# DIVISION 02 -CITY OF NORTH BATTLEFORD SPECIFICATIONS

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# SPECIFICATION 01100 – SITE CLEARING AND GRUBBING

## 1 GENERAL

### 1.1 WORK INCLUDED

.1 This section refers to general site clearing, which includes:

.2 Pulling down and disposing of obstructions such as:

- Fences;
- Clearing and grubbing consisting of the cutting of trees, brush and shrubs;
- Removal, piling and disposal of trees (except trees to be preserved), brush, stumps, roots and logs from areas required to facilitate the works.

.3 Breakout and disposal of existing pavement and concrete.

### 1.2 REGULATIONS

.1 Abide by the laws of the Province, Territory and/or Municipality in which the work is located, particularly with regard to fire regulations and public safety.

### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01210 - Stripping and Respreading

## 2 PRODUCTS

Not applicable.

## 3 EXECUTION

### 3.1 CLEARING

.1 Cut, pile or remove, and dispose of all obstructions such as old fences, signs, trees, brush, shrubs, stumps, roots, logs and rubbish as required for the execution of the work under this contract; except such tress, shrubs etc. as may be designated for preservation by the Engineer.

.2 Complete site clearing work before commencing earth work.

.3 The Contractor shall be responsible for locating and protecting all existing underground and surface structures, utility pipelines, overhead lines and poles, fences, water, and sewer mains, building services, cables, culverts, side walks and any other works. All damage incurred shall be repaired by the Contractor at his expense.

# END OF SPECIFICATION

# SPECIFICATION 01210 – STRIPPING AND RESPREADING

## 1 GENERAL

### 1.1 WORK INCLUDED

This section refers to stripping of topsoil and organic material, and includes:

.1 Stripping and stockpiling for re-use.
.2 Stripping and hauling to disposal.
.3 Stripping and respreading on completed area inclusive of side slopes.
.4 Excavating from stockpile and respreading.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01223 – Trenching
- Section 01224 – Grading
- Section 01240 – Backfilling

### 1.3 REGULATIONS

Abide by the by-laws and regulations of the province, territory or municipality in which the work is located, with regard to stream crossings, diversions or alterations to drainage patterns.

### 1.4 LIMITS

.1 Strip only those areas shown on the drawings to be stripped, or those areas specified or ordered in writing by the Engineer.
.2 Strip all roadways, utility lots, lanes, easements and rights-of-way.
.3 Strip all borrow areas.

## 2 PRODUCTS

Not applicable.

## 3 EXECUTION

### 3.1 STRIPPING AND STOCKPILING

.1 Strip to depth ordered by Engineer.
.2 Load, haul and pace in stockpiles in the designated areas.
.3 Stockpile in a manner that will not endanger persons, the work, or adjacent property.
.4 Do not mix loam with unsuitable material. The Engineer may require that the Contractor provide a separate stockpile for topsoil contaminated with common material.
.5 Stockpile topsoil in the designated areas.

### 3.2 STRIPPING AND DISPOSAL

.1 Strip organic material that will not be re-used, and strip material which is unsuitable to the Engineer.

.2 Strip to the depth ordered by the Engineer.
.3 Load, haul, and dispose of stripped material off the site.

3.3 DISPOSAL AREAS

.1 Disposal areas shall be shown on the drawings marked in the field by the Engineer.
.2 Grade the disposal areas to provide adequate drainage, as directed by the Engineer.

3.4 SEPARATE OPERATION

Carry out stripping as a separate operation from the excavation of suitable material.

3.5 Stripping and respreading

.1 Strip to the depth ordered by the Engineer.
.2 Load, haul and respread on boulevards, reserve areas, park site areas or as so indicated to the depth shown on the drawings or ordered by the Engineer.
.3 Timing of respreading of loam from stockpile will not necessarily coincide with grading operations.

# END OF SPECIFICATION

# SPECIFICATION 01223 - TRENCHING

## 1 GENERAL

### 1.1 WORK INCLUDED

.1 This section refers to excavation, maintenance and backfill of trenches for underground pipes including:

- Removal of surface materials and structures.
- Excavation from the trench of all materials of whatever kind encountered so that pipes and structures can be laid to alignment and depth required.
- Support of the adjoining ground or structures.
- Stockpiling and disposal of excess excavated material.
- Control of surface and subsurface water in trenches.
- Temporary railings, coverings and enclosures to excavations.
- Removal and replacement of unsuitable material.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01100 – Clearing and Grubbing
- Section 01210 - Stripping and Respreading
- Section 01240 – Backfilling
- Section 06600 - Pressure Pipe
- Section 06720 – Sewer/Gravity Pipe
- Section 06722 – Manholes, Vaults and Catch Basins

## 2 PRODUCTS

### 2.1 GRAVEL

.1 Pit-run gravel for stabilization of trench bottoms, as requested by the Engineer, 75mm minus graded to comply with the following sieve analysis:

Passing 25mm - 80% maximum
Passing 5mm - 60% maximum
Passing 80µm - 10% maximum

.2 Base gravel for stabilization of trench bottoms, as requested by the Engineer - maximum size 50 mm crushed rock or gravel.

.3 Screened rock for stabilization of trench bottoms, as requested by the Engineer - maximum size 25mm.

### 2.2 COMMON BACKFILL

.1 Suitable Material shall be used as common backfill, which is defined as selected material obtained from trench, common or borrow excavations that is free of organic, wet or frozen materials, that is suitable for compacted backfill construction.

.2 Backfill to be moisture conditioned to +/- 2% of the optimum moisture content as determined by ASTM D698.

2.3 PIPE BEDDING MATERIALS

2.3.1 Granular Materials, General

.1 Gradation shall be within specified limits when tested to ASTM C136-81 and ASTM C117-80 (AASHTO T11-78 and T2k7-78) and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.2 Bedding Gravel - crushed gravel to following grading requirements:

| Sieve Size | Percent Passing (%) |
|---|---|
| 25 mm | 100 |
| 20 mm | 95-100 |
| 10 mm | 60-80 |
| 5 mm | 40-60 |
| 1.25 mm | 20-40 |
| 0.630 mm | 9-22 |
| 0.080 mm | 4-10 |

.3 Bedding Sand - sand to following grading requirements (CSA A23.1):

| Sieve Size | Percent Passing (%) |
|---|---|
| 10 mm | 100 |
| 5 mm | 95-100 |
| 2.5 mm | 80-100 |
| 1.25 mm | 50-90 |
| 0.630 mm | 25-65 |
| 0.315 mm | 10-35 |
| 0.160 mm | 2-10 |
| 0.080 mm | 0-1 |

.4 Screened Rock

| Sieve Size | Percent Passing (%) |
|---|---|
| 40 mm | 100 |
| 20 mm | 45-90 |
| 5 mm | 10-40 |
| 2 mm | 0-10 |

2.4 IMPORTED FILL

.1 Imported backfill material for trenches - free from organic material or any perishable or objectionable material that would prevent proper consolidation. Maximum rock size 100mm.

## 3 EXECUTION

3.1 INSPECTION OF MATERIALS

.1 All material supplied is subject to inspection and testing at the discretion of the Engineer.

.2 Furnish the Engineer a list of sources of materials and furnish without charge sufficient samples, tests and reports as may be required for preliminary approval of the material.

3.2 PROTECTION

3.2.1 Existing Buried Utilities

.1 Size, depth and location of existing utilities as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work: notify applicable utility authorities; establish location and state of use of buried utilities; clearly mark such locations to prevent disturbance during work.

.3 Maintain and protect from damage all utilities encountered.

.4 Obtain authorization from utility owner and Engineer prior to moving or otherwise disturbing utility infrastructure.

3.2.2 Existing Surface Features

.1 Protect from damage existing buildings, trees and other plants, lawns, fencing, service poles, paving and other surface features located within adjoining properties while work is in progress and repair damage resulting from work.

.2 Where excavation necessitates root or branch cutting, do so only as approved by the Engineer.

3.2.3 Shoring and Bracing

.1 Whenever shoring, sheeting, timbering, and bracing of excavations is required engage the services of a professional engineer registered in the province where the work is being completed to design and assume responsibility for the adequacy of shoring and bracing.

.2 When requested, submit for review drawings and documentation signed and stamped by a professional engineer.

.3 Shoring and bracing shall be inspected by the professional engineer responsible for their preparation.

.4 Close sheeting, when required, shall be designed and constructed to prevent adjacent soil from entering the excavation and to control water infiltration.

3.2.4 Protect open excavation against flooding and damage from surface water run-off.

3.2.5 Protect the public at all times by securing access to open excavation sites. Secure all open excavations when daily construction activities cease.

3.3 PREPARATION

3.3.1 Site Clearing

.1 Clear the surface of the ground or road within the working area.
.2 Dispose of refuse in a manner satisfactory to the Engineer.

3.3.2 Gravel and Topsoil Removal

Windrow reusable gravel and topsoil, and keep separate from the remainder of the excavated material so that they can be replaced when the backfilling operation has been completed.

3.3.3 Pre-cutting Paved Surfaces

.1 Cut pavement in straight lines parallel to the trench centre line.
.2 Cut width of pavement shall exceed the specified maximum trench width at the ground surface by 0.5m.
.3 Dispose of cut pavement.

3.3.4 Frost Removal

.1 Frost removal is required when frost has penetrated the ground to a depth of 450 mm or more.

3.4 EXCAVATION

3.4.1 General

.1 Excavate to lines, grades, elevations and dimensions indicated on the drawings. For pipe trenches, comply with the Pipe Trench Width Schedule.
.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
.3 Notify Engineer when soil at proposed elevation of trench bottom appears unsuitable for foundation of installation.
.4 Remove unsuitable material from trench bottom to extent and depth directed by Engineer.
.5 Unless otherwise authorized by Engineer in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
.6 Stockpile suitable excavated materials required for trench backfill in approved location.

.7 Dispose of surplus and unsuitable excavated material in approved location.
.8 Do not obstruct flow of surface drainage or natural water courses.
.9 Secure all open trenches at the end of daily operations.
.10 Limit the length of open trench to 50 meters or less and the work zone to 100 meters or less at any location.

3.4.2 Water

.1 The expense of removing water from trenches, regardless of origin, is the responsibility of the Contractor.
.1 Divert surface water away from trenches by means of permanent or temporary drainage structures.
.2 Remove water by acceptable means to allow installation of pipe without detrimental effect on pipes, trench bottom or adjacent property.
.3 Direct discharge of surface water, pumps or well points away from the work to an acceptable location without damage to the construction or to other property structures or persons.
.4 Existing sanitary sewers cannot be used to carry away water. Silt or sand laden water cannot be discharged into existing storm sewers.

3.4.3 Rock Excavation

.1 Rock is defined as:

- any material that will require for its removal drilling, blasting or breaking up with power operated hand tools;
- a single boulder(s), or pieces of concrete or masonry with a volume in excess of 0.5 $m^3$.

.1 No extra payment will be considered, and is incidental to the Work, when soft or disintegrated rock can be removed with a hand pick; or loose and/or previously blasted rock or broken stone which may fall into the excavation occurs.
.2 Measurements for rock excavation are taken from the top of the rock to 150mm below the pipeline invert at a trench width of the outside diameter of the pipeline plus 300mm.
.3 Approval by the Engineer must be obtained before blasting can be undertaken. Obtain permits to blast; take precautions to protect persons and property and blast only at times permitted by the Engineer. Observe all the requirements of the Workers Compensation Board respecting explosives and their use.

3.4.4 Unsuitable Material

.1 Unsuitable material is material in the trench at sub-grade that is unstable or found to contain ashes, cinders, organic material, and large pieces of inorganic material which in the judgement of the Engineer should be removed.

.2 Excavate and remove unsuitable material to a width and depth ordered by the Engineer. Backfill the sub-grade with an approved material compacted in 150mm lifts to provide a continuous bearing for pipes.

.3 Compact the backfilled material for the trench bottom to a density at least equal to the density of adjacent surrounding soil.

.4 Material that becomes unstable or unsuitable through the Contractor's failure to divert surface water or control ground water in the trench shall be excavated, removed, and replaced with approved material compacted in 150 mm lifts at the expense of the Contractor.

3.4.5 Trench Bottom Preparation

.1 Where required due to removal of unsuitable material or unauthorized over-excavation, bring bottom of excavation to design grade with approved material.

.2 Compact trench bottom to density at least equal to density of adjacent surrounding soil.

.3 Grade and shape pipe trench to give uniform and even bearing for each length of pipe.

3.4.6 Pipe Trench Width

.1 Except as otherwise specified, minimum and maximum trench widths, up to a point 300 mm above top of pipe, shall be as specified in Pipe Trench Width Schedule.

.2 Maximum trench widths indicated in Pipe Trench Width Schedule exclude an allowance for shoring.

.3 Trench width at any point shall not be less than trench width at any depth below such point.

3.4.7 Pipe Trench Width Schedule – For Flexible and Rigid Pipe

| Pipe Size (Outside Diameter) | Minimum Trench Width | Maximum Trench Width |
|---|---|---|
| 850 mm diameter or less | 300 mm greater than external pipe diameter | 600 mm greater than external pipe diameter or 750 mm total trench width, whichever is greater |
| Greater than 850 mm diameter | 300 mm greater than external pipe diameter | 600 mm greater than external pipe diameter |

3.4.8 Trench Crossings

.1 Railways - Methods of crossing railway property are subject to the approval of the railway company and "Standards Regulations Regarding Pipe Crossing Under Railways" - The Board of Transport Commissioners for Canada - General Order No. E.10.

.2 Pipe Lines - Methods of crossing existing pipelines are subject to the conditions of General Order No. 2 - National Energy Board.

3.4.9 Temporary Protective Structures

.1 Temporary protective structures, bracing, shoring and sheeting are the responsibility of the Contractor.

.2 Observe safety regulations of the Workers' Compensation Board with regard to protection of the Work, property, structures adjacent to the work and maintenance of the trench widths.

.3 When close sheeting is required it shall be installed such that adjacent soil cannot enter the trench either below or through sheeting.

.4 Increase trench widths as necessary to allow placing of supports, sheeting and bracing.

.5 When damages to adjacent structures will not result, remove temporary protective structures and backfill as specified for the pipe zone and the trench.

3.4.10 Hand Trenching, Tunnelling, Boring

.1 Employ hand trenching, tunnelling or boring methods where specified on the drawings or ordered by the Engineer.

.2 Tunnelling, boring or hand trenching may be used if it is to the advantage of the Contractor to use such methods in lieu of machine trenching.

.3 Observe safety regulations of the Workers' Compensation Board with respect to tunnelling and submit an outline of the proposed methods to the Engineer for approval.

3.4.11 Interfering Services

.1 Provide for the uninterrupted flow of all watercourses, sewers and drains encountered during the work.

.2 Support existing water mains, sewer pipes, gas lines, and other pipes to protect them from damage (subject to approval of bracing structures by the utility provider).

.3 Repair and make good at no extra cost to the Owner any damage which may occur to any waterman, sewer pipe, gas line or other pipe and to any electrical conductor, cable, sidewalk, or curb or structure.

.4 Determine the locations of all structures, pipes, manholes, valves by examination of drawings and by excavation. If necessary explore and excavate for such purposes.

3.5 CLEAN UP

.1 Clean up and dispose of all excess material, trash, rocks, boulders and debris as work progresses.

3.6 RESTORATION

.1 Restore or replace all sidewalks, curb, gutter, shrubs, fences, poles or other property and surface structures damaged or removed during the course of the work to a condition equal to that before the work began; furnishing all labour and materials at no extra cost to the Owner.

.2 Restore the trench surface to the original grade and condition after backfilling.

.3 Restore other working areas that were affected by the construction operation by regrading, regravelling and pavement repair as necessary to restore these surfaces to the original grade and condition.

3.7 PIPE PROTECTION

In all cases it will be the responsibility of the Contractor to protect the installations from damage. Any pipe, fitting, structure, etc. found damaged prior to final acceptance of the work will be replaced by the Contractor at his cost.

# END OF SPECIFICATION

# SPECIFICATION 01224 - GRADING

## 1 GENERAL

### 1.1 WORK INCLUDED

This section refers to earthwork, sub-grade preparation, and general site grading.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01100 - Site Clearing and Grubbing
- Section 01210 - Stripping and Respreading
- Section 01223 – Trenching
- Section 01230 – Sub-grade Preparation
- Section 01240 – Backfilling
- Section 02200 – Granular Base and Sub Base
- Section 04210 – Sidewalk Construction
- Section 04225 – Extruded Concrete

### 1.3 REGULATIONS

.1 Abide by the by-laws and regulations of the province, territory or municipality in which the work is located with regard to stream crossing diversions or alterations to drainage patterns.

.2 Obtain permission from the Local or Highway Authority for haul routes, and abide by the regulations with respect to their maintenance.

### 1.4 TESTING

#### 1.4.1 Density Testing by the Owner

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.

.4 Testing frequency will be a minimum of one test for every 400$m^2$ of surface area.

#### 1.4.2 Re-testing of Failed Areas

Re-testing due to failure to meet density requirements will be the responsibility of the Contractor and the Owner will deduct the costs of re-tests from monies owed to the Contractor.

#### 1.4.3 Reworking of Failed Areas

Reworking of failed areas shall be in accordance with this section. Any reworking of failed areas is considered incidental work. No additional claim will be paid by the Owner for reworking of failed areas.

## 2 PRODUCTS

### 2.1 COMMON EXCAVATION

.1 Common excavation shall be approved material from site grading, or material from approved borrow pits.
.2 The Contractor shall strip the overburden from any borrow pit.
.3 Borrow pits shall be left in a neat and uniform condition, to the grades set by the Engineer.

### 2.2 ROCK EXCAVATION

.1 Rock is defined as:

- any material that will require for its removal drilling, blasting or breaking up with power operated hand tools;
- a single boulder(s), or pieces of concrete or masonry with a volume in excess of 0.5 $m^3$.

## 3 EXECUTION

### 3.1 INSPECTION OF MATERIALS

.1 Obtain Engineer's approval prior to use of any embankment material in the field.
.2 Preliminary approval of material does not constitute general acceptance.
.3 Final acceptance of embankment material shall depend on field test results and performance in place.
.4 Remove any rejected material off site at no cost to Owner.

### 3.2 PREPARATION OF SITE

Stripping of top soil and site clearing work must be complete before commencement of any grading.

### 3.3 GRADING PROCEDURES

#### 3.3.1 Excavation

.1 Excavate excess materials to the required grade, elevations and cross-sections as shown on the drawings or as directed by the Engineer.
.2 Load, haul or dump approved selected excavated materials to areas where embankments are to be constructed.
.3 Load, haul dump and grade excavated material unsuitable for embankment construction in disposal/stockpile areas as per the Contractor’s Waste Management Plan or as directed by the Engineer.
.4 Maintain the roadway crown adequate for drainage during grading.

#### 3.3.2 Embankments

.1 Areas to be filled shall be scarified to a depth of 150mm before fill is placed.

.2 Use one of the following to construct embankments and for replacing unsuitable materials in the sub-grade and in utility trenches or as instructed by the Engineer in the field:

- common excavation
- common borrow

.3 Schedule work to utilize the common excavation material completely.

.4 Obtain the Engineer's approval with respect to the existing ground prior to constructing embankments.

.5 Provide, deposit, shape and compact accepted approved material to embankment.

.6 Where embankments are to be made on hill sides, or where a new fill is to be applied upon an existing embankment, the slopes of the original ground or embankment (except rock embankment) shall be terraced or stepped by approved means before filling is commenced.

.7 Spread fill material in 200mm lifts (uncompacted) over the width of the trench, each lift compacted to a minimum of 98% of the Standard Proctor maximum dry density and moisture conditioned to between ± 2% of optimum moisture content as determined by ASTM D698, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures.

.8 In the event that the embankment material is too wet to obtain specified density, thoroughly work the material until the optimum moisture content is reached uniformly throughout.

.9 Shape, trim and roll to grade, elevations and cross-sections as shown on the drawings.

3.3.3 Finishing

.1 Final surfaces shall be reasonably smooth and uniform, free from lumps, loose earth, stones and debris.

.2 Grades shall be within 150mm of design grades.

3.3.4 Utilities and Appurtenances

.1 Locate, protect and adequately mark all utilities and appurtenances including manholes, catch basins, valves and hydrants.

.2 Manholes, catch basins and valves shall be accurately adjusted to 10mm - 15mm below the finished grade line and elevation of the finished road surface or ground design grade.

# END OF SPECIFICATION

# SPECIFICATION 01230 – SUB-GRADE PREPARATQION

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section refers to the sub-grade construction of the roadways.

.2 Sub-grade construction shall include scarifying, moisture conditioning, compacting and fine grading.

.3 All the above to be carried out in accordance with these specification and the lines, grades and dimensions shown on the drawings.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 02200 – Granular Base/Sub Base Preparation.

### 1.3 DEFINITIONS

.1 Sub-grade elevation: elevation immediately below the granular sub base structure.

## 2 PRODUCTS

### 2.1 MATERIALS

.1 Fill materials require approval by the Engineer.

.2 Fill Material – fill materials, where required, shall be free of stones larger than 150mm, clods, sticks, roots, concrete, any toxic materials (e.g. salt, oil, etc.) and other objects, extraneous matter and debris. These materials shall be removed from the site and disposed of. Disposal locations for fill containing any of the above materials shall be approved by the Engineer.

.3 Imported granular material shall be well graded, select, pit-run or crushed gravel and shall contain no organic or other deleterious substances. It shall be graded as per Clause 2.1 of Section 02200.

.4 The synthetic filter fabric shall consist of durable, permeable, woven, polypropylene fabric composed of continuous synthetic filaments with typical properties as follows:

| | |
|---|---|
| Puncture Strength | 420 N |
| Tensile Grab Strength | 890 N |
| Trapezoidal Tear Strength | 400 N |
| Mullen Burst Strength | 2,900 kPa |

## 3 EXECUTION

### 3.1 EQUIPMENT

.1 All proposed routes for hauling equipment must be approved by the appropriate road authority prior to commencement of the work. Rubber tired motor scrapers shall not be used to haul over improved streets. When any travelled roadway is being entered or crossed by hauling equipment, traffic must be controlled as per Section 01.111.00.

.2 Trucks must be loaded in such a manner that no spillage occurs, and care must be taken to prevent dragging construction materials onto improved streets.

.3 Trucks must follow applicable cargo securement requirements as per the Highway Traffic Act.

.4 Haul routes must be kept clear and free from dust by grading and sprinkling with moisture whenever, in the opinion of the Engineer, conditions warrant this treatment.

.5 All excavating and hauling equipment must be equipped with suitable muffling systems.

3.2 RESERVATION OF MATERIAL

.1 Whenever gravel, sand, topsoil, or any other material suitable for special use is encountered, it shall be deemed to be the property of the Owner and shall be used as fill or any special purpose, or otherwise disposed of as directed by the Engineer.

.2 Where layers of gravel, or gravely mixtures are encountered they shall be excavated separately from other excavation, and shall be stockpiled, or incorporated into the work as base or subbase material, or otherwise disposed of as directed by the Engineer.

3.3 UNSTABLE SUB-GRADE

.1 Where the sub-grade is un-stable, or where it contains materials such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth (minimum 300 mm) and length ordered by the Engineer and dispose of the material as directed. The sub-grade shall then be made by backfilling with approved native material or imported granular material as per Section 02200 clause 2.1. Material shall be placed in successive layers as directed by the Engineer and compacted to a minimum of 98% Standard Proctor maximum dry density at ± 2% of the optimum moisture content as determined by ASTM D698.

3.4 SUB-GRADE PREPARATION

.1 The sub-grade shall be scarified to a depth of 150 mm and compacted to a minimum of 98% Standard Proctor maximum dry density at ± 2% of the optimum moisture content as determined by ASTM D698, over the full width of the cross-section. The material shall be worked to ensure as much uniformity as possible.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-grade.

.3 Apply water as necessary during compacting to obtain specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until moisture content is correct.

.4 In areas not accessible to rolling equipment, compact to the specified density with approved mechanical tampers.

3.5 ALLOWABLE TOLERANCES

.1 The finished sub-grade shall be within 30 mm vertically and 150 mm horizontally, but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until the surface is within the specified tolerances.

3.6 TESTING

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.

.4 Density Tests shall be performed at a minimum frequency of 1 Test per 400 square meters.

.5 When required by the Engineer the Contractor shall supply and operate a loaded test vehicle with a minimum of 18,200 Kg. (gross vehicle weight) to test the sub-grade for rutting, weaving and soft spots. Where proof rolling indicates areas that are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the sub-grade construction.

.6 Construction or material not meeting the specifications will not be accepted.

3.7 MAINTENANCE

.1 Maintain finished sub-grade in a condition conforming to this section until succeeding material is applied or until acceptance.

# END OF SPECIFICATION

# SPECIFICATION 01240 - BACKFILLING

## 1 GENERAL

### 1.1 DESCRIPTION

.1 The following specifications apply to compaction of all water, sewer (storm and domestic) service cuts, repairs, replacements, main breaks, extensions, etc. and all shallow utility cuts by utility companies.

.2 A trench cut is defined as that portion of any excavation extending from within 300 mm below the pipe to the finished sub-grade surface.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01100 - Clearing and Grubbing
- Section 01210 - Stripping and Respreading
- Section 01223 – Trenching
- Section 06600 - Pressure Pipe
- Section 06720 – Sewer-Gravity Pipe
- Section 06722 – Manholes, Vaults and Catch Basins

### 1.3 REGULATIONS

.1 Abide by the by-laws and regulations of the Province, Territory or Municipality in which the work is located, and abide by the laws and regulations with regard to stream crossings, fire regulations and public safety.

.2 Perform work under observation of Safety Regulations of the Occupational Health and Safety Act.

## 2 PRODUCTS

### 2.1 BACKFILL MATERIALS

#### 2.1.1 NATIVE BACKFILL

.1 Selected material from excavation approved by the Engineer for the intended use, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

#### 2.1.2 NON SHRINK BACKFILL

.1 Low strength concrete (fillcrete):

- Compressive Strength of 0.2 MPa to 0.5 MPa.
- Maximum compressive strength shall not exceed 0.5 MPa in 56 days.

.2 Slump Requirements:

- Minimum Slump – 75 mm
- Maximum Slump – 125 mm

.3 Admixtures:

- .1 Calcium Chloride may be used.
- .2 Air entrainment 4 – 7 %.

.4 Aggregate Gradation:

| Sieve Size | Percent Passing |
|---|---|
| 10 mm | 100 |
| 5 mm | 95 – 100 |
| 2.5 mm | 80 – 100 |
| 1.25 mm | 50 – 100 |
| 630 um | 25 – 65 |
| 315 um | 10 – 35 |
| 160 um | 2 – 5 |
| 80 um | 0 - 10 |

2.1.3 GRANULAR BACKFILL

.1 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

| Sieve Size (microns) | Percent Passing By Weight |
|---|---|
| 20 000 | 100 |
| 16 000 | 84 - 94 |
| 10 000 | 63 – 86 |
| 5 000 | 40 – 67 |
| 1 250 | 20 – 43 |
| 630 | 14 – 34 |
| 315 | 9 – 26 |
| 160 | 5 – 18 |
| 80 | 2 - 10 |

## 3 EXECUTION

### 3.1 GENERAL

.1 Requirements apply to the full width of the right-of-way with the exception of the boundary area from the property line up to one (1) meter from the constructed or designed surface installation.

### 3.2 SITE PREPARATION

.1 The Contractor at his own expense shall clear and broom clean the surface of the pavement as may be necessary for full width and length of the work area and shall dispose of all refuse in a manner satisfactory to the Engineer.

### 3.3 BACKFILL AND COMPACTING

.1 Do not proceed with backfilling operations until Engineer has inspected and approved installations.

.2 Prior to backfilling, the excavation shall be completely free of debris, ponding water or drifted snow.

.3 Place suitable backfill material in uniform layers not exceeding 300mm uncompacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.4 Fill materials shall be moisture conditioned, by drying or by adding water, to obtain an in-place moisture content ± 2% of the optimum moisture content.

.5 Compact each lift throughout its entirety to the following:

- Pipe or Cable Zone - 300 mm below to 300 mm above the pipe or cable zone to a minimum of 95% of Standard Proctor maximum dry density.
    - Avoid contact between the pipe and the compaction equipment.
    - Compaction in the haunch area is to be obtained by use of mechanical tampers or tamping bars.
    - Mechanical tampers shall not be used directly above the pipe until a minimum of 300 mm of backfill material is in place above the top of the pipe.
    - Roller compacting equipment is not to be used until a minimum of 500 mm of backfill material is in place above the top of the pipe.
    - A hydro-hammer is not to be used until a minimum of 1000 mm of backfill material is in place above the top of the pipe.
- Above Pipe or Cable Zone to the finished elevation – to a minimum of 98% of Standard Proctor maximum dry density.

.6 Backfilling around installations:

- Place bedding and surround material as specified.
- Do not backfill around or over cast in place concrete within 24 hours of placing.
- Place layers simultaneously on all sides of installed work to equalize loading.

.7 When soils removed from any trench appear unsuitable for replacement in the trench due to excessive moisture content, or for any other reason and suitable material is not available on site, the trench shall be backfilled with granular material or non-shrinkable backfill with prior written approval by the Engineer. Under no circumstances shall frozen material be used for backfill.

.8 In landscaped areas place native backfill to 300mm below the finished grade to allow for topsoil placement.

.9 On existing paved streets and lanes, or existing graveled streets and lanes native backfill shall be brought up to the existing sub-grade only. The final 150 mm depth of the sub-grade shall be compacted and moisture conditioned in accordance with Section 01230.

.10 On existing paved streets and lanes, or existing graveled streets and lanes the base structures shall be rebuilt with specified granular sub base and base materials shall be in accordance with Section 02200. Compaction of the base granular base structures shall be in accordance with Section 02200.

.11 On existing paved streets and paved lanes, asphalt shall be replaced in accordance with Section 03140 Asphalt Concrete.

## 3.4 WINTER COMPACTION

.1 Winter compaction is permitted only if agreed to in writing by the Engineer.

.2 During these portions of the year, when specified densities cannot be obtained due to cold weather, a minimum of 95% of Standard Proctor maximum dry density above the pipe zone will be acceptable.

.3 If a minimum of 95% of Standard Proctor maximum dry density above the pipe zone is unobtainable, non shrink backfill is an approved alternate and recommended during winter backfill operations versus the use of native and granular materials.

.4 Cold mix asphalt shall be used for the final surfacing of roadways during the winter months. The cold mix shall be removed and replaced with the specified hot mix asphalt in early spring. All settlements related to winter backfill operations must be repaired by the Contractor prior to placing hot mix asphalt.

.5 Winter compaction is approved only for emergency excavation situations.

## 3.5 NON SHRINK BACKFILL PLACEMENT

.1 Non shrink backfill delivered in cold weather shall conform to the requirements specified in Section 18 of CSA Standard a23.1-M04.

.2 Non shrink backfill shall be rodded or vibrated to eliminate voids, rough areas, honeycombing and to ensure contact with the sides of the excavation.

.3 Place materials using methods which do not lead to segregation.

.4 Pumping of material is permitted with the approval of the Engineer.

.5 In landscaped areas place non shrink backfill to 300 mm below the finished sub-grade to allow for topsoil placement.

.6 Temporary plating or other means of supporting traffic loads shall be used to provide safe driving surface for traffic until pavement materials are replaced.
.7 Protect freshly placed material from heavy rain to prevent washout.
.8 Protect freshly placed non shrink backfill from freezing.
.9 Allow material to cure for a period of 48 hours to ensure adequate strength.

## 3.6 TESTING

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.
.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.
.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.
.4 Density tests shall be representative of the entire length, width and depth of the trench backfill including around catch basins, manholes, valves and service connections.
.5 The following is the minimum testing frequency:

- Trenches more than 15 meters in length shall require a minimum of 3 density tests per 500 mm of trench depth per 75 m of trench length.
- Trenches less than 15 m in length shall require a minimum of 2 density tests evenly distributed throughout the length of the trench, per 500 mm of trench depth.
- Maintenance excavations less than 6 square meters in area shall require 1 density test per 500 mm of depth.
- Backfill adjacent to valves, manholes, catch basins and other structures shall require a minimum of 2 density tests for every 500 mm of trench depth.
- All sewer and water main installations within the City right-of-way are subject to continuous testing and inspection to verify compliance with current backfill and compaction specifications.
- Inspection and testing of non shrink fill will be carried out by a CSA certified testing agency designated by the Engineer. Tests for compressive strength, slump and air entrainment shall be performed for each 50 $m^3$ of non shrink fill placed.
- The Engineer may determine additional testing as necessary.

## 3.7 PIPE PROTECTION

In all cases it will be the responsibility of the Contractor to protect the installations from damage. Any pipe, fitting, structure, etc. found damaged prior to final acceptance of the work will be replaced by the Contractor at his cost.

## 4 MAINTENANCE AND WARRANTY

4.1 GENERAL

.6 The Contractor will be responsible for the rehabilitation costs of failures due to settlement of the backfill during the maintenance and warranty period. If any obvious major settlement occurs, the Engineer may require the trench to be re-compacted for its full depth and length.

# END OF SPECIFICATION

# SPECIFICATION 02200 – GRANULAR BASE / SUB BASE PREPARATION

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section specifies requirements for supply, producing, hauling, placing and compacting processed gravel or quarried stone as a granular base or sub base to lines, grade and typical cross-sections, or as otherwise directed.

.2 Granular sub base is defined as the initial layer of granular material placed upon prepared sub-grade to form an integral part of the total pavement structure.

.3 Granular base is defined as the layer of granular material placed upon the compacted granular sub base or prepared sub-grade to form an integral part of the total pavement structure.

### 1.2 RELATED SECTIONS

- Section 01230 - Sub-grade Preparation

### 1.3 SAMPLES

.1 At least fourteen (14) calendar days prior to commencing work, inform the Engineer of proposed source of aggregates and provide access for sampling.

### 1.4 MATERIALS CERTIFICATION

.1 Aggregates: At least fourteen (14) calendar days prior to commencing work provide:

.1 Test data reports representing granular base and/or granular sub base processed into stockpile. Submit one complete aggregate gradation analysis report for every 1000 tonnes of each material required for the project, or one complete analysis for each production day when production rate is less than 1000 tonnes. Include percentage of crushed coarse aggregate particles in granular base reports.

.2 Certification that the physical properties of the aggregates meet the requirement of this section.

.1 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least fourteen (14) calendar days prior to contemplated change in source of aggregates, provide written notification to the Engineer and provide new materials certification in accordance with the requirements of this section.

### 1.5 SUBMISSIONS

.1 Granular sub base and base sources and test results shall be submitted to the Engineer for review and approval before being used.

.2 Preliminary review of the material as represented by the test results shall not constitute general acceptance of all the material in the deposit or source of

supply. Materials may be considered unsuitable even though particle sizes are within the limits of gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for. The Engineer has the right to request additional testing if there are any concerns with the proposed aggregate.

1.6 DELIVERY AND STORAGE

.1 Deliver and stockpile aggregates in accordance with the requirements of this section.
.2 Stockpile minimum of fifty (50%) percent of each type of base material required before commencing to haul products to the project site.
.3 Handle and transport products to avoid segregation, contamination and degradation.
.4 Stockpile products in sufficient quantities to meet project schedules. When adding new products to the stockpile after removal to the project site has commenced, do not deposit material against working face of stockpile.
.5 Separate product stockpiles by substantial dividers or stockpile far enough apart to prevent intermixing.
.6 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed by the Engineer within 48 hours of rejection.
.7 Construct stockpiles in uniform lifts using trucks or rubber-tired loading equipment, being careful to avoid spillage of materials over the ends of previously place lifts. Do not use conveyors or tracked equipment in stockpile construction.
.8 Provide a previously stabilized stockpile base or provide a compacted sand base not less than 300 mm in depth to prevent contamination. Alternatively, stockpile aggregates on the ground but do not incorporate bottom 300 m of pile into the work.

## 2 PRODUCTS

2.1 GRANULAR SUB BASE

.1 Crushed stone or gravel consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious material.

.2 Physical properties of aggregates:

| | |
|---|---|
| Los Angeles Abrasion, Loss, % | 50 max. |
| Liquid Limit, % | 25 max. |
| Plasticity Index, % | 6 max. |
| Lightweight particles, % | 5 max. |
| California Bearing Ratio when compacted to 100 % of ASTM D698 | 20 min. |
| Crushed Particles ( 1 face, plus 5 000 sieve fraction) , % | 50 min. |

.3 Gradation to be within the following limits when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

| **Sieve Size (microns)** | **Percent Passing By Weight** |
|---|---|
| 50 000 | 100 |
| 25 000 | 66 – 90 |
| 16 000 | 54 – 81 |
| 10 000 | 45 – 73 |
| 5 000 | 35 – 63 |
| 1 250 | 22 – 45 |
| 630 | 17 – 38 |
| 315 | 13 – 30 |
| 160 | 9 – 20 |
| 80 | 4 – 10 |

## 2.2 GRANULAR BASE

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Physical properties of aggregates:

| | |
|---|---|
| % Fracture, by weight (2 faces) | 60 min. |

| | |
|---|---|
| Los Angeles Abrasion, loss, % | 45 max. |
| Liquid Limit, % | 25 max. |
| Plasticity Index, % | 6 max. |
| Lightweight particles, % | 5 max. |
| California Bearing Ratio, when compacted to 100% of ASTM D698 | 80 min. |

.3 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

| Sieve Size (microns) | Percent Passing By Weight |
|---|---|
| 20 000 | 100 |
| 16 000 | 84 - 94 |
| 10 000 | 63 – 86 |
| 5 000 | 40 – 67 |
| 1 250 | 20 – 43 |
| 630 | 14 – 34 |
| 315 | 9 – 26 |
| 160 | 5 – 18 |
| 80 | 2 - 10 |

## 3 EXECUTION

### 3.1 GENERAL

.1 The sub-grade shall be prepared according to the requirements of Section 01230 and to cross-sections shown on the Drawings. The Contractor shall maintain the sub-grade to the specified section, free from ruts, waves and undulations until granular sub base material is placed. The sub-grade shall be in a firm dry condition and must be approved by the Engineer before gravel is placed. The depositing of granular base or sub base on a soft, muddy or rutted sub-grade will not be permitted.

3.2 PLACING

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of aggregate. Use approved methods to create uniform windrow of material along a crown line or high side of a one-way slope.

.3 Place material to full width in layers not exceeding 150 mm in compacted thickness.

**.4** Shape each layer to a smooth contour and compact to the specified density before a succeeding layer is placed.

.5 Apply water as necessary during compacting to obtain specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until moisture content is correct.

.6 Remove and replace any portion of a layer in which material becomes segregated during compaction.

3.3 COMPACTING

.1 The granular base and sub base layers shall each be compacted to a density not less than 100% of Standard Proctor maximum dry density at ± 2 % of the optimum moisture content as determined by ASTM D698 (Method C) over the full width of the cross-section.

.2 Shape and compact alternately to obtain a smooth, even and uniformly compacted base and sub base.

.3 Apply water as necessary during compacting to obtain specified density. If the material is excessively moist, aerate by scarifying with suitable equipment until moisture content is correct.

.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

**3.4** ALLOWABLE TOLERANCES

.1 Finished sub base and base surfaces shall be within ± 10 mm of established grade, but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing materials until surface is within the specified tolerances.

3.5 TESTING

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.

.4 Density Tests shall be generally performed at a minimum frequency of 1 Test per 400 square meters.

.5 When required by the Engineer the Contractor shall supply and operate a loaded test vehicle with a minimum of 18,200 Kg. (gross vehicle weight) to test the granular materials for rutting, weaving and soft spots. Where proof rolling indicates areas that are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the sub base and base construction.

.6 Construction or material not meeting the specifications will not be accepted.

3.6 MAINTENANCE

.1 Maintain finished sub base and base surfaces in a condition conforming to this section until succeeding material is applied or until Substantial Completion.

# END OF SPECIFICATION

# SPECIFICATION 02210 – GEOTEXTILES AND GEOGRIDS

## 1 GENERAL

### 1.1 DESCRIPTION

.1 Work under these specifications shall include the supplying and installation of geotextile and geogrid material that meets all requirements shown for each classification.

## 2 PRODUCTS

### 2.1 GEOTEXTILES

.1 The use of Geotextile may be needed to act as a platform to place the granular material on the roadway. This material will be placed on the subgrade and covered with a minimum of 300mm of granular material.

.2 The woven Geotextile shall have a minimum grab tensile strength of 1.4kN and a minimum puncture resistance of 0.7kN.

.3 Measurement and payment for the geotextile will be on a unit price basis per square meter of finished horizontal placement area and include all material, labour, equipment and superintendence to supply and place as per the manufacturer's recommendations.

.4 Geotextiles come in a variety of structures and polymer compositions. The main function of geotextiles are: separation, reinforcement, filtration, drainage and protection. There are two types of geotextiles which the contractor will be permitted to use; Woven and Non-Woven (Needle Punched) fabrics.

### 2.1A WOVEN GEOTEXTILES

Physical properties for woven geotextiles shall meet the following requirements:

Table 1: Physical Property Requirements for Woven Geotextiles

| **Properties** | **Test Method** | **Units** | **Woven Geotextile Specification** |
|---|---|---|---|
| Grab Tensile Strength | ASTM-D 4632 | kN | 1.4 |
| Trapezoid Tearing Strength | ASTM-D 4533 | kN | 0.5 |
| CBR Puncture | ASTM-D 6241 | kN | 6.0 |
| Permittivity | ASTM-D 4491 | $sec^{-1}$ | 0.7 |

### 2.1B NON-WOVEN GEOTEXTILES

Physical properties for non-woven geotextiles shall meet the following requirements:

Table 2: Physical Property Requirements for Non-Woven Geotextiles

| **Properties** | **Test Method** | **Units** | **Non-Woven Geotextile Specification** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Grab Tensile Strength | ASTM-D 4632 | kN | 0.80 |
| Trapezoid Tearing Strength | ASTM-D 4533 | kN | 0.35 |
| CBR Puncture | ASTM-D 6241 | kN | 2.2 |
| Permittivity | ASTM-D 4491 | $sec^{-1}$ | 1.5 |

All non-woven geotextile shall be a needle punched fabric.

## 2.2 GEOGRIDS

.1 Geogrids come in a range of polymer type and cross-sectional dimensions and are to be used when specified by the engineer for reinforcement. When the geogrid has been installed apertures (openings) between the longitudinal and transverse elements allow soil particles on either side to come into direct contact thus increasing the interaction between the geogrid and soils above and below.

Physical properties for geogrids shall meet the following requirements:

Table 3: Physical Property Requirements for Geogrids

| **Properties** | **Test Method** | **Units** | **Geogrid Specification** |
|---|---|---|---|
| Aperture Size | Measured | mm | 25-40 |
| Tensile Strength @ 5% Strain | ASTM-D 6637 | kN/m | 11 (in weakest direction) |
| Ultimate Tensile Strength | ASTM-D 6637 | kN/m | 17 (in weakest direction) |
| Junction Efficiency | GRI-GG2-05 | % | 90 |

All geogrids shall be bi-oriented geogrid.

## 2.2A BIAXIAL GEOGRID WITH INTEGRATED NON-WOVEN GEOTEXTILE

Where specified, Biaxial Geogrid shall be provided meeting the following properties:

- Polypropylene extruded monolithic flat structured bars
- Integrated non-woven geotextile
- Square shaped apertures
- Welded rigid joints

Table 4: Biaxial Geogrid Specification

| **Properties** | **Test Method** | **Units** | **Geogrid Specification** |
|---|---|---|---|
| Aperture Size | EN ISO 10319 | mm | 31x31 |
| Tensile Strength @ 5% Strain | EN ISO 10319 | kN/m | 32 |

| | | | |
|---|---|---|---|
| Ultimate Tensile Strength | EN ISO 10319 | kN/m | 40 |

Table 5: Non-Woven Geotextile Specification

| **Properties** | **Test Method** | **Units** | **Geotextile Specification** |
|---|---|---|---|
| Mass per unit area | EN ISO 9864 | g/m2 | ≥ 150 |
| Grab Tensile Strength | EN ISO 10319 | kN/m | 7.5 |
| Puncture Force | EN ISO 12236 | N | 1670 |

## 3 EXECUTION

### 3.1 GENERAL

.1 The contractor will supply and install, when directed to do so by the engineer, a geotextile (woven or non-woven) or geogrid between the specified structural material (sub-grade, sub-base, base).

### 3.2 PLACING

.1 The geotextile or geogrid after placement will lie flat and free of wrinkles, and the contractor will ensure that it remains flat during placement of the overlying material. The geotextile or geogrid will be overlapped by 300mm along the seams.

# END OF SPECIFICATION

# SPECIFICATION 03100 – PRIME, TACK, AND FOG COATS

## 1. GENERAL

### 1.1 Description

.1 This section specifies the requirements for low-viscosity bituminous materials (emulsified asphalt) to be used in prime coats, tack coats, and fog coats, as well as associated materials.

.2 The Work consists of supplying emulsified asphalt including ordering, scheduling, delivery, storage facilities, handling, storing, sampling, testing, placement of the emulsified asphalt on the required locations or as directed in writing by the Project Engineer, and other related items.

### 1.2 Related Sections

.1 Asphalt Concrete – Section 03140.

### 1.3 Definitions

.1 Acceptance is the process undertaken by the Engineer in which the available Quality Control and Quality Assurance test data is reviewed and the Work is inspected by Project Engineer to ensure that it meets the requirements of the specifications. Recommendation for acceptance may be provided by Project Engineer.

.2 Emulsified asphalt is a suspension of minute globules of asphalt binder in water that contains a small amount of emulsifying agent.

.3 Fog coat is an application of emulsified asphalt to seal small cracks and surface voids in existing Hot Mix Asphalt (HMA) concrete to inhibit ravelling and / or the ingress of moisture. A fog coat will only be required if, in the written opinion of the Engineer, the HMA concrete is open in texture/segregated and/or contains small surface cracks.

.4 Prime coat is an application of emulsified asphalt which is designed to penetrate, bond, and stabilize a previously prepared granular base course or an existing absorbent surface, preparatory to placing bituminous surfacing materials or HMA concrete and is intended to promote bonding between the 2 differing materials.

.5 Quality Assurance (QA) is the planned and systematic activities, on the part of a purchaser or owner, implemented in a quality system so that the quality requirements for a material, product or service are verified or confirmed.

.6 Quality Control (QC) is the operational techniques and activities, on the part of a material, product or service provider, used to achieve and maintain the material, product or service to the required quality.

.7 Sand blotter is the application of clean granular material used to absorb excess emulsified asphalt, which has failed to penetrate into the granular base course or ponded on other surfaces.

.8 Tack coat is an application of emulsified asphalt to a previously constructed paved surface of any type or age in preparation for placing a new layer of HMA concrete and is intended to provide a thorough bond between the old and new materials.

## 2. PRODUCTS

.1 All emulsified asphalts must be homogeneous and uniform in character throughout and meet the requirements indicated in the current edition of Alberta Transportation's Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt, Table ASPH-7 Specifications for Anionic Emulsified Asphalts. In the case of a discrepancy between this specification and Section 5.7 Supply of Asphalt this section will govern.

## 2.2 Prime Coat

.1 The emulsified asphalt must be a Slow Setting (SS) type SS-1 diluted at a maximum of 1 part potable water added to 1 part SS-1 up to September 30. After September 30 the Contractor may use an undiluted Medium Setting (MS) type MS-1 or a Rapid Setting (RS) type RS-1.

## 2.3 Tack Coat

.1 The emulsified asphalt type must be a SS-1 diluted at a maximum of 1 part potable water added to 1 part SS-1 up to September 30. After September 30 the Contractor may use an undiluted Rapid Setting (RS) type RS-1.

## 2.4 Fog Coat

.1 The emulsified asphalt type may be a SS-1 or a MS-1 depending on the surface material to be sealed.

## 2.5 Sand Blotter

.1 The materials for sand cover used to blot excessive emulsified asphalt must consist of clean granular aggregate material, all of which must pass a 5 000 µm sieve, be free from organic matter or other deleterious materials, and approved in writing for use by the Project Engineer.

## 2.6 Materials Certification

.1 At least 3 weeks prior to commencing Work on the project, the Contractor shall submit written and signed certification, from the emulsified asphalt supplier to the Project Engineer, that the emulsified asphalt complies with these specifications. This certification must include but is not limited to:

a. Name of the emulsified asphalt supplier.
b. Source(s) of the base asphalt binder(s).
c. Current laboratory test results for the emulsified asphalt.

## 2.7 Sampling and Testing

.1 All emulsified asphalt may be subject to inspection, sampling, and testing by the Project Engineer.

.2 Upon written request by the Project Engineer submit supplier's most recent test data indicating that the emulsified asphalt meets requirements of this specification and the current edition of Alberta Transportation's Standard Specification for Highway Construction, Section 5.7 Supply of Asphalt, Table ASPH-7 Specifications for Anionic Emulsified Asphalts.

.3 The Contractor must obtain representative, uncontaminated samples of each type of the emulsified asphalt delivered for use on the project for QA testing. Samples must

be obtained once from every 500 tonnes of each type of emulsified asphalt delivered for use on the project. At least 1 sample of each type of emulsified asphalt must be obtained for each project, regardless of project size, unless directed otherwise, in writing by the Project Engineer.

.4 The QA samples must be appropriately labelled in order to identify the Contractor, emulsified asphalt supplier, project, date and time sampled, type of emulsified asphalt, and the weigh bill number of the load sampled.

### 2.8 Quality Control

.1 The Contractor must have monitoring procedures in-place to provide daily "bulk" measurements of emulsified asphalt and potable water, as applicable, to verify that the maximum dilution rates indicated in 2.1.1 and 2.2.1 are not exceeded. If requested in writing by the Project Engineer, the Contractor must provide the daily bulk quantity checks within 1 working day of the HMA being placed on the project.

### 2.9 Quality Assurance

.1 The Contractor must deliver the QA samples to the Project Engineer within 1 working day after they were obtained.

.2 The Project Engineer may test random QA samples. If a tested sample indicates non-compliant emulsified asphalt, testing will occur on the QA sample taken immediately prior to and immediately after the non-compliant sample.

.3 Acceptance or rejection of the emulsified asphalt will be based on the test results.

## 3. EXECUTION

### 3.1 Delivery and Storage

.1 All emulsified asphalt storage facilities must be equipped with sampling valves maintained in good operating condition which are designed and located to enable representative sampling into the appropriate 1 or 2 litre containers of the emulsified asphalt. The Contractor must provide safe, convenient access, acceptable to the Project Engineer, for inspection and sampling of the emulsified asphalt, and must cooperate in the inspection and sampling process when requested to do so.

.2 The Contractor must follow the supplier's specified handling and storage requirements for each type of emulsified asphalt. All asphalt emulsions must be protected from freezing.

.3 The Contractor must prevent contamination of the emulsified asphalt, by emulsified asphalt of another type, by solvent, or by any other material.

.4 No emulsified asphalt type must be diluted or mixed with a different type, or with any other material, without the specific written approval of the Project Engineer.

.5 Emulsified asphalt storage tanks must be emptied of one type of emulsified asphalt and cleaned as necessary to prevent detrimental contamination of the emulsified asphalt, before placing another type of emulsified asphalt therein.

.6 Provide to the Project Engineer, upon written request, all freight and weight bills / bill of lading for emulsified asphalt binder received.

## 3.2 Equipment

.1 Pressure Distributor:

a. Designed, equipped, maintained, and operated so that the emulsified asphalt materials can be heated to a uniform temperature and can be applied uniformly on variable widths of surface up to 5 meters. The application rate must be readily determined and controlled at rates from 0.2 to 5.0 liters/square meter ($L/m^2$) and with an allowable variation from any specified rate not exceeding 0.1 $L/m^2$.
b. Capable of distributing emulsified asphalt material from a spray bar in a pressurized, uniform spray without atomization at the temperature required. The spray patterns made by the nozzles must result in overlap so that 3 nozzles cover any given area (except the 2 nozzles at the very end of the spray bar) to avoid streaking. Nozzles must be of the same manufacture, size, type, and must be set in the spray bar so that all nozzle slots make the same angle with the longitudinal axis of the spray bar.
c. Capable of maintaining the spray bar, at a constant height for uniform application of the emulsified asphalt, as material is withdrawn from the reservoir tank.
d. Equipped with a meter registering lineal meters per minute visibly located to enable the operator to maintain constant speed required for application at specified rates.
e. Has a positive displacement pump equipped with flow meter registering liters per minute passing through the nozzles and visible to the operator of the distributor. The pump must operate by a hydraulic motor powered by the truck power unit or by a separate independent power unit.
f. Equipped with an easily read, accurate, and sensitive device, which registers the temperature of the emulsified asphalt in the reservoir tank.
g. Equipped with accurate volume measuring device or calibrated tank.
h. Equipped with heating attachments and circulation or agitation capability.
i. Has a pressurized hand wand that can be used to treat areas not readily accessible by the spray bar.
j. Has a positive shut-off valve to prevent dripping from the spray bar or hand wand.

## 3.3 Application

.1 Before application of the emulsified asphalt all loose, dirty or objectionable material must be removed from the surface by power brooming or by other methods acceptable

.2 to the Project Engineer. Obtain Project Engineer 's written approval of existing surface before applying any emulsified asphalt.

.3 Temperature of the emulsified asphalt is to be between 20°C and 60°C in the reservoir tank prior to application.

.4 Upon the prepared and approved surface, the emulsified asphalt must be applied uniformly without streaking at a rate of: from 0.50 to 3.00 $L/m^2$ for prime coats; from

.5 0.20 to 0.90 $L/m^2$ for tack coats; from 0.20 to 0.60 $L/m^2$ for fog coats; or as directed in writing by the Project Engineer.

.6 The emulsified asphalt must be uniformly applied and without streaking or ponding. Joints and seams must not be excessively overlapped. Correct all areas that have not received sufficient coverage or have been damaged by traffic with the additional application of emulsified asphalt, to the written satisfaction of the Project Engineer. Immediately correct all areas of ponding or excessive emulsified asphalt by an

application of a sand blotter, removal by squeegeeing or scraping, rolling with a pneumatic tired roller or other means, to the written satisfaction of the Project Engineer. If the emulsified asphalt has set remove excess material by cold milling or other means, to the written satisfaction of the Project Engineer.

.7 Where traffic is to be maintained treat no more than 1/2 of the roadway surface at a time with emulsified asphalt.

.8 Cover all contact surfaces of curbs, gutters, headers, manholes, water valves, and like appurtenances with a uniform coat of the same emulsified asphalt material.

.9 Do not apply emulsified asphalt when rain is forecast within 2 hours, the weather is foggy, excessively windy or when the air temperature is less than 5°C, unless otherwise permitted in writing by the Project Engineer.

.10 All areas and structures adjacent to the roadway must be completely protected from the emulsified asphalt application operation including any accidental spillage of emulsified asphalt. Any unnecessary spraying or splashing by emulsified asphalt of areas adjacent to the roadway Work that will be visible when placement of the HMA concrete is complete must be cleaned to the written approval of the Project Engineer. All costs related to cleaning these areas will be borne solely by the Contractor.

.11 Traffic must not be permitted to travel on the prime coat until at least 6 hours after application or until it has completely cured. The Contractor must maintain the prime coat surface until the HMA concrete has been place on it. Maintenance must include spreading any additional sand blotter and patching any breaks in the prime coat surface with additional emulsified asphalt.

.12 Preferably, the emulsified asphalt prime coat should be entirely absorbed by the granular base course and therefore require no sand cover. However, if the emulsified asphalt has not been completely absorbed 6 hours after application, just sufficient sand blotter must be spread over the surface to blot up the excess emulsified asphalt and prevent it from being picked up by any traffic.

.13 Traffic must not be permitted to travel on the tack coat or fog coat until they are completely cured. The Contractor must use flagmen, if required, and signage to control traffic until the tack coat or fog coat has completely cured.

## 3.4 Acceptance

.1 The Contractor must provide emulsified asphalt, prime coats, tack coats, and fog coats conforming to the requirements of this specification and to workmanship in accordance with industry standards.

.2 If non-compliant emulsified asphalt is identified by the Engineer, use of the non-compliant emulsified asphalt must be suspended until the Contractor, Project Engineer and Engineer can determine the impact of the non-compliance and what the necessary remedial actions to be taken by the Contractor will be. Remedial actions must be either acceptance at full payment, acceptance at a payment adjustment or rejection.

.3 If the Contractor, Project Engineer and Engineer cannot agree on an acceptable payment adjustment for the HMA concrete affected by the non-compliant emulsified asphalt the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine the payment adjustment.

.4 If, in the written opinion of the Engineer, any emulsified asphalt that fails to meet the required specifications is significant enough to result in the probable unsatisfactory performance of the HMA concrete affected by the non-compliant emulsified asphalt, it will be rejected. The Contractor must remove and replace all the HMA concrete placed on the failed emulsified asphalt. Removal and replacement of the rejected HMA concrete must be at the Contractor's cost. If the Contractor disagrees and submits in writing to the Engineer within 3 working days of receipt of notice from the Engineer that the HMA concrete is rejected, the Contractor, Project Engineer and the Engineer will jointly hire an independent third party to determine if the non-compliant emulsified asphalt will result in the probable unsatisfactory performance of the HMA concrete and its subsequent rejection.

.5 If the Contractor, Project Engineer and the Engineer cannot agree on an independent third party, the Contractor and Engineer will each nominate an independent third party to a Panel and those two parties will select an independent third party to act as the chair of the Panel. The Panel will then determine the payment adjustment or if the HMA concrete should be rejected.

.6 All costs for the independent third party or the Panel will be split evenly between the Contractor and the Project Engineer.

.7 If suspended, the paving program must only recommence upon written authorization of the Engineer.

.8 Acceptance in writing by the Engineer will only occur if there are no obvious defects just prior to the placement of HMA concrete in the case of prime coats and tack coats and upon complete curing in the case of fog coats. In addition, the required QA samples have been provided to the Engineer within the time frame specified.

# END OF SPECIFICATION

# SPECIFICATION 03130 – ASPHALT CEMENT

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section specifies requirements for asphalt cement to be used in producing hot mix asphalt concrete paving mixtures.

.2 The work consists of supplying asphalt materials including storage facilities, handling, storing, sampling, testing and other related work.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Asphalt Concrete - 03140

### 1.3 MATERIALS CERTIFICATION

.1 At least 10 business days prior to commencing work submit current temperature viscosity chart for asphalt cement showing kinematic viscosity in $mm^2$ per sec. Over a temperature range of 105 $^{O}C$ to 175 $^{O}C$.

.2 Upon request submit manufacturer's test data and certification that asphalt cement meets requirements of the latest Saskatchewan Highways and Transportation Standards for supply of asphalt.

### 1.4 DELIVERY AND STORAGE

.1 Provide storage facilities capable of heating the material under effective and positive control at all times, with provisions for measuring and sampling.

.2 Provide, upon request, freight and waybills for asphalt cement shipments received.

.3 No asphalt type or grade shall be diluted or mixed with a different type or grade, or with any other material, without the specific approval of the Engineer.

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

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

## 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Asphalt Cement:

.1 The Contractor shall supply the types and grades of asphalt specified in the contract. Asphalt suppliers' products to be approved by the Engineer.

.2 All asphalt binders shall be prepared from petroleum oils. They shall be free from impurities. Solvents used in the manufacture of cut-back asphalts shall be derived from petroleum oils. Emulsifiers used to stabilize asphalt emulsion shall not be harmful to the performance of the asphalt in service.

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

## 3 SAMPLING AND TESTING

### 3.1 GENERAL

.1 All asphalt may be subject to inspection, sampling and testing by the Engineer or its designated agents. The Contractor shall provide safe, convenient access, acceptable to the Engineer, for inspection and sampling of the asphalt, and shall cooperate in the inspection and sampling process when requested to do so.

### 3.2 QUALITY CONTROL

.1 Quality control and quality control testing is the responsibility of the Contractor. Quality control testing shall be carried out by a qualified supplier's laboratory or a qualified testing laboratory licensed to practice in the Province of Saskatchewan.

### 3.3 QUALITY ASSURANCE

.1 If requested by the Engineer, the Contractor shall deliver quality assurance samples to the Engineer on the day they were sampled. The Engineer will test the quality assurance samples and will accept or reject asphalt material based on the test results.

# END OF SPECIFICATION

# SPECIFICATION 03135 – PERFORMANCE GRADED ASPHALT BINDER

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section specifies requirements for Performance Graded (PG) Asphalt Binder utilized in hot mix asphalt (HMA) production.

.2 This specification describes the property criteria, and handling and storage requirements for Performance Graded Asphalt Binder.

.3 The work includes supply of Performance Graded Asphalt Binder to the storage tanks at the HMA plant facility.

.4 When Performance Graded Asphalt Binder is designated for use, this specification shall apply rather than Section 03130.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Asphalt Concrete - Section 03140

### 1.3 MATERIALS CERTIFICATION

.1 At least 10 business days prior to commencing work submit current temperature viscosity chart for asphalt cement showing kinematic Viscosity in $mm^2$ per sec. Over a temperature range of 105 $^{O}C$ to 175 $^{O}C$.

**.2** Upon request submit manufacturer's test data and certification that the Performance Graded Asphalt Binder meets requirements of AASHTO MP1a-04, "Standard Specification for Performance Graded Asphalt Binder".

### 1.4 DELIVERY AND STORAGE

.1 Provide storage facilities capable of heating the material under effective and positive control at all times, with provisions for measuring and sampling.

.2 Provide, upon request, freight and way bills for asphalt cement shipments received.

.3 No asphalt type or grade shall be diluted or mixed with a different type or grade, or with any other material, without the specific approval of the Engineer.

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

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

## 2 PRODUCTS

### 2.1 MATERIALS

2.1.1 Asphalt Cement:

.1 The Contractor shall supply the types and grades of asphalt specified in the contract. Asphalt suppliers' products must be pre-qualified by the Owner.

.2 All asphalt binders shall be prepared from petroleum oils. They shall be free from impurities. Solvents used in the manufacture of cut-back asphalts shall be derived from petroleum oils. Emulsifiers used to stabilize asphalt emulsion shall not be harmful to the performance of the asphalt in service.

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

## 3 SAMPLING AND TESTING

### 3.1 GENERAL

.1 All asphalt may be subject to inspection, sampling and testing by the Engineer or its designated agents. The Contractor shall provide safe, convenient access, acceptable to the Engineer, for inspection and sampling of the asphalt, and shall cooperate in the inspection and sampling process when requested to do so.

### 3.2 QUALITY CONTROL

.1 Quality control and quality control testing is the responsibility of the Contractor. Quality control testing shall be carried out by a qualified supplier's laboratory or a qualified testing laboratory licensed to practice in the Province of Saskatchewan.

### 3.3 QUALITY ASSURANCE

.1 If requested by the Engineer, the Contractor shall deliver quality assurance samples to the Engineer on the day they were sampled. The Engineer will test the quality assurance samples and will accept or reject asphalt material based on the test results.

# END OF SPECIFICATION

# SPECIFICATION 03140 – ASPHALT CONCRETE

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section specifies requirements for the hot mix asphalt concrete paving.

.2 The work includes the supply of aggregates and asphalt cement, and reclaimed asphalt pavement and liquid anti-strip where applicable; asphalt plant mixing, transporting, placement finishing, and compaction to all requirements of this specification.

.3 The work includes all materials certification, quality control, verification and mix design testing, analysis and reporting to be completed as required in this specification.

### 1.2 STANDARD MIX TYPES (FOR INFORMATION ONLY)

Mix Type Designations and typical applications are as follows (Note: Mix Types to be selected on a project specific basis, as required by the nature of the project and quantities):

.1 Mix Type S1 - Surfacing mix for high traffic applications, including arterial and industrial classified roadways, using either 120/150 A penetration/viscosity graded asphalt cement or Performance Grade (PG) 64-31 binder, as identified in the Tender Form.

- PG 64-31 binder would be preferred for applications with high truck traffic and/or slower speed roadways with frequent signalized intersections.
- 120/150 A penetration/viscosity graded asphalt cement could be utilized for low truck traffic applications and/or roadway sections with no, or few signalized intersections.

**.2 Mix Type S2 - Surfacing mix for low to medium traffic applications, such as local and minor collector roadways, using 150/200 A penetration/viscosity graded asphalt cement.**

.3 Mix Type B1 - Base course mix for all traffic applications using 150/200 A penetration/viscosity graded asphalt cement.

.4 Mix Type M1 - Maintenance mix for patching, levelling course, and thin overlay of low traffic pavements, using 150/200 A penetration/viscosity graded asphalt cement.

### 1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 03130 - Asphalt Cement
- Section 03100 - Prime, Tack and Fog Coats

### 1.4 DEFINITIONS

.1 Asphalt Concrete - Generally refers to the final HMA product in place.

.2 End Product Specification (EPS) - A specification whereby the methods of construction are not defined. Under EPS the Engineer will monitor the Contractor's control of the process that produces the items of construction and will accept or reject the end product according to a specified acceptance plan. The Contractor is responsible for quality control. End product acceptance, including quality assurance is the responsibility of the Engineer.

.3 Hot Mix Asphalt (HMA) - Generally refers to the mixture of aggregates and asphalt cement, and other additives where applicable.

.4 Job Mix Formula - The job mix formula (JMF) establishes the proportioning of aggregate, asphalt cement and reclaimed asphalt pavement (RAP) and/or liquid anti-strip where applicable, to be used for the production of hot mix asphalt (HMA).

.5 Lot - A lot is a portion of the Work being considered for acceptance, and is defined as the following:

- Category A Projects - One day of plant production, per mix type, when the day's quantity is greater than 1000 tonne. When a day's production is less than 1000 tonne the material may be added to the previous or subsequent day(s) of production, at the Engineer's discretion. The maximum Category A lot size shall be 2000 tonne.
- Category B Projects - The entire project quantity for each mix type.
- At the Engineer's discretion, any portion of the Work may be deemed a Lot.

.6 Post-Production Quality Control - Materials and construction quality control conducted in accordance with this specification during and after plant mixing.

.7 Pre-Production Quality Control - Materials and process quality control conducted in accordance with this specification prior to plant mixing.

.8 Project Category - For the purposes of this specification, projects are to be identified in the Contract Special Provisions as Category A or Category B. Generally, Category A projects have asphalt concrete quantities greater than 2000 tonne of any one mix type and Category B projects have quantities of any one mix type less than 2000 tonne. In all cases the Special Provisions govern with respect to the applicable Project Category.

.9 Quality Control - Materials and process monitoring and testing conducted by, or on behalf of the Contractor.

.10 Quality Assurance - Acceptance testing and monitoring conducted on behalf of the Owner.

## 2 PRODUCTS

### 2.1 MATERIALS

.1 Asphalt Cement: - to Section 03130.

.2 Performance Graded Asphalt Binder – to Section 03135.

.3 Aggregates:

1. Coarse aggregate is aggregate retained on the 5000 µm sieve; fine aggregate is aggregate passing the 5000 µm sieve.
2. Aggregate material shall be crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps cementation, organic material, frozen material and any other deleterious materials.
3. Gradations to be within limits specified, when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSB 8.2-M88.
4. Aggregate shall be processed to meet the following requirements:
   - Natural fines shall be pre-screened and stockpiled with not more than 20% of material retained on the 5 000 µm sieve and 100% passing the 10000 µm sieve.
   - Aggregate delivered to the crushing plant shall be pre-screened and shall contain not more than 5% passing the 5 000 µm sieve.
   - If separating crushed aggregates, stockpile the fraction or manufactured sand such that not more than 15% of material retained on the 5000 µm sieve.
5. Physical properties of aggregates to meet the requirements in Table 2.1.2.5

**Table 2.1.2.5**

**Aggregate Physical Property Requirements**

| REQUIREMENT | ASTM TEST STANDARD | ALL MIX TYPES |
|---|---|---|
| Los Angeles Abrasion, Grading B (% Loss) | C131 | 32 max. |
| Magnesium Sulphate Soundness (% Loss)<br>Coarse Aggregate:<br>Fine Aggregate: | C88 | <br>12 max.<br>12 max. |
| Lightweight Particles (%) | C123 | 1.5 max. |

6. Blend Sand:
   - To consist of natural or manufactured sand passing the 5 000 µm sieve.
   - Stockpile volumes shall be maintained to ensure a minimum of 5 000 tonne of plant mix production, or the entire project quantity.
   - Blend sand shall be dried if necessary to provide a uniform feed.
7. Blended Aggregate Requirements:

- Aggregate Gradation Requirements, including RAP, to meet the requirements of Table 2.1.2.7.1.

**Table 2.1.2.7.1**

**Blended Aggregate Gradation Requirements**

| SIEVE SIZE (µm) | PERCENT PASSING SIEVE SIZE | | | |
|---|---|---|---|---|
| | MIX TYPE S1 | MIX TYPE S2 | MIX TYPE B1 | MIX TYPE M1 |
| 25 000 | - | - | 100 | - |
| 20 000 | 100 | - | 95 - 83 | - |
| 16 000 | 100 - 97 | 100 | 90 - 74 | - |
| 12 500 | 95 - 85 | 100 - 90 | 80 - 64 | 100 |
| 10 000 | 85 - 70 | 90 - 75 | 72 - 56 | 100 - 90 |
| 5 000 | 65 - 50 | 70 - 55 | 56 - 40 | 75 - 65 |
| 2 500 | 55 - 36 | 60 - 45 | 46 - 30 | 65 - 45 |
| 1 250 | 45 - 26 | 45 - 26 | 40 - 22 | 45 - 26 |
| 630 | 38 - 18 | 38 - 18 | 33 - 15 | 38 - 18 |
| 315 | 28 - 12 | 28 - 12 | 27 - 11 | 30 - 12 |
| 160 | 16 - 8.0 | 18 - 8.0 | 18 - 8.0 | 20 - 8.0 |
| 80 | 8.0 - 4.0 | 10 - 4.0 | 8.0 - 4.0 | 10 - 4.0 |

- Coarse Aggregate Fracture: Of coarse fraction (retained on 5 000 µm sieve size) the percentage of particles with two (2) or more fractured faces shall be by mass:
  - Mix Type S1 - 90% minimum
  - Mix Type S2 - 80% minimum
  - Mix Type B1 - 60%minimum
  - Mix Type M1 - 60% minimum
- Flat and Elongated Particles: Of coarse fraction (retained on 5000 µm sieve size) the percentage of flat and elongated particles greater than a 5:1 ratio shall be by mass less than 10%.
- Manufactured Sand: Of total fine fraction (passing 5000 µm sieve size), manufactured sand shall be by mass:
  - Mix Type S1 - 70% minimum
  - Mix Type S2 - 50% minimum
  - Mix Type B1 - 40% minimum
  - Mix Type M1 - No minimum specified

- For mixes incorporating RAP, 50% of the RAP sand portion shall be considered manufactured sand.
- The sand equivalent value (ASTM D2419, mechanical method) determined for the fine aggregate portion shall be:
  - Mix Types SI and S2 - 45% minimum
  - Mix Types B1 and M1 - 40% minimum
- Of total aggregate, the maximum RAP portion shall be by mass shall be 15%.

8. Delivery and Storage

- Aggregates: Stockpile minimum of 50% of total amount of aggregate required before commencing trial mix designs.
- Reclaimed Asphalt Pavement (RAP): Stockpile minimum of 100% of total amount of RAP required before commencing trial mix designs.

## 2.2 MIX DESIGN

.1 An asphalt mix design must be prepared and submitted to the Engineer for review and approval at least one week prior to the Work. The Contractor shall use qualified engineering and testing services licensed to practice in the Province of Saskatchewan.

.2 The mix design shall follow the Marshall method of mix design as outlined in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2), and shall include five separate trial values of asphalt content.

.3 Design of Mix:

- Mix Types S1 and B1 - 75 Blows on each face of test specimens.
- Mix Types S2 and M1 - 50 Blows on each face of test specimens.

.4 Include the following data with mix design submission:

1. Aggregate specific gravity and asphalt absorption.
2. Sand equivalent, coarse aggregate fracture, flat and elongated particles, and percent manufactured sand values.
3. Asphalt cement supplier/refinery, specific gravity and mixing and compaction temperatures, based on temperature – viscosity properties of asphalt cement.
4. Job mix formula including aggregate gradation and blending proportions, and design asphalt content.
5. Maximum relative density at each trial asphalt content.
6. Where reclaimed asphalt pavement (RAP) is to be incorporated into the mix supply, RAP gradation, RAP asphalt cement content and design recycle percentage.
7. Data to satisfy the requirements of the following:

**Table 2.2.4.7**

**Mixture Physical Property Requirements**

| PROPERTY | REQUIREMENTS | | | |
|---|---|---|---|---|
| | MIX TYPE | | | |
| | S1 | S2 | B1 | M1 |
| Marshall Stability (kN) | 12 min. | 8 min. | 10 min. | 5.3 min. |
| Marshall Flow (mm) | 2.0 - 3.5 | 2.0 - 4.0 | 2.0 - 4.0 | 2.0 - 4.0 |
| Air Voids (%) | 3.8 - 4.2 | 3.3 - 3.8 | 4.3 - 4.7 | 2.8 - 3.2 |
| Voids in Mineral Aggregate (%) | 13.5 - 15.0 | 14.0 - 16.0 | 12.5 - 14.0 | 14.5 - 16.5 |
| Voids Filled With Asphalt (%) | 65 - 75 | 70 - 80 | 60 - 70 | 70 - 80 |
| Film Thickness (µm) | 6.5 – 8.5 | 7.0 min. | 6.0 – 8.0 | 7.0 min. |
| Retained Stability (%) | 70 min. | 70 min. | 70 min. | 70 min. |

2.3 JOB MIX FORMULA

.1 Subject to approval by the Engineer, the aggregate proportioning (including RAP), target gradation, asphalt content and air void content from the Mix Design will become the Job Mix Formula for the supply of hot mix asphalt.

