**Project Location**

- Rural community in Scioto County
- 90 miles south of Columbus, OH
- 100 miles east of Cincinnati, OH
APPALACHIAN MOUNTAIN RANGE
The Appalachian Highway System is designed to:

- Generate economic development;
- Connect Appalachia highways to the Interstate system;
- Improve Regional & National market access to Appalachia.

Completes Appalachian Highway in Ohio

Reduces current 26 mile travel time by avoiding:

- 30 traffic signals, 80 intersections, 500 driveways

Improves safety and congestion
Largest single project ODOT has ever done ($429M) – First P3

16-mile, 4-lane, limited access with concrete median barrier

Crosses NS and CSX Railroads

5 Interchanges, 22 bridges (5 Steel/16 Concrete/1 Pre-cast)

26 MSE retaining walls along 17 bridges – 330,000 sf

+80 culverts; 7 >300’, 403’, 8>500’, 649’, 764’ 826’. Deepest -135’

1M square yards of asphalt pavement

Massive Earthwork: >20.5M Cubic Yards of Excavation, 90% rock

Mountainous type Terrain – 187’ High Fill Embankments, 200’ Rock Cuts
MANPOWER

• Over 350 Craft personnel onsite at peak. 505 Total.

• More than 1.3 million man-hours worked to date

EQUIPMENT

• Over 350 pieces of major equipment
  - 6 EA - 1200 Excavators (10 CY)
  - 30 EA - 50 TON Rock Trucks
HITACHI 1200 (10 CY) & CAT 773 (60 TON, 46CY)
Financial Close

Commencement of Construction

Design

Utilities

Wick Drains

Culverts

Excavation – Segment 1

Excavation – Segment 2

Excavation – Segment 3

Excavation – Segment 4

Subgrade

Pavement

Structures

Finishes

Current

Design Complete - 100%

Construction Complete - 90%
P3 Benefits for Owner - Geotech Aspect

- Significant transfer of risk to private sector
  - Geotechnical Risk
  - Design and Construction Risk
  - Schedule Risk
  - Finance Risk
- Developer prepared their own construction and material specifications
- Owner prepares Performance Specifications that Developer maintains the assets during 35 year O&M period
- Owner defines the handback condition
- Monetary disincentives in the form of Unavailability and Non-Compliance Deductions from monthly payment
• Earthworks – volume, swell, balancing cut/fill, rock catchment areas, 3D models – machine control
• Minford Clays – landslides, lengthened bridges, special handling
• Soft silts under MSE – stone columns
• Speed of Construction – wick drains, limit consolidation periods, monitor, MSE construction during primary settlement, preloading, oversizing piles for up to 400k downdrag, pile sleeves
• Culverts – camber, geogrid/stone mats
• Rock Cuts & Embankments – opening day condition, O&M period
US 23 Interchange
Bridges 15, 16, 17 (Fairground Road)
Bridges 18, 19 (Norfolk & Southern Railway)
Bridge 20 (US 23)

NB on Ramp – MSE wall
Silts, clays, saturated, SPT= 2,3, WOH
3. STONE COLUMN DESIGN CRITERIA
3.1. MINIMUM FACTORED BEARING RESISTANCE OF 9.30 KSF FOR BOTH UNDRAINED AND DRAINED CONDITIONS.
STONE COLUMNS
TEST COLUMN
- 5’-7’ Spacing
- 25’ – 60’ Depth
Ideas?

• Lateral Strip Drains to daylight
• Soil Cover
DEPTH INDICATOR ON MAST
- Developer-maintained Rock Cuts, Soil Cuts and Embankment slopes must be assessed in accordance with ODOT Manual for Rock Inventory and Landslide Inventory before the road can be opened to traffic.

- All shall have a vulnerability rating of non-rated (Tier 1) before opening to traffic

Idea? - add this criteria to all ODOT projects before acceptance
MULTI PLATE CULVERT
12’-6” DIAMETER
135’ COVER
7.9” PREDICTED SETTLEMENT/CAMBER
1.06% FINAL SLOPE
Idea?
- On SCI-823: All Embankments received 2 - 18” (36” total) shot rock layers as Rock Roadbed
- CBR=15 translates into pavement buildup of 6” 304 + 7” asphalt
12” MAX PARTICLE SIZE
ANCHOR 1/2" THREADED ROD 1
HILTI HIT-RE 500SD EPOXY ANC
INSTALL PER MANUFACTURER
3 1/2" MIN EMBEDMENT INTO P.

FILL VOID WITH DOW FROST-PAK
FOAM SEALANT OR APPROVED EQUAL.

4"X4"X1/2" PLASTIC SHIM
DRILL 5/8" HOLE IN CENTER
OF SHIM AND FASTEN BOLT
THROUGH HOLE.

MSE WALL FACE

REINFORCED FILL

FILTER FABRIC

FORMLINER FINISH
Traditionally:
Design-Bid-Build (DBB)
- Prescriptive Specifications
- Construction

“Alternative Delivery”:
Design-Build (DB)
- Prescriptive Specifications
- Prescriptive Specifications (Supplemental)
- Design and Construction

Public Private Partnership (P3)
- Performance Specifications
- Design, Construction, Operate, and Maintain

Contract Length
1-5 years
1-5 years
20-50 years
<table>
<thead>
<tr>
<th>REF</th>
<th>GEOTECHNICAL ELEMENT</th>
<th>GENERAL REQUIREMENT</th>
<th>DEFECT REMEDY PERIOD</th>
<th>MAINTENANCE PERFORMANCE REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cat. 1 Immediate Action</td>
<td>Cat. 2 Permanent Repair</td>
</tr>
<tr>
<td>10</td>
<td>Rockfall</td>
<td>Slopes are evaluated for the probability of rockfall occurrence and the probability of significant impacts to the roadway and adjacent property or features.</td>
<td>Slopes are inspected and instances of rockfall are assessed against Preliminary Rockslope Rating Criteria and remedial action plans developed where required in accordance with the Manual for Rockfall Inventory.</td>
<td>Inspection frequency as defined in the Manual for Rockfall Inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>24hrs 30 days</td>
<td>Rockfall Vulnerability Risk Very high</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7 days 30 days</td>
<td>Rockfall Vulnerability High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 days 12 months</td>
<td>Rockfall Vulnerability Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A N/A</td>
<td>Low Risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corrective actions to clear rockfalls and mitigate future risk are implemented</td>
<td>Corrective actions implemented in line with timescales defined in Remedial Action Plans</td>
<td>100%</td>
</tr>
<tr>
<td>1.1</td>
<td>Rockfall in Clear Zones (exclusive of the shoulder)</td>
<td>Clear Zones exclusive of the shoulder are maintained free of rock debris.</td>
<td>N/A 7 days</td>
<td>Clear Zones exclusive of the shoulder free of all rocks taller than 4 inches</td>
</tr>
<tr>
<td>REF</td>
<td>ELEMENT</td>
<td>GENERAL REQUIREMENT</td>
<td>DEFECT REMEDY PERIOD</td>
<td>MAINTENANCE PERFORMANCE REQUIREMENTS</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cat. 1 Immediate Action</td>
<td>Cat. 2 Permanent Repair</td>
</tr>
<tr>
<td>10.2</td>
<td>Landslide</td>
<td>Slopes are evaluated for the probability of additional movement and the probability of significant impacts to the roadway and adjacent property or features. Note: Slopes include MSE structures flatter than 1H:3V and reinforced soil slopes</td>
<td>24hrs 30 days</td>
<td>Slopes are inspected such that landslides and potential landslides are assessed against</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corrective actions to stabilize slopes and mitigate future risk are implemented</td>
<td>30 days 12 months</td>
<td>Corrective actions implemented in line with timescales defined in Remedial Action Plans</td>
</tr>
<tr>
<td>10.3</td>
<td>Slope - General</td>
<td>Slopes are maintained in general conformance to the original graded cross-sections</td>
<td>24 hrs 6 months</td>
<td>Area where replacement of material (geosynthetic or soil) and re-seeding of vegetation for erosion control purposes or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Slopes include reinforced soil slopes flatter than 1H:3V</td>
<td>N/A 3 months</td>
<td>Areas of exposed geosynthetic</td>
</tr>
<tr>
<td>13</td>
<td>MONITORING AND CLEARANCE OF OBSTRUCTIONS, DEBRIS, LITTER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.1</td>
<td>Sweeping and cleaning</td>
<td>Remove accumulations of dirt, sand, gravel and rocks from roadways and shoulders or along medians and</td>
<td>2hrs</td>
<td>28 days</td>
</tr>
</tbody>
</table>

**Other Performance Criteria that is tied to Geotechnical Engineering**

- **Structures** – example – bridge or wall footing settlement affecting annual bridge inspection rating

- **Roadway** – International Roughness Index (IRI), asphalt pavement PCR rating issues due to embankment settlement/consolidation and/or sub-surface seepage

- **Retaining Walls** – MSE wall performance, ie - panel joints and plumbness issues due to primary/secondary settlement

- **Storm drainage and culvert ratings** – due to settlement affecting joints and connections
After 35 years of operations, developer hands back roadway to ODOT in a good condition or suffers deductions

21.2.5 Geotechnical
All slopes shall be assessed utilizing the Department’s Manual for Rockfall Inventory and the Manual for Landslide Inventory. All slopes shall have a vulnerability rating of moderate or better at the end of the Maximum Term.
Southern Ohio Veterans Memorial Highway
State Route 823