

Georgia Department of Transportation

Office of Materials and Research

Standard Operating Procedure (SOP) 29 Quality Assurance for Soil-Cement Base Construction

I. General

The [Office of Materials and Research](#) and the Districts shall be responsible for the quality control of soil-cement construction. This procedure will outline the general responsibilities of each office, identify the operations of soil cement construction and delineate specific duties and responsibilities for persons accountable for the work.

II. General Responsibilities

A. Office of Materials and Research

The [Office of Materials and Research](#) will be responsible for the following:

1. Establishing policy on materials and construction procedures.
2. Approval of all materials and methods of handling.
3. Preparation of Specifications and guidelines for soil cement base construction.
4. Providing technical assistance to District personnel through Testing Technicians and Technical Services personnel.
5. Providing Independent Assurance Sampling and Testing.

B. Districts

The Districts will be responsible for supervising the Construction of soil-cement base to ensure that the work is carried out in accordance with established policies, Specifications and procedures.

III. Operations and Specific Responsibilities

Soil-cement construction will be divided into three operations: Pit Management, Base Plant Operations and Roadway Operations. The Project Engineer will be responsible for coordinating the work of various personnel

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involved in construction and ensuring that each of these operations conform to all applicable procedures and Specifications.

A. Pit Management

1. Investigation and Approval

Prior to excavation of any material pits for soil cement base, the District Materials Engineer shall make a preliminary inspection of the proposed source. If the District Materials Engineer determines that the material in the pit is worthy of testing, the pit area will be gridded and sampled. A copy of the grid notes and pit sketch shall be submitted to the [Office of Materials and Research](#) and representative soil samples from each grid point shall then be submitted to the [Office of Materials and Research](#) for a soil cement design analysis.

The [Office of Materials and Research](#) will issue a report on the results of the design analysis to the District Engineer with copies to the District Materials Engineer, Area Engineer, and District Testing Management Supervisor. Included in the report will be pertinent design criteria and any special conditions for using or handling of the pit materials.

2. Preconstruction Conference

Once a soil-cement base pit has been approved for use and the Contractor indicates their intention to use the pit, the Area Engineer shall request a soil-cement base preconstruction conference with the Contractor to discuss proposed work plans, procedures and Specifications for Pit Management as well as base plant operations and roadway operations. Personnel present at the meeting should include the District Materials Engineer, Project Inspectors, District Testing Management Supervisor and Technical Services Personnel.

3. Construction Monitoring

After the Contractor begins stockpiling pit materials, the District Materials Engineer and the Project Engineer shall be responsible for ensuring that the pit mining procedures are in accordance with the Specifications. Pit operations are to be inspected daily and recorded in the Project diary.

After the plant has started production of soil-cement base and if the plant is located adjacent to the pit site, the Testing Management technician shall also make daily inspections of the pit operations. If any deviations from the established mining procedures are observed, the technician shall make recommendations to the Contractor for corrective action and notify the Project Engineer immediately.

B. Base Plant Operation

1. Preproduction Equipment Inspection

Prior to calibration, the Soil-Cement Base Engineer will make a detailed inspection of the base plant equipment including motor truck scales and roadway equipment to ensure that all pieces of equipment are in satisfactory condition and meet the applicable requirements of the Specifications. In addition, the Soil-Cement Base Engineer shall issue a letter to the Project Engineer accepting or rejecting the

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equipment. If corrections are necessary, any subsequent reinspections by the Soil-Cement Base Engineer shall be followed up with a letter of acceptance or rejection.

2. Plant Calibration

The Contractor shall be responsible for calibrating and maintaining calibration of the base plant. The Soil-Cement Base Engineer shall be responsible for observing and verifying the calibration results. A copy of the calibration results shall be issued to the Project Engineer and the same recorded in the Base Plant Diary and posted at the base plant.

3. Plant Production

During production of soil cement base, Testing Management shall be responsible for inspecting all plant operations to ensure that the equipment is functioning properly and that Specification materials are shipped to the roadway. In the event of a malfunction in equipment, or at any time the materials fail to meet the Specifications, the Base Plant Inspector shall have the authority to cease operations until the problem(s) are corrected. This authority shall also be extended to include misuse of truck covers whether it be a violation of the 20-minute haul time or State law for vehicles hauling on State or Federal roads, and/or improper back-up warning devices on haul vehicles and other equipment where the driver's vision is restricted.

Whenever it is necessary to make corrections at the plant, the Base Plant Inspector shall notify the Project Engineer immediately.

Any desired modifications to the Job Mix Formula, including the proportioning of materials and/or cement content shall be as approved by the [Office of Materials and Research](#) and directed by the Plant Inspector.

