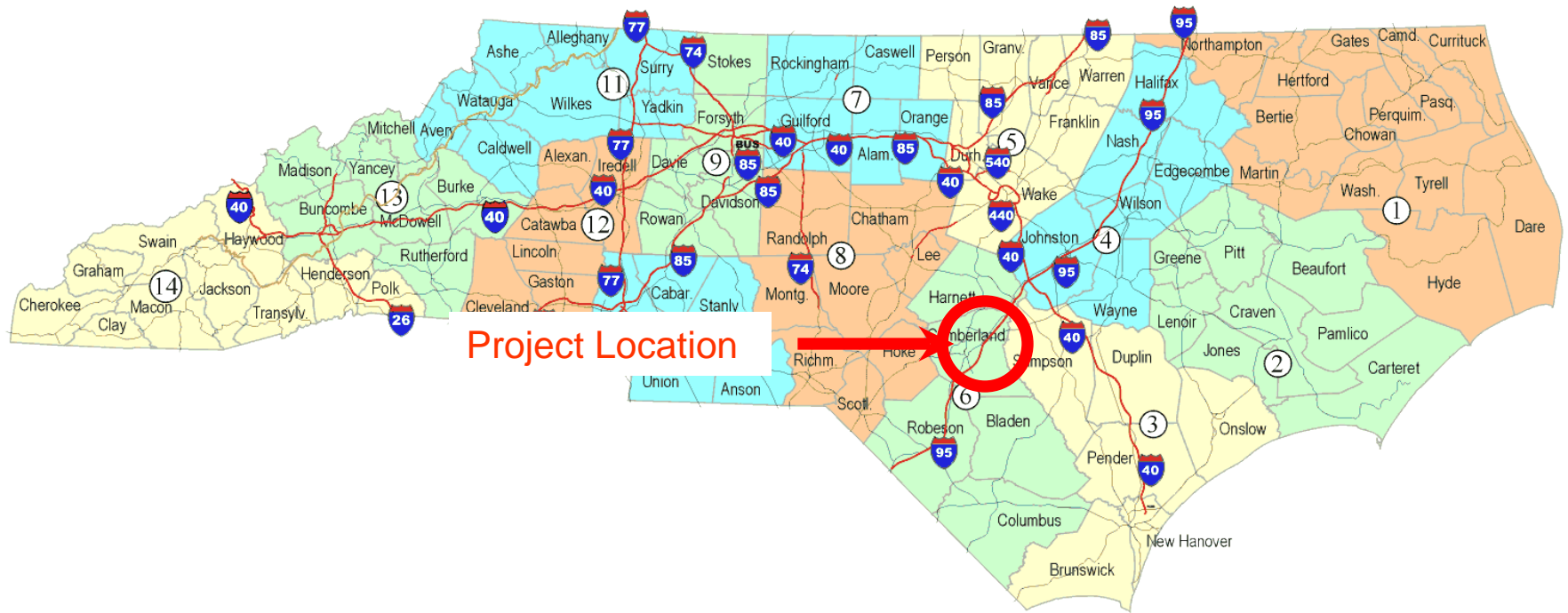




# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

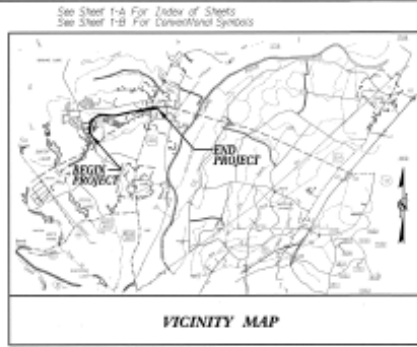


**Fayetteville Outer Loop Extension Project Location**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CONTRACT: C202618 TIP PROJECT: X-0002CB



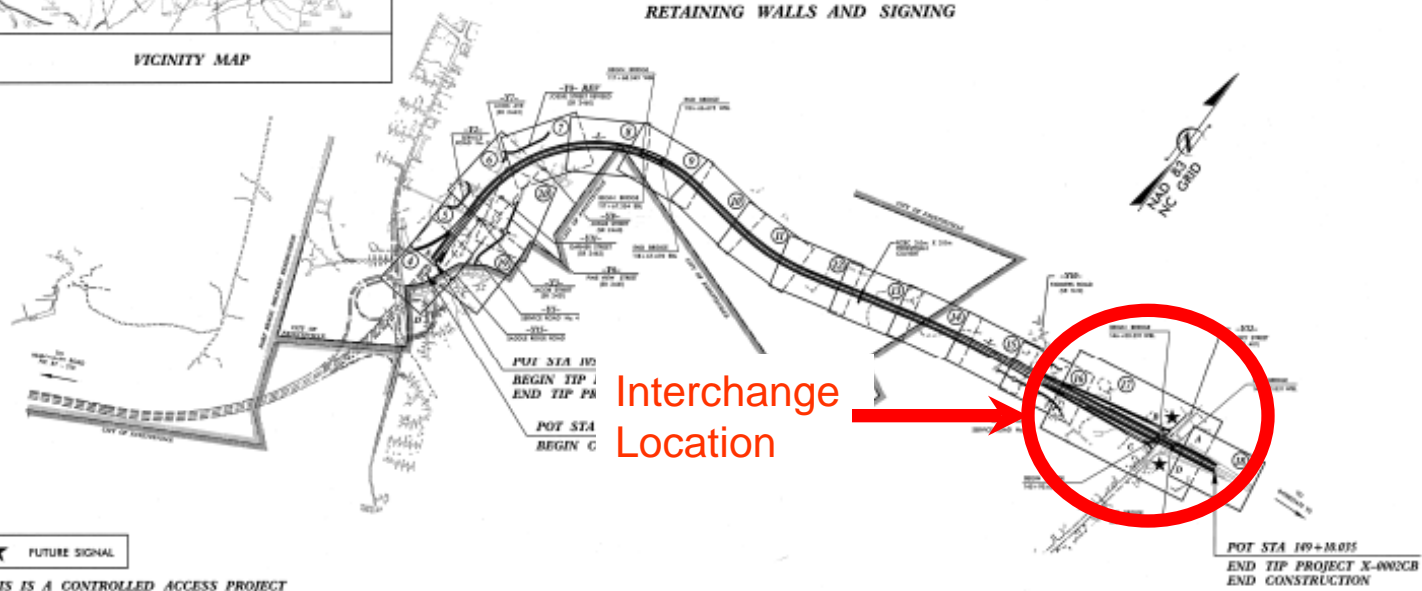
STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

## CUMBERLAND COUNTY

LOCATION: FAYETTEVILLE OUTER LOOP  
FROM EAST OF SR1600 (MCARTHUR RD.)  
TO WEST OF US401 (RAMSEY ST.)

TYPE OF WORK: GRADING, DRAINAGE, PAVING, STRUCTURES,  
RETAINING WALLS AND SIGNING

<p>ALL DIMENSIONS IN THESE PLANS ARE IN METERS UNLESS OTHERWISE SHOWN</p>	STATE	STATE PROJECT REFERENCE NO.	HEET NO.	TOTAL
	N.C.	X-0002CB	1	
	DATE PREP'D	DRAWING NO.	DESCRIPTION	
	3/27/06, 1, 2	NHP-0100202	P.E.	
	3/21/06, 3, 4	NHP-0100201	ROW & UTIL.	
	3/27/06, 3, 20	NHP-0100201	CONTR.	



<b>GRAPHIC SCALES</b> 	<b>DESIGN DATA</b> ADT 2011 = 38,100 ADT 2036 = 66,390 DHV = 9 % D = 55 % T = 10 % * V = 110 km/h * (TTS 4 % DUAL 6 %) FUNC. CLASS = INTERSTATE
---------------------------	---

<b>PROJECT LENGTH</b> LENGTH ROADWAY TIP PROJECT X-0002CB = 4.170 km LENGTH STRUCTURES TIP PROJECT X-0002CB = 0.190 km TOTAL LENGTH OF TIP PROJECT X-0002CB = 4.360 km	
---	--

Prepared to the office of:  
  
 FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

RIGHT OF WAY DATE: MAY 31, 2006  
 LETTING DATE: FEBRUARY 15, 2011

T.R. REID, P.E.  
PROJECT ENGINEER

T.R. HUFFMAN, P.E.  
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER  
  
 SDG  
 SINGAPORE DESIGN GROUP, P.A.  
 1101 NORTH BRIDGE STREET, SUITE 1100  
 WASHINGTON, D.C. 20002-4242  
 PHONE: (202) 462-1100  
 FAX: (202) 462-1101  
 WWW.SDG.COM

ROADWAY DESIGN ENGINEER  
  
 MOFFATT & NICHOL  
 1000 W. HARRIS STREET, SUITE 100  
 RALEIGH, NC 27601  
 PHONE: (919) 876-1100  
 FAX: (919) 876-1101  
 WWW.MOFFATTANDNICHOL.COM

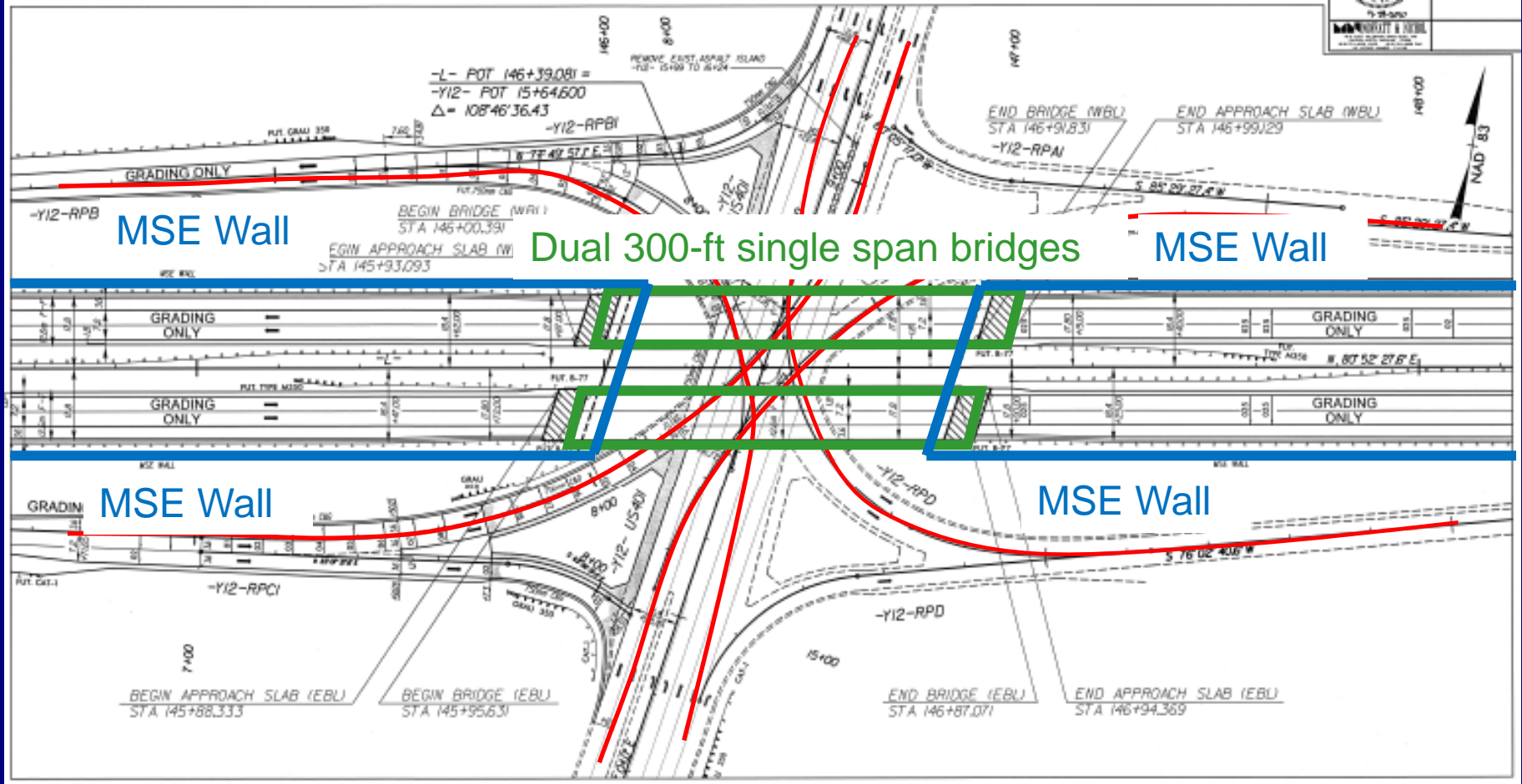
DIVISION OF HIGHWAYS  
 STATE OF NORTH CAROLINA

STATE HIGHWAY DESIGN ENGINEER

**Single Point Urban Interchange (SPUI) Location**



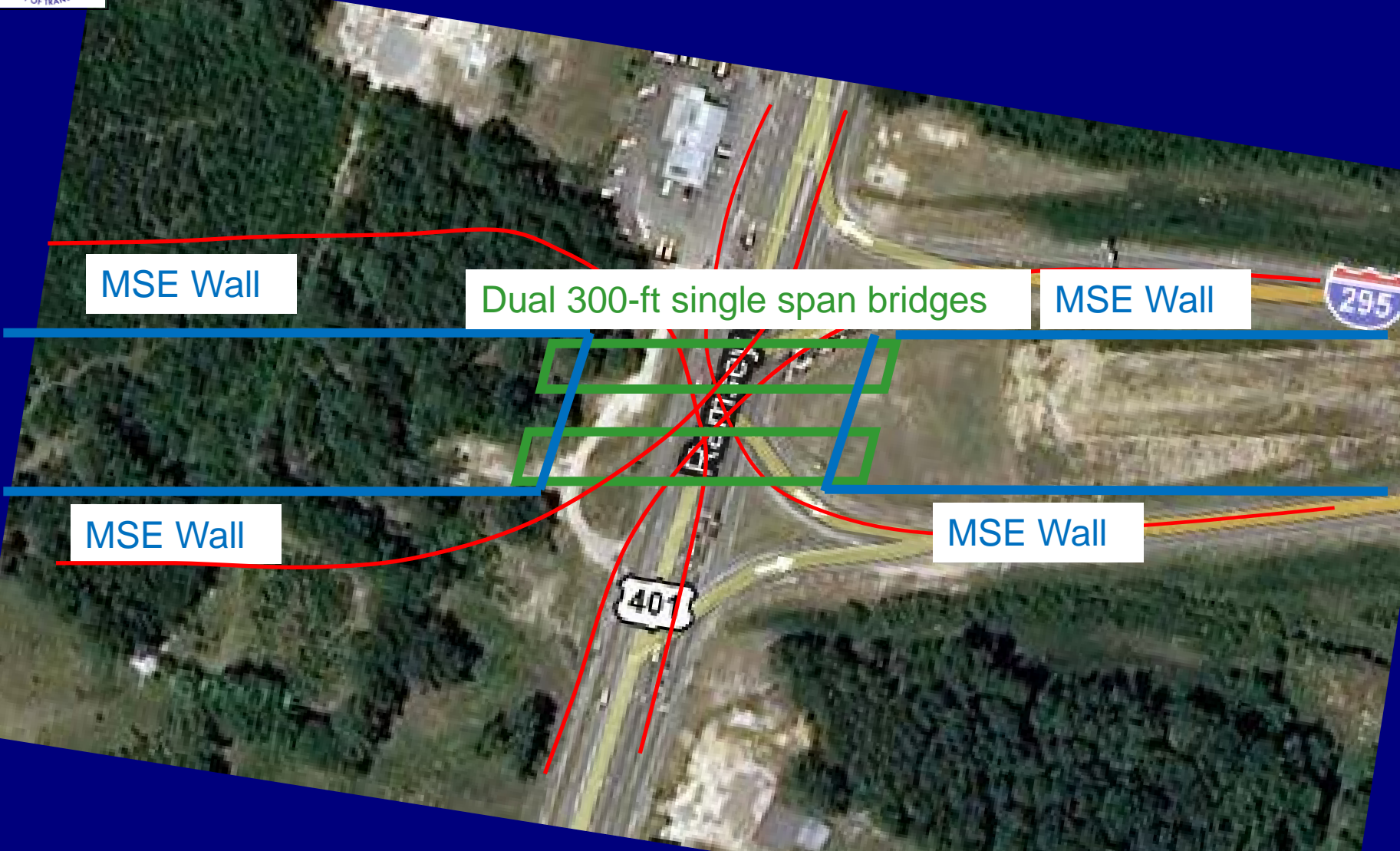
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



