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3.5 ASPHALT STABILIZED BASE COURSE

3.5.1 GENERAL

Asphalt Stabilized Base Course shall consist of an intimate mixture of crushed aggregate and cutback or emulsified asphalt, produced by plant-mixing at elevated temperatures and placed in layers upon a previously prepared surface, compacted and finished as specified herein.

3.5.1.1 **Alberta Transportation Test Procedures**

Test methods designated in these specifications as "ATT" or "TLT" refer to Alberta Transportation Tests.

3.5.2 MATERIALS

3.5.2.1 **Aggregate**

The Contractor shall produce crushed aggregate in accordance with Specification 3.2, Aggregate Production and Stockpiling for the Designation and Class of materials specified. The Contractor shall supply aggregate materials in accordance with Specification 5.2, Supply of Aggregate and haul aggregate materials in accordance with Specification 4.5, Hauling. Aggregate shall not contain lime.

3.5.2.2 **Asphalt**

The Contractor shall supply asphalt material in accordance with Specification 5.7, Supply of Asphalt by Contractor.

Unless otherwise specified in the Special Provisions, asphalt binder for Asphalt Stabilized Base Course shall be MC-250 or MC-800. The Contractor shall make the choice between these two.

3.5.3 MIX DESIGNS AND JOB MIX FORMULA

3.5.3.1 **Responsibility for Mix Designs**

Preparation and submission of Asphalt Stabilized Base Course mix designs for Consultant approval are the responsibility of the Contractor. All costs incurred in mix design formulation are the responsibility of the Contractor. Shipping costs for samples sent to the Consultant for approval are the responsibility of the Contractor.

The Contractor shall use Professional Engineering services and a qualified testing laboratory licensed to practice in the Province of Alberta to assess the aggregate materials proposed for use on the Work and to carry out the design of the Asphalt Stabilized Base Course mixture.

3.5.3.2 **Requirements for Mix Design**

The Asphalt Stabilized Base Course mix design shall follow the Marshall Method of Mix Design as outlined in the latest edition of procedure TLT-302 or TLT-303, as appropriate. A minimum of four specimens shall be prepared at each asphalt content and the grade of asphalt used in the design shall conform to Specification 5.7, Supply of Asphalt, shall be identical to that being supplied to the project and shall be

obtained from the same supplier.

Mix designs shall meet the following characteristic requirements at the design asphalt content:

**TABLE 3.5.3.2
MIX DESIGN CHARACTERISTICS**

	HF-500M	MC-250 OR MC-800
Marshall Stability (N)	3000+	6700+
Air Voids	3% to 6%	3% to 6%

3.5.3.3 Approval of Mix Designs

The Contractor shall submit the mix design to the Consultant for approval. The Contractor’s submission shall include the following information:

- (a) The gradation of each aggregate to be used in the mixture;
- (b) The percentage by mass of each aggregate to be used in the mixture;
- (c) The mix design gradation of the combined aggregate;
- (d) Other characteristics of the combined aggregate specified in Specification 3.2, Aggregate Production and Stockpiling;
- (e) All Marshall mix design characteristics, including graphs used in arriving at the final mix design, the bulk specific gravity of the combined aggregates, and the asphalt absorption of the combined aggregate; and
- (f) The recommended design asphalt content expressed as a percentage of dry weight of the aggregate.

The Consultant will require up to five working days from the time of receipt of the mix design to complete the evaluation.

The Consultant may, at any time, require the Contractor to provide representative samples of the individual aggregates in sufficient quantity that, when combined at the design proportions, a 100 kg sample is achieved. The Consultant will require up to five working days from the time of receipt of such samples to verify the mix design. The cost of such mix design verification will be borne by the Department.

Where required by the Consultant because of a change in the nature or source of the aggregates, or where a new mix design is desired by the Contractor, the Contractor shall provide a separate and complete mix design. This new mix design shall be subject to the approval of the Consultant.

The Consultant will not accept any asphalt mix produced prior to the Contractor receiving written approval of the mix design from the Consultant.

The aggregate proportioning and asphalt content for the approved mix design will then be the Job Mix Formula for the production of the Asphalt Stabilized Base Course mixture.

The Contractor shall be totally responsible for the production of mixes in conformance with the Contract.

3.5.3.4 Variation from the Approved Job Mix Formula

After the Job Mix Formula gradation and proportioning of the various aggregate sizes have been established and approved, no alteration to the Job Mix Formula will be permitted. The maximum permissible variation between an individual Cold Feed sample gradation and the Job Mix Formula gradation shall be as shown in the following table:

**TABLE 3.5.3.4
GRADATION VARIATION**

MAXIMUM PERMISSIBLE VARIATION * PERCENT BY WEIGHT PASSING	
Sieve Designation	Individual Cold Feed Sample
5000	±6
1250	±4
630	±3
315	±3
160	±2
80	±2
* In any case, the Gradation must meet the gradation requirements of Specification 3.2, Aggregate Production and Stockpiling.	

