An NCDOT Geotechnical Standard Presentation

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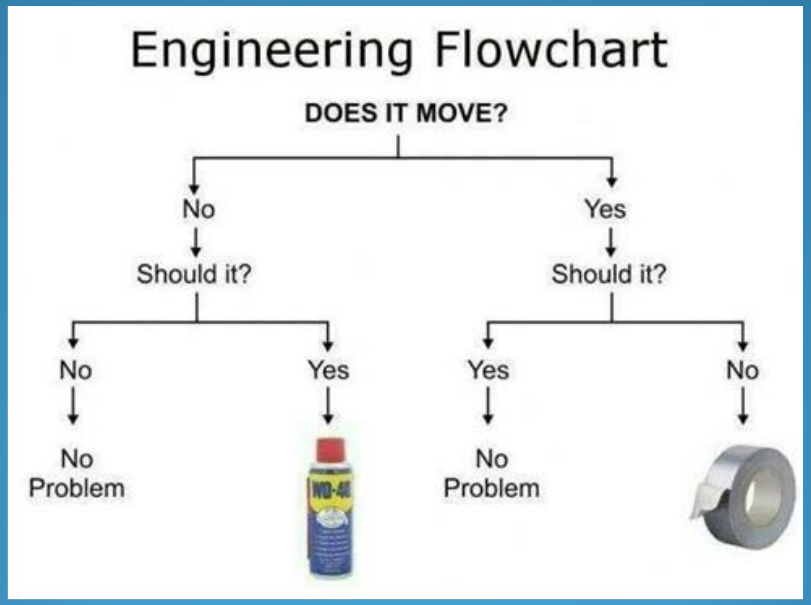
What is a Geotechnical Standard?

- It is a standard maintained by the Technical Support Group of the GEU Support Services Section
- Standard provisions and drawings are effective with some letting date and are intended to be used as is
- Standard notes and cells should be included and modified based on project specific designs
- Do not assume that a standard is applicable to every situation!

Why are standards so conservative?

- Complexity vs. Conservatism
- If a standard is to complex, it will not get used
- If a standard is to conservative, it will not be widely applicable or if it is, it will be too expensive



What standards are available?

- All major types of retaining walls (MSE, Gravity, Soil Nail, Soldier Pile and Anchored)
- Rock Embankments
- Rock Plating
- Reinforced Soil Slopes (RSS)
- Embankment Monitoring
- Standard Shoring and Temporary Soil Nail Walls
- Rock Slope Materials
- Pile Driving Criteria
- Geotextile for Pavement Stabilization

What product lists are available?

- Polymer Slurries
- MSE Retaining Wall Systems (for panels and SRW units)
- SRW Units for Standard Segmental Gravity Walls
- Pile Points and Splicers
- Wire Mesh and Nets
- Geogrids (administered by M&T)
- Geotextiles (under development)
- Precast Retaining Wall Units (future development)

Where can I find these standards?

- GEU Website –
  connect.ncdot.gov/resources/geological
- NCDOT Approved Product Lists –
  https://apps.dot.state.nc.us/vendor/approvedproducts/
- Geotechnical Design Cell Library –
  Geotechnical_Design_English.cel
- GEU Contacts –
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  or
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How do I keep informed of changes?

Sign up for the Geotechnical Distribution List to receive NCDOT Geotech Alerts

(it's free and we promise not to flood your inbox or use your email for marketing purposes!☺)

