Proposed Low Groundwater Solution

Ryan McTigue
Jake Leahey
Dan Walton

Senior Design Project
Civil & Construction Engineering
City of Boston
1670 Shoreline outline
Neighborhood Location - South End, Boston

- Next to Back Bay Station & Mass Pike
- Berkeley St, Clarendon St, and Chandler St. 2004
The Problem

- Area of design project has a persistent problem of low groundwater
- A recharge system has been set at St. Charles St.
- Wood pile tops will rot if not submerged under groundwater
Current Groundwater Elevations
Exposed Piles & Low Groundwater
Solutions

- Underpin all 55 houses within project design area (eventual cost $15-20 million)
- Fix leak at MBTA/railroad structure ($8-10 million not including cost of disruption to railroad traffic)
- Permanent recharge from hydrants: current hydrant at 6 gal/min = 3,153,600 gal/year = $30,000/yr.
- Enclose the design area within a grout curtain creating a “bath tub” to retain groundwater within the curtain wall
Typical Profile

- Depths Below Street
  - Basement: 6’
  - Top of Piles: 14’
  - Organic Silt: 22’
- Grout Wall
  - Top: 13’ & 12’
  - Bottom: 25’
Grout Curtain Routing
Demonstration of Grout Curtain

Photo courtesy of
Hayward Baker
Installation-Jet Grout

- 4” dia. installation holes drilled to desired bottom elevation every 4’ +/-
- Curtain started @ desired depth
- Curtain is formed up to desired top elev.
- Wall sections installed incrementally
Main Utilities
Grout Curtain w/ Utilities
Grout Curtain Under Utilities
Today - Exposed Piles
Install Grout Curtain
Raised Groundwater Submerges Piles
Advantages of Grout Curtain

- Cost effective solution
- Structures within walls of curtain unaffected by groundwater level drops outside of walls
- Sidewalk readily restored to existing conditions
- Small machine used to place grout curtain
- Grout curtain will be placed on public property
- Unaffected by future sidewalk / utility reconstruction
- No future maintenance
Disadvantages to Grout Curtain

- Once installed, no disadvantages
- During construction-small local messes, cleaned daily
- General construction inconveniences (blocked sidewalks, operating noise from installation rig)
- Daytime parking within path of installation may be affected (overnight parking, generally available)
## Cost Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design engineering</td>
<td>$250,000</td>
</tr>
<tr>
<td>Test pits, etc.</td>
<td>$125,000</td>
</tr>
<tr>
<td>Jet grout wall: Mobilization/De-mobilization</td>
<td>$20,000</td>
</tr>
<tr>
<td>18,500 ft² of wall</td>
<td>$1,110,000</td>
</tr>
<tr>
<td>25% Contingency</td>
<td>$277,500</td>
</tr>
<tr>
<td>Police detail, permits, utility clearance</td>
<td>Allow $200,000</td>
</tr>
<tr>
<td>Total jet grout</td>
<td>$1,607,500</td>
</tr>
<tr>
<td>Surface reconstruction (if required by DPW)</td>
<td>?</td>
</tr>
<tr>
<td>Total estimated cost</td>
<td>$1,982,500</td>
</tr>
</tbody>
</table>
### Time to Install

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Preparation</td>
<td>1 month</td>
</tr>
<tr>
<td>Jet Grouting</td>
<td>2-3 months</td>
</tr>
<tr>
<td>Surface Restoration</td>
<td>1-2 months</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6-8 months</strong></td>
</tr>
</tbody>
</table>
Summary

- Grout curtain:
  - Cost effective, relatively non-intrusive, and rapidly constructed
  - Zero maintenance cost
  - Neighborhood appearance unaffected
  - Eliminates need for future recharge systems