

417-R-655 COLD CENTRAL PLANT RECYCLING, CCPR

(Revised 04-20-17)

The Standard Specifications are revised as follows:

SECTION 417, BEGIN LINE 1, INSERT AS FOLLOWS:

SECTION 417 - COLD CENTRAL PLANT RECYCLING, CCPR

417.01 Description

This work shall consist of a mixture of sized Reclaimed Asphalt Pavement, RAP, millings from existing asphalt pavement or existing stockpiles, asphalt emulsion, water and other additives. The mixture shall be produced at a nearby location, then placed and compacted to produce a recycled asphalt layer to the approved design properties in accordance with 105.03.

417.02 Just-in-Time Training, JITT

The Engineer and Contractor are required to attend a just-in-time training, JITT, course regarding CCPR and both shall mutually agree on the course instructor, course content and training site. The training class shall be conducted at a project field location convenient for all project construction personnel responsible for CCPR operations and inspection to attend.

The JITT course shall be held during normal working hours and be completed not more than 14 days prior to the start of CCPR operations.

The Contractor shall provide a JITT instructor experienced in the construction methods, materials and test methods associated with asphalt emulsion stabilized CCPR. A copy of the course syllabus, handouts and presentation materials shall be submitted to the Engineer at least five business days before the course is to be taught.

417.03 Quality Control

A quality control plan, QCP, shall be submitted to the Engineer a minimum of five calendar days prior to the JITT. The QCP shall include the proposed CCPR mix design, a start to finish process description to include discussion on corrective action measures, a list of proposed equipment, a list of proposed QC tests and testing frequencies, and the curing methods and procedures applied to the CCPR. All QC test results shall be maintained during the duration of the contract and made available to the Engineer upon request.

The following table provides the type and minimum frequency for tests:

QC TESTING	
<i>Test</i>	<i>Frequency^{1,2}</i>
<i>Depth of Laydown</i>	<i>1 per 500 ft</i>
<i>Pulverized Material Gradation</i>	<i>1 per 1,000 tons of production</i>
<i>Pulverized Material Moisture Content</i>	<i>1 per 500 tons of production</i>
<i>Asphalt Emulsion Content³</i>	<i>1 per 500 tons of production</i>
<i>Water Content³</i>	<i>1 per 500 tons of production</i>
<i>Compacted In-Place Field Density</i>	<i>1 per 1,000 ft</i>

<i>Field Moisture Content for Curing</i>	<i>1 per each day of production</i>
<i>Note 1: The Contractor shall perform all quality control tests within the first 500 ft after startup and after any change in the mix design.</i>	
<i>Note 2: Testing frequency is based upon either linear foot of CCPR laydown or tons of CCPR mixture processing.</i>	
<i>Note 3: Asphalt emulsion content and water content shall be taken from the readings of the control settings of the mixing unit.</i>	

MATERIALS

417. 04 Materials

CCPR shall consist of a homogenous blend of RAP combined with asphalt emulsion, water, and when required, recycling additives such as corrective aggregate or cement. Cement recycling additives used in asphalt emulsion stabilized CCPR may be dry powder or slurry with a minimum dry solids content of 60%. The actual materials used are dependent on the CCPR mix design and project requirements.

Materials for use in CCPR shall be in accordance with the following:

Asphalt EmulsionAs Defined*
 Corrective Aggregate to adjust gradation or supplement material volume:

1. Coarse or Dense Graded Aggregate, Class C or Higher 904.03
2. Fine Aggregate..... 904.02
3. RAP shall be the product resulting from the cold milling or crushing of existing asphalt pavement and processed so that 100% passes the 1 1/4 in. (31.5 mm) sieve.

