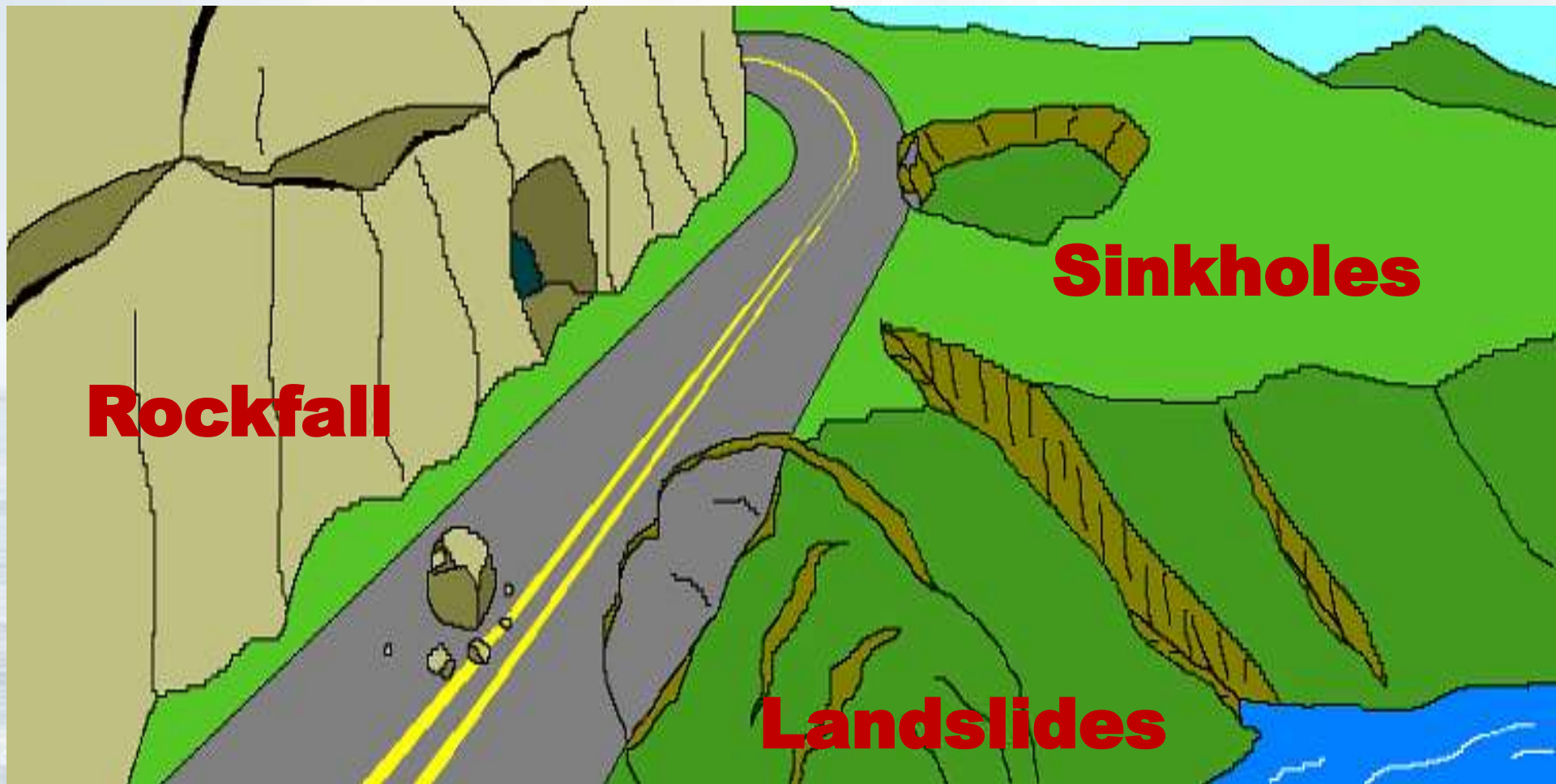
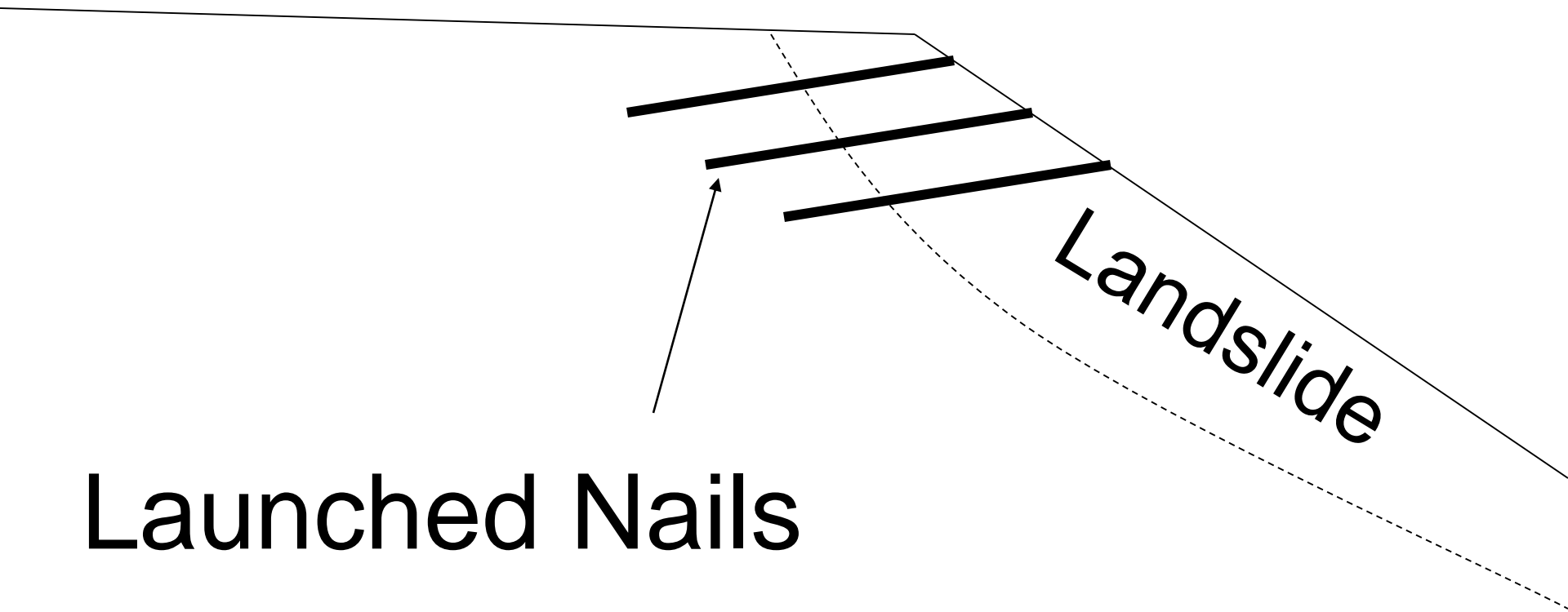


