Expanding Structural Polymer

Tommy Russum
Tom Strauss, P.E.

ADVANTAGES

- Time
- Injection v. Point Load
- Site
- Durability
- Access
- Disturbance
### Project Challenges

- Foundation Settlement up to 1-3/8” along the wall.
- Length of roof of structure – 84’
- 4500 LBS/Lineal Foot
- Interior and Exterior Flatwork settlement
- Large picture windows
- Elevated Construction with Retaining walls

### Solution

- Inject ESP using multiple elevations to stabilize weak base work.
- On-site Testing to determine weak soil zones
- Utilize precise locations to cradle foundation to lift soil mass back to target grade
- Injection System that meets or exceeds the original foundation performance standard.

### Support

- Designed injection locations, quantities and depths with ISG & Associates
- Pre-construction and Safety meeting onsite with crew
- On-site installation

### Outcome

- Foundation Restoration: ESP compacted and void-filled loose surrounding soils to rehabilitate foundation system and lift and realign foundation and surrounding flatwork
- In-situ Technology: Restored and increased soil load-bearing capacity at depth in 3 days with minimal disruption

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**SITE ACCESS**

- **ENGINEERED DESIGN**
- **PRECISE IMPLEMENTATION**
- **UTILITY CONFLICT**
- **TIGHT CONDITIONS**

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ISG Associates, Inc.

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MINIMAL DISTURBANCE

<table>
<thead>
<tr>
<th>Project Challenges</th>
<th>Solution</th>
<th>Support</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 50,000-gallon milk tank and foundation pad were settling, also affecting 2 adjacent buildings.</td>
<td>• The ESP process was used to stabilize and bridge weak soils at two different levels below the pad.</td>
<td>• Designed and injection plan that would allow the densified soils to bridge over the weaker soils at depth, which was more cost efficient approach.</td>
<td>• No lost production. The tank was filled and emptied 3x per day while crews worked, and no production was lost.</td>
</tr>
<tr>
<td>• High water table and fine grain soils (80% passing 200 sieve).</td>
<td>• Grouting with ESP added just over 7,000 lbs of materials, where cementitious grout would have added over 25 tons.</td>
<td></td>
<td>• The tank pad was monitored for 2 years after ESP stabilized the soils, and no settlement was observed.</td>
</tr>
<tr>
<td>• No bearing horizon down to 75' below the surface</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DURABILITY

<table>
<thead>
<tr>
<th>TEST BOXES</th>
<th>STRENGTH</th>
<th>TRUST but VERIFY</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>• R&amp;D to replicate geographic location</td>
<td>• No lateral support tracks lifted off ground</td>
<td>• Engineer Support to put the polymer to the test</td>
<td>• ENCAPSULATES &amp; BINDS AGGREGATE</td>
</tr>
<tr>
<td>• Test ESP in native soils</td>
<td></td>
<td></td>
<td>• Densifies &amp; Weak areas COMPACTED</td>
</tr>
</tbody>
</table>

ISG Associates, Inc.

Randall W. Brown, PhD, PE
Vice President for Engineering
URETEK USA, Inc.
PO Box 1929
Tomball, Texas 77377
Subject: Certification for URETEK High Density Polyurethane Grout

BEI Project No. 13-071

Dear Dr. Brown:

Boudreau Engineering, Inc. (BEI) has completed the required physical property testing of a high density polyurethane grout referenced as URETEK 486 (02-40R-V3). The testing was conducted in conformance to applicable ASTM and AASHTO Test Standards. Those pertinent to the Mississippi Department of Transportation’s Special Provision No. 907-420-4 are summarized below.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test Method</th>
<th>Result</th>
<th>Specified Value (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, lbs./ft.</td>
<td>ASTM D1622</td>
<td>8.13</td>
<td>4.0</td>
</tr>
<tr>
<td>Tensile Strength, psi</td>
<td>ASTM D1622</td>
<td>127</td>
<td>100</td>
</tr>
<tr>
<td>Compressive Strength, psi (at yield point)</td>
<td>ASTM D1621</td>
<td>160</td>
<td>90</td>
</tr>
</tbody>
</table>

The test results summarized in the table above clearly demonstrate that this high density polyurethane grout satisfies the requirements set forth by the Mississippi Department of Transportation.

If you have any questions, please do not hesitate to contact me at (404) 388-1137.

Sincerely,

Richard L. Boudreau, P.E.
Executive VP – Director of Engineering

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Norcross, GA 30092
404.388.1137
INJECTION V. POINT LOAD

ISG Associates, Inc.

Expanding Structural Polymer

Tommy Russum
Tom Strauss, P.E.
KAAPA ETHANOL RAVENNA, NEBRASKA
750,000 Gallon Storage Tank
3,800 Load Sq. Ft  60 Ft Diameter

Proximity of berm to tank
Ditch
Proximity of pipe chase to berm

BERM PROXIMITY TO STORAGE TANK
Small Site Footprint

Proximity of berm to tank
Ditch
Berm
Berm Toe

ISG Associates, Inc.
Peerless Compaction Grouting
NO MODIFICATIONS TO BASE STRUCTURE SYSTEM
Limited Modification to Construction Schedule

SIMPLICITY OF THE INSTALLATION
Completed Without Altering Restrictive Access
Saved 3+ Months on Construction Scheduling
Lexington VIADUCT: SOUTH ADAMS STREET & HWY 30  
Lexington, Nebraska

Segmented Wall Anchor Failure  
North and South Abutments

LARGEST DISPLACEMENT 6 INCHES  
Moved 2 Inches in 6 Months
**DRILLING FOR ANCHOR SYSTEM**
Use of Platform for Injection and General Repairs

**ANCHORS INSTALLED**
Injection Tubes Placed and Ready for Injection
**NO NEED FOR ROAD CLOSURE**

Completed Repair with Minimal Disturbance to Existing Structure

Aesthetically Pleasing Results

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**Restorative Structural Demolition**

*Partial Structural Demolition*

Task: Increase Foundation and Footing Capacities
From 6,000 to 11,000 Sq. Ft.
PLACEMENT OF INJECTION RODS

Quantity Dependent on Size and Measure of improvement Necessary

INJECTION OF BASEMENT AREA

Limited Access to Entire Foundation
INJECTION TO AREAS OF VARYING CONDITIONS

OUTER STRUCTURE COMPLETED
Improved Structure in Place and Without Modifications

Restorative Justice Center
Des Moines, IA
**BIG LIFT**
Poor Initial Slope Stability
45 Ft Slope
Structure Sliding Towards Pond

**POND CUT THROUGH A SAND SEAM FAILURE**
Solution: Fill in Pond and Stabilize Berm

Winter Working Conditions
ESP SLOPE STABILIZATION INJECTIONS

7,000 SQ FT LIFT AREA
Lifted From 0 to Over 6.5 Displacement
PORTABLE DCP TEST BEFORE AND AFTER INJECTIONS

Correlates to SPT and UNC

ADVANTAGES

QUESTIONS?