

COLD-IN-PLACE PAVEMENT RECYCLING**PART 1 - GENERAL****1.01 SECTION INCLUDES**

Cold-in-place recycling (CIR) of asphalt roadways

1.02 DESCRIPTION OF WORK

Includes milling and mixing of existing asphalt materials, addition of recycling agents and additives if required, compaction of the reclaimed materials, and curing of the compacted street.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants as well as the following:

- A. Prepare and submit the job mix formula to the Engineer for approval prior to initiating full recycling operations.
- B. Provide quality control test results.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. Cold-in-place Recycling:**

1. **Measurement:** Measurement will be in square yards for the area of roadway recycled.
2. **Payment:** Payment will be at the unit price per square yard of roadway recycled.
3. **Includes:** Unit price includes, but is not limited to, milling and sizing of existing asphalt layers; protecting street fixtures; development of a job mix formula; adding and mixing recycling agents and additives, if required; supplying and incorporating water; compacting the reclaimed mix; shaping of the mix; completing secondary compaction, if required; removing any loose or excess material; and final clean up.

1.08 MEASUREMENT AND PAYMENT (Continued)**B. Bituminous Recycling Agents:**

1. **Measurement:** Measurement will be in gallons of asphalt emulsion or foamed asphalt furnished and incorporated.
2. **Payment:** Payment will be at the unit price per gallon of asphalt emulsion or foamed asphalt furnished and incorporated.
3. **Includes:** Unit price includes, but is not limited to, furnishing and placing of materials and mixing the agent into the recycled mix.

C. Chemical Recycling Additives:

1. **Measurement:** Measurement will be in tons of chemical recycling additives.
2. **Payment:** Payment will be at the unit price per ton of chemical recycling additives.
3. **Includes:** Unit price includes, but is not limited to, furnishing and placing of materials and mixing the agent into the recycled mix.

D. Fixture Adjustment: Comply with Section 6010 for adjustment of manholes and intakes and Section 5020 for adjustment of water valves and fire hydrants.

E. Surface Course: Comply with Section 7011 or Section 7021 for overlay pavement.

PART 2 - PRODUCTS**2.01 MATERIALS**

A. Bituminous Recycling Agent: Use asphalt emulsion (HFMS-2s or CSS-1) meeting the requirements of Iowa DOT Section 4140, or foamed asphalt using PG 52-34S asphalt binder meeting the requirements of Iowa DOT Sections 2318 and 4137.

B. Chemical Recycling Additives:

1. Cement complying with Iowa DOT Article 4101.01, A.
2. Hydrated lime complying with AASHTO M 216.
3. If approved by the Engineer, use other proprietary products according to the manufacturer's requirements.

C. Water: Comply with Iowa DOT Section 4102. Potable water obtained from an approved supply does not need to be tested.

2.02 JOB MIX FORMULA

Compile a job mix formula using an analysis of the existing asphalt pavement layers and the required strength of the recycled pavement section as specified in the contract documents. The job mix formula will identify the recycling agent and any additives; the rates for the recycling agent and additive, if needed; and the rate of water to reach the optimum moisture content. Tolerances should be included to allow the Contractor to adjust the mixture so that it is placed successfully.

PART 3 - EXECUTION**3.01 EQUIPMENT****A. General:**

1. Perform cold-in-place recycling between May 1 and October 1.
2. Perform recycling operations when weather conditions are such that proper mixing, shaping, and compacting the recycled mix can be accomplished. General criteria includes:
 - a. Begin operations when air temperature is 55°F and rising.
 - b. Cease operations when air temperature is 55°F or less and falling.
 - c. Do not begin operations if the National Weather Service forecasts a temperature of 35°F or less in the next 24 hours or if the weather is rainy or foggy.

B. Equipment:

1. Furnish a self-propelled machine capable of milling the existing paving material to the width and depth specified in the contract documents. Ensure the equipment meets the following:
 - a. Equipped with automatic depth control to maintain a constant depth and width.
 - b. Capable of milling the existing roadway to the required gradation in one pass.
 - c. Accurately controls the rate of flow and total delivery of the recycling agent and additives, if needed, into the recycled mixture in relation to the speed and quantity of the material being recycled.
 - d. Capable of mixing the recycled material and any recycling agent and additive required by the job mix formula into a homogeneous mixture.
2. If specified in the contract documents, use an asphalt foaming system that accurately and uniformly adds the required percent of water to the hot asphalt binder. Use equipment fitted with a test nozzle to provide field samples of the foamed asphalt. Equip tankers supplying the hot asphalt binder with a thermometer to continuously monitor the temperature of the asphalt in the bottom third of the tank.
3. Use a bituminous paver complying with Iowa DOT Article 2001.19. Heating the screed will not be allowed.
4. Have the following rollers available for use:
 - a. Double drum steel roller (static and vibratory)
 - b. Pneumatic tire roller (25 ton or greater)

3.02 PREPARATION

Prior to initiating the recycling process, undertake the following tasks:

- A. Identify and protect all affected utilities.
- B. Remove excess dirt, vegetation, raised pavement markings, standing water, and any other objectionable materials.