Portland Cement, Type I901.01(b)
 Water913.01

* The requirements for asphalt emulsion shall be in accordance with the following:

<i>CCPR ASPHALT EMULSION⁽¹⁾⁽³⁾</i>			
<i>Test</i>	<i>Procedure</i>	<i>Min.</i>	<i>Max.</i>
<i>Viscosity, Saybolt Furol, @ 77°F (25°C), SFS</i>	<i>AASHTO T 59</i>	<i>20</i>	<i>100</i>
<i>Sieve Test, No. 20 (850 µm), retained on sieve, %</i>	<i>AASHTO T 59</i>		<i>0.10</i>
<i>Storage Stability Test, 24 hr, %</i>	<i>AASHTO T 59</i>		<i>1</i>
<i>Distillation Test, Residue by distillation, %</i>	<i>AASHTO T 59⁽²⁾</i>	<i>64.0</i>	
<i>Oil Distillate by volume, %</i>	<i>AASHTO T 59</i>		<i>1</i>
<i>Penetration, 77°F (25°C), 100 g, 5 s, dmm</i>	<i>AASHTO T 49</i>	<i>50</i>	<i>200</i>
<i>Notes:</i>			
<i>(1) The asphalt emulsion shall be selected for the project by the asphalt emulsion supplier based on the Contractor's mixture design. The penetration of the supplied asphalt emulsion shall be within ± 25 dmm of the penetration of the design asphalt emulsion. The asphalt emulsion shall be received on the job site at a temperature no greater than 120°F.</i>			
<i>(2) Modified AASHTO T 59 – distillation temperature of 350 ± 9°F (177±5°C) with a 20 minute hold.</i>			
<i>(3) Type A certification shall be required to be furnished by the asphalt emulsion supplier.</i>			

417.05 Mix Design

CCPR mix designs shall be in accordance with ITM 592 and comprised of existing RAP, asphalt emulsion and recycling additives, if necessary. The mix design and all associated testing shall be performed using samples of each proposed material. RAP samples shall either be collected from the existing pavement at the project site representing the milling depth or from the RAP stockpile to be used during construction. The mix design shall be completed by a design laboratory that is AMRL accredited in HMA and asphalt emulsion. Additional mix designs shall be performed when the proposed material changes significantly in order to establish representative mixes for the entire job. The Contractor shall be responsible for obtaining all samples required to develop the mix design. One sample per lane mile of planned CCPR shall be the minimum sampling frequency for mix design preparation.

The Contractor shall provide a mix design or designs for approval at least five calendar days prior to the JITT. The mix design shall include all test results performed. If new materials are added, a new mix design, including the updated test results, shall be submitted at least one day prior to implementation.

CONSTRUCTION REQUIREMENTS

417.06 Roadway Preparation

Snowplowable raised pavement markers shall be removed in accordance with 808.11(e) prior to CCPR operations.

Grass and other vegetation shall be removed from the edge of the existing pavement to prevent contamination of the pulverized asphalt material during milling operation.

All areas of soft or yielding subgrade shall be corrected prior to CCPR operations.

If the CCPR mix is to be placed on a prepared subgrade or aggregate base, ensure the subgrade soils and base have been properly prepared, moisture treated and compacted to the minimum density according to plans or specifications, immediately prior to placement of the CCPR mix, so as to create an evenly graded, unyielding surface.

417.07 Pavement Removal

The existing asphalt pavement shall be milled in accordance with 306 to the length, depth and width as shown on the plans or specifications. The RAP shall be free of contamination of dirt, base, concrete or other deleterious materials such as silt and clay.

When a paving fabric is encountered during the pulverization operation, the Contractor shall make the necessary changes in equipment or operations so that incorporation of shredded fabric into the CCPR does not affect the performance parameters or inhibit placement or compaction of the CCPR. The Contractor shall be required to remove and properly dispose of oversized pieces of paving fabric. The

Contractor shall make the necessary adjustments in equipment or operations so that the shredded fabric in the recycled material is no more than 5 sq in. No fabric piece shall have a dimension exceeding a length of 4 in.

Rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be removed as observed from the roadway. Residual materials that cannot be completely removed may be incorporated into the mixture if the Contractor can demonstrate that those added materials will not adversely affect performance.

Any such materials retained in the mix shall be appropriately sized and blended so as not to adversely affect the strength of the recycled pavement.

417.08 Equipment

The equipment shall consist of the following major components:

(a) Milling Machine/Pavement Cold Planer

Milling equipment shall be in accordance with 306.03(a). The equipment shall be capable of pulverizing the existing asphalt material in a single pass to the depth shown on the plans. The machine shall have automatic depth controls to maintain the cutting depth to within $\pm 1/4$ in. of that shown on the plans. The milling operation shall not disturb or damage the underlying material. The use of a heating device to soften the pavement will not be allowed.

(b) Additive Slurry Storage and Supply Equipment

Slurry shall be produced using a batch or continuous-flow type stationary mixer equipped with calibrated metering and feeding devices that introduce the cement, water and additives into the mixer in the specified quantities. Additive slurry storage and supply equipment shall have agitators or similar equipment to keep the slurry in suspension when held in the slurry batch or storage tanks. Slurry shall be kept in suspension during transport using agitator equipment.

(c) Sizing Equipment

A material sizing unit shall be capable of sizing using a scalping screen or crushing capabilities to reduce RAP to a maximum size of 1 1/4 in. (31.5 mm) or to the maximum size requirements specified prior to mixing with the asphalt emulsion.

(d) Mixing and Proportioning Equipment

The equipment shall be capable of processing sized RAP, asphalt emulsion, water and any additives stipulated in the mix design to a homogenous and uniformly coated CCPR mixture. The equipment shall be in accordance with 409.02(b) and display automatic digital readings shall be displayed for flow rate of both the RAP and asphalt emulsion in appropriate units of weight and time.

The mixing apparatus shall have cold feed hopper equipped with vibrators on the hopper's walls to assist the free flow of materials to a variable speed belt conveyor. Control of the RAP shall be by mechanically adjustable gate valves at the point of discharge or a RAP belt scale for the continuous weighing of the RAP. The variable

speed belt conveyor or RAP belt scale shall be interlocked to the asphalt emulsion metering device.

The asphalt emulsion metering device shall be capable of automatically adjusting the flow of asphalt emulsion to compensate for any variation in the amount of RAP introduced into the mixing apparatus. Asphalt emulsion shall be metered by weight of RAP using a calibrated meter that will accurately measure the amount of asphalt emulsion to within a tolerance of $\pm 2.0\%$ of the specified rate.

(e) Hauling Equipment

Hauling equipment shall be in accordance with 409.03(b).

(f) Laydown Equipment

Laydown equipment shall be in accordance with 409.03(c).

The paver screed shall be controlled by electronic grade and cross-slope control. Heating of the screed shall not be allowed.

CCPR material shall either be loaded directly into the paver hopper from transport trucks or loaded by a pickup device. If utilizing a pickup device, it shall be capable of removing and transferring the entire windrow of recycled mix in a single pass.

The equipment used for placement of the CCPR mixture shall be capable of the placement in accordance to 105.03.

(g) Compaction Equipment

Compaction equipment shall be in accordance with 409.03(d). The number, weight, and types of rollers shall be as necessary to obtain required compaction. At a minimum, the following rollers shall be used:

- 1. At least one pneumatic tired roller in accordance with 409.03(d)3 with a minimum weight of not less than 20 t.*
- 2. At least one double drum vibratory roller in accordance with 409.03(d)4 with a minimum weight of not less than 10 t.*

417.09 Weather Restrictions

CCPR operations shall be performed when the RAP temperature, or pavement surface temperature, is above 50°F with ambient temperatures above 35°F for seven days. The Engineer may restrict work when the heat index is greater than 100°F. The CCPR shall not be performed before May 1st or after October 1st.

417.10 Material Sizing and Stockpiling

The gradation of the RAP shall have 100% passing the 1 1/4 in. (31.5 mm) sieve, or be sized to meet specific contract requirements.

RAP that has been crushed and screened shall be stockpiled and maintained to prevent reconsolidation. Water may be added to RAP as it is screened and crushed to abate dust and mitigate reconsolidation.

Corrective aggregate, if required, shall either be mixed with RAP to create a homogenous mixture during stockpiling or fed into the mixing apparatus at the rate determined by the mix design.

417.11 Processing and Mixing Operation

The sized RAP shall be processed through a mixing unit capable of combining the sized RAP, asphalt emulsion, and any additives to produce a homogenous recycled mixture.

An additive used in asphalt emulsion stabilized CCPR may be dry powder or slurry and the Contractor shall address the application methods and fugitive dust control procedures in the QCP when dry powder materials are used.

The asphalt emulsion shall be injected into the CCPR materials at the initial rate determined by the mix design and approved by the Engineer. Sampling and mix design may determine different levels of asphalt emulsion at various portions of the project.

The asphalt emulsion shall have an application tolerance determined by adding $\pm 0.25\%$ to the percent total asphalt emulsion content.

The Contractor can request the asphalt emulsion percentage to exceed the upper tolerance provided the mix design requirements are satisfied at the requested percentage. The request will be subject to approval by the Engineer.

417.12 Placement

The depth of CCPR shall be as indicated on the plans.

The hauling equipment shall deliver the blended CCPR material into the paver within one hour of mixing or before the asphalt emulsion begins to break and set.

CCPR single lift thickness shall be a minimum compacted depth of 3 in. and not exceed a maximum compacted depth of 6 in. A minimum lift thickness of 2 in. can be utilized if the crushed RAP has a maximum size of 1 in.

417.13 Control Strip and Compaction

A minimum 500 ft long control strip shall be conducted on the first day of production to verify the construction process meets the requirements as specified. The control strip shall allow the Contractor to:

- (a) demonstrate the equipment, materials and processes proposed to produce a CCPR layer in accordance with specification requirements, and;*
- (b) determine the optimal rates for the asphalt emulsion, water and any additives recommended for the material, and;*

- (c) *determine the sequence and manner of rolling necessary to obtain specified density requirements in one uniformly compacted layer.*

The CCPR density shall be achieved with the same equipment, materials, construction methods and density requirements used on the accepted control strip. A new control strip shall be constructed if changes are made outside of the tolerances of the original mix design, equipment or construction methods.

A rolling pattern that produces the maximum obtainable density, or optimum field density, shall be determined during the control strip. The Contractor shall provide a sequence and manner of rolling by establishing a roller pass versus density chart that shows the progress of densification from initial lay down through optimum field density using a properly calibrated nuclear gauge in accordance to AASHTO T 310. Production may continue after approval of the control strip.

The Contractor shall perform compaction testing in accordance with AASHTO T 310 during production to ensure compaction is between 97% and 102% of the optimum field density established during the control strip. If two successive tests indicate compaction is over 102% or below 97% of the optimum field density, a new rolling pattern and roller pass versus density chart shall be established.

The QC technician shall be on site, observing all compaction efforts and approving areas as they reach minimum relative compaction. Care shall be taken not to over compact the mat.

Any type of rolling effort that causes cracking, displacement or other type of pavement distress shall be discontinued until such time as the problem can be resolved and approved by the Engineer.

Rollers shall not be started or stopped on recycled material unless when changing direction during the compaction process.

All tests shall be conducted at the stated QC testing frequencies throughout CCPR operations.

417.14 Opening to Traffic

Opening to traffic shall occur after sufficient cure time has been applied to the CCPR so traffic will not initiate raveling or permanent deformation. All loose particles that may develop on the pavement surface shall be removed by a rotary power broom in accordance with 409.