.2 Once established, no alterations to the Job Mix Formula will be permitted unless a new Job Mix Formula is submitted by the Contractor and approved by the Engineer.

.3 If the sum of any alterations to the Job Mix Formula are in excess of any one of the following limits, a new Mix Design is required.

- ± 5% passing the 5000 µm sieve size
- ± 1% passing the 80 µm sieve size
- ± 0.3% asphalt content

.4 Any alteration to the Job Mix Formula shall not result in properties which do not meet the requirements of this Specification.

2.4 PRODUCTION TOLERANCES

.1 All mixtures shall be supplied to the Job Mix Formula within the range of tolerances specified.

.2 Asphalt cement content: +0.3% of JMF value.

.3 Temperature: Mix temperature at point of plant discharge shall not vary from the mixing temperature identified in the mix design by more than +10 C.

.4 Aggregate Gradation:

**Table 2.4.4**

**Aggregate Gradation Tolerances**

| AGGREGATE PASSING SIEVE SIZE (µm) | TOLERANCE (% BY MASS) |
|---|---|
| Max. size to 5 000 | ±5.0 |
| 2 500 & 1 250 | ±4.0 |
| 630 & 315 | ±3.0 |
| 160 | ±2.0 |
| 80 | ±1.5 |

.5 The above tolerances for JMF gradation are allowed as long as the JMF gradation remains within the tolerances indicated in Table 2.2.4.7.

.6 Air Voids: + 0.8% of the JMF value.

.7 Mixture Properties: Marshall Stability, Marshall Flow, Voids Filled with Asphalt, and Voids in Mineral Aggregate as per requirements identified in Table 2.2.4.7.

.8 Film Thickness: Will be calculated using current Saskatchewan Highways and Transportation methods. For plant production, a 0.5□m reduction in the minimum values identified in Table 2.2.4.7 will apply.

.9 Moisture in Mix: Maximum permissible moisture, at point of plant discharge, is 0.2% by mass of mix.

.10 Asphalt cement recovered from freshly produced hot mix by the Abson Method, ASTM D1856 and subsequently tested in accordance with ASTM D5, shall retain a minimum value of 50% of its original penetration value.

## 3 SAMPLING AND TESTING

### 3.1 GENERAL

.1 The Engineer shall have access to all production processes and materials used for the work to monitor material quality as often as deemed necessary. Such inspection and testing shall not in any way relieve the Contractor of the responsibility for meeting the requirements of this specification.

.2 At least twenty one (21) calendar days prior to commencing work, inform the Engineer of the proposed source of aggregates and provide access for sampling, and provide samples of asphalt cement in accordance with Section 03130.

## 3.2 QUALITY CONTROL

.1 Quality control is the responsibility of the Contractor throughout every stage of the Work from aggregate processing to the final accepted product. Tests performed by the Engineer will not be considered as quality control tests.

.2 The Contractor shall be totally responsible for production of materials and construction that meet all specified requirements.

.3 All quality control shall be conducted by qualified personnel. The Contractor shall bear the cost of all quality control testing and consulting services.

.4 Pre-Production testing and sampling and minimum frequencies are described in Table 3.2.4, Pre-Production Quality Control Requirements.

**Table 3.2.4**

**Pre-Production Quality Control Requirements**

| Quality Control Requirement | Minimum Frequency |
|---|---|
| Asphalt Cement Certification | Once per Year or for change in supplier. |
| Aggregate Physical Properties<br>Table 2.1.2.5 | Once every 3 Years, or for change in source. |
| Crushed Coarse Aggregate Gradation Analysis and Fracture Content | One for every 1000 tonne of each class of material processed into stockpile, or one analysis for each material every production day when production rate is less than 1000 tonne. |
| Manufactured Sand Aggregate Gradation | |
| Natural Fine Aggregate Gradation | |
| Blend Sand Aggregate Gradation | |
| Reclaimed Asphalt Pavement (RAP) Asphalt Content and Extracted Aggregate Gradation | One for each 500 tonne delivered to stockpile, or one for each location when delivery rate is less than 500 tonne. |
| Penetration of asphalt cement recovered from RAP by Abson Method | One for each 2000 tonne delivered to stockpile |
| Trial Mix Design by Marshall Method<br>Section 2.2 | One per Year, or as required for a change in asphalt cement supply, aggregate gradation or aggregate source. |
| Plant Calibration | As required. |

.5 Post-Production testing and sampling and minimum frequencies are described in Table 3.2.5, Post-Production Quality Control Requirements.

**Table 3.2.5**

**Post-Production Quality Control Requirements**

| Quality Control Requirements | Minimum Frequency |
|---|---|
| Hot Mix Asphalt Analysis (including Asphalt Content, Aggregate Gradation, Marshall Density and Void Properties) | One for every 500 tonne of each mix type supplied under this specification. See Note 1. |
| Quality Control Charts (including 3 test running average for Binder Content, Aggregate Gradation, Marshall Density and Void Properties) | For each hot mix analysis. Test results and updated 3 test running average to be submitted to the Engineer as they become available. |
| Hot Mix Asphalt Temperature | Minimum frequency not specified. |
| Cold Feed Aggregate Analysis | Minimum frequency not specified. |
| Maximum Relative Density of Hot Mix Asphalt | Minimum frequency not specified. |
| Compaction Monitoring (Core or Nuclear Density) | Minimum frequency not specified. See Note 2 |

Note 1: Where an individual test indicates non-compliance, another test shall be initiated immediately.
Note 2: Coring is subject to approval by the Engineer.

.6 Pre-Production Quality Control test data as specified in Table 3.2.4 shall be reported to the Engineer for approval seven (7) calendar days prior to commencing the project, or as requested. No Work shall commence until the Engineer approves submitted test data.

.7 Post-Production Quality Control test data as specified in Table 3.2.5 shall be reported to the Engineer daily as the Work proceeds.

3.3 QUALITY CONTROL COMPLIEANCE WITH SPECIFIED TOLERANCES

.1 Asphalt Content, Aggregate Gradation and Mixture Properties

- The test data derived by Post-Production Quality Control mix testing, described in Section 3.2, shall be compared to the tolerances set forth in Section 2.4 of this specification. The Contractor shall suspend mix production when the 3 test running average for any property is outside of the specified tolerance limits.
- Supply shall not commence again until it is demonstrated that corrective action has been taken.

- Following initial supply, suspension of operations, or initiation of a new Job Mix Formula, a new 3 test running average is initiated and the subsequent mix production is subject to rejection until such time as an acceptable 3 test running average is attained.

.2 Hot Mix Asphalt Temperature

- Plant mix that does not meet temperature requirements of Section 2.4.3, at the point of plant discharge shall be subject to rejection at the discretion of the Engineer.

3.4 ACCEPTANCE SAMPLING AND TESTING

.1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements shall be determined from acceptance testing as described in this section.

.2 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.

.3 The Contractor shall allow access and provide material for all tests by the Owners testing agency.

.4 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.

.5 Initial acceptance testing will be undertaken free of cost to the Contractor.

**Table 3.4.4**

**Acceptance Testing Requirements - Category A & B Projects**

| Acceptance Testing | Minimum Frequency |
|---|---|
| Hot Mix Asphalt Analysis (including Binder Content, Aggregate Gradation, Marshall Density, Maximum Relative Density, Void Properties, Marshall Stability and Flow) | For each mix type, one test for each 3500 sq.m. of placement, or three tests per lot, which ever is greater.<br>See Note 1. |
| Compaction Testing (Core Density) and Thickness Determination | For each mix type, one test for each 2000 sq.m. of placement, or three tests per lot, whichever is greater. |
| Hot Mix Asphalt Temperature | No minimum frequency. |

.6 Acceptance Sampling Procedures:

1. Loose mix samples shall be acquired from the Work site in accordance with standard industry procedures. Auger samples may be used if approved by both the Engineer and the Contractor.

2. The timing of mix sampling shall be stratified, with each sample representing a similar production quantity.
3. Core locations will be selected using stratified random sampling procedures. The lot will be divided into segments meeting or exceeding the minimum frequency in Table 3.4.4 and of approximately equal area. In each segment a test site will be located using random numbers to determine the longitudinal and transverse coordinates.
4. Areas within 3m of transverse joints or 0.3m of a mat edge are excluded from compaction acceptance sampling and testing.

## 3.5 APPEAL OF ACCEPTANCE TESTING RESULTS

### .1 General

1. The Contractor may appeal the results of acceptance testing for Compaction Standard or Asphalt Content for any lot subject to rejection or unit price reduction. The notice of appeal shall be in writing and submitted to the Engineer within two (2) calendar days of receipt of the acceptance testing results.
2. Appeals will only be considered if cause can be shown and the requirements of Table 3.2.5 have been satisfied.
3. Quality Control tests initiated after the Contractor's receipt of the acceptance test results will not be considered when evaluating cause for appeal.
4. For Category A Projects, only Quality Control testing during production for the subject project will be considered when evaluating cause for appeal. For Category B Projects, Quality Control test results from production prior to the subject project may be considered when evaluating cause for appeal.

### .2 Asphalt Content Appeal

1. A stratified random sampling plan shall be developed by the Engineer with the same number of segments as the original number of samples for the subject lot. Sufficient core sample (150mm diameter) will be acquired from each segment to enable asphalt content determinations.
2. For asphalt content appeal testing, the Contractor will have the option for the testing to be done by the testing laboratory undertaking the project acceptance testing, or an independent testing laboratory selected by the Engineer.
3. The average of the appeal test results will be used for acceptance and unit price adjustment, and shall be binding on both the Owner and the Contractor.
4. If the average appeal test result verifies that any unit price reduction or rejection applies for that Lot, the costs of the appeal sampling and testing will be borne by the Contractor. If the result show that a penalty or rejection no longer applies, the sampling and appeal costs will be the responsibility of the Owner.

.3 Compaction Standard

1. The testing laboratory conducting the project acceptance sampling and testing will routinely retain companion samples sufficient for the determination of maximum relative density.
2. For compaction standard appeal testing, the Contractor will have the option for the testing to be done by the testing laboratory undertaking the project acceptance testing, or an independent testing laboratory selected by the Engineer.
3. The average of the appeal tests will be used for acceptance and unit price adjustment, and shall be binding on both the Owner and the Contractor.
4. If the new compaction standard verifies that any unit price reduction or rejection applies for that Lot, the costs of the appeal sampling and testing will be borne by the Contractor. If the result shows that a unit price reduction no longer applies, the appeal testing costs will be the responsibility of the Owner.

.4 Core Density and Thickness Appeals

1. Core density and thickness appeals will only be considered if a case can be made that the stratified random sampling plan was biased or testing was in error.

## 4 EXECUTION

### 4.1 CONTINUITY OF PRODUCTION

.1 During the time period that work is in progress on any project for which this specification is in effect, and at the Engineer's discretion, the plant may be limited to producing only the mix type required for that project.

### 4.2 MIX PRODUCTION

.1 Preparation of Mineral Aggregate

- The mineral aggregates shall be at as low a temperature as is consistent with proper mixing and laying and in no case to exceed 175 $^{O}$C.

.2 Composition of Mixture

- The mineral aggregate, reclaimed asphalt pavement (where applicable) and asphalt cement shall be mixed in a manner to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated.
- Incorporate RAP such that it does not come in direct contact with the burner flame.
- Plant emissions shall not exceed the limits set by Saskatchewan Environment.

## 4.3 PREPARATION FOR PAVING

.1 The Contractor shall provide the Engineer a minimum of six hours notice of the intention to commence paving over any previously approved primed or tacked surface.

.2 The hot asphalt mixture shall be laid upon a dry firm surface, true to grade and cross-section and free from all loose or foreign material. No hot mix shall be placed when the surface is wet or when other conditions prevent proper spreading, finishing or compaction.

.3 If undercutting, and subsequent backfill with asphalt concrete is done, the backfill operation shall be performed sufficiently far ahead of the paving operation to allow the asphalt concrete time to cool down enough to support equipment.

## 4.4 HOT MIX ASPHALT PLACING – AMBIENT AIR TEMPERATURE

.1 No hot mix asphalt shall be dispatched to the field unless the ambient air temperature, as issued by Environment Canada, is rising and meets the following minimum requirements:

- Thickness less than 50mm +7 $^{O}$C
- Thickness equal to or greater than 50mm +2 $^{O}$C

.2 A tolerance will be permitted for plant start-up.

.3 No surface lift asphalt shall be placed regardless of ambient air temperature until the road surface is 5 $^{O}$C or higher.

## 4.5 HOURS OF OPERATION

.1 No loads of hot mix asphalt shall be dispatched from the plant after sunset or during hours of darkness unless loads can be placed and compacted in accordance with these specifications, and suitable artificial illumination is provided, all subject to the Engineer’s approval.

## 4.6 TRANSPORATION OF HOT MIX ASPHALT

.1 Trucks shall be equipped with tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins shall be used.

.2 Vehicles used for the transportation of hot mix asphalt from the plant to the site of work shall have tight metal boxes previously cleaned of all foreign matter. The inside surface may be lightly lubricated with a soap solution just before loading. Excess lubrication will not be permitted.

.3 For purposes of checking asphalt mixture temperatures, trucks shall have an accessible 13 mm diameter hole drilled into the driver's side of the truck box, at a distance of 0.3 metres from the bottom of the box and 150 mm clear of the reinforcing ribs.

.4 The speed and weight of hauling trucks shall be regulated so that, in the opinion of the Engineer, no damage will occur to any portion of the work underway. Any damage to the tack coat, prime coat or the existing surface caused by the Contractor's equipment shall be repaired by the Contractor at their own expense.

.5 Any load of hot mix with a temperature less than 120 $^{O}$C, will be considered reject.

4.7 HOT MIX ASPHALT SPREADERS

.1 The spreading machine shall be self-propelled and capable of placing a uniform layer of asphalt mix to the depth and grades as shown on the plans or as indicated by the Engineer.

.2 The screed shall include a tamping bar or vibratory strike-off device for use when required. The screed shall strike-off the mix to the depth and cross-section specified and produce a finished surface of uniform texture.

.3 Control of the screed shall be by automatic sensing devices. Longitudinal control shall be accomplished by a sensor, which follows a string-line, ski, or other reference. The grade sensor shall be moveable and mounts provided so that grade control can be established on either side of the paver. A slope control sensor shall also be provided to maintain the proper transverse slope of the screed. Use of manual screed control may be used subject to approval by the Engineer.

4.8 HAND TOOLS

.1 Only lutes shall be used during the spreading operation and when the asphalt is worked by hand in areas in which the paver cannot reach.

.2 Tamping irons may be used to consolidate the material along structures inaccessible to the rollers. Mechanical compaction equipment, satisfactory to the Engineer, may be used instead of tamping irons.

.3 For purposes of checking the finished surface, Contractors must provide and carry on each paving machine a 3 metre straight edge and slope measuring level.

4.9 PRE-LEVELLING FOR ASPHALT CONCRETE

.1 Pre-levelling of uneven surfaces over which asphalt concrete is to be placed shall be accomplished by the use of asphalt concrete placed with a grader, paver, hand or by a combination of these methods as directed by the Engineer.

.2 After placement, the asphalt concrete used for pre-levelling shall be compacted thoroughly with pneumatic-tired rollers.

4.10 PAVING OPERATIONS

.1 The asphalt concrete shall be placed to the design thickness as shown on the contract drawings. On new construction where an established reference is lacking, a string-line reference will be required. Adjacent mats on the same lift are to be controlled by use of the grade sensor. No relaxation of the above procedure will be permitted without written approval of the Engineer.

.2 The spreader shall be operated in such a manner as to distribute the asphalt concrete mix to proper cross-section, width and thickness without causing segregation of the mix. Segregated areas, which may occur, shall be corrected immediately. The forward motion of the spreader shall be controlled so that no irregularities in the pavement surface are caused by excessive speed. The rate of placement of the mixture shall be uniform, and shall be co-ordinated with the production rate of the asphalt plant without intermittent operation of the spreader.

.3 Any failure of the machine or operation to produce a smooth, uniformly dense mat, free from irregularities, shall be corrected immediately to the satisfaction of the Engineer.

4.11 AREAS INACCESSIBLE TO THE PAVING MACHINE

.1 Areas that are inaccessible to the paving machine may be paved by other methods, as approved by the Engineer.

.2 In small areas or where the use of mechanical equipment is not practical, the mix may be spread and finished by hand. The asphalt mixture shall be dumped on the area and immediately thereafter distributed into place by shovels and spread with lutes in a loose uniform layer of uniform density and correct depth. Material must be handled so as to avoid segregation.

4.12 COMPACTION

.1 The Contractor shall supply sufficient compaction equipment to:

- Provide a compaction rate that will equal or exceed the placing rate of the spreader. Maximum suggested rate of speed 8 km/hr. for Rubber Tire and 5 km/hr. for Steel Drum.
- Ensure the specified compaction is attained before the temperature of the mat falls below 80 $^{O}$C.

4.13 LONGITUDINAL AND TRENSVERSE JOINTS

.1 Longitudinal and transverse joints shall be made in a manner consistent with industry standards. Coarse aggregate removed from the hot mix during joint preparation shall not be broadcast on to the mat.

.2 Paving joints shall not be placed in the same vertical plane. Longitudinal joints shall be offset at least 150 mm and transverse joints shall be offset at least 2 m.

.3 Longitudinal joints shall not be located within travel lanes, unless approved by the Engineer.

.4 Edges where additional pavement is to be placed shall be vertically formed to true line. A lute shall be used immediately behind the paver when required to obtain a true line and vertical edge.

.5 The exposed edges of all cold asphalt joints and the face of concrete curb and gutter shall be cleaned and painted with a thin coat of asphalt tack.

.6 At the end of each day's paving of the surface course and upper lift of the base course mix, the uncompleted paving mats shall be provided with vertically cut transverse joints. Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to ensure a thorough and continuous bond between the old and new surfaces.

.7 If public access to the site is allowed at the end of each day's paving abrupt changes in the roadway surface profile shall be avoided. The longitudinal transition shall be a maximum of 25mm vertically per meter.

4.14 UTILITY APPURTENANCES

.1 Pavement incorporating utility appurtenances, including water valves, gas valves, manholes and other surface utility fixtures shall be constructed in a manner satisfactory to the Engineer.

.2 A tack coat shall be provided to the vertical surface of utility appurtenances prior to paving.

.3 The paved surface adjacent to utility appurtenances shall be free of segregation with a tight uniform surface.

4.15 OPENING TO TRAFFIC

.1 Prior to any application of traffic, paving mats shall be sufficiently cool to resist any deformation or surface scuffing.

.2 The Engineer may, at their discretion, require means of cooling (e.g. application of water) completed pavements prior to opening to traffic.

.3 At their discretion, the Engineer may prohibit traffic from travelling on newly paved surfaces for any length of time deemed necessary.

4.16 TOLERANCE

.1 The finished surface shall conform to the standard cross-section as shown on the Standard Drawings to within 10mm of dimensions shown.

## 5 END PRODUCT ACCEPTANCE OR REJECTION

5.1 GENERAL

.1 The Contractor shall provide an end product conforming to the quality and tolerance requirements of this specification. Where no tolerances are specified, the standard of workmanship shall be in accordance with accepted industry standards.

.2 Acceptance of any Lot at full or increased payment will occur if there are no obvious defects and the Lot mean results for asphalt content, pavement density, and thickness meet or exceed the specified tolerances.

.3 Unit price reductions will only be applied on the basis on full acceptance testing in accordance with Table 3.4.4.

.4 Failure to satisfy the Post-Production Quality Control requirements of this specification will result in the mix supplied during such period to be subject to rejection.

.5 Mix supplied during periods when the Post-Production Quality Control 3 test running average is outside the specified tolerances is subject to rejection.

.6 Mix not meeting the plant discharge or on-site temperature requirements specified herein shall be subject to rejection.

.7 In the event where the work does not meet the requirements specified herein the Engineer and its representatives, at their discretion, may require that the portion(s) deemed "Reject" be completely removed and replaced at the expense of the Contractor.

**.8 No payment shall be made for sections of rejected asphaltic concrete should the Engineer elect to keep the rejected material in place.**

5.2 ASPHALT CONTENT

.1 For full payment, the Lot Mean Asphalt Content must be within + 0.30% of the approved JMF value, as specified in Section 2.4.

.2 Payment adjustment for asphalt content is as follows:

| **Asphalt Content Deviation form JMF Value (%)** | **Payment Adjustment Factor** |
|---|---|
| ± 0.30 or less | 1.00 |
| ± 0.31 to ±0.50 | As per Chart A |
| Greater than ± 0.50 | Reject (Note 1) |

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.3 PAVEMENT COMPACTION

.1 For full or increased payment, the Lot Mean Pavement Compaction must be equal to or greater than 93% of the Lot Mean Maximum Relative Density.

.2 Payment adjustment for pavement compaction is as follows:

| **Pavement Compaction % of Maximum Relative Density** | **Payment Adjustment Factor** |
|---|---|
| 94.6 to 95.5 | 1.03 |
| 93.5 to 94.5 | 1.02 |
| 93.0 to 93.4 | 1.00 |
| 90.0 to 92.9 | As per Chart B |
| Less than 90.0 | Reject (Note 2) |

Note 2: Subject to removal and replacement at the discretion of the Engineer.

5.4 THICKNESS (NEW CONSTRUCTION AND TOP LIFT ONLY)

.1 Pavement found to be out-of-scope in thickness by more than 13mm shall be removed and replaced by pavement of specified thickness, at the Contractor's expense.

.2 The Lot Mean Thickness for any Lot will be determined on the basis of the acceptance cores described in Table 3.4.4. If the deficiency of any individual core exceeds 13 mm, additional cores may be extracted in the proximity to the location of the core of excessive deficiency, to identify the extremities of the pavement area subject to be removed and replaced. The Contractor shall pay for such additional coring.

.3 For full payment, the Lot Mean Thickness must be equal to, or greater than, the specified thickness.

.4 Payment adjustment for thickness is as follows:

| **Average Thickness Compared to Specified Thickness** | **Payment Adjustment Factor (Note 1)** | |
|---|---|---|
| | **Total Thickness (Single or Multiple Lifts)** | **Top Lift Thickness (Multiple Lifts)** |
| Compliant or Greater | 1.00 | 1.00 |
| 1mm to 5mm Out-Of-Scope | 0.90 | 0.95 |
| 6mm to 12mm Out-Of-Scope | 0.80 | 0.90 |
| 13mm or more Out-Of-Scope | Reject (Note 2) | Reject (Note 2) |

Note 1: A single Thickness Payment Adjustment Factor shall be applied, Total Thickness or Top Lift Thickness, whichever is less.

Note 2: Subject to removal and replacement at the discretion of the Engineer.

5.5 AIR VOIDS

.1 Air voids payment adjustment factors are as follows:

| **Deviation (Note 1)** | **Asphalt Mix Type S2** |
|---|---|
| +1.6 | |
| +1.5 | REJECT |
| +1.4 | 0.30 |
| +1.3 | 0.50 |
| +1.2 | 0.60 |
| +1.1 | 0.68 |

| | |
|---|---|
| +1.0 | 0.75 |
| +0.9 | 0.80 |
| +0.8 | 0.85 |
| +0.7 | 0.90 |
| +0.6 | 0.93 |
| +0.5 | 0.96 |
| +0.4 | 0.98 |
| +0.3 | 1.00 |
| +0.2 | 1.00 |
| +0.1 | 1.00 |
| 0.0 | 1.00 |
| -0.1 | 1.00 |
| -0.2 | 1.00 |
| -0.3 | 1.00 |
| -0.4 | 0.95 |
| -0.5 | 0.90 |
| -0.6 | 0.85 |
| -0.7 | 0.65 |
| -0.8 | 0.50 |
| -0.9 | 0.25 |
| -1.0 | REJECT |

Note 1: Deviation in % air voids at 100% Marshall from mix specifications.

## 5.6 MARSHALL STABILITY

.1 Marshall stability payment adjustment factors are as follows:

| **Adjustment Factor (%)** | **Asphalt Mix Type S2** |
|---|---|
| | 150/200 A |
| 100 | >7.9 |
| 98 | 7.8-7.9 |
| 95 | 7.6-7.7 |
| 90 | 7.3-7.5 |

| | |
|---|---|
| 80 | 7.1-7.2 |
| 65 | 6.8-7.0 |
| 50 | 6.5-6.9 |
| 0* | <6.5 |

* No payment or remove and replace as directed by the engineer.

5.7 SMOOTHNESS

.2 The completed asphalt concrete surface shall be true to the dimensional and tolerance requirements of the specifications and drawings. Unless detailed otherwise in the contract documents, the tolerances in both profile and crown are:

- Base Course - 10mm in 3 m
- Surface Course - 5mm in 3 m

.3 When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by methods satisfactory to the Engineer. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

5.8 SEGREGATION

.1 The finished surface shall have a uniform texture and be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement.

.2 All segregation will be evaluated by the Engineer to determine repair requirements.

.3 The severity of segregation will be rated as follows:

- Slight - The matrix of asphalt cement and fine aggregate is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.
- Moderate - Significantly more stone than the surrounding mix, and exhibit a lack of surrounding matrix.
- Severe - Appears as an area of very stony mix, stone against stone, with very little or no matrix.

.4 Segregated areas shall be repaired by the Contractor as directed by the Engineer. The following methods of repair are identified.

- Slight - Squeegee asphalt to completely fill the surface voids.
- Moderate - slurry seal for full mat width.
- Severe - removal and replacement or overlay.

.5 All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Engineer.

.6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Engineer.

.7 Repairs will be carried out by the Contractor at his expense.

5.9 GRADATION

.1 The following requirements apply to asphalt concrete pavement material in all lifts except preliminary levelling.

.2 Price Adjustments for aggregate gradation variation will be based on the variation of the Lot Mean Gradation from the Job Mix Formula tolerance, for each sieve size, as shown in Tables 5.8.1 and 5.8.2 and the corresponding adjustment points as shown in Table 5.8.3.

.3 When the Lot Mean Gradation is outside the Job Mix Formula tolerance, the penalty assessment will be $0.04 per tonne for each Mean Adjustment Point, up to the limits shown in Table 2.1.2.7.1. When the Lot Mean Gradation is outside the limits of Table 2.1.2.7.1 the penalty assessment will be $0.40 per tonne for each Mean Adjustment Point outside those limits, regardless of the Job Mix Formula tolerance. If the maximum deviation shown in Table 5.8.2 is exceeded the lot is rejected.

**Table 5.8.1**

**GRADATION TOLERANCES FOR THE LOT MEAN FROM THE JOB MIX FORMULA AND MAXIMUM RANGE BETWEEN INDIVIDUAL TEST RESULTS IN A LOT**

| CHARACTERISTICS | SIEVE SIZE (µm) | | | | | |
|---|---|---|---|---|---|---|
| | (1) 20000, 16000, 12500, 10000, 5000 | 1250 | 630 | 315 | 160 | 80 |
| Tolerances for the Lot Mean from the Job Mix Formula | ± 5 | ± 3 | ± 2 | ± 2 | ± 1.5 | ±1. 5 |
| Maximum Range between Individual Test Results in a Lot | 10 | 6 | 5 | 4 | 3 | 3 |

(1) Note: Include all sieves up to one size smaller than top size.

**Table 5.8.2**

**MAXIMUM DEVIATION FOR THE LOT MEAN FROM THE GRADATION LIMITS SPECIFIED IN TABLE 2.1.2.7.1**

| CHARACTERISTICS | SIEVE SIZE (µm) | | |
|---|---|---|---|
| | (1) 20000, 16000, 12500, 10000 | 5000, 1250, 630, 315 | 160, 80 |
| Maximum Deviation for the Lot Mean from Table 2.1.2.7.1 Gradation Limits | 2 | 1 | 0.5 |

(1) Note: Include all sieves up to one size smaller than top size.

**"A" AND "B" ADJUSTMENT POINTS FOR DEVIATION IN GRADATION**

| SIEVE SIZE (µm) | MEAN |
|---|---|
| (1) 20000, 16000, 12500, 10000, 5000 | 5 for each 1% Deviation |
| 1250 | 1 for each 1% Deviation |
| 630 | 2 for each 1% Deviation |
| 315 | 2 for each 1% Deviation |
| 160 | 0.2 for each 0.1% Deviation |
| 80 Deviation < 1.0%<br>80 Deviation > 1.0% | 1.0 for each 0.1% Deviation<br>0.2 for each additional 0.1% Deviation |

Lot Mean Adjustment points will be calculated for each Lot. If the Lot Mean does not exceed the requirements in Table 2.1.2.7.1 a Lot Gradation Price Adjustment per tonne will be applied based on the following formula:

PAg = (A x -0.04) + (B x -0.40)

Where:

PAg = Unit Price Adjustment for Gradation

A = Mean Adjustment Points assessed within the gradation limits specified in Table 2.1.2.7.1 but beyond the Job Mix Formula tolerance requirements in Table 5.8.1

B = Mean adjustment Points assessed outside the gradation limits specified in Table 2.1.2.7.1 regardless of the Job Mix Formula tolerance.

## 6 PAYMENT

.1 The Unit Price applicable to each Lot quantity of asphalt concrete will be calculated as follows:

LOT UNIT PRICE = CONTRACT UNIT PRICE x $PA_{AC}$ x $PA_{COM}$ x $PA_T$

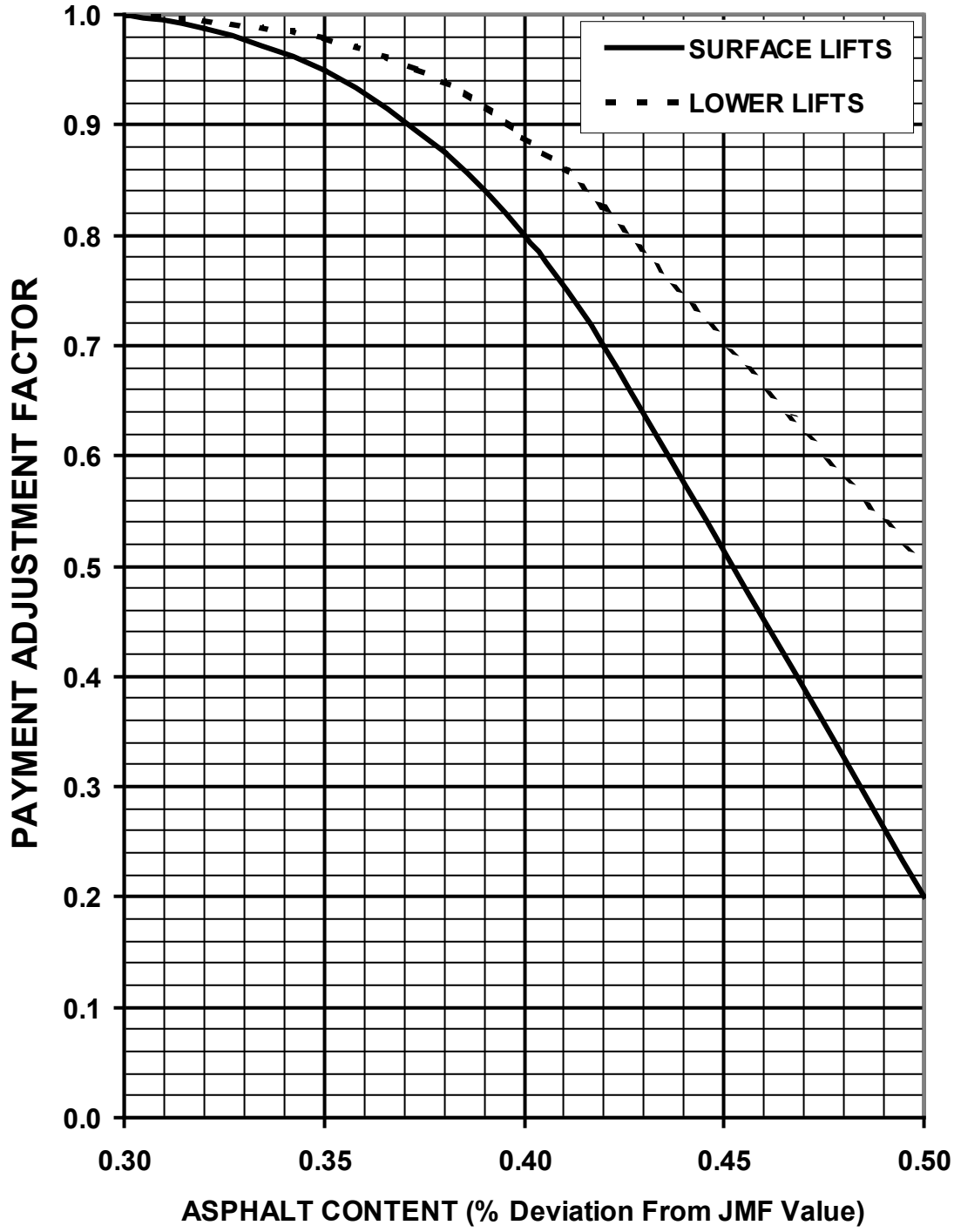
Where:

$PA_{AC}$ = Asphalt Content Payment Adjustment

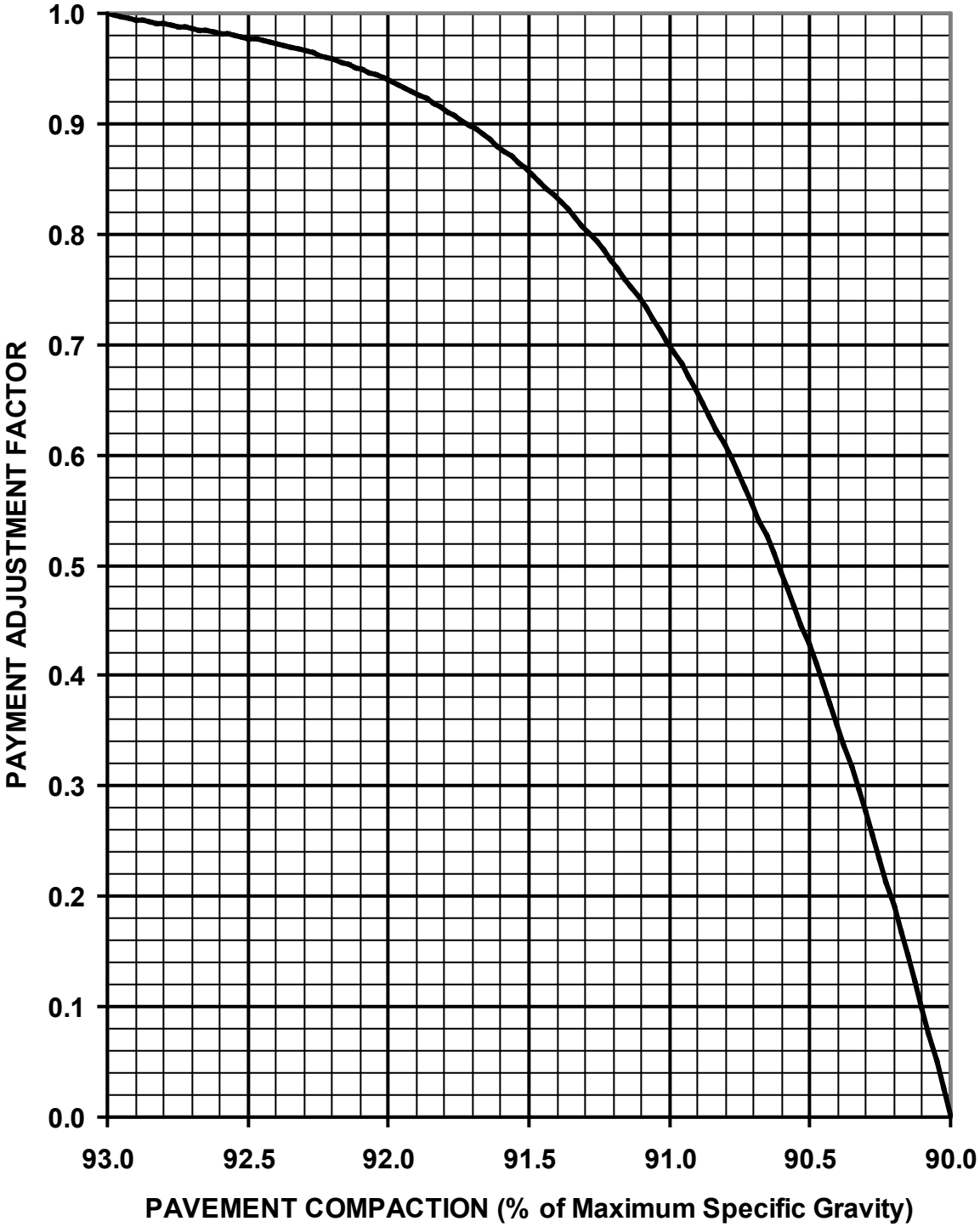
$PA_{COM}$ = Compaction Payment Adjustment

$PA_T$ = Thickness Payment Adjustment (When applicable)

## CHART A
## ASPHALT CONTENT
## PAYMENT ADJUSTMENT FACTOR



## CHART B
## COMPACTION
## PAYMENT ADJUSTMENT FACTOR




**END OF SPECIFICATION**

# SPECIFICATION 03145 – EMULSIFIED ASPHALTS

## 1 GENERAL

### 1.1 DESCRIPTION

.1 The work covered by this specification shall consist of all plant, labour, equipment and materials and in performing all operations in connection with Emulsified Asphalts in accordance with this specification.

