The Design and Construction of Hybrid Soil Nail/MSE Walls

John G. Delphia, P.E.
TxDOT Bridge Division
Geotechnical Branch
COMMON RETAINING WALL TYPES

- **Concrete Block**
- **MSE**
- **Temporary Earth**
- **Spread Footing**

**Fill Situations**
- MSE
- Concrete Block
- Spread Footing
- Temporary Earth
- Gabion

**Cut Situations**
- Drilled Shaft
- Tiedback
- Soil Nail

**Cut/Fill Situations**
- MSE with Shoring
- Spread Footing with Shoring
- Hybrid – Soil Nail/MSE

**Hybrid Walls – MSE/Soil Nail**

**Tiedback**
Soil Nail Wall
“Texas Turn Around”
Hybrid Walls

MSE Wall in front of a Soil Nail Wall

Soil Nail Wall adjacent to Tied-Back Wall

Tied-Back Wall
Soil Nail Wall

MSE Wall

Soil Nail Wall

Tied-Back Wall
Soil Nail Wall
Widening of Existing Roadway

What wall type would you choose?

Existing Roadway Geometry

Proposed Roadway Geometry
Shoring

Existing Ground

Earth Reinforcement Connection

Filter Fabric (Covering Joints)

Coping

Earth Reinforcement

Select Backfill

Precast Concrete Facing Panels

Bearing Pads

Leveling Pad

Natural Ground
HYBRID SOIL NAIL/MSE WALL

MSE (Fill) Wall on top of Soil Nail (Cut) Wall
HYBRID SOIL NAIL/MSE WALL

• Consider when existing ground line is not coincident with top of wall.

• Function of:
  – Wall Height; Fill vs. Cut
  – Soil Conditions
  – Aesthetic Considerations
  – Phasing Requirements
  – Etc.,

Very Project Specific
Soil Nail Wall

Fill vs. Cut

Fill \leq 3'$
Fill vs. Cut
Fill \leq 3'$
Hybrid Soil Nail/MSE Wall

Fill vs. Cut

Fill > 3’

Case 1

Case 2
Case History 1 – IH 35 Comal Co.

Fill vs. Cut

Fill > 3’

Case 1
Case History 1 – IH 35 Comal Co.

Existing Ground

Fill = 10’

Cut = 28’
Case History 1 – IH 35 Comal Co.

- Establish wall geometry including bottom of wall profile.
- Determine soil design parameters.
- Determine controlling loading condition and appropriate analysis approach.
- Insure that the proposed wall geometry will be globally stable.
Case History 1 – IH 35 Comal Co.

**GEOMETRY**

- MSE Wall
- Soil Nail Wall
- Temporary Special Shoring
Design of the Soil Nail Wall

Two Options

Option 1
Model the Entire System

Option 2
Model the Soil Nail Wall Only & consider MSE Wall/Roadway as a Surcharge & Horizontal Shear

Surcharge from Roadway

MSE Wall

Surcharge from Roadway and Fill

Soil Nail Wall

Fill

Soil Nail Wall

Horizontal Shear at Base of MSE Wall
Option 1
Model the Entire System

Nail Length = 28 ft

Option 2
Model the Soil Nail Wall Only & consider MSE Wall/Roadway as a Vertical Surcharge & Horizontal Shear

Nail Length = 26 ft
Nail Sizing Guidelines

- 8” diameter soil nails
- #8 grade 60 threadbar
- 3.5’ X 3.5’ horizontal and vertical spacing
Case History 1 – IH 35 Comal Co.

Global Stability Check

IH 35 Comal County No Name Creek Hybrid Wall

Safety Factors Are Calculated By The Modified Bishop Method
Design Details

- Not a Standard !!
- Not a proprietary system. No vendor.
- Complete details must be provided.
Specific Nail Locations

**Legend**
- Location of 8.5 m Soil Nails
- Location of 3.5 m Soil Nails

### Panel No. 7

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<thead>
<tr>
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<td>3.5 m</td>
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<td>6</td>
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<td>9</td>
<td>10</td>
<td>NTW</td>
<td>8.5 m</td>
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</table>

**Notes:**
- Horizontal direction based on drilling position in front of wall.
- NTW: Normal to wall.

**Specific Nail Locations**

- **11.5 ft**
- **28.0 ft**

**Table:**

<table>
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<th>Length (m)</th>
<th>Area (m²)</th>
<th>No. of nails</th>
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*Nail reinforcement length shall be the nail length shown in the table plus 150 mm.*

**Texas Department of Transportation**

Design Division (B1)

**SOIL NAIL LAYOUT**

**Panel 7**

**IH 35**

**WALL "A1"**

[Stamp with date: 5/78/83]
Case History 1
Completed Temp. Face
Case History 1
Completed Temp. Face
Case History 1
Completed Temp. Face
Case History 1     Finished Wall – Precast Panel Fascia
Design Considerations

1. MSE Wall conflict with soil nails

2. Can a vertical wall face be used instead of an offset wall face
Design – Project Specific

Conflicts at the Top of Wall

MSE Wall

Soil Nail Wall
Vertical Wall Face

- MSE Wall
- Interface of MSE/Soil Nail Wall
- Existing Ground
- Soil Nail Wall
- Proposed Ground
Vertical Wall Face

Approximate location of the bottom of the MSE Wall

Note water seepage from the panels with horizontal joints near the bottom of the MSE Wall
Vertical Wall Face

- MSE Wall
- Interface of MSE/Soil Nail Wall
- Existing Ground
- Soil Nail Wall
- Proposed Ground
Case History 2 – US 67 Sherwood Way

Fill vs. Cut

Fill > 3’

Case 2
Case History 2 – US 67 Sherwood Way
Case History 2 – US 67 Sherwood Way
Case History 2 – US 67 Sherwood Way

Step 1 - Install first row of soil nails in portion of wall between the existing bridge abutment and the proposed TEW. Install the remaining soil nails in a sequence as required to ensure stability.

Step 2 - Construct TEW to the face and grout as shown in the plans. The zone behind the face of the TEW shall be filled with cement-based grout. The fill zone beyond the limits of the TEW shall be filled with materials meeting the zone requirements as listed in the reinforced zone of the TEW.

Step 3 - Install soil nails through the TEW in the locations indicated on the plans. Apply the required UHC temporary facing.

Step 4 - Install reinforcement details as indicated in the plans.

Step 5 - Apply permanent C.I.P. concrete and complete wall.
Case History 2

Constructing Gunnite Fascia to receive TEW
Case History 2
Finished Wall
HYBRID SOIL NAIL/MSE WALL

In Conclusion:

• Consider when existing ground line is not coincident with top of wall.

• Function of:
  – Wall Height; Fill vs. Cut
  – Soil Conditions
  – Aesthetic Considerations (facing options)
  – Drainage
  – Phasing Requirements
  – Etc.,
    – Very Project Specific
Questions?