
1.1 RELATED SECTIONS

- 1.1 Section 31 05 99 – Common Work Results for Earthworks.
- 1.2 Section 31 32 19.16 – Geotextiles.
- 1.3 Section 32 11 16.01 – Granular Sub-Base.
- 1.4 Section 32 11 23 – Aggregate Base Courses.
- 1.5 Section 32 13 13 – Concrete Paving, Sidewalks, Curbs and Gutters.
- 1.6 Section 32 17 23 – Pavement Markings.
- 1.7 Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C 88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C 117-13, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 123-12, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C 127-12, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C 128-12, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C 131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C 136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C 207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D 995--95b (2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D 2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .11 ASTM D 3203-11, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .12 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

- .13 ASTM D 6373-13, Standard Specification for Performance Graded Asphalt Binder ASTM D6927-06, Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures.
 - .14 ASTM D6928-10, Standard Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
 - .15 ASTM C 1252-06, Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading).
 - .16 ASTM D 4867, Standard Test for Effect of Moisture on Asphalt Concrete Paving Mixtures (Lottman Test).
- .2 Government of Newfoundland and Labrador, Department of Transportation and Works, Highway Design Division.
- .1 The Department of Transportation and Works (DTW) specifications Book, latest edition.

1.3 SUPPLY OF MATERIALS

- .1 Notify Departmental Representative of proposed date for use of materials; order and schedule shipments to coincide with construction schedule.

1.4 SOURCE SAMPLING

- .1 At least 4 weeks prior to commencing work inform Departmental Representative of proposed source of aggregates and provide access for sampling.
- .2 At least 4 weeks prior to commencing work submit samples of following materials proposed for use as requested by the Departmental Representative:
 - .1 One 5 L container of asphalt cement.

1.5 MATERIAL CERTIFICATION

- .1 Submit manufacturer's test data and certification that asphalt cement meets requirements of this section.

1.6 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.
- . 2 All asphalt concrete mix supplied for the work shall conform to the requirements of the 'surface course' designation.

1.7 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 aggregates 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 right to check weights as material is received.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt cement: PG 58-28 in accordance with ASTM D6373.
- .2 Aggregate material to following requirements:
 - .1 Crushed rock consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, and other deleterious materials.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on semi-log grading chart.

Sieve Size (mm)	Percent Passing
19.0	100
12.5	93-100
9.5	75-92
4.75	55-75
2.0	32-55
.425	12-25
.150	5-12
.075	2-5

- .3 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75mm when tested to ASTM C136.
- .4 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75mm sieve and stockpile separately from coarse aggregate.
- .5 Coarse aggregate stockpile shall contain no more than 15% passing 4.75mm sieve.
- .6 Fine aggregate stockpile shall contain no more than 15% retained on 4.75mm sieve.
- .7 Petrographic Number: CSA A23.2 – 15A, Max: 135.
- .8 Do not use aggregates having known polishing characteristics in mixes for surface courses.
- .9 Sand equivalent: ASTM D2419 Min: 50
- .10 Magnesium Sulphate Soundness: ASTM C88. Max. percent loss by mass: Coarse aggregate, surface course: 12. Fine aggregate, surface course: 16
- .11 Los Angeles abrasion; Gradation B. to ASTM C131. Max. percent loss by mass: Coarse aggregate, surface course: 35
- .12 Absorption: ASTM C127, max. percent by mass: Coarse aggregate, surface course: 1.75
- .13 Loss by washing: to ASTM C117. Max. percent passing 0.075mm sieve: Coarse aggregate, surface course: 1.75
- .14 Flat and elongated particles with length to thickness ratio greater than 4: Max. percent by mass: Coarse aggregate, surface course: 20
- .15 Crushed fragments at least 100% of particles by mass within each of following sieve designation ranges to have at least 2 freshly fractured faces. Material to be divided into ranges using methods of ASTM C136.

Passing Retained on:

19.0mm to 12.5mm

12.5mm to 4.75mm

- .16 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- .17 Micro – Deval abrasion, to ASTM D6928, Coarse aggregate: Max. 20%.
- .18 Micro – Deval abrasion, to CSA A23.2–23A, Fine aggregate: Max 20%.

- .19 Fine aggregate angularity, to ASTM C1252, Min. 45%.
- .3 Mineral Filler
 - .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 to improve mix properties.
 - .3 Mineral filler to be dry and free flowing when added to aggregate.

2.2 MIX DESIGNS

- .1 Job mix formula to be provided by Contractor and designed and certified by a Professional by a Professional Engineer licensed to practice in the Province of Newfoundland and Labrador. Job mix formula to be approved by Departmental Representative.
- .2 Design of mix: by Marshall Method to requirements below and as directed by Departmental Representative.
 - .1 Compaction blows on each face of test specimens: 75.
 - .2 Mix physical requirements: Marshall Stability at 60°C: 10000 N(minimum) Flow Value mm: 2 to 4.25 Air Voids in Mixture, percent: 3-5 Voids in Mineral Aggregate, percent min: 15 Index of Retained Stability percent minimum: 75
- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM D6927.
 - .2 Air voids: to ASTM D3203.
- .4 Do not change job-mix without prior approval of Departmental Representative. Should change in material source be proposed, new job-mix formula to be reviewed by Departmental Representative.
- .5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.
- .6 Asphalt content: 5.5-6.25% based on total weight.

-
- .7 Asphalt mixtures containing RAP shall be designed in accordance with the latest edition of the Asphalt Institute Manual Series No. 2.
 - .8 The quality of the final pavement mixture shall meet all requirements set forth in this specification.
 - .9 Use liquid type anti-stripping agent. Ensure compatibility with cement being used. Tensile Strength Ration (TSR) required is 80% minimum.

2.3 ACCESSORIES

- .1 Line Paint: to Section 32 17 23 – Pavement Markings
- .2 Adjustment Rims: as required to adjust elevation of maintenance hole rims and valve chambers.

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 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 5°C 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 three (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):

Sieve Size (mm)	Percent of Total Mass
Greater or equal to 4.75	5.0
2.00	4.0
0.425	2.5
.075	1.0

.2 Permissible variation of asphalt cement from job mix, 0.30%.

.3 Permissible variation of mix temperature 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 contact 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 310cm² 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, 4.5m in length, to test finished surface.

3.3 PREPARATION

- .1 Reshape granulars to Departmental Representative's approval.
- .2 Prior to laying mix, clean surfaces of loose and foreign material.
- .3 Saw cut adjacent asphalt surfaces and prior to placing new asphaltic pavement.
- .4 Construct key joint at locations where the new top lift of asphalt will meet existing asphalt as indicated on the drawings.

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 materials 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 mixtures 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 Place asphalt concrete in compacted lifts of thickness as noted on the plans.
- .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 Departmental Representative parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .3 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .4 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.
 - .5 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 straightedges 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 Start rolling operations as soon as placed mix can bear weight of roller without undue displacement of material or cracking of surface.
 - .2 Operate rollers slowly initially to avoid displacement of material. For subsequent rolling do not exceed 5km/h for static steel- wheeled rollers and 8km/h for pneumatic-tired rollers.
 - .3 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per metre of travel.
 - .4 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.
 - .5 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .6 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism.
 - .7 Do to permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
 - .8 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .9 Where 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 Rolling:
 - .1 Commence 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 Accomplish finish rolling with steel drum roller while material is still warm enough for removal of roller marks.
 - .4 Use only experienced roller operators for this work.

3.7 JOINTS

- .1 General:
 - .1 Trim vertical face by saw-cutting to provide true surface and cross section against which new pavement may be laid.
 - .2 Paint joint face with thin coat of hot asphalt cement or cutback 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 2m.
 - .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 150 mm extending onto previously placed and compacted lane.
- .5 Offset longitudinal joints in succeeding lifts by at least 150mm.

3.8 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 5mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5mm when checked with a 4.5m straight edge place 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.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.10 PAVEMENT MARKING

- .1 Provide pavement markings to Section 32 17 23 – Pavement Markings

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 10 – General Requirements: Cleaning.
 - .1 Remove spillage and over-spray of paint from pavement, sidewalks, building and other site features. Use methods and materials without damaging and leaving visible residue on substrates.
 - .2 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 10 – General Requirements: Cleaning.
- .3 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 11 10 – General Requirements: Waste Management and Disposal.
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility

3.12 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38°C. Do not permit stationary loads on pavement for 24-hours minimum after placement.
- .2 Keep traffic off pavement markings for a time as recommended by paint manufacturer.

END OF SECTION