Primary Geohazards for Road Infrastructure









Launched Nails

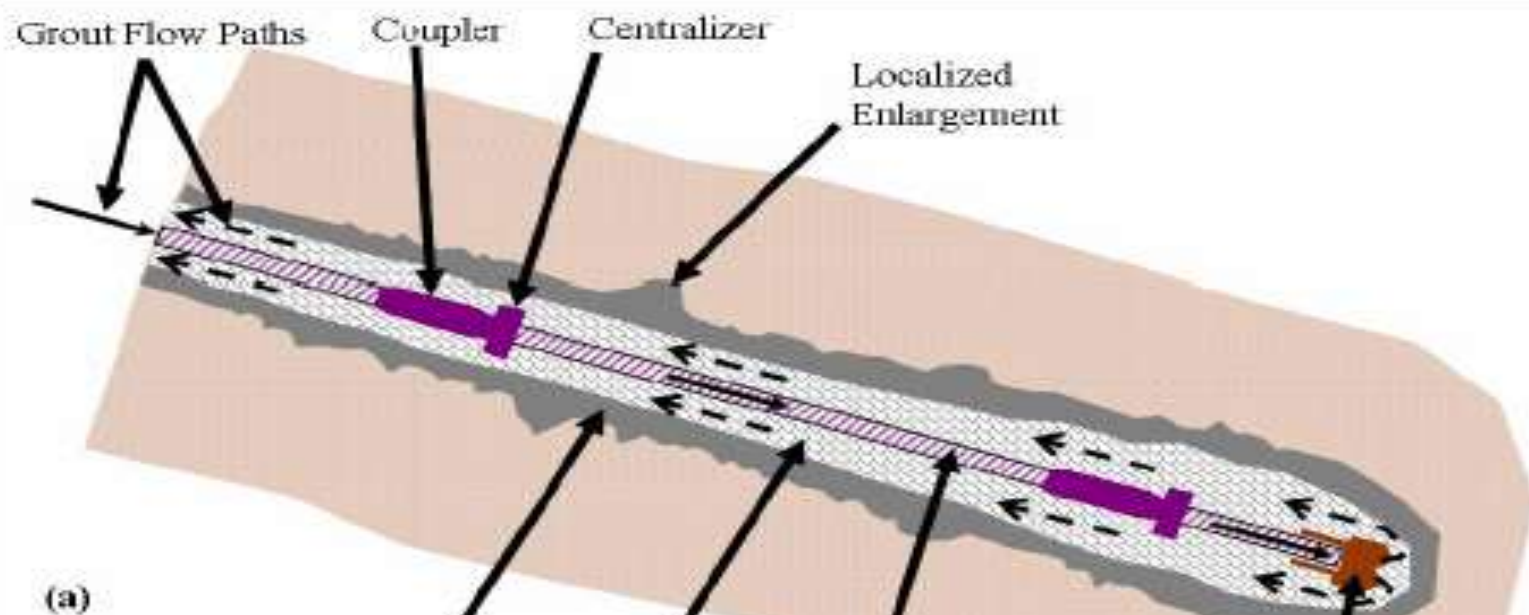
Landslide



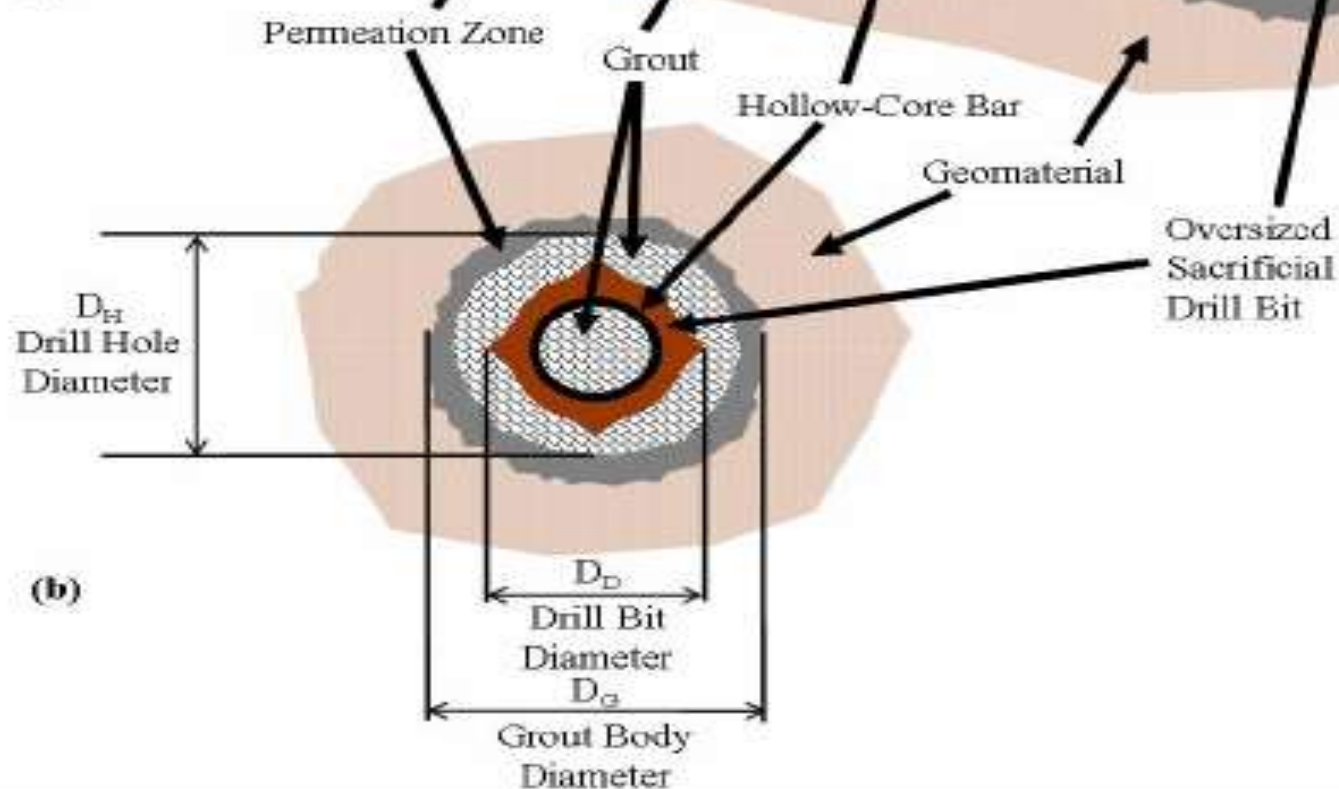
SUMMIT COUNTY, OHIO

- 2004 – 7 slides
 - \$400,000 vs. \$3,000,000 traditional fix
- Fixed 15 slides in 2004, 2005 & 2007