If any deviation from the approved Job Mix Formula beyond the variations given above, or any alteration of aggregate proportioning, is requested by the Contractor in writing, the Consultant will evaluate the request and determine if a new mix design is required.

Any deviation whatsoever from the approved Job Mix Formula shall require the prior written approval of the Consultant, and the Consultant will not accept any asphalt mix produced prior to this approval.

The Estimated Original Binder content of any individual sample shall not vary by more than 0.5% from the Job Mix Formula and the daily average by more than 0.3% from the Job Mix Formula.

3.5.4 SAMPLING AND TESTING

3.5.4.1 Test Methods

Unless otherwise specified, the latest edition of the following Test Methods shown in Table 3.5.4.1 will be

used to determine material characteristics.

TABLE 3.5.4.1
TEST METHODS

TEST	STANDARD
Moisture or Volatile Distillates in Bituminous Paving Mixtures	AASHTO T 110
Extraction	ATT-12
Correction Factor, Extracted Asphalt Content	ATT-12, Part III
Sieve Analysis, 20 000 μm Minus	ATT-26
Density, ASBC Control Strip Method	ATT-66
Sampling, Mixes	ATT-37
Sampling, Asphalt	ATT-42
Sampling, Gravel and Sand	ATT-38
Moisture Content, Oven Method, Part II, Emulsified Asphalt Mixes	ATT-15, Part II
Moisture Content, Oven Method, Part III, Cutback Asphalt Mixes, Calcium Oxide Method	ATT-15, Part III

NOTES:

- (1) In all test methods used as reference in this specification, metric sieves as specified in Canadian General Standards Board Specification 8-GP-2M shall be substituted for any other specified wire cloth sieves in accordance with Specification 3.2, Aggregate Production and Stockpiling.
- (2) In all cases the latest amendment or revision current at the closing date of the tender is implied when reference is made to one of the above standards in the specification.

3.5.4.2 Quality Control Testing

Quality control testing is the responsibility of the Contractor throughout every stage of the Work, from the crushing and production of aggregates to the final accepted product. Tests performed by the Consultant will be quality assurance tests and will not be considered as quality control tests. The Contractor shall provide and maintain equipment and qualified personnel to perform all field testing necessary to determine and monitor the characteristics of the materials produced and incorporated into the Work.

The minimum frequencies of quality control testing are described in Table 3.5.4.2. The Consultant may require an increase in the frequency of any quality control test. The Contractor shall arrange and pay for any additional tests required by the Consultant. Copies of all quality control tests shall be submitted to the Consultant within one working day of the completion of each test.

The Contractor shall bear the cost of all consulting services retained by him.

**TABLE 3.5.4.2
ASPHALT STABILIZED BASE COURSE
QUALITY CONTROL TESTING**

TEST	STANDARD	MINIMUM TEST FREQUENCY	
Plant Calibration	ATT-17	Once per project or as required by the Consultant	
Moisture or Volatile Distillates in Bituminous Paving Mixtures	AASHTO T110	<u>PLANT PRODUCTION</u> One per day ⁽¹⁾	<u>FINAL PLACEMENT</u> One per day ⁽²⁾
Asphalt Extraction	ATT-12	Two per day	
Sieve Analysis	ATT-26	Each Extraction	
Asphalt Correction Factor	ATT-12, Part III	One per design	
Moisture Content of: Emulsified Asphalt Mixes Cutback Asphalt Mixes	ATT-15, Part II ATT-15, Part III	<u>PLANT PRODUCTION</u> Two per day	<u>DURING LAYDOWN</u> After a rain, as required by the Consultant
Aggregate Sieve Analysis (Cold Feed)	ATT-26	One per day	
Mix Temperature	ATT-30	Four per day	
Plant Inspection	ATT-16	Four per day	
Sampling Cutback Asphalts and Emulsions	ATT-42	One sample per day	
Sampling Tack, Prime and Fog Materials	ATT-42	One per load	
Emulsion Breaking Point	ATT-65	During laydown as required	

NOTE:

- (1) One test per day for the first 3 days of production if all mix specification criteria are met.
- (2) Not required if Plant Production test results for % of the original cutback weight are between 40-70% for MC 250, and more than 75% for MC 800.

