes and surfaces, all surveying, including establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, trim staking, as-built and referencing, traffic control and accommodation and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

If the Contract unit price includes a density requirement for embankments, the unit price will also be compensation in full for compacting embankments and sub-cuts.

##### **3.3.5.2 Roadway Excavation Rock**

Payment for Roadway Excavation Rock will be at the Contract unit price per cubic metre.

The unit price shall be compensation in full for material, equipment and work required for drilling and blasting, pre-shearing if required, blast suppression, detour construction, dewatering, excavation, loading, hauling, dumping and spreading rock material, forming embankments, shaping and trimming and chinking slopes and surfaces, scaling, clean-up, all surveying, including establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, trim staking, as-built and referencing, traffic control and accommodation, permitting, and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

If the Contract unit price includes a density requirement for embankments, the unit price shall also be compensation in full for compacting embankments and sub-cuts.

**3.3.5.3 Geotextile/Geogrid**

Payment at the Contract unit price for the above bid item shall be full compensation for geotextile/geogrid material, all labour for handling and installation and required equipment to perform the Work.

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### 3.4 SECTION 4 – BORROW EXCAVATION

#### 3.4.1 DESCRIPTION

Borrow excavation consists of the excavation and placing of material obtained from locations outside of the cleared right-of-way when the amount of embankment exceeds the amount of excavation.

#### 3.4.2 MATERIALS

Borrow Excavation material shall consist of earth or other excavation as approved by the Engineer. Borrow Excavation will be paid for under one of the following two classes:

##### 3.4.2.1 **Borrow Excavation Common**

Borrow Excavation Common shall consist of all other materials of whatever nature, including dense tills, hardpan and frozen materials (including permafrost) that do not come under the classification of Borrow Excavation Rock.

##### 3.4.2.2 **Borrow Excavation Rock**

Borrow Excavation Rock is defined as:

- a) Material in solid beds or masses consisting of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting.
- b) Boulders or rock fragments measuring 2 m<sup>3</sup> or more in volume.

##### 3.4.2.3 **Geotextile/Geogrid**

- a) Refer to Division 3, Section 3 for the Specifications, installation, measurement and payment requirements for geotextile and geogrid.

#### 3.4.3 CONSTRUCTION

- a) Unless otherwise specified, the Department shall be responsible for the selection of borrow sources and selection of corresponding haul roads required for embankment construction. The development and use of such sources and haul roads shall be subject to the prior approval of the applicable Land Use Authority. The Contractor is responsible at their sole expense for obtaining and adhering to any permits or restrictions that apply to such haul. The Contractor shall construct the haul roads to the details as follows unless modified in the Special Provisions. Haul roads from borrow pits shall consist of one two-way road having a maximum cleared right-of-way width of 12 m or two one-way haul roads each having a maximum cleared right-of-way width of 9 m each. Haul roads shall be dog-legged such that only a short section is visible from the highway. Haul roads and borrow areas shall be constructed in such a manner that drainage patterns are not unduly restricted. If drainage impacts cannot be avoided, the Contractor shall propose temporary drainage accommodation for review and acceptance by the Engineer.

Where trees are present, a minimum thirty 30 m belt of trees shall be left standing between the edge of the right-of-way and the edge of the borrow area.

- b) The actual location, dimension and depths for excavation of borrow sources shall be subject to the prior approval of the applicable Land Use Authority. The Contractor shall provide a pre-blast survey, blasting details and drill hole logs to the Engineer and Land Use Authority, as per the quarry permit and land use permit requirements.
- c) All suitable materials excavated shall be placed in roadway embankments except as otherwise approved by the Engineer. Embankment construction shall be as specified in "Embankment Construction" (Division 3, Section 6).
- d) Unsuitable material excavated from borrow pits shall generally be disposed of by placing it as

approved by the Engineer or Land Use Authority, immediately adjacent to the borrow pit in such a location as not to interfere with the natural ground drainage from or into the borrow pit. The disposal material shall be trimmed as approved by the Engineer. For certain borrow excavations the Engineer may direct that all or part of the unsuitable material be placed back into the excavation area upon completion of the borrow excavation.

If during excavation, material appearing to be unsuitable is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of the material in question to compare to the Contractor's measurements.

- e) If during excavation, material appearing to conform to the classification of Borrow Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of the material in question to compare to the Contractor's measurements.
- f) Rock shall be drilled and blasted in such a manner that all materials excavated will be usable for embankment construction. The method of drilling and blasting of borrow areas shall be in accordance with Clause 3.3.3.2.
- g) The method of clearing and grubbing of borrow areas, haul roads and any other such areas shall be in accordance with "Clearing" (Division 3, Section 1) and "Grubbing" (Division 3, Section 2).
- h) Borrow pits shall be excavated to regular lines as shown on the Drawings and shall be left in a neat condition with uniform slopes and the area within the slopes suitably graded and drained with all dead trees, stumps, weeds, brush, roots, stones, boulders and other objectionable material disposed of to the satisfaction of the Engineer.
- i) Slopes of the excavated borrow pits shall not be steeper than 2:1 for Borrow Excavation Common and 1/4:1 for Borrow Excavation Rock, unless otherwise directed by the Engineer. Staging to be provided on the excavated quarry walls.
- j) The Contractor will generally be permitted to place the clearing and grubbing debris into a section of the pit where excavation is completed or along the outside edge of the pit and to flatten, cover with waste excavation and trim such debris to a condition acceptable to the Engineer and the Land Use Authority.
- k) Temporary fencing may be required around excavated borrow pits at the discretion of the Engineer. If required, the cost of erecting and removing temporary fences associated with excavated borrow pits shall be considered incidental to the Work, and no separate or additional payment will be made.
- l) Haul roads shall be neatly and uniformly trimmed to the satisfaction of the Engineer. Approaches and accesses to borrow areas within the right-of-way shall be removed and all existing drainage ditches shall be restored to their original condition by the Contractor at their sole expense.

#### 3.4.4 MEASUREMENT

- a) Borrow Excavation Common will not be measured separately for payment. Measurement will be made in accordance with "Embankment Construction" (Division 3, Section 6), for the quantity of compacted material in cubic metres in the final in-place position.
- b) Borrow Excavation Rock will not be measured separately for payment. Measurement will be made in accordance with "Embankment Construction" (Division 3, Section 6) for quantity of compacted material in cubic metres in the final in-place position.

#### 3.4.5 BASIS OF PAYMENT

- a) There will be no separate payment for Borrow Excavation Common. Payment will be made in

accordance with "Embankment Construction" (Division 3, Section 6), for the quantity of material in cubic metres in the final in-place position. There will be no additional compensation should frozen materials be encountered in borrow areas.

- b) There will be no separate payment for Borrow Excavation Rock. Payment will be made in accordance with "Embankment Construction" (Division 3, Section 6) for quantity of compacted material in cubic metres in the final in-place position.
- c) The unit price shall also include all work required to comply with the provisions of the *Northwest Territories Lands Act*.

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### 3.5 SECTION 5 – CHANNEL EXCAVATION

#### 3.5.1 DESCRIPTION

Channel Excavation consists of the excavation required for permanently deepening, widening and relocating water channels, the construction of ditches other than contiguous roadway ditches; clearing and grubbing of the channel site; loading, hauling within the free haul distance, placing or disposing and trimming of materials in accordance with these Specifications and to the lines and grades shown on the Drawings or as designated by the Engineer. Except for interceptor ditches running generally parallel to the roadway embankment but not contiguous with it, channel excavation will be designated beyond a distance of 4.6 m from the staked toe of the embankment, or as specified by the Engineer.

#### 3.5.2 MATERIALS

##### 3.5.2.1 **Channel Excavation Rock**

Channel Excavation Rock is defined as:

- a) Material consisting of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting.
- b) Boulders or rock fragments having a volume of 2 m<sup>3</sup> or greater.

##### 3.5.2.2 **Channel Excavation Common**

Channel Excavation Common will consist of the excavation of all other materials of whatever nature including dense tills, hardpan and frozen materials (including permafrost) that do not come under the classification of Channel Excavation Rock.

#### 3.5.3 CONSTRUCTION

- a) All materials excavated shall be disposed of as shown on the Drawings or as directed by the Engineer. Suitable material shall be used in the roadway embankment, where considered practical by the Engineer. When excavated material is placed near the banks of a channel or ditch, provisions will be made to ensure proper flow of water from adjacent land to this waterway. The excavation will be neatly finished and the disposed of material will be shaped and trimmed to a condition satisfactory to the Engineer. The excavation equipment is subject to prior approval by the Engineer.
- b) All Channel Excavation will be carried out in a manner as not to damage the natural ground cover on adjacent areas.
- c) Clearing of the channel site will be carried out in areas designated by the Engineer in accordance with the Specifications for "Clearing" (Division 3, Section 1).
- d) If during excavation, material appearing to conform to the classification of Channel Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of material in question.
- e) Rock shall be drilled and blasted in such a manner that all materials excavated will be usable for embankment construction.

#### 3.5.4 MEASUREMENT

##### 3.5.4.1 **Channel Site Clearing**

Measurement for payment for clearing of the channel site will be in accordance with the Specifications for "Clearing" (Division 3, Section 1).

**3.5.4.2 Channel Excavation Common**

The quantity of Channel Excavation Common to be measured for payment shall be the number of cubic metres of material determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance, in its original position, acceptably excavated and placed in accordance with these Specifications.

**3.5.4.3 Channel Excavation Rock**

The quantity of Channel Excavation Rock to be measured for payment shall be the number of cubic metres of material, determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance, in its original position, acceptably excavated and placed in accordance with these Specifications.

Measurement for payment of material excavated beyond the lines shown on the Drawings or staked by the Engineer will not be made except that for Channel Excavation Rock where, in the opinion of the Engineer, unavoidable overbreak occurs.

Measurement for payment will be made of the actual quantities involved, provided the overbreak quantity does not exceed 10% of the actual quantity of rock within the lines and grades as staked by the Engineer between the established station intervals where the overbreak occurs. Channel Excavation Rock beyond the allowable overbreak will not be measured for payment.

**3.5.5 BASIS OF PAYMENT****3.5.5.1 Channel Site Clearing**

Payment for clearing of the channel site will be in accordance with the requirements for "Clearing" (Division 3, Section 1).

**3.5.5.2 Channel Excavation Common**

Payment for Channel Excavation Common will be at the Contract unit price per cubic metre, measured as provided above.

The unit price will be compensation in full for the Channel Excavation Common required for permanently deepening, widening and relocating water channels, the construction of ditches other than contiguous roadway ditches, grubbing of the channel site, loading, hauling within the free haul distance, placing or disposing and trimming of materials and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

**3.5.5.3 Channel Excavation Rock**

Payment for Channel Excavation Rock will be at the Contract unit price per cubic metre, measured as provided above.

The unit price will be compensation in full for material, equipment and work required for drilling and blasting, excavation, loading, hauling except for overhaul, dumping and spreading rock material, forming embankments, shaping and trimming slopes and surfaces and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.



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### 3.6 SECTION 6 – EMBANKMENT CONSTRUCTION

#### 3.6.1 DESCRIPTION

Embankment Construction consists of the construction of embankments for highways, haul roads and access roads and the backfilling of structures and sub-excavated areas in accordance with these Specifications and to the lines, grades and cross-sections shown on the Drawings or plans or as designated by the Engineer.

#### 3.6.2 MATERIALS

The materials shall consist of acceptable earth and/or rock, free from wood, brush, roots, organic matter and other deleterious material. All materials shall be subject to the approval of the Engineer prior to use in embankment construction.

##### 3.6.2.1 **Geotextile/Geogrid**

- a) Refer to Division 3, Section 3 for the Specifications, installation, measurement and payment requirements for geotextile and geogrid.

#### 3.6.3 CONSTRUCTION

##### 3.6.3.1 **General**

- a) The embankment shall be constructed to the lines, grades and cross-sections shown on the Drawings or plans or as designated by the Engineer.  
If an embankment is constructed beyond the designated lines, grades or cross-sections, the excess material shall be removed by the Contractor and placed where the embankment is below grade level. If the excess material cannot be acceptably used in embankment construction, it shall be disposed of at a location and in a manner approved by the Engineer.
- b) Embankment material shall not be placed if frozen, nor shall frozen soils, ice or snow be placed in any embankment. Any frozen material in the embankment shall be removed and disposed of at the Contractor's expense prior to the continuance of Embankment Construction operations.
- c) Sufficient crown shall always be maintained on the embankment surface during construction to ensure surface water runoff.
- d) The Contractor shall maintain completed embankment surfaces to the specified grade and cross-section and to the required density until the application of subsequent material thereon or until the Work is accepted by the Engineer.

##### 3.6.3.2 **Quality Control**

###### General

Refer to Division 2 for the Contractor's responsibilities for quality control. Quality control and quality control testing are the responsibility of the Contractor throughout every stage of the Work, from the excavation of embankment construction materials to the final accepted product. The Contractor's quality control Work is considered incidental and no separate payment will be made.

###### Compaction Testing Requirements

The Contractor's quality control and quality control testing program shall include the carrying out of all compaction density and moisture testing required for the construction of embankments in accordance with the Specifications.

The Contractor shall establish the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698, for each source and type of material incorporated into the Work. Original copies of all worksheets and laboratory test results shall be submitted to the Engineer prior to

the commencement of embankment construction operations.

The Contractor shall carry out compaction testing utilizing nuclear equipment in accordance with the latest edition of AASHTO T 310 or ASTM D6938, at a sufficient frequency and in such a manner that each layer of the embankment is thoroughly and adequately tested.

All compaction test results for completed sections of the embankment shall be submitted to the Engineer for verification of compliance with the Specifications, prior to the application of subsequent layer material thereon.

Embankment compaction inspection shall be carried out as per Specification and the Contractor's approved quality control plan until such time that grading and shaping has been completed.

For quality control purpose, the Contractor will submit a report for compaction of the embankment in which an engineering company retained by the Contractor will verify that they have witnessed the compaction process of the embankment and confirm that embankment is compacted as per Specifications. Retaining an engineering company to witness the compaction and reporting will be incidental to the embankment construction and will not be paid separately.

Compaction inspection will consist of field witnessing of the number of passes performed and production of compaction reports, at a minimum. Information to be contained in the compaction report will include, but not be limited to: ambient conditions, mass and force of vibratory rollers, number of passes performed, distance of drum overlap, lift thickness, description of aggregates, number and types of vibratory rollers and any other information that the Engineer may determine to be of value.

All compaction test results for completed sections of the embankment shall be submitted to the Engineer on a daily basis for verification of compliance with the specifications, prior to the application of subsequent material thereon.

#### Quality Acceptance

Within this Specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, limits and tolerances may be measured and the Work accepted or rejected based on Department's quality assurance test results.

The Engineer and their representatives reserve the right to sample, test, inspect and monitor the quality of material being utilized and incorporated into the Work by the Contractor at any time and as often as they deem necessary. The Contractor shall cooperate with the Engineer and their representatives for such sampling, testing, inspecting and monitoring. The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way relieve the Contractor of their responsibility to construct embankments that meet the Specifications in all respects.

The Contractor shall provide, at their own expense, such stands, sampling devices and other facilities as the Engineer may require to safely obtain representative samples of the materials being utilized and incorporated into the Work.

The materials testing laboratory provided by the Professional Engineering services company utilized by the Department to carry out quality assurance testing will not be located at the project site. Quality assurance test results will therefore not be completed for approximately 10 days from the date of sampling.

#### **3.6.3.3 Survey, Layout, Staking and Grading Requirements**

- a) The Contractor shall provide and pay for qualified personnel to carry out all surveying required for the

accurate placement and control of embankment construction operations, including the control of overbuilding and the quantity of embankment material placed beyond the specified grading tolerances. Surveying shall include the provision of an adequate number of stakes and grades every 20 metres along the roadway to ensure construction of the embankment and any adjacent roadway excavation areas in accordance with the Specifications and the Drawings. The Contractor's survey requirements may also include, but are not limited to, establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, shoulder and trim staking and referencing. The Contractor shall provide advanced notice to the Engineer to perform quality assurance survey of the original ground and embankment cross-sections prior to the commencement of Embankment Construction operations.

- b) It shall be the Contractor's responsibility to identify any material placed beyond the specified grading tolerances and to remove this material from the embankment, prior to notifying the Engineer that the embankment has been completed in accordance with the Specifications and the Drawings. The grading tolerance for each sideslope in Embankment Construction is defined as the minimum being the Contract standard and the maximum being the Contract standard plus 150 mm measured horizontally.
- c) Prior to the application of subsequent layer material thereon, the Contractor shall carry out the grading of the embankment surface as required to ensure that the embankment surface is placed to the lines, grades and cross-sections indicated on the Drawings. Grading shall include the surveying, staking and setting of grades every 20 m along the roadway.

The Contractor shall blade and shape the embankment such that the finished surface is smooth, uniform, true to the specified grade and cross-section and suitable for the application of subsequent material thereon.

The finished surface shall not deviate more than 30 mm from the specified grade and cross-section. The tolerance for the cross fall will be +/- 0.3% (upper limit 3.3% & lower limit 2.7%) or as specified by the Engineer.

- d) The Contractor shall prepare as-built information as per the Department's Standard Drawing for every 20 meters along the roadway for the completed embankment including side slopes and send to the Engineer for verification prior to the application of subsequent layer material thereon. Production and supply of as built data will be incidental to the embankment construction and will not be measured separately for payment. The Contractor shall notify the Engineer when the embankment has been completed in accordance with the Specifications and Drawings with advance notice to allow the Engineer to perform quality assurance surveys of cross-sections of the completed embankment prior to the application of subsequent layer material thereon. The completion of embankment cross-sections by the Engineer shall in no way constitute acceptance of the embankment by the Engineer.
- e) As soon as any section of subgrade/embankment, subbase and base courses is constructed, the Contractor shall perform as-built cross-sectional surveys for these surfaces at 20 m interval and provide to Engineer for verification with the specifications and drawings prior to placing subsequent layer thereon. The topographic survey data shall include the Elevation (m) (left shoulder, center line, the right shoulder of the roadway), Cross Fall % (left side and right side of the center line of the roadway), Side Slope % (left side and right side) and Road Width (m).
- f) The Contractor shall prepare as-built info for every 20 metres along the roadway for the completed subgrade/embankment, subbase and base course and send to the Engineer for verification in the following format:
- a. Electronic ASCII text file on the standard USB in the format Point Number, Northing, Easting, Elevation, Description (Point descriptions shall be self-explanatory)

- b. File names shall refer to as-built item and date of survey,
- c. Hard copy (paper) showing station, offset, and elevation derived at 20 metre intervals and referenced to design centerline shall be made available to the Engineer upon request,
- d. Survey data shall reference the same datum as the design layout information, which normally would be North American Datum 1983 (horizontal) and Mean Sea Level (vertical).
- e. The electronic cross-section file shall be industry-standard ASCII Civil Cad cross-section data capable of being uploaded into Softree RoadEng.

#### **3.6.3.4 Preparation of Existing Ground**

##### Fill Sections

Unless otherwise specified, where the existing ground surface is less than 1.0 m below the embankment design subgrade surface, unsuitable material shall be excavated and disposed of as directed by the Engineer. The exposed surface shall be bladed and compacted.

Where exposed surfaces, other than the existing road surface, are less than 0.5 m below the embankment design subgrade surface, excavation shall be carried out to 0.5 m below the design subgrade surface, or to the elevation as directed by the Engineer. The exposed surface shall be bladed and compacted, and the excavated material utilized or disposed of as directed by the Engineer.

Where the existing ground surface is more than 1.0 metre below the embankment design subgrade surface, excavation and disposal of unsuitable material shall be carried out only if directed by the Engineer.

##### Cut Sections

Where the embankment design subgrade surface is in a cut, except where the cut is in an existing road surface, excavation shall be carried out to a depth of 0.5 m below the design subgrade surface. The exposed surface shall be bladed and compacted and the excavated material utilized or disposed of as directed by the Engineer.

#### **3.6.3.5 Embankment Widening**

Where existing roadbeds are being widened or extended, the existing embankment sideslopes and affected ditch bottoms shall be denuded of all grass, vegetation and other unsuitable materials and benched to obtain bonding between the existing embankment and new embankment. Benching shall be carried out in accordance with Standard Drawing SD-300-06-01 "Benching for Embankment Widening".

Where directed by the Engineer, unsuitable material shall be excavated from the existing embankment and replaced with material approved by the Engineer. The unsuitable material shall be disposed of as directed by the Engineer.

#### **3.6.3.6 Hillside Benching**

Where an embankment is to be constructed on a hillside or slope which, in the opinion of the Engineer, will preclude a proper bond between the existing and newly placed materials, the existing ground on which the embankment is to be placed shall be denuded of all grass, vegetation and other unsuitable materials and benched in accordance with Standard Drawing SD-300-06-01 "Benching for Embankment Widening". Otherwise, the existing ground on which the embankment is to be placed shall be scarified to obtain bonding between the new material and the existing ground.

#### **3.6.3.7 Embankment Placed on Existing Road**

Prior to the placement of embankment material on an existing roadbed, material within the roadbed designated as unsuitable by the Engineer shall be excavated and replaced with material approved by the Engineer. The

unsuitable material shall be disposed of as directed by the Engineer.

To obtain bonding between the existing and new embankment materials on sideslopes, the existing embankment sideslopes shall be denuded of all grass, vegetation and other unsuitable materials and benched in accordance with Standard Drawing SD-300-06-01 "Benching for Embankment Widening".

Where embankment material of 0.30 m or less in depth is placed on an existing road that is not surfaced with asphalt material, the existing road surface shall be scarified to a depth of 0.15 m bladed and prepared to the lines, grades and cross-section as per the Drawings prior to placing embankment materials. The moisture content in this scarified material shall be adjusted as required, and the material compacted to the density requirements in accordance with the applicable sections of the Specifications.

#### **3.6.3.8 Use of Rock Material**

- a) Embankments constructed principally of rock shall be formed by distributing the materials in successive uniform layers not exceeding 600 mm of loose thickness and shall be formed of layers of a lesser thickness when the size of the rock will permit, as determined by the Engineer.
- b) The maximum dimensions of rock placed in the embankments shall not exceed 300 mm and shall be well graded.
- c) The rock shall be placed in the embankment by end dumping or dozing over the advance face of the fill. The embankment shall be constructed to full width and true to the required cross-section as the Work progresses. No dumping over the side slopes of the embankment will be permitted.
- d) The rock shall be carefully distributed, and the interstices filled with finer material to form a dense compact mass. Each layer shall be compacted using suitable equipment to achieve sufficient compaction to the satisfaction of the Engineer.
- e) Each embankment layer is to be compacted using single drum, vibratory, smooth steel drum rollers, with a minimum static drum weight of 8 tonnes (8000 kilograms) and minimum operating dynamic force of 150 kilo-newton. 100% roller pass coverage with a minimum number of eight passes shall be provided. Additional passes may be required, as determined by the Engineer. Each roller pass shall overlap the coverage of the preceding pass by a minimum of 0.5 m.
- f) All finished rock embankments, including sideslopes, shall be surface dense and chinked with small rock fragments. The chinked rock embankment shall conform to the lines and grades shown on the Drawings or as designated by the Engineer and shall be uniform and free from any ruts or irregularities. Trimming and chinking of rock embankments will not be measured separately for payment and shall be considered incidental to the Work.

#### **3.6.3.9 Construction on Muskeg, Yielding Ground or Permafrost**

- a) When the roadway embankment is to be constructed on muskeg or other unstable materials containing excessive moisture, deleterious materials shall not be excavated.
- b) Minimize disturbance of the organic mat.
- c) Where it is not possible to place the initial layer of embankment material in a 150 mm compacted depth, the Contractor may, subject to the Engineer's approval, construct the initial layer to a depth sufficient to support construction equipment. All subsequent layer embankment construction shall be carried out in layers not exceeding 150 mm compacted depth.
- d) Drainage ditches shall be constructed and functioning as far in advance as possible of embankment construction operations.
- e) The placing of embankment in permafrost areas shall be carried out in such a manner that the existing natural insulation of fibrous material under the embankment and adjacent areas is not damaged.

- f) In swampy, muskeg or permafrost areas, a suitable earth mat may be required to be laid over embankment areas prior to the placing of boulders and/or rock fill.
- g) Remove as much snow and ice as practical without disturbing the organic mat prior to placing material. Snow and ice removal will be considered incidental to Embankment Construction and no separate measurement or payment will be made.

#### **3.6.3.10 Layer and Density Requirements**

- a) Embankments shall be formed by distributing materials in successive uniform layers not exceeding 150 mm compacted depth to the full width of the cross-section. However, layers of compacted depth less than 150 mm shall be placed if required to obtain the specified density and layers of compacted depth greater than 150 mm may be permitted providing the specified density is obtained.  
Sidehill embankments may be permitted to be constructed by dumping excessive loads in uniformly distributed layers until the embankment is wide enough to allow the use of compacting equipment, after which the remainder of the embankment shall be constructed as specified.  
When the original ground will not support the weight of the compaction equipment, the lower part of the embankment may be constructed by dumping successive loads in uniformly distributed layers of thickness not greater than that necessary to support the equipment, after which the remainder of the embankment shall be constructed as specified.
- b) Embankment material placed below 300 mm from the top of the subgrade shall be compacted to 98% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698, except that if such material contains over 50% rock of maximum dimension larger than 150 mm it shall be compacted until there is visible evidence of no further consolidation during compaction to the satisfaction of the Engineer.
- c) All embankment material and material in cuts within the top 300 mm shall be compacted in layers not exceeding 150 mm compacted depth to 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698.
- d) Material used in the final 150 mm lift of embankment, shall be selected by the Contractor to ensure a minimum of boulders or stone fragments having dimensions larger than 150 mm. After placing the final 150 mm lift, all stones, boulders or rock fragments having a major dimension greater than 150 mm shall be removed from the material and disposed of at locations approved by the Engineer. Boulders which are not placed in the subgrade shall be removed and/or disposed as directed by the Engineer. The boulders shall be disposed in such a manner as not to be visible from the right-of-way.

#### **3.6.3.11 Moisture Content Adjustments for Compaction**

##### Water for Compaction

Where moisture content tests indicate the material for embankment is below optimum moisture, water shall be added to increase the moisture content of the soil to optimum moisture conditions within the ranges identified in these Specifications. The material shall be thoroughly disced and broken down, water added in amounts as required, and the material thoroughly worked to mix the water uniformly throughout the soil prior to commencing compaction operations.

##### Drying

In the event embankment material is too wet for compaction as specified herein, the Contractor shall allow it to become sufficiently dry before being compacted. Manipulation of such wet material to speed drying will be permitted by scarifying with suitable equipment until the moisture content is corrected. If the Contractor elects to excavate and waste suitable embankment material which has an excessive moisture content, rather than



drying and utilizing the material, the excavation and waste of the material, and its replacement with the corresponding required quantity of suitable embankment construction material will not be measured separately for payment.

### **3.6.3.12 Embankment Adjacent to Structures**

#### **Embankment at Bridge Approaches**

The permission of the Engineer must be obtained before any fill is placed against concrete arches, abutments, or wing walls. Approach fills within the lines shown on the Drawings or as directed by the Engineer shall be constructed of approved granular material placed in layers not exceeding 150 mm compacted depth and compacted to 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698.

In cases of arch and rigid frame structures, the embankment shall be placed simultaneously at uniform elevations on both sides of the structure.

#### **Embankment at Culverts**

Embankment materials around culverts shall be selected by the Engineer and placed to the limits shown on the Drawings or as designated by the Engineer.

All backfill material shall be placed in layers not exceeding 150 mm in depth. Each layer shall be compacted alternately on each side of the culvert to not displace the culvert during installation. Compact layers by means of pneumatic or other mechanical tamping equipment to 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698. Special attention is required to obtain the required compaction under the haunches. Compaction equipment shall be operated parallel to the longitudinal axis of the culvert. The Contractor shall correct any culvert displacements at their sole expense, to the satisfaction of the Engineer.

#### **Fill - Retaining Walls**

The permission of the Engineer must be obtained before any fill is placed behind a retaining wall. The fill behind the walls shall consist of approved material placed in layers not exceeding 150 mm in compacted depth and compacted as directed by the Engineer. In the case of cell type retaining walls, the fill behind the wall shall be tamped and kept near but not above the level of the compacted material within the cells.

Where fill is to be placed on a sloping surface, the surface must first be benched to reduce the load on the retaining structures.

### **3.6.3.13 Construction Equipment**

The completed embankment shall be sound and stable and shall not exhibit excessive deflection or consolidation, as determined by the Engineer, under construction equipment loading.

The Contractor shall be responsible for any damage to the existing embankment, design embankment or subsequent layers of material placed thereon caused by their construction equipment or activities. There will be no compensation for any delays in productivity resulting from such damage or for its repair.

### **3.6.4 MAINTENANCE OF WORK AND DUST CONTROL**

Maintenance and dust control of the entire roadway shall be carried out in accordance with "Execution of Work, Maintenance of Work and Dust Control During Construction" (Division 2, Section 4).

### 3.6.5 MEASUREMENT

- a) The volume of embankment will be measured in cubic metres in the final in-place position. The volume will be determined as the number of cubic metres approved and placed between the original ground cross-section (top of grubbing) and the embankment design cross-section. Where the Contractor has been required to carry out sub-excavation, the final in-place volume of subsequent embankment backfill material will be added. There will be no measurement for any embankment material placed outside of the limits of the embankment design cross-section unless authorized by the Engineer. The quantity of embankment fill material required between the original ground surface (top of grubbing) and the surface beneath the grubbing will not be measured separately for payment and shall be considered incidental to the embankment construction operation. The volume will be determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance.
- b) Work described in Section 3.6.3.1 will not be measured separately for payment and shall be considered incidental to the embankment construction operation.
- c) The removal and disposal of stones, boulders or rock fragments as described in Section 3.6.3.10 (d) will not be measured separately for payment and shall be considered incidental to the embankment construction operation.
- d) The addition of water to the embankment material, in order to obtain the specified density, will not be measured separately for payment and shall be considered incidental to the embankment construction operation.
- e) The drying of embankment materials in order to obtain the specified density will not be measured separately for payment and shall be considered incidental to the embankment construction operation.
- f) The preparation of the ground following grubbing, benching of the existing embankment sideslopes and the scarifying and compacting of the existing road surface to obtain bonding will not be measured separately for payment and shall be considered incidental to the embankment construction operation.

### 3.6.6 BASIS OF PAYMENT

Payment for Embankment Construction will be at the Contract unit price per cubic metre in the final in-place position. There will be no payment for any embankment material placed outside of the limits of the embankment design cross-section unless authorized by the Engineer.

The unit price shall be compensation in full for clearing, grubbing and stripping of borrow areas and haul roads, upgrading or construction of haul roads, removing and disposing of unsuitable materials, unclassified rubbish, shrubs and vegetation, trimming of all slopes and surfaces in borrow areas and haul roads, the restoration of all existing drainage ditches, grubbing, stripping, benching and widening, scarifying, excavating, loading, hauling, dumping, spreading and blading borrow materials, forming and compacting embankments, the disposal of clearing and grubbing debris, the supply and application of water, drying, trimming and grading of all embankment surfaces, all surveying, including establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, shoulder and trim staking, as-built and referencing, quality control and quality control testing, reporting and certification, maintenance and dust control of the Work and haul roads, traffic control and accommodation and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

The unit price shall also include all work required to comply with the provisions of the *Northwest Territories Lands Act*.

3.7 SECTION 7 – RIGHT-OF-WAY GRADING AND CLEANUP ..... 3

3.7.1 DESCRIPTION ..... 3

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3.7.4 MEASUREMENT AND PAYMENT ..... 3

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**3.7 SECTION 7 – RIGHT-OF-WAY GRADING AND CLEANUP****3.7.1 DESCRIPTION**

Right-of-Way Grading and Cleanup consists of the grading, shaping, contouring and cleanup of the road right-of-way to the satisfaction of the Engineer.

**3.7.2 MATERIALS**

Not applicable.

**3.7.3 CONSTRUCTION**

- a) As a conditional requisite for acceptance of the project, the Contractor shall grade, shape, contour and clean-up the entire road right-of-way in a manner which results in a smooth, uniform, neat and tidy condition, suitable for mowing operations, to the satisfaction of the Engineer and the Land Use Authority.
- b) Connect new ditches to existing ditches to facilitate proper drainage and prevent ponding of surface runoff. Abandoned ditches shall be contoured to prevent water ponding.
- c) The entire right-of-way shall be made free from ruts and ridges and all surface debris, including any clearing, grubbing and stripping debris, clods, stumps, roots, weeds and trash. All boulders which would interfere with mowing operations shall be removed and disposed of and the resultant cavities, if any, backfilled.
- d) The manner and location(s) of the disposal of Right-of-Way Grading and Cleanup debris and boulders will be subject to the approval of the applicable Land Use Authority.

**3.7.4 MEASUREMENT AND PAYMENT**

- a) Payment for Right-of-Way Grading and Cleanup will be incidental unless there is a separate bid item in the Unit Price Table.
- b) Payment for Right-of-Way Grading and Cleanup will be at the Contract unit price per kilometer or hectare.
- c) The unit price shall be compensation in full for grading, contouring, blading, piling, windrowing, burning, removing, disposing, construction of disposal pits, burying, backfilling, compacting and levelling of disposal pits, disposal of boulders, removing ruts and ridges and surface debris, including clearing, grubbing and stripping debris, contouring of abandoned interceptor ditches, dragging, spreading, levelling, shaping, contouring, trimming and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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3.8 SECTION 8 - WATERING ON THE ROAD ..... 3

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3.8.3 CONSTRUCTION ..... 3

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### **3.8 SECTION 8 - WATERING ON THE ROAD**

#### **3.8.1 DESCRIPTION**

Watering on The Road consists of loading, transporting and distributing water required for the construction of highway embankment or the placing of road surfacing materials, and/or for dust control to ensure the safety of the travelling public, all in accordance with these Specifications.

#### **3.8.2 MATERIALS**

The Contractor shall supply the water and obtain the necessary licenses or permits. The water shall be free from undesirable quantities of organic matter, mineral salts, hazardous or toxic wastes and other materials that are harmful to the natural environment. The water quality will be subject to the approval of the Engineer.

If water is supplied from hydrants, the Contractor shall conform to all regulations set forth by municipal authorities or the relevant Land Use Authority. The Contractor shall supply any special equipment required for obtaining water from hydrants, at no direct expense to the Department.

#### **3.8.3 CONSTRUCTION**

- a) Watering equipment shall consist of water-tight tank(s) mounted on adequately powered trucks. The water shall be applied through a spray bar or nozzle of such design as to provide a uniform unbroken spread of water over a minimum width of 2.5 m. A suitable device for positive shut-off of the spray bar shall be located as to permit control from the cab of the truck.
- b) The Contractor will determine the quantity of water to be applied and the rate of application.
- c) When water is required for the construction of highway embankment or the placing of road surface materials, the water shall be distributed only if equipment is available to mix the materials or when the compaction operation is in progress.
- d) The Contractor shall be responsible for determining areas requiring water application for dust control to ensure adequate safety of the traveling public. In addition, the application of water for dust control may also be carried out at specific locations as directed by the Engineer.

