

SPECIFICATION

for

Sealing Infrastructure, Filling Voids, Densifying Soils and Raising Pavements

using

Expanding Polyurethane Materials

1.0 DESCRIPTION

- 1.1 The work consists of injecting expanding polyurethane material to various depths around buried pipes or utility accesses to:
- A. Seal leaking joints, connections and cracks;
 - B. Stabilize the soils around and under a pipe or utility access for support;
 - C. Stabilize the weakened soils so they will support the load they are bearing and;
 - D. Lift the concrete, asphalt or composite pavement to grade, if necessary.
- Sealing and supporting the leaking buried infrastructure will preserve its life and re-establish a sound base and sub-grade which will extend the life of the existing pavement.

2.0 MATERIAL

- 2.1 A two-part, closed cell, high density polyurethane system.
- 2.2 The material shall have a minimum free rise density of 3.0 lbs/cubic foot and a minimum compressive strength of 38 PSI.
- 2.3 The material shall be hydro-insensitive in its component reaction so that the injected product is not significantly compromised by soil moisture or free water under the pavement.
- 2.4 The high density polyurethane formulation shall reach 90% of full compressive strength within 15 minutes from the time of injection.
- 2.5 Contractor warrants the application of its products and methods for a period of one year from project completion. If at any time during the first year the material or application should fail, the Contractor shall repair the failure at no charge to the Contracting Authority. The material shall have a warranty against shrinkage and deterioration for a period of ten years. During the warranty period, the Contractor shall replace by injection any failed material at the Contractor's expense.
- 2.6 Testing and Submittals supplied by Contractor at Engineers request:
- A. Material Safety Data Sheets for all pertinent production materials.

- B. Certificate of Compliance from the manufacturer of the polyurethane component materials to be used. The certification shall include the results of density and compressive strength analysis performed in accordance with ASTM D 1622 and ASTM D 1621 respectively.
- C. A comparative panel test, witnessed by the Project Engineer, of injection of the Contractor's polyurethane material that demonstrates dimensional stability and hydro-insensitivity. The material shall be at ambient temperature and not heated. The resulting product shall demonstrate consistent closed cell polyurethane material. The methods for such a test are available from the Contractor.
- D. A copy of the Contractor's Employee Safety Manual specific to Polyurethane pavement raising, under-sealing, and infrastructure work.
- E. A report from an industrial hygienist who has conducted a personnel, production vehicle and typical jobsite safety review of the contractor's implementation procedures involving the polyurethane material.

3.0 CONSTRUCTION

- 3.1 The Contractor shall provide all equipment, materials, labor, and supervision required for the work. The Contracting Authority will provide on-site inspection personnel and engineering oversight for any special project conditions and specific project objectives. The Contracting Authority will be responsible to obtain and pay for any special permits as required for the work.
- 3.2 The Contractor shall have a minimum of three years of experience in performing this type of work and a minimum of thirty projects on which the Contractor has successfully done this type of work. Prior to beginning work, the Contractor shall submit certification to the Engineer that the Contractor meets the minimum required experience. The certification shall include a listing of previous clients with contact names and phone numbers.
- 3.3 The Contractor shall, at a minimum, provide the following equipment for such projects:
 - A. A truck-mounted pumping unit capable of injecting the high density polyurethane formulation beneath the pavements and controlling the volume of injected material along with the rate and magnitude of soil densification and/or pavement lifting, if required.
 - B. Pressure and temperature control devices to assure and maintain proper temperature and proportionate mixing of the polyurethane component materials. All necessary electric generators, compressors, heaters, hoses, containers, valves, and gauges to efficiently conduct and control the project work.

- C. Pneumatic and/or electric drills capable of efficiently drilling 7/8 inch diameter injection holes, or smaller, through pavement, to depths up to 30 feet.
 - D. Equipment to place metal or PVC probes to depths up to 30 feet.
 - E. Suitable laser levels and/or dial indicator devices, used to insure that the soils are sufficiently densified and that the pavement is raised to an even plane and to the required elevation.
 - F. A Dynamic Cone Penetrometer (DCP) capable of measuring soil density to a depth of 30 feet. The results of the DCP must be convertible to Standard Penetration Test (SPT).
- 3.4 A pavement profile from laser level readings or string lines shall be used to determine where the pavement needs to be raised.
- 3.5 The Contractor shall be responsible for and perform any work including damming pipes, sand-bagging, and pumping water as required to remove water from the work area to properly and safely perform the work.
- 3.6 If required an individual or series of dynamic cone penetrometer (DCP) test(s) shall be performed by the Contractor at the project location to locate the zone(s) of weak soil strata. This testing is referred to as pre-injection DCP testing as it is done prior to injection of the material.
- 3.7 In the project area, a series of 7/8 inch or smaller diameter holes shall be drilled through the pavement and underlying base to an appropriate depth as determined by the Contractor. Generally the pattern is 3 – 6 feet O.C. in three dimensions. This uniform sequential pattern of injection is determined by the Contractor based on soils testing information, results of section 3.6 above and experience.
- 3.8 Metal or PVC probes or injection nozzles shall be place in drilled holes to the depths determined by the Contractor.
- 3.9 The material shall be injected through the probes or injection nozzles until all known or encountered voids under the pavement are filled. The material shall then be injected through the probes or injection nozzles to the depth required to substantially seal the leaking structures (pipe joints, culverts, catch basins, utility accesses, etc.) or densify the soils. The material shall be injected in a manner to minimize the flow of material into the structures. To monitor the flow of material into the pipe, the Contractor may choose to: inject material into the soils from inside the structure; utilize a camera in the pipe; use the expanded gasket placement technique or a plug (bladder). The Contractor will remove excessive amounts of material out cropping in the structure. The Contractor shall determine the injection rate and amount of material.

- 3.10 In the event a confined space entry is required, the Contractor shall be certified in confined space entry and have the proper equipment to perform the work without additional cost.
- 3.11 At the completion of injection of the material the Contractor will perform a post-injection DCP test within 3' of the pre-injection DCP test locations completed in section 3.6 above. The results of the pre and post-injection DCP test shall be evaluated to determine if sufficient increases in soil densification has been achieved.
- 3.12 Corrections to the grade of adjacent slabs, if necessary and as determined by the Engineer, shall be made in the same manner that is required for pavement that is raised. All raised pavements must match the existing grade of adjacent slabs that provide positive drainage. Final elevations shall be within 1/4 inch of the required elevations as determined by the profile or the Engineer.
- 3.13 The Contractor shall be responsible for any pavement blowouts or excessive pavement lifting which may occur as a result of his work and shall repair the subject area to the satisfaction of the Project Engineer without additional cost.
- 3.14 The Contractor's injection nozzles shall prevent leakage during injection and shall be removed at completion or driven into the injection hole to a depth of 1 inch below the pavement surface. Holes shall be filled with the material to within 1 inch of the surface and a non-shrink grout placed flush to the pavement surface.
- 3.15 At the end of each work shift, the work area shall be left in a clean, swept, and neat condition.

4.0 METHOD of MEASUREMENT

- 4.1 Daily material usage shall be attested by the Engineer and the Contractor and reported on a field production report.
- 4.2 At the request of the Engineer, all pumping units in service shall perform a product density test by injecting a sample of the unit's polyurethane material into a test cylinder of known volume, provided by the Contracting Authority. The sample's net weight and density result shall be witnessed by the Engineer. The density shall not be less than the requirement of section 2.2 above.
- 4.3 The Contracting Authority may test the contents and quality of the polyurethane at the Contracting Authority's expense at any time.

5.0 BASIS of PAYMENT

- 5.1 The contracted price which shall include full compensation for furnishing all labor, supervision, materials, tools, equipment, and incidentals for all work as called for in this specification **or** by unit costs:

<u>Pay Item</u>	<u>Pay Unit</u>
Polyurethane Material	Pound (lbs.)
DCP Testing (1 pre and 1 post)	Set

- 5.2 Payment is full compensation for all work prescribed in this section.

END OF SPECIFICATION