Single Point Urban Interchange (SPUI) Layout



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

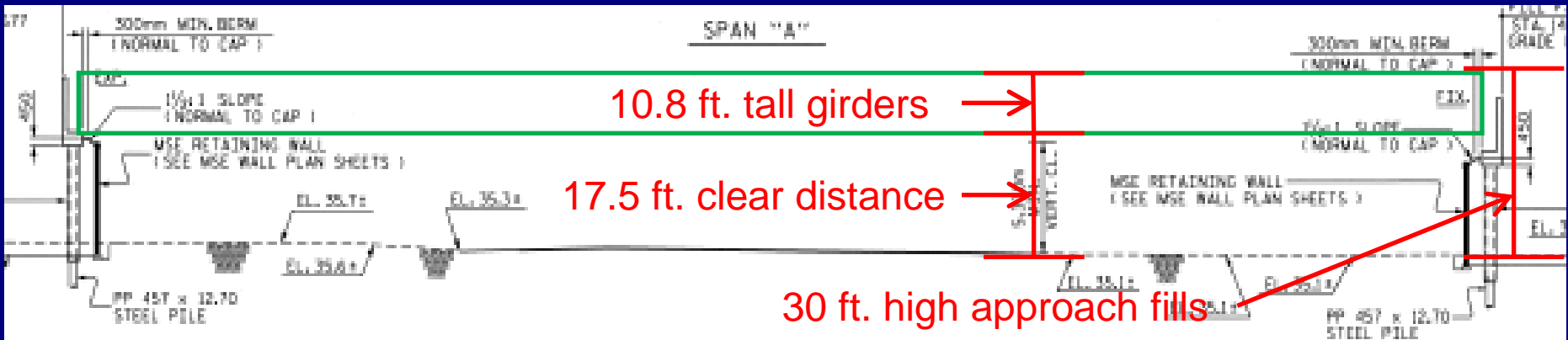


**Single Point Urban Interchange (SPUI) Layout**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

## Dual 300-ft single span bridges



## Single Point Urban Interchange (SPUI) Bridge



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Single Point Urban Interchange (SPUI) Bridge**



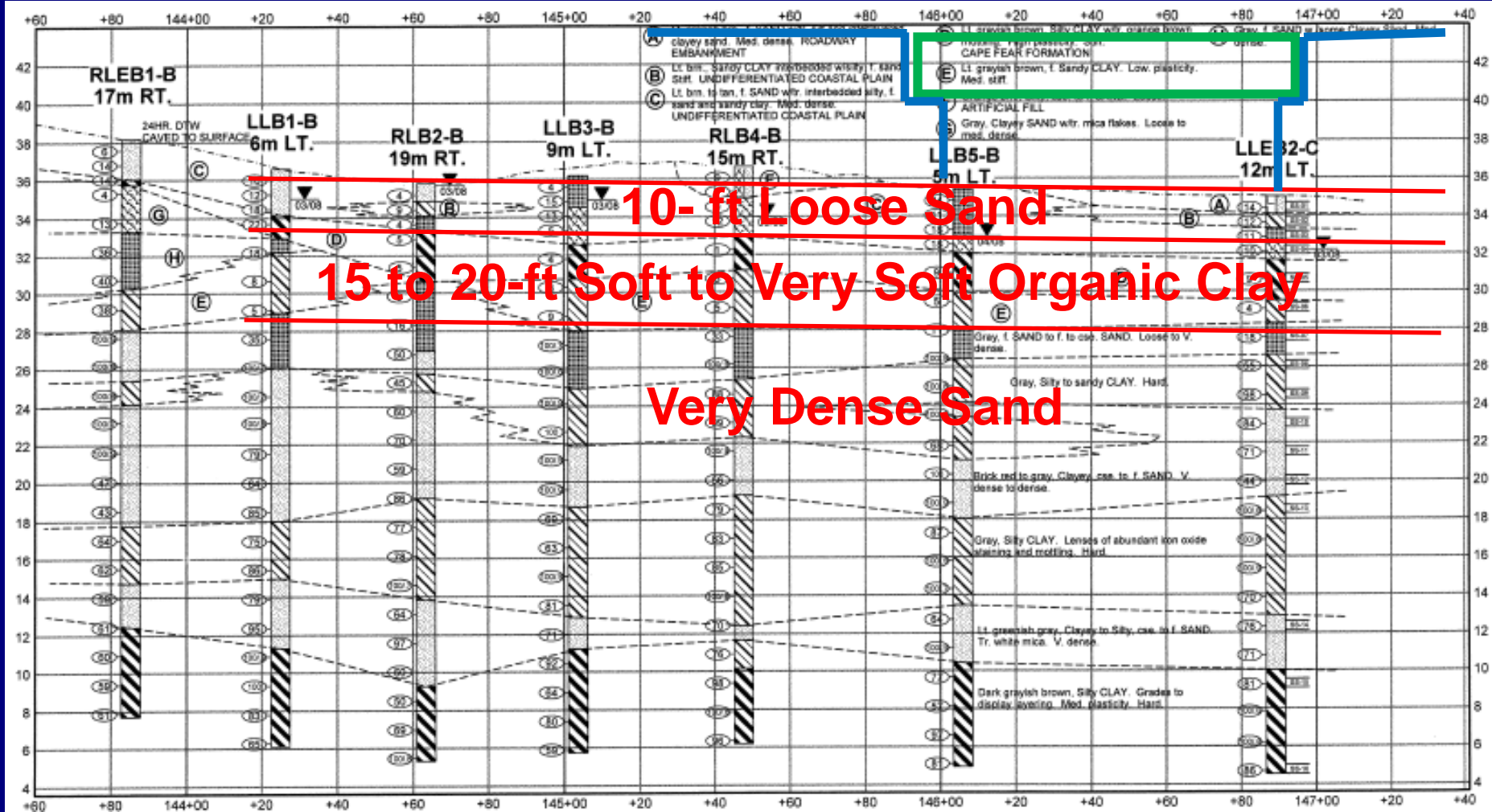
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Single Point Urban Interchange (SPUI) Bridge**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

