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September 25, 2012

Jackson County Public Works
303 West Walnut Street
Independence, MO 64050
Phone: 816-881-4532

Re: Jackson County Historic Court House-Elevator Pit
112 West Maple
Independence, MO 64050
PSI Project Number 338-649

As requested, Professional Service Industries, Inc. (PSI) has performed a limited geotechnical investigation within the basement of the Jackson County Historic Court House in Independence, Missouri. This investigation was completed within the proposed elevator location to investigate the subsurface soil conditions within the proposed elevator location and to determine the bearing materials of the existing foundation elements located directly adjacent to the proposed elevator pit.

PSI was contacted by Richard C. Crabtree of Bob D. Campbell & Co., Inc. on September 07, 2012 concerning the following:

- Subsurface soil conditions within the proposed elevator location and beneath the existing foundations elements near the proposