

Chester County Engineers Professional Classroom Series

Intro to Segmental Retaining Walls Presented by: Bart Shippee, P.E.



SHIPPEE ENGINEERING, INC.
4050 SKYRON DRIVE - SUITE A2
DOYLESTOWN, PA 18902
215.589.1952(T) 267.224.4414(F)
Bold Ideas Shaping the Earth

11/18/2010

AGENDA

- Definition of a Segmental Retaining Wall
 - Gravity and Reinforced Walls
- Basic attributes of an SRW
 - Mortarless
 - Battered Wall Face
 - Soil Reinforcement (Geogrid)
 - Not an Infiltration Structure!
- Cost comparison to other wall types
- Roles & Responsibilities
- Suggested Cross Section for Civil Engineers
 - Do's and Don'ts on a Detail Sheet
 - Recommended Language
- Actual Design "Examples" & Some Solutions

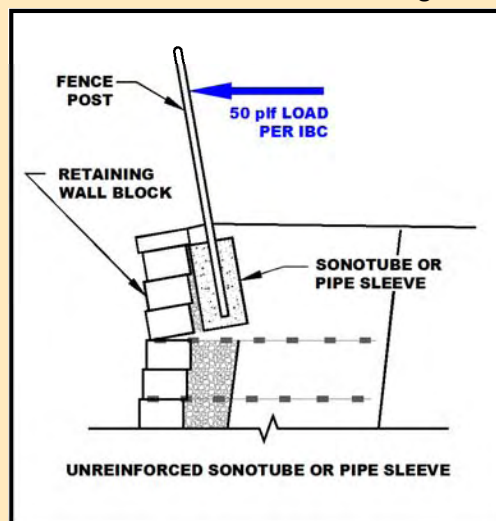
DEFINITION

- Earth retaining structure comprised of dry-stack, modular concrete block units and compacted soil fill with or without the inclusion of soil reinforcement.
- Two types:
 - gravity
 - reinforced



Basic Attributes of an SRW

1. They are MORTARLESS structures. The face cannot resist an overturning moment.



Basic Attributes of an SRW

2. Most SRW's will utilize GEOGRID (Soil Reinforcement) behind them for stability.



Basic Attributes of an SRW

3. All walls have a BATTERED FACE. The higher the wall the larger the "footprint".



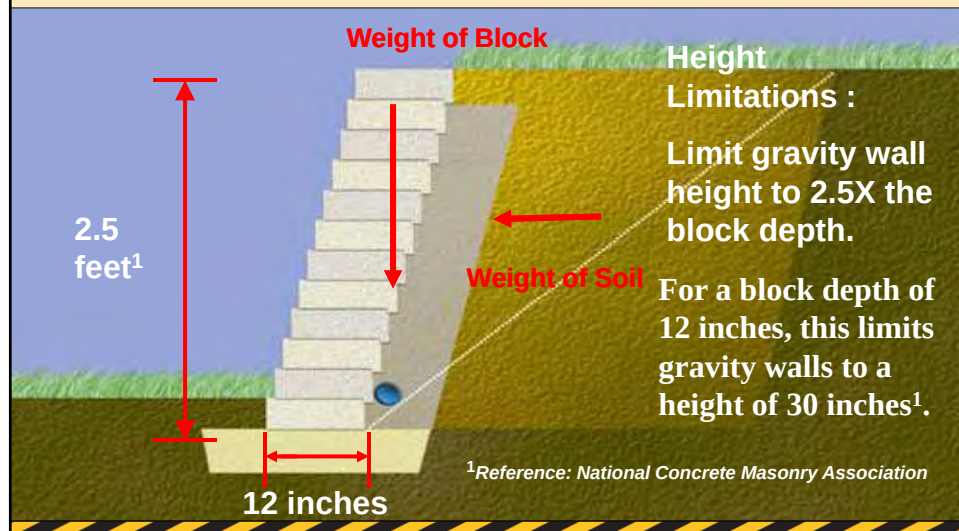
SRW's – Gravity and Reinforced



Gravity Retaining Walls

- Stability provided by wall weight (mass)
- Low height grade changes
 - Garden Walls, Tree Wells, Landscape Walls

Gravity Retaining Walls



GEOGRID



So, how do we have retaining walls built to heights of 20, 30, or 40 feet?