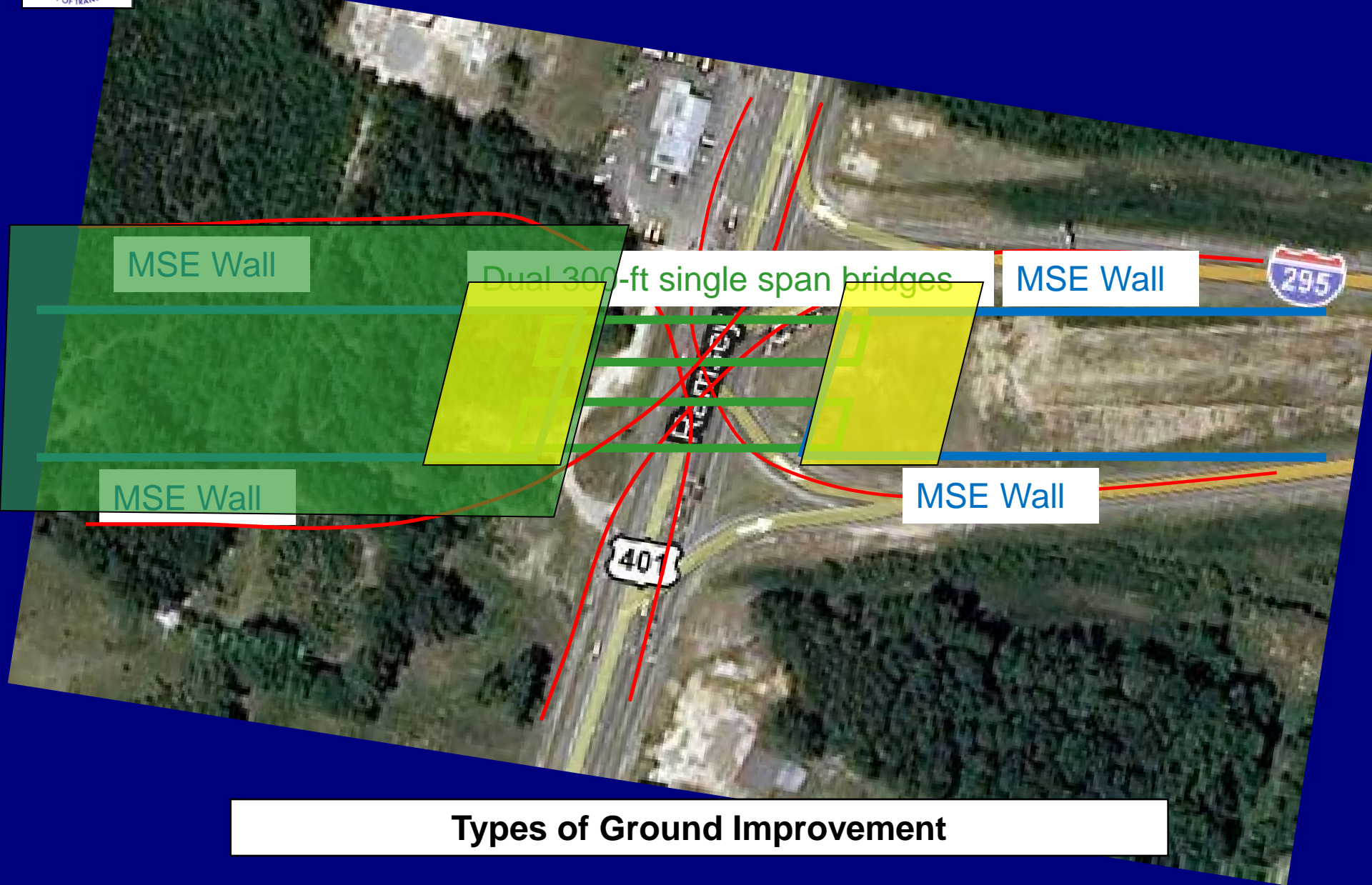


Subsurface Conditions Below Approaches





# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



MSE Wall

Dual 300-ft single span bridges

MSE Wall

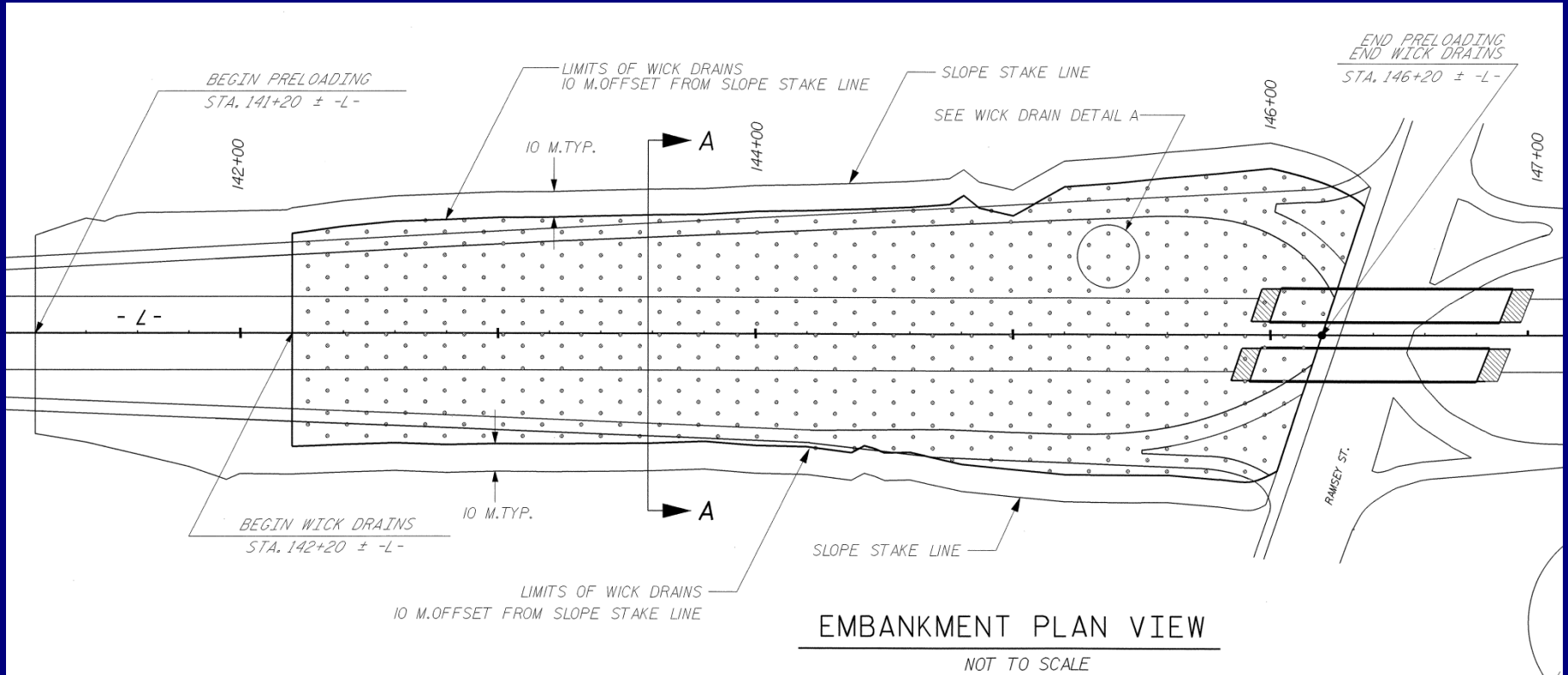
MSE Wall

MSE Wall

Types of Ground Improvement



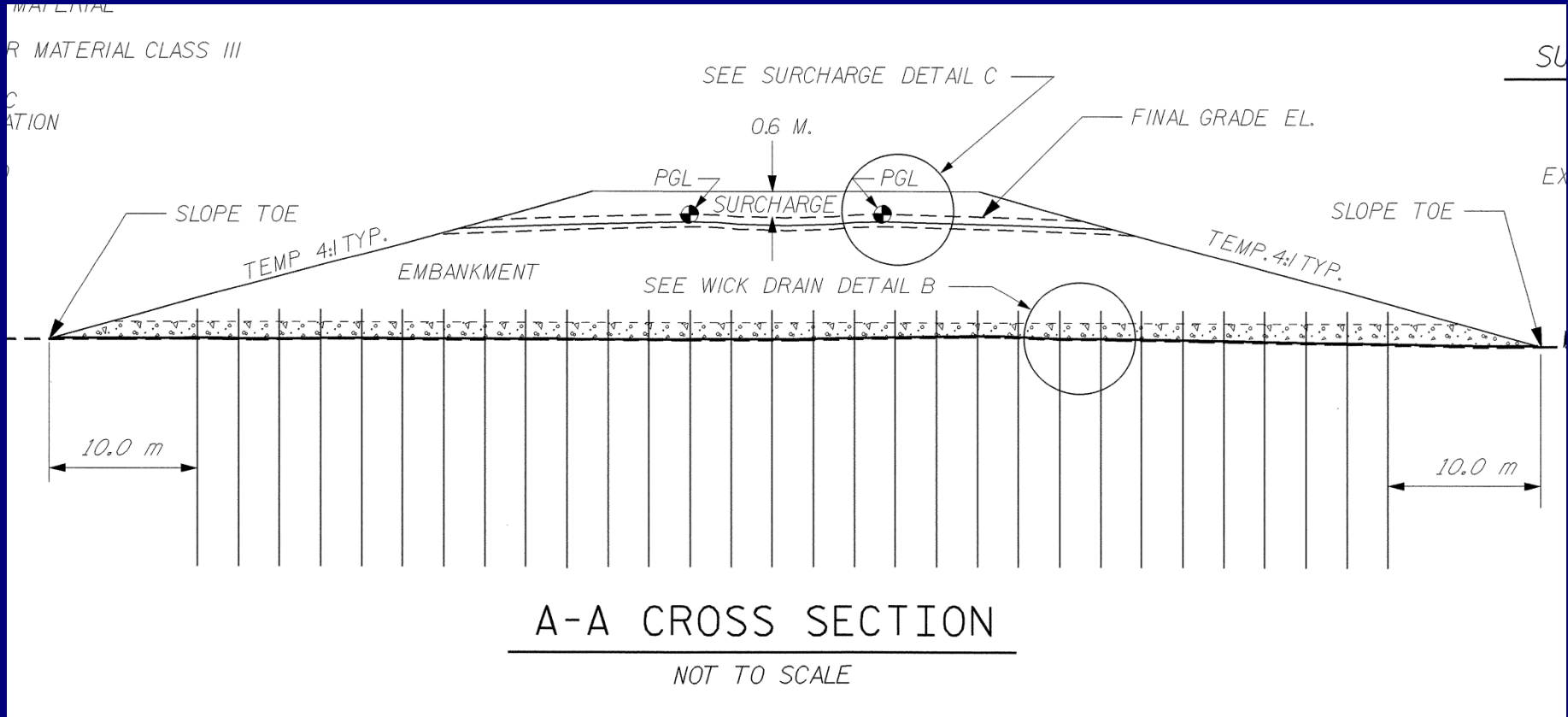
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Limits of Wick Drains and 11 Month Surcharge**



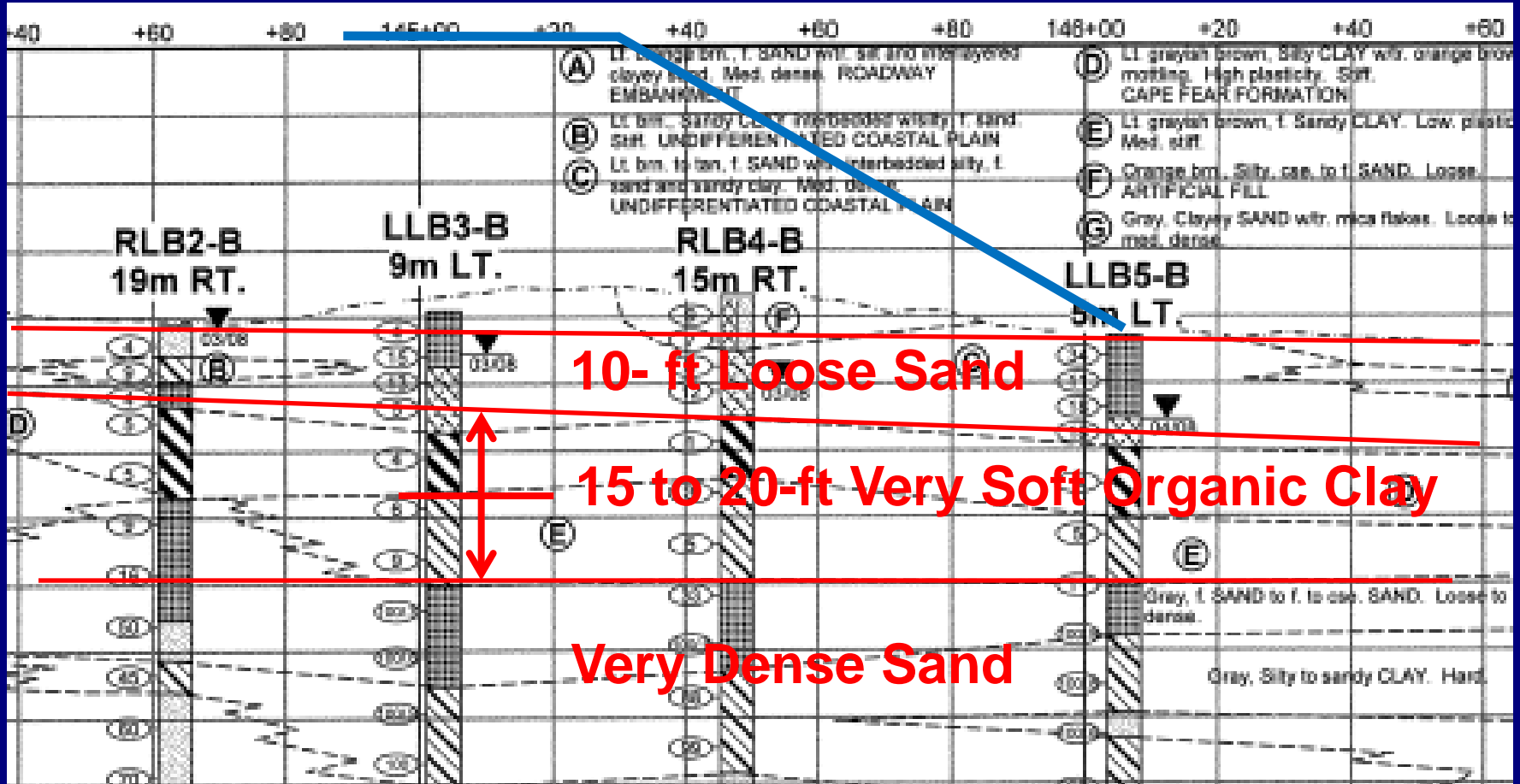
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Limits of Wick Drains and 11 Month Surcharge**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

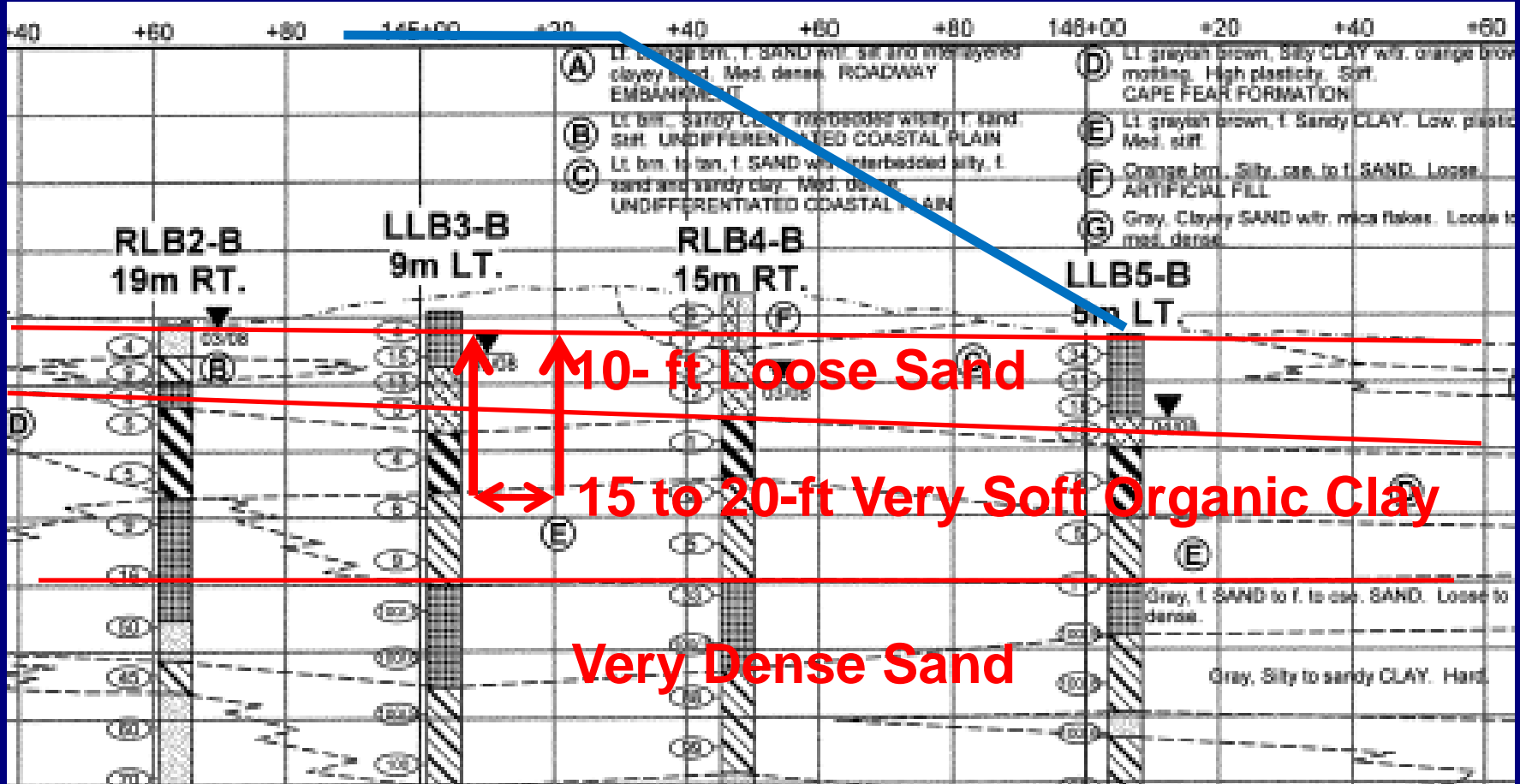


90% of Settlement expected to take 2 to 5 years – 10 to 28 inches total

Traditional Time Rate Consolidation



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



90% of Settlement expected to take 11 months – still 10 to 28 inches total

Wick Drain Consolidation



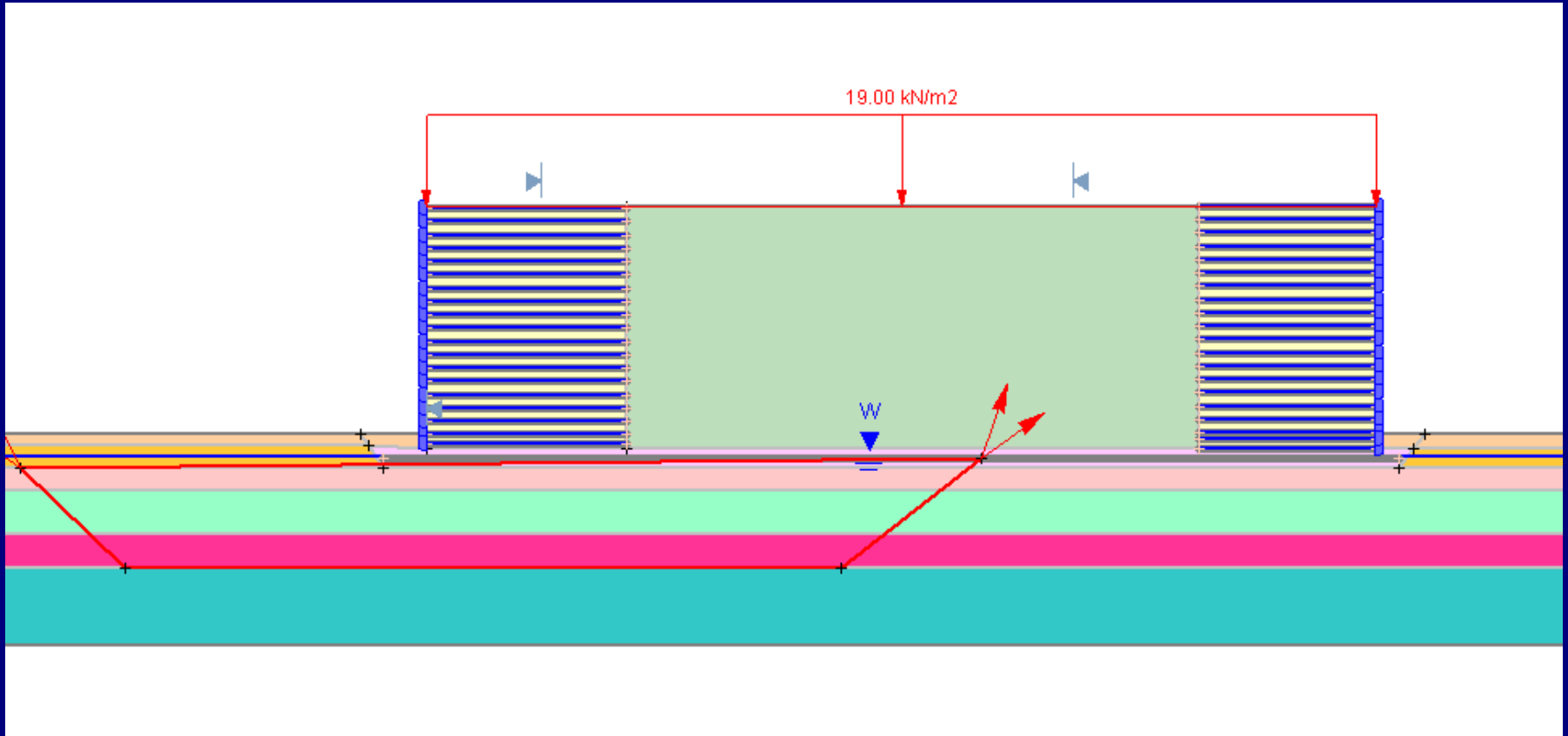
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Wick Drain Installation**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



