**FULL DEPTH RECLAMATION BASE:**

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| (11-19-13)(Rev. 7-15-25) |  | SP5 R20 |

**Description**

Construct and cure a full depth reclamation (FDR) base by treating the existing asphalt pavement, subgrade, existing base, or any combination of these materials to a design depth as specified in the contract, by pulverizing, adding Portland cement, adding aggregate or asphalt millings when required, mixing, wetting and compacting the mixture to the required density. Proportion, spread and mix the materials on the roadway; manipulate, compact and finish in accordance with the contract and the lines, grades, depths and typical sections shown on the plans or established by the Engineer.

Define “full depth reclamation (FDR)” as a type of cement stabilized base that includes treating the existing flexible pavement section and a predetermined portion of the underlying materials, consisting of asphalt pavement, base course, and/or subgrade.

**Materials**

Refer to Division 10 of the *Standard Specifications*.

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| **Item** | **Section** |
| Coarse Aggregate | Table 1005-1 |
| Portland Cement, Type I | 1024-1 |
| Portland Cement, Type II | 1024-1 |
| Type IL Blended Cement | 1024-1 |
| Type IS Blended Cement | 1024-1 |
| Water | 1024-4 |

For aggregate for FDR base, use any standard size coarse aggregate meeting the requirements of Table 1005-1 of the *Standard Specifications*, or use asphalt millings in accordance with Section 607 of the *Standard Specifications*. If a combination of these materials is used, proportion as determined by the Engineer. Standard size coarse aggregate meeting the requirements of Table 1005-1 of the *Standard Specifications* may be provided by the Department.

**Limitations**

Do not construct FDR base when the air temperature is below 40 degrees Fahrenheit nor when conditions indicate that the temperature may fall below 40 degrees Fahrenheit within 24 hours. Do not place nor mix materials with frozen subgrade. Perform the work in this special provision during daylight hours unless otherwise specified in the contract.

Do not construct FDR base that will not be covered with a layer of pavement by December 1st of the same year, failure to do so requires the Contractor to cover the base with asphalt surface treatment (AST) within 72 hours of December 1st. Place the AST in accordance with Section 660 of the *Standard Specifications* except Article 660-3 will not apply. The placement of the AST by the Contractor or other forces will in no way relieve the Contractor of the responsibility to maintain or repair the damaged base, no matter what the cause of damage.

**Equipment**

Submit details of the FDR equipment to the Engineer for acceptance at least 5 days before mobilizing equipment to the site.

1. **General**

Use any combination of machines or equipment that will produce the required results meeting the approval of the Engineer. Correct any leakage of fluids and/or materials promptly or the Engineer may order such equipment removed and replaced with satisfactory equipment. Use equipment and methods for applying cement, water, curing seal, blotting sand and AST that will not damage the base and in accordance with Article 107-21 of the *Standard Specifications*.

1. **Cement Spreaders**

Use automatic or mechanical control spreaders that have an adjustable rate of flow and the capability of spreading the required amount of cement in one pass.

1. **Mixers**

Use a self-propelled asphalt reclaimer with at least 400 horsepower (hp), a cutter capable of mixing to a compacted depth of at least 12 inches, a cutter width of at least 8 feet and a metered water additive system with a full width spray bar. Disc harrows, motor graders and other equipment may be used only to supplement the mixing done by the reclaimer.

1. **Water Distribution Equipment**

Add water to the FDR mixture with equipment capable of uniformly distributing the required amount as established by the Engineer. Use a water truck with automatic or manual flow rate control to add water directly to the asphalt reclaimer. The asphalt reclaimer full width spray bar jets shall be maintained to prevent clogs, repair or replace the system parts as necessary.

1. **Compaction Equipment**

Use self-propelled compaction equipment. Use vibratory sheepsfoot, vibratory smooth drum and pneumatic tire rollers for FDR, unless otherwise approved by the Engineer.

1. **Scarifying and Grading Equipment**

Use a motor grader equipped with a cross slope indicator for FDR. The motor grader shall be capable of scarifying the FDR mixture to the full depth of the stabilized treatment.

1. **Miscellaneous Finishing Equipment**

A rotary brush/broom may be required by the Engineer for maintenance of the finished FDR base.

