Unknown Foundations Investigations
The Experiences of the LA DOTD
Background & Stats

• 1990’s – Began assessing bridges for scour susceptibility.
• Bridges without plans rated “U” - Unknown
• Keeping an eye on the uncertain ones.
• 2002 – 5,460 Unknown Foundations
• No real method to eliminate them except replace them as we are able……(250 yrs)
LADOTD Bridge Inspection

- Divided into 10 parts – 9 districts, 1 HQ
- Program manager at HQ manages statewide
- 2 year inspection cycle
- Bridge inspectors collect streambed profile to be kept with bridge inspections
• Non-State owned bridges make up most of our unknowns
• Many of them are timber
• No pile driving records
• No record of what standard plan they are from
Research

• In 2003, LA DOTD was approached by FDH-SE, Inc. (Dispersive Wave)

• Parallel Seismic
• Cross bore-hole logging
• Sonic Echo
Technology Demo

• 3 bridges tested (2 concrete, 1 timber)
• 2.66% - Average error for concrete
• 4.92% - Average error for timber
Pilot Project

- 107 Bridges were tested
- 11 “Control” structures
Test Pile Selection

• Location of channel
• Previous streambed profiles
• Pile conditions per most recent inspection reports
• Good locations for distribution statewide
Distribution of Test Sites
Issues Identified

• Inconsistent results for steel piles
• Larger errors in timber piles than expected
Typical Steel Results Experienced

Length Result Comparison (Site# XXX)

Test Pile

<table>
<thead>
<tr>
<th></th>
<th>B3P2</th>
<th>B4P3</th>
<th>B7P3</th>
<th>B8P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Length</td>
<td>40.5</td>
<td>55.0</td>
<td>49.8</td>
<td>48.7</td>
</tr>
<tr>
<td>Rec. Length</td>
<td>76.00</td>
<td>56.00</td>
<td>75.50</td>
<td>55.92</td>
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</table>
Typical Timber Results Experienced

Length Result Comparison (Pilot Project)

Test Pile

- B2P4
- B2P5

Pile Length (ft)

<table>
<thead>
<tr>
<th>Pile Length</th>
<th>Comp. Length</th>
<th>Rec. Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.0</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>39.75</td>
<td>39.75</td>
<td>39.10</td>
</tr>
</tbody>
</table>

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Problems with Steel Bridges

• LADOTD observed very large errors in computed vs. recorded pile length
Other Results

- 2.69% - Average error for concrete piles
- Timber results varied because of poor selection of control structures
Typical Concrete Results Experienced

Length Result Comparison (Site# XXX)

Test Pile

<table>
<thead>
<tr>
<th>B2P1</th>
<th>B3P2</th>
<th>B4P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.5</td>
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<td></td>
</tr>
<tr>
<td>35.00</td>
<td>34.10</td>
<td>34.30</td>
</tr>
</tbody>
</table>

Pile Length (ft)

- Comp. Length
- Rec. Length

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Typical Timber Results
Experienced

Length Result Comparison (Demo)

Test Pile

B7 P5

B8 P5

Rec. Length

Comp. Length

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LADOTD Data Usage

• Bridge Scour analysis to be conducted
  – Phase 1 and 2
• Scour Susceptibility rated based on predicted scour and tested pile length
• Statistical approach to selecting future testing sites
Scour Vulnerability Codes

• Structure Inventory and Appraisal Coding Guide
  – Item 113

• Range from 9-0, indicating vulnerability to scour

• Also have “N”, “U”, and “T” ratings
Scour Vulnerability Codes Cont’d

• 8 - indicates that bridge foundation is stable for calculated scour conditions
• 6 – indicates bridge has not yet been evaluated for scour
• 3 – indicates a structure that is scour critical
Testing

- LA DOTD Contracted FDH-SE, Inc. to test 1248 concrete and timber piles
- FDH promised to find the problem with steel pile testing
- LA DOTD assisted them (at no cost) in verifying a testing procedure for steel piles
Upgrades in Testing Methodology

- Dispersive wave
- Problems with steel piles prompted switch to Parallel Seismic
S.P.# 700-99-0378

- Data mining operation (unknowns)
- Scour Analysis and NDT Testing on approx. 1,156 bridges statewide
- Three piles per bridge
- 110 “knowns” inserted for QA/QC
S.P.# 700-99-0378 Cont’d

• 75% completion
• 5% tolerance in pile lengths

• Trouble Bridges:
  – Have no pile records
  – Awaiting PE review
  – Awaiting pile data from LADOTD
S.P.# 700-99-0499

• Awarded Jan. 2010
• Approx. 900 bridges
  – 50% timber
  – 42% concrete
  – 8% steel

• 90 “knowns” for QA/QC
Forecast

• At the conclusion of S.P.#700-99-0499, LADOTD will have approx. 2,433 unknown structures left in our database

• LADOTD estimates that the majority of these will be 3’s and 6’s due to age of the inventory
Observations

• LADOTD has been pro-active in removal of unknown foundation
• Dispersive wave and parallel seismic work best for our application, but open to other methods
• LADOTD will continue to decrease number of unknowns in accordance with FHWA
• Cost will play a significant role
Questions ???
Comments /
Suggestions
Thank you!