ITEM P-220 CEMENT TREATED SOIL BASE COURSE

DESCRIPTION

220-1.1 This item shall consist of constructing a base course by uniformly mixing together soil, Portland cement, and water. The mixed material shall be spread, shaped, and compacted in accordance with these specifications and in conformity to the dimensions and typical cross section shown on the plans. Tests shall be required for each approved soil that will be included in the treated layer.

Runway, taxiway, or apron pavements shall be built in a series of parallel lanes using a plan of processing that reduces longitudinal and transverse joints to a minimum.

Provide an experienced Soil-Cement technician on site to supervise the Soil-Cement process and to supervise the related process control testing.

MATERIALS

220-2.1 PORTLAND CEMENT. Portland cement shall conform to the requirements of AASHTO M85 Type I or II.

220-2.2 WATER. Water used in mixing and curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602.

220-2.3 SOIL. The soil shall consist of an approved select soil. The soil shall be free of roots, sod, weeds, have an organic content less than 1.5% as determined by ATM 203, and shall meet the following gradation as determined by WAQTC FOP for AASHTO T27/T11.

TABLE 1. GRADATION REQUIREMENTS

Sieve designation per WAQTC FOP AASHTO T27/T11	Percentage by Weight Passing Sieves	
1 inch	100	
No. 4	55-100	
No. 200	0-20	

CONSTRUCTION REQUIREMENTS

220-3.1 CONTRACTOR'S SOIL-CEMENT TECHNICIAN. At the start of production, the Contractor shall provide an onsite technician to supervise the soil-cement process and the related process control of the product for at least 10 days of production. This technician shall have successfully supervised at least five (5) successful projects using soil-cement with similar base material and equipment. The technician must also be qualified to supervise the process control.

At the preconstruction conference, provide a submittal that includes the following information:

- a. Resume of technician including; successful project(s) listing, owners- contact, address, and telephone number; location of projects and description of soil-cement equipment used on the projects.
- **b.** Construction plan including equipment to be used and procedures to be used for mixing and paving.

220-3.2 COMPOSITION OF MIXTURE. Submit the following to the Engineer at least 30 days before the production of soil-cement base course:

a. A letter stating the source of soil, Portland cement, and water proposed for use.

Betnel Airport		
Parallel Runway Reconstruction		(DOT rev. 12/21/18)
Project CFAPT00429/ AIP 3-02-0029-026-2019	P-220-1	(R&M rev. 5/10/19)

......

Deleted: shall be clean and free from sewage, oil, acid, strong alkalies, or vegetable matter. Water of questionable quality shall be tested in accordance with the requirements of AASHTO T 26

- **b.** Furnish a minimum 300 pound representative soil sample for laboratory tests.
- c. Furnish one sack (94 pounds) of Portland cement proposed for use in the mixture.

The Engineer will evaluate the material using procedures and test methods contained in the Portland Cement Association's "Soil-Cement Laboratory Handbook" and establish the approved job mix design which will become a part of the contract.

The approved job mix design will specify the target values for Portland cement content, the maximum density, and optimum moisture content of the soil-cement. The amount of Portland cement shall not vary more than 1% from the designated rate.

Molded soil-cement cylinders tested in accordance with ASTM D1633. Method A shall have a minimum 7day compressive strength of 300 psi.

The following table provides the pre soil-cement job mix design estimating factors, and specifies the tolerance allowed the Contractor during production.

Material	Pre Soil-Cement Job Mix Design Estimating Factor	Specified Tolerance
Soil	Dry Unit Weight = 107 lb/ft ³ (AASHTO T99)	
	Optimum Moisture Content = 14%	
Soil-Cement Mixture	Dry Unit Weight = 111 lb/ft ³ (AASHTO T134)	
	Optimum Moisture Content = 13%	
Portland Cement	8% Portland Cement by weight of soil	_±1%Portland Cement _

220-3.3 PRE SOIL-CEMENT PRODUCTION MEETING. Submit a soil-cement base course production plan at the pre soil-cement production meeting to be held a minimum of 10 working days before initiating soil-cement operations. Address the sequence of operations and joint construction. Outline steps to assure product consistency, protection, and curing of the soil-cement base course. Provide calibration records of cement distributor.

220-3.4 WEATHER LIMITATIONS. The soil-cement base shall not be mixed or placed while the atmospheric temperature is below <u>40°</u> F or when conditions indicate that the temperature may fall below <u>40°</u> F within <u>24</u> hours, or when the weather is foggy or rainy, or when the soil or subgrade is frozen or contains frost.

220-3.5 EQUIPMENT. The soil-cement may be constructed with any equipment that will meet the requirements for soil pulverization, cement application, mixing, water application, incorporation of materials, compaction, finishing, and curing specified herein. The cement distributor shall be designed to spread a uniform coverage of Portland cement at a specified rate. The spread rate shall be integrated with the speed of travel to maintain a uniform coverage. Equipment must be calibrated prior to use.

220-3.6 PREPARATION. The area to be paved shall be graded and shaped to conform to the grades and typical cross section shown on the plans. Any soft or yielding areas in the subgrade shall be removed and replaced with acceptable soil and compacted as specified.

220-3.7 PULVERIZATION. The soil for the base course shall be so pulverized that at the completion of moist-mixing, 100% by dry weight passes a 1-inch sieve and a minimum of 80% passes a No. 4 sieve.

 Bethel Airport

 Parallel Runway Reconstruction

 Project CFAPT00429/ AIP 3-02-0029-026-2019

 P-2

P-220-2

(DOT rev. 12/21/18) (R&M rev. 5/10/19) Deleted: 7

Deleted: 35 Deleted: 35 Deleted: 48 **220-3.8 CEMENT APPLICATION, MIXING, AND SPREADING.** Mixing of the soil, cement, and water shall be accomplished by the mixed-in-place method or the central-plant-mixed method.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations, and it shall not exceed the specified optimum moisture content for the soil-cement mixture.

Method A - Mixed-in-place. The specified quantity of cement shall be spread uniformly on the soil.

Cement that has been displaced shall be replaced before mixing is started. After the cement has been applied, it shall be mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied.

Immediately after the soil and cement have been mixed, water shall be incorporated into the mixture. Excessive concentrations of water on or near the surface shall be avoided. A water supply and pressure distributing equipment shall be provided that will assure the application within 3 hours of all mixing water on the section being processed. After all mixing water has been applied, mixing shall continue until a uniform and intimate mixture of soil, cement, and water has been obtained.

Not more than 60 minutes shall elapse between the start of moist mixing and the start of compaction of soil-cement.

Method B – Central plant mixed. The soil, cement, and water shall be mixed in a pugmill, either of the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices that will add the soil, cement, and water into the mixer in the specified quantities. Soil and cement shall be mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall continue until a uniform and intimate mixture of soil, cement, and water is obtained.

The mixture shall be hauled to the project in trucks equipped with protective covers. The mixture shall be placed on the moistened subgrade in a uniform layer by an approved spreader(s). Not more than 30 minutes shall elapse between the placement of soil-cement in adjacent lanes.

The layer of soil-cement shall be uniform in thickness and surface contour and of such quantity that the completed base will conform to the required line, grade, and cross section. Dumping of the mixture in piles or windrows upon the subgrade will not be permitted.

Not more than 60 minutes shall elapse between the start of moist mixing and the start of compaction of soil-cement.

220-3.9 COMPACTION. Immediately upon completion of the spreading operations, the mixture shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The field density of the compacted mixture shall be at least 98 percent of the maximum density of laboratory specimens prepared from the Job Mix Design and compacted and tested in accordance with AASHTO T134. The in-place field density and moisture content shall be determined in accordance with WAQTC FOP for AASHTO T310. Test the in-place field density at a frequency of 1 per 1,000 yd², but not less than four (4) tests per day of production. Any mixture that has not been compacted shall not be left undisturbed for more than 30 minutes. The moisture content of the mixture at the start of compaction shall not be below nor more than 2 percentage points above the optimum moisture content. The optimum moisture content shall be determined in accordance with AASHTO T134 and shall be less than that amount which will cause the mixture to become unstable during compaction and finishing. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted at the Contractor's expense and two additional random tests made. This procedure shall be followed until the specified density is reached.

Bethel Airport Parallel Runway Reconstruction Project CFAPT00429/ AIP 3-02-0029-026-2019

P-220-3

(DOT rev. 12/21/18) (R&M rev. 5/10/19) Deleted: 5

220-3.10 FINISHING. Finishing operations shall be completed during daylight hours, and the completed base course shall conform to the required lines, grades, and cross section. If necessary, the surface shall be lightly scarified to eliminate any imprints made by the compacting or shaping equipment. The surface shall then be recompacted to the required density.

220-3.11 CONSTRUCTION JOINTS. At the end of each day's run,

of the cement are interrupted for more than 30 minutes, a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true vertical face free of loose material.

The protection provided for construction joints shall permit the placing, spreading, and compacting of base material without injury to the work previously laid. Where it is necessary to operate or turn any equipment on the completed base course, sufficient protection and cover shall be provided to prevent damage to the finished surface. A supply of mats or wooden planks shall be used and maintained as approved and directed by the Engineer.

Care shall be exercised to ensure thorough compaction of the base material immediately adjacent to all construction joints. When spreading or compacting base material adjacent to a previously constructed lane, care shall be taken to prevent injury to the work already constructed.

220-3.12 PROTECTION AND CURING. After each area of the base course has been finished to grade and compacted as specified herein, it shall be kept moist and protected against drying for a period of 7 days by the application of a fog-type water spray. The water shall be maintained and applied as needed by the Contractor during the 7-day protection period.

