

200-3 PORTLAND CEMENT TREATED MATERIAL.

200-3.1 General. Portland cement treated materials shall consist of:

- a) In-place materials (i.e. pulverized asphalt pavement, portland cement concrete, base, subbase and native soil) or,
- b) Local borrow conforming to 300-5.1 or,
- c) Untreated base material as specified in the Special Provisions or,
- d) A combination of these materials as specified in the Special Provisions,
- e) Type II/V portland cement conforming to 201-1.2.1 or as specified in the Special Provisions, and
- f) Water conforming to 201-1.2.3.

The material to be treated shall not contain material retained on the 3 inch (75 mm) sieve, and at least 95 percent by dry weight shall pass the 2 inch (51 mm) sieve. The material shall not contain roots, topsoil, or any material deleterious in its reaction with portland cement. Pozzolan material shall not be substituted for portland cement.

200-3.2 Soil Cement. The material to be treated to produce soil cement shall conform to 200-3.1. However, 95 percent, by dry weight, shall pass the 1 inch (25 mm) sieve, and not less than 60 percent shall pass the No. 4 (4.75 mm) sieve, exclusive of pulverized asphalt, gravel or stone retained on these sieves.

200-3.3 Cement Treated Base. In addition to the materials conforming to 200-3.1, pulverized miscellaneous base conforming to 200-2.8 may be mixed with the portland cement and water to produce CTB. Not less than 35 percent of the material to be treated to produce CTB shall pass the No. 4 (4.75 mm) sieve.

Cement Treated Base shall be classified as:

- a) Cement-modified silt-clay soils which contain more than 35 percent silt and clay and plasticity index of greater than 20 or
- b) Cement-modified granular soils which contain less than 35 percent silt and clay and plasticity index of less than 20.

301-3 PORTLAND CEMENT TREATED MIXTURES MATERIAL.

301-3.1 General. Cement treated material shall conform to 200-3. The material shall be uniformly mixed, compacted, finished, and cured in such a manner that the material forms a dense, uniform mass conforming to the lines, grades, and cross sections shown on the Plans.

301-3.2 Mixing of Portland Cement Treated Materials.

301-3.2.1 General. Mixing of portland cement treated materials shall be accomplished either by the mixed-in-place or central-plant-mix method as specified in the Special Provisions. Portland cement treated materials shall not be mixed or placed when the material to be treated or subgrade is muddy, frozen or when the air temperature is 40°F (5°C) or less in the shade.

301-3.2.2 Mixing-In-Place.

301-3.2.2.1 General. The Work consists of in-place mixing of pulverized existing asphalt concrete, underlying base material, and/or subgrade soil with portland cement and water. The material to be treated shall be mixed to the depth shown on the Plans or specified in the Special Provisions. The mixed material shall then be spread, compacted, trimmed, and cured. The resulting placed material shall conform to the density, lines, grade and elevation shown on the Plans and specified in the Special Provisions. The entire operation of cement spreading, water application, and mixing shall result in a uniform mixture for the full depth and width of the Work.

Cement-modified silt-clay soils shall be damp at the time of pulverizing to reduce dust and aid in processing.

Windrows or blankets shall be limited to the size of material that can be passed through the mixing machine at each operation.

Should the Contractor elect to perform mixing-in-place operations off the roadbed at a designated location, the preparation of the material for mixing and the mixing of the material to be treated, portland cement, and water shall conform to the provisions specified herein. When the materials are mixed-in-place off the subgrade, the device used to load the mixed materials into the transporting vehicle shall be so constructed and so operated that no untreated material will be picked up. The time required for loading and hauling the mixed material shall be taken into account when determining the amount of material to be mixed at any one time for placement and compaction within the time specified herein.

301-3.2.2.2 Existing Asphalt Concrete Paved Roadways. For existing asphalt concrete paved roadways the Contractor shall not remove asphalt concrete pavement from the existing pavement section prior to mixing with the subgrade.

Before portland cement is applied initial pulverization or scarification shall be done if specified in the Special Provisions. Initial pulverization or scarification shall provide a uniform distribution of the portland cement over the material to be treated without excessive runoff or ponding.

Trimming may be required to allow for the net placement of the thickness of asphalt or portland cement pavement shown on the Plans or specified in the Special Provisions. Trimming, if required, shall be performed on the intimate mixture of pulverized asphalt concrete, base materials and subgrade prior to portland cement treatment. The pulverized subgrade shall be trimmed sufficiently to allow for the added portland cement volume, proper material compaction, and subsequent layers of leveling and surface courses of asphalt or portland concrete overlay, all as required to meet the finished surface grades called for on the Plans.

Excess pulverized material is the surplus that results after trimming and grading the pulverized pavement section to the lines and grades shown on the Plans. Excess pulverized material shall consist of, non-portland cement treated, well mixed pulverized asphalt or portland concrete pavement and subgrade, including rocks greater than 3 inches (76 mm). Disposal of excess pulverized material shall be paid for at the price Bid for unclassified excavation.

301-3.2.2.3 Equipment. Portland cement treated material shall be mixed utilizing a four-wheel drive single shaft or multiple shaft rotary mixer. The Contractor shall submit a description of the equipment that is to be used in conformance with 2-5.3.4. The equipment shall be made

available at a site specified in the Special Provision for inspection by the Engineer prior to use. Agricultural disks or motor graders are not acceptable mixing equipment.

Water may be applied through the mixer or with water trucks equipped with pressure-spray bars. The mixing machine shall have equipment for introducing water, under pressure, at the time of mixing through a metering device. Leakage of water from distribution equipment shall not be permitted.

The portland cement spreader shall be capable of uniformly distributing the portland cement at the specified rate.

301-3.2.2.4 Proportioning of Portland Cement. The rate of application and/or content of portland cement shall be as specified in the Special Provisions.

301-3.2.2.5 Spreading of Portland Cement. Portland cement conforming to 200-3.1 may be added in a dry or slurry form. Initial pulverization or scarification shall be performed when slurry application of portland cement is utilized. Portland cement shall be applied uniformly in a manner that minimizes dust and is satisfactory to the Engineer.

A) **Blanket Mixing Method.** If the portland cement is applied in slurry form, the slurry mixer and truck shall be capable of completely dispersing the portland cement in the water to produce uniform slurry, and shall continuously agitate the slurry once mixed. The time from first contact of portland cement with water to the application of the portland cement slurry on the material to be treated shall not exceed 60 minutes. The time from slurry placement on the material to be treated to start of mixing shall not exceed 30 minutes.

If the portland cement is added in a dry form the portland cement shall be spread uniformly on the materials to be treated with a non-pressurized mechanical vane-feed spreader. The spreader shall be capable of spreading the portland cement at the specified rate. Portland cement may be supplied in sacks and spread by hand when specified in the Special Provisions or approved by the Engineer. When hand spreading is used, the sacks shall be spaced at uniform intervals and then emptied, following which the portland cement shall be spread in a layer of uniform thickness.

No traffic other than the mixing equipment shall be allowed to pass over the spread portland cement until the mixing operation is completed. Portland cement that has been spread and then tracked or displaced shall be replaced before mixing is started to provide a uniform coverage in all areas.

B) **Windrow Mixing Method.** Material to be treated in a windrow shall be shaped and sized before the addition of portland cement. The top of the windrowed material shall be flattened or slightly trenched to receive the portland cement.

The cement content of samples taken from the road bed shall not vary more than 0.5 percent under and not more than 1.0 percent over the specified cement content (i.e. the tolerance on a spread rate of 6 percent is 5.5 to 7.0 percent) when tested by California Test 338. However, the moving average of each day's rate of application of portland cement tests/inspections shall not be less than the specified portland cement content.

The Engineer reserves the right to modify the rate of application of the portland cement from the specified rates during the progress of the Work as necessary to maintain the desired characteristics of the portland cement treated material. The cost of the additional portland cement above and beyond the specified amount will be paid at the Contract Unit Price bid for

portland cement. The Agency shall be given a credit based on the Contract Unit Price for any decrease in the amount of portland cement.

Portland cement shall not be spread upon the prepared material more than one hour prior to the mixing operation.

301-3.2.2.6 Mixing. After the portland cement has been spread, it shall be uniformly mixed with the material that is being treated. Mixing shall begin as soon as possible after the cement has been spread and shall continue until a uniform mixture is produced. Mixing shall continue until the mixture is uniform in color, meets the specified gradation, and is at the moisture content specified in 301-3.2.2.6. If equipment is used that requires more than one pass of the mixer, at least one pass shall be made before any water is added to the material. The final mixture shall meet the specification in 200-3.

301-3.2.2.7 Application of Water. The percentage of water added to the mixture during the mixing operations shall be the amount necessary to assure a uniform and intimate mixture of the materials. Water shall be applied in a manner that will produce a completed mixture with uniform moisture content. The amount of water added shall be within ± 2 percent of the optimum moisture content (i.e. the tolerance for an optimum moisture content of 12 percent is 10 to 14 percent) as determined by California Test 312. Care shall be exercised to avoid the addition of excess water.