Geosynthetics

GEOGRIDS

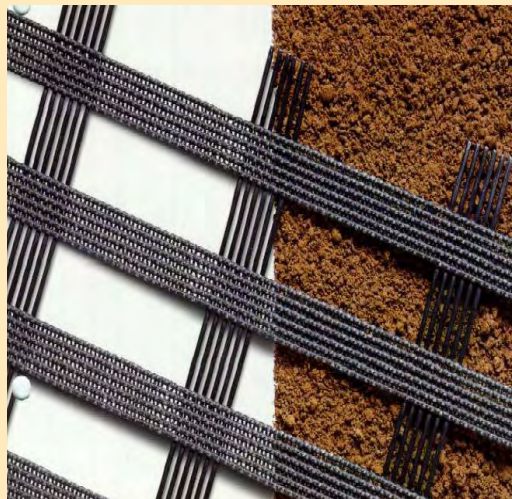


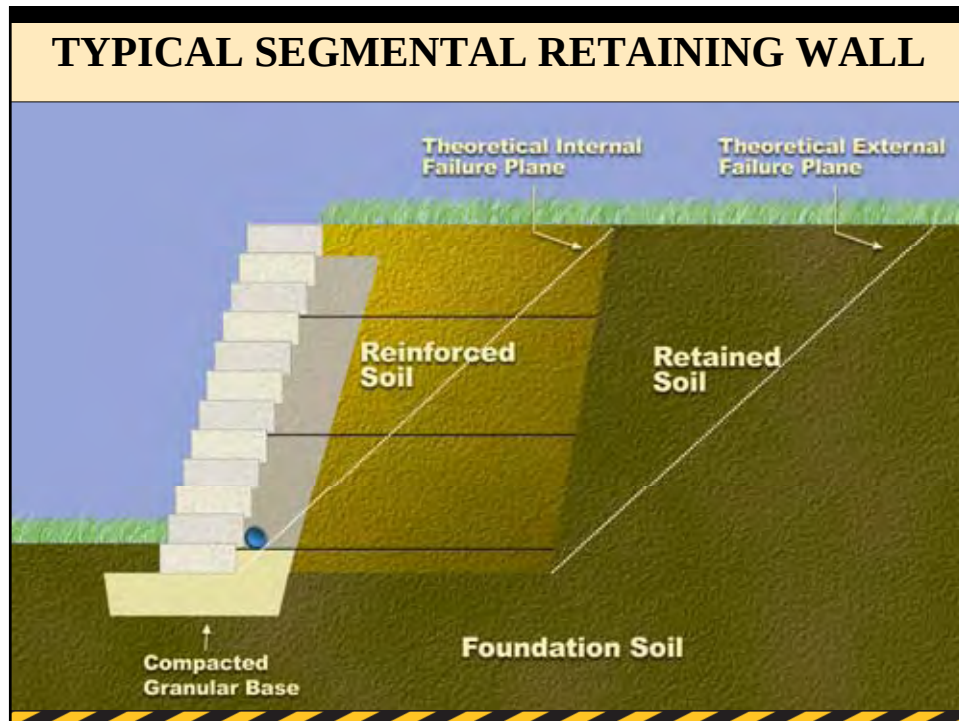
GEOTEXTILES



Geogrids

- **Geosynthetic Reinforcement**
 - Open grid structure
 - No impact on water flow
 - Widely used in SRW construction

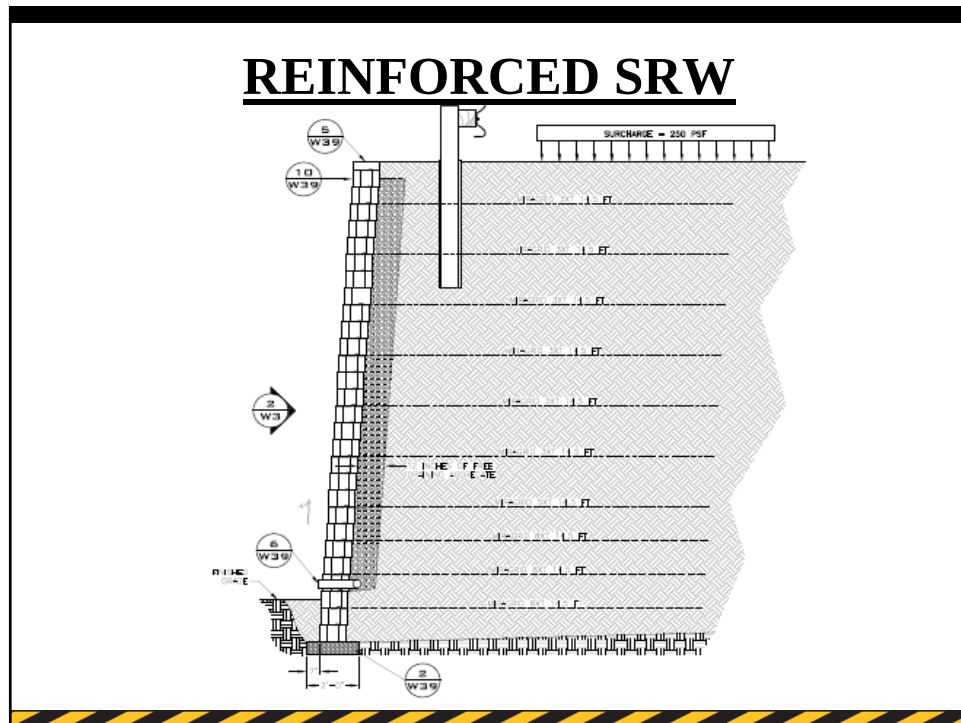




Minimum Requirements

Reinforced Soil Retaining Walls

- **Minimum** length of reinforcement: 60% of the design height. Minimum length of soil reinforcement is 4 ft.
- Maximum reinforcement spacing: 2X the block depth (e.g. 12" block = 2 ft. spacing)
- Place one foot thick drainage stone column for full wall height





How Much Does a Wall Cost?

