OVERHEAD TRAFFIC SIGN SUPPORT GENERAL NOTES

27. PERFORM OVERTURNING AND SLIDING ANALYSES.

DEEP FOUNDATIONS: DRILLED SHAFTS AND DRIVEN PILES: CHECK TO ENSURE THAT THE EMBEDMENT DEPTH PROVIDED FOR DRILLED SHAFT OR DRIVEN PILES IS SUFFICIENTTO PREVENT OVERTURNING OR EXCESSIVE HORIZONTAL MOVEMENT (SLIDING) OF THE FOUNDATION. FOR SPREAD FOOTING FOUNDATIONS ENSURE THAT ECCENTRICITY IS WITHIN ACCEPTABLE LIMITS AND THAT FACTOR OF SAFETY AGAINST SLIDING IS ACCEPTABLE.

FOR DRILLED SHAFT TYPE FOUNDATIONS, THE BROM'S METHOD, AS OUTLINED IN AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, 2009 5TH EDITION, SECTION 13.6.1.1, CAN BE USED TO VERIFY EMBEDMENT DEPTHS. FOR BROM'S ANALYSES, USE AN UNDERCAPACITY FACTOR EQUAL TO 0.7 AND AN OVERLOAD FACTOR OF 2.1.

ALTERNATIVELY, A MORE DETAILED LATERAL LOAD ANALYSIS CAN BE PERFORMED. AN EXAMPLE OF A MORE DETAILED ANALYSIS IS A P-Y METHOD OF ANALYSIS UTILIZING THE LPILE SOFTWARE PROGRAM OR A SIMILAR SOFTWARE PROGRAM THAT CONSIDERS SOIL-STRUCTURE INTERACTION. DEFLECTIONS DUE TO COMBINED LOADING ON THE STRUCTURE SHALL BE LIMITED TO 12 mm AT THE GROUND SURFACE.

SHALLOW FOUNDATIONS: THE CALCULATED ECCENTRICITY VALUES FOR FOOTINGS ON SOIL SHOULD BE DESIGNED SO THAT THE ECCENTRICITY, E, OF THE LOADING IS LESS THAN 1/6 OF THE FOOTING DIMENSION IN ANY DIRECTION. [REF. 4, SECTION 4.4.7.1.1.1] FOR SPREAD FOOTINGS ON BEDROCK THE ECCENTRICITY SHOULD BE LIMITED TO ¼ OF THE FOOTING DIMENSION IN ANY DIRECTION. [REF. 3, SECTION 6.4.1]. OVERTURNING IS NOT CONSIDERED TO BE AN ISSUE FOR ECCENTRICITY VALUES WITHIN THESE RANGES.

THE REQUIRED FACTOR OF SAFETY USED FOR SLIDING ANALYSES SHALL BE 1.5.

28. COMPUTE ANTICIPATED SETTLEMENT OF EACH FOUNDATION.

EXCESSIVE VERTICAL SETTLEMENTS MUST BE ACCOUNTED FOR SO THAT THE FOUNDATION CAN BE CONSTRUCTED TO THE DESIRED ELEVATION, HOWEVER, DIFFERENTIAL SETTLEMENT, I.E., MOVEMENTS THAT WOULD CAUSE THE STRUCTURE TO TIP, PRESENT MORE OF A SERVICEABILITY CONCERN. WHERE CONCERNS LIKE THIS MAY EXIST, CONSIDER UNDERCUTTING THE FOUNDATION AND PLACING 0.3 TO 0.6 METERS OF STONE UNDER THE FOUNDATION TO DECREASE THE LOADS APPLIED TO THE IN-SITU FOUNDATION SOIL. SETTLEMENT ANALYSES SHOULD BE CONDUCTED USING THE HOUGH METHOD AS OUTLINED IN THE FHWA - GEC NO. 6, SHALLOW FOUNDATIONS, SECTION 5.3.4.

