

Part 1 General

1.1 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-Sixth Edition 1994, 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 D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .9 ASTM D3203-94(2005), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .10 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-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.2 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 mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit asphalt concrete mix design and trial mix test results to Engineer for review at least 4 weeks prior to commencing work.
- .3 Samples:
 - .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks prior to beginning Work.
- .4 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.
 - .2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.
 - .3 Submit asphalt concrete mix design and trial mix test results to Departmental Representative at least 4 weeks prior to beginning Work.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 Asphalt cement: to CAN/CGSB-16.3, grade: 150-200, group: A according to chart of Absolute viscosity versus penetration.
- .2 Aggregates to the following requirements:
 - .1 Aggregate to Saskatchewan Highways and Infrastructure Type 2 mix design.
 - .2 Virgin aggregate shall be composed of sound, hard and durable particles of sand, gravel and rock, free from injurious quantities of elongated, soft or flaky particles, shale, clay, loam, ironstone, coal and organic or other deleterious material.
 - .3 Crushed stone or gravel.

- .4 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.
- .3 Table (type 2)
- | Sieve Designation | % Passing |
|-------------------|-----------|
| 16 mm | 100 |
| 12.5 mm | 78-98 |
| 9.0 mm | 66-90 |
| 5.0 mm | 46-72 |
| 2.0 mm | 23-51 |
| 900 µm | 15-37 |
| 400 µm | 10-27 |
| 160 µm | 3-14 |
| 75 µm | 2-9 |
- .4 Coarse aggregate: aggregate retained on 5.0 mm sieve and fine aggregate is aggregate passing 5.0 mm sieve when tested to ASTM C136.
- .5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 5.0 mm sieve and stockpile separately from coarse aggregate.
- .6 Separate stockpiles for coarse and fine aggregates not required for sheet asphalt.
- .7 Do not use aggregates having known polishing characteristics in mixes for surface courses.
- .8 Sand equivalent: to ASTM D2419. Min: 45.
- .9 Crushed fragments: at least 70% 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.
- .1 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max % by mass:
- .1 Coarse aggregate, surface course: 15%.

2.2 MINERAL FILLER

- .1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by Departmental Representative are thoroughly dry and free from lumps.
- .2 Add mineral filler when necessary to meet job mix aggregate gradation to improve mix properties.
- .3 Ensure mineral filler is dry and free flowing when added to aggregate.

2.3 EQUIPMENT

- .1 Pavers: mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Drum diameter: 1200mm minimum.
- .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.

2.4 MIX DESIGN

- .1 Mix design to Saskatchewan Highways and Infrastructure Type 2 mix design.
- .2 Design of mix: by Marshall method to requirements below.
 - .1 Compaction blows on each face of test specimens: 50.
 - .2 Mix physical requirements:

Property		
Marshall Stability at 60 degrees C kN min		5.5
Flow Value mm		1.5 – 3.5
Air Voids in Mixture, %		3-5
Voids in Mineral Aggregate, % min		14-16
Index of Retained		75

Stability % minimum		
Fracture, min %		70
Film Thickness um		7.5
Sand Equivalent, min		45

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM D1559.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D3203.
 - .4 Voids in mineral aggregates: to AI MS2.
 - .5 Index of Retained Stability: measure in accordance with Marshall Immersion Test for Bitumen.
- .4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be reviewed by Departmental Representative.

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. Do not heat asphalt cement above maximum temperature indicated on temperature-viscosity chart.

- .9 Maintain temperature of materials within 5degrees C of specified mix temperature during mixing.
- .10 Mixing time:
 - .1 Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.
- .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 and RAP 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 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.

- .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.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Apply prime coat in accordance with Section 32 12 13.23- Asphalt Prime Coats prior to paving.
- .3 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 Schedule delivery of material for placing in daylight.
- .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 not less than 135degrees C.

3.4 PLACING

- .1 Obtain Departmental Representative's approval of prime coat tack coat 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 5degrees C minimum.

- .2 When temperature of surface on which material is to be placed falls below 10degrees 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 in one layer of 65mm.
- .5 Spread and strike off mixture with self propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .2 Maintain constant head of mix in auger chamber of paver during placing.
 - .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.
 - .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.
 - .6 Do not throw surplus material on freshly screeded surfaces.
- .6 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.
- .2 Roll asphalt continuously to density not less than 98% of Marshall density in accordance with ASTM D1559.
- .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 5km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers.
 - .4 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.
 - .5 Overlap successive passes of roller by minimum of 200 mm 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 operating.
 - .8 Do not 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.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
 - .10 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.

3.6 JOINTS

- .1 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600mm.
 - .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.

- .2 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150mm.
 - .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 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 25to 50mm.
 - .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.

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 5mm when checked with 4.5m 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