

PART 1 - GENERAL

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| 1.1 | <u>Related Sections</u> | .1 | Refer to other specification sections for related information. |
| 1.2 | <u>Reference Standards</u> | .1 | ASTM D698 (or latest edition) Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lb/ft) – Method C. |
| 1.3 | <u>Measurement for Payment</u> | .1 | Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement. |

PART 2 - PRODUCTS

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|------------------------|--------------------------|----|---|------------------------|--------------------------|-------|-----|-------|-------|------|-------|----------|------|
| 2.1 | <u>Materials</u> | .1 | Granular Sub-base material to Section 31 05 17 and the following requirements:
.1 Crushed stone or gravel consisting of hard durable angular particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials. | | | | | | | | | | |
| | | .2 | Type 2 (previously Class “C”) granular material gradation will be within the following limits:
<table border="0" style="margin-left: 40px;"><tr><td style="text-align: center;"><u>ASTM Sieve Size</u></td><td style="text-align: center;"><u>% Passing by Mass</u></td></tr><tr><td style="text-align: center;">56 mm</td><td style="text-align: center;">100</td></tr><tr><td style="text-align: center;">28 mm</td><td style="text-align: center;">60-80</td></tr><tr><td style="text-align: center;">5 mm</td><td style="text-align: center;">25-45</td></tr><tr><td style="text-align: center;">0.160 mm</td><td style="text-align: center;">0-10</td></tr></table> | <u>ASTM Sieve Size</u> | <u>% Passing by Mass</u> | 56 mm | 100 | 28 mm | 60-80 | 5 mm | 25-45 | 0.160 mm | 0-10 |
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| 56 mm | 100 | | | | | | | | | | | | |
| 28 mm | 60-80 | | | | | | | | | | | | |
| 5 mm | 25-45 | | | | | | | | | | | | |
| 0.160 mm | 0-10 | | | | | | | | | | | | |
| | | .3 | Backfill material shall be material removed during demolition and removal operations provided the material is sorted such that it is free of dredge spoils, timber debris or concrete pieces greater than 300 mm diameter and is approved by the Departmental Representative. | | | | | | | | | | |

- .4 The use of additional backfill material other than the material on site is subject to the approval of the Departmental Representative and is to be free from rocks larger than 150 mm cinders, ashes, sods, refuse, or other deleterious materials.

PART 3 - EXECUTION

- 3.1 Inspection of Existing Sub-Base Surface
 - .1 Do not place new granular sub-base until underlying backfill material is compacted, inspected and approved by the Departmental Representative.
- 3.2 Placing
 - .1 Place material only on a clean unfrozen surface, properly shaped and compacted, inspected and approved by the Departmental Representative.
 - .2 Place Type 2 (Class "C") and backfill material to full width in uniform layers not exceeding 100mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .3 Shape each layer to a smooth contour and compact to specified density before the succeeding layer is placed.
 - .4 Remove and replace portion of a layer in which material has become segregated during spreading.
- 3.3 Compacting
 - .1 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698.
 - .2 Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-base.
 - .3 Apply water as necessary during compaction to obtain specified density. If sub-base is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
 - .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 Finish Tolerances

- .1 Granular sub-base compacted thicknesses will be as follows:
 - .1 Type 2 (Class "C") 200 mm fill in correct thickness in 3.4.1 and delete this line.
- .2 Backfill material will be compacted to the thickness as required to attain the grades indicated on the drawings.
- .3 Finish compacted surface to within plus or minus 25 mm of established grade, but not uniformly high or low.
- .4 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Maintenance

- .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.
- .2 Departmental Representative will pay costs for inspection and testing. Refer to Section 01 45 00.

-- END OF SECTION --

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Refer to other specification sections for related information.
 - .2 Refer to Section 01 33 00 for Shop Drawings/ Submission Requirements.
- 1.2 Submissions
- .1 Product Data/Samples:
 - .1 Provide samples of materials proposed for the work.
 - .2 Methodology:
 - .1 Provide methodology for carrying out the work.
- 1.3 Measurement for Payment
- .1 Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Granular Base: Material to Section 31 05 17 and the following requirements:
 - .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .2 Type 1 (previously Class 'A') granular fill gradation will be within the following limits:

<u>ASTM Sieve Size</u>	<u>% Passing by Mass</u>
20 mm	100
14 mm	50-85
5 mm	20-50
0.16 mm	0-10
0.080 mm	0-7

PART 3 - EXECUTION

3.1 Placement

- .1 Do not place clear stone material until rock fill area has been accepted by Departmental Representative.
- .2 Place clear stone material to avoid segregation of material sizes.
- .3 Level top surface to specified grade.
- .4 Grade, lines, dimensions, and quantity of rock fill material to be reviewed and approved by the Departmental Representative before proceeding with pouring the concrete deck.

3.2 Tolerances

- .1 Surfaces of bearing layer to be within 25mm of elevation indicated and variation in elevation over whole area of bearing layer not to exceed 50mm. Variation shall be acceptable if the top surface is below the design grade only.

3.3 Protection

- .1 Take into account anticipated weather conditions and degree of exposure of site in setting requirements for protection.
- .2 Schedule and carry out construction so that each phase of work is not left exposed longer than necessary.
- .3 The Contractor should note that the work site is subject to water level variations due to tidal action.
- .4 The Contractor will be responsible to replace any material lost due to storms, tidal erosion or by his own activities.

-- END OF SECTION --

PART 1 – GENERAL

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| 1.1 | <u>Related Work</u> | .1 | Section 01 29 00 – Project Particulars & Measurement |
| | | .2 | Section 01 35 43 – Environmental Procedures |
| | | .3 | Section 31 05 17 – Aggregates - General |
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| 1.2 | <u>Measurement Procedures</u> | .1 | Measurement for payment will be in accordance with Section 01 29 00 – Project Particulars and Measurement. |
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| 1.3 | <u>References</u> | .1 | ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate. |
| | | .2 | ASTM D3203-11, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures. |
| | | .3 | ASTM D1159-07 (R2012), Test Method for Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus. |
| | | .4 | Nova Scotia Transportation and Infrastructure Renewal Standard Specifications for Highway Construction and Maintenance. |
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| 1.4 | <u>Supply of Materials</u> | .1 | Notify Departmental Representative of proposed date for use of materials. Order and schedule shipments to coincide with construction schedule. |
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| 1.5 | <u>Source Sampling</u> | .1 | At least 4 weeks prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling. |
| | | .1 | A copy of the location letter shall be forwarded to the Departmental Representative. |
| | | .2 | At least 4 weeks prior to commencing work, submit samples of the following materials proposed for use: |

.1 One 5 L container of asphalt cement.

1.6 Material
Certification

- .1 At least 4 weeks prior to commencing work, submit viscosity-temperature chart for asphalt cement to be supplied showing Kinematic Viscosity in centistokes, temperature range 105-175°C.
- .2 Submit manufacturer's test data and certification that asphalt cement meets requirements of this section.

1.7 Submission
Of Mix Design

- .1 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to commencing work.

1.8 Delivery and
Storage

- .1 Deliver and stockpile aggregates in accordance with Section 31 05 17 – Aggregates – General. Stockpile minimum 50% of total amount of aggregate required before commencing asphalt mixing operation.
- .2 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
- .3 Stockpile fine aggregate separately from coarse aggregate.
- .4 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
- .5 Furnish copies of freight and weigh bills for asphalt cement as shipments are received. Departmental Representative reserves the right to check weights as material is received.

PART 2 – PRODUCTS

- 2.1 Materials .1 Shall conform to Type C Asphalt as specified in Division 4, Section 4 of NSTIR's Standard Specifications for Highway Construction and Maintenance.

PART 3 – EXECUTION

- 3.1 Plant and Mixing Requirements .1 Batch and continuous mixing plants:
- .1 To ASTM D995.
 - .2 Heat asphalt cement and aggregate to mixing temperature directed by Departmental Representative. Do not heat asphalt cement above 160°C.
 - .3 Before mixing, dry aggregates to a moisture content not greater than 0.5% by mass or to a lesser moisture content if required to meet mix design requirements.
 - .4 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, Departmental Representative will direct temperature of completed mix at plant and at paver after considering hauling and placing conditions.
 - .5 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
 - .6 Feed cold aggregates to plant in proportions that will ensure continuous operations.
 - .7 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
 - .8 Store hot screened aggregates in a manner to minimize segregation and temperature loss.
 - .9 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
 - .10 Maintain temperature of materials within plus or minus 5oC of specified mix temperature during mixing.
 - .11 Mixing time:
 - .1 In batch plants, both dry and wet mixing times as directed by Departmental Representative. Continue wet mixing as long as necessary to obtain a thoroughly

- blended mix but not less than 30s or more than 75s.
 - .2 In continuous mixing plants, mixing time as directed by Departmental Representative, but not less than 45s.
 - .3 Do not alter mixing time unless directed by Departmental Representative.
- .2 Dryer drum mixing plant:
- .1 Feed aggregates to burner end of dryer drum by means of a multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
 - .2 Meter total flow of aggregate by an electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and asphalt entering mixer remain constant.
 - .3 Provide for easy calibration of weighing systems for aggregates without having material enter mixer.
 - .4 Calibrate individual feed bin conveyors to ensure mix proportions are achieved.
 - .5 Make provision for conveniently sampling the full flow of materials from the cold feed.
 - .6 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.
 - .7 Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.
 - .8 Accomplish heating and mixing of asphalt mix in an approved parallel flow dryer-mixer in which aggregate and asphalt enter drum at burner end and travel parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each day.
 - .9 Mixing period and temperature to produce a uniform mixture in which particles are thoroughly

coated, and moisture content of material as it leaves mixer to be less than 1%.

- .3 Temporary storage of hot mix:
 - .1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.
 - .2 Do not store asphalt mix in storage bins in excess of 3 hours.
- .4 While producing asphalt mix for this project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied to this project.
- .5 Mixing Tolerances:
 - .1 Permissible variation in aggregate gradation from job mix (percent of total mass):

4.75	mm sieve	and larger	5.0
2.00	mm sieve		4.0
0.425	mm sieve		2.5
0.075	mm sieve		1.0
 - .2 Permissible variation of asphalt cement from job mix, 0.30%.
 - .3 Permissible variation of mix temperatures at discharge from plant, 10°C.

3.2 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, general: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Haul trucks: 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 content area of each truck box.
- .4 Trucks which cannot be weighed in a single operation on scales supplied will not be accepted.

.4 Hand Tools:

- .1 Lutes or rakes with covered teeth for spreading operations.
- .2 Provide tamping irons having mass not less than 12 kg and a bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.
- .3 Straight edges, 4.5 m in length, to test finished surface.

3.3 Preparation

- .1 Reshape granular roadbed to Departmental Representative's approval.
- .2 Prior to laying mix, clean surfaces of loose and foreign material.
- .3 Sawcut adjacent asphalt prior to placing new asphaltic pavement.
- .4 Tack coat existing asphalt edges prior to placing new asphalt mix.

3.4 Transportation
Of Mix

- .1 Transport mix to job site in vehicles cleaned of foreign material in good mechanical working order, tight gates and with tarps.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.

- .4 Deposit mix from surge or storage silo into trucks in multiple drops and use methods necessary to prevent segregation.
- .5 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at a temperature within range directed, but not less than 130°C.

3.5 Placing

- .1 Obtain Departmental Representative's approval of base prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines indicated or directed by Departmental Representative.
- .3 Placing Conditions:
 - .1 Place asphalt mixture only when air temperature is above 5°C.
 - .2 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot mix asphalt when pools of standing water exist on surface to be paved, during rain or when surface is damp.
 - .4 A material transfer device shall be used for the placement of all asphalt mix on the project. Prior to use, the material transfer device shall be approved by the Departmental Representative.
- .4 Place asphalt concrete in compacted lifts of thickness as noted on the plans.
 - .1 In areas of sub-excavation, the asphalt shall be placed in two lifts of 62.5 mm thickness each.
- .5 Spread and strike off mixture with self-propelled mechanical finisher:
 - .1 Construct longitudinal joints and edges true to line markings. Lines for paver to follow will be

- established by the Departmental Representative parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
- .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
 - .3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .4 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
 - .6 Do not throw surplus material on freshly screeded surfaces.
- .6 When Hand Spreading is used:
- .1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross section.
 - .2 Distribute material uniformly. Do not broadcast material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straight edges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a higher temperature than temperature of mix being placed.
- 3.6 Compacting
- .1 Roll asphalt continuously to a density not less than 93% of the mix maximum theoretical density.