3.03 UTILITIES

All utilities within the project limits should be protected prior to the milling. Locate and lower manholes, water valve boxes, and other fixtures a minimum of 2 inches below the bottom of the recycled section. Re-set manhole castings, water valves, and other fixtures to the proper elevations following completion of the compaction of the recycled mixture and placement of any surface course. Protect stormwater intakes by preventing recycled material from entering the drainage system.

3.04 CONTROL STRIP

Construct a control strip during the first day of production to verify that the equipment, construction methodology, and workmanship meet the specifications. Adequately size the control strip to verify that the optimal rates of water, recycling agent, and additives can be achieved. Establish a rolling pattern that will result in optimum compaction. The Engineer may waive the control strip provided the Contractor provides proof that the work will meet the specifications based on previous experience using the same equipment, personnel, and materials.

3.05 MILLING THE PAVEMENT

Mill the existing asphalt pavement and underlying areas to initiate the recycling process.

- A. Mill the full depth of the asphalt layers in a single pass.
- B. Verify the gradation of the pulverized material meets the specifications.
- C. Provide a 3 inch overlap of the longitudinal joint and 24 inches between transverse joints

3.06 RECYCLING AGENT APPLICATION

For single unit recycling trains, add the bituminous agent in the cutting drum. For two-unit trains, add it in the mix paver and for multi-unit trains add the bituminous agent in the pugmill. Ensure residual asphalt content is $\pm 0.5\%$ of the target established in the job mix formula. Maintain foamed asphalt binder $\pm 20^{\circ}\text{F}$ of the optimum temperature established by the job mix formula.

3.07 RECYCLING ADDITIVES

Add chemical recycling agents as additives to applications that use bituminous recycling agents at the rates required by the job mix formula. Apply the chemical additive in dry or slurry form by adding it on the pavement ahead of the milling operation, adding it directly to the mixing chamber, or spraying it over the cutting teeth of the milling machine.

3.08 COMPACTION

Ensure recycled material is $\pm 2\%$ of the optimum moisture content.

- A. **Timing:** Compact the mixed recycled roadway materials based on the type of recycling agent used as follows.
 - 1. **Asphalt Emulsion:** Complete compaction at or just after the emulsion breaks.
 - 2. **Foamed Asphalt:** Initiate immediately after mixing and complete prior to the mixture drying out.

3.08 COMPACTION (Continued)

- B. Process:** Follow the rolling pattern established with construction of the control strip regarding type and size of roller. Perform initial rolling with the pneumatic tired roller and final rolling with the steel wheeled roller. Set the vibratory amplitude/frequency, tire pressure for pneumatic, and static weight of all rollers based on the depth of the recycled mixture to be compacted. Uniformly compact the mixture to a minimum of 94% of maximum dry density according to AASHTO T 134 on a moving average of five consecutive tests with no individual test below 92%.
- C. Shaping:** Complete rolling to achieve the required density. Ensure the crown of the compacted recycled roadway is within 6 inches of the established centerline, unless otherwise specified in the contract documents.

3.09 SECONDARY COMPACTION

If necessary, complete secondary compaction to eliminate wheel marks and minor consolidation caused by construction traffic prior to opening. Complete secondary compaction during daylight hours and when the minimum ambient temperature is 80°F. Suspend operations if cracking of the mat occurs.

3.10 SMOOTHNESS

Ensure surface of recycled base course is free of bumps, ruts, indentations, segregation of aggregates and conforms to the required elevations. Check surface with a 10 foot straightedge and correct any irregularity 3/8" or larger. Complete corrective measures at no cost to the contracting agency.

3.11 SURFACE COURSE

Protect the CIR surface from damage prior to adding the surface course. Any damage will be repaired at Contractor's expense. Restrict application of overlays and other surface treatments until one of the following has been met:

- A. Average moisture content of the CIR layer is no more than 0.3% above the residual moisture content according to Iowa DOT Materials I.M. 504 or 3.5%, whichever is greater.
- B. The moisture content of the CIR layer has reached a plateau of less than 5% and has remained constant (within $\pm 0.3\%$) for a minimum of 3 calendar days.
- C. The CIR layer has been completed for 21 calendar days.

The Engineer may adjust this drying period depending on field conditions.

3.12 QUALITY CONTROL

The Contractor is responsible for the quality control of the materials and the CIR process.

- A. Sample and test the asphalt recycling agent according to Iowa DOT Materials I.M. 204.
- B. Apply the asphalt recycling agent at the target application rate ± 0.06 gallon per square yard per inch for standard emulsion and ± 0.33 gallon per square yard per inch for foamed asphalt.

END OF SECTION