**405-1 Cold In-Place Recycling (Partial Depth) (Revised 10-10-19)**

COLD IN-PLACE RECYCLING (PARTIAL DEPTH) [405] (REVISED 10-10-19)

Description. This work is the partial depth pulverizing, crushing, and screening of the in-place bituminous materials to the dimensions shown on the plans and incorporating emulsified asphalt binder agent, water and mineral filler into the pulverized material. The work also includes paving the cold in-place recycled (CIR) material to the dimensions shown on the plans.

Materials.

Mixture Design. Perform the mixture design using the procedure in the special provision for Cold In-place Recycling (Partial Depth) Mixture Design found elsewhere in the proposal. Include all costs associated with the mixture design in the pay item, “Cold Recycled Plant Mix”.

Asphalt Emulsion. Use an asphalt emulsion with the properties listed in Table 405-2 and the mixture design properties listed in Table 405-3, found elsewhere in the proposal. The target asphalt emulsion content will be determined from the mixture design. Adjust the asphalt emulsion rate, with concurrence from the Project Manager, to improve coating or to adjust breaking properties. Do not reduce asphalt emulsion content below 2% without concurrence from the Materials Bureau.

Pulverized Bituminous Material. Meet the following gradation before adding asphalt emulsion:

|  |  |
| --- | --- |
| Sieve Size | Percent Passing |
| 1.25-inch (31.5 mm) | 100 |

Mineral Filler. Furnish 1.0% mineral filler by dry weight of cold recycled material. Obtain written approval by the Project Manager to increase the application rate of mineral filler prior to production changes. Furnish mineral filler as specified elsewhere in the contract.

Reclaimed Asphalt Pavement (RAP). If available, RAP may be added as approved by the Project Manager if it meets the requirements in Table 405-1. Ensure that when RAP is added to the cold recycled material, the resulting material meets the specifications in Table 405-3.

Table 405-1

Additional Crushed RAP

|  |  |  |
| --- | --- | --- |
| Tests | Method | Limit |
| Deleterious Materials: Clay Lumps and Friable Particles in Aggregate, % max | AASHTO T 112 | 0.2 recommended |
| Maximum size, 100% Passing | AASHTO T 27 | 1.25-inch (31.5 mm) sieve |

Water. Provide water free of organics or deleterious materials that does not cause an adverse reaction with the asphalt emulsion or mineral filler.

Construction Requirements.

Seasonal and Weather Limitations. Place cold recycled material between the dates of May 15 and August 1 when surface treatment will consist of seal and cover. Place cold recycled material between the dates of May 15 and October 1 when surface treatment will consist of an overlay.

If precipitation occurs during recycle operations, reprocess any areas with signs of raveling or stripping due to precipitation at Contractor expense. Suspend recycling operations when the temperature is 60 °F (15.5 °C) and falling.

The National Weather Service weather forecast will be used for the following items c) and d). Do not perform recycling operations:

Unless the ambient air temperature measured in the shade is 50 °F (10 °C) and rising.

During foggy or rainy weather regardless of temperature.

If weather conditions are such that proper mixing, placing, and compacting of the recycled material cannot be accomplished.

When the weather forecast for the project site predicts the temperature will be below 35 °F (1.7 °C) within 24 hours after placement of any portion of the project.

Equipment. Meet the following equipment requirements.

Use a self-propelled cold milling machine capable of pulverizing the existing bituminous material in a single pass to the plan depth and a minimum 12.5-foot (3.6 m) width. Ensure the machine has automatic depth control to maintain cutting depth to within plus or minus 0.25-inch (6 mm) of the plan depth. The machine must have positive means to control cross slope elevations. Heating devices to soften the pavement are prohibited.

The Contractor will be required to cold recycle the full pavement width, as shown on the plans. If the primary milling machine is unable to process one half of the road in one pass, multiple passes with a milling machine will be necessary to process the pavement remaining along shoulder. A smaller milling machine may be used to mill shoulders and miscellaneous areas.

Submit a milling plan for Project Manager’s approval 10 business days before starting the cold recycling operation.

Use a mixing unit equipped with a belt scale to continuously weigh the pulverized material. A coupled/interlocked computer controlled liquid metering device is required. Ensure the liquid metering device can automatically adjust the asphalt emulsion flow to compensate for variations in the weight and water content of pulverized material introduced into the mixer. Ensure the metering device delivers the asphalt emulsion to within plus or minus 0.2 percent of the required amount, based upon dry weight of pulverized material. Ensure the asphalt emulsion pump is capable of emulsion contents up to 3.5 percent by weight of pulverized material. Ensure automatic digital readings are displayed for both the emulsion and pulverized material flow rates. Use a pugmill with interlocked water metering system capable of adding water at a rate between 0.5 and 5.0 percent by weight of pulverized material.

Prior to beginning work, provide Project Manager with documentation of calibration and certification of flow meters and internal scales required to achieve the required control of mixing rates.

Use a self-propelled bituminous paver equipped with electronic grade and cross slope control for the screed. Ensure the paver is capable of spreading and laying cold recycled material during one continuous pass to the specified dimensions.

Use at least one 20-ton (18.1 MT) minimum pneumatic roller and at least two 10-ton (9.07 MT) minimum steel wheel static/vibratory rollers. Ensure scrapers and water-spraying systems are in working order.

Use a self-propelled power broom to remove loose particles and other materials from the cold recycled surface prior to overlay or seal and cover.

Construction Methods and Procedures. Remove dirt, vegetation, standing water, combustible materials, oils, and thermoplastic markings from the entire roadway width.

Complete recycling operations through initial compaction and open the roadway to two-lane traffic at the end of each day's work. Maintain traffic through the project at all times. Close one lane only as necessary to permit recycling and compaction operations.

Mill to required depth and width as indicated on the plans. Do not disturb the material underlying the bituminous pavement. Make adjustments to milling depth as directed by the Project Manager. Process pulverized material so 100 percent passes the 1.25-inch (31.5 mm) sieve. Ensure that the screening and crushing unit includes a closed circuit system capable of continuously returning oversized material to the crusher. Remove oversized crack filler and fabric within the pulverized material from the crusher screens. Oversized crack filler is crack filler not passing the 1.25-inch (31.5 mm) screen. Waste oversized crack sealer as directed by the Project Manager.

Produce cold recycled material using a mixing unit that processes the pulverized material, asphalt emulsion, and mineral filler into a homogeneous mixture. Introduce asphalt emulsion and mineral filler into the pulverized material at the rate shown in the mix design(s). Do not deviate from asphalt emulsion or mineral filler rates shown in the mix design without Project Manager approval.

Do not heat paver screed. Use a pick-up machine to transfer the windrowed material into the paver hopper. Ensure the pickup machine is within 50 yards (46 m) of the mixing unit during the work.

Begin rolling within 30 minutes after paving. Use double drum steel rollers for final rolling to remove pneumatic tire marks. Complete finish rolling within 1 hour after paving is completed. Do not start, stop or park rollers on the un-compacted mat. Discontinue rolling if cracking is observed or if material is being displaced.

After compaction, do not permit traffic, including that of the Contractor, on the cold recycled material for 2 hours. Do not allow stopped or standing traffic, including that of the Contractor, on the cold recycled material for 36 hours after placement. Place traffic control at the beginning of the previous day’s work so vehicles waiting in queue park on cold recycled material more than 36 hours old. After compaction and before placing the overlay or seal and cover, maintain the recycled pavement surface in a condition suitable for the safe movement of traffic.

When the surface treatment consists of an overlay, begin placing overlay between twelve and fifteen calendar days after the completion of cold recycling. An overlay can be placed earlier provided the CIR meets the water content specifications under Construction Requirements part 3) of this provision. When the surface treatment consists of a seal and cover, begin placing seal and cover between twenty-five and thirty calendar days after the completion of cold recycling. A seal and cover can be placed earlier provided the CIR meets the water content specifications under Construction Requirements part 3) of this provision.

The method for determining the moisture content is to divide each paver pass into 3000 foot (915 m) sections. At one location selected and witnessed by Department personnel, remove a 2.2 lb. (1000 g) sample withdrawn from a uniform section representing the full depth of the compacted cold recycled material. Extract using a dry method such as a pick or a diamond saw. Immediately place samples in a previously weighed moisture proof container. Fill sample hole by placing and compacting cold recycled, hot, or cold mix asphalt pavement in 2 inch (50 mm) lifts to the finished surface. Furnish samples to the Department. The Department will determine moisture content using AASHTO T 329. Each location must have moisture contents less than 2.0 percent before an overlay or seal and cover is placed on the section.

Quality Assurance/ Quality Control. Be responsible for sampling, testing and control of the cold recycled material and cold recycling process.

Milled Bituminous Material Sizing. Provide equipment needed to collect a representative sample from the belt conveyer before introducing emulsion. Sample each 0.5 mile (0.8 km) and test using a 1.25-inch (31.5 mm) sieve to determine compliance with the particle size requirement. Use ASTM D979 or AASHTO T 168.

Asphalt Emulsion. Ensure the asphalt emulsion arrives on the project not exceeding 120ºF. For all asphalt emulsion delivered to the project, provide supplier’s documentation that asphalt emulsion meets the requirements of Table 405-2. Asphalt Emulsion not meeting these requirements will be rejected. When requested by the Department, obtain samples for verification testing in accordance with Subsection 402.03.2. Obtain samples from shipping trailers before transferring emulsion into the Contractor’s storage units for verification testing.

Table 405-2

Asphalt Emulsion Requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Test | | Minimum | Maximum |
| Residue from distillation, % | AASHTO T 59 | 63.0 |  |
| Oil distillate by distillation, % | AASHTO T 59 |  | 1.0 |
| Sieve Test, % | AASHTO T 59 |  | 0.3 |
| Penetration range (TBD1), 77ºF (25°C), in (mm) | AASHTO T 49 | -25% | +25% |

Notes:

1. To be determined by the CIR mixture design before manufacturing emulsion for project. Submit penetration range to Project Manager for approval before project start.

Asphalt Emulsion Content. Use asphalt emulsion content required by the mixture design, or as allowed by Project Manager. Do not reduce asphalt emulsion content below 2% without concurrence from the Materials Bureau. Check and record emulsion content for each segment where the percentage is changed. Record emulsion content from the belt scale and asphalt pump totalizers.

Mixture Testing. When instructed by the Project Manager, submit representative samples of loose cold recycled material from windrow for testing and review. Samples may be tested by the Department to verify the material meets the properties in Table 405-3, found elsewhere in the proposal. Take samples from the windrow following MT 303. Seal samples in a waterproof bag.

If mixture properties do not meet the properties in Table 405-3, work may be suspended until proper corrective actions or adjustments can be made. This may include but not be limited to changing production rate and the amount or type of recycling agent or other additives.

Milling Depth. Check and record the nominal depth on both outside vertical faces of the cut at 700 feet (210 m) intervals.

Compaction and Density Requirements. Compaction and Density requirements will be determined using the test strip method. Compact cold recycled material to a minimum of 97 percent of the target density obtained from test strip.

Construct test strip, establish target density, and monitor density during construction in accordance with MT 219, *Control-Strip B – Plant Mix Paving* with the following exceptions:

Construct test strip when pavement temperature is 68 °F (20 °C) or higher;

Construct test strip at a depth representative of the project; and

Construct test strip using rollers specified in Construction Requirements, part 2) f).

If mix proportions, weather conditions or other controlling factors change, the Department may require construction of additional test strip(s) to establish a new target density.

Cold Recycled Surface Cross Slope / Smoothness. Use a level to check the cold recycled surface cross slope regularly during placement. Ensure the smoothness varies less than 0.25-inch (6 mm) from the lower edge of a 10-foot (3 m) straight edge placed on the surface parallel and transversely to the centerline after rolling is completed.

Conditions of Acceptance and Corrective Actions for Cold Recycled Material. Acceptance for payment of the cold recycled material will be determined by visual inspection of the mixture on the roadway. Before proceeding to other work or surfacing treatments, correct deficient cold recycled material to the satisfaction of the Project Manager as follows:

Reprocess or repair any area showing an excess or deficiency of asphalt emulsion.

Reprocess or repair any area that ravels.

If rutting occurs before the surface treatment is placed, re-compact to remove ruts.

Reprocess or repair areas not meeting smoothness criteria.

Method of Measurement. Work as described will be measured by the square yard of the completed sections for the depth specified. Asphalt emulsion will be measured by the ton (metric ton). Water used in this operation will not be measured for payment.

Basis of Payment. Payment for completed and accepted quantities is made under the following:

|  |  |
| --- | --- |
| Pay Item | Pay Unit |
| Cold Recycled Plant Mix | Square Yard (square meter) |
| Cold Recycling Emulsion | Ton (metric ton) |

Mineral filler will be paid for as described elsewhere in the contract.

Reprocess and/or repair Cold Recycled Material not meeting specifications at no cost to the Department.

Payment at the contract unit price is full compensation for all necessary resources necessary to complete the contract work items.