**Preparation of FDR Materials**

Prior to pulverization, any widening areas, including shoulders, must be free of vegetation and unsuitable material. Spread aggregate for FDR base or asphalt millings at the rate shown in the contract or as directed by the Engineer. Correct and make stable soft or yielding areas before construction proceeds.

**Pulverization**

Pulverize full width of roadway, including existing asphalt pavement and any widening areas with an asphalt reclaimer to the required depth in the contract or as directed by the Engineer. Maintain moisture content at or below optimum as determined by the Engineer. If a road remains open to traffic during FDR operations, pulverize pavement in sections sized so FDR base is completed within the same working day unless otherwise approved by the Engineer.

Before the addition of any cement to the pulverized FDR materials, grade and shape the pulverized FDR materials in accordance with the contract or typical sections, lines and grades shown on the plans. Before the addition of cement, perform drying or addition of moisture to not exceed the optimum moisture content established by the Engineer for the FDR moisture except by permission.

**Determination of Optimum Moisture Content and Maximum Dry Density**

The optimum moisture content and density will be determined in the field by a moisture-density test on representative samples of pulverized FDR materials; however, preliminary moisture-density values may be determined by laboratory tests using blended materials from the project. The maximum dry density for the mix shall be obtained by performing a moisture-density test in accordance with AASHTO T 99 Method D as modified by the Department. Copies of these modified testing procedures are available upon request from the Materials and Tests Unit.

**Application of Cement**

Uniformly spread cement at the rate in the contract or as directed by the Engineer for the full depth of treatment over the previously pulverized materials. Do not apply cement on excessively wet FDR materials or on windy days. No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement until it is mixed with the FDR materials. Replace all spread cement that has been displaced before mixing is started.

Apply cement only to such an area that all operations shall be completed in the same day during daylight hours. Apply cement to sections sized so FDR base is completed within the traffic control requirements.

Apply cement to the pulverized FDR materials when the percentage of moisture in the materials is the correct amount that assures a uniform mixture of material and cement during the mixing operation. Do not exceed the optimum moisture content established by the Engineer for the FDR moisture except by permission. Moisture content will be determined by the Engineer in accordance with standard test procedures used by the Department.

**Mixing**

Immediately after the cement has been spread, mix it with the pulverized FDR materials for the full depth of the treatment until a homogenous and uniform mixture is produced. Mixing will be sufficient when 100% of the mixture passes a 2 inch sieve. Mixing will be sufficient when at least 50% passes a No. 4 sieve, exclusive of any aggregate or asphalt millings.

Immediately after mixing the pulverized materials and cement, add any additional water that is necessary to bring the moisture content between optimum and optimum plus 1.5% as determined by the Engineer. If moisture content exceeds this optimum range specified by the Engineer, the FDR-cement mixture may, if approved by the Engineer, be manipulated by remixing or blading to reduce the moisture content to within the specified optimum range. Avoid excessive concentrations of water as well as wet spots or streaks on or near the surface. After all mixing water has been applied, continue mixing until a uniform mixture is obtained at the required moisture content. Perform the operations of cement spreading, water application and mixing so that they result in a uniform cement and water mixture for the full depth and width of the area being treated. Remix any hydrated FDR-cement mixture that has been left undisturbed for over 30 minutes. Complete finishing the FDR base within 3 hours of adding water to the FDR base.

**Compaction**

Begin compaction of the mixture immediately after the mixing operation is completed. At the start of compaction, ensure the moisture in the mixture is at or no more than 1.5% above the optimum moisture content and is less than the quantity which will cause the FDR mixture to become unstable during compaction and finishing. Compact the mixture to at least 97% of the determined maximum dry density.

Maintain the moisture content of the surface material at optimum or higher during compacting operations. Initial shaping may be required to obtain uniform compaction and required grade and cross section. Construct the thickness of the FDR base within a tolerance of +/- 1/2 inch of the base thickness required in the plans.

Where the base is deficient in density, remove and replace the area of deficient base with base of the required depth and density. As an exemption to removal and replacement, if the deficiency is not considered sufficient to seriously impair the required strength of the FDR base, the deficient area may be left in place at the discretion of the Engineer. Additional testing using a DCP (dynamic cone penetrometer) or other strength testing methods may be required to determine deficiency.

**Finishing**

When initial compaction is nearing completion, shape the surface of the FDR base to the required lines, grades and cross section. Construct the FDR base so that the maximum differential between the established grade and the FDR base per each density test section is +/- 1/2 inch, or as approved by the Engineer. Maintain the moisture content of the surface material at optimum or higher during finishing operations.

If necessary, lightly scarify the surface to remove any tire imprints or irregular surfaces left by equipment. Continue compaction until a uniform and adequate density is obtained.

Perform the compaction and finishing to produce a dense surface free of compaction planes, cracks, ridges or loose material. Complete finishing the FDR base within 3 hours of adding water to the FDR base.

When rain causes excessive moisture, reconstruct the entire section. Where such reconstruction is necessary, furnish all work and cement required.

**Curing**

After the FDR base has been finished as specified herein, cure it in accordance with Section 543 of the *Standard Specifications* unless otherwise approved by the Engineer.

**Construction Joints**

Build FDR base for large wide areas in a series of parallel lanes of convenient length and width meeting the approval of the Engineer. Form straight longitudinal joints at the edge of each day’s construction by cutting back into completed work to form a true vertical face free of loose or shattered material.

Construct joints to provide a vertical joint having adequately mixed properly compacted material immediately adjacent to the joint. A longitudinal joint adjacent to partially hardened FDR base built the preceding day may be formed by cutting back into the previously constructed area during mixing operations. Set guide stakes for cement spreading and mixing if deemed necessary.

**Traffic**

Completed sections of the FDR base may be opened when necessary to light-weight local traffic, provided the base has hardened sufficiently to prevent marring or distorting of the surface and provided the curing is not impaired. Do not use construction equipment on the FDR base for hauling except as necessary to discharge into the spreader during paving operations.

**Maintenance**

Maintain the FDR base in an acceptable condition until final acceptance of the project. Include, in maintenance operations, immediate repair of any defects or damage that may occur. Repeat as often as may be necessary to keep the base in an acceptable condition. Perform repairs to the FDR base by replacing the base for its full depth rather than by adding a thin layer of FDR mixture to the existing layer of FDR base.

**Measurement and Payment**

*Full Depth Reclamation Base* will be measured and paid at the contract unit price per square yard that has been completed and accepted. In measuring this quantity, the width of the FDR base will be measured across the top surface of the FDR base. The length will be the actual length constructed, measured along the centerline of the surface of the FDR base. Measurement will not be made of any FDR base added or replaced for corrective measures during construction or for repairing damaged areas.

*Aggregate for FDR Base* will be measured and paid at the contract unit price per ton that has been placed and mixed into the work. The aggregate will be measured by weighing in trucks or certified platform scales or other certified weighing devices. No deductions will be made for any moisture contained in the aggregate at the time of weighing.

*Milling Asphalt Pavement,* *\_\_" Depth* will be measured and paid in accordance with Article 607-5 of the *Standard Specifications*.

*Portland Cement for FDR Base* will be paid at the contract unit price per ton that has been incorporated into the mix. When bulk cement is used, the quantity will be measured by weighing in trucks on certified platform scales or other certified weighing devices. Measurement will not be made of any cement added or replaced for corrective measures during construction or for repairing damaged areas.

*Asphalt Curing Seal* will be paid as provided in Article 543-5 of the *Standard Specifications*.

*Blotting Sand* will be paid as provided in Article 818-4 of the *Standard Specifications*.

*Asphalt Surface Treatment, Single Seal* or *Asphalt Surface Treatment, Double Seal* will be paid as provided in Article 660-12 of the *Standard Specifications*.

If a layer of *Full Depth Reclamation Base* is deficient in density but has been permitted to be left in place in accordance with the above Compaction section, payment for that *Full Depth Reclamation Base* will be made at 50% of the contract unit prices for *Full Depth Reclamation Base*.

Sand seal or asphalt surface treatment applied due to the failure of the Contractor to cover the *Full Depth Reclamation Base* as required will be incidental to the work of this section. If the Contractor fails to provide sand seal or Asphalt Surface Treatment as required and the Engineer has the work performed by other forces, the cost of such work will be deducted from monies due or to become due to the Contractor.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
| --- | --- |
| Full Depth Reclamation Base | Square Yard |
| Aggregate for FDR Base | Ton |
| Portland Cement for FDR Base | Ton |