In addition to these responsibilities, the Plant Inspector shall also fulfill the following requirements before the plant is allowed to begin operations and after production of soil cement base begins.

a. Before Production

1) Pit Mining and Mixing

The Base Plant Inspector should have copies of and be familiar with the grid notes, pit sketch and job mix formula for the project. The Base Plant Inspector is to make sure that the Contractor is mining, mixing and stockpiling material as previously agreed upon in preconstruction conference.

2) Stockpile

The stockpile shall be approved by the Base Plant Inspector in regards to size, moisture, temperature and pulverization.

3) Mechanical Checklist

Base Plant and Roadway Equipment—A checklist completed by the Technical Services Inspector approving the equipment shall be in possession of the Base Plant Inspector before the plant is allowed to begin operation.

4) Report of Calibration

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The Base Plant Inspector must have a copy of the contractor's calibration report and be thoroughly checked for accuracy of proportions.

5) Field Laboratory Building

The Base Plant Inspector must check the field laboratory building to see that it conforms to Subsection 152.2 of the Specifications.

6) Scale House Checklist

A Certified Public Weigher (CPW) is required when soil-cement base is paid for by the ton (megagram). The Base Plant Inspector must inspect the scale house for compliance with the following:

- a) Report of scale certification displayed.
- b) CPW certificate displayed.
- c) The CPW is using his or her seal or stamp.
- d) The CPQ seal or stamp is legible on ticket.
- e) Insure that CPW has tare weight reports, tally sheet reports, and is familiar with the weigh ticket requirements as well as SOP 15 covering legal load limits.

7) Sampling

The Base Plant Inspector must see that the Contractor provides satisfactory equipment for obtaining samples from belt and from trucks such that it will be safe and provide an accurate representation of the material being furnished. Representative samples of soil and cement shall be blended to the right proportions and theoretical maximum dry densities established before plant is allowed to begin operation.

8) Water

If the water to be used in the mix is from an unpotable source, a one-quart sample of water shall be secured and submitted to the [Office of Materials and Research](#) for approval before the base plant is allowed to begin operation.

9) Weather Limitations

Whenever weather conditions do not conform to the governing Specifications in regards to placing or producing soil-cement stabilized base, the base plant will not be allowed to begin operation.

10) Roadway

The Base Plant Inspector should always check with the Project Engineer on the road before he allows the base plant to begin operation. The Contractor should provide a constant means of communication between the base plant and the roadway.

b. After Plant Begins Operation

1) Moisture Control

Moisture shall be uniform throughout the mix and controlled between 100 and 120 percent of optimum moisture content. The Base Plant Inspector should check the moisture content of the mix at a frequency of at least one per hour or more if necessary to meet and maintain this

moisture requirement. Trucks should be covered if the soil-cement base material experiences too much loss in moisture due to evaporation regardless of haul time.

2) Belt Samples

Representative samples are to be taken from the belt, quartered, and half of the sample submitted to the District Laboratory (elutriation and Maximum dry density) and half dried and run at the base plant (clay ball content). The frequency of sampling should be in accordance with that recommended by the Sampling and Testing Manual [one per 1500 tons (one per 1360 megagrams)] or more frequent if deemed necessary. If at anytime the material fails to meet the requirements of the job mix formula, the Base Plant Inspector should shut down the plant, notify Contractor and Project Engineer and investigate the cause of failure. If a significant material change has occurred, a new job mix may be required.

3) Cement Checks

Immediately following calibration of the soil-cement base plant, cement checks should be performed on each of the first two tankers supplying cement to the plant. If these first two cement checks are within the specified tolerance of the Job Mix Formula, one cement check per day will be sufficient. Should a cement check be out of the tolerance required in the Specifications, two consecutive passing, one-tanker checks should be performed before returning to a one cement check per day basis. When three consecutive cement checks fail to meet the specified tolerance, base plant production should be discontinued, the problem corrected, and the base plant recalibrated. Cement checks are to be noted on scale tickets and tally sheets so that its location can be identified and located on the road.

4) Cement Deliveries

A cement delivery ticket should accompany every bulk tanker load of cement that arrives at the base plant. Before the driver is allowed to pump cement into the silo at plant, the Base Plant Inspector should check the tanker to see that it is sealed, check invoice for source of supply, and check for CPQ stamp and for accuracy of weights. Then, the Base Plant Inspector should sign the invoice; record date received on invoice and let the driver pump it into the silo. The Base Plant Inspector should randomly check tankers after they have pumped off to see that they are empty. Cement delivery tickets should be logged in a field or level book. All calculations for deductions should be shown on the back of delivery tickets and turned over to the Project Engineer for him to make out Pay Item Reports. When the cement silo is empty, the Base Plant Inspector should require the Contractor to pump off at least half of a tanker of cement before the plant is allowed to resume operation.