#### **3.8.4 MEASUREMENT AND PAYMENT**

Watering on The Road shall be considered incidental to the work and will not be measured separately for payment.



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## **4.1 SECTION 1 – SUPPLY AND INSTALLATION OF CORRUGATED STEEL PIPE CULVERTS**

### **4.1.1 DESCRIPTION**

Supply and Installation of Corrugated Steel Pipe Culverts consists of the supply and installation of Corrugated Steel Pipe (CSP) Culverts less than 1500 mm equivalent diameter in accordance with these Specifications and to the lines, dimensions and grades shown on the Drawings, or as designated by the Engineer.

### **4.1.2 MATERIALS**

#### **4.1.2.1 General**

- a) Culverts, sloped end sections, couplers, bolts and hardware shall be supplied by the Contractor.
- b) Galvanized corrugated steel pipe culverts, sloped end sections, couplers, bolts and hardware shall be fabricated and supplied in accordance with the latest edition of the Canadian Standards Association CAN/CSA-G401 specifications.
- c) Previously installed culverts shall not be used.
- d) All culverts supplied shall be clearly marked with the following information at intervals of not more than 3 m:
  - i) Manufacturer's Name or Trademark
  - ii) Nominal Thickness and Type of Metal
  - iii) Specification Designation
  - iv) Plant Designation Code
  - v) Date of Manufacture

#### **4.1.2.2 Recorrugated Ends**

Culverts shall be helically corrugated, and the ends shall be recorrugated to provide annular corrugations for coupling purposes.

The minimum length of annular corrugated culvert ends shall be 300 mm for culvert diameters of 900 mm or less and 600 mm for culvert diameters greater than 900 mm.

#### **4.1.2.3 Sloped End Sections**

All culverts shall have prefabricated sloped end sections supplied in accordance with Standard Drawing SD-400-01-51 "Standard Sloped End Sections".

#### **4.1.2.4 Couplers**

Couplers shall be annular corrugated band type not less than 600 mm wide and shall have a minimum of three bolts per coupler for culvert diameters of 800 mm or greater.

#### **4.1.2.5 Termination of Lock Seams**

For culvert diameters of 1000 mm or greater, lock seams terminating at the cut edges of slopes or square ended sections shall have a 50 mm length fillet weld run along the lock seam at each cut edge. The weld and surrounding area shall be recoated with the appropriate material in accordance with the latest edition of the Canadian Standards Association CAN/CSA-G401 specifications.

#### **4.1.2.6 Cut Edges**

All cut edges of a sloped or square end section shall be made smooth by grinding so that all of the burrs are removed. Edges of sheets or culverts saw cut after coating, including the exposed edges of sloped end sections shall be recoated with the appropriate material in accordance with the latest edition of Canadian Standards Association CAN/CSA-G401 specifications.

**4.1.2.7 Wall Thicknesses**

For culvert diameters from 600 mm to 1200 mm, the culvert wall thickness shall be 2.8 mm. For culvert diameters more than 1200 mm and less than 1500 mm, the culvert wall thickness shall be 3.5 mm.

**4.1.2.8 Corrugation Profile Dimensions**

All culvert and coupler corrugation profile dimensions shall be 68 mm by 13 mm.

**4.1.2.9 Geotextile**

Refer to Division 3 Grading for the geotextile material Specifications.

**4.1.2.10 Bedding and Backfill**

The Contractor shall use aggregate materials for the culvert base, bedding and structural backfill as indicated on the Drawings.

**4.1.2.11 Clay Cut-Off Curtains**

During culvert excavation, if permafrost is encountered, a clay cut-off curtain or equivalent will be installed on the upstream end of the culvert pipe as shown on the Drawings. Suitable clay materials found on site may be used for the cut-off curtain or as approved by the Engineer. The clay cut-off material should be medium plastic, with Liquid Limits in the range of 30 to 50% and Plastic Limits in the range of 15 to 30%.

**4.1.2.12 Steam Pipes**

The Contractor shall supply and install steam piping for all culverts. The Contractor's attention is referred to, Standard Drawing SD-400-01-54 "Typical Steam Pipe and Hanger Detail", for the materials required for the supply and installation of the steam piping. The steam pipes shall be 12.5 mm inside diameter black iron with vertical extensions 1.6 m in length above each end of the culvert. The vertical extensions shall be threaded and capped. The Contractor shall provide support for the vertical extensions subject to approval by the Engineer.

**4.1.2.13 Riprap**

Refer to Division, 4 Section 3 Hand-Placed and Random Riprap for riprap material Specifications, unless otherwise specified in the Contract Documents.

**4.1.3 CONSTRUCTION****4.1.3.1 Quality Control****General**

Quality control and testing is the responsibility of the Contractor throughout every stage of the Work, from the supply of culvert materials to the final accepted product.

Tests performed by the Department will not be considered to be quality control tests.

The Contractor shall provide, pay for and maintain equipment and qualified personnel to carry out all field testing necessary to determine and monitor the characteristics of the materials produced and incorporated into the Work and the final product produced.

**Compaction Testing Requirements**

The Contractor's quality control and quality control testing program shall include the carrying out of all compaction density and moisture testing required for the construction of culvert foundations, bedding and structural backfill materials in accordance with the Specifications.

The Contractor shall establish the standard Proctor maximum dry density at the optimum moisture content in



accordance with the latest edition of ASTM D698, for each source, type, Designation and Class of material incorporated into the Work. Original copies of all worksheets and laboratory test results shall be submitted to the Engineer prior to the commencement of culvert installation operations.

The Contractor shall carry out compaction testing utilizing nuclear equipment in accordance with the latest edition of ASTM D698, at the specified frequency and in such a manner that each layer of the culvert foundation, bedding, and structural backfill materials are thoroughly and adequately tested.

All compaction test results for completed culvert foundations, beddings and structural backfill operations shall be submitted to the Engineer for verification of compliance with the Specifications, upon completion of each culvert installation operation.

#### Quality Acceptance

Within this Specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, limits and tolerances may be measured and the Work accepted or rejected based on Department quality assurance test results.

The Engineer and their representatives reserve the right to sample, test, inspect and monitor the quality of material being utilized and incorporated into the Work by the Contractor at any time and as often as they deem necessary. The Contractor shall cooperate with the Engineer and their representatives for such sampling, testing, inspecting and monitoring. The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way relieve the Contractor of their responsibility to construct culverts, bedding and backfill that meet the Specifications in all respects. The Contractor shall provide, at their own expense, such stands, sampling devices and other facilities as the Engineer may require to safely obtain representative samples of the materials being utilized and incorporated into the Work.

The Department may elect to perform quality assurance testing. Where quality assurance testing is performed, the materials testing laboratory used by the Department will not be located at the project site. Quality assurance test results will be available in approximately 10 days from the date of sampling.

#### **4.1.3.2 Survey, Layout, Staking and Grading Requirements**

- a) The Contractor shall provide and pay for qualified personnel to carry out all surveying required for the accurate installation of culverts and the accurate placement and control of culvert foundation, bedding and structural and backfill construction operations. This shall include the excavation of existing embankments and the removal of existing culverts, where applicable, and the control of overbuilding and the quantity of any materials placed beyond the specified grading tolerances.

The Contractor's survey requirements may include, but are not limited to, establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, shoulder and trim staking and referencing.

The finished foundation, bedding and structural and backfill surfaces shall not deviate more than 30 mm from the required grade and cross-section.

- b) The Contractor shall notify the Engineer when the culvert installation has been completed in accordance with the Specifications and shall provide ample opportunity for the Engineer to take measurements, at their discretion, prior to the commencement or continuance of embankment construction operations.

The Engineer will not take measurements of the culvert installation at any time prior to notification by the Contractor that the culvert installation has been completed in accordance with the Specifications, nor will the Engineer be obliged to notify the Contractor of any deficiencies, after the

measurements have been completed.

The completion of culvert installation measurements by the Engineer shall in no way constitute acceptance of the culvert materials or culvert installation by the Engineer.

#### **4.1.3.3 Excavation**

- a) Culvert installation locations and design grades will be provided by the Engineer. All surveying and layout required for the excavation and installation of culverts shall be carried out by the Contractor. Culvert excavations shall be carried out to the lines and dimensions indicated on the applicable Standard Drawings or Drawings. Culvert locations may be changed to suit the site conditions and the Engineer will fix the location at the site.
- b) Where culvert installation or removal is required on roadways which must remain in service during construction, the Contractor shall carry out the installation or removal operation by either constructing and maintaining a detour or by working on one half of the roadway while maintaining adequately controlled and signed traffic flow on the other half of the roadway. The Contractor shall ensure that all traffic is safely accommodated at all times. Details of all proposed traffic accommodation methodologies shall be provided in the Contractor's Traffic Accommodation Strategy. The Work above will be considered incidental and will not be measured separately for payment.
- c) If temporary watercourse or channel diversion is required in conjunction with a culvert installation, the Contractor shall acquire approval for the diversion from the appropriate regulatory authority prior to commencement of excavation. The Contractor is to assume full responsibility for maintaining a dry excavation during placement of granular bedding and backfill. Erosion and sediment control structures, silt fencing, shall be installed as required. The Work above will be considered incidental and will not be measured separately for payment.

#### **4.1.3.4 Preparation of Bedding and Foundation**

- a) The culvert bed shall be firm, sound and uniform throughout its entire area. All soft, yielding or unsuitable material encountered at the foundation grade of the culvert excavation shall be sub-excavated to a depth determined by the Engineer and replaced with gravel material or other material specified by the Engineer.
- b) Material used for bedding shall consist of gravel material or other materials as specified on the Drawings. The selection, excavation, loading, hauling, placing and compacting of bedding and foundation material will not be measured separately for payment and shall be considered incidental to the Work.
- c) All bedding and foundation material shall be free from frozen lumps and organic material.
- d) The bedding and foundation material shall be free from stones of a diameter larger than 80 mm in the long dimension.
- e) The bedding and foundation material shall be compacted to a minimum of 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698, in lifts not exceeding 150 mm in depth. Each layer shall be thoroughly compacted and tested in at least three locations, with each location tested meeting the compaction requirements as specified above. Testing locations will be chosen randomly covering the entire bedding area.
- f) Geotextile materials as specified shall be installed, with a minimum 1.0 m lap length, for the entire length and width of the culvert foundation and to sides of the trench walls to limits indicated on the appropriate Drawings for permafrost or non-permafrost installation locations.

**4.1.3.5 Installation**

- a) Culverts shall be installed on the prepared bed, true to the lines, dimensions and grades established as per the Drawings.
- b) Culverts shall be placed with the inside circumference laps pointing downstream. The longitudinal laps shall be located at the side or quarter points.
- c) Separate sections of the culverts shall be firmly and securely joined with couplers in accordance with the manufacturer's instructions. At all coupling and joint areas, depressions shall be constructed in the culvert bed so that the culvert is uniformly supported along its entire length.
- d) The Contractor shall use due care when installing culverts to avoid damage to the culverts. Damaged culverts shall be removed and replaced by the Contractor at their expense.

**4.1.3.6 Backfilling**

- a) The placing of structural backfill material around the culvert shall be carried out to the lines and dimensions indicated on the applicable Standard Drawing or Drawings.
- b) Material used for structural backfill around culverts shall consist of select gravel or soil and granular pit run as specified or approved by the Engineer. The selection, excavation, loading, hauling, placing and compacting of structural backfill material will not be measured separately for payment and shall be considered incidental to the Work.
- c) Structural backfill under the haunches of culverts shall be compacted using suitable hand-held pneumatic, mechanical or power tools.
- d) All backfill material shall be free from frozen lumps and organic material.
- e) The structural backfill material shall be free from stones of a diameter larger than 80 mm measured in the long direction.
- f) The structural backfill material shall be compacted to a minimum of 98% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698. Each layer shall be thoroughly compacted and tested in at least three locations both sides of the culvert, with each location tested meeting the compaction requirements as specified above. Testing locations will be chosen randomly covering the entire backfilling area.
- g) The structural backfill shall be placed, simultaneously and uniformly on both sides of the culvert in lifts not exceeding 150 mm in depth.
- h) Backfilling of the remainder of the culvert excavation, beyond the immediate region of the culvert shall be carried out in accordance with "Embankment Construction" (Division 3, Section 6).
- i) Compaction equipment shall be operated parallel to the longitudinal axis of the culvert until sufficient fill has been placed to proceed with the construction of the embankment in the normal manner.
- j) The remainder of the embankment construction over the installation may then proceed in accordance with "Embankment Construction" (Division 3, Section 6).
- k) Unless otherwise approved by the Engineer or the Department in advance and in writing, vehicular traffic and construction equipment shall not cross over a culvert until the backfill has been constructed and compacted to a minimum depth of 600 mm over the highest point of the culvert.
- l) The Contractor shall provide erosion protection for all slopes at culvert installations. Slope protection shall be provided in the form of riprap as per the Drawings.
- m) No work (preparation of bedding and backfilling) for the installation of the culvert will be performed when the temperature in the next 24 hours is expected to be below 0° C as forecasted by Environment Canada's website for the site or nearest location.

**4.1.3.7 Extension of Existing Culverts**

The extension of existing culverts will be considered as new installations. Where an existing culvert is to be extended, the removal, salvage and reinstallation of an existing sloped end section may be required.

Where the existing culvert was manufactured to imperial dimensions and the new culvert is manufactured to metric dimensions and a mismatch occurs at the joint, the Contractor shall adequately calk the joint with oakum and shall ensure that a water-resistant joint is obtained.

**4.1.3.8 Schedule of Installation**

Culvert installations shall be completed as far in advance of earthmoving and surfacing operations as possible.

**4.1.3.9 Culvert Markers**

The Contractor shall supply and install "Iceworm Advantage Culvert Savers" (culvert markers) to the manufacturer's specifications and standards at the ends of each culvert. If the reinstallation of existing culvert markers is specified, the Contractor shall reinstall the markers at the ends of each culvert as outlined above.

**4.1.4 MEASUREMENT****4.1.4.1 Supply and Installation**

The quantity of Corrugated Steel Pipe Culvert to be measured for payment will be the number of linear metres of the sizes of culvert specified, acceptably fabricated, supplied and installed in accordance with these Specifications. Measurements will be based on the total invert length of culvert supplied and installed, including sloped end sections.

The supply and installation of couplers, bolts and hardware necessary for the installation of culverts will not be measured separately for payment and shall be considered incidental to the culvert supply and installation.

The supply and installation of geotextiles and culvert inlet/outlet riprap as per the Specifications and Drawings will not be measured separately for payment and shall be considered incidental to the culvert supply and installation.

**4.1.4.2 Excavation and Backfilling for Culvert Installation**

Quantities of culvert excavation and backfill material will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation. There will be no additional payment for excavation beyond the lines and grades shown on the Drawings without prior approval of the Engineer.

**4.1.4.3 Temporary Channel Diversion**

The provision of a temporary channel diversion will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.4 Culvert Installation and Removal on Roadways in Service**

The staging of construction required for culvert installations or removals on roadways in service will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

The construction, maintenance and subsequent removal of detours will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.5 Extension of Existing Culverts**

The removal, salvage and reinstallation of existing sloped end sections will not be measured separately for

payment and shall be considered incidental to the culvert supply and extension operation.

**4.1.4.6 Accommodation of Traffic**

Work required for the safe, controlled and signed accommodation of traffic during installation or removal of culverts will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.7 Caulking of Joints**

The installation of oakum in joints, if required, will not be measured separately for payment and shall be considered incidental to the culvert supply and extension operation.

**4.1.4.8 Damaged or Lost Culvert Materials**

The replacement of any lost or damaged culvert material will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.9 Culvert Markers**

The supply and installation of "Ice Worm Advantage Culvert Savers" (culvert markers), and the reinstallation of existing culvert markers if specified, will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.10 Geotextile Materials**

The supply and installation of geotextile materials, in accordance with the Drawings, will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.11 Clay Cut-Off Curtains**

The supply and installation of clay cut-off curtain material, in accordance with the Drawings, will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.12 Steam Pipes**

The supply and installation of steam pipes, in accordance with the Drawings, will not be measured separately for payment and shall be considered incidental to the culvert supply and installation operation.

**4.1.4.13 Riprap**

The supply and installation of riprap will not be measured separately for payment and shall be incidental with the culvert supply and installation operation.

**4.1.5 BASIS OF PAYMENT**

Payment for Supply and Install Corrugated Steel Pipe Culverts will be at the Contract unit price per linear metre for the various sizes of culverts specified.

Payment for Supply and Install Corrugated Steel Pipe Culvert Extensions will be at the Contract unit price per linear metre for the various sizes of culvert extensions specified.

The unit price shall be compensation in full for the construction and removal of detours, traffic control and accommodation, temporary channel diversion, dewatering, fabricating, supplying, unloading, storing, handling and hauling the culvert materials and hardware, excavating, preparing the bed, installing and assembling the culvert, caulking, producing, selecting, excavating, loading, geotextile materials, riprap, steam pipes, clay cut-off curtains, hauling and placing foundation, bedding and structural and backfill materials, compacting,

disposing of surplus materials, the supply of water, drying, the fabricating, supplying and installing of culvert markers, the reinstalling of existing culvert markers, all surveying, quality control and quality control testing, reporting and certification and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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## **4.2 SECTION 2 – CULVERT REMOVAL**

### **4.2.1 DESCRIPTION**

Culvert Removal consists of the removal of embedded culverts shown on the Drawings or as designated by the Engineer.

### **4.2.2 MATERIALS**

Not applicable.

### **4.2.3 CONSTRUCTION**

#### **4.2.3.1 Excavation**

Culvert excavations shall be carried out to the lines and dimensions indicated on the Drawings or as designated by the Engineer.

Where culvert removal is required on roadways which must remain in service during construction, the Contractor shall carry out the removal operation by either constructing and maintaining a detour or by working on one half of the roadway, while maintaining adequately controlled and signed traffic flow on the other half of the roadway. The Contractor shall ensure that all traffic is safely accommodated at all times. Details of all proposed traffic accommodation methodologies shall be provided in the Contractor's Traffic Accommodation Strategy.

#### **4.2.3.2 Removal and Disposal**

Where the removal and disposal of existing culverts or drainage structures from the roadbed, ditches or other waterways is specified, all culvert materials, including existing culvert markers, shall become the property of the Contractor.

The crushing and burying of existing culverts is not permitted on the site. The Contractor shall remove and properly dispose of the excavated culvert materials to the satisfaction of all authorities having jurisdiction.

#### **4.2.3.3 Removal and Salvage**

Where the removal and salvage of existing culverts or drainage structures from the roadbed, ditches or other waterways is specified, the Contractor shall carefully excavate, remove and neatly store the materials, including culvert markers, at locations approved by the Engineer. All culvert materials shall remain the property of the Department.

If a culvert or culvert marker specified for salvage is damaged beyond use by the Contractor during the removal operation, due to their negligence, the Contractor shall replace the damaged culvert or marker at their own expense.

#### **4.2.3.4 Culvert Markers**

The Contractor shall dispose of or salvage existing culvert markers in conjunction with the specified culvert disposal or salvage operation.

### **4.2.4 MEASUREMENT AND PAYMENT**

#### **4.2.4.1 Culvert Removal**

The removal of culverts, including sloped ends, will not be measured separately for payment and shall be considered incidental to the Work.

**4.2.4.2 Culvert Removal on Roadways in Service**

The staging of construction required for culvert removals on roadways in service will not be measured separately for payment and shall be considered incidental to the Work.

The construction, maintenance and subsequent removal of detours will not be measured separately for payment and shall be considered incidental to the Work.

**4.2.4.3 Culvert Disposal**

The removal and offsite disposal costs of culvert materials will not be measured separately for payment and shall be considered incidental to the Work.

**4.2.4.4 Culvert Salvage**

The salvage and storing of culvert materials will not be measured separately for payment and shall be considered incidental to the Work.

**4.2.4.5 Accommodation of Traffic**

Work required for the safe, controlled and signed accommodation of traffic during removal of culverts will not be measured separately for payment and shall be considered incidental to the Work.

**4.2.4.6 Damaged Culvert Materials**

The replacement of culvert materials damaged where salvage is specified will not be measured separately for payment and shall be considered incidental to the Work.

**4.2.4.7 Culvert Markers**

The removal and disposal or salvage of existing culvert markers will not be measured separately for payment and shall be considered incidental to the Work.

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### 4.3 SECTION 3 – HAND-PLACED AND RANDOM RIPRAP

#### 4.3.1 DESCRIPTION

Hand-Placed and Random Riprap shall consist of a protective covering of stone constructed on an earth bed or granular filter blanket. Riprap shall be constructed at the locations and in conformity with the lines, grades, and dimensions shown on the Drawings or as designated by the Engineer.

#### 4.3.2 MATERIALS

The Contractor shall supply all materials required for the Work.

Riprap materials, for culverts and other drainage work, shall consist of hard and durable field stone, boulders, or quarry rock. All riprap shall be verified by testing as non-PAG (Potential Acid Generating) with low Metals Leaching potential. No stone shall be less than 150 mm in its smallest dimension. For the purpose of this Specification, dimension is defined as being length, width, and depth.

Riprap material for bridges shall consist of hard and durable field stones, boulders or quarry rocks. At least 80% of the stone shall have a volume of not less than 0.014 m<sup>3</sup> each.

#### 4.3.3 CONSTRUCTION

##### 4.3.3.1 **Excavation**

###### Hand-Placed Riprap

Aprons and slopes to be riprapped shall be excavated to provide an adequate foundation upon which the riprap shall rest, as shown on the Drawings or as specified by the Engineer. The whole area to be riprapped shall be trimmed to a uniform and even surface.

###### Random Riprap

If required, a shelf or ledge shall be excavated to permit dumping of the stone.

##### 4.3.3.2 **Placing**

###### Hand-Placed Riprap

Stones shall be placed, by hand, to the required length, width and thickness. Stones shall be placed so that the largest dimension is perpendicular to the slope, unless such dimension is greater than the specified thickness of the riprap. The largest stones shall be placed in the bottom rows. No shaping of stones will be required. Stones shall be laid in close contact and supported by the prepared foundation material.

###### Random Riprap

Random riprap shall be dumped onto the surface to be riprapped. Sufficient hand work shall be performed to produce a uniform surface and the depth shown on the Drawings, to the satisfaction of the Engineer.

#### 4.3.4 MEASUREMENT

- a) No separate measurement will be made for hand placed riprap or random riprap unless there is a separate bid item in the unit price table. Hand placed riprap and random riprap shall be considered incidental to the Work.
- b) Measurements will be based on surface area and average thickness of the riprap.
- c) Hand Placed Riprap will be measured in place, in cubic metres, except that riprap for culverts may be based on design quantities specified on the Drawings.
- d) Random Riprap will be measured in cubic metres or tonnes.

The volume of riprap dumped or placed into water, or other sites where in-place measurements are impractical, will be computed from the volumetric capacity of the vehicle.

**4.3.5 BASIS OF PAYMENT**

Payment for Hand-Placed Riprap and/or Random Riprap will not be measured separately for payment unless there is a separate bid item in the unit price table.

Payment for Hand-Placed Riprap and/or Random Riprap will be at the Contract unit price per cubic metre or per tonne, measured as provided above.

The unit price will be compensation in full for excavating and preparing the bed, loading, hauling, unloading, and placing the stones and the supply of all materials, equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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## 4.4 SECTION 4 – SAND BAG RIPRAP

### 4.4.1 DESCRIPTION

Sand Bag Riprap consists of a protective covering of sand bag riprap constructed on an earth bed, at the locations and in conformity with the lines, grades and dimensions shown on the Drawings or as designated by the Engineer.

### 4.4.2 MATERIALS

The Contractor shall supply the granular material, the Portland cement, the burlap bags and any other necessary materials. The bags will be made of 285 grams per square metre jute. The dimensions of the bags shall be 370 mm by 685 mm. The top of each bag shall be hemmed. The bags shall be of sufficient strength to permit them to be lifted by the top corners of the bag when filled with the applicable materials.

The granular material may be pit run, screened or crushed. The granular material shall consist of fragments of durable rock, free from undesirable quantities of soft or flaky particles, shale, loam or other deleterious materials and must be approved by the Engineer prior to being incorporated into the Work.

Granular material which will not pass a 50 mm square opening shall be excluded. The portion of material passing the 4.75 mm Sieve (No. 4 U.S. Standard) shall not be greater than 50% of the material by weight. The portion of the material passing the 0.075 mm Sieve (No. 200 U.S. Standard) shall not exceed 5% of the material by weight.

Cement shall be General-Use (GU) Portland cement conforming to the requirements of the current specifications for such as issued by the Canadian Standards Association. CSA-A3001. Up to 25% by mass of the Portland cement can be substituted with a supplementary cementitious material.

At the discretion of the Department, the use of any cement may be held up pending the results of tests to ensure that the cement conforms up to the requirements as specified.

### 4.4.3 CONSTRUCTION

#### 4.4.3.1 **Excavating**

Aprons and slopes to be riprapped shall be excavated to provide an adequate foundation upon which the riprap shall rest as shown on the Drawings or specified by the Engineer. The whole area to be riprapped shall be trimmed to a uniform and even surface. The entire base shall be thoroughly compacted to provide a smooth and firm foundation of uniform density.

#### 4.4.3.2 **Mixing**

Eight parts of granular material and one part of Portland cement by weight or such proportions as determined by the Engineer, shall be mixed in a batch mixer until the granular material is uniformly coated with cement.

#### 4.4.3.3 **Filling Bags**

The bags shall be filled 70% full, with the dry mixture. Each bag shall be securely sewn or stapled to form a straight edge closure.

#### 4.4.3.4 **Placing**

- a) The bags shall be placed by hand, within 30 minutes after mixing of the concrete, in their final position on the prepared base, to the required length, width and thickness. The riprap shall be commenced in a trench below the toe of the slope. The bags shall be placed in horizontal rows. Each bag shall be firmly bedded into the slope and securely butted against the adjacent bags. The tied end of the bag shall rest

on and against the face of the slope.

Each row of bags shall overlap the preceding row of bags by at least 250 mm. The joints in adjacent rows shall be staggered. All earth and other debris shall be removed from the surface of bags in place before succeeding rows of bags are placed. Not more than five courses of sacks shall be placed in any tier before such time as initial set has taken place in the first course of any such tier.

The riprap shall have a minimum thickness of 150 mm measured perpendicular to the slope, and its surface shall not vary from the theoretical surface by 80 mm at any point.

- b) Sand bag riprap shall not be placed during heavy rain, snow, freezing temperatures or other unsuitable conditions. Sand bag riprap shall not be placed if it appears likely that the temperature will fall below 5°C within the next 24 hours, unless special precautions approved by the Engineer are taken.

#### **4.4.3.5 Watering**

Water shall be sprayed onto the surface of each row. Excess water shall not be applied. Each layer of riprap shall be thoroughly wetted with water and shall be kept moist for a period of 24 hours by sprinkling or other means approved by the Engineer.

#### **4.4.4 MEASUREMENT**

The volume of Sand Bag Riprap will be measured in cubic metres in place. The surface area and thickness of the riprap will be measured to compute the volume.

Cement for Sand Bag Riprap shall be measured in kilograms acceptably incorporated into the construction of sand bag riprap in accordance with these Specifications.

#### **4.4.5 BASIS OF PAYMENT**

Payment for Sand Bag Riprap will be at the Contract unit price per cubic metre, measured as provided above.

The unit price will be compensation in full for excavating and preparing the bed, supplying granular material, mixing the Portland cement and granular material, supplying, filling and placing the bags, supplying the water, watering the riprap and the supply of all materials, equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

Cement for Sand Bag Riprap will be paid for at the Contract unit price for this item, measured as provided above, complete in place and accepted.

The unit price will be compensation in full for all costs of cement, hauling, storing and the supply of all materials, equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.



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## 5.1 SECTION 1 – CRUSHED AGGREGATE PRODUCTION

### 5.1.1 DESCRIPTION

This specification covers the general requirements for the production, gradation, stockpiling and pit operations for the crushed aggregate materials specified.

### 5.1.2 MATERIALS

#### 5.1.2.1 **Sources**

##### a) Department Supply Sources

When it is specified in the Contract that the Contractor shall use pits, stockpiles or quarry sites as shown on the plans or as designated by the Engineer for the production of crushed or uncrushed aggregate, these sources shall be termed Department Supply Sources.

Unless otherwise specified, the Department will obtain the necessary Land Use and Quarry permits. Copy of the quarry permit will be made available to the contractor during the pre-construction meeting.

The Contractor shall abide by all Terms and Conditions associated with these permits.

In addition to these Terms and Conditions the Contractor shall also abide to the following conditions:

- i) The Contractor shall ensure that all fuel storage containers with a capacity exceeding 4,000 litres are double-walled tanks.
- ii) Mobile fuel tankers are not permitted for onsite storage and are only permitted for delivering fuel to the main storage tank or to equipment.
- iii) Vehicles and storage tanks shall not be left unattended during refueling.
- iv) Fuel spill kit(s) shall be kept on site at all times.
- v) In addition to reporting chemical and fuel spills immediately to the NWT 24-Hour Spill Report line at 1-867-920-8130, the Contractor shall also complete a spill report form and forward a copy to the appropriate regulatory bodies within 12 hours of a reported incident.
- vi) The Contractor shall ensure that all workers on site are aware of all Terms and Conditions of all Permits. Copies of Permits and Permit Terms and Conditions shall be posted on site for viewing by workers, at the location, that is accessible and frequented by all workers.

The Contractor shall prepare a quarry development plan, indicating location and dimensions of the proposed quarry area to be drilled and blasted, stockpile bases, overburden disposal, and fuel storage facilities (including size and type of storage containers). The contractor shall submit this quarry development plan to the Department of Lands and get their approval before starting the drilling operation.

##### b) Contractor Supply Sources

When it is specified in the Contract that the Contractor:

- i) Is required to arrange for and supply the entire aggregate commitment for the contract from sources of their own choice or,
- ii) Has the option of supplying the aggregate for part or all of the Contract from Department Supply Sources identified in the Contract or sources of their own choice.

The following shall apply to any aggregate sources used including Department Supply Sources and Contractor Supply Sources identified in the Contract:

- i) The Contractor shall ensure all required permits, licenses and approvals are in place in accordance with the provisions of the Northwest Territories Lands Act, including but not limited to Land Use Permits, Quarry Permits, Water Licenses and Fisheries Authorizations.

The Contractor assumes full responsibility for the quantity and quality of the material in the source.

The Contractor shall specify in their bid submission their designated supplier of all aggregates and the name and location of their proposed aggregate sources and haul routes.

The Contractor shall obtain the necessary rights to take materials from the sources.

The Contractor shall explore and develop the sources.

The Contractor shall save the Department harmless from any and all claims resulting from the use of the aggregate sources.

The Engineer will not consider the use of aggregate from existing stockpiles unless the Contractor can satisfy the Engineer that the material meets all required specifications.

Agreement by the Engineer that such pre-prepared aggregates can be used will not constitute acceptance of the material in stockpile. Acceptance of such material will be based on quality control testing done by the Contractor or quality assurance testing performed by the Engineer as the material is incorporated into the Work.

### 5.1.3 CONSTRUCTION

#### 5.1.3.1 **General**

Aggregate produced from all sources shall comply fully with the specifications and the Contractor shall recognize and satisfy himself as to the type and amount of work that may be necessary to produce the required material.

The aggregate shall meet the requirements for the Designation and Class of material specified. The Contractor shall adjust and modify aggregates as required in order to meet the specification requirements.

The crushed aggregate shall be composed of sound, hard and durable particles of sand, gravel and rock and shall be free from elongated particles, injurious quantities of flaky particles, soft shales, organic matter, clay lumps, deleterious materials, and other foreign matter.

A tolerance of 3% in the amount passing the maximum size sieve will be permitted providing all oversize material passes the next larger standard sieve size.

The Contractor shall be entirely responsible for the quantity and quality of crushed aggregate produced but shall also be responsible for organizing production and stockpiles on designated base and survey those with record of time, date, materials type, volume and chronological pile number in order.

#### 5.1.3.2 **Quality Control and Quality Control Testing**

##### a) General

In all sources, quality control and quality control testing are the responsibility of the Contractor throughout every stage of the work.

Tests performed by the Department will not be considered to be quality control tests.



The Contractor shall provide, pay for and maintain equipment and qualified personnel to carry out all field testing necessary to determine and monitor the characteristics of the materials produced and incorporated into the work and the final product produced.

The Contractor shall provide safe and convenient means for accurately and representatively sampling each aggregate stream being produced during all screening, splitting and crushing processes.

Prior to commencement of the work, the Contractor shall provide the Engineer with their program and schedule of testing for quality control and shall demonstrate to the satisfaction of the Engineer that the program and schedule are adequate to provide reliable quality control within the limits specified.

- i) The Contractor shall retain and utilize Professional Engineering Services to carry out all quality control and quality control testing and to assess and where necessary, modify the aggregate materials being produced to ensure their end use meets all specification requirements. The Professional Engineering Services employed by the Contractor shall be licensed to operate in the Northwest Territories.

The Contractor shall not retain or utilize the Professional Engineer and/or Geoscientist or personnel retained by the Department of Infrastructure with respect to the Contract, for any work on or associated with the Contract.

All quality control tests, and test results shall be calculated and submitted to the Engineer on industry standard worksheets. The tests and test results shall be certified for correctness by the Professional Engineering Services employed by the Contractor to perform the tests and shall be signed by the Contractor's representative. Original copies of all worksheets, including calculations, shall be submitted to the Engineer daily. All worksheets shall be reviewed and certified for correctness by a Professional Engineer from the Professional Engineering Services employed by the Contractor to perform test, on a minimum weekly basis.

- ii) Test Methods

Unless otherwise specified, the most recent version of the following test methods shall be used to determine material characteristics:

<b>Test Description</b>	<b>Standard</b>
(1) Sampling Aggregates	ASTM D75/AASHTO T2
(2) Sieve Analysis of Fine and Coarse Aggregates	ASTM C136 /AASHTO T27
(3) Sieve Analysis of Materials Finer than 75-micron Sieve	ASTM C117/ AASHTO T11
(4) Mineral Filler for Road and Paving	ASTM D546/AASHTO T37
(5) Determining the Liquid Limit of Solis	ASTM D4318/AASHTO T89
(6) Determining the Plastic Limit and Plasticity Index of Soils	ASTM D4318/AASHTO T90
(7) Percent Fracture	ASTM D5821
(8) L.A. Abrasion	ASTM C131/ASTMC535/AASHTO T96
(9) Flakiness Index or Percent Flat and Elongated Particles	ASTM D4791
10) Detrimental Matter in Coarse Aggregates	TLT-107
11) Standard Proctor Maximum Dry Density	ASTM D698
12) Magnesium Sulphate Soundness (coarse and fine)	ASTM C88/AASHTO T104

\* The terms "ATT" and "TLT" refer to Alberta Transportation Test methods

### iii) Quality control Testing Requirements

The Contractor's Quality Control Testing shall be carried out on a per lot basis using the following lot sizes:

- For aggregates having a maximum aggregate size of 50 mm or higher the lot size shall be 2,000 cubic meters; and
- For aggregates have a maximum aggregate size of less than 50 mm the lot size shall be 1,000 cubic meters.

