

## **Injection Specifications**

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### **SOIL MODIFICATION WATER PRESSURE INJECTION (WPI) GUIDELINE SPECIFICATIONS**

#### **Purpose**

1. The purpose of this specification is to provide a procedural basis for using water pressure injection as a method to obtain a relatively uniform, moist, pre-swelled zone of soil beneath the floor slab. Specifically, the intent of this procedure is to reduce the average free swell potential of soil is within the injected zone to 1 percent or less.

#### **Material**

1. Only potable water shall be used during the entire injection process.
2. A non-ionic surfactant (wetting agent) will be added to the water according the manufacturer's recommendations, but, in no case will proportions be less than one part (undiluted) per 3,500 gallons of water.

#### **Application**

1. The water pressure injection work shall be accomplished after the site has been brought to near final subgrade elevation and prior to installation of any plumbing, trenches, and utilities.
2. The injection vehicle will have a minimum gross weight of 5 tons and shall be capable of making straight vertical penetrations to minimize pressure loss around the injector rods to at least the depths specified.
3. Injections will be continued to "REFUSAL" (until the maximum reasonable quantity of water has been injected into the soil and water is flowing freely at the surface, either out of previous injection holes or from areas where the surface soils have fractured).
4. Injection pipe(s) will penetrate the soil in approximately 12 to 18-inch intervals, injecting to refusal at each interval for the specified depth or impenetrable material, whichever occurs first. If a seemingly impenetrable layer is encountered, the geotechnical engineer of record must be contacted to evaluate the significance of the lack of penetration with the injector tubes or provide alternate recommendations. A minimum of seven (7) injection intervals will be provided for the 10 ft. injection depth and five (5) for the 7 ft. injection depth. The lower portion of the injection pipe will consist of a hole pattern that will uniformly disperse water throughout the entire depth.

5. Spacing for the injections will not exceed 5 feet on-center each way. Subsequent injections will be offset in two orthogonal directions at one-half the distance between the original injection centers.

6. Injection pressures should be adjusted to inject the greatest quantity of water possible within a pressure range of 50 - 200 psi pump pressure.

7. After a minimum curing time of 24 hours, the water injected pad shall be tested for moisture content and swell abatement to determine if additional injections with water are necessary. Subsequent water injections will be 5 feet on-center each way and spaced 2 1/2 feet offset in two orthogonal directions from the initial injection.

### **Special Considerations**

Several water injections may be required to achieve the desired final moisture content and corresponding soil swell abatement. A minimum 24 hour waiting period should be implemented between water injection passes. Due to variations in the subsurface soils, the number of injection passes required to reduce the swell potential of the injected soils to 1 percent or less is unknown. Hence, the Client should allow for extra construction time on the site considering the time frame required to achieve the desired reduction in swell potential is unknown.

Between the time the sub grade is water pressure injected and either the nonexpansive material or plastic sheeting is placed, the upper surface of the injected soil should not be allowed to dry.

To allow for adequate pre-swelling of the soils from the injection procedure, concrete for slabs should not be placed above injected areas until at least two (2) weeks following the final water injection. During this two week period, the surface of the injected soil must be kept moist or covered with plastic sheeting to prevent moisture loss. An unknown level of heave can be expected in the pad during and shortly after completion of the injection process.

Additionally, experience indicates injection adjacent to existing structures (such as, but not limited to, buildings, pavements, grade slabs, and buried utility conduits) can result in swelling of soil in the injected zone as well as those beneath existing nearby structures. Swelling of soil supporting existing structures can result in distress (movement) to existing structures. Therefore, if an existing structure or property line is located within 30 ft. of the proposed water injection area, it is recommended a temporary vertical moisture barrier be installed longitudinally between the existing structure and the injected pad to prevent injected water from entering the subgrade of the existing structure. The moisture barrier could consist of an 11-ft deep trench (about 1 ft. wide) backfilled with lean concrete or other suitable relatively impermeable material for a 10ft injection depth. For a 7 ft. injection depth, an 8 ft. deep trench could be utilized.