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17.1 General

Asphalt Concrete Pavement shall consist of crushed aggregates with reclaimed asphalt pavement (RAP), blend sand and filler material as required, and asphalt cement, combined in a hot mix plant as hereinafter specified, placed and compacted on bridge decks and approaches in conformity with the lines, grades, dimensions and cross-section as provided and as shown on the drawings.

This specification is for the following applications:

- ACP Wearing Surface applied over hot applied rubberized asphalt membrane waterproofing complete with protection board.
- ACP Wearing Surface applied on polymer membrane waterproofing.
- Asphalt Concrete Pavement transition and approach road paving.

For projects where transition ACP is required, the Contractor shall cold mill to achieve a 40 mm minimum thickness of ACP. The joint between the existing ACP and the new transition ACP shall be sawcut a minimum of 40 mm across the full width of roadway. Milling shall be considered as part of Asphalt Concrete Pavement and no separate or additional payment will be made.

This specification shall be used in conjunction with the current version of the Standard Specifications for Highway Construction which is referred to below as “Standard Specifications”. In areas of conflict between this specification and the “Standard Specifications”, this specification shall govern.

17.2 Materials

The Contractor shall supply Asphalt Cement and Aggregate in accordance with sections 3.50.2.1 and 3.50.2.2 of the Standard Specifications for Highway Construction.

The liquid asphalt shall be applied as a tack coat to ensure a bond between the surface being paved and the subsequent course, and shall consist of SS-1 or RC 30/70. When SS-1 is used it shall be diluted with an equal volume of water. In all cases where weather conditions permit, SS-1 shall be used in preference to RC 30/70. The tack coat materials shall conform to the Specifications listed in Tables ASPH6 and ASPH7 of Specification 5.7 of the Standard Specifications for Highway Construction.

17.3 Asphalt Mix Design

The Contractor shall prepare and submit asphalt mix designs in accordance with section 3.50.3 Asphalt Mix Design and Job Mix Formula of the Standard Specifications that are representative of materials to be used. For asphalt mix designs which were completed in excess of six months prior to anticipated production, additional analysis of more recent sampling shall be provided, as required to confirm that the mix ingredients continue to meet requirements.
The Type of Asphalt Mix to be used shall be as specified. Generally on primary highways (Highway 1 - 216) a Type H2 Asphalt Mix using a 150-200A asphalt cement grade will be specified, and on secondary highways (Highway 500 - 986) and local roads a Type M1 Asphalt Mix using a 200-300A asphalt cement grade will be specified.

When accepted by the Consultant the Contractor will be permitted to supply a Type H2 Asphalt Mix where a Type M1 Asphalt Mix has been specified.

### 17.4 Sampling and Testing

Unless otherwise specified sampling and testing procedures used to determine material characteristics shall be as outlined in the Standard Specifications for Highway Construction section 3.50.4 Sampling and Testing.

The Consultant shall have access to the work at all times for taking samples. The Contractor shall provide any assistance necessary for taking samples and shall reinstate pavement layers or other structures to the satisfaction of the Consultant at the positions where samples have been taken. Compensation for providing assistance with sampling and for reinstatement where samples are taken shall be included in the unit price bid for the various items of Work tested and no separate payment will be made.

Sampling of the asphalt mixture by the Consultant shall be done at a minimum frequency of two samples for each lift of placement. Sample size shall be 6 kg.

Quality Assurance (QA) testing done by the Consultant on each sample shall consist of an uncorrected asphalt content determination and aggregate gradation.

The Consultant shall use the Contractors correction factor determination as a guide to approximate the actual asphalt content. The actual asphalt content is the amount of asphalt binder in the mix as determined by ATT-12 or ATT-74, and includes a correction factor for the asphalt binder lost due to absorption by the aggregate or aggregate loss.

In-place density testing may be carried out on an as required basis at locations as determined by the Consultant.

Inspections during construction for pavement segregation shall be as outlined in section 3.50.4.7 of the Standard Specifications. Contrary to section 3.50.4.7.4 “Repairing Pavement Segregation”, areas identified as either moderate or severe segregation, shall be removed and replaced. Areas identified as slight segregation shall be repaired using a slurry patch.

