

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .4 ASTM D1557-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .5 ASTM D4318-17, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

Part 2 PRODUCTS

2.1 Materials

- .1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .3 Table

Sieve Designation	% Passing
100 mm	-
75 mm	-
50 mm	75-100
37.5 mm	-
25 mm	-
19 mm	-
15.9 mm	45-80
12.5 mm	-
9.5 mm	-
4.75 mm	25-55
2.00 mm	-
1.20 mm	12-35
0.425 mm	-
0.180 mm	-
0.075 mm	3-6
 - .4 Liquid Limit: to ASTM D4318, Maximum 25.

- .5 Plasticity Index: to ASTM D4318, Maximum 6.

Part 3 EXECUTION

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Department Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 98% corrected maximum dry density ASTM D698 ASTM D 1557.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-16, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-17, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.2 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials. Stockpile minimum 50% of total aggregate required prior to beginning operation.
- .2 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .1 Gradation to:

Sieve Designation	% Passing (Base Type 1)
100 mm	-

Sieve Designation	% Passing (Base Type 1)	
75 mm	-	
50 mm	-	
37.5 mm	-	
25 mm	-	
19 mm	100	
12.5 mm	-	
9.5 mm	55-80	
4.75 mm	35-60	
2.00 mm	-	
1.20 mm	17-35	
0.425 mm	-	
0.180 mm	-	
0.075 mm	3-6	
.2	Liquid limit: to ASTM D4318, maximum 25	
.3	Plasticity index: to ASTM D4318, maximum 6	
.4	Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45	
.5	Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.	
Passing		Retained on
50 mm	to	25 mm
25 mm	to	19.0 mm
19.0 mm	to	4.75 mm
.6	Soaked CBR: to ASTM D1883, min 100, when compacted to 100% of ASTM D1557.	

Part 3 EXECUTION

3.1 PLACEMENT AND INSTALLATION

- .1 Place granular base after granular sub-base surface is inspected and approved by Departmental Representative.
- .2 Placing
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment

- .1 Compaction equipment to be capable of obtaining required material densities.
- .4 Compacting
 - .1 Compact to density not less than 100% corrected maximum dry density ASTM D698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-14, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .5 ASTM C128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .9 ASTM D977-17, Standard Specification for Emulsified Asphalt.
 - .10 ASTM D995-09, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .11 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .12 ASTM D3203-17, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .13 ASTM D4318-17e1, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .14 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1993 Sixth Edition-94, Mix Design Methods for Asphalt Concrete.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-16.1, Cutback Asphalts for Road Purposes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:

- .1 Submit asphalt concrete mix design to Departmental Representative for approval.
- .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Test and Evaluation Reports:
 - .1 Materials to be tested by testing laboratory approved by Departmental Representative.
 - .2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

Part 2 Products

2.1 MATERIALS

- .1 Granular base and sub-base material: to Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .3 Table

Sieve Designation	Granular Base	Granular Sub-Base
200 mm	-	-
75 mm	-	-
50 mm	-	75-100
38.1 mm	-	-
25 mm	-	-
19 mm	100	-
15.9 mm	-	45-80
9.5 mm	55-80	-
4.75 mm	35-60	25-55
2.00 mm	-	-
1.20 mm	17-35	12-35
0.180 mm	-	-
0.075 mm	3-6	3-6
 - .4 Granular base aggregates:
 - .1 Crushed particles: at least 50 % of particles by mass retained on 4.75 mm sieve to have at least 1 freshly fractured face.
- .2 Asphalt concrete aggregates:
 - .1 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C117.
 - .2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.
 - .3 Separate stock piles for coarse and fine aggregate are not required for sheet asphalt.
 - .4 Do not use aggregates having known polishing characteristics in mixes for surface courses.

- .5 Aggregate: material to Section 31 05 16 - Aggregate Materials and following requirements:
- .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117, latest edition. Sieve sizes to CAN/CGSB-8.1 latest edition.
 - .3 Table

Sieve Designation	Asphalt Concrete
19.0 mm	100
9.5 mm	60-80
4.75 mm	40-65
2.00 mm	30-50
0.425 mm	15-30
0.180 mm	5-20
0.075 mm	3-8

- .4 Sand equivalent: to ASTM D2419, Minimum 50.
 - .5 Magnesium Sulphate soundness: to ASTM C88. Max % loss by weight: coarse aggregate 12, fine aggregate 16.
 - .6 Los Angeles Degradation: to ASTM C131. Max % loss by weight: coarse aggregate, 35.
 - .7 Absorption: to ASTM C127. Max % by weight: coarse aggregate, 1.75.
 - .8 Lightweight particles: to ASTM C123. Max % by mass, with less than 1.95. Relative density (formally Specific Gravity): 1.5.
 - .9 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max % by weight: coarse aggregate, 15.
 - .10 Crushed particles: at least 60 % of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.
 - .11 Table
- | Passing | | Retained on |
|---------|----|-------------|
| 19 mm | to | 9.5 mm |
| 9.5 mm | to | 4.75 mm |
- .12 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

- .3 Mineral filler for asphalt concrete:
- .1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
 - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.
- .4 Asphalt cement: to AASHTO M320.
- .5 Asphalt prime: to ASTM D997.
- .6 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

- .7 Asphalt tack coat: to ASTM D997.

2.2 EQUIPMENT

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveways:
- .1 Minimum drum diameter: 750 mm.
- .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
- .1 Boxes with tight metal bottoms.
- .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .5 Suitable hand tools.

2.3 MIX DESIGN

- .1 Job mix formula to be approved by Departmental Representative
- .2 Design of mix: by Marshall method to requirements below:
- .1 Compaction blows on each face of test specimens: 50
- .2 Mix physical requirements
- | Property | Asphalt / Concrete |
|--|--------------------|
| Marshall Stability at 60° kN minimum | 5.5 |
| Flow Value, mm | 2 – 4 |
| Air Voids in mixture, % | 3 – 5 |
| Voids in mineral aggregate, % minimum | 15 |
| Index of Retained Stability, % minimum | 75 |
- .3 Measure physical requirements as follows:
- .1 Marshall load and flow value.
- .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127, and ASTM C128. Make allowances for volume of asphalt absorbed into pores of aggregate.
- .3 Air voids to ASTM D3203.
- .4 Voids in mineral aggregate: to Asphalt Institute, MS-2 chapter 4.
- .5 Index of Retained Stability.

- .4 Do not change job mix without prior approval of Departmental Representative. When change in material source proposed, new job mix formula to be approved by Departmental Representative.
- .5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.

Part 3 Execution

3.1 SUBGRADE AND SURFACE PREPARATION AND INSPECTION

- .1 Verify grades of subgrade drains and other items set in paving area for conformity with elevations and sections before placing granular base material.
- .2 Obtain approval of subgrade by Departmental Representative before placing granular base.

3.2 GRANULAR SUB-BASE AND GRANULAR BASE

- .1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.
- .2 Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 98% maximum dry density in accordance with ASTM D698.
- .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

3.3 ASPHALT PRIME

- .1 Emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.
 - .2 Apply diluted asphalt emulsion at rate directed by Departmental Representative but do not exceed 5 L/m².
 - .3 Apply on damp surface unless otherwise directed by Departmental Representative.
- .2 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within 2 hours.
- .3 If asphalt prime fails to set within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

3.4 PLANT AND MIXING REQUIREMENTS

- .1 In accordance with ASTM D995.

3.5 ASPHALT CONCRETE PAVING

- .1 Obtain approval of primer from Departmental Representative before placing asphalt mix.

- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees C.
- .3 Place asphalt concrete in compacted layers not exceeding 50 mm.
- .4 Minimum 135 degrees C mix temperature required when spreading.
- .5 Maximum 160 degrees C mix temperature permitted at any time.
- .6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .7 Compact parking lot and driveway asphalt concrete to density not less than 95 % of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated.
- .8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .9 Moisten roller wheels with water to prevent pick up of material.
- .10 Compact mix with hot tampers or other equipment approved by Departmental Representative, in areas inaccessible to roller.
- .11 Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.
- .12 Repair areas showing checking, rippling or segregation as directed by Departmental Representative.

3.6 JOINTS

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

3.7 TESTING

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory in accordance with Section 01 45 00 - Quality Control.
- .2 Costs of first test will be paid by Departmental Representative. Any costs associated with additional testing required due to test failure is the responsibility of the contractor.

3.8 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C. Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.2, Boiled Linseed Oil.
 - .2 CAN/CGSB-3.3, Kerosene.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).

1.2 TESTING

- .1 Testing of concrete to CAN3-A23.1 and requirements of Section 03 30 00 – Cast-in-Place Concrete.

1.3 ENVIRONMENTAL CONDITIONS

- .1 If temperature is below 5°C or if Departmental Representative (DR) anticipates a temperature drop below this value within the next 24 hours, take all necessary measures to protect concrete from freezing.
- .2 Do not place concrete on frozen base.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and materials: to Section 03 30 00 - Cast-in-Place Concrete
- .2 Reinforcing steel: to Section 03 20 00 - Concrete Reinforcing.
- .3 Joint filler to Section 03 30 00 - Cast-in-Place Concrete, 20 mm performed, non-extruding, resilient bituminous type.
- .4 Granular base: to Section 32 11 23 – Aggregate Base Courses and to Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
- .6 Fill material: to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

- .7 Clear, polyethylene film to ASTM C171, minimum thickness 0.10 mm.

PART 3 EXECUTION

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials. Dispose of surplus and unsuitable excavated material off site.
- .3 Place fill in maximum 150 mm layers and compact to at least 95% of maximum density to ASTM D698.
- .4 Ensure that Sub Grade, Granular Sub Base and Granular Base preparation has been inspected and approved by Departmental Representative (DR) before commencing work.

3.2 GRANULAR SUB BASE

- .1 Obtain Departmental Representative (DR)'s approval of subgrade before placing granular sub base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular sub base to at least 100% of maximum dry density to ASTM D698.

3.3 FORMING

- .1 Form vertical surfaces to full depth using forming material that will not deform under loading by plastic concrete.
- .2 Securely position forms to required lines and grades.
- .3 Coat forms with form release agent.
- .4 Obtain approval of forms before placing concrete.
- .5 Install metal fabrication as required.

3.4 CONCRETE

- .1 Obtain Departmental Representative (DR) approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Finish exposed surface to a smooth, uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to the surface that required. Do not use neat cement as a dryer to facilitate finishing.

- .4 Wood float finish surface to provide no-skid texture.
- .5 Immediately after floating, give sidewalk surface uniform finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .6 Provide edging as indicated with 10 mm radius edging tool.
- .7 Cure and protect concrete in accordance with CAN3-A23.1.

3.5 TOLERANCES

- .1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.6 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
- .2 Install expansion joints at intervals of 6 m.
- .3 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .4 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- .5 Install joint filler in expansion joints as indicated.

3.7 ISOLATION JOINTS

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints as indicated.

3.8 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1, to exposed finished surfaces for at least 1 day after placing.
- .2 Where polyethylene sheets are used for moist curing, place polyethylene over sufficiently hardened concrete to prevent drainage. Overlap adjacent edges 150 mm and tightly seal with sand or wood planks. Weigh sheets down to maintain close contact with concrete during the entire curing period.
- .3 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.

3.9 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material approved by Departmental Representative (DR). Compact and shape to required contours as indicated or as directed by Departmental Representative (DR).

END OF SECTION

Part 1 GENERAL

1.1 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics, criteria and physical requirements.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
- .3 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .2 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 TOPSOIL

- .1 Topsoil for seeded areas: mixture of mineral particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20% to 70% sand, minimum 7% clay, and contain 2% to 10% organic matter by weight.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

- .1 Fertilizer:
 - .1 Fertility: major soil nutrients present in following amounts:
 - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
 - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
 - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .6 Ph value: 6.5 to 8.0.

- .2 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .5 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

- .1 Advise Departmental Representative of sources of topsoil to be utilized seven (7) working days in advance of starting time.
- .2 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.

Part 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Commence topsoil stripping of areas as indicated after area has been cleared of brush weeds and grasses and removed from site.
- .3 Strip topsoil to depths as indicated Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .4 Stockpile in locations as directed by Departmental Representative Stockpile height not to exceed 2 m.
- .5 Disposal of unused topsoil is to be as directed by Departmental Representative.
- .6 Protect stockpiles from contamination and compaction.

3.2 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 75 mm above surface.
 - .3 Dispose of removed material off site.
- .4 Course cultivate entire area which is to receive topsoil to minimum depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 For sodded areas keep topsoil 50/100 mm below finished grade.
- .4 Spread topsoil as indicated to following minimum depths after settlement and 80% compaction.
 - .1 150 mm for seeded areas.
 - .2 135 mm for sodded areas.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative. Leave surfaces smooth, uniform and firm against deep footprinting.

3.5 ACCEPTANCE

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading. Approval of topsoil material subject to soil testing and analysis.
- .2 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative. Soil sampling, testing and analysis to be in accordance with provincial regulations and standards. Departmental Representative will pay for costs of tests as specified in Section 01 45 00 – Quality Control

3.6 RESTORATION OF STOCKPILE SITES

- .1 Restore stockpile sites acceptable to Departmental Representative

3.7 SURPLUS MATERIAL

- .1 Dispose of materials not required where directed by Departmental Representative.

3.8 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit:
 - .1 Sod for each type specified.
 - .1 Install approved samples in one square metre mock-ups and maintain in accordance with maintenance requirements during establishment period.
 - .2 Bio-degradable geotextile fabric.
 - .2 Obtain approval of samples by Departmental Representative.

1.2 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.3 SCHEDULING

- .1 Schedule sod installation when frost has left ground and before June 15 or between August 15 and September 30.
- .2 Schedule sod laying to coincide with preparation of soil surface.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Number one Named Cultivars: Nursery Sod grown from certified seed.
 - .2 Turf Grass Nursery Sod Quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.

- .2 Commercial Grade Turf Grass Nursery: Sod that has not been grown as Turfgrass Nursery Sod crop.
 - .1 Mow sod at height directed by Departmental Representative within 36 hours prior to lifting, and remove clippings.
- .3 Sod establishment support:
 - .1 Geotextile fabric: biodegradable, 25 mm square mesh.
 - .2 Wooden pegs: 17 x 8 x 250 mm.
- .4 Water:
 - .1 Supplied by Departmental Representative at designated source.
 - .2 Potable, free of impurities.
- .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turfgrass Nursery Sod, and plus or minus 15 mm for commercial grade turfgrass nursery, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Departmental Representative.
- .5 Cultivate fine grade approved by Departmental Representative to 25mm depth immediately prior to sodding.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted.
- .2 Lay sod sections in rows, longitudinally, along contours of slopes, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Lay sod sections longitudinally, along contours of slopes as indicated.
- .4 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catchbasins and within 1 m of drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 9 pegs per square metre.
 - .3 Not less than 12 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods to following program agreed to by Departmental Representative.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings as directed by Departmental Representative.
- .4 Maintain sodded areas weed free.
- .5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.6 ACCEPTANCE

- .1 Turfgrass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots, and without weeds.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum 2 times, and within 24 h prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.
- .2 Sodded Commercial Grade Turfgrass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Extent of surface soil visible when grass has been cut to height of 60 mm is acceptable.
 - .3 Sod is free of bare or dead spots and extent of weeds.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.
- .3 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.
- .4 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

3.7 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Water sodded Turfgrass Nursery Sod and Commercial Grade Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
 - .2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.
 - .3 Cut grass and remove clippings as directed by Departmental Representative.
 - .1 Turf Grass Nursery Sod:
 - .1 50 mm during normal growing conditions.
 - .2 Commercial Grade Turfgrass Nursery Sod:
 - .1 60 mm during normal growing conditions.
 - .3 Cut grass as directed by Departmental Representative but at intervals so that approximately one third of growth is removed in single cut.

- .4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- .5 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

3.8 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION