

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
STANDARD SPECIFICATION

Section 315 – Cement Stabilized Reclaimed Base Construction (CSRB)

315.1 General Description

This work includes constructing a cement stabilized base course by pulverizing the existing flexible pavement, underlying base and subgrade, and mixing with Portland cement. Construct according to these Specifications and to the lines, grades, thickness, and typical cross-sections shown on the Plans or established by the Engineer.

315.1.01 Related References

General Provisions 101 through 150

A. Standard Specifications

[Section 109—Measurement and Payment](#)

[Section 301—Soil Cement Construction](#)

[Section 412—Bituminous Prime](#)

[Section 814—Soil Base Materials](#)

[Section 821—Cutback Asphalt](#)

[Section 822—Emulsified Asphalt](#)

[Section 824—Cationic Asphalt Emulsion](#)

[Section 830—Portland Cement](#)

[Section 880—Water](#)

B. Referenced Documents

GDT 19 – Determining Maximum Density of Soil-Cement mixtures

GDT 20 – Determining Field Density of soils with <45% retained on the No. 10 sieve and < 10% retained on the 1 inch sieve

GDT 21 - Determining Field Density of soils containing >45% retained on the No.10 sieve or >10% retained on the 1 inch sieve

GDT 59 - Testing Density of roadway materials with Nuclear Gauge

GDT 65 – Laboratory Design of Soil-Cement and Cement Stabilized Graded Aggregate

GDT 67 – Family of Curves Method for determining Maximum Density of soils

GDT 86 – Determining the compressive strength of Cement Stabilized Base cores taken from the roadway

315.1.02 Submittals

Prior to construction, submit a Construction Work Plan to the Engineer consisting of the proposed equipment, materials, and operation procedures. If the Engineer determines that the Work Plan is not satisfactory, revise the procedures and augment or replace equipment, as necessary, to complete the Work.

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315.1.03 Mix Design

The Contractor shall submit a mix design to the Office of Materials and Testing for approval at least three weeks prior to construction. The Mix Design process shall be completed in accordance with [GDOT Test Method/GDT 65](#) by an accredited materials laboratory. The sampling, testing, proportioning, and documentation shall be completed by an accredited materials laboratory. The Contractor will be responsible for ensuring that appropriate traffic control measures are in place during the sampling operations. In-place samples of the road structure shall be taken at a minimum frequency of 1000 feet (300m) per two lanes; alternating the sample locations to achieve a sample every 500 lane-feet (152m). Additional samples may be needed to represent material changes and/or problem areas. Each sample shall contain at least 30lbs (14kg) of proportionally blended materials to be reclaimed. The Portland cement used in the design process must be from an approved source listed on [GDOT's Qualified Products List/QPL3](#) and representative of the same material to be used in construction.

The mix design submittal to the Office of Materials and Testing shall include the following:

1. Approximately 100lbs (45kg) of proportionally blended material from all in-place samples taken from the roadway.
2. A one gallon sample (plastic container) of the stabilizer used in the mix design.
3. All Test Data (charts, graphs, spreadsheets, etc.) along with design parameters. Test data should include the target gradation of the blended material, optimum moisture content of mixing, and application rate of the stabilizer to meet the design requirements.

Note: Since the Mix Design is based on source specific materials, any changes to materials or sources will render the design invalid.

315.2 Materials

Ensure that materials meet the requirements of the following GDOT Standard Specifications:

| Material | Section |
|--|------------------------------|
| Blotter material (sand) | 412.3.05.G.3 |
| Soil Base Material | 814.2.02 |
| Cutback asphalt, RC-30, RC-70, RC-250 or MC-30, MC-70, MC-250, CSS-1h, AEP, EAP, CRS-2 | 821.2.01 |
| Portland Cement (Type I or Type II) | 830.2.01 |
| Water | 880.2.01 |

315.3 Construction Requirements

315.3.01 Personnel

Ensure that only experienced and capable personnel operate equipment.

315.3.02 Equipment

Equipment used in CSRB construction must meet the following requirements prior to the beginning of construction. All equipment shall be in satisfactory condition and capable of its intended purpose. The Engineer may at any time reject any equipment that is deemed unsafe, erratic, or produces an inadequate performance.

A. Reclaimer

CSRB will require a reclaimer unit that meets the following requirements:

1. Designed expressly for reclamation capable of pulverizing and mixing through asphaltic pavement, granular/soil base, Subbases, and subgrade down to depths of at least 12 inches (300mm).
2. Having a cutting drum with a minimum width of 7ft (2m).
3. Capable of continuously mixing materials to a homogenous blend and at a consistent depth.

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4. Powered by an engine of at least 500 horsepower with steerable front and rear wheels.
5. Controlled by an electronic metering system capable of injecting mix water directly into the mixing chamber and has automatic sensors to monitor water application and mixing depth.

B. Spreader

For CSRB construction, use a cyclone-type mechanical spreader equipped with on-board scales that will spread Portland cement in a relatively dust-free process. Spreader must have an electronic or mechanical metering system which monitors the application rate.

Note: The use of pneumatic tubes to transfer cement or lime directly onto the roadway will not be allowed.

C. Additional Equipment (Water Truck, Compaction and Grading equipment, and Prime Distributer)

Additional equipment necessary to complete the work must be in satisfactory condition and proper for its intended purpose. Compactive equipment includes a sheep's foot roller, vibratory steel wheel roller and a pneumatic rubber tire roller. Use the correct size/type rollers or combination thereof that is capable of achieving the required density. A pressure distributor that complies with [GDOT Standard Specifications/Subsection 424.3.02.B](#) will be required to apply the bituminous prime coat.

315.3.03 Preparation

Prior to commencing reclaiming operations, blade grass and excess soil a minimum of 12 inches (300mm) from the edge of pavement. Locate, mark and preserve existing centerline, manholes, and utilities (gas, water, and electric lines). Relocate mailboxes and other appurtenances within such proximity to the roadway as to risk damage or interfere with the work. Remove sections of driveway aprons in the right-of-way where necessary to permit the reclaimer to operate without damaging the machinery or driveway pavement. If necessary, saw-cut a neat parallel line to the proposed edge of pavement and remove the concrete along the road. After all work is complete, replace appurtenances to their original location as nearly as possible.

315.3.04 Construction

A. Weather Limitations

1. Mix only when the weather permits the course to be finished without interruption and within the time specified.
2. Mix materials only when the moisture of the materials to be used in the mixture meets the specified limits.
3. Begin mixing only when the air temperature is above 40°F in the shade and rising.

B. Moisture Adjustment

Prior to compaction, ensure a uniform moisture content of the mixture is 100 to 120 percent of the optimum moisture content. The optimum moisture content is determined by the Job Mix Design and can be adjusted by the Engineer.

C. Cement Application

1. Apply cement on days when wind will not interfere with spreading.
2. Apply cement at the rate specified on the Job Mix Design (as established by [GDT-65](#)) and mix to the depth shown on the Plans. The Engineer may alter the spread rate during the progress of construction if necessary. Maintain the application rate within ± 10 percent of that specified by the Engineer.
3. Provide both equipment and personnel to measure the application rate of cement placed. The first tanker of cement shall be checked with a square yard cloth/certified scales. Any subsequent loads may be tested at the discretion of the Engineer. Multiple checks may be necessary to ensure that the spread rate is maintained within the ± 10 percent limit.
4. If the cement content falls below the 10 percent limit in the mixing area, add additional cement to bring the affected area within the tolerance specified, make necessary adjustments to the spreader, and perform additional checks to ensure the problem is corrected. If the cement content is more than the 10 percent limit in the mixing area, the excess quantity will be deducted from the Contractor's pay for cement.
5. Regulate operations to limit the application of cement to sections small enough so that all of the mixing, compacting, and finishing operations can be completed within the required time limits.

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6. Pass only spreading and mixing equipment over the spread cement and operate this equipment so that it does not displace cement.
7. Replace damaged cement at no cost to the Department when damage is caused by:
 - a. Hydration due to rain, before or during mixing operations.
 - b. Spreading procedures are contrary to the requirements stated above.
 - c. Displacement by the Contractor's equipment or other traffic.