3.5.4.3 Acceptance Sampling and Testing

Within this specification certain requirements, limits, and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements where so specified, shall

be measured and accepted based on the Consultant's quality assurance test results.

3.5.5 CONSTRUCTION

3.5.5.1 **General**

The Contractor shall mix the Asphalt Stabilized Base Course through a central mixing plant at elevated temperatures.

The mix shall be produced, placed and compacted in a manner which results in a uniform and non-segregated product. The Contractor shall eliminate the causes of any aggregate segregation or non-uniform asphalt distribution which may occur and shall correct any areas which are segregated or excessively rich, lean or wet.

3.5.5.2 **Asphalt Mixing Plant Requirements**

3.5.5.2.1 All Plants

The Contractor shall calibrate the plant at each production location and shall provide the Consultant with a calibration certificate and data attesting to the calibration.

The Consultant may, when he deems necessary, verify the calibration of the plant at any time. The Contractor shall provide all equipment, facilities and operating staff required to verify the calibration safely and accurately.

The cold aggregate feed shall contain separate bins for each aggregate to be introduced into the mix. Each cold feed bin shall have an adjustable gate and a variable speed feed belt. The cold feed bins shall be calibrated by diverting and weighing the aggregate flow at various speeds of the feed belt. The Contractor shall provide vibrators or other devices to ensure a uniform flow of material.

Each cold feed unit shall be equipped with a sampling device which will allow a representative sample of the aggregate material being delivered to the mixing plant to be obtained safely and without disrupting the continuous operation of the plant.

3.5.5.2.2 Batch Plants

Batch plants shall be equipped with weigh scales on both the asphalt and the aggregate hoppers.

The asphalt scale accuracy shall be checked with enough test weights to simulate the size of the anticipated asphalt batch.

The aggregate scale accuracy shall be checked with test weights or by diverting a number of pre-weighed batches into a truck and verifying the weight on the platform scale.

Each scale shall be accurate to 1.0%.

3.5.5.2.3 Continuous Mix Plants (Pug-Mill Type)

The hot aggregate hopper shall be equipped with an adjustable gate and may also have a variable speed apron feeder. The hot bin shall be calibrated by diverting and weighing the hot aggregate flow into a truck at various gate settings or apron feeder speeds or both. The asphalt pump shall be of the positive displacement type and shall be mechanically or electronically interlocked with the aggregate flow. The asphalt pump shall be calibrated by diverting asphalt into a suitable container for a time at various settings and weighing the pumped asphalt on the platform scale. The container shall have a volume of at least 3 000 litres.

3.5.5.2.4 Drum Mix Plants

Drum mix plants shall be equipped with electronic controls that automatically and continuously measure the amounts of aggregate and asphalt that are being delivered to the mixing drum. The flow of aggregate shall be weighed by an electronic belt scale.

The calibration shall be performed by diverting the aggregate flow into a truck and the asphalt flow into a container of at least 3 000 litres capacity. The materials shall be weighed on a platform scale and the weight compared to the plant readings.

During the calibration, the asphalt percent delivered shall not vary by more than 0.1% from a particular setting.

The rates of flow of aggregate and asphalt shall be displayed on the control panel.

The belt scale shall be accurate to within 1.0% of the truck weight at the anticipated production rate and also at the lesser of the following rates:

100 t/h less than the anticipated production rate, or

25% lower than the anticipated production rate.

3.5.5.3 **Production**

Asphalt binder, of the designated type and grade, shall be uniformly applied to the combined crushed aggregate at the rate approved in the Job Mix Formula. The temperature of any ingredient of the mix shall not exceed 100°C at the time of plant mixing. Mixing shall continue until all the asphalt is uniformly dispersed throughout the mix and all aggregate particles are coated with asphalt. The drying and mixing process shall not reduce the cutback level to such a degree that the mix cannot be properly placed. Up to the time of spreading and placing material that is to be blade laid, the amount of cutback in the mix shall be maintained as shown below for each binder grade:

MC-250 Between 40% and 70% of the original cutback weight;

MC-800 More than 75% of the original cutback weight

Mixes containing emulsified asphalt shall not be placed and compacted until the Emulsion Breaking Point Test (ATT-65) indicates the emulsion breaking point has been reached.

The moisture content at the plant discharge of mixes containing cutback asphalt shall be 1.0% or less as measured by any individual test.

