Dewey Dam
Seismic Assessment

2005 Tri-Service Infrastructure Systems
Conference
St. Louis, MO
Site Location

Cincinnati, OH
Huntington, WV
Lexington, KY
Dewey Dam
Project Description

- Homogeneous Earth Dam
- 118' Tall; 913' Long
- On John's Creek
- Completed in 1949
Typical Embankment Section

Station 3+50

Elev. 718’
Seasonal Pool Elev. 650’
Clay
Sands and Silts
Filter Blanket
Rock Toe
Seismic Assessment

- Intermediate Seismic Assessment 1995
- Feature Design Memorandum 1997
- SPT & CPT Tests 1996-98
- Seismic Assessment Report 1998

View of Downstream Area
1998 Seismic Analysis Report

Conclusions

- Remediation Cost $\approx$ $13$ Million

Recommendations

- Site Specific Seismic Study (2000)
- Additional Field Work (1999)
- Hydro-fracture Potential (1999)
- Specific Design Criteria (pending)
• Incorporated the TARA model into FLAC
• Obtained Parameters used by Dr. Finn
• Completed 1998 TARA Analysis using FLAC
• Dr. Finn Reviewed & Concurred with Results
TARA – FLAC Comparison

TARA

- Static Analysis w/ Gravity
- Seismic Analysis w/o Gravity
- Deformation Analysis w/ Gravity

FLAC

- All Combined w/ Gravity
# TARA – FLAC Comparison

## Idealized Cross-Section

<table>
<thead>
<tr>
<th>Region</th>
<th>Unit Weights</th>
<th>Undrained Strength</th>
<th>Drained Strength</th>
<th>Clean Sand</th>
<th>Residual Strength</th>
<th>Shear Modulus</th>
<th>PWP Model</th>
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<tbody>
<tr>
<td>Embankment</td>
<td>127, 130</td>
<td>18, 2.0</td>
<td>29.0, 0.0</td>
<td>--</td>
<td>--</td>
<td>60-80</td>
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<td>Filter Blanket</td>
<td>--, 130</td>
<td>16, 1.8</td>
<td>34.0, 0.0</td>
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<td>--</td>
<td>60</td>
<td>--</td>
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<tr>
<td>Toe Drain</td>
<td>110, 110</td>
<td>--, --</td>
<td>38.0, 0.0</td>
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<td>--</td>
<td>61</td>
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<td>--, 133</td>
<td>16, 1.8</td>
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<td>0.7</td>
<td>27</td>
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<td>16, 1.8</td>
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<td>0.6</td>
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<td>16, 1.8</td>
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<td>14</td>
<td>0.5</td>
<td>27</td>
<td>0.0279-0.0287</td>
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<td>30.0, 0.0</td>
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<td>0.4</td>
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<td>11</td>
<td>0.3</td>
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<td>0.2</td>
<td>27</td>
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<td>Foundation #7</td>
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<td>5</td>
<td>0.1</td>
<td>27</td>
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</tbody>
</table>

\[ C_1 = 0.76; C_2 = 0.53 \]
TARA – FLAC Comparison
FLAC PWP Calibration

- FLAC Modeling Calibrated with Time History and ENC.
- Results for both analyses shown for comparison.
TARA – FLAC Comparison
TARA – FLAC Comparison

Excess PWP Ratio Contours
Existing Condition Analyses

- New Design Earthquake, $M_w = 5.5$, PGA=0.17
- Three Time Histories
- Improved Characterization of Foundation
- Undrained Strengths in Embankment
- Review and Concurrence by Dr. Finn
Existing Condition Analyses

Design Time Histories

![Graph showing time histories with labels: Synthetic, Miramichi, Nahanni.](image-url)
Deformations

Maximum Displacement 0.25 feet
Existing Condition Analyses

Shear Strain

Excess PWP Ratio

Contour interval = 5.00E-04
Max. shear strain increment

Contour interval = 2.50E-03

Post Earthquake SF = 1.6
1998 TARA Analyses for OBE

- OBE $M_w = 5.0$ w/ PGA=0.09g
- New Design MCE $M_w = 5.5$ w/ PGA = 0.17g
- TARA OBE used $M_w = 5.5$ w/ PGA = 0.09g
  - System Stable w/ Excess PWP < 13%
- FLAC New MCE
  - System Stable w/ Excess PWP < 25%
Distance and Magnitude

(USBR)
Summary

• TARA model incorporated into FLAC
• FLAC analyses compare well with TARA
• New existing condition analyses indicate a stable dam because:
  – Reduced earthquake magnitude
  – Use of undrained strengths in embankment
  – Improved foundation characterization
• Dr. Finn reviewed and concurred with results.
Recommendations

- Remediation of Dewey Dam unwarranted at this time.
- Further assessment warranted only upon advancement of the state-of-the-art.
- Prepare a comprehensive seismic analysis report incorporating the present study.
Huntington District

Teaming to Provide Practical Solutions to Complex Problems