D. Mixing

1. Begin mixing as soon as possible after the cement is spread, and continue until a homogeneous and uniform mixture is produced. The Engineer at any time may require adjustments or replacement of equipment if a homogeneous and uniform mixture conforming to these Specifications is not achieved.
2. Continue pulverizing until the base mixture is uniform in color and conforms to the following gradation requirements:
 - a. 100 percent passing the 3 inch sieve (75mm) or the natural size of the in-situ aggregate.
 - b. 55 percent of the roadway material, excluding gravel, passes the No. 4 sieve (4.75mm) or the natural size of the in-situ aggregate.
3. Add water as needed to maintain or bring the moisture content to within the moisture requirements immediately after the preliminary mixing of the cement and roadway material.
4. Mix the additional water homogeneously into the full depth of the mixture.

E. Compaction and Finishing

1. Test Section
 - a. A test section shall be constructed with the first tanker of cement delivered to the project. The length of the test section will be determined by area in which the entire tanker of cement will cover.
 - b. The Engineer will evaluate compaction, moisture, homogeneity of mixture, thickness of stabilization, and finished base surface. If the Engineer deems necessary, revise the compaction procedure or replace equipment.
2. Time Limits
 - a. Complete compaction within 2 hours after the cement begins hydrating.
 - b. Do not perform vibratory compaction on materials more than 90 minutes old, measured from the time cement was added to the mixture.
 - c. Complete all operations within 4 hours from adding cement to finishing the surface.
3. Moisture Control
 - a. During compaction, ensure that the moisture is uniformly distributed throughout the mixture at a level of between 100 and 120 percent of the optimum moisture content.
4. Compaction Requirements
 - a. Use a sheep's foot roller, steel wheel roller or pneumatic-tired roller for initial compactive effort unless an alternate method is approved by the Engineer.
 - b. Compact the cement-stabilized base course to at least 98 percent of the maximum dry density established on the Job Mix Design. If 98 percent of the maximum dry density is not achieved, proof rolling will be required for that section.
 - c. Uniformly compact the mixture and then shape to the grade, line, and cross-section shown on the Plans.
 - d. Remove all loosened material accumulated during the shaping process. Do not use additional layers of cement-treated materials in order to conform to cross-sectional or grade requirements.
 - e. Use a pneumatic-tired roller to roll the finished surface until it is smooth, closely knit, and free from cracks or deformations, and conforming to the proper line, grade, and cross-section.

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- f. In places inaccessible to the roller, obtain the required compaction with mechanical tampers approved by the Engineer. Apply the same compaction requirements as stated above in [Subsection 315.3.04.E.4](#).
- g. Perform grading operations immediately after the placement and compaction operations. Roll the stabilized base course again with a pneumatic-tired roller.

F. Construction Joints

1. Form a straight transverse joint at the end of each day's construction or whenever the work is interrupted.
2. Create the straight transverse joint by cutting back into the completed work to form a true vertical face free of loose or shattered material.
3. Form the joint at least 2ft (0.6m) from the end of the day's work, or at the point of interruption.
4. Form a longitudinal joint as described above if cement-stabilized mixture is placed over a large area where it is impractical to complete the full width during one day's work. Use the procedure for forming a straight transverse joint. Remove all waste material from the compacted base.

G. Priming the Base

1. The surface of the completed base course must be moist cured until the cure coat is applied.
2. Apply cure coat only to an entirely moist surface. If weather delays cure coat application, apply cure coat as soon as the surface moisture is adequate.
3. Apply cure coat according to [GDOT Standard Specifications/Section 412/Section 822/Section 824](#) as soon as possible and in no case later than 24 hours after completion of the finishing operations.
4. Protect finished portions of the cement-stabilized base course that are used by equipment in the construction of an adjoining section to prevent marring or damaging of the completed work. Protect the stabilized area from freezing during the curing period.
5. Apply cure coat depending on project ADT:
 - < 400 ADT: Prime and sand.
 - ≥ 400 ADT: Apply single 89 surface treatment layer.