3.5.5.4 Stockpiling

When Asphalt Stabilized Base Course stockpiles are used as part of construction operations, the general provisions for stockpiling contained in Specification 3.2, Aggregate Production and Stockpiling shall apply, modified and supplemented as follows:

- (a) Stacking conveyors only shall be used in the construction of the stockpiles.
- (b) The free fall distance from the conveyor to the base of the stockpile at the commencement of stockpiling operations at a given site shall not exceed 3.5 m, and the conveyor shall not be raised until the free fall is less than 2 m. Thereafter, the free fall shall not exceed 2 m.
- (c) No equipment shall be allowed on the stockpile at any time.
- (d) Stockpiles shall be constructed so as to minimize segregation and the taking on of moisture. The height of stockpiles shall not exceed 8 m.
- (e) The Contractor shall not plant-mix or stockpile Asphalt Stabilized Base Course mix during periods of rain. Work may resume when the rain ceases.

3.5.5.5 Spreading and Compaction

For blade laid material, up to the time of spreading and placing, the amount of cutback in the mix shall be maintained as shown below for each binder grade:

MC-250 Between 40% and 70% of the original cutback weight;

MC-800 More than 75% of the original cutback weight.

Mixes containing emulsified asphalt shall not be placed until the Emulsion Breaking Point Test (ATT-65) indicates the emulsion breaking point has been reached.

The mix shall be uniformly placed on the prepared and approved surface at the rate of application required to yield the nominal compacted thicknesses specified or designated by the Consultant.

The mix shall be spread and compacted only when the ambient temperature is 5°C or greater and its moisture content is 1.0% or less as measured by any individual test.

Vibratory compaction equipment shall not be used over Cement Stabilized Base Course unless specifically approved by the Consultant in writing.

The mix shall be spread and compacted to specified grade and cross-section, be stable, uniform in depth, gradation, density and asphalt content at the values specified or designated, and the finished surface shall be smooth, waterproof and free of roller and tire marks.

The Contractor shall, at his own expense and to the satisfaction of the Consultant, repair or restore to specified condition any Asphalt Stabilized Base Course which fails, loses specified density or becomes too wet or too dry, or becomes unstable, rutted, distorted, loose or rough prior to placing subsequent layers of material and prior to final acceptance of the Work.

3.5.5.6 Density Control

3.5.5.6.1 General

Control over the density to which Asphalt Stabilized Base Course is compacted will be exercised by the construction of a Control Strip.

A Control Strip is a layer of Asphalt Stabilized Base Course of specified depth constructed on a section of prepared surface. The length of the control strip section shall be 200 m long or as directed by the Consultant.

The Control Minimum Number of Passes is the number of passes with the minimum compaction equipment to attain a Control Maximum Wet Density for a Control Strip.

To determine the Control Minimum Number of Passes, the Consultant will take density measurements by means of nuclear equipment during the compaction operation until a maximum wet density is achieved. The wet density so achieved is the Control Maximum Wet Density.

A new Control Strip with its corresponding Control Maximum Wet Density may be required at any time throughout the project as determined by the Consultant.

3.5.5.6.2 Minimum Compaction Equipment

A Control Strip over Granular Base Course shall be compacted using the following equipment as a minimum:

- (i) Two vibratory steel-wheeled rollers, weighing not less than 6 t each and having vibratory capacities of at least 1 500 vibrations per minute with a minimum dynamic or centrifugal force of 8 000 kg, operated in the vibratory mode at a speed not to exceed 8 km/h; or
- (ii) One vibratory steel-wheeled roller, weighing not less than 6 t and having a vibratory capacity of at least 1 500 vibrations per minute with a minimum dynamic or centrifugal force of 8 000 kg, operated in the vibratory mode at a speed not to exceed 8 km/h; and one of the following:
 - (a) Six wobbly-wheel pneumatic-tired rollers with tires inflated to a pressure of from 165 kPa to 235 kPa, ballasted with at least a level load and towed at a speed not to exceed 8 km/h; or
 - (b) Two self-propelled pneumatic-tired rollers, each ballasted to its maximum capacity, weighing not less than 10 t, having a minimum tire pressure of from 365 kPa to 435 kPa, and travelling at a speed not to exceed 8 km/h; or

- (c) A combination of 4 wobbly-wheel pneumatic-tired rollers and one self-propelled pneumatic-tired roller, all of which meet the appropriate criteria described above.

A Control Strip over Cement Stabilized Base Course shall be compacted using the equipment options as described in Section 3.5.5.6.2 (ii) above as a minimum, except that the vibratory steel roller is to be operated in static mode.

3.5.5.6.3 Method of Compaction for the Control Strip

A "pass" is one complete coverage of the Control Strip area with at least the minimum compaction equipment specified in Section 3.5.5.6.2 of this Specification.