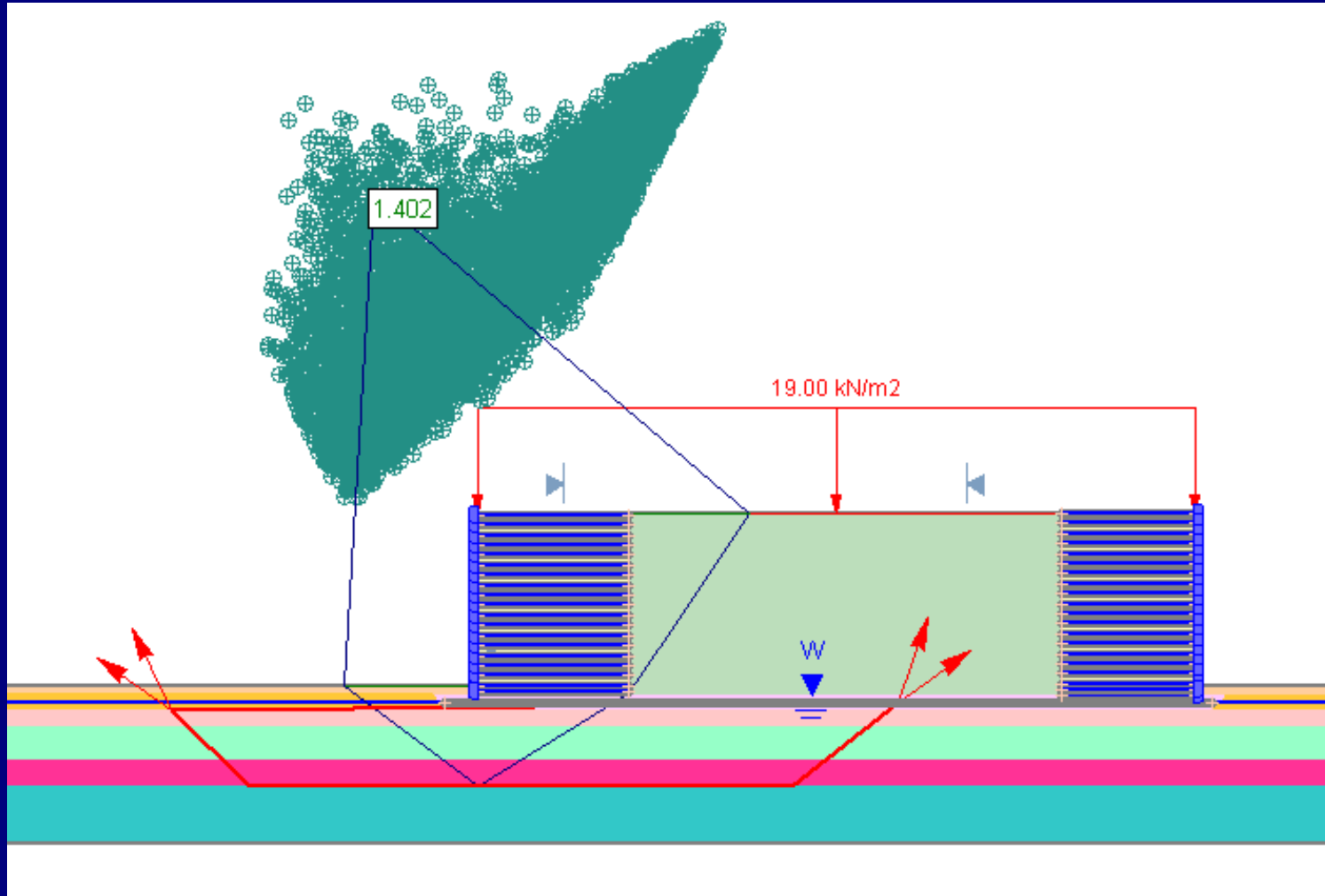
**Global Stability of MSE Walls**







# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

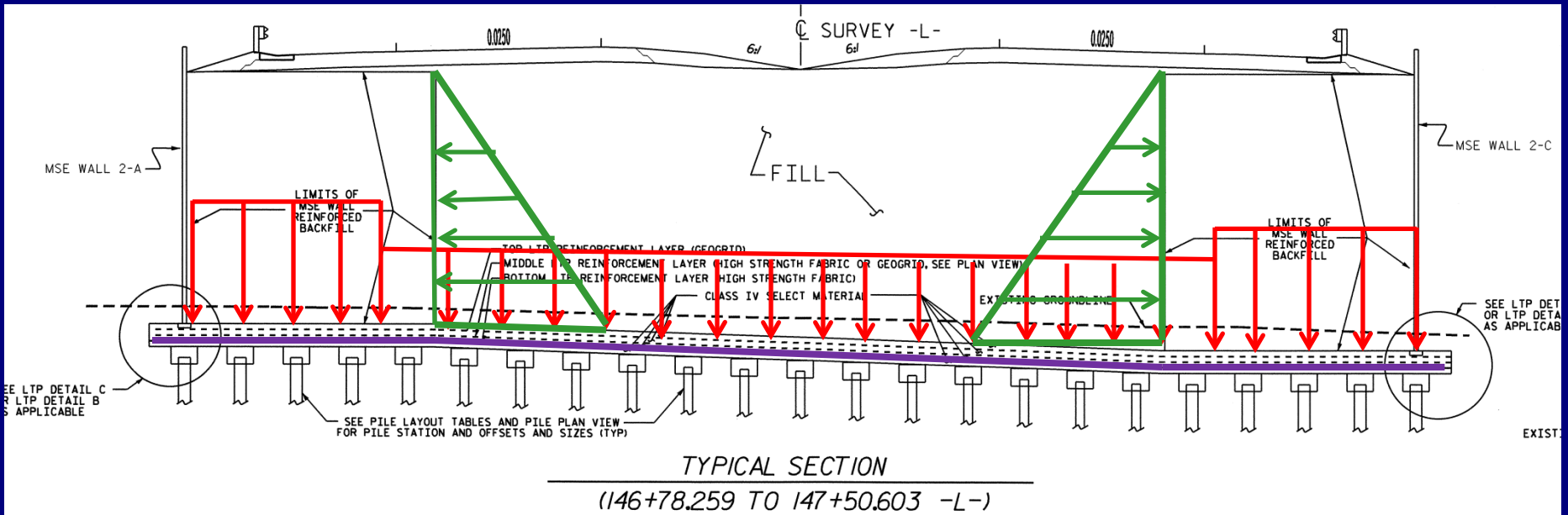


**Local Bearing Capacity and Lateral Squeeze still an issue**

**High Strength Fabric Reinforced Global Stability**



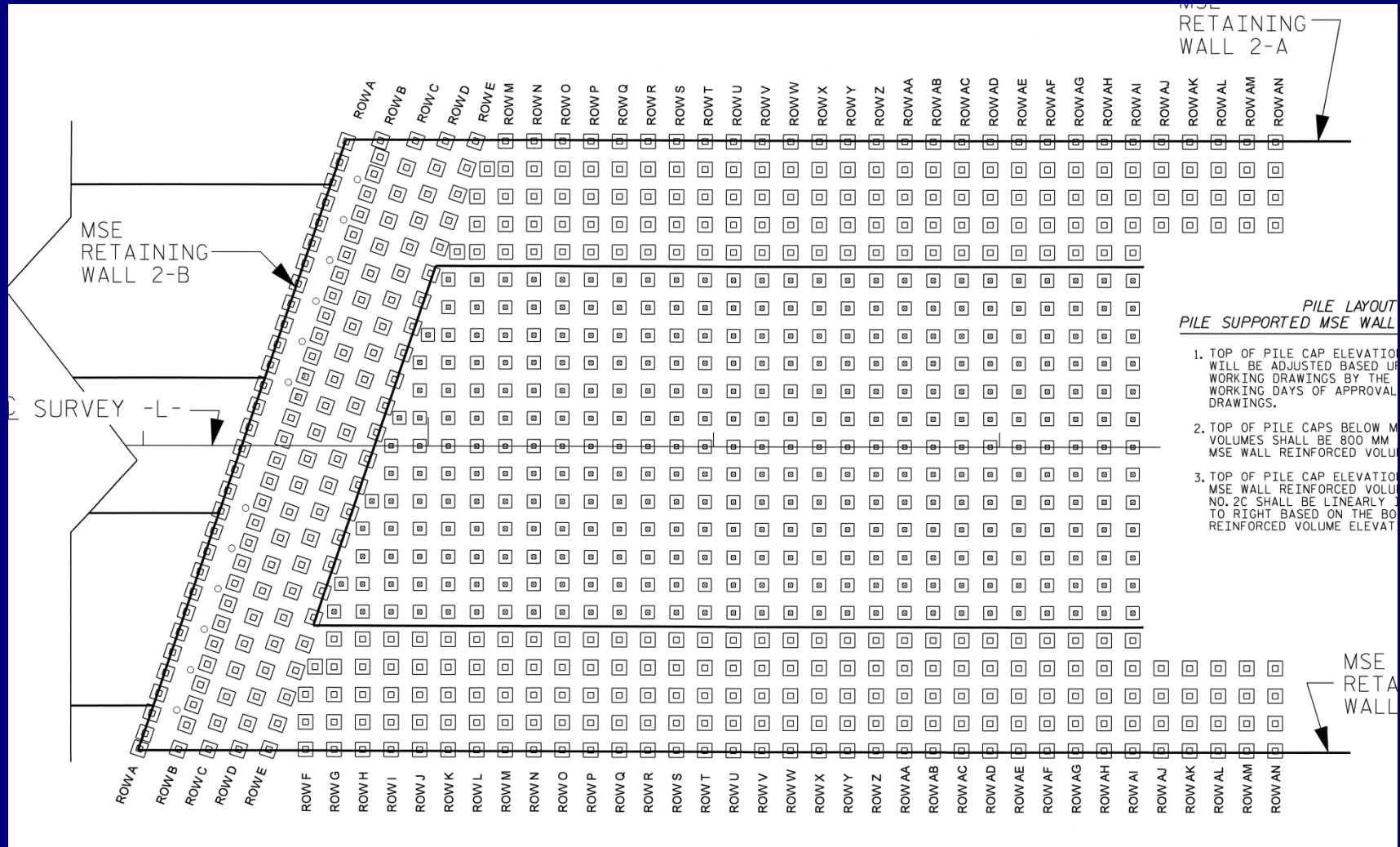
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Section through Pile Supported MSE Walls**



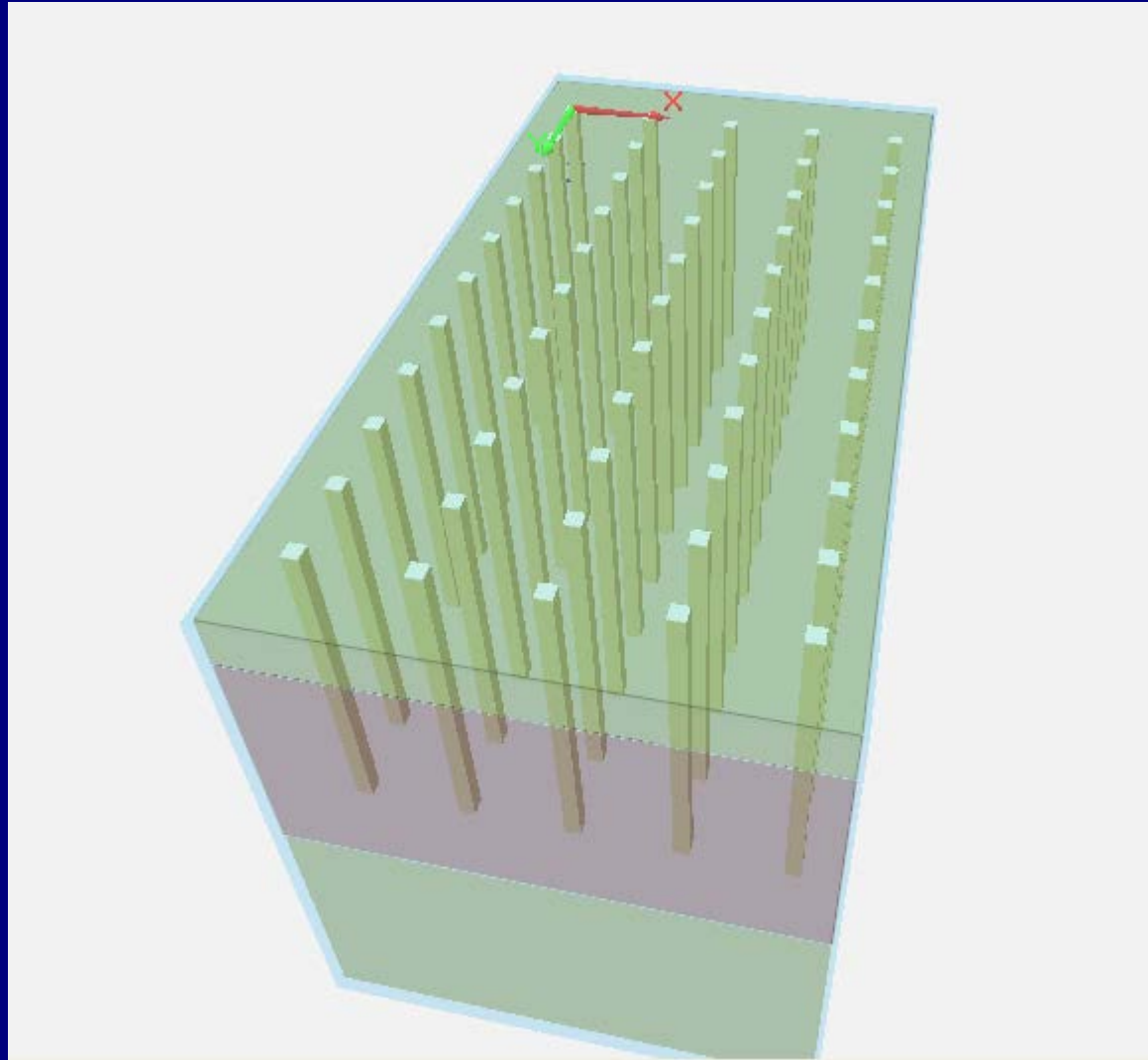
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Plan View of Pile Supported MSE Walls**



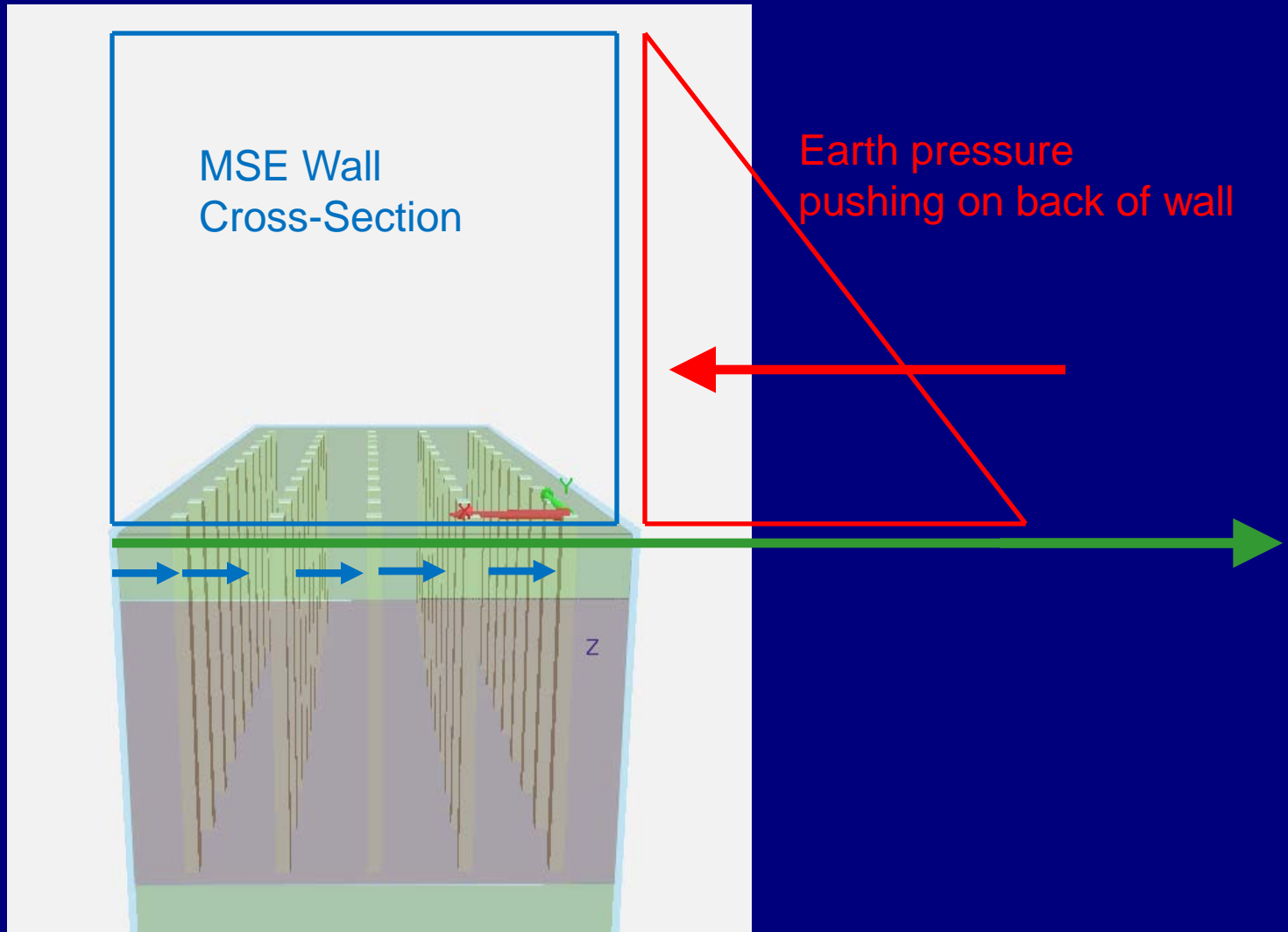
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**FB-Pier Model of Piles Below MSE Wall**



