

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- .2 Withdrawn or obsolete Standards may still apply unless it has been replaced with a different Standard, in which case the new Standard shall apply. Report any withdrawn Standards to the Departmental Representative for instruction.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).
 - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .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

- .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 C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .9 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .11 ASTM D1559, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
 - .12 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .13 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .14 ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .15 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

- .2 Asphalt Institute (AI)
 - .1 AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 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.
- .4 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 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt paving mix, aggregate, and coatings and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit asphalt concrete mix design for review and 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 of following materials proposed for use at least 4 weeks prior to commencing work:
 - .1 One 5 L container of asphalt cement.
- .4 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.
- .5 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.
- .2 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect aggregate from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base, base material: to *Section 31 05 16 - Aggregates for Earthwork* 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, CAN/CGSB-8.2.
 .3 Table:

Sieve Designation Micro-millimetres	% Passing			
	3-40 Base	Granular	3-20 Base	Granular Sub-base
80 000	-	-	-	100
63 000	100	-	-	-
25 000	70-94	-	-	46-85
20 000	60-90	100	-	40-81
16 000	55-85	84-95	-	32-76
12 500	50-80	60-90	-	30-70
10 000	44-74	50-84	-	-
8 000	-	-	-	-
6 300	-	-	-	-
5 000	32-62	37-62	-	25-50
2 500	-	-	-	-
2 000	20-50	26-50	-	19-42
1 250	17-43	19-43	-	15-38
630	12-34	14-34	-	10-32
400	10-28	11-28	-	7-27
315	8-25	10-25	-	6-24
160	5-18	6-18	-	3-18
80	0-10	2-10	-	0-10

- .4 Granular base aggregates:
- .1 Crushed particles: at least 60% of particles by mass retained on 4.75 mm sieve to have at least 2 freshly fractured face.
 .2 Liquid limit: to ASTM D4318, maximum 25.
 .3 Plasticity index: to ASTM D4318, maximum 6.
- .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. Sieve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.
 - .3 Design: City of Edmonton "10mm - HT"
Parameter Specification
Asphalt Content (%total mix): –
Design Bulk Specific Gravity (kg/m³) 2361 –
Air Voids (%): 3.6 – 4.4
Voids in Mineral Aggregate (VMA) (%): 13 min
Voids Filled (%): 70 - 80
Asphalt Film Thickness (µm): 7.5 min
Bailey CA-CUW: 60 - 80 (fine grained mix)
Density at Nmax (Gmm%): 98 max
Tensile Strength Ratio (%): 80 min
APA (mm, 520C, 8,000 cycles): 5.0 max
 - .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 2 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 City of Edmonton 10 mm HT, 5%
- .5 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

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 Mix design to City of Edmonton 10 mm HT.
- .2 Job mix formula to be approved by Departmental Representative.
- .3 Design of mix: by Marshall method to requirements below:
 - .1 Compaction blows on each face of test specimens: 50.
 - .2 Mix physical requirements:
 - Design: City of Edmonton "10mm - HT"
 - Parameter Specification
 - Asphalt Content (%total mix):—
 - Design Bulk Specific Gravity (kg/m³) 2361: —
 - Air Voids (%): 3.6 – 4.4
 - Voids in Mineral Aggregate (VMA) (%): 13 min
 - Voids Filled (%): 70 - 80
 - Asphalt Film Thickness (µm): 7.5 min
 - Bailey CA-CUW: 60 - 80 (fine grained mix)
 - Density at Nmax (Gmm%): 98 max
 - Tensile Strength Ratio (%): 80 min
 - APA (mm, 520C, 8,000 cycles): 5.0 max
 - .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM D1559.

- .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C128, ASTM C127. Make allowance for volume of asphalt absorbed into pores of aggregate.
- .3 Air voids: to ASTM D3203.
- .4 Voids in mineral aggregate: to AI MS-2, chapter 4.
- .4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be reviewed and approved by Departmental Representative.
- .5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving 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 (SUBGRADE) (SURFACE) PREPARATION AND INSPECTION

- .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 [requirements of authorities having jurisdiction] [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.
- .2 Verify grades of subgrade drains and other items set in paving area for conformity with elevations and sections before placing granular sub-base, base material.
- .3 Obtain written approval of subgrade by Departmental Representative before placing granular base, sub-base.

3.3 GRANULAR SUB-BASE AND GRANULAR BASE

- .1 Place granular sub-base, base material on clean unfrozen surface, free from snow and ice.

- .2 Place granular sub-base, 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, ASTM D1557.
- .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

3.4 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 in writing 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 directed by Departmental Representative.
- .2 Do not apply primer when air temperature is below 5°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.

3.5 PLANT AND MIXING REQUIREMENTS

- .1 In accordance with ASTM D995.

3.6 ASPHALT PAVING

- .1 Obtain written approval of base, tack coat, 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°C.
- .3 Place asphalt concrete in one lift compacted layers not exceeding 50 mm.
- .4 Minimum 135°C mix temperature required when spreading.
- .5 Maximum 160°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 to density not less than 97% 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 in writing 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 metres.
- .12 Repair areas showing checking, rippling or segregation as directed by Departmental Representative.

3.7 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 50 mm.

3.8 PROTECTIVE COATING

- .1 Apply 2 coats of protective coating to completed paved areas and asphalt curbs in accordance with manufacturer's instructions.

3.9 TESTING

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory in accordance with Division 01 - Quality Control.

3.10 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 recycling and reuse in accordance with Division 01 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 PROTECTION

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

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 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.

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- .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