### 1.2 RELATED SECTIONS

- Section 03100 - Prime, Tack and Fog Coat

### 1.3 MICROSURFACING DESIGN SUBMITTAL

.1 Prior to construction, the Contractor shall submit a signed mix design for each aggregate type and source. This design will be performed by a testing firm which has experience in designing micro surfacing mixes. After the mix design has been approved, no material substitution will be permitted unless approved by the Engineer.

.2 Compatibility of the aggregate, polymer-modified emulsified asphalt, water, mineral filler, and other additives shall be evaluated in the mix design. The mix design shall be completed using materials consistent with those supplied by the contractor for the project. The mix design submittal shall include the following:

- Emulsified Asphalt data;
  - Emulsion supplier
  - Type of emulsion
  - 24-hour settlement results
  - Distillation results
  - Sofetning point
  - Penetration @ 25º C
- Aggregate data;
  - Source(s) of aggregate
  - Los Angeles Abrasion test results
  - Sand Equivalency results
- Micro Surfacing Mix Data;
  - Emulsion content
  - Residual Asphalt
  - Mineral Filler type and content
  - Polymer content
  - Additives
  - Water Content
  - Aggregate gradation
  - Mix time @ 25º C
  - Wet Cohesion @30 min
  - Wet Cohesion @ 60 min

## 2 PRODUCTS

### 2.1 EMULSIFIED ASPHALTS

Emulsifiers used to stabilize asphalt emulsions shall not be harmful to the performance of the asphalt in service.

#### 2.1.1 Slurry Seal

The emulsified asphalt shall conform to the requirements of the current specifications of the Asphalt Institute. SS-1 grade emulsified asphalt shall be used with the Penetration of Residue at 38º C shall be 40-90 and a viscosity range of 20-50.

SS-1 and SS-2 grade emulsified asphalt may be used if approved by the Engineer.

The Contractor shall supply the emulsified asphalt.

#### 2.1.2 Micro Surfacing

The emulsified asphalt shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process. A minimum of three percent (3%) polymer solids based on asphalt weight is required.

The emulsified asphalt and emulsified asphalt residue shall meet the requirements of AASHTO M 208 or ASTM D 2397 for CQS-1HP, with the exceptions shown in Table 1. The temperature for this test should be held at 177º C for 20 minutes.

The climatic conditions should be considered when establishing this range. The solubility test, if required, should be evaluated on the base asphalt.

Table 1: Emulsified asphalt test exception

| Test | Test Method | | Requirement |
|---|---|---|---|
| | AASHTO | ASTM | |
| Settlement of storage stability of emulsified asphalts, 24h | T 59 | D 6930 | 1% maximum |
| Distillation of emulsified asphalt | T 59 | D 6997 | 62% minimum |
| Test on Emulsified Asphalt Residue | | | |
| Softening point of bitumen (ring-and-ball apparatus) | T 53 | D 36 | 57º C minimum |
| Penetration of bituminous materials at 25º C | T 49 | D 5 | 40-902 |

### 2.2 AGGREGATE

#### 2.2.1 Slurry Seal

Aggregates shall consist of natural, hard, durable, angular sand. The aggregate shall be clean, free from deleterious material, lumps of dried fines or adherent coatings.

The mineral aggregate shall meet the following gradation requirements:

Table 2: Slurry Seal Mineral Aggregate Gradation

| Sieve Designation | Percent Passing by Weight |
|---|---|
| 2.0 mm | 100 |
| 900 µm | 40 - 65 |
| 400 µm | 25 – 45 |
| 160 µm | 11 – 22 |
| 71 µm | 7 – 15 |

### 2.2.2 Micro Surfacing

The mineral aggregate used shall be the type specified for the particular application requirements of the micro surfacing. The aggregate shall be a crushed stone such as granite, slag, limestone, chat, or other high-quality aggregate, or combination thereof. To assure the material is 100 percent crushed, the parent aggregate will be larger than the largest stone in the gradation used.

To account for aggregate bulking, it is the responsibility of the contractor to check stockpile moisture content and to set the machine accordingly.

The aggregate shall meet the specified polishing values and minimum requirements shown in Table 3.

Table 3: Micro Surfacing Aggregate Physical Properties

| Test | Test Method | | Requirement |
|---|---|---|---|
| | AASHTO | ASTM | |
| Sand equivalence | T 176 | D 2419 | 65% maximum |
| Aggregate Soundness by use of sodium sulfate and magnesium sulfate | T 104 | C 88 | 15% maximum w/ $Na_2SO_4$<br>25% maximum w/ $MgSO_4$ |
| Los Angeles Abrasion[1] | T 96 | C 131 | 30% maximum |

*Notes:*
*1. The LA Abrasion test shall be run on the parent aggregate.*

The aggregate gradations for Type 2 and Type 3 Micro Surfacing shall meet the following requirements in Table 4.

Table 4: Micro Surfacing Gradation Requirements

| Sieve Designation | Percent by Weight Passing | |
|---|---|---|
| | Type II | Type III |
| 9.0 mm | 100.0 | 100.0 |
| 5.0 mm | 90.0 – 100.0 | 75.0 - 90.0 |
| 2.0 mm | 59.0 – 84.0 | 35.0 – 70.0 |
| 900 µm | 38.0 – 60.0 | 26.0 – 40.0 |
| 400 µm | 21.0 – 35.0 | 15.0 – 30.0 |
| 160 µm | 10.0 – 22.0 | 7.0 – 18.0 |
| 71 µm | 5.0 – 14.0 | 5.0 – 15.0 |

The aggregate will be accepted based on five gradation tests sampled according to AASHTO T 2 (ASTM D 75). If the average of the five tests is within the stockpile tolerance from the mix design gradation, the material will be accepted. If the average of those test results is out of specification or tolerance, the contractor will be given the choice to either remove the material or blend the additional aggregate with the stockpile material to bring it into compliance. Materials used in blending must meet the required aggregate quality test specifications before blending and must be blended in a manner to produce a consistent gradation. Aggregate blending shall require the submittal of a new mix design.

## 2.3 FILLER

### 2.3.1 Slurry Seal

When required to produce a proper “slurry consistency”, the addition of a correct filler shall be added as required. Commercial fillers consisting of Portland Cement, Hydrated Lime, limestone dust or crusher run dust shall be used. Natural occurring materials, namely, silt or clay, will only be permitted to be used as a filler when approved by the Engineer.

### 2.3.2 Micro Surfacing

Mineral filler may be used to improve mixture consistency and to adjust mixture breaking and curing properties. Portland cement, hydrated lime, limestone dust, fly ash, or other approved filler meeting the requirements of ASTM D 242 shall be used if required by the mix design. Typical use levels are normally 0.0 – 3.0 percent and may be considered part of the aggregate gradation.

## 2.4 MICROSURFACING MIX

The micro surfacing mix shall be designed to pass the following test requirements in Table 5.

Table 5: Micro Surfacing Mix Requirements

| Test | ISSA Table No. | Requirement |
|---|---|---|
| Mix Time @ 25º C | TB 113 | Controllable to 120 seconds minimum |
| Wet Cohesion<br>@ 30 minutes minimum (set)<br>@ 60 minutes minimum (traffic) | TB 139 | 12 kg-cm minimum<br>20 kg-cm or near spin minimum |
| Wet stripping | TB 114 | Pass (90% minimum) |
| Wet-track abrasion loss over one-hours soak<br>Six-day soak | TB 100 | 538g/$m^2$ maximum<br><br>807g/$m^2$ maximum |
| Lateral displacement<br>Specific gravity after 1000 cycles of 56.71 kg | TB 147 | 5% maximum |
| Excess asphalt by LWT sand adhesion | TB 109 | 538g/$m^2$ maximum |

| | | |
|---|---|---|
| Classification compatibility | TB 144 | 11 grade points minimum (AAA, BBB) |

The micro surfacing mix shall be designed to the limits listed in Table 6.

Table 6: Micro Surfacing Mix Limits

| Components Materials | Limits |
|---|---|
| Residual asphalt | 5.5 – 10.5% by dry weight of aggregate |
| Type of mineral filler | 0 – 3% by dry weight of aggregate |
| Polymer content | Minimum of 3.0% solids based on bitumen weight content |

2.4.1 Water

The water shall be free of harmful salts and contaminants. If the quality of the water is in question a sample shall be submitted to the City.

The Contractor is responsible for providing all water required at the construction site. An application form for a portable water meter is available form the City's Water and Waste Stream Division.

The Contractor shall not operate any hydrant, valve, or curb stop without the Engineer's permission.

2.4.2 Additives

Additives may be used to accelerate or retard the break/set of the micro surfacing. Appropriate additives, and their applicable use range, should be approved by the City as part of the mix design.

2.4.3 Fibers

Fibers shall be added to the micro surfacing mix before the pug mill by mechanical distributor in order to ensure an even distribution throughout the mix.

Fibers shall be 12.5mm (0.5 inches) in length.

## 3 **EQUIPMENT**

All equipment, tools, and machinery used in the performance of this work shall be maintained in satisfactory working condition.

### 3.1 SLURRY SEAL

3.1.1 Mixer Equipment

The slurry seal coat mixing machine shall be a continuous flow mixing unit and be able to accurately deliver and proportion aggregate, asphalt emulsion, and water to a revolving spiraled

multiblade mixer and discharge the thoroughly mixed product on a continuous basis in a minimum amount of time.

The mixing machine shall be equipped with an approved fines feeder with an accurate metering device or method to introduce a predetermined amount of mineral filler into the mixer at the same time and location where the aggregate is fed. A calibrated control for aggregate and asphalt shall be provided capable for accurately proportioning materials.

The mixing machine shall be equipped with a water pressure system and a fog type spray bar adequate for complete fogging of the surface preceding spreading equipment with a maximum application of 0.30 liters per square meter.

The machine while in operation shall have a minimum speed of 18 meters per minute and shall not be allowed to exceed 55 meters per minute. Sufficient machine storage capacity shall be provided to properly mix and apply a minimum of 5 tonnes of slurry.

3.1.2 Spreading Equipment

The mechanical type squeegee distributor shall be equipped with flexible material in contact with the surface to prevent the loss of slurry from the distributor. It shall be maintained as to prevent loss of slurry on varying grades and crown adjustments to assure uniform spread and depth.

There shall be a steering device and a flexible strike-off. A piece of burlap or a piece of heavy canvas shall be attached behind the spreader to provide a smooth surface. The squeegee shall be attached behind the mixer.

3.1.3 Auxiliary Equipment:

Hand squeegees, shovels and hand equipment shall be provided as necessary to perform the work.

3.2 Micro Surfacing

All equipment, tools, and machines used in the application of micro surfacing shall be maintained in satisfactory working condition at all times.

All water and emulsion storage containers used in delivery or application of micro surfacing shall be free of contaminants and shall not leak. Spray bar nozzles shall be regularly inspected to ensure that a continuous even spray is being maintained. All lighting and reflectors must remain clean and operational at all times.

Equipment must be maintained to ensure that contaminants such as, but not limited to, motor oil, antifreeze, or hydraulic fluids are not leaking onto the road. At the discretion of the Engineer, the Contractor will cease operations and rectify the concerns regarding the condition of the equipment or tools.

All counting devices shall be in proper working condition prior too work commencing at each location. The Contractor will not receive payment for work completed with non-working counting devices.
For the safety of the crew, all equipment used in the application of micro surfacing or transportation of its components will have sufficient lighting, reflectors and warning lights to be clearly seen at night.

If the Engineer deems there is insufficient lighting or reflectors, the Contractor will take necessary steps to satisfy the requirements of the Engineer.

### 3.2.1 Mixing Equipment

The machine shall be specifically designed and manufactured to apply micro surfacing. The material shall be mixed by an automatic-sequenced, self-propelled, front feed, continuous loading, micro surfacing mixing machine. A mobile truck mounted micro surfacing unit is also acceptable.

It shall be a continuous-flow mixing unit that accurately delivers and proportions the mix components through a revolving multi-blade, double-shafted mixer. Sufficient storage capacity for all mix components is required to maintain an adequate supply to the proportioning controls.

When utilizing continuous machinery to minimize transverse joints, the specified machine must be capable of loading materials while continuing to apply micro surfacing. The continuous-run machine shall be equipped to provide the operator with full control of the forward and reverse speeds during application. It shall be equipped with the opposite-side driver stations to assist in alignment. The self-loading device, opposite-side driver stations, and forward and reverse speed controls shall be of original-equipment-manufacturer design.

### 3.2.2 Proportioning Devices

Individual volume or weight controls for proportioning mix components shall be provided and properly labeled. These proportioning devices are used in material calibration to determine the material output at any time.

### 3.2.3 Spreading Equipment

The mixture shall be agitated and spread uniformly in the surfacing box by means of twin - shafted paddles or spiral augers fixed in the spreader box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as a final strike-off and shall be adjustable. The spreader box and rear strike-off shall be designed and operated such that a uniform consistency is achieved and a free flow of material is provided to the rear strike- off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry.

A secondary strike-off shall be provided to improve surface texture. The secondary strike-off shall be adjustable to match the width of the spreader box and allow for varying pressures to control the surface texture.

3.2.4 Auxiliary Equipment

Suitable surface preparation equipment, traffic control equipment, hand tools, and other support and safety equipment necessary to perform the work shall be provided by the contractor unless otherwise stated.

## 4 EXECUTION

Immediately prior to applying slurry seal coat or micro surfacing, the surface shall be cleaned of all loose material, silt spots and other objectionable material.

### 4.1 Slurry Seal Coating

The Slurry Seal Coat shall consist of a mixture of emulsified asphalt, mineral aggregate and water, properly mixed and spread on the surface as specified and as directed by the Engineer.

On old pavement, a tack coat consisting of a dilution of 1 part emulsified asphalt to 3 parts water shall be applied with a conventional pressure distributor

#### 4.1.1 Mix Preparation

The quantities of aggregate, emulsified asphalt and water shall be measured or weighed into each batch. When preparing slurry seal mixes, the water and emulsified asphalt shall be added first, and then the aggregate. The amount of water used shall be a minimum to provide a fluid homogeneous mixture.

The Contractor shall make trial batches, at his expense, to determine the final blend of mineral aggregate, mineral filler and asphaltic binder until approved by the Engineer. Approximately 9.5 to 11.5 liters of emulsified asphalt shall be used per 45 kilograms of dry aggregate weight

#### 4.1.2 Application

The surface shall be fogged with water from pressure nozzles directly preceding the drag distributor. No puddles of free water shall remain after fogging. The slurry mix shall be of the desired consistency when deposited on surface and no additional elements added. Total time of mixing shall not exceed 4 minutes. A maximum amount of slurry shall be carried in the distributor and the maximum allowable speed shall be 55 m per minute.

The average thickness of slurry seal coat applied shall be 3 mm or approximately 1 tonne per 1,500 square meters of surface.

Slurry seal shall be protected from all traffic until the slurry has set. The minimum time period, in excellent drying weather, shall be 4 hours or the time required for the slurry color to change from uniform brown to uniform black.

Slurry application shall be suspended when rain is imminent within 12 hours.

## 4.2 Micro Surfacing

Microsurfacing shall consist of a mixture of polymer-modified emulsified asphalt, mineral aggregate, water, and additives, proportioned, mixed and uniformly spread over a properly prepared surface. The microsurfacing shall be applied as a homogeneous mat, adhere firmly to the prepared surface, and have a skid- resistant texture throughout its service life.

### 4.2.1 Calibration

Each mixing unit to be used in the performance of the work shall be calibrated in the presence of the Engineer prior to the start of the project. Previous calibration documentation covering the exact materials to be used may be acceptable, provided that no more than 60 days have passed. The documentation shall include an individual calibration for each material at various settings that can be related to the machine metering devices. Any component replacement affecting material proportioning or measuring requires that the machine be recalibrated.
No machine will be allowed to work on the project until the calibration has been completed and accepted by the Engineer.

The Contractor shall repair defective metering devices and components and provide the Engineer notice as to when the equipment will be recalibrated. The Engineer may request the Contractor to verify the calibration of the equipment. There will be no additional payments for calibrating, re-calibration or for verifying the calibration of the equipment.

### 4.2.2 Tack Coat

Tack Coats shall be applied in accordance to Section 04025.

### 4.2.3 Protecting Existing Utilities

All utilities shall be protected from the microsurfacing and tack oil by a suitable method. The Engineer must approve the method employed to protect the utility covers. If the Engineer deems the protective coverings material or installation to be unacceptable, the Contractor will cease operations until the installation meets the approval of the Engineer.

Protective coverings must be removed within 24 hours of completion of the work or before the roadway is reopened to traffic. Removal of utility covers includes removal of protective covering material and removal of any microsurfacing material or other material that may be present on the utility.

### 4.2.4 Application

The microsurfacing is to be applied with a drag (burlap or a similar material) to ensure a uniform textured finish. The Contractor is to apply the microsurfacing in

such a manner to ensure a continuous seal, tight along curb or gutter where present.

The microsurfacing shall be of the appropriate consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that complete coverage is obtained. Overloading of the spreader box shall be avoided. No dry aggregate either spilled from the lay-down machine or existing on the road will be permitted.

Mixes resulting in lumping, unmixed aggregate, roughness or excessive streaking in the mat surface will be rejected and operations ceased until the Contractor proves to the Engineer that the situation has been corrected.
Excessive streaking is defined as more than four drag marks greater than 10mm wide and 100mm long, or 25mm wide and 75mm long, in any 25 square meter area. No transverse ripples or longitudinal streaks of 5mm in depth will be permitted, when measured by placing a 3m straight edge over the surface. Mixes that are unable to hold straight lines or that cause an asphalt-rich surface with segregation will be rejected.

It is the responsibility of the Contractor to protect the microsurfacing until it has cured sufficiently to prevent pickup or damage. The Contractor will not be responsible for damage caused by circumstances that are out of their control, such as emergency vehicles requiring access through the work area.

4.2.4.1 Rate of Application

Acceptable Micro Surfacing application rate shall be in accordance with Table 7. Application rates are based upon the weight of aggregate in the mixture.

Table 7: Micro Surfacing Application Rates

| Aggregate Type | Application Rate |
|---|---|
| Type I | 14 – 17 kg/$m^2$ |
| Type II | 16 – 19 kg/$m^2$ |

4.2.4.2 Joints

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The contractor shall provide suitable width.

spreading equipment to produce a minimum number of longitudinal joints throughout the project. Longitudinal joints shall be placed 200mm from lane lines or as approved by the Engineer. Partial width passes will only be used when necessary and shall not be the last pass of any paved area. The joint shall have no more than a 5mm difference in elevation when measured by placing a 3m straight edge over the joint and measuring the elevation difference.

4.2.4.3 Mixture

The microsurfacing shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess liquids which create segregation of the aggregate. Spraying of additional water into the spreader box will not be permitted.

4.2.4.4 Handwork

Areas which cannot be accessed by the mixing machine shall be surfaced using hand squeegees to provide complete and uniform coverage. Handwork shall exhibit the same finish as that applied by the spreader box. All handwork shall be completed prior to final surfacing.

4.2.4.5 Lines

Lines at intersections, curbs, and shoulders will be kept straight to provide a good appearance. A suitable material will be used to mask off the end of streets to provide straight lines. Longitudinal edge lines shall not vary by more than +/- 50mm in any 30m length.

## 5 TESTING

The supplier shall, prior to initial delivery, undertake standard control tests and provide test results to prove compliance with the requirements for the desired type and grade of emulsified asphalt.

# END OF SPECIFICATION

# SPECIFICATION 03150 – COLD MIX ASPHALTS

## 1 GENERAL

### 1.1 DESCRIPTION

Cold Mix Asphalt shall be used for patching potholes and utility cuts primarily during the winter months and early spring before Hot Mix Asphalt is available.

## 2 PRODUCTS

### 2.1 ASPHALT CEMENT

The Asphalt Cement shall be SC-250 which conforms to the requirements listed in Table 1. Asphalt Cement content by dry weight of aggregate shall be from 5.5 - 6.5.

Table 1: Asphalt Cement Properties for Cold Mix Asphalt

| | Asphalt Grade | SC-250 | |
|---|---|---|---|
| Requirements | ASTM Test Method | Min | Max |
| Flash point (C.O.C.), ºC | D92 | 80 | - |
| Kinematic Viscosity at 60ºC $mm^2/s$ | D2170 | 250 | 500 |
| Distillation Test Total Distillate to 360ºC % by Volume | D402 | 4 | 20 |
| Distillation Residue Kinematic Viscosity at 60ºC $mm^2/s$ | D2170 | 800 | 10000 |
| Asphalt Residue of 100% Penetration % by mass | D243 | 60 | - |
| Ductility of 100% Penetration Residue at 25ºC cm | D113(1) | 100 | - |
| Solubility of Distillation Residue to 360ºC cm % by mass | D2042(2) | 99.0 | - |
| Water, % by Mass or Volume | D95 | - | 0.5 |

*Note (1) If the Ductility at 25°C is less than 100, the material will be acceptable if its ductility at 15ºC is more than 100.*
*Note (2) Using trichloroethylene as solvent or use of ignition burn furnace.*

### 2.2 Aggregate

The Aggregate gradation for Cold Mix Asphalt shall conform to the Type 3 mix as specified in Section 04010. The maximum allowable mixing temperature is 80°C

## 3 MEASUREMENT

Cold Mix asphalt shall be measured in tonnes of material loaded as determined by scales at the Contractor's plant location.

Material is to be scaled and recorded by the Contractor on duplicate weigh slips. Weigh slips must be signed by both parties at the time of loading and a copy supplied to the City of North Battleford. Tickets shall include a ticket number, gross, net and tare weights, truck number and cumulative total by asphalt type and project for that day.

The weight of each vehicle shall be determined at the beginning of the work with the fuel tank half full, spare tire in place and the driver in the cab. This weight, called the vehicle weight will be checked and/or amended at the discretion of the Engineer.

## 4 TESTING

The supplier shall, prior to initial delivery, undertake standard control tests and provide test results to prove compliance with the requirements for the desired type and grade of asphalt cement as listed in Table 1.

All tests conducted by the City shall be in accordance with the procedures and methods of the American Society for Testing and Materials (ASTM) except where the Canadian Government Specification Board (C.G.S.B.) and the National Standard Council (N.S.C.) of Canada is indicated.

### 4.1 QUALITY CONTROL

Suppliers shall provide all standard control tests as listed in Table 1 for every 100 tonnes of SC-250.

If requested by the City, the supplier shall supply a representative 5 litre sample of SC-250 prior to delivery of any order. The City shall also have the right to obtain samples of not more than 5 litres from each shipment during the course of delivery of any order.

# END OF SPECIFICATION

# SPECIFICATION 03155 – INFRARED ASPHALT HEATING

## 1 GENERAL

### 1.1 DESCRIPTION

The work under this section includes, but is not limited to, the supply of all superintendence, traffic control, labour, material, equipment and tools required to perform pavement repairs using infrared heater equipment.

## 2 MATERIALS

### 2.1 ASPHALT MIX TYPE

Type 2 and Type 4 asphalt concrete and reclaimed asphalt product (RAP) shall be used and will follow the City of North Battleford Specification unless otherwise approved by the Engineer.

### 2.2 EQUIPMENT

All tools, machinery, plant and equipment used in handling materials and executing any part of the work shall be subject to the approval of the Engineer. All such equipment shall be maintained in efficient working order and where any of the machinery plant or equipment is found to be unsatisfactory; it shall be improved or replaced by the Contractor to the satisfaction of the Engineer.

## 3 EXECUTION

### 3.1 PREPARATION

Upon arriving on site, the construction area shall be swept to remove any standing water, loose asphalt, and dirt.

### 3.2 HEATER PLACEMENT

The area to be restored as shown in Figure 1 shall be squared off at least 150 mm away from the damaged area (pothole).

The area to be heated as shown in Figure 1 shall be squared off at least 150 mm away from the area to be restored.

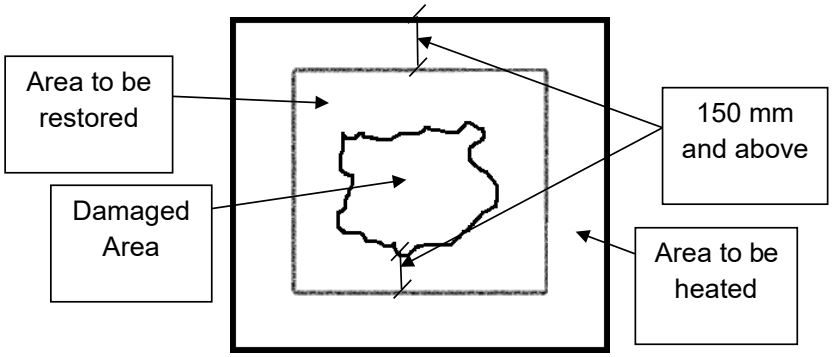



Figure 1: Heater Placement Area Location (not to scale)

The infrared burners shall be 250mm above the highest point in the damaged area.

### 3.3 HEATING TEMPERATURE

The Contractor shall heat the asphalt pavement to 135˚C to 175˚C evenly throughout the area to be heated as shown in Figure 1 without burning the asphalt pavement.

### 3.4 RAKING

The Contractor shall rake the heated asphalt in the area to be restored as shown in Figure 1, while not disturbing the area to be heated.

The Contractor shall roughly level the area to be restored with a slight trough at the edges.

### 3.5 REJUVINATING

The Contractor shall spray a small amount of rejuvenator that is listed on the City approved product list.

### 3.6 ADDITION OF NEW ASPHALT

In a case where a new asphalt is required, the Contractor shall use Type 2 and Type 4 asphalt concrete and reclaimed asphalt product (RAP) unless otherwise approved by the Engineer.

### 3.7 COMPACTION

The Contractor shall have available, at all times, the necessary labour, equipment and tools required to compact the asphalt and base in the area to be heated as shown in Figure 1.

### 3.8 COLD WEATHER APPLICATION

During when the temperature is below 4˚C the Contractor shall maintain the temperature of asphalt pavement above 135˚C during the duration of construction.

## 4 **TESTING**

The City of North Battleford shall appoint an independent testing consultant to perform all tests for quality control of the mix to determine compliance with specification during production (process control), and quality assurance to determine acceptance and payment adjustments to material supplied and placed.

Sampling for quality assurance will be done using a random sampling procedure as identified by the Engineer. Where there is continuous production uninterrupted by plant shutdown due to quality control only the predetermined random sampling frequency will be used to determine payment adjustments to the unit bid price.

The quality assurance random sampling will also be the basis for quality control for generating control charts and determining plant shutdown. In addition to the quality assurance sampling the Engineer may also initiate supplementary tests independent of the quality assurance random sampling procedure to supplement the quality control tests for determining process control. These additional tests will not be used for payment adjustment factors unless it results in plant shutdown prior to the sampling for quality assurance in that specific lot of material. The supplementary test in this case will then be used for payment adjustment on that portion of the

untested lot. If the supplementary test results in termination of production the Contractor will be required to pay for the test.

The Contractor shall retain and pay an independent testing consultant to perform all materials certification tests and mix designs required in this section.

# END OF SPECIFICATION

# SPECIFICATION 03158 – RUBBERIZED ASPHALT CRACK SEALING

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section specifies requirements for labour, machinery, equipment and material required to rout cracked asphaltic pavement and supply and place hot-poured rubberized asphalt in transverse and longitudinal cracks.

## 2 MATERIALS

### 2.1 SELECTION OF MATERIALS

.1 The crack sealant shall be a high-quality rubberized asphalt sealing compound. This material shall adhere to all bituminous and concrete surfaces and have the flexibility and resiliency to withstand pavement temperatures encountered in North Battleford.

.2 All products must meet or exceed ASTM Specification D6690. The City has approved Crafco Road Saver 552. This is the only crack seal product approved at this time. Other crack sealing products must be evaluated and approved by the City of North Battleford prior to use.

## 3 EQUIPMENT

The following list of equipment is required but not limited to complete the work.

### 3.1 MELTING KNIFE

The rubberized asphalt sealant shall be heated in a portable, rubber tired, double boiler type unit capable of indirect heating of the sealant. The kettle shall be equipped with:

- Automatic heat controlling device to control product temperature.
- A horizontally mounted built-in paddle agitator capable of automatic operation to keep the sealant under vigorous continuous movement during heating.
- Monitoring the thermometers for the sealant temperature and heat transfer oil if present.
- A positive displacement pump to discharge the sealant via a connecting want such that proper temperatures are maintained.

### 3.2 PAVEMENT CRACK ROUTER

A vertical router capable of cutting grooves with vertical sides in asphaltic concrete pavements to specified widths and depths. Routers must be able to achieve consistent and accurate routing depths. The router must be capable of following meandering cracks with routing restricted to the crack without unnecessary pavement cutting. The router shall be equipped with suitable screens to prevent flying particles that may be hazardous to personnel or may damage vehicles or property.

### 3.3 HOT COMPRESSED AIR LANCE (HCA LANCE)

The HCA Lance shall be capable of providing a combined jet of compressed air and a propane flame capable of clearing, heating, drying and darkening a routed or unrouted crack.

### 3.4 CRACK FILLING DEVICES AND STRIKE-OFF TOOLS

This equipment must be capable of flattening a head of sealant over the prepared crack if it has been overfilled.

## 4 **EXECUTION**

### 4.1 CRACK PREPARATION

.1 All areas to be routed and or cleaned shall be inspected by the Engineer prior to the work starting. Cracks less than 19 mm width must be routed to a width of 19mm or greater. Both sides of the crack shall be routed. All cracks routed shall be routed to a minimum depth of 20 mm. Cracks greater than 30 mm shall not be routed or sealed.

.2 Wedged chips or other non-compressible materials shall be removed prior to sealing. The routed and non-routed crack must be cleaned and heated using HCA lance to remove debris, dust and moisture. The hot rubberized asphalt sealant must be placed within 30 seconds of hot lancing. Pavement surfaces adjacent to the cleaned cracks shall be blown and cleared of all debris that might otherwise contaminate the cleaned crack prior to sealing.

### 4.2 PREPARATION OF CRACK SEALANT

.1 During the melting operation, all foreign material shall be prevented from entering the melter. All sealant protection wrapping is to be removed prior to melting the compound if required by the manufacturer. The compound shall be melted slowly with constant agitation. The manufacturer’s maximum safe heating temperature and minimum pour temperatures shall be adhered to at all times. The Engineer may allow temperature lower than the minimum pour temperature when the ambient temperature is high or on steep gradients where the sealant might otherwise flow after placement. The maximum crack seal batch size shall be as much crack filling sealant as can be placed in a given day, or 400 liters, whichever is less.

.2 Reheating unused sealant is not permitted. All overheated, diluted or contaminated material shall be removed from the site and disposed of at the Contractor's expense.

### 4.3 CRACK SEALING

.1 At the time of crack filling the ambient temperature shall be a minimum of 5º C and rising. All areas of crack to be sealed shall be inspected by the Engineer prior to placement of the sealant. Crack sealing shall not be performed on alligator cracking or block cracking or cracks wider than 30mm.

.2 Care is to be taken when filling routed or cleaned cracks. The tip of the wand shall be placed at the bottom of the routed crack or as far into the unrouted crack as possible to ensure uniform application and that no sealant bridges entrapped air pockets. A second application of sealant may be required where excess subsidence occurs. Sealant should be placed so as to fill the route or crack such that both edges of the route or crack are covered.

.3 After placement of the sealant, excess material should be struck off with a strike-off device to leave a fluish surface over the crack. The methods of application must be approved by the Engineer in the field prior to commencement of the work.

.4 Where pedestrian or vehicular traffic may cause tracking of the sealant (crosswalks or intersections), the sealed cracks shall be dusted with silica sand or cement powder. Supply and placement of this material shall be a subsidiary obligation of the Contractor and as such there will be no direct payment.

.5 The Contractor shall ensure traffic is not allowed on the newly sealed surface for a period of 1 hour from completion of the crack sealing in order to prevent tracking.

.6 Damage such as embedded stones, excessive debris or moisture in the sealant or obvious contamination shall be rejected. The defective work shall be repaired, removed, replaced or remedied at the Contractor's cost.

.7 All debris from the cleaning and routing operation shall be swept or blown from the surface of the roadway into the gutter for removal by City Forces. All refuse such as wrappings, containers or any other debris resulting from this operation shall be gathered and removed from the site on a daily basis by the Contractor.

.8 The sealed cracks shall be guaranteed for a period of two years from the date of completion of the sealing operation. If, during the warrantee period, the sealant pops our or there is an obvious evidence of water or material ingress through the crack, the sealant shall be removed, the crack cleaned and resealed.

## 4.4 CONCRETE ROADWAY AND SIDEWALK JOINT SEALING

1. Only the deep tooled longitudinal joint located at the top of the rolled curb section of the sidewalk is intended to be sealed. Weeds shall be removed from this joint prior to sealing by handpicking or use of such tools as a rotary edger. The joint shall then be thoroughly cleaned of debris and remaining organic material by hydro blasting or sand blasting. Any other cleaning method requires the Engineer’s approval.
2. The concrete faces on either side of the joint shall be dried with compressed air prior to sealing with hot rubberized sealant. Prior to leaving the worksite, the Contractor shall sweep up from both the sidewalk and the gutter all loose debris left as a result of cleaning and shall properly dispose of this debris off-site.
3. The Contractor shall fill these longitudinal joints with rubberized sealant to a minimum depth of 20mm measured from the top of the concrete surface. To ensure proper shape factor and mitigate waste of the sealant product the Contractor shall employ one of the following methods:
    - Insert heat resistant backer rod in the prepared joint. The depth of the backer rod will be set to accommodate the minimum required depth of Hot Rubberized Sealant.
    - Fill the void at the bottom of the prepared join with fine dry sand. The depth of the sand filler will be set to accommodate the minimum required depth of Hot Rubberized Sealant. After the sand filler has been placed, the exposed sides of the joint between the top of the sand and the top of the concrete shall be wire brushed clean of any sand particles.
    - If the Contractor deems the width of the prepared joint to be sufficiently narrow, he may apply full depth sealant. There will be no additional payment for the extra Sealant used.

4. Transverse joints a t 1.5 meter typical spacing extend from back of sidewalk to lip of gutter. The Contractor shall place temporary filler in the transverse joints on both sides of the longitudinal joint. This temporary filler shall match the color of the hot sealant if it is to be left in place to disintegrate over time or shall be removed after the sealant has set up, with the method of removal such that no holes are left in the sealant afterwards. The Contractor's temporary filler method must be approved by the Engineer prior to the start of the sidewalk crack sealing.
5. Any spillage of sealant on the surface of the concrete sidewalk  or curb shall be cleaned up immediately by the Contractor.
6. For aesthetic purposes, the completed longitudinal join shall be lightly dusted with a fine sand, talcum powder, or cementitious powder at those locations, such as driveway crossings, where there is a risk of traffic driving over newly completed joints.

# END OF SPECIFICATION

# SPECIFICATION 03160 – ASPHALT MILLING

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This work shall consist of removal of asphalt concrete pavement by cold planing in accordance with these specifications and to the specified lines, grade, and cross-section shown on the drawings or as designated by the Engineer.

.2 The sequence of the locations to be milled will be determined by the Engineer.

### 1.2 DEFINITIONS

.1 Reclaimed Asphalt Pavement (RAP): The material produced as a result of cold planing shall be defined as Reclaimed Asphalt Pavement (RAP).

## 2 EQUIPMENT

### 2.1 GENERAL

.1 The equipment for removing the existing asphalt pavement surface shall be a cold planing machine specifically designed for automatically controlled profiling.

.2 Automatic grade and slope shall be provided for accurately establishing profile grades at each edge of the machine by referencing from the existing asphalt pavement or an independent grade reference, where required, or be capable of automatically maintaining a designated cross slope from a single reference.

.3 The machine will be self-propelled and shall have sufficient power, traction and stability to maintain an accurate depth of cut.

.4 The cutting head shall be capable of full drum width milling of a 75 mm thickness of asphaltic concrete in a single pass.

.5 The equipment shall be equipped with means to effectively control dust generated by the cutting operation.

.6 Hauling equipment shall be available to receive milled material directly from the milling machine. Personnel shall be provided to insure that all cuttings are removed from street surface within 30 m of milling operation and swept within 150 m. Stockpiling of planed material (RAP) shall not be permitted on the project site.

.7 Equipment for removing any loose material during the sweeping operation shall have the capability to pick the material up off the milled and/or adjacent roadway and be able to unload onto the hauling equipment.

.8 The machine shall be capable of producing a minimum coverage of 2,000 $m^2$ per hour while planing a minimum of 15 mm of the existing pavement per pass and be able to cut flush to all gutters, curb walls, manholes, valves, catch basins or other obstructions within the paved area.

## 3 EXECUTION

### 3.1 CONSTRUCTION

.1 The Contractor shall provide all necessary labour, materials and equipment to load the RAP into dump trucks supplied by him and hauled to a disposal area designated by the Engineer.

.2 Sufficient passes, or cuts, shall be made such that all irregularities or high spots are eliminated, and that 100 percent of the surface area is planed to the design grade or to the satisfaction of the Engineer.

.3 The number of passes required to achieve the specified width and depth shall be determined by the Contractor.

.4 If the milled surface is to be used as the final wearing surface, the texture produced by the planing operation should be characterized by uniform, discontinuous longitudinal striations or other patterns which will, in the opinion of the Engineer, provide a satisfactory riding surface and skid resistance.

.5 The milling is to expose frames of all manholes, water valves, survey monuments, power and telephone poles and water valves to the required depth of milling.

.6 Dust produced shall be controlled to a level acceptable to the Engineer.

.7 When existing asphalt pavement removal is to be completed across the entire roadway width, it shall be completed to a uniform termination point in any given working day. For divided roadways, the interpretation of “entire roadway width” shall be that portion of the roadway facility associated with the movement of traffic in one direction.

.8 At the point of daily termination of removal operations, abrupt changes in the roadway surface profile shall be avoided. The longitudinal transition shall be a maximum of 25 mm vertically per meter.

.9 In the event the entire roadway of pavement along a section has not been milled by the end of the working period, resulting in a vertical longitudinal face, the maximum deviation between the two surfaces should not exceed 40 mm.

.10 Vertical cuts along a gutter line will be allowed at the end of the working period. Should the depth of cut be 75 mm or greater, proving hazardous to traffic, suitable signing and/or warning devices shall be provided by the Contractor.

.11 Existing asphalt pavement that cannot be removed by the milling equipment because of physical or geometrical restraints should be removed by other methods suitable to the Engineer.

.12 All RAP shall be loaded directly onto trucks from the milling machine and hauled to the designated stockpile site.

.13 The milling equipment shall be operated and maintained in such a manner that tearing and breaking out of the underlying and adjacent material is minimized.

.14 The resultant milled roadway surface shall be swept clean immediately after the removal of the milled material, and in no case should the sweeping operation be more than 100 meters behind the milling operation.

.15 Any distress of the newly milled surface caused by the milling which may constitute a driving hazard, shall be promptly repaired to the satisfaction of the Engineer.

.16 The contractor shall at all times minimize contamination of the RAP with granular or deleterious material.

.17 The Contractor shall make necessary allowances for drainage of water that may pond in areas where the milled sections have not been paved.

.18 Certain streets may require night planing or weekend planing as designated by the Engineer. Upon completion of planing, the surface shall be left in such condition that it can be reopened to traffic as soon as the loose materials have been removed.

3.2 OWNERSHIP

.1 The Contractor shall assume ownership of the RAP. The Contractor shall haul and place the RAP at an Engineer approved stockpile area on site or disposed of or stockpiled in a location determined by the Contractor.

# END OF SPECIFICATION

# SPECIFICATION 03200 - CONCRETE AND ASPHALT REMOVAL, DISPOSAL AND SALVAGE

## 1 GENERAL

### 1.1 PROTECTION

.1 Protect existing items designated to remain. In the event of damage to such item, immediately replace or make repairs to approval of the Engineer at no cost to the Owner.

## 2 EXECUTION

### 2.1 EQUIPMENT

.1 All proposed routes for hauling equipment must be approved by the appropriate road authority prior to commencement of the work.
.2 Trucks must be loaded in such a manner that no spillage occurs, and care must be taken to prevent dragging construction materials onto improved streets.
.3 Haul routes must be kept clear and free from dust by grading and sprinkling with moisture whenever, if in the opinion of the Engineer, conditions warrant this treatment.
**.4** All excavating and hauling equipment must be equipped with suitable muffling systems.

### 2.2 PREPARATION

.1 Inspect the site and verify with the Engineer, items designated for removal and items to remain.
.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing the site.

### 2.3 REMOVAL OF EXISTING CONCRETE

.1 Remove existing curbs, gutters, and sidewalks and other structures shown on the drawings or as directed by the Engineer.
.2 Cut existing concrete neatly, and load and haul debris to a designated disposal area or approved facility.
.3 Avoid damage to adjacent concrete surfaces not scheduled for removal. Damages will be the responsibility of the Contractor.
.4 Properly sign and barricade areas of removed concrete areas.
.5 Deter the public from access to the removed concrete areas until the new concrete has been replaced and hardened.

### 2.4 REMOVAL OF EXISTING ASPHALT

.1 Remove existing pavement structure as indicated on the drawings or as identified by the Engineer.
.2 Do not disturb adjacent items designated to remain in place.

.3 In removal of pavement:

1. Square up adjacent surfaces to remain in place by saw cutting or other methods approved by the Engineer.
2. Protect adjacent joints and load transfer devices.
3. Protect and stockpile underlying granular materials for re-use as directed by the Engineer.

2.5 DISPOSAL

.1 Recycle removed concrete and asphalt in a suitable manner.
.2 If recycling is not available, removed concrete and asphalt shall be separated and disposed of at an Engineer approved facility.

2.6 RESTORATION

.1 Upon completion of the work, remove debris, trim surfaces and leave work site clean.
.2 Reinstate areas and existing works to original or better condition.

# END OF SPECIFICATION

# SPECIFICATION 04100 – READY MIXED CONCRETE

## 1 REFERENCES

### 1.1 REFERENCE TO STANDARD SPECIFICATIONS

1. Reference in these Specifications will be made to the latest edition of the Canadian Standards Association (C.S.A.) for Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

## 2 CONCRETE AGGREGATE

Aggregate shall consist of clean, hard, durable, crushed stone or gravel free from lumps, soft and flaky particles, organic matter, salt, alkali, free from adherent coatings and shall conform to the C.S.A. Standard Specification for Concrete Aggregates.

### 2.1 AGGREGATE REJECTION

#### 2.1.1 Fine Aggregate:

.1 Aggregate shall comply with the grading requirements of C.S.A. Standard Specifications.
.2 Aggregate shall be rejected if it:
- Produces a color darker than the reference standard specified in the C.S.A. Test Method for Organic Impurities in Sands for Concrete.
- Contains more than 1% clay lumps, as determined by C.S.A. Methods.
- Contains more than 3% of material finer than 80 µm sieve.

#### 2.1.2 Coarse Aggregate:

.1 Coarse aggregate shall be 20mm nominal and comply with the grading requirements of C.S.A. Standard Specifications.
.2 Aggregate shall be rejected if it:
- Contains clay lumps in excess of 0.3% as determined by C.S.A. Methods.
- Contains more than 1% of material finer than the No. 80 µm Sieve.
- Percentage loss is greater than 35% as determined by the Los Angeles Abrasion Test described in C.S.A. Methods.
- Contains more than 0.5% low density material as determined by C.S.A. Methods.

## 3 TESTS ON CONCRETE AGGREGATE

.1 The Contractor shall have a Testing Laboratory, approved by the Engineer, perform certain tests on the concrete aggregate according to the current C.S.A. Specifications.
.2 The Contractor shall, at his own expense, supply the following material tests:
- Wash Sieve Analysis - C.S.A. - A23.2-2A / C.S.A. - A23.2-5A.
- Organic Impurities - C.S.A. - A23.2-7A.
- Clay Lumps - C.S.A. - A23.2-3A.
- Specific Gravity Test - C.S.A. - A23.2-6A for sand and A23.2 - 12A for course aggregate.
- Los Angeles Abrasion Test - C.S.A. - A23.2-16A & C.S.A. - A23.2-17A.
- Test for Soundness of Aggregate - C.S.A. - A23.2-9A.

- Low density material in aggregate - C.S.A. - A23.2-4A.

.3 The above aggregate tests shall be submitted to the Engineer each year as follows:
- Seven days before any concrete is placed.
- During the first week in July.
- During the first week in September.

.4 The Contractor shall also, at his own expense, supply to the Engineer the proposed concrete mix design at least 7 days before any concrete is placed.

.5 In the event that the original concrete design mix submitted to the Engineer requires changes, such design changes shall be approved by the Engineer or requested by the Engineer and a new concrete design mix shall be submitted at the cost of the Contractor. At no time shall the mix design be changed by the Contractor or concrete supplier unless approved by the Engineer.

.6 All test or mix design reports shall be submitted in duplicate to the Engineer and whenever applicable, be compared to the current C.S.A. Standard or as specified. The report shall be complete and to the satisfaction of the Engineer.

## 4 CEMENT

.1 Cement used on the work shall be a type of Portland Cement conforming to C.S.A. - A23.3.1 unless a different type of cement is specified.

## 5 PROVIDING CHEMICAL AND PHYSICAL TEST ON CEMENT

.1 The results of the chemical and physical tests on the cement to be used in the production of the ready-mixed concrete shall be supplied to the City Engineer by the manufacturer of the cement. Frequency of tests shall be:
- As specified by the Engineer.
- Any time when there is a change in either the chemical or physical properties of the cement.

.2 Copies of the test results supplied by the manufacturer of the cement will be sufficient, providing that they are certified.

.3 One copy of the report shall be submitted within 5 days to the City Engineer and one copy to the supplier of the ready-mix concrete.

## 6 WATER

.1 All water used for concrete shall be clean and free from injurious amounts of acid, oil, alkali, organic matter or other deleterious substances.

## 7 CONCRETE PROPORTIONS AND CONSISTENCY

.1 The proportions of aggregates to cement for concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms without permitting the materials to segregate or excess free water to collect on the surface. The quantity of water used shall be the minimum necessary to produce workable concrete.

.2 The consistency of the concrete shall be such that the slump shall not exceed 70mm or be less than 25mm for hand placed concrete, and less than 25mm for extruders when

tested by the "Standard Method of Slump Test for consistency of Portland Cement Concrete" as described in C.S.A. A23.2-5C. Non-compliance with the slump specified shall constitute sufficient ground for rejection of the concrete.

## 8 MIXING OF CONCRETE

.1 The mixing of concrete shall be done in an approved type of mixer which shall ensure a uniform distribution of materials throughout the mass so that the mixture is homogeneous and uniform in colour. The entire contents of the mixing drum shall be discharged before recharging and the drum shall be thoroughly cleaned at frequent intervals. The volume for the mixed material, per batch, shall not exceed the manufacturer's rated capacity of the mixer. The mixing of each batch shall continue for not less than 2 minutes after all the materials (including the water) are in the mixer, at the manufacturer's recommended speed.

.2 Ready-mixed or/and transit mix concrete shall conform in every respect to all specifications herein contained and with the "Standard Specifications for Ready-Mixed Concrete" as described in C.S.A. specifications and shall further be subject to any additional written directions that the Engineer may deem necessary to ensure the obtaining of concrete of the quality specified.

## 9 FLYASH

.1 Flyash shall not be used in concrete unless the mix design containing flyash has been approved in writing by the Engineer.
.2 As a mineral admixture, flyash shall conform to C.S.A. specification. The material shall be sampled and tested by an independent testing laboratory and copies of the test results shall be submitted to the Engineer for approval.
.3 Flyash shall not replace more than 20% by mass of cement in the concrete. The use of flyash will not be permitted in concrete placed after September 30 each year unless approval is given by the Engineer.

## 10 ACCELERATING ADMIXTURES

.1 Accelerating admixtures may only be used in non-reinforced concrete with the approval of the Engineer.
.2 The quantity accelerating admixtures shall be approved by the Engineer but at no time shall exceed 2% by weight of cement. Accelerating admixtures shall be used in the concrete when the air temperature is below 5□ C or at the discretion of the Engineer.

## 11 WINTER SERVICE AND SULPHATE RESISTANCE

.1 The Contractor shall submit additional unit prices per cubic metre for:
- Heating concrete during cold weather construction.
- Providing sulphate resistant - Type HS/HSb cement.
- High early strength - Type HE cement.

## 12 TEST ON CONCRETE

.1 During the progress of work, test cylinders will be taken to determine the quality of the concrete. There shall be a minimum of one test per 60 m³. Concrete tests will be done by a Testing Laboratory appointed by the Engineer and paid for by the City of North Battleford unless otherwise specified. The following tests will be carried out:
- Slump Test, as per Section 04100-7 of this Specification.
- Air-Entraining Test, as per Section 04100-13, 04100-14 & 04100-15 of this Specification.
- Concrete Compressive Strength (set of 3 test cylinders). One test cylinder will be broken at 7 days and two test cylinders will be broken at 28 days.

.2 The Contractor shall provide, at his own expense, materials and facilities as the Engineer may require for carrying out the above-mentioned tests.

.3 The fresh concrete will be sampled in accordance with C.S.A. Specification. Concrete with a slump greater than 75mm shall be rodded. Concrete with slump of 25mm to 75mm may be rodded or vibrated. Concrete with slump of less than 25mm shall be consolidated by vibration.

.4 The concrete supplied shall have a basic minimum specified compressive strength at 28 days. The average of the 2 cylinders of any single test broken at 28 days shall be equal to or greater than the specified strength at 28 days.

.5 Concrete compressive strengths are expressed in the metric designation of megapascals (MPa). The following standard compressive strengths are to be provided as requested:
- 20.0MPa, 25.0MPa, 30.0MPa, 32.0MPa, 35.0MPa.

.6 The length of concrete cores shall be measured in accordance with the current C.S.A. Specification.

## 13 MIX DESIGN, TESTING AND DELETERIOUS MATERIALS

.1 Concrete shall meet CSA specifications unless otherwise specified. Concrete mix properties shall conform to exposure classification C-2 and air content is summarized as follows:
- Minimum specified 28-day compressive strength: 32MPa
- Maximum W/C ratio: 0.45
- Air content: 5% to 8% (20mm aggregate)

.2 The minimum Portland cement content shall be 285kg/m3 with a total minimum cementitious content of 330kg/m3.

.3 Contrary to CSA, the time requirement for casting cylinders will be within 60 minutes from the time of sampling. All testing for slump, air content, and sample for casting cylinders will be done immediately after the first meter of concrete is removed from the concrete truck. Also, contrary to CSA, retempering of concrete to add air entrainment will only be considered for the first truck tested. Following a low air test the City will initiate another concrete test on the next load. The Contractor will be charged for the second concrete test.

.4 In addition to the mix design testing requirements set out in Section 06005 - Ready Mixed Concrete, the Contractor shall provide the following information:

- A legal description for the location of the source pits for the aggregates used in this contract.
- A linear traverse, as per ASTM Standard C457, showing size and spacing of air bubbles entrained in the concrete.
- Petrographic analysis as per ASTM Standard Practice C295.
- Alkali-Silica Reactivity of Aggregate as per CSA A23.2 – 14A

.5 In addition to the deleterious requirements contained in Clause 5.6 of CSA-A23.1-94, the following limits shall apply when the aggregate is tested in accordance with ASTM Standard Practice C295.

Table 1: Aggregate Testing Limits

| **Deleterious Substance** | **Maximum Percent by Mass of Total Sample** | |
|---|---|---|
| | **Fine Aggregate** | **Coarse Aggregate** |
| Siliceous Shalestone (1) | 1.0 | 0.5 |
| Ironstone (2) | 1.5 | 1.0 |
| Chert (3) | 2.0 | 2.0 |
| Other Deleterious (3) | 7.0 | 3.0 |

.6 Materials above are defined as follows for the purposes of these specifications:

- SILICEOUS SHALESTONE - light to medium grey, or greenish grey shale generally exhibiting a platy shape. The material absorbs water readily, and turns dark grey, dark green or black on wetting. The shalestone is composed of varying amounts of opal, clay materials and fine quartz grains.
- IRONSTONE - derived from clay ironstone concretions which consist of a relatively hard, dark brown outer shell of limonite and clay surrounding a relatively soft, brown or grey core of siderite and clay. The material has a high absorption.
- CHERT - this chert category also includes cherty limestones and cherty claystones. The rocks are generally dense and hard but contain varying amounts of potentially reactive chalcedony.
- OTHER DELETERIOUS - physically weak and/or absorptive rocks such as sandstones, siltstones, argillaceous or deeply weathered carbonate, friable or weathered schists or gneisses.

.7 All petrographic examination on fine and coarse aggregates for concrete must be done on material sampled in the year that the concrete is being placed, unless the following information about the concrete aggregate production is provided to the project engineer:

- A summary of all test results for sieves sampled at a rate of a minimum of one test per 2,000 tonnes.
- A petrographic analysis at a rate of a minimum of one analysis for coarse and one for fine aggregate based on a random sample taken during the production of the first 3,000 tonnes. If the first set of petrographic analysis detects no deleterious materials within the specified limits, a random sample taken during each 3,000 tonnes of production shall be recombined and split

to produce a representative sample of the concrete aggregate produced. A petrographic analysis for fine and coarse aggregate shall be performed on this aggregate sample.

- A summary test results for percentage of lightweight aggregates at a frequency of a minimum of one test every 5000 tonnes.
- The production date of the aggregate stockpile and the estimated current quantity in the stockpile.
- The location of the gravel pit where the aggregate was produced and the location of the stockpile in the pit area.

## 14 AIR ENTRAINING ADMIXTURES

.1 An approved air-entraining agent shall be used in all concrete and shall comply with the "Specifications for Air-Entraining Admixtures for Concrete" as described in C.S.A. specifications and used in strict accordance with the manufacturer's recommendations.

.2 The Contractor shall submit a letter, at least 7 days prior to construction, to the Engineer certifying that the air-entraining agent to be used meets the C.S.A. requirements.

.3 The air-entrainment limits shall be between 5 to 8 percent by volume as determined in accordance with C.S.A. - A 23.2-4C.

## 15 PAYMENT REDUCTION FOR LOW AIR ENTRAINMENT

.1 Reduction of payment for air entrainment below the minimum specified value shall be calculated and applied as follows:

Table 2: Air Entrainment Payment Adjusting Factors

| Air Entrainment | Payment |
|---|---|
| 5.0% - 8.0% | 100% |
| 4.5% - 4.9% | 95% |
| 4.0% - 4.4% | 75% |
| 3.5% - 3.9% | 30% |
| Less than 3.5% or greater than 8% | No Payment.<br>Concrete must be removed.<br>No Payment for Concrete Removed |

.2 The first concrete test will be taken after the first cubic meter has been removed from the truck. This test result will represent all of the concrete from that truck and all concrete placed in this location until the next test.

.3 Any additional tests for air entrainment done on this truck load shall be at the request of the Contractor and shall be at the expense of the Contractor. The result of this concrete test plus any additional tests on that load shall be averaged and used as the basis for payment. If the test results for the air entrainment do not meet specifications, the Contractor may make adjustments at the plant or request further air entrainment in the field. The cost of any additional tests shall be the responsibility of the Contractor.

16 **PAYMENT REDUCTIONS FOR LOW STRENGTH CONCRETE**

.1 When the average 28 day compressive strength is less than 5.0 MPa below the specified strength, the price paid for the work will be; the contract unit price multiplied by the average strength, divided by the specified strength.

*Example:*

*Contract unit price $12.00. Specified strength 32 MPa.*

*Average Measured 28 day compressive strength of 28 MPa.*

*New unit price payable to Contractor = $12.00 x 28/32 = $10.50*

.2 When the average 28 day compressive strength of the test cylinders is more than 5.0 MPa below but less than 7 MPa below the specified strength, the price paid for the work performed will be 50% of the contract unit price.

.3 When the average 28 day compressive strength of the test cylinders is 7 MPa or more below the specified strength, the work shall be replaced at the expense of the Contractor.

.4 The limits of work included in the price reduction or replacement shall be the entire construction represented by the low test(s), but shall not exceed a volume of 60$m^3$ of concrete produce in any one day.

# END OF SPECIFICATION

# SPECIFICATION 04110 – SUPPLY OF READY MIXED CONCRETE

## 1.1 DESCRIPTION

.1 This section specifies requirements for supply of ready mix concrete to the City of North Battleford for placement by its own forces or its agents.

.2 The work includes the supply of all constituent materials, handling, mixing, delivery and discharge at the construction site(s).

## 1.2 RELATED SECTIONS

- Section 04100 – Ready Mixed Concrete

## 2 SPECIFIC REQUIREMENTS

## 2.1 MATERIAL

.1 Ready Mixed Concrete: To the requirements as per Section 04100, Ready Mixed Concrete.

## 2.2 SUPPLY

.1 Normal days of work for the supply of ready mixed concrete shall be 5 days a week, Monday to Friday.

.2 Hours of Work

.1 Hours of delivery will be between 7:00 a.m. and 5:00 p.m., Monday through Friday. Exceptions to the scheduled hours of work will be agreed upon by both parties 24 hours prior to the time of supply. During inclement weather, deliveries will be confirmed on the day of delivery. The number of delivery trips will be minimized by using the largest truck reasonable for that size of load, unless smaller trucks are specified for a delivery location due to access constraints.

.3 Ordering Ready Mixed Concrete

.1 The City will place orders for concrete before 4:30 p.m. prior to the day of delivery, specifying quantity, location(s), and time when concrete is to be delivered.

.4 Truck Routes for Heavy Loads

.1 Vehicles used in the delivery of Ready Mixed Concrete will be governed by the City of North Battleford Traffic Bylaws. A marked plan will be provided that shows routes to be used by vehicles with a gross weight in excess of 5,000 kg.

.2 Concrete delivery trucks will use the routes determined by the City of North Battleford for delivery of concrete from the plant to a point closest to the delivery site. The Engineer reserves the right to establish the truck routes.

.5 Supply

.1 Further to General Conditions Section 00.45.00, if the Seller fails to supply the specified materials or meet provision under this section, the City may without terminating this contract;
.2 Secure other sources of supply immediately upon written notice to the Contractor, until the Contractor can demonstrate that their product meets specifications and provision under this Section. The City shall deduct from the Contractor's payment an incremental cost to secure an alternate supply. The total contract price shall be reduced accordingly.
.3 Terminate acceptance of materials immediately upon written notice to the Contractor until the Contractor can demonstrate that their product meets specifications and provisions under this section. The City shall deduct from the payment due the Contractor damages resulting from lost production and/or delay in schedule.
.4 Deduct from the payment due the Contractor damages resulting from lost production and/or delay in schedule for plant breakdown.

.6 Waiting Time

.1 Discharge time will include a time allotment on a site the greater of 15 minutes or 10 minutes per cubic meter. Site arrival times will be noted on the delivery slip and verified by a City representative on site.

2.3 PAYMENT ADJUSTMENTS

.1 Materials
- Payment reductions will be used to adjust the contract unit price for materials not complying with the specification limits. Payment reductions and specification limits are specified in Section 04100 - Ready Mixed Concrete.
- All payment adjustments will be determined on the basis of individual test results. The quantity of material represented by a single test lot will not exceed the quality of material delivered on the test day, up to and including the test load. Reduced payment and not the original price.

## 3 QUALITY CONTROL DOCUMENTATION

.1 An integral part of the quality assurance testing program is the ongoing verification of concrete quality by the Contractor as part of a daily quality control program. The basis of payment adjustment as per Section 06015-2.3 includes only the concrete supplied on the day of the quality assurance test. This means that more emphasis will be placed on documented procedures that the Contractor has in place for ongoing monitoring of concrete quality.
.2 Of primary interest is the daily verification of air entrainment. As per of the tender submission the Contractor will be required to submit:
- A brief summary of their quality control program that will be in place during the contract.
- A sample of daily logs for air entrainment testing and/or other quality control testing initiated by the Contractor.

.3 The proposed quality control program will be considered in the evaluation of the tenders.

4 **DUMPING OF EXCESS MATERIAL**

.1 Excess material is to be properly disposed of. Dumping of material in back lanes or vacant lots will not be allowed.

# END OF SPECIFICATION

# SPECIFICATION 04210 – SIDEWALK CONSTRUCTION

## 1 GENERAL

### 1.1 DESCRIPTION

This section specifies requirements for construction of sidewalks, curbs and gutters.

### 1.2 REFERENCES

.1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
.2 CAN/CSA-A23.2-04, Methods of Test for Concrete.
.3 CAN/CSA-A5-M89, Portland Cement.
.4 CAN3-A266.1-M78, Air-Entraining Admixtures for Concrete.
.5 CAN3-A266.2-M78, Chemical Admixtures for Concrete.
.6 CAN3-A266.4-M78, Guidelines for the Use of Admixtures in Concrete.
.7 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.
.8 ASTM C109-88, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).
.9 ASTM C309-89, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.10 CSA G30.12-M1977, Billet Steel Bars for Concrete Reinforcement.

## 2 PRODUCTS

### 2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A5, Type 50 sulphate resistant. (Type HS)
.2 Water: to CAN/CSA-A23.1.
.3 Aggregates: to CAN/CSA-A23.1.
.4 Air entraining admixture: to CAN3-A266.1.
.5 Chemical admixtures: to CAN3-A266.2. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.
.6 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309, Type 1-D with fugitive dye.
.7 Polyethylene film 0.15 mm: to CGSB 51-GP-51M.
.8 Reinforcement for Concrete: CSA G30.12-M1977.

### 2.2 CONCRETE MIXES

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following properties for all concrete:

1. Cement: Type 50 Portland cement.
2. Minimum compressive strength at 28 days: 25.0 MPa.
3. Minimum cement content: 300 kg/$m^3$ of concrete.
4. Maximum water cement ration: 0.45
5. Class of exposure: A.

6. Nominal size of coarse aggregate: 20 mm.
7. Slump at time and point of discharge: 30 mm to 80 mm.

   - No water adjustment is allowed to the delivered concrete after 1 hour of the concrete batch time.

8. Air content: 5 to 8%.

2.3 CURING COMPOUND

.1 Curing compound shall conform to ASTM specifications C309-89 Type 1-D or 2, and be approved by the Engineer.
.2 The compound shall be sufficiently free from permanent colour to result in no pronounced change in colour from that of natural concrete.
.3 The compound shall, however, contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

2.4 SEALING SOLUTION

.1 The sealing solution shall be a mixture of 50% boiled linseed oil and 50% kerosene or varsol.

## 3 EQUIPMENT

3.1 GENERAL

.1 All equipment necessary for the proper handling of materials, batching, mixing, placing, finishing and curing of concrete pavement shall be on the project in good working condition. Throughout the construction of the project, the Contractor shall maintain sufficient, adequate equipment in good, clean, working condition, to assure the proper execution of the work.

3.2 MIXING EQUIPMENT

.1 Concrete may be mixed at the site of construction, at a central point, or wholly or in part in truck mixers. Each mixer shall be an approved type and shall have attached, prominently, a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

3.3 FORMS

.1 Forms, either of steel or wood shall conform to the shape, lines and dimensions of the concrete as called for on the drawings.
.2 Forms shall be substantial and sufficiently tight to prevent leakage of concrete; they shall be properly braced or tied together so as to maintain position and shape.
.3 The inside of the forms shall be smooth, cleaned and coated with non staining mineral oil or other approved material.

3.4 ADDITIONAL EQUIPMENT

.1 The Contractor shall furnish all other tools and supplies necessary for the proper execution of the Work.

## 4 EXECUTION

4.1 GENERAL

.1 Notify the Engineer two (2) business days prior to commencement of operation.

4.2 TESTING AND INSPECTION

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications.
.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency.
.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.
.4 Testing frequency shall be at 1 test per 50 cubic meters or 1 test per day on placed concrete whichever is greater.
.5 The cost of further testing will be at the expense of the Contractor if the concrete does not meet the specification criteria in the initial tests.
.6 Remedial action shall be at no expense to the Owner or the Engineer.

4.3 BASE CONSTRUCTION

.1 Sidewalks and curb & gutter base material shall consist of cutting the existing sub-grade or filling with sub-grade material from with-in the construction site to the design grades or as directed by the Engineer. The sidewalk base shall be compacted to a minimum of 100 % standard Proctor maximum dry density. The sidewalk base shall be moisture conditioned through the entire fill or to a minimum depth of 150 mm in areas not requiring fill, by drying or adding water, to obtain an in-place moisture content of ± 2% of the specified optimum moisture content.
.2 When directed by the Engineer to stabilized soft areas, or as shown on the drawings granular base material shall be placed and compacted to the following requirements.

- Granular fills will be made up of 150 mm layers and consolidated with approved compaction equipment which will produce a minimum of 100% (standard Proctor maximum dry density). The fill shall be moisture conditioned, by drying or adding water, to obtain an in-place moisture content between the optimum moisture content and two percent below the specified optimum moisture content (-2% to optimum).
- Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

| Sieve Size (microns) | Percent Passing By Weight |
|---|---|
| 20 000 | 100 |
| 16 000 | 84 - 94 |
| 10 000 | 63 – 86 |
| 5 000 | 40 – 67 |
| 1 250 | 20 – 43 |
| 630 | 14 – 34 |
| 315 | 9 – 26 |
| 160 | 5 – 18 |
| 80 | 2 - 10 |

4.4 DOWELLING

.1 Steel dowels to CSA G 30.12-M 1977, clean, plain, free from flattened or burred ends, free from rust, scale or other substances that prevent the bonding of the concrete to the reinforcement, uncoated.

.2 10 mm steel dowels shall be installed at a minimum of 1 dowel per 0.45m when tying into existing concrete structures.

4.5 REINFORCEMENT

.1 Reinforcing bars, tie bars to CSA G30.12M 1977 Grade 300, billet-steel, deformed bars, uncoated.

.2 Place reinforcing bars as detailed.

.3 Clean reinforcing bars free of loose rust and mill scale.

4.6 DELIVERY

.1 When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within one and one-half (1½) hours after the introduction of the mixing water to the cement and aggregates (otherwise known as batch time). If the concrete has not been discharged within one and one-half (1½) hours from batch time, the concrete shall be retested for slump, air and compressive strength. The concrete shall be rejected if any of the mix properties do not conform to the specified requirements.

.2 No water or chemical admixtures shall be added to the concrete mixture after one (1) hour from batch time.

.3 The concrete will be rejected if the discharge has not been completed within two (2) hours from the batch time.

## 4.7 PLACEMENT AND CONSOLIDATION

.1 All concrete sections to be constructed in accordance with the detailed drawings.
.2 Placing shall be continuous between planned transverse joints without the use of intermediate bulkheads. If concrete pavement is interrupted for more than 30 minutes, transverse construction joints shall be made.
.3 The concrete shall be placed or subsequently distributed to an even depth.
.4 All concrete construction shall be vibrated by means of a vibrating screed or internally by means of a poker or pencil vibrator which shall not exceed 50 mm in diameter.

## 4.8 WEATHER REQUIREMENTS

.1 Concrete when deposited shall have a temperature of not more than 27 degrees Celsius.
.2 Do not place concrete when air temperature is below 5 degrees Celsius, unless the following requirements are met:
  .1 Preheat water and aggregates as well as reinforcement, forms and the ground.
  .2 Concrete when deposited, shall have a temperature of not less than 4 degrees Celsius. Concrete shall be covered and maintained at a temperature of at least 10 degrees Celsius for not less than seventy two (72) hours after placing, or until the concrete has cured.
  .3 Do not use calcium chloride, except with the written permission of the Engineer and then only with normal Portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careless mixing is required.

## 4.9 CONCRETE FINISHING

.1 After placing, concrete shall be finished as per the relevant sections of Clause 22 of CAN/CSA A23.1-04. Excess finishing is to be avoided. No plaster coat will be allowed. Adding water to the surface of the concrete to assist with finishing will not be allowed.
.2 Prior to final finishing, the surface grade of concrete slabs shall be checked to an accuracy of ± 5 mm with a 3 m long metal straight edge. The straight edge shall be drawn across the surface in a scraping motion to identify deviations for immediate correction. The straight edge shall be advanced one-half its length for successive checks.
.3 Provide 15 mm deep by 5 mm wide contraction joints every 1.5 m on centre by means of marking tool or other approved method.
.4 Finish the outside edges of sidewalks and each edge of joints with 50 mm wide edging tool having a 6 mm radius.

.5 A broom finish shall be obtained by the use of a stiff, coarse fibre broom. A tined finish shall be obtained by the use of a device having irregularity spaced wire tines with an average spacing of 12 to 18 mm. The device shall be dragged transversely across the surface to form ridges. Transverse texturing shall be delayed until the concrete is sufficiently hard to retain the ridges.

.6 Apply curing compound to finished surface immediately after floating in accordance with manufacturer's printed instructions.

.7 The Contractor shall have material available to protect the surface of the plastic concrete from damage from the rain. The materials shall consist of burlap, cotton mats, waterproof paper or plastic sheeting. Protection shall be employed when rain, sufficient to mar the texture of the concrete surface is expected. The decision of the Engineer in this regard shall be final.

.8 The Contractor is responsible to ensure the surface of the concrete is not vandalized during set-up. Any damaged surface must be repaired, or replaced, to the satisfaction of the Engineer.

4.10 CONCRETE CURING

.1 As soon as practical, after the texturing operation is complete, the entire pavement surface, including exposed sides, shall be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury, in accordance with the requirements of Clause 21 of CSA A23.1-04 for Class C-2 concrete.

.2 The Contractor shall be responsible for taking all necessary measures to protect freshly placed concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Engineer. Concrete shall be adequately protected in accordance with the requirements specified in CAN/CSA-A23.1 – 04, Section 21.2.

.3 When Polyethylene film sheets (light coloured) or waterproof paper sheets are used, the sheets shall be long enough to cover the entire width and edges of the section and shall be lapped a minimum of 300 mm at joints. The sheets shall be adequately weighed to prevent displacement or billowing due to wind.

.4 When white liquid membrane forming curing compounds are employed, the compound shall be applied to exposed surface and edge of the concrete section following the final texturing operation, after all free bleed water has evaporated or been removed from the surface. Complete and uniform coverage, at a rate of three (3) to four (4) m2/L shall be required. The compound shall be agitated to prevent pigment from settling.

.5 If the curing compound method of curing is used in combination with sawn control joints, provisions shall be made to cure and protect the exposed faces of the cleaned joint.

.6 When concrete has been placed in cold weather and the air temperature is expected to drop below 5 $^{0}$C, then polyethylene sheets, insulated curing blankets or other suitable material shall be placed beside the concrete members. Whenever the

temperature is expected to reach the freezing point, during the day or night, the protective material shall be spread over the concrete surface and weighted to prevent movement to protect the concrete from freezing. Curing shall continue until the cumulative number of days, not necessarily consecutive, or fraction thereof, during which the temperature of the air in contact with the concrete is above 10 C, has totalled a minimum of five (5) business days. Alternatively, if compressive test of cylinders cured under field conditions achieve at least 70 percent (70%) of the specified compressive strength, curing may be discontinued.

.7 Concrete placed in cool weather shall experience a minimum 30 day air drying period, following final curing, before the first application of de-icing salts.

.8 Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense.

4.11 TOLERANCES

.1 Meet the following criteria for exposed concrete surfaces:

- Trueness of surface: 6 mm maximum deviation in 3 m length.
- Elevation: 10 mm maximum deviation from given elevation.
- Alignment: 25 mm maximum deviation from given alignment.
- Cross-fall: 2.0% +/- 0.2%

4.12 BACKFILL

.1 Backfilling shall be completed by the Contractor on all the concrete poured.

.2 Backfilling shall commence within 10 days, but no sooner than five (5) business days from the day the concrete was finished, or as directed by the Engineer.

.3 Material placed behind sidewalks or curb and gutter shall be compacted to a minimum 90% of Standard Proctor Density. Material shall be placed to the full height of concrete unless otherwise specified by the Engineer.

.4 Where landscaping is required, leave backfill 100 mm below finished grade to allow for topsoil and sod.

4.13 OPENING TO TRAFFIC

.1 In no case shall traffic or construction equipment be allowed on the concrete until the concrete has reached a minimum in situ compressive strength of 20 MPa, or has been allowed to cure for a minimum of five (5) business days.

## 5 FINAL INSPECTIONS AND ACCEPTANCE

5.1 INSPECTION

.1 All workmanship and all materials furnished and supplied under this Section are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all

operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this Section.

5.2 ACCESS

.1 The Engineer or a designate shall be afforded full access for the inspection and assurance testing of concrete and constituent materials, both at the site of work and at any plant used for the production of concrete, to determine whether the concrete is being supplied in accordance with this section.

5.3 THICKNESS

.1 At the opinion of the Engineer, the thickness of concrete members may be determined by coring sections representing each day's pour and determining the depth of each core by average measurements of the core.

.2 Members found deficient in thickness by more than 5 percent shall be paid for at the reduced price as follows:

| Deficiency in Concrete Thickness (mm) | Percentage Contract Unit Price |
|---|---|
| 5 | 100 |
| 15 | 75 |
| 20 | 50 |
| 25 or Greater | Reject |

.3 The cost of the initial quality assurance core testing shall be paid for by the Engineer. Additional cores requested by the Contractor to determine the extent of areas deficient in thickness shall be paid for by the Contractor.

5.4 COMPRESSIVE STRENGTH

.1 Payment adjustment for compressive strength is as follows:

| Average Compressive Strength | Payment Adjustment Factor |
|---|---|
| Compliant or greater | 1.00 |
| 24.0 MPa to 24.9 MPa | 0.95 |
| 23.0 MPa to 23.9 MPa | .090 |
| Below 23.0 MPa | Reject (Note 1) |

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.5 AIR CONTENT

.1 Payment adjustment for air content is as follows:

| Average Air Content | Payment Adjustment Factor |
|---|---|
| 5% or greater | 1.00 |
| 4.59% - 4.9% | 0.90 |
| 4.09% – 4.4% | 0.80 |
| Below 4.0% | Reject (Note 1) |

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.6 ACCEPTANCE

.1 In the event where the compressive strength of the test cylinders, low air entrainment, deficient slump, improper compaction of the concrete base, poor finishing or cross-fall, trueness of surfaces, elevation and alignment tolerances, or cross-section for any portion of the work does not meet the requirements specified herein, the Engineer and its representatives, at their discretion may require that the portion(s) deemed “Reject” be completely removed and replaced at the expense of the Contractor.

.2 No payment shall be made for sections of rejected concrete should the Engineer elect to keep the rejected material in place.

# END OF SPECIFICATION

# SPECIFICATION 04225 – EXTRUDED CONCRETE

## 1 GENERAL

### 1.1 DESCRIPTION

This section specifies to extruded concrete pavements, sidewalks, curbs and gutters and other related work constructed through the use of slip form machines (extruders).

### 1.2 REFERENCES

.1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
.2 CAN/CSA-A23.2-04, Methods of Test for Concrete.
.3 CAN/CSA-A3000-08, Portland Cement.
.4 CAN3-A266.1-M78, Air-Entraining Admixtures for Concrete.
.5 CAN3-A266.2-M78, Chemical Admixtures for Concrete.
.6 CAN3-A266.4-M78, Guidelines for the Use of Admixtures in Concrete.
.7 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.
.8 ASTM C109-08, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).
.9 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.10 CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.

## 2 PRODUCTS

### 2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A5, Type HS sulphate resistant.
.2 Water: to CAN/CSA-A23.1.
.3 Aggregates: to CAN/CSA-A23.1.
.4 Air Entraining Admixture: to CAN3-A266.1.
.5 Chemical Admixtures: to CAN3-A266.2. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.
.6 Curing Compound: to CAN/CSA-A23.1 white and to ASTM C309-07, Type 1-D with fugitive dye.
.7 Polyethylene film 0.15 mm: to CGSB 51-GP-51M.
.8 Reinforcement for Concrete: to CSA G30.18-M92.

### 2.2 CONCRETE MIXES

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following properties for all concrete.
  .1 Cement: Type HS Portland cement.
  .2 Minimum compressive strength at 28 days: 25.0 MPa.
  .3 Minimum cement content: 300 kg/m³ of concrete.
  .4 Maximum water cement ration: 0.45.

.5 Class of exposure: A.

.6 Nominal size of coarse aggregate: 20 mm.

.7 Slump at time and point of discharge: maximum 30 mm.

- No water adjustment is allowed to the delivered concrete after 1 hour of the concrete batch time.

.8 Air content: 5 to 8%.

2.3 CURING COMPOUND

.1 Curing compound shall conform to ASTM specifications C309-07 Type 1-D or 2, and be approved by the Engineer.

.2 The compound shall be sufficiently free from permanent colour to result in no pronounced change in colour from that of natural concrete.

.3 The compound shall, however, contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

2.4 SEALING SOLUTION

.1 The sealing solution shall be a mixture of 50% boiled linseed oil and 50% kerosene or varsol.

## 3 EQUIPMENT

3.1 GENERAL

.1 All equipment necessary for the proper handling of materials, batching, mixing, placing, finishing and curing of concrete pavement shall be on the project in good working condition. Throughout the construction of the project, the Contractor shall maintain sufficient, adequate equipment in good, clean, working condition, to assure the proper execution of the work.

3.2 MIXING EQUIPMENT

.1 Concrete may be mixed at the site of construction, at a central point, or wholly or in part in truck mixers. Each mixer shall be an approved type and shall have attached, prominently, a manufacturer’s plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

3.3 SUB-GRADE TRIMMERS

.1 Trimmers shall be self powered, capable of producing a clean smooth surface true to line and grades as indicated on the Drawings. Remaining loose material on sub-grade shall not exceed 6 mm.

3.4 SLIP FORM PAVING MACHINES (EXTRUDERS)

.1 Slip form paving machines, used for concrete placement, shall be of a size and type adequate to handle the width and thickness of the concrete section to be constructed. The slip form paver shall distribute the fresh concrete evenly to the required grade without segregation and without disturbing in-place reinforcing steel. The concrete shall be thoroughly consolidated by means of vibrators, struck off to exact grade and given a float finish, all automatically and continuously by the machine and with a minimum of hand finishing. The machine shall be equipped with automatic controls capable of controlling both the elevation and direction of the machine within a tolerance of 5mm from the specified grade and alignment. Slip forms shall extend the full depth of the section and shall be of sufficient length that the concrete will not deform at the edges by the time the forms have passed.

3.5 ADDITIONAL EQUIPMENT

.1 The Contractor shall furnish all other tools and supplies necessary for the proper execution of the Work.

## 4 EXECUTION

4.1 GENERAL

.1 Notify the Engineer 24 hours prior to commencement of operation.

4.2 TESTING AND INSPECTION

.1 The Owner may engage a CSA certified testing company to confirm the compliance to the specifications

.2 The Contractor shall allow access and provide material for all tests by the Owners testing agency

.3 The testing company is only authorized to report results of the tests and is not authorized to approve the construction.

.4 Testing Frequency shall be at 1 test per 50 cubic meters or 1 test per day on placed concrete whichever is greater.

.5 The cost of further testing will be at the expense of the Contractor if the concrete does not meet the specification criteria in the initial tests.

.6 Remedial action shall be at no expense to the Owner or the Engineer.

4.3 BASE CONSTRUCTION

.1 Sidewalks and curb & gutter base material shall consist of cutting the existing sub-grade or filling with native material or if the contract specifies uniform backfill, specified granular materials will be installed to the designed grades as directed by the Engineer. The sidewalk base shall be compacted to a minimum of 100% (Standard Proctor maximum dry density) with a moisture content of ± 2% of the specified optimum moisture content.

.2 When directed by the Engineer to stabilize soft areas, or as shown on the drawings granular base material shall be placed and compacted to the following requirements.

- Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSB 8.2-M88, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

| Sieve Size (microns) | Percent Passing By Weight |
|---|---|
| 20,000 | 100 |
| 16,000 | 84 – 94 |
| 10,000 | 63 – 86 |
| 5,000 | 40 – 67 |
| 1,250 | 20 – 43 |
| 630 | 14 – 34 |
| 315 | 9 – 26 |
| 160 | 5 – 18 |
| 80 | 2 - 10 |

4.4 DOWELLING

.1 Steel dowels to CSA G 30.18-M92, clean, plain, free from flattened or burred ends, free from rust, scale or other substances that prevent the bonding of the concrete to the reinforcement, uncoated.

.2 10 mm steel dowels shall be installed at a minimum of 1 dowel per 0.45m when tying into existing concrete structures.

4.5 REINFORCEMENT

.1 Reinforcing bars, tie bars to CSA G30.18-M92 Grade 300, billet-steel, deformed bars, uncoated.

.2 Place reinforcing bars as detailed.

.3 Clean reinforcing bars free of loose rust and mill scale.

4.6 DELIVERY

.1 When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within one and one-half (1½) hours after the introduction of the mixing water to the cement and aggregates (otherwise known as batch time). If the concrete has not been discharged within one and one-half (1½) hours from batch time, the concrete shall be retested for slump, air and compressive strength. The concrete shall be rejected if any of the mix properties do not conform to the specified requirements.

.2 No water or chemical admixtures shall be added to the concrete mixture after one (1) hour from batch time.

.3 The concrete will be rejected if the discharge has not been completed within two (2) hours from the batch time.

## 4.7 PLACEMENT AND CONSOLIDATION

.1 All concrete sections to be constructed in accordance with the detailed drawings.

.2 Placing shall be continuous between planned transverse joints without the use of intermediate bulkheads. If concrete pavement is interrupted for more than 30 minutes, transverse construction joints shall be made.

.3 The concrete shall be placed or subsequently distributed to an even depth. The machine shall spread, screed, compact and float finish the concrete in one pass.

.4 Reinforcing bars may be inserted through temporary side forms located behind the paver, or mechanically inserted into the plastic concrete by approved devices associated with the slip form paver. Bars shall be inserted in such a manner that no voids are created around the bar, and no distortion of the pavement surface shall occur.

.5 The concrete shall be consolidated by internal vibrators of sufficient number, spacing and frequency to provide uniform consolidation to the entire section width and depth. The vibrators shall conform to the requirements of Clause 19.4.2 of CAN/CSA-A23.1-04. The vibrators shall not operate while the paver is stopped.

.6 The concrete surface shall be protected from rain until the final set occurs.

## 4.8 WEATHER REQUIREMENTS

.1 Concrete when deposited shall have a temperature of not more than 27 degrees Celsius.

.2 Do not place concrete when air temperature is below 5 degrees Celsius, unless the following requirements are met:

.1 Preheat water and aggregates as well as reinforcement, forms and the ground.

.2 Concrete when deposited, shall have a temperature of not less than 4 degrees Celsius. Concrete shall be covered and maintained at a temperature of at least 10 degrees Celsius for not less than seventy two (72) hours after placing, or until the concrete has cured.

.3 Do not use calcium chloride, except with the written permission of the Engineer and then only with normal Portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careful mixing is required.

## 4.9 CONCRETE FINISHING

.1 After placing, concrete shall be finished as per the relevant sections of Clause 22 of CAN/CSA A23.1-04. Excess finishing is to be avoided. No plaster coat will be allowed. Adding water to the surface of the concrete to assist with finishing will not be allowed.

.2 Prior to final finishing, the surface grade of concrete slabs shall be checked to an accuracy of ± 5 mm with a 3 m long metal straight edge. The straight edge shall be drawn across the surface in a scraping motion to identify deviations for immediate correction. The straight edge shall be advanced one-half its length for successive checks.

.3 Provide 15 mm deep by 5 mm wide contraction joints every 1.5 m on centre by means of marking tool or other approved method.

.4 Finish the outside edges of sidewalks and each edge of joints with 50mm wide edging tool having a 6 mm radius.

.5 A broom finish shall be obtained by the use of a stiff, coarse fibre broom. A tined finish shall be obtained by the use of a device having irregularity spaced wire tines with an average spacing of 12 to 18 mm. The device shall be dragged transversely across the surface to form ridges. Transverse texturing shall be delayed until the concrete is sufficiently hard to retain the ridges.

.6 Apply curing compound to finished surface immediately after floating in accordance with manufacturer's printed instructions.

.7 The Contractor shall have material available to protect the surface of the plastic concrete from damage from the rain. The materials shall consist of burlap, cotton mats, waterproof paper or plastic sheeting. Protection shall be employed when rain, sufficient to mar the texture of the concrete surface is expected. The decision of the Engineer in this regard shall be final.

.8 The Contractor is responsible to ensure the surface of the concrete is not vandalized during set-up. Any damaged surface must be repaired, or replaced, to the satisfaction of the Engineer.

## 4.10 CONCRETE CURING

.1 As soon as practical, after the texturing operation is complete, the entire pavement surface, including exposed sides, shall be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury, in accordance with the requirements of Clause 21 of CSA A23.1-04 for Class C-2 concrete.

.2 The Contractor shall be responsible for taking all necessary measures to protect freshly placed concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Engineer. Concrete shall be adequately protected in accordance with the requirements specified in CAN/CSA-A23.1-04, Section 21.2

.3 When Polyethylene film sheets (light colored) or waterproof paper sheets are used, the sheets shall be long enough to cover the entire width and edges of the section and shall be lapped a minimum of 300mm at joints. The sheets shall be adequately weighed to prevent displacement or billowing due to wind.

.4 When white liquid membrane forming curing compounds are employed, the compound shall be applied to exposed surface and edge of the concrete section

following the final texturing operation, after all free bleed water has evaporated or been removed from the surface. Complete and uniform coverage, at a rate of three (3) to four (4) m²/L shall be required. The compound shall be agitated to prevent pigment from settling.

.5 If the curing compound method of curing is used in combination with sawn control joints, provisions shall be made to cure and protect the exposed faces of the cleaned joint.

.6 When concrete has been placed in cold weather and the air temperature is expected to drop below 5 $^0$C, then polyethylene sheets, insulated curing blankets or other suitable material shall be placed beside the concrete members. Whenever the temperature is expected to reach the freezing point, during the day or night, the protective material shall be spread over the concrete surface and weighted to prevent movement to protect the concrete from freezing. Curing shall continue until the cumulative number of days, not necessarily consecutive, or fraction thereof, during which the temperature of the air in contact with the concrete is above 10$^0$C, has totaled a minimum of seven (7) days. Alternatively, if compressive test of cylinders cured under field conditions achieve at least 70% of the specified compressive strength, curing may be discontinued.

.7 Concrete placed in cool weather shall experience a minimum 30 day air drying period, following final curing, before the first application of de-icing salts.

.8 Concrete damage as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense.

## 4.11 TOLERANCES

.1 Meet the following criteria for exposed concrete surfaces:

- .1 Trueness of surface: 6mm maximum deviation in 3m length.
- .2 Elevation: 10mm maximum deviation from given elevation.
- .3 Alignment: 25mm maximum deviation from given alignment.
- .4 Cross-fall: 2.0% ± 0.2%

## 4.12 BACKFILL

.1 Backfilling shall be completed by the Contractor on all the concrete poured.

.2 Backfilling shall commence within 10 days, but no sooner than 7 days from the day the concrete was finished, or as directed by the Engineer.

.3 Material placed behind sidewalks or curb and gutter shall be compacted to as minimum 90% of Standard Proctor Density. Material shall be placed to the full height of concrete unless otherwise specified by the Engineer.

.4 Where landscaping is required, leave backfill 100mm below finished grade to allow for topsoil and sod.

4.13 OPENING TO TRAFFIC

.1 In no case shall traffic or construction equipment be allowed on the concrete until the concrete has reached a minimum in situ compressive strength of 20 MPa, or has been allowed to cure for a minimum of seven (7) days.

## 5 FINAL INSPECTIONS AND ACCEPTANCE

5.1 INSPECTION

.1 All workmanship and all materials furnished and supplied under this Section are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this Section.

5.2 ACCESS

.1 The Engineer or a designate shall be afforded full access for the inspection and control testing of concrete and constituent materials, both at the site of work and at any plant used for the production of concrete, to determine whether the concrete is being supplied in accordance with this Section.

5.3 THICKNESS

.1 At the opinion of the Engineer, the thickness of concrete members may be determined by coring sections representing each day's pour and determining the depth of each core by average measurements of the core.

.2 Members found deficient in thickness by more than 5 percent shall be paid for at the reduced price as follows:

| Deficiency in Concrete Thickness (mm) | Percentage Contract Unit Price |
|---|---|
| 5 | 100 |
| 15 | 75 |
| 20 | 50 |
| 25 or Greater | Reject |

.3 The cost of the initial quality assurance core testing shall be paid for by the Engineer. Additional cores requested by the Contractor to determine the extent of areas deficient in thickness shall be paid for by the Contractor.

5.4 COMPRESSIVE STRENGTH

.1 Payment adjustments for compressive strength are as follows:

| Average Compressive Strength | Payment Adjustment Factor |
|---|---|

| | |
|---|---|
| Compliant or Greater | 1.00 |
| 24.0 MPa to 24.9 MPa | 0.95 |
| 23.0 MPa to 23.9 MPa | 0.90 |
| Below 23.0 MPa | Reject (Note 1) |

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.5 AIR CONTENT

.1 Payment adjustments for air content are as follows:

| **Average Air Content** | **Payment Adjustment Factor** |
|---|---|
| 5% or Greater | 1.00 |
| 4.59% - 4.9% | 0.90 |
| 4.09 – 4.4% | 0.80 |
| Below 4.0% | Reject (Note 1) |

Note 1: Subject to removal and replacement at the discretion of the Engineer.

5.6 ACCEPTANCE

.1 In the event where the compressive strength of the test cylinders, low air entrainment, deficient slump, improper compaction of the concrete base, poor finishing or cross-fall, trueness of surfaces, elevation and alignment tolerances, or cross-section for any portion of the work does not meet the requirements specified herein, the Engineer and its representatives, at their discretion may require that the portion(s) deemed “Reject” be completely removed and replaced at the expense of the Contractor.

.2 No payment shall be made for sections of rejected concrete should the Engineer elect to keep the rejected material in place.

# END OF SPECIFICATION

# SPECIFICATION 06600 – PRESSURE PIPE

## 1 GENERAL

### 1.1 WORK INCLUDED

This section refers to the supply and installation of water main and accessories, and sewage force mains and accessories.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01223 – Trenching
- Section 06722 – Manholes, Vaults and Catch Basins
- Section 01240– Backfilling

### 1.3 REGULATIONS

.1 Saskatchewan Environment Standards and Guidelines for Waterworks, Wastewater, and Storm Drainage Systems.
.2 Saskatchewan Environment Storm Water Management Guidelines.
.3 The Public Water Supply Regulations, Environment Protection, Environment Canada shall apply to the work of this section.

### 1.4 MATERIALS TESTING

.1 Materials supplied shall be in accordance with AWWA, ASTM and CSA Standards.
.2 The Engineer may at any time require the Contractor to produce certification by an independent testing agency that materials used conform to the specified standards.
.3 The Engineer may reject the material that in the opinion of the Engineer is unsuitable for the intended application.
.4 Areas of backfill failing to meet density requirements will be reworked in accordance with this section, Section 01223, and Section 01240.

### 1.5 HANDLING OF PIPES AND ACCESSORIES

.1 Pipe and accessory materials shall be unloaded and stored at the site by the Contractor with care to prevent damage.
.2 Store materials so that they are kept clean and in accordance with the manufacturer's recommendations.
.3 Drain valves and hydrants of water to eliminate damage due to freezing of trapped water.

## 2 PRODUCTS

### 2.1 PIPE

#### 2.1.1 PVC

.1 DR18 Pipe to AWWA C-900, CSA B137.3-M; 100mm-300mm size; pressure class 150.

.2 DR18 Pipe to AWWA C-905, CSA B137.3-M; 350mm-900mm size; pressure rating 235.

.3 All products shall comply with NSF/ANSI 61 “Drinking Water System Components – Health Effects”.

2.1.2 Rubber Gasket Joint Fittings

.1 Polyvinylchloride molded fittings to AWWA. C907, SDR 18, Class 150, ASTM cell classification 12454B, with rubber gasket joints and outside diameter conforming to cast iron fitting, bell ends, c/w 1 MPa elastomeric gasket push-on joint

.2 Ductile iron and cast iron fittings to ANSI/AWWA C110or ANSI/AWWA C152, pressure class 150 minimum. Exterior and interior fittings to be factory Fusion Bonded Epoxy Coated according to ANSI/AWWA C116and NSF/ANSI 61 “Drinking Water System Components-Health Effects”. Joints shall be to the latest revision ANSI/AWWA C111, “Tyton Joint” or approved equal.

2.1.3 Pipe Lubricants

.1 Only Manufacturer’s recommended organic, non-toxic, water soluble gasket lubricant to be used.

.2 Pipe gasket lubricants shall comply with NSF/ANSI 61 “Drinking Water System Components-Health Effects”.

## 2.2 COUPLINGS AND REPAIR CLAMPS

2.2.1 Repair Clamps

.1 Designed for joining plain end pipes of equal outside diameter. To be flexible, all stainless steel construction. All welded stainless steel to be "passivated" after welding to eliminate sensitizing of the stainless steel.

.2 Shell, Sidebars, Nuts, and Bolts to be Type 304 fully passivated stainless steel. Gasket to be continuous ringed S.B.R. rubber conforming to latest revision AWWA C-111 / ANSI A21.11.

.3 Approved Products:

- Robar 1606 Style 2
- Robar 5606, 5616, 5626 and 5636
- Smith Blair 267 and 268
- EZMAX plus 4000
- Cambridge Brass (Stainless Steel) Series 425, 435, 825 & 835

2.2.2 Epoxy Coated Couplings

.1 All products to be to ANSI/AWWA C116/A21.16 ( American National Standard for Protective Fusion-Bonded Epoxy Coatings for the interior and exterior surfaces of ductile iron and gray-iron fittings for Water Supply Service).

.2 Epoxy Coated couplings are supplied in the three following configurations:

- Standard Couplings: designed for joining plain end pipes of equal outside diameter
- Transition Couplings: designed for connecting pipes of the same nominal size, which have great differences in outside diameter, transition to be made by "stepped-down" center ring, c/w special end plate
- Reducing Couplings: designed for connecting pipes of different nominal sizes, reduction to be made by "stepped-down" center ring, c/w special end plate

.3 Centre ring to be cast ductile iron to latest revision ASTM A536, factory coated with fusion bonded epoxy. Coating thickness to be 0.30 mm (12 mils) minimum, 0.50 mm (20 mils) maximum.

.4 End plates to be heat-treated cast ductile iron to latest revision ASTM A536, factory coated with fusion bonded epoxy. Coating thickness to be 0.30 mm (12 mils) minimum, 0.50 mm (20 mils) maximum. End plates shall be provided with one 6 mm (1/4") SAE J429 Grade 5, NC cadmium plated setscrew to provide electrical conductivity between the end plates and the sleeves and wrapped with petrolatum tape.

.5 Gasket to be S.B.R. rubber conforming to latest revision AWWA C- 111 / ANSI A21.11.

.6 Bolts to be 15.875 mm (5/8") NC track head, c/w heavy-duty hex nuts. Material to be low alloy steel conforming to latest revision AWWA C-111 / ANSI A21.11. All bolts (except threaded area) to be factory coated with fusion bonded epoxy. Coating thickness to be 0.30 mm (12 mils) minimum, 0.50 mm (20 mils) maximum.

.7 Coupling components to be marked as follows:

- Centre Ring: Nominal size and manufacturers' name
- End-Plate: O.D. range and manufacturers' name
- Gaskets: O.D. range and manufacturers' name

.8 Approved Coupling Products:

- Robar 1506 or approved “Smith-Blair” or “Dresser” equivalent
- Romac 501 or approved “Smith-Blair” or “Dresser” equivalent
- Hymax coupling and flanged adapter
- Romac Macro 2 bolt coupler
- Robar Vantage Coupling 1596/1598
- Robar Mega Coupling Series 3800

## 2.3 TAPPING SLEEVES

.1 Shall be full circle type designed to allow tightening of the sleeve bolts from the opposite side of the flange outlet. Install according to manufacturer’s specifications and torque ratings. With specific approval from the Environmental Utilities Department only, a non-full circle sleeve may be used where the branch tap is a

minimum of two nominal diameters smaller than the tapped main. Taps on asbestos-cement pipe always require special consideration.

.2 To be constructed of stainless steel or corrosion protected mild steel material. Corrosion protected sleeves shall be epoxy coated and lined. All welded stainless steel to be "passivated" after welding to eliminate sensitizing of the stainless steel.

.3 Sleeves to include a 19 mm (3/4") NPT test plug for pressure testing of sleeve and installed tapping valve. Test plug shall be at the 12 o'clock position after installation. Manufacturer's working pressure ratings to be approved by Engineer.

.4 Sleeves to have permanent identification marking to identify the manufacturer's name, nominal size, and O.D. range. All sleeves to be packaged and delivered as a complete unit (i.e. sleeves, gaskets, nuts, and bolts).

.5 Sleeves to have Class D flanges conforming to the latest revision of AWWA C207, 150 lb. drilling. Flanges to be fixed, not floating.

.6 Flange materials for stainless steel tapping sleeves to be stainless steel. Flange materials for fusion bonded epoxy tapping sleeves to be cast ductile iron.

.7 Gasket materials as follows:

- Flange - Virgin SBR compounded for water service use
- Ring Seal - Buna N, or virgin SBR compounded for water service use
- Liner - 3.18 mm (1/8") Neoprene, or virgin SBR compounded for water service use

.8 Bolts to be 16 mm (5/8") NC stainless steel c/w heavy hex nuts and washers, factory treated to prevent galling.

.9 Tapping sleeve to be wrapped in 6 mil polyethylene when thrust block required.

.10 Approved Products:

- Robar 6606
- Romac "SST"
- Ford FAST
- Smith Blair 663
- PowerSeal (Stainless Steel) Series 3480 & 3490

2.4 TRACER WIRE

.1 Type 14/1B MDPE Tracer Wire

.2 Tracer wire to be 14 gauge single conductor copper wire, un-stranded, color of insulation: white. Wire coating must be made for direct bury.

.3 When joining tracer wire use underground waterproof splice kit.

.4 Approved Products:

- 3- M DBR or DBY splice kit or equivalent

## 2.5 VALVES AND VALVE BOXES

### 2.5.1 Resilient Wedge Gate Valves

.1 Valves sized 100 mm to 300 mm diameter shall be resilient wedge gate valves, conforming to latest revision AWWA C509, c/w fully rubber encapsulated solid wedge, non-rising stem, suitable for direct bury.

.2 Valves to open counter clockwise (turn left to open).

.3 Valve body to be constructed of cast iron, in accordance with ASTM A126, Class "B". All nuts, bolts, and washers shall be stainless steel.

.4 Interior and exterior of valve to be fusion bonded epoxy coated, as per latest revision AWWA C550.

.5 Bronze valve stem to be operated by a 50 mm x 50 mm square operating nut. The valve stem (stuffing box) shall contain a double "O" ring seal.

.6 Valve ends to be push-on "Tyton Joint" conforming to latest revision of AWWA C111 / ANSI A21.11.

.7 Approved Products:

- Mueller A-2360 Resilient Wedge Gate Valve
- Clow F-6112 Resilient Wedge Gate Valve
- Bibby-Ste-Croix Resilient Wedge Gate Valve
- American AVK Co. Resilient Wedge Gate Valve Series 45
- East Jordan Iron Works Flowmaster Resilient Wedge Gate Valve sizes 100 mm to 300 mm diameter
- American Flow Control Series 2500 Resilient Wedge Gate Valves sizes 50mm to 300mm
- Or equivalent approved by the Engineer.

### 2.5.2 Resilient Wedge Tapping Gate Valves

.1 Valves sized 100 mm to 300mm diameter shall be resilient wedge gate valves, conforming to latest revision AWWA C509, c/w fully rubber encapsulated solid wedge, non-rising stem, suitable for direct bury.

.2 Valves to open counter clockwise (turn left to open).

.3 Valve body to be constructed of cast iron, in accordance with ASTM A126, Class "B". All nuts, bolts, and washers shall be stainless steel.

.4 Interior and exterior of valve to be fusion bonded epoxy coated, as per latest revision AWWA C550.

.5 Bronze valve stem to be operated by a 50 mm x 50 mm square operating nut. The valve stem (stuffing box) shall contain a double "O" ring seal.

.6 Valve ends to be push-on "Tyton Joint" by flange. Push-on joints shall conform to latest revision of AWWA C111/ ANSI A21.11. Flanged valve ends shall meet the requirements of ANSI B16.1, Class 125. Bolts, nuts, washers to be stainless steel.

.7 Approved Products:

- Clow F-6113 Resilient Wedge Tapping Gate Valve flange x push- on for sizes 100 to 300 mm diameter
- Mueller A-2360-41 Resilient Wedge Tapping Gate Valve flange x push-on for sizes 100 mm to 300 mm diameter
- Bibby-Ste-Croix Resilient Wedge Tapping Gate Valve flange x push-on for sizes 100 mm to 300 mm diameter
- Or equivalent approved by the Engineer.

2.5.3 Butterfly Valves

.1 Valves sized 350 mm to 900 mm diameter shall be butterfly valves conforming to latest revision AWWA C504. They shall be short body design, Class 150B, c/w adjustable rubber seats, suitable for direct bury. All nuts, bolts, and washers shall be stainless steel.

.2 Valves to open counter clockwise (turn left to open).

.3 Valve must be rated at 1034 kPa (150 psi) working pressure and must be able to pass a hydrostatic test at 2068 kPa (300 psi) with the valve partially open.

.4 Valve to be operated by 50 mm x 50 mm square operating nut connected to a totally enclosed gear actuator.

.5 Orientate valve as per manufacturer's design for flow direction. Where flow could be in either direction (looped) then place valve so that actuator is away from other utilities.

.6 Valve ends to conform to the following patterns:

- Mechanical Joint: shall meet the requirements of the latest revision AWWA C111/ ANSI A21.11, bolts to be stainless steel
- Flanged End: shall meet the requirements of ANSI B16.1
- Class 125 bolts to be stainless steel.

.7 Interior and exterior of valve to be fusion bonded epoxy coated, as per latest revision AWWA C550.

.8 Approved Products:

- Pratt
- Mueller Lineseal III 3211
- Or equivalent approved by the Engineer.

2.5.4 Automatic Control Valves (Pilot Controlled PRV's, PSV's, and Check Valves)

.1 Control valves to be fusion bonded epoxy coated and lined with stainless steel seats, brass position indicator rod, copper tubing, brass fittings and pilots.

.2 PRV's and PSV's must fail in open position and Check Valves must fail in closed position.

.3 Must be designed for minimum and maximum flows. ACV's 200 mm and larger require a secondary, smaller ACV installed in parallel to handle low flows. Minimum size for secondary ACV is 100 mm (flows to be confirmed by Engineer).

.4 Each ACV to have an NRS, hand wheel operated, resiliently seated isolation valve bolted to each end. Valves to be fusion bonded epoxy coated and lined complete with stainless steel bolts.

.5 Piping to be schedule 40 with 150 # ANSI flanges and fusion bonded epoxy coated/lined. Pipe must extend through vault wall and span open excavation. Installation to include 2-1/2" pressure indictors with ½" ball valves. Low pressure side to have 0-100 psi gauge and high pressure side to have 0-200 psi gauge.

.6 Watertight, concrete vault to fit equipment complete with lifting lugs and cored or formed holes. Minimum height to be 2 m with MSU steps or ladder. If main ACV is larger than 400 mm in size, vault must have access hatch directly over ACV for removal.

2.5.5 Cast Iron Valve Boxes

.1 To be completely fusion bonded epoxy coated sliding type, adjustable over a minimum of 450 mm. Bottom casing diameter to be compatible to size of valve. All castings shall clearly have the manufacturer's identification cast on them.

.2 Depth of bury to be 1.83 m (6') to 2.75 m (9').

.3 Valve operating extension spindle to be 25 mm x 25 mm square. Spindle length shall be such that the operating nut will not be more than 300 mm below the cover when set on the valve operating nut.

.4 Bottom of spindle to fit 50 mm x 50 mm square valve operating nut and shall be riveted to spindle.

.5 Top of spindle shall have removable 50 mm x 50 mm square operating nut c/w stone catcher flange.

.6 Top casing to fit over 120 mm outside diameter casing. Pipe set screws shall be removed to allow top casing to slide up and down.

.7 Lid to be marked "V".

.8 Approved Products:

- Norwood "Type C"
- Trojan Industries "Type C"
- Sovereign Castings Ltd. "Type C"
- East Jordan Iron Works
- Westview "Type C"

## 2.6 HYDRANTS

.1 Post type hydrants according to AWWA C502 and ULC S520 listed. Designed for a working pressure of 1724 kPa and tested at 3447 kPa.

.2 Hydrant shall include two AMA–AWO 65 mm threaded hose outlets and 100 mm N pumper port to be located 460 mm above the ground flange; 150 mm riser barrel and 25 mm bottom valve.

.3 Hydrant inlet to be 150 mm diameter push-on “Tyton Joint” c/w elastomeric gasket conforming to the latest revision of AWWA. C111/ANSI A21.11; and 150 mm connection for main.

.4 Hydrants to open counterclockwise. Threads to W.C.U.S., 6 threads per inch, 123 mm (4.84”) outside dia. and 120 mm (4.742”) pitch dia.

.5 Standard depth of bury 2.75 m for new development. Depth of water mains must be confirmed by the Contractor prior to ordering each hydrant for installation.

.6 Provide key operated gate valve to isolate hydrant from water main as detailed.

.7 Hydrant body to be red in color with silver caps. If considered high pressure, hydrant body to be yellow.

.8 Operating nut to be pentagon configuration, 22 mm (7/8”) flats, 35 mm (1 3/8”) flat to point.

.9 Hydrants to be constructed with a breakaway flange complete with a safety stem (spindle). Bottom of breakaway flange set a minimum of 0.05 m (2”) above finished grade. Bottom of breakaway flange cannot exceed 0.20 m (8”) above finished grade.

.10 All nuts, bolts, and washers to be stainless steel.

.11 Approved Products:

- Mueller Modern Centurion
- Clow Canada "Brigadier" M-67
- East Jordan Watermaster 5CD250

## 2.7 CATHODIC PROTECTION

### 2.7.1 General

.1 Prior to backfilling, arrange for the Engineer to witness the installation of the sacrificial anode, wires, cadwelding, etc., and the necessary continuity check. Location of anode packs to be determined by the Engineer.

.2 Use sacrificial zinc anodes only if specified.

### 2.7.2 Metallic Pipe and Valves

.1 Sacrificial zinc anodes shall conform to ASTM B418 Type II and are to be supplied and installed by the Contractor on each buried steel pipe and adapter.

.2 Zinc anodes to be supplied and installed by the Contractor shall consist of an alloy of the following chemical composition:

- Al - 0.005% maximum
- Cd - 0.003%
- Fe - 0.0014% maximum
- Zinc - Remainder

.3 The anode lead wires shall be 3 meters (10-feet) in length and shall consist of #13 solid copper wire with Type TW insulation. The lead wire shall be connected to the core with silver solder. The entire connection shall be insulated by filling the recess with an electrical potting compound.

.4 The anode shall be packaged in a permeable cloth bag containing a backfill mixture of the following composition:

- Ground Hydrated Gypsum 75%
- Powdered Wyoming Bentonite 20%
- Anhydrous Sodium Sulphate 5%

.5 Backfill shall have a grain size so that 100% is capable of passing through a 20 mesh screen and 50% will be retained by a 100 mesh screen. The mixture shall be firmly packaged around the zinc within the cloth bag by means of adequate vibration.

## 2.8 PIPE DISINFECTION

.1 Sodium hypochlorite to AWWA B300 to disinfect water mains.

## 2.9 CORROSION PROTECTIVE TAPES AND WRAPS

.1 Field installed corrosion protective coatings to be two part paste & tape systems.

.2 Approved Products:

- Polyken 900 system:
  - No. 930 Joint Wrap Tape
  - No. 931 Filler Tape
- Denso of Canada Ltd:
  - Denso Paste
  - Denso Tape
- Corexco Inc.:
  - Petro Primer Paste
  - Petro 40 Tape
  - Petro Overwrap Tape
- Polyguard Products Inc.:
  - Polyguard 600 Primer
  - Polyguard 600 Series Coating Tape
  - Polyguard 606 Filler System
- The Trenton Corporation:
  - Trenton Tec-Tape Primer
  - Trenton Tec-Tape Wrapper
  - Trenton Glas-Wrap
  - Trenton Fill-Putty

## 2.10 THRUST BLOCKING

### 2.10.1 Concrete

.1 Concrete mix shall satisfy the requirements of Exposure Classification C-2 of Table 8, CAN/CSA A23.1, and shall be in accordance with the following minimum requirements unless shown in the drawings:

- 28 day compressive strength – 25 MPa
- Maximum nominal size of course aggregate – 25 mm
- Slump – 40 mm to 75 mm
- Maximum water cementing materials ratio – 0.45
- Portland Cement – Type 50, Sulfate Resistant
- Minimum cement content – 300 kg/m3
- Fly Ash Content – 20% max.

### 2.10.2 Plastic

.1 6 mil polyethylene to be placed between all fittings, valve, pipe and the concrete.

### 2.10.3 Mechanical Restraint

.1 Product used and method of mechanical restraint to be approved by Engineer.

# 3 EXECUTION

## 3.1 TRENCH INSPECTION

.1 Check trench bottom for stability and ensure that pipes can be properly laid to design grade. Notify the Engineer if conditions prevent successful pipe installation.

.2 Remove unstable soil and replace with compacted pit run gravel or washed rock, if directed by the Engineer.

## 3.2 INSPECTION OF PIPE AND ACCESSORIES

.1 Inspect for defects immediately before lowering into trench. Promptly remove and replace defective material.

.2 Clean pipes, fittings, valves before installation.

## 3.3 TRENCING AND BACKFILL

.1 Complete trenching and backfill work as specified.

.2 Trench depth to provide minimum cover over pipe of 2.6 m from finished grade.

.3 Where minimum cover is less than 2.6 m from finished grade, use an approved insulation method to prevent frost penetration.

.4 Depth of cover shall not exceed 4.0 m without approval of the Engineer.

## 3.4 GRANULAR BEDDING

.1 Place granular bedding materials in accordance with details.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to accommodate pipe bell or other non-uniform pipe components. Care must be taken so as not to create unfilled voids in the bedding that would cause pipe "bridging".

.4 Compact full width of bed to at least 95% Standard Proctor ASTM D698, Method D.

.5 Fill any excavation below level of bottom of specified bedding with approved granular bedding material as directed.

## 3.5 PIPE INSTALLATION

.1 Installation and handling of pipe shall be to manufacturer's standard instructions and specifications, and applicable AWWA Specification for the type of pipe selected or as specified herein.

.2 Join pipes in accordance with manufacturer's recommendations.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends. Lift pipe by means of slings and lower into the trench by hand or mechanical equipment. **Do not roll or drop pipe into the trench.** If the Contractor elects to use a narrow trench, the method of lowering the pipe into the trench shall be such that no rocks or lumps of earth fall into the trench beneath the pipe. Lumps of earth and rock greater than 25 mm will not be permitted beneath the pipe and must be removed prior to pipe replacement.

.4 Lay pipes on prepared bed, true to line and grade. Ensure the barrel of each pipe is in contact with shaped bed throughout its full length. Provide bell or coupling holes and support the pipe uniformly and continuously throughout its length.

.5 Replace defective pipe.

.6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.

.10 Cut pipes, as required, for special fittings or closure pieces, in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe. Cut pipes squarely and accurately.

.11 Align pipes carefully before jointing.

.12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.14 Use only Manufacturer's approved gasket lubricant for potable water lines.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Engineer.

.19 When stoppage of work occurs, backfill and compact trench in an approved manner to prevent the pipe shifting during down time. Cap and mark at construction stage interfaces. Where existing pipe is cut in one stage but is to remain operational through the next stage, cap and seal by method approved by the Engineer.

.20 Do not lay pipe on frozen bedding.

.21 Protect hydrants, valves and appurtenances from freezing.

.22 Install couplings, fittings and repair couplings to Manufacturers specifications and torque ratings.

.23 Install tracer wire along top of pipe using duct tape to secure wire from movement during backfill procedure; secure every 3 m. Wire to be continuous and terminate with three wraps around fire hydrant. Start new run of tracer at same hydrant as termination hydrant. Start run of tracer wire with three wraps around fire hydrant. Where hydrants are not available, tracer wire will be terminated at ground level inside an approved enclosure such as an irrigation box or fink post. When tying onto existing water mains (that have tracer wire), use an approved water proof splice kit. Continuity will be checked prior to Substantial Completion.

.24 Aquifer and non-potable waterlines to be clearly labeled to distinguish from potable waterlines.

.25 Upon completion of pipe laying and after Engineer has inspected work in place, surround and cover pipes with approved granular material placed to dimensions indicated or directed.

.26 Hand place select native granular material in uniform layers not exceeding 300 mm thick to minimum 300 mm over top of pipe. Dumping of material directly on top of pipe is not permitted.

.27 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

.28 Compact each layer in the pipe zone to at least 95% of Standard Proctor maximum dry density at ± 2% of optimum moisture content as determined by ASTM D698, Method C.

.29 Backfill only after hydrostatic and leakage test results are acceptable to the Engineer.

.30 Notify the Environmental Utilities Department if there is water supply service interruption to any hydrants.

.31 Maintain constructed grade to within ± 50 mm from the lines, grades and elevations shown in the Contract Documents. Where departures occur, return to established grade gradually over a distance of not less than 25 m.

## 3.6 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations and applicable AWWA Specifications.

.2 Support valves 300 mm and larger by means of concrete located between valve and solid ground as detailed. Bedding to be the same as adjacent pipe. Minimum length of pipe on each end of valve shall be 1 m. Valves are not to be supported by the pipe.

.3 When replacing a valve on an existing water main, ensure any portion of a valve that comes into contact with the pipe, is swabbed with 1% hypochlorite solution. Flush line to remove excess chlorine residual.

.4 Set the valve accurately in position and place the valve box carefully over the bonnet with the valve casing perpendicular to the axis of the pipe, and adjust the top box to the grades specified. Remove bolts from slider before backfilling.

.5 Securely set the extension rods on the valve nut.

.6 Install wooden markers as directed by the Engineer.

.7 Valves and valve boxes shall have approved granular backfill (Class B).

.8 Main valve placement, whenever possible, should not be less than 3 m from other fittings and a minimum of 5 m from thrust blocks.

.9 At future stubs or dead-ends a boundary valve must be provided. For 200 mm diameter and smaller, a minimum of 12 m of pipe must be installed past the boundary valve to a plug with a thrust block. For 250 mm and larger diameter water mains, a minimum of 18 m is required. At the approval of the Engineer, mechanical restraint may be considered as an alternative.

.10 When paving roads, avoid spraying oil on valve lids and remove excess asphalt on lid.

.11 Top of valve lid to be set flush or slightly below top of asphalt or finished grade.

## 3.7 TAPPING VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations and applicable AWWA Specifications.

.2 When connecting to an existing main that is in service an approved tapping valve and sleeve shall be used, provided the size of the existing main is at least one size larger than the connecting main. All bolts to be torqued to manufacturer’s specifications. Municipal forces may tap sizes 100 mm to 250 mm.

.3 Ensure any portion of a tapping sleeve that comes into contact with the pipe is swabbed with 1% hypochlorite solution.

.4 Set the valve accurately in position and place the valve box carefully over the bonnet with the valve casing perpendicular to the axis of the pipe, and adjust the top box to the grades specified. Remove bolts from slider before backfilling.

.5 Securely set the extension rods on the valve nut. Install wooden markers as directed by the Engineer.

.6 Provide thrust block and concrete support for valve.

.7 Fittings and pipe must be wrapped with 6 mil polyethylene to keep joints and couplings free of concrete.

.8 Valves and valve boxes shall have approved granular backfill (Class B).

## 3.8 HYDRANT INSTALLATION

.1 Install hydrants in accordance with manufacturer's recommendations and AWWA Manual of Practice M-17.

.2 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated. Valve to be positioned in asphalt roadway a minimum of 3.0m from thrust blocks where ever possible. A minimum of 1.0 m may be accepted if valve is mechanically restrained to tee. Remove bolts from slider before backfilling.

.3 Set hydrants plumb with hose outlets parallel with edge of pavement or curb line, pumper connection facing roadway with underside of body flange set at elevation between 50 mm and 200 mm above final grade. Where the hydrant barrel needs to be lengthened to achieve the specified flange elevation, no more than one barrel extension per hydrant will be permitted.

.4 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.

.5 Install deep bury hydrants with valve and drain holes at 2.75m deep if water main depths exceed standard cover.

.6 To provide proper draining for each hydrant, excavate a pit measuring not less than 1 m x 1 m x 0.5 m deep and back-fill with coarse gravel or crushed stone to a level 150 mm above drain holes.

.7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

.8 Hydrants shall have approved granular backfill (Class B).

.9 In high water table plug drain holes from the inside as per manufacturer's recommendation.

## 3.9 THRUST BLOCKS

.1 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by the Engineer.

.2 Thrust-blocking material shall be purchased from a Redi-Mix concrete supplier and will not be manufactured on site.

.3 Thrust blocking shall be placed between undisturbed ground and the fitting to be anchored with a minimum bearing area between the pipe and the ground in each instance shall be in accordance with. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. Bearing areas shall be inspected by the Engineer prior to placing concrete.
.4 Keep joints and couplings free of concrete by wrapping with 6 mil polyethylene.
.5 Do not backfill or compact over concrete within 24 hours after placing.
.6 Mechanical restraint may be used as an alternative if approved by the Engineer. All mechanical restraints must be sealed from moisture with an approved paste and tape product.

## 3.10 CATHODIC PROTECTION

3.10.1 Factory Applied Fusion-Bonded Epoxy Coatings

.1 Fittings that are factory fusion-bonded epoxy coated do not require cathodic protection unless specifically requested by Engineer.
.2 Fittings that have damaged or deficient coatings may be rejected. An approved coating repair product may be allowed to cover small coating defects and/or anodes may be required at the discretion of Engineer.

3.10.2 Corrosion Protective Coatings

.1 Install as per manufacturer's recommendations.
.2 Ensure steel to be coated is clean so that coating adheres to the surface.
.3 Allow any cadwelds to cool before placing coating over cadweld.
.4 All coatings to comply with NSF/ANSI 61"Drinking Water System Components-Health Effects".

3.10.3 Sacrificial Anodes

.1 Remove the plastic bag from the anodes, leaving the cloth bag intact.
.2 Place the anodes a minimum distance of 915 mm (3-feet) from the main in a horizontal position at approximately the same elevation and parallel to the main.
.3 Ensure that soil is packed uniformly around the anodes to eliminate voids or air pockets adjacent to the anodes.
.4 Zinc anodes shall be cadwelded onto each length of buried steel pipe and each metal adapter.
.5 Coordinates of anodes to be recorded and marked on Record Drawings.

3.10.4 Cadwelding

.1 Remove a small portion of coating on the pipe or fitting if a coating exists.
.2 Thoroughly clean area to be cadwelded and file metal until a shiny, roughened surface is obtained approximately 75 mm (3-inches) square.
.3 Crimp a copper sleeve onto the bared end of the wire to be cadwelded.
.4 Use a cadweld mold M108 or equal and powder CA-15 or equal.

.5 Knock any slag off of the completed cadweld and file smooth any sharp edges.

.6 Thoroughly coat the cadweld and any area adjacent that has had the coating removed with a molded plastic patch.

**3.11** CLEAN TIE-INS AND REPAIRS

.1 All in-service valves and appurtenances shall be operated by the municipality. Contractor is responsible for arranging all locates and for site safety.

.2 Contractor is responsible for notifying the public and businesses affected by a shutdown as specified in the contract documents.

.3 Contractor to have all necessary, approved parts onsite to perform the task including valves, hydrants, fittings, trash pumps and hoses and/or vac trucks. All ditch water must have sediments removed by a suitable filtration method when pumping into storm and sanitary manholes to prevent silt deposits/sand/gravel from entering storm drainage or sanitary systems.

.4 Whenever possible, laterals should be connected by hot taps instead of cut-ins. Hot taps are performed with the line left under pressure. In a situation where there may be some risk involved because of high pressure, high volume, pipe material or location, proximity valves will be closed by the municipality and the line will be fed from one direction.

.5 Prior to cut-ins and water shutdown, turbidity and chlorine residual levels may be taken by the municipality as a reference to indicate the levels to be obtained after the work has been completed.

.6 Excavate below pipe to allow for a rock sump. Maintain ditch water levels below the bottom of the pipe to avoid contamination. Positive pressure must be maintained until water level is safely below the bottom of the pipe. If water, soil or other contaminants from the ditch enters the open pipe, uni-directional flush the line from all directions to flush out the line.

.7 If positive pressure is lost, the line must be isolated and bacteriological samples are to be taken. Results must be confirmed negative before line is returned into service.

.8 For valve, hydrant, fitting or pipe repair, swab all parts with a minimum 1% hypochlorite solution. Prevent contamination by sealing parts with poly prior to assembling and use clean disposable gloves when handling and making connections.

.9 All fittings to be installed and torqued to manufacturer's specifications.

.10 A static pressure test or a visual inspection by the Engineer will be required prior to completing the backfill. Once repair is made, backfill pipe as specified.

.11 When the pipe has sufficient backfill weight on it, the waterline may be safely loaded by the municipality. All air and excess chlorine residual to be expelled utilizing the closest existing hydrants or flush points. Chlorinated water must be discharged to sanitary sewer or dechlorinated before being directed to storm drainage. Contractor required to supply all fittings, hoses and manpower.

.12 Turbidity and chlorine residual will be monitored until they return to their original readings. Once that is accomplished the municipality will return all valves to normal position.

3.12 PLUGGING OF DEAD ENDS

.1 Insert standard plugs into the bell ends of fittings or pipe bells. Place caps over spigot ends of fittings and pipes.
.2 Construct concrete thrust blocks for all plugs and caps or ties to fittings using approved mechanical restraints.

**3.13** TEMPORARY FLUSHING AND CHLORING INJECTION POINTS

.1 Size and location of injection and flushing points as shown on the drawings or as determined by Engineer.
.2 Curb stops to be stop and drain type.
.3 Removal and abandonment of connections to be witnessed and approved by Engineer.
.4 An approved cap or saddle to be installed on closed main stop to prevent future leaks.
.5 Flush points that are located in roadways or temporary graveled turnarounds where vehicle traffic could damage the flush point shall be protected by enclosing curb stop and pigtail in a vault or manhole.
.6 Flush points in undeveloped roadways or easements shall have marker posts to prevent damage to the curb stop.

**3.14** TEMPORARY WATER SERVICES

.1 Notify the Engineer at least one (1) business day prior to installation, removal, or relocation temporary water service.
.2 If the temporary service line is for domestic use, the following procedures must be adhered to.
.3 The Contractor will string out the temp water line and necessary laterals using new or clean pipe approved by the Engineer. Valves to be installed at each lateral and at the end of the line.
.4 The municipality will supply water for initial leak testing and a pre-flush of the main line and laterals of the temporary water supply system.
.5 The temporary system including all laterals are to be disinfected and bacteriological tested as outlined in this section. The line is to be isolated until bacteriological results come back negative.
.6 Water used for flushing and super-chlorination must be disposed of in the sanitary sewer system or a water truck with an approved air gap.
.7 Once bacteriological tests have passed, Contractor will have to arrange for the municipality to charge the temporary line.

.8 Contractor must arrange to ensure the residence's internal meter shut-off valve is accessible and in good working condition. Outside hose bibs that are used must allow water to flow into the home. Frost-free hose bibs may have to be modified if used as a connection. Direct connection to the existing water service or other proposed service methods may be allowed as an alternative only with specific approval from the Engineer.

.9 Contractor is responsible to coordinate appointments with individual homeowners for hook-ups to the temporary water service system. The shut-off valve at meter is to be closed and confirmed to hold before temporary water is hooked up to the building. Using clean disposable gloves and a 1% hypochlorite solution, spray connections. Flush and make all the necessary connections. Homeowners or their designate to be present at all times.

.10 Each residence or business will be additionally isolated by the municipality to eliminate reverse flow when testing the new water main.

.11 Once the new water main has been put into service, the Contractor will again have to make arrangements with the municipality and individual homeowners to disconnect the temporary service and restore permanent water service.

.12 Temporary water must be disconnected first and meter valve opened. The municipality will then open up the curb stop and the Contractor shall flush the house service through the outside hose bib until water flows clear and air is expelled.

.13 Once all residences have been converted over to the permanent water line, the temporary water service is to be removed and hydrant will be put back into normal service by the municipality.

## 4 FIELD TESTING

### 4.1 LEAKAGE AND PRESSURE TESTING

#### 4.1.1 General

.1 Provide labour, equipment and materials required to perform leakage tests hereinafter described. Equipment shall include a pump, pipe connections, pressure gauges with adequate pressure range, and all other necessary equipment.

.2 Test is to be completed after services are installed.

.3 Notify Engineer at least one (1) business day in advance of all proposed tests. Perform tests in presence of Engineer.

.4 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.5 Before testing, bed and cover pipe to prevent movement or snaking of pipe line when pressure test is applied.

.6 Backfill, mechanically restrain or strut and brace all caps, bends, tees and valves to prevent movement when pressure test is applied.

.7 In coordination with the municipality, open all valves necessary to test section of pipe.

.8 Expel air at services and hydrants by slowly filling main with potable water. Install temporary taps wherever necessary to expel air, remove and cap after completion.

.9 Thoroughly examine exposed parts and correct for leakage as necessary.

.10 Locate and repair defects if leakage is greater than amount specified. Any leaks, breaks, failures, or blockages, which are a result of faulty material and/or workmanship, are the sole responsibility of the Contractor to correct at his expense.

.11 Repeat test until leakage is within specified allowance for full length of water main.

4.1.2 Procedure

.1 After completing the installation of the Pipeline or a section of the line including water services the lines shall be hydrostatically pressure tested. The completed line shall be tested at a pressure equal to one and one-half times the maximum operating pressure or 1,000 kPa whichever is greater, but not in excess of the Manufacturer's recommended operating pressure measured at the lowest point in the test section.

.2 Apply test pressure by means of a test pump with a measurable volume container, acceptable to the Engineer, supplied by the Contractor.

.3 To compensate for initial pipe stretch and to expel all entrapped air, the pipe shall be pressurized until pressure is maintained before the test period is started.

.4 After completion of the initial expansion phase, the pressure shall be at the specified level and the test period shall commence. The test period shall be for a period of 2 hours and shall only commence prior to 2:00 p.m.

.5 During the test if the pressure drops more than 35 kPa (5 psi) then attempt to expel air and retest.

.6 After the test period, a measured amount of "make-up" water shall be added to return the pipe to the test pressure. The amount of "make-up" water shall not exceed the allowance given in AWWA C-605.

.7 The formulas for make-up for PVC pipe per hour are as follows :

- Where $Q_m$ is the quantity of make-up water per hour in liters, L is the length of the testing section in meters, D is the diameter of the pipe in mm, and P is the testing pressure in kPa.
- Or $Q_m$ is the quantity of make-up water per hour in liters, N is the number of joints in the testing section, D is the diameter of the pipe in mm, and P is the testing pressure in kPa.

$$Q_m = \frac{L \times D \sqrt{P}}{795{,}000} \qquad \text{OR} \qquad Q_m = \frac{N \times D \sqrt{P}}{130{,}400}$$

.8 For pressure testing HDPE pipe, the test pressure shall be 50% greater than the rated pressure of the pipe or specified by Engineer. The testing pressure shall be

based on the lowest elevation of the test section and if there are pipes with different pressure ratings, they shall be tested separately.

.9 Testing procedures and allowable losses to be determined by Engineer.

4.2 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations shall be witnessed by Engineer. Notify Engineer at least two (2) business days in advance of proposed date when disinfecting operations will commence.

.2 Flush water mains through available outlets with a sufficient flow in accordance with AWWA Standards to clean the pipe. If velocities cannot be achieved then an approved foam pig may be used to scour the pipe.

.3 Open and close valves, hydrants, and service connections using a uni-directional flushing method to ensure thorough cleaning.

.4 Boundary valves shall be operated by the municipality and the Contractor must ensure a positive flow during the flushing procedure at all times.

.5 Ensure that all water flushed from the main is de-chlorinated and properly discharged to an approved disposal point. Testing and sampling to be witnessed by the Engineer.

.6 When flushing has been completed to satisfaction of Engineer, introduce a strong solution of chlorine into water main and ensure that it is distributed throughout entire system using a continuous feed method.

.7 Disinfect water mains to AWWA C651 under the supervision of the Engineer and the municipality.

.8 Provide connections and pumps as required.

.9 Install any necessary chlorination points along the pipeline route in order to properly inject the disinfectant. Connections made shall be appropriately marked and abandoned to the satisfaction of the Engineer.

.10 Take water test samples at hydrants and service connections in suitable sequence to test for chlorine residual.

.11 When a free chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 hrs. After 24 hours of contact time; test samples shall be taken to ensure that there is no less than 10 ppm of chlorine residual remaining throughout system.

.12 Flush system to remove excess chlorine. Abide by all local and provincial regulations relative to the discharge of super-chlorinated water. Test samples at all hydrants and flush points are then taken to confirm that free chlorine residuals are between 0.1ppm and 1ppm.

.13 As early as the following day after flushing, samples may be obtained in approved sample bottles provided by Saskatchewan Disease Control Laboratory for analysis. Under supervision of the Engineer, one sample shall be taken and submitted for every 360 m of water main installed, at all dead ends, and end points of pipe. Additional sampling may be required at the discretion of the Engineer. Samples are

to be delivered to the Environmental Public Health Office for transfer to the Provincial Lab.

.14 A second water sample shall be taken at the same locations a minimum of 24 hours after the first samples were taken and submitted for bacterial analysis.

.15 Submit all bacterial sample results to the Engineer. Two consecutive negative results must be attained at each test location before the water main can be turned-in by the municipality and become part of the water distribution system.

.16 If test results indicate a positive result, an additional sample must be taken at that location. If that sample comes back positive for pathogens again the water main is to be re-flushed, chlorinated, and sampled again.

.17 All new valves and hydrants will be only operated by the municipality once the water main is accepted and turned into the system. If any further work is required the municipality shall be notified.

4.3 OPERATION

.1 Check the operation of all valves and hydrants in the presence of the Engineer.

.2 Mark locations of valves and other underground appurtenances with 50mm x 100mm stakes 1m long, driven 0.6m into the ground at the property line opposite the valve. Marker stakes shall be painted blue.

.3 Valves shall only be operated by their respective owners.

# END OF SPECIFICATION

# SPECIFICATION 06720 - SEWER GRAVITY PIPE

## 1 GENERAL

### 1.1 WORK INCLUDED

The work of this section includes the supply and installation of all sewer pipe, pipe bedding, appurtenances and miscellaneous materials necessary for the installation of sewer pipe to the sizes, alignments and grades shown on the drawings. This work also includes all temporary supports, connections to existing systems and testing.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01100 – Site Clearing and Grubbing
- Section 01210 - Stripping and Respreading
- Section 01223 – Trenching
- Section 06722 – Manholes, Vaults, and Catch Basins
- Section 01240 – Backfilling

### 1.3 DEFINITIONS

Sewer pipe is sanitary sewer or storm sewer pipe including catch basins, catch basin leads, sub-drains, catch basin leads etc.

### 1.4 REGULATIONS

.1 Saskatchewan Environment Standards and Guidelines for Waterworks, Wastewater, and Storm Drainage Systems.
.2 Saskatchewan Environment Storm Water Management Guidelines.
.3 The regulations respecting Public Sewerage Systems, Environment Protection, Environment Canada, shall apply to the work of this section.
.4 General Order E10, Board of Transport Commissioners for Canada (1981-8-RAIL) and Standard Practice Circular No. 1202-CN Rail.

### 1.5 MATERIALS TESTING

.1 Laboratories or agencies employed to test materials shall be independent testing agencies approved by the Engineer.
.2 The Contractor shall, before the commencement of pipe laying, at the request of the Engineer:

- provide the Engineer with the pipe manufacturer’s quality control testing data,
- Provide the Engineer date of manufacture of all pipe to installed,
- Notify the Engineer that the pipe is onsite for the Engineer’s inspection.

.3 The Engineer may reject pipe that in the opinion of the Engineer is unsuitable for the intended application.
.4 Areas of backfill failing to meet density requirements will be reworked in accordance with this section, Section 01223, and Section 01240.

1.6 STORAGE OF PIPE & FITTINGS

.1 Pipe and accessory materials shall be unloaded and stored at the site by the Contractor with care to prevent damage.
.2 Store materials so that they are kept clean.
.3 Store pipe in accordance with the manufacturer's recommendations.

## 2 PRODUCTS

### 2.1 PLASTIC PIPE

2.1.1 Type PSM Poly Vinyl Chloride (PVC) - Sanitary sewer 200mm to 375 mm to ASTM D3034

.1 Standard Dimensional Ratio (SDR): 35
.2 Locked-in gasket and integral bell system
.3 Nominal lengths, 4m
.4 CSA certified to CAN/CSA B182.2

2.1.2 Type Poly Vinyl Chloride (PVC) - Sanitary sewer 450mm to 900 mm to ASTM F679

.1 Standard Dimension Ratio (SDR): 35
.2 Locked-in gasket and integral bell system
.3 Nominal lengths, 4m
.4 CSA certified to CAN/CSA B182.2

2.1.3 Type Poly Vinyl Chloride (PVC) - Storm sewer to ASTM D3034

.1 Standard Dimension Ratio (SDR): 35
.2 Locked-in gasket and integral bell system
.3 Nominal lengths, 4m
.4 CSA certified to CAN/CSA B182.4
.5 Approved product: Ultra-Rib or Kor-Flow

### 2.2 CONCRETE PIPE

2.2.1 Non-Reinforced Circular Concrete Pipe 200mm to 300 mm to ASTM C14M

.1 CSA certified to CAN/CSA-A257, Series-M
.2 Flexible rubber gasket joints to ASTM C443M

2.2.2 Reinforced Circular Concrete Pipe 300mm to 3660 mm to ASTM C76M

.1 CSA certified to CAN/CSA-A257, Series M
.2 Flexible rubber gasket joints to ASTM C443M
.3 For pipe with lifting holes, provide fabricated plug to seal hole and grout in place

### 2.3 CORRUGATED METAL

.1 Galvanized pipe conforming to AASHO M-36.

2.4 CATCH BASIN LEADS

Conform to the requirements for sewer pipe.

2.5 CEMENT GROUT

.1 Non-shrink type grout for pipe joints, manhole and catch basins. Use Sika 212 or approved equivalent.
.2 In freezing weather, protect grout from freezing until cured.

## 3 EXECUTION

### 3.1 PREPARATION

.1 Installation and handling of pipe shall be according to the manufacturer's recommendations and applicable ASTM or CSA Standards for the type of pipe selected or as specified herein.
.2 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

### 3.2 TRENCHING AND BACKFILL

.1 Trench line and depth require approval prior to placing bedding material and pipe.
.2 Do not backfill trenches until pipe grade and alignment have been checked and accepted.

### 3.3 GRANULAR BEDDING

.1 Place granular bedding materials in accordance with details.
.2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
.3 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
.4 Compact full width of bed to at least 95% standard Proctor AASHTO T99.
.5 Fill excavation below bottom of specified bedding adjacent to manholes or structures with approved granular bedding material as directed.

### 3.4 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations.
.2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends. Do not roll pipe into the trench. If the Contractor elects to use a narrow trench, the method of lowering the pipe into the trench shall be such that no rocks or lumps of earth fall into the trench beneath the pipe. Lumps of earth and rock greater than 25 mm will not be permitted beneath the pipe and must be removed prior to pipe placement.
.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure the barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipe during construction, except as may be permitted by Engineer.

.7 Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials at construction staging limits. No extra payment will be made for capping and marking pipe ends and continuing work in subsequent stage.

.8 Position and join pipes by Pipe Manufacturer's approved methods. Do not use excavating equipment to force pipe sections together.

.9 Install PVC pipe and fittings in accordance with CSA B181.12.

.10 Pipe Jointing:

- .1 Install gaskets in accordance with manufacturer's recommendations and applicable AWWA Standards for the type of pipe selected.
- .2 Support pipes with hand slings or crane as required minimizing lateral pressure on gasket and maintaining concentricity until gasket is properly positioned.
- .3 Align pipes carefully before joining.
- .4 Maintain pipe joints free from mud, silt, gravel and other foreign material. Clean the gasket, the bell or coupling interior, especially the groove area, and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket; pipe spigot, bevel, gasket groove and sealing surface for damage or deformation. Lubricants shall be applied as specified by the pipe manufacturer.
- .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
- .6 Complete each joint before laying next length of pipe.
- .7 Minimize joint deflection as per Manufacturers recommendation to avoid joint damage during installation.
- .8 At rigid structures, install pipe joints not more than 1.2m from side of structure.
- .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.11 Backfill and compact trench as directed when any stoppage of work occurs to prevent the pipe shifting during down time. Install plug or cap to prevent debris or water from entering pipe.

.12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes. Use non-shrink non-metallic grout when suitable gaskets are not available.

.14 Upon completion of pipe laying and after Engineer has inspected pipe joints, place specified granular material to dimensions indicated or directed.

.15 Hand place granular material in uniform layers not exceeding 300mm thick to minimum 300mm over top of pipe. Dumping of material directly on top of pipe is not permitted.

.16 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe. Ensure the pipe is adequately secure to prevent the pipe from lifting.

.17 Compact each layer, in the pipe zone, to at least 95% of standard Proctor maximum dry density ASTM D698.

.18 For ties to existing mains requiring interruption of the sewer service, advise the Engineer two (2) business days in advance of the proposed interruption for approval. Upon approval notify the occupants, residents and businesses at least one (1) working day in advance by way of a written notice and verbal advisory. Submit a copy of the notice to the Engineer for approval prior to distribution. Minimize the period of time of the interruption and schedule the interruption for a non-peak demand time.

.19 For special fittings and tie-ins, cut the pipe to the length required as recommended by the pipe manufacturer without damaging the pipe or its coating. The end shall be cut smooth at right angles to the axis of the pipe.

.20 Prevent any large debris from entering the existing system by using a screen at the downstream tie to the existing system.

.21 In areas of high ground water conditions manufactured inline tees are required for sewer service connections. Cutting of pipe and installations of “inserta tee” or service saddles will not be permitted.

.22 Sewer mains to be installed with a minimum depth of cover of 2.6m from the finished grade to top of pipe. Insulation is required if cover is less than specified. Type of insulation and R values required to be approved by Engineer. Refer to Environmental Utilities Standard Drawing EU-221.

.23 Sanitary sewer force mains to be clearly marked or labeled and tracer wire installed along top of pipe using duct tape to secure wire from movement during backfill procedure.

.24 Force main appurtenances to be approved by the Engineer.

.25 The use of sewer pipe as a conduit for other buried utilities will not be permitted.

.26 Color coding of all piping in sanitary sewer lift stations and similar facilities to be approved by the Engineer.

3.4.1 Corrugated Metal Pipe

.1 Slip band over end of one pipe with band open to receive next section.

.2 For helically corrugated pipe, butt adjacent ends together.

.3 For circumferentially corrugated pipe, bring adjoining length to within approximately one inch of first section.
.4 Tighten band so that corrugations of band match corrugations of pipe sections.
.5 Keep dirt and gravel out of joint so that corrugations fit snugly.
.6 Tap galvanized band with mallet or hammer when tightening to ensure tight fit.

**3.5** FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.
.2 When directed by Engineer, a CCTV camera will be used to ensure that the pipe is free of obstruction. Before application for Substantial Performance all flexible pipe sanitary sewer trunk and main pipe shall be tested to ensure the pipe has not deflected in excess of 5%. The flexible pipe deflection test shall be performed by successfully pulling a mandrel, not less than 95% of the base internal diameter (as defined by the CSA or ASTM standard to which the pipe is manufactured), through the pipe. Contact the pipe manufacturer for the supply of the required mandrels.
.3 Remove foreign material from sewers and related appurtenances by flushing with power flushing equipment prior to placing the pipe into service.
.4 All concrete sanitary sewer trunk lines shall be tested by means of an air or water test according to ASTM C924M or C969M. Pipe larger than 600 mm will be accepted more conveniently by visual and individual joint testing according to ASTM C1103M.
.5 All sanitary sewer trunk and main pipe shall be inspected by means of video camera for leaks and other deficiencies as noted under 3.6 Tolerance. Refer to Section 3.7 for video camera inspections.
.6 Contractor shall inform the Engineer two (2) business days before all testing and inspections are to begin.
.7 Pressure testing of sanitary sewer force mains to be conducted based on Manufacturer's specifications and approval of Engineer.

**3.6** TOLERANCE

.1 Maintain constructed grade to within ±5 mm from the lines, grades and elevations shown in the Contract Documents. Where departure from grade occurs, pipe shall be removed to the last joint where the pipe is within allowable tolerance and pipe shall be reinstalled to grade.
.2 Rigid Pipe - The Contractor shall repair all deficiencies found during testing and inspections. In general deficiencies include: improper joints; any cracks wider than 0.6 mm, sheared, out of round or unduly deflected pipe; sags or rises which pond water in excess of 5% of pipe diameter; protruding service connections; and visible leaks.
.3 Flexible Pipe - The Contractor shall repair all deficiencies found during testing and inspections. In general deficiencies include: improper joints; any cracked, sheared, out of round or unduly deflected pipe in excess of 5% deflection for flexible pipe;

sags or rises which pond water in excess of 5% of pipe diameter; protruding service connections; and visible leaks.

.4 Construct sanitary sewer as watertight as possible using rubber gaskets to the pipe manufacturer's specifications. Infiltration of groundwater into the entire system shall not exceed the allowable infiltration / exfiltration limits specified by ASTM Standards as noted under Field Testing 3.5. After the installation and backfilling of sewer pipe, services and manholes is completed, the Engineer shall have the right to require the Contractor to measure the leakage of groundwater. Should this leakage exceed the amount specified, the Contractor shall at his own expense, repair the sewer by replacing or otherwise until the leakage does not exceed the amount specified.

## 3.7 CATCH BASIN LEADS

.1 Lay catch basin leads in accordance with the specifications for sewer pipe, above.

.2 Catch basin leads shall be installed at a minimum of 1% grade between the manhole and the catch basin through the entire lead.

.3 Catch basin leads to protrude between 50 mm and 100 mm from the inside wall of the catch basin or manhole. Grout pipe in place using non-shrink grout.

## 3.8 SEWER INSPECTION BY CCTV (CLOSED CIRCUIT TELEVISION)

### 3.8.1 General

.1 Gravity mains shall be inspected by CCTV after backfilling of the trench to finished grade. CCTV inspection shall be performed by the Contractor on all sewer mains, unless otherwise directed by the Engineer.

.2 The Contractor shall employ a qualified CCTV Contractor acceptable to the Owner.

.3 Sewer mains shall be flushed prior to the CCTV Inspection. The CCTV Inspection shall be performed immediately after the sewer mains have been flushed.

.4 All CCTV inspection shall be carried out in the presence of the Engineer, who shall be given at least 2 days advance notice of any testing to be carried out.

.5 Two (2) copies of the CCTV video in DVD format and report (to NASSCO Standards) shall be submitted to the Engineer. Reports to be in a format complying with PACP codes developed by NASSCO.

.6 Acceptance of the Sewer CCTV Inspection shall be based on the Engineer's review of submitted material.

### 3.8.2 CCTV Testing Equipment

.1 The CCTV Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.

.2 The CCTV Operator shall be certified by NASSCO and certification shall be supplied prior to commencing the work.

.3 The CCTV equipment shall be a self-contained camera and monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of quality to show the entire pipe periphery. There must

be capability of providing measurement within the line to any accuracy of 0.1% or 0.3 m whichever is greater. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:

- A direct voice communication.
- A solid state camera with pan and tilt capabilities mounted on a crawler.
- Self-contained electrical power.
- Proper safety equipment to protect employees and the general public.
- Position camera lens centrally in the pipeline with a positioning tolerance of ± 10% off the vertical centreline axis of the pipeline.

.4 The camera's rate of progress shall be uniform during inspection and shall not exceed the following limits:

- 0.10 m/s for pipe diameters less than 200 mm.
- 0.15 m/s for pipe diameters 200 mm and larger but not exceeding 310 mm.
- Camera to be stationary when panning and tilting defects or pipe features.

3.8.3 CCTV Report

.1 A CCTV log shall be maintained during the inspection reporting any defects based on PACP Codes developed by NASSCO or any other defect affecting the overall performance of the sewer main. The location of the defect shall be referenced from the manhole where the CCTV camera was inserted. A colour photo of the defect shall be required as well as a pan and tilt clearly showing the defect.

.2 The log shall include service connections with comments of condition. The CCTV report shall also contain a pan and tilt of each service connection.

.3 Manhole identity shall be noted clearly as indicated on the drawings.

.4 Two (2) copies of the final typewritten report with corresponding video referenced to the text, along with two (2) copies of the video media (DVD), shall be submitted within two weeks after compilation of inspection.

.5 Pipe condition comments made in the report shall be in NASSCO industry terminology.

3.8.4 CCTV Cleaning

The Contractor is responsible for cleaning and flushing all lines prior to CCTV inspection.

3.8.5 CCTV Miscellaneous

The Contractor shall be responsible for all works performed by the subcontractor for traffic control and any other related work incidental to the completion of CCTV inspection.

3.8.6 CCTV Inspection and Acceptance

.1 The location of all deficient work will be recorded and the Contractor will be required to repair, restore or otherwise make good, to the satisfaction of the Engineer, any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks, or any other faults not conforming with these specifications or the pipe manufacturers which the CCTV inspection revealed.

.2 After the deficiencies are repaired and corrected and before final acceptance, the Owner reserves the right to have the faulty areas re-televised at the Contractor's expense.

3.9 OTHER TESTING

3.9.1 Mandrel

.1 If there is doubt as to the trueness of the pipe, a mandrel with a diameter not less than 95% of the base internal pipe diameter shall be passed through the pipe section in question.

.2 If the mandrel is unable to pass through the pipe section, the Contractor shall repair the defective pipe at no cost to the Owner.

3.9.2 Infiltration and Ex-filtration

.1 Concrete sanitary sewer trunk lines shall be tested.

.2 Test to applicable ASTM standards:

- ASTM C1103M: Joint Acceptance Testing of Installed Concrete Pipe
- ASTM C969M: Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
- PVC Pipe 100-375mm: 4.63L/mm Pipe Diameter/Km/day (24hours) PVC Pipe +450mm: 0.93L/mm Pipe Diameter/Km/day (24hours)(Referenced from IPEX PVC Sewer Pipe Installation Guide)

3.10 CLEANING

Prior to acceptance, the Contractor shall:

.1 Remove all sand, dirt and other foreign matter from the completed sewer mains.

.2 Flush sewer mains clean.

.3 Take precautions to prevent debris from new construction from entering an existing system.