Cost of a Retaining Wall

Labor and Equipment
50%

Block and Grid
30%

Aggregate
20%

Cost varies depending on project requirements

Cost Comparison

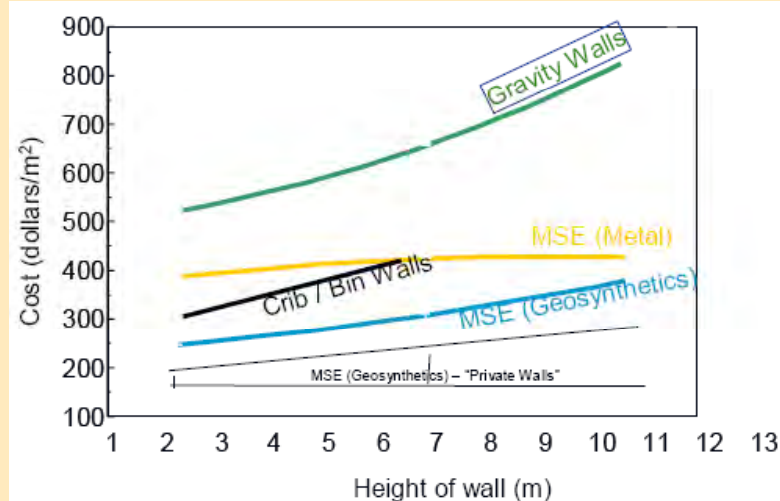
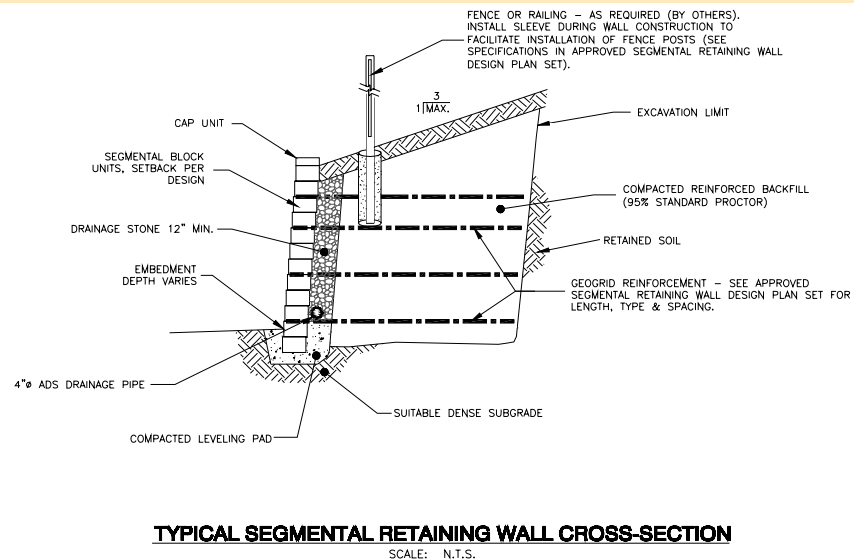


Figure 1.2 - Construction cost comparison of different types of retaining walls (Koerner, 1998)

