Project Update
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From: Dave Jermstad
Subject: Site Reconnaissance & Soil Classification
Project: 4543-01-03 Barnett BP-Durock Widening

Comments: Total pages: 2

Ken;

Carlton Engineering performed a site reconnaissance of the cut slope area and of the planned culvert improvements in order to classify the soils and make recommendations for slope inclination and foundation parameters respectively.

OBSERVATIONS
The cut north of Durock Road, in the vicinity of Business Drive is planned for widening and will require additional slope excavation. The existing slope appears stable at it's current approximately 1:1 (H:V) inclination. The cut exposes a thin layer of near-surface silty SAND with gravel which is developed on native bedrock. The bedrock is Gabbro, gray, moderately weathered, widely fractured, and moderately strong.

The outlet for the existing 24" CMP east of Business Drive and on the south side of Durock Road is planned for replacement and is anticipated to include the construction of inlet and outlet headwalls. The existing culvert was installed with a simplified concrete headwall and a narrow apron. The existing headwall is undercut by scour and has structurally failed as evidenced by the horizontal open crack running approximately at the mid-culvert elevation. The scour has also apparently exposed the top of a cement pipeline running parallel with Durock Road. The material exposed in the scour is silty SAND with gravel, medium dense to loose, and wet.

DISCUSSION
We anticipate that the cut slope can be tapered such that the near-surface soil is sloped at an inclination of 2:1 and that the cut can quickly transition to a 1:1 inclination.

We also understand that the new CMPs will extend beyond the current outlet and that the headwall will likely be founded south of the suspect cement pipeline observed at the site. With that understanding, we anticipate that the headwall backfill will be select material for this project.

RECOMMENDAITONS
The north cut should be tapered such that the upper 2-feet is sloped at an inclination of 2:1 and the cut should quickly transition to a 1:1 inclination where deeper than 2-feet. The cut slope should be prepared and protected to promote vegetation and include seeding and fertilizing in accordance with El Dorado County standards and SCS recommendations. The prepared cut slope should be covered with an erosion control fabric such as North American Green C350 placed in accordance with the manufacturer's recommendations and using staple pattern "E".

The CMP headwall improvements may be designed using Class 4 Materials from the 2001 UBC, Table 18-I-A. If loose or clayey materials are encountered during excavation, they should be completely removed and replaced with CalTrans Class 2 AB compacted to 95% of its maximum dry density (ASTM D1557). The import fill for the headwalls must classify as Class 4 or better materials or be Class 2 AB. The headwalls must be freely draining and include a 12-inch thick drainage layer immediately behind the wall. With this understanding, the Structural Engineer may use an equivalent fluid weight of 35 psf/ft.

Carlton Engineering should be retained to observe the excavation and backfill conditions and to confirm the design parameters discussed herein.

Please feel free to call if you have any questions regarding this update.

Sincerely Yours,
Carlton Engineering, Inc.

David B. Jermstad, C.E.G.
V.P. / Geotechnical Manager

Lateral Earth Pressures

	ENTER		
φ	31.0	(degrees)	Angle of Internal Friction
c	0.0	(psf / kPa)	Cohesion
α	90.0	(degrees)	Angle off of horizontal of the earth-side of the wall
β	0.0	(degrees)	Backfill slope angle off of horizontal (infinite) (+=Up; -=Down)
δ	7.0	(degrees)	Wall-soil interface wall friction angle
H	10.00	(ft / meter)	Height of Retained material
γ	125.0	(pcf / kN/m³)	Moist Unit Weight of material
F.S.	1.0	(unitless)	Factor of Safety on the PASSIVE-Equivalent Fluid Weight (EFWp)

Rankine's Method

Assumptions:

a) No Wall Friction (δ = 0)
b) Cohesion = 0
c) Plane failure surface

Solutions:

Cohesionless Material		Units	FS	
Ka =	0.3201	Unitless	--	Coefficient inclined at angle β with respect to the wall
Kp =	3.1240	Unitless	--	Coefficient inclined at angle β with respect to the wall
EFP active	**40.0**	(pcf / kN/m³)	1.0	Horizontal
EFP passive	390.5	(pcf / kN/m³)	1.0	Horizontal

Coulomb's Method

Assumptions:

a) Wall Friction (δ > 0)
b) Cohesion > 0
c) Plane failure surface

Solutions:

Cohesive Material		Units	FS	
Ka =	0.3022	Unitless	--	Coefficient inclined at angle δ with respect to the wall
Kp =	3.9159	Unitless	--	Coefficient inclined at angle δ with respect to the wall
EFP active	**37.5**	(pcf / kN/m³)	1.0	Horizontal
EFP passive	485.8	(pcf / kN/m³)	1.0	Horizontal
EFP passive	485.8	(pcf / kN/M³)	1.0	Horizontal β = 0

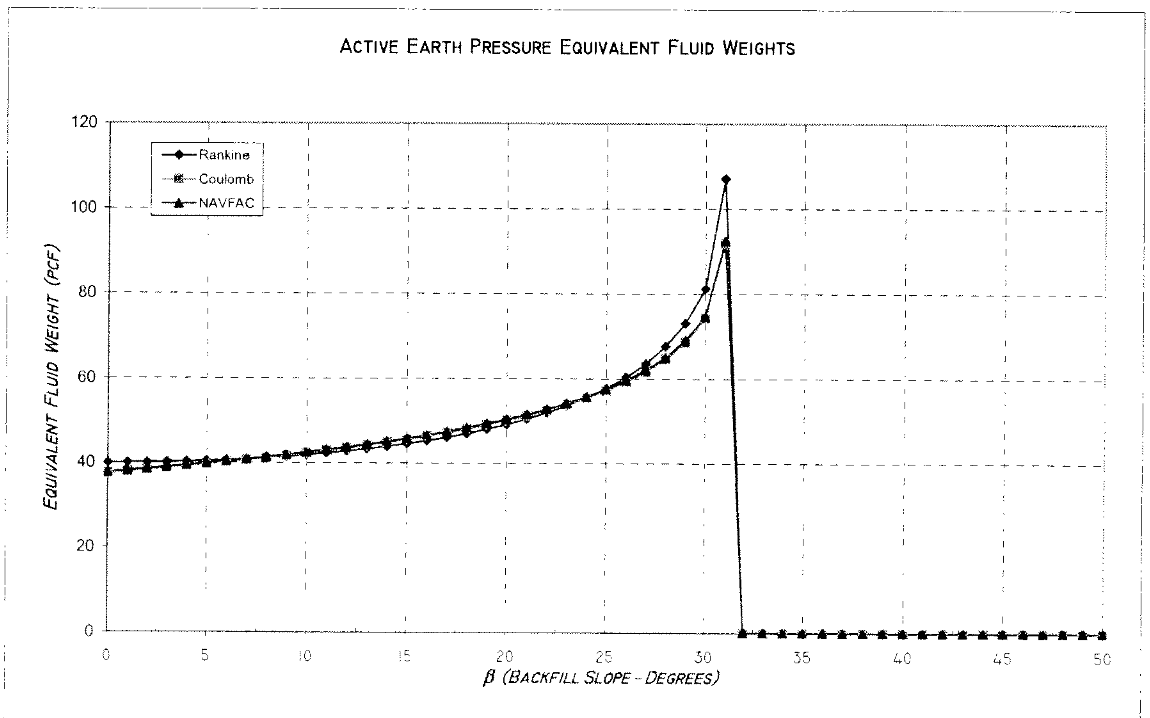
NAVFAC Methods

Assumptions:

a) Wall Friction (δ > 0)
b) Cohesion = 0
c) Plane failure surface

Solutions:

Cohesionless Material		Units	FS	
Ka =	0.3022	Unitless	--	Horizontal
Kp =	3.9159	Unitless	--	Horizontal
EFP active	**37.8**	(pcf / kN/m³)	1.0	Horizontal
EFP passive	489.5	(pcf / kN/m³)	1.0	Horizontal



Allowable Bearing Capacity

Project Name: Durock Road Widening
Project No.:
CEI Staff: D. Jermstad
Date: 12/27/2005

Input Variables

ϕ = 29 deg.
c = 0 psf
γ_T = 132.0 pcf
$FS_{bearing}$ = 3

Rectangular Foundation

B = 1.0 ft
L = 1.0 ft
D = 1.0 ft

Continuous Foundation

B = 1.0 ft
D = 1.0 ft

Common Bearing Capacity Factors

N_c = 27.86
N_q = 16.44

Lateral Resistance

ϕ = 29 deg.
Passive EFW = **380 pcf**
Base Friction = **0.37**

Meyerhof's Method (1961,1963)

Bearing Capacity Factors

Bearing Capacity Factors		Shape Factors[1]		Depth Factors -- Rect.		Depth Factors -- Cont.	
N_γ =	13.24	s_c =	1.58	d_c =	1.34	d_c =	1.34
		s_q =	1.29	d_q =	1.17	d_q =	1.17
K_p (Rankine) =	2.88	s_γ =	1.29	d_γ =	1.17	d_γ =	1.17

		cohesion		depth		width			
Continuous Foundations:	q_{ult} =	0	psf +	2,539	psf +	1,022	psf +	3,561	psf
	q_{all} =	**0**	**psf +**	**846**	**psf +**	**341**	**psf +**	**1,187**	**psf**
Rectangular Spread Foundations:	q_{ult} =	0	psf +	3,271	psf +	1,316	psf +	4,587	psf
	q_{all} =	**0**	**psf +**	**1,090**	**psf +**	**439**	**psf +**	**1,529**	**psf**

Hansen's Method (1970)

Bearing Capacity Factors		Shape Factors[1]		Depth Factors -- Rect.		Depth Factors -- Cont.	
N_γ =	12.84						
k_{rect} =	1.00	s_c =	1.59	d_c =	1.40	d_c =	1.40
k_{cont} =	1.00	s_q =	1.48	d_q =	1.29	d_q =	1.29
		s_γ =	0.60	d_γ =	1.00	d_γ =	1.00

		cohesion		depth		width			
Continuous Foundations:	q_{ult} =	0	psf +	2,809	psf +	847	psf +	3,657	psf
	q_{all} =	**0**	**psf +**	**936**	**psf +**	**282**	**psf +**	**1,219**	**psf**
Rectangular Spread Foundations:	q_{ult} =	0	psf +	4,171	psf +	508	psf +	4,680	psf
	q_{all} =	**0**	**psf +**	**1,390**	**psf +**	**169**	**psf +**	**1,560**	**psf**

Vesic's Method (1973,1975)

Bearing Capacity Factors		Shape Factors[1]		Depth Factors -- Rect.		Depth Factors -- Cont.	
N_γ =	19.34						
k_{rect} =	1.00	s_c =	1.59	d_c =	1.40	d_c =	1.40
k_{cont} =	1.00	s_q =	1.55	d_q =	1.29	d_q =	1.29
		s_γ =	0.60	d_γ =	1.00	d_γ =	1.00

		cohesion		depth		width			
Continuous Foundations:	q_{ult} =	0	psf +	2,809	psf +	1,276	psf +	4,085	psf
	q_{all} =	**0**	**psf +**	**936**	**psf +**	**425**	**psf +**	**1,362**	**psf**
Rectangular Spread Foundations:	q_{ult} =	0	psf +	4,366	psf +	766	psf +	5,132	psf
	q_{all} =	**0**	**psf +**	**1,455**	**psf +**	**255**	**psf +**	**1,711**	**psf**

Note 1: Shape factors are equal to 1.0 for continuous foundations.