“Drilled Shafts for Bridge Foundation Stability Improvement: Ohio 833 Bridge over the Ohio River”

Meigs County, Ohio
Mason County, West Virginia

By
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Project Location

[Map showingProject Location in Ohio]
Project Team

- **Owner:** ODOT/WVDOT
- **Designer:** URS Corporation
- **Contractor:** Mahan/National Joint Venture
- **Geotechnical Consultant –** FMSM
Existing Structure

[Image of a bridge spanning a river, with labels indicating Ohio and West Virginia]
Proposed Structure
## Project Timeline

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Background

- Slope Inclinometers/Controlled Rate-of-Fill
- Initial Detection of Movement
- Additional Instrumentation
- Extents of Movement
Probable Causes of Slope Movement

- Weak slickensided clay shale (mudstone)
- Possible ancient movement
- Construction activity/embankment
- Rapid drawdown cycles of Ohio River
Extents of Slope Movement

Approximate Limits of Slope Movement
Slope Geology/Geometry

- Residual Clay
- New Fill
- Existing Fill
- Alluvial Silt and Clay
- Shale/Clay Shale/Mudstone Bedrock
- Apparent Failure Surface
- Siltstone
- Ohio River
Options for Stabilization

- Drilled Shafts – Cantilevered or Tied Back
- Truncated Drilled Shafts
- Tied-Back Precast Concrete Panels
Option 1: Drilled Shafts

- Residual Clay
- New Fill
- Existing Fill
- Alluvial Silt and Clay
- Apparent Failure Surface
- Shale/Clay Shale/Mudstone Bedrock
- Siltstone
- Ohio River
Option 2: Truncated Drilled Shafts

- Shale/Clay Shale/Mudstone
- Bedrock
- Residual Clay
- Alluvial Silt and Clay
- Existing Fill
- New Fill
- Apparent Failure Surface
- Siltstone
- Ohio River
Option 3: Tied Back Precast Concrete Panels

- Residual Clay
- New Fill
- Existing Fill
- Shale/Clay/Shale/Mudstone Bedrock
- Alluvial Silt and Clay
- Apparent Failure Surface
- Siltstone

Ohio River

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ODOT’s Preferred Option and Related Decisions

- Drilled shafts with no tiebacks
- Realign Main Street
- Ohio Touch-Down Pier and Abutment Foundations
- Instrumentation Program
Stabilization Shaft Design Methodology

- Limit-Equilibrium method-of-slices used to determine net driving forces
- The force per drilled shaft determined by Dr. Liang’s (U. of Akron) method, which takes into account arching between shafts
- LPile Analysis
Final Design for Bridge Foundation Stabilization

8' Diameter Drilled Shafts on 12' c/c Spacing
Revised Roadway Plan
Instrumentation

- Existing Bridge – tiltmeters, thermistors, survey targets
- Touch-Down Pier Shafts – strain gauges, inclinometer casing
- Stabilization Shafts – strain gauges, thermistors, inclinometer casing, tiltmeters
Stabilization Shaft Instrumentation Plan

FIGURE A - PLAN VIEW OF STABILIZATION SHAFTS
SCALE 1"=10'

Note: Instrumented Shafts Are Shown Cross-Hatched.
Preliminary Results of Instrumentation/Monitoring Program

- Slope Inclinometers – Limits of movement slowly moving toward new bridge
- Existing Bridge – No significant movement of the abutment or piers
- New Bridge Touch-Down Pier – No apparent lateral loading or movement detected (interpretation complicated by construction activity)
- Stabilization Drilled Shafts – Minimal data collected to date
Touch-Down Pier Instrumentation Data
Slope Inclinometers

Cumulative Displacements at Elevation 578 ft
Pier 7 Drilled Shaft 52
Pomeroy-Mason Bridge Project
Mingo County, Ohio
Touch-Down Pier Instrumentation
Strain Gauges

DS-52: Moment Diagram
With regression from L/R gages

Elevation (ft)
- Bottom of Cap
- Top of Rock
- Bottom of Shaft

Moment (kip-ft)
-6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000 5000 6000
Positive Moment = Tension on Upslope Face

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