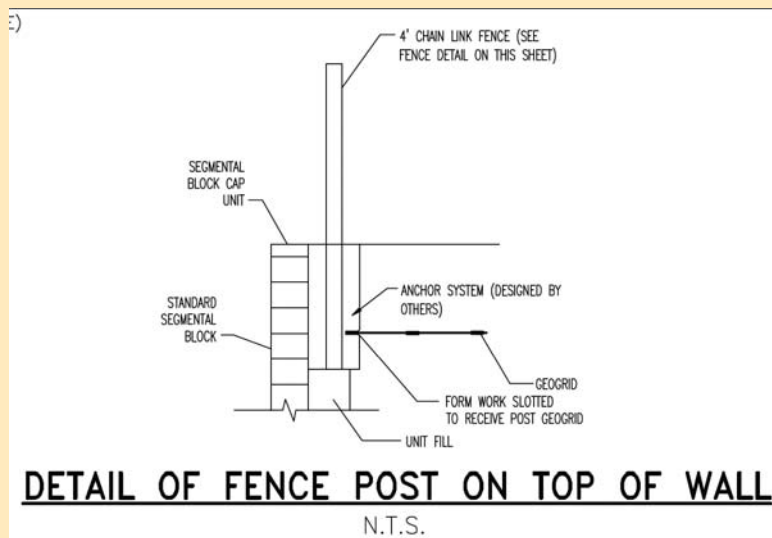
Cost Comparison

- Cast-in-Place Concrete (Cantilever Footings) are around \$50-\$65 per sq. ft. with 75-100 yr design life
- Timber Walls are around \$8-\$14 per sq. ft. with 10-15 yr design life
- SRW's are around \$20-\$25 per sq. ft. with 75 yr design life due to dry cast facing
- 18,000+ sq. ft. SRW project in Hershey, PA went for \$13.50 last week!

