

Part 1 General

1.1 SECTION INCLUDES

- .1 This section consists of the supply and placement of hot mixed conventional asphalt concrete.
- .2 The asphalt concrete shall be identified by the mix designation B and/or C for conventional mixes.

1.2 RELATED SECTIONS

- .1 Section 31 05 17 – Aggregate Materials
- .2 Section 32 23 33 – Excavating, Trenching and Backfilling

1.3 SUBMITTALS

- .1 The Contractor shall submit, in writing, the proposed source(s) of supply of coarse aggregate, fine aggregate and blending sand for approval by the Departmental Representative, and shall arrange for the Departmental Representative to take samples of the proposed sources.
- .2 The Contractor shall submit in writing, the proposed supplier of the asphalt cement.
 - .1 The Contractor shall supply to the Departmental Representative, the temperature-viscosity relationship for CAN/CGSB 16.3 Group A asphalts.
 - .2 The Contractor shall supply, to the Departmental Representative, at the time of delivery of the material to the plant, for each tanker load of asphalt cement, the refinery certification and delivery slip.
 - .3 If the source of supply of the asphalt cement changes during the work, the Contractor shall submit in writing, this proposed change prior to using the new asphalt cement supply in the work.
- .3 The Contractor shall submit the Design Mix Formula (DMF) to the Departmental Representative for approval a minimum of two (2) weeks prior to commencing the production and placement of the asphalt concrete mix.

1.4 REFERENCES

- .1 ASTM D995, Standard Specification for Mixing Plants for Hot Mixed, Hot Laid Bituminous Paving Mixtures.
- .2 ASTM D2041, Standard Test method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- .3 ASTM D5361, Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing.
- .4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .5 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .6 ASTM C117, Standard Test Method for Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing.
- .7 ASTM D4867, Standard Test Method for Effect of Moisture in Asphalt Concrete Paving Mixture.
- .8 ASTM D75, Standard Practice for Sampling Aggregates.
- .9 MTO LS609, Procedure for the Petrographic Analysis of Coarse Aggregate.
- .10 MTO LS607, Method of Test for Determination of Percent Crushed Particles in Processed Coarse Aggregate.
- .11 MTO LS608, Method of Test for Determination Percent Flat and Elongated Particles in Coarse Aggregate
- .12 MTO LS618, Method of Test for the Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
- .13 MTO LS614, Method of Test for the Freezing and Thawing of Coarse Aggregate.

1.5 MEASUREMENT FOR PAYMENT

- .1 Payment for work under this section shall be by the tonne.
 - .1 All materials, labour, equipment, mixing, weighing, placing, compacting, and the supply and application of tack coat shall be considered incidental to the work.

- .2 No extra payment shall be made for any handwork required around catch basins, manholes, curbs and gutters as directed by the Departmental Representative but shall be considered as incidental to the work.

Part 2 Products

2.1 ASPHALT CEMENT

- .1 The asphalt cement shall be 120/150 penetration or equivalent.
- .2 Asphalt cement shall be supplied by the Contractor.
- .3 The asphalt cement grade shall be as specified in the contract documents:
 - .1 "Penetration Grade" asphalt cement shall meet the requirements as specified in CAN/CGSB 16.3, Group A; and
 - .2 When anti-stripping admixtures are required, then the asphalt cement grade shall meet the specified requirements after the addition of the required admixtures.

2.2 COARSE AGGREGATE

- .1 Coarse aggregate shall be supplied by the Contractor.
- .2 The coarse aggregate shall be prepared by crushing rock or gravel and shall consist of hard, sound, durable particles, free from adherent coatings, shale, clay, loam, schist and other soft or disintegrated pieces, or other deleterious substances.
- .3 Coarse aggregate is the portion retained on the 4.75 mm sieve, tested in accordance with ASTM C136, and shall meet the physical requirements of Table 02741 – 1.

Table 02741 – 1
Physical Requirements for Coarse Aggregates

Test	Standard	Requirements	
		Surface Mixes	Base Mixes
Petrographic Number (Maximum)	MTO LS609	180	230
Crushed Particles (Min. % by wt., two face)	MTO LS607	95 80	95 80
Flat and Elongated Particles (Max. % @ 4:1)	MTO LS608	15	15
Micro-Deval (Max. % loss)	MTO LS618	14	18
Freeze/Thaw (Max. % loss)	MTO LS614	12	14
Absorption (Max. % by wt. retained)	ASTM C127	1.75	2.00

- .4 Coarse aggregate may also be accepted or rejected on the basis of past performance.

2.3 FINE AGGREGATE

- .1 Fine aggregate shall be supplied by the Contractor.
- .2 Fine aggregate shall be prepared by crushing rock or gravel or screening a manufactured sand and shall consist of hard, sound, durable particles free from adherent coatings, shale, clay, loam, schist and other soft or disintegrated pieces, or other deleterious substances.
- .3 Fine aggregate shall be the portion passing the 4.75 mm sieve, when tested in accordance with ASTM C117 and C136, and shall meet the physical requirements in Table 02741 – 2.

Table 02741 – 2
Physical Requirements for Fine Aggregates

Test Property	Test Method	Surface Mixes	Base Mixes
Micro Deval (Max. % loss)	MTO LS619	16	20

- .4 Fine aggregate may also be accepted or rejected on the basis of past performance.

2.4 BLENDING SAND

- .1 Blending sand, if required shall be supplied by the Contractor.
- .2 Blending sand shall be used to obtain acceptable physical mix properties as outlined in Table 02741 – 4 and the source shall be approved by the Departmental Representative before the material is incorporated into the asphalt concrete mix.
- .3 The maximum mass of blending sand to be used in the total mix shall not exceed 10% of the total mass.

2.5 ANTI-STRIPPING ADMIXTURES

- .1 Anti-stripping admixtures, if required, shall be supplied by the Contractor and shall be approved by the Departmental Representative before the material is incorporated into the asphalt concrete mix.
- .2 Hydrated lime shall meet the requirements of ASTM C207.
- .3 The type and dosage of all anti-stripping additives to the asphalt cement shall be noted on the delivery slip.

2.6 PRODUCTION OF AGGREGATES

- .1 Grading Requirements.
- .1 Pit run gravel or quarried rock shall be crushed and separated into coarse and fine aggregates.
- .2 The gradation of coarse aggregate and fine aggregate for each type of mix shall meet the pegged limits as shown in Table 02741 – 3, when tested in accordance with ASTM C117 and/or C136.
- .3 For quarried rock, exclusively, an additional one percent (1%) passing the 75 µm sieve may be permitted for the fine aggregate in surface mixes provided the total percent passing the 75 µm sieve, of the blend of aggregates as required by the mix design, is less than the maximum limits shown in Table 02741-5.

Table 02741 – 3
Pegged Limits Gradation of Aggregates (by Mix Type)

ASTM Sieve Size	Coarse Aggregate	Blending Sand	Fine Aggregate % Passing	
	% Passing	% Passing	Base Mixes	Surface Mixes
50 mm				
25.0 mm	100 for B			
16.0 mm	100 for C			
12.5 mm	100 for D			
9.5 mm		100	100	100
4.75 mm	Maximum 15		Minimum 80	Minimum 80
75 µm	Maximum 2.5		Maximum 9	Maximum 8

.2 Blending Aggregates

- .1 Blending of aggregates will only be allowed to meet the grading requirements or to increase the percentage of crushed particles.
- .2 Blending of aggregates shall be performed with the cold feed units to produce a consistently graded product.

2.7 COMPOSITION OF ASPHALT CONCRETE MIX

.1 Mix Design

- .1 The Design Mix Formula (DMF) is the Laboratory determination of the precise proportions of asphalt cement and aggregates to be blended together to meet the requirements in Table 02741-4.
 - .1 The asphalt mix design shall follow the Marshall test using a compactive effort of 75 blows and as detailed in *Mix Design Methods - For Asphalt Concrete and Other Hot-Mix Types*, Asphalt Institute Manual Series No. 2 (MS-2).
 - .2 The Contractor shall have the DMF prepared by an independent testing laboratory and all costs shall be borne by the Contractor.
 - .3 The quality assurance testing during aggregate production shall in no way relieve the Contractor from their obligation to provide aggregate in accordance with the Contract Documents.
- .2 The Job Mix Formula (JMF) establishes the single definite percentage for each sieve fraction of aggregate and for the asphalt cement that will produce the desired mix properties under field conditions.
 - .1 The JMF is established by producing one or more trial mixes using the plant proposed for the work.

.2 Aggregate Requirements

.1 Sampling for DMF shall not be undertaken until:

.1 At least 30% of each aggregate type is produced and in stockpile.

.2 The Contractor shall be responsible for locating a suitable source of blending sand and arranging for the Departmental Representative to take samples.

Table 02741 – 4
Physical Requirements for Asphalt Concrete Mix Design

Test Property	B		C		D	
	Min.	Max.	Min.	Max.	Min.	Max.
Marshal Stability (N at 60°C)	8000		8000		8000	
Marshall Flow (0.25 mm)	8	16	8	16	8	16
% Air Voids	3	5	3	5	3	5
% Voids in Mineral Aggregate (VMA)	13		14		15	
% Voids filled with Asphalt (VFA)	65	75	65	75	70	77
Film Thickness (microns) DOT Method	8 minimum		8 minimum		9 minimum	
Moisture Sensitivity (Stripping) TSR/TRS	minimum 75 %					

.3 The aggregates, including any required hydrated lime, blending sand and/or reclaimed asphalt concrete, shall be combined in such proportions as to provide a mix conforming to the grading requirements of Table 02741 – 5.

Table 02741 – 5
Grading Requirements of Combined Aggregate*

Asphalt Mix Designation	ASTM C 136, ASTM C117		
ASTM Sieve Size	B % Passing	C % Passing	D % Passing
31.5 mm			
25.0 mm	100		
19.0 mm	84-94		
16.0 mm	72-90	100	
12.5 mm	60-83	88-98	100
9.5 mm	51-75	68-90	76-98
6.3 mm	41-66	54-77	60-84
4.75 mm	34-60	46-69	52-77
2.36 mm	22-50	28-58	36-65
1.18 mm	12-42	20-50	25-55
600 µm	6-32	13-40	16-44
300 µm	3-20	7-27	8-26
150 µm	2-8	3-10	4-12
75 µm	2-6	2-7	2-7

*includes hydrated lime, if required.

.3 Handling and Stockpiling Aggregates

- .1 The coarse aggregate, fine aggregate and blending sand shall each be stockpiled separately.
- .2 Stockpiles shall be placed on a level, well drained base and constructed in such a manner that segregation and contamination does not occur.
- .3 Segregated or contaminated stockpiles shall not be incorporated into the work.
- .4 Aggregates shall be loaded into cold feed bins so as to prevent the intermixing of separate sizes.
- .5 Mixing of materials or loading of more than one type of material into a single bin shall not be permitted.

.4 Physical Requirements for Asphalt Concrete

- .1 Once the JMF has been designated by the Departmental Representative, the Contractor shall produce an asphalt concrete mix to the mix control tolerances and ranges as shown in Table 02741 – 6.

Table 02741 – 6
Asphalt Mix Control Tolerances and Ranges

Tolerances

Asphalt Cement Content	±0.3 %
4.75 mm and above sized material	±5 %
2.36 mm – 150 µm sized material	±4 %
75 µm and below sized material	±1 %

Ranges

% Air Voids	3 – 5 %
Moisture Sensitivity (Stripping) TSR/TRS ASTM D4867	minimum 75 %

.5 Sampling and Testing of Aggregates

- .1 The crushed product may be monitored throughout the period of the work and may be accepted or rejected on the basis of the testing performed by the Departmental Representative.

Part 3 Execution

3.1 GENERAL

- .1 The Contractor shall carry out the work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.

3.2 EQUIPMENT AND PRODUCTION

.1 General

- .1 Equipment shall be on site and available for inspection, testing and approval before paving operations start.
- .2 The Contractor shall provide access to plant and equipment to the Departmental Representative for purposes pertaining to the work.
- .3 The asphalt mixing plant and its components shall meet the requirements of ASTM D995 and the Contract Documents.

.2 Asphalt Cement Storage

- .1 Tanks for storage of asphalt cement shall be capable of heating the material and maintaining it within the range of not less than 118°C and not greater than 165°C.
- .2 Heating shall be by a means such that no flame shall contact the asphalt cement.

- .3 Tanks shall be installed level and in such a manner that an accurate determination of quantities can be made at any time.
- .3 Cold Bins
 - .1 Cold bins shall be divided into not less than three compartments, each equipped with individual gate control to enable accurate and absolute proportioning of each size of cold aggregate.
 - .2 Compartment dimensions shall be such as to promote free flow of material with a minimum gate opening of 50 mm.
 - .3 An individual compartment shall be provided for each aggregate type (i.e. coarse and fine) and intermingling of aggregates shall not be permitted.
- .4 Thermometric Equipment
 - .1 An armoured thermometer reading from 90°C to 200°C shall be fixed in the asphalt cement feed line near the discharge valve at the mixer unit and in each asphalt cement storage tank.
- .5 Dust Collectors
 - .1 Plants shall be equipped with a dust collecting system and this system must comply with all environmental regulations including but not limited to those initiated by the Dominion of Canada, the Province of New Brunswick, and/or municipal and/or local regulatory agencies having jurisdiction.
- .6 Anti-stripping Admixtures
 - .1 If hydrated lime is required in the mix, the Contractor shall supply and operate the equipment necessary to uniformly incorporate the prescribed proportion of hydrated lime into the mix.
- .7 Safety and Inspection Requirements
 - .1 Safe and adequate stairways, ladders and platforms shall be provided for access, by the Departmental Representative, to trucks, mixer units and other plant units where inspection and sampling is required.
- .8 Additional Requirements for Batch and Continuous Mix Plants
 - .1 A rotary drier designed for drying and heating mineral aggregates shall be provided.
 - .2 The drier capacity shall be sufficient to heat aggregate to the required temperatures.
 - .3 Plant screens capable of efficient screening of aggregates to sizes required for proportioning each type of asphalt mix shall be provided.
 - .1 Screens shall be kept clean and in good repair.

- .2 Aggregates shall be screened such that the stone portion (retained on the 4.75 mm sieve) is stored separately from the sand portion (passing the 4.75 mm sieve).
- .3 Carry-over for any mix, defined as the amount of stone which enters the sand bins and/or the amount of sand which enters the stone bins, in no case shall exceed 20 percent and shall not vary by more than $\pm 5\%$ from the established value.
- .4 Each plant shall contain a minimum of 2 hot storage bins.
 - .1 Bins shall be divided into compartments of sufficient size to allow continuous operation of the plant.
 - .2 Each compartment shall be provided with an overflow chute of such size and at such location to prevent backing up of material into other compartments.
 - .3 Gates on hot storage bins shall be constructed to prevent leakage when closed.
 - .4 Compartments shall be provided with suitable means of obtaining representative test samples as the aggregate is discharged.
- .5 Satisfactory means shall be provided to deliver the required quantity of asphalt cement to the mix at the specified temperature.
- .6 Asphalt cement shall be delivered to the mixer in a thin uniform sheet or in multiple streams over full length or width of mixer.
- .7 All plants shall be further equipped with a recording thermometer or pyrometer to record the temperature of the aggregate at the drier discharge chute.
- .9 Additional Requirements for Batch Mix Plants
 - .1 Each hot storage bin shall contain a sensing device to indicate, at the control panel, when the aggregate level falls below one third capacity of the bin.
 - .1 When automatic batching controls are in use, batching shall not take place if the level of the aggregate, in any hot bin in use, falls below one third full.
 - .2 Equipment shall include a means for accurately weighing aggregate from each bin in a weighing box or hopper of ample size to hold a full batch without running over.
 - .3 Gates on the hopper shall be constructed to prevent leakage when closed.
 - .4 Scales for weighing aggregate shall be accurate to 0.5% and for asphalt cement shall be accurate to 2% through the working range.

- .5 After plant set up and prior to batching materials and whenever deemed necessary by the Departmental Representative, batching plant scales shall be tested for accuracy in the presence of the Departmental Representative.
- .6 Plant shall include a batch mixer capable of producing a consistent and homogeneous mix.
 - .1 The mixer shall be constructed to prevent leakage of contents until batch is discharged.
 - .2 The mixer gate shall be equipped with a timing lock which shall lock the gate until the specified mixing time has elapsed.
- .10 Additional Requirements for Continuous Mix Plants
 - .1 The plant shall include a means for accurately proportioning, by volumetric measurement, aggregate discharged from each hot bin and each bin shall have an orifice, which can be adjusted and set to the required flow rate.
 - .2 The unit shall include a feeder mounted under compartment bins.
 - .3 Each plant shall include a means for calibration of gate openings by weighed test samples.
 - .4 Equipment shall include a method of obtaining hot aggregates from the bins being representative of the flow from specific gate openings.
 - .5 Calibration equipment, including revolution counters, shall be kept in good operating order and available on plant site.
 - .6 A positive interlock control between the flow of aggregate samples from the bins and the asphalt cement feed shall be provided.
 - .7 Plant shall be equipped with a means of maintaining a constant flow of asphalt cement to and from the metering device.
 - .8 Plant shall include a continuous mixer capable of producing a consistent and homogeneous mix.
 - .1 Mixer shall be equipped with an adjustable dam gate at discharge end to control level of material.
 - .9 Continuous mix plants shall be equipped with a controlled discharge storage hopper. This hopper shall be operated to prevent segregation of mix.
 - .10 Each hot storage bin shall contain a sensing device to indicate, at the mixing platform, when the aggregate level falls below one third capacity of the bin.
 - .1 Operation of the mixer shall not take place if the level of the aggregate, in any hot bin in use, falls below one third full.

- .2 Sensing device indicators shall be easily visible from mixer platform.
- .11 Additional Requirements for Drum Mix Plants.
 - .1 Each cold feed bin shall have a variable speed belt feeder as well as an adjustable gate.
 - .2 Plant control shall be such that aggregate feed shall have both individual and total proportional control.
 - .1 Monitors indicating individual cold feed bin feeder speeds shall be installed on the control panel.
 - .3 A means of warning the plant operator shall be provided on each aggregate bin so the flow of aggregate and asphalt cement can be stopped if the material from any aggregate bin should stop flowing.
 - .4 Screen(s) shall be installed on the conveyor system to prevent oversized materials from entering the drum.
 - .5 The conveyor belt with a load cell shall be equipped with a belt cleaner to prevent build-up of material on the belt.
 - .6 The total flow of aggregate shall be measured by an electronic weighing system.
 - .1 The Contractor shall ensure, monitor and maintain the system so that the aggregate flow shall be interlocked with the asphalt pump and corrected for aggregate moisture content so that the proportions of aggregate and asphalt cement entering the mixer remain constant.
 - .7 The weighing systems for aggregates and the metering system for asphalt cement shall have provision to enable easy sampling and calibration without having the material enter the drum.
 - .1 Weighing systems for weighing aggregate shall be accurate and sensitive to 0.5% over the entire working range of the maximum loading required.
 - .2 Metering systems for asphalt cement, shall be accurate and sensitive to 2% over the entire working range.
 - .3 The asphalt cement system shall have provisions to compensate for fluctuations in temperature and relative density.
 - .8 The heating of aggregates and asphalt cement shall be controlled to prevent the fracture of the aggregate and to meet the criteria for Penetration of Residue, Table 1, in CAN/CGSB 16.3.
 - .1 The system shall be equipped with automatic burner controls and shall provide a printed record of the mix temperature at discharge.

- .9 The mixing period and temperature shall be such as to produce a consistent and homogeneous mix at the required mix temperature.
- .10 The method used to transfer the mix from the drum mixer to the haulage units shall be designed, constructed and operated so that there shall be no segregation of, damage to or loss of the mix.
- .12 Surge Bins and Storage Silos
 - .1 Surge bins and storage silos, and their components, shall be designed so as not to damage or segregate the mix.
 - .2 Storage silos equipped with a heating system shall be capable of maintaining the temperature without localized overheating.
 - .3 Surge bins and storage silos shall be equipped with mix level indicators.
 - .4 When the plant is in continuous operation, the minimum level of mix in the silo must be maintained above the one-third capacity level.
- .13 Placing Equipment
 - .1 Mechanical self-powered pavers shall be capable of spreading mix true to line, grade and cross-slope.
 - .2 Pavers shall be equipped with hoppers and distributing screws to place mix evenly in front of the screeds.
 - .3 Pavers shall be equipped with vibrating screeds and shall be capable of spreading mixes, without segregation and with a smooth and uniform textured surface, to the required thickness and in widths from 3 to 5 m.
 - .1 Screeds shall be equipped with heaters which are capable of preheating the entire screed and screed extensions.
 - .4 The Contractor shall provide a 3 m straight edge with each paver.
 - .5 Pavers shall be equipped with automatic screed controls for the control of longitudinal grade and transverse slope.
 - .1 The longitudinal grade control shall be equipped to operate from either side of the paver and be capable of providing longitudinal grade control as well as matching longitudinal joints.
 - .2 The transverse slope control shall also be capable of operating from either side of the paver.
 - .3 The Contractor shall use a minimum 12 m ski or floating beam for longitudinal grade control.

- .4 A calibrated slope indicator shall be installed in a readily visible location on each paver.
- .6 Longitudinal grade control shall be used on all lifts and transverse slope controls shall be used on all lifts except surface course unless otherwise directed by the Departmental Representative.
- .7 Vibrating hydraulic screed extensions and vibrating bolt-on screed extensions shall be used in placing mat widths greater than 3 m.
- .1 Hydraulic strike-off extensions are only acceptable
- .14 **Compaction Equipment**
 - .1 All rollers shall be of types specifically designed for asphalt compaction.
 - .2 Rollers shall be in good condition and capable of reversing without backlash.
 - .3 Steel wheeled rollers shall be equipped with a means of supplying a controlled flow of water to the wheels to prevent adhesion of the asphalt mix.
 - .4 Pneumatic-tired rollers shall be self-propelled with a mechanical means of adjusting the tire inflation pressure.
 - .5 Vibratory rollers shall be equipped with a device that accurately indicates the speed of the roller and should not be operated at a speed and vibrating frequency that will produce less than 30 impacts per metre.
 - .6 All rollers shall be provided with skirts or windbreaks to protect rubber tires from cooling.
 - .1 Height of skirts or windbreaks from road surface shall not be greater than 100 mm when roller is in operation.

3.3 **PREPARATION**

- .1 When a levelling course is not required, the contractor shall pad and/or patch to correct depressions and other irregularities to the approval of the Departmental Representative, prior to commencing the paving operations.

3.4 **PLACEMENT**

- .1 Place asphalt concrete in compacted lifts of thickness as follows:
 - .1 Lower course in 1 layer of 60 mm – Type B.
 - .2 Surface course in 1 layer of 40 mm – Type C

.2 Timing of Paving Operations

- .1 Paving operations shall only be conducted during the daylight hours unless specifically altered by written approval by the Departmental Representative.

.3 Plant Calibration and Trial Mix

- .1 The asphalt plant must be calibrated to the satisfaction of the Departmental Representative, prior to commencement of paving or at any time the Departmental Representative has reason to suspect that the calibration values may be incorrect.
- .2 A trial mix based on the Design Mix Formula (DMF) shall be prepared by the Contractor for testing by the Departmental Representative and shall only be carried out during daylight hours.
- .3 Continuous placement of asphalt concrete in the work shall only be permitted after the Departmental Representative is satisfied that the mix properties are in accordance with the applicable specified requirements.

.4 Mixing Times and Temperatures

- .1 For batch plants, the wet mixing time, beginning when the asphalt cement is introduced into the pug mill, shall be at least 35 seconds or longer if required, to produce a homogeneous mix where all of the aggregate is thoroughly coated with asphalt cement.
- .2 With continuous mix plants the mixing time shall be in accordance with the following formula:

$$\text{Mixing time in seconds} = \frac{\text{Mixer Capacity (kg)}}{\text{Mixer Output (kg/s)}}$$

- .1 The minimum mixing time shall be at least 35 seconds or longer if required, to produce a homogeneous mix where all of the aggregate is thoroughly coated with asphalt cement.
- .3 The mixing time for drum mix plants shall be such to produce a homogeneous mix where all of the aggregate is thoroughly coated with asphalt cement.
- .4 Mixing temperature for all types of plants shall be such that the temperature of the mix when discharged from the mixer unit shall be controlled within $\pm 5^{\circ}\text{C}$ of the temperature requirement of the Job Mix Formulas (JMF).

.5 Moisture Content

- .1 The maximum moisture content allowed in the mix as it is discharged to the surge bin, storage silo, or pug mill shall not exceed one-third of one percent (0.3%).
- .2 The aggregate shall be dried sufficiently so that visual evidence of moisture, such as but not limited to the presence of foaming or slumping of the mix does not occur.

.6 Transportation of Asphalt Mix

- .1 Trucks for transporting asphalt mixes shall have tight, metal boxes free of foreign materials.
- .2 Loads shall be covered with tarpaulins of sufficient size to overhang the fully loaded truck boxes and be tied down on three sides and the front shall be tight to the box of the truck or shielded to prevent air infiltration.
- .3 Truck boxes may be lightly lubricated with an approved release agent, as required, but must be raised and drained after each application and before loading.
- .4 Tarpaulins shall be rolled back and the hot mix shall be uncovered immediately prior to dumping the load into the paver.

.7 Padding

- .1 Material for padding shall be the same mix designation as specified in the contract documents.
- .2 Asphalt mix for padding shall be placed by means of a self-powered paver or by other means approved by the Departmental Representative.
- .3 The compaction equipment shall be in accordance with 3.2.14.
 - .1 The acceptance requirements for compaction shall not be applied to padding.
- .4 Padding is intended to be a separate operation and shall not be done as part of the construction of the subsequent lift of asphalt concrete.

.8 Placing Asphalt Mix

- .1 Any mix which does not comply with the specifications shall not be incorporated in the work.
- .2 Mixes placed on existing paved surfaces shall be laid upon a dry base.
- .3 When paving on an aggregate base, the aggregate base must be free from standing water.
- .4 All prepared surfaces shall be cleaned of loose or foreign material prior to placing of the asphalt mix.
 - .1 Milled and aged asphalt concrete surfaces shall be treated with bituminous tack coat prior to the placing of asphalt.
- .5 Temperature of mix shall not exceed 165°C.
- .6 When laying base and/or surface course the alignment of the paver shall be controlled by an approved method, such as following a stringline, placed by the Contractor from an alignment designated by the Departmental Representative.

- .7 Irregularities in alignment and grade along the outside edge of the asphalt concrete shall be corrected by the addition or removal of mix before the edge is rolled.
- .8 In narrow base widening, deep or irregular sections, intersections, turn-outs or driveways where it is impractical to spread and finish mix by machine methods, the mix shall be spread by hand in accordance with standard hand placement practices.
- .9 Paving of intersections, extra widths and other variations from standard lane alignment and as defined in the contract documents, whether by hand spreading or machine laying, shall be carried out concurrently with the machine laying operation of the regular mat, unless otherwise approved by the Departmental Representative.
 - .1 Driveway entrances and aprons shall be paved concurrently or after the machine laying operation of the regular mat.
- .10 Fuel spills from the Contractor's equipment shall be immediately repaired by the Contractor to the satisfaction of the Departmental Representative.
- .11 After placement, all visible surface defects shall be repaired to the satisfaction of the Departmental Representative before compaction is started.
- .12 Spreading of asphalt concrete by hand shall be kept to an absolute minimum and shall be carried out concurrently with the machine laying operation of the regular mat, unless otherwise approved by the Departmental Representative.
- .13 All placement, spreading, compacting and rolling shall occur only during daylight hours and any loads arriving at the work site such that these requirements cannot be met shall be rejected by the Departmental Representative.

3.5 JOINTS

.1 General

- .1 Joints shall be constructed to ensure thorough and continuous bond and to provide a smooth riding surface.
- .2 Dirt or other foreign and loose material shall be removed from the faces against which joints are to be made.
- .3 The Contractor shall remove and dispose of waste materials, resulting from joint construction or other work activity, outside the work site by the end of each workday.

.2 Transverse Construction Joint

- .1 A transverse construction joint shall be constructed at the end of each day's work and at other times when paving is halted for a period of time which will permit the asphalt concrete to cool below 118°C.

- .2 Where the asphalt concrete surface and/or base course has been terminated due to the conditions noted in the preceding clause, the mat shall be tapered at 50:1 minimum.
- .3 When paving resumes, tapers from surface courses previously laid shall be cut back to full mat thickness to expose fresh, straight vertical surfaces, free from broken or loose material and tacked.
- .3 Transverse Key Joint
 - .1 A transverse key joint shall be constructed between existing and new asphalt concrete pavement at the beginning and at the end of the project and other locations where the new pavement terminates against an existing pavement.
 - .2 If a key is cut in advance of paving the joint area, the Contractor shall construct a smooth taper at the joint area to a slope of 50:1 minimum.
- .4 Longitudinal Construction Joints
 - .1 The following requirements shall apply when constructing longitudinal joints.
 - .1 Widths of succeeding individual courses shall be offset by 100-200 mm.
 - .2 The Contractor shall be required to apply an application of tack coat to the longitudinal joint.
 - .3 All longitudinal joints left exposed overnight or which are exposed to moisture shall receive an application of tack coat.
 - .4 Longitudinal joints shall not be permitted between the edges of driving Lanes in the final lift of asphalt concrete.
 - .5 Longitudinal joints shall be constructed to ensure that maximum compression under rolling is achieved.
 - .6 On surface courses, the method of making joints shall be such that excess material is not scattered on the surface of the freshly laid mat and all excess material shall be carefully removed.
- .5 A tapered cut shall be constructed by milling between the existing concrete curb and gutter and the new asphalt concrete overlay.

3.6 COMPACTION OF MIX

- .1 The mix shall be compacted to a density not less than 92.5% of the theoretical maximum relative density, having been determined in accordance with ASTM D2041.
 - .1 The acceptance of asphalt concrete compacted to a density less than 92.5% of the theoretical maximum relative density shall be at the discretion of the Departmental Representative.

- .2 Compaction equipment shall consist of at least one of each of the following:
 - .1 Vibratory roller;
 - .2 Pneumatic tire roller; and
 - .3 Finish roller.
- .3 Finish rolling will be carried out with a steel drum roller, without vibration and exerting a contact pressure on compression roll of at least 3.0 kg/mm of drum width.
- .4 If damage to components on adjacent property is occurring while using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed with the work using static rolling equipment.
- .5 Along curbs, manholes and similar structures and places not accessible to full size rollers, the mix shall be compacted with either smaller compactive equipment, such as vibrating plate tampers, or by hand tampers.

3.7 ADDITIONAL REQUIREMENTS FOR FINISHED PAVEMENT COURSES

- .1 Each course shall be smooth and true to required cross slope and grade after final compaction.
- .2 Each course shall have average thickness and/or application rate as specified in the contract documents.
- .3 The surface of the finished pavement shall be free from bumps and/or dips exceeding 5 mm as measured with a 4.5 m straight edge.

3.8 QUALITY ASSURANCE TESTING

- .1 Mix Testing
 - .1 The Departmental Representative shall test the asphalt concrete mix for compliance with the requirements detailed in the contract documents.
 - .2 The Departmental Representative reserves the right to inspect and/or test any of the Contractor's operations or materials and those of subcontractors and suppliers, regardless of location.
 - .1 Such inspections and tests shall not relieve the Contractor of his responsibilities to control quality.
 - .2 The Departmental Representative's approval of any materials or mixture shall in no way relieve the Contractor from his obligation to provide materials, mixtures and workmanship in accordance with the contract documents.

.2 Asphalt Density

- .1 The Departmental Representative shall test asphalt concrete cores for compliance with the requirements detailed in the contract documents.
- .2 Compaction testing and acceptance shall be based on a daily average.
- .3 Pavement samples will be taken on the parking lot by coring using stratified random sampling procedures.
- .4 A stratified random sample is defined as the division of the day's production into areas or segments as defined in Table 02741 – 8. A random sample is taken from each area or segment in an unbiased way.

Table 02741 – 8
Areas or Segments per Day

Asphalt Concrete Tonnage	Areas or Segments per day
less than 1000 tonnes	3
1000 to 1200 tonnes	4
more than 1200 tonnes	5

- .5 Mat densities shall be tested by the Departmental Representative by core analysis (ASTM D5361), a minimum of 12 hours after placement, throughout the course of the work.
 - .1 The random core locations shall be determined by the Departmental Representative.
 - .2 The cores shall be a nominal 100 mm diameter.
 - .3 The Departmental Representative shall reinstate the pavement at the locations where the samples were taken.
- .6 The number of tests per day will be selected as per Table 02741 – 8 and as follows:
 - .1 The day will be divided into segments of approximately equal quantity;
 - .2 In each segment a test site will be located by using random numbers to determine the longitudinal distance from the end of the segment and the lateral distance from the edge of the segment;
 - .3 In no case will a lateral distance be less than 0.5 m from the shoulder or 0.3 m from any other edge of a mat; and
 - .4 Cores shall be obtained a minimum of 12 hours after the placement of the asphalt concrete.

- .7 The percent compaction of a day will be determined by comparing the average of the core densities with the average theoretical maximum relative density derived from the field loose samples.

.3 Surface Defects

- .1 The finished surface of any pavement course shall have a uniform texture and be free of visible signs of poor workmanship.
- .2 Any obvious defects, as determined by the Departmental Representative, will be cause for rejection of the pavement course.
- .3 Defects shall include but not necessarily be limited to the following:
 - .1 Segregated areas;
 - .2 Areas of excess or insufficient asphalt cement;
 - .3 Roller marks;
 - .4 Cracking or tearing;
 - .5 Improper matching of longitudinal and transverse joints;
 - .6 Tire marks;
 - .7 Sampling locations not properly reinstated;
 - .8 Improperly constructed patches;
 - .9 Improper cross slope; and
 - .10 Fuel spills on the mat.

3.9 REPAIRS

.1 General

- .1 Rejected work shall be repaired, remedied, overlaid, or removed and replaced at the Contractor's expense.
 - .1 The cost of retesting for quality assurance shall be borne by the Contractor.
 - .2 No payment will be made for work in any section that has been rejected until the defects have been remedied.

.2 Removal and Replacement

- .1 The full thickness of the appropriate lift of pavement in the rejected quantity shall be removed by cold milling or other means as approved by the Departmental Representative.

- .2 All joints shall be tack-coated.
 - .3 The asphalt concrete mix used to replace pavement shall meet the same requirements as that removed.
 - .4 Repaired areas will be retested for acceptance. Those failing will be rejected and shall require further repair.
 - .5 Material removed shall become the property of the Contractor, who shall dispose of the material outside the work site, in an environmentally acceptable manner.
- .3 Overlaying
- .1 The asphalt concrete mix used to overlay pavement shall meet the same requirements as that overlaid.
 - .2 A key shall be constructed at each end of the overlaid section.
 - .3 Repaired areas will be retested for acceptance.
 - .1 Those failing will be rejected and a second overlay will not be permitted.
 - .2 The Contractor shall then effect repairs by removal and placement.
 - .3 Removal depth shall be sufficient to remove the full thickness of the overlay lift and the original unsatisfactory surface lift.
 - .4 If an acceptable grade and cross-section cannot be achieved the Contractor shall repair by removal and replacement.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section specifies requirements for supplying and installing timber guide posts.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Vehicle W-Beam Guide Rail: Section 32 17 39

1.3 SOURCE SAMPLING

- .1 At least 4 weeks prior to commencing work inform Departmental Representative of proposed sources of guide posts and provide access for inspection.

1.4 MEASUREMENT PROCEDURES

- .1 Include all costs of vehicle guide posts in unit costs of Vehicle W-Beam Guide Rail in Section 32 17 39.

Part 2 Products

2.1 MATERIALS

- .1 Timber
 - .1 Acceptable species: Eastern Hemlock.
 - .2 Sound, seasoned wood, peeled and with ends cut square or as indicated.
 - .3 Straight, free from splits, shakes and excessive knots.
 - .4 Existing knots trimmed flush with surface.
 - .5 Pressure treatment to CSA 080.14-M.
 - .1 Use empty cell process.
 - .2 Minimum preservative retention 5.6 kg/m³.

Part 3 Execution

3.1 SUPPLY

- .1 Deliver guide posts to site and stockpile as directed.

3.2 INSTALLATION

- .1 Erect posts to details indicated or as directed.
- .2 Auger post holes and compact bottom of hole to provide firm foundation. Set post plumb and backfill in 150 mm layers. Compact each layer before placing succeeding layer.

- .3 Accurately cut off tops of installed posts to elevations indicated.
- .4 Treat cut tops with three liberal coats of end cut preservative as approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section specifies requirements for supplying and installing steel W-beam guide rail on guide posts.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Vehicle Guide Posts: Section 32 17 31

1.3 SOURCE SAMPLING

- .1 At least 4 weeks prior to commencing work inform Departmental Representative of proposed sources of guide rail and components, and provide access for sampling.
- .2 Supply and erection of steel W-beam guide rail timber posts and offset blocks to be considered incidental to the work.

1.4 MEASUREMENT PROCEDURES

- .1 Supply and installation of Vehicle W-Beam Guide Rail including posts and necessary hardware in metres of guide rail installed and measured from outer tips of guide rail, including guide rail used in anchorage and terminal sections.

Part 2 Products

2.1 MATERIALS

- .1 Steel W-beam guide rail:
 - .1 Steel rail and terminal sections: to AASHTO M180 Class A, Type 1 – hot dip galvanized to CSA G164.
 - .2 Metal conditioner, to CGSB 21-GP-107a.
 - .3 Offset Blocks:
 - .1 Well seasoned, straight and sound, free from loose knots or other defects, and dressed four sides.
 - .2 Acceptable species or wood: Eastern Hemlock.
 - .3 Treat posts and blocks to CSA 080.14-M, CCA or ACA. Minimum retention of preservative 5.6 kg/m³.

Part 3 Execution

3.1 ERECTION

- .1 Erect steel W-beam components to details indicated. Tighten nuts to 100 N.m torque. Maximum protrusion of bolt 6 mm beyond nut. Lap joints in direction of traffic.

3.2 PAINTING

- .1 Treat galvanized steel, after erection, with metal conditioner. Apply one coat of primer and two coats of finish paint to exposed surface.
- .2 Thoroughly clean shop primed steel of dirt, grease or other foreign materials and touch up with primer any surfaces scratched during installation.
- .3 Touch up damage to galvanized finish with two coats of zinc rich paint.
- .4 Apply two coats of finish paint to exposed surface. Ensure each coat is dry before applying next.
- .5 Do not apply paint when relative humidity is greater than 85 percent or when ambient temperature is below 5 deg C.

END OF SECTION