LIMIT OVERALL VERTICAL SETTLEMENT TO 50 mm. LIMIT DIFFERENTIAL SETTLEMENT TO 25 mm. SIGNIFICANT FOUNDATION ROTATION DUE TO DIFFERENTIAL SETTLEMENT SHOULD BE COMMUNICATED TO THE DESIGN ENGINEER AS THE CAMBER OF THE HORIZONTAL SUPPORT MAST ARM) COULD BE DESIGNED TO ACCOUNT FOR THE ANTICIPATED FOUNDATION MOVEMENT.

29. PERFORM ANALYSES FOR TORSION TO ENSURE THAT THE TORSIONAL FACTOR OF SAFETY MEETS OR EXCEEDS 1.1. THE BETA METHOD SHALL BE USED FOR DRILLED SHAFT TYPE FOUNDATIONS AND THE FLORIDA STRUCTURAL DESIGN OFFICE METHOD FOR SPREAD FOOTING FOUNDATIONS. OTHER METHODS MAY BE USED AS APPROVED BY THE VTRANS SOILS AND FOUNDATIONS ENGINEER. [GENERALLY, ONLY MAST ARM FOUNDATIONS NEED TO BE CHECKED FOR TORSIONAL LOADING].

30. ADDITIONAL DESIGN GUIDELINES:

A. THE VERTICAL OFFSET IS THE DISTANCE FROM THE GROUND SURFACE TO THE TOP OF THE FOUNDATION. THIS IS ASSUMED TO BE 150 mm UNLESS OTHERWISE DEPICTED.

B. ASSUME THAT THE GROUNDWATER TABLE (GWT) IS AT THE GROUND SURFACE UNLESS A DIFFERENT GWT CAN BE REASONABLY DETERMINED FROM A SUBSURFACE INVESTIGATION, MONITORING WELLS, OR LABORATORY MOISTURE CONTENTS.

C. NEGLECT A MINIMUM OF THE UPPER 0.6 METERS OF SOIL SURROUNDING THE FOUNDATION FOR CONTRIBUTIONS TO TORSION AND SKIN FRICTION RESISTANCE. THIS IS DUE TO POTENTIAL FOR FUTURE DISTURBANCE. NOTE: THE USE OF A "SONOTUBE" AS A FORM MAY NEGATE OR REDUCE SKIN FRICTION RESISTANCE FOR DESIGN PURPOSES.

D. A MINIMUM DEPTH OF 1.5 METERS TO THE BOTTOM OF SPREAD FOOTING FOUNDATIONS ON SOIL SHALL BE USED TO MITIGATE THE POTENTIAL FOR MOVEMENT FROM FROST EFFECTS.

E. TO SIMPLIFY CALCULATIONS OF TORSION FOR SQUARE FOOTINGS THE SQUARE FOOTING CAN BE ASSUMED TO BE CIRCULAR, I.E, AN 2.4 METERS WIDE SQUARE FOOTING IS MODELED AS AN 2.4 METERS DIAMETER. THIS IS A CONSERVATIVE ASSUMPTION.

F. UPLIFT (NEGATIVE CONTACT PRESSURE) OF A SPREAD FOOTING IS RESTRICTED. THE FOOTING MUST HAVE A MINIMUM CONTACT PRESSURE EXCEEDING 0 PSF. IN EXTREME CASES WHERE THE FOOTING WIDTH AND COST IS EXCESSIVE THE AGENCY MAY CHOOSE TO ALLOW UPLIFT ON ONE CORNER ONLY. HOWEVER, THE CONTRACTOR WILL HAVE TO DOCUMENT THE COMPUTED CONTACT PRESSURE AT ALL FOUR CORNERS.

CONTRACTOR DESIGN SUBMITTAL REQUIREMENTS

31. THE CONTRACTOR SHALL SUBMIT THE FINAL DESIGN LOADS, GEOTECHNICAL ANALYSES (INCLUDING COMPUTED FACTORS OF SAFETY), DETAILED CONSTRUCTION METHODS, AND PROVIDE DOCUMENTATION OF ALL APPLICABLE CALCULATIONS AS OUTLINED BELOW. THE AGENCY WILL DECIDE WHETHER TO ACCEPT THE CONTRACTOR'S DESIGN OR REQUEST CHANGES TO THE DESIGN.

