

260.4.5.1.2.2 One day's production and placement of less than 500 t of asphalt concrete, excluding the Quantity used for padding and the Quantity in the Shoulder area where a single lift of surface mix is placed over granulars, will be evaluated per 260.4.5.1.2.2.1 and 260.4.5.1.2.2.2.

Add

260.4.5.1.6.4 Padding lifts.

260.4.5.2.1.1.1 The smoothness requirements of both 260.4.5.2.2 and 260.4.5.2.3 shall apply on this Contract.

260.5.5.1.1 Payment adjustment for a change in the PG asphalt binder price will be calculated in accordance with Attachment "A".

ITEM 726 – PARTIAL DEPTH RECYCLING

ALTERNATIVE A – WITH EMULSIFIED ASPHALT

726.1 **DESCRIPTION**

726.1.1 This Item consists of in-place partial depth reclaiming of the existing asphalt Pavement and placement of a recycled cold bituminous mixture.

726.1.2 The reclaimed asphalt Pavement (RAP) shall be recycled by a mobile "Recycling Train" that performs all operations simultaneously.

726.2 **MATERIALS**

726.2.1 All added materials shall be supplied by the Contractor.

726.2.1.1 Supply of corrective aggregate shall be subject to 726.4.4.4.6, with payment per 726.5.2.

726.2.2 The RAP material shall be sized to 100% passing the 31.5 mm sieve.

726.2.3 The binder shall be a CSS-1 or CSS-1H emulsified asphalt or equivalent approved by the Engineer.

726.2.4 The emulsion may be cationic or anionic, the best performing type having been selected through coating tests conducted in the initial phase of the Design Mix Formula (DMF).

726.2.5 **Mix Design**

726.2.5.1 The Emulsified DMF shall be in accordance with the procedures outlined in "A Basic Asphalt Emulsion Manual – Manual Series No. 19", third edition (Asphalt Institute, Lexington, Kentucky).

726.2.5.2 The emulsified asphalt by mass of the RAP shall have a minimum residual asphalt content of 0.8%.

726.2.5.3 The DMF shall identify the maximum field adjustment allowed to the design rate without adversely affecting the mix properties. A new DMF shall be submitted when the emulsified asphalt design rate is adjusted by 0.5% or greater.

726.2.5.4 Separate or new DMF's shall be submitted to the Engineer if the composition of the existing Pavement changes significantly.

- 726.2.5.5 The DMF report shall contain complete information on the type, manufacturer and supplier of the asphalt emulsion with the technical specifications of the product.
- 726.3 SUBMITTALS
- 726.3.1 The Contractor shall submit, at least 10 Days in advance of the Work, a listing of all pieces of Equipment intended for use in the Work.
- 726.3.2 The Contractor shall submit, at least 10 Days in advance of the Work, the DMF as established on the basis of the preliminary sampling of the material to be recycled, and a copy of all calculations done to determine the design binder rate.
- 726.3.3 The Contractor shall submit, at least 7 Days in advance of the Work, recent calibration certificates of all metering, weighing and other controlling devices to be used in controlling and monitoring the mix production.
- 726.3.4 The Contractor shall provide the Engineer, on a daily basis, all field testing and sampling reports.
- 726.3.5 Not later than 6 months after completion of the Work, the Contractor shall provide the Engineer the DMF report and the results of all field and laboratory tests.
- 726.4 CONSTRUCTION
- 726.4.1 GENERAL
- 726.4.1.1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.
- 726.4.1.2 In-place partial depth reclaiming of existing asphalt concrete Pavement, sizing, and mixing with binder and water (if required) shall be completed to an average width of **7.6 m and a depth of 100 mm ± 10 mm.**
- 726.4.1.3 The recycled cold bituminous mixture shall be spread and compacted to an average width of **7.6 m.**
- 726.4.1.4 The Work shall be carried out in-place on the Roadbed in a manner that does not disturb the underlying Aggregate Base.
- 726.4.1.5 The Contractor shall ensure that the in-place partial depth recycled material contains a negligible amount of granular material.
- 726.4.2 PRELIMINARY SAMPLING OF MATERIALS
- 726.4.2.1 Prior to commencing the Work, the Contractor shall obtain representative samples of the material to be produced during the reclaiming operation, and shall carry out the laboratory testing necessary to establish the DMF.
- 726.4.2.2 The Contractor shall restore the Roadbed surface with hot mix asphalt concrete on the same day that samples are taken, as approved by the Engineer.
- 726.4.3 TEST STRIP
- 726.4.3.1 The Contractor shall initially stabilize a test strip 0.5 km in length and one lane in width, to demonstrate his ability to produce a stabilized Roadbed in conformance with this Item.

- 726.4.3.2 The test strip must be free of visual defects after lay down and compaction.
- 726.4.3.3 If the test strip is not acceptable, as determined by the Engineer, the Contractor shall rework the test strip.
- 726.4.3.4 If the material changes significantly another test strip may be done at the Contractor's request, as approved by the Engineer.
- 726.4.3.5 The test strip shall be rolled until an optimum dry density is achieved as determined by the nuclear density gauge. The densities shall be measured after compaction by the pneumatic-tired roller. The optimum density is representative of the nuclear gauge reading when succeeding passes of the roller increase the density by less than 30 kg/m³. A DOT representative shall be present to verify the establishment of the optimum test strip dry density. This density will be used as target dry density for the recycled material.
- 726.4.3.5.1 The optimum density will be determined from readings taken after rolling by the pneumatic-tired roller, in the presence of the Engineer.

726.4.4 EQUIPMENT

726.4.4.1 General

- 726.4.4.1.1 In-place partial depth reclamation shall be carried out using a Multi-Unit Train consisting of a cold milling machine, trailer-mounted screening and sizing unit, and trailer-mounted pugmill mixer. The material leaving the pugmill shall not be placed in a windrow but shall be deposited into the paver hopper.

726.4.4.2 Cold Milling Machine

- 726.4.4.2.1 The cold milling machine shall be self-propelled, with a cutting drum capable of reclaiming the asphalt Pavement to the required depth, and automatically controlled for grade and slope.

726.4.4.3 Screening and Sizing Unit

- 726.4.4.3.1 The screening and sizing equipment shall be capable of reducing the RAP to the maximum size specified and consistently producing the gradation required for the approved mix design.

726.4.4.4 Mixing Unit

- 726.4.4.4.1 The aggregate feed system of the mixing unit shall be equipped with a means of measuring the mass of material being deposited into the mixing unit prior to the addition of the binder.
- 726.4.4.4.2 The scale shall be calibrated to the manufacturer's tolerance at the start of the Contract and whenever deemed necessary thereafter by the Engineer.
- 726.4.4.4.3 The mixing unit shall be equipped with a device that will continuously maintain the amount of emulsion added to within $\pm 0.5\%$ by mass of the aggregate feed.
- 726.4.4.4.4 The emulsion control unit shall be equipped with a flow meter and a total delivery meter.
- 726.4.4.4.5 The mixing unit shall produce a uniform thoroughly mixed cold-mix product.

- 726.4.4.4.6 Corrective aggregate shall be incorporated into the mix if the mix design properties per 726.2.5.1 cannot be met.
- 726.4.4.5 Placing Equipment
- 726.4.4.5.1 Placement of the stabilized mix shall be carried out by means of a self-propelled mechanical paver capable of spreading the material in one continuous pass.
- 726.4.4.5.2 The paver shall distribute the mixture evenly in front of a vibratory screed, which shall be capable of vibrating the full width of the mix placed.
- 726.4.4.6 Compaction Equipment
- 726.4.4.6.1 Compaction Equipment shall consist of a vibratory drum roller of at least 15 t mass, a pneumatic-tired roller of at least 10 t mass, and, for areas inaccessible to full size rollers, smaller compactors as required.
- 726.4.5 OPERATIONAL CONSTRAINTS
- 726.4.5.1 In-place partial depth recycling shall only be carried out when the ambient temperature at the Work Area is above 10 °C, and/or when the Roadbed is free of standing water.
- 726.4.5.2 Asphalt Concrete may be placed once all of the following requirements have been met, upon approval of the Engineer:
- 726.4.5.2.1 The in-place partial depth recycled Pavement has been allowed to cure for a minimum of 5 days of good curing weather (sunny, warm, low humidity);
- 726.4.5.2.2 The in-situ mean moisture content of the cold recycled mix is 3% or less with no single test greater than 3.5%.
- 726.4.5.2.3 The specified density has been achieved; and
- 726.4.5.2.4 Defective areas involving ravelling, flushing, rutting, and poor longitudinal and transverse joints have been repaired to the approval of the Engineer.
- 726.4.5.3 Prior to the planned overlay of the stabilized mat, the Contractor shall obtain two slab samples per lane-km at random locations as directed by the Engineer: one to test for moisture content and the other to test for thickness and compaction.
- 726.4.5.3.1 Each slab sample shall be dry cut (150 mm x 150 mm) and removed from the stabilized mat, packaged in non-absorptive materials to protect the sample integrity, sealed in waterproof containers, appropriately labelled, and delivered by the Contractor in good condition to the Engineer within four hours of sampling.
- 726.4.6 PLACEMENT
- 726.4.6.1 Binder shall be added to the RAP at the design rate.
- 726.4.6.2 The binder rate shall be adjusted by the Contractor as required, to produce a uniform, thoroughly coated, cold recycled mix of the specified density.
- 726.4.6.3 Water may be required to be added to the RAP prior to or concurrently with the binder to facilitate uniform mixing.
- 726.4.6.4 The recycled mix shall be spread to the profile and cross section as directed by the Engineer.