301-3.2.3 Central-Plant Mixing.

301-3.2.3.1 General. Portland cement treated material shall conform to 200-3.

301-3.2.3.2 Mixing. The proportions of portland cement, water and other materials shall be determined by the Contractor so as to produce the 7 day compressive strength specified in the Special Provisions. The Contractor shall submit a mix design with laboratory results in conformance with 2-5.3.4. The laboratory result shall show that the proposed mix design will achieve the specified 7 day compressive strength. The mix design shall show the amount, and type of portland cement, and the amount of water, and other materials (including their gradation). The material to be treated and the portland cement shall be sufficiently mixed together to prevent balling up of the material when water is added.

301-3.2.3.3 Equipment. The portland cement treated material shall be mixed in an approved batch-type pugmill, or rotary-drum mixer. Materials mixed in rotary drum or pugmill mixer shall be proportioned by weight. The material to be treated, portland cement and water shall be stored separately.

The materials shall be drawn from storage bins by means of a continuous feeder through adjustable calibrated gates that supply the correct amounts of portland cement, water and material being treated to the mixer. If necessary, a screening device shall be used to remove oversized material to be treated greater than 3 inches (75 mm) from the raw feed gate for the material being treated prior to mixing. The gates shall be arranged so that amount of each material can be separately adjusted. The metering devices and feeder shall be interlocked and synchronized so as to maintain a constant ratio between portland cement, water, and material

being treated. Storage bins shall be equipped with overflow chutes for each compartment. A positive signal system shall be provided to indicate when the level of material in each bin approaches the "strikeoff" capacity of the feed gate. The plant shall not be permitted to operate unless this signal system is in good working condition. The plant shall be equipped with facilities to weigh samples for calibrating gate openings.

The mixer shall be equipped with metering devices that will introduce the portland cement, water and material being treated into the mixer in the proportions conforming to the mix design. The metering devices and feeder shall be interlocked and so synchronized as to maintain a constant ratio between cement, water, and material to be treated. The portland cement, water, and material being treated shall be within 3 percent, by weight, of the amounts specified for each material in the mix design. Water shall be so proportioned that the Engineer can readily verify the amount of water in a batch.

The charge in a pugmill mixer or the rate of feed to a drum mix shall not exceed the amount that will permit complete mixing of the materials. Dead areas in the mixer, in which the materials do not move or are not sufficiently mixed, shall not be allowed.

Mixing shall continue until a homogeneous mixture of uniformly distributed and properly coated material of unchanging appearance is produced. After mixing is completed no additional water shall be added to the mixture unless approved by the Engineer.

301-3.2.3.4 Handling. The final mixture shall be transported from the mixing plant to the Work site in trucks or other equipment having beds that are smooth, clean and tight. Truck bed covers shall be provided and used to protect the final mixture during transport from moisture variations due to weather conditions. Haul time shall not exceed 45 minutes. Total elapsed time between the addition of water to the mixture and the start of compaction shall not exceed 1 hour 15 minutes.

301-3.2.3.5 Preparation of Subgrade. The subgrade shall be prepared in conformance with 301-1 as modified herein or as specified in the Special Provisions. Before mixing or placement is started, if necessary, prewet dry soils to aid pulverization or dry wet soils with a disc harrow or rotary mixer with the hood open. The existing grade shall be scarified and thoroughly broken up by means of equipment constructed and operated to leave an undisturbed plane at a uniform depth below the surface of the typical sections, lines, and grades as shown on the Plans. Precautions shall be taken to avoid forming furrows of loosened material below the referenced plane and to obtain a uniform condition of the material for the full width to be treated. Material other than rock shall be pulverized such that 95 percent will pass a 2 inch (51 mm) sieve and a minimum of 90 percent shall pass a 1 inch (25 mm) sieve.

During this process, any unsuitable material shall be removed and replaced with acceptable material. Soft or yielding subgrade shall be corrected and made stable as directed by the Engineer before construction proceeds. The subgrade shall be firm and able to support without yielding or subsequent settlement the construction equipment and compaction of the portland cement treated material. The in-place material and surface shall be approved by the Engineer before the next phase of construction is begun.

The removal and replacement of unsuitable material and correction of soft or yielding subgrade shall be paid for in accordance with 3-3.

301-3.3 Placement, Spreading and Compaction.

301-3.3.1 General. Immediately prior to placement of the mixed material, the receiving surface shall be in a moist condition. The mixed material shall be spread and rolled to the width, grade and cross section shown on the Plans and kept moist.

Materials mixed at a location off the subgrade shall be deposited by means of approved spreading equipment. Dumping in piles upon the subgrade will not be permitted.