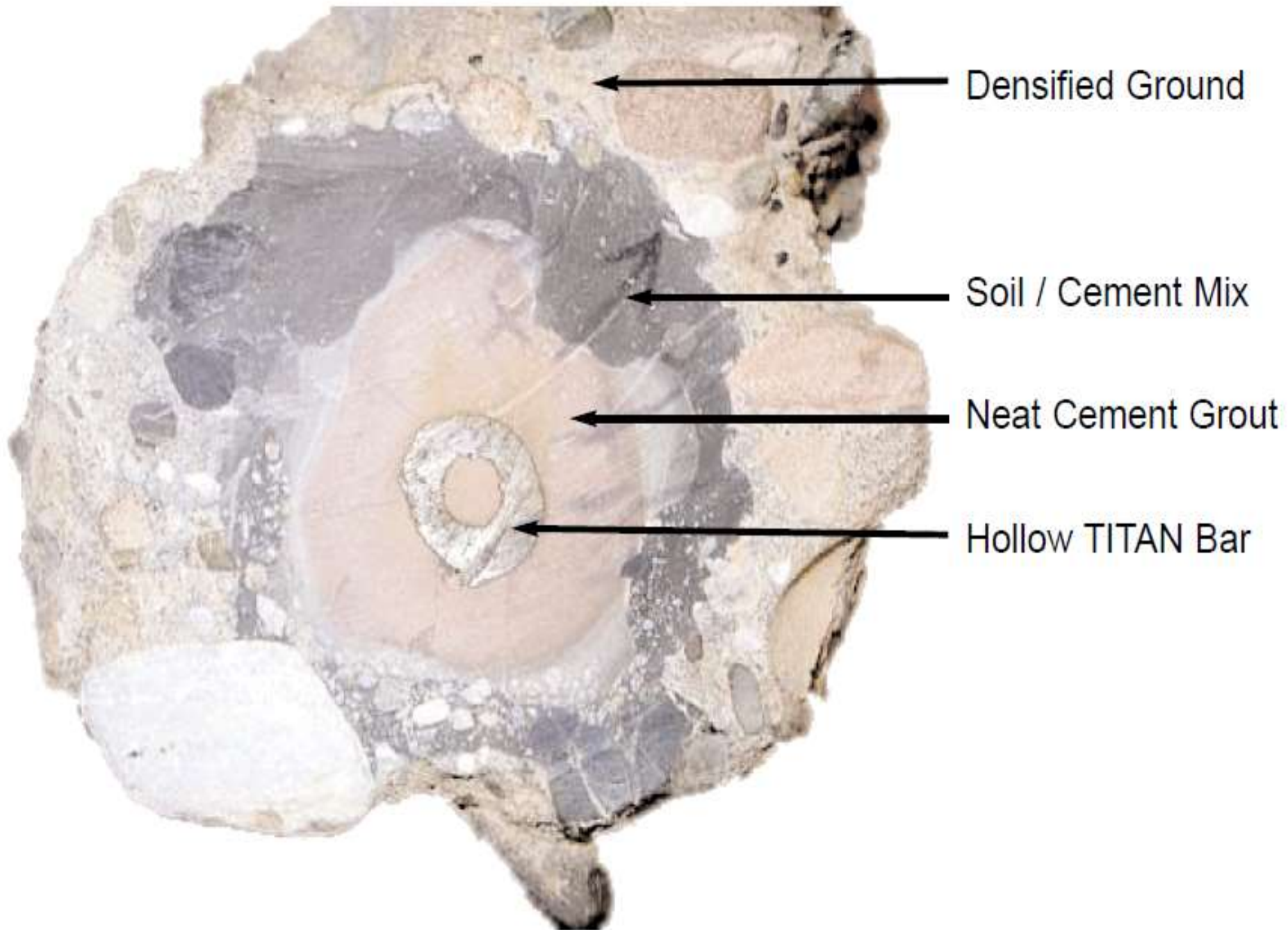




(a)



(b)





ODOT District 4





















04/03/200



05/30/2008



Soil Parameters

$$\begin{aligned}\gamma &= 120 \text{ pcf} \\ \phi &= 20^\circ \\ c &= 0\end{aligned}$$

Nail Parameters

$$\begin{aligned}f_{ur} &= 10 \text{ psi} \\ \text{bond diameter} &= 4 \text{ in} \\ L_{\text{tot}} &= 30 \text{ ft @ } 15^\circ \\ L_B &= 18, 20 \text{ ft} \\ S_H &= 4 \text{ ft} \quad S_V = 2 \text{ ft}\end{aligned}$$

$$q = 240 \text{ psf (traffic load)}$$

Active Zone

← assumed failure plane

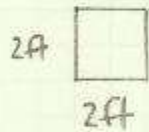
$$H = 19 \text{ ft}$$

$$L_{\text{tot}} = 30 \text{ ft}$$

$$L_B = 18 \text{ ft}$$

$$L_B = 20 \text{ ft}$$

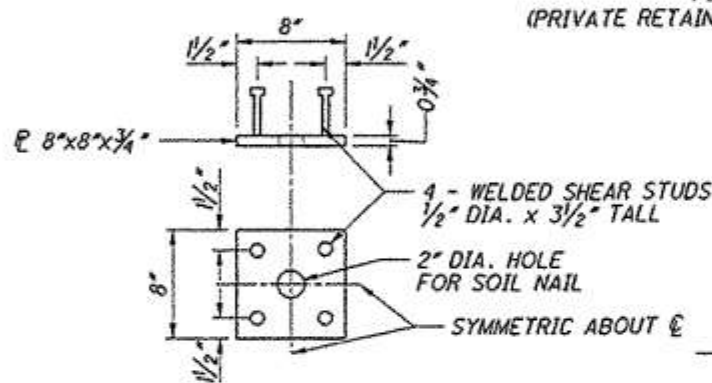
$$\alpha = 55^\circ = (45^\circ + \phi/2)$$



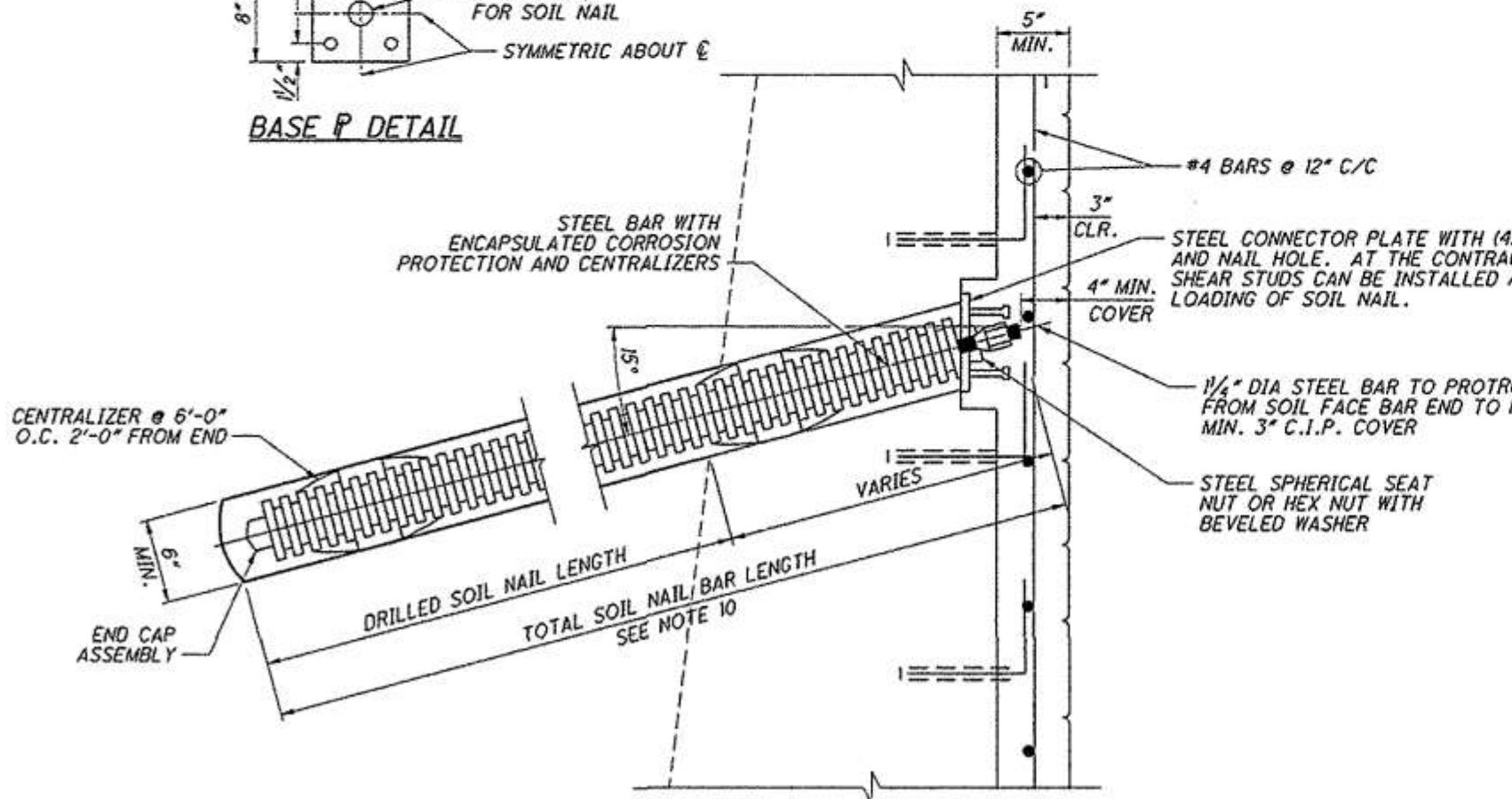




(PRIVATE RETAINING WALL NOT SHOWN FOR CLARITY)



BASE P DETAIL



TYPICAL SOIL NAIL SECTION



ifference!

