

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 00.06 Special Procedures for Traffic Control
- .2 Section 32 17 23 Pavement Markings

1.2 REFERENCES

- .1 Ministère des Transports du Québec
 - .1 Cahier des charges et devis généraux, Infrastructures routières-Construction et réparation, Édition 2012, Québec, MTQ.
 - .2 Tome V, Signalisation Routière, Collection des Normes et ouvrages routiers du ministère des Transports du Québec, Québec, MTQ.
- .2 Transportation Association of Canada
 - .1 Manual of Uniform Traffic Control Devices for Canada, Fourth Edition
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
- .4 Material Safety Data Sheets (MSDS).
- .5 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS 710 November,2010, Construction Specification for Pavement Marking

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for each type of abrasives and solvent used on project.
 - .2 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate disposal or recycling facilities.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

- .4 Do not dispose of unused solvent materials into landfill.
- .5 Unused solvent material to be disposed of in accordance with local regulations.

Part 2 Products

2.1 MATERIALS

- .1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by Departmental Representative.

Part 3 Execution

3.1 REMOVING PAVEMENT MARKINGS

- .1 Remove rubber tire deposits and paint markings, in areas as directed by Departmental Representative by sand water shot blasting, rotary grinding, heater planing or other method approved in writing by Departmental Representative.
- .2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.
- .3 Do not heat pavement surfaces above 120 degrees C, when using heater planning equipment.

3.2 PAVEMENT SURFACE CLEANING

- .1 Remove sealing compound which has protruded excessively, where directed by Departmental Representative.
 - .1 Dispose of removed material as directed by Departmental Representative.
- .2 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed and by method approved in writing by Departmental Representative. Use rotary power brooms or vacuum sweepers supplemented by hand brooming.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m²).
 - .2 ASTM D1557-07 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m²).
- .2 Ontario Provincial Standard specification, Ontario Ministry of Transportation
 - .1 OPSS 1001, November 2005, Material Specification for Aggregates - General
- .3 Ministère des Transports du Québec
 - .1 Tome VII, Matériaux, Collection des Normes et ouvrages routiers du ministère des Transports du Québec, Québec, MTQ.
- .4 Cahier des charges et devis généraux, Infrastructures routières-construction et réparation, Edition 2013, Québec, MTQ

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Handling Requirements:
 - .1 Store materials away from drainage course and waterways.
 - .2 Replace defective or damaged materials with new.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused granular material from landfill to local facility as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Granular base: material in accordance with references in article 1.1.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Excavation:

- .1 Strip and excavate to lines and grades required for aggregate base installation..

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after sub-base surface is inspected and approved in writing by Departmental Representative.
- .2 Placing:
 - .1 Construct granular base to depth and grade in areas required for traffic control device installation.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .5 Shape each layer to smooth contour and compact to specified density before successive layer is placed.
 - .6 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
 - .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting:
 - .1 Compact to density not less than 100% maximum dry density in accordance with references in article 1.1 and ASTM D698 and ASTM D1557.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade required but not uniformly high or low.

3.4 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until successive material is applied or until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO PP28-03, Practice for Designing Superpave Volumetric Design for HMA.
 - .3 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .4 AASHTO R35-12, Standard Practice for Volumetric Design for Hot-Mix Asphalt (HMA).
 - .5 AASHTO T040-02, Sampling Bituminous Materials.
 - .6 AASHTO T84-00 (2004), Specific Gravity and Absorption of Fine Aggregate.
 - .7 AASHTO T85-91 (2004), Specific Gravity and Absorption of Course Aggregate.
 - .8 AASHTO T166-05, Bulk Specific gravity of Compacted Asphalt Mixtures Using Saturated surface-Dry Specimens.
 - .9 AASHTO T176-02, Plastic fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
 - .10 AASHTO T209-05, Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
 - .11 AASHTO 275-91 (2000), Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
 - .12 AASHTO T283-03, Resistance of Compacted Bituminous Mixtures to Moisture Induced Damage.
 - .13 AASHTO T304-96 (2004), Uncompacted Void Content of Fine Aggregate.
 - .14 AASHTO T305-97 (2001), determination of Draindown Characteristics in Uncompacted Asphalt Mixtures.
 - .15 AASHTO T312-04, Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by means of the Superpave Gyrotory Compactor
- .2 Asphalt Institute (AI)
 - .1 ASTM C88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-13, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C127-12, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .4 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small- Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .5 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .6 ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .7 ASTM D3665-12, Standard Practices for Random Sampling of Construction Materials.

- .8 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .9 ASTM D5821-01 (2006), Standard Test Method for Determining the Percentage of Fractured Particles in coarse Aggregate.
- .10 ASTM D6752 / D6752M-11, Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method.
- .3 Tome VII, Matériaux, Collection des Normes et ouvrages routiers du ministère des Transports du Québec, Québec, MTQ.
- .4 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS 723, November 2011, Construction Specification for Energy Attenuators
 - .2 OPSS 1150, November 2010, Material Specification for Hot Mix Asphalt
- .5 Ontario Provincial Standard Detail (OPSD)
 - .1 OPSD 923.180 November 2011, Energy Attenuator, Crash Cushion Quadguard System Installation - Temporary Unidirectional

1.2 DEFINITIONS

- .1 AMRL: AASHTO Materials Reference Library.
- .2 CCIL: Canadian Council of Independent Laboratories.
- .3 Chip: Aggregate product predominately containing material passing the 6.7mm sieve and retained on the 4.75mm, 2.36mm, and 1.18mm sieves.
- .4 Designated Large Sieve (DLS): sieve specifically designated for each mix type for gradation testing.
- .5 Equivalent single Axle Load (ESAL): equating the damage to a pavement structure caused by the passage of non-standard load to a standard 80 kN axle load.
- .6 Job Mix Formula (JMF): the percentage passing on each designated sieve for the total mass of aggregate and the amount of asphalt cement as a percentage by mass of aggregate and the amount of asphalt cement as a percentage by mass of the mix design procedures that when mixed result in a paving mix that is in accordance with the specifications.
- .7 Joint: a vertical contact between a HMA pavement course and any HMA pavement or any rigid object that exists at the time that the HMA is laid.
- .8 Maximum Aggregate Size: one sieve larger than the nominal maximum size.
- .9 Mix Design: design of the proportions of aggregates, asphalt cement, and additives that when uniformly mixed results in an acceptable HMA in accordance with the specified method.
- .10 Performance Graded Asphalt Cement (PGAC): asphalt binder that is an asphalt –based cement produced from petroleum residue, either with or without the addition of non-particulate modifiers according to AASHTO M320.

- .11 Primary Control Sieve (PCS): sieve defining the break point between fine and course graded mixes for each nominal maximum aggregate size.
- .12 Quality Assurance (QA): a system or series of activities carried out by the Departmental Representative to ensure that materials or products received from the Contractor meet the specified requirements.
- .13 Quality Control (QC): a system or series of activities carried out by the Contractor to ensure that materials or products meet the specified requirements.
- .14 Superpave: acronym for Superior Performing Asphalt Pavements, an alternate system to the Marshall method for specifying material components and asphalt mix design using the Superpave gyratory compactor.
- .15 Vertical Surface: all edges of concrete curbs, longitudinal joints, and transverse joints for application of tack coat.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submission of Test Data:
 - .1 Supply the Departmental Representative with test result for PGAC at least 10 business days prior to placement of HMA. Demonstrate that results are in conformance with AASHTO R29, Section 7.
 - .2 Mix Design and JMF Documentation. Submit a copy of the Mix Design and JMF documentation signed, dated and certified correct by the person responsible for the engineering and management of the laboratory undertaking the Work. Documentation required is detailed in AASHTO PP28 and includes, but is not limited to, the following:
 - .1 All test results, mix design work sheets, and graphs.
 - .2 Material proportions and sources.
 - .3 Designation of fine and course aggregate.
 - .4 Graph of the temperature-viscosity relationship.
 - .5 Additives, including source, type, percent passing by mass of asphalt cement, and test results in accordance with AASHTO T283
 - .6 Information pertaining to fines that are returned to the mix, aggregate breakdown during production, and the resultant change in the aggregate gradations.
 - .7 Gradations for fine and course aggregates.
 - .8 Volumetric properties, including graphs for air voids, voids in mineral aggregate, void filled with asphalt, dust-to-asphalt ratio, bulk relative density, maximum relative density, and the gyratory curves of the mix plotted against asphalt cement content.
 - .9 Aggregate absorptions.
 - .10 Bulk specific gravity and saturated surface dry density for each aggregate.
 - .11 Bulk Specific gravity of the mix per ASSHTO T166.
 - .12 Theoretical maximum specific gravity per AASHTO T209.

- .13 Mixing and compaction temperatures used in the Mix Design.
- .14 Typical mix weight to produce a gyratory specimen with a height of 115 mm \pm 5 mm.
- .3 Have available all test results of aggregates, filler, and asphalt cement used in the Work. At the request of the Departmental Representative, make available or submit QC test results prior to the delivery of material. Test results to be submitted by either the stockpile method or from previous tests undertaken within the last 12 months on material from the same stockpile.
- .4 Submit documentation confirming that the laboratory undertaking PGAC testing has participated in the most recent AASHTO AMRL proficiency sample correlation program for PGAC and to have obtained acceptable proficiency ratings in the program.

1.4 Mix Design

- .1 Top course asphalt pavement to be Superpave 12.5 mm Level C (PG 58-34) or ESG-10, designed to AASHTO R35.
- .2 Base course and binder to be Superpave 12.5 mm Level C (PG 58-34) or ESG-10 designed to AASHTO R35.
- .3 Take the responsibility for the mix design. The JMF selected for use in works to produce HMA that meets the requirements of this Section.
- .4 Use a laboratory that has current CCIL Type A Certification with CCIL Superpave Certified Technicians or AMRL equivalent certification to undertake mix design.
- .5 Mix Design to include the determination of the density of the blended fine and blended course aggregate. The calculation of Voids in Mineral Aggregate (VMA) to be based on the densities of the blended fine and blended course aggregates.
- .6 Changes to the JMF and Mix Design
 - .1 Changes to the JMF are to be permitted when it has been determined that the mix proportions specified in this Section are not being met.
 - .2 Changes to the material proportions based on process control test results are to be permitted without a new mix design. Submit the revised JMF to the Departmental Representative when required.
 - .3 Departmental Representative to review the revised JMF for conformance with the mix requirements in this Section within (2) two business day of receipt of the revised JMF, Departmental Representative to provide, in writing, conditional permission to use the revised HMA or specify the reasons why the revised JMF is rejected.
 - .4 When submitting a new mix design, include a Mix Design Report, all supporting documents as required for the original mix Design, and sample for monitoring purposes (when specified by the Departmental Representative). A new Mix Design and supporting documentation to be required when:
 - .1 Any material is eliminated from the original Mix Design.
 - .2 A new material is added to the Mix Design.
 - .3 Revisions to the JMF have not corrected any problems or deficiencies with the mix.
 - .4 The net impact of all adjustments to the original JMF exceeds:

- .1 $\pm 0.2\%$ asphalt content
- .2 $\pm 5.0\%$ passing 26.5mm, 25.0mm, 19mm, and 16mm sieves.
- .3 $\pm 4.0\%$ passing 13.2mm, 12.5mm, and 9.5mm sieves.
- .4 $\pm 3.0\%$ passing 4.75mm, 2.36mm, and 1.18mm sieves.
- .5 $\pm 1.0\%$ passing the 75 μ m sieve.
- .5 New Mix Designs, new JMF documentation, and all new samples for monitoring purposes to be delivered to the Departmental Representative. The Departmental Representative to accept or reject the new Mix Design of JMF within (5) five business days of their delivery to the Departmental Representative.
- .7 Samples for Monitoring Purposes
 - .1 Representative samples of the materials to be used in the work to be provided to the Departmental Representative upon request, at the same time as the submission of the Mix Design and JMF documentation.
 - .2 Samples to be labeled with material type, material source and date of sampling. Each sample to be packaged separately in clean sealable containers that will not rupture when lifted or moved. Maximum weight of each sample to be 25 kg
 - .3 Minimum samples to be as follows:
 - .1 Asphalt cement: 4 liters evenly split in (2) two containers.
 - .2 Aggregate: 75 kg of each type
 - .3 Fines passing the 75 μ m sieve: 5 kg when mix is produced at a plant that returns fines to the mix.

Part 2 Products

2.1 MATERIALS

- .1 Performance graded asphalt cement: to AASHTO M320, grade PG 58-34 when tested to AASHTO R29. Asphalt cement to be in accordance with the Products accepted on MTO or MTQ construction projects
- .2 Aggregates: General and requirements as follows:
 - .1 Crushed stone, gravel sand, provided the source is of such nature as to ensure acceptable processed aggregates of a consistent graduation and quality..
 - .2 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.
 - .3 Aggregate sources to be obtained from the Products accepted on MTO or MTQ construction projects..
 - .4 Steel slag, nickel slag, and copper slag to not be used. When selecting sample blended aggregates from the cold feed, the blended aggregates to meet the requirements of this Section.
 - .5 Regardless of compliance with specified physical requirements, aggregates may be accepted or rejected on the basis of past filed performance.
- .3 Fine Aggregate:
 - .1 Fine aggregate to be composed of clean, hard, durable particles.