The Contractor's quality control and quality control testing program shall include the methods at the minimum specified frequencies in the table below.

## iv) Lot Testing System

Test	Standard	Minimum Frequency
<b>(A) Sampling</b>		
(1) Sampling Aggregates	ASTM D75/AASHTO T2	4 per lot. (This frequency applies to each fraction being produced for Designation 1 split stockpiles.)
<b>(B) Sieve Analysis</b>		
(1) Crushed aggregates (a) Fine and Coarse aggregates (b) Materials Finer than 75 microns Sieved by washing	ASTM C136/AASHTO T27  ASTM C117/AASHTO T11	4 per lot.
(2) Blend Sand (a) Mineral Filler for Road and Paving Materials	ASTM D546/AASHTO T37	4 per lot.
(3) Manufactured Blend Sand (a) Mineral Filler for Road and Paving Materials	ASTM D546/AASHTO T37	4 per lot.
<b>(C) Other</b>		
(1) Determination of Plastic Limit and Plasticity Index of Soils	ASTM D4318/AASHTO T90	1 per 3 lots.
(2) Percent Fracture	ASTM D5821	1 per lot.
(3) L.A. Abrasion	ASTM C131/ASTM C535/AASHTO T96	1 per source.
(4) Flakiness Index or Percent Flat and Elongated	v) ASTM D4791	1 per source.
(5) Detrimental Matter in Coarse Aggregate	TLT-107	1 for the first lot. Additional tests at rate of 1 per 3 lots if first test indicates deleterious material is $\geq 4\%$ .
(6) Magnesium Sulphate Soundness	ASTM C88/AASHTO T104	1 per source.
(7) Standard Proctor Maximum Dry Density	ASTM D698	1 per stockpile.

Note: The terms "ATT" and "TLT" refer to Alberta Transportation Test methods

- b) The Contractor shall perform a minimum of two washed sieve analysis tests from the crusher belt and two washed sieve analysis tests from the stockpile for every lot.

The Engineer will, upon review of the Contractor's submitted test results and the Department's quality assurance test results, accept the lot only if the test results indicate that the granular material has been produced in accordance with the specifications.

If more than one test result per lot from the Contractor's quality control testing reveals that the material is not within acceptable specification criteria, the following shall apply:

- i) The material will be rejected, and the Contractor shall remove the entire lot from the stockpile, and the rejected material will become the property of the Department or:
  - ii) If in the opinion of the Engineer, the material is only slightly out of specification and will not be detrimental to the usage of the material, the material, if requested by the Contractor in writing, may be accepted by the Engineer at a reduced payment of 75% of the unit price bid for the applicable item.
- c) Reporting of Sieve Analysis Test Results and Production Quantities  
The Contractor shall record all sieve analysis test results on industry standard grain size curve sheets and work sheets, which provide all test data, calculations, error checks, test results and any additional information requested by the Engineer. The Contractor shall also determine and record on each sieve analysis worksheet, the time and date of sampling, the total quantity of granular material produced at the time of sampling and, where applicable, the test lot that the sample refers to.
- d) Quality Acceptance  
Within this specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, limits and tolerances may be measured and the work accepted or rejected based on the Department's quality assurance test results.

Acceptance of processed aggregates will take place when they are in their final position and have met all the requirements of the Contract. The Engineer may test at any time and reject material that does not meet the specifications. The final position for a crushing and stockpiling Unit Price Table item will be the stockpile as when quantity and quality is certified by the Engineer.

The Engineer and the Engineer's representatives reserve the right to sample, test, inspect and monitor the quality of material being produced and incorporated into the work by the Contractor at any time and as often as the Engineer deems necessary. The Contractor shall cooperate with the Engineer and the Engineer's representatives for such sampling, testing, inspecting and monitoring. The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way relieve the Contractor of responsibility to produce aggregates that meet the specifications in all respects.

#### **5.1.3.3 Pit Operations**

- a) General  
All reject and screening materials produced in a Department Supply Source designated in the Contract shall be stockpiled in a neat and regular form separate from the crushed aggregate stockpiles. All such materials are the property of the Department and the Contractor shall have no claim to the materials.
- b) Department Supply Sources  
The area from which gravel material is to be obtained shall be as shown on the plans or as designated by the Engineer.

Clearing of material source areas, haul road(s) and stockpile site(s) shall be carried out in accordance with "Clearing" (Division 3, Section 1).

Grubbing of material source areas, haul road(s) and stockpile site(s) shall be carried out in accordance with "Grubbing" (Division 3, Section 2).

Excavation and disposal of material overlaying the gravel source, excavation of the granular material and the construction of haul roads and stockpile sites shall be carried out in accordance with "Borrow Excavation" (Division 3, Section 4).

Excavation and disposal of material overlaying the rock source, drilling, blasting and excavation of rock material shall be carried out in accordance with "Roadway Excavation" (Division 3, Section 3).

The Contractor shall open a sufficient area ahead of the quarrying or excavating operation to positively prevent contamination of aggregate by deleterious materials.

Crushing, blending, screening and loading shall be performed by such methods that a uniform grade of material will be delivered to the stockpile site. In the event of an excessive fines content developing in a deposit of gravel, the Contractor shall provide screening equipment for the removal of fines in excess of that specified.

The Contractor may be required to obtain blending materials from sources other than the pit/quarry site in order to achieve the specified crushed aggregate limits.

The excavation of aggregate shall extend to the full depth of the deposit and shall advance uniformly to obtain maximum yield from the deposit. Under no circumstances will the waste of useable material be permitted.

All material up to and including 600 mm in diameter in Department Supply Sources identified in the Contract shall be crushed.

All material encountered in the gravel pit or stockpile suitable for the production of the gravel specified shall be used.

Plastic soils or other deleterious material encountered in the pit or stockpile shall be eliminated prior to processing the material through the crusher.

All aspects of clearing, grubbing, stripping, removal of overburden, pit management and clean-up shall be carried out in accordance with the provisions of the Northwest Territories Lands Act.

c) Contractor Supply Sources

All aspects of clearing, grubbing, stripping, removal of overburden, pit management and clean-up shall be the responsibility of the Contractor.

**5.1.3.4 Aggregate Production**

a) General

The Contractor shall produce aggregates conforming to the specifications for the Designations and Classes called for in the Contract.

The Contractor shall notify the Engineer a minimum of two days in advance of the start of aggregate production to allow the visual inspection of the process and testing of the production as deemed necessary by the Engineer. This inspection and testing will not relieve the Contractor of responsibility to produce aggregate materials that meet all specification requirements.

Any recombining of aggregates or addition of blend materials shall be carried out such that a uniform mix of the various sizes is obtained.

Unless otherwise specified, the Contractor shall ensure that manufactured fines are retained in the crushed aggregate stockpile.

b) Production of Aggregates

The Contractor shall split aggregates for all aggregates into coarse and fine fractions prior to crushing the coarse fraction. The crushed coarse and fine fractions shall be stockpiled separately.

The Contractor shall set the screen size at which splitting will take place. Splitting of aggregates shall be controlled such that the coarse aggregate fraction, before crushing, shall contain no more than 5% passing the 5000-micron sieve.

The fine fraction shall contain no more than 20% of material retained on the 5000-micron sieve.

Further splitting of the crushed coarse aggregate into separate stockpiles may be carried out at the Contractor's option. No additional payment will be made for this work.

The combined aggregate fractions shall meet the requirements in the tables below for the Designations and Classes called for in the Contract.

## i) Designation: Embankment Rock Fill

Parameter	Sieve Size (micron)	Class: 150 mm	Class: 200 mm	Class: 300 mm
Sieve Analysis (Percent Passing)	400 000			
	300 000			100
	200 000		100	50 - 80
	150 000	100	50 - 80	
	125 000		0	0
	100 000	50 - 97		
	80 000			
	50 000	20 - 90		
	37 500			
	25 000			
	20 000	0 - 60		
	16 000			
	12 500			
	10 000	0 - 30		
	5 000	0 - 10		
	2 500			
	2 000			
	1 000			
	1 250			
	800			
	630			
	400			
	315			
	160			
80				
45				
% Fractures by Weight (2 Faces)		N/A	N/A	N/A
Plasticity Index (PI)		N/A	N/A	N/A
LA. Abrasion Loss (Percent Maximum)		50	50	50
Flakiness Index		N/A	N/A	N/A
Coefficient of Uniformity (C <sub>u</sub> )		N/A	N/A	N/A

ii) Designation: Granular Base Course

Parameter	Sieve Size (micron)	Class: 12.5 mm	Class: 16.0 mm	Class: 19.0 mm	Class: 20.0 mm
	125 000				
	80 000				
	63 000				
	50 000				
	40 000				
	25 000				
	20 000			100	100
	16 000		100	97 - 100	
	12 500	100	75 - 95	70 - 95	
	10 000	75 - 90	55 - 80	45 - 80	63 - 86
	6 300		22-45		
	5 000	50 - 70	35-55	25 - 50	40 - 67
	2 500	35 - 50	16-26		
	2 000	-	-	13 - 45	
	1 600	-	-		
	1 250	25 - 40	15 - 40		20 - 43
	800	-	-	10 - 37	
	630	20 - 30	13 - 20		14 - 34
	400	-	-	7 - 32	
	315	14 - 23	5 - 22		9 - 26
	160	7 - 14	10 - 16	6 - 18	5 - 18
	80	4 - 8	9-13	5 - 15	2 - 10
	45	-	-		
% Fractures by Weight (2 Faces)		90 (min)	75 (min)	50 (min)	60 (min)
Plasticity Index (PI)		0	4 (max)	NP-8	4 (max)
LA. Abrasion Loss (Percent Maximum)		32	50	N/A	50
Flakiness Index		N/A	N/A	N/A	N/A
Coefficient of Uniformity (C <sub>u</sub> )		N/A	N/A	N/A	N/A



## iii) Designation: Granular Subbase

Parameter	Sieve Size (micron)	Class: 40 mm	Class: 50 mm	Class: 76 mm	Class: 80 mm	Class: 100 mm
	100 000					100
	80 000			100	100	
	63 000					
	50 000		100	80 - 100	55 - 100	80 - 100
	37 500	100	87 - 100			
	25 000			60 - 100	38 - 100	60 - 100
	20 000	65-100	60 - 95			
	16 000				32 - 85	
	12 500	55 - 95	46 - 80	45 - 100		45 - 100
	10 000					
	5 000	30-- 65	35 - 60	25 - 100	20 - 65	25 - 100
	2 500					
	2 000	20 - 50	25 - 45	15 - 100		15 - 100
	1 600					
	1 250					
	800					
	630					
	400	7 - 35	10 - 20	5 - 95		5 - 95
	315				6 - 30	
	160	6 - 20		3 - 65		3 - 65
	80	2 - 12	2 - 12	2 - 12	2 - 12	3 - 12
	45					
% Fractures by Weight (2 Faces)		50 (min)	50 (min)	50 (min)	NA	NA
Plasticity Index (PI)		6 (max)	6 (max)	6 (max)	6 (max)	6 (max)
LA. Abrasion Loss (Percent Maximum)		50	50	50	50	50
Flakiness Index		N/A	N/A	N/A	N/A	N/A
Coefficient of Uniformity (C <sub>u</sub> )		N/A	N/A	N/A	N/A	N/A

iv) Designation: Chip Seal – Seal Coat

Parameter	Sieve Size (micron)	Class: 12.5 mm	Class: 16.0 mm
	125 000		
	80 000		
	63 000		
	50 000		
	40 000		
	25 000		
	20 000		
	16 000		100
	12 500	100	55 - 92
	10 000		18 - 80
	5 000	0 - 60	7 - 30
	2 500		
	2 000	0 - 50	0 - 20
	1 600		
	1 250		
	800		
	630		
	400	0 - 15	
	315		
	160		
	80	0 - 4	0 - 4
	45		
% Fractures by Weight (2 Faces)		60 (min)	60 (min)
Plasticity Index (PI)		4 (max)	4 (max)
LA. Abrasion Loss (Percent Maximum)		30	30
Flakiness Index		N/A	N/A
Coefficient of Uniformity (C <sub>u</sub> )		N/A	N/A

v) Designation: Spray Patch Repair

Parameter	Sieve Size (micron)	Class: 12.5 mm
Sieve Analysis (Percent Passing)	125 000	
	80 000	
	63 000	
	50 000	
	40 000	
	25 000	
	20 000	
	16 000	
	12 500	100
	10 000	90 - 100
	5 000	20 - 100
	2 500	5 - 30
	2 000	
	1 600	
	1 250	0 - 10
	800	
	630	
	400	
	315	
	160	
80		
45		
% Fractures by Weight (2 Faces)		60 (min)
Plasticity Index (PI)		0
LA. Abrasion Loss (Percent Maximum)		32
Flakiness Index		N/A
Coefficient of Uniformity (C <sub>u</sub> )		N/A

c) Production and Addition of Blend Sand

When the aggregate being produced is destined for further processing through a mixing plant, the addition of any required blend sand, natural or manufactured, shall take place at the mixing plant.

All blend sand shall be screened before being incorporated into the mix to remove oversize material, clay lumps, roots and other deleterious materials. All blend sand so screened shall pass the 5000-micron sieve.

Blend sand shall be dried if necessary, to provide a uniform feed.

Manufactured blend sand is defined as material passing the 5000-micron sieve, which is produced by crushing.

All other aggregates requiring the addition of blend sand to meet the specified gradation shall be adjusted at the crushing stage by means of a separate conveyor or other approved device capable of

metering the sand at a specified uniform rate. The blend sand shall be added prior to or onto the crusher screen deck.

#### **5.1.3.5 Stockpiling**

Before gravel can be placed in stockpile(s), approval must be received from the Engineer. When aggregate stockpiles are specified or used as part of construction operations, the following will apply:

- a) When stockpiling is specified in the Contract, the stockpile sites shall be located as indicated on the plans or as designated by the Engineer.
- b) If, in order to expedite the operation, the Contractor constructs temporary stockpiles at sites other than that designated by the Engineer, the Contractor shall arrange for such sites and shall be responsible for them in all respects, including all costs for clearing, grubbing, stripping, removal of overburden and other site preparation and reclamation. The Contractor shall also be responsible for obtaining the necessary approvals and clearances for such sites in accordance with the provisions of the Northwest Territories Lands Act.

Stockpiles shall not be constructed at locations or by methods that will interfere with or damage any utility lines, such as power lines, telephone lines, pipelines and underground utilities.

Stockpile site(s) shall be approved and/or designated by the Engineer and shall be cleared, grubbed and stripped to the necessary dimensions. Grubbing, stripping and overburden material shall be excavated to their full depth and disposed of separately.

Stockpile sites shall be firm, level and free of all deleterious material and shall be shaped to a uniform smooth surface and graded to ensure positive drainage.

Stockpiles shall be constructed by first distributing material uniformly over the entire base and building upwards in successive layers not exceeding 1 m in depth.

Construction operations shall be controlled to prevent segregation of the various particle sizes. The crushed aggregate or pit-run material shall not be pushed or dumped over the edges or down the faces of stockpiles.

Radial Telescopic Conveyor/Super Stacker will be permitted for stockpiling 80 mm, 50 mm and 20 mm crushed granular materials except 16 mm and 12.5 mm Surface Treatment Aggregates. Crushed Surface Treatment Aggregate (16 mm and 12.5 mm) shall be stockpiled by spilling aggregate into truck box and stockpiled in a series of piles and layers. The height of the conveyor should be as low as possible to minimize segregation and that layer should be evenly distributed. For blend sand, newly processed material shall be blended into the stockpile.

Completed stockpiles shall be neat and regular in form and shall be constructed to occupy the smallest feasible area taking into consideration the bearing capacity of the foundation soils and the requirements of the Safety Act and the Mine Health and Safety Act.

If different types, Designations or Classes of materials are to be stockpiled, the stockpiles shall be located and constructed such that no intermixing of materials will occur.

Any surplus crushed aggregates produced in a Department Supply Source designated in the Contract shall be stockpiled in a neat and regular form separate from the crushed aggregate stockpiles.

**5.1.3.6 Surplus Crushed Aggregates**

Surplus crushed aggregates are aggregates that have been produced in a Department Supply Source designated in the Contract, which remain in stockpile after the completion of the Contract. All such aggregates are the property of the Department and the Contractor shall have no claim to the aggregates.

**5.1.4 MEASUREMENT AND PAYMENT****5.1.4.1 General****a) Professional Engineering Services**

The Contractor shall retain and utilize professional engineering service provided by an Engineering Firm registered in the Northwest Territories to carry out all quantity control and quantity measurements.

- i) Surveys – General Requirement
- ii) Stockpile bases shall be surveyed prior to stockpiling of produced aggregates.
  - Surveyed perimeter points: 5 metre intervals on tangents and cross-section
- iii) Stockpiles shall be surveyed for measurement for payment upon completion of production of the defined aggregate type.
  - Surveyed perimeter points: 5 metre intervals on tangents and 3 metre intervals at rounded corners.
  - Surveyed interior grid points: 5 metre intervals with additional points gathered at significant grade changes along the top plateau.
  - Unlevelled dumps on the top of the stockpile shall be ignored.
- iv) Sufficient surveyed points shall be gathered over the full extent of the pile to clearly define the shape inclusive of irregular features such as loading ramps, secondary ridges that may be formed at levels between the base and the top of the stockpile and any undulations that may, if not defined, skew the true value of the volume quantity.
- v) A minimum of three control/reference stations shall be established for each stockpile site. Survey reference points shall be clearly visible with an identity marker in the field. The Northing, Easting and Elevation coordinates shall be made available for use by the Engineer where quantity assurance is required.

**b) Volume Determinations**

The Contractor shall choose the "Average End Area Method" or the "Prismoidal Method" to determine quantities for payment. The following conditions will apply:

- i) For "Average End Area Method": The volume determined for quantity payment shall be accompanied with proof of computation as follows:
  - Plan of survey of the stockpile showing a theoretic or physical baseline (horizontal alignment) to which the cross-sections refer by station and offset, the stockpile and base outlines and contour lines at 0.5 metre interval, the type of aggregate produced and the determined volume quantity.
  - Generated cross-section plots at 10 metre interval stations that show the area of the section and accumulated volume. Additional stations at 3 to 5 metre intervals must be generated to clearly define the beginning and the ending toe of slope for the stockpile.
  - The start station value for each stockpile baseline shall be 0+000 and shall fall on the stockpile

base and before the toe of slope of the stockpile to be measured.

- The end station shall fall on the stockpile base and beyond the toe of slope of the stockpile at its opposite end.

Or,

- ii) For “Prismoidal Method”, the volume determined for quantity payment shall be accompanied with proof of computation as follows:
  - Plan of survey of the stockpile showing the stockpile and base outlines and contour lines at 0.5 metre interval, the type of aggregate produced and the determined volume quantity.
- iii) In addition to the above, the Contractor shall submit the following to the Engineer when making claim for payment.
  - The survey data files for each survey (two per stockpile) in electronic ASCII text file on standard USB in the format Point Number, Northing, Easting, Elevation, Description. Files shall be names in accordance with the survey they are related to. (Example: 20 mmBaseDDMMYYYY.txt) or 20 mm StkDDMMYYYY.txt)
- iv) Any Crushed Aggregates deposited outside of the stockpile base areas shall not be measured for payment.
- v) The stockpile base shall be constructed with 0.3 metres of the specified crushed aggregate. This material will not be included in the measurement for payment and will be considered incidental to the work.

c) Payment

Payment for all items will be at the unit price per cubic metre as specified in the Unit Price Table. The total amount eligible for payment will be the actual total quantity of crushed aggregate produced minus the stockpile base.

i) Unit Price Bid

The unit price bid as given in the Unit Price Table shall be full compensation for all equipment, mobilization, demobilization, signing, clearing, grubbing, removal of overburden, stockpiling of overburden, salvaging and stockpiling of merchantable timber, drilling, blasting, producing and stockpiling of the aggregates, relocation of previous stockpiles to make room for new stockpiles, access road construction (if applicable), labour, accommodations and board, quality and quantity control, site clean-up, tools, rentals, fuel, maintenance, repairs, insurance, licensing, taxes, and any other associated costs necessary, to complete the production of aggregates in accordance with the specifications.

- ii) Unless otherwise specified, the production of aggregates, including the processing or production, hauling and addition of blend sand and any other aggregate gradation adjustments and modifications will not be paid for separately. The cost of this work will be considered included in the unit price of the Contract item for which the aggregates are being produced.
- iii) Payment for Production and Stockpiling of Crushed Aggregate shall be at the Contract unit price per tonne or cubic metre. Payment will not be made for the quantity of any aggregate in excess of unit price table estimates, unless otherwise authorized by the Engineer in writing.
- iv) The Contractor shall be responsible for the cost of all quality control and quality control testing and for the cost of the engineering consulting company and consulting services that it retains.
- v) The applicable unit price shall include all work required to comply with the provisions of the

*Northwest Territories Lands Act.*

- vi) The haul of material from the deposit or stockpile to the crusher and from the crusher to the stockpile will not be measured separately for payment and shall be considered incidental to the crushing operation.
- vii) Clearing, grubbing, stripping and the removal of overburden at the source and for the upgrading or construction of haul roads will not be measured separately for payment and shall be considered incidental to the crushing operation.
- viii) The upgrading or construction, and maintenance and dust control, of haul roads will not be measured separately for payment and shall be considered incidental to the crushing operation.
- ix) The quantity of blending material required to meet the specified crushed aggregate gradation will not be measured separately for payment and shall be considered incidental to the crushing operation.
- x) Aggregate crushing and breaking of oversize materials and sloping of the quarry walls to 2:1 and staging will not be measured separately and shall be considered incidental to the crushing operation.

**5.1.4.2 Department Supply Sources**

Unless otherwise specified, the aggregate in Department Supply Sources will be supplied to the Contractor free of cost.

**5.1.4.3 Surplus Crushed Aggregates**

No payment will be made for any quantity of crushed aggregate produced in a Department Supply Source designated in the Contract, which is in excess of the tendered quantity required for the completion of the Contract item for which the aggregates are being produced, unless otherwise approved by the Engineer in writing. All surplus aggregates are the property of the Department at no additional cost to the Department and the Contractor shall have no claim to the aggregates.

**5.1.4.4 Contractor Supply Sources**

The cost of obtaining all permits, licenses, approvals and rights to use a source and the exploration, development and reclamation of the source shall be the responsibility of the Contractor. These costs will not be measured separately for payment and shall be considered incidental to the crushing operation.

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## 5.2 SECTION 2 – GRANULAR BASE AND SUBBASE COURSE CONSTRUCTION

### 5.2.1 DESCRIPTION

This work consists of the construction of granular base course and granular subbase course placed in layers upon a prepared surface and compacted and finished in accordance with these specifications to the lines, grades and cross-sections shown on the plans or as designated by the Engineer.

### 5.2.2 MATERIALS

#### 5.2.2.1 **Aggregate**

Unless otherwise specified, the Contractor shall produce crushed aggregate in accordance with "Crushed Aggregate Production" (Division 5, Section 1) for the Designation and Class of materials specified.

#### 5.2.2.2 **Water**

The Contractor shall, at its own expense, supply and haul all water required for the construction and maintenance of the work. Water shall only be extracted from pre-designated sources complying all permits conditions and Acts.

The water shall be free from substances which render it unfit for use.

### 5.2.3 CONSTRUCTION

#### 5.2.3.1 **General**

- a) Granular base/subbase course material shall be composed of sound, hard and durable particles of sand and/or gravel and/or rock and shall be free from elongated particles, injurious quantities of flaky particles, soft shales, organic matter, boulders, oversize material, clay lumps, deleterious material, and other foreign matter.
- b) The road surface shall be smooth, uniform, true to the specified lines, grades and cross- sections, free of ponded water/ice/snow, and to the required density prior to the application of granular base/subbase course.
- c) Granular base/subbase course shall be placed on the prepared roadway surface to the lines, grades and cross-sections and to the depth(s) or within the limits of the application rate range(s) as specified on the Contract Drawings.  
The Contractor is responsible for monitoring the accurate placement and spreading of the granular materials and ensuring that they are placed to the depth(s) or within the limits of the application rate range(s), as specified. There will be no payment for any granular materials placed in excess of the depth(s) or application rate range(s) as specified, without the prior approval of the Engineer.
- d) The granular base/subbase shall be dumped, windrowed and spread uniformly on the roadbed surface without segregation.
- e) The Contractor shall maintain completed granular base/subbase course to the specified lines, grades and cross-sections and to the required density until the application of subsequent material thereon or until the work is accepted by the Engineer.

#### 5.2.3.2 **Quality Control and Quality Control Testing**

##### a) General

Quality control and quality control testing are the responsibility of the Contractor throughout every stage of the work, from the crushing and production of aggregates to the final accepted product.

Tests performed by the Department will not be considered to be quality control tests.

The Contractor shall provide, pay for and maintain equipment and qualified personnel to carry out all field testing necessary to determine and monitor the characteristics of the materials produced and incorporated into the work and the final product produced.

Prior to commencement of the work, the Contractor shall provide the Engineer with a program and schedule of testing for quality control and shall demonstrate to the satisfaction of the Engineer that the program and schedule are adequate to provide reliable quality control within the limits specified.

The Contractor shall retain and utilize Professional Engineering Services provided by a registered Professional Engineer or a Professional Geologist to carry out all quality control and quality control testing. The Professional Engineer or the Professional Geologist shall be licensed to operate in the Northwest Territories and shall be registered to practice in the NWT.

The Contractor shall not retain or utilize the same Professional Engineer or a Professional Geologist or personnel retained by the Department with respect to the Contract, for any work on or associated with the Contract.

All quality control tests, and test results shall be calculated, recorded and submitted to the Engineer on industry standard worksheets. The tests and test results shall be certified for correctness by the Professional Engineer, or the Professional Geologist employed by the Contractor to perform the tests and shall be signed by the Contractor's representative.

Original copies of all worksheets, including calculations, shall be submitted to the Engineer daily. All worksheets shall be reviewed and certified for correctness by the Professional Engineer, or the Professional Geologist employed by the Contractor to perform the tests, on a minimum weekly basis.

The Contractor shall interpret quality control test results and alter its operation if necessary, so that the product meets all required specifications.

In any section or segment of road work no compaction work shall be carried on any materials and no materials shall be placed on surface when weather forecasts on Environment Canada's website at <https://weather.gc.ca/> for the subsequent 24 hours is projected to be equal to or below freezing, i.e. 0°C, for the project locality or nearest surrounding community.

b) Compaction Testing Requirements

The Contractor's quality control and quality control testing program shall include the carrying out of all compaction density and moisture testing required for the construction of granular subbase and base course in accordance with the specifications.

The Contractor shall carry out compaction testing using nuclear equipment, two tests per 40 m along the roadway randomly; one on left and one on right side of centreline for the subbase and base courses construction and as directed by Engineer. The Contractor shall apply water as necessary during compacting to obtain specified density.

Each layer of material shall be compacted to the specified density and results shall be submitted to the Engineer before the next layer is placed for verification of compliance with the specifications.

i) Compaction of base course and subbase course:

The Contractor shall apply compaction effort sufficient to achieve a uniform density not less than 100% of maximum density at optimum moisture content.

The Contractor shall establish the maximum density at the optimum moisture content in accordance with the latest edition of ASTM D698, for each Classification and Designation of material incorporated into the work. Original copies of all worksheets and laboratory test results shall be submitted to the Engineer prior to the commencement of chipsealing operations.

c) Quality Acceptance

Within this specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, limits and tolerances may be measured and the work accepted or rejected based on Department quality assurance test results.

The Engineer and Engineer's representatives reserve the right to sample, test, inspect and monitor the quality of material being utilized and incorporated into the work by the Contractor at any time and as often as they deem necessary. The Contractor shall cooperate with the Engineer and their representatives for such sampling, testing, inspecting and monitoring. The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way relieve the Contractor of responsibility to construct granular base/subbase courses that meet the specifications in all respects.

The Contractor shall provide, at the Contractor's own expense, such stands, sampling devices and other facilities as the Engineer may require to safely obtain representative samples of the materials being utilized and incorporated into the work.

The materials testing laboratory provided by the Professional Engineer or the Professional Geologist utilized by the Department to carry out quality assurance testing will not be located at the project site. Quality assurance test results will therefore not be completed for approximately 10 days from the date of sampling.

**5.2.3.3 Survey, Layout, Staking and Grading Requirements**

a) The Contractor shall provide and pay for qualified personnel to carry out all surveying, layout, staking, grading and referencing required for the establishment of centerline, and the accurate placement and control of granular base/subbase course operations.

b) The Contractor shall place shoulder stakes prior to the application of granular base/subbase course to ensure the placement of the materials to the limits indicated on the Contract Drawings. Materials placed outside of these limits shall be recovered and placed within the specified limits at the Contractor's expense.

If, in the opinion of the Engineer, material placed outside of the specified limits cannot be satisfactorily recovered, the Engineer will estimate the quantity of such material and no payment will be made for this quantity.

c) Following the completion of the granular base/subbase course, and prior to the application of subsequent material thereon, the Contractor shall utilize an in-place balance grading method to ensure that the granular base/subbase course is placed to the lines, grades and cross-sections indicated on the Contract Drawings. The in-place balance grading method shall include the surveying, staking and setting of grades every 20 m along the roadway.

The Contractor shall blade and shape the granular base/subbase course such that the finished surface

is smooth, uniform, true to grade and cross-section and suitable for the application of subsequent material thereon.

The finished subbase course surface and base course surface shall not deviate more than 30 millimeters from the specified grade and cross section. The tolerance for the cross fall will be +/- 0.3% (upper limit 3.3% & lower limit 2.7%).

- d) The Contractor shall prepare as-built info for every 20 metres along the roadway for the completed subbase and base course and send to the Engineer for verification prior to the application of subsequent material thereon. Production and supply of as built data for subbase and base courses will be incidental to construction of base and subbase courses.

#### 5.2.3.4 Establishing the Control Density

a) General

- i) The control density is the maximum dry density attained on a lift of granular base/subbase course using the equipment and method of compaction prescribed herein for construction of a control strip.
- ii) For establishing the Control Density, a control strip method may be authorized by the Engineer, otherwise the Contractor shall carry out compaction testing using nuclear densometer in accordance with AASHTO T310, with one test performed for every 20 linear meters, for each lift randomly left and right of centerline. The Contractor shall apply compaction effort sufficient to achieve a uniform density not less than 100% of maximum dry density at optimum moisture content to compact the base course and subbase course materials.
- iii) A control strip is a compacted lift of granular base/subbase course constructed on a 400 m section of prepared surface selected by the Engineer.
- iv) The lift thickness of a granular base/subbase course shall be determined by the Contractor but shall not exceed 150 mm. The total design granular base/subbase course thickness may require that more than 1 lift be constructed, in which case each subsequent lift will also require a control strip to determine a control density for that lift.
- v) Aggregate for construction of a control strip shall be spread by means of a motor grader.
- vi) To determine the control density, moisture and density readings shall be taken by the Contractor, using nuclear equipment, during the compaction process until a maximum dry density is reached.
- vii) A new control strip, with its corresponding control density, is required for each lift and for a change in Designation or Class or source of aggregate or when called for by the Engineer.
- viii) The control strip moisture content shall be adjusted as required during spreading of the aggregate. The surface of the granular base/subbase course shall be kept moist until testing is completed.
- ix) Control strips shall not be constructed during freezing ambient temperatures, with frozen aggregate, or on frozen subgrade.

b) Control Strip Minimum Compaction Equipment

The control strip shall be compacted using the following equipment:

- i) Two vibratory steel rollers weighing not less than 10 tonnes and having a vibratory capacity of at least 1,500 vpm with a minimum dynamic or centrifugal force of 8,000 kg, operated in vibratory mode, and at a speed not exceeding 8 km/h; plus one of the following:
  - Six wobbly tired rollers with tires inflated to a pressure of 200 kPa, plus or minus 35 kPa, ballasted with at least a level load of gravel, and towed at speed not exceeding 8 km/h; or
  - Two self-propelled pneumatic rollers, each ballasted to its maximum capacity, weighing not less than 10 tonnes, having a minimum tire pressure of 400 kPa plus or minus 35 kPa, and

traveling at a speed not exceeding 8 km/h; or

- A combination of four wobbly tired rollers and one self-propelled pneumatic roller each of which meets the requirements described above.

c) Control Strip Method of Compaction

- i) A Pass is one complete coverage of the Control strip with at least the minimum compaction equipment specified herein.

As portions of the lift are being spread, the aggregate shall be compacted such that when the entire lift has been spread, a minimum of four complete passes with the specified compaction equipment shall have been made over the Control Strip area.

- ii) Once the aggregate for the Control Strip lift has been completely spread, the measurements for the Control Density shall commence and continue during repeated passes of the specified compaction equipment until a maximum dry density is achieved. This maximum dry density will be the Control Density for subsequent granular base/subbase course construction for the same lift and thickness of the same material. The surface of the granular base/subbase course shall be kept moist until testing is completed.

- iii) If vibratory compaction causes a loss of density during granular base/subbase course construction, vibratory compactors shall operate in the static mode supplemented with the specified pneumatic rollers.

When pneumatic self-propelled or wobbly type rollers are used for compaction the pneumatic self-propelled or wobbly type rollers shall lead the steel vibratory compactor.

**5.2.3.5 General Construction of Granular Base and Subbase Course Using the Control Density**

- a) Once the Control Density has been established, the Contractor may choose its own combination of compaction equipment.
- b) The granular materials shall be uniformly placed at the same lift thickness as the corresponding Control Strip lift thickness.
- c) Each lift of granular base/subbase course shall be constructed true to grade and cross-section and the finished surface shall be smooth and free of loose material.
- d) Each lift of base course and sub-base course shall be compacted to at least 100% and of the applicable Control Density, at the optimum moisture content established by the Contractor in accordance ASTM D698. The Contractor shall carry out compaction testing using nuclear densometer with one test performed for every 20 linear meters, for each lift randomly left and right of centerline.
- e) Water shall not be added in such quantities that it seeps into the underlying subgrade.
- f) As specified for Control Strip construction, the surface of the granular base/subbase course shall be kept moist until testing is completed.
- g) Materials shall be handled such that segregation of the coarser and finer fractions does not occur and the Contractor shall take all necessary precautions to prevent aggregate segregation. Any segregation shall be corrected by reblending or replacement with new material, at the Contractor's expense.
- h) Granular base/subbase course shall not be spread on frozen subgrade and compaction shall be completed before freezing.
- i) The Contractor shall, at its own expense, repair and/or restore to the specified condition any subgrade or granular material layer which fails, loses specified density or becomes too wet or too dry, or becomes rutted, distorted, loose or rough prior to the placement of subsequent material thereon.

