

## **MEDINA COUNTY REQUIREMENTS FOR CEMENT STABILIZED SUBGRADE**

### **Description**

This work shall consist of constructing a cement-stabilized subgrade (CSS) and designing an admixture of Portland cement and pozzolanic material (PC&PM) percentage in the soil. ODOT Specification 204 Subgrade Compaction shall apply, except as noted herein. This item shall consist of a mechanically mixed admixture of a minimum of fifty (50) percent Portland cement and maximum fifty (50) percent pozzolanic materials which includes lime kiln dust, fly ash, Portland cement kiln dust, and precipitated lime dust with the subgrade soil constructed, mixed, shaped, compacted, fine graded, and finished.

### **Materials**

Furnish Portland cement conforming to the requirements of ODOT Specification 701.04. Furnish pozzolanic materials including lime kiln dust, fly ash, Portland cement kiln dust and precipitated lime dust. Use between 6 and 12 percent of the PC&PM in the soil. This percentage is based on the dry weight of the subgrade soil.

Furnish emulsified petroleum or emulsified petroleum resin additive mixed with water for dust control at a rate of 0.5 gallons per square yard.

### **Construction**

#### **A. Limitations**

Cement stabilization work shall be performed when the air temperature is 40°F or above and the material to be treated is not frozen. No work shall be done during wet or unsuitable weather. Winds should be minimal.

A proofroll shall be performed prior to addition of the PC&PM. The deflection shall determine depth of correction needed to provide a uniform CSS.

The proofroll shall be performed with a loaded tandem dump truck with a gross weight of 60,000 pounds minimum (30 ton). The proofroll truck will be operated at a rate not to exceed three (3) mph or a comfortable walking pace. The weight of the truck on the soil will be observed for any deflection of the subgrade. The amount of deflection will indicate depth of stabilization needed. Where a deflection does exist, the area will be marked out one-half (½) width by the length of the job on the proposed curb line. The total curb area will be proofrolled in a perimeter pass. A second pass shall be made with the nose of the proofroll truck on the centerline of the proposed road for the length of the new road, once again delineating with paint markings any deflection that may occur.

Shape the subgrade to the profile grade prior to mixture of the PC&PM so as to permit the construction of a uniform compacted course of the treated soil to the thickness shown on the plans.

The subgrade shall be initially cut to allow for displacement due to addition of PC&PM. Displacement of the subgrade shall be estimated to be one-eighth (1/8) inch per inch of stabilization. For eight (8) inch stabilization, you would need to lower the subgrade by one (1) inch. For twelve (12) inches of stabilization, you would need to lower the subgrade by one and one-half (1-1/2) inches.

The roadway shall be closed along short sections as approved by the engineer, and the soil stabilization work completed as further detailed below. Both lanes shall be completed at the same time in order to assure proper grading. At all times, the contractor shall keep residents notified of closure locations and keep the dust to a minimum.

### **B. Spreading**

Three (3) working days prior to the spreading operation, the contractor shall submit the proposed rate of application of the PC&PM to obtain the percentage set by the engineer. This information shall include, but is not limited to the calculations, rate of PC&PM applied or speed of the spreading operation.

The PC&PM shall be applied at the rate set by the engineer using dry methods, as specified. The PC&PM shall be spread uniformly on the subgrade by means of distributors or tanks. Bulk PC&PM shall be pneumatically spread by way of a tube or mechanical spreader approved by the engineer. Dry PC&PM must be uniformly spread at a constant slow rate of speed. It is acceptable to use a dozer or motor grade to tow the pneumatic truck in order to maintain this slow rate of speed. No PC&PM shall be spread on standing water.

The contractor shall provide a square yard canvas to check the amount of PC&PM spread on grade ahead of the mixing operation. The canvas and PC&PM shall be carefully picked up and weighed after the spreader has passed to assure conformance with the approved mix design.

Dry PC&PM shall be spread in such a manner as to minimize a dust nuisance. The distribution bar shall be at a maximum of three (3) feet above the subgrade. A canvas shroud shall surround the distribution bar and shall extend to the subgrade. The dry PC&PM shall not be applied when wind conditions, in the opinion of the engineer, are such that blowing cement becomes objectionable.

### **C. Mixing**

Immediately after spreading of the PC&PM, mix the PC&PM and soil using a power driven transverse type mixer. Continue mixing until the PC&PM have been thoroughly incorporated into the soil and is a uniform color. Do not add water during the initial mixing. Complete the

initial mixing, so that eighty (80) percent of the soil-admixture must pass a No. 4 Sieve and one hundred (100) percent must pass the one (1) inch sieve, exclusive of gravel or stone.

Following the initial mixing, remix the soil and introduce water to bring the mixed material to at least two (2) percent above optimum moisture. Uniformly distribute the water in sufficient quantity to hydrate the PC&PM.

Restrict the addition of water when the moisture content of soil exceeds four (4) percent above optimum. Add water to the mixed soil in less than three (3) hours after the initial mixing.

Mix the PC&PM to the minimum design depth or greater depth as directed by the engineer based on the proofroll. If required by the engineer you may check the uniformity of the mix by digging trenches or a series of holes at regular intervals for the full depth of treatment and inspecting the color and depth of the exposed material.

#### **D. Compaction**

After mixing, shape the subgrade. Start compaction immediately after final mixing. Use rollers complying with ODOT Specification 203.06A.

The maximum dry density shall be based on the moisture density curves. The field one-point Proctor tests can supplement these curves, as approved by the County Engineer. All CSS shall be compacted to ninety-six (96) percent of the laboratory maximum dry density.

The PC&PM/soil obtain ninety-six (96) percent of the maximum dry density at optimum moisture content within six (6) hours from spreading to testing operations. Compaction must be completed in two (2) hours from start to finish.

The use of a vibratory sheepsfoot roller or rollers with additional ballast to give greater unit pressure may be required. Use must be made of the greatest contact pressure that will not exceed the bearing capacity of the soil/cement mixture and that will still "walkout" in a reasonable number of passes. Scarifying and re-compacting may be necessary to enhance compaction.

Use the moisture controls according to ODOT Specification 203.07 A., except ensure that the moisture content at time of compaction is at least two (2) percent above optimum.

Perform the final rolling using a steel drum roller meeting the requirements of ODOT Specification 401.13. Shape or fine grade the compacted CSS to the profile grade within the tolerances in ODOT Specification 203.08.

Complete the mixing, compacting, shaping and fine grading within three (3) hours from start to finish.

## **Dust Control**

A dust palliative shall be applied to the subbase within two (2) hours following the completion of the construction of the stabilized subbase to alleviate a dust nuisance. A second application may be required during the curing period if the dust remains a problem. The dust palliative shall consist of an emulsified petroleum (such as SS-1) or emulsified petroleum resin additive product diluted in water as approved by the engineer.

One part of the emulsified petroleum shall be diluted with three (3) parts water or one (1) part emulsified petroleum resin additive shall be diluted with four (4) parts water. The rate of application of the dust palliative mixture shall be one-half (0.50) gallons per square yard.

It is the desire of the engineer to open the road to traffic one (1) hour after the application of the dust control. Application rates and/or the ratio of the dilution mixture may be adjusted by the engineer to achieve this goal.

## **Curing**

Immediately following the final grading, cure the CSS for seven (7) days before the placement of the overlaying course. Protect the CSS. Do not operate construction equipment on the CSS during the cure period.

Do not allow the CSS to freeze during the cure period.

## **Proofrolling**

After the cure period, proofroll the CSS to determine stability of the soils. A zero (0) deflection during the proofroll is required to pass.

Proofroll with a loaded tandem dump truck with a gross weight of 60,000 pounds minimum (30 ton). The proofroll truck will be operated at a rate not to exceed three (3) mph or a comfortable walking pace. The weight of the truck on the soil will be observed for any deflection of the subgrade. Where a deflection does exist, the area will be marked out one-half (½) width by the length of the job on the proposed curblines. The total curb area will be proofrolled in a perimeter pass. A second pass shall be made with the nose of the proofroll truck on the centerline of the proposed road for the length of the new road, once again delineating with paint markings any deflection that may occur.

Correction of a deflection in the subgrade may be made by restabilizing the subgrade, use of stone aggregate, asphalt or flowable fill as directed by the engineer.

After correction, a final proofroll will take place where corrections have been made to assure zero (0) deflection.

### **Contractor Designed Cement Admixture Soil**

The contractor shall design the percent of PC&PM in the soil. Take one soil sample for every 5000 square yards of soil, one per major type of soil, a minimum of two soil samples per project. Take soil samples at approximate equal intervals along the project area.

Classify the soils according to the AASHTO Group Classification and perform a standard Proctor analysis of soil.

Determine the percent of PC&PM by using compressive strength tests performed on soil/cement cylinders prepared as per ASTM D-1633. Perform the compressive strength test on cylinders using 7-day cures, 28-day cures and 28-day cures with a capillary soak. To simulate a 28-day strength, a 7-day oven cured can be performed. Use a percentage of PC&PM in the soil of 6, 8, 10, and 12 for each soil sample. Make three (3) soil cylinders for each percentage at the optimum moisture of the cement soil mixture. Recommend the percentage of PC&PM for the project that obtains an unconfined strength of two hundred (200) psi in seven (7) days and three hundred and thirty (330) psi in twenty-eight (28) days after a capillary soak.

