

Part 1 General

1.1 REFERENCE STANDARDS

- .1 All Code and Standard references refer to current updates, revisions, and adjustments in effect as of date of contract.
- .2 Withdrawn or obsolete Standards may still apply unless it has been replaced with a different Standard, in which case the new Standard shall apply. Report any withdrawn Standards to the Departmental Representative for instruction.
- .3 Perform work in accordance with the following Standards, except where specified otherwise.
 - .1 ASTM International
 - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .6 ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
 - .3 United States Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01 - Submittal Procedures.

- .2 Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Division 01 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials in accordance with erosion and sedimentation control plan.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with *Section 31 05 16 - Aggregate for Earthwork* 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-8.2, CAN/CGSB-8.1.

- .3 Table

Sieve Designation Micro-millimetres	% Passing	
	3-63 Granular Base	3-80 Granular Sub-base
80 000	-	100
63 000	100-	-
25 000	55-75	46-85
20 000	50-70	40-81
16 000	44-65	32-76
12 500	38-60	30-70
10 000	-	-
8 000	-	-
6 300	23-47	-
5 000	20-45	25-50
2 500	-	-
2 000	14-38	19-42
1 250	12-34	15-38
630	10-28	10-32
400	8-24	7-27
315	7-22	6-24
160	4-17	3-18
80	0-10	0-10

- .4 Other properties as follows:
 - .1 Liquid Limit: to ASTM D4318, Maximum 25.
 - .2 Plasticity Index: to ASTM D4318, Maximum 6.
 - .3 Los Angeles degradation: to ASTM C131.
 - .1 Maximum loss by mass: 40%.

- .4 Particles smaller than 0.02 mm: to ASTM D422, Maximum 3%.
- .5 Soaked CBR: to ASTM D1883, Minimum 40 when compacted to 100% of ASTM D1557.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 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 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.

- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace portion of layer in which material has become segregated during spreading.

3.4 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
- .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compact to density of not less than 98% maximum dry density in accordance with ASTM D1557, ASTM D698.
- .5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .6 Apply water as necessary during compaction to obtain specified density.
- .7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 PROOF ROLLING

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated.
 - .1 If non-standard proof rolling equipment is approved, Departmental Representative will determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with sub-base material and compact in accordance with this section.
 - .3 Replace sub-base material and compact.
- .6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 SITE TOLERANCES

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

3.8 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 All Code and Standard references refer to current updates, revisions, and adjustments in effect as of date of contract.
- .2 Withdrawn or obsolete Standards may still apply unless it has been replaced with a different Standard, in which case the new Standard shall apply. Report any withdrawn Standards to the Departmental Representative for instruction.
- .3 Perform work in accordance with the following Standards, except where specified otherwise.
 - .1 ASTM International
 - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
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 - .6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
 - .3 United States Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01 - Submittal Procedures.
- .2 Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 01 - Common Product Requirements and *Section 31 05 16 - Aggregate for Earthwork*.
- .2 Storage and Handling Requirements:
 - .1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
 - .2 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Granular base: material in accordance with *Section 31 05 16 – Aggregates for Earthwork* and following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136, ASTM C117. Sieve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.

- .1 Gradation Method #1 to:

Sieve Designation Micro-millimetres	% Passing		
	3-40 Granular Base	3-25 Granular Base	3-20 Granular Base
80 000	-	-	-
63 000	100	-	-
25 000	70-94	100	-
20 000	60-90	82-97	100
16 000	55-85	70-93	84-95
12 500	50-80	60-86	60-90
10 000	44-74	52-79	50-84
8 000	-	-	-
6 300	-	-	-
5 000	32-62	35-64	37-62
2 500	-	--	-
2 000	20-50	24-50	26-50
1 250	17-43	19-43	19-43
630	12-34	14-34	14-34
400	10-28	10-27	11-28
315	8-25	9-24	10-25
160	5-18	6-18	6-18
80	0-10	2-10	2-10

- .2 Gradation Method #2 to: percentage finer than 0.075 mm not to exceed 10%.
- .3 Material to level surface depressions to meet gradation (2) limits in accordance with Method #1.
- .4 Liquid limit: to ASTM D4318, maximum 25
- .5 Plasticity index: to ASTM D4318, maximum 6.