- 726.4.6.5 The surface of the stabilized mix shall be uniform in texture and free of segregation, contamination, ravelling, rutting, potholing, cracking and other surface defects.
- 726.4.6.5.1 Ravelled sections shall be repaired to the satisfaction of the Engineer.
- 726.4.6.6 The recycled mix shall be compacted to a minimum of 98% of its target dry density. The compacted surface shall be smooth.
- 726.4.6.6.1 Secondary rolling, if necessary to achieve the required density, will be permitted within 10 days of placing.
- 726.4.6.7 Recycled mix that for any reason cannot be compacted to the specified density shall be removed and replaced with two lifts of Asphalt Concrete B at a rate of 120 kg/m² each in accordance with 260.2 and 260.4, unless the situation is caused by variation in the recycled material in which case new criteria for that particular section should be determined.
- 726.4.6.8 Traffic, including construction vehicles, shall be kept off the freshly placed and compacted recycled mix until such time as it is able to carry traffic without damage to the mat.
- 726.4.6.8.1 The Contractor shall supply any pilot vehicles with operator, and other labour, Equipment and material required to convoy traffic through or around the Work Area, at a maximum convoy speed of 30 km/h.
- 726.4.6.8.2 The Contractor shall be responsible for ensuring that the recycled Pavement is not damaged by traffic while curing.
- 726.4.6.9 The Contractor shall, at his own cost, remove any damaged recycled Pavement and replace the damaged material with two lifts of Asphalt Concrete B at a rate of 120 kg/m² each in accordance with 260.2 and 260.4, or as approved by the Engineer.
- 726.4.6.9.1 Removal for repair shall be for the full depth of recycling and for the full lane width of the damaged area, or as approved by the Engineer.
- 726.4.7 TEMPORARY TRAFFIC MARKINGS
- 726.4.7.1 The Contractor shall supply all temporary marking paint and associated reflectorization material.
- 726.4.7.2 The Contractor shall place the temporary markings on the stabilized mix surface exposed to traffic, on the same day as the stabilizing, and shall replace ineffective or missing markings daily until no longer required.
- 726.4.7.3 Temporary painted line segments shall be a minimum of 2 m long and applied lengthways, with centre to centre spacing of 50 m on tangents and 25 m on horizontal and vertical curves.
- 726.4.8 QUALITY CONTROL AND QUALITY ASSURANCE
- 726.4.8.1 The Contractor shall implement a comprehensive quality control program to ensure the quality of Work.
- 726.4.8.2 All sampling shall be done in the presence of the Engineer.
- 726.4.8.3 Sample duplicates shall be supplied to the Engineer.
- 726.4.8.4 The calibration of measuring equipment and regular verification of their accuracy during the course of the Work shall be the responsibility of the Contractor.

- 726.4.8.4.1 The accuracy of the metering devices controlling the binder rate shall be verified by the Contractor by checking the binder quantities on the delivery slip that accompanies each tank of binder delivered at the Work Site.
- 726.4.8.5 Binder samples shall be taken at the Work Site from each tank truck of material using sample containers supplied by the Owner.
- 726.4.8.5.1 Each sample shall be taken after a minimum of 4000 kg has been drawn from the tanker, from a sampling spigot on the transfer line, if available, or from the end of the transfer line.
- 726.4.8.5.2 Each sample of material shall be a minimum of 2 litres and shall be identified with a completed label.
- 726.4.8.5.3 Each sample of binder will be tested by the Owner per Table 726-1.