.2 General:

- .1 Provide minimum three (3) rollers and as many additional rollers as necessary to achieve specified pavement density. One roller must be pneumatic-tired type.
- .2 Start rolling operations as soon as placed mix can bearing weight of roller without undue displacement of material or cracking of surface.
- .3 Operate rollers slowly initially to avoid displacement of material. For subsequent rolling, do not exceed 5 km/h for static steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.
- .4 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per meter of travel.
- .5 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.
- .6 Keep wheels of roller slightly moistened with water to prevent pick up of material, but do not over water.
- .7 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism.
- .8 Do to permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
- .9 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
- .10 When paving in echelon, leave unrolled 50 to 75mm of edge which second paver is following and roll when joint between lanes is rolled.
- .11 When rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.3 Breakdown Rolling:

- .1 Commence breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
- .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

- .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. Exceptions may be made when working on steep slopes or superelevated sections.
- .4 Second Rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling shall be continuous after initial rolling until mix placed has been thoroughly compacted.
- .5 Finish Rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheel rollers while material is still warm enough for removal of roller marks. If necessary to obtain desired surface finish, Departmental Representative shall specify use of pneumatic-tired rollers.
 - .2 Conduct rolling operations in close sequence.

3.7 Joints

- .1 General:
 - .1 Trim vertical face by sawcutting to provide true surface and cross section against which new pavement may be laid. Remove loose particles.
 - .2 Paint joint face with thin coat of hot asphalt cement or cut back asphalt or preheat joint face with approved heater, prior to placing of fresh mix.
 - .3 Overlap previously laid strip with spreader by 100mm.
 - .4 Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.
 - .5 Construct joints between asphalt concrete pavement and Portland Cement concrete pavement as directed by Departmental Representative.
 - .6 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse Joints:
 - .1 Construct and thoroughly compact transverse joints to provide a smooth riding surface.

- .2 Stagger joint locations 2 meters.
 - .3 Offset transverse joint in succeeding lifts by at least 600mm.
 - .3 Longitudinal Joints:
 - .1 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a lute or rake.
 - .2 Roll longitudinal joints directly behind paving operation.
 - .3 When rolling with static roller, shift roller over onto previously placed lane in order that 100 to 150mm of drum width rides on newly laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until thoroughly compacted neat joint is obtained.
 - .4 When rolling with static or vibratory roller, have most of drum width ride on newly placed lane with remaining 100 to 150mm extending onto previously placed and compacted lane.
 - .5 Offset longitudinal joints in succeeding lifts by at least 150mm.
 - .4 The use of feather joints shall not be permitted.
 - 3.8 Finish Tolerances
 - .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
 - .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed in any direction.
 - 3.9 Defective Work
 - .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.
 - .2 Repair areas showing checking, rippling or segregation.
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- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.
- 3.10 Hours of Work .1 Unless specifically authorized otherwise by Departmental Representative, all spreading of asphalt mix shall stop at least ½ hour before sunset and the paver shall be off the road by sunset.
- 3.11 Pollution Control/
Site Clean-Up .1 Control emissions from equipment and plant to Provincial emission requirements.
- .2 Copies of the Contractor's current Provincial Asphalt Plant Approval Permit must be provided to PSPC and the EPO.
- .3 Excess asphaltic concrete material must be disposed of at approved locations. No material will be deposited outside the lines and grades indicated for asphalt paving, except as approved by the Departmental Representative.
- .4 The EPO on behalf of Provincial Department of Communities, Land and Environment will be monitoring the Contractor's operation, including site clean-up.

-- END OF SECTION --