- .6 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 2 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

- .7 Soaked CBR: to ASTM D1883, minimum 80, when compacted to 100% of ASTM D1557.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after sub-base and subgrade surface is inspected and approved in writing 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.
 - .1 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 Ensure compaction equipment is capable of obtaining required material densities.

- .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
- .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compacting:
 - .1 Compact to density not less than 100% Standard Proctor maximum dry density to ASTM D698, ASTM D1557.
 - .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 in writing by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling:
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated.
 - .1 If use of non-standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with sub-base material and compact in accordance with *Section 32 11 16.01 - Granular Sub-Base*.
 - .3 Replace sub-base material and compact in accordance with *Section 32 11 16.01 - Granular Sub-base*.
 - .4 Replace base material and compact in accordance with this Section.
 - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with *Section 32 11 16.01 - Granular Sub-base* and this section at no extra cost.

3.3 SITE TOLERANCES

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

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Division 01 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 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

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- .3 Perform work in accordance with the following Standards, except where specified otherwise.
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 - .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM C 309, Liquid Membrane Forming Compounds for Curing Concrete.
 - .4 ASTM D1751, Standard Specification For Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .5 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
 - .2 CSA Group
 - .1 CSA-A23.1 /A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete, Including Update No. 1 2015.
 - .2 CSA B651 Accessible Design for the Built Environment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Division 01 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, and limitations.
- .3 Inform Departmental Representative of proposed source of materials and provide access for sampling minimum 4 weeks prior to commencing work.
- .4 If materials have been tested by accredited testing laboratory testing laboratory approved by Departmental Representative within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Division 01 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Division 03 - Cast-in-Place Concrete.
- .2 Reinforcing steel: in accordance with Division 03 - Concrete Reinforcing.
- .3 Joint filler, Curing Compound: in accordance with Division 03 - Cast-in-Place Concrete.
- .4 Granular base: material to *Section 31 05 16 – Aggregates for Earthwork* following requirements:
 - .1 Type 2 fill.
 - .2 Crushed stone or gravel.
 - .3 Gradations: within limits specified when tested to ASTM C136, ASTM C117.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds reacting with free lime to provide water-soluble soap.
- .6 Fill material: to *Section 31 05 16 – Aggregates for Earthwork* following requirements:
 - .1 Type 2 fill.
 - .2 Crushed stone or gravel.
 - .3 Gradations: within limits specified when tested to ASTM C136, ASTM C117. Sieve sizes to CAN/CGSB-8.1.
- .7 Curing Agent: to ASTM C309, Type 1.
- .8 Expansion Joint Filler: Premoulded bituminous fibre board, conforming to ASTM D1751.

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.
 - .1 Dispose of surplus and unsuitable excavated material off site.
- .3 Place fill in maximum 150 mm layers and compact to minimum 98% of maximum dry density to ASTM D698.

3.2 GRANULAR BASE

- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to minimum 98% of maximum density to ASTM D698.

3.3 CONCRETE

- .1 Obtain Departmental Representative approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Division 03 - Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom side to side across sidewalk.
- .4 Provide edging as indicated with 10 mm radius edging tool.
- .5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.

3.4 TOLERANCES

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

3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete stiff, but still plastic, at intervals of 3 metres.
- .2 Install expansion joints as directed by Departmental Representative.
- .3 When sidewalk adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.6 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 in accordance with Division 03 - Cast-in-Place Concrete.
- .3 Seal isolation joints with sealant approved by Departmental Representative.

3.7 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for minimum 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.

- .2 Where burlap used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.8 BACKFILL

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

3.9 CLEANING

- .1 Proceed in accordance with Division 01 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION