Geotechnical Session-Summary

National Workshop on Highway Asset Management & Data Collection

September 25, 2008
Durham, North Carolina

Session Committee
Mo Gabr
K. J. Kim
Chris Kreider
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Geotechnical Assets

Unknown Foundation	**▪Length of piles: timber, concrete, and steel**
Bridge Approach Slab	**▪Relative movement of bridge slab and flexible pavement**
Drilled Shaft Foundation	**▪Depth of defect ▪Geometrical changes/discontinuities in cross-section ▪Automating the measurement of depth of scour**
Retaining Walls	**▪ Wall Inventory ▪ Condition Assessment**

Geotechnical Engineering Assets and Liabilities on Surface Transportation Facilities

Jerry A. DiMaggio, P. E., M. ASCE
Principal Bridge Engineer - Geotechnical
Federal Highway Administration, Washington D.C.

Effective Very Soon: Implementation Manager of SHRP2 Program at the National Academies

Asset Management of Geotechnical Features

- **Defined Geotechnical Assets**
  - 175 million ft^2 of wall at \$20-\$200/ft^2
  - Highway infrastructure is “in” or “on” Soils and Rock
- **Asset Management**
  - Excluding Geotechnical Features “since they last forever”
  - Aging Infrastructure, Growing Congestion, Funding Limitations
  - Increase in Load and Performance Requirements
  - Management of Data as Assets; Quality is an issue!
  - Life Cycle Cost Analysis

Asset Management of Geotechnical Features

Challenges:

- Asset Management and decision making
- Performance measures
- Top management support and commitment
- Individuals responsible for implementation
- Overcome resistance to change

Asset Management and Condition Assessment of Buried Metal Tensioned Systems in Geotechnical Applications

Kenneth L. Fishman, Ph.D., P.E., President,

ERTesting

Asset Management of Geotechnical Features

- **Focus Assets**
  - ❑ MSE, Rock Bolt, Ground Anchors Soil Nails
  - ❑ Data Base of Assets
  - ❑ Field Testing and Techniques: Potential of Corrosion and Corrosion Rate (polarization Resistance Test)
  - ❑ North Carolina and California Programs
- **Results**
  - ❑ MSE Walls in North Carolina ~0.5 mohm/yr
  - ❑ High Quality of Backfill
  - ❑ In Comparison, CA is on the average one order of magnitude higher than NC; often do not meet AASHTO's 4 mohm/yr
- **Asset Life Expectancy**
  - ❑ Document Performance
  - ❑ Check Design Assumptions
  - ❑ Maintenance Needs

NPS Wall Inventory Program

Program Development and Implementation

Matthew DeMarco

Central Federal Lands Highway Division

Asset Management of Geotechnical Features

Focus Assets

- ❑Earth Retaining Structures (including Culverts)
- ❑Inventory of ERS
- ❑Data Base of Assets including Attributes and Condition Assessment

Wall Type, Function, Recommended Actions

Results

- ❑Work Orders:~ $3K – maintenance, , $35K – minor/major repair, ~$250K – replacement
- ❑Condition Versus Performance
- ❑$15+M Total Deferred Maintenance, $400+M Total Wall Assets
- ❑FCI = 0.04

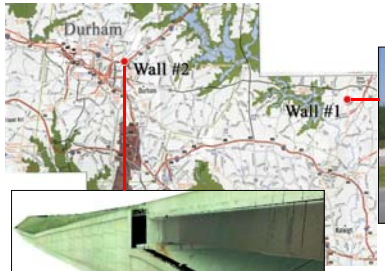
Resources

- ❑Completion of NPS WIP Procedures Manual 2008
- ❑New ERS Brochure from FHWA

Office of Asset Management: http://www.fhwa.dot.gov/asset/if08014/

Mechanically Stabilized Earth Walls

- Map

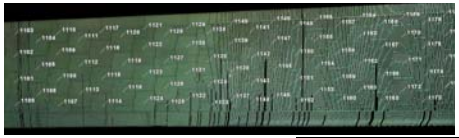


1. US-1/NC-98 MSE Wall:
On the right side of Northbound US1 under NC98

2. I-85/US-70 Tie-back Wall:
On Southbound I-85 where the US70 Westbound flyover bridge ties into SB I-85

Mechanically Stabilized Earth Walls

US-1/NC-98 MSE Wall: LiDar Survey
On the right side of Northbound US-1 under NC98



Items	US 1 - NC 98	US 70 - I-85
Wall Coordinates		
Height		
Length		
Wall Type	MSE Wall	Tie-Back Wall
Backfill Type		
Foundation Type		
Year Built		
Survey Year		

Condition Assessment of Unknown Foundations

Presented by Larry D. Olson, P.E.

Olson Engineering, Inc.

Olson Instruments, Inc.

Wheat Ridge , Colorado – Rutherford, New Jersey – Hercules, California – Socorro, New Mexico

Asset Management of Geotechnical Features

- **Focus Assets**
  - ❑ Unknown Foundation: type and Geometry
  - ❑ 88,826 with 26000 “Scour Critical” (2002 Data)
  - ❑ NCHRP 21-5 “Determination of Unknown Bridge Foundation Parallel Seismic Method Research Results”
  - ❑ Foundations
    - Parallel Seismic
    - Ultraseismic
    - Sonic Echo/Impulse Response
  - ❑ North Carolina Program: Performed Tests at 100 Sites
- **Results (Think within10% Accuracy)**
  - ❑ Several Case Studies Show Parallel Seismic Borehole to be Robust
  - ❑ Induction Field, Radar, Sonic Echo, Surface Waves have Specialized Uses
  - ❑ Suggest 1 Parallel Seismic Test and Ultraseismic Tests for Correlation on piles, etc.
  - ❑ Surface Tests did not See Below Pilecap

Asset Management of Geotechnical Features

Wake Bridge 235-Steel Piles (Pile#8)


- **12x53 Piles Set in Concrete Encasement**
- **Estimated Length from Rod=16.6 ft**
- **Estimated Length from PIT = 16.9 ft**
- **Length of Pile #7 from Record = 16’ 8”**

Asset Management of Geotechnical Features

Wake Bridge 182-Concrete Piles


- **12 inch Prestressed Concrete**
- **Estimated Length from Rod=29.7 ft**
- **Estimated Length from PIT = 31 ft**
- **Length of Pile from Bridge Scour Assessment = 44.9 ft**

The Bump at the End of the Bridge:
Can We Avoid or Correct
Poor Bridge Rideability?

by Brian L. Schleppi

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

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Asset Management of Geotechnical Features

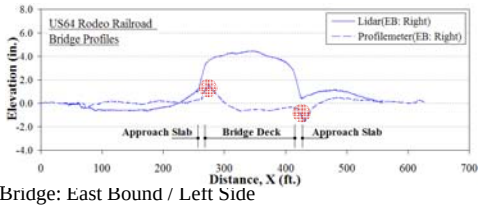
- **Focus Assets**
  - ❑ Approach Slab and Rideability
  - ❑ International Roughness Index (IRI)
  - ❑ Causes:
    - Roughness in Deck Surface
    - Camber in structure/spans
    - Lack in Continuity: Settlement, Creep, Material Loss

❑ **Results**

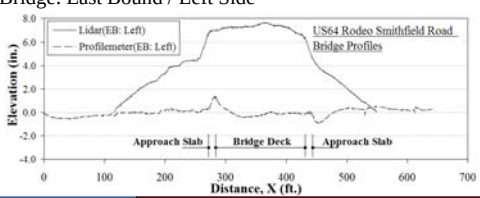
- ❑ Diamond Grinding:
  - It is possible to grind and make ride poorer in some locations
  - 25' Grinder the only choice, 18' would not work
  - Improved IRI from 167 to 114 in/mile
- ❑ Experimental Bridge Ride Specifications
  - IRI below 150 in/mile (proper threshold?) (25' pavement, approach slab, deck, approach slab, 25' pavement) IRI <= 150"/mi
  - Incentive – max of 20% with IRI <= 80"/mi paid on price concrete in deck
- ❑ Research Needed

Bridge Approach Slab

- US-64, Railroad Bridge: East Bound / Right Side



- US-64 - Smithfield Bridge: East Bound / Left Side



Asset Management of Geotechnical Features

- **Geotechnical Assets**
  - Data Assets
  - Infrastructure Assets
- **Asset Management**
  - Asset Identification
  - Condition Assessment
  - Performance Rating and Thresholds
  - Maintenance, Rehabilitation, Replacement Plan
- **Automation and Network Level**
  - Automation is here
  - Network Level is Possible on Some Features
  - Mostly Project-Level Data Collection at Present