

SPECIAL NOTE FOR FULL DEPTH RECLAMATION WITH CEMENT

1. GENERAL

1.1. Description. Full-depth reclamation (FDR) with cement, shall consist of pulverizing and mixing existing asphalt pavement and base course material with portland cement, soil, and water to produce a dense, hard, cement treated base. It shall be proportioned, mixed, placed, compacted, and cured in accordance with this specification, and shall conform to the lines and grades shown in the plan.

2. MATERIALS

2.1. Recycled Asphalt Pavement (RAP) and Base Material. Shall consist of the existing asphalt pavement, existing base course material and/or subgrade material. The base course and subgrade material shall not contain roots, topsoil, or any material deleterious to its reaction with cement. The particle distribution of the processed material shall be such that 100% passes a 3-inch sieve, at least 95% passes a 2-inch sieve, at least 55% passes a No. 4 sieve, and maximum 20% passing the 200 sieve.

2.1.1. Mix Design. Remove samples of RAP and base material to the specified depth and perform appropriate testing to establish mix design. Submit mix design to the Engineer for approval one week before the planned start of work. Approval of the mix design by the Engineer is solely for monitoring quality control and in no way releases the Contractor from his responsibilities.

2.1.2. Mix Design Development. Mix Design Development - Samples must be obtained inclusive of the depth to be recycled. Sampled materials must be properly processed and prepared to closely simulate field conditions (use auger cuttings taken from the surface to 2-3 inches below the treatment depth). A Qualified Technical Representative will analyze the samples and provide the following information as part of the mix design to the Engineer:

- Location of core samples.
- Thickness and description of existing pavement and aggregate layers to be reclaimed.
- A selected matrix of soils testing standards (performed on mixed sample, except T208.)
 - Moisture Content AASHTO T265 - Mechanical and Hydrometer
 - Particle Size Analysis of Soils AASHTO T88
 - Liquid Limit AASHTO T89
 - Plastic Limit AASHTO T90
 - Moisture Density AASHTO T99
 - Unconfined Compression AASHTO T208 - To be performed on subgrade soil only if more than 20% of the underlying subgrade is to be included in the portland cement stabilized layer.

2.2. Cement. Shall comply with Section 801 of the KYTC Standard Specifications for Road and Bridge Construction, current edition.

2.3. Water. Shall be free from substances deleterious to the curing of the cement-treated material.

3. EQUIPMENT

3.1. Description. FDR may be constructed with any machine or combination of machines that will produce a satisfactory product meeting the requirements for depth of pulverization, cement and water application, mixing, compacting, finishing, and curing as provided in this specification.

3.2. Mixing Methods. Mixing shall be accomplished in place, using single-shaft or multiple-shaft mixers. Agricultural disks or motor graders are not acceptable mixing equipment.

3.3. Cement Proportioning. Spreading of the cement shall be done with a spreader truck designed to spread dry particulate such as cement to insure a uniform distribution. Spreaders or distributors used shall be able to demonstrate a consistent and accurate application rate, as well as dust control during application. The mechanical cement spreader shall be capable of dispensing a measured quantity of cement +/- 3 lbs per square yard in advance of the pulverizer just prior to each pass of the stabilizing operation. The pulverizer shall abut or slightly overlap (3") previous pass to ensure a continuous homogeneous mass of granular material and cement. Cement spreader does not have to abut or overlap previous pass as long as the calculated quantity of cement is dispersed in front of the pulverizer.

3.4. Application of Water. Water may be applied through the mixer or with water trucks equipped with pressure-spray bars. If using the spray bar system, road base shall be pre-wet to obtain optimum moisture content prior to the dispensing of cement. Do not apply water directly to the roadway before or after cement placement without first pulverizing the roadbed.

3.5. Compaction. Compact the FDR base uniformly to a minimum of 98% of maximum dry density in accordance with ASTM D558 or AASHTO T134 based on a moving average of five consecutive tests with no individual test below 96%. Establish a compaction pattern that will achieve the required density without over compaction.

4. CONSTRUCTION REQUIREMENTS

4.1. General

4.1.1. Preparation. Methods, equipment, tools, and any machinery to be used during construction shall be approved by the Engineer prior to the start of the project. Prior to the actual reclaiming of the roadway, drop inlets or catch basins that might be affected shall be sufficiently barricaded to prevent reclaimed subbase material, silt or runoff from plugging the drainage system.

Sufficient surface drainage must be provided for each stage of construction so that ponding does not occur on the reclaimed sub-base course prior to the placement of bituminous concrete.

Reclamation shall be accomplished by means of a self-propelled, traveling rotary reclaimer or equivalent machine capable of cutting through existing bituminous concrete pavement to depths of up to 15 inches with one pass. The machine shall be equipped with an adjustable grading blade leaving its path generally smooth for initial compaction. Equipment such as road planers or cold milling machines designed to mill or shred the existing bituminous concrete, rather than crush or fracture it, shall not be allowed.

Existing bituminous concrete pavement and any underlying granular material must be pulverized and mixed so as to form a homogenous mass of reclaimed sub-base material which will bond together when compacted.

In areas where the vertical or horizontal geometry of the proposed roadway is different than that of the existing, the roadway shall be reclaimed in-place and the reclaimed material sub-base placed in windrows or stockpiled while any filling or excavation is performed. When the proposed sub-grade elevation is achieved, the reclaimed sub-base material will be placed back onto the roadway in lifts no greater than five (5) inches in depth before being compacted.

Reshaping using the reclaimed sub-base material should be minimized in order to insure that the roadway has a uniform thickness of reclaimed sub-base material throughout. Unless otherwise specified, when reshaping of the roadway is required, it should be performed utilizing additional sub-base or processed aggregate base.

The reclaimed sub-base material shall be compacted prior to the placement of any additional granular material used (sub-base or processed aggregate base). Subsequent to the compaction of the reclaimed sub-base material, any reshaped material or additional material placed on the roadway should not exceed five (5) inches in depth before being compacted.

A motor grader shall be used for shaping, fine grading, and finishing the surface of the reclaimed material or any other granular materials placed to form the surface prior to paving.

Any surface irregularities which develop during or after the above described work shall be corrected until it is brought to a firm and uniform surface satisfactory to the Engineer.

- 4.1.2. Mixing and Placing.** FDR processing shall not commence when the soil aggregate or sub-grade is frozen, or when the air temperature is below 40°F (4°C). Moisture in the base course material at the time of cement application shall not exceed the quantity that will permit a uniform and intimate mixture of the pulverized asphalt, base material and cement during mixing operations, and shall be within +/-2% of the optimum moisture content for the processed material at start of compaction.

The operation of cement application, mixing, spreading, compacting, and finishing shall be continuous and completed within 2 hours from the start of mixing. Any processed material that has not been compacted and finished shall not be left undisturbed for longer than 30 minutes.

4.1.3. Scarifying. Before cement is applied, initial pulverization or scarification may be required to the full depth of mixing. Scarification or pre-pulverization is a requirement for the following conditions:

- When the processed material is more than 3% above or below optimum moisture content. When the material is below optimum moisture content, water shall be added. The pre-pulverized material shall be sealed and properly drained at the end of the day or if rain is expected.
- For slurry application of cement, initial scarification shall be done to provide a method to uniformly distribute the slurry over the processed material without excessive runoff or ponding

4.2. Application of Cement. The specified quantity of cement shall be applied uniformly in a manner that minimizes dust and is satisfactory to the engineer. If cement is applied as a slurry, the time from first contact of cement with water to application on the soil shall not exceed 60 minutes. The time from cement placement on the soil to start of mixing shall not exceed 30 minutes.

4.3. Mixing. Mixing shall begin as soon as possible after the cement has been spread and shall continue until a uniform mixture is produced. The mixed material shall meet the following gradation conditions:

4.3.1. The final mixture (bituminous surface, granular base, and sub-grade soil) shall be pulverized such that 100% passes the 3-inch sieve, at least 95% passes the 2-in. sieve, and at least 55% passes the No. 4 sieve. Additional material can be added to the top or from the sub-grade to improve the mixture gradation, as long as this material was included in the mixture design.

4.3.2. The final pulverization test shall be made at the conclusion of mixing operations. Mixing shall be continued until the product is uniform in color, meets gradation requirements, and is at the required moisture content throughout. The entire operation of cement spreading, water application, and mixing shall result in a uniform pulverized asphalt, soil, cement, and water mixture for the full design depth and width.

4.4. Compaction. The processed material shall be uniformly compacted to a minimum of 98% of maximum density based on a moving average of five consecutive tests with no individual test below 95%. Field density of compacted material can be determined according to the KYTC standard specifications. Optimum moisture and maximum density shall be determined prior to start of construction and also in the field during construction by a moisture-density test approved by the Engineer.

At the start of compaction, the moisture content shall be within +/-2% of the specified optimum moisture. No section shall be left undisturbed for longer than 30 minutes during

compaction operations. All compaction operations shall be completed within 2 hours from start of mixing.

- 4.5. Finishing.** As compaction nears completion, the surface of the FDR material shall be shaped to the specified lines, grades, and cross sections. If necessary or as required by the engineer, the surface shall be lightly scarified or broom-dragged to remove imprints left by equipment or to prevent compaction planes. Compaction shall then be continued until uniform and adequate density is obtained.

During the finishing process the surface shall be kept moist by means of water spray devices that will not erode the surface. Compaction and finishing shall be done in such a manner as to produce a dense surface free of compaction planes, cracks, ridges, or loose material. All finishing operations shall be completed within 4 hours from start of mixing.

- 4.6. Curing.** Finished portions of the FDR base that are traveled on by equipment used in constructing an adjoining section shall be protected in such a manner as to prevent equipment from marring or damaging completed work.

After completion of final finishing, the surface shall be cured according to section 208.03.06 of the standard specifications.

- 4.7. Traffic.** Completed portions of FDR base can be opened immediately to low-speed local traffic and to construction equipment if a curing seal is used and provided the curing material is not impaired, and provided the FDR base is sufficiently stable to withstand marring or permanent deformation. The section can be opened up to all traffic after the FDR base has received a curing compound or subsequent surface and is sufficiently stable to withstand marring or permanent deformation. If continuous moist curing is employed in lieu of a curing compound or subsequent surfacing within 7 days, the FDR base can be opened to all traffic after the 7-day moist curing period, provided the FDR base has hardened sufficiently to prevent marring or permanent deformation.

- 4.8. Surfacing.** In most cases, allow the FDR to cure for a minimum of two days (48 hours after completing finishing operations) before applying a surface course in order to determine if any isolated soft spots exist. If the Engineer deems the situation warrants faster construction, the surfacing can be placed any time after finishing, as long as the soil-cement is sufficiently stable to support the required construction equipment without marring or permanent distortion of the surface.

- 4.9. Maintenance.** The contractor shall maintain the cement-treated material in good condition until all work is completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. If it is necessary to replace any processed material, the replacement shall be for the full depth, with vertical cuts, using either cement-treated material or concrete. No skin patches will be permitted. Such maintenance shall be done by the contractor at his own expense.

5. INSPECTION AND TESTING

5.1. Description. The contractor shall make such inspections and tests as deemed necessary to ensure the conformance of the work to the contract documents. These inspections and tests may include, but shall not be limited to:

Recycling operations including recycling speed, yield monitoring, monitoring treatment depth, procedures for avoiding recycling and curing in inclement weather, methods to ensure that segregation is minimized, procedures for mix design modification, grading and compacting operations, and cement application procedure.

Density testing of the recycled material will be performed using the nuclear method.

Only those materials, machines, and methods meeting the requirements of the contract documents shall be used unless otherwise approved by the engineer.

All testing of processed material or its individual components, unless otherwise provided specifically in the contract documents, shall be in accordance with the latest applicable ASTM or AASHTO specifications in effect as of the date of advertisement for bids on the project.

6. MEASUREMENT AND PAYMENT

6.1. Measurement.

6.1.1. Full Depth Reclamation. This Department will measure the quantity in square yards of completed and accepted full depth reclamation. The Department will not measure corrective or reconstructed work for payment. The Department will not measure water for payment and will consider it incidental to this item of work.

6.1.2. Asphalt Curing Seal. The Department measure curing seal for payment according to section 208 of the standard specifications.

6.2. Payment. This Department will make payment for the completed and accepted quantities under the following:

<u>Code</u>	<u>Pay Item</u>	<u>Pay Unit</u>
24936EC	Full Depth Reclamation with Cement	Square Yard
02542	Cement	Ton
02702	Sand for Blotter	Ton
00358	Asphalt Curing Seal	Ton