How to Use Standard Temporary Wall Drawings

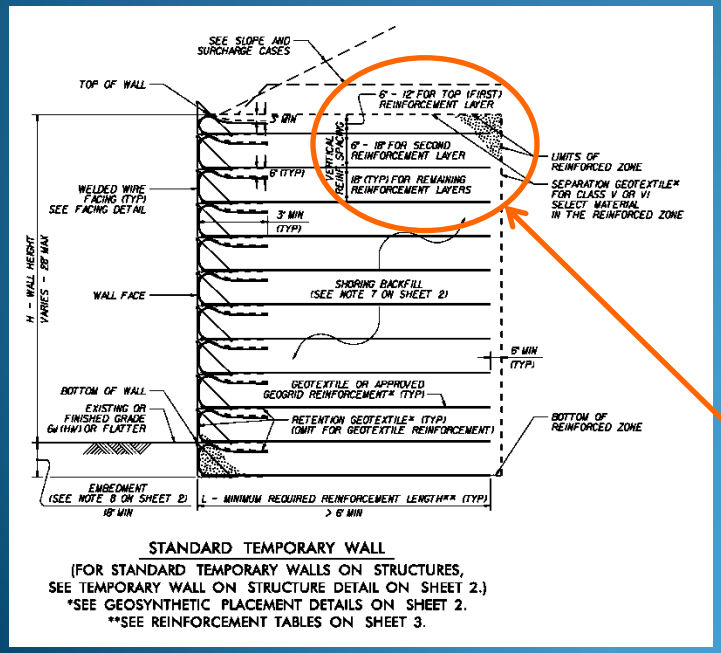
- Determine minimum required reinforcement length from table on sheet 3 (global stability or pullout controls)
- Standard temporary wall example
  - Surcharge case with H = 18 ft
  - Class III select material for shoring backfill in the reinforced zone
  - Groundwater depth below bottom of reinforced zone is 10 ft

SLOPE OR SURCHARGE CASE	GROUNDWATER DEPTH BELOW BOTTOM OF REINFORCED ZONE (SEE NOTE 6 ON SHEET 2) (FT)	SHORING BACKFILL TYPE IN THE REINFORCED ZONE (SEE NOTE 7 ON SHEET 2)	H – WALL HEIGHT (FT)																									
			< 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
SLOPE CASE	> 0	CLASS II, TYPE I, CLASS III, CLASS V OR CLASS VI SELECT MATERIAL	6	6	7	8	9	11	12	13	13	14	15	16	17	18	19	20	21	22	23	24	24	25	26	27	27
SURCHARGE CASE	> 0 TO 7 FOR H < 20' > 0 TO 10 FOR H ≥ 20'	ALL SHORING BACKFILL TYPES	6	7	7	8	8	9	9	10	11	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21
	> 7 FOR H < 20' > 10 FOR H ≥ 20'	A-2-4 SOIL	6	6	7	8	8	9	9	10	11	11	12	12	13	14	14	15	15	16	16	17	17	18	19	19	20
		CLASS II, TYPE I OR CLASS III SELECT MATERIAL	6	6	7	7	8	8	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	19
		CLASS V OR CLASS VI SELECT MATERIAL	6	6	7	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	16	16	17	18	18

L – MINIMUM REQUIRED REINFORCEMENT LENGTH (FT)
(FOR ALL REINFORCEMENT TYPES)

How to Use Standard Temporary Wall Drawings

- Determine minimum required geotextile reinforcement strength from table on sheet 3 (strength controls)
- Standard temporary wall example (continued)
  - Surcharge case with H = 18 ft and 18" of embedment (minimum)
  - Class III select material for shoring backfill in the reinforced zone
  - Groundwater depth below bottom of reinforced zone is 10 ft



STANDARD TEMPORARY WALL

(FOR STANDARD TEMPORARY WALLS ON STRUCTURES, SEE TEMPORARY WALL ON STRUCTURE DETAIL ON SHEET 2.)
*SEE GEOSYNTHETIC PLACEMENT DETAILS ON SHEET 2.
**SEE REINFORCEMENT TABLES ON SHEET 3.