- .2 Los Angeles degradation to ASTM C131: 15% maximum loss by mass.
- .3 Magnesium Sulphate soundness to ASTM C88: 16% maximum loss by mass.
- .4 Uncompacted voids per AASHTO T304: 45% minimum.
- .4 Course Aggregate:
 - .1 Course Aggregate to be produced by crushing bedrock or gravel.
 - .2 Sand to AASHTO T176: 45% minimum.
 - .3 Flat and elongated particles to ASTM D4791: 10% maximum at 5:1.
 - .4 Fractured particles in course aggregate to ASTM D5821: 85/80.
 - .5 Magnesium Sulphate soundness to ASTM C88: 12% maximum loss by mass.
 - .6 Los Angeles degradation to ASTM C131: 15% maximum loss by mass.
 - .7 Absorption to ASTM C127: 1%
 - .8 Loss by washing per ASTM C117: 1.0% maximum passing 75 µm. Sieve.
- .5 Silicon oil to be less than (5) five ppm of asphalt cement.
- .6 Filler:
 - .1 Filler to consist of mineral filler, hydrated lime, Portland cement, or other material approved by the Departmental Representative.
 - .2 Filler to be dry, free from clumps, non plastic, and to meet the following gradation:
 - .1 100% passing the 600 µm sieve.
 - .2 95-100% passing the 300 µm sieve.
 - .3 70% passing the 75 µm sieve

2.2 EQUIPMENT

- .1 Vibratory rollers:
 - .1 Frequency of vibrations of the roller to be 2,200 vibrations per minute or greater..
 - .2 Rollers to be equipped with automatic shutoff of vibrations
 - .3 Rollers to be capable of reversing without backlash.
 - .4 Drum to be kept moist with water or non-petroleum based release agents to prevent adhesion to HMA to drum. Excess water or release agents not permitted.
 - .5 Vibratory function not to be used on bridge deck..
- .2 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .3 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to

roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.

- .3 Straight edges, 4.5 m in length, to test finished surface.

2.3 MIX DESIGN APPROVAL

- .1 Mix design to be approved in writing by Departmental Representative before placement.

Part 3 Execution

3.1 PRODUCTION

- .1 HMA to be per submitted JMF or revised JMF where required, that was previously accepted in writing by Department Representative.
- .2 Take responsibility for process control of all materials during production of HMA. Determine any necessary adjustments in proportioning materials used to produce HMA to meet Contract requirements.
- .3 Batching and placement of asphalt not to proceed until written permission from Departmental Representative for submitted JMF.
- .4 Blending of aggregates permitted at the HMA plant.
- .5 Heated and dried aggregate delivered to the HMA plant to be at temperature consistent with proper mixing and layering of the mix. Surfaces of all dried aggregates to be free of carbon and un-burnt fuel oil.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .2 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.
- .3 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.
 - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.

- .1 Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range as directed by Departmental Representative but not less than 135 degrees C.

3.4 PLACING

- .1 Obtain Departmental Representative's approval prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses of 150mm in accordance with requirements of OPSD 923.180 and OPSS 723.
- .3 Placing conditions:
 - .1 Place base and binder asphalt course only when ambient air temperature is 2 degrees C minimum.
 - .2 Place surface course only when ambient air temperature is 7 degrees C minimum.
 - .3 HMA not to be placed on previously laid course until a minimum of 4 hours have elapsed, following final compaction after previous course and the temperature of the previous course is 50 degrees C or less.
 - .4 The Temperature of the HMA immediately after spreading and prior to initial rolling not to be less than 120 degrees C.
 - .5 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .6 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
 - .7 Place asphalt concrete in compacted lifts of thickness as indicated.
 - .8 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .4 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.
 - .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly without broad casting material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.
 - .1 Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

3.5 COMPACTING

- .1 Roll asphalt continuously to density not less than 91 % Bulk Relative Density (BRD) and not greater than 96.5% BRD.
- .2 General:
 - .1 Determine correct sequence and of rollers to meet compaction requirements.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material.
 - .4 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
 - .5 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.
 - .6 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .7 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .8 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
 - .9 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
 - .10 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .3 Breakdown rolling:
 - .1 Begin breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super- elevated sections use operation approved by Departmental Representative.
 - .4 Use only experienced roller operators.
- .4 Finish rolling:
 - .1 Accomplish finish rolling with two- axle or three- axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic- tired rollers as directed by Departmental Representative.
 - .2 Conduct rolling operations in close sequence.

3.6 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.

- .1 Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 Overlap previously laid strip with spreader by 25 to 50 mm.
- .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
- .5 Roll longitudinal joints directly behind paving operation.
- .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

3.7 QUALITY CONTROL

- .1 Laboratories undertaking QC for the Contractor to have current CCIL Type B and C Certification or AMRL equivalent certification. HMA testing to be undertaken under the direct supervision of certified technical personnel.
- .2 Sampling
 - .1 Take responsibility for obtaining, packaging, and labeling QC samples.
 - .2 QC samples to be taken as directed by, and in the presence of Departmental Representative.
 - .3 QC Samples to be delivered to a location designated by the Departmental Representative within 24 hours of sampling time.
 - .4 The Departmental Representative has the option of having QC sampling of aggregates:
 - .1 Done on a stockpile basis and ensuring that each aggregate stockpile meets the requirements of this Section, or
 - .2 After the cold feed bins but before the aggregate is mixed with asphalt cement, when the blended aggregates meet the requirements of this Section.
- .3 Results of the QC testing undertaken will be used for acceptance purposes.

3.8 FINISH TOLERANCES AND CRITERIA FOR ACCEPTANCE OF HMA

- .1 Tolerance
 - .1 Finished asphalt surface to be within 5 mm of required elevation but not uniformly high or low.
 - .2 Finished asphalt surface not to have irregularities exceeding 3 mm when checked with 3 m straight edge placed in any direction.

3.9 APPEARANCE

- .1 Top of finished mat to be of uniform texture and be free of defects such as segregation fat spots, oil spills, and roller marks.
- .2 Areas that do not meet the finish requirements are to be removed and replaced with acceptable HMA, to the satisfaction of the Departmental Representative, at no extra cost.

3.10 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Areas that do not meet the tolerance or finish indicated are to be removed and replaced with acceptable HMA, to the satisfaction of the Departmental Representative, at no extra cost.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 00.06 Special Procedures for Traffic Control
- .2 Section 32 01 11.01 Pavement Cleaning and Marking Removal.

1.2 REFERENCES

- .1 Ministère des Transports du Québec
 - .1 Cahier des charges et devis généraux, Infrastructures routières-Construction et réparation, Édition 2012, Québec, MTQ.
 - .2 Tome V, Signalisation Routière, Collection des Normes et ouvrages routiers du ministère des Transports du Québec, Québec, MTQ.
- .2 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS 710 November,2010, Construction Specification for Pavement Marking
- .3 Transportation Association of Canada
 - .1 Geometric Design Guide for Canadian Roads, 1999 Edition Part 2.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
- .5 Material Safety Data Sheets (MSDS).
- .6 U.S. FED-STD-595B Colours Used in Government Dec. 15, 1989 Procurement.
- .7 CGSB -1-GP-12C, Standard Paint Colours.
- .8 CGSB -1-GP-71, Testing Paints and Pigments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for temporary pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements .
- .3 Samples:
 - .1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.
 - .1 Two 1 L samples of each type of paint.
 - .2 Sampling to Master Painting Institute(MPI) Painting Manual.

- .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Material and equipment is to meet or exceed provincial standards using materials that are approved for use in Ministry of Transportation Ontario (MTO) or Ministère des Transports du Québec (MTQ) construction projects. Demonstrate in writing that each product meets or exceeds provincial requirements.
- .2 Paint:
 - .1 To MPI -EXT 2.1B, Alkyd zone/traffic marking.
 - .2 Paints: in accordance with MPI recommendation for surface conditions.
 - .1 Paints: maximum VOC limit 100 g/L
 - .3 Colour: to MPI listed, yellow, white.
- .3 Thinner: to MPI listed manufacturer.
- .4 Glass reflective beads: type suitable for application to wet paint surface for light reflectance.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

- .1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.
- .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.

3.3 TRAFFIC CONTROL

- .1 Traffic Control to Section 01 35 00.06.- Special Procedures for Traffic Control.

3.4 APPLICATION

- .1 Pavement markings: Lay out pavement markings.
- .2 Unless otherwise approved by Departmental Representative apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
- .3 Apply traffic paint evenly at rate of 3 m²/L.
- .4 Do not thin paint unless approved by Departmental Representative
- .5 Symbols and letters to dimensions indicated.
- .6 Paint lines: of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.
- .8 Apply glass beads at rate of 0.5 kg/l of painted area immediately after application of paint.

3.5 TOLERANCE

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION