

The Design and Construction of Hybrid Soil Nail/MSE Walls

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TxDOT Bridge Division
Geotechnical Branch**

COMMON RETAINING WALL TYPES

CONCRETE BLOCK



MSE



TEMPORARY EARTH



SPREAD FOOTING



Gabions



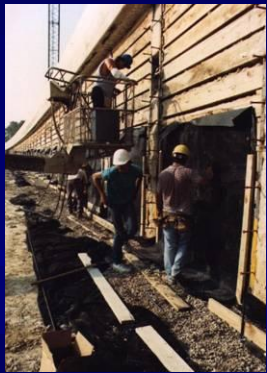
Drilled Shaft



Soil Nail



Tiedback



Hybrid Walls – MSE/Soil Nail



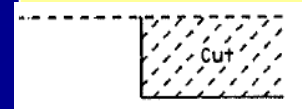
RETAINING WALL SELECTION

FILL SITUATIONS



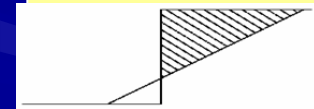
**MSE
CONCRETE BLOCK
SPREAD FOOTING
TEMPORARY EARTH
GABION**

CUT SITUATIONS

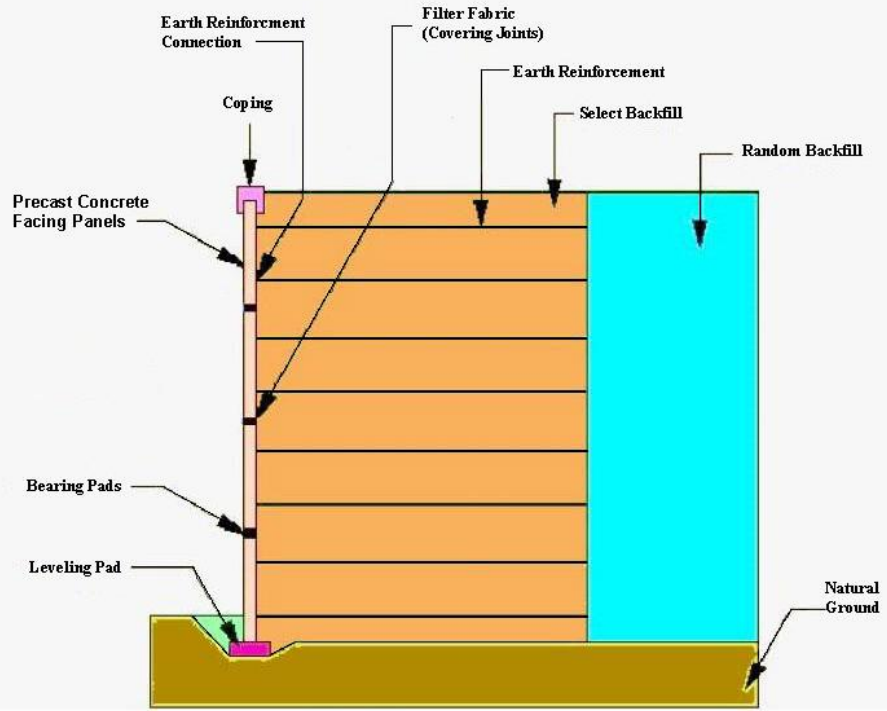


**DRILLED SHAFT
TIEDBACK
SOIL NAIL
MSE WITH SHORING
SPREAD FOOTING
WITH SHORING**

CUT/FILL SITUATIONS



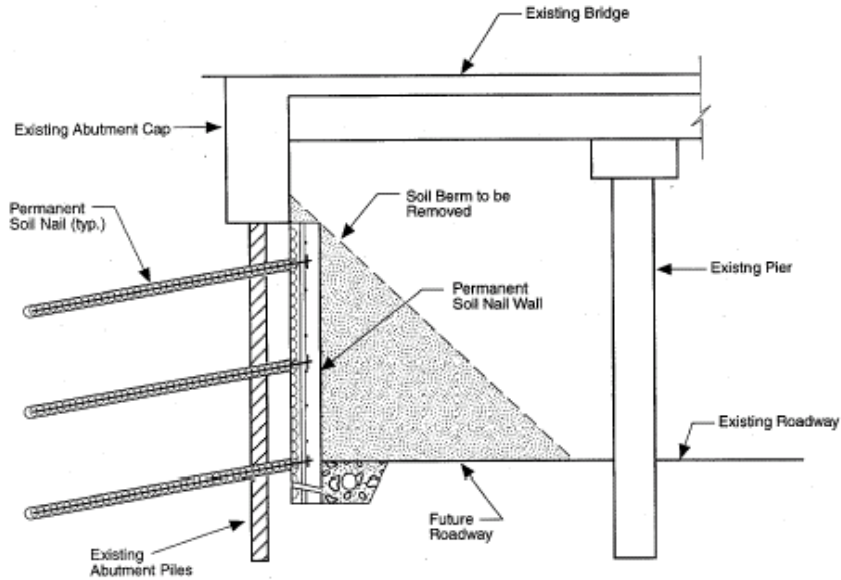
**DRILLED SHAFT
MSE WITH SHORING
SPREAD FOOTING
WITH SHORING
HYBRID – SOIL NAIL/MSE**



MSE Wall



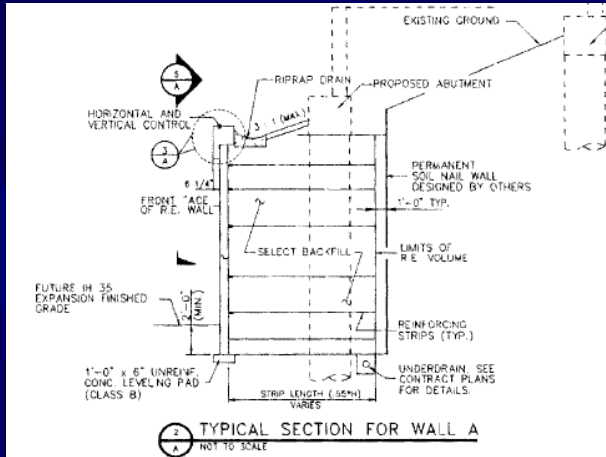
Soil Nail Wall “Texas Turn Around”



Hybrid Walls

MSE Wall in front of a Soil Nail Wall

Soil Nail Wall adjacent to Tied-Back Wall



Soil Nail Wall

MSE Wall



Tied-Back Wall

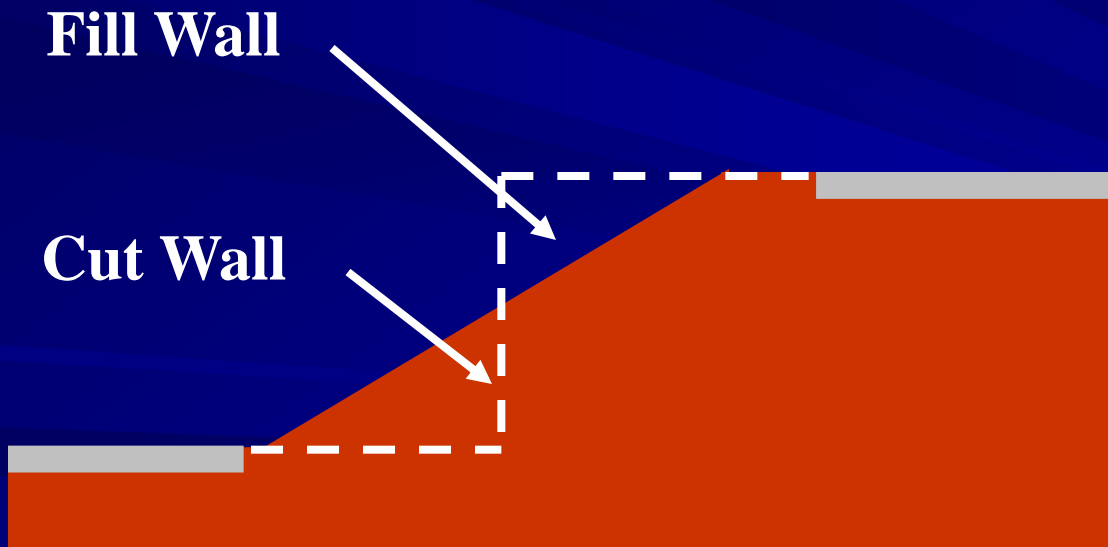
Soil Nail Wall



Widening of Existing Roadway

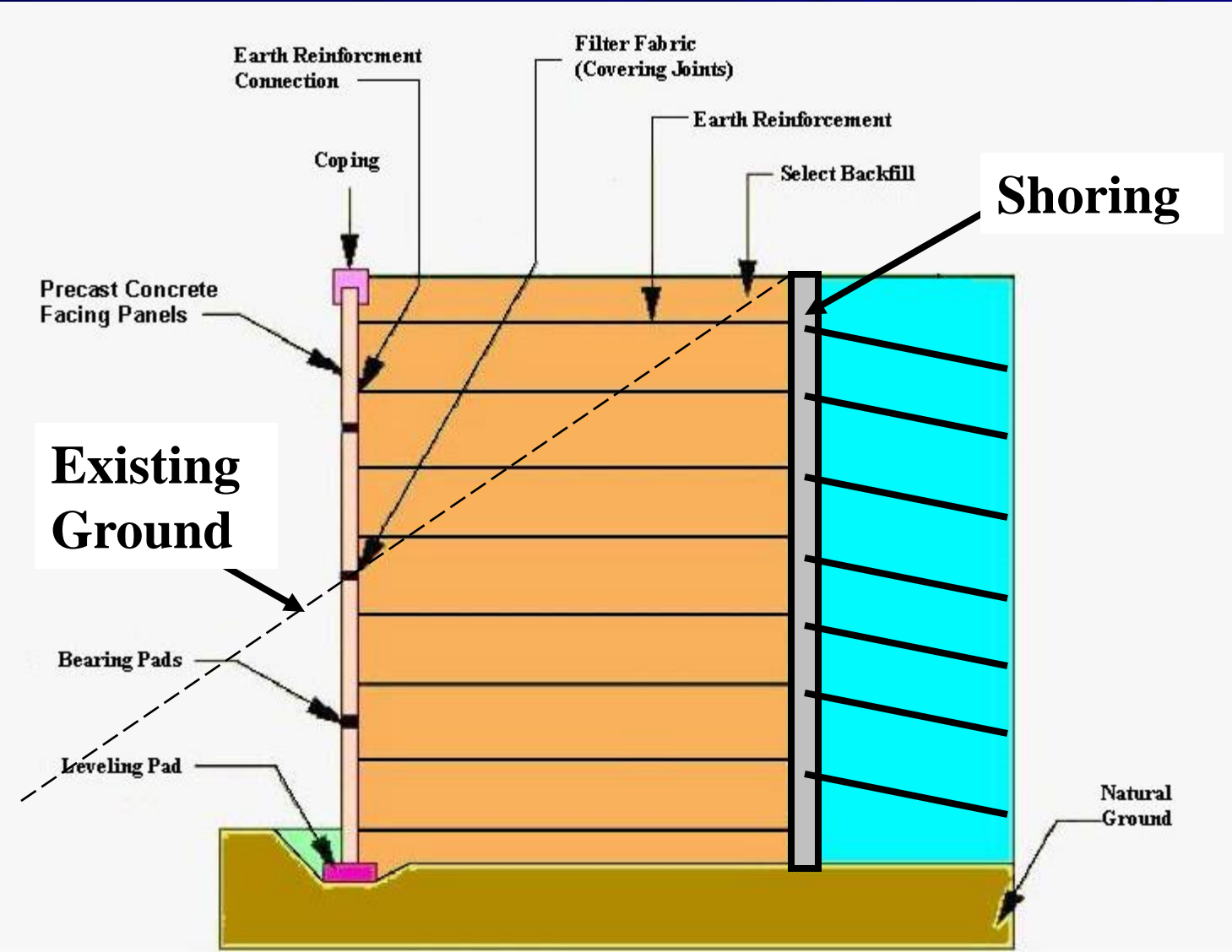


**Existing Roadway
Geometry**



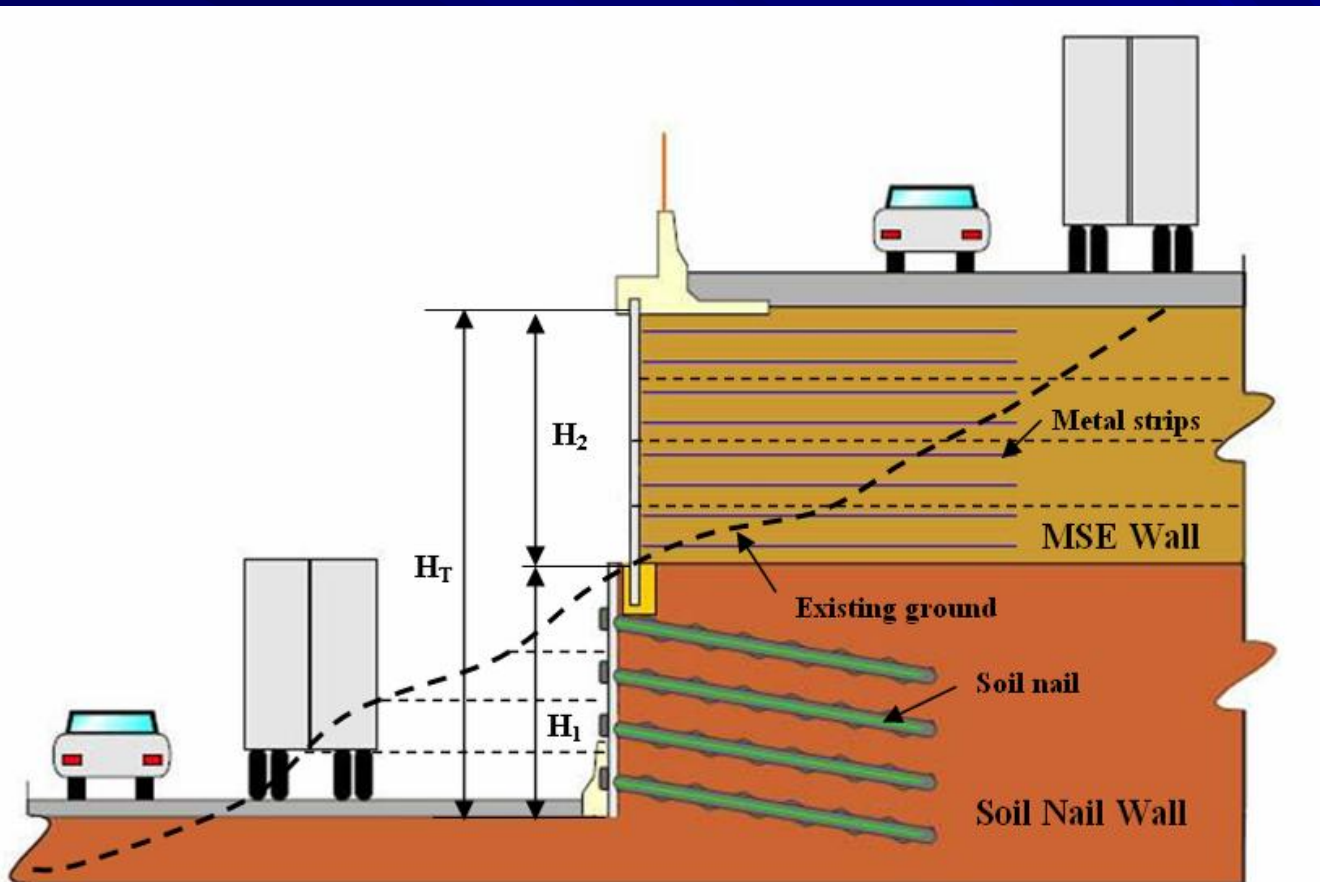
**Proposed Roadway
Geometry**

What wall type would you choose?



HYBRID SOIL NAIL/MSE WALL

MSE (Fill) Wall on top of Soil Nail (Cut) Wall



HYBRID SOIL NAIL/MSE WALL

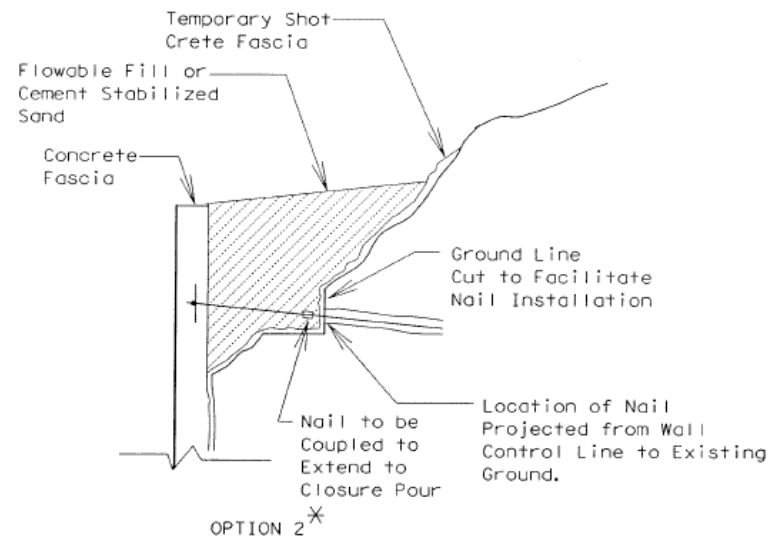
- **Consider when existing ground line is not coincident with top of wall.**
- **Function of:**
 - **Wall Height; Fill vs. Cut**
 - **Soil Conditions**
 - **Aesthetic Considerations**
 - **Phasing Requirements**
 - **Etc.,**

Very Project Specific

Soil Nail Wall

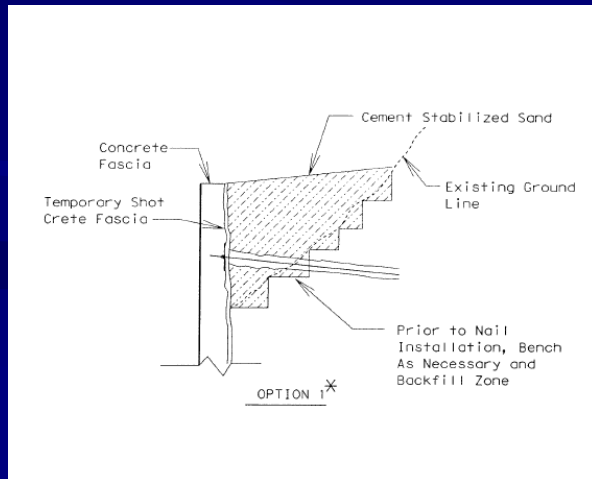
Fill vs. Cut

Fill $\leq 3'$



Fill vs. Cut

Fill $\leq 3'$

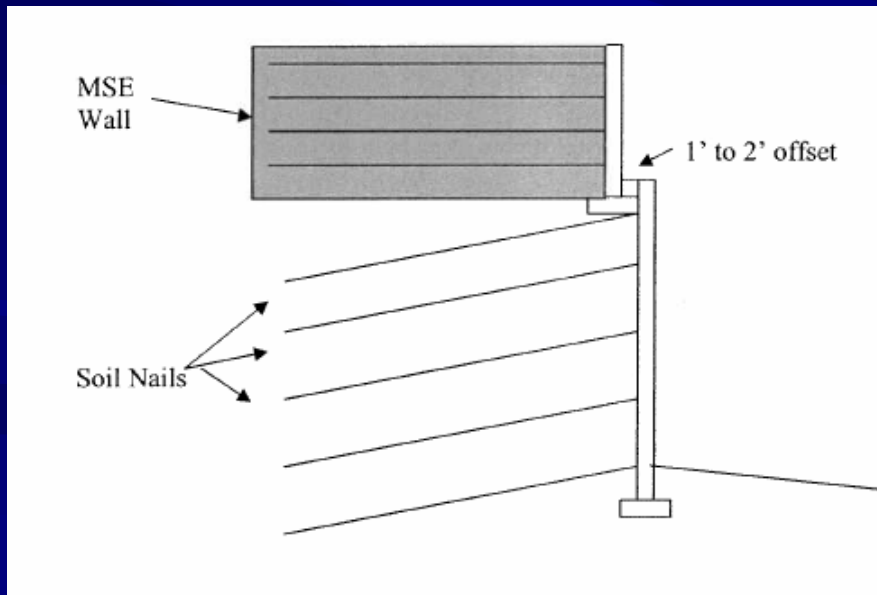


Hybrid Soil Nail/MSE Wall

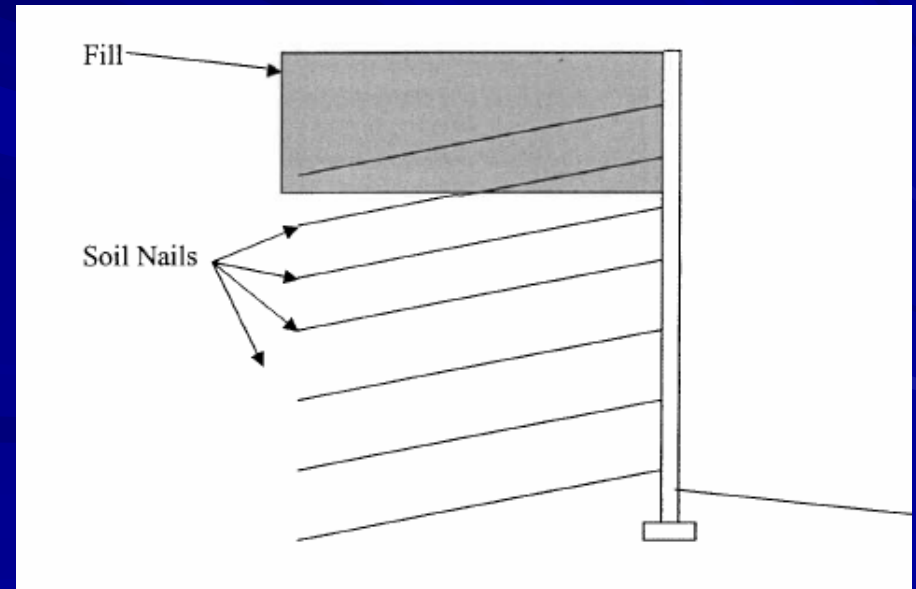
Fill vs. Cut

Fill > 3'

Case 1



Case 2

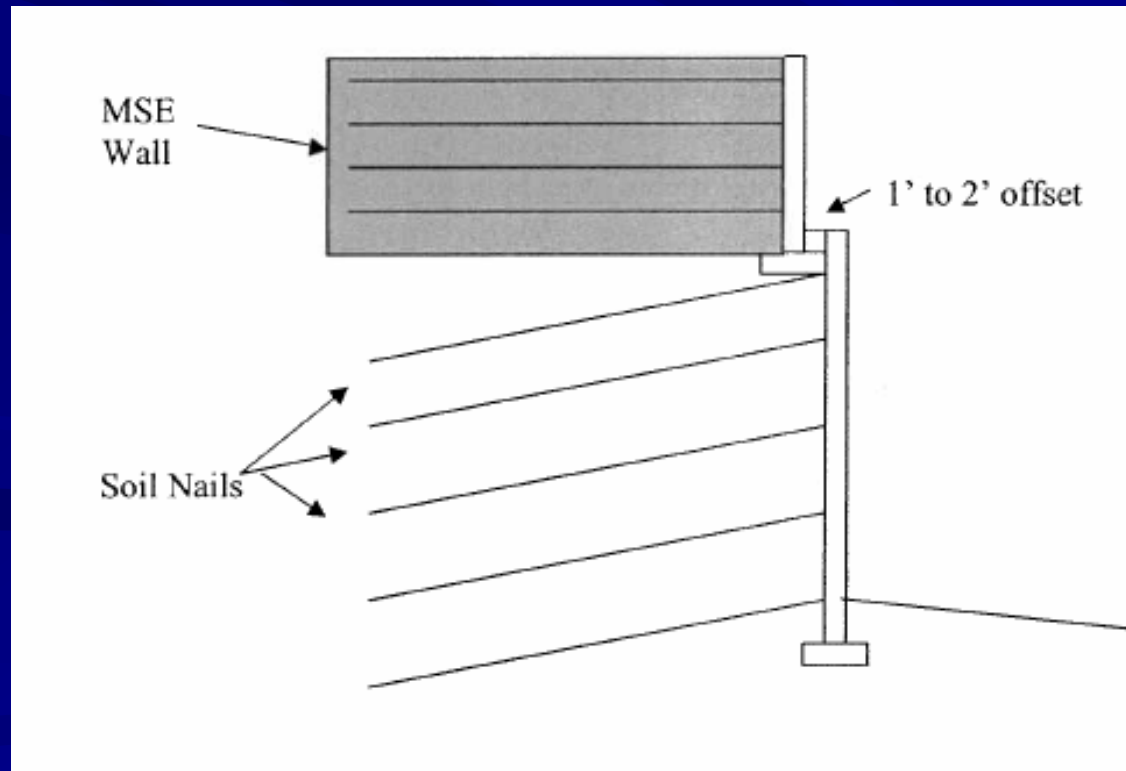


Case History 1 – IH 35 Comal Co.

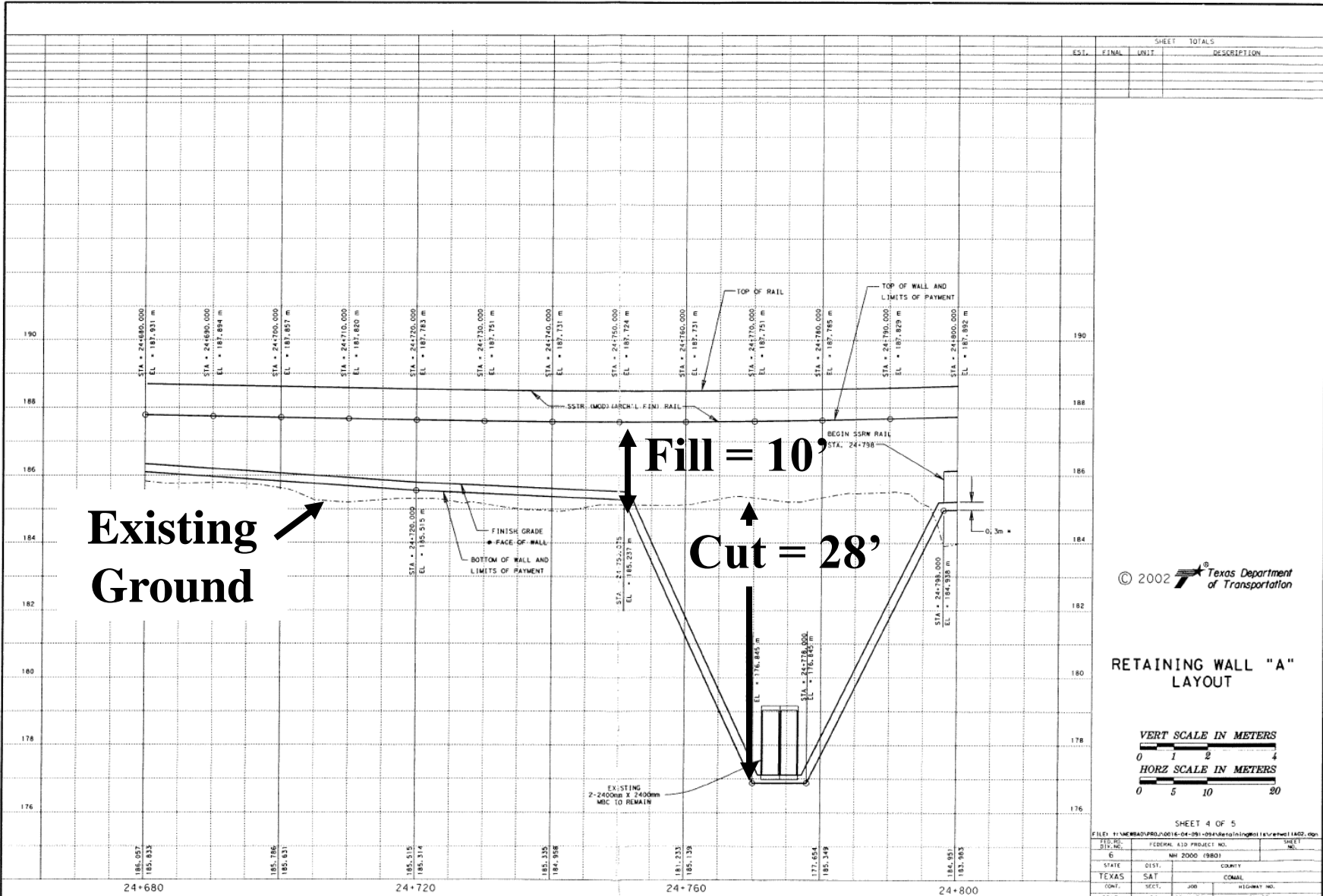
Fill vs. Cut

Fill > 3'

Case 1



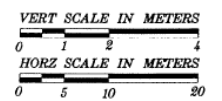
Case History 1 – IH 35 Comal Co.



SHEET TOTALS			
EST.	FINAL	UNIT	DESCRIPTION

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RETAINING WALL "A" LAYOUT



SHEET 4 OF 5

FILE: T:\MCR\AD\PROJ\0016-04-091-09\RetainingWall\sheet11A02.dgn			
DATE:	FEDERAL AID PROJECT NO.:	SHEET NO.:	TOTAL SHEETS:
01/11/00		11	11
STATE:	COUNTY:	CORNER:	
TEXAS	SAT	COMAL	
CONF. SECT.:	JOB:	HIGHWAY NO.:	
0016	04	091, Etc.	IH 35

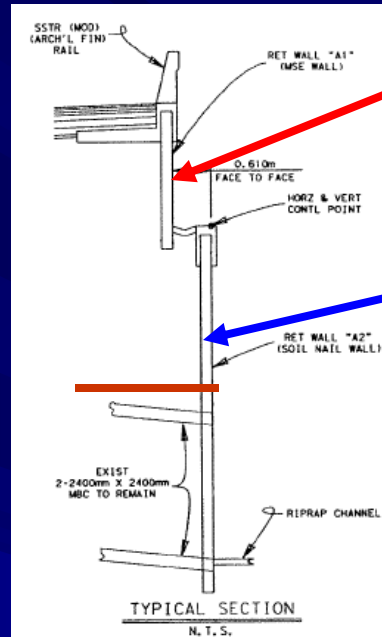
ACC1: 48141A1/UBP/0481303
 FILE: .DDN

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



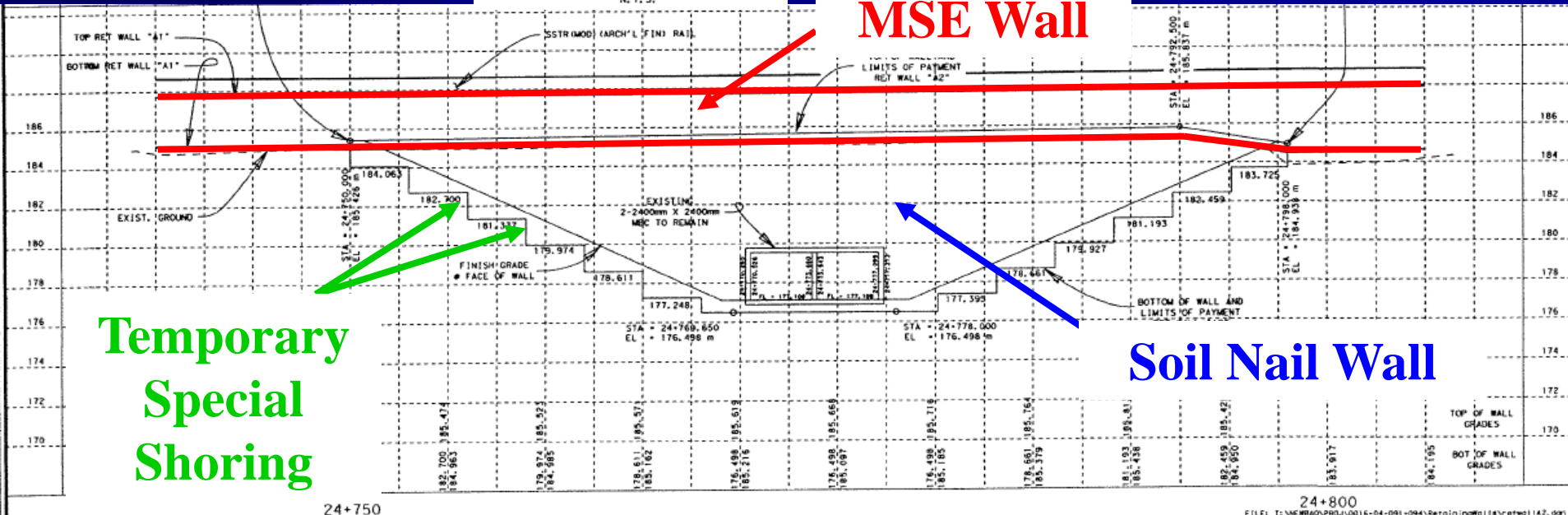
MSE Wall

Soil Nail Wall

MSE Wall

Soil Nail Wall

**Temporary
Special
Shoring**

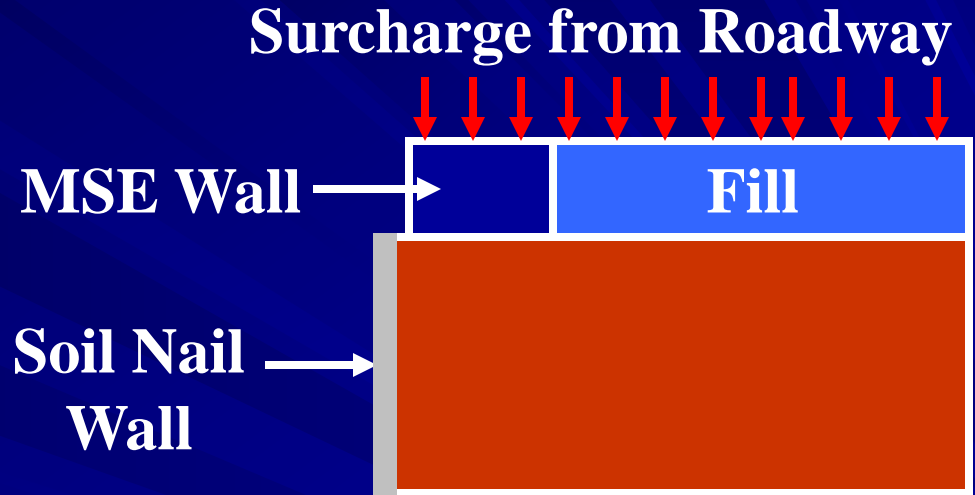


Design of the Soil Nail Wall

Two Options

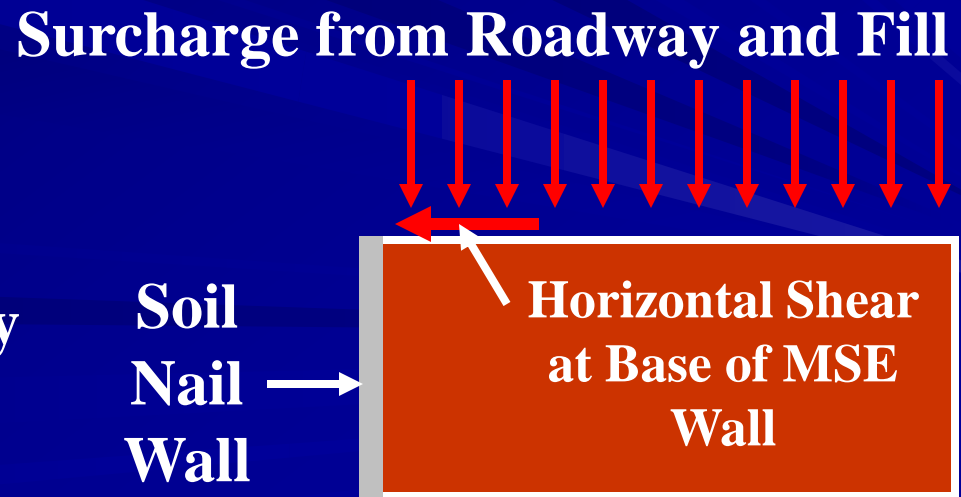
Option 1

Model the Entire System



Option 2

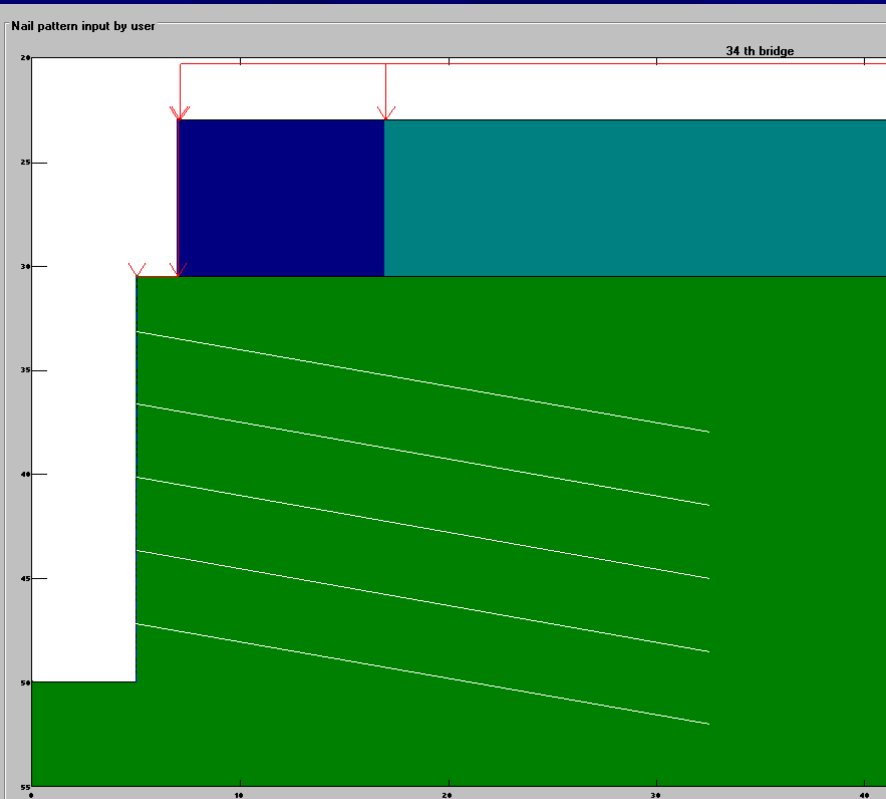
Model the Soil Nail Wall Only
& consider MSE Wall/Roadway
as a Surcharge & Horizontal
Shear



Option 1

Model the Entire System

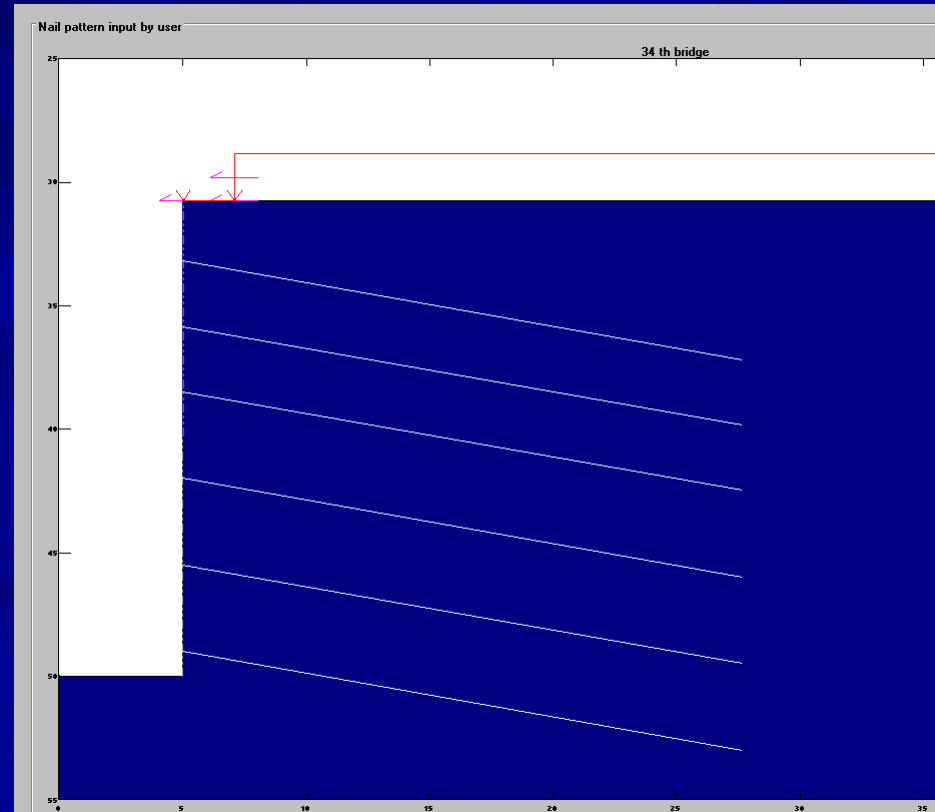
Nail Length = 28 ft



Option 2

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

Nail Length = 26 ft

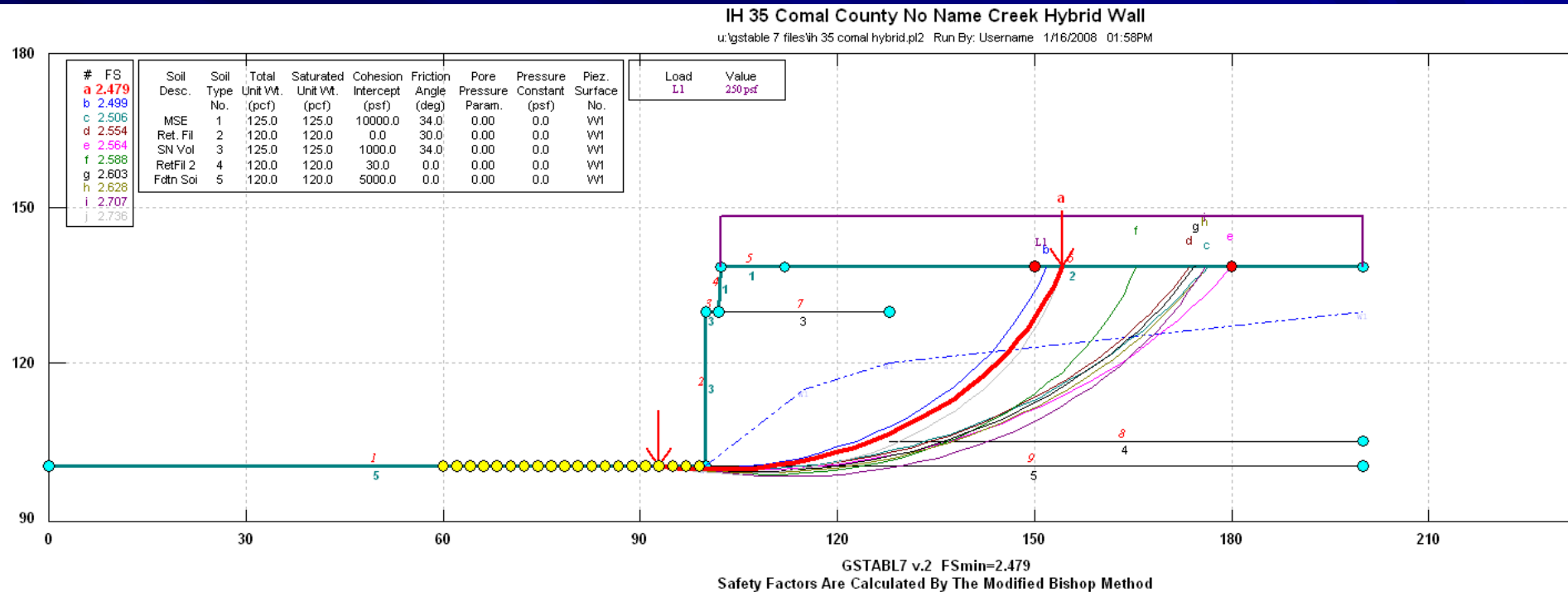


Nail Sizing Guidelines

- 8" diameter soil nails
- #8 grade 60 threadbar
- 3.5' X 3.5' horizontal and vertical spacing

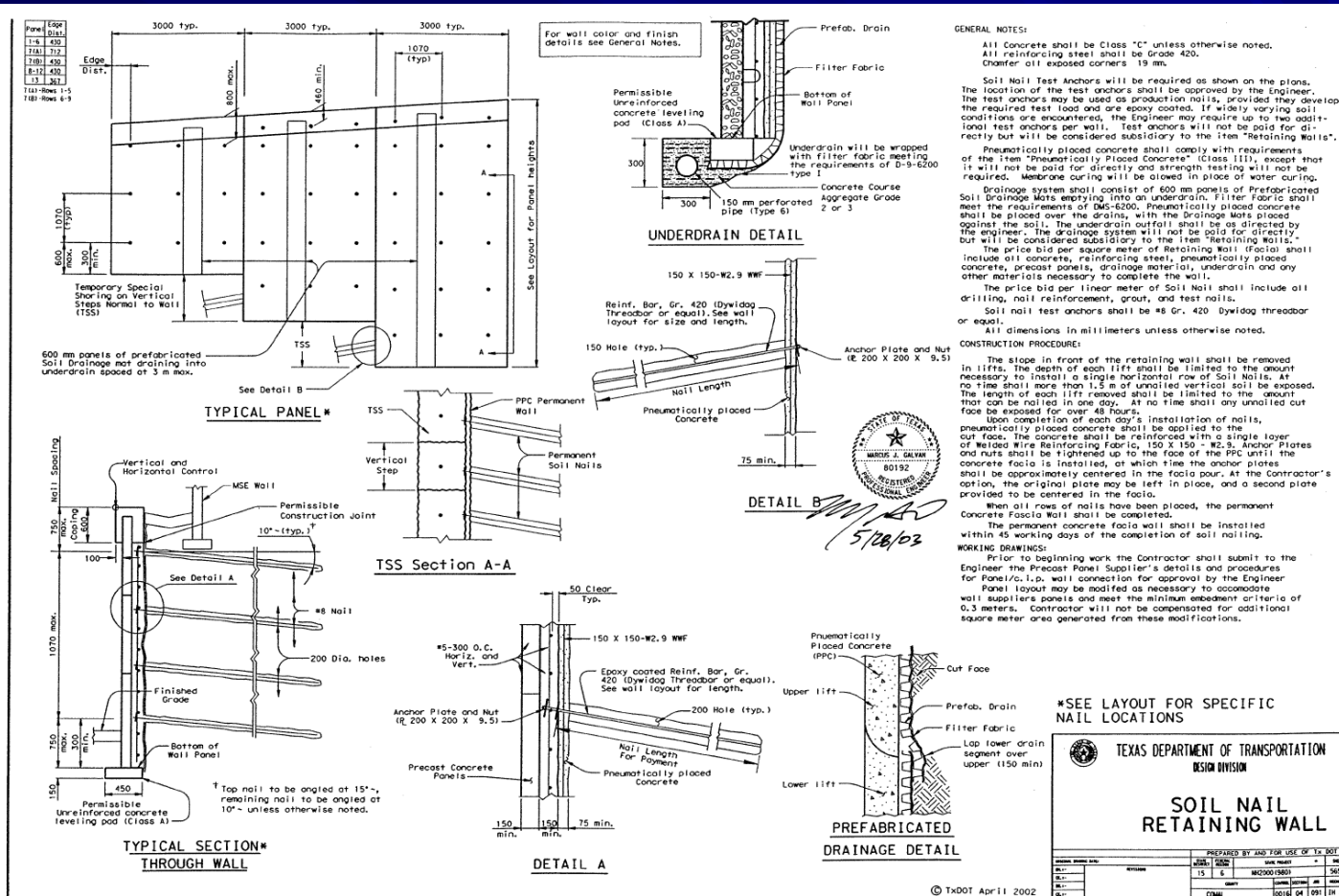
Case History 1 – IH 35 Comal Co.

Global Stability Check

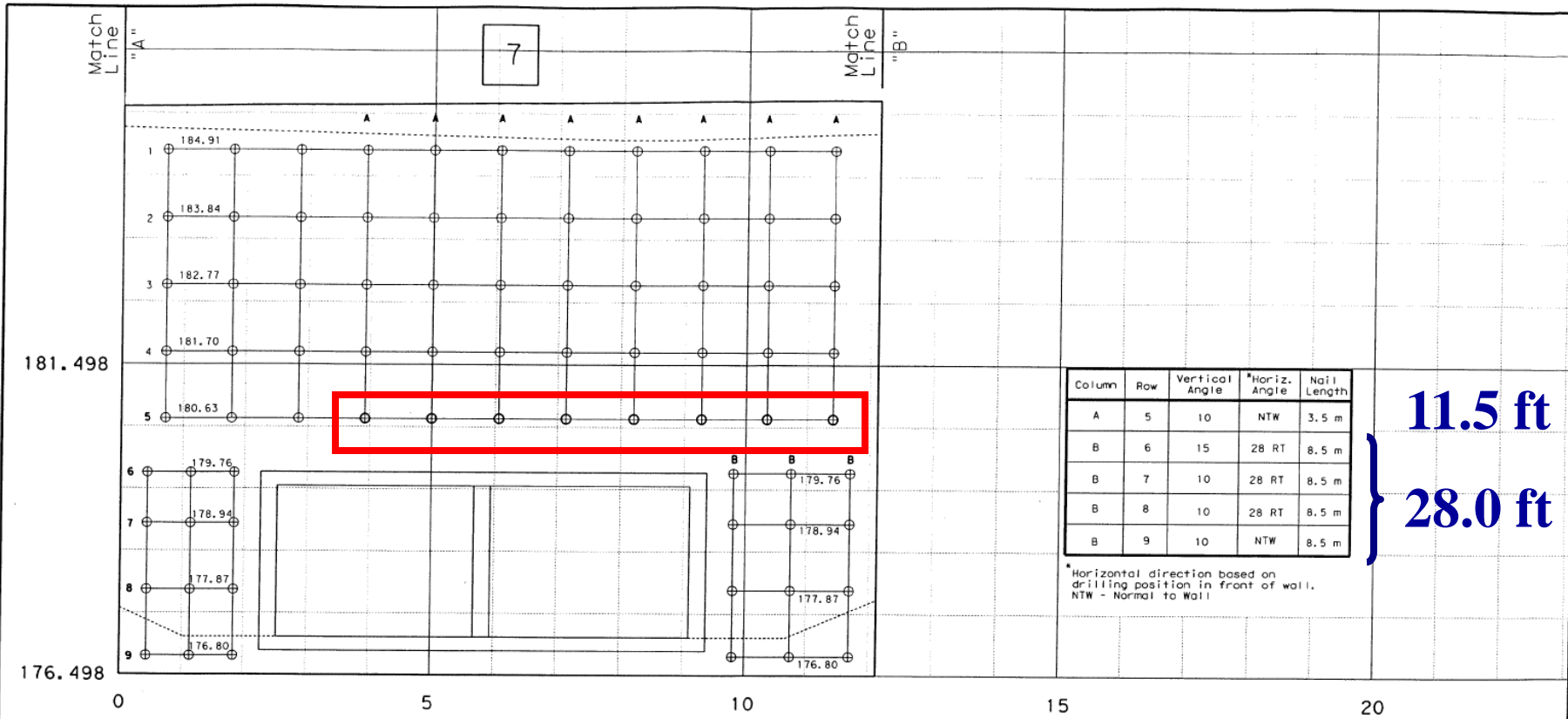


Design Details

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



Specific Nail Locations



11.5 ft

28.0 ft

Panel No.	
7	
Length (m)	12.13
Area (m ²)	90.64
No. of nails	8 71
Nail length (m)	3.5* 8.5*
Total nail length (m)	631.5

LEGEND

- ⊕ Location of 8.5 m Soil Nails
- ⊙ Location of 3.5 m Soil Nails

* NAIL REINFORCEMENT LENGTH SHALL BE THE NAIL LENGTH SHOWN IN THE TABLE PLUS 150 mm.



5/28/03

Texas Department of Transportation
Design Division (B/Bridge)

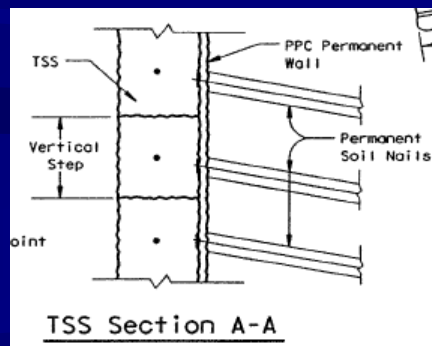
**SOIL NAIL LAYOUT
PANEL 7
IH 35
WALL "A1"**

FILE#	Dist	W/JC	Dist	MEM	Dist	CHK
ORIG DATE:	FEB 2003					
REVISIONS	15	6	NH200019801			564
COUNTY	BEKAR	CONTRACT	0016	SHEET	04	091
						IH 35

DATE PLOTTED: 05/28/03 10:00 AM
PLOTTER: HP PLOTTER
SCALE: 1/8" = 1'-0"
SHEET: 564

Case History 1

Completed Temp. Face



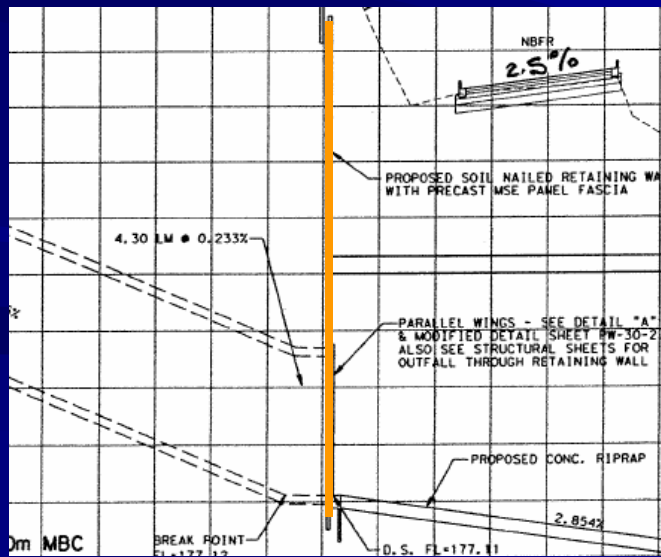
Case History 1

Completed Temp. Face



Case History 1

Completed Temp. Face



Case History 1 Finished Wall – Precast Panel Fascia

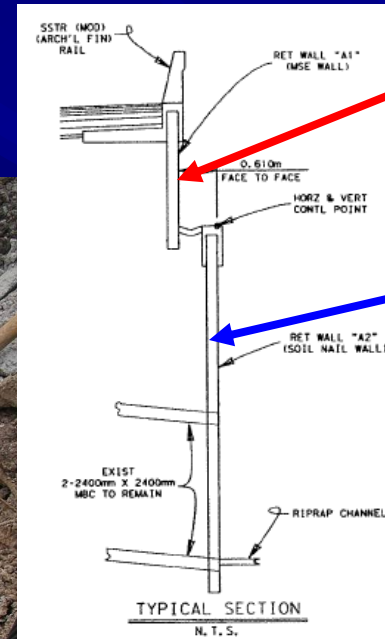


Design Considerations

1. **MSE Wall conflict with soil nails**
2. **Can a vertical wall face be used instead of an offset wall face**

Design – Project Specific

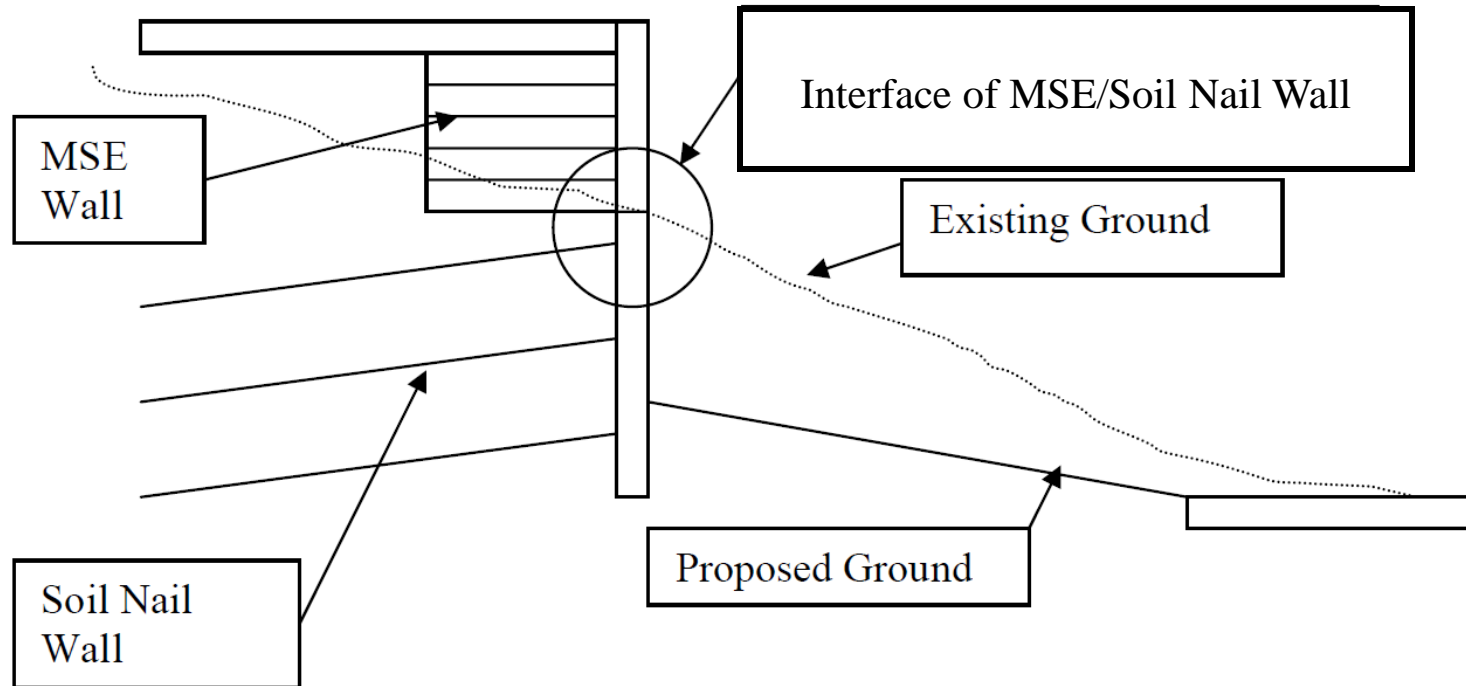
Conflicts at the Top of Wall



**MSE
Wall**

**Soil
Nail
Wall**

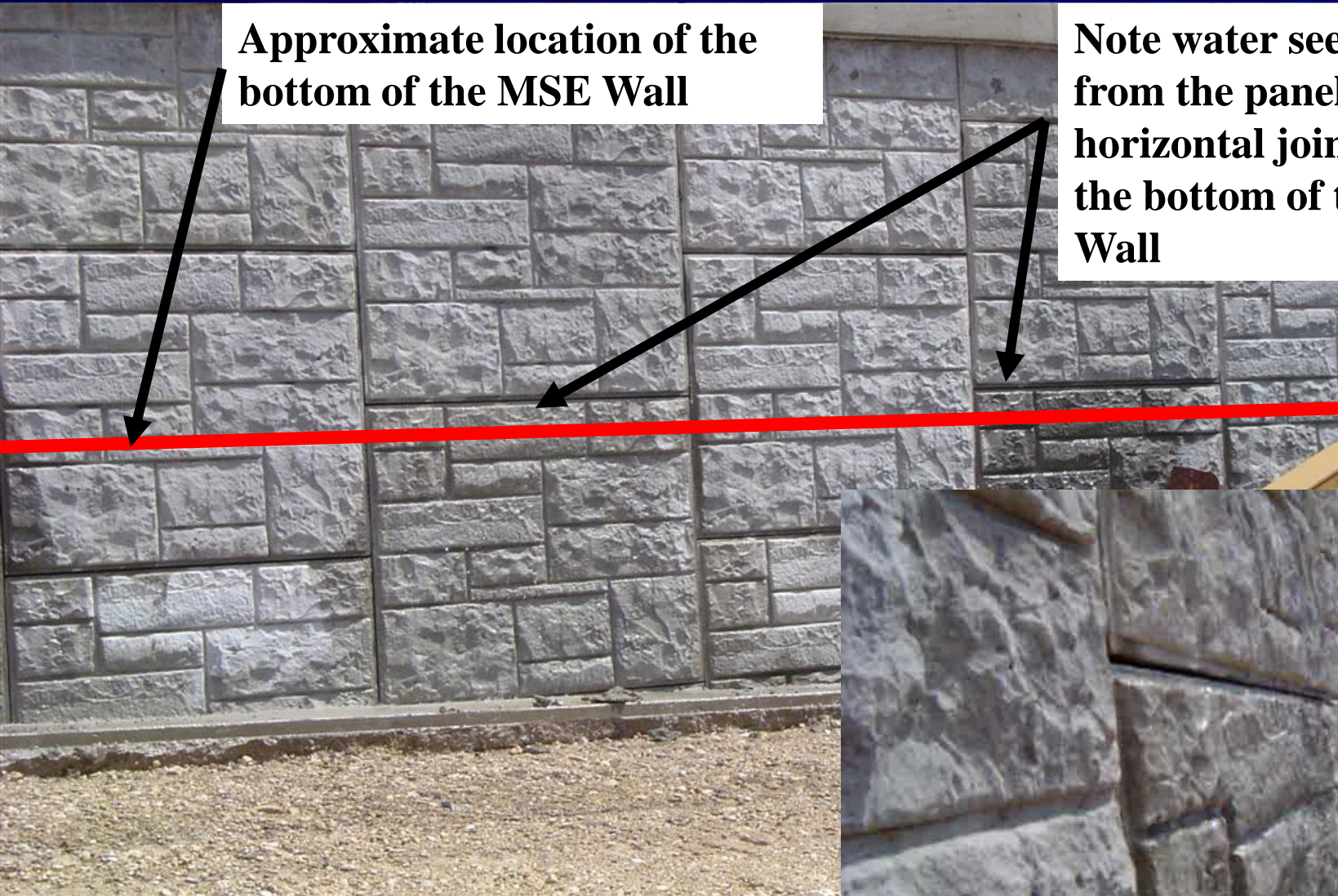
Vertical Wall Face



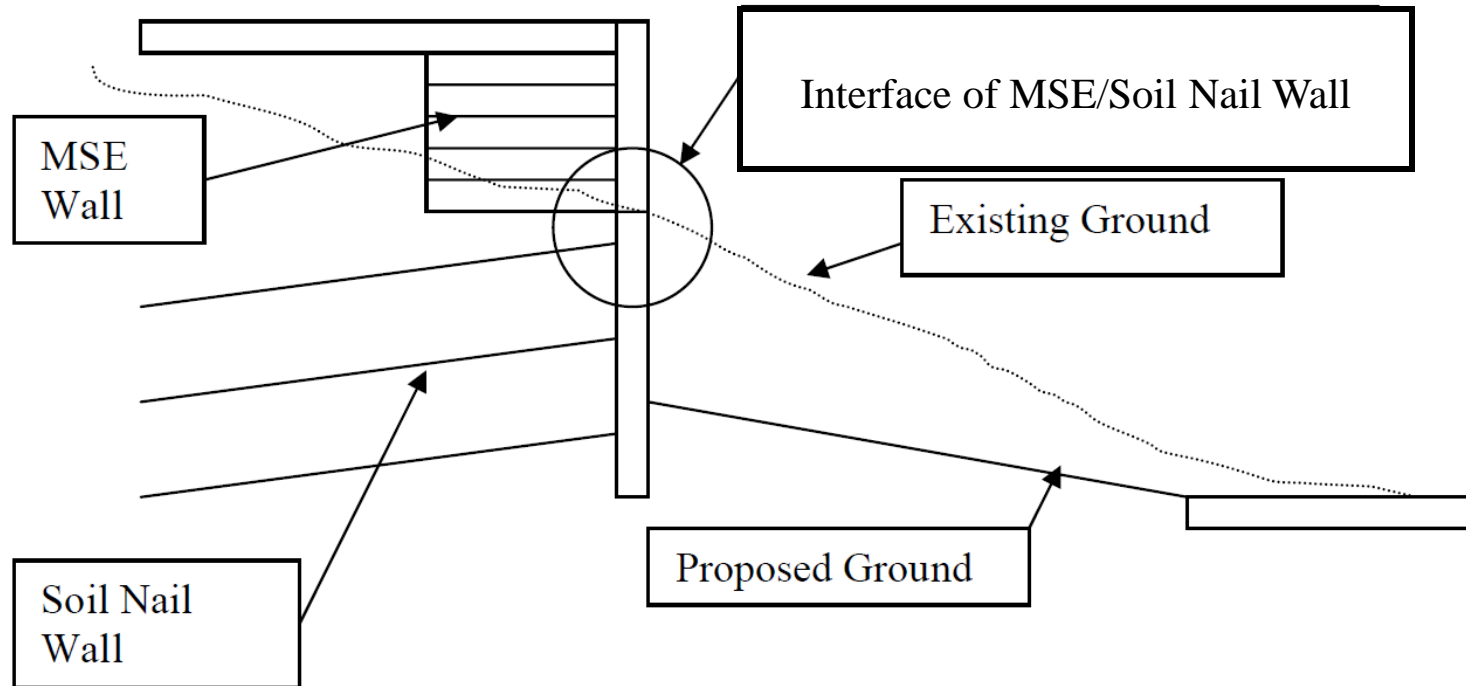
Vertical Wall Face

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

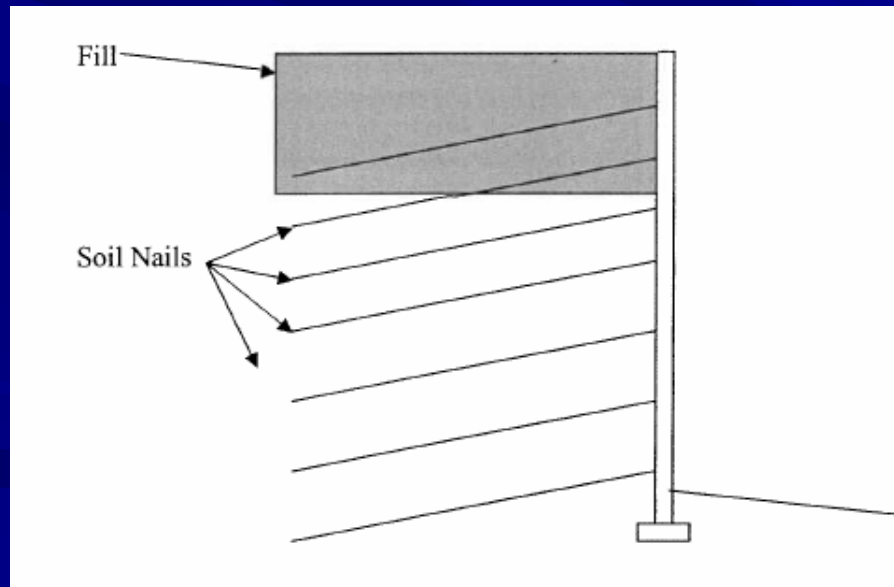


Case History 2 – US 67 Sherwood Way

Fill vs. Cut

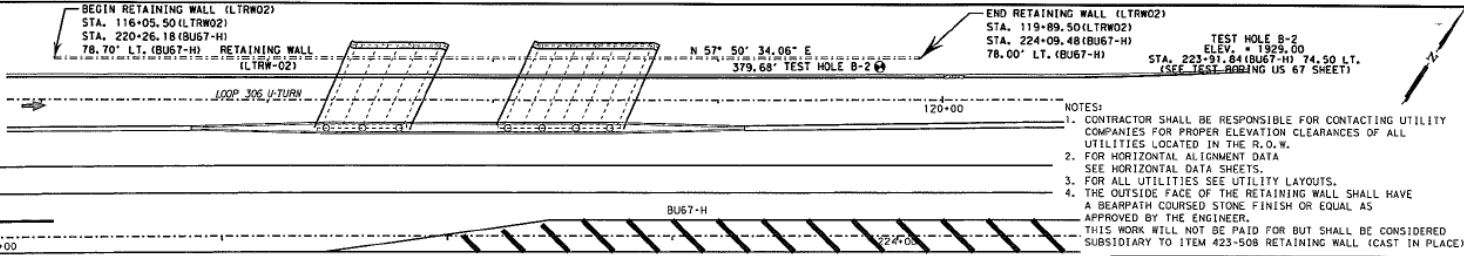
Fill > 3'

Case 2



Case History 2 – US 67 Sherwood Way

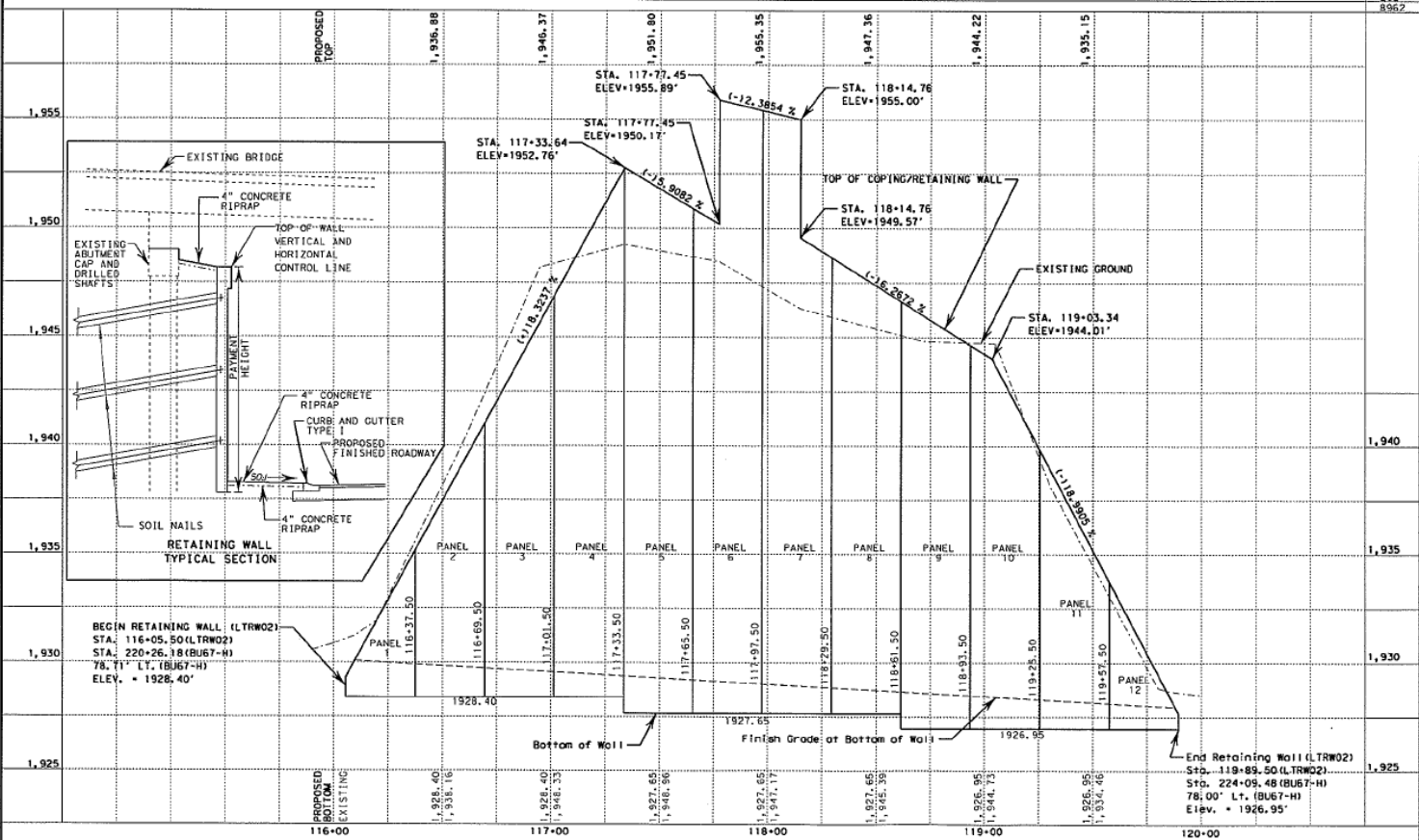
General Notes:
 Square foot surface area of retaining wall is measured between top of retaining wall and bottom of retaining wall as shown.
 1' minimum cover shall be provided from bottom of wall to bottom finish grade.



- NOTES:**
1. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING UTILITY COMPANIES FOR PROPER ELEVATION CLEARANCES OF ALL UTILITIES LOCATED IN THE R.O.W.
 2. FOR HORIZONTAL ALIGNMENT DATA SEE HORIZONTAL DATA SHEETS.
 3. FOR ALL UTILITIES SEE UTILITY LAYOUTS.
 4. THE OUTSIDE FACE OF THE RETAINING WALL SHALL HAVE A BEARPATH COURSED STONE FINISH OR EQUAL AS APPROVED BY THE ENGINEER.
- THIS WORK WILL NOT BE PAID FOR BUT SHALL BE CONSIDERED SUBSIDIARY TO ITEM 423-50B RETAINING WALL (CAST IN PLACE)

Distance Along Face of Retaining Wall = 372.47 Ft.

SHEET TOTALS			
EST.	UNIT	ITEM	DESCRIPTION
6141	S.F.	423-2012	RETAINING WALL (CAST IN PLACE)
252	S.F.	403-XXXX	TEMPORARY EARTH WALL (ITEM)
R962	L.F.	XXXX	SOIL NAIL ANCHOR



P. E. SEAL REQUIRED
PRELIMINARY
 SUBJECT TO REVISION
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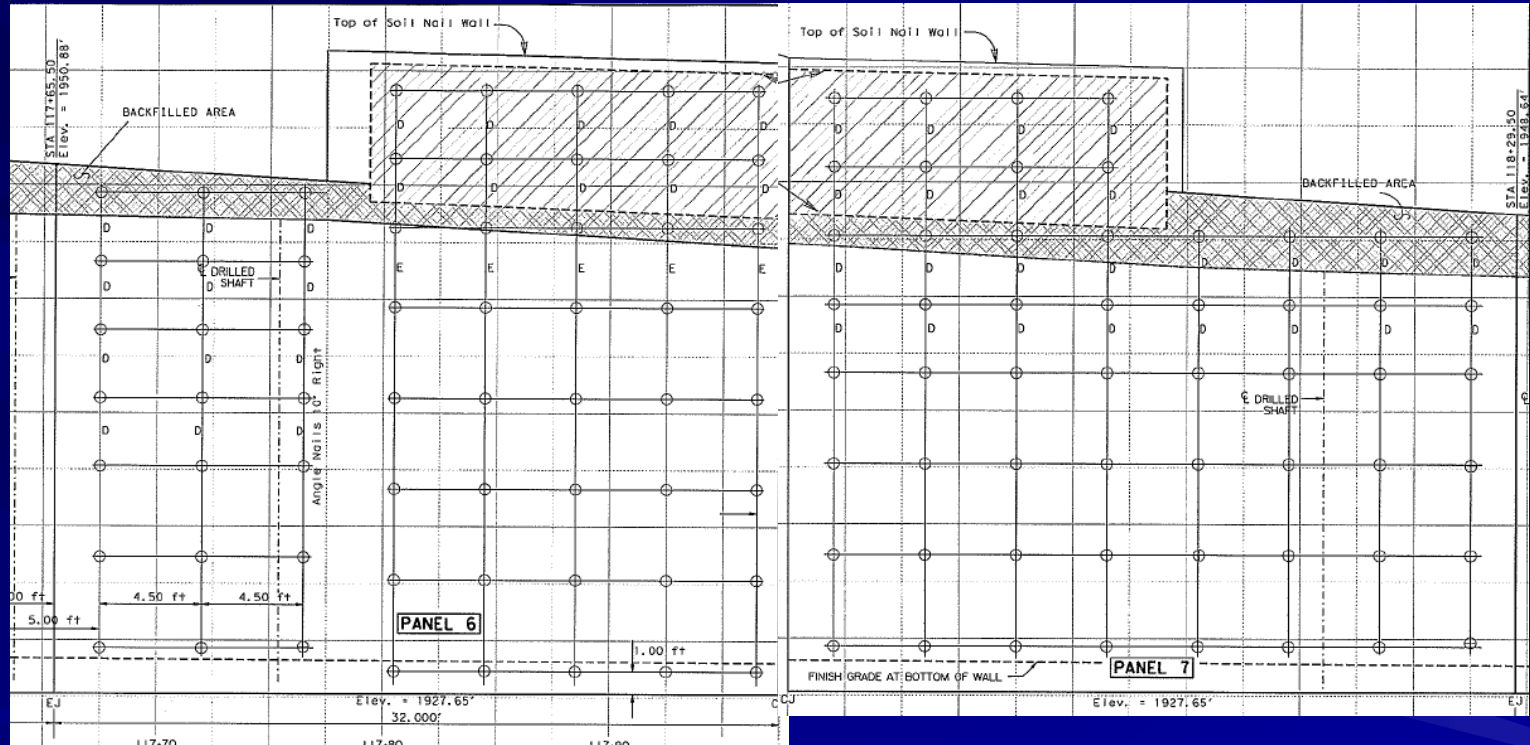
Texas Department of Transportation
 © 2005 1000'

US 67 RETAINING WALL PLAN AND PROFILE

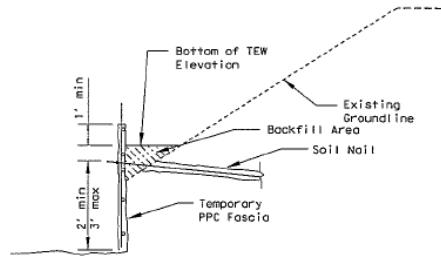
STA. 116+11.27 TO STA. 119+83.74
 TO STA. 119+89.50
 SCALE 1" = 50' HORIZONTAL
 SCALE 1" = 5' VERTICAL
 SHEET 3 OF 4 SHEETS

REV. NO.	PROJECT NO.	SHEET NO.
6	C 77-6-79	XX
STATE	DIST.	COUNTY
TEXAS	SJT	TOM GREEN
CONTR.	SECT.	JOB HIGHWAY NO.
77	6	79 US 67

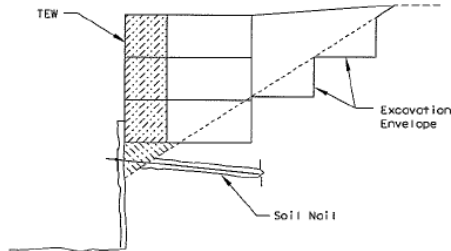
Case History 2 – US 67 Sherwood Way



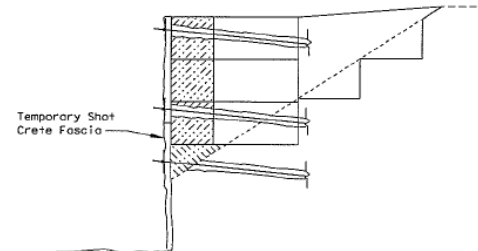
Case History 2 – US 67 Sherwood Way



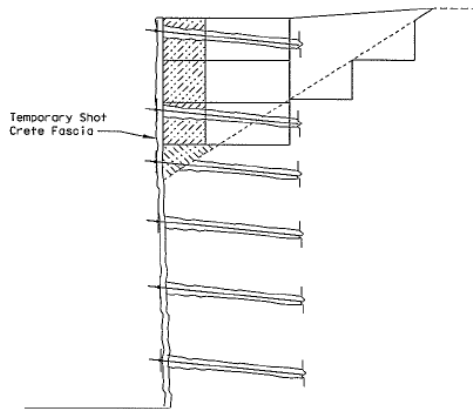
Step 1 - Install 1st row of nails in portion of wall between the existing bridges excavating no less than 2' nor more than 3' below the installed nail. Existing geometry may require that nails be drilled into slope and projected to the alignment of the wall face. An area between the existing ground line and the back of the temporary PPC fascia may need to be filled. This backfill may consist of cement stabilized sand, PPC or other cementitious material as approved by the Engineer. Project the temporary PPC fascia a minimum of 1' above the proposed TEW bottom of wall elevation. This section of the temporary PPC fascia is to be reinforced with the welded wire mesh as well as #4's @ 12" (vertical) and #4's horizontal. The vertical reinforcing steel shall project a minimum of 1' above the 1' PPC projection. The horizontal steel shall be placed as follows: 4" below the top of the PPC projection, above and below the soil nail behind the nail plate (water bars) and at 12" there after.



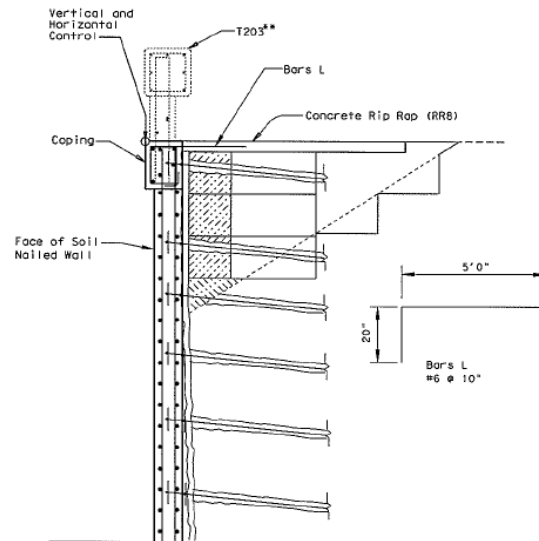
Step 2 - Construct TEW to the lines and grades shown in the plans. The 2' zone behind the face of the TEW shall be filled with cement stabilized sand. The fill zone behind the limits of the TEW mass shall be filled with material meeting the same requirements as the select fill used in the reinforced zone of the TEW.



Step 3 - Install soil nails through the TEW in the locations indicated on the plans and apply the required 4" PPC temporary facing.

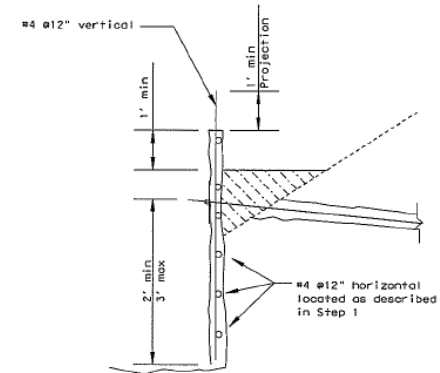


Step 4 - Install remainder of the soil nails.



Step 5 - Apply permanent C.I.P. Fascia and complete wall.

** See Sheet Type T203 Rail Standard (sheet 1 of 2) for details on T203 rail attachment to C.I.P. wall fascia.



Step 1 Reinforcement Details

TEXAS DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

SOIL NAIL/TEW RETAINING WALL CONSTRUCTION SEQUENCE

4 of 4

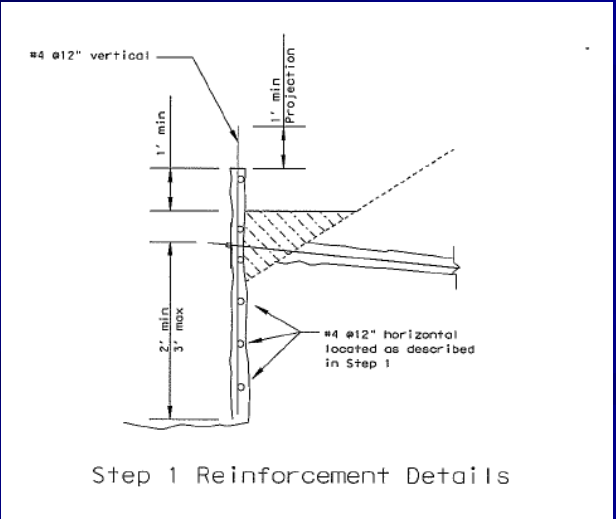
REVISIONS		PREPARED BY AND FOR USE OF THE GOVT			
NO.	DATE	BY	SCALE	PROJECT	SHEET
01	6			C17-6-75, etc.	XXXX
02					
03					
04					
TOM GREEN		0077	06	079	US 67

Case History 2

Constructing Gunnite Fascia to receive TEW



NOV 7 20



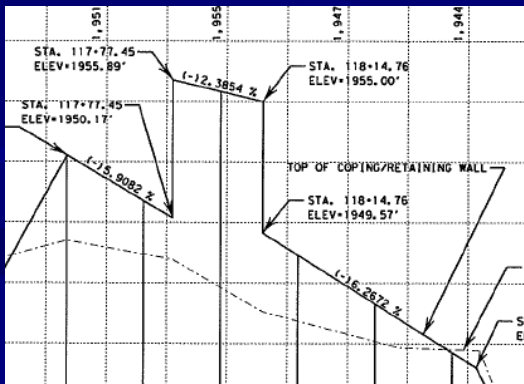
Step 1 Reinforcement Details



NOV 28 2007

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?

