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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

21 MAR 2017

DEPARTMENT ORDER)
)
No. 35)
Series of 2017 02.M.17)

SUBJECT: **Standard Specification on Subgrade Improvement and Pavement Levelling Using GEOLIFT High Density Polyurethane Injection System**

In line with the continuing efforts to upgrade the construction technology thru adoption of successful research studies, this Department has approved the use of **GEOLIFT High Density Polyurethane Injection System for Subgrade Improvement and Pavement Levelling**, subject to the specifications hereto attached. A Certificate of Conditional Approval has been issued by this Department accrediting its use in DPWH road projects from March 9, 2017 until March 8, 2022.

This Order takes effect immediately.

MARK A. VILLAR
Secretary

14.1.2 FET/RPF

Department of Public Works and Highways
Office of the Secretary
WIN7U01447

STANDARD SPECIFICATION ON SUBGRADE IMPROVEMENT AND PAVEMENT LEVELLING USING GEOLIFT HIGH DENSITY POLYURETHANE INJECTION SYSTEM

1. Description

This Specification shall consist of densification, voids filling, undersealing of subbase and subgrade soils and stabilization of joints of concrete pavement slabs using GEOLIFT, a high density polyurethane injection system in accordance with this Specification and in conformity with the treatment plan as directed by the Engineer.

2. Material Requirements

The material to be injected shall be a high-density polyurethane material, as approved by the Engineer. It shall consist of a polyurethane-foaming mixture having properties and performance that will not be significantly affected by excess water in the soil. The manufacturer shall certify that the material has properties that conform to the requirements specified in Table 1.

Table 1: High density polyurethane material properties

Property	**Test Method**	**Requirement**
Density, average	ASTM D 1622	64.218 kg/m^3
Compressive Strength, minimum	ASTM D 1621	413.7 KPa
Water Absorption, maximum	ASTM D2842	0.20% by volume

3. Construction Requirements

3.1 Injection Equipment

High Density Polyurethane Injection machine shall be designed for low and medium output foam application up to 9 kg/min at 13,790 KPa. Injection ports shall be placed on the drilled holes where the injection gun will be attached to pump material into the subbase. A 16 mm drill bit shall be used to penetrate the PCCP. The length of the drill bit may vary depending on the depth needed. Laser level shall be used to measure movement of the PCCP.

3.2 Pavement Profile of the Treatment Area

The Contractor shall provide a pavement profile of the treatment areas from laser level measurements of each area where high density polyurethane injection is to be performed. Each profile shall be reviewed and accepted by the Engineer prior to performing the polyurethane injection. Any laser levels used shall be required to control both the target longitudinal profile at the same time as the cross-fall. Target level for each corner of each PCCP slab should be calculated first and the laser level used to give an audible signal when target level for each corner reached.

3.3 Testing before Injection of Polyurethane Material

Before injection of polyurethane material, the Contractor shall conduct Dynamic Cone Penetration (DCP) testing in accordance with ASTM D6951 *"Standard Test Method for Use of the Dynamic Cone Penetrometer in Shallow Pavement Applications"* to determine the locations, and depth of the holes. The Contractor shall prepare a DCP testing plan that includes a minimum of five (5) DCP tests per 1,000 meters. The Engineer shall review the testing plan and provide comments within seven (7) working days. DCP testing shall not commence until the testing plan is approved by the Engineer.

3.4 Treatment Plan

The holes shall be drilled through the pavement and above the area requiring treatment. The Contractor/Applicator shall be fully responsible to identify the location and to treat the voids and stabilize the base to the satisfaction of the Engineer. The Engineer shall review the treatment plan within seven (7) working days. Work shall not commence until the treatment plan is approved by the Engineer.

3.5 Injection of Polyurethane Material

The polyurethane material shall be injected through a 16 mm injection ports inserted into the drilled holes to the proper depth, or depths, as shown in the treatment plan. The rate and amount of material injected to obtain proper densification of the subbase and subgrade soils shall be determined by the Engineer.

Continuous laser level or dial indicator micrometer readings shall be monitored by the Contractor during injection to determine sufficient material usage and soils densification as indicated by pavement movement. Injection shall cease immediately as soon as the affected area is raised to the required grade.

The Contractor shall be responsible for any excessive pavement lifting or pavement damage that may occur as a result of the Contractor's work. The Contractor shall repair any subject areas to the satisfaction of the Engineer at the Contractor's expense.

Upon completion of the injections, the Contractor shall perform a minimum of three (3) additional DCP tests as per approval of the Engineer to verify the effectivity of the treatment. If any adjustments in the depths or pattern of the injection points are needed, the Contractor shall propose the adjustments for approval by the Engineer prior to further injection. Once the adjustments have been approved, injection may proceed.

4. Warranty

The restored pavement shall not have a ± 5 mm difference in elevation to the adjacent pavement blocks within one (1) year from the date of completion. In the event that more than 5 mm of the movement in the injected area occurs, the Contractor shall restore the pavement to the proper grade together with void filling and densification at no cost to the Government.

5. Method of Measurement

The quantity of High Density Polyurethane Injection shall be measured for payment by the area (sq.m.) of the pavement block raised and accepted. Payment shall be the full compensation for furnishing the material specified, for performing polyurethane injection, laser survey, and profiling in accordance with the specification and approved plans and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

6. Basis of Payment

The accepted quantity, measured as prescribed in Section 5, Method of Measurement shall be paid for at the contract unit price for High Density Polyurethane Injection System.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
	High Density Polyurethane Injection	Square Meter