301-3.3.2 Placement. The use of self-propelled graders will be permitted for spreading the mixed material on the roadbed and for trimming. The mixed material shall be placed without segregation at a rate that will produce a uniformly compacted layer.

When two or more layers of portland cement treated material are to be placed, the surface which will be in contact with succeeding layers shall be kept continuously moist for 7 days or until the placement of the subsequent layer. Any loose material on the surface of the completed layer shall be removed and the surface moistened immediately before placement of the next layer. No standing water will be permitted.

301-3.3.3 Spreading. The mixed material shall be spread by one or more approved spreading devices. The mixed material shall be spread for the full width of the subgrade or base under construction, either by one spreader or by several spreaders operating in echelon across the subgrade, unless traffic conditions require part-width construction.

Where traffic or other conditions make part-width construction necessary, and mixing is performed off the roadbed, a windrow of shoulder material or soil shall be placed and compacted to form a choker to restrain the inner edge of the mixed material during compacting operations. The choker shall be constructed to the same elevation as that of the compacted mixed material, and shall be completed in advance of the spreading of the soil cement. The toe of the choker shall be not less than 3 inches (75 mm) outside the finished trimming line of the compacted section of the mixed material. The use of side forms, or other methods which will satisfactorily retain the mixed material during compacting operations, shall be permitted in lieu of a choker.

Should only one spreader be used, not more than 45 minutes shall elapse between the time of placing the mixed material in adjacent lanes at any location without trimming the longitudinal joint.

After a part-width section has been completed, the longitudinal joint against which additional mixed material is to be placed shall be trimmed to a vertical edge at the neat line of the section. Choker material and material cut away in trimming shall be used only in the construction of adjacent shoulders or otherwise disposed of along the roadway, unless suitable for incorporation in the Work.

301-3.3.4 Compaction. The mixed material shall be spread and compacted in a single lift of between 6 inches (152mm) and 12 inches (305mm). If multiple lifts are required they shall be of equal thickness that does not exceed 6 inches (152mm). Initial compaction shall be with a tamping roller. The section shall be finished by rolling with a steel drum, vibratory or other suitable roller approved by the Engineer. Compacting equipment shall be capable of producing the specified compaction within the operational time limits specified herein. The material shall be compacted to 98 percent relative compaction as determined by California Test 312. The in place density shall be determined by California Test 231, Part 1. The surface shall be sealed

with a pneumatic-tire roller without inducing hair-line cracking. Areas inaccessible to rollers shall be compacted to the specified compaction by other means satisfactory to the Engineer. The total elapsed time between the addition of water to the mixture and the start of compaction shall not exceed 45 minutes. Not more than 1-1/2 hours shall elapse between the time water is added to the material and portland cement and the time of completion of initial rolling. Not more than 2-1/2 hours shall elapse between the time water is added to the material and portland cement and the time of completion of final compaction after trimming. Any portland cement treated material that has not been compacted and finished shall not be left undisturbed for longer than 30 minutes. Not more than 60 minutes shall elapse between placement of the mixed material in adjacent lanes at any location except at longitudinal and transverse construction joints.

The finished surface of portland cement treated material shall not vary more than 1/4 inch (6 mm) above or below the grade shown on the Plans. The thickness of portland cement treated material shall not be more than 5/8 inches (15 mm) thinner than the thickness shown on the Plan at any point. If the portland cement treated material is damaged, it shall be removed and replaced for the full depth of the affected layers in the damaged area. Feathering or thin layers shall are not permitted to fill or repair thin or low sections.

301-3.4 Construction Joints. At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the completed Work.

Construction joints shall have vertical faces and shall be made in thoroughly compacted material. Additional mixture shall not be placed against the construction joint until the joint has been approved by the Engineer. The face of the cut joint shall be clean and free of deleterious material and shall be kept moist until the placement of the adjacent portland cement treated material.

Alternatively, mixed in place adjacent passes shall overlap 3 inches to tie-in the new material with the previous pass.

301-3.5 Curing.

301-3.5.1 General. After compaction of the portland cement treated material is completed, it shall be protected against drying, freezing and from heavy traffic for 7 days. Light vehicular traffic and construction equipment may be allowed sooner provided the portland cement treated material is not damaged.

In cases where the Contractor has permitted equipment or traffic to operate on the portland cement treated material, the Contractor shall, before the paving material is placed on the surface, completely remove any other material which has been spread to protect the treated surface and shall apply additional curing seal to any areas where the curing seal has been destroyed. Full compensation for furnishing, spreading, and removing such material and for furnishing and applying the additional curing seal will be considered as included in the price bid for the portland cement treated material and no additional compensation will be made.