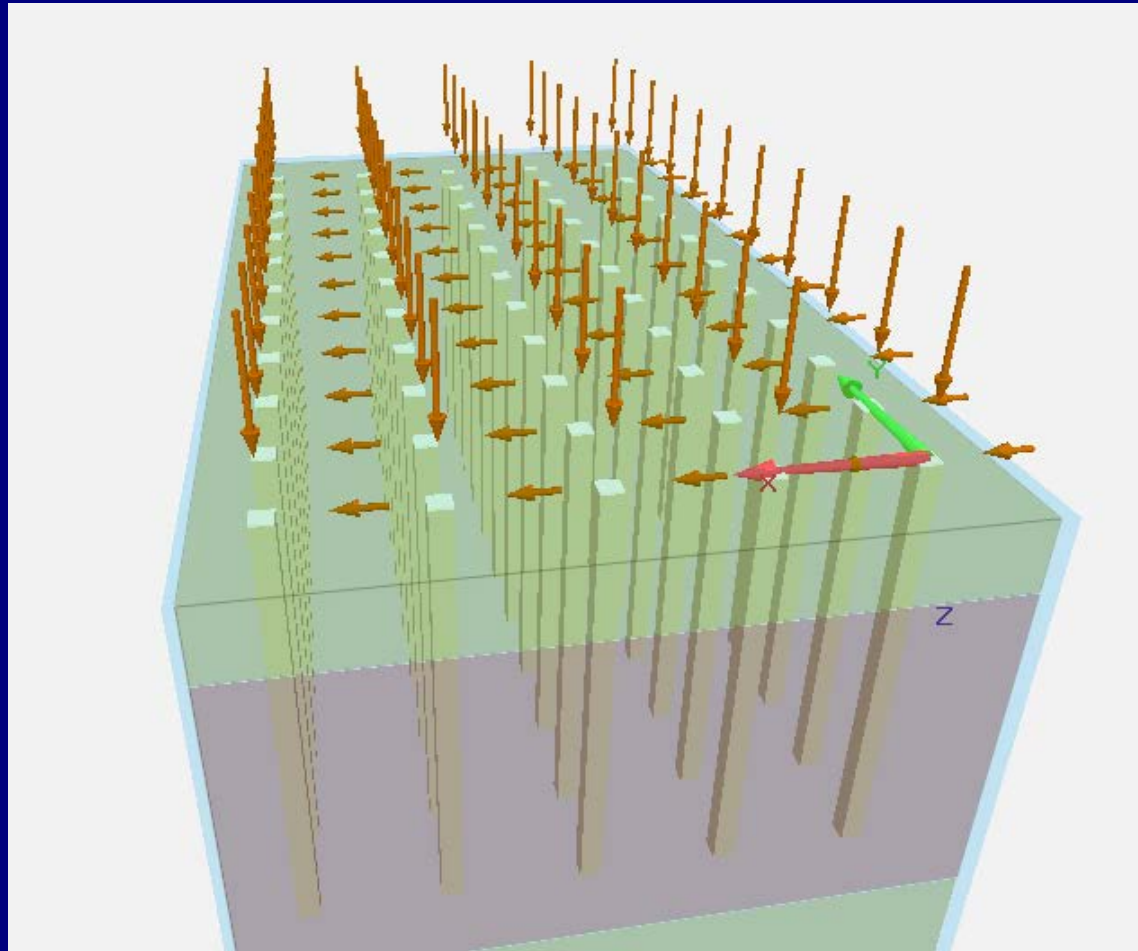
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**FB-Pier Model of Piles Below MSE Wall**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

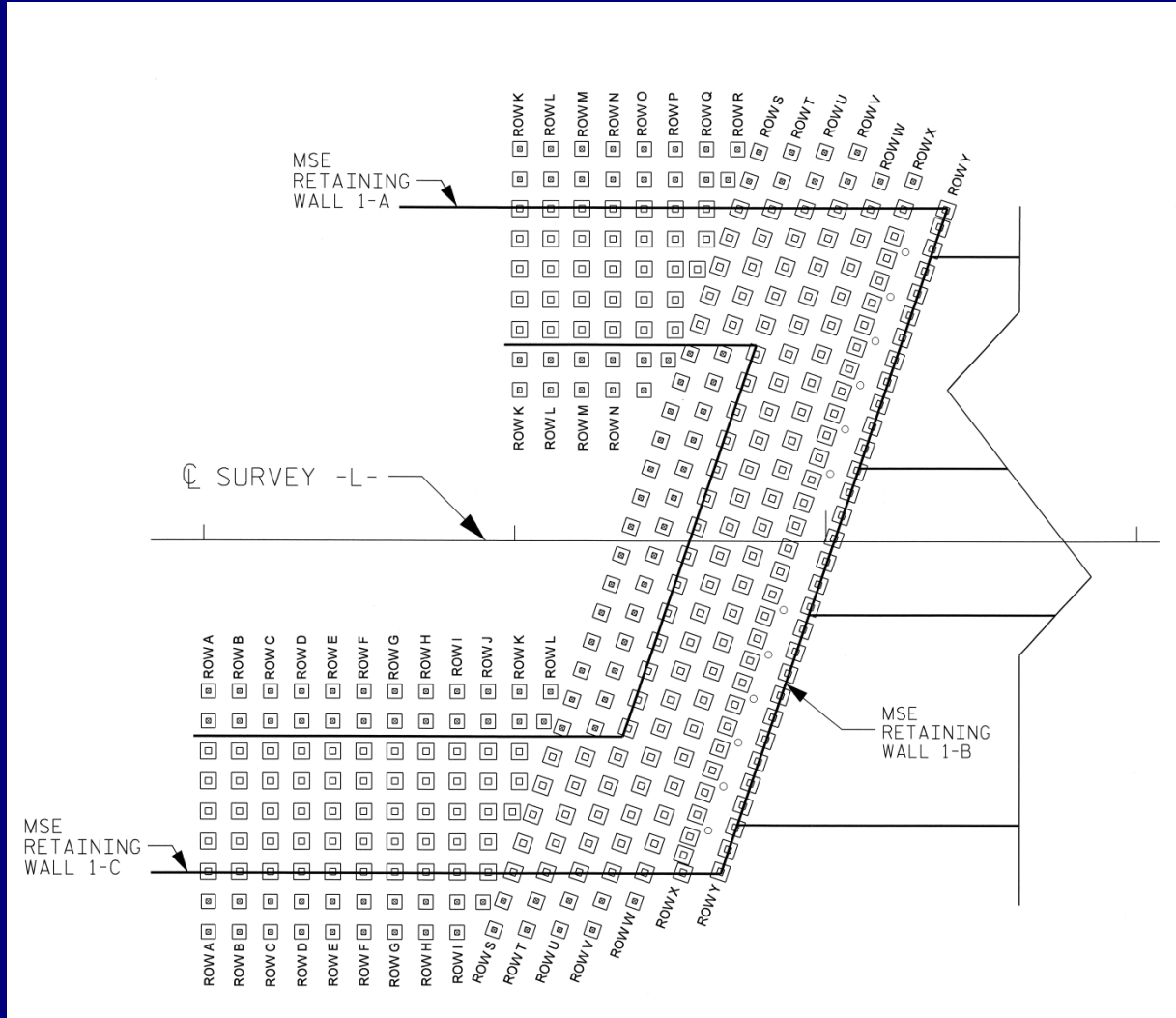


**Shear load shared about equally between fabric and piles at  
1.5 inches of movement**

**FB-Pier Model of Piles Below MSE Wall**



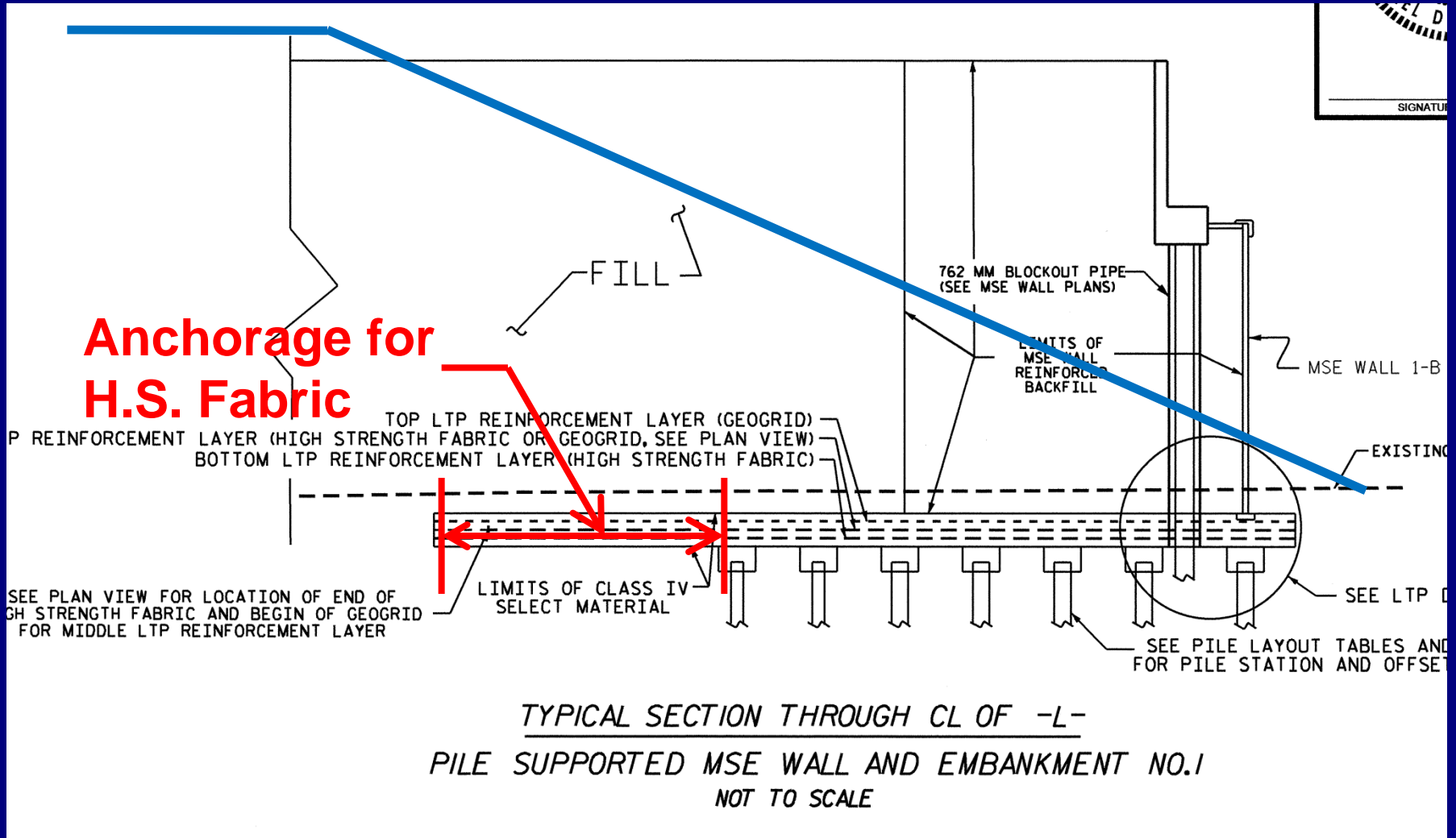
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Pile Supported MSE Wall Plan View at Surcharge Location**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

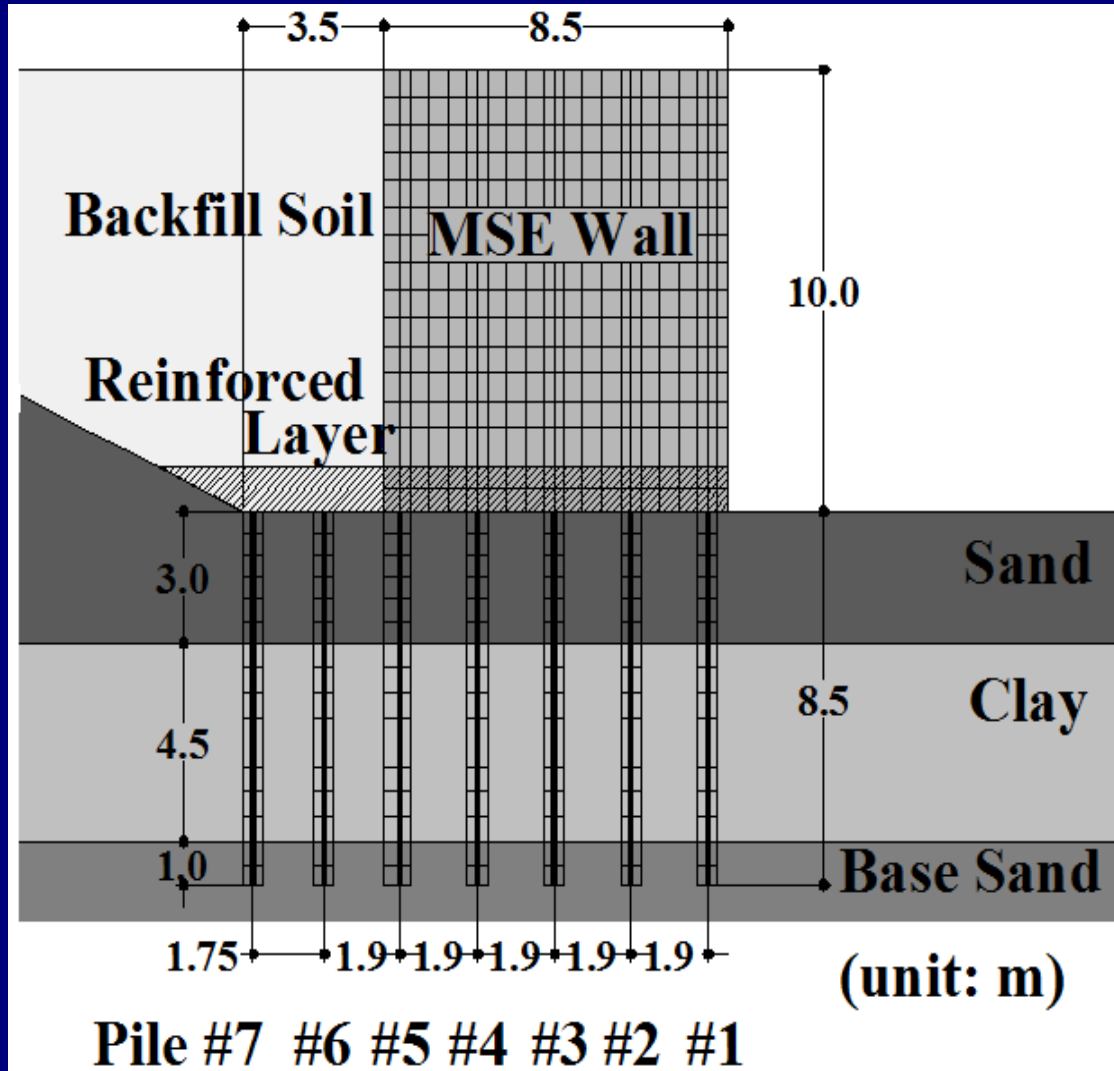


**Typical Section Through Wall at Surcharge**





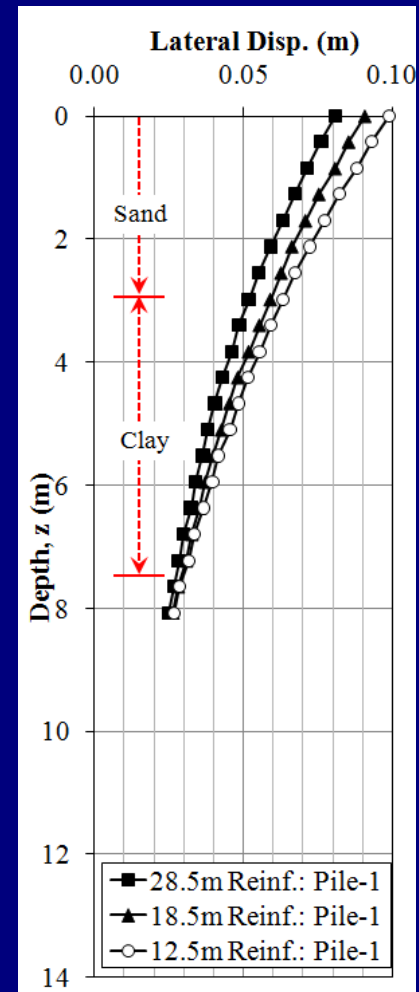
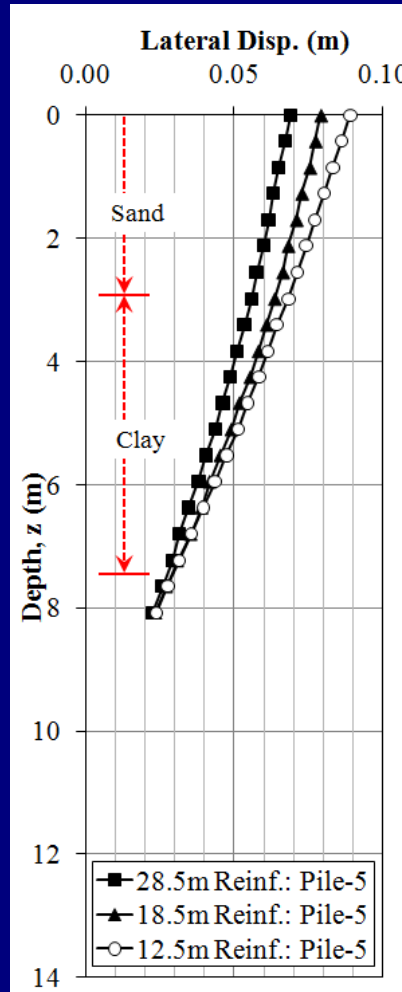
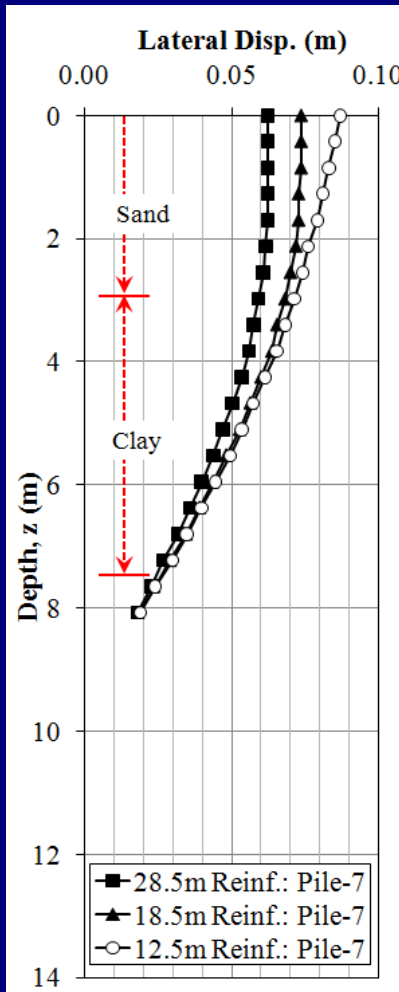
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



Finite Element Model of Piles and MSE Wall



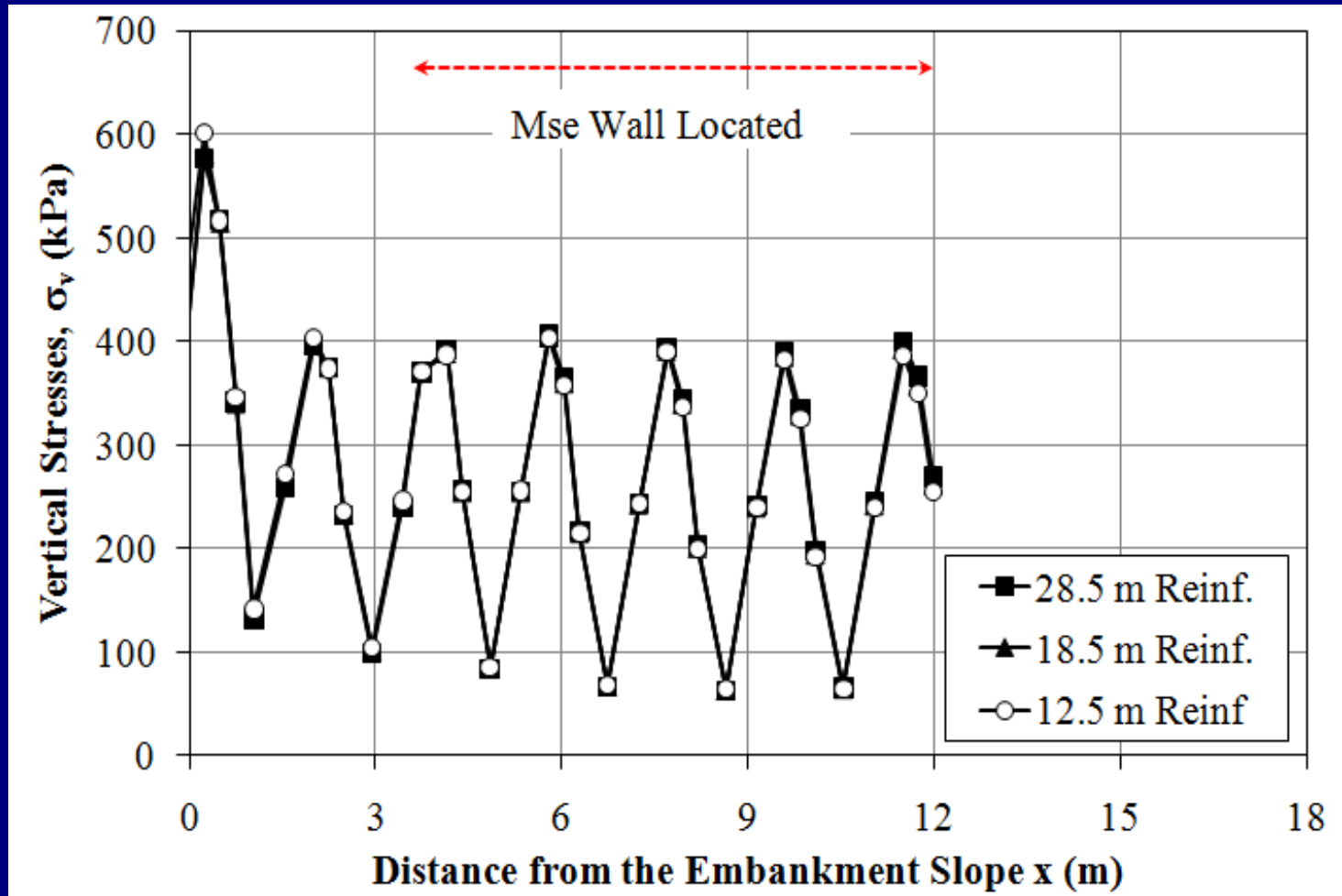
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Pile Displacement Curves for Different Fabric Anchorage Lengths**



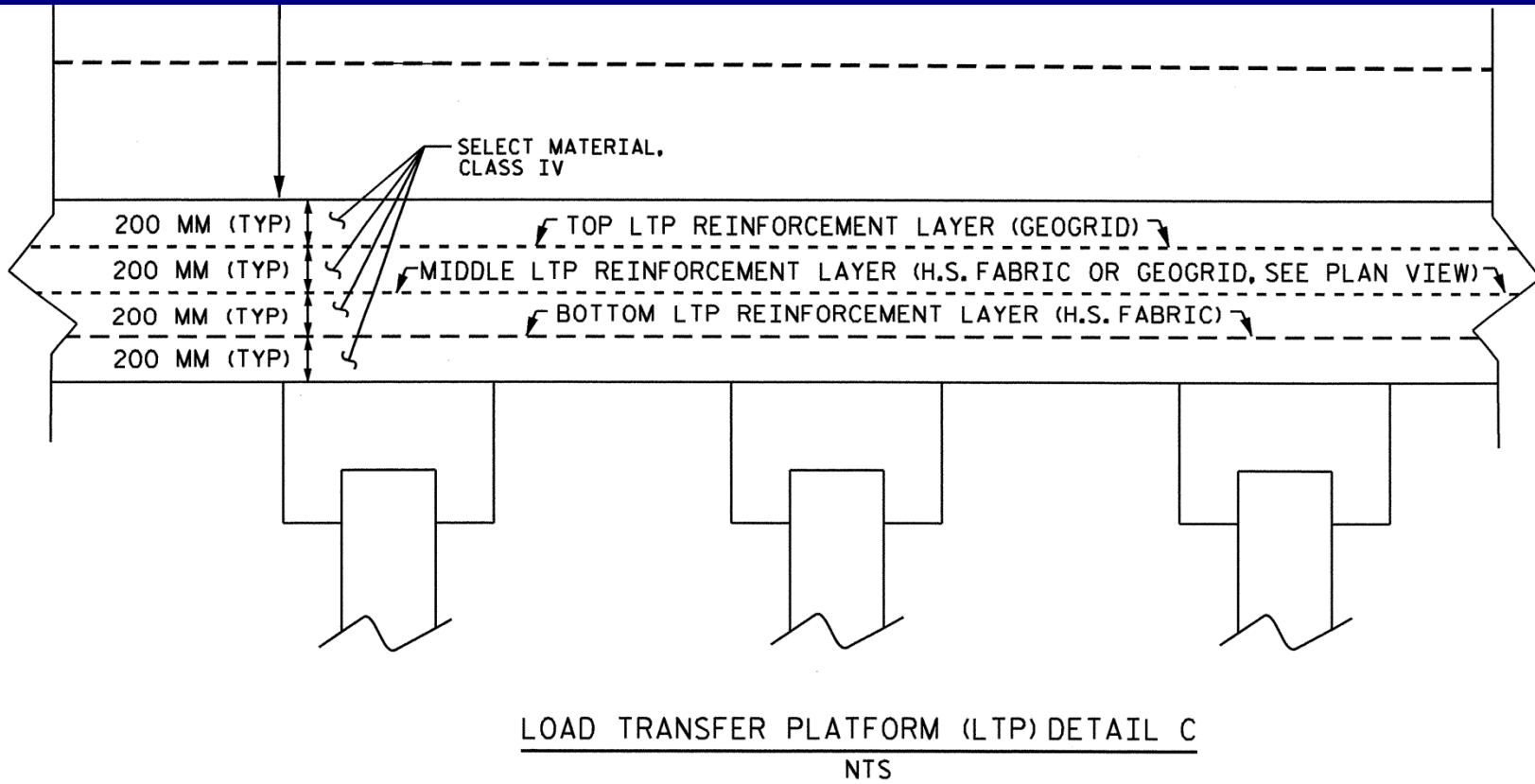
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Vertical Stress Distribution at bottom of LTP**



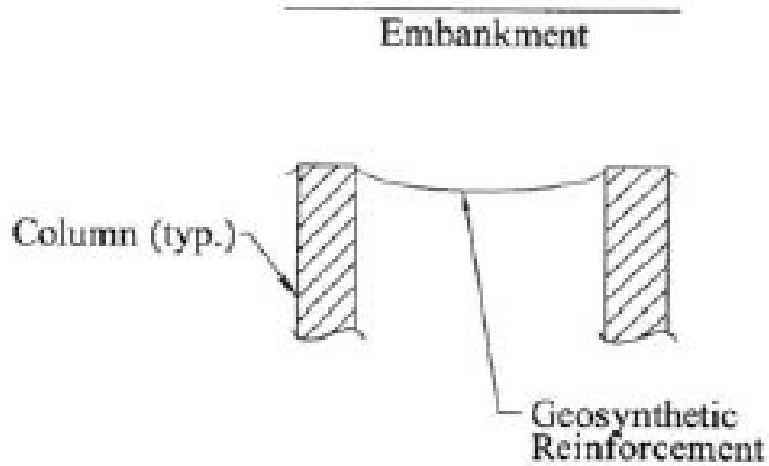
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



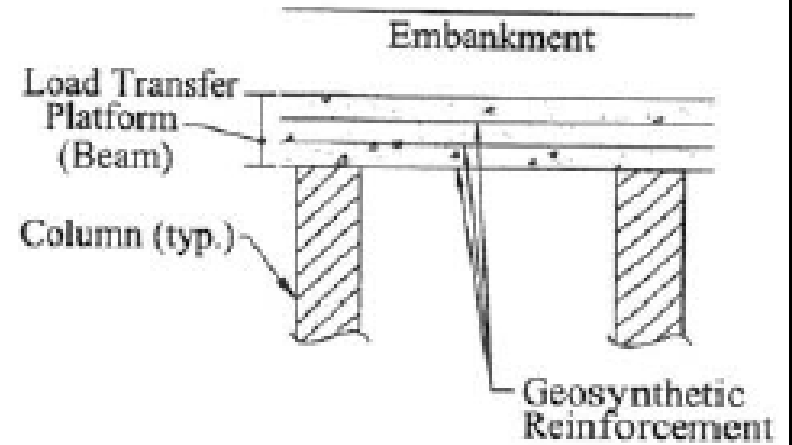
**Load Transfer Platform Typical Section**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



a) Catenary Theory

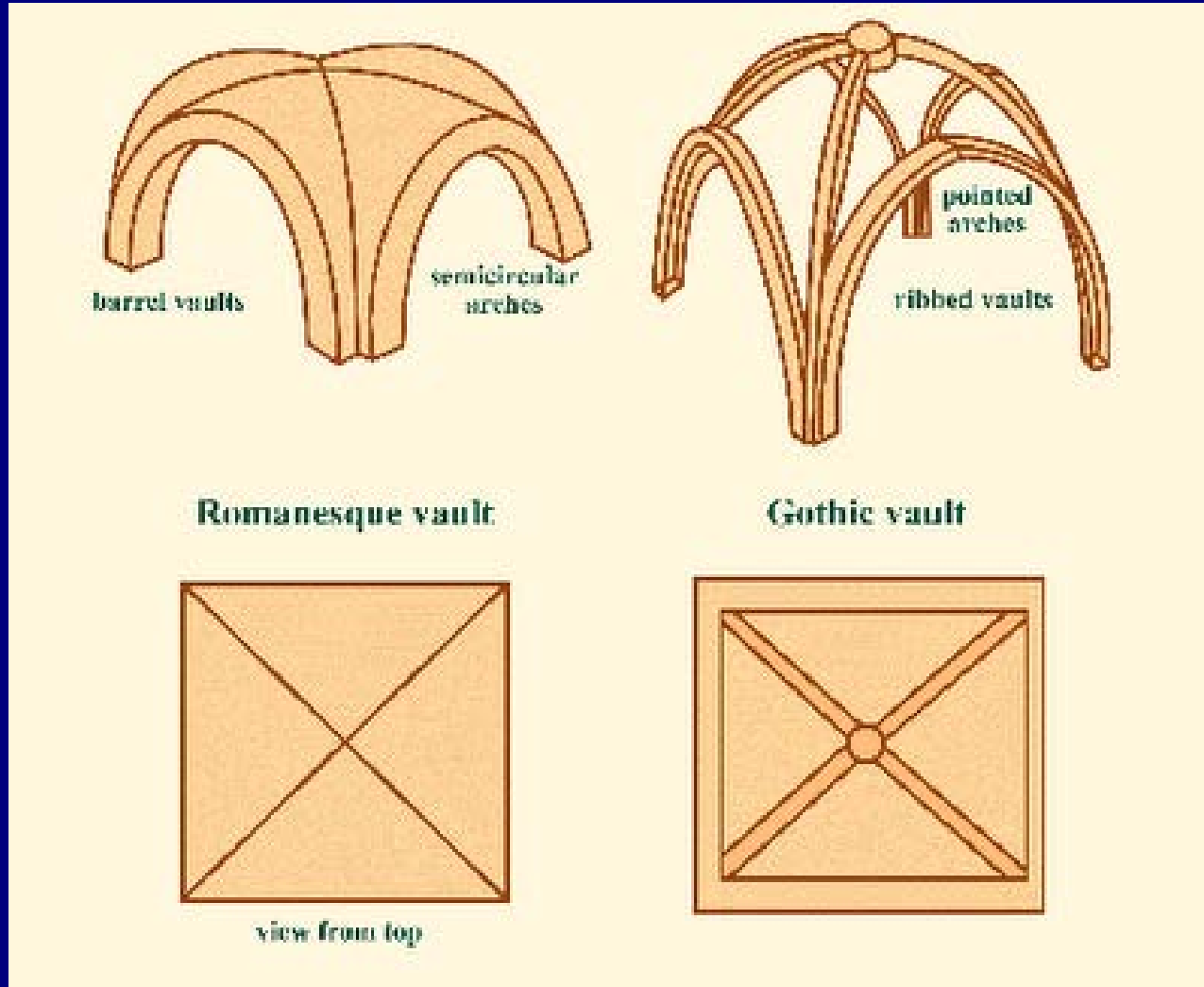


b) Beam Theory

LTP Design Concepts



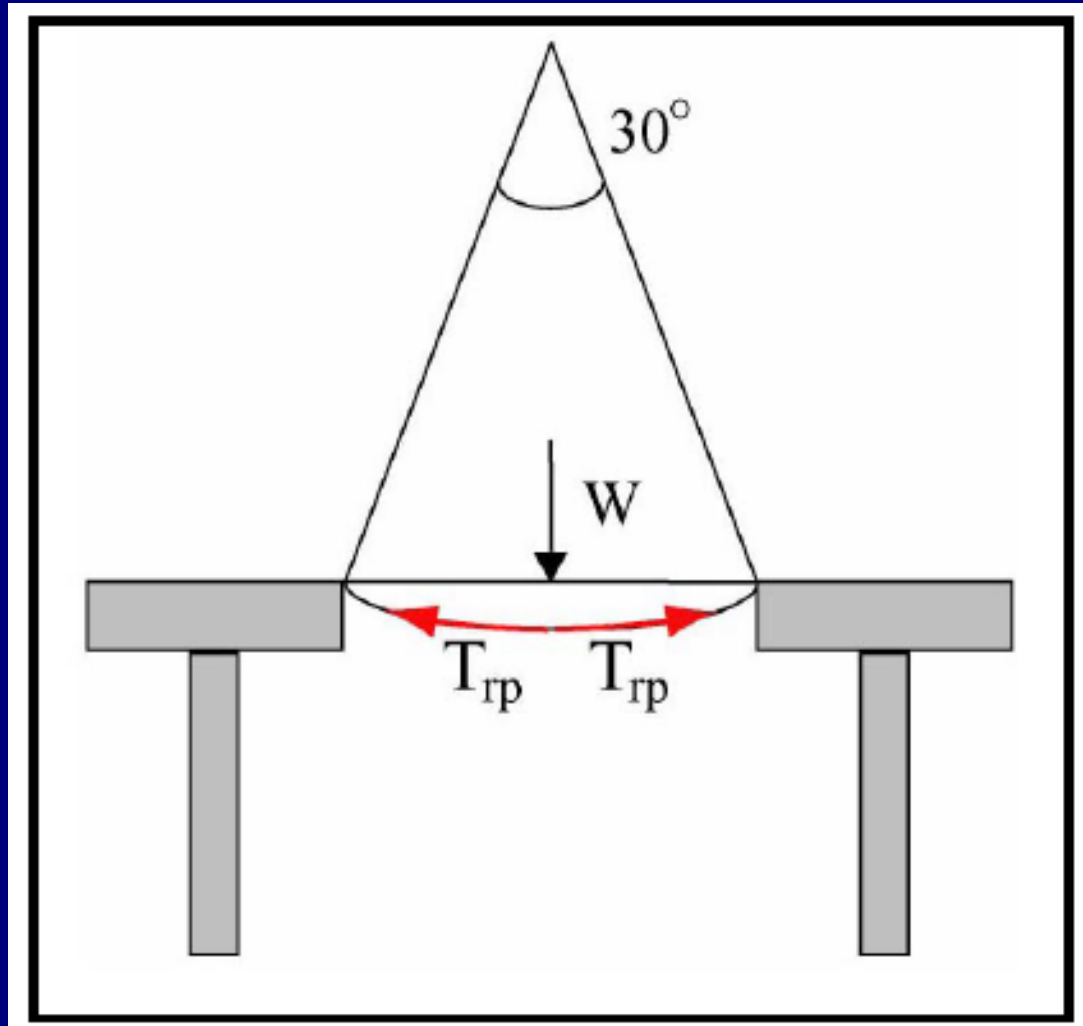
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



## Architectural Arches



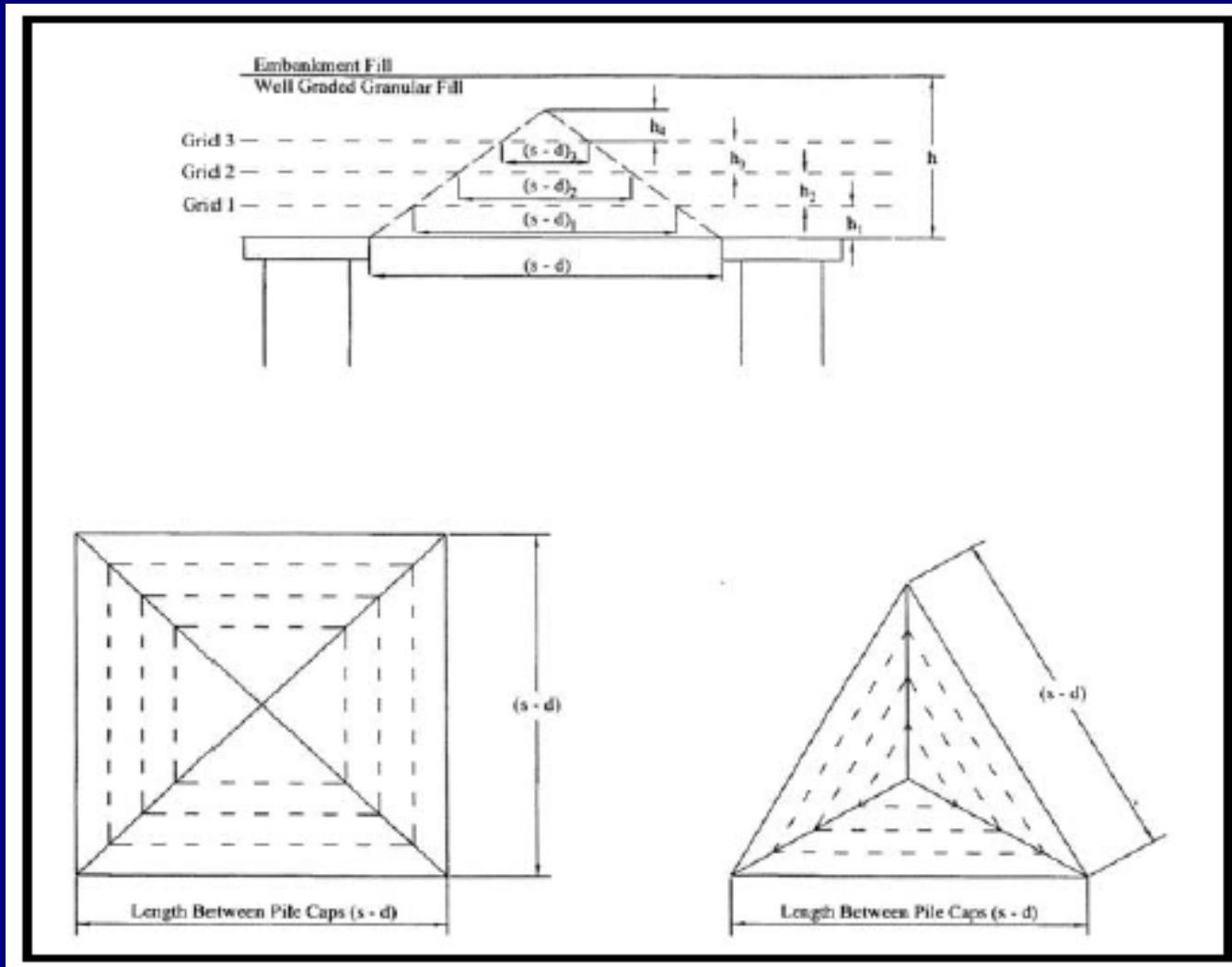
**STATE OF NORTH CAROLINA**  
**DEPARTMENT OF TRANSPORTATION**



**Catenary Method**  
**Single Layer of High Strength Fabric with Sand Blanket**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



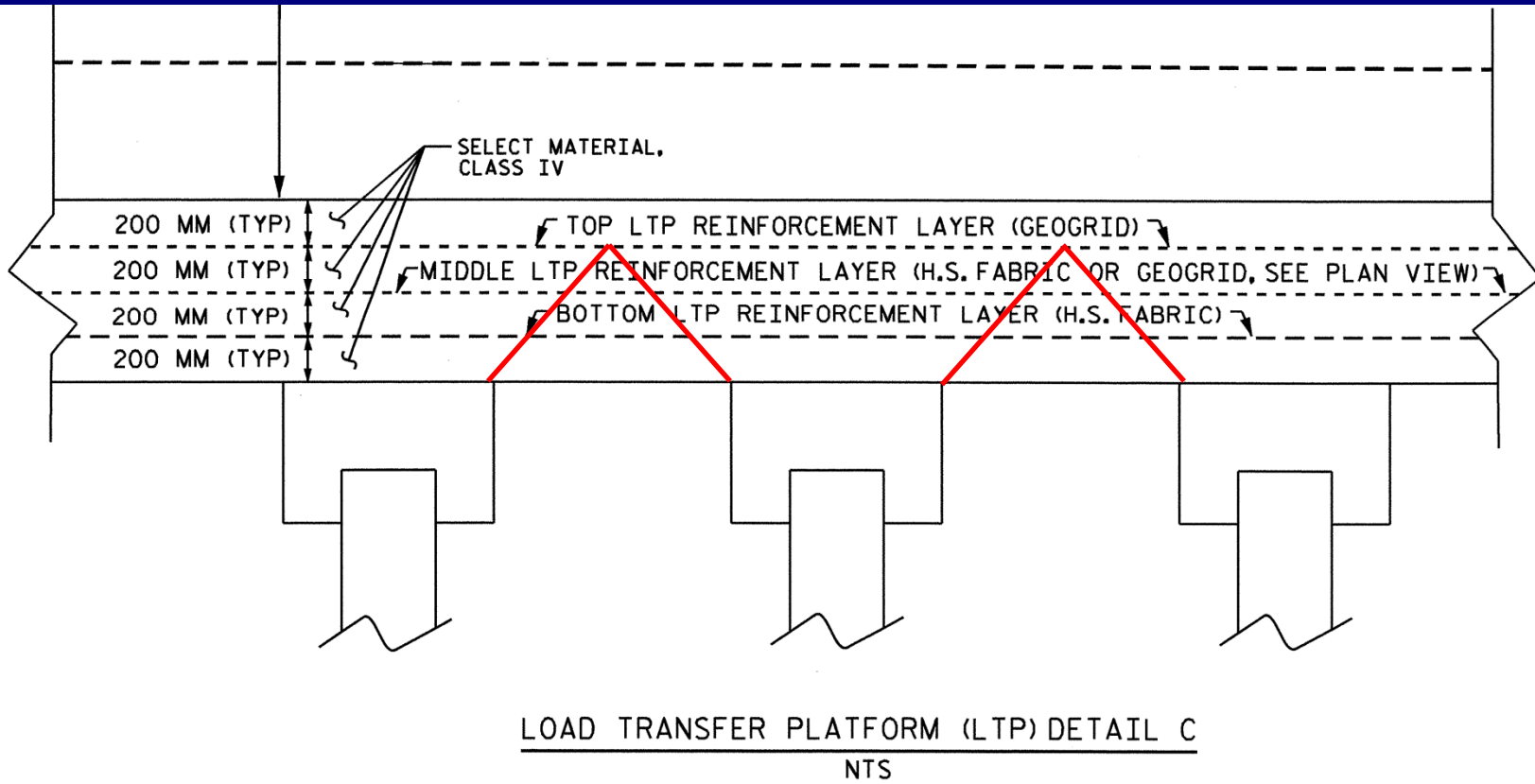
## Beam Method

Uses Multiple Layers of Fabric and Geogrid Combined with ABC





# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Load Transfer Platform Typical Section**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



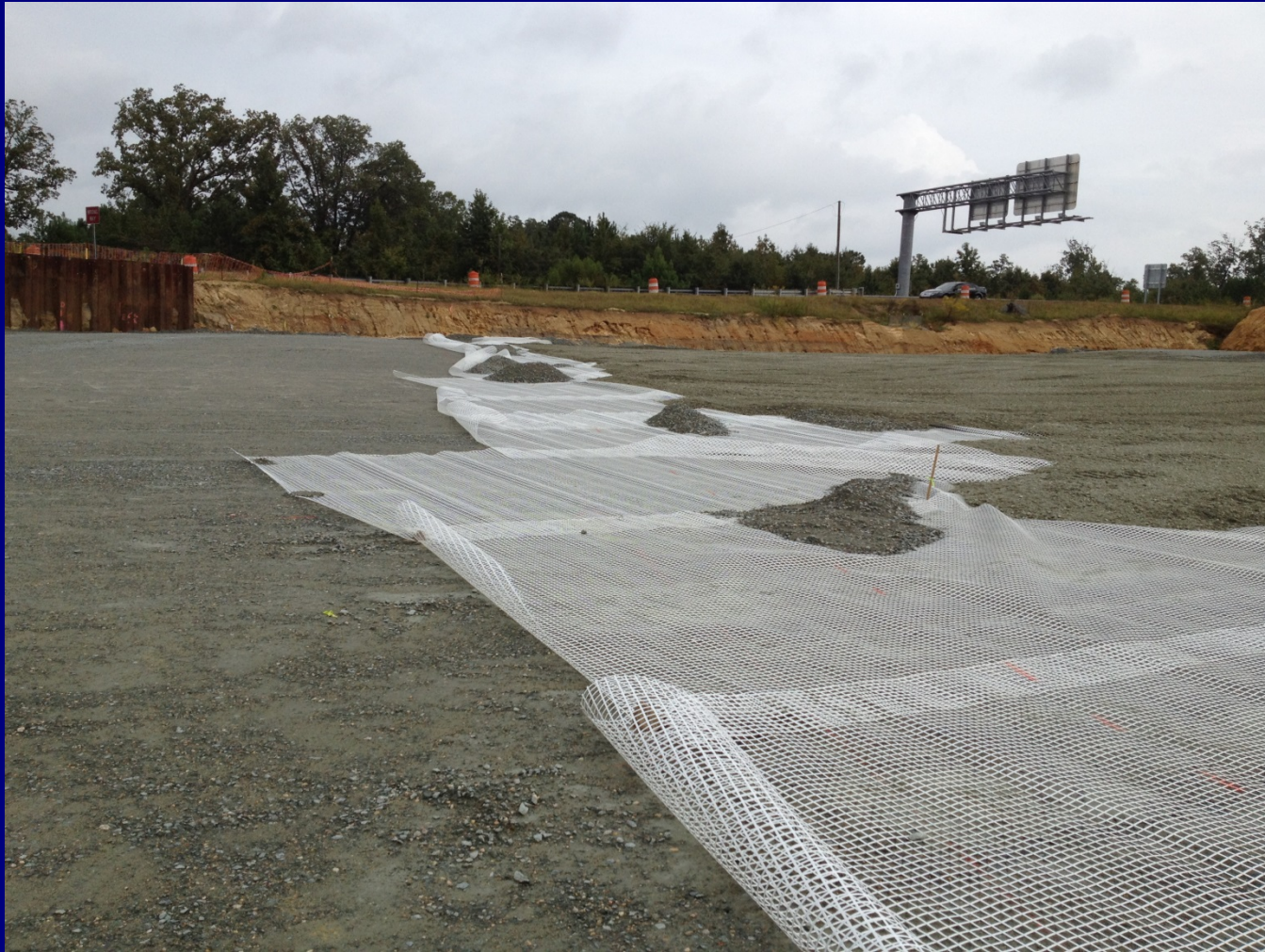
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**





# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



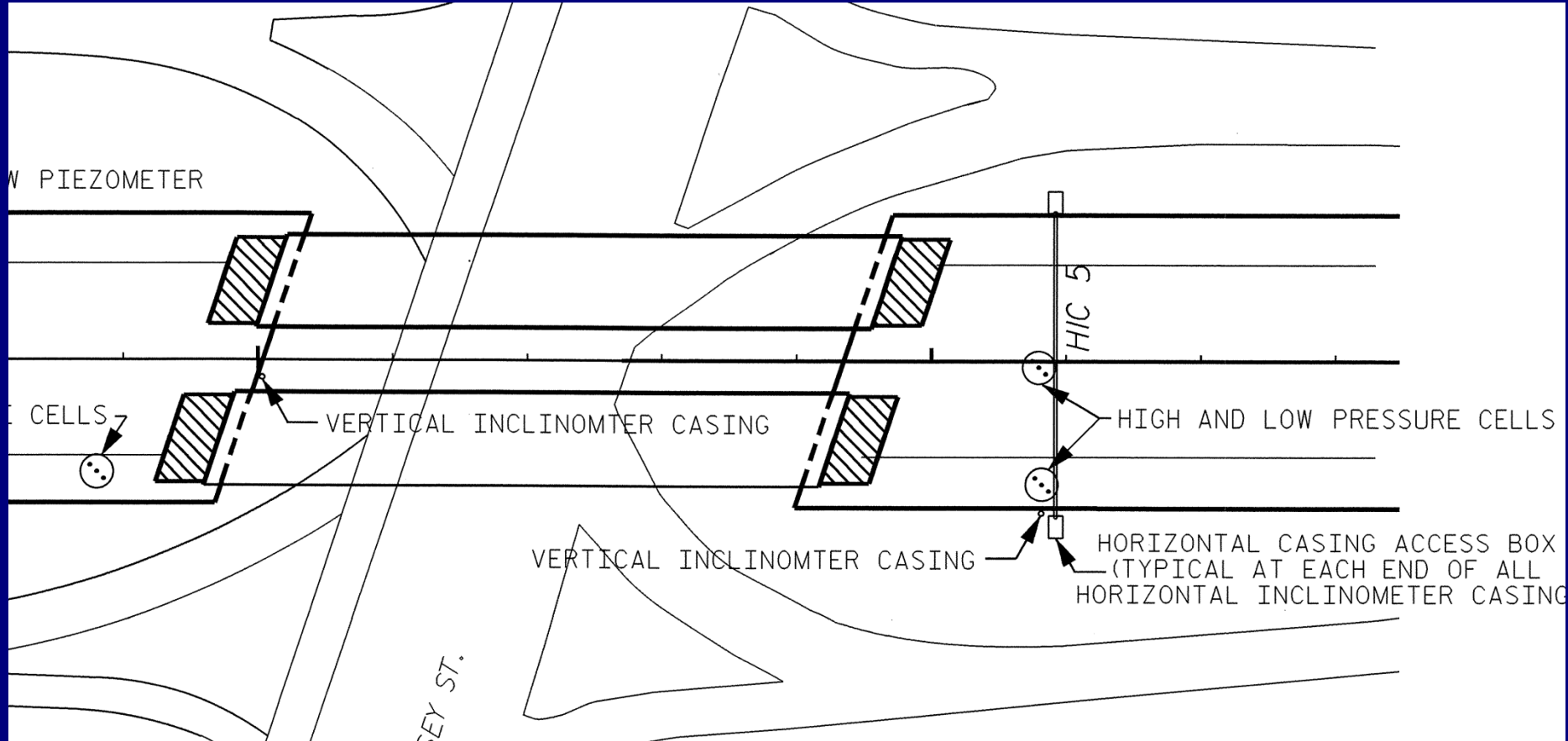
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**Construction Photos**



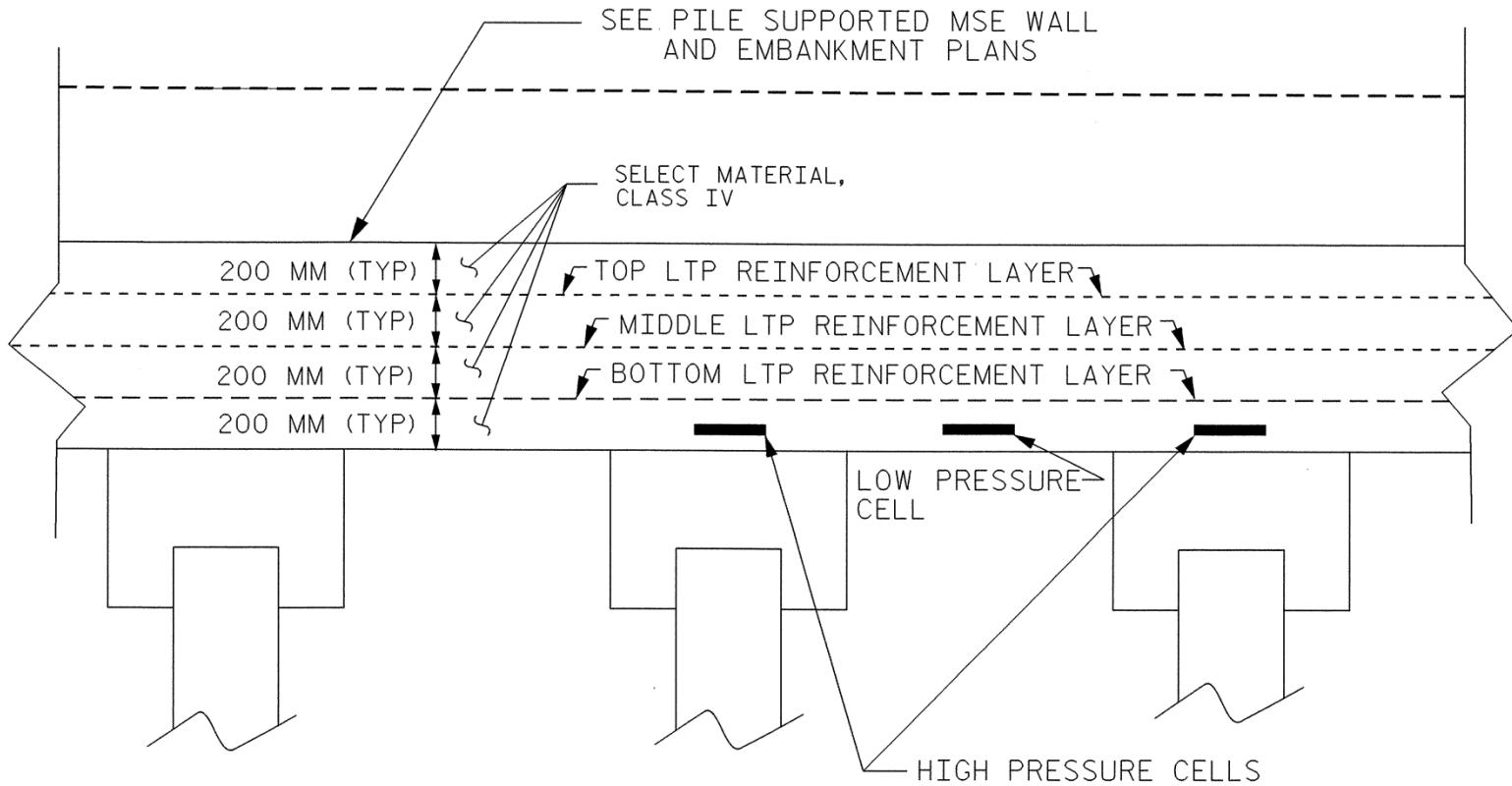
# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



## LTP Instrumentation



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



PRESSURE CELL LOCATION DETAIL  
N.T.S.

## LTP Instrumentation



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION



**LTP Instrumentation**





# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

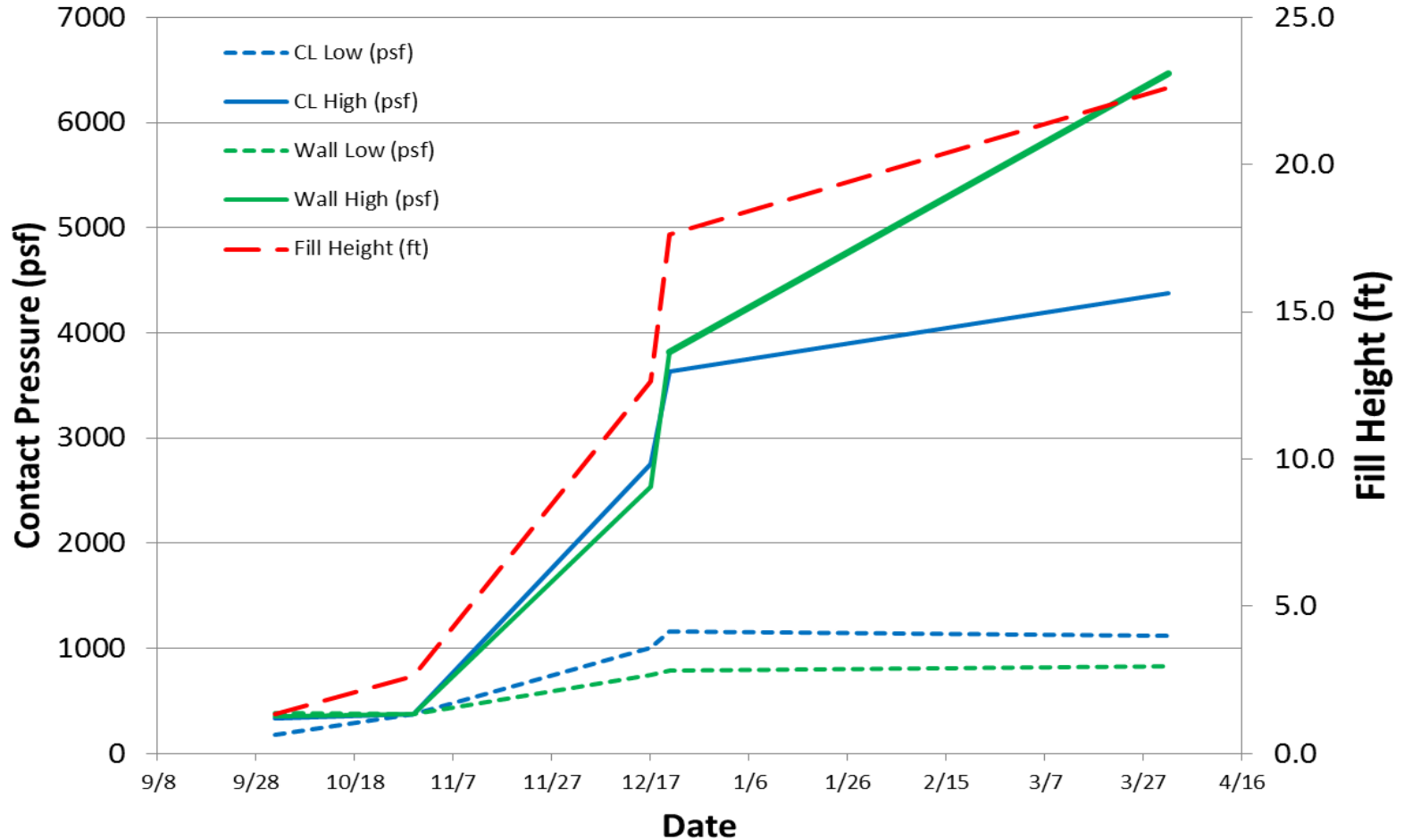


**LTP Instrumentation**



# STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

## Contact Pressures and Fill Height



LTP Instrumentation



**STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION**

**Wick Drains - 580,000 ft. - \$0.31 / ft**

**12" Concrete Piles – 468 total – 12,300 ft - \$33.50 / ft**

**16" Concrete Piles – 683 total – 17,900 ft - \$44.50 / ft**

**Geogrid for LTP – 8,400 sqyd - \$3.57 / sqyd**

**H.S. Fabric for LTP – 8,200 sqyd - \$23.65 / sqyd**

**MSE Walls – 55,800 sqft - \$48.60 / sqft**

**Project Quantities**



**STATE OF NORTH CAROLINA**  
**DEPARTMENT OF TRANSPORTATION**

**Questions ?**