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 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 400m^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 04050 - 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. Concrete must be removed. 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 60m^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 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