The method of curing shall be water curing, bituminous seal, or other method as specified in the Special Provisions.

301-3.5.2 Water Curing Method. After placement, spreading and compaction are completed the portland cement treated material shall be kept continuously wet by the application of water.

The application of water shall continue for a period of at least 5 to 7 days after compaction is completed.

Cotton mats, rugs, carpets, or earth or sand blankets shall be used as a curing medium to retain moisture during the curing period. When cotton mats, rugs, carpets, or earth or sand blankets are used to retain moisture, the entire surface of the portland cement treated material shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed until the surface is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the portland cement treated material and shall not be allowed to accumulate on the portland cement treated material in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period the surface shall be cleared of all curing mediums.

301-3.5.3 Curing Compound Method. Surfaces of the portland cement treated material that are exposed to the air shall be sprayed uniformly with a bituminous curing seal. The bituminous curing seal shall be SS-1-h or CSS-1-h emulsified asphalt conforming to 203-3. The emulsified asphalt shall be diluted 50/50 and spread at a rate of 10 gal/yd² to 20 gal/yd² (46 L/m² to 91 L/m²), the exact rate shall be determined by the Engineer.

The bituminous curing seal shall be applied in sufficient quantity to provide a continuous membrane over the treated surface at a rate of between 0.10 and 0.20 gallon per square yard (450 mL/m² and 900 mL/m²) 0.45 L/m² and 0.90 L/m² (0.10 and 0.20 gallon per square yard) of surface with the exact rate determined by the Engineer.

The curing compound shall be applied as soon as possible after the completion of final rolling. The surface of the portland cement treated material shall be kept moist until the curing compound is applied. At the time the curing compound is applied, the surface of the portland cement treated material shall be dense, free of all loose and extraneous material, and contain sufficient moisture to prevent excessive penetration of the curing compound.

No traffic or equipment shall be permitted on the portland cement treated material during the first 3 days after applying the curing compound, unless otherwise permitted by the Engineer.

301-3.5.4 Repair. If the portland cement treated material is damaged, it shall be removed and replaced for the entire depth of affected layers in the damaged area.

301-3.1 301-3.6 Soil cement.

301-3.1.1 301-3.6.1 General. Soil-cement shall consist of materials conforming to 200-3.2. soil, portland cement, and water which are uniformly mixed, compacted, finished, and cured in such a manner that the in place soil cement mixture forms a dense, uniform mass conforming to the lines, grades, and cross sections shown on the Plans. Soil cement mixtures shall also include cement treated base and cement modified soil.

301-3.1.2 Materials Portland cement and water shall conform to the provisions of 201-1.2.1 and 201-1.2.3, respectively, or as otherwise specified. Cement content and moisture content shall be specified.

Preparation. ~~Prior to importing materials to be treated, the soil subgrade shall be prepared as provided in 301-1.~~

~~301-3.1.3 Equipment.~~ 301-3.6.2 Mixing of Soil Cement. ~~Mixing of soil cement shall conform to 301-3.2. Soil cement shall be constructed utilizing a machine or a combination of machines that will produce results meeting all the requirements herein. Such machines shall be approved by the Engineer prior to use.~~

~~After mixing is complete, the soil shall be so pulverized that 100 percent by dry weight passes a 25 mm (1 inch) sieve, and a minimum of 80 percent passes a 4.75 mm (No. 4) sieve, exclusive of gravel or stone retained on these sieves.~~

~~301-3.1.4 Preparation.~~ ~~Prior to importing materials to be treated, the soil subgrade shall be prepared as provided in 301-1.~~

~~Subgrade material that is to be treated in place shall be shaped and rolled to specified cross section prior to the scarification and treatment. No further subgrade preparation will be necessary.~~

~~The soil subgrade shall be firm enough to support construction equipment without displacement. Unsuitable soils shall be removed in accordance with 300-2.2.~~

~~301-3.1.5 Cement Application, Mixing and Spreading.~~ ~~Mixing of the soil, cement, and water shall be accomplished either by the mixed in place or the central plant mixed method. No cement or soil cement mixture shall be spread when the aggregate or subgrade is frozen or when the air temperature is less than 5°C (40°F) in the shade. The finished soil cement shall be protected against freezing.~~

~~After mixing is complete, the soil shall be so pulverized that 100 percent by dry weight passes a 25 mm (1 inch) sieve, and a minimum of 80 percent passes a 4.75 mm (No. 4) sieve, exclusive of gravel or stone retained on these sieves.~~

~~301-3.1.6~~ 301-3.6.2.1 **Mixing In Place.** ~~Soil-cement mixed in place shall conform to in conform to 301-3.2.2. The specified quantity of cement shall be spread uniformly on the soil to be treated. Cement that has been spread and then tracked or displaced by traffic or other operations shall be replaced before mixing is started to provide a uniform coverage in all areas. For the windrow method of mixing, the material shall be shaped and sized uniformly prior to the addition of cement. The tops of soil windrows shall be flattened or slightly trenched to receive the cement. Windrows shall be limited to such size that all material can be passed through the mixing machine in one operation.~~

~~Cement shall be spread by an approved cement spreader in such a manner that cement content shall not vary from the specified rate of application by more than 10 percent.~~

~~Cement may be supplied in sacks and spread by hand when specified or when approved by the Engineer. When hand spreading is used, the sacks shall be spaced at uniform intervals and then emptied following which the cement shall be spread in a layer of uniform thickness. After the cement has been spread, it shall be uniformly mixed with the soil.~~

~~Water shall be applied under pressure by means of controlled distributing equipment which will produce a completed mixture with uniform moisture content. Leakage of water from equipment shall not be permitted. Care shall be exercised to avoid the addition of excess water.~~

~~Mixing shall continue until a uniform mixture of soil, cement, and water has been obtained. If equipment is used that requires more than one pass of the mixer, at least one pass shall be made before any water is added to the material.~~

301-3.1.7 301-3.6.2.2 Central-Plant Mixing. Soil-cement mixed in a central plant shall conform to 301-3.2.3. central mixing plants shall use an approved pugmill or continuous flow mixer. Soil, cement, and water shall be stored separately.

~~The rate of feed of soil, cement, and water shall be within 3 percent of the amount of each material designated by the Engineer or as specified.~~

~~Water shall be so proportioned that the Engineer may readily verify the amount of water in a batch or the rate of flow for continuous mixing. The quantity of water added to the soil cement mixture shall be adjusted to produce between optimum moisture content and three percent above optimum moisture content (i.e. the tolerance for an optimum moisture content of 12 percent is 12 to 15 percent).~~

~~The charge in a batch mixer or the rate of feed to a continuous mixer shall not exceed that which will permit complete mixing of all of the material. Dead areas in a mixer, in which the material does not move or is not sufficiently mixed, will not be permitted.~~

~~Mixing shall continue until a homogeneous mixture of uniformly distributed and properly coated aggregates of unchanging appearance is produced. Cement content shall not vary more than 5 percent from that specified.~~

~~The soil-cement mixture shall be transported from the mixing plant to the site in clean equipment provided with suitable protective devices to prevent material loss and significant moisture change. The total elapsed time between the addition of water to the mixture and the start of compaction shall not exceed 45 minutes.~~

301-3.6.2.3 Preparation of the Subgrade. Prior to placement of the soil-cement ~~importing materials to be treated,~~ the soil subgrade shall be prepared in conformance with ~~as provided in 301-1 301-3.2.3.5.~~

301-3.1.8 301-3.6.4 Placement, Spreading and Compaction ~~Placing, Compacting, and Finishing.~~

301-3.6.4.1 General. Soil cement shall be placed, spread and compacted in conformance with 301-3.3.

~~Soil-cement shall be uniformly compacted to at least 95 percent of relative compaction, the mixture shall be placed on the moistened subgrade or previously completed soil-cement, using mechanical spreading equipment that will produce layers of such width and thickness that it will compact to the required dimensions of the completed soil-cement layers. Dumping in piles upon the subgrade will not be permitted.~~

~~The mixture may be spread and compacted in one layer where the required thickness is 200 mm (8 inches) or less. Where the required thickness is more than 200 mm (8 inches), the mixture~~

shall be spread and compacted in two or more layers of approximately equal thickness, provided that the maximum compacted thickness of any one layer does not exceed 200 mm (8 inches).

Compaction shall commence within 30 minutes after the mixture is placed on the grade and shall proceed continuously until completed. Final compaction of the mixture to the specified density shall be completed within 2 1/2 hours after the application of water during the mixing operation.

When two or more layers of soil cement are to be placed, the surface which will be in contact with succeeding layers shall be kept continuously moist for 7 days or until the placement of the subsequent layer. Any loose material on the surface of the completed layer shall be removed and the surface moistened immediately before placement of the next layer. No standing water will be permitted.

At the start of compaction, the mixture shall be in a uniform, loose condition throughout its full depth.

During finishing operations, the surface of the soil cement shall be shaped to the required lines, grades, and cross sections and shall be kept moist. The finished surface of the soil cement shall conform to the requirements of 301-1.4.