The Consultant’s acceptance of any materials or mixtures shall in no way relieve the Contractor from his obligation to provide materials, mixtures and workmanship in accordance with the specifications.

Generally, sampling and testing will only be carried out on projects consisting of 50 tonnes or more of ACP.
17.5 Quality Control Testing

The Contractor shall produce crushed aggregates in accordance with Specification 3.2, Aggregate Production and Stockpiling for Designation 1 aggregate and requirements listed in section 3.50.3.2 Design Requirements. The Contractor shall be totally responsible for production of aggregate that meets all the specified requirements.

The Contractor shall be responsible for all costs associated with quality control testing. Results of all quality control tests shall be submitted to the Consultant as they become available.

Unless otherwise specified, the latest edition of the following standard Alberta Transportation test methods (ATT) will be used to determine material characteristics.

Test methods and minimum frequencies of testing are shown in Table 17.5 Quality Control Testing Requirements.

<table>
<thead>
<tr>
<th>Test</th>
<th>Standard</th>
<th>Minimum Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGGREGATE PRODUCTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIEVE ANALYSIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Sieve Analysis Crushed Aggregate</td>
<td>ATT-26</td>
<td>Minimum of one test for each aggregate component.</td>
</tr>
<tr>
<td>PERCENT FRACTURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Percent Fracture Crushed Aggregate</td>
<td>ATT-50</td>
<td>Minimum of one test for each crushed aggregate component.</td>
</tr>
<tr>
<td>ASPHALT MIX PLANT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Calibration</td>
<td>ATT-17</td>
<td>Once per project or as required Minimum of one per lift.</td>
</tr>
<tr>
<td>2. Inspection</td>
<td>ATT-16</td>
<td></td>
</tr>
<tr>
<td>SAMPLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Asphalt Cement</td>
<td>ATT-42</td>
<td>If requested by the Consultant</td>
</tr>
<tr>
<td>2. Tack, Prime and Fog Materials</td>
<td>ATT-42</td>
<td>If requested by the Consultant</td>
</tr>
<tr>
<td>3. Cold Feed Aggregate</td>
<td>ATT-38</td>
<td>-3</td>
</tr>
<tr>
<td>4. Mix</td>
<td>ATT-37</td>
<td>Minimum of one per lift</td>
</tr>
<tr>
<td>5. QA Cores - Stratified Random Test Sites Chosen By The Consultant (Coring done by Contractor)</td>
<td>ATT-56 ATT-5</td>
<td>As requested by the Consultant</td>
</tr>
</tbody>
</table>
### 17.6 Equipment and Methods

#### 17.6.1 General

Equipment and methods used on this work shall be adequate to produce and place the material as specified herein, and shall be subject to the acceptance of the Consultant. The Department reserves the right to order changes or the discontinuance of use of any equipment or method which, in the opinion of the Consultant, fails to produce satisfactory results.

#### 17.6.2 Asphalt Mixing Plant Requirements

All asphalt mixing plants used by the Contractor for the preparation of asphalt concrete material shall conform to the requirements of section 3.50.5.1.2 of the Standard Specifications for Highway Construction. The Contractor shall provide the Consultant with a certificate of calibration which certifies that the plant has been calibrated to produce a uniform mixture in accordance with the Job Mix Formula.
17.6.3 Equipment for Transportation of Mixture

The mixture shall be transported from the asphalt plant to the worksite in trucks with smooth metal boxes in good and leakproof condition, previously cleaned of all foreign materials or hardened asphalt concrete mixture. Each vehicle shall be equipped with a tarpaulin of suitable material and of sufficient size to overhang the vehicle box when fully loaded. Tarpaulins shall be on the haul unit at all times and shall be used to cover the mixture completely unless otherwise determined by the Consultant. Tarpaulins shall be securely fastened on all sides of the box.

Truck boxes shall be clean, free from accumulations of asphalt mix and foreign material. Excess truck box lubricants such as detergent or lime solutions shall not be allowed to contaminate the mix, and shall be disposed of in an environmentally acceptable manner. Petroleum based truck box lubricants shall not be used.

17.6.4 Paver

Pavers shall be acceptable to the Consultant and be self-propelled and operated to maintain required levels, cross-falls and joint matching.

17.6.5 Compaction Equipment

The Contractor shall provide sufficient self propelled equipment to obtain the required degree of compaction of the asphalt concrete mixture. The compaction capability of the equipment used shall equal or exceed the placing rate of the spreading operations and shall be capable of obtaining the required compaction before the temperature of the mat falls below specified levels. Compaction equipment shall be of a suitable size, weight and type as acceptable to the Consultant, such that displacement of the mat and/or disruption of underlying materials does not occur. Specialized equipment may be required to achieve adequate compaction and smoothness in tight corners, such as adjacent to expansion assemblies and deck joints.

The Contractor is advised that a minimum of two pieces of compaction equipment shall be provided. They shall be rollers of at least 10 tonnes mass, one rubber tired and one smooth steel drum type. Vibrators on vibratory rollers shall not be activated.

The compaction equipment shall be in proper mechanical condition and shall be operated such that uniform and complete compaction is obtained throughout the entire width, depth and length of the pavement being constructed. Rollers provided shall leave a smooth, properly finished surface, true to grade and cross-section without ruts or other irregularities. All compaction equipment shall be equipped with methods of wetting the tires or drums to prevent adhesion or pickup of the asphalt mixture.
17.7 Construction

17.7.1 Asphalt Temperatures

The asphalt tank supplying the plant mixer shall be equipped with heating apparatus capable of producing asphalt temperatures up to but not greater than 160°C uniformly throughout the entire contents of the tank. The Contractor shall maintain the asphalt temperature within plus or minus 10°C of the specified mixing temperature.

17.7.2 Mix Production

The Contractor shall produce an asphalt mixture in accordance with section 3.50.5.1.3 Mix Production of the Standard Specifications for Highway Construction.

17.7.3 Protection of Adjacent Bridge Components

The Contractor must protect curbs, deck joints, and expansion assemblies to prevent splatter or spillage of asphaltic materials.

17.7.4 Tack Coat

Asphalt tack coat shall be applied to the existing protection board, polymer membrane waterproofing, granular base course, or existing asphalt concrete substrate and between lifts of asphalt concrete pavement, at the locations and to the dimensions designated by the Consultant.

The surface to be tacked shall be dry and free of loose or deleterious material when the tack is applied.

The asphalt tack coat shall be applied in a uniform manner at an application rate of 0.5 ℓ/m² and asphalt temperature designated by the Consultant. Air temperature in the shade at the time of application shall be 5°C or higher.

On areas where the Contractor is required to accommodate traffic, he shall tack the surface in two operations. In the first operation one half of the width shall be tacked with the remaining half being tacked after the first half has cured.

The tack coat shall be protected from traffic or other damage. Areas on which the tack has been damaged by traffic shall be retacked at the Contractor’s expense.

17.7.5 Spreading and Compaction

17.7.5.1 General

The mixture shall be placed only upon a dry, frost free substrate on which the tack coat has cured and under weather and temperature conditions acceptable to the Consultant. Prior to the delivery of the mixture on the work, the base shall be cleaned of all loose or foreign material. The mixture shall be spread and compacted during daylight hours only, unless artificial light satisfactory to the Consultant is provided.
During spreading and compaction operations, care shall be taken at all times to ensure that:

- Asphalt mixture is not wasted over the side or onto the adjacent surface mat.
- Damage is not done to the waterproofing membrane, curbs, manholes, drains or medians.
- Damage is not done to guide posts, guardrails, signs, power conduits or any other roadside installations.

The Contractor shall make immediate and adequate repair of any damage resulting from his operations at his own expense.

17.7.5.2 Spreading

The mix shall be spread at a temperature sufficient for specified compaction and finishing at the final placement area.

The manner of placing shall be as acceptable to the Consultant to ensure safe accommodation of traffic, quality control and drainage. The longitudinal and transverse edges of each lane shall be straight in alignment, uniform, and of the same thickness as the adjoining pavement layer. Adequate measures for the protection of the exposed edges shall be maintained throughout the work.

Each layer shall be placed, finished and compacted for the full width, and then allowed to cool down to 50°C or colder prior to commencing the subsequent layer.

In the placing of successive layers, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in successive layers do not coincide. Unless otherwise directed, the lateral distance between the longitudinal joints in the successive layers shall be not less than 0.30 m. The longitudinal joint of the final lift of asphalt concrete pavement shall not be located within the wheel path areas.

The surface of all lifts shall not exhibit evidence of segregation, such as pockets of fine and coarse material.

All longitudinal and transverse joints shall be of the vertical butt joint type, made in a careful manner, well bonded and sealed, and shall be finished to provide a continuous, smooth profile across the joints.

17.7.5.3 Compaction

The Contractor shall monitor the compaction process using a Control Strip Method. Control Strips are generally established on each mat placed.

The Control Strip lift shall be compacted using at least the following equipment:

(a) One steel roller weighing not less than 10 t; and

(b) One self-propelled pneumatic rollers, ballasted to its maximum capacity, weighing not less than 10 t.
Once the mix has been spread by the paver and the initial pass of the breakdown roller has been done, moisture and density measurements for determining the Control Density will commence at five locations within the Control Strip area, and will continue following repeated passes of the compaction equipment until the apparent maximum density is attained. These measurements will be taken by the Contractor using nuclear testing equipment.

The Contractor shall compact the pavement to a minimum average density of 97% of Marshall Density, with no individual density less than 95%.

When the compaction methods and procedures, in the opinion of the Consultant are not achieving the desired compaction specifications, the Consultant may require the Contractor, at any time to obtain cores of the top lift pavement. The number of cores will be determined by the Consultant. The cores will be tested by the Contractor and the results provided to the Consultant as they become available.

Percent compaction will be expressed in percent of Marshall Standard Density. The Marshall Standard Density used for determining pavement compaction shall be as follows:

(a) Marshall Densities determined on field sampled mix, or if not available then;

(b) Marshall Design Density as reported in the accepted mix design.

Coring shall be done using methods which will not damage the rubberized asphalt membrane or protection board. Core holes shall be completely de-watered and dried. A generous application of liquid asphalt shall be applied to the bottom and sides of the core hole and allowed to cure. Asphalt mix shall then be tamped in lifts into the core hole until flush with the surface of the surrounding pavement.

The Contractor shall not undertake any coring unless acceptance by the Department and the Consultant.

The Contractor shall be reimbursed for obtaining, preparing and testing cores at the rate of $100 per core location.

In order to maintain the crown of the bridge deck and approaches, the contractor shall avoid operating the compaction equipment on or across the crown. Compaction procedures and equipment shall be such that displacement of the mixture does not occur. Roller wheels shall be kept slightly moistened by water or oil to prevent picking up the mixture, but an excess of either water or oil will not be permitted.

In cases where the asphaltic mixture is placed under weather and temperature conditions which may be considered less than ideal, the Contractor shall modify normal operations and provide special attention to these situations such that specified compaction results are achieved.
17.7.5.4 Hot-Applied Rubberized Membrane Waterproofing

The first layer of the ACP Wearing Surface shall be spread by the asphalt paver moving with the laps in the protection board.

With the possibility of damage to the waterproofing membrane, the paver must not push the delivery trucks and all equipment must perform all turning movements off the bridge deck. Dumping of the asphalt mixture onto the protection board ahead of the paver will not be permitted.

The prepared material shall be placed and compacted in two nominal 40 mm layers.

To avoid displacement of the mixture the first lift shall be compacted only after the spread asphalt mixture has cooled to 105°C. The second lift shall be compacted when the spread asphalt mixture is within the following temperature ranges:

<table>
<thead>
<tr>
<th>ASPHALT GRADE</th>
<th>FIRST LIFT</th>
<th>SECOND LIFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 - 200 (A)</td>
<td>MAX. 105°C</td>
<td>128°C - 138°C</td>
</tr>
<tr>
<td>200 - 300 (A)</td>
<td>MAX. 105°C</td>
<td>123°C - 133°C</td>
</tr>
</tbody>
</table>

Due to the cooler compaction temperature (105°C) of the first lift, it may not be possible to achieve the 97% average density.

17.7.5.5 Polymer Membrane Waterproofing

The ACP Wearing Surface shall be placed in one lift of 50 mm nominal thickness. Dumping of the asphalt mixture onto the waterproofing membrane ahead of the paver will not be permitted.

The temperature of the asphalt mixture shall be between 123°C and 138°C at the start of compaction.

17.7.5.6 Transition and Approach Road Paving

The asphalt concrete pavement shall be placed as shown on the drawings and determined by the Consultant. Lifts of ACP shall not exceed 70 mm. Coarse aggregates shall be raked out of “feathered” edges of the asphalt concrete mat, to provide a smooth transition to the existing pavement.

The temperature of the asphalt mixture shall be between 123°C and 138°C at the start of compaction.
17.7.6 Surface Defects and Material Tolerances

The completed pavement and all intermediate lifts shall be smooth, true to established cross-section and grade, thoroughly compacted and free from ruts, humps, depressions, or other irregularities. Any ridges, indentations or other objectionable marks left in the surface of the asphalt concrete pavement shall be eliminated by rolling or by other means. The Contractor shall be responsible for all costs including materials associated with the repair of Surface Defects.

17.7.6.1 Smoothness

Except across the crown, the surface shall be such that when tested with a 3 m long straight edge placed anywhere in any direction on the surface, there shall not be a gap greater than 3 mm between the bottom of the straight edge and the surface of the deck anywhere below the straight edge. The surface shall be checked by the Contractor, as described above, immediately after the final rolling.

Any final lift pavement surface which does not meet the smoothness requirements given above shall be repaired by the Contractor to meet the requirements using methods acceptable to the Consultant.

Material removed by cold milling shall be hauled and disposed of by the Contractor, at his expense.

17.7.6.2 Segregated Areas

Segregated areas identified by the Consultant shall be repaired by the Contractor. Methods of repair for segregation shall be as reviewed and accepted by the Department and Consultant. All repairs carried out by the Contractor shall be at his own expense.

17.7.6.3 Obvious Defects

The finished surface of any lift shall have a uniform close texture and be free of visible signs of poor workmanship. Any obvious defects as determined by the Consultant such as, but not limited to the following, shall be promptly repaired in a manner acceptable to the Consultant.

(a) Areas of excess or insufficient asphalt
(b) improper matching of longitudinal and transverse joints
(c) roller or tire marks
(d) cracking or tearing
(e) sampling locations not properly reinstated
(f) improperly constructed patches

17.7.6.4 Asphalt Content

For top lift material the average asphalt content shall not be greater than ± 0.50% from the accepted mix design asphalt content.

For bottom lift material the average asphalt content shall not be greater than ± 0.65% from the accepted mix design asphalt content.
17.7.6.5 Aggregate Gradation

For each lift of placement the difference between the average gradation and the Job Mix Formula gradation shall not exceed the amounts shown in the following table:

### Aggregate Gradation Variation

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Maximum Permissible Variation* (&lt;br&gt;Percent by Weight Passing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>±6</td>
</tr>
<tr>
<td>1250</td>
<td>±4</td>
</tr>
<tr>
<td>630</td>
<td>±3</td>
</tr>
<tr>
<td>315</td>
<td>±3</td>
</tr>
<tr>
<td>160</td>
<td>±2.5</td>
</tr>
<tr>
<td>80</td>
<td>±2.0</td>
</tr>
</tbody>
</table>

*In any case the Average Gradation must meet the gradation requirements of Specification 3.2 Aggregate Production and Stockpiling

17.8 Measurement and Payment

17.8.1 By Lump Sum Price Bid

Payment for Asphalt Concrete Pavement will be made on the basis of the lump sum price bid for the Asphalt Concrete Pavement acceptably placed on the bridge deck, approach slabs and approach roadways (as specified) and remaining in the completed work, which price shall include full compensation for the cost of furnishing all labour, equipment, tools, materials, milling, hauling and placing the mix, quality control testing and incidentals necessary to complete the work.

17.8.2 By Unit Price Bid

Payment for Asphalt Concrete Pavement will be made on the basis of the unit price bid per tonne for the Asphalt Concrete Pavement acceptably placed on the bridge deck, approach slabs and approach roadways (as specified) and remaining in the completed work, which price shall include full compensation for the cost of furnishing all labour, equipment, tools, materials, milling, hauling and placing the mix, quality control testing and incidentals necessary to complete the work. The number of tonnes to be paid for will be calculated based on the field measurement. The conversion factor for Asphalt Concrete Pavement from cubic metre to tonne shall be 2.3.