WALL HEIGHT (H) + EMBEDMENT (FT)	NUMBER OF REINFORCEMENT LAYERS*
2.5 - 4	3
4 - 5.5	4
5.5 - 7	5
7 - 8.5	6
8.5 - 10	7
10 - 11.5	8
11.5 - 13	9
13 - 14.5	10
14.5 - 16	11
16 - 17.5	12
17.5 - 19	13
19 - 20.5	14
20.5 - 22	15
22 - 23.5	16
23.5 - 25	17
25 - 26.5	18
26.5 - 28	19
28 - 29.5	20

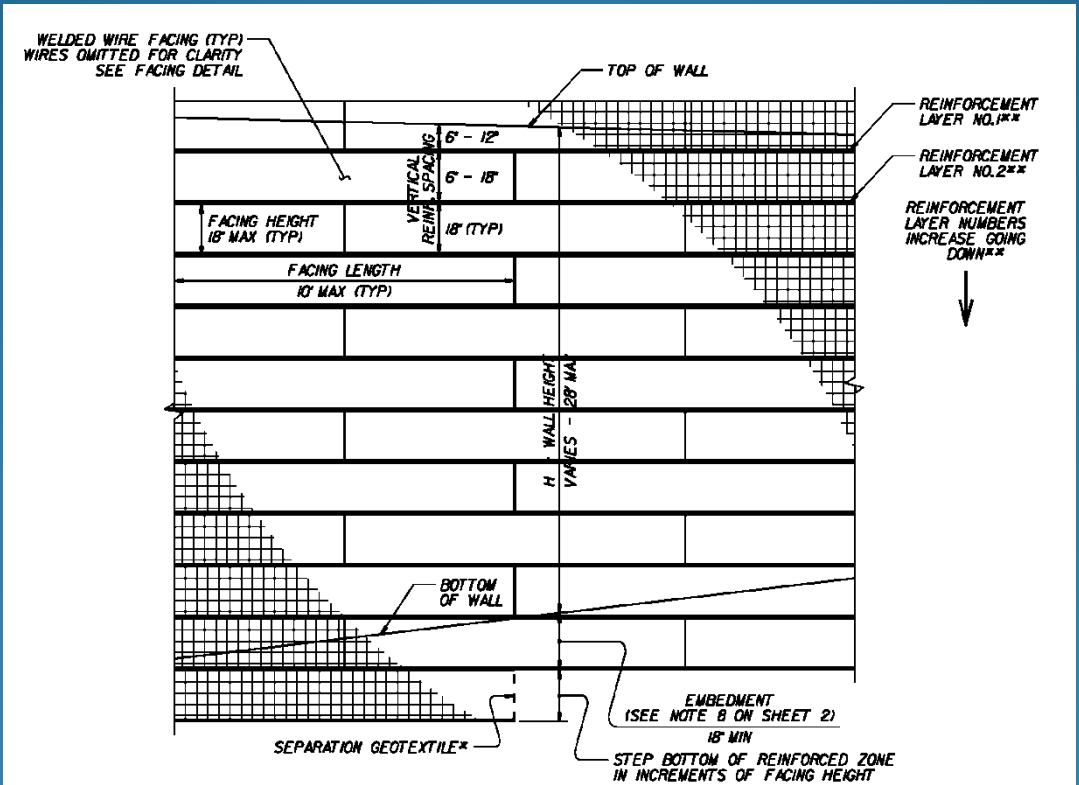
*BASED ON VERTICAL REINFORCEMENT SPACING SHOWN ON SHEET 1.

REINFORCEMENT LAYER NUMBER*	SHORING BACKFILL TYPE IN THE REINFORCED ZONE (SEE NOTE 7 ON SHEET 2)				
	SLOPE CASE			SURCHARGE CASE	
	CLASS II, TYPE I OR CLASS III SELECT MATERIAL	CLASS V SELECT MATERIAL	A-2-4 SOIL	CLASS III OR CLASS III SELECT MATERIAL	CLASS V SELECT MATERIAL
1	2400	2400	2400	2400	2400
2	2400	2400	2400	2400	2400
3	2400	2400	2400	2400	2400
4	2400	2400	2500	2400	2400
5	2500	2400	3000	2400	2400
6	3000	2400	3500	2800	2400
7	3500	2700	4000	3200	2600
8	4000	3100	4500	3600	2900
9	4500	3500	5000	4000	3200
10	5000	3900	5500	4400	3500
11	5500	4300	6000	4800	3800
12	6000	4700	6500	5200	4100
13	6500	5100	7000	5600	4400
14	7000	5400	7500	6000	4700
15	7500	5800	8000	6400	5000
16	8000	6200	8500	6800	5300
17	8500	6600	9000	7200	5600
18	9000	7000	9500	7600	5900
19	9500	7400	10000	8000	6200
20	10000	7800	10500	8400	6500