301-3.6.5 Construction Joints. Construction joints in soil cement shall conform to 301-3.4.

301-3.1.9 3.6.6 Curing. Curing of soil cement shall be in conformance with 301-3.5. After placement and compaction of the soil cement is completed, it shall be protected against drying and from heavy traffic for 7 days.

Curing shall be moist (water fogging), bituminous seal, or other method approved by the Engineer. If moist curing is used, exposed surfaces of the soil cement shall be kept continuously moist with a fog spray for 7 days. If a bituminous curing is used, it shall consist of liquid asphalt or emulsified asphalt meeting the requirements of Section 203.

The bituminous curing seal shall be applied in sufficient quantity to provide a continuous membrane over the soil at a rate of between 0.45 L/m² and 0.90 L/m² (0.10 and 0.20 gallon per square yard) of surface with the exact rate determined by the Engineer. It shall be applied as soon as possible after the completion of final rolling. The surface shall be kept moist until the seal is applied. At the time the bituminous material is applied, the soil surface shall be dense, shall be free of all loose and extraneous material, and shall contain sufficient moisture to prevent excessive penetration of the bituminous material.

301-3.1.10 Construction Joints. Construction joints shall have vertical faces and shall be made in thoroughly compacted material. Additional mixture shall not be placed against the construction joint until the joint has been approved by the Engineer. The face of the cut joint shall be clean and free of deleterious material and shall be kept moist until the placing of the adjacent soil cement.

301-3.1.11 Repair. If the soil cement is damaged, it shall be repaired by removing and replacing the entire depth of affected layers in the damaged area. Feathering will not be permitted for repair of low areas.

301-3.1.12 Measurement and Payment. Soil cement shall Cement treated materials soils, base, and subbase will be paid for by the square meter (square yard) or cubic meter (cubic yard) in place as shown on the Plans or as directed by the Engineer. The Contract Unit Price shall include full compensation for mixing, spreading, shaping, compacting, trimming, and curing.

301-3.2 Plastic Soil-Cement.

301-3.2.1 General. Plastic soil cement shall consist of soil, cement, and water. It shall be proportioned, uniformly mixed to the consistency of plastering mortar, finished and cured in such a manner that the completed plastic soil cement in place forms a dense uniform mass conforming to the lines and grades shown on the Plans.

301-3.2.2 Mixing and Finishing. Mixing of the soil, cement, and water shall be accomplished by a pugmill or rotary drum mixer.

The soil, cement, and water shall be proportioned as specified and uniformly mixed to a consistency similar to that of plastering mortar.

The plastic soil cement shall be placed on the prepared grade, consolidated, and finished to the lines and grades shown on the Plans.

Finished, plastic soil cement shall be kept moist and cured as specified in 301-3.1.9.

301-3.2.3 Measurement and Payment. Measurement and payment of plastic soil cement will be in accordance with 301-3.1.12.

301-3.3 301-3.7 Cement-Treated Base.

301-3.3.1 301-3.7.1 General. The cement treated base CTB mixtures shall consist of materials that conform to 200-3 conform to the requirements of 301-3.1 and 301-3.3.

Cement treated base shall consist of a combination of specified base material and portland cement, uniformly mixed, moistened, and compacted as described herein, and shaped to conform to the lines, grades, and cross sections shown on the Plans.

301-3.7.2 Mixing of CTB. Mixing of CTB shall conform to 301-3.2. The mixing method shall be determined by the class of the existing underlying material and/or subgrade (i.e. Cement-modified silt-clay or Cement modified granular soil).

301-3.3.2 Mixed In Place. 301-3.7.2.1 Mixing In Place. CTB mixed in place shall in conform to 301-3.2.2 and in-place mixing of either cement modified silt-clay or cement modified granular soils. Water distributing equipment shall be provided with a metering device for introducing water at the time of mixing.

Should the Contractor elect to perform road mixing operations off the roadbed at a designated location, the preparation of the material for mixing and the mixing of base material, cement, and water shall conform to the applicable provisions specified herein for preparing and mixing the materials on the roadbed. When the materials are road mixed off the roadbed, the device for loading the mixed material into the transporting vehicle shall be so constructed and so operated that no untreated material will be picked up. The time required for loading and hauling

the material shall be taken into account when determining the amount of material to be mixed at any one time for placement and compaction within the time specified in 301-3.1.8.