5) Documentation

- a) A Base Plant Inspector's diary shall be kept at the plant so that comments can be made each day regarding weather, temperatures, time plant started, time plant stopped, down time, tons produced, tons wasted, reasons why soil-cement material was wasted, pit mining and stockpiling, Contractor's activities, visitors, problems encountered and solutions, etc.

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- b) A field or level book should be used to record cement checks, moisture checks and cement delivery tickets. Also, it should be used to record time and dates that checks are made and the load number and station number from the roadway.
 - c) D.O.T. 496-Rev. 5-73 (Base Plant Inspector's Daily Report). This report should be filled out completely including roadway information, rate of spread and test results.
 - d) Copies of daily tare weight reports, daily tally reports and inspector's weight check reports are to be filled at base plant. The Base Plant Inspector is to randomly check loaded and unloaded vehicles weights when soil-cement base is paid for by the ton.
- 6) Random Check of Pit Mining
- The Base Plant Inspector should check the mining of the pit each day and make note of it in the Project diary.

C. Roadway Operations

1. The Project Inspector shall be responsible for ensuring that the roadway construction equipment previously approved by the Soil-Cement Base Engineer continues to meet the Specifications, that Specification Materials are placed on the roadway, that placing, compacting and finishing of the base material is performed in accordance with the Specifications and that all necessary documents and diaries are kept.

Specific responsibilities of the Roadway Testing Management technician prior to and after construction of the base begins shall be as follows:

a. Before Placement of Base

1) Subgrade

Subgrade samples and compaction tests shall be taken prior to placement of soil-cement base at the recommended frequency of the Sampling, Testing and Inspection Manual. The testing technician should also look for areas that are unstable and bring them to the attention of the Project Engineer and the Contractor. These areas should be investigated prior to placement of base and appropriate corrective action taken.

2) Theoretical Densities

The technician should have copies of all theoretical densities and curves for the soil-cement base material prior to placement of base.

3) Rate of Spread

The testing technician should give the Project Engineer the Plan pounds per square yard (pounds per square meter) of base material so that a check can be made against the actual pounds per square yard (square meter) to determine the percent waste. The Plan pounds per square yard (square meter) should be based on the wet weight per cubic foot (cubic meter) of soil-cement material as determined from theoretical densities of samples taken during the stockpiling operations.

b. After Placement Begins

1) Roller Pattern

As soon as the soil-cement base material is placed on the roadway and brought to approximate typical section, the Contractor is to begin compactive effort within 45 minutes from the time the material is mixed. At this time, the testing technician is to establish a roller pattern that produces maximum compactive effort. This is done by taking nuclear gauge readings after each pass made by each roller until maximum effort is reached. Once this roller pattern is established, it is to be strictly adhered to. The rolling pattern shall be documented on an OMR-TM-159 "Rolling Pattern Form" and a copy given to the Project Engineer.

2) In Place Density

The In-Place density should be tested by the testing technician in accordance with the Sampling, Testing and Inspection Manual to determine the percent compaction. In the event of failing compaction tests, the Contractor and Project Engineer should be notified immediately while material is still wet and before cement begins its initial set so that additional rolling can be done. The Soil-Cement Base Engineer, Area Engineer, District Materials Engineer and Testing Management Supervisor should also be made aware of failing tests.

3) Cores

Testing Management will be responsible for cutting 6 in (150 mm) cores after the soil-cement base material has been in-place for at least 7 days at the frequency recommended by the Sampling, Testing and Inspection Manual. The Soil-Cement Base Engineer should be notified of failing cores as soon as possible. The testing technician is also responsible for keeping up with the location of failing compaction tests so that 6 in (150 mm) cores can be secured to determine the extent compressive strength of the failing area.

4) Depth Checks

The testing technician shall check the depth of the compacted soil-cement base at a frequency of at least one per 1500 feet (450 m) per two lanes to ensure that the Contractor is meeting the Plan thickness.

5) Documentation

The testing technician shall keep records of all samples and tests up to date, recorded on the proper form and reported to a branch laboratory as soon as possible.

IV. Technical Services

In addition to equipment inspection and calibration verification, Soil-Cement Base Engineer shall provide assistance as needed in solving construction problems that may arise. He shall also make random inspections of each phase of the operations during construction to determine if the equipment, materials, and construction are in accordance with the Specifications. If any phase of the operation is found to be in noncompliance with the Specifications, the Soil-Cement Base Engineer will make a recommendation to the Area Manager or Project Engineer for corrective action.

A report on the results of each inspection shall be forwarded to the [Office of Materials and Research](#).

V. Independent Assurance Samples and Testing

Independent Assurance Personnel shall monitor the acceptance sampling and testing of soil cement materials. Soil cement ingredients including Portland cement and soil will be sampled, compaction tests run, and the coring and thickness measurement operations observed at the frequencies designated in the Sampling, Testing and Inspection Manual. Any discrepancies between Acceptance and Independent Assurance results will be investigated and resolved immediately.

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