
Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 19 - Granular Sub-base.
- .2 Section 32 11 23 – Aggregate Base Course

1.2 MEASUREMENT PROCEDURES

- .1 Payment for testing to be included in the tendered price of the work to which it is incorporated and accepted by Engineer.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .2 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m³).
 - .4 ASTM D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8., Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.
- .3 All references to be latest revision.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Granular base material: to Section 32 11 23 - Aggregate Base Course and following requirements:
 - .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material and other deleterious materials.
 - .2 Gradation to: NSTIR type 1
 - .3 Other properties as follows:
 - .1 Liquid limit: ASTM D4318, maximum 25.
 - .2 Plasticity index: ASTM D4318, maximum 6.

- .3 Crushed particles: at least 50 % of particles by mass within 19.0 mm to 4.75 mm sieve designation range to have at least 1 freshly fractured face. Material divided into ranges using methods of ASTM C136.

Part 3 Execution

3.1 SEQUENCE OF OPERATION

- .1 Scarifying and reshaping:
 - .1 Scarify roadbed to width as indicated unless directed otherwise by Engineer and to minimum depth of 100 mm.
 - .2 Pulverize and break down scarified material to 25 mm maximum particle size.
 - .3 Blade and trim pulverized material to elevation and cross section dimensions as indicated unless directed otherwise by Engineer.
 - .4 Where deficiency of material exists, add and blend in new granular base material as directed by Departmental Representative.
- .2 Compaction equipment:
 - .1 Compaction equipment capable of obtaining required material densities.
- .3 Compacting:
 - .1 Compact to density minimum 100 corrected maximum dry density.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compaction to obtain specified density.
 - .4 Use mechanical tampers, approved by Engineer to compact areas not accessible to rolling equipment to specified density.
- .4 Repair of soft areas:
 - .1 Correct soft areas by removing defective material to depth and extent directed by Engineer. Replace with material acceptable Engineer and compact to specified density.
 - .2 Maintain reshaped surface in condition conforming to this section until succeeding material is applied or until acceptance by Engineer.

3.2 SITE TOLERANCES

- .1 Reshaped compacted surface within plus or minus 10 mm of elevation as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 16 - Aggregate Materials
- .2 Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .3 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 All references to be latest revision.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials.
- .2 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

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 and CAN/CGSB-8.2.

- .3 Gradation: NSTIR Type 1.

Part 3 Execution

3.1 SEQUENCE OF OPERATION

- .1 Place granular base after sub-base surface is inspected and approved by Engineer.
- .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 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .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 200 mm compacted thickness. Engineer 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 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 maximum dry density in accordance with 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 Engineer.
 - .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 Engineer.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 - Aggregate Materials
- .2 Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
- .3 Section 32 11 19 - Granular Sub-base.
- .4 Section 32 11 223 -Aggregate Base Course

1.2 MEASUREMENT AND PAYMENT

- .1 Asphalt concrete pavement including granular [base] [sub-base] will be measured in square metres of asphalt surface in place.

1.3 REFERENCES

- .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 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations .
- .4 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.
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/5, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - 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 and trial mix test results for review.
 - .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 if requested:
 - .1 One- 5 L container of asphalt cement.
- .4 Test and Evaluation Reports:
 - .1 Materials to be tested, if requested, by accredited testing laboratory approved by Departmental Representative.
 - .2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

- .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.
- .3 Packaging Waste Management: remove for as specified in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

Part 2 Products

2.1 MATERIALS

- .1 Granular base, sub-base material: to Section 31 05 16 - Aggregate Materials.
- .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 Table:

Sieve Designation	% Passing	
Asphalt Concrete	Sheet Asphalt	
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	-	-
19.0 mm	[100]	-
12.5	-	[100]
9.5 mm	[60-80]	[100]
4.75 mm	[40-65]	[85-100]
2.00 mm	[30-50]	[80-95]
0.425 mm	[15-30]	[40-70]
0.180 mm	[5-20]	[10-35]
0.075 mm	[3-8]	[4-14]

- .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 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.

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 NSTIR C-HF.
- .2 Design of mix: by Marshall method to requirements below:
 - .1 Compaction blows on each face of test specimens: 75.
 - .2 Mix physical requirements:

Property	Concrete
Marshall Stability at 60 degrees C, kN minimum.	7.5
Flow Value, mm.	2-4
Air Voids in Mixture, %	3-5
Voids in Mineral Aggregate, % minimum	65-78

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM 6927.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM d4469, ASTM D2041. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D2041.
- .4 Do not change job-mix without prior approval of 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 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.

- .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 material.
- .3 Obtain written approval of subgrade by Departmental Representative before placing granular sub-base.

3.3 GRANULAR 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 200 mm compacted thickness. Compact to density not less than 98 % maximum dry density in accordance with 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 Cutback asphalt:
 - .1 Apply cutback asphalt prime to granular base, at rate directed by Departmental Representative, but do not exceed 2.2 L/m².
 - .2 Apply on dry surface, unless otherwise directed by Departmental Representative.
- .2 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.
- .3 Do not apply primer when air temperature is below 5 degrees C or when rain is forecast within 2 hours.
- .4 If asphalt prime fails to cure 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 CONCRETE PAVING

- .1 Obtain written 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 in writing by Departmental Representative.
- .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

3.7 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 minimum 25 mm.

3.8 TESTING

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory approved by the Department representative.
- .2 Costs of tests will be paid under unit pricing for site paving .

3.9 CLEANING

- .1 Leave Work area clean at end of each day.

- .2 Waste Management: separate waste materials for [reuse] [recycling] in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees 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