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CONSTRUCTION SPECIFICATION FOR COLD CENTRAL PLANT RECYCLING

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CONSTRUCTION SPECIFICATION FOR COLD CENTRAL PLANT RECYCLING

817. 1 SCOPE

This Specification covers all operations necessary for and pertaining to the Cold Central Plant Recycling (CCPR) of reclaimed asphalt pavement (RAP) and the construction of a CCPR layer.

817. 2 DEFINITIONS

Cold Central Plant Recycling (CCPR): A process in which the reclaimed asphalt pavement recycling takes place at a central location on or near the project site using a stationary cold mix plant.

Lot Size: One (1) day’s production of Cold Central Plant Recycling of at least four (4) hours. If one day’s production of CCPR is less than four (4) hours, it will be combined with the previous lot or the subsequent lot at the discretion of Contract Administrator.

Sub-Lot: Each lane-km, or part thereof, portions of the Lot. The final Sub-Lot of the day’s production may vary in length.

817. 3 MATERIALS

3.1 Emulsified Asphalt

The emulsified asphalt cement Type CSS-1h shall be used for the CCPR mix.

At the Contractor’s request, the Contract Administrator may consider the use of alternate asphalt cement for the CCPR mix. No additional payment for alternate asphalt cement will be made as it will be considered to be included in the unit price for “Cold Central Plant Recycling”.

The required asphalt cement shall be supplied from pre-approved Suppliers and meet current Manitoba specifications as outlined in the *Grading and Surfacing Approved Products List* at <http://www.gov.mb.ca/mit/mateng/product.html>.

3.2 Water

The water shall be clean and free from injurious amounts of oil, alkalis, salts, organic matter or other deleterious materials.

3.3 Mineral Filler

If required to meet the CCPR mix requirements, portland cement, lime or lime kiln dust shall be incorporated into the CCPR mixes. The addition of mineral filler shall meet the requirements as specified in Table 3.1.

Table 3.1 Mineral Filler Requirements

Type	Maximum Dosage Rate, %
Cement, Type GU	0.4
Hydrated Lime	1.0
Lime Kiln Dust	1.0

Portland cement and hydrated lime shall be from pre-approved Suppliers and meet current

Manitoba specifications as outlined in the *Grading and Surfacing Approved Products List* at <http://www.gov.mb.ca/mit/mateng/product.html>

3.4 Corrective Aggregate

Corrective aggregate may be required to improve the CCPR mix properties. The gradation and amount of corrective aggregate shall be determined by the Contractor to ensure a well-graded, stiff and stable mix. The corrective aggregate shall meet the requirements as specified in Table 3.2.

Table 3.2 Corrective Aggregate Requirements

Test Description	Test Method	Criteria
Gradation Max Size, mm	ASTM C136	25
Fractured Faces, Min. %	ASTM D5821	60
Lightweight Particles Content, Max% (Note 1)	ASTM C123	7
L.A. Abrasion Loss, Max. %	ASTM C131	35
Plasticity Index, Max. %	ASTM D4318	3

Note 1: The lightweight particle content is the percentage of lightweight particles by weight of all particles retained on 4.75mm sieve.

The methods used to determine the addition rate of corrective aggregate must be in accordance with the mix design and its properties are subject to the approval of the Contract Administrator.

3.5 Reclaimed Asphalt Pavement (RAP)

Reclaimed asphalt pavement material, after processing shall meet the gradation requirements as specified in Table 3.3.

Table 3.3 RAP Gradation Requirements

Sieve Size (mm)	% Passing by Weight	
	CCPR Type A	CCPR Type B
37.5	100	100
25	90 - 100	100
19		90 - 100

3.6 Mix Design

The Contractor shall prepare and submit a CCPR mix design for acceptance by the Contract Administrator.

The CCPR mix design shall be prepared in accordance with the *Wirtgen Cold Recycling Manual-Appendix 2* and meet the Contract requirements.

Mix design work shall be completed by a laboratory with Canadian Council of Independent Laboratories (CCIL) Type "A" certification or equivalent equipped to carry out CCPR mix designs.

The Contractor shall obtain samples that are representative of the RAP material in the stockpile. The samples shall be used, along with any corrective aggregate and additive, to establish the design rate of emulsified asphalt as a percent by mass of the reclaimed asphalt pavement plus the corrective aggregate.

The Contract Administrator will require seven (7) days, from the time of receipt of the CCPR mix design submission, to evaluate the proposed Job Mix Formula (JMF).