A. A DESCRIPTION OF THE SOIL PROFILE WITH VALUES FOR γ - UNIT WEIGHT, γ' - EFFECTIVE UNIT WEIGHT, C-COHESION, Φ- INTERNAL SOIL FRICTION ANGLE AND Su-UNDRAINED SHEAR STRENGTH FOR CLAYS.

B. ESTIMATES FOR SOIL MODULUS PARAMETERS, K - FOR L-PILE ANALYSES

C. LATERAL EARTH PRESSURE PARAMETERS, Ko, Ka, AND Kp.

D. COMPUTED VALUES FOR ECCENTRICITY AND THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES, INCLUDING CORRESPONDING FACTORS OF SAFETY.

E. THE CALCULATED LATERAL DEFLECTION OF A DRILLED SHAFT FOUNDATION OR DRIVEN PILE FOUNDATION, IF APPLICABLE

F. RESULTS OF SETTLEMENT ANALYSES.

G. THE COMPUTED FACTOR OF SAFETY FOR OVERTURNING, TORSION, AND SLIDING.

H. DOCUMENTATION OF THE GROUNDWATER ELEVATION USED IN THE ANALYSES.

32. WHEN PROVIDING VTRANS WITH COPY OF FOUNDATION DESIGNS THE DESIGNS SHOULD INCLUDE THE STRUCTURAL LOADS (USED FOR DESIGN) ACTING AT THE TOP OF EACH FOUNDATION, I.E., AT THE ANCHOR BOLT ELEVATION: AXIAL (P), SHEAR (V), OVERTURNING MOMENT (M), AND TORSION (T).

33. THE CONTRACTOR SHALL SUBMIT A SET OF SCALED DRAWINGS TO THE AGENCY IN ACCORDANCE WITH THE FOLLOWING:

A. THE CALCULATED ULTIMATE BEARING CAPACITY ALONG WITH THE FACTOR OF SAFETY USED FOR DESIGN PURPOSES FOR SPREAD FOOTINGS OR THE CALCULATED ULTIMATE SHAFT OR DRIVEN PILE CAPACITY ALONG WITH THE DESIGN FACTOR OF SAFETY FOR DRILLED SHAFT OR PILE SUPPORTED FOUNDATIONS.

B. CROSS SECTIONS SHOWING LOCATION OF ANY OVERHEAD STRUCTURES DEPICTING THE PROXIMITY TO ANY ADJACENT SLOPES, EXISTING OR PROPOSED INFRASTRUCTURE, AND UTILITIES. THESE CROSS SECTIONS SHOULD ALSO DEPICT THE ANTICIPATED FOUNDATION ELEMENTS.

C. A SERIES OF CONSTRUCTION NOTES THAT WILL ENSURE THAT THE STRUCTURE(S) ARE CONSTRUCTED IN ACCORDANCE WITH THE CURRENT EDITION OF THE VTRANS STANDARD SPECIFICATIONS FOR CONSTRUCTION.