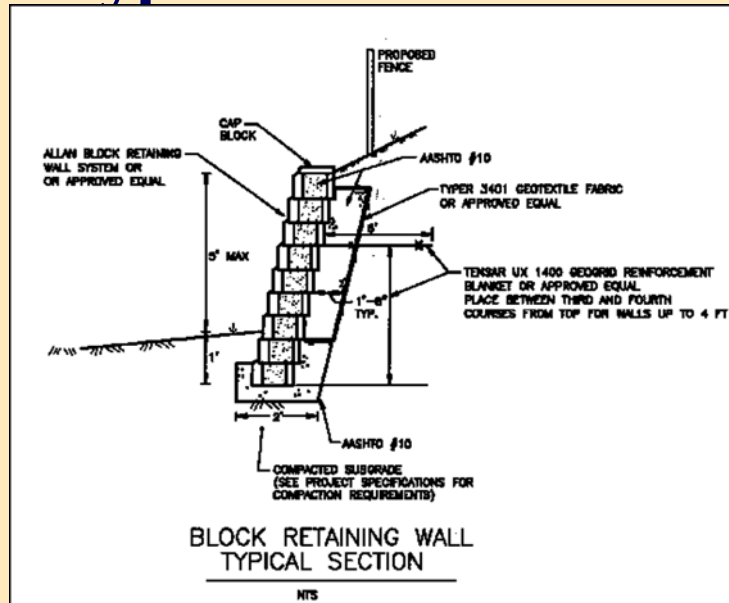
Typical Cross Section



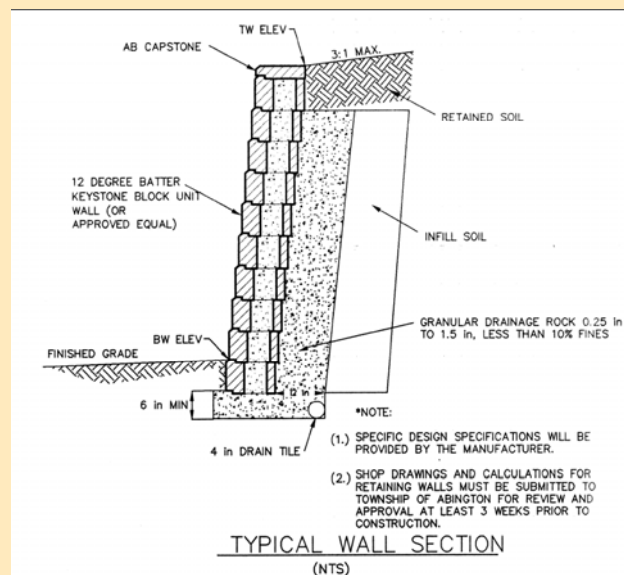
Typical Cross Section



Typical Cross Section



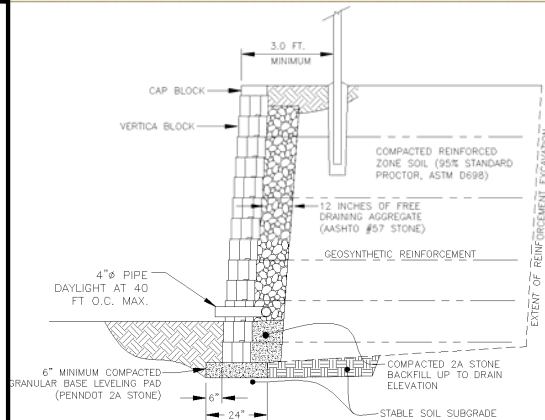
Typical Cross Section



Typical Cross Section

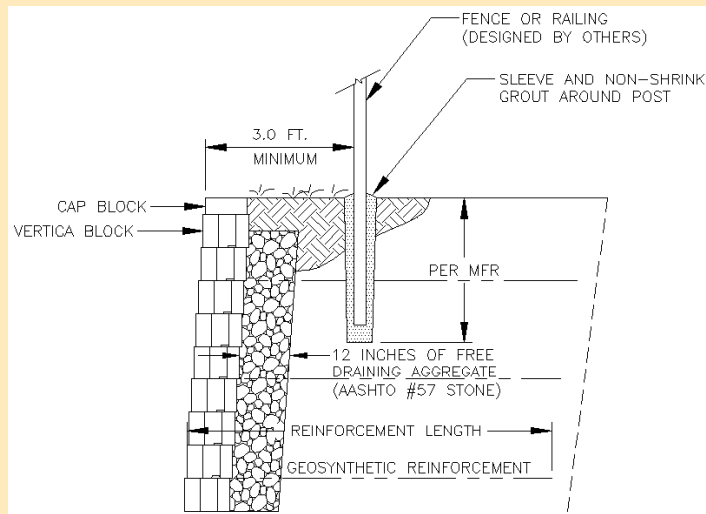
- Generally found on the civil engineer's Detail Sheets.
- Should contain specific language stating that this section is NOT for construction.

"Note: Wall Section is for preliminary bidding purposes only. Final design is the responsibility of the wall contractor and his professional engineer, who will prepare and submit sealed designs and drawings for the civil engineer or Township to review."



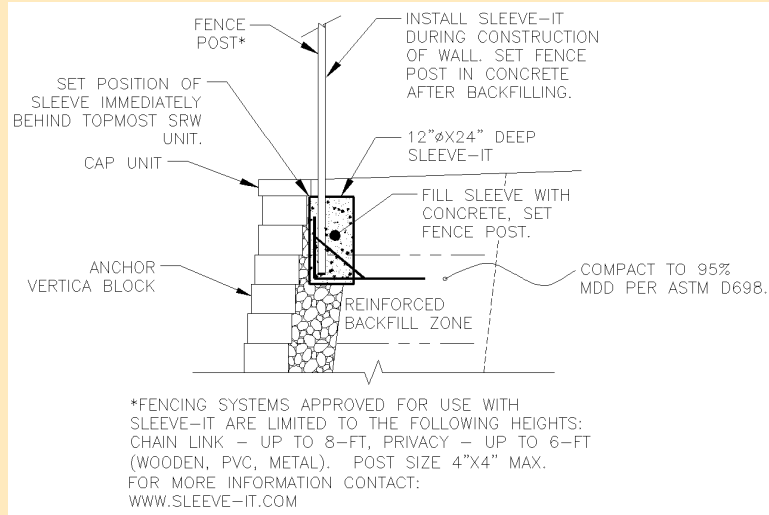
TYPICAL CROSS SECTION

Setback Considerations



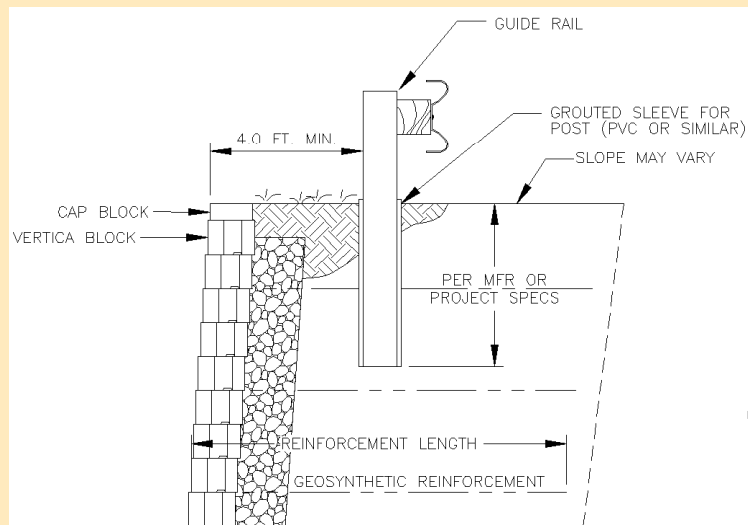
SETBACK IS 3'-0" FOR FENCE POSTS. ALTERNATIVELY, SLEEVE-IT CAN BE SPECIFIED IF THERE IS NO ROOM FOR THE SETBACK.

Setback Considerations



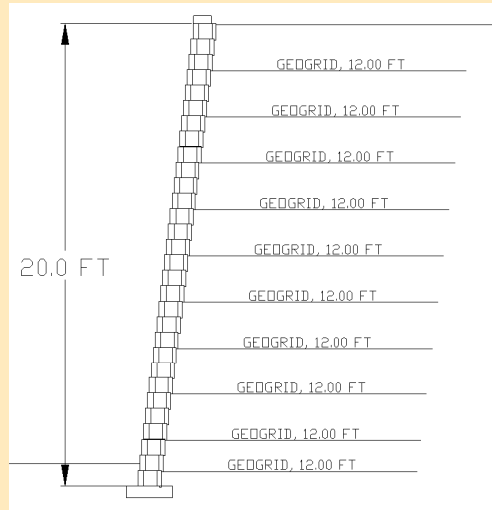
SLEEVE-IT OPTION ON TOP OF WALL

Setback Considerations



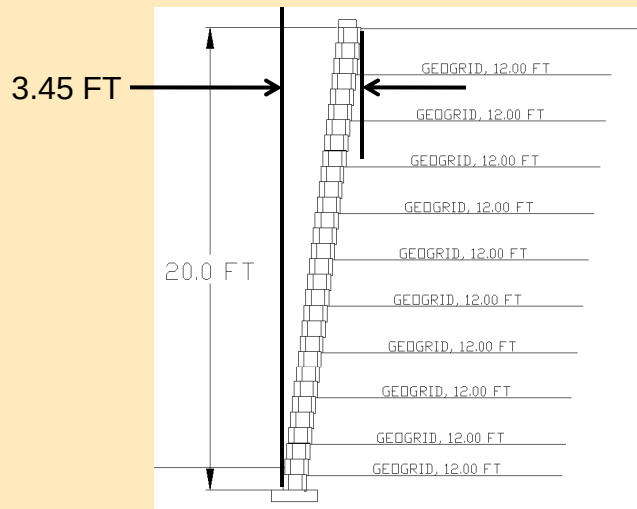
SETBACK IS 4'-0" FOR GUIDE RAIL. DON'T FORGET THICKNESS OF GUIDE RAIL (AROUND 16") AND CURBING (AROUND 6")!

Setback Considerations



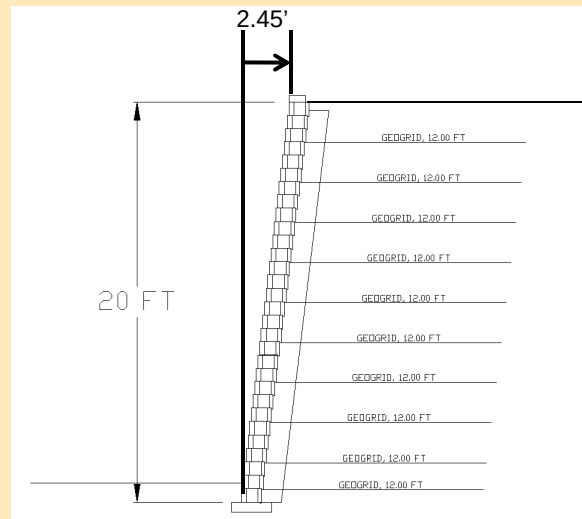
FOR A TYPICAL SRW WITH A 7-DEGREE BATTER (1 INCH PER 8" HIGH COURSE), THE SETBACK ON A 20' FT TALL WALL IS...

Setback Considerations



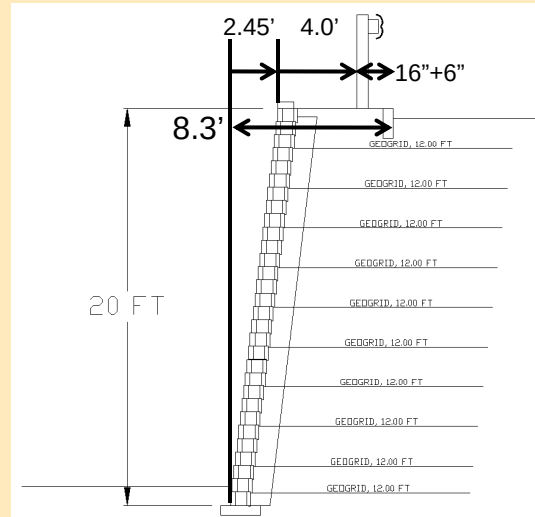
3.45 FEET... $20 \text{ FT} \times \tan(7^\circ) = 2.45 + 1 \text{ FT OF WALL THICKNESS}$.

Setback Considerations



BATTER, GUIDE RAIL SETBACK (AND FENCE SETBACK), AND CURB THICKNESSES MUST ALL BE ACCOUNTED FOR WHEN LAYING OUT A SITE.

Setback Considerations



BATTER, GUIDE RAIL SETBACK (AND FENCE SETBACK), AND CURB THICKNESSES MUST ALL BE ACCOUNTED FOR WHEN LAYING OUT A SITE.

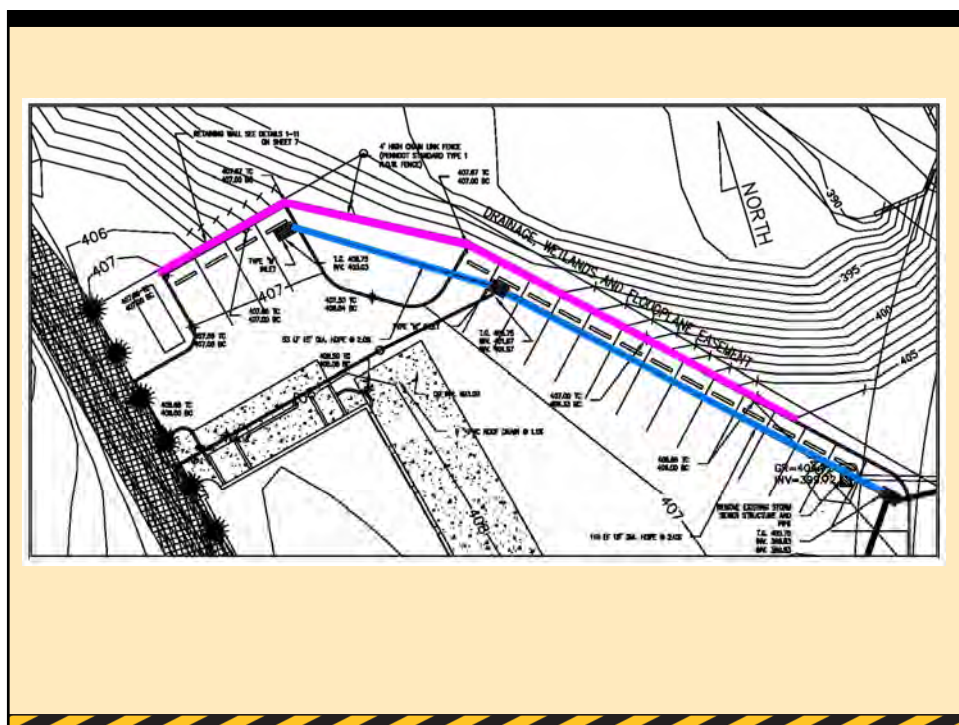
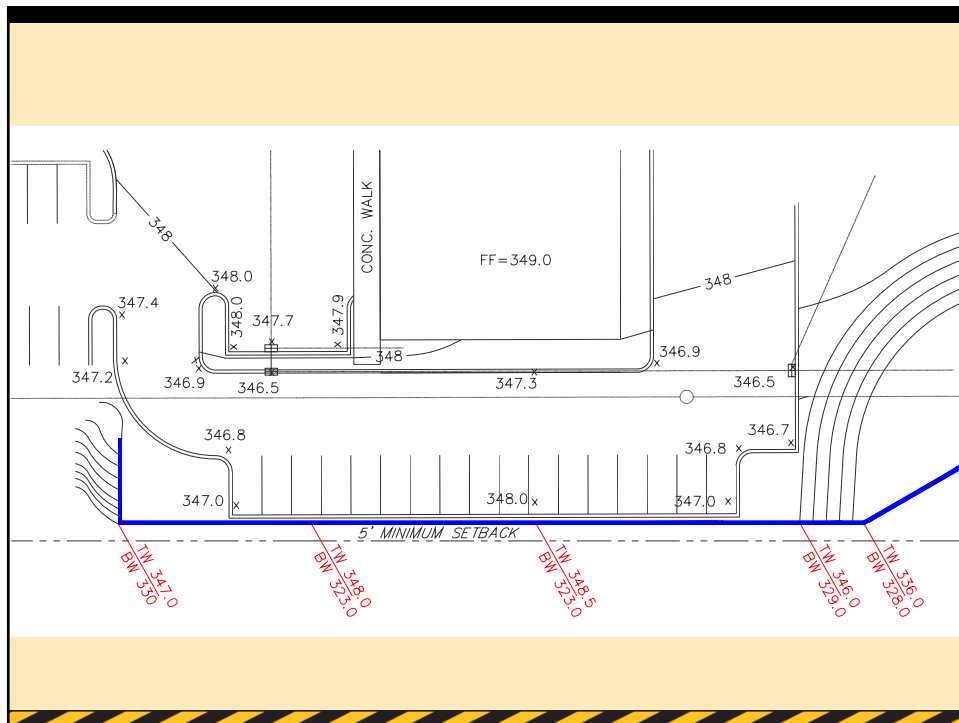
SRW Project Responsibilities Site Civil Engineer's Roles

- Specify retaining walls appropriate to site conditions.
- Act as Wall Design Engineer when design is done in-house.
- Prepare site plan and grading plan, including slopes and SRW heights and alignments.
- Address any space limitations and easement issues in regard to SRW layout.
- Design of surface grading for drainage and design for erosion control around SRWs.

SRW Project Responsibilities Site Civil Engineer's Roles

- Design of storm water collection structures and detention/retention ponds.
- Utility design and layout around SRWs.
- Pavement section design and grading above SRWs.
- Layout of traffic control structures such as pedestrian fall protection, curbs, wheel stops, guide rails, and traffic barriers behind walls.
- Hydrologic evaluations including water flows, scour depths, flood areas and high water level predictions around SRWs.