The Contractor shall not commence CCPR operations on the project prior to receiving the Contract Administrator's written notice that the CCPR mix design has been accepted. The resulting combination shall, when accepted by the Contract Administrator, be the CCPR Job Mix Formula.

3.6.1 Submission Requirements

The CCPR mix design submission shall include the following:

- Information on the type of emulsified asphalt including the supplier name and location;
- The asphalt content, penetration grade, gradation and fractured faces of the RAP;
- Material type, source, gradation and the physical properties of corrective aggregates.
- Bulk relative density, maximum specific gravity and air void content for the mix at each emulsified asphalt content;
- The recommended design rate of emulsified asphalt, mineral filler and corrective aggregate;
- The amount of water to be added to the mix;
- RAP coating test results as per AASHTO T59 using recommended design rates,
- Dry tensile strength, wet tensile strength and tensile strength ratio; and
- The maximum field rate adjustment allowed to the recommended design rate without adverse affects to the mix properties.

A new mix design may be required at the discretion of the Contract Administrator if the asphalt design rate is adjusted by greater than 0.2% and/or if the composition of the reclaimed asphalt pavement material changes significantly.

3.6.2 Mix Design Requirements

The CCPR mix design shall have a minimum of 1.2% emulsified asphalt and shall meet the requirements as specified in Table 3.4.

Table 3.4 CCPR Mix Requirements

Mix Properties	Minimum Requirement
Dry Tensile Strength at 25°C	225 kPa
Wet Tensile Strength	115 kPa
Tensile Strength Ratio (TSR)	50%
Air Void Content	9-15%

817. 4 EQUIPMENT

4.1 Cold Mix Plant

The cold mix plant shall be equipped with the following:

- A continuous pug mill equipped with a device capable of producing a uniform and thoroughly

blended CCPR mix.

- A cold feed hopper for the RAP. If new aggregates or fractionation is required based on the approved mix design, the cold mix plant will require additional hoppers or the cold feed hopper will require separation chamber.
- An emulsified asphalt control system equipped with flow meter calibrated in litres per tonne and a total delivery meter calibrated in litres to maintain continuously the required amount of emulsified asphalt added to within 0.2% by mass of the reclaimed plus any new aggregates material feed.
- A screening unit to control the maximum size of RAP.
- A means of monitoring and controlling the addition of water via independent spraying system.
- All measuring devices shall be calibrated according to the manufacturer’s specifications at the start of the Contract and whenever deemed necessary by the Contract Administrator.

4.2 Paver

The CCPR mix shall be placed by a mechanical paver capable of spreading the mix evenly in front of the screed in one continuous pass to the specified cross fall and grade. The paver shall be equipped with distributing augers for the full width to be paved. The paver shall have a vibratory screed capable of vibrating the full width of mix placed.

4.3 Compaction Equipment

The Contractor shall supply rollers in sufficient quantities to produce a uniform, tight knit surface.

The Contractor shall supply a minimum of one self-propelled rubber tired roller or a combination roller having a vibratory steel drum on one end and at least four pneumatic tires on the other end and one steel vibratory roller of no less than 10t.

817. 5 CONSTRUCTION

5.1 Mixing

The emulsified asphalt shall be added at the recommended mix design rate. The rate of emulsified asphalt shall be field adjusted as required to within 0.2% of the mix design rate or to the maximum field rate adjustment allowed to the mix design rate, whichever is less, to produce a uniformly coated CCPR mix that can be compacted to the required density.

The Contractor may add water in a controlled manner to facilitate uniform mixing.

5.2 Lift Thickness

The minimum and maximum thickness of a compacted Lift of CCPR shall meet the requirements in Table 5.1.

CCPR Type	Min Thickness	Max Thickness
A	75	125
B	50	100

5.3 Spreading Mix

The paver shall produce a uniformly textured surface free from tearing, tracking, segregation or other unacceptable surface irregularities.

The CCPR mixture shall be spread and compacted to the specified width; thickness and cross slope as indicated in the Detailed Design Drawings or as specified in the Special Provisions.

For Lift thickness greater than 75 mm, the length of CCPR constructed on a lane shall be controlled so that the length of CCPR layer in adjacent lane is matched by the end of each day's work.

The Contractor shall control their operations to ensure the outside edge of the CCPR is stable and does not slump.

When paving is suspended on the roadway, the CCPR shall be temporarily feathered to a slope of 10 horizontal to 1 vertical. When CCPR is resumed, the taper shall be removed and a vertical transverse joint shall be constructed.