~~301-3.3.3~~ **301-3.7.2.2 Central-Plant Mixing.** CTB mixed in a central plant shall conform to 301-3.2.3 and in-place mixing of cement modified granular soils.. Base material, cement, and water shall be mixed in a rotary drum or pugmill mixer with the materials proportioned by batch weights. If a continuous type of mixer is used, the materials shall be proportioned by volume.

If the Contractor elects to use a continuous type mixer, the correct proportions of each aggregate size introduced into the mixer shall be drawn from the storage bins by means of a continuous feeder through adjustable calibrated gates, which gates shall supply the correct amount of aggregate in proportion to the cement and water, and the gates shall be so arranged that the proportion of each aggregate size can be separately adjusted. The mixer shall be equipped with metering devices which will introduce the cement and water into the mixer in the specified proportions. The metering devices and feeder shall be interlocked and so synchronized as to maintain a constant ratio between cement, water, and aggregate. Storage bins shall be equipped with overflow chutes for each compartment. A positive signal system shall be provided to indicate when the level of material in each bin approaches the strikeoff capacity of the feed gate. The plant shall not be permitted to operate unless this signal system is in good working condition. The plant shall be equipped with facilities to weigh samples for calibrating gate openings.

Water may be proportioned by weight or volume. The quantity of water added to the mixture shall be adjusted to produce optimum moisture content. The addition of water shall be made under conditions which will permit an accurate determination of the quantity of water utilized.

301-3.3.4 Placing, Compacting, and Finishing. 301-3.7.3 Placement, Spreading and Compaction.

301-3.7.3.1 General. CTB shall be placed, spread and compacted in conformance with 301-3.3. Materials mixed at a location off the roadbed shall be deposited by means of approved spreading equipment. Dumping in piles upon the subgrade will not be permitted.

The surface of the finished cement treated base at any point shall vary not more than 6 mm (0.02 foot) above or below the grade established by the Engineer.

The mixed materials shall be spread for the full width of the subgrade or base under construction, either by one spreader or by several spreaders operating in echelon across the subgrade, unless traffic conditions require part width construction. Should only one spreader be used, not more than 45 minutes shall elapse between the time of placing material in adjacent lanes at any location without trimming the longitudinal joint.

Where traffic or other conditions make part width construction of a base necessary, a windrow of shoulder material or soil shall be placed and compacted to form a choker to restrain the inner edge of the base during compacting operations. The choker shall be constructed to the same elevation as that of the compacted base, and shall be completed in advance of the spreading of the treated material. The toe of the choker shall be not less than 75 mm (3 inches) outside the finished trimming line of the compacted section of base material. The use of side forms, or other methods which will satisfactorily retain the base material during compacting operations, will be permitted in lieu of a choker.

~~After a part width section has been completed, the longitudinal joint against which additional material is to be placed shall be trimmed to a vertical edge at the neat line of the section. Choker material and material cut away in trimming shall be used only in the construction of adjacent shoulders or otherwise disposed of along the roadway, unless suitable for incorporation in the Work.~~

~~The use of self-propelled graders will be permitted for spreading the mixed material on the roadbed and for trimming.~~

301-3.7.4 Construction Joints. Construction joints in CTB shall conform to 301-3.4.

301-3.3.5 301-3.7.5 Curing. Curing of soil cement shall be in conformance with 301-3.5. No equipment or traffic shall be permitted on the finished surface of the CTB during the first 3 days after the application of the curing seal.

~~In cases where the Contractor has permitted equipment or traffic to operate on a cement-treated base, or subbase, the Contractor shall, before the paving material is placed on the surface, completely remove any other material which has been spread to protect the treated surface and shall apply additional curing seal to any areas where the curing seal has been destroyed. Full compensation for furnishing, spreading, and removing such material and for furnishing and applying the additional curing seal will be considered as included in the price bid for cement-treated base and no additional compensation will be made therefore.~~

301-3.3.6 301-3.7.6 Measurement and Payment of Portland Cement-treated Base Materials. Measurement and payment of cement-treated base will be in accordance with 301-3.1.12.

301-3.9.1 Mixed-In-Place Portland Cement Treated Materials. Mixed in-place portland cement treated materials shall be paid for by the square yard (square meter) or cubic yard (cubic meter) in place as shown on the Plans or specified in the Special Provisions. The Contract Unit Price shall include full compensation for mixing, spreading, shaping, compacting, trimming, and curing.

301-3.9.2 Central-Plant Mixed Portland Cement Treated Materials. Central plant mixed portland cement treated materials shall be paid for by the by the Contract Unit Price per square foot (square meter), or at the Contract Unit Price per ton (tonne) as shown in the Bid. The Contract Unit Price shall include full compensation for mixing, spreading, shaping, compacting, trimming, and curing.