atient
Center

ELANDS
Medical Center

open 24/7

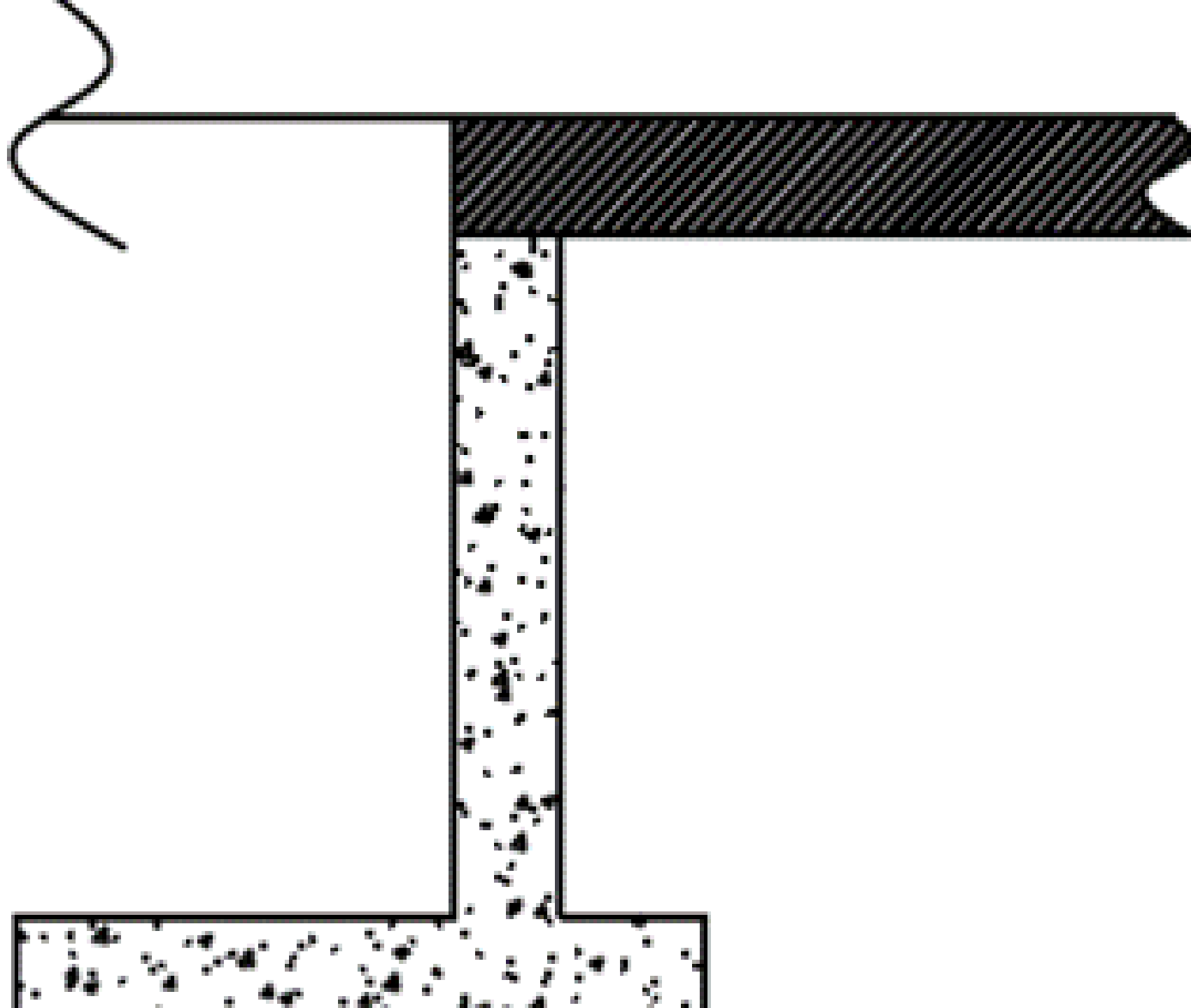


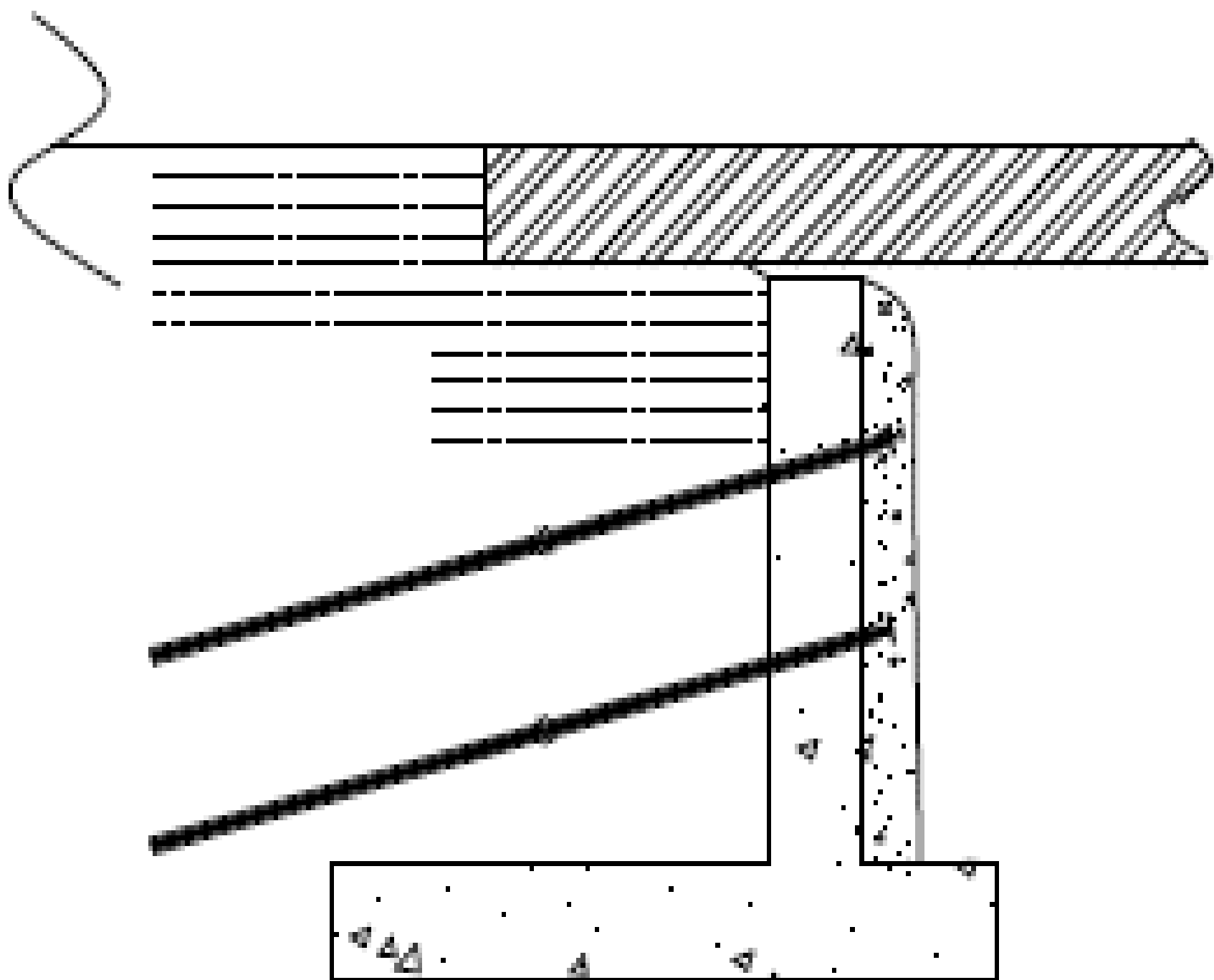
Oregon - Jefferson Marion Bridge Repair
No reinforcement in upper levels





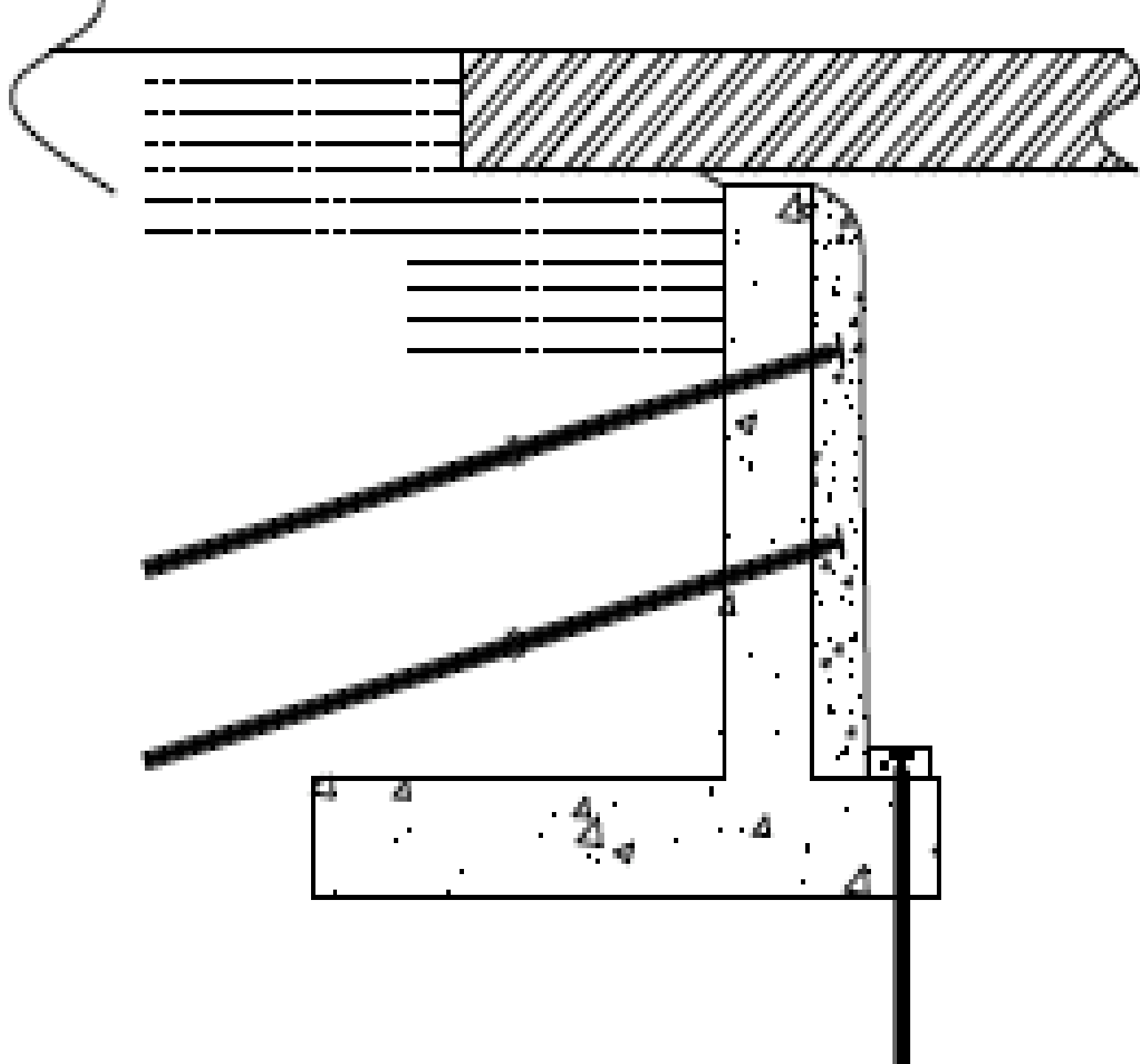




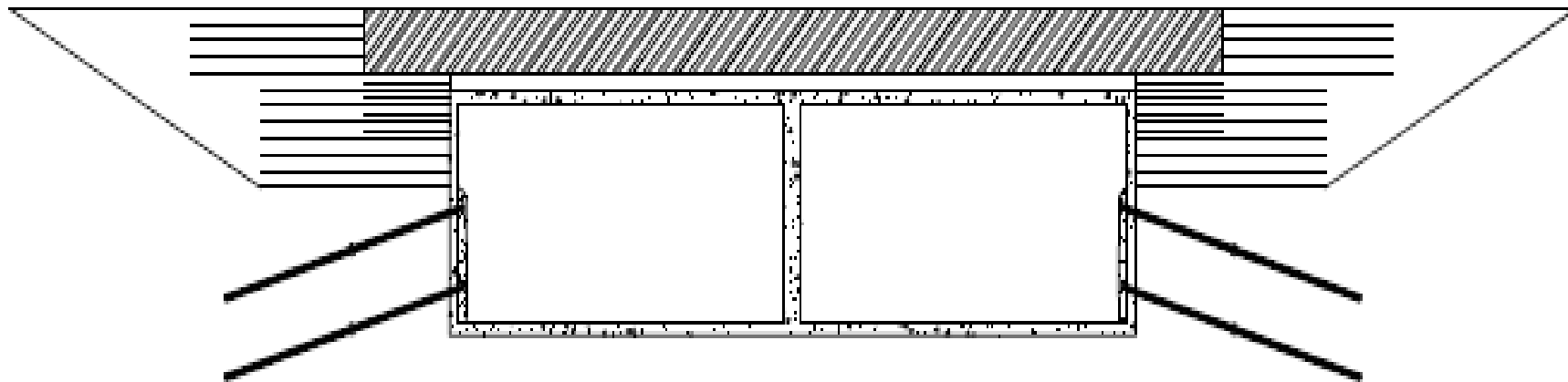


Limited Access Drilling