**5.2.3.6 Slopes and Ditches**

Slopes shall be neatly trimmed and loose or waste material from the sideslopes shall be either neatly bladed against the edge of the granular layer or spread neatly over the sideslope and ditches as directed by the Engineer.

**5.2.3.7 Construction Equipment**

The completed granular base/subbase course shall be sound and stable and shall not exhibit deflection or consolidation, as determined by the Engineer, under construction equipment loading.

The Contractor shall be responsible for any damage to the existing embankment, design embankment, granular base course or subbase course caused by construction equipment or activities. There will be no compensation for any delays in productivity resulting from such damage or for its repair.

**5.2.4 MAINTENANCE OF WORK AND DUST CONTROL**

Maintenance and dust control of the entire roadway shall be carried out in accordance with "Execution of Work, Maintenance of Work and Dust Control During Construction" (Division 2, Section 4).

**5.2.5 MEASUREMENT**

- a) The Contractor shall, at its own expense, provide, install and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to accurately determine the mass of Granular Base Course/Granular Subbase Course loaded in each haul vehicle. Such scales shall be in acceptable condition and will be tested from time to time by the Engineer.
- b) The quantity of Granular Base Course/Granular Subbase Course to be measured for payment will be the number of tonnes or cubic meters of material acceptably placed on the road in accordance with these specifications.
- c) Unless otherwise specified, the haul of granular base course/granular subbase course will not be measured separately for payment and shall be considered incidental to the granular base course/subbase course operation.
- d) Preparation of the roadbed surface, including scarifying and blading, and the maintenance, repair and restoration of haul roads, will not be measured separately for payment and shall be considered incidental to the granular base course/granular subbase course operation.
- e) Water, if required for construction or maintenance of the work, will not be measured separately for payment and shall be considered incidental to the granular base course/granular subbase course operation.

**5.2.6 BASIS OF PAYMENT**

- a) Payment for Granular Base Course and Granular Subbase Course will be at the Contract unit price per tonne or cubic meter.

The unit price shall be compensation in full for preparation of the roadbed surface, excavating, loading, hauling, dumping, windrowing, spreading, mixing, blading, shaping and compacting the material, construction of Control Strips, the supply and application of water, drying as required, surveying, layout, staking, balance grading, setting grades, referencing, quality control and quality control testing, reporting and certification, upgrading or construction of haul roads, trimming and grading of slopes, ditches and surfaces in the gravel source areas and haul roads, maintenance and dust control of the work and haul roads, traffic control and accommodation and the supply of all equipment, labour, tools and incidentals necessary to complete the work in accordance with the specifications.



Unless otherwise specified, the unit price shall also be compensation in full for the production of crushed aggregate in accordance with "Crushed Aggregate Production" (Division 5, Section 1), for the Designation and Class of materials specified.

- b) Unless otherwise specified, the unit price shall also be compensation in full for the hauling of granular base course/granular subbase course in accordance with "Hauling" (Division 5, Section 3).

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### 5.3 SECTION 3 – HAULING

#### 5.3.1 DESCRIPTION

This specification applies to the hauling of all granular materials, including blend sand, and the hauling of all mixtures of granular material with asphalt cement as shown on the plans or as designated by the Engineer. This specification covers the following:

- a) The administration of haul roads from both Department Supply Sources and Contractor Supply Sources of granular materials,
- b) Hauling granular materials and mixtures of granular material with asphalt cement Tendered Bid by unit weight or volume, and
- c) Hauling granular materials and mixtures of granular material with asphalt cement bid with haul included in the Contract item for which the granular material has been produced or is required.

#### 5.3.2 DEFINITIONS

For the purpose of this specification, the following definitions will apply:

##### 5.3.2.1 **Hauling**

The process of transporting material from its point of loading to its designated delivery point.

##### 5.3.2.2 **Haul Road**

The route over which materials are hauled for the performance of the Contract and can be either: (a) an approved route from a Department Supply Source, or (b) a Contractor selected route from a Contractor Supply Source.

##### 5.3.2.3 **Dead Haul Road**

The section of the route over which materials are hauled for the performance of the Contract, between the highway or roadway and the loading location.

##### 5.3.2.4 **Loading**

The process of filling a truck at the Department Supply Source or the Contractor Supply Source.

##### 5.3.2.5 **Weighing**

The process of using a calibrated scale to determine the weight of a loaded truck at the Department Supply Source or the Contractor Supply Source prior to traveling on the Haul Road.

##### 5.3.2.6 **Unloading**

The process on emptying the filled truck at the delivery point after it has travelled along the haul road.

#### 5.3.3 MATERIALS

##### 5.3.3.1 **Department Supply Sources**

Unless otherwise specified, material from deposits designated by the Department will be made available to the Contractor for the upgrading or construction of dead haul roads free of cost.

The Contractor shall supply, apply and pay for all water used on haul roads for whatever purpose, including maintenance and dust control.

##### 5.3.3.2 **Contractor Supply Sources**

The Contractor shall supply, apply and pay for all materials required for the upgrading, construction, drainage, maintenance and dust control and restoration of haul roads from Contractor Supply Sources.

#### 5.3.4 CONSTRUCTION

##### 5.3.4.1 **General**

Haul vehicles shall comply with all applicable Northwest Territories Acts and Regulations. Haul vehicles shall be registered by the Contractor and bear a project registration number.

Weight certificates will not be issued to overloaded vehicles and there will be no loading tolerance in excess of the allowable GVW limit.

There will be no loading tolerance in excess of the allowable GVW limit for any vehicles or construction equipment which haul over existing or newly constructed granular or asphalt subbase, base or surface courses.

For vehicles hauling on a cubic metre basis, the approved capacity will be the struck measure of the truck box to the nearest zero point one cubic metres (0.1 m<sup>3</sup>), as calculated by the Engineer.

The Engineer may direct that hauling operations will not be permitted if excessive damage to highways or public roads will occur or when hauling operations cause serious hazards or difficulties to the travelling public. The conditions when this may occur will generally be:

- a) When spring thaw is taking place,
- b) During or after heavy rainfall,
- c) During periods of exceptionally heavy traffic.

The Contractor shall abide by all load restrictions and allowable GVW limits established by the road or bridge authority having jurisdiction.

The Contractor shall repair any damage to public roads caused by its hauling operations.

##### 5.3.4.2 **Haul from Department Supply Sources**

###### a) General

The Department will not consider claims because of conditions imposed by local road authorities.

Approaches required for access to deposits, pits or stockpiles shall be constructed and, if required by the Engineer, removed at no direct expense to the Department.

If clearing is required on specified access or haul road routes, the work shall be carried out in accordance with "Clearing" (Division 3, Section 1) but such activities shall be incidental to hauling and at no cost to the Department.

If grubbing is required on specified access or haul road routes, the work shall be carried out in accordance with "Grubbing" (Division 3, Section 2) but such activities shall be incidental to hauling and at no cost to the Department.

Unless otherwise specified, where the construction of dead haul roads is required, the dead haul road shall be constructed by the Contractor in a manner and at a location as approved by the Engineer, and if required the Contractor may have to remove back access road to original state of ground at no cost to the Department.

###### b) Maintenance During Haul

Maintenance and dust control of haul roads shall be carried out in accordance with "Execution of Work,

Maintenance of Work and Dust Control During Construction" (Division 2, Section 3).

Existing drainage or drainage constructed during haul road upgrading or construction shall be maintained by the Contractor throughout the hauling operations.

The maintenance and repair of paved haul roads shall be carried out by the Contractor where and as directed by the Engineer, utilizing materials specified by the Engineer.

c) Restoration of Haul Roads

Upon the completion of hauling operations, haul roads shall be restored by the Contractor to a condition equivalent to or exceeding the condition of the road prior to the commencement of hauling operations. Contractor shall take detailed inventory of existing haul road condition survey before commencement of hauling and submit those to the Engineer as record. The Engineer will be the final authority in assessing the restoration required. Hauling shall be considered incidental to Work and will not be measured separately for payment.

**5.3.4.3 Haul from Contractor Supply Sources**

a) General

The Contractor shall specify in its bid submission the designated supplier of all granular materials and the name and location of its proposed granular material sources and haul routes.

The Contractor shall be responsible for obtaining authority to haul over the proposed haul routes from the agency having jurisdiction. The use of Territorially owned or controlled highways and roads as haul routes is subject to prior approval from the Department.

The Contractor shall upgrade, construct, carry out maintenance and dust control and restore roads used as haul roads to the satisfaction of the agency having jurisdiction, and in the case of Territorially owned or controlled highways and roads, to the satisfaction of the Engineer.

The Contractor shall be responsible for the upgrading, construction and restoration of public and private roads required for its hauling operations. All costs incurred for such work shall be the responsibility of the Contractor.

b) Maintenance During Haul

Where the use of Territorially owned or controlled highways and roads for haul roads has been approved by the Engineer, maintenance and dust control of haul roads shall be carried out in accordance with "Execution of Work, Maintenance of Work and Dust Control During Construction" (Division 2, Section 4).

Where the use of Territorially owned or controlled highways and roads for haul roads has been approved by the Engineer, existing drainage or drainage constructed during haul road upgrading or construction shall be maintained by the Contractor throughout the hauling operations.

Where the use of Territorially owned or controlled highways and roads for haul roads has been approved by the Engineer, the maintenance and repair of paved haul roads shall be carried out by the Contractor where and as directed by the Engineer, utilizing materials approved by the Engineer.

c) Restoration of Haul Roads

Where the use of Territorially owned or controlled highways and roads for haul roads has been

approved by the Engineer, haul roads shall be restored by the Contractor upon the completion of hauling operations to a condition equivalent to or exceeding the condition of the road prior to the commencement of hauling operations. Contractor shall take detailed inventory of existing haul road condition survey before commencement of hauling and submit those to the Engineer as record. The Engineer will be the final authority in assessing the restoration required. Hauling shall be considered incidental to Work and will not be measured separately for payment.

### 5.3.5 MEASUREMENTS

#### 5.3.5.1 **Haul**

- a) Construction contracts involve hauling of blast rock/pit run and crushed aggregates for construction of embankment, subbase and base courses. Hauling of these materials is included in the payable unit prices of the respective items as per unit price table included in the contract documents. There will be no additional payment for hauling of blast rock/pit run and crushed aggregates.
- b) The Contractor shall, at its own expense, provide, install and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to accurately determine the mass of material loaded in each vehicle. Such scales shall be in acceptable condition and will be tested from time to time by the Engineer.
- c) When a Contract contains Unit Price Table Items for Haul by unit weight or volume, the haul distance will be the measured distance in kilometres and tenths of a kilometre along the designated route, from the junction of the dead haul road to the loading location and the highway or roadway, to the mid-point of the project kilometre or section of a kilometre that the material is acceptably delivered and placed. If a section is shorter than one kilometre, the haul distance will be measured to the mid-point of the section.  
If sections within a project kilometre are specified to be constructed at varying application rate ranges, the haul distance will be measured to the mid-point of such sections within the kilometre.  
If a dead haul road splits a project kilometre into two sections, the haul distance will be measured to the mid-point of each section within the kilometre.  
No payment will be made for the haul distance along the dead haul road from the loading location to the highway or roadway.
- d) The quantity of Haul to be measured for payment will be calculated by multiplying the weight or volume of the material hauled, delivered and placed, by the haul distance to the mid-point of each project kilometre or section of a kilometre that the material is acceptably delivered and placed.
- e) When a Contract contains Unit Price Table Items in which Haul is included in the Contract item for which the material has been produced or is required, the haul distance will be measured by the Department for record purposes only.
- f) No payment will be made for hauling to or from stockpiles where the source and the stockpiles are located within the boundary of the site where the granular material is being processed.

#### 5.3.5.2 **Haul Roads**

- a) General
  - i) The repair of any damage to public roads caused by the Contractor's hauling operations will not be measured separately for payment and shall be considered incidental to the Hauling operation.
  - ii) The upgrading and restoration of haul roads will not be measured separately for payment and shall be considered incidental to the Hauling operation.
  - iii) The construction and removal of approaches required for access to deposits, pits or stockpiles will not be measured separately for payment and shall be considered incidental to the Hauling operation.



- operation.
- iv) Maintenance and dust control of haul roads will not be measured separately for payment and shall be considered incidental to the Hauling operation.
  - v) Maintenance of existing drainage or drainage constructed during haul road upgrading, construction or restoration will not be measured separately for payment and shall be considered incidental to the Hauling operation.
  - vi) Unless otherwise specified, the maintenance and repair of paved haul roads will not be measured separately for payment and shall be considered incidental to the Hauling operation.
- b) Department Supply Sources
- i) Unless otherwise specified, the clearing, grubbing and construction of dead haul roads will not be measured separately for payment and shall be considered incidental to the Hauling operation.
  - ii) Unless otherwise specified, the removal or installation of culverts required for the upgrading, construction and restoration of haul roads will not be measured separately for payment and shall be considered incidental to the Hauling operation.
- c) Contractor Supply Sources
- i) The Contractor shall be responsible for all costs for the upgrading, construction, drainage, maintenance and dust control and restoration of all haul roads used from Contractor Supply Sources.
  - ii) The Contractor shall carry out maintenance and dust control and restore roads used as haul roads to the satisfaction of the agency having jurisdiction, and in the case of Territorially owned or controlled roads, to the satisfaction of the Engineer, who will be the final authority.
- 5.3.6 BASIS OF PAYMENT
- a) Payment for Haul will be at the Contract unit price per tonne-kilometre or cubic metre-kilometre. The unit price shall be compensation in full for all work and requirements described in this specification.
  - b) Haul will not be paid for separately when the Contract unit price for the item to be hauled includes compensation in full for hauling.

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5.4 SECTION 4 – SUBGRADE PREPARATION..... 3

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5.4.5 BASIS OF PAYMENT ..... 3

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## 5.4 SECTION 4 – SUBGRADE PREPARATION

### 5.4.1 DESCRIPTION

This work consists of scarifying, blading and preparing the existing road surface to the lines, grades and cross-section as designated by the Engineer.

### 5.4.2 MATERIALS

Not applicable.

### 5.4.3 CONSTRUCTION

- a) The existing road surface shall be scarified to a depth of 150 millimeters, unless otherwise specified.
- b) The loosened material shall be windrowed to the side and the exposed surface shall be thoroughly compacted. The windrowed material shall then be mixed and spread uniformly by motor graders or other equipment approved by the Engineer. The material shall be handled such that segregation does not occur and the Contractor shall take all necessary precautions to prevent segregation.
- c) Unless specified otherwise, the Contractor shall compact the material to 100% of the maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698. The moisture content shall be adjusted as necessary, by aerating or the addition of water, such that the optimum moisture content designated by the Engineer is uniformly attained throughout. Water shall not be added in such quantities that it seeps into underlying gravel layers or subgrade.
- d) Compaction shall be carried out by the use of tamping rollers or other equipment approved by the Engineer to be of adequate type and capacity to effectively obtain the specified density requirement.
- e) The road surface shall be prepared true to grade and cross-section at the specified density and moisture content. Road surface that does not conform to the requirements as to grade, cross-section or density shall be re-worked until such requirements are met. The finished surface shall be firm and uniform and free of loose material, ruts, waves and undulations.
- f) The Contractor shall maintain the road surface to this standard until the placement of subsequent material thereon or until accepted by the Engineer.
- g) Where required, the road surface shall be prepared to a depth exceeding 150 millimetres on sections of the roadway designated by the Engineer. When such work has been ordered, it shall be carried out in layers not exceeding 150 millimetres in depth. Preparation and compaction shall be carried out as specified herein.
- h) Material encountered in the top 300 mm of the road surface having a dimension exceeding 150 mm in any one direction shall be removed and disposed of at locations approved by the Engineer.

### 5.4.4 MEASUREMENT

The quantity of Subgrade Preparation to be measured for payment shall be the number of square metres per layer, or linear kilometers measured along centerline of the roadway, of existing road surface acceptably prepared in accordance with these specifications. Measurement for Subgrade Preparation will be made prior to the placement of any materials in these areas.

### 5.4.5 BASIS OF PAYMENT

Payment for Subgrade Preparation will be at the Contract unit price per square metre or linear kilometers measured along centerline of the roadway measured as provided above.

Separate payment will not be made for leveling, removing ruts or blading the subgrade surface required between the time of preparation and the placement of subsequent material thereon.

The unit price will be compensation in full for scarifying, windrowing, mixing, watering, blading, spreading,

shaping, compacting, trimming, disposal of any surplus material and the supply of all equipment, labour, tools and incidentals necessary to complete the work in accordance with the specifications.

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**6.1 SECTION 1 – SUPPLY OF ASPHALT CEMENT AND/OR ASPHALT EMULSION****6.1.1**     DESCRIPTION

This work consists of supplying asphalt materials including ordering, scheduling, delivering, supplying storage facilities, handling, storing, sampling, testing and other related work.

For this specification, "Asphalt Cement and/or Emulsion Supplier" shall mean the party awarded an order by the Contractor for the supply of asphalt cement and/or emulsion.

**6.1.2**     MATERIALS**6.1.2.1**       **General**

The Contractor shall supply the types and grades of asphalt cement and/or emulsion specified in the Contract.

All asphalt cements and/or emulsion shall be prepared from petroleum oils and shall be free from impurities. Emulsifiers used to stabilize asphalt emulsions shall not be harmful to the performance of the asphalt in service.

The Contractor shall ensure that the asphalt cement and/or emulsion supplied meets all requirements for the types and grades specified. The Contractor may be required to use more than 1 type or grade of asphalt cement and/or emulsion for a particular purpose. Any change in asphalt cement and/or type or grade must be approved by the Engineer.

The Engineer reserves the right to discontinue the use of any asphalt product that fails to handle or perform to expectation or satisfaction, regardless of its compliance with the specifications.

**6.1.2.2**       **Delivery, Handling and Storage**

The Contractor shall supply the Engineer with the Asphalt Suppliers' weight certificates and records of all asphalt received and/or returned, on a daily basis.

The Contractor shall provide, maintain and reclaim asphalt storage facilities.

The Contractor must receive approval from the applicable Land Use Authority of the storage location of their asphalt materials, prior to the set-up of storage facilities.

Storage facilities for asphalt cement shall be capable of heating the material under effective and positive control at all times and shall contain provisions for measuring and sampling.

No asphalt cement and/or emulsion type or grade shall be diluted or mixed with a different type or grade of asphalt, or with any other material, without the specific prior approval of the Engineer.

The Contractor shall prevent contamination of the asphalt cement and/or emulsion, by asphalt cement and/or emulsion of another type or grade, by solvent, or by any other material. Asphalt cement and/or emulsion storage tanks shall be emptied of one type or grade of asphalt cement and/or emulsion and cleaned as necessary to prevent detrimental contamination of the asphalt cement and/or emulsion, before placing another type or grade of asphalt cement and/or emulsion therein. Asphalt emulsions shall be protected from freezing.

**6.1.3**     TESTING AND SAMPLING**6.1.3.1**       **Quality Control and Quality Control Testing**

Quality control and quality control testing are the responsibility of the Contractor.

Tests performed by the Department will not be considered to be quality control tests.

The Contractor shall retain and utilize either Professional Engineering Services provided by an engineering consulting company registered by NAPEG, or a qualified Asphalt Suppliers' laboratory or other certified laboratory, to carry out all quality control and quality control testing.

The Contractor shall not retain or utilize the engineering consulting company or personnel retained by the Department with respect to the Contract, for any work on or associated with the Contract.

#### **6.1.3.2 Quality Assurance Sampling and Testing**

The Contractor shall obtain representative, uncontaminated samples of all asphalt products delivered to the project for quality assurance testing, in accordance with the latest edition of AASHTO T 40, Sampling Bituminous Materials.

The Contractor shall ensure that all asphalt delivery vehicle tanks are equipped with sampling valves maintained in good operating condition which are designed and located to enable the safe and representative sampling of asphalt into 1 L containers. Where pressure distributors are utilized for the application of asphalt subsequent to delivery to the project, quality assurance samples shall be obtained from the pressure distributor.

The Contractor shall deliver all quality assurance samples to the Engineer on the day they are sampled, at the following minimum frequencies, and the Engineer will test the quality assurance samples and accept or reject the asphalt material based on the results of the tests:

<b>Product</b>	<b>Minimum Frequency for Each Asphalt Type and Grade</b>
1) Asphalt Cement for Asphalt Concrete Pavement	1 per day
2) Asphalt Emulsion for Prime, Tack and Fog Coats	1 per each 100 tonnes
3) Asphalt Emulsion for Asphaltic Surface Treatments and Seal coats	1 per day

The Engineer may require increases in the minimum frequencies specified for quality assurance sampling and all asphalt shall be subject to inspection and sampling by the Department or its representatives.

#### **6.1.3.3 Quality Acceptance**

Within this specification, certain requirements, limits and tolerances are specified regarding the quality of materials to be supplied. Compliance with these requirements, limits and tolerances shall be measured and the materials accepted or rejected based on the Department's quality assurance test results.

Asphalt products supplied and incorporated into the work will be considered for acceptance provided the specified quality assurance samples have been submitted to the Engineer within the time frame specified and where both the work and the asphalt product meet the specifications.

Should the Contractor fail to supply the required quality assurance samples, or the asphalt material fails to meet the specifications, the Engineer reserves the right to deduct the value of the corresponding quantity of asphalt, as estimated by the Engineer, from payment to the Contractor. If the asphalt material fails to meet the specifications, the Engineer reserves the right to reject the corresponding quantity of asphalt, and the Contractor shall remove and replace the rejected material at their own expense.

The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way

relieve the Contractor of their responsibility to supply asphalt materials that meet the specifications in all respects.

The materials testing laboratory, provided by the engineering consulting company utilized by the Department to carry out quality assurance testing, will not be located at the project site. Quality assurance test results will therefore not be completed for approximately 10 days from the date of receipt of the quality assurance samples from the Contractor.

#### 6.1.4 MEASUREMENT AND PAYMENT

- a) Unless otherwise specified, the Supply and/or Application of accepted Asphalt will not be paid for separately. The cost of this work will be considered included in the unit price of the Contract item for which the asphalt material is used.
- b) If the Contract calls for the Supply of Asphalt, then measurement will be made in tonnes for the quantity of asphalt material acceptably supplied.  
Measurement for payment for the Supply of Asphalt will be by the tonne for the net weight as indicated on the refinery weight certificate or as verified by the Engineer, whichever is applicable, acceptably supplied. The net weight certificate from the refinery shall include the density and temperature of the supplied asphalt.  
The final measurement for payment will be adjusted after reconciliation with actual quantities required on the project.
- c) If the Contract calls for the Supply and Application of Asphalt, then measurement will be made in square-metres for the quantity of asphalt material acceptably supplied and applied.  
The final measurement for payment for the Supply and Application of Asphalt will be reconciled with the net weight as indicated on the refinery weight certificate or as verified by the Engineer, whichever is applicable, for the quantity of asphalt material acceptably supplied and applied.
- d) The Engineer reserves the right to check quantities of asphalt delivered to and/or applied on the project by weighing the delivery vehicles before and after unloading at the asphalt storage facility and/or by weighing the application vehicles before and after application.
- e) If the Contract does not require the installation of a weigh scale for weighing materials, the Engineer will determine quantities by measuring the liquid level in each tank truck or storage tank, as required. When asphalt quantities are determined by this method, the Contractor shall calibrate the distributor trucks and storage tanks. The measurement of liquid level in the storage tank or trucks shall be by means of pre mounted meters that are capable of showing accurate temperature measurements at mid volume or mass, and not the edge.
- f) If there is a variance between the quantities measured by the Engineer and the Asphalt Suppliers' weight certificates, the Engineer will determine the quantity on which payment will be based.
- g) No payment will be made for asphalt materials delivered to the project that exceed the actual quantities required, unless otherwise required by the Engineer.
- h) Payment for Supply of Asphalt at the applicable contract unit price shall be compensation in full for the ordering, purchasing, scheduling, delivering, supplying, storage facilities, handling, storing, sampling, heating, application, quality control and quality control testing and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the work in accordance with the specifications.
- i) The applicable unit price shall include all work required to comply with the provisions of the Territorial Lands Act.

## 6.1.5 SPECIFICATIONS FOR ANIONIC EMULSIFIED ASPHALTS

Anionic emulsified asphalts shall conform to the requirements specified in the following table, in accordance with the latest edition of the following test methods, for the grade designated by the Engineer.

Requirements	Type	Rapid Setting						Medium Setting				Slow Setting						Test Method
	Grade	RS-1		RS-2		RS-1HH		MS-1		MS-2		SS-1		SS-1H		SS-1HH		
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Emulsion																		
Viscosity, Saybolt Furol Seconds: at 25°C		20	100	--	--	20	60	20	60	--	--	20	60	20	60	20	60	ASTM D 244 and D 88
at 50°C		--	--	75	300	--	--	--	--	35	400	--	--	--	--	--	--	
Residue by Distillation, % by Mass		55	--	60	--	55	--	55	--	65	--	55	--	55	--	55	--	ASTM D 244
Settlement, %																		
5 Days		--	3	--	3	--	5	--	3	--	3	--	5	--	5	--	5	ASTM D 6930
7 Days		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Demulsibility, %																		
35 ml, 0.02 N CaCl <sub>2</sub>		60	--	60	--	60	--	--	--	--	--	--	--	--	--	--	--	ASTM D 244
50 ml, 0.1 N CaCl <sub>2</sub>		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Oil Portion of Distillate, % by Volume/Mass		--	--	--	--	--	1	--	--	--	10	--	--	--	--	--	1	ASTM D 244
Sieve Text, % by Mass		--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	ASTM D 244
Cement Mixing Test, % by Mass		--	--	--	--	--	--	--	--	--	--	--	2.0	--	2.0	--	--	ASTM D 244
Particle Charge		NEGATIVE OR NEUTRAL																ASTM D 244
Coating Ability and Water Resistance, %, Note 1		--	--	--	--	--	--	80	--	80	--	80	--	80	--	--	--	ASTM D 244
Tests on Residue																		
Penetration (at 25°C, 100 g, 5 s), 0.1 mm		100	200	100	200	20	55	100	200	100	250	100	200	40	100	20	55	ASTM D 5
Ductility (at 25°C, 5 cm/min), cm		60	--	60	--	40	--	40	--	40	--	40	--	40	--	40	--	ASTM D 113

6.1.6 SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALTS

Cationic emulsified asphalts shall conform to the requirements specified in the following table, in accordance with the latest edition of the following test methods, for the grade designated by the Engineer.

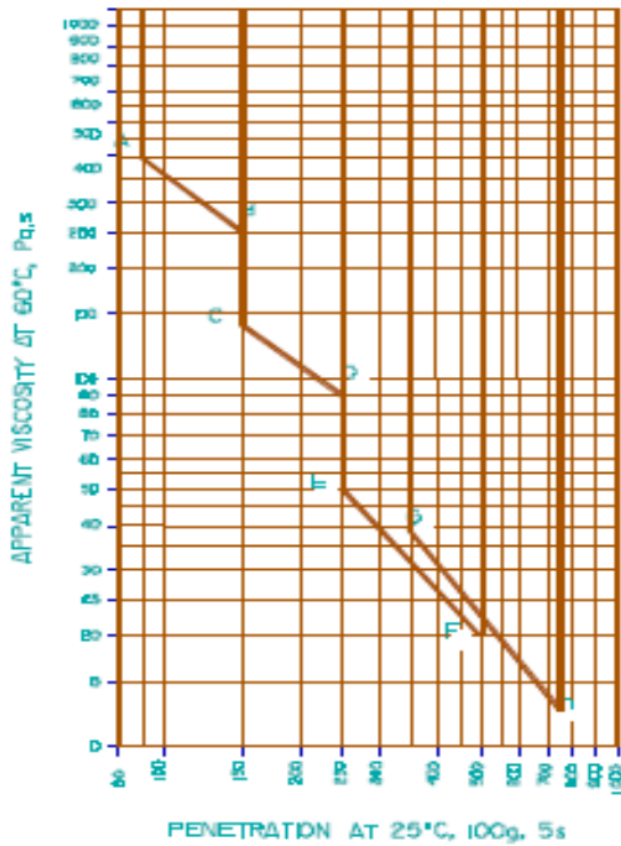
Requirements	Type	Rapid Setting						Medium Setting				Slow Setting						Slurry Seal		Test Method
	Grade	CRS-1		CRS-2		CRS-1HH		CMS-2		CMS-2H		CSS-1		CSS-1H		CSS-1HH		CSS-H		
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Tests on Emulsion																				
Viscosity, Saybolt Furol Seconds: at 25°C at 50°C		--	--	--	--	20	60	--	--	--	--	20	100	20	100	20	60	20	100	ASTM D 244 and D 88
Residue by Distillation, % by Mass		62	--	67	--	55	--	65	--	65	--	57	--	57	--	55	--	57	--	ASTM D 244
Settlement, %, 5 Days		--	5	--	5	--	5	--	5	--	5	--	5	--	5	--	5	--	5	ASTM D6930
Demulsibility, % 35 ml 0.8% Dioctyl Sodium Sulfosuccinate Solution		40	--	40	--	40	--	--	--	--	--	--	--	--	--	--	--	--	--	ASTM D 244
Oil Portion of Distillate, % by Volume/Mass		--	3	--	3	--	1	--	10	--	10	--	5	--	5	--	1	--	--	ASTM D 244
Sieve Text, % by Mass		--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	--	0.1	ASTM D 244
Cement Mixing Test, % by Mass		--	--	--	--	--	--	--	--	--	--	--	2.0	--	2.0	--	--	--	--	ASTM D 244
Particle Charge		POSITIVE																		ASTM D 244
Coating Ability and Water Resistance, % (Note 1)		--	--	--	--	--	--	80	--	80	--	80	--	80	--	--	--	--	--	ASTM D 244
Test on Residue																				
Penetration (at 25°C, 100 g, 5 s), 0.1 mm		100	250	100	250	20	55	100	250	40	125	100	250	40	125	20	55	40	125	ASTM D 5
Ductility (at 25°C, 5 cm/min), cm		60	--	60	--	40	--	60	--	40	--	60	--	40	--	40	--	40	--	ASTM D133

## 6.1.7 SPECIFICATION FOR HIGH FLOAT EMULSIFIED ASPHALT

High float emulsified asphalts shall conform to the requirements specified in the following table, in accordance with the latest edition of the following test methods, for the grade designated by the Engineer.

Test on Emulsion	HF-150S/HF-150P		HS-250S		HF-350S		Test Method
	Min	Max	Min	Max	Min	Max	
Viscosity, Saybolt Furol Second at 50°C	30	150	35	150	75	400	ASTM D244
Residue by Distillation, % by mass	62	-	62	-	65	-	CAN 2-16.5-M84 Section 6.2.1
Demulsibility, % 50 ml 0.10 N CaCl <sub>2</sub>	75	-	-	-	-	-	ASTM D244
Oil Proportion of Distillate, % by Volume/Mass	0.5	4	1	6	1.5	6	ASTM D244
Sieve Test, % by Mass	-	0.10	-	0.10	-	0.10	ASTM D244
Coating Test	Note 1		Note 1		Note 2		ASTM D6988
Storage Stability 24h, % by Mass	-	1.5	-	1.5	-	1.5	ASTM D6930
Test on Residue	HF150S		HS250S		HF350S		Test Method
	Min	Max	Min	Max	Min	Max	
Penetration (at 25°C, 100 g, 5 s, 0.1 mm)	150	250	250	500	350	750	CAN 2-16.5-M84 Section 6.2.4
Solubility in Trichloroethylene, % by Mass	-	97.5	-	97.5	-	97.5	ASTM D2042
Float Test at 60 °C, s	-	1200	-	1200	-	1200	CAN 2-16.5-M84 Section 6.2.6
Apparent Viscosity (at 60 °C), Pa·s	Requirements outlined in figure below.						CAN 2-16.5-M84 Section 6.2.5
<p>Note 1: Follow ASTM D244, except that the mixture of limestone and emulsified asphalt shall be capable of being mixed vigorously for five min., at the end of which period the stone shall be thoroughly and uniformly coated. The mixture shall then be completely immersed in tap water and the water poured off. The stone shall then not be less than 90% coated.</p> <p>Note 2: Follow ASTM D244, except that the mixture of limestone and emulsified asphalt shall be mixed vigorously for five min., then allowed to stand for three hours after which the mixture shall be capable of being mixed an additional five min. The mixture shall then be rinsed twice with approximately its own volume of tap water, without showing appreciable loss of bituminous film. After the second mixing the aggregate shall be at least 90% coated.</p>							





Viscosity shall be within the graphic regions above the line designated by specific letters, and between penetration limits contained in vertical lines extending upwards from these points.

Viscosity value shall be reported at  $0.5s^{-1}$  for grades HF-100S and HF-150S and at  $10s^{-1}$  for grades HF-250S and HF-350S.

Grade of HF Emulsified Asphalt	HF-100S	HF-150S	HF-250S	HF-350S
	A, B	C, D	E, F	G, H

**FIGURE 1**

Viscosity Requirements for Distillation Residues from High-Fat Emulsified Asphalts

6.1.8 SPECIFICATION FOR ASPHALT CEMENTS

Asphalt cements used in asphalt concrete mixes shall conform to CAN/CGSB 16.3-M.

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## 6.2 SECTION 2 – ASPHALT CONCRETE PAVEMENT

### 6.2.1 DESCRIPTION

Asphalt concrete pavement shall consist of well graded crushed aggregate, filler material as required, and asphalt cement, combined in a hot mix plant as hereinafter specified, placed and completed on a prepared base in conformity with the lines, grades, dimensions and cross-sections as provided and as shown on the plans herein.

### 6.2.2 MATERIALS

#### 6.2.2.1 **Asphalt**

- a) The Contractor shall be responsible for the supply and delivery of all necessary asphalt to the approved job site storage point. The Contractor shall be responsible for arranging delivery, and handling of asphalt product in accordance with the provision of "Asphalt", (Division 6, Section 1.).
- b) The Contractor shall not order asphalt heated above a temperature of 175°C for delivery to their plant site.
- c) Asphaltic materials supplied by the Contractor for the purpose of this contract shall not be fluxed with oil or any other fluxing agent.
- d) The asphalt cement grade to be used in asphaltic concrete pavement shall be as specified in the Special Provisions.

#### 6.2.2.2 **Aggregates**

Hot Mix Paving Aggregate shall satisfy all requirements of Tables 1 and 2 of this specification and unless otherwise specified shall be:

- a) Crushed rock composed of hard, uncoated, cubical fragments, produced from rock formations or boulders of uniform quality.  
or,
- b) Crushed gravel composed of hard, durable, uncoated particles, produced from naturally formed deposits.

Fine aggregates shall consist of natural sand and/or manufactured material derived from crushing stone, slag or gravel. All particles shall be clean, durable, moderately sharp and free from coatings of clay, silt or other deleterious materials and shall contain no organic matter.

#### 6.2.2.3 **Physical Requirements**

- a) Physical requirements of aggregates shall be within limits shown on Table 2.
- b) Do not use aggregates having known polishing characteristics in mixtures for surface courses.
- c) Regardless of compliance with the physical requirements, aggregates may be accepted or rejected based on past field performance.

#### 6.2.2.4 **Gradation**

- a) Gradation of aggregates blended to the job mix formula shall be within the limits shown in Table 1 when tested to ASTM C117 and ASTM C136 and giving a smooth curve without sharp breaks when plotted on semi-log grading chart.
- b) Coarse aggregate is aggregate retained on 5,000 µm sieve and fine aggregate is aggregate passing 5,000 µm sieve.
- c) When a dryer drum mixing plant is used, process aggregate through a 5,000 µm sieve and stockpile fine aggregate separately from coarse aggregate.

**6.2.2.5 Mineral Filler**

- a) Mineral filler shall be finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
- b) Add mineral filler when necessary to meet asphalt mix design properties or as directed to improve mix properties.
- c) Mineral filler shall be dry and free flowing when added to aggregate.

**6.2.2.6 Blend Sand**

- a) Shall be one or a blend of following:
  - i) Natural sand
  - ii) Manufactured sand
  - iii) Screenings produced in crushing of quarried rock, boulders or gravel.
- b) Add blend sand when necessary to meet the job mix aggregate gradation or as directed to improve mix properties.
- c) Blend sand shall be sufficiently dry to be free flowing when added to aggregate.

Table 1

CAN/CGSB-8.2-M Sieve Designation ( $\mu\text{m}$ )	Percent Passing Designated Sieve			
	Sand Mix	12.5 mm	16 mm	20 mm
20,000				100
16,000			100	
12,500	100	100		83 - 100
10,000	83 - 100		75 - 100	72 - 92
5,000	47 - 81	55 - 75	50 - 72	50 - 70
2,500	33 - 65			36 - 55
2,000		35 - 55	32 - 51	
1,250	24 - 51			27 - 42
630	17 - 41			18 - 30
400		12 - 30	15 - 27	
315	13 - 30			14 - 24
160	7 - 19	5 - 16		8 - 16
80	3 - 10	3 - 8	3 - 8	4 - 10

Table 2 – Physical Tests for Hot Mix Aggregate

Physical Test	Fine Aggregate	Coarse Aggregate	Notes
Los Angeles Abrasion ASTM C131 Gradation "B" Max % Loss	----	25	
Percent Crushed Minimum * (Minimum 2 freshly fractured faces)	----	85	
Sand Equivalent ASTM D2419 Minimum	35	----	
Magnesium Sulphate Soundness ASTM C88 Max % Loss	16	12	
Absorption ASTM C127 Max % by Mass	----	1.75	
Loss by Washing ASTM C117 Max % Passing Sieve	----	1.5	
Light Weight Particles (Specific Gravity less than 1.95) ASTM C123M Max % by Mass		1.5	For surface course only
Flat & Elongated Particles Ratio greater than 5:1 Max % by Mass	----	15	
Liquid Limit ASTM D4318 (minimum)	25	----	
Plasticity Index ASTM D4318 (maximum)	4	----	

\* The percent of crushed material will be determined by examining the fraction retained on the 5,000  $\mu\text{m}$  sieve and dividing the mass of the crushed particles by the total mass retained on the 5,000  $\mu\text{m}$  sieve.

### 6.2.3 MIX DESIGN

- a) Job mix formula shall be provided by the Contractor.
- b) Design of mix shall employ Marshall method using 75 compaction blows on each face of test specimen.
- c) At least one week before commencing paving operations, the Contractor shall supply, for approval, a mix design based on the aggregate and asphalt materials as specified in this Section.
- d) The Contractor shall use professional engineering services and a qualified testing laboratory certified for Marshall mix design and approved by the Engineer. The asphalt mix design must be signed off by a qualified member of a professional engineering association or a registered member of an applied science technology association in Canada.
- e) Do not change job mix without prior approval of the Engineer. Should a change in a material source be proposed and approved, a new job mix formula shall be provided by the Contractor at no additional cost. The new job mix formula must be signed off by the individual who signed the original, or if that

individual is unavailable, someone with equal or better qualifications from the same company.

- f) The mix design shall meet the following specifications:

Marshall Method Mix Criteria	12.5 mm and 16.0 mm Mix		Sand and 20 mm Mix	
	Minimum	Maximum	Minimum	Maximum
Stability ASTM D6927 (kN @ 60°C)	8.0		6.7	
Flow ASTM D6927 (mm)	2	4	2	4
Air Voids ASTM D3203 (% Total Mix)	3.0	5.0	3.0	5.0
Film Thickness (µm)	7.0		7.0	
Voids in Mineral Aggregate (%)	See Asphalt Institute MS-2 Table 5.3	---	See Asphalt Institute MS-2 Table 5.3	---
Voids Filled with Asphalt (%)	68	75	65	75

Notes:

Percent voids in mineral aggregate to be calculated on the basis of the ASTM bulk specific gravity for the aggregate.

The portion of asphalt cement lost by absorption into the aggregate particles must be allowed for when calculating percent air voids.

Retained Stability is percentage of original stability retained after immersion in water at 60°C for 24 hours.

#### 6.2.4 CONSTRUCTION

##### 6.2.4.1 **Plant and Mixing Requirements**

- a) Batch and continuous mixing plants
  - i) To conform to ASTM D995
  - ii) Heat asphalt cement and aggregate to mixing temperature as per asphalt mix design. Do not heat asphalt cement above 160°C.
  - iii) Before mixing, dry aggregates to a moisture content not greater than 0.5% by mass or to a lesser moisture content if required to meet mix design requirements.
  - iv) Using current asphalt cement viscosity data at the plant and relative to the viscosity of asphalt being used, adjust the temperature of the completed mix at the plant and the paver after considering hauling and placing conditions.
  - v) Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
  - vi) Feed cold aggregates to plant in proportions that will ensure continuous operations.
  - vii) Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job mix requirements.
  - viii) Store hot screened aggregates in a manner to minimize segregation and temperature loss.



- ix) Maintain temperature of materials within + 5°C of the specified mix temperature during mixing.
  - x) Mixing time:
    - In batch plants, adhere to both dry and wet mixing times as per asphalt mix design. Continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 45 s.
    - In continuous mixing plants, mixing time shall be as per asphalt mix design but not less than 45 s.
    - Do not alter mixing time unless directed by Engineer.
- b) Dryer drum mixing plant
- i) Feed aggregates by means of a multi-bin cold feed unit and blend to meet job mix requirements by adjustments of variable speed feed belts and gates on each bin.
  - ii) Meter total flow of aggregate by an electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and asphalt entering mixer remain constant.
  - iii) Provide for easy calibration of weighing systems for aggregates without having material enter mixer.
  - iv) Make provision for convenient sampling the full flow of materials from the cold feed.
  - v) Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.
  - vi) Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.
  - vii) Accomplish heating and mixing of asphalt mix in a dryer-mixer approved by the Engineer. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures daily to the Engineer.
  - viii) Mixing period and temperature shall produce a uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves the mixer shall be less than 2%.
- c) Temporary Storage of Hot Mix
- i) Provide mixture storage of sufficient capacity to permit continuous operation and designed to prevent segregation.
  - ii) Do not store asphalt mix in storage bins in excess of 3 hours.
- d) While producing asphalt mix for this project, do not produce mix for other projects unless approved by the Engineer.
- e) Mixing tolerances
- i) Permissible variation in aggregate gradation from job mix (percent of total mass):

CAN/CGSB 8.2-M Sieve Designation ( $\mu\text{m}$ )	Variation %
5,000 sieve and larger	5.0
2,000 sieve	4.0
400 sieve	3.0
80 sieve	2.0

- ii) The amount of asphalt cement designated for the job mix shall be maintained within the tolerance of 0.3 percentage points.
- iii) The temperature of mixing asphaltic mixtures shall not vary from those specified in the job mix formula by more than +5°C.

#### 6.2.4.2 Equipment

- a) Pavers: Mechanical, grade controlled, self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- b) Rollers: Sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- c) Haul trucks: Of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
  - i) Boxes with tight metal bottoms and cleaned of all foreign materials.
  - ii) Covers of sufficient size and weight to completely cover and protect asphalt mix when truck is fully loaded.
  - iii) In cool weather or for long hauls, insulate entire contact area of each truck box.
  - iv) Trucks which cannot be weighed in a single operation on scales supplied will not be accepted.
- d) Hand tools:
  - i) Lutes or rakes with covered teeth during spreading and finishing operations.
  - ii) Straight edges, 4.5 m in length to test finished surface.
- e) Plant testing facility: Provide electric power and water for Engineer's laboratory trailer at plant site. The laboratory trailer will be supplied by the Engineer.

#### 6.2.4.3 Preparation

- a) Level existing road surface to design grades and prepare shoulders.
- b) Apply tack coat in accordance with Division 6 Section 4 Bituminous Prime, Tack and Fog Coat, to edges of existing pavement, curbs, gutters, utility covers, and other structures which will abut the new asphaltic concrete, and allow to cure before paving.
- c) Prior to laying mix, clean surfaces of loose and foreign material.

#### 6.2.4.4 Transportation of Mix

- a) Transport mix to job site in vehicles cleaned of foreign material.
- b) Paint or spray truck beds with light oil, limewater, soap or detergent solution, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted.
- c) Schedule delivery of material for placing in daylight, unless Engineer approves artificial light.
- d) Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
- e) Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place

mixes at a temperature within range as specified in the asphalt mix design, but not less than 135°C.

#### **6.2.4.5 Material Transfer Vehicle (MTV)**

- a) The Contractor has the option of using an MTV for the placement of all asphalt material.
- b) MTVs shall be self-propelled equipment capable of transferring asphalt material from the hauling equipment into the paver, and shall have the following characteristics:
  - i) Minimum storage capacity of 20 tonnes;
  - ii) A conveyor system to transfer asphalt material from the hauling equipment to the paver hopper insert and an auger system in the MTV or paddle mixers in the hopper insert to remix the asphalt mix prior to discharge from the hopper insert;
  - iii) MTV shall be a Roadtec Model SB-2500D or equivalent as approved by the Engineer.

#### **6.2.4.6 Placing**

- a) Place asphalt concrete in compacted lifts to thicknesses, grades and lines as indicated on the drawings, plans, or in the Contract documents, or as directed by the Engineer.
- b) Placing conditions:
  - i) Place asphalt mixture only when air temperature is above 5°C.
  - ii) When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
  - iii) Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
  - iv) Use only skilled, well experienced paver operators to place asphalt concrete.
  - v) Spread and strike off mixture with self-propelled mechanical finisher.
    - Construct longitudinal joints and edges true to line markings. Establish line parallel to centreline of proposed pavement for paver to follow. Position and operate paver to follow established line closely.
    - When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
    - If segregation occurs, immediately suspend spreading operation until cause is determined and corrected as per 6.2.5.1 d) Pavement Segregation.
    - Correct irregularities in alignment left by paver by trimming directly behind machine.
    - Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
    - Do not throw surplus materials on freshly screeded surfaces.
  - vi) When hand spreading is used
    - Distribute the material uniformly. Do not broadcast material.
    - During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
    - Following placing and before rolling, check surface with templates and straight edges and correct irregularities.
    - Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a greater temperature than temperature of mix being placed.

**6.2.4.7 Compacting**

- a) Roll asphalt continuously to a density not less than 97% of 75 blow Marshall Density.
- b) General
  - i) Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one roller must be pneumatic tired type.
  - ii) Start rolling operations as soon as placed mixture can bear weight of roller without undue displacement of material or cracking of surface.
  - iii) Operate roller slowly initially to avoid displacement of material. For subsequent rolling, do not exceed 5 km/h for steel wheeled rollers and 8 km/h for pneumatic tired rollers.
  - iv) Overlap successive trips of roller by at least one half width of roller and vary trip lengths.
  - v) Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
  - vi) After longitudinal joints and edges have been compacted, start rolling longitudinally at low side and progress to high side.
  - vii) Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
  - viii) Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
  - ix) When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
  - x) Do not use rollers with vibrator operating when pavement is cooler than 100°C.
- c) Breakdown rolling
  - i) Commence breakdown rolling immediately following rolling of longitudinal joint and edges.
  - ii) Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
  - iii) Operate breakdown roller with drive roll or wheel nearest the finisher. Exceptions may be made when working on steep slopes or super-elevated sections.
  - iv) Use only experienced roller operators for this work.
- d) Second rolling
  - i) Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
  - ii) Rolling shall be continuous after initial rolling until mix placed has been thoroughly compacted.
- e) Finish rolling
  - i) Accomplish finish rolling with two-axle or three-axle tandem steel wheel rollers while material is still warm enough for removal of roller marks. If necessary, to obtain desired surface finish, the Engineer will specify use of pneumatic-tired rollers.
  - ii) Conduct rolling operations in close sequence.

**6.2.4.8 Joints**

- a) General:
  - i) Trim to vertical face to provide true surface and cross section against which new pavement may be laid. Remove loose particles.
  - ii) Overlap previously laid strip with spreader by 100 mm.
  - iii) Remove surplus material from surface of previously laid strip. Do not dispose on surface of

freshly laid strip.

- b) Transverse joints:
  - i) Prior to placing asphalt concrete, preheat joint face with an approved heater or apply a tack coat as directed by the Engineer.
  - ii) Construct and thoroughly compact transverse joints to provide a smooth riding surface.
  - iii) Stagger joint locations by a minimum of 2 m.
  - iv) Offset transverse joint in succeeding lifts by at least 600 mm.
  - v) For transverse end transitions to existing asphaltic pavement, create butt joint by milling a minimum depth of 40 mm of sufficient longitudinal distance to provide smooth transition profile approved by Engineer.
  - vi) At the end of each completed portion and prior to opening that portion of pavement to traffic, sections of hot mix concrete course shall be ramped transversely for a minimum distance of 1.5 m. In all cases, the ramps shall not form part of the permanent asphalt pavement and shall be removed prior to continuing paving operations.
- c) Longitudinal joints:
  - i) Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a lute or rake.
  - ii) All longitudinal joints left exposed overnight or those that have been exposed to moisture shall receive an application of tack coat as directed by the Engineer.
  - iii) Roll longitudinal joints directly behind paving operation.
  - iv) When rolling, shift roller over onto freshly placed lane in order that not more than 150 mm of roll rides on edge of previously laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until a thoroughly compacted neat joint is obtained.
  - v) Offset longitudinal joints in succeeding lifts by at least 150 mm.
- d) Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade.

#### 6.2.5 MEASUREMENT AND PAYMENT

“Lot” is a portion of the work being considered for acceptance and is defined as the following:

- a) One day’s plant production of more than four hours where approved changes to the following criteria have not occurred:
  - i) Mix design
  - ii) Pavement density specifications
  - iii) The project
- b) One day’s plant production of less than four hours will be dealt with at the discretion of the Engineer, as follows:
  - i) The material will be added to the previous day’s Lot if the criteria specified in 6.2.5 remains the same, or
  - ii) The material will be added to the next day’s Lot with the same criteria specified in 6.2.5, or
  - iii) If it is the last time the mix is produced with these criteria then the production will be designated as a Lot.
- c) If the Engineer identifies a portion of a Lot as substandard, the Engineer may order extra testing to define the area and severity of the deficiency. A new Lot will be designated for this portion if this extra testing indicates the mix is subject to Unit Price adjustment or rejection.

“Lot Mean and Range”: The Lot Mean is the arithmetic mean of a set of five or more test results constituting the sample for the Lot. The Range represents the difference between the highest and lowest values within a set of test results.

“Rejection Limit” is the Rejection Limit for Density and asphalt content, and is the limiting value of the Lot Mean beyond which a Lot is rejected and not paid for.

“Sublot” is a portion of a Lot that is one paver width wide and 100 m long on which the quality of surface finish and assessment of segregation and obvious defects are based.

#### 6.2.5.1 Measurement of Payment

- a) Accepted Hot Mix Asphalt Concrete Paving for Overlays will be measured in tonnes of asphalt concrete actually incorporated into work, based on approved weigh scale tickets submitted as the asphalt concrete mix is delivered to the paving site.
- b) The Unit Price bid for Hot Mix Asphalt Concrete Paving for Overlays is subject to the Unit Price adjustments and assessments hereinafter specified and will be full compensation for mix design, production and supply of aggregates, supply of asphalt cement, production and transportation of asphalt concrete mix, preparation of road surface, placement and compaction of the mixture, finishing, cleanup and all other work, equipment, and materials incidental to complete the work as specified.
- c) Density price adjustment
  - i) The Engineer may use a nuclear densometer, core samples, or other methods to monitor pavement densities.
  - ii) Each density test using core samples will represent approximately 1,000 m<sup>2</sup> per constructed driving lane lift. Asphalt densities shall be not less than 97% of laboratory Marshall.
  - iii) Each density test using a nuclear densometer will represent approximately 100 m per paving lane, per lift. Asphalt densities shall be not less than 97% of laboratory Marshall density.
  - iv) If any density test indicates failure to achieve the specified density, two additional density tests within 1 m of the failed tests will be taken within the area in question, and the average density of the three tests will represent the area.
  - v) Density test locations will be determined by the Engineer using random methods.
  - vi) Density tests will not be taken on the shoulders where only one lift is placed or on small areas such as access roads. The Contractor shall establish a rolling pattern under supervision of the Engineer to achieve maximum compaction in these areas.
  - vii) If the densities for any particular lift are less than specified, the Contract Unit Price will be adjusted as follows:

Percentage of 75 blow Marshall Density	Percentage Reduction
97 and over	0
96.6 – 96.9	5
96.1 – 96.5	15
95.1 – 96.0	30
94.1 – 95.0	50
94 and lower	Replace

- viii) The Engineer reserves the right to reject density deficient pavement rather than apply a price

adjustment.

d) Pavement segregation

i) General

- The finished surface of the top lift of hot mix asphalt concrete pavement shall have a uniform texture and be free of segregated areas.

ii) Classifying pavement segregation

- A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement. For the purposes of classifying pavement segregation, only segregated areas greater than 0.1 m<sup>2</sup> and centre-of-paver streaks greater than 1 m long will be considered.
- Moderate or severe segregated areas which do not meet these size parameters will be considered obvious defects. Pavement segregation will be classified as follows:
  - “Slight”: The matrix, asphalt cement and fine aggregate are in place between the coarse aggregate. However, there is more stone in comparison to the surrounding acceptable mix.
  - “Moderate”: Significantly more stone than the surrounding mix; moderately segregated areas usually exhibit a lack of surrounding matrix.
  - “Severe”: Appears as an area of very stony mix, stone against stone, with very little or no matrix.
  - “Centre-of-Paver Streak”: Appears as a continuous or semi-continuous longitudinal "streak" typically located in the middle of the paver "mat".

iii) Inspections for pavement segregation

- Inspections by the Contractor
  - The Contractor shall perform a daily inspection of the paving operations on all lifts of pavement to identify any instances of pavement segregation. If segregation is evident, the Contractor shall take immediate corrective action to their operations to identify the cause and prevent any further occurrence of segregation.
- Inspections by the Engineer
  - Inspections during construction
    - The Engineer will inspect the pavement to identify any instances of pavement segregation. If segregation is evident, the Engineer will immediately notify the Contractor so that corrective action can be taken to prevent further occurrence of segregation.
    - Typically, each pavement Lot would be inspected as soon as possible after the Lot is placed. During the inspection(s), the Engineer will identify and record any areas of moderate and severe segregation and any areas of centre-of-paver streak. Areas requiring repair in accordance with 6.2.5.1 d) will be marked. The Engineer will provide the Contractor with a written assessment (location and severity) of the segregated areas as soon as possible following each inspection. The locations referenced in the Engineer’s written assessment shall be only approximate.
  - Inspection following construction
    - The Engineer will conduct a second inspection of the top lift, normally one week after the substantial completion of paving work. During this inspection, the Engineer will identify and record any areas of slight, moderate and severe segregation and any areas of centre-of-paver streak which were not

identified in the inspections during construction. The Engineer will provide the Contractor with a written assessment (location and severity) of the segregated areas as soon as possible following this inspection.

iv) Repairing pavement segregation

- Pavement segregation, obvious defects, deteriorated repairs or failures identified during the inspection performed approximately one week after Substantial Performance of paving operations will require repair.
- Pavement segregation identified in the inspections performed during construction shall be repaired at the Contractor's expense and in accordance with the following:
  - Moderate and severe segregation in the top lift of pavement and on entrances and intersections shall require repair.
  - For entrances and the portion of intersections outside the through travel lanes and shoulders, areas of moderate and severe segregation shall be repaired in accordance with the methods of repair listed for moderate segregation. Intersections and entrances shall also be neatly shaped, smooth and free of surface defects and depressions.
- Slight segregation on any lift of pavement will not require repair.
- Moderate segregation on lower lifts will not require repair.
- Severe segregation on lower lifts will only require repair in instances where, in the opinion of the Engineer, the segregated area will affect the long term structural integrity of the pavement structure. Such repair will not be required in instances where the Engineer determines that the paver screed is "dragging" due to distortion of the existing surface.
- Only moderate and severely segregated centre-of-paver streak on the top lift of pavement will require repair.
- Methods of repair
  - Moderate Segregation - The Contractor has the option of using a slurry patch or a hot mix asphalt concrete patch.
  - Severe Segregation - The Contractor has the option of removal and replacement or overlay.
  - Any other methods of repair proposed by the Contractor will be subject to the approval of the Engineer.
  - The minimum repair area shall be such that the repair can be carried out using paver for a hot mix asphalt concrete patch and using machine application for a slurry patch.
- The Engineer will mark out the area of repair. The "marked area" will extend a minimum of 0.5 m beyond the segregated area. For centre-of-paver streak, the "marked area" will extend a minimum of 100 mm laterally and 0.5 m longitudinally beyond the streak.
- Cut the pavement so that all edges are vertical, the sides are parallel to the direction of traffic and the ends are skewed between 15 and 25 degrees. Coat edges with a tack coat conforming to Division 6, Section 4 Bituminous Prime, Tack and Fog Coat and allow to cure.
- Repairs for segregation using an overlay shall be for the entire pavement width. Repairs for segregation using removal and replacement shall be for the full lane width, full lane width and shoulder or the shoulder only as applicable, depending on the extent of the segregated area. The full depth of the asphalt lift shall be removed and replaced with new hot mix asphalt concrete pavement using an appropriate paver and cold milling



- equipment.
  - Make all repairs regular in shape and finish using good workmanship practices to provide an appearance suitable to the Engineer. Keep traffic off all repairs for a sufficient period of time to ensure that tracking does not occur.
  - Properly compact all hot mix asphalt concrete patching and other repairs for which compaction is normally required.
  - In the event repairs cover existing roadway lines or markings, the Contractor shall reinstate the lines and markings at their expense and to the satisfaction of the Engineer.
  - Repairs shall be completed during construction or shortly after construction, except when prevented by inclement weather or seasonal shutdown. In these cases, the Contractor shall complete the repairs prior to June 15 of the following year.
- v) Segregation payment holdback
- Payment holdbacks of up to 25% of each progress payment may be withheld until the final product is accepted by the Engineer. If deficiencies are identified during the inspection approximately one week after Substantial Performance, the payment will be held until the deficiencies are repaired and meet specification requirements. If no deficiencies are identified during the inspection approximately one week after Substantial Performance, the payment will be released within two weeks of the inspection.
  - Payment holdbacks for pavement segregation will apply to deficiencies identified in the top and bottom lift of hot mix asphalt concrete pavement. Segregated areas, centre-of-paver streak and any repaired segregated areas identified by the Engineer either during construction or during the inspection conducted approximately one week after Substantial Performance of paving work, will be used to determine payment holdbacks.
- e) Payment for work that had been rejected, but was made acceptable
- i) When defects have been remedied in Lots or Sublots which had been rejected, the work will no longer be considered deficient. Acceptable work will not delay the release of payment.
- f) Repair of failed areas in existing surfaces
- i) Repair of failed areas in existing surfaces will be paid for at the Contract Unit Prices bid for the work.
- g) Finish surface quality tolerances
- i) Finished asphalt surface will be inspected after final rolling at selected locations.
  - ii) Finished asphalt surface shall not have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed between any two contacts.
- h) Defective work
- i) Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.
  - ii) Repair areas showing checking or hairline cracking.
  - iii) Asphalt pavement not meeting the specified density, thickness, segregation or finish surface quality tolerances may be required to be replaced or overlaid at the Contractor's expense.
- i) Cored areas
- i) Fill all core holes with hot mix asphalt concrete material immediately after the core has been removed from the road surface. Compaction and finished surface quality are required to meet density specifications and surface quality specifications.

**6.2.5.2 Quality Control and Quality Assurance**

- a) The Contractor will be responsible for quality control.
- b) The Engineer will be responsible for quality assurance.
- c) Provide the Engineer with full access to production and storage sites at all times during production.
- d) Core samples taken by the Engineer will conform to ASTM D5361, and will be taken at locations determined by the Engineer using random access methods.
- e) Random samples will not be taken in areas of obvious defects as indicated in 6.2.5.1 Classifying Pavement Segregation. These areas will be marked and repaired in accordance with 6.2.5.1 Repairing Pavement Segregation.
- f) Core samples will not be taken closer than 300 mm to edges of pavement and longitudinal joints, nor closer than 5 m to transverse joints.
- g) Density, thickness, and percentage of asphalt cement will be based on core samples.

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### 6.3 SECTION 3 – ASPHALT STABILIZED BASE COURSE

#### 6.3.1 GENERAL

##### 6.3.1.1 Description

The asphalt stabilized base course shall consist of an intimate mixture of gravel and/or crushed stone, sand and asphalt, combined as hereinafter specified, and shall be placed, compacted and finished upon the previously prepared roadway, entrances and intersections, in accordance with the typical plans herein, in layers to the thickness, density, grade and cross-section specified.

#### 6.3.2 MATERIALS

##### 6.3.2.1 Aggregate Materials

Production and processing of crushed aggregate shall be carried out by the Contractor in accordance with the provisions of Division 5, Section 1, "Crushed Aggregate Production". Gradation of the aggregate produced shall meet the requirements for the Designation and Class as specified in the Special Provisions.

##### 6.3.2.2 Asphalt

The Contractor shall be responsible for the scheduling, ordering, and receipt into storage, of asphalt products in accordance with the provisions of "Asphalt", (Division 6, Section 1).

#### 6.3.3 EQUIPMENT

##### 6.3.3.1 Weigh Scales

The Contractor shall at their own expense provide, install and maintain a scale approved by Weights and Measures, which shall be tested at the Contractor's expense as often as the Engineer may direct. The test certificates shall be exhibited to the Engineer as requested. The approved scale shall be of enough size and capacity such that the weighing of any vehicle can be carried out in a single operation with all wheels on the platform.

##### 6.3.3.2 Compaction Equipment

The compacting unit of each pneumatic-tired roller used in base course compaction shall be not less than 1.5 m in width and shall weigh not less than 45 kg per linear centimetre of width. It shall be so constructed that the entire surface for the full width of the compacting unit shall be compacted at a single passage of the roller.

Each steel roller shall be an approved type of self-propelled smooth steel-tired roller weighing not less than eight tonnes and equipped with a satisfactory means of varying the weight when and as required by the Engineer.

Compaction equipment other than that specified above may be used upon the approval of the Engineer, providing such equipment will produce a completed stabilized base equal to that which would be produced by the means specified.

The Department reserves the right to order the discontinuance of the use of any equipment which, in the opinion of the Engineer, fails to produce satisfactory results.

#### 6.3.4 CONSTRUCTION METHODS

##### 6.3.4.1 General

Asphalt stabilized base course shall consist of a mixture of crushed gravel of the designation numbers and classes specified and as shown on the plans, and asphalt, constructed to a total compacted thickness as specified and, in a manner, as hereinafter detailed.

The material shall be laid in a single layer when the compacted thickness specified does not exceed 75 mm. When thicknesses in excess of 75 mm are specified, the material shall be laid and compacted in layers not exceeding 75 mm per layer.

Each layer shall be compacted to 100% of Standard Proctor density, at the required asphalt content and any ruts or irregularities formed in the surface of any layer during compaction shall be eliminated by blading during the rolling operations.

The Contractor may carry on the placing, spreading, compacting and shaping operations on sections of the roadway of convenient lengths, subject to the approval of the Engineer, but each layer must be thoroughly consolidated, finished and dried on a section before the succeeding layer is placed on that section.

The crushed gravel shall be windrowed uniformly upon the prepared base and mixed and dried by blading back and forth.

When the material has dried to a moisture content of 2% or lower, it shall be spread by blades, and light cut-back asphalt uniformly applied by an approved type of pressure distributor at a rate of from 4.3 to 7.1 L/m<sup>2</sup> as required by the Engineer.

The application of asphalt emulsion shall be performed only when the air temperature in the shade is not less than 5°C, and under general weather conditions acceptable to the Engineer. Care shall be taken to avoid rich or lean areas at the ends of each distributor run.

Mixing shall start immediately and shall continue until uniform colour is obtained and the cut-back has been released by thorough aeration of the material. The mixture shall then be brought to a single windrow and from there bladed out to required cross-section and uniform depth.

The surface shall then be rolled with pneumatic-tired rollers or such other equipment as approved by the Engineer in conjunction with light blading where necessary to maintain the required cross-section and grade until 100% of Standard Proctor density, as determined by the Engineer, is obtained.

Rolling shall be continued where necessary, until the asphalt layer is impervious to moisture penetration. Final rolling shall be done by an approved type of steel roller to obtain a smooth, finished surface.

In lieu of mixing the asphalt emulsion with the aggregate as specified above, the Contractor may employ such other procedures as approved by the Engineer.

The Department reserves the right to order the discontinuance of the use of any equipment or procedure which, in the opinion of the Engineer, fails to produce a satisfactory mixture.

Where the crushed gravel placed in any course becomes segregated during the work operations, the Contractor shall reblend the material in a manner to produce satisfactory grading such that the required density and resistance to moisture penetration will be obtained.

Loose material and other waste shall be bladed off the side slopes and uniformly spread over the ditch bottom in a manner satisfactory to the Engineer.

#### **6.3.4.2 Bituminous Fog Coat**

Following final rolling of the asphalt stabilized base course the finished surface shall be cleaned of loose

deleterious material by sweeping with a power broom supplemented by hand brooming, if necessary.

Upon the broomed surface of the asphalt stabilized base course, a bituminous fog coat shall be applied uniformly at the rate of 0.8 to 0.5 L/m<sup>2</sup> by means of an approved pressure distributor and at an application temperature between 10°C and 65°C as directed by the Engineer.

It shall be applied only after the finished surface has been approved by the Engineer and when the surface is dry or slightly damp and when the air temperature in the shade is not less than 5°C.

The bituminous fog coat shall be applied for the full width of the roadway between shoulders, or to such other width as may be specified by the Engineer and shall be MC-30 unless otherwise specified.

#### 6.3.5 MEASUREMENT

The Contractor shall, at their own expense, provide, install, and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to determine accurately the weight of gravel loaded in each vehicle.

Such scales shall be in acceptable condition and may be tested from time to time by Inspectors appointed by the Engineer. All testing shall be carried out at the Contractor's own expense.

- a) The Supply and Application of Bituminous Materials to be measured for payment shall be the number of tonnes of each Bituminous Material, acceptably utilized in the "Bituminous Prime Treatment", "Asphalt Stabilized Base Course", and "Bituminous Fog Coat", which has been acceptably placed on the road in accordance with these specifications.

The quantity of Asphalt Stabilized Base Course to be measured for payment shall be the number of tonnes of Base Course Gravel utilized in the Asphalt Stabilized Base Course mixture, acceptably placed on the road in accordance with these specifications.

No payment will be allowed for any material used to repair failures which may occur in the base course laid under this contract. Any expense incurred in the production, hauling and placement of such material shall be borne by the Contractor.

- b) The quantity of blending material required to meet the specified crushed aggregate gradation will be considered incidental to the gravel operation and will not be measured separately for payment.
- c) The quantity of Haul to be measured for payment shall be the number of tonne-kilometres of Base Course Gravel Haul for Asphalt Stabilized Base Course acceptably placed in accordance with these specifications.

#### 6.3.6 BASIS OF PAYMENT

- a) Payment for Supply and Application of Bituminous Material for "Asphalt Stabilized Base Course" will be at the Contract unit price per tonne, measured as provided in Section 6.3.5.

The unit price will be compensation in full for all equipment, plants, labour, tools and incidentals necessary to complete the work in accordance with these specifications and shall include preparing the gravel on the road, heating, handling, hauling from the Contractor's storage to the work and spraying the asphalt emulsion, mixing and aerating the mixture.

The cost of spreading, shaping, and compacting the cured mix shall be considered as part of the

Contract unit price per tonne of "Asphalt Stabilized Base Course" in Section 6.3.6. The Contractor shall comply with the provisions of "Asphalt" (Division 6, Section 1).

- b) Payment for Asphalt Stabilized Base Course material will be at the Contract unit price per tonne of Base Course Gravel measured as provided in Section 6.3.5.

Payment will be compensation in full for all equipment, plants, labour, tools and incidentals necessary to complete the work in accordance with these specifications and shall include either:

- i) Loading from crushed stockpile, adding or eliminating sand, loading to trucks, or
- ii) Excavating, screening, crushing, adding or eliminating sand, loading to trucks, or
- iii) Loading to crusher from uncrushable stockpile, screening, crushing, adding, or eliminating sand, loading to trucks, or
- iv) Excavating, screening, crushing, adding or eliminating sand, hauling and loading to railway cars, unloading from railway cars at the specified points of delivery, or
- v) Loading from crushed stockpile, adding or eliminating sand, hauling and loading to railway cars, unloading from railway cars at the specified points of delivery, loading to trucks, and
- vi) Placing the material on the roadway, entrances and intersections, mixing, blading, shaping and compacting the material, maintaining traffic and constructing the surface complete.

Payment will only be made for the quantity of accepted base course gravel actually incorporated into the work and compacted to the density and thickness specified.

- c) Payment for Supply and Application of Bituminous Materials for "Bituminous Prime Treatment" and "Bituminous Tack Coat" will be at the Contract unit price per tonne measured as provided in Section 6.3.5.

The unit price will be compensation in full for preparing the surface, providing traffic control, loading, unloading, storing, hauling, heating, and applying the Bituminous Material and the supply of all materials, equipment, labour, tools and incidentals, including supply, haul, and application of sand for blotting purposes (as specified by the Engineer) necessary to complete the work in accordance with the specifications.

The application of the Prime Coat shall be carried out in accordance with "Bituminous Prime Treatment" (Division 6, Section 4). Furthermore, the Contractor shall comply with the provisions of "Asphalt" (Division 6, Section 1).

- d) Payment for clearing will be in accordance with the requirements for "Clearing" (Division 3, Section 1).
- e) Payment for grubbing will be in accordance with the requirements for "Grubbing" (Division 3, Section 2).
- f) Payment for removal of overburden and construction of haul roads will be in accordance with the requirements for "Borrow Excavation" (Division 3, Section 4).
- g) Payment for haul will be at the Contract unit price per tonne-kilometre of Base Course Gravel hauled for the Asphalt Stabilized Base Course in accordance with these specifications and the requirements for "Haul" (Division 5, Section 3).



**6.3.7** FINAL ACCEPTANCE**6.3.7.1** **Acceptance**

Conditions requisite for the final acceptance of the work shall include, in addition to the terms and conditions set forth in the Contract:

- a) A roadway smooth and compact over its entire width,
- b) Smooth side slopes with regular shoulder lines,
- c) Clean side ditches and satisfactory approaches.

Gravel pits and stockpile sites shall be left in a neat and tidy condition and haul roads repaired and restored, to the satisfaction of the Engineer.

Any Contractor shall, at their own expense, adequately repair any failures which may occur due to their neglect or faulty workmanship and shall maintain the subgrade and each layer of base course constructed, to the satisfaction of the Engineer.

**6.3.7.2** **Maintenance Requirement**

Prior to the release of the Contract Holdback, the Contractor shall furnish the Department with a Maintenance Bond in the amount of 10% of the total Contract bid price as a guarantee that they will hold themselves responsible for, and will repair at their own expense, any failures and/or damages resulting from failures in the work by reason of neglect or faulty workmanship by the Contractor in the performance of the work, which have occurred within the period of one year as specified in the Maintenance Bond.

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## **6.4 SECTION 4 – BITUMINOUS PRIME, TACK AND FOG COATS**

### **6.4.1 DESCRIPTION**

This work consists of placing an asphalt material on a prepared surface at locations shown on the plans or as designated by the Engineer.

### **6.4.2 DEFINITIONS**

#### **6.4.2.1 Prime Coat**

An application of emulsified asphalt to an absorbent surface to waterproof and promote bonding between the surface being primed and the next course.

#### **6.4.2.2 Tack Coat**

An application of emulsified asphalt to ensure a bond between the surface being paved and the next course.

#### **6.4.2.3 Fog Coat**

An application of emulsified asphalt to seal small cracks and surface voids.

### **6.4.3 MATERIALS**

The Contractor shall supply the types and grades of asphalt material specified in the Contract.

The Contractor shall supply the asphalt material in accordance with "Supply of Asphalt" (Division 6, Section 1).

When emulsified asphalt is used for Prime, Tack or Fog Coat, the material as delivered by the supplier shall be diluted by adding an amount equal volume of water to the volume of emulsified asphalt supplied.

Sand used for the blotting of excess asphalt material on Prime Coats shall be supplied by the Contractor.

### **6.4.4 CONSTRUCTION**

#### **6.4.4.1 Quality control and Quality Control Testing**

##### **a) General**

- i) Quality control and quality control testing are the responsibility of the Contractor throughout every stage of the work, from the supply of the asphalt material to the final accepted product.
- ii) Tests performed by the Department will not be considered to be quality control tests.
- iii) The Contractor shall provide, pay for and maintain equipment and qualified personnel to perform all field testing necessary to determine and monitor the characteristics of the materials supplied and incorporated into the work and the final product produced.
- iv) Prior to commencement of the work, the Contractor shall provide the Engineer with their program and schedule of testing for quality control and shall demonstrate to the satisfaction of the Engineer that the program and schedule are adequate to provide reliable quality control within the limits specified.
- v) The Contractor shall retain and utilize Professional Engineering Services provided by an engineering consulting company registered by NAPEG to carry out all quality control and quality control testing.
- vi) The Contractor shall not retain or utilize the engineering consulting company or personnel retained by the Department with respect to the Contract, for any work on or associated with the Contract.
- vii) All quality control tests and test results shall be calculated, recorded and submitted to the Engineer on industry standard worksheets. The tests and test results shall be certified for correctness by the engineering consulting company employed by the Contractor to perform the tests and shall be

signed by the Contractor's representative. Original copies of all worksheets, including calculations, shall be submitted to the Engineer daily. All worksheets shall be reviewed and certified for correctness by a Professional Engineer from the engineering consulting company employed by the Contractor to perform the tests, on a minimum weekly basis.

viii) The Contractor shall interpret quality control test results and alter their operation if necessary, so that the product meets all required specifications.

#### **6.4.4.2 Survey, Layout, Staking and Grading Requirement**

##### **a) General**

i) The Contractor shall provide and pay for qualified personnel to carry out all surveying, layout, staking, grading and referencing required for the blading, shaping and/or preparation of the surface to be treated, the establishment of centreline and the accurate placement and control of Prime, Tack and Fog Coat operations.

ii) Prior to the application of Prime Coat on untreated granular surfaces, the Contractor shall utilize an in-place balance grading method to ensure that the surface to be treated is bladed and shaped to the lines, grades and cross sections indicated on the Drawings. The in-place balance grading method shall include the surveying, staking and setting of grades every 20 m along the roadway. The Contractor shall blade and shape the surface to be treated such that the finished surface is smooth, uniform, true to grade and cross-section and suitable for the application of subsequent material thereon.

The finished surface shall not deviate more than 30 mm from the specified grade and cross-section.

iii) The Contractor shall notify the Engineer when the surface to be treated has been completed in accordance with the specifications and shall provide ample opportunity for the Engineer to take cross-sections prior to the application of subsequent material thereon.

The Engineer will not take cross-sections at any time prior to notification by the Contractor that the surface to be treated has been completed in accordance with the specifications.

The completion of cross-sections by the Engineer shall in no way constitute acceptance of the surface to be treated by the Engineer.

#### **6.4.4.3 Seasonal, Weather and Other Limitation**

Asphalt material for Prime, Tack and Fog Coat shall be applied only when:

- a) The surface to be treated is dry,
- b) The weather is not foggy or rainy,
- c) The surface temperature is above 0°C for the application of cutback asphalts, and
- d) The surface temperature is above 5°C for the application of emulsions,

or as otherwise approved by the Engineer.

#### **6.4.4.4 Equipment**

Equipment shall be provided in good mechanical condition, properly adjusted and free from wear which would impair the quality of work.

The asphalt shall be applied by means of a self-powered pressure distributor equipped with the following control devices in proper operating condition:

- a) Tachometer.
- b) Pressure gauge.

- c) Adjustable length spray bar.
- d) Positive displacement asphalt pump with separate power unit.
- e) Heating coils and burner capable of applying even heat to the asphalt material.
- f) Thermometer well and accurate thermometer.

Before applying asphalt material, the Contractor shall ensure that the distributor meets the following adjustments and requirements:

The distributor vehicle will maintain a constant height of the spray bar as the tank is unloaded.

- a) All spray bar nozzles are of the same manufacture, type and size.
- b) Clogged nozzles have been removed and cleaned with solvent.
- c) All nozzles have been set in the spray bar so that the nozzle slots make the same angle (15° to 30°) with the horizontal axis of the spray bar.
- d) The spray bar has been adjusted to the correct height to ensure uniform application without streaking.
- e) The spray bar has been provided with a positive shut-off to prevent dribbling.
- f) The distributor can maintain a uniform speed.

The distributor may be checked for calibration by the Engineer before being used on the work.

#### **6.4.4.5 Surface Preparation**

Before applying the asphalt material, loose dirt or other objectionable material shall be removed from the prepared surface by brooming or other methods acceptable to the Engineer.

Where base courses become ravelled, the loose material shall be moistened and recompact to achieve a tight, uniform surface.

#### **6.4.4.6 Application of Asphalt Material**

Application rates for Prime, Tack and Fog Coats shall be as specified by the Engineer. The application rate of for a diluted tack coat on a milled asphalt pavement surface or an asphalt pavement surface that was placed in the previous calendar year or prior shall be a minimum of 0.30 L/m<sup>2</sup> and a maximum of 0.40 L/m<sup>2</sup>. The application rate for a diluted tack coat on asphalt pavement surface that was placed in the same calendar year shall be a minimum of 0.20 L/m<sup>2</sup> and a maximum of 0.30 L/m<sup>2</sup>. The application rate for a diluted prime coat on granular surface shall be a minimum of 0.80 L/m<sup>2</sup> and 1.0 L/m<sup>2</sup>. The application rate for a diluted fog coat on asphalt stabilized base course shall be a minimum of 0.45 L/m<sup>2</sup> and 0.70 L/m<sup>2</sup>.

The asphalt material shall be uniformly applied without streaking.

Joints and seams shall not be excessively overlapped.

Structures, curbs, wheel guards, guardrail and other roadway appurtenances shall not be splattered by the asphalt material. The Contractor shall remove any spattering caused by their operation, at their own expense.

Areas missed by the distributor or inaccessible to the distributor shall be treated using a hand spray or pouring pot.

#### **6.4.5 ACCOMMODATION OF TRAFFIC**

Traffic shall not be permitted to travel on Tack Coat or Fog Coat until it has cured.

Traffic shall not be permitted to travel on Prime Coat until six hours after application or until it has cured. After this period, excess asphalt material remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface. The "blotter sand" may be any clean sand free from organic or other deleterious materials, approved by the Engineer.

When traffic must be accommodated, the Contractor shall apply the Prime, Tack or Fog Coat to only one-half of the roadway at a time. The other half shall not be sprayed until the first half has properly cured, and in the case of Prime Coat, all puddles and excess free asphalt have been blotted.

#### 6.4.6 MAINTENANCE OF WORK

Prime Coat and Tack Coat shall be maintained by the Contractor at their own expense, including the cost of the required liquid asphalt. Any area of Prime Coat or Tack Coat that has become fouled shall be repaired before the application of subsequent material thereon.

#### 6.4.7 MEASUREMENT AND PAYMENT

Accepted Prime Coat and Fog Coat will be measured in square metres.

Payment for Prime Coat and Fog Coat will be at the Contract unit price per square metre. No separate payment shall be made for prime coat and fog coats if there is no Contract unit price for these items and they are considered to be incidental to placement of granular layer or asphalt stabilized granular layers, respectively.

For Prime Coat, the unit price shall be compensation in full for preparing and cleaning the surface to be treated, surveying, layout, staking, balance grading, setting grades, referencing, supplying and applying the asphalt material, supplying and applying blotting sand when required, quality control and quality control testing, reporting and certification, maintenance and dust control of the work and haul roads, traffic control and accommodation and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the work in accordance with the specifications.

For Fog Coat, the unit price shall be compensation in full for preparing and cleaning the surface to be treated and the supplying and applying of the asphalt material.

Payment for Tack Coat will be considered included in the unit price of the Contract item for which the Tack Coat is required, and no separate payment will be made.

No payment will be made for any material used to replace or repair rejected work, and all corrective work shall be performed entirely at the Contractor's expense.



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## 6.5 SECTION 5 - SINGLE ASPHALTIC SURFACE TREATMENT

### 6.5.1 DESCRIPTION

This work consists of a wearing course composed of an asphalt emulsion and a crushed aggregate spread and compacted in one application on a prepared surface to the lines and dimensions shown on the plans or as designated by the Engineer.

### 6.5.2 MATERIALS

#### 6.5.2.1 **Aggregate**

Unless otherwise specified, the Contractor shall produce crushed aggregate in accordance with "Crushed Aggregate Production" (Division 5, Section 1), for the Designation and Class of material specified.

#### 6.5.2.2 **Asphalt**

The Contractor shall supply asphalt emulsion in accordance with "Supply of Asphalt Cement and/or Asphalt Emulsion" (Division 6, Section 1).

The asphalt emulsion shall be a high float type emulsion with the grade being as specified in the Special Provisions.

### 6.5.3 CONSTRUCTION

#### 6.5.3.1 **Quality Control and Quality Control Testing**

##### a) General

Quality control and quality control testing are the responsibility of the Contractor throughout every stage of the work, from the crushing and production of aggregates to the final accepted product.

Tests performed by the Department will not be quality control tests.

The Contractor shall provide, pay for and maintain equipment and qualified personnel to perform all field testing necessary to determine and monitor the characteristics of the materials produced and incorporated into the work and the final product produced.

Prior to commencement of the work, the Contractor shall provide the Engineer with their program and schedule of testing for quality control and shall demonstrate to the satisfaction of the Engineer that the program and schedule are adequate to provide reliable quality control within the limits specified.

The Contractor shall retain and utilize Professional Engineering Services provided by an engineering consulting company registered by NAPEG to carry out all quality control and quality control testing.

The Contractor shall not retain or utilize the engineering consulting company or personnel retained by the Department with respect to the Contract, for any work on or associated with the Contract.

All quality control tests and test results shall be calculated, recorded and submitted to the Engineer on industry standard worksheets. The tests and test results shall be certified for correctness by the engineering consulting company employed by the Contractor to perform the tests and shall be signed by the Contractor's representative. Original copies of all worksheets, including calculations, shall be submitted to the Engineer daily. All worksheets shall be reviewed and certified for correctness by a Professional Engineer from the engineering consulting company employed by the Contractor to perform the tests, on a minimum weekly basis.

The Contractor shall interpret quality control test results and alter their operation if necessary, so that the product meets all required specifications.

The Contractor shall calibrate distributors and aggregate spreaders in a manner acceptable to the Engineer before the work commences.

b) Aggregate and Asphalt Emulsion Application Rates Testing Requirements

The Contractor's quality control and quality control testing program shall include field sampling to determine the asphalt emulsion and aggregate application rates. The minimum field sampling frequency, and quality control testing procedure requirements, shall include but not be limited to:

- a) At the start of each day's work,
- b) When application rates are changed,
- c) When spraying widths are changed,
- d) For confirming that the correct application rate is being maintained.

For situations (a), (b) and (c), a trial section of 50 m, or an alternate length approved by the Engineer, shall be placed and sampled. Spraying shall not continue until the test result has been obtained. For situation (d), the sample shall be obtained when approximately 1/2 of the total day's production is completed.

All sampling and testing methods shall be to industry standards and shall be approved by the Engineer.

Acceptance

If the test result is within plus or minus 5% of the desired application rate, the test result will be considered acceptable and work may proceed.

If the test result is not within 5% of the desired application rate, the test result will be considered unacceptable and work shall be stopped, and adjustments made to the equipment. Field sampling will be repeated until two consecutive acceptable test results or four unacceptable test results are obtained.

When two acceptable test results are obtained work may proceed.

When four unacceptable test results are obtained before two consecutive acceptable test results, the single asphaltic surface treatment placed with unacceptable test results shall be removed and replaced at the Contractor's expense.

c) Reporting

In addition to the requirements of Section 6.5.3.1 (b), the Contractor's quality control and quality control testing program shall include the reporting of aggregate and asphalt emulsion application rates to the Engineer at the following minimum frequencies:

Description	Minimum Frequency
(A) Aggregate Application	
1) Spread Rate	Every half day
2) Daily Average	Daily
3) Job Average	On completion of the Contract
(B) Asphalt Emulsion Application	
1) Spray Rate	Every 3 lane-km
2) Daily Average	Daily
3) Job Average	On completion of the Contract

d) Quality Acceptance

Within this specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, limits and tolerances shall be measured and the work accepted or rejected based on the Department's quality assurance test results.

The Engineer and their representatives reserve the right to sample, test, inspect and monitor the quality of material being produced and incorporated into the work by the Contractor at any time and as often as he deems necessary. The Contractor shall cooperate with the Engineer and their representatives for such sampling, testing, inspecting and monitoring. The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way relieve the Contractor of their responsibility to construct single asphaltic surface treatments that meet the specifications in all respects.

The Contractor shall provide, at their own expense, such stands, sampling devices and other facilities as the Engineer may require to safely obtain representative samples of the materials being produced and incorporated into the work.

The materials testing laboratory provided by the engineering consulting company utilized by the Department to carry out quality assurance testing will not be located at the project site. Quality assurance test results will therefore not be completed for approximately 10 days from the date of sampling.

### 6.5.3.2 Survey, Layout, Staking and Grading Requirements

a) General

- i) The Contractor shall provide and pay for qualified personnel to carry out all surveying, layout, staking, grading and referencing required for the blading, shaping and/or preparation of the surface to be treated, the establishment of centreline and the accurate placement and control of asphaltic surface treatment operations.
- ii) Prior to the application of asphaltic surface treatment on untreated granular surfaces, the Contractor shall utilize an in-place balance grading method to ensure that the surface to be treated is bladed and shaped to the lines, grades and cross-sections indicated on the Design Drawings. The in-place balance grading method shall include the surveying, staking and setting of grades every 20 m along the roadway.

The Contractor shall blade and shape the surface to be treated such that the finished surface is smooth, uniform, true to grade and cross-section and suitable for the application of asphaltic

surface treatment thereon.

The finished surface shall not deviate more than 30 mm from the specified grade and cross-section.

iii) The Contractor shall provide cross-sections per the specified sheets in the contract drawings prior to the application of asphaltic surface treatment thereon. The Engineer will not obtain any measurements to develop the cross-sections.

b) Interim Centreline Spotting

The Contractor shall be responsible for the supply and application of interim centreline roadway markings (spotting) on all newly constructed asphaltic surface treatments. Interim centreline spotting shall be completed in accordance with Division 8 Section 8.1.3.2

### 6.5.3.3 Seasonal, Weather and Other Limitations

Single asphaltic surface treatment shall not be constructed when, in the opinion of the Engineer, damage to the finished product may occur for any reason.

Construction shall be carried out during daylight hours only.

Asphalt emulsion shall not be applied to the prepared surface during any of the following conditions:

- a) The atmospheric temperature at the construction area is less than 10°C,
- b) The weather is misty or rainy,
- c) Precipitation is a threat for the construction area within 12 hours as forecast by Environment Canada for the vicinity, and
- d) An atmospheric temperature at the construction area of less than 5°C is predicted by Environment Canada within 24 hours.

### 6.5.3.4 Equipment

The Contractor shall use the following equipment:

- a) Self-powered pressure asphalt distributors meeting the requirements listed in "Bituminous Prime, Tack and Fog Coats" (Division 6, Section 4).
- b) Power Sweepers.
- c) Self-propelled aggregate spreaders capable of spreading the aggregate uniformly at the established rate in 1 application over the full width of the asphalt applied.  
Spreaders shall be capable of controlling and adjusting the width and rate of spread. Each spreader shall be equipped with the necessary devices to enable it to be attached securely to the aggregate haul truck while in the process of dumping the aggregates into the spreader.
- d) Self-propelled pneumatic tire rollers or self-propelled vibratory rollers with rubber coated drums or both.

A minimum of two pneumatic tired rollers shall be provided with each aggregate spreader.

Hauling vehicles shall be suitably equipped to enable secure attachment to the spreader while in the process of dumping the aggregates.

### 6.5.3.5 Surface Preparation

- a) When Asphalt Surface Treatment is being placed on untreated granular base, before the asphalt emulsion is applied, the surface to be treated shall be swept clean of all dirt, sand, dust or objectionable matter by means of a power sweeper.

If base courses become raveled, the loose material shall be compacted before brooming.

Dried mud or other foreign matter which cannot be removed with the power sweeper shall be removed by hand, blade or other methods.

Asphalt emulsion shall not be applied until the surface has been cleaned as required and approved by the Engineer.

- b) When Asphalt Surface Treatment is placed on an existing surface treated layer, the surface preparation will include the following:
- i) Wheel path treatment.
  - ii) Asphalt Surface Treatment surface improvement.
  - iii) Hauling/placing/packing 20 mm gravel.
  - iv) Alligator and transverse crack sealing.
  - v) Other crack sealing.
  - vi) Pot hole repairs.

Typically, these activities are planned to be completed in order to cause the least delays to the start of overlay application.

Alligator & Transverse or any other Cracks sealing and Pot hole repairs will not be measured separately for payment and shall be considered incidental to works.

The Contractor shall provide, ahead of mobilization to sites, an experienced quality control technician to cooperate with the Engineer in the establishing of priorities and locations of all the activities required for surface preparation. This will ensure a well-organized completion of this phase of the work.

The cost for the quality control technician shall be considered incidental to the work.

Wheel path treatment shall be measured by actual width and length for each chip layer length applied. Chip layer width shall vary and be placed horizontally to minimize water retention. Deeper wheel ruts shall be applied more than one layer as directed by the Engineer. If any layer applied without consent of Engineer, the layer shall not be measured for payment.

Asphalt Surface Treatment surface improvements consist of asphalt oil specified and 16 mm Asphalt Surface Treatment chips applied to improve areas showing weak seal, surface distortion, breaks, dips, loss of crown/flat areas, failed cold mix repairs, alligator cracking.

Alligator cracking sections where the separation of the surface is negligible shall be applied Asphalt Surface Treatment layer(s) as required to achieve surface seal. Where separation is open, if seal improvement is not applicable, the area may be excavated locally and replaced with gravel and AST application.

At soft, rough areas with underlying ACP, improvements shall be achieved with Asphalt Surface Treatment application.

In areas, where it is known that ACP has been removed with the surface showing softness or roughness and existing chip seal surface is soft and not ready for overlay application, the areas shall be ripped/excavated, compacted, applied 20 mm gravel (not exceeding 150 mm in each lift) and reshaped to crown before Asphalt Surface Treatment application. Each layer of 20 mm

gravel/aggregate shall be compacted to the satisfaction of Engineer.

Ripping/ excavation and compaction will not be measured separately for payment and shall be considered incidental to highway surface preparation.

Cracking shall be repaired with applied asphalt oil using a distributor truck wand and sand. The Engineer may direct the Contractor to apply oil and chips to some large areas with minor size cracking as applicable.

Crack sealing shall be considered incidental to the project.

Major cracking showing surface depressions mostly found at transversal cracking shall require the use of a spray injector patcher as directed by the Engineer. Aggregate material for use with the spray injector patcher shall be available to the Contractor. Contractor will use spray injector where needed.

Major crack sealing shall be considered incidental to the project.

- c) If the Contract contains a bid item for the supply and application of a Bituminous Prime Coat, the Contractor shall apply the Bituminous Prime Coat, as specified, prior to the application of the single asphaltic surface treatment.

The Bituminous Prime Coat shall be applied in accordance with "Bituminous Prime, Tack and Fog Coats" (Division 6, Section 4).

The Contractor shall supply Bituminous Prime Coat material in accordance with "Supply of Asphalt" (Division 6, Section 1).

#### **6.5.3.6 Application of Asphalt Emulsion**

Generally, the application rate will be in the range of 1.9 L/m<sup>2</sup> to 2.5 L/m<sup>2</sup>.

The application temperature of the asphalt emulsion shall be between 50°C and 70°C.

The asphalt emulsion shall be applied with a pressure distributor at the established rate and in a single uniform continuous spread over the section to be treated.

Asphalt emulsion shall be applied only to dry surfaces.

The longitudinal edge of a previously constructed single asphaltic surface treatment shall be power swept prior to constructing the single asphaltic surface treatment on the adjacent section.

All loose aggregates on the sealed lane must be removed to at least 0.15 m from the proposed longitudinal joint with a minimum dislodgement of embedded aggregates.

The Contractor shall ensure that asphalt emulsion application on the previously constructed longitudinal edge is overlapped by not less than 50 mm and not more than 100 mm.

Transverse joint: of successive sections or lanes shall be started and ended on a strip of building paper for each spread, to prevent overlap. The paper shall be removed and disposed of as approved by the Engineer. Skipped areas shall be corrected by hand spray.



Structures, curbs, guardrail, and other appurtenances shall not be spattered with the asphalt emulsion. The Contractor shall remove any spattering caused by their operation.

The application of asphalt emulsion shall not precede the application of the single asphaltic surface treatment by more than 30 m. Asphalt emulsion shall not be spilled, sprayed, or tracked on completed sections of single asphaltic surface treatment. Bridge expansion joints and drains shall be protected with building paper.

Application on bridge decks, where specified, will generally be from curb face to curb face.

#### **6.5.3.7 Application of Aggregate**

Generally, the application rate will be in the range of 20 kg/m<sup>2</sup> to 24 kg/m<sup>2</sup> or as instructed by Engineer.

The application of aggregates shall follow within 30 m of the application of asphalt emulsion.

The aggregates shall be uniformly spread at the established rate by means of a mechanical spreader.

Longitudinal construction joints between adjacent lanes shall be kept clean of foreign material.

At longitudinal joints, the Contractor shall ensure that aggregates are overlapped by not less than 50 mm and not more than 100 mm.

Immediately after spreading, the aggregate shall be rolled. A minimum of two coverages by the rollers shall be completed within 15 minutes after the aggregate has been spread.

Vibratory rollers shall not operate in the vibratory mode when they are stationary.

After initial set of the asphalt emulsion (normally from one to three hours), further compaction of the asphaltic surface treatment shall continue by using either further rolling or controlled traffic or a combination of both, until the aggregate is properly seated in the asphalt emulsion and a smooth, thoroughly compacted surface is obtained. The Contractor shall determine the amount of additional compaction required based on consideration of compaction equipment, traffic conditions, atmospheric conditions and acceptance requirements.

#### **6.5.3.8 Sweeping**

Once compaction has been achieved, light brooming of the surface shall be undertaken to remove any loose aggregate.

The Contractor shall broom the single asphaltic surface treatment during daylight hours only, when required and as often as required, during a two-week period following the initial application or as directed by the Engineer.

Any areas that have not been properly covered after brooming shall be treated using hand methods if necessary.

The chips/aggregate shall be swept off the roadway towards the side slope of the Highway. No windrow shall be accepted on the travel lane or shoulder.

Initial and secondary sweeping operations of the highway surface shall include traffic control signs, flag persons and pilot vehicles.

The Contractor shall use a water truck to dampen the highway surface during sweeping operations for dust

control.

The Contractor shall ensure that highway sections with loose chips are posted with a reduced speed that is suitable for the surface condition but shall not exceed a maximum speed of 50 km/hour and do not exceed 10 kilometres in length. Once the initial sweeping is completed, the Contractor shall increase the speed limit to the posted speed limit but shall reduce the speed to 50 km/hour for subsequent sweeping operations.

#### 6.5.4 ACCOMMODATION OF TRAFFIC

Traffic shall be safely accommodated through the work. The Contractor shall, at their own expense, provide flag persons, pilot vehicles and/or illuminated arrow boards as required.

Traffic and construction equipment, including aggregate haul trucks, shall not travel over uncovered surfaces of fresh asphalt emulsion.

Traffic shall not use sections of single asphaltic surface treatment until after final rolling is complete. From the time all rolling is complete and until 6 hours thereafter, traffic shall be conveyed by pilot vehicles at speeds not exceeding 50 km per hour.

#### 6.5.5 REQUIREMENTS FOR ACCEPTANCE

Requirements for the acceptance of the completed Single Asphaltic Surface Treatment include the following:

- a) Materials shall meet all specific requirements,
- b) A minimum of 99% aggregate coverage shall be obtained with no single bare area greater than 0.01 m<sup>2</sup>) in any 1 square metre,
- c) There shall be no streaking or raveling,
- d) The finished surface shall have a uniform, even texture,
- e) No over-rich or bleeding areas shall be evident, and
- f) No loose aggregates shall be evident.

Single Asphaltic Surface Treatment that does not meet the foregoing requirements shall be repaired or reconstructed to the satisfaction of the Engineer at the Contractor's expense.

#### 6.5.6 MAINTENANCE OF WORK AND DUST CONTROL

Maintenance and dust control of the entire surface to be treated shall be carried out in accordance with "Execution of Work, Maintenance of Work and Dust Control During Construction" (Division 2, Section 4).

#### 6.5.7 MEASUREMENT AND PAYMENT

Accepted Asphaltic Surface Treatment will be at the Contract unit price per square metre.

The unit price shall be compensation in full for preparing, sweeping and cleaning the surface to be treated, surveying, layout, staking, balance grading, setting grades, referencing, supplying, heating, storing and applying the asphalt emulsion, excavating, loading, hauling, placing and compacting the aggregate, brooming the finished surface, supplying and applying interim centreline spotting material, quality control and quality control testing, reporting and certification, upgrading or construction of haul roads, trimming and grading of all slopes and surfaces in the gravel source areas and haul roads, maintenance and dust control of the work and haul roads, traffic control and accommodation and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the work in accordance with the specifications.

No payment will be made for any material used to replace, repair or overlay rejected work, and all corrective

work shall be performed entirely at the Contractor's expense.

No payment will be made for materials used that exceed the upper limit of application ranges described in specifications or any portion of the Asphaltic Surface Treatment Overlay that does not meet the Requirements for Acceptance. Excessive applications of materials shall not be permitted. The Contractor will be assessed the cost of any excessive application and waste of aggregate or asphalt emulsion.

**6.5.8 REPAIR OR RECONSTRUCTION WORK**

Single Asphaltic Surface Treatment that does not meet the Requirements for Acceptance shall be repaired or reconstructed to the satisfaction of the Engineer at the Contractor's expense.

The Contractor's one-year warranty period will commence on the date that the Single Asphaltic Surface Treatment is accepted by the Engineer.





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## 7.1 SECTION 1 – TRAFFIC SIGNS

### 7.1.1 DESCRIPTION

This Specification covers the requirements for the supply and installation, removal and reinstallation, removal and disposal and removal and salvage of permanent roadway signs, delineators and kilometre posts and includes traffic control regulatory and warning signs, information signs, guide signs and facility signs for the normal use of the roadway, as shown on the Drawings or as designated by the Engineer.

### 7.1.2 SUPPLY AND INSTALLATION

#### 7.1.2.1 **General**

Where specified, new traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts shall be supplied by the Contractor.

All materials shall be free from wane, and shipments shall be protected from road and weather conditions.

Any materials damaged by the Contractor shall be replaced by the Contractor at their own expense.

#### 7.1.2.2 **Signs and Posts**

Signs shall be fabricated and supplied in accordance with the standards set out in the latest edition of the *Manual of Uniform Traffic Control Devices for Canada*.

Galvanized signposts, breakaway base posts, bolts and hardware shall be fabricated and supplied in accordance with the latest version of Standard Drawing SD-200-02-13 "Breakaway Sign Post".

The length of post(s) required for each sign shall be determined by the Contractor, but shall, in all cases, meet the minimum and maximum values shown in the latest version of Standard Drawing SD-200-02-12 "Typical Sign Installation Height and Lateral Locations".

#### 7.1.2.3 **Delineators and Posts**

Flexible marker posts, reflective tab delineators and galvanized delineator posts shall be fabricated and supplied in accordance with the latest version of Standard Drawing SD-200-02-11 "Delineators".

#### 7.1.2.4 **Kilometre Posts**

Kilometre posts shall be fabricated and supplied in accordance with the latest version of Standard Drawing SD-200-02-14 "Typical Kilometre Post Installation".

### 7.1.3 REMOVAL AND REINSTALLATION

Where the removal and reinstallation of existing traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts is specified, any materials damaged by the Contractor or their agents shall be replaced by the Contractor at their own expense.

### 7.1.4 REMOVAL AND DISPOSAL

Where the removal and disposal of existing traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts is specified, all materials shall become the property of the Contractor. The crushing and burying of the materials are not permitted on the site. The Contractor shall remove and properly dispose of the materials to the satisfaction of all authorities having jurisdiction.

### 7.1.5 REMOVAL AND SALVAGE

Where the removal and salvage of existing traffic signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts is specified, the Contractor shall carefully remove, dismantle, clean and neatly store the materials at a location approved by the Engineer. All salvaged materials shall remain the property of the Department.

Any materials damaged by the Contractor or their agents shall be replaced by the Contractor at their own expense.

### 7.1.6 CONSTRUCTION

- a) Signs and posts, delineators and posts and kilometre posts shall be supplied and installed and/or removed and reinstalled and/or removed and disposed of and/or removed and salvaged in accordance with and at the locations shown in the Drawings, or as designated by the Engineer.
- b) Signs shall be installed in accordance with the latest versions of Standard Drawing SD-200-02-12 "Typical Sign Installation Height and Lateral Locations" and Standard Drawing SD-200-02-13 "Breakaway Sign Post".
- c) Delineators shall be installed in accordance with the latest version of Standard Drawing SD-200-02-11 "Delineators".
- d) Kilometre posts shall be installed in accordance with the latest version of Standard Drawing SD-200-02-14 "Typical Kilometre Post Installation".
- e) Signs shall be mounted on single or multiple posts and a single installation may include more than one (1) sign on each post or multiple posts.
- f) Posts shall be set vertically and backfilled with material free of organics. The backfill around the posts shall be placed in thin layers and thoroughly compacted for the full depth.
- g) Signs, delineators and tabs shall be fixed securely to the post(s).
- h) The Contractor is responsible for the maintenance and protection of the signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts until the completion of the project.

### 7.1.7 ACCEPTANCE OF WORK AND WARRANTY

Prior to the final acceptance of the Work, any damage or deficiencies from any cause to the signs, delineators, sign and delineator posts, bolts and hardware or kilometre posts shall be rectified by the Contractor at their own expense, to the satisfaction of the Engineer.

The Contractor shall, during the warranty period, straighten and recompact or reinstall as required, all posts that are more than 50 mm from vertical in a 2 m length of post.

### 7.1.8 MEASUREMENT

#### **7.1.8.1 Supply and Installation**

Measurement for Supply and Install Traffic Signs, Delineators and Kilometre Posts will be the number of complete units acceptably fabricated, supplied and installed in accordance with these Specifications.

The number of complete units shall be the number of posts regardless of the number of signs installed on the same post.

#### **7.1.8.2 Removal and Reinstallation**

The Removal and Reinstallation of Traffic Signs, Delineators and Kilometre Posts will not be measured separately for payment and shall be considered incidental to the Work.

The number of complete units shall be the number of posts regardless of the number of signs installed on the same post.

**7.1.8.3 Removal and Disposal**

The Removal and Disposal of Traffic Signs, Delineators and Kilometre Posts will not be measured separately for payment and shall be considered incidental to the Work.

**7.1.8.4 Removal and Salvage**

The Removal and Salvage of Traffic Signs, Delineators and Kilometre Posts will not be measured separately for payment and shall be considered incidental to the Work.

7.1.9 BASIS OF PAYMENT

Payment for Supply and Install Traffic Signs, Delineators and Kilometre Posts and/or Remove and Reinstall Traffic Signs, Delineators and Kilometre Posts will be at the contract unit price as per the Unit Price Table for the total number of complete units.

The unit prices shall be compensation in full for removing and reinstalling, fabricating, supplying, unloading, storing, handling and hauling the signs, delineators, sign and delineator posts, breakaway base posts, bolts and hardware and kilometre posts, assembling, installing, cutting and trimming posts, maintenance and protection of all materials and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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## 7.2 SECTION 2 – STEEL GUARDRAIL REMOVAL

### 7.2.1 DESCRIPTION

This Work consists of the removal of steel guardrail shown on the Drawings or as designated by the Engineer.

### 7.2.2 MATERIALS

Not applicable.

### 7.2.3 CONSTRUCTION

#### 7.2.3.1 **Removal and Disposal**

Where the removal and disposal of existing steel guardrail is specified, all guardrail materials shall become the property of the Contractor.

Crushing and burying of existing steel guardrail materials is not permitted on the site. The Contractor shall remove and properly dispose of the materials to the satisfaction of all authorities having jurisdiction.

#### 7.2.3.2 **Removal and Salvage**

Where the removal and salvage of existing steel guardrail is specified, the Contractor shall carefully remove and neatly store the materials, including all hardware, at locations approved by the Engineer. All rails shall be carefully removed from timber posts and offset blocks and dismantled, all posts and offset blocks shall be removed from the ground and cleaned, and all post holes shall be backfilled, firmly compacted and levelled. All guardrail materials shall remain the property of the Department.

If any guardrail materials specified for salvage are damaged beyond use, or to an unacceptable state as determined by the Engineer, by the Contractor or their agents during the removal operation, the Contractor shall replace the damaged guardrail materials at their own expense.

#### 7.2.3.3 **Removal and Reinstallation**

Where the removal and reinstallation of existing steel guardrail is specified, the Contractor shall carefully remove and neatly store the materials, including all hardware, at locations approved by the Engineer. All rails shall be carefully removed from timber posts and offset blocks and dismantled, all posts and offset blocks shall be removed from the ground and cleaned, and all post holes shall be backfilled, firmly compacted and levelled. All guardrail materials shall remain the property of the Department.

If any guardrail materials specified for reinstallation are damaged beyond use, or to an unacceptable state as determined by the Engineer, by the Contractor or their agents during the removal operation, the Contractor shall replace the damaged guardrail materials at their own expense.

Reinstallation shall be in accordance with Section 7.3.

### 7.2.4 MEASUREMENT

#### 7.2.4.1 **Steel Guardrail Removal**

The quantity of Steel Guardrail Removal to be measured for payment will be the number of linear metres based on the total length of guardrail measured from end to end along the face of the rail to be removed, including terminal sections, acceptably removed in accordance with the Specifications. No extra allowance will be made for laps of splices.

#### 7.2.4.2 **Steel Guardrail Disposal**

The removal and offsite disposal costs for steel guardrail materials will not be measured separately for

payment and shall be considered incidental to the guardrail removal operation.

**7.2.4.3 Steel Guardrail Salvage**

The salvage, cleaning and storing of guardrail materials will not be measured separately for payment and shall be considered incidental to the guardrail removal operation.

**7.2.4.4 Steel Guardrail Reinstallation**

The quantity of Steel Guardrail Reinstallation to be measured for payment will be the number of linear metres based on the total length of guardrail measured from end to end along the face of the rail reinstalled, including terminal sections, acceptably installed in accordance with the Specifications. No extra allowance will be made for laps of splices.

**7.2.4.5 Accommodation of Traffic**

Work required for the safe, controlled and signed accommodation of traffic during the removal of guardrail will not be measured separately for payment and shall be considered incidental to the guardrail removal operation.

**7.2.4.6 Damaged Steel Guardrail Materials**

The replacement of guardrail materials damaged where salvage is specified will not be measured separately for payment and shall be considered incidental to the guardrail removal operation.

**7.2.5 BASIS OF PAYMENT**

Payment for Steel Guardrail Removal will be at the Contract unit price per linear metre.

The unit price shall be compensation in full for accommodation of traffic, removing, dismantling, cleaning, hauling, disposing, storing of the guardrail materials, including hardware, backfilling, compacting and levelling post holes and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

Payment for Reinstallation of Steel W-Beam Guardrail will be at the Contract unit price per linear metre.

The unit price shall be compensation in full for reinstalling steel guardrail, traffic control and accommodation, excavating holes, placing and trimming posts, erecting the guardrail, burring the bolts, loading, hauling, placing, watering and tamping the backfill material from the Department's source or quarry, all surveying, supplying and attaching reflectors and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.



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### 7.3 SECTION 3 – SUPPLY AND INSTALLATION OF STEEL W-BEAM GUARDRAIL

#### 7.3.1 DESCRIPTION

This Work consists of the supply and installation of Steel W-Beam Guardrail on treated timber posts and offset blocks at the locations and in conformity with the dimensions and other details shown on the Drawings or as designated by the Engineer.

#### 7.3.2 MATERIALS

##### 7.3.2.1 **Supply**

The Contractor shall be responsible for the supply of all guardrail materials.

##### 7.3.2.2 **Steel W-Beam Rails and Terminal Elements**

Steel W-Beam rails and terminal elements shall consist of rail sections fabricated for installation to develop a continuous beam strength with the necessary safety end feature components.

Rail and terminal elements shall conform to the latest requirements of the latest edition of “Corrugated Sheet Steel Beams for Highway Guardrail” (AASHTO M180).

All rail sections and terminal sections shall conform to the latest AASHTO/ARTBA requirements for full interchangeability of similar components regardless of the source or manufacturer.

All components supplied shall be clearly and permanently stamped, clear of the splicing overlap and on the opposite face to the traffic side, with the following information: manufacturer's name or trademark, nominal thickness of metal, and date of manufacture.

The rails and terminal sections shall also conform to the following requirements:

##### a) Metal Properties

- Minimum Yield Point: 345 MPa
- Minimum Tensile Strength: 483 MPa
- Minimum Elongation: 12% in 50 mm length

##### b) Sheet Thickness

The rails and terminal sections shall be manufactured in accordance with the latest requirements of Corrugated Sheet Steel Beams for Highway Guardrail (AASHTO M180), Table 2 (Class A, Type 2), with a nominal base metal thickness of 2.82 mm and a minimum base metal nominal thickness of 2.67 mm.

##### c) Sheet Width

The sheet width for W-beam rails shall be 483 mm with a permissible tolerance of +/- 3.2 mm.

Welding for the fabrication of terminal elements shall conform to the latest requirements of Welded Steel Construction (Metal Arc Welding) (CSA W59).

Rails and terminal elements shall be hot-dip galvanized after fabrication and shall conform to the latest requirements of Hot Dip Galvanizing of Irregularly Shaped Articles (ASTM A123/123M). The galvanizing shall have a minimum thickness of 80 mm.

Hot dip galvanized coating shall be smooth and free of beading and sharp projections at the edges. The coating shall be sufficiently adherent to prevent peeling by cutting or prying with a stout knife under considerable pressure (bond check). Magnetic gauge testing may be used for verifying the galvanized coating thickness in

accordance with the latest requirements of Magnetic Gauge Testing of Galvanizing Coating (ASTM E316.3). Dimensions of the finished guardrail shall have a tolerance of +/- 3 mm.

#### **7.3.2.3 Bolts, Nuts and Washers**

Bolts, nuts and washers shall conform to the latest requirements of Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength (ASTM A307) and shall be hot-dip galvanized in accordance with the latest edition of ASTM F2329/F2329M.

#### **7.3.2.4 Timber Posts and Offset Blocks**

Posts and offset blocks shall be either Douglas fir, hemlock, Lodgepole pine or better and shall meet the requirement of the National Lumber Grades Authority (NLGA) for No. 1 Structural Posts and Timbers graded conforming to the NLGA Standard Grading Rules for Canadian Lumber. Timber posts and offset blocks shall be rough sawn with holes drilled to the finished dimensions shown in the Standard Drawings. Timber posts and offset blocks shall conform to the dimensions shown on the Standard Drawings. Unless otherwise specified, the timber posts shall be 1.76 m in length.

Timber posts shall be date stamped at the top of either side of the post not used for rail attachment, with the last two digits of the year of fabrication. The stamp shall be at least 50 mm by 50 mm and have an indentation of 3 mm.

Stamping and drilling shall be completed prior to treating the posts and offset blocks. Timber posts and offset blocks shall be pressure treated in accordance with the latest requirements of Wood Preservation (CSA 080) with a water borne preservative of chromated copper arsenate (CCA) or ammoniacal copper arsenate (ACA) to 8 kg/m<sup>3</sup>.

The penetration and retention of preservatives shall conform to the requirements of CSA Standard 080.14, Table 1, Minimum Retention of Preservatives in Pressure Treated Wood for Highway Construction, under the headings "Post-Guardrail, Guide, Sign and Sight" for posts, and "Bridge Hand Rails, Guardrails and Posts" (not in contact with ground or water). The penetration and retention of the preservative may be verified by the Engineer by the array method.

#### **7.3.2.5 Materials Certification and Specifications Conformance**

The Contractor shall provide the Engineer with the following, prior to installation:

- a) A copy of the manufacturer's certificate(s), conforming to the latest requirements of General Requirements for Rolled or Welded Structural Quality Steel (CSA G40.20/G40.21), for each of the mechanical and chemical tests, and
- b) Certification, by letter attached to the copy of the manufacturer's certificate(s), that all the materials provided are from the materials identified by the manufacturer as being represented by the copies of the manufacturer's certificate(s).

All guardrail material that does not conform to the Specifications will be rejected. Rejected guardrail material shall be replaced at the Contractor's expense, including shipping charges and the removal of rejected material from the project site.

### **7.3.3 CONSTRUCTION**

#### **7.3.3.1 Survey, Layout, Staking and Grading Requirements**

- a) The Contractor shall provide and pay for qualified personnel to carry out all surveying, layout, staking,

grading, and referencing required for the accurate placement and control of guardrail installation operations. This shall include the removal of existing guardrail, where applicable.

- b) The Contractor shall notify the Engineer when the guardrail installation has been completed in accordance with the Specifications and shall provide ample opportunity for the Engineer to take verification measurements of the installation.

The Engineer will not take measurements of the guardrail installation at any time prior to notification by the Contractor that the guardrail installation has been completed in accordance with the Specifications, nor will the Engineer be obliged to notify the Contractor of any deficiencies, after the measurements have been completed.

The completion of guardrail installation measurements by the Engineer shall in no way constitute acceptance of the guardrail materials or guardrail installation by the Engineer.

#### **7.3.3.2 Installation**

The guardrail, posts and offset blocks shall be accurately set to the required depth, height, line, grade and alignment in a manner that results in a smooth, continuous installation which parallels the line and grade of the highway surface, in accordance with the Standard Drawings. The permissible tolerance for plumb is less than 1.5 degrees from vertical and grade of the posts shall be a maximum of 6 mm.

The diameter of the post holes for the guardrail shall be of sufficient size to allow for pneumatic tamping.

The Contractor shall thoroughly compact the bottom of each post hole and the guardrail posts shall rest directly and solidly on the bottom of each hole at the time of installation.

Excavated material which is unsuitable for use as backfill shall be substituted with granular material by the Contractor at his expense. The backfill material shall be free of large stones and shall be thoroughly compacted utilizing pneumatic tampers, in layers not exceeding 150 mm, for the full depth of the excavation.

All rail elements shall be lapped in the direction of traffic. Bolts shall be tightened to a torque of 100 N-m and exposed threads shall be burred.

The Contractor shall repair or replace, at no direct expense to the Department, any guardrail material damaged by his operations, to the satisfaction of the Engineer. Minor damage to galvanized surfaces shall be repaired in accordance with ASTM A780/A780M Method A2, Repair Using Paints Containing Zinc Dust. Major abrasions shall be repaired by re-galvanizing or replacement, as determined by the Engineer.

The guardrail shall be connected to new or existing bridge walls or parapets in accordance with the Drawings.

Surplus excavated material and debris shall be removed from the site by the Contractor at his expense.

#### **7.3.3.3 Guardrail Reflectors**

The Contractor shall be responsible for the supply and attachment of reflector strips to the two top corners of the traffic side of every 6<sup>th</sup> guardrail post/offset block.

Reflectors shall have minimum dimensions of 102 mm x 76 mm.

Reflective sheeting meeting the requirements of ASTM D4956 for Type IX or XI sheeting shall be installed on both sides of the reflector.

White reflectors shall be attached to the top corners of the offset blocks facing adjacent traffic and yellow reflectors shall be attached to the top corners of the offset blocks facing oncoming traffic.

#### 7.3.4 ACCEPTANCE OF WORK AND WARRANTY

Prior to installing any guardrail, the Contractor shall provide the Engineer with copies of the Manufacturer's certificates verifying that the supplied guardrail material conforms to Section 16 of CSA G40.20 for each of the mechanical and chemical tests; and the supplied reflective sheeting conforms to ASTM D4956 for Type IX or XI sheeting.

Prior to final acceptance of the Work, any damage or deficiencies from any cause to the guardrail, posts, offset blocks, bolts and hardware shall be rectified by the Contractor at their own expense.

The permissible tolerance at the end of the warranty period for all posts will be two degrees from vertical for plumb and shall be less than 13 mm for grade.

#### 7.3.5 MEASUREMENT

##### **7.3.5.1 Supply and Installation**

The quantity of Supply and Installation of Steel W-Beam Guardrail to be measured for payment will be the number of linear metres based on the total length of guardrail measured from end to end along the face of the installed rail, including rail terminal sections, acceptably fabricated, supplied and installed in accordance with the Specifications. No extra allowance will be made for laps or splices.

The supply and installation of wing terminal sections will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

The supply and application of paint, if required, will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

The supply and attachment of guardrail reflectors will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

##### **7.3.5.2 Accommodation of Traffic**

Work required for the safe, controlled and signed accommodation of traffic during installation or removal of guardrail will not be measured separately for payment and shall be considered incidental to the guardrail supply and installation operation.

#### 7.3.6 BASIS OF PAYMENT

Payment for Supply and Installation of Steel W-Beam Guardrail will be at the Contract unit price per linear metre.

The unit price shall be compensation in full for ordering, fabricating, purchasing, loading, transporting, unloading, storing, handling, hauling, delivering and supplying guardrail materials and hardware, including rail terminal sections and wing terminal sections, traffic control and accommodation, excavating holes, loading, hauling, placing, watering and tamping the backfill material from the Department's source or quarry, all surveying, supplying and attaching metal reflectors and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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## **8.1 SECTION 1 - SUPPLY AND APPLICATION OF PAINTED ROADWAY MARKINGS**

### **8.1.1**     DESCRIPTION

Painted Roadway Markings consists of the supply and application on paved roadways of two colours of paint and reflecting glass beads and includes painting single and double, solid and broken directional dividing lines, edge lines, lane lines, continuity lines, gore areas, arrows, stop lines, crosswalk areas and railway crossing markings.

### **8.1.2**     MATERIALS

#### **8.1.2.1**     **General**

The Contractor shall be responsible to supply and safely apply and cure as specified all roadway marking materials.

The Contractor shall choose the white and yellow traffic paints to be supplied and applied from the list of traffic paint suppliers and paint formulations which have been approved for the same by Alberta Transportation or its successor at the time of the supply and application of the roadway markings.

Paints shall be reflectorized in accordance with the latest edition of AASHTO M 247.

The Contractor shall provide the Engineer with the following information prior to commencing the Work:

- a) Names and addresses of the suppliers and manufacturers.
- b) Formulation to be supplied.
- c) Written confirmation from the manufacturer that the materials to be supplied meet all specified requirements.

The Contractor shall verify that all materials delivered and used in the Work are the type specified.

#### **8.1.2.2**     **Supply, Handling and Storage**

The Contractor shall make all arrangements for the supply and delivery of paint and glass beads and shall provide the Engineer with records of all materials received and/or returned, on a daily basis.

The Contractor shall provide, maintain and reclaim all material storage sites. The storage of materials at Department facilities will not be permitted.

No paint formulation shall be diluted or mixed with a different formulation or with any other material, without the specific prior approval of the Engineer.

The Contractor shall take all necessary steps to prevent contamination of materials. Materials shall be protected from freezing.

The Contractor shall be responsible for the proper clean-up of waste or spilled material to the satisfaction of the Engineer, and the proper disposition of containers.

#### **8.1.2.3**     **Quality Control**

The Contractor shall be totally responsible for quality control inspection throughout every stage of the Work to ensure that materials and workmanship comply with the requirements of this Specification and the Manufacturer's recommendations. The Contractor shall develop and submit in writing to the Engineer a quality control inspection plan that addresses all the elements that affect the quality of the Painted Roadway Markings including but not limited to:

- a) Colour
- b) Retro-reflectivity
- c) Paint Application Rates
- d) Glass Bead Application Rates
- e) Pavement Surface and Atmospheric Conditions
- f) Line Widths, Line Lengths and Space Lengths.

The Contractor shall maintain records of quality control data, complaints from the public, and other details relevant to the Work and shall provide these records to the Engineer daily.

#### **8.1.2.4 Quality Assurance Sampling and Testing**

The Contractor shall supply the Engineer with the manufacturer's quality control test results and a quality assurance sample for each batch of material as it is delivered to the project. Samples for quality assurance shall be obtained by the Contractor from the manufacturer or from drums as delivered to the Contractor's storage location.

If the Contractor obtains quality assurance samples at the time of delivery to their storage location, the sampling and minimum frequency of testing shall be as described in the latest edition of Alberta Transportation's (or successor's) Test Methods for Sampling Traffic Paint (TLT-636) and Sampling Glass Beads (TLT-601), or ASTM and AASHTO equivalent (T 346).

If glass beads are supplied in bags, a minimum of one 25 kg bag shall be selected from each project or for every 10,000 kg of glass beads delivered to the project.

All materials shall be subject to further inspection, sampling and testing by the Engineer and the Contractor shall provide safe, convenient access, acceptable to the Engineer, for inspection and sampling of the materials, and shall cooperate in the inspection and sampling process when requested to do so.

### **8.1.3 CONSTRUCTION**

#### **8.1.3.1 General**

The locations of painted roadway markings include the sections of highway and intersections specified, as well as through towns, at roadside turnouts, rest areas, points of interest and weigh scale turnouts.

#### **8.1.3.2 Survey, Layout and Referencing Requirements**

##### **Interim Roadway Markings**

The Contractor shall be responsible for the supply and application of interim roadway markings (spotting) required for the application of the permanent painted roadway markings, prior to the application of the permanent markings.

The spots shall be applied exactly on the location of the roadway marking using paint suitable for temporary pavement markings. The Contractor shall provide paint product data used for spotting to the Engineer for review and approval.

The Contractor shall carry out all surveying, layout and referencing required for the establishment of roadway marking locations and the accurate application of the spots.

All spots shall be 100 mm wide and a minimum of 150 mm long, applied lengthwise to the road surface.

The maximum distance between spots shall be 15 m on tangents and 10 m on curves.

On roadways exposed to traffic overnight, the spotting shall be carried out daily.

#### Barrier Line Limits

The Contractor will establish and carry out pre-marking of barrier line limits (solid yellow line) for no-passing zones. The Contractor shall be responsible for determining the locations of the no-passing zones based on the requirements in the most recent version of the Transportation Association of Canada Geometric Design Guide for Canadian Roads and the Manual of Uniform Traffic Control Devices for Canada. The location of no-passing zones shall be certified by a Professional Engineer. Provide certification to the Engineer prior to construction.

The Contractor shall be responsible for referencing all existing paint and traffic markings and the end points of no-passing zones on stakes such that the markings and the end points of no-passing zones can be accurately re-established and pre-marked by the Contractor. While referencing the existing roadway markings, the Contractor shall verify all roadway markings are in compliance with the most recent versions of the Transportation Association of Canada Geometric Design Guide for Canadian Roads and the Manual of Uniform Traffic Control Devices for Canada. The station location shall be recorded on each stake and in a field book which shall become the property of the Department.

#### **8.1.3.3 Safety and Traffic Control Equipment**

Safety and traffic control equipment shall be the Contractor's responsibility.

Traffic control equipment requirements shall include:

- a) One pilot truck and,
- b) Warning signs and traffic cones as required.

The paint truck and the pilot truck shall each be equipped with the following:

- a) All lights as required by the Northwest Territories *Motor Vehicles Act*, including a roof mounted overhead rotating amber beacon. The beacon shall be mounted on the top of the vehicle and fully visible to traffic approaching from both front and rear.
- b) A two-way radio for voice communication.
- c) A sequential arrowboard meeting the following Specifications:
  - i. Minimum size 0.75 m x 1.52 m.
  - ii. Operating modes which include:
    - sequential left arrow or chevron,
    - sequential right arrow or chevron,
    - sequential double arrow or chevron,
    - horizontal bar,
    - all flash warning mode.
  - iii. The arrowboard shall be controlled from a console located in the vehicle cab.
  - iv. The arrowboard display shall be visible to traffic approaching the rear of the trucks.
- d) A "Slow Moving Vehicle" sign. The sign shall be mounted at the rear of the vehicle and shall be visible to the public only when the paint truck is applying paint.
- e) A warning sign, mounted at the rear of the truck, stating "Wet Paint - Keep Off". The sign shall have standard warning colours and shall be visible to the public only when the paint truck is applying paint.

Operation of the paint truck against the flow of traffic is not permitted.

**8.1.3.4 Pavement Surface and Atmospheric Conditions**

Painting shall not be carried out during the following conditions: When the ambient temperature is below 0°C for solvent based paints, and 10°C for water-based paints, when wind conditions cause overspray, when the visibility is less than 700 m and during periods of rainfall.

Areas to be painted shall be clean and dry during the application of paint.

Prior to the commencement of work, the Contractor shall inspect the areas to be painted to ensure they are clean, dry, free of sand and debris and suitable for painting.

The Contractor shall carry out sweeping operations as required, prior to the application of the roadway markings.

**8.1.3.5 Hours of Work**

The Contractor shall only carry out roadway marking operations during hours of daylight and must receive approval from the Engineer prior to commencing roadway marking operations. There will be no payment for roadway markings applied during hours of darkness or without the Engineer's approval.

The Engineer's approval to commence roadway marking operations shall in no way relieve the Contractor from their obligation to provide materials, mixtures and workmanship in accordance with the Specifications.

**8.1.3.6 Paint and Bead Application**Paint

The Contractor shall apply paint to the road surface such that all markings have a minimum wet film thickness of 375 microns (minimum 38.7 L/km of solid 100 mm wide line).

On tangents, the roadway lines shall not deviate more than 40 mm from either side of the tangent line at any point, as measured between the tangent line and the edge of the roadway marking.

Beads

Reflectorization of all painted markings shall be obtained by uniformly covering the markings with glass beads at a minimum rate of 600 gm/L of paint sprayed on the road surface. The glass beads shall be applied to the wet paint film on the roadway surface by means of guns and under air pressure, immediately following the application of paint.

Evaluation of Road Surface

The Contractor shall be responsible for evaluating the porosity and texture of the road surface and applying the paint and beads at rates and in a manner, which results in the optimum visibility and reflectivity of the markings. All roadway markings shall be applied uniformly in thickness and coverage with no splatter, excessive overspray, shadowing, bare areas or other defects.

**8.1.3.7 Dimensions of Markings**

Directional dividing line spacing for dashed or broken lines shall consist of 3 m dashes and 6 m gaps.

Unless otherwise specified, all directional dividing lines, edge lines, lane lines and continuity lines shall be 100 mm wide.

Edge line markings shall be applied no less than 100 mm clear distance from the edge of the pavement surface.

Gore areas, arrows and stop lines shall be applied in accordance with the Drawings.

Crosswalk areas and railway crossing markings shall be applied in accordance with the standards set out in the latest edition of the *Manual of Uniform Traffic Control Devices for Canada*.

#### **8.1.3.8 Existing Paint and Traffic Markings**

When painting is required in areas where there are existing paint and traffic markings, the Contractor shall ensure that the paint and markings match the existing paint and markings exactly, unless specified otherwise.

When specified, remove existing painted roadway markings prior to the application of new Painted Roadway Markings. Removal of the existing painted roadway markings shall be considered incidental unless a separate bid item is identified.

#### **8.1.3.9 Protection of Markings**

The Contractor shall make every reasonable effort to protect the roadway markings from damage until they are dry. This shall include the use of warning signs and traffic cones as required. Roadway markings which in the opinion of the Engineer have been damaged as a result of the Contractor's failure to reasonably protect the Work will not be eligible for payment. The Contractor shall repair and make good the damaged Painted Roadway Markings at the Contractor's expense to the satisfaction of the Engineer.

#### **8.1.3.10 Quality of Markings and Acceptance Criteria**

Painted Roadway Markings which in the opinion of the Engineer do not comply with the Specifications for application rates, thickness, visibility, reflectivity, coverage, overspray, shadowing, dimensions, alignment, straightness and location shall be removed, repaired or repainted by the Contractor, as required by the Engineer, at the Contractor's expense.

##### Acceptance Criteria

- a) All painted lines shall not exceed a dimensional width of 110 mm for specified 100 mm wide line.
- b) No tolerance below 100 mm is allowed for the specified 100 mm wide line.
- c) All painted lines shall not exceed a dimensional width of 210 mm for specified 200 mm wide line.
- d) No tolerance below 200 mm is allowed for the specified 200 mm wide line.
- e) All painted direction dividing, lane dividing or continuity lines shall not exceed a maximum dimensional length deviation of +/- 100 mm for specified 3 m length of line.
- f) All spaces between painted direction dividing, lane dividing or continuity lines shall not exceed a maximum dimensional length deviation of +/- 100 mm for specified 6 m or 3 m length of space.
- g) All paint shall be applied at the proper locations in accordance with the Drawings or as directed by the Engineer.
- h) All paint and glass beads shall be uniformly applied.
- i) All painted lines shall be uniform in thickness and free of tire tracking, with no splatter, excessive overspray or other defects.

#### **8.1.3.11 Removal of Incorrectly Painted Markings**

Any markings that are incorrectly painted by the Contractor or painted where no markings are specified shall be removed by the Contractor at their own expense and to the satisfaction of the Engineer. The method and equipment used by the Contractor to remove incorrectly painted markings shall be subject to the Engineer's approval.

#### **8.1.3.12 Contractor's Records and Reporting**

The Contractor shall maintain complete and accurate records of the daily production and quantities of paints and glass beads used, weather conditions and other details relevant to the Work.

The Contractor shall provide original copies of this information to the Engineer on industry standard forms, daily.

#### 8.1.4 MEASUREMENT AND PAYMENT

Payment for Supply and Apply Painted Roadway Directional Dividing Lines, Edge Lines, Lane Lines and Continuity Lines will be at the Contract unit price per line-kilometre.

Directional dividing lines consisting of two lines will be considered as one line for measurement and payment purposes.

Payment for Supply and Apply Painted Roadway Gore Area and Crosswalk Area Markings will be at the Contract unit price per square metre.

Payment for Supply and Apply Painted Roadway Arrows, Stop Lines and Railway Crossing Markings will be at the Contract unit price per unit.

The unit price shall be compensation in full for inspecting and evaluating the roadway surface, cleaning, sweeping, all surveying, layout and referencing, supplying and applying centreline spotting material, applicable pre-marking, paint truck, pilot truck, ordering, purchasing, scheduling, delivering, supplying, storage facilities, handling, storing, sampling and applying paint and glass beads, quality control and quality control testing, protection of markings, signing, traffic control and accommodation, safety, record keeping and reporting and the supply of all equipment, labour, materials, tools and incidentals required for the supply and application of the painted roadway markings in accordance with the Specifications.



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## **8.2 SECTION 2 – PORTLAND CEMENT CONCRETE**

### **8.2.1 DESCRIPTION**

This Specification refers to the supply and production of Portland cement concrete for Roadway Concrete (Division 8, Section 3) such as curbs, gutters, sidewalks, medians and traffic islands.

### **8.2.2 SUPPLY**

Unless otherwise specified, the Contractor shall be responsible for the supply and delivery of all Portland cement, coarse aggregate, fine aggregate, water, and admixtures where required.

The Contractor shall indicate in their bid submission under "List of Subcontractors", their designated source of all specified Portland cement, aggregates, water and admixtures.

#### **8.2.2.1 Cement Storage Facilities**

The Contractor shall provide, at their expense and to the satisfaction of the Engineer, cement storage facilities of sufficient capacity to store all cement ordered to the job site and, notwithstanding the foregoing, shall provide, at least, sufficient cement storage capacity to store the cement required for one full day of production. Cement storage facilities shall be capable of protecting the materials from the weather.

When more than one type of cementitious material is specified, separate storage shall be provided for each type.

Cement and cementitious materials shall be stored and handled in such a way as to prevent any damage or contamination.

#### **8.2.2.2 Protection of Materials**

No cement type shall be mixed with a different type or with any other material without the specific approval of the Engineer.

The Contractor shall take all necessary precautions to prevent contamination of the cement by cement of another type or by any deleterious material. Any cement contaminated, or damaged for any reason whatsoever, shall be replaced by the Contractor at their own expense.

The Contractor shall take all necessary precautions to prevent the segregation, damage and contamination of all aggregates used in the production of Portland cement concrete. Any segregated, damaged or contaminated aggregate shall be replaced by the Contractor at their own expense.

#### **8.2.2.3 Production of Concrete**

The Contractor is responsible for the proper operation and maintenance of all equipment necessary for handling materials, producing and delivering of the concrete and performing all parts of the Work to meet this Specification.

Concrete shall be supplied from a facility that is certified in accordance with a recognized independent concrete organization which operates a formal facility certification program. Certification shall conform to a recognized standard (e.g., ASTM C94 and/or ASTM C685), be completed by a Professional Engineer, and shall include periodic documentation that demonstrates compliance with the applicable certification standard.

Scales or other mass-measuring devices shall be accurate to  $\pm 0.4\%$  of the total capacity of the device when static-load-tested. A certificate of accuracy not more than 180 days old shall be provided for the scales or measuring devices by a company using weights traceable to national standards. Where there is reasonable

doubt concerning the accuracy of the scales or measuring devices, the Department may require calibration before or during progress of Work.

#### **8.2.2.4 Sampling and Testing**

In accordance with Division 2, quality control testing and inspections are the sole responsibility of the Contractor. The Contractor shall outline in the QC Plan the quality control planned for Portland cement concrete.

Quality assurance sampling, testing and inspections may be performed by the Engineer and/or their representative on all cement and concrete materials.

The Contractor shall cooperate with the Engineer and/or their representatives in obtaining the samples required, and shall provide safe, convenient access, acceptable to the Engineer for inspection and sampling of materials used to supply the Portland cement concrete.

All properties shall be determined in accordance with the requirements of the latest versions of CSA A23.1 (Concrete Materials and Methods of Concrete Construction), CSA A23.2 (Test Methods and Standard Practices for Concrete), and CSA A3000 (Cementitious Materials Compendium).

Field sampling and test procedures shall be carried out in accordance with the requirements of CSA A23.2 by personnel certified under an industry-recognized program such as: CSA A283 or ISO 9001 with equivalent scope to CSA A283; CCIL Certified Concrete Testing Technician; or ACI Concrete Field Testing Technician Grade 1.

### **8.2.3 MATERIALS**

#### **8.2.3.1 Portland Cements and Supplementary Cementitious Materials**

Portland cements and all cementitious materials shall conform to CSA A3001.

Unless otherwise specified, Type GU (General Use) Portland cement shall be used in all concrete.

The blending proportions of the supplementary cementitious materials shall not qualify the concrete mix design as a concrete made with high-volume supplementary cementing materials (HVSCM) as defined by CSA A23.1, clause 8.7. Use of HVSCM concrete shall be subject to the prior approval of the Engineer.

#### **8.2.3.2 Water**

Water used for producing and curing shall conform to the requirements of the latest version of CSA A23.1/A23.2.

Water deemed not potable shall be subject to the prior approval of the Engineer. The testing shall be performed by an organization certified by the Standard Council Canada.

#### **8.2.3.3 Aggregates**

All aggregates used in the production of Portland cement concrete shall conform to the requirements of the latest version of CSA Standard CSA A23.1, Concrete Materials and Methods of Concrete Construction. All aggregates shall be subject to the prior approval of the Engineer.

#### **8.2.3.4 Admixtures**

All admixtures shall be in liquid form and non-chloride base. The admixtures shall be stored and handled in accordance with the requirements of the manufacturer. All admixtures shall be supplied by one manufacturer.

**Air Entraining Agent**

Air entraining admixtures shall conform to the requirements of the latest version of CSA A23.1 and ASTM C260. Air-entraining admixtures shall be subject to the prior approval of the Engineer.

**Water-Reducing Admixture**

Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. High-range water reducing admixtures (superplasticizers) shall meet the requirements of ASTM C494, Type A and F or ASTM C1017.

**Other Admixtures**

Where the use of other admixtures is approved by the Engineer, the admixtures shall conform to the requirements of the latest versions of CSAA23.1 and ASTM C494.

**8.2.3.5      Aggregates**

Aggregates are suitable for most concrete applications if the aggregates comply with Clauses 4.2.3.1 to 4.2.3.7 and Tables 10 to 12 of the latest version of CSA A23.1.

Additionally, the maximum Petrographic Number (PN) of coarse aggregate shall not exceed 125 for concrete pavements and shall not exceed 140 for Structures, Sidewalk, Curb and Gutter, and Concrete Base, and shall be determined in accordance with CSA A23.2-15A. The petrographic analysis report shall be signed and sealed by a Professional Engineer or a Professional Geologist.

Fine aggregates shall have no more than 45% passing any sieve and retained on the next consecutive sieve. The fineness modulus shall be a minimum of 2.3 and a maximum of 3.1.

All aggregates shall be subject to the prior approval of the Engineer. All required supporting test data shall be less than 12 months old at the time the concrete mix design is submitted.

**8.2.4      CONSTRUCTION****8.2.4.1      Mix Design**

The concrete shall be produced in accordance with CSA A23.1, Table 5, Alternative Number 1, Performance Approach. The Contractor is responsible for the preparation and submission of a mix design for the production of Portland cement concrete to be used in the Contract. The concrete mix shall be designed to provide adequate strength and durability for the intended use and to meet the requirements specified in the Contract.

The Contractor shall use professional engineering services and a qualified testing laboratory licensed to practice in the Northwest Territories to carry out the design of the concrete mixture.

A complete mix design submission (e.g., the Sample Concrete Mix Submittal Form in CSA A23.1- Annex J), shall be submitted to the Engineer for approval a minimum of seven days prior to the production of concrete. The Contractor shall not produce concrete until the mix design has been approved by the Engineer.

If, during the progress of the Work, it is determined that the concrete does not meet the requirements of the Specification, the Contractor shall provide a new mix design for the Engineer's approval, in accordance with the foregoing requirements.

All concrete shall be produced in accordance with the approved mix design.

**8.2.4.2 Class of Concrete and Properties**

The CSA Class of Exposure of the concrete and its corresponding properties (i.e., maximum water-to-cementing materials ratio, minimum specified compressive strength, air content category, curing type and chloride penetrability requirement) and any additional/special performance requirements of the Portland cement concrete at 28 days shall be specified in the Contract.

Unless otherwise specified, the concrete for concrete roadway structures such as curbs, gutters, sidewalks, medians and traffic islands shall be CSA Class of Exposure of C-2 concrete with a minimum 28-day compressive strength of 32 MPa and shall have a nominal maximum aggregate size of 19 mm. The air content of plastic concrete shall be 5.0% to 8.0% ( $6.5 \pm 1.5\%$ ) at the time of placement.

**8.2.4.3 Air Content**

The air content of the plastic concrete shall be in accordance with the requirements of the latest version of CSA A23.1, Table 4 based on the nominal maximum size of the coarse aggregate and air content category.