Finished portions of soil-cement that are used by equipment in constructing an adjoining section shall be protected to prevent equipment from marring or damaging the completed work.

When the air temperature may be expected to reach the freezing point, sufficient protection from freezing shall be given the soil-cement for 7 days after its construction and until it has hardened or as approved by the Engineer

220-3.13 CONSTRUCTION LIMITATIONS. When any of the operations after the application of cement are interrupted for more than 30 minutes or when the uncompacted soil-cement mixture is wetted by rain so that the moisture content is exceeded by a small amount, the decision to reconstruct the portion affected shall rest with the Engineer. In the event the uncompacted, rain-wetted mixture exceeds the specified moisture content tolerance, the Contractor shall reconstruct at his/her expense the portion affected. All material along the longitudinal or transverse construction joints not properly compacted shall be removed and replaced, at the Contractor's expense, with properly moistened and mixed soil-cement compacted to specified density.

220-3.14 SURFACE TESTS. The finished surface shall not vary more than 3/8 inch when tested with a 12-foot straightedge applied parallel with, or at right angles to, the longitudinal axis of the pavement. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid. The Contractor shall perform all final smoothness and grade checks in the presence of the Engineer. Any variations in excess of this tolerance shall be corrected by the Contractor, at his/her own expense, and in a manner satisfactory to the Engineer. The grade and crown will be measured on a 50-foot grid and shall be within +/- 0.05 feet of the specified grade.

In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be, scarified to a depth of at least 3 inches, supplemented with an approved amount of new cement, remixed, reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be correct by the Contractor at the Contractor's expense.

Bethel Airport Parallel Runway Reconstruction Project CFAPT00429/ AIP 3-02-0029-026-2019

P-220-4

(DOT rev. 12/21/18) (R&M rev. 5/10/19) Deleted: d.

220-3.15 THICKNESS. The thickness of the soil-cement base course shall be determined from measurements of <u>B-inch (min)</u> cores drilled from the finished base or from thickness measurements at holes drilled in the base at intervals so that each test shall represent no more than <u>500</u> square yards <u>incless than</u> <u>4 tests per day of production shall be performed</u>. The average thickness of the base constructed during one day shall be within 1/2 inch of the thickness shown on the plans, except that the thickness of any one point may be within 3/4 inch of that shown on the plans. Where the average thickness shown by the measurements made in one day's construction is not within the tolerance given, the Engineer shall evaluate the area and determine if, in his/her opinion, it shall be reconstructed at the Contractor's expense.

220-3.16 MAINTENANCE. The Contractor shall be required to maintain, at his/her own expense, the entire base course within the limits of his/her contract in a condition satisfactory to the Engineer from the time he starts work until all the work has been completed. Maintenance shall include immediate repairs of any defects that may occur either before or after the cement is applied. The work shall be done by the Contractor at his/her own expense and repeated as often as necessary to keep the area intact at all times. Repairs shall be made in a manner that will insure restoration of a uniform surface and the durability of the part repaired. Faulty work must be replaced for the full depth of treatment. Any low areas shall be remedied by replacing the material for the full depth of treatment rather than by adding a thin layer of soil-cement to the completed work.

METHOD OF MEASUREMENT

220-4.1 The quantity of soil-cement base course to be paid for shall be the number of square yards of completed and accepted base course.

220-4.2 Portland cement shall be measured by the ton.

BASIS OF PAYMENT

220-5.1 Payment shall be made at the contract unit price per square yard for soil-cement base course. This price shall be full compensation for furnishing all materials, except Portland cement, and for all preparation, delivering, placing, and mixing of these materials; and for all labor, equipment, tools and incidentals necessary to complete the item.

220-5.2 Payment shall be made at the contract unit price per ton for cement. This price shall be full compensation for furnishing this material and for all delivery, placing, and incorporation of this material, and for all labor including the experienced soil technician, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P220.010.0000Soil-Cement Base Course - per square yardItem P220.020.0000Portland Cement - per ton

TEST REQUIREMENTS

ATM 203 Organic Content of Soils by Ignition

ASTM D1633 Compressive Strength of Molded Soil-Cement Cylinders

WAQTC FOP for AASHTO T27/T11 Sieve Analysis of Aggregate and Soil

AASHTO T 26 Quality of Water to be Used in Concrete

AASHTO T134 Moisture-Density Relations of Soil-Cement Mixtures

Bethel Airport Parallel Runway Reconstruction Project CFAPT00429/ AIP 3-02-0029-026-2019 P-220-5

(DOT rev. 12/21/18) (R&M rev. 5/10/19)

l	υ	e	e	te	a	•

-hotolo	30	n
Jeieceu.	00	U

AASHTO T310 In-place Density and Moisture Content of Soil and Soil Aggregate By Nuclear Methods

MATERIAL REQUIREMENTS

AASHTO M85 Portland Cement

(DOT rev. 12/21/18) (R&M rev. 5/10/19)