Innovative Strategies for Bridge Preservation: A Case Study on Pile Jackets in Cape Cod

Charles Packer, PE
BL Companies
South Main Street over Bumps River, Barnstable
Case Study
South Main Street over Bumps River, Barnstable, Case Study
FASTEN PILE JACKET AS RECOMMENDED BY MANUFACTURER

FIBERGLASS PILE JACKET (\(\frac{3}{8}\)" MINIMUM THICKNESS)

UNDERWATER NON-SHRINK GROUT

2"X2" CARBON FIBER OR GALVANIZED STEEL GRID

EXISTING PILE

INJECTION PORT (TYP.)

3"

1'-0"

2" (MIN.)

REMOVE AND REATTACH EXISTING 3X8, REPLACE AS NEEDED BASED ON THE APPROVAL OF THE ENGINEER

3/8" DIA. TIMBER BOLT (REUSE EXISTING BOLTS AS APPROVED BY THE ENGINEER)
# BID RESULTS 9-29-2020

Contractor 1 Awarded Contract based on overall Bid

<table>
<thead>
<tr>
<th>UNIT</th>
<th>QUANTITY</th>
<th>CONTRACTOR 1</th>
<th>CONTRACTOR 2</th>
<th>CONTRACTOR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPAIRS TO TIMBER PILES</td>
<td>LF 540</td>
<td>$626.4 K</td>
<td>$588.6 K</td>
<td>$275.4K</td>
</tr>
</tbody>
</table>
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SUBSTRUCTURE CONDITION RATING

9/5/2019
Underwater Inspection (Pre-Repairs)
5-Fair

4-Poor
7/23/2020
Routine and Special Member Inspection (Pre-Repairs)

7/5/2022
Routine Inspection (Post Repairs)
6-Satisfactory

7-Very Good
10/26/2023
Underwater Inspection

BEFORE

AFTER
LESSONS LEARNED

- Bid on an EA Unit not LF
- Consideration for Form Work Cost and Methods
- Encapsulate Entire Pile?
- Guidance Regarding Connections to Piles
- Grout for Other Contract Items
FABRICATION
Technical Information
Axial Compression
<table>
<thead>
<tr>
<th>Specimen</th>
<th>Added Diameter (Including Jacket)</th>
<th>Grout Type</th>
<th>Max Stress (KSI)</th>
<th>Percent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (8.75” Timber)</td>
<td>NA</td>
<td>NA</td>
<td>2.10</td>
<td>NA</td>
</tr>
<tr>
<td>Specimen 1</td>
<td>5.50 in.</td>
<td>Seashield 510 U/W Grout (9ksi-28 day)</td>
<td>2.71</td>
<td>29%</td>
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<tr>
<td>Specimen 2</td>
<td>5.56 in.</td>
<td>Seashield 510 U/W Grout (9ksi-28 day)</td>
<td>2.5</td>
<td>19%</td>
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<tr>
<td>Specimen 3</td>
<td>3.75 in.</td>
<td>Seashield 550 Grout (9.9ksi-11.2 - 28 day)</td>
<td>3.5</td>
<td>66%</td>
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<tr>
<td>Specimen 4</td>
<td>3.88 in.</td>
<td>Seashield 550 Grout (9.9ksi-11.2 - 28 day)</td>
<td>3.73</td>
<td>77%</td>
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</tbody>
</table>
TECHNICAL INFORMATION
BENDING
## TECHNICAL INFORMATION

### Bending

<table>
<thead>
<tr>
<th>Added Diameter (Including Jacket)</th>
<th>Grout Type</th>
<th>Max Load (Kips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (~8” Diameter)</td>
<td>NA</td>
<td>9.05</td>
</tr>
<tr>
<td>Specimen 1</td>
<td>Epoxy Grout</td>
<td>20.5</td>
</tr>
<tr>
<td>Specimen 2</td>
<td>Cementitious Grout</td>
<td>23.5</td>
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</tbody>
</table>
FUTURE RESEARCH AND CONSIDERATIONS

Standardized Bolted Connection Detail
FUTURE RESEARCH AND CONSIDERATIONS

Standardized Forming Detail
FUTURE RESEARCH AND CONSIDERATIONS

Standardized Temporary Bracing
FUTURE RESEARCH AND CONSIDERATIONS

Ability to Increase Unbraced Lengths