H. Opening to Traffic

1. Correct any failures caused by traffic at no additional cost to the Department. Make repairs specified in [GDOT Standard Specifications/Subsection 300.3.06.B](#) whenever defects appear. This preservation action does not relieve the Contractor of his responsibility to maintain the work until final acceptance as specified in [GDOT Standard Specifications/Section 105](#).

315.3.05 Quality Acceptance

A. Compaction Tests

1. Determine the maximum dry density from representative samples of compacted material, according to [GDOT Test Method/GDT 19](#) or [GDT 67](#).
2. Determine the in-place density of finished courses according to [GDOT Test Method/GDT 20](#), [GDT 21](#) or [GDT 59](#) as soon as possible after compaction, but before the cement sets.

B. Gradation Tests

1. Ensure that the gradation of the completely mixed cement-stabilized base course meets the requirements as stated above in [Subsection 315.3.04.D.2](#).

C. Finished Surface Tests

1. Check the finished surface of the cement-stabilized base course transversely using one of the following tools:
 - a. A template, cut true to the required cross-section and set with a spirit level on non-superelevated sections.
 - b. A system of ordinates measured from a string line.

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- c. A surveyor' level.
2. Ensure the ordinates measured from the bottom of the template, string line, or straightedge, to the surface do not exceed ½ inch (12.5mm) at any point.

D. Thickness Tolerances

1. Determine the thickness of the cement-stabilized base course by making as many checks as necessary to determine the average thickness, but not less than one check per 1000 feet (300m) per 2 lanes. Checks shall be taken after the completion of the base course and prior to applying cure coat.
2. If any measurement is deficient in thickness by more than ½ inch (12.5mm), make additional measurements to isolate the affected area. Correct any area deficient by more than ½ inch (12.5mm) to the design thickness by using one of the following methods:
 - a. Apply GDOT approved asphaltic concrete 9.5mm Superpave.
 - b. Remix to the required thickness.

No payment will be made for any Asphaltic Concrete 9.5mm Superpave used to correct deficiencies nor will pavement be made for removing and reconstructing the deficient work.

3. If any measurement exceeds thickness by more than ½ inch (12.5mm), make additional measurements to isolate the affected area. If the basis of payment is per cubic yard and the average thickness for any mile increment exceeds the allowable ½ inch (12.5mm) tolerance the excess quantity in that increment will be deducted from the Contractor's payments. The excess quantity is calculated by multiplying the average thickness that exceeds the allowable ½ inch (12.5mm) tolerance by the surface area of the base, as applicable.

E. Strength

In lieu of 300 psi strength requirement the compaction requirement shall be a minimum of 98 percent of the specified theoretical density. If 98 percent of the maximum dry density is not achieved, proof rolling will be required for that section and no more the ½" depression will be accepted.

315.4 Measurement

A. Cement-Stabilized Base Course

Measure the surface length along the centerline when payment is specified by the square yard. The width is specified on the Plans. Measure irregular areas, such as turnouts and intersections, by the square yard.

B. Portland Cement

Measure Portland cement by the ton.

C. Cure Coat

Cure Coat is not measured for separate payment. Include the cost of furnishing and applying cure coat according to the provisions of [GDOT Standard Specifications/Section 412/Section 822/Section 824](#) in the Unit Price Bid for each individual base item.

315.5 Payment

A. Cement-Stabilized Base Course

Cement-stabilized base, in-place and accepted, will be paid for at the Contract Unit Price per square yard. Payment will be full compensation for roadbed preparation, mixing on the road, shaping, pulverizing, watering, compaction, defect repair, cure coat and maintenance.

B. Portland Cement

Portland cement will be paid for at the Contract Unit Price per ton. Payment is full compensation for furnishing, hauling, and applying the material. Only Type I or Type II Portland cement incorporated into the finished course will be paid for

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and no payment will be made for cement used to correct defects due to the Contractor’s negligence, faulty equipment, or error.

Payment will be made under:

| | | |
|--------------|----------------------------|-------------------------|
| Item No. 315 | Cement Treated Base Course | Per square yard (meter) |
| Item No. 315 | Portland Cement | Per ton (megagram) |