# END OF SPECIFICATION

# SPECIFICATION 06722 – MANHOLES, VAULTS, CATCH BASINS

## 1 GENERAL

### 1.1 WORK INCLUDED

The work of this section includes the supply and installation of all manholes, vaults, catch basins, appurtenances and miscellaneous materials necessary for the installation of such to the locations, alignments and grades shown on the drawings. This work also includes all temporary supports, connections to existing systems, benching, rim, frame and cover adjustments as may be required.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01223 – Trenching
- Section 06720 – Sewer / Gravity Pipe
- Section 06600 – Pressure Pipe
- Section 06800 – Adjustment of Appurtenances
- Section 01240 – Backfilling

### 1.3 REGULATIONS

.1 Saskatchewan Environment Standards and Guidelines for Waterworks, Wastewater, and Storm Drainage Systems.
.2 Saskatchewan Environment Storm Water Management Guidelines.
.3 The regulations respecting Public Sewerage Systems, Environment Protection, Environment Canada, shall apply to the work of this section.
.4 General Order E10, Board of Transport Commissioners for Canada (1981-8-RAIL) and Standard Practice Circular No. 1202-CN Rail.

### 1.4 MATERIALS TESTING

.1 Laboratories or agencies employed to test materials shall be independent testing agencies approved by the Engineer.
.2 The Contractor shall, before the commencement of pipelaying and installation of manholes, vaults and catch basins, at the request of the Engineer:
- Provide the Engineer with the manufacturer's quality control testing data,
- Provide the Engineer date of manufacture of all material to be installed,
- Notify the Engineer that the material is onsite for the Engineer's inspection.

.3 The Engineer may reject the material that in the opinion of the Engineer is unsuitable for the intended application.
.4 Areas of backfill failing to meet density requirements will be reworked in accordance with Section 01223 and Section 01240.

### 1.5 HANDLING OF MATERIAL

.1 Materials shall be unloaded and stored at the site by the Contractor with care to prevent damage.
.2 Handle all material with approved equipment to prevent damage.

.3 Store materials in such a way as to prevent damage, in accordance with manufacturer's directions.

1.6 SUBMISSIONS

.1 Provide shop drawings for the Engineer's review of the following items:
- Manhole bases
- Catch basin manholes
- Vaults

.2 Provide the Engineer with the manufacturer's installation instruction sheet(s) (i.e. build-up sheet).

## 2 PRODUCTS

2.1 MANHOLES

.1 Sections shall conform to ASTM C478 circular precast reinforced concrete manhole.
.2 Sections shall be 1200mm Inner Diameter or as shown on the drawings.
.3 Tops shall be precast flat top with opening offset for vertical ladder installation or as shown on the drawings.
.4 Monolithic bases to be approved by the Engineer.
.5 Reinforcing steel to CSA G30.12.
.6 Welded steel fabric to CSA G30.5.
.7 Wire ties to CSA G30.3.
.8 Joints to be made watertight by using:
- Boot Connection,
- Grout Connection,
- Kwik-Seal (Pre-Con),
- A-Lok (Pre-Con),
- Link Seal,
- Or equivalent as approved by the Engineer.

.9 Ladder rungs to be 20mm diameter aluminium steps (drop step type) to ASTM C478, as detailed on drawings.
.10 Adjusting rings to ASTM C478.
.11 Frames and Covers:
- Covers to bear evenly on frames.
- Grey iron castings to ASTM A48 class 20.
- Frames and cover minimum weight shall be 122kg per set.
- Frame and cover to come as a complete unit.

2.2 CATCH BASINS

.1 Barrels shall conform to ASTM C478 and ASTM C139.
.2 Barrels shall be 900mm Diameter or as shown on the drawings.
.3 Frames and covers shall have precast top as specified on the drawings.
.4 Frames and covers shall have a minimum weight of 57 Kg per set.
.5 Cover to bear evenly on frame. Frame and cover to come as a complete unit.

2.3 CONCRETE FOR MANHOLES AND APPURTENANCES

.1 Cement – Sulphate Resistant (to CAN3-A5, Type 50).
.2 20mm maximum size coarse aggregate.
.3 Maximum slump 75mm.
.4 Minimum Strength 25 MPa @ 28 days.
.5 Water/cement ratio to CAN3-A23.1, table 7 for class A exposure.
.6 Provide concrete with temperature not less than 10°C in freezing weather and maintain this temperature for the first 72 hours.

2.4 CATCH BASIN LEADS

Conform to Section 06720.

2.5 CEMENT GROUT

.1 Non-shrink type grout for pipe joints, manhole and catch basins. Use Sika 212 or approved equivalent.
.2 In freezing weather, protect grout from freezing until cured.

## 3 EXECUTION

3.1 GENERAL

.1 Construct units to details indicated on the drawings, plumb and true to alignment and grade. Excavate for installation of manholes to the required depths and lateral dimensions to allow for the safe and accurate installation of the structure.
.2 Complete units as pipe laying progresses.
.3 Pump excavation free of standing water. Remove soft and foreign material before placing concrete base and replace with compacted native material or compacted granular material to bridge the unstable sub-grade conditions.
.4 Bases for all structures shall be placed or poured on solid, unfrozen ground.
.5 Cast bottom slabs directly on undisturbed ground.
.6 Pre-cast concrete bases shall be placed:

- In an excavation free of standing water,
- Where all soft sub base material and deleterious materials have been removed and replaced with approved granular backfill,
- On a minimum of 150 mm of well graded, granular material compacted to 100% Standard Proctor Density.

.7 Place stub outlets, bulkheads and inverts at design elevations and in positions indicated on the drawings.
.8 Pipes entering manholes, catch basins and appurtenances shall be cut off flush with interior surfaces and rough concrete surfaces shall be grouted smooth.
.9 Clean the whole sewer system by removing grout, dirt, debris and other foreign material. Prevent debris from entering the system.

3.2 MANHOLE / VAULT CONSTRUCTION

.1 Pre-benched manhole bases shall be used wherever possible.

.2 Set manhole base sections in place and fill around with cement or place pre-cast concrete base on granular base as detailed above.

.3 For all manholes, make each successive joint watertight with approved rubber ring gaskets.

.4 For sanitary sewer manholes:

- Plug all lifting holes with non-metallic, non-shrink grout or epoxy resin cement to make a watertight seal. In areas of high ground water conditions use an approved bitumastic riser – wrap on all submerged joints or an approved equivalent.
- Unused channels in manhole to be sealed off at manhole wall using grout or other permanent method approved by Engineer.
- Place stub outlets and bulkheads at elevations and in positions indicated.
- All pipe laterals entering manhole to discharge directly into channel (not onto bench). Cut out top half of pipe where lateral extends to channel from manhole wall to end of lateral pipe.

.5 Make watertight connections to manholes and catch basins. Use non-shrink grout when suitable gaskets are not available or suitable conditions for gaskets are not present.

.6 Construct manholes as close behind the pipe laying operations as practical. In no case shall manhole construction be further behind the pipe laying operations than 100 m.

.7 Manhole benching shall be a smooth, “U” shaped channel at least the half height of the diameter of the pipe.

.8 Slope adjacent floor at 1 vertical to 10 horizontal. Curve flow channels smoothly and ensure new slope ties smoothly to established sewer grade.

.9 Manholes that require the Contractor to remove concrete to add additional inverts must have the concrete saw cut or cored.

.10 When installing manholes onto existing pipe:

- Ensure adequate support of existing pipe during installation of new base.
- New concrete benching and first section of manhole riser shall be installed and all pipe grouted to the first manhole riser prior to “breaking” into the existing pipe.
- Carefully remove the portion of existing pipe to dimensions required.
- Make joints watertight between new and existing pipe.

.11 Place frame and cover on top section to elevation indicated on approved drawings. If adjustment is required, use approved adjustment rings.

.12 Ensure the ladder rungs are aligned in a straight vertical line. The hole in the slab top shall be aligned with the ladder rungs. Top ladder rung should not exceed 750 mm below top of manhole rim. Ladder position to be aligned above largest portion of clear benching.

.13 Prevent any debris and foreign materials from entering the system. Clean surplus grout and joint compounds from interior surface of unit as work progresses. Clean units of debris and foreign materials. Do not flush debris into sewer.

.14 Compact backfill around manholes with mechanical tampers the full depth of the manhole to 98% of the standard Proctor maximum dry density and moisture conditioned

and between plus or minus 2% of optimum moisture content as determined by ASTM D698 to the finished grade.

.15 Compacted backfill is required around manholes regardless of the class of backfill specified for the pipeline.

.16 Where the separation between manholes precludes the use of mechanical tampers, the manholes shall be backfilled with lean concrete (approx. 10 Mpa, < 150mm slump).

.17 When paving roads, avoid spraying oil on manhole covers and remove all excess asphalt from manhole covers.

.18 Where a manhole requires additional laterals, the contractor must have the added holes saw cut or cored.

3.3 CATCH BASIN CONSTRUCTION

3.3.1 Pre-cast concrete catch basins shall be placed:

.1 At locations indicated on the approved drawings,

.2 In an excavation free of standing water,

.3 Where all soft sub base material and deleterious materials have been removed and replaced with approved granular backfill,

.4 On a minimum of 150 mm of well graded, granular material compacted to 100% Standard Proctor Density.

.5 Level

- Place lead pipe in position and grout in place.
- Set precast top, adjust to grade and set frame and side inlet. Frame and side inlet shall be grouted in place.
- Backfill with native materials placed in 150mm lifts compacted to 98% of the standard Proctor maximum dry density and moisture conditioned to between plus or minus 2% of optimum moisture content as determined by ASTM D698 to the finished grade.

3.3.2 Catch Basin Leads

Conform to Section 06720.

3.4 TOLERANCE

.1 Maintain constructed grade to within ± 5mm from the lines, grades and elevations shown in the drawings.

# END OF SPECIFICATION

# SPECIFICATION 06740 – SERVICE CONNECTIONS

## 1 GENERAL

### 1.1 WORK INCLUDED

This section refers to the supply of materials and installation of water and sewer service connections from the mains to the property line.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01223 – Trenching
- Section 06600 – Pressure Pipe
- Section 06720 – Sewer / Gravity Pipe
- Section 01240 – Backfilling

### 1.3 REGULATIONS

.1 Saskatchewan Environment Standards and Guidelines for Waterworks, Wastewater, and Storm Drainage Systems.
.2 The Public Water Supply Regulations, Environment Protection, Environment Canada shall apply to the work of this section.

### 1.4 MATERIALS TESTING

.1 Materials supplied shall be in accordance with AWWA, ASTM and CSA Standards.
.2 The Engineer may at any time require the Contractor to produce certification by an independent testing agency that materials used conform to the specified standards.
.3 The Engineer may reject the material that in the opinion of the Engineer is unsuitable for the intended application.
.4 Areas of backfill failing to meet density requirements will be reworked in accordance with this section, Section 01223, and Section 01240.

### 1.5 HANDLING OF PIPE AND ACCESSORIES

.1 Materials shall be unloaded and stored at the site by the Contractor with care to prevent damage.
.2 Handle all material with approved equipment to prevent damage.
.3 Store materials in such a way as to prevent damage, in accordance with manufacturer's directions.

## 2 PRODUCTS

### 2.1 WATER SERVICE

#### 2.1.1 General

.1 For service connection sizes 25 mm to 50 mm diameter, pipe to be Type K Copper Tubing, Municipex or Kitec (Q-Line).

.2 For service connection sizes 100 mm to 300 mm diameter, pipe to be polyvinyl chloride (PVC) pressure pipe as specified in Section 06600.

.3 Valves and valve boxes for service connection sizes 100 mm to 300 mm to be as specified in Section 06600.

.4 Refer to the latest revision of AWWA – C-900.

2.1.2 Copper Tubing

.1 Conforming to ASTM B88M, Type K, annealed (as described in AWWA C-800, Appendix – Collected Standards for Service Line Materials).

2.1.3 Municipex Water Service Tubing

.1 For service connection sizes 25 mm to 50 mm in diameter, Municipex tubing (cross-linked polyethylene pipe) certified to CSA B137.5 and ASTM F876 and shall comply with NSF 14.

.2 The pipe and resin (compound) shall be manufactured in an ISO 9001 certified production facility.

.3 Degree of cross-linking not less than 80% when tested in accordance with ASTM D2765 Method B.

.4 Approved pressure rating of:

- 160 psi @ 23 $^{0}$C / 73.4 $^{0}$F.
- 100 psi @ 82 $^{0}$C / 180 $^{0}$F.
- 80 psi @ 93 $^{0}$C / 200 $^{0}$F.

.5 The outside diameter of the pipe shall be copper tube size (CTS) and shall have a standard dimension ratio (SDR) 9.

.6 The pipe shall carry the following marks every 5 feet minimum:

- Manufacturer's Name.
- Nominal Size.
- ASTM, CSA 7 NSF designations.
- SDR (standard dimension ratio).
- Pressure / temperature rating.
- Potable Tubing.
- Manufacturing date and machine number.
- Footage mark. The pipe shall have consecutive footage marks every 5 feet (minimum starting with 0 at the beginning of each coil).

.7 Color: blue.

.8 The pipe shall be shipped in protective cardboard boxes marked with the product name and size.

.9 When connecting Municipex tubing to fittings, manufacturer approved stainless steel inserts shall be used.

2.1.4 Kitec (Q-Line)

.1 For service connections 25 mm in diameter, Kitec (Q-Line) composite tubing constructed of flexible aluminum tubing permanently bonded between inner and outer layers of polyethylene.

.2 Kitec (Q-Line) shall be AWWA. C903, ASTM F1282, CSA B137.9 certified.

.3 Approved pressure rating of:

- 200 psi @ 23°C / 73.4°F
- 100 psi @ 82°C / 180°F

.4 The pipe shall carry the following marks every 5 feet minimum:

- Manufacturer's name.
- Nominal size.
- ASTM, CSA 7 NSF designations.
- SDR (standard dimension ratio).
- Pressure / temperature rating.
- Potable tubing.
- Manufacturing date & machine number.
- Footage mark. The pipe shall have consecutive footage marks every 5 feet (minimum starting with 0 at the beginning of each coil) .

.5 Color: blue.

.6 The pipe shall be shipped in protective cardboard boxes marked with the product name and size.

.7 When connecting Kitec (Q-line) tubing to fittings install to manufacturer's instructions.

2.1.5 Water Service Tubing Couplings

.1 Compression type suitable for 1 MPa working pressure. Couplings shall be supplied without internal pipe stop.

.2 Approved couplings:

- Ford "Quick Joint" couplings.
- Mueller Mark II "Oriseal" couplings.
- Cambridge Brass compression couplings.
- A.T. McDonald compression couplings.

.3 All fittings to be certified NSF 61.

2.1.6 Corporation (Main) Stops

.1 Lead free brass valve construction with or without Teflon coating.

.2 Body to be red brass to ASTM B62, compression type outlet fitting, inlet having thread conforming to AWWA C800.

.3 Valves to be full round port; reduced port not permitted.

.4 All brass fittings and valves shall be certified by a NSF or ANSI accredited test lab per ANSI/NSF Standard 61, Section 8. Proof of certification is required.

.5 Approved Products:

- Mueller B-25008 c/w “110 Compression” outlet for sizes 25, 38 and 50 mm diameter.
- Ford FB1000 – X-NL “Ballcorp” c/w “Pack Joint” outlet for sizes 25, 38 and 50 mm diameter.
- Cambridge Brass Series 301 N.L. outlet for sizes 25, 38 and 50 mm diameter.
- A.Y. McDonald Mfg. Compression outlet Series 4701 BT for sizes 25, 38 and 50 mm diameter.

2.1.7 Curb Stop

.1 Curb stops to be of ball valve construction.

.2 Balls to be lead free Teflon coated brass or industrial chrome plated stainless steel c/w Teflon seats.

.3 Body to be lead free red brass to ASTM B62, without drain.

.4 Inlets and outlets to be compression type fittings suitable for copper, Municipex or Kitec (Q-Line) pipe.

.5 Valves to be full port, reduced port not permitted.

.6 All brass fittings and valves shall be certified by a NSF or ANSI accredited test lab per ANSI/NSF Standard 61, Section 8. Proof of certification is required.

.7 Approved Products:

- Cambridge Brass Series 202 N.L. for sizes 25, 38 and 50 mm diameter.
- A.Y. McDonald Mfg. Series 6100 “Q” Compression outlet for sizes 25, 38 and 50 mm diameter.
- Ford B44 Q-NL c/w “Quick Joint” outlet for sizes 25, 38 and 50 mm diameter.
- Mueller B-25209 c/w “110 Compression” outlet for sizes 25, 38 and 50 mm diameter.

2.1.8 Service Saddles

.1 Outlet to be 25 mm to 50 mm AWWA Taper thread for standard service connections. For use on chlorination points only, outlet to be 25 mm to 50 mm IP thread.

.2 Fasteners to be 15.88 mm ($^5/_8$”) NC thread T304 stainless steel. Hex nuts and washers to be T304 stainless steel, lubricated to prevent galling.

.3 Approved Products:

- Robar 2616 DBL Bolt for main sizes 150 mm to 300 mm.
- Robar 2616 DBL Bolt for main sizes 350 mm to 450 mm.
- Canada Pipeline SC-2 for main sizes 100 mm to 400 mm.
- Robar 2636 for main sizes 450 mm to 750 mm.

- Canada Pipeline SC-4 for main sizes 100 mm to 600 mm.
- Smith Blair 372 Service Saddle DBL Bolt.
- Robar 2706 for main sizes 100 mm to 600 mm.
- Cambridge Brass Series 812 for sizes 100 mm to 300 mm.
- Cambridge Brass Series 8403 for sizes 100 mm to 400 mm.

2.1.9 Curb Stands (Service Boxes)

.1 Standard depth of bury to be 2.75 m. Maximum depth from finish grade to curbstop valve cannot exceed 3.05m without approval.

.2 Sliders shall be 31.75 mm (1 ¼") O.D. galvanized Standard Schedule 40, wrought iron pipe. Distance from top of cap to bottom of slider to be 610 mm minimum, 1000 mm maximum. Set screw to be removed before backfill. A maximum of 150mm threaded riser can be used for adjustment.

.3 Casing shall be 25 mm O.D. (1"), galvanized Standard Schedule 40, iron pipe. Casing must be long enough to allow a minimum of 150mm overlap by the slider.

.4 Cap to be cast iron, ribbed, marked “WATER” c/w 32 mm pentagonal head brass plug. The exterior of the cap is to be bituminous coated.

.5 Bottom box to be 127 mm (5”) I.D. cast or ductile iron. Bottom box to be factory applied fusion bonded epoxy coated.

.6 Operating rod shall be 12.70 mm (½”) on a 25 mm service or 15.875 mm ($^5/_8$”) on a 38 mm or 50 mm service, supplied as a single unit comprised of a solid AISI Type 304 stainless steel. Rod welded to a stainless steel clevis, or approved equivalent, and fastened with a brass cotter pin.

.7 Operating rod shall be manufactured with a "W" centering bend (standard pigtail). The rod must be a minimum of 2.0 m if used on a standard bury service. The top of rod should be below the top of casing.

.8 Manufacturer name to be cast into the bottom boot.

.9 Approved Manufacturers:

- Trojan.
- Norwood Foundry.
- East Jordan Iron Works.
- Westview Sales Ltd.

2.1.10 Tracer Wire Type 14/1B MDPE Tracer

.1 Tracer wire to be 14 gauge, single conductor copper wire, unstranded, color of insulation: white, made for direct bury

.2 When joining tracer wire use underground waterproof splice kit.

.3 Approved Products:

- 3- M DBR or DBY splice kit or equivalent

## 2.2 SEWER SERVICE MATERIALS

### 2.2.1 Pipe - "Smooth Wall" Polyvinyl Chloride (PVC) Pipe

.1 For PVC service connections 100 mm to 150 mm in diameter, PVC pipe conforming to ASTM D3034, CSA certified as meeting CSA B182.2, SDR 35, integral locked-in gasket bell and spigot joints.

.2 For PVC service connections 200 mm and larger, PVC pipe conforming to Section 06720.

### 2.2.2 Fittings

.1 For PVC service connections 100 mm to 150 mm in diameter, all fitting conforming to ASTM D3034-83, CSA certified as meeting CSA B182.2, SDR 35, integral locked-in gasket bell and spigot joints.

### 2.2.3 Connections to Mains

.1 PVC Tee Saddle c/w rubber gasket joint

- Saddles to be manufactured with integral centering ring to teeth to align saddle opening with hole in pipe.
- Saddles to be fastened to main by adjustable stainless steel straps.
- Screw mechanism on straps to be completely stainless steel.

.2 PVC Insert Type Fittings

- PVC PSM gasket joint stubs c/w molded rubber sleeve and adjustable stainless steel strap.
- Screw mechanism on straps to be completely stainless steel.

.3 Approved Products:

- IPEX Ring-Tite or equivalent.

.4 In areas of high ground water conditions, manufactured inline tees are required for sewer service connections. Cutting of pipe and installations of "inserta tee" or service saddles will not be permitted.

.5 Inline tees to be used in situations where service lateral diameter is less than two nominal sizes smaller than main diameter.

### 2.2.4 Flexible Rubber Couplings

.1 To be elastomeric PVC construction c/w stainless steel straps.

.2 Approved Products:

- Fernco.
- Clow "Super-Seal".
- Mission Rubber Co. "Flex Seal".
- Pipeconx.
- Rollee.

## 3 EXECUTION

### 3.1 TRENCH INSPECTION

.1 Check trench bottom for stability and ensure that pipes can be properly laid to design grade. Notify the Engineer if conditions prevent successful pipe installation.

.2 Remove unstable soil and replace with compacted pit run gravel or washed rock, if directed by the Engineer.

### 3.2 INSPECTION OF MATERIALS

.1 Inspect for defects immediately before lowering into trench. Promptly remove and replace any defective material.

.2 Clean pipes, fittings, valves before installation.

### 3.3 TRENCHING AND BACKFILL

.1 Complete trenching and backfill work as specified.

.2 Trench depth to provide minimum cover over water service pipes of 2.75 m to a maximum of 3.05 m from finished grade unless otherwise indicated.

.3 In existing areas where watermains do not have sufficient minimum cover, insulation is required if cover over service is less than specified. Type of insulation and R values required to be approved by Engineer.

### 3.4 GRANULAR BEDDING

.1 Place granular bedding materials in accordance with details.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to accommodate pipe bell or other non-uniform pipe components. Care must be taken so as not to create unfilled voids in the bedding that would cause pipe “bridging”.

.4 Compact full width of bed to at least 95% Standard Proctor ASTM D698, Method D.

.5 Fill any excavation below level of bottom of specified bedding with approved granular bedding material as directed.

### 3.5 BORED OR AUGURED SERVICES

.1 Bore holes shall be large enough to pass service pipes through without disturbing joints.

### 3.6 ALIGNMENT AND GRADE

.1 Lay service pipes to the required alignment and grade from the main to the point inside the lot as indicated on the approved drawings (distance into lots past street property line varies, consult approved drawings).

.2 Lay service pipes in a common trench wherever possible.

.3 Maximum vertical deflection shall be $4.5^{O}$.

.4 Minimum grades for sewer service pipes shall be:

- 100mm diameter pipe - 2%
- 150mm diameter pipe - 1%
- Storm sewer service (weeping tile drain) 75mm diameter pipe - 1%

.5 Maximum grades for sewer service pipes shall be:

.1 100mm diameter pipe - 5%

.2 150mm diameter pipe - 5%

.3 Storm sewer service (weeping tile drain) 75mm diameter pipe - 5%

## 3.7 INSTALLATION

### 3.7.1 Water Service Installation

.1 Installation and handling of pipe and fittings shall be according to the manufacturer's recommendations and applicable AWWA Specification for the type of pipe and fitting selected or as specified herein.

.2 Service pipes to extend 3.0 m into lot from property line. In the case where a gas and/or electric easement exists on front of property, service pipes shall extend 5.0 m into property.

.3 Construct service connections at right angles to main.

.4 Drill and direct tap water mains under pressure by means of a tapping machine and thread in corporation main stop with tapping machine. Use only when tapping PVC C900 or C905 DR 18 pipe. Do not direct tap PVC Series pipe.

.5 Single and multiple tap service connections and cul de sac flushing points shall be tapped in the top half of the pipe at the 10:00 o'clock and 2:00 o'clock positions.

.6 Service connections to be tapped and a minimum distance of 0.6 m on center from other service taps or 0.6 m from the nearest edge of the tapping sleeve or other service tap.

.7 Service connections to be tapped a minimum of 1 m from a joint on the main or the minimum distance recommended by the pipe manufacturer, whichever is greater.

.8 Manual air release points to be installed at the 12 o’clock position.

.9 Service saddles are required on water mains 150 mm and smaller. Direct tap is only allowed on mains 200 mm and larger. Torque bolts to Manufacturer’s specifications. In high ground water conditions an approved protective tape or wrap may be required.

.10 Leave corporation stop fully open, upon completion of installation.

.11 Curb stops are to be placed as detailed near the property line. Curb stops are to be marked with a blue 38 mm x 76 mm marker extending 600 mm (24 inches) above finished grade.

.12 Provide chair and blocking under curb stop to support curb stop. Rod to be fastened to curb stop with brass cotter pin. Install cotter pin bending both legs in same direction.

.13 Set service boxes plumb over the centre of the curb stop and set the top of service box to proper elevation. Remove set screw leveling bolt from top slider.

.14 In areas of clay soil, water service shall be a minimum of 2.75m below the final grade or as specified. In areas where the soil is predominantly gravel, water services may be set deeper to prevent frost penetration with approval from the Engineer.

.15 Tracer wire and water tight connections to be installed along top of water service pipe with duct tape.

.16 Services shall have Class B granular backfill.

.17 Abandonment of main stops to be done with an approved cap or saddle. A surveyed as-built is required and location of abandoned services to be shown on record drawings.

.18 Backfill of trenches to occur only after until installed work has been inspected and accepted by the Engineer. Elevation of service pipes are to be recorded on the record drawings.

3.7.2 Sanitary/Storm Sewer Service Installation

.1 Installation and handling of pipe and fittings shall be according to the manufacturer's recommendations for the type of pipe and fitting selected or as specified herein.

.2 Lay pipe straight and true at a minimum grade of two percent (2%) for 100 mm and one percent (1%) for 150 mm diameter pipe. Maximum vertical deflection shall be 4.5 degrees.

.3 Make all service lead joints watertight.

.4 No part of the saddle or service pipe shall protrude beyond the inside surface of the sewer main.

.5 Install services to centerline of individual lots unless otherwise approved by the Engineer.

.6 Remove material that drops into the sewer during service tie-in. Plug or cap the open end with a watertight PVC fitting to prevent dirt intrusion.

.7 Service pipes to extend 3.0 m into lot from property line. In the case where a gas and/or electric easement exists on front of property, service pipes shall extend 5.0 m into property.

.8 Mark location of end of service with a green 38 mm x 76 mm marker extending from the service invert to a height of 750 mm (30 inches) above finished grade.

.9 Service connections shall be tapped in the top half of the pipe at the 10:00 o'clock and 2:00 o'clock positions.

.10 Use long radius sweep bends.

.11 Service saddles to be spaced a minimum of 0.6 m on center from adjacent service saddles and a minimum of 1.0 m from a joint on the main.

.12 Services shall have Class B granular backfill.

.13 Monitoring/sampling manholes to be installed for new multi-family housing (6 plex and larger), institutional, commercial, and industrial customers if service is connected directly to main or tied in with other services.

.14 Service lines may require CCTV inspection at the discretion of Engineer.

.15 Backfill of trenches to occur only after until installed work has been inspected and accepted by the Engineer. Elevation of service pipes are to be recorded on the record drawings.

3.7.3 Sanitary, Storm and Water Service Common Trench Installation

.1 Lay water and sewer service pipe 300 mm (12 inches) apart when services are in a common trench and the water service pipe size is less than 50 mm (2 inches). Maintain a horizontal separation of 1.4 m (4.5 feet) at property line when the water service pipe size is 50 mm (2 inches) or greater.

.2 The water service shall be center in the common trench with sanitary on the left side and storm sewer on right side, when viewed from main line to the property.

.3 Install each service as described in accordance with this section for each of the respective services.

.4 Separate services to be installed at quarter points on lot frontage for duplexes. On corner lots, duplexes shall be serviced separately on front and side of lot if possible.

.5 Where the sewer service (or services) are above the water service, lay the sewer services on a shelf of undisturbed ground of such width of ensure complete bedding, or lay water service at a specified depth then backfill and compact to required elevation to accommodate sewer service.

.6 If the bedding under a service is disturbed, replace and compact bedding as specified.

.7 Storm services shall be properly marked and sized to avoid cross connection with the sanitary sewer service.

# END OF SPECIFICATION

# SPECIFICATION 06800 – ADJUSTMENT OF APPURTENANCES

## 1 GENERAL

### 1.1 DESCRIPTION

This section refers to the adjustment of valves and manholes within the roadways to be paved.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 03140 – Asphalt Concrete

## 2 PRODUCTS

### 2.1 VALVE BOX RISERS

.1 Valve box extensions shall be 75, 100 or 150 mm cast iron conforming to ASTM A48 Class 25 and are to be completely coated with an asphaltic type varnish to prevent corrosion.

### 2.2 GAS VALVES

.1 Contact the gas utility for arranging adjustments to gas valves.

### 2.3 MANHOLE GRADE RINGS AND BLOCK

.1 Precast grade rings and blocks for manhole grade adjustment shall conform to ASTM C478 and C139, respectively.
.2 Infra-Riser Rubber adjustment rings.

### 2.4 MORTAR

.1 Mortar shall be Sulphate resistant ASTM Type 50 producing a minimum strength of 10 MPa.

## 3 EXECUTION

### 3.1 GENERAL

.1 For asphalt base course, adjustments to valves and manholes shall be made to the asphalt base course elevation.
.2 For asphalt surface course, adjustments to valves and manholes shall be made to the asphalt surface course elevation.
.3 Where top/final lift of asphalt is not placed in the same year as the base lift, manhole frames/covers and other surface appurtenances shall be set to the interim asphalt grade.
.4 Where top lift of asphalt is to be placed in the same year as the base lift, manhole frames/covers and other surface appurtenances shall be set to the final asphalt grade. Projecting manholes and valves shall be ramped at 1:40 prior to placing final asphalt lift.

.5 Final adjustments shall be made to the final Asphalt Surface Course elevation using adjustment rings only prior to the placement of the final asphalt lift.

3.2 VALVE BOXES

.1 The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be so made that the valves operate effectively.
.2 If the top box fails to move, risers can be used to bring it to grade.
.3 The Contractor shall replace any valve top box that becomes broken during adjustment at his expense.

3.3 MANHOLES

.1 Manholes shall be adjusted so that the cover conforms to the required elevation. All adjustments are to be made with grade rings firmly set in position. All bearing loads of the manhole frame to the manhole slab top shall be evenly distributed.
.2 Raise existing manholes frames and covers and catch basin frames and grates to final design elevation, using adjusting rings.
.3 If adjustment exceeds more than 0.3 m the adjustment shall be made using a new manhole barrel c/w ladder rung.
.4 The final 0.025 m shall be adjusted utilizing a composite rubber adjustment ring directly beneath the frame and cover assembly. Sloped composite rubber adjustment rings shall be used to match the roadway profile.
.5 Wood or metal shims shall not be used to level the adjustment rings or frames.
.6 Depth from top of manhole covers to first ladder rung shall not exceed 0.75 m. Install additional ladder rungs as necessary or as directed by the Engineer.

3.4 BACKFILL

.1 Should any backfill be required around the valve box or manhole below the elevation of the road base course surface, mortar or granular base shall be used and properly compacted in place.

# END OF SPECIFICATION

# SPECIFICATION 08050 – TEMPORARY FENCING

## 1 GENERAL

### 1.1 DESCRIPTION

This section specifies requirements for temporary security fencing around excavation areas, working areas, environmental reserve areas, and protected areas.

### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- Section 01223- Trenching

### 1.3 TEMPORARY FENCING

.1 Temporary fencing around excavations shall be polyethylene safety fence or approved alternate.
.2 Temporary fencing around environmental reserve and protected areas shall be polyethylene safety fence or approved alternate.

## 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Polyethylene Safety Fence

High density polyethylene fencing material with; 33mm x 33mm square or diamond shaped mesh, minimum height of 1200mm, orange color. Tensar Safety Grid-GS as manufactured by Nilex Inc. or approved alternate.

#### 2.1.2 Posts

.1 Studded Steel T-Posts - Minimum length – 900mm longer than the fabric width.
.2 Portable Posts - The Contractor shall submit details for approval.

#### 2.1.3 Gates

The Contractor shall submit details for approval for gates for access to working area.

## 3 EXECUTION

### 3.1 GRADING

Remove debris and grade between posts to provide ground clearance between 40mm and 100mm.

### 3.2 POST SPACING

Space T-posts at 3.0m centre to centre, if portable posts are used, reduce spacing to suit.

### 3.3 POST-SETTING – T-POSTS

.1 Drive T-posts into the ground, at specified spacing.

.2 Set posts in line and plumb so that the fence forms a straight line between corner posts.
.3 Install straining posts where required.

3.4 FABRIC INSTALLLATION

.1 Set braces for gates and corners.
.2 Install fabric in accordance with the manufacturer's instructions.
.3 Fasten fabric to posts and bracing wire with nylon ties.
.4 Stretch fabric and secure using steel bars in accordance with the manufacturer's instructions.

3.5 CLEAN-UP

Clean up debris and trim all areas disturbed.

# END OF SPECIFICATION

# SPECIFICATION 08100 – ROADWAY SIGNS

## 1 GENERAL

### 1.1 DESCRIPTION

.1 This section specifies the supply and installation of Regulatory Roadway Signs for the normal use of roadways.

### 1.2 DESIGN REQUIREMENTS

.1 Sign supports and appurtenances to be capable of withstanding summation of the following loads:

.1 Wind and ice loading specified to be consistent with anticipated loads in the City of North Battleford. Refer to the National Building Code of Canada and/or Provincial Building Code.

.2 Dead load of signboards, sign supports and appurtenances.

.3 Ice load on one face of signboards and around surface of all structural members and appurtenances.

.2 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), “Specification for the Design and Construction of Structural Supports for Highway Signs”.

### 1.3 SHOP DRAWINGS

.1 Submit shop drawings for signage structures indicating product data and design.

## 2 PRODUCTS

### 2.1 SIGN SUPPORTS

.1 Steel posts:

.1 To CAN-G40.21, (4) m long, flanged “U” shaped in cross section, measuring (65) mm wide by (30) mm deep.

.2 Metal thickness: (4.5) mm.

.3 Hot dipped galvanized: to CAN/CSA-G164.

.4 Standard tubular supports for small signs: to ASTM B210M.

.2 Base plates:

.1 To ASTM B209M.

.3 Fasteners:

.1 Bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

2.2 SIGN BOARDS

.1 Aluminum sheet to ASTM B209M, pre-cut to required dimensions. Minimum thickness shall be 1.6 mm for signboards up to 750 mm wide. Minimum thickness for signboards 750 3 1200 mm wide shall be 2.0 mm.

.2 Connecting straps and bracket to ASTM B209M.

.3 3M HI-Intensity Scotchlite or equal approved by the Engineer.

2.3 FABRICATION

.1 Signboards

.1 Aluminum blanks shall be degreased, etched and bonderized with chemical conversion coating. Clean surfaces with xylene thinner. Aluminum signboards shall be painted prior to installation. Spray and back face of signboards with two coats of enamel in accordance with CAN/CGSB-1.104.

## 3 EXECUTION

3.1 GENERAL

.1 The Engineer will provide plan layout information in the form of a base line for the installation of permanent signs. The Contractor shall establish the height and elevation of the sign and install it in accordance with the plans or as directed by the Engineer.

.2 The Contractor shall have all utilities located prior to digging holes for sign posts. Any adjustments to the location of the signs will be subject to the approval of the Engineer.

.3 Signs shall be mounted to the posts in accordance to Standard Drawing MW 200.

.4 The installed sign shall be clean and not bent or twisted. The reflectorized surface shall be free of scratches, dents and marks and must be securely fastened to the post.

.5 The disturbed area around all installations shall be restored to the original contours or as directed by the Engineer.

3.2 INSTALLATION OF BREAKAWAY STEEL POSTS

.1 Breakaway steel posts shall be installed to within 1.5 degrees of vertical and as indicated on the drawings.

.2 Breakaway steel posts are to be driven to the required depth without damage to the posts. If rock or concrete is encountered, auger the post holes to the required depth and backfill the post with material free of organics. All backfill shall be placed in 150 mm thick lifts and thoroughly compacted for the full depth.

.3 Damage to galvanized surfaces shall be repaired by treating the damaged areas with zinc rich paint conforming to MIL SPEC DOD-P-21035.

3.3 INSTALLATION OF WOODEN POSTS

.1 Wooded posts shall be installed to within 1.5 degrees of vertical and as indicated on the drawing.

.2 Wooden posts shall be set in augured holes to the required depth. The wooden post shall be backfilled with material free of organics. Backfill shall be placed in 150 mm thick lifts and thoroughly compacted for the full depth.

3.4 INSTALLATION OF CONCRETE BASES

.1 Concrete bases shall be installed as shown on the drawings. The Contractor shall excavate hole to a minimum of 300 mm larger than the base and the base shall be installed in the center of the excavation. The concrete base shall be backfilled with material free of organics. Backfill shall be placed in 150 mm thick lifts and thoroughly compacted for the full depth.

# END OF SPECIFICATION