**8.2.4.4 Slump**

The minimum permissible slump shall be that which allows the concrete to be placed efficiently and provide a homogenous mass. The maximum permissible slump shall be 80 mm,  $\pm 30$  mm, unless otherwise specified in the contract documents.

When superplasticizer is approved by the Engineer, the Contractor shall identify target slump for the concrete after the addition of superplasticizer. The tolerance on measurement of concrete slump after addition of superplasticizer shall be  $\pm 30$  mm and the maximum slump including tolerance shall not exceed 230 mm. Slump of concrete shall be measured before and after the addition of superplasticizer.

Re-tempering concrete by adding water will not be permitted.

**8.2.4.5 Concrete Temperature**

The concrete temperature at the time of placement shall be according to the requirements of the latest version CSA A23.1, Table 14 based on the thickness of the section.

**8.2.4.6 Sampling and Testing**

All sampling and testing shall be in accordance with the requirements of the latest version of CSA A23.1 and CSA A23.2 by personnel certified under an industry-recognized program. Temperature shall be measured according to CSA A23.2-17C. Slump shall be measured according to CSA A23.2-5C. Air content shall be measured according to CSA A23.2-4C. Compressive strength shall be measured according to CSA A23.2-9C. Copies of calibration certificates shall be available for review.

Samples for determining acceptance of concrete for slump and air shall be collected according to CSA A23.2-1C after approximately 10% of the load has been discharged. The discharge shall be stopped until found acceptable. If the test results indicate that the concrete does not meet the specified requirements and adjustments permitted in the Acceptance and Field Adjustments of Plastic Concrete clause cannot produce acceptable concrete, the remainder of the load shall be rejected.

Slump, air content, and temperature shall be measured on each load of concrete until satisfactory control is established. It is established when five consecutive concrete loads are within the specified requirements without field adjustments as described in the Acceptance and Field Adjustments of Plastic Concrete clause. After satisfactory control has been established, quality control testing shall be carried out on every third load.

If testing indicates that a load does not meet the requirements, quality control testing shall resume on each load until satisfactory control is established.

Not less than one compressive strength test shall be made from samples from each 50 m<sup>3</sup> of concrete placed, and in no case shall there be less than one test from each day's production. Concrete test cylinders for compressive strength testing for acceptance, and for referee testing purposes where required, shall be cast, cured and transported according to CSA A23.2-3C. One set of cylinders for concrete made with aggregate of nominal maximum size larger than 19.0 mm shall consist of three 150 mm diameter x 300 mm long cylinders. For all other concrete, a set of cylinders shall consist of four 100 mm diameter x 200 mm long cylinders. Additional samples may be cast, at the discretion of the Engineer or Contractor.

When any individual strength test result falls below the specified minimum strength at the corresponding testing age by more than 3.5 MPa or when the average strength test result falls below the specified minimum strength, the Engineer may require the Contractor to extract and test concrete cores in accordance with CSA-A23.2-14C by an independent CSA certified testing laboratory. The compressive strength of the concrete in the area of the structure represented by the core tests shall be considered adequate when satisfies the requirements of clause 4.4.6.2.2 of the CSA A23.1. Unacceptable concrete shall be subject to removal and replacement.

The Contractor shall supply temperature-controlled storage boxes (e.g., cooler box), as specified in Subsection 8.3.2.1 of CSA A23.2-3C, to store the samples for a period of not less than 24 hours or until removed from the site. The Contractor shall place a max-min thermometer in each storage box and record site curing temperatures. Further protection from adverse weather conditions may be required.

Slump, temperature of plastic concrete, air content shall be determined in conjunction with each strength test.

The Contractor is responsible to deliver the test cylinders to an independent CCIL certified testing laboratory.

#### **8.2.4.7 Acceptance and Field Adjustments of Plastic Concrete**

Slump of concrete shall be measured before and after the addition of superplasticizer (if allowed by the Engineer). Air content shall be measured after any addition of superplasticizer. No field adjustment for air content or temperature shall be permitted.

The following actions may be allowed prior to acceptance of the load when the measured slump is high:

- a) Concrete before addition of superplasticizer or concrete without superplasticizer: When the measured slump is higher than that specified, the Contractor shall be permitted to immediately measure the slump again when there is time available within the discharge time limit specified. When the measured slump is higher than that specified, the plastic concrete shall be rejected.
- b) Concrete containing superplasticizer: When superplasticizer is added on site and the measured slump prior to addition of superplasticizer is within specified limits but exceeds the upper limit after the addition of superplasticizer and there is time available within the discharge time limit specified, the Contractor shall be permitted to wait and measure the slump again. If the measured slump is higher than that specified, the plastic concrete shall be rejected.

The following field adjustments may be carried out prior to acceptance of the load when the measured slump is low:

- a) For site-added superplasticizer:
  - i. Water may be added before superplasticizer is added at the site. Water additions may be done

- before discharge of concrete from the truck has started or when the measured slump of concrete is lower than the maximum targeted range provided the extra water does not exceed the maximum specified water-to-cementing ratio of the mixture.
- ii. No water shall be added after the addition of a superplasticizer. Only one dosage of the superplasticizer is allowed.
- b) For plant-added superplasticizer:
- i. No water shall be added at the site.
  - ii. Only one dosage of the superplasticizer may be added.

To ensure that the concrete is uniformly mixed, the load of concrete shall be mixed for 30 revolutions or more at the designated mixing speed after the field adjustment. The load shall be tested for acceptance for slump, air content and temperature.

#### **8.2.4.8 Discharge Time**

When concrete is transported to the site by means of agitating or mixing equipment, discharge of the concrete shall be completed within 120 minutes after introduction of the mixing water to the cement and aggregates, except when the air temperature exceeds 28°C, the concrete shall be discharged within one hour after the introduction of the mixing water.

Exceptions to the maximum time limit, if required, shall be approved by the Engineer prior to placement of the concrete.

#### **8.2.4.9 Delivery Ticket**

A delivery ticket shall be issued for each load. The following information shall be printed on each delivery ticket:

- a) Contract number;
- b) Date and time of batching concrete;
- c) Address of the batching plant;
- d) Truck number;
- e) Any adjustments at the site;
- f) Concrete Mix Design number; and
- g) Specified minimum compressive strength of concrete at the corresponding testing age.

#### **8.2.4.10 Submission of Plastic Concrete Test Results**

After each day's work, the Contractor shall submit to the Engineer a copy of the delivery ticket for each load of concrete and a daily summary report summarizing air contents, slumps before and after any modifications, concrete temperature, and all adjustments made to each load of concrete and shall identify rejected material.

#### **8.2.4.11 Submission of Hardened Concrete Test Results**

The test results on the hardened properties of the concrete along with the properties of the fresh concrete and recorded max-min temperatures during the first 24 hours shall be provided to the Engineer once they become available. One cylinder shall be tested at seven days. Three cylinders shall be tested at 28 days. Three cylinders shall be tested at 56 days (when required).

The compressive strength of concrete shall be considered satisfactory if: the averages of all sets of three consecutive strength tests equal or exceed the specified strength with no individual strength test result below the specified minimum strength by more than 3.5 MPa.



**8.2.5 BASIS OF PAYMENT**

Supply and Production of Portland Cement Concrete will not be measured separately for payment but shall be measured and paid for in accordance with the applicable Specifications for the respective structure for which the concrete is being used.

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### **8.3 SECTION 3 – ROADWAY CONCRETE**

#### **8.3.1 DESCRIPTION**

This Specification refers to concrete roadway structures, such as curbs, gutters, sidewalks, medians and traffic islands.

These structures shall consist of air entrained Portland cement concrete with or without reinforcing steel, prepared in accordance with the Specifications and to the lines, grades and typical cross-sections as shown in the Drawings or as designated by the Engineer.

#### **8.3.2 SUPPLY AND MATERIALS**

##### **8.3.2.1 Supply**

Unless otherwise specified, the Contractor shall be responsible for the supply of all materials, including concrete, formwork, bedding, joint filler, curing compound, and reinforcing steel.

##### **8.3.2.2 Materials**

- a) Concrete shall be in accordance with Division 8, Section 2, Portland cement concrete and the Class of Exposure shall be according to the most recent version of CSA A23.1, Table 1. Coarse aggregate for the concrete shall have a nominal maximum size of 19.0 mm.
- b) Bedding and/or level course aggregate shall be Designation 2, Class 20 crushed granular base course.
- c) Joint filler shall conform to the requirements in the most recent version of ASTM D1751 and shall be of adequate dimensions to fill the joint fully and continuously throughout its entire depth.
- d) Curing compound shall conform to the most recent version of ASTM C309, Type 2 (white pigmented), Class B (must be a resin).
- e) Reinforcing bars shall conform to the most recent version of CSA G30 Grade 400W and shall be deformed bar unless indicated otherwise on the Drawings. Welded steel wire fabric shall conform to the most recent version of ASTM A1064.

#### **8.3.3 CONSTRUCTION**

##### **8.3.3.1 General**

Equipment and methods used on this work shall be suitable to produce and place materials as specified herein and shall be subject to the approval of the Engineer. The Engineer may order the discontinuance of use of any equipment or method which, in the opinion of the Engineer, fails to produce satisfactory results.

##### **8.3.3.2 Testing**

###### General

In accordance with Division 2, quality control testing and inspections are the sole responsibility of the Contractor. The Contractor shall outline in the QC Plan the quality control planned for the Concrete Roadway Structures.

Quality assurance testing and inspections may be performed by the Engineer and/or their representative who shall take samples, carry out testing and inspection of materials incorporated or being incorporated into the Work. The Contractor shall cooperate with the Engineer during the sampling, testing and inspection. Such inspection and testing shall not relieve the Contractor from any obligation to perform all the Work in accordance with the requirements of the Contract.

Results of the tests will be made available to the Contractor for their information. The Contractor shall be responsible for interpretation of test results and alter their operation if necessary, so that the product meets

the Specifications.

#### Test Methods

Unless otherwise specified, the most recent versions of the following test methods shall be used to determine the material characteristics.

<b>Test Description</b>	<b>Method No.</b>
Slump	CSA A23.2-5C
Plastic Air Content	CSA A23.2-7C
Concrete Temperature	CSA A23.2-17C
Compressive Strength	CSA A23.2-9C
Hardened Air Void System	ASTM C457
Rapid Chloride Permeability	CSA A23.2-23C

#### **8.3.3.3 Construction Conditions**

Concrete shall not be placed during heavy rain, snow, freezing temperatures or other unsuitable conditions. Concrete shall not be placed upon a frozen, wet, muddy or rutted base unless otherwise directed by the Engineer.

Concrete shall not be placed when it appears likely that the temperature will fall below 5°C within the next twenty-four hours, unless special precautions approved by the Engineer are taken.

#### **8.3.3.4 Excavation and Subgrade Preparation**

Excavation and subgrade preparation shall be as specified in Division 5, Section 4, Subgrade Preparation.

#### **8.3.3.5 Level Course**

Level course shall be placed and compacted to a maximum depth of 50 mm as required to adjust the subgrade to the design grades and cross-sections.

#### **8.3.3.6 Dimensions**

Concrete roadway structures shall be constructed to the dimensions shown in the Drawings, or as designated by the Engineer.

#### **8.3.3.7 Joints**

##### Expansion Joints

Expansion joints shall be formed at the beginning and end of all curves. The expansion joint material shall be installed flush with the concrete surfaces.

##### Isolation Joints

Isolation joints shall be formed using joint filler around telephone poles, light poles, hydrants, manholes and all other structures located within the curb and gutter and sidewalk areas.

Longitudinal isolation joints shall be formed using joint filler where sidewalk is installed directly against a wall or other permanent or fixed structure.

##### Contraction Joints

Contraction joints shall be sawcut or formed within a sufficient time of placing the concrete to prevent uncontrolled cracking.

## a) Curb and Gutter

Transverse contraction joints shall be constructed every 3 m by means of sawcut or formed or as approved by the Engineer. Joints shall be not less than 50 mm in depth and shall be 5 mm in width. When steel plates are used, an area of not less than 50% of the concrete shall be continuous through the joint. The joint shall be edged with a tool having a radius of 5 mm.

## b) Sidewalk

Transverse contraction joints shall be constructed every 3 m by means of sawcut or formed or as approved by the Engineer. Joints shall be not less than 50 mm in depth and shall be 5 mm in width. The joint shall be edged with a tool having a radius of 5 mm.

## c) Monolithic Sidewalk curb and Gutter

Transverse contraction joints shall be constructed every 3 m by means of sawcut or formed or as approved by the Engineer. Joints shall be not less than 50 mm in depth and shall be 5 mm in width and shall extend through the full width of the monolithic sidewalk, curb and gutter. The joint shall be edged with a tool having a radius of 5 mm.

Surface Joints

## a) Sidewalk

Transverse surface joints shall be constructed midway between contraction joints and shall be 15 mm deep and 5 mm wide. The joints shall be edged with a tool having a radius of 5 mm.

## b) Monolithic Sidewalk Curb and Gutter

Transverse surface joints shall be constructed midway between contraction joints and shall be constructed the full width of the sidewalk but shall not extend through the curb and gutter section. An additional surface joint shall be constructed to mark the back of the curbs. This joint shall be at the distance from the back of the walk as shown on the drawings and shall be continuous through all driveway and lane crossings. The surface joints shall be 15 mm deep, 5 mm wide and edged with a tool having a radius of 5 mm.

**8.3.3.8 Steel Reinforcement**

Steel reinforcement, dowels or tie bars, when specified, shall be properly spaced, aligned, and held in the correct position during the placement of the concrete using bar chairs or other means to be approved by the Engineer. Longitudinal bars shall extend through all contraction joints and shall terminate a minimum of 50 mm from any expansion or construction joint. Bars shall overlap at splices by at least 300 mm.

**8.3.3.9 Wire Mesh Reinforcement**

Wire mesh reinforcement, when specified, shall be properly placed and held in the correct position during the placement of concrete using chairs or other means approved by the Engineer. Joints in the wire mesh shall be overlapped 100 mm. Wire mesh reinforcement shall terminate a minimum of 50 mm from any expansion or construction joint.

**8.3.3.10 Extra Reinforcing Bars**

Extra reinforcing bars shall be installed in concrete roadway structures as directed by the Engineer.

**8.3.3.11 Crossings**

Lane, commercial and private crossings shall be constructed on prepared bases at locations and to the depths and widths indicated on the Drawings and as directed by the Engineer. When specified, crossings shall be

reinforced with steel wire mesh.

#### **8.3.3.12 Precast Sections**

Precast sections shall be placed on a prepared base, to the lines and grades specified, as shown on the Drawings or as directed by the Engineer.

#### **8.3.3.13 Construction with Forms**

##### Forms

Forms may be either steel or wood but shall produce a true line without irregularities in the alignment. Flexible forms shall be used for all structures having a radius less than 40 m. Forms shall be cleaned of hardened concrete or other foreign matter and shall be smooth and free from warps and holes and shall be constructed and maintained to be mortar tight. Any form which has lost its shape or has become dented or rough shall not be used. Enough forms shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well-stayed and braced or otherwise held rigidly to the established line and grade. Any form which has lost its shape or has become dented or rough shall not be used.

##### Placing Concrete

Concrete shall be placed only after the forms have been inspected and approved by the Engineer.

Concrete shall be placed only on base which is sufficiently moist to prevent absorption of water from the freshly placed concrete. Where necessary, the base be sprinkled with water to raise the moisture content to the desired level.

All forms shall be thoroughly moistened or oiled prior to placing concrete. Chemicals shall not be used to remove ice or hardened loss of the ingredients.

Concrete shall be handled from the mixer to the place of use as rapidly as possible by methods which will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as close as possible to its ultimate location to reduce rehandling or flowing.

Under no circumstances shall concrete that has partially hardened or exceeded the specified delivery time be used.

A mechanical vibrator shall be used during the concrete placing operation as required to eliminate air pockets and honeycombing. To secure uniform dense surfaces, vibration shall be supplemented by hand spading.

Pours shall start and stop at expansion joint and surplus material shall be wasted.

##### Stripping Forms

The face of curb form shall be removed within two hours after the initial set to permit proper finishing of the concrete. Adequate care shall be taken to avoid damage to the concrete surface when removing the forms. Any patching that is necessary shall be done immediately after the forms have been removed.

#### **8.3.3.14 Construction with Extruding Equipment**

##### Equipment

Slip-form paving machines or concrete extruding machines may be used for placing concrete provided they meet the following requirements and have been approved by the Engineer prior to commencement of the Work.



## a) Vibrators

The vibrators on the equipment shall be adequate to produce a dense mass with a smooth surface free of honeycombing. Internal vibrators shall be of the high frequency type with 8,000 minimum to 12,000 maximum vibrations per minute when immersed in concrete. External vibrators shall have a minimum frequency of 3,600 vibrations per minute.

## b) Grade Control

The equipment shall include automatic grade and line control.

Additional Subgrade Preparation

Any special grading or preparation of the subgrade required by the Contractor to accommodate their equipment shall be the responsibility of the Contractor. The roadway and right-of-way shall be restored promptly to their original condition after the extruding operation is completed.

Continuity of Work

Whenever possible, the hand forming and placing of concrete as may be required at corners, driveways and catch basins shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the "fill-ins" shall be completed within seven days after construction of the adjacent extruded sections.

**8.3.3.15 Finishing**Curb and Gutter

The top of the gutter and the top and face of the curb shall be troweled to a smooth finish and the edges neatly rounded by use of a 5 mm radius edging tool. Excessive troweling shall be avoided. The final finish shall be lengthwise brushing with a soft bristle brush as approved by the Engineer. Neat cement or water shall not be used in the finishing process.

Surface cavities larger than 50 mm and any honeycombed areas occurring along the formed surfaces shall be filled with mortar composed of one part Portland cement and two parts sand with 12% of entrained air. The location of repair areas shall be reported to the Engineer.

Sidewalk and Medians

The top of the sidewalk shall be troweled to a smooth, uniform finish. Excessive troweling shall be avoided. The final finish shall be a transverse brushing with a soft bristle brush approved by the Engineer. The edges shall be neatly rounded by use of a 5 mm radius edging tool. Neat cement or water shall not be used in the finishing process.

Surface cavities larger than 50 mm and any honeycombed areas occurring along the formed surfaces shall be filled with mortar composed of one part Portland cement and two parts sand with 12% of entrained air. The location of repair areas shall be reported to the Engineer.

**8.3.3.16 Identification Stamp**Contractor and Year of Construction

The Contractor shall mark the concrete structure with a marking tool showing the initials of the Contractor and the year of construction. These marks shall be made at the ends of each block and at the termination points if the construction is terminated within the middle of a block.

**Reinforcing steel**

All sections containing reinforcing steel shall be marked at their extreme limits with a marking tool showing the letter "R".

**Curb Boxes**

Any sidewalks constructed adjacent to curb boxes shall be marked directly opposite the curb box with a marking tool showing the letter "CC".

The letters and numerals of the marking tools shall be approximately 50 mm high.

**8.3.3.17 Curing**

The surface of the concrete shall be protected from the sun and wind by an approved curing compound. This protection shall be accomplished by coating the entire exposed surface of the concrete with a curing compound immediately after the concrete has received its finish treatment. The curing compound shall be approved by the Engineer prior to application. When the front and the back forms are removed, the exposed concrete surfaces shall immediately be coated with the approved material.

The curing compound shall be applied uniformly at the manufacturer's recommended rate of application by means of a pressure spray distributor. The curing compound shall be so applied that the concrete surface is completely coated. A second application of curing compound shall be applied within 30 to 60 minutes after the first application. The surface shall be maintained in this condition for a minimum period of seven days.

Under no circumstances shall any material be added to the curing compound as delivered by the manufacturer.

**8.3.3.18 Hot Weather Requirements**

When the ambient air temperature is at or above 27°C, or when there is a probability of the temperature rising above to 27°C during the placing period (as forecast by the nearest official meteorological office), facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions in accordance with the most recent version of CSA A23.1, clause 7.1.1. Concrete shall be protected from excessive loss of moisture during periods of hot or windy weather. Placing operations shall be discontinued if surface cracking due to excessive drying is evident.

**8.3.3.19 Cold Weather Requirements**

When there is a probability of the air temperature falling below 5°C within 24 hours of placing (as forecast by the nearest official meteorological office), all materials and equipment needed for adequate protection and curing shall be on hand and ready for use before concrete placement is started as per the most recent version of CSA A23.1, clause 7.1.2. All reinforcing materials, forms, and ground with which the concrete is to come in contact shall be defrosted by means of live steam, or as approved by the Engineer. Calcium chloride or other de-icing salts shall not be used.

During cold weather, as defined above, adequate protection of the concrete by means of heated enclosures, coverings, insulation or a combination of these methods shall be provided that will maintain the concrete temperature at a minimum of 10°C for the duration of the required curing period. The protective measures shall be modified as necessary.

Protective coverings used to conserve heat shall be kept clear of the concrete to permit free circulation of air.

Straw or similar materials for protection against frost shall not be allowed to come in contact with fresh concrete.

**8.3.3.20 Frozen Concrete**

Concrete showing evidence of freezing shall be replaced and removed from the job at the Contractor's expense.

**8.3.3.21 Backfilling Structures**

The boulevard area behind the concrete structures, medians or traffic islands shall be cleared of construction debris prior to backfilling to the design cross section with the specified material. Backfill shall be placed as shown on the Drawings or as staked by the Engineer. Placing of the backfill shall be done promptly after the forms have been stripped to avoid any possible damage to the concrete structure. The Contractor shall leave all backfill areas in a trimmed, neat condition.

**8.3.3.22 Finished Grades**Surface

All exposed concrete surfaces shall be checked by the Contractor with a 3 m straightedge, and any water pockets or deviations in line or grade exceeding 5 mm shall be corrected immediately, at the Contractor's expense.

Elevation

Differences in elevation at any given point from that specified shall not exceed  $\pm 25$  mm and the variation over 10 m intervals shall not be greater than 25 mm. Any deviations greater than those specified shall be corrected immediately at the Contractor's expense.

**8.3.4 REQUIREMENTS FOR ACCEPTANCE**

Completed concrete work will not be accepted unless the following requirements have been met:

**8.3.4.1 Strength**

If the concrete strength requirements specified in Division 8, Section 2, Portland cement concrete, are not met, the construction represented by the low tests is not acceptable and shall be removed and replaced. Removing and replacing of rejected concrete construction shall be done at the Contractor's expense.

**8.3.4.2 Air Content**

If the measured air content falls outside the limits specified in Division 8, Section 2, Portland cement concrete, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the load or batch of concrete shall be rejected. No field adjustment for air content will be allowed. Replacement of the rejected material shall be done at the Contractor's expense.

**8.3.4.3 Slump**

If the measured slump falls outside the limits specified in Division 8, Section 2, Portland cement concrete, a check test shall be made immediately on another portion of the same sample. If the second test results indicate that the concrete does not meet the specified requirements and adjustments permitted in the Acceptance and Field Adjustments of Plastic Concrete clause cannot produce acceptable concrete the load or batch of concrete shall be rejected. Replacement of the rejected material shall be done at the Contractor's expense.

**8.3.4.4 Other**

Any work found to be defective or damaged by weather, traffic or other causes, shall be repaired or removed and replaced, as directed by the Engineer, at the Contractor's expense.

### 8.3.5 BASIS OF PAYMENT

#### 8.3.5.1 **General**

The quantities, determined as specified, will be paid for at the applicable Contract unit prices which shall be compensation in full for permits, royalties, aggregate purchase, excavating, crushing, blending, screening, elimination of fines, drying, storing, loading and stockpiling of aggregates; purchasing, transporting, storing and handling of cement; preparation of mix design, base preparation, levelling course, forming, concrete mixing and transporting, placing, vibrating, jointing, reinforcing, finishing, curing, backfilling, construction of crossings, and the supply of all materials, equipment, plants, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

#### 8.3.5.2 **Concrete Structures**

- a) Curbs, Gutters, Combination Curb and Gutter sections, Sidewalks, Monolithic Sidewalk Curb and Gutter Sections, concrete Barriers, and Swales or combinations thereof.

The following structures will be measured in linear metres to the nearest 0.1 m and payment will be made at the applicable contract unit price for the item:

- i. Curbs, measured along the length of the curb, with separate payment for each type of curb.
- ii. Gutters, and outlet gutters, measured along the length of the gutter.
- iii. Combination curb and gutter, measured along the length of the curb face.
- iv. Separate sidewalk, measured along the length, with separate payment for each specified width.
- v. Monolithic sidewalk curb and gutter, measured along the length, with separate payment for each specified width.
- vi. Swales, measured along the flow line.
- vii. Concrete barriers, measured along the length.

- b) Sidewalk Tie-in

Payment for sidewalk Tie-ins shall be at the all-inclusive Contract unit price per tie-in. Payment will be based on the actual number of sidewalk tie-ins completed.

- c) Solid Concrete Medians and Islands

Solid concrete medians and islands will be measured in square metres of completed top surface area and payment will be made at the applicable Contract unit price per square metre.

The unit prices for solid concrete medians and islands will include the cost of any curbing or curb and gutter forming part of the solid concrete median or island.

#### 8.3.5.3 **Median and Island Fill**

Granular fill material for solid concrete medians or islands will be measured in tonnes and payment will be made under the applicable Contract unit price per tonne for the specified granular fill.

#### 8.3.5.4 **Median Surfacing**

Median asphalt concrete surfacing will be measured in tonnes and payment will be made at the Contract unit price per tonne for Asphalt Concrete Pavement.

Median Portland cement concrete surfacing will be measured in square metres based on the width excluding the curbs and will be paid for at the Contract unit price per square metre for Median Concrete Surfacing. Separate payment will be made for the curb or curb and gutter section forming the perimeter of the median.

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## **8.4 SECTION 4 – ENGINEER'S CAMP AND BOARD**

### **8.4.1 DESCRIPTION**

Engineer's Camp consists of the supply and operation of accommodation, kitchen facilities, housekeeping services, washroom, laundry and recreation facilities, and Engineer's Board consists of the provision of meals for the Department's Engineer's staff, and subject to the Engineer's approval.

### **8.4.2 GENERAL**

The Contractor shall provide, set-up, operate and maintain, separate from their own camp, self-contained compartment trailer accommodations, including washroom, laundry and recreation facilities, for the exclusive use of the Engineer's staff.

The compartment trailer accommodations and washroom, laundry and recreation facilities shall be in good condition and subject to the approval of the Engineer.

The trailer shall have adequate windows on all sides with screens, shades and security bars, windproof, weatherproof and insulated with adequate lighting, heating, cool air conditioning, and ventilation.

### **8.4.3 ENGINEER'S CAMP**

#### **8.4.3.1 Accommodation Facilities**

Accommodation facilities shall include a minimum of two separate bedrooms plus living area. Each bedroom within the accommodation facilities shall be equipped with the following:

- a) One queen size bed (minimum) with three sets of linen with box spring and mattress, complete with a minimum of three blankets,
- b) One night table/writing shelf and one chair,
- c) One closet suitable for storage and hanging clothes, opening windows with screens,
- d) Entrances fitted with locking doors (keyed) and freezer-lock door handles that will accommodate padlocks, and
- e) Central vacuum.

#### **8.4.3.2 Kitchen Facilities**

Provide kitchen facilities in each accommodation as follows:

- a) A kitchen with appliances (refrigerator, freezer, stove top with oven, microwave oven, coffee maker) and kitchenware (pots and pans, cups, plates and bowls, cutlery, cutting knives and boards) and supplies (three sets of wash cloths and dish towels, serviettes),
- b) Stainless steel kitchen sinks, and
- c) Paper waste basket and kitchen garbage can.

#### **8.4.3.3 Washroom and Laundry Facilities**

The washroom and laundry facilities shall satisfactorily accommodate both male and female staff and shall include an electrically operated automatic clothes washer and dryer.

#### **8.4.3.4 Recreation Facility**

The recreation facility in each accommodation shall be equipped with the following:

- a) One sofa and one lounge chair,
- b) One remote controlled colour smart television (32-inch screen) and stand,

- c) Wi-Fi internet connection with minimum 150Mbps download speed and unlimited data restrictions. Fully active Wi-Fi to be provided throughout the camp.
- d) Phone, and
- e) Satellite dish with satellite receivers.

The Contractor shall also supply, install and maintain a satellite receiver dish fully compatible with and operational for use in conjunction with the television.

#### **8.4.3.5 Housekeeping and Maintenance**

The Contractor shall provide a minimum of two clean towels per day for each of the Engineer's staff staying in the camp. Clean linen shall be provided on a weekly basis, or whenever a change in personnel occurs.

The Contractor shall clean the living quarters, hallways and walkways and wash sinks, urinals, toilets, showers, washing machines and laundry tubs daily.

#### **8.4.3.6 Smoke Detectors**

All rooms shall be equipped with CSA approved smoke detectors and an adequate number of CSA approved fire extinguishers shall be installed throughout the facilities.

#### **8.4.3.7 Location**

The Contractor must receive approval from the applicable Land Use Authority of the location of the Engineer's camp and Contractor's camp, prior to set-up.

The Engineer's Camp may be located in the same general area as the Contractor's camp; however, the Engineer's camp facilities shall be arranged such that the privacy of the Engineer's staff is ensured.

#### **8.4.4 ENGINEER'S BOARD**

The Contractor shall provide all facilities, supplies, services, equipment, labour and materials necessary to supply the Engineer's staff with meals of the same quality and quantity as provided for the Contractor's staff. Meals shall be provided for visiting Department staff or Engineer's guests on an extra basis, if required.

#### **8.4.5 AVAILABILITY REQUIREMENTS**

The Engineer's Camp and Engineer's Board shall be set-up and fully operational for use by the Engineer and their staff an ample amount of time prior to the commencement of construction operations and shall remain fully operational until the completion of all construction operations.

#### **8.4.6 MEASUREMENT**

Measurement for Engineer's Camp will be for the number of months or portions thereof that the Engineer's staff is acceptably provided with accommodation, washroom, laundry and recreation facilities and housekeeping and maintenance services.

Measurement for Engineer's Board will be for the number of person-days or portions thereof that the Engineer's staff is registered in camp and acceptably provided with meals. Variations in person-day numbers may occur from time to time.

#### **8.4.7 BASIS OF PAYMENT**

Payment for Engineer's Camp will be at the Contract unit price per month or portions thereof.

Payment for Engineer's Board will be at the Contract unit price per person-day or portions thereof.



The unit prices shall be compensation in full for the supply, mobilization, set-up, operation, maintenance, dismantling and demobilization of the accommodation, washroom, laundry and recreation facilities and the provision of furnishings, housekeeping services, electrical power, heat, water, satellite, internet, sewage and garbage disposal, insurance and any other equipment, labour, materials, tools and incidentals necessary for the supply and operation of the Engineer's Camp and Engineer's Board in accordance with the Specifications.

Any costs incurred by the Department in providing suitable accommodations, meals and services for the Engineer's staff due to the Contractor's failure to provide these will be recovered from the Contractor.

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## **8.5 SECTION 5 – ENGINEER'S OFFICE TRAILER**

### **8.5.1 DESCRIPTION**

This work consists of the supply and operation of an Engineer's Office Trailer for the Department's Engineer's staff.

### **8.5.2 GENERAL**

The Contractor shall provide, set-up, operate and maintain, separate from their construction camp, a self-contained office trailer for the exclusive use of the Engineer and their staff.

The office trailer shall be in good condition and subject to the approval of the Engineer.

### **8.5.3 OFFICE TRAILER REQUIREMENTS**

The Engineer's office trailer shall have minimum dimensions of 3 m by 16 m and ceiling height of 2.4 m. A separate and private office shall be located at one end of the trailer and the remaining area shall be open.

The trailer shall be equipped with the following minimum requirements:

- a) Adequate lighting inside and exterior entrance lights, heating, central cool air conditioning and ventilation.
- b) Windproof, weatherproof and insulated.
- c) Two lockable exterior doors equipped with steps and freezer-lock door handles that will accommodate padlocks.
- d) Adequate windows on all sides with screens, shades and security bars.
- e) Safe and reliable electricity supply and six double electrical wall receptacles.
- f) Resilient flooring materials.
- g) CSA approved smoke detectors and fire extinguishers.
- h) Satellite dish and receivers with internet connection with minimum 150 Mbps download speed and unlimited data restrictions. Fully active Wi-Fi to be provided throughout the office trailer.
- i) The Contractor shall provide heat, water, sewage disposal and electrical power to the trailer on a continuous 24-hour basis.
- j) Gravelled surface all weather parking.

Additional project specific requirements, if necessary, will be detailed in the Special Provisions.

### **8.5.4 FURNISHING REQUIREMENTS**

The Engineer's office trailer shall be furnished with the following minimum furniture:

- a) Four desks with drawers
- b) Two tables (750 x 1500 mm each)
- c) Three bookcases with multiple shelves (1 m long)
- d) Four padded steno chairs with casters and four stacking chairs
- e) Two vertical filing cabinets (three drawers per cabinet)
- f) Three wastepaper baskets and one coat rack.

### **8.5.5 OFFICE TRAILER LOCATION**

The Contractor must receive approval from the Engineer and the applicable Land Use Authority of the location of the Engineer's office trailer, prior to set-up.

The trailer shall be situated such that the privacy of the Engineer's staff is ensured and noise and exhaust from the Contractor's power plant are minimized.

**8.5.6 AVAILABILITY REQUIREMENTS**

The Engineer's office trailer shall be set-up and fully operational for use by the Engineer and their staff an ample amount of time prior to the commencement of construction operations and shall remain fully operational until the completion of all construction operations.

**8.5.7 MEASUREMENT AND PAYMENT**

- a) Payment for Engineer's Office Trailer will be at the Contract lump sum price.

The lump sum price shall be compensation in full for the supply, mobilization, set-up, operation, maintenance, dismantling and demobilization of the trailer and the provision of furnishings, electrical power, heat, water, satellite, internet, sewage and garbage disposal, insurance and any other equipment, labour, materials, tools and incidentals necessary for the supply and operation of the Engineer's Office Trailer in accordance with the Specifications. The lump sum price will be paid out as a proportion of the time acceptably onsite until the end of construction operations.

or;

- b) Payment for Engineer's Office Trailer will be at the Contract unit price per day.

The unit price per day shall be compensation in full for the supply, mobilization, set-up, operation, maintenance, dismantling and demobilization of the trailer and the provision of furnishings, electrical power, heat, water, satellite, internet, sewage and garbage disposal, insurance and any other equipment, labour, materials, tools and incidentals necessary for the supply and operation of the Engineer's Office Trailer in accordance with the Specifications. The unit price per day will be paid out for the duration in days from the Department's occupation of the trailer from the date as requested by the Engineer. Daily rate compensation shall not be provided for any days that the Engineer's Office Trailer set up onsite without any request of Engineer or vacant. Daily rate compensation shall not be paid for any days that the Engineer's Office Trailer is set up onsite beyond the date of completion of Work in Article A2 of the Construction Contract unless agreed with the Engineer in writing.