After opening to traffic, the surface of the recycled pavement shall be maintained in a condition suitable for the safe movement of traffic.

417.15 Maintenance

The Contractor shall maintain the recycled pavement in a manner satisfactory to the Engineer until the surface course has been constructed.

Any damage to the completed recycled material shall be repaired by the Contractor prior to the placement of new asphalt concrete or final surface sealing. Patching shall be in accordance with 304. The excavated patch areas shall be filled and compacted with HMA or CCPR material as directed by the Engineer. No direct payment will be made for damage repair unless approved by the Engineer.

417.16 Curing

Before placing the final surfacing, the recycled surface shall remain in-place for a minimum of three days and meet one of the following conditions:

- (a) There is less than 3.0% moisture remaining in the mixture, or;*
- (b) The material has remained in-place for a minimum of 10 days without rainfall.*

The planned method and duration of curing for CCPR shall be in accordance with the QCP. The specified surface course shall be placed within two weeks of the CCPR final cure, but no later than November 1.

417.17 Pavement Smoothness

Pavement smoothness of the cured CCPR mat shall meet the requirements of 401.18(b) The Contractor shall correct humps or depressions exceeding the tolerances in accordance with 401.18(c).

417.18 CCPR Surface Course

The CCPR shall be swept of all loose material and standing water with a rotary power broom in accordance with 409 immediately prior to placing the tack coat. A tack coat shall be required and shall be applied to the CCPR in accordance with 406.

Monuments shall be reestablished in accordance with 615.10 after the surface course is placed.

417.19 Method of Measurement

The CCPR will be measured by the square yard, complete in place. Asphalt emulsion will be measured by the ton. Aggregate to adjust the CCPR gradation will be measured by the ton of material used. HMA Patching will be measured in accordance with 304.06. Re-established monuments will be measured in accordance with 615.13. Grade adjustment of existing structures will be measured in accordance with 720.06. Removal of snowplowable raised pavement markers will be measured in accordance with 808.12.

417.20 Basis of Payment

The CCPR will be paid for at the contract unit price per square yard, complete in place. Asphalt emulsion will be paid for at the contract unit price per ton, complete in place. Aggregate used to adjust the CCPR gradation will be paid for at the contract unit price per ton, complete in place. HMA patching will be paid for in accordance with 304.07, of the thickness specified on the plans. Re-established monuments will be paid for

in accordance with 615.14. Grade adjustment of existing structures will be paid for in accordance with 720.07. Removal of snowplowable raised pavement markers will be paid for in accordance with 808.13.

Payment will be made under:

<i>Pay Item</i>	<i>Pay Unit Symbol</i>
<i>Cold Central Plant Recycling</i>	<i>SYS</i>
<i>Corrective Aggregate, CCPR.....</i>	<i>TON</i>
<i>Stabilizing Material, Asphalt Emulsion</i>	<i>TON</i>

The costs associated with the CCPR mix design and quality control testing shall be included in the cost of the cold central plant recycling.

The costs associated with the removal of grass and vegetation, rubberized crack filler, durable pavement markings, loop wires and other non-pavement materials shall be included in the cost of the cold central plant recycling.

The costs associated with pulverizing, stabilizing, compacting, curing and maintenance of the CCPR not related to failing subgrade shall be included in the cost of the cold central plant recycling.

The cost associated with mixing water for cold central plant material shall be included in the cost of the cold central plant recycling.

The cost associated with aggregate when used to supplement material volume shall be included in the cost of the cold central plant recycling.

The cost associated with the use of portland cement when used as an additive shall be included in the cost of the cold central plant recycling.

The cost associated with aggregate when used to adjust the CCPR gradation shall be included in the cost of the corrective aggregate pay item.

The costs of the asphalt emulsion stabilizing material shall be included in the cost of the stabilizing material pay item.

In the locations of failing subgrade, removal of the CCPR shall be included in the cost of subgrade treatment.