5.4 Compaction

The Contractor shall be responsible to determine the in place density, as per *MEB P052 Density of In Place Material by Control Strip Method*, to ensure the minimum compaction requirements are met.

The Contractor shall determine the achievable maximum dry density (MDD), in the presence of the Contract Administrator.

Each Sub-lot of CCPR layer shall be thoroughly compacted to a minimum of 96% of the maximum dry density (MDD).

The Contract Administrator shall be notified after the completion of in situ density test and compaction calculations.

The Contractor shall sign and certify the density report before submission to the Contract Administrator.

The Contract Administrator will endeavor to verify and accept the density report submitted by the Contractor within 24 hours.

No extra payment will be made to construct the control strips and determine the achievable MDD as the Work will be considered incidental to the compaction operation.

Spreading and compacting operations shall be restricted to the hours between official sunrise and official sunset as per Environment Canada.

5.5 Trial Section

The Contractor shall demonstrate their ability to successfully carry out CCPR and construct the CCPR layer in accordance with Contract requirements by placing a trial section within the Contract limits.

The Contractor shall have onsite personnel experienced in CCPR work to monitor the trial section, advise on the suitability of mixed material, emulsified asphalt dispersion within the mixed material, moisture control within mixed material, compaction and surface finish.

The trial section shall be one lane width and 500 m in length. The Contractor shall propose the location of the trial section to the Contract Administrator for acceptance. The Contract Administrator shall be given a minimum of 48 hours notice prior to placing the trial section.

Bulk application rates for each constituent material and CCPR mix, thickness checks and achievable maximum dry density shall be submitted to the Contract Administrator.

The Contract Administrator will allow the Contractor to continue the CCPR work based on the

submission and acceptable visual assessment of the trial. If a CCPR trial section is rejected, the Contractor shall place additional trial sections until the CCPR mix and layer meets the requirements of the Contract.

The Contractor shall use the same material, equipment and construction methods that were approved based on trial section(s) for the remainder of the CCPR operations in the Contract.

The Contractor shall produce a new trial section if there are changes to the material, equipment or construction method, unless otherwise permitted by the Contract Administrator.

The Contractor shall be responsible for the repair, removal, or replacement of all unacceptable trial sections.

5.6 Weather Limitations

Paving shall not be permitted when the ambient temperature is less than 10 °C or during periods of rain or when weather conditions are unfavourable, or are likely to become unfavourable. Paving operations may be suspended by the Contract Administrator without liability or cost to the Contract Administrator, if weather conditions are unfavourable.

After September 1st, written approval shall be obtained from the Contract Administrator prior to CCPR mix paving.

5.7 Opening to Traffic

Traffic shall be kept off the freshly placed CCPR mat until it is able to carry traffic without damage. The Contractor shall be responsible for repair or replacement of the damaged CCPR mat.

5.8 Subsequent Lift or Wearing Surface

The subsequent lift or wearing surface shall not be placed on the CCPR mat until the CCPR meets the acceptance criteria and has cured for a minimum of four (4) days.

The wearing surface shall be placed within 30 days of placing the CCPR mat, provided that the CCPR mix meets the requirements of this specification. The Contractor shall schedule all operations to ensure that all CCPR is covered with a wearing surface prior to the seasonal shutdown.

5.9 Tack Coat

A tack coat shall be applied in accordance with *Specification for Applying Prime Coat and Tack Coat (No.806)*, unless otherwise approved by the Contract Administrator, before placing subsequent lift of CCPR or bituminous material.

817. 6 QUALITY CONTROL

The Contractor shall meet the requirements of the *Specification for Quality Control (No. 110)*.

The Contractor shall perform process and quality control sampling and testing, and exercise management control to ensure that CCPR and its construction conform to the Contract requirements.

Density testing and moisture content of the CCPR mat is a mandatory requirement.

ARRA CR301 - Recommended Quality Control Guidelines for Cold Recycling Using a Bituminous Recycling Agent shall be utilized to develop the contractors' quality management plan.

817. 7 QUALITY ASSURANCE

7.1 General

The Contract Administrator will conduct Quality Assurance testing and inspection for emulsified asphalt quality, materials and mix properties, compaction, moisture, segregation, surface defects and surface tolerance.

The Contract Administrator may test for any property outlined in the Contract. The Contractor will be provided with results from the completed tests.

Quality Assurance testing and inspection will be performed at no cost to the Contractor.

The inability of the Contract Administrator to provide Quality Assurance test results within the time provided in this Specification shall not relieve the Contractor of their obligation to remedy any defect.

7.2 Quality Assurance Testing and Inspection

Sampling and Quality Assurance testing will be in accordance with this section.

7.2.1 Emulsified Asphalt Quality

The Contractor shall be responsible for sampling the emulsified asphalt in accordance with *MEB P031 Sampling and Testing Asphalt Binder Materials* and providing all samples to the Contract Administrator for Quality Assurance testing.

Samples shall be taken from each truckload of emulsified asphalt delivered to the Contractor's storage tanks. The Contract Administrator will be present during the sampling process unless otherwise authorized by the Contract Administrator in writing.

7.2.2 Corrective Aggregate Quality

Corrective aggregate samples for Quality Assurance testing will be taken from the plant site during production of CCPR mix at the discretion of the Contract Administrator.

The Contractor shall obtain samples, in the presence of the Contract Administrator, in accordance with *MEB P047 Sampling Aggregate Materials for Laboratory Testing*.

Sample will be tested to ensure they meet the requirements of this Contract.

7.2.3 Mix Properties

The Contract Administrator will locate one test site in each Lot as per *MEB P044 Random Sampling for Acceptance Testing – Method B*.

The Contractor shall obtain one sample of the CCPR mix, in the presence of the Contract Administrator.

Samples shall be taken between 0.5 to 1.0 m from the outside edge of the CCPR layer for a standard 3.7 m wide lane and shall consist of material from the full depth of CCPR layer prior to the start of compaction. The individual representative sample weight shall be 15 to 20 kg.

Quality Assurance testing for the mix properties will be in accordance with the *Wirtgen Cold Recycling Manual-Appendix 2*.

7.2.4 Compaction

The Contract Administrator will locate three test site in each Sub-Lot as per *MEB P044 Random Sampling for Acceptance Testing – Method A*.

Each test site will be tested as per *MEB P052 Density of In Place Material by Control Strip Method* by the Contract Administrator.

The Contract Administrator will identify and notify the Contractor of the areas that do not meet the minimum compaction, based on the results submitted by the Contractor or the verification checks.

7.2.5 Moisture

If required, the Contract Administrator will locate three test site in each Lot as per *MEB P044 Random Sampling for Acceptance Testing – Method A*.

The Contractor shall obtain a slab sample, from each test site, in the presence of the Contract Administrator, as per *MEB P043 Sampling Compacted Bituminous Mixtures for Laboratory Testing*.

A test specimen shall be prepared from each CCPR slab sample to represent material being assessed.

Each test specimen will be tested for moisture content, as per *ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass*.

The Contract Administrator will identify and notify the Contractor of the areas that do not meet the moisture requirements, based on the quality assurance test results. Re-testing may be done once the Contractor reconfirms the moisture content.

Contractor may be required to collect additional samples after any exposure to rain to determine if moisture content is acceptable prior to the placement of subsequent lift of CCPR or wearing surface.

7.2.6 Segregation and Surface Defects

Each lane-km, including shoulders, will be inspected for areas of segregation and surface defects as per the Ministry of Ontario SP-027 Manual for Assessment of Surface Defects of In-Place Recycled Pavement Mats.

The Contract Administrator will provide the Contractor with the locations of the visually identified segregation and surface defects within two (2) working days after receiving notification from the Contractor that the CCPR mat is ready for acceptance testing.

7.2.7 Surface Tolerance

Each lane-km, including shoulders will be inspected for areas of deviation in any direction using a 3 metre straight edge.

The Contract Administrator will provide the Contractor with the locations of identified deviation within two (2) working days after receiving notification from the Contractor that the CCPR mat is ready for acceptance testing.

817 8 ACCEPTANCE CRITERIA

8.1 General

The acceptance of emulsified asphalt, CCPR mix and finished product shall be based on the following criteria from the Quality Assurance test results:

- Emulsified Asphalt Quality
- Corrective Aggregate Properties, if applies
- Mix Properties
- Compaction
- Moisture
- Segregation and Surface Defects
- Surface Tolerance

If the test results on a Sub-Lot or Lot are out of the acceptance limits, refer to Table 9.1 for the required repair.

8.2 Emulsified Asphalt Quality

Unless otherwise specified, the emulsified asphalt shall conform to the latest Specifications for Emulsified Asphalt on the approved products list (APL).

Emulsified asphalt with test results failing to meet the specification will be subjected to pay adjustment depending on the extent of the problem.

The Contract Administrator will notify the Contractor of out-of-specification test results.

8.3 Corrective Aggregate Properties

Corrective aggregate, if used, that does not meet the pre-approved gradation or other physical requirements, submitted by the contractor at the mix design phase, will be rejected. Contractor shall supply and use alternative material meeting the approved requirements.

8.4 Mix Properties

The Contractor will be notified of the deficiencies by the Contract Administrator within 24 hours of the Contract Administrator receiving the information.

The Contract Administrator may rescind the acceptance of CCPR Mix Design if it cannot be demonstrated that the in-place material is compliant with the Specification requirements.

Non-conforming CCPR material is subject to corrective action as specified in Table 9.1.

8.4.1 Air voids

If the air voids requirements are not met on the loose mix samples, the Contractor shall make adjustments to the mix design. The Contract Administrator may accept previously placed CCPR if the in-place air voids are within Contract requirements.

8.5 Compaction

The Mean percent compaction per Sub Lot per Lift of CCPR will be determined by the Contract Administrator for acceptance.

Compaction in any Sub-Lot lower than 96.0% is subject to corrective action as specified in Table 9.1.

8.6 Moisture

The mean moisture content for each Lot shall be less than 3.0% with no Sub-Lot moisture content exceeding 4.0%. A Lot of CCPR material with mean moisture content above 3.0% may be accepted at the discretion of the Contract Administrator.

8.7 Segregation and Surface Defects

If the Contractor conducts the Work in such a manner that the CCPR materials in a localized area has defects or becomes segregated or ravelled to unacceptable level, that area is subject to corrective action as specified in Table 9.1.

Defects include but are not limited to potholes, surface failures, ravelling, rutting, bumps or dips, irregular cross-slope and soft spots.

8.8 Surface Tolerance

After the completion of compaction, a CCPR mat with a surface deviation exceeding 10 mm is subject to corrective action as specified in Table 9.1.

817 9 CORRECTIVE ACTIONS

A CCPR mat that is unacceptable shall be repaired or removed and replaced as specified in Table 9.1.

Repairs shall be for the full width of CCPR mat and to the depth specified in Table 9.1. Removal shall be for the full depth and lane width of the CCPR mat. Reprocessing may be considered as a repair method, upon submission of a proposal by the Contractor and acceptance by the Contract Administrator.

The Contractor shall not undertake any correction on any defective work prior to notifying the Contract Administrator.

All corrective actions shall be performed at the Contractor’s expense.

Table 9.1 – Unacceptable CCPR and Repair Requirements

Distress	Severity	Required Repair
Raveling/Coarse Aggregate Loss	Moderate to Severe	<ul style="list-style-type: none"> Mill 50mm and replace with an acceptable bituminous pavement. Remove and replace with acceptable CCPR.
	Very Severe	<ul style="list-style-type: none"> Remove all CCPR and replace with an acceptable bituminous pavement. Remove and replace with acceptable CCPR
Segregation	Severe	<ul style="list-style-type: none"> Mill 50mm and replace with an acceptable bituminous pavement. Remove and replace with acceptable CCPR.
Compaction	Unacceptable	For rejected Sub-Lots: <ul style="list-style-type: none"> Remove all CCPR material and replace with an acceptable bituminous pavement. Remove and replace with acceptable CCPR
Moisture Content	Unacceptable	For rejected Sub-Lots: <ul style="list-style-type: none"> Remove CCPR material to full depth and replace with acceptable bituminous pavement.

		<ul style="list-style-type: none"> Remove and replace with acceptable CCPR Wait to dry
Surface Tolerance	Unacceptable	<ul style="list-style-type: none"> Mill 50 mm and replace with acceptable bituminous pavement. Re-profile by milling
Other Defects	Unacceptable	<ul style="list-style-type: none"> Repair or replace as directed by the Contract Administrator.
<p>Notes</p> <ul style="list-style-type: none"> Bituminous mix and lift thickness shall be in accordance with the Construction Specification for Bituminous Pavement (Spec. No. 801) 		

817 10 METHOD OF MEASUREMENT

CCPR mix will be measured by weight in tonnes supplied and placed on the road in accordance with this Specification.

817. 11 BASIS OF PAYMENT

Payment for the CCPR mix will be at the Contract Unit Price per tonne and will be full compensation for all labour, equipment, material and activities necessary to do the Work.

The addition of mineral filler, corrective aggregate and emulsified asphalt that is required to meet Contract requirement shall be at no extra cost to the Department.