GEOTEXTILE REINFORCEMENT ULTIMATE TENSILE STRENGTH (LB/FT)

How to Use Standard Temporary Wall Drawings

- Reinforcement layers for standard temporary walls are numbered from the top down!



STANDARD TEMPORARY WALL – PARTIAL ELEVATION

*SEE GEOSYNTHETIC PLACEMENT DETAILS ON SHEET 2.
**SEE REINFORCEMENT TABLES ON SHEET 3.

How to Use Standard Temporary Wall Drawings

- Select geotextile reinforcement that meets standard shoring provision (type 5 and 8 oz/sy mass per unit area) and ultimate tensile strength requirements in the MD
- Standard temporary wall example (continued)
  - For Mirafi HP geotextile series, ultimate tensile strength (wide width tensile strength) ranges from 2640 to 7200 lb/ft and 2400 to 6000 lb/ft is required

REINFORCEMENT LAYER NUMBER*	SHORING BACKFILL TYPE IN THE REINFORCED ZONE (SEE NOTE 7 ON SHEET 2)				
	SLOPE CASE			SURCHARGE CASE	
	CLASS II, TYPE I OR CLASS III SELECT MATERIAL	CLASS V SELECT MATERIAL	A-2-4 SOIL	CLASS II, TYPE I OR CLASS III SELECT MATERIAL	CLASS V SELECT MATERIAL
1	2400	2400	2400	2400	2400
2	2400	2400	2400	2400	2400
3	2400	2400	2400	2400	2400
4	2400	2400	2500	2400	2400
5	2500	2400	3000	2400	2400
6	3000	2400	3500	2800	2400
7	3500	2700	4000	3200	2600
8	4000	3100	4500	3600	2900
9	4500	3500	5000	4000	3200
10	5000	3900	5500	4400	3500
11	5500	4300	6000	4800	3800
12	6000	4700	6500	5200	4100
13	6500	5100	7000	5600	4400
14	7000	5400	7500	6000	4700
15	7500	5800	8000	6400	5000
16	8000	6200	8500	6800	5300
17	8500	6600	9000	7200	5600
18	9000	7000	9500	7600	5900
19	9500	7400	10000	8000	6200
20	10000	7800	10500	8400	6500

GEOTEXTILE REINFORCEMENT
ULTIMATE TENSILE STRENGTH (LB/FT)

TENCATE
Mirafi®

Mirafi® HP-Series Woven Polypropylene Geotextiles
for Stabilization and Soil Reinforcement Applications