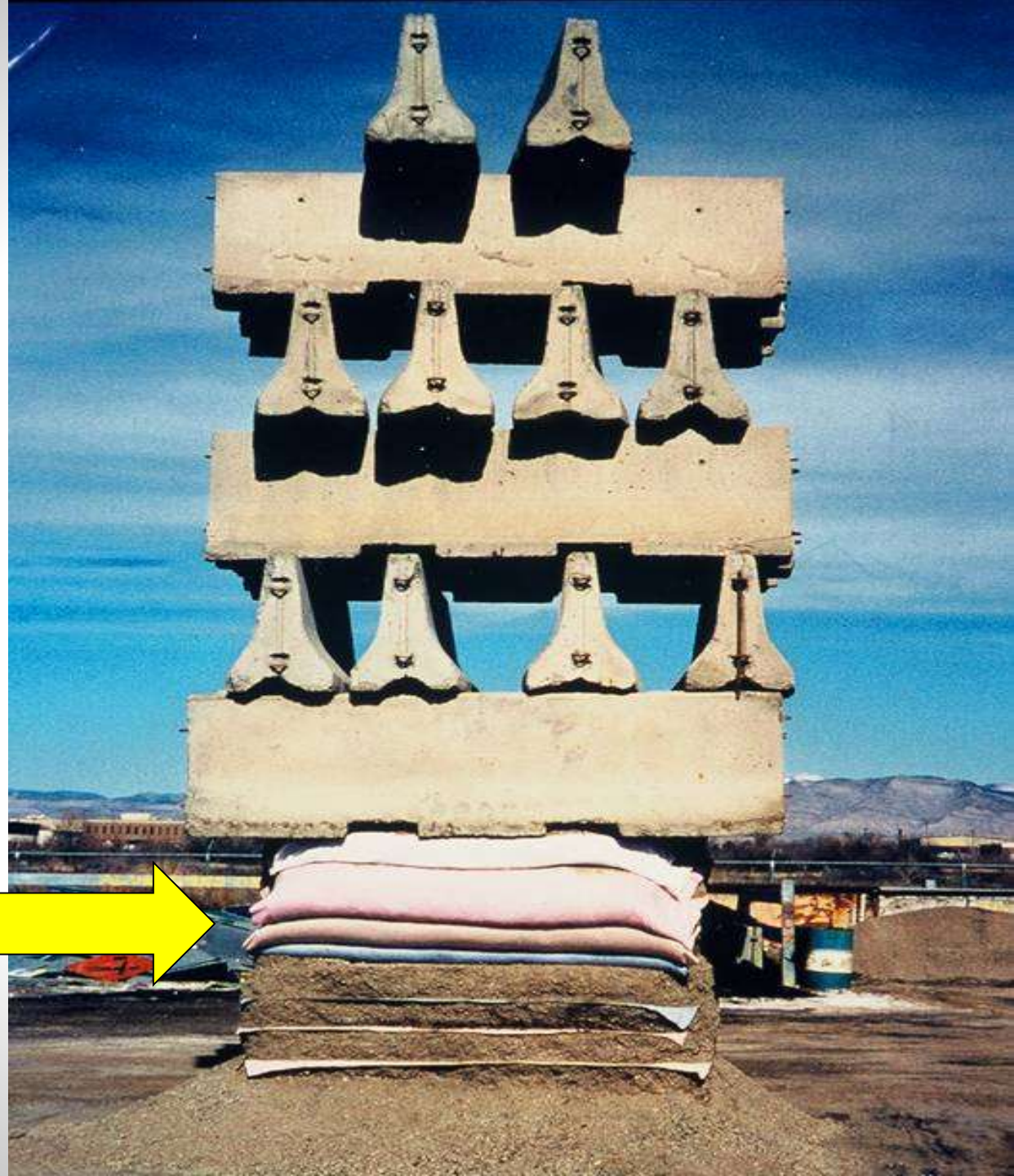
Option 2

COLORADO
DOT
GCS DEMO
WITH

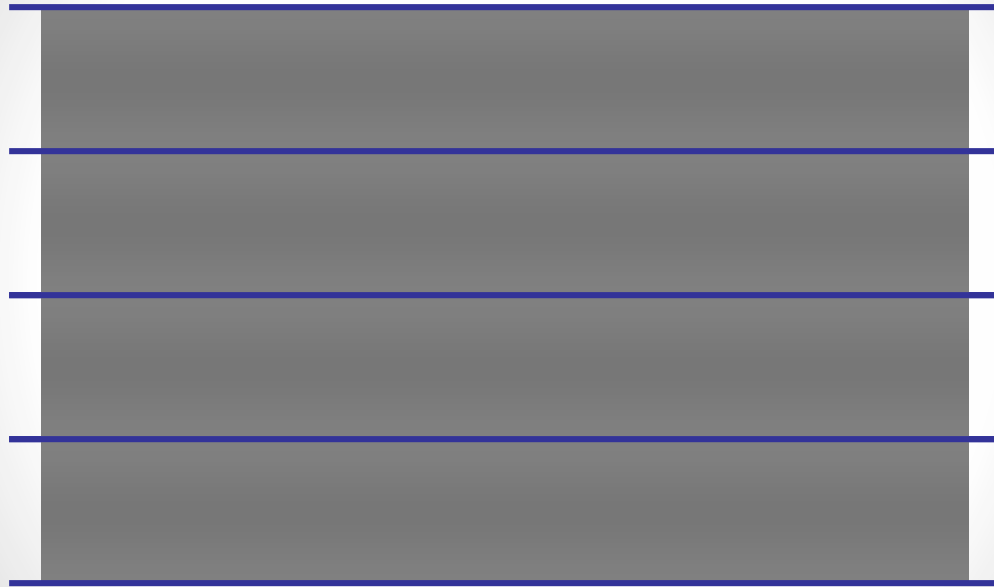
BEDSHEETS??

8 INCH
SPACING

3400 lbs sq ft



Spacing Controls PerformanceNot Strength of the Inclusion

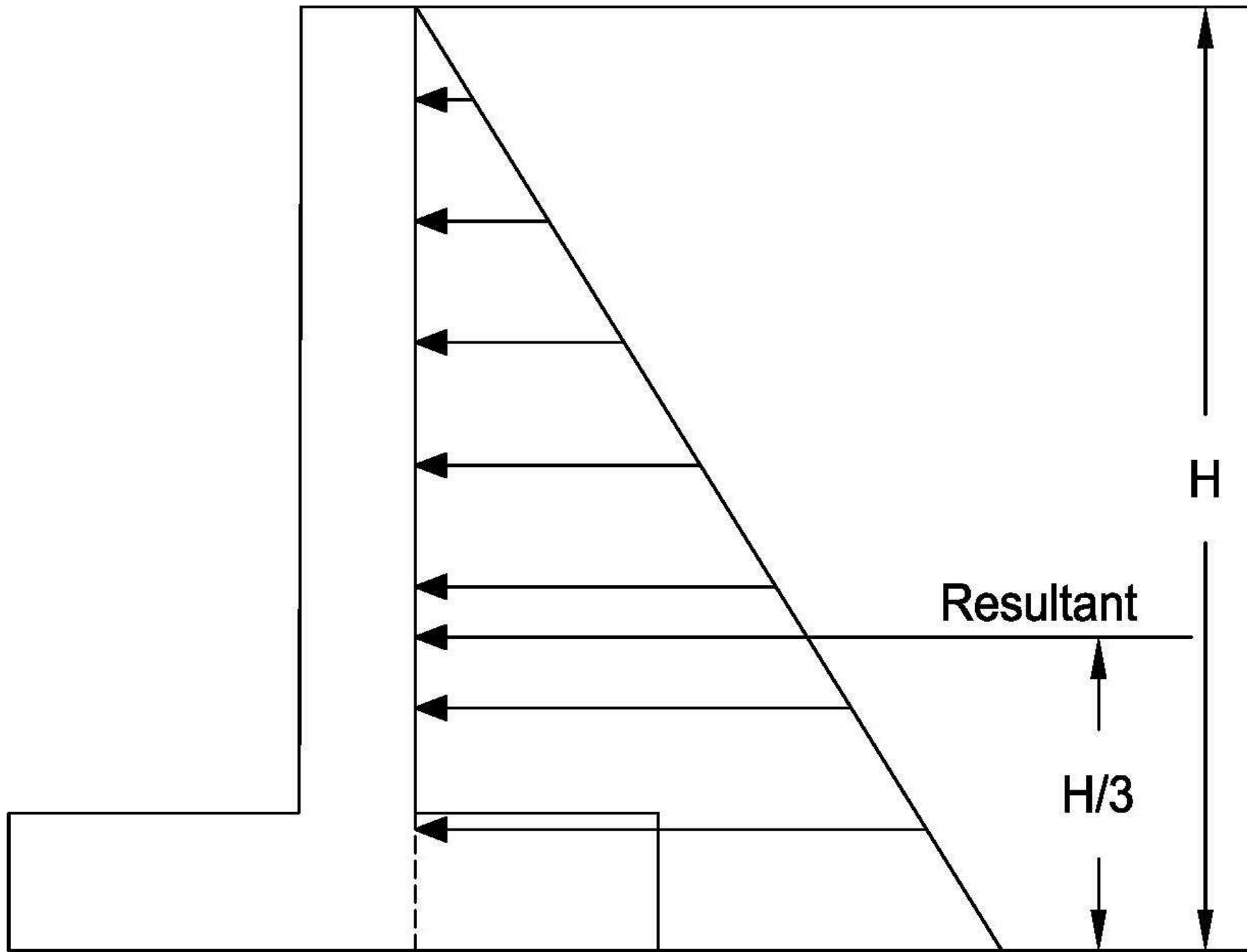


BASED ON
NCHRP REPORT 556





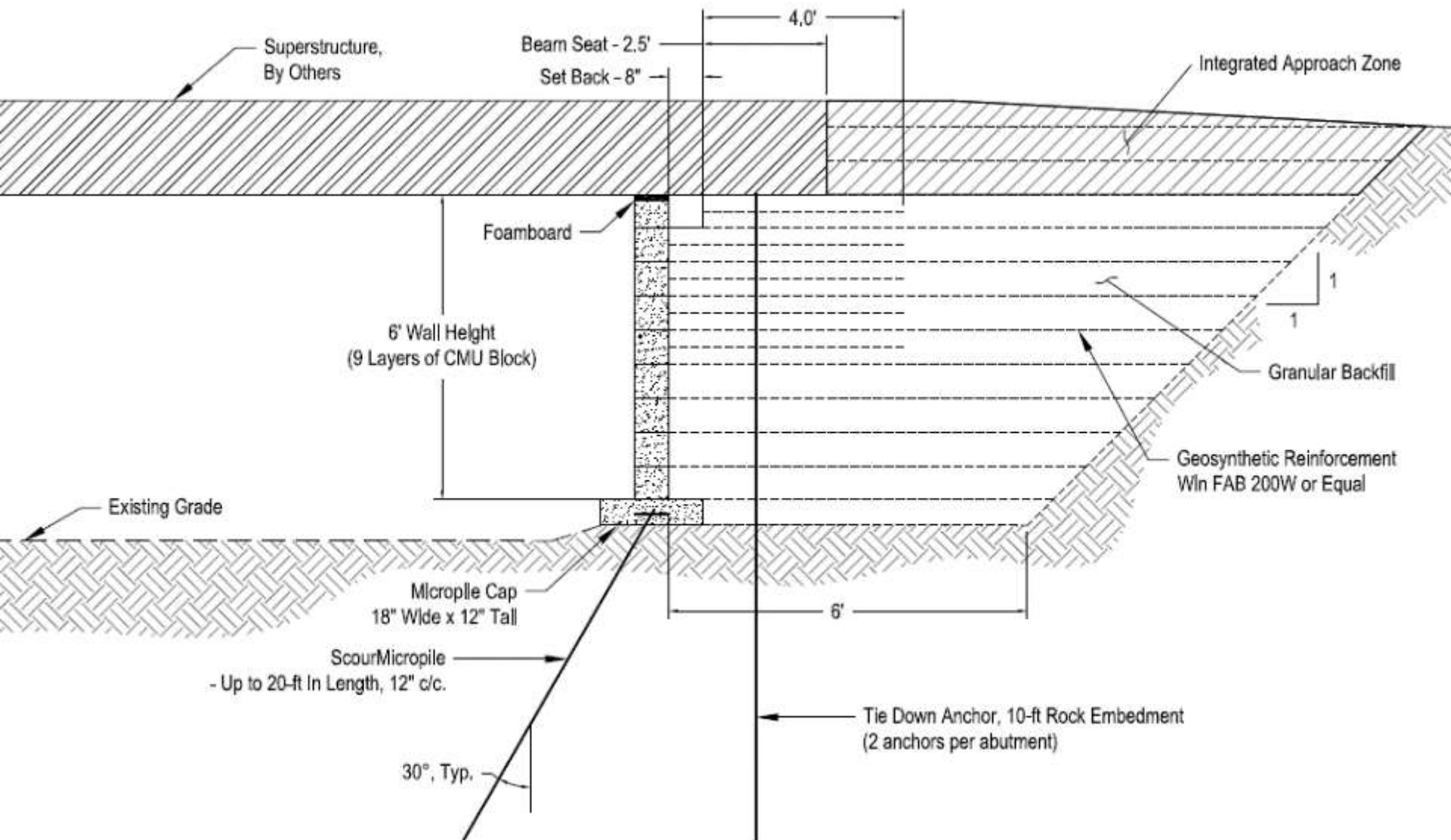








WV DOT
Summer 2013















08/22/2013

30 BRIDGES ON GCS™ ABUTMENTS
DEFIANCE COUNTY, OHIO
DESIGNED WITH CRITERIA PROVIDED IN
NCHRP REPORT 556 & FHWA



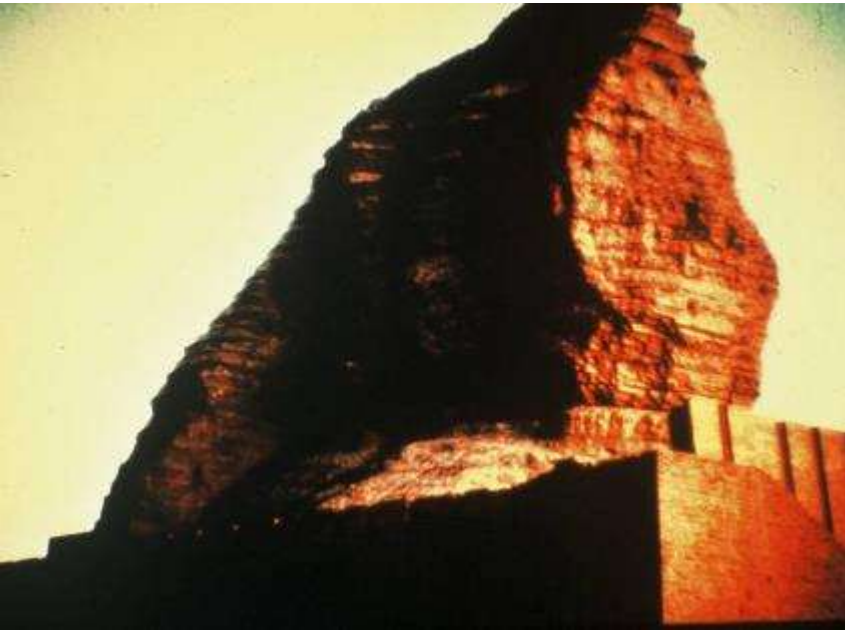
Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide

PUBLICATION NO. FHWA-HRT-11-026

JANUARY 2011



3000 Years of Use



Agar-Quf Ziggurat (Iraq)
1000 B.C.



Great Wall – Western Desert –
Ming Dynasty (1368 – 1644)

The ancients have stolen all
of our great ideas!

- Mark Twain