As portions of the mix are being spread, the Contractor shall initially compact the mix either with one of the vibratory steel-wheel rollers specified in Section 3.5.5.6.2(i) or (ii), or with the equipment specified in Section 3.5.5.6.2(ii) (a), (b) or (c), as the case may be, so that when the entire lift has been spread he shall have covered the Control Strip area completely at least twice with this compaction equipment.

Once the Contractor has completely spread the Asphalt Stabilized Base Course for the Control Strip, the Consultant will commence measurements of wet density using nuclear equipment. Compaction using all the minimum equipment specified in Section 3.5.5.6.2(i) or (ii) shall then proceed, and shall continue until the Control Maximum Wet Density is attained and the Control Minimum Number of Passes is established.

When pneumatic-tired rollers are used for compaction, they shall precede the vibratory steel-wheeled roller.

3.5.5.6.4 General Construction Using the Control Strip

Once the Control Minimum Number of Passes and the Control Maximum Wet Density have been established using a given combination of equipment, the Contractor shall use the same equipment, spreading technique and minimum number of passes for the general construction operation unless otherwise approved by the Consultant.

The Consultant may at any time take measurements using nuclear equipment to determine if the Control Maximum Wet Density has been attained. If the results at ten randomly selected test sites do not average at least 98.0% of the Control Maximum Wet Density, then the Contractor shall carry out more passes until such an average is attained, or he shall construct a new Control Strip to establish a new Control Maximum Wet Density and a new Control Minimum Number of Passes, as directed by the Consultant.

The Contractor shall compact areas such as entrances, where all of the specified equipment cannot work practically, using a vibratory steel-wheeled roller as specified in Section 3.5.5.6.2 until 95.0% of the Control Maximum Wet Density has been achieved.

3.5.5.7 **Asphalt Fog Coat**

The Contractor shall apply an asphalt fog coat to the finished Asphalt Stabilized Base Course surface as soon as is practical, as the Work progresses, and at locations and to dimensions designated by the Consultant, according to Specification 3.19, Prime, Tack and Fog Coats. Areas of Asphalt Stabilized Base Course which have been repaired or restored shall be refogged to the satisfaction of the Consultant.

3.5.5.8 Interim Lane Markings

The Contractor shall provide interim lane markings on all newly constructed asphalt stabilized base course surfaces, or on tacked surfaces that are to be exposed to traffic overnight. All paint spots shall be 100 mm wide and 300 mm long, shall be applied lengthwise to the road surface, shall be spaced 15 m apart on centre in tangent sections and 7.5 m apart on curves, shall employ the same paint colour as the permanent marking to come and shall be completely covered with glass beads at the time of painting.

3.5.5.9 Slopes and Ditches

Slopes shall be neatly trimmed, and loose or waste material shall be either neatly bladed against the edge of the base course or spread neatly over the sideslopes and ditches as directed by the Consultant. All rocks larger than 75 mm in diameter shall be removed from the side slopes and ditches and disposed of in a manner satisfactory to the Consultant. This is considered incidental to the Work and no separate payment will be made.

3.5.5.10 Asphalt Stabilized Base Course for Others

The Contractor shall make available, on request, additional asphalt stabilized base course for the use of the Department. The estimated quantity of additional material is shown in the unit price schedule as "Asphalt Stabilized Base Course For Others". This additional material will either be picked up at the mixing plant by other forces at times that are mutually agreeable to the Contractor and the Consultant or stockpiled by the Contractor, as determined by the Consultant.

3.5.6 MEASUREMENT AND PAYMENT**3.5.6.1 Asphalt Stabilized Base Course**

Accepted Asphalt Stabilized Base Course material will be measured in tonnes and paid for at the unit price bid per tonne for "Asphalt Stabilized Base Course". This payment will be full compensation for processing, hauling and placing the mix; stockpiling if appropriate, interim lane marking and quality control.

No payment will be made for any material used to repair failures which may occur in the base courses constructed under this Contract. Any expense incurred in the supply, processing, hauling and placing of such material shall be borne by the Contractor.

3.5.6.2 Asphalt Stabilized Base Course For Others

Payment will be made at the unit price bid per tonne for "Asphalt Stabilized Base Course For Others." This payment will be full compensation for processing the mix, loading to trucks or stockpiling the material and quality control.

3.5.6.3 Supply of Aggregate

Payment for the supply of aggregate will be made in accordance with Specification 5.2, Supply of Aggregate.

3.5.6.4 Fog Coat

Measurement and payment for Fog Coat will be in accordance with Specification 3.19, Prime, Tack and Fog Coats.

3.5.6.5 Supply of Asphalt

Payment for the supply of asphalt for Asphalt Stabilized Base Course will be made at the unit price bid per tonne for "Supply of Asphalt for Asphalt Stabilized Base Course."