

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 12 13.16 – Asphalt tack coats

1.2 REFERENCE STANDARDS

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-04, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-07, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D995-95b (2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .9 ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .10 ASTM D3203-94 (2005), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .11 ASTM D4791-05e1, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

- .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
- .3 CAN/CGSB-16.3-M90 – Bituminous binder for roads.
- .5 Standard specifications, road work, volume VII « Materials », latest edition.
 - .1 4101 – Asphalts
 - .2 4105 – Emulsified asphalt
 - .3 4201 – Hot mixes according to Marshall Method
 - .4 4202 – Hot mixes according to pavement laboratory method

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.
 - .2 Submit certificate of conformity containing all information specified in 4101 standard « Asphalt », volume VII, materials, from the MTQ standard for road work, as well as viscosity / temperature graph of proposed asphalt at least four (4) weeks prior to beginning work.
- .3 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.
 - .2 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning Work.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section and erosion and sedimentation control plan 31 05 16- Aggregate Materials. Stockpile minimum 50% of total amount of aggregate required before beginning asphalt mixing operation.
- .2 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
- .3 Submit to Departmental Representative copies of freight and waybills for asphalt cement as shipments are received.
 - .1 Departmental Representative reserves right to check weights as material is received.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt in accordance to MTQ 4101 standard « Asphalt », specified in the following performance criteria:
 - ESG-14 – One course.

- .2 Aggregates : In according to NQ 2560-114 standard « Civil engine work – Aggregates », part V, specified for the following categories, including additional characteristics described in table 3 (NQ 2560 -114).

	LOWER COURSE	SURFACE COURSE
Coarse Aggregates	3C	2b
Fine Aggregates	2	1

- .3 Recycled materials : Recycled materials are forbidden.

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 minimum of 3 per paver of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
- .1 Drum diameter: 1200 mm minimum.
 - .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .4 Haul trucks: 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.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
- .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.
- .6 Plant testing facility: provide laboratory space at plant site for exclusive use of Departmental Representative, for performing tests, keeping records and making reports.

2.3 MIX DESIGN

- .1 Lower course : ESG-14 as specified on drawings.
- .2 Plant mix to be produced by a company operating an asphalt mixing plant and holder of a certificate of registration that confirms that their quality management system meets ISO requirements. Recycled materials are not permitted in plant mix.
- .3 Mix design to be approved by Departmental representative. Contractor must supply to Departmental Representative theoretical and final formulas of hot mixes, produced using

Pavement Laboratory formula method that includes information specified in article 5.3.4 of the MTQ 4202 standard « Hot Mixes According to Pavement Laboratory Method », as well as submit all test and computation results.

- .4 Mix physical requirements : Plant mix to comply with table 4202-1 of 4202 standard. Rutting resistance test requirements are applicable to surface and lower course.
- .5 Do not change job-mix without prior approval of Departmental representative. When change in material source proposed, new job-mix formula must be reviewed and approved by Departmental Representative.
- .6 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.
- .7 When more than one mixing plant supplies plant mix, the source of aggregates must be the same for all plants.

Part 3 Execution

3.1 PLANT AND MIXING REQUIREMENTS

- .1 Batch and continuous mixing plants:
 - .1 To ASTM D995.
 - .2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
 - .1 Do not load frozen materials into bins.
 - .3 Feed cold aggregates to plant in proportions to ensure continuous operations.
 - .4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
 - .5 Before mixing, dry aggregates to moisture content not greater than 1% by mass or to lesser moisture content if required to meet mix design requirements.
 - .6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
 - .7 Store hot screened aggregates in manner to minimize segregation and temperature loss.
 - .8 Heat asphalt cement and aggregate to mixing temperature directed by Departmental Representative. Do not heat asphalt cement above 160 degrees C..
 - .9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, Departmental Representative to review temperature of completed mix at plant and at paver after considering hauling and placing conditions.
 - .10 Maintain temperature of materials within 5degrees 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 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.
- .2 Dryer drum mixing plant:
 - .1 To ASTM D995.
 - .2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.
 - .3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
 - .4 Meter total flow of aggregate using electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump to ensure proportions of aggregate prepare, and asphalt entering mixer remain constant.
 - .5 Allow for easy calibration of weighing systems for aggregates without having material enter mixer.
 - .6 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
 - .1 Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time.
 - .2 Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.
 - .7 Make provision for conveniently sampling full flow of materials from cold feed.
 - .8 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.
 - .9 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.
 - .10 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream.
 - .1 Control heating to prevent fracture of aggregate or excessive oxidation of asphalt.
 - .2 Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator.
 - .3 Submit printed record of mix temperatures at end of each day.
 - .11 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is 2% maximum.
- .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 as specified in 4202 standard.
 - .2 Characteristics of mix being produced must comply with specification of table 4202-1 of 4202 standard.
 - .3 Permissible variation of asphalt cement from job mix : 0.25%.
 - .4 Permissible variation of mix temperature at discharge from plant : 5 degrees C.
- .6 Addition of anti-stripping agent:
 - .1 Plant to be equipped with pug mill to thoroughly mix aggregates and lime prior to entering the plant.
 - .2 Plant to be equipped with suitable conveyor systems capable of supplying aggregates and lime at constant rate.
 - .3 Plant and equipment used for addition of lime to be equipped with covers to control loss of lime.
 - .4 Plant to be equipped to control rate of lime incorporation to within 1/4%.
 - .5 Add water to aggregate prior to entering pug mill.
 - .6 Add water to lime sufficiently in advance to permit time to slake prior to entering pug mill.

3.2 PREPARATION

- .1 Apply tack coat in accordance with Section 32 12 13.16- Asphalt Tack Coats prior to paving.
- .2 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required.
 - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
- .3 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
 - .1 Do not dribble mix into trucks.
- .4 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .5 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 135 degrees C.

3.4 PLACING

- .1 Obtain Departmental Representative's approval of tack coat existing surface prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees 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 indicated follows:
 - .1 Lower course in 70 of s mm.
- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Place individual strips no longer than 500 m.
- .7 On airport runways and taxiways, aprons and parking lots commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.
- .8 Spread and strike off mixture with self-propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .1 Departmental Representative to establish lines for paver to follow 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.
 - .1 Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
 - .3 Maintain constant head of mix in auger chamber of paver during placing.
 - .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .6 Correct irregularities in surface of pavement course directly behind paver.
 - .1 Remove excess material forming high spots using shovel or lute.
 - .1 Fill and smooth indented areas with hot mix.
 - .2 Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.
- .9 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.

- .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
- .2 Distribute material uniformly without broad casting material.
- .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.
 - .1 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.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

3.5 COMPACTING

- .1 Do not change rolling pattern unless mix changes or lift thickness changes.
 - .1 Change rolling pattern only as directed by Departmental Representative.
- .2 Roll asphalt continuously to density between 93% and 98%, following method LC 26-510 and LC 26-500, but not less 92% PMR (Proctor Modified Rice), Joints to be compacted ne less than 89% using same method.
- .3 General:
 - .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
 - .4 Use static compaction for levelling coarse less than 25 mm thick.
 - .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
 - .6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.
 - .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
 - .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

- .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
- .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
- .12 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.
- .4 Breakdown rolling:
 - .1 Begin breakdown rolling with static steel wheeled roller 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. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.
 - .4 Use only experienced roller operators.
- .5 Intermediate 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 to be continuous after initial rolling until mix placed has been thoroughly compacted.
- .6 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
 - .2 Conduct rolling operations in close sequence.

3.6 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
 - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 For airfield runway paving, avoid cold joint construction in mid 30 m of runway.
 - .2 If cold joint can not be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.
- .4 Construct butt joints as indicated.

3.7 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 4.5 m straight edge placed in any direction.

3.8 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form 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.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- 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 Section 01 74 11- Cleaning.

END OF SECTION