The seven (7) day oven cured/capillary soak process shall be as follows. Soil samples are to oven cured seven (7) days at 40°C in sealed plastic bags to retain sufficient moisture for the curing process. After the seven (7) day oven cure, the samples are to be capillary-soaked prior to compressive testing. The capillary soak is for twenty-four (24) hours for lean clay and forty-eight (48) hours for fatty clays. The capillary soak protocol consists of moisture soak through a porous stone at the base of each sample and an absorption wrap placed around the circumference of the sample. The porous stone and the fabric wrap are placed in contact with the water throughout the capillary soak process. After the twenty-four (24) hour or forty-eight (48) hour soak, the samples are to be tested in an unconfined compressive stress machine to record results. Those samples that achieve 330 psi or greater are deemed acceptable to determine the percentage PC&PM required.

The data suitably presented shall be submitted to the engineer for acceptance. The engineer will determine the percentage to be used on the project. The percentage of PC&PM used on the project may be increased to meet field conditions.

Moisture density curves for the percentage chosen by the engineer shall be made in accordance with AASHTO T-99 by the soils consultant for each soil classification on the project. This data shall be submitted to the engineer three (3) working days prior to the work.

### **Testing and Quality Control**

Two (2) field cylinder cores shall be prepared each day to determine the actual strength of the stabilized subgrade. Compressive strength tests shall be performed on the field cylinder cores at a seven (7) day cure or as approved by the engineer. The engineer shall be satisfied the soil has reached 200 psi strength prior to allowing paving work to proceed.

Immediately following the grading or fine grading, cure the compacted stabilized subgrade for a period of at least four (4) days before any trimming operations can commence. In lieu of the four (4) day wait period, a cylinder break with a 125-psi strength must be obtained.

**Method of Measurement**

- (A) Measurement of Subgrade Material Testing. The payment for Item 204 Subgrade Material Testing shall be a lump sum payment of all material testing satisfactorily completed.
- (B) Measurement of Subgrade Preparation. The quantity for this item shall be the number of square yards properly graded and accepted in place paid under Item 204 Subgrade Preparation.
- (C) Measurement of Test Rolling. The quantity for this item shall be measured in accordance with Item 204 Proofrolling.
- (D) Measure of Cement Stabilized Subgrade. The quantity for this item shall be the number of square yards computed from the typical sections and the profile grade completed and accepted in-place.
- (E) Measurement of Cement. The quantity for this item shall be the number of tons delivered for CSS and incorporated in the work. The PC&PM incorporated in the CSS will be measured for payment in tons.

**Basis of Payment**

The contractor will be paid for accepted quantities at the contract price as follows:

Item	Unit	Description
204	Lump Sum	Subgrade Material Testing
204	Square Yards	Subgrade Preparation
204	Hour	Proofrolling
204	Square Yards	Cement Stabilized Subgrade
Spec.	Tons	PC&PM
Spec.	Square Yards	Dust Control

TABLE 300/1

PAVEMENT TYPE AND DEPTH

DESIGN ADT	PAVEMENT WIDTH		CONCRETE PAVEMENT THICKNESS			
			PLAIN CONCRETE WITH POLYPROPYLENE FIBERS 2" #411 LIMESTONE AGGREGATE BASE AND STABILIZED SUBGRADE		PLAIN CONCRETE WITH POLYPROPYLENE FIBERS AND 3" #304 LIMESTONE AGGREGATE BASE	
	CURBS (FEET)	NO CURBS (FEET)	204 CEMENT STABILIZED SUBGRADE MINIMUM (INCHES)	452 PLAIN CONCRETE PAVEMENT (INCHES)	452 PLAIN CONCRETE PAVEMENT WITH 3/4" EPOXY DOWELS (INCHES)	452 PLAIN CONCRETE PAVEMENT (INCHES)
< 1,000	25' B/B	20' E/E	6	7	8	9
< 2,000	27' B/B	22' E/E	6	7	8	9
> 2,000	29' B/B	24' E/E	8	8	9	N/A
COMMERCIAL & INDUSTRIAL STREETS - TO BE DETERMINED BY COUNTY ENGINEER (< 29'-34' WIDTH >)						

DESIGN ADT	PAVEMENT WIDTH		ASPHALT PAVEMENT THICKNESS			
			FULL DEPTH ASPHALT WITH 3" #304 LIMESTONE AGGREGATE BASE			
	CURBS (FEET)	NO CURBS (FEET)	204 CEMENT STABILIZED SUBGRADE MINIMUM (INCHES)	301 ASPHALT CONCRETE BASE (INCHES)	448 ASPHALT CONCRETE SURFACE COURSE TYPE 2 (INCHES)	448 ASPHALT CONCRETE SURFACE COURSE TYPE 1 (INCHES)
< 1,000	25' B/B	20' E/E	9	3.5	2	1.5
< 2,000	27' B/B	22' E/E	9	3.5	2	1.5
> 2,000	29' B/B	24' E/E	9	6	2	1.5

NOTE: FOR DETAILS ON ITEM 405 BITUMINOUS COLD MIX PAVEMENT SEE  
MEDINA COUNTY PAVEMENT DETAIL DRAWING