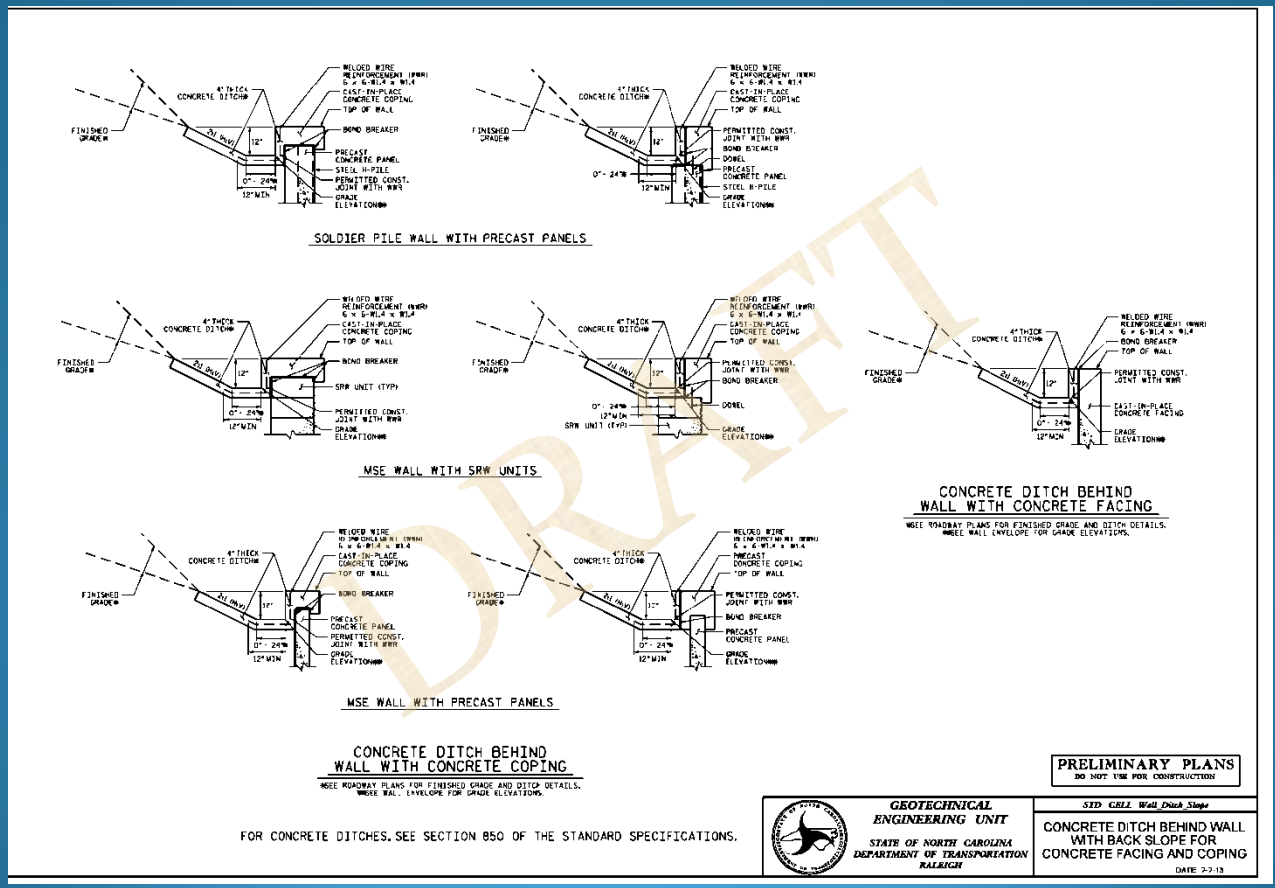
Property	Test Method	Units	HP270	HP370	HP565	HP570	HP665	HP770	PP200
Mechanical Properties									
Wide Width Tensile Strength									
Strength @ Ultimate (MD)	ASTM D 4595	kN/m (lbs/ft)	38.5 (2640)	52.5 (3600)	66.5 (4560)	70.0 (4800)	70.0 (4800)	105.1 (7200)	200 (13706)

Mirafi® HP270

Physical Properties	Unit	Typical Value
Mass/Unit Area (ASTM D5261)	oz/yd^2 (g/m^2)	6.7 (227)
Roll Dimensions (width x length)	ft (m)	15 x 300 (4.5 x 91)
Roll Area	yd^2 (m^2)	500 (418)
Estimated Roll Weight	lbs (kg)	220 (100)

What is in the pipeline?

Standard Concrete Ditch Behind Wall for all retaining wall types - modified roadway standard base ditch



What is in the pipeline?

- Drilled Pier Axial Resistance Spreadsheet
  - Calculates developed factored side and tip resistances and required tip resistance for drilled piers in sand, clay, IGM, weathered rock and hard rock
  - Follows LRFD design based on AASHTO 6th Edition
  - Incorporates NCDOT GEU design policy for drilled piers in weathered rock (material classification not covered in AASHTO)
  - Includes tip resistance methods based on both RMR and GSI

Questions?