**Table 726-1
Schedule of Binder Testing**

Emulsion	Residual Asphalt in the Emulsion
% Residue by distillation (ASTM D-244)	
% Oil Distillate (ASTM D-244)	
Saybolt-Furol viscosity at 50 °C (ASTM D-244)	Penetration test 25°C - 50 g 5 s (ASTM D-5)

- 726.4.8.6 The RAP shall be sampled, by the Contractor, at the entrance to the mixing unit at the rate of 1 sample per lane kilometre.
- 726.4.8.6.1 The samples shall be tested, by the Contractor, for their gradation (ASTM C136) and moisture content.
- 726.4.8.6.2 A composite sample of each day's samples shall be tested, by the Contractor, for their residual asphalt content (ASTM D2172).
- 726.4.8.7 The QC program shall include provision and operation of a nuclear density gauge to determine compacted density of the Work.
- 726.4.9 **GUARANTEE**
- 726.4.9.1 The Contractor, for a period of two years after completion of the Work, shall guarantee the Work against failure and defects, including surface defects as described in 726.4.4.4, and shall hold the Owner blameless in all claims arising from Work, whether resulting from poor workmanship; poor or incompatible materials; improper design of application rates; inadequate traffic control; failure to practice proven partial depth recycling procedures; and/or other factors.
- 726.4.9.2 Structural failure of the mat, and areas of rutting or other depressions, will generally be construed as failure; however, the Engineer will decide as to what areas must be reprocessed in accordance with Work under this Item.
- 726.4.9.3 Reprocessing shall be carried out promptly and efficiently as directed by the Engineer. The Contractor shall, for a period of two years after its completion, guarantee the reprocessing against defects and failure as described in 726.4.9.1 and 726.4.9.2.
- 726.4.9.4 For the purposes of this Item and at the discretion of the Engineer, failure of intermittent areas that comprise 40% or more of the area processed or reprocessed on this Contract shall be deemed a complete failure, and the Contractor shall be required to redo the entire Work under this Item.

- 726.5 MEASUREMENT FOR PAYMENT
- 726.5.1 The Quantity to be measured for payment will be the number of square metres of in-place partial depth recycled bituminous Pavement placed in accordance with this Item.
- 726.5.2 The Owner will reimburse the Contractor the actual cost, to a maximum of \$8.00/t, of corrective aggregate supplied and incorporated into the mix per 726.4.4.4.6.
- 726.6 BASIS OF PAYMENT
- 726.6.1 Payment at the Unit Price will be full compensation for all the Work performed under this Item.
- 726.6.2 Haulage for corrective aggregate shall be paid under Item 801.

OR

ITEM 726 – PARTIAL DEPTH RECYCLING

ALTERNATIVE B – USING EXPANDED ASPHALT

- 726.1 DESCRIPTION
- 726.1.1 This Item consists of in-place partial depth reclamation with expanded asphalt stabilization of the existing asphalt Pavement, sizing, and mixing with binder and water. The Work includes spreading and compacting the recycled bituminous mixture to the lines, grades, thicknesses and cross sections as directed by the Engineer. The reclaimed asphalt pavement (RAP) shall be recycled using a "Recycling Train" that performs all operations simultaneously.
- 726.2 MATERIALS
- 726.2.1 All added materials shall be supplied by the Contractor.
- 726.2.1.1 Supply of corrective aggregate shall be subject to 726.2.5.9, with payment per 726.5.3.
- 726.2.2 Asphalt Binder
- 726.2.2.1 The asphalt binder grade shall be PG 58–28.
- 726.2.2.2 Performance Grade (PG) asphalt binder shall meet the requirements of AASHTO MP1-98, Table 1 – Performance Graded Asphalt Binder Specification, and shall contain no anti-foaming agents.
- 726.2.2.3 The Contractor shall provide one asphalt binder sample every tanker load of material arriving at the Work Area, taken in accordance with ASTM D140. Sample containers and labels will be supplied by the Owner.
- 726.2.3 Water
- 726.2.3.1 Water shall be obtained from a source approved by the appropriate regulatory agency/agencies, and shall be free of any deleterious materials.