34. CONTRACTOR SHALL SCHEDULE THEIR WORK TO ALLOW FOR A PERIOD OF 10 WORKING DAYS TO ALLOW FOR AGENCY REVIEW.

GEOTECHNICAL ENGINEERING PARAMETERS FOR OVERHEAD STRUCTURES FOR BENNINGTON CONTRACT 54

BORING I.D.	NORTHING m	EASTING m	STATION m	OFFSET m	GROUND ELEVATION m	BORING DEPTH m	SOIL DESC.	INTERNAL FRICTION ANGLE, ϕ	UNIT WEIGHT γ, pcf	UNIT WEIGHT γ, kg/m^3	GROUNDWATER TABLE[2]	NOTES
PB-1	44894.79	443070.06	EB 9+717.26	16.45 RT	215.61	2.00	mixed Gr w/broken rock	37	130	77.126166	NOT TAKEN	Boring was terminated when auger refusal was met which is indicative of possible boulders or shallow bedrock.
PB-2	44922.49	443073.64	F 1+000.19	14.23 RT	215.47	1.00						
PB-3	45134.08	442772.77	F 1+883.97	4.07 RT	210.16	3.15	SiSa / SaSi	32	120	71.193384	NOT TAKEN	
PB-4	45150.18	442794.94	WB 10+154.99	9.52 RT	212.64	6.45						
PB-5	45307.20	442532.70	NB 10+467.04	14.58 LT	201.57	4.15	SaGr w/ some Si	32	120	71.193384	NOT TAKEN	Foundation for PB5 should be constructed at a depth of 2.0 m. Soil conditions at PB5 govern OHS footing design at this location.
PB-6	45335.01	442540.87	NB 10+467.05	9.00 RT	204.30	1.75						
PB-9	45263.80	441932.28	EB 10+969.65	7.83 LT	193.36	4.75	Sa & Sa/Gr	30	110	65.260602	8.0 m	Soil conditions at PB9 govern design.
PB-10	45280.21	441930.78	EB 10+969.70	8.65 RT	194.06	8.60						
PB-16	44573.48	442833.47	NB 9+551.61	23.69 LT	205.39	2.75	SaGr w/broken rock	32	120	71.193384	NOT TAKEN	Boring was terminated when auger refusal was met which is indicative of possible boulders or shallow bedrock. Exposed bedrock nearby.
PB-17	44570.92	442674.91	NB 9+551.61	16.82 RT	202.95	1.75						
PB-18	45946.68	442121.08	SB 11+455.85	11.37 LT	225.71	1.80	GrSa	33	125	74.159775	NOT TAKEN	Boring was terminated when auger refusal was met which is indicative of possible boulders or shallow bedrock Exposed bedrock nearby.
PB-19	45946.54	442143.83	SB 11+455.85	8.38 RT	224.73	1.85						
PB-23	46350.86	442145.26	US 7 MM 5.8	10.0 LT	243.56	1.80	SiSa	37	130	77.126166	NOT TAKEN	
PB-24	46350.91	442125.35	US 7 MM 5.8	10.0 RT	242.28	3.70	Sa/Si w/some Gr	32	120	71.193384		Foundation for PB24 should be constructed at a depth of 2.0 m.
PB-28	45050.26	442336.10	EB 10+490.00	14.60 RT	193.00	5.15	Si w/some Cl	28	90	53.395038	8.0 m	Due to loose Silt encountered at this location, the installation of a "drilled shaft" type foundation should be considered at PB28 and PB29.
PB-29	45027.49	442317.97	EB 10+490.00	14.61 LT	192.59	8.60						

Additonal Notes

1. The geotechnical parameters (unit weight and friciton angle) are based on an assumption that the foundation will be embedded 1.5 meters (spread footing type foundation) below the ground surface - unless otherwise noted.
2. The borings indicated that the groundwater table was not taken, this may mean "not encountered" based on presence of shallow bedrock in the area, the granular nature of the overburden soils, the moisture contents reported during the laboratory analysis, and the 8.0 m water table recorded for borigns PB9, PB10, PB28, and PB29.
3. Borings PB1, PB2, PB6, PB16, PB17, PB18, PB19,and PB23 were stopped fairly shallow, indicative of a dense layer below the bottom of the boring.A "drilled shaft type" foundation at these locations may not be feasible.

Stantec

PROJECT NAME: BENNINGTON
PROJECT NUMBER: NH 019-1(54)

FILE NAME: ...\plot_files\zd307c4det_osd.ptf PLOT DATE: 1/26/2010
DESIGN SUPERVISOR: GREG EDWARDS DRAWN BY: STANTEC
DESIGNED BY: MARC FOISY CHECKED BY: GARY SANTY
OVERHEAD SUPPORT DETAILS OSD-02 SHEET 213 OF 468

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