

PERMAZYME 11X

ROAD BUILDING SPECIFICATIONS GUIDELINES

Description:

This work consists of placing a mixture of aggregate, Permazyme 11X Stabilizer and water on a prepared surface in accordance with this specification, as shown on the plans.

No provision is made herein to address site conditions such as: load-bearing capacity of the subbase, ground moisture, drainage or climate.

The road shall have a properly engineered design prior to the start of construction.

Materials:

The aggregates shall conform to the requirements of a modified grading as shown below:

SIEVE	% PASSING
1" (25MM)	100
¾" (19mm)	90-100
#1/2 (12.5mm)	60-85
#4 (4.75mm)	50-70
#8 (2.36mm)	35-55
#200 (.075mm)	15-20 (cohesive)
L.L. SPEC 30 MAX	
P.I. SPEC 2-10	

The Liquid Enzyme Stabilizer shall be PERMAZYME 11X. Permazyme 11X consists of a multi-enzymatic formulation containing water, fermented organic compounds and other proprietary ingredients.

The Contractor shall make adjustments in the material which may include, but not be limited to, increasing colloidal fines (clay) or reducing the amount of material passing a #200 sieve as directed by the engineer.

In order to create optimum results a minimum of 20-25% clay must be available throughout the area to be treated.

CONSTRUCTION

The aggregate, water and Permazyme 11X shall be mixed and placed by the following method.

Preparation of Surface:

The in-place soil to be stabilized, if not already in a loose state, must first be ripped, scarified, disced or rototilled into a well-pulverized mixture. If the stabilization area involves the treatment of heavy clay soils, the Project Representative may specify the use of a cross-shaft rotary mixer to assure proper pulverization and mixing. If the material to be treated is already at or above optimum moisture content, it must be dried to a minimum of four percentage points below optimum in preparation for addition of the stabilizer solution. Do not prewet the soil material ahead of applying the stabilizer solution.

Application of Stabilizer:

Application of the Permazyme 11X solution shall be limited to the area specifically shaped and sized to receive the solution. It shall be limited to such an area that all operations, including mixing and compaction, can be continuous and completed in one day.

Permazyme 11X solution shall not be applied or mixed with in-place material if atmospheric temperature may fall below 35°F/1.66°C within 24 hours.

Application of the Permazyme 11X shall be limited to periods when rainfall is not expected during the application or during the 72 hour period following application. If rainfall is encountered during application, construction should cease.

The Permazyme 11X Solution shall be applied at the rate of one gallon per 150 cubic yards (1 liter per 30 cubic meters) of material to be treated. The variance from the specified dilution rate will be +/- ten percent.

The amount of water to be used shall be calculated to bring the soil or aggregate material to be treated to optimum moisture content. Stabilizer solution should be added in increments and mixing continued so as to carefully approach optimum moisture content.

In conditions where the in-place material to be treated is already close to optimum moisture content, be aware that no less than two percent moisture must be added as part of the Permazyme 11X solution in order to properly disperse the highly concentrated Permazyme 11X.

The stabilizer solution should be applied to the material to be treated with a pressurized spreader truck or a water truck with a pressurized spreader bar with an accurate speedometer to ensure uniform distribution, or with a grinder/mixer machine capable of injecting the solution into the soil, i.e., Asphalt Zipper, or similar.

The material to be treated and the Permazyme 11X solution shall be thoroughly mixed by tractor drawn spike disc harrows, motor grader or grinder/mixers. Water should not be added to the material prior to adding the stabilizer solution. Mixing equipment shall follow no more than one quarter mile behind spray application truck.

Moisten the road sub-grade prior to adding the treated base material. Spray the subgrade surface with a diluted enzyme water mixture of one gallon of Permazyme 11X per 500 gallons - (1,892.71 L) of water.

If the entire Permazyme solution has been added without achieving the range of allowable moisture content, the water may be added to the aggregate to bring the base aggregate within specified moisture range. Water should be applied with the same attention to uniform distribution as was given to the Permazyme solution.

Compaction

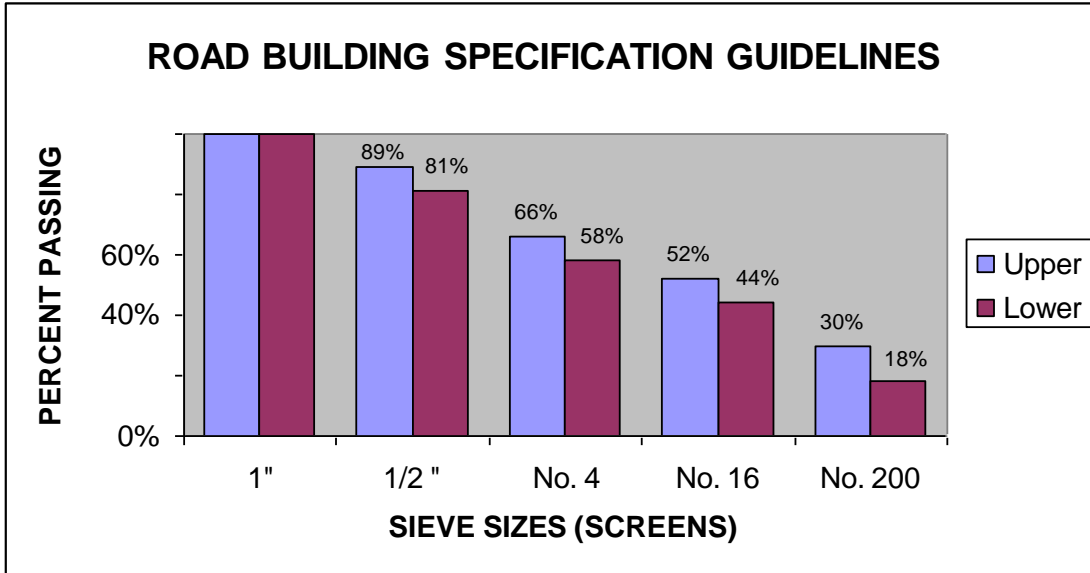
Compaction operations can begin immediately following attainment of proper grade, mixing and moisture content of the treated material. The moisture content of the material at the time of compaction shall not exceed nor be less than two (2) percentage points below the optimum moisture content. Compaction equipment should be capable of achieving compaction of the untreated material to a density no less than 95 percent of the density prescribed in ASTM D-1557- (Modified Proctor).

If site conditions warrant or compaction equipment is not of sufficient size, the road shall be compacted in lifts of 3 to 6 inches maximum. Prior to placing and compacting a second lift, the surface shall be pre-wetted to insure bonding.

Upon completion, the surface shall be smooth and in conformance with the typical sections, lines and grades. The surface shall be properly sloped to allow runoff of surface moisture. The thickness of the compacted treated base material shall be a minimum of six inches (15cm) or greater designated thickness. The compacted thickness shall not vary one-half inch over the entire area.

Curing and Return to Service

Following final completion, the prepared soil shall be allowed to cure for three (3) days. No surface watering or curing membrane is required during this period. If the surface must be rapidly returned to service under traffic, it should be dried-back adequately so that it is not susceptible to rutting or damage by rapid acceleration or braking.



GRADATION SPECIFICATION

Sieve Size	Gradation (% Passing)	Gradation Limit Upper	Gradation Limit Lower
1"	100%		
1/2"	85%	89%	81%
No. 4	62%	66%	58%
No. 16	48%	52%	44%
No. 200	24%	30%	18%

PERMAZYME 11X can be used effectively over a wide range of soil gradation mixes (aggregate sizes), as can be seen from the above graph. In weaker soils, 1 1/2" aggregate may be desired for addition road bearing strength.

To achieve effective stabilization, materials containing approximately 20-25% cohesive fines (non-granular clay) have been found a satisfactory target. However, excellent results have been achieved outside this range.

Additionally, the soil should contain a wide range of material sizes to provide shear strength and internal friction which increases load bearing values.

Permazyme 11X has proven useful over a wide range of soil types. This range continues to expand as Permazyme 11X is used in more diverse locations throughout the world.