- [illegible]



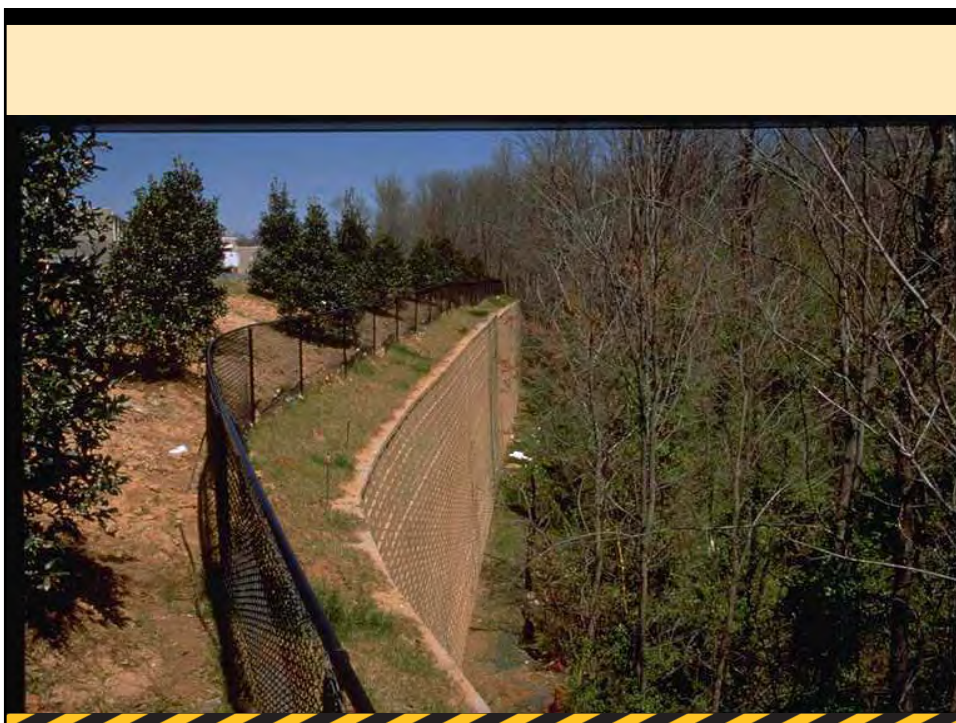
Leave Enough Room for a Guide Rail! Four feet from face of wall (at the top) to the fence post is required. Leaving less space requires much more money to build. And much, much more to fix!

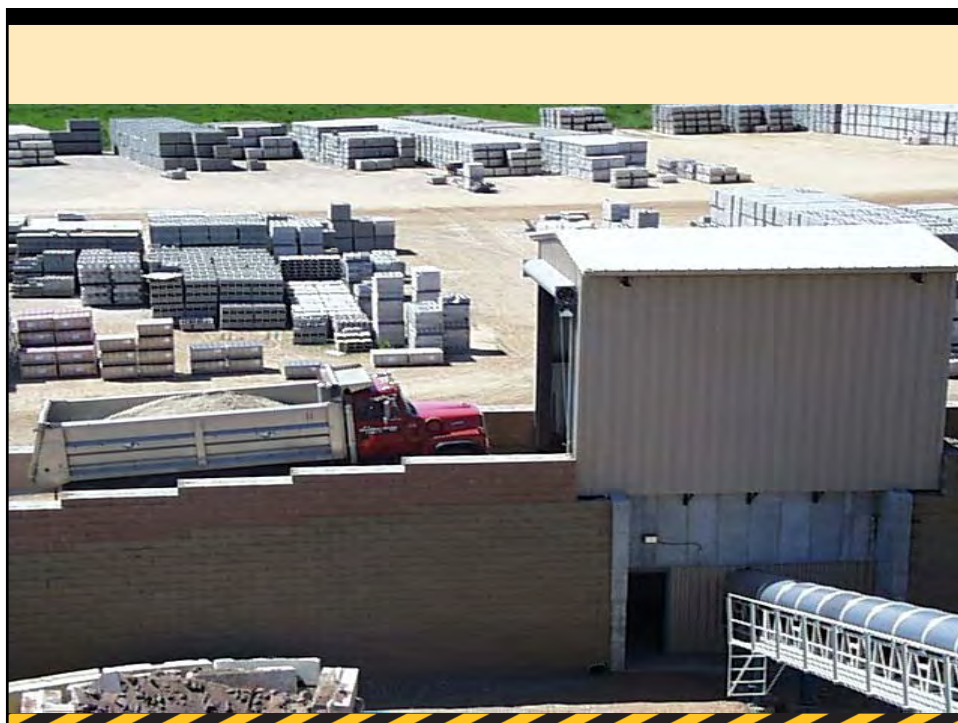


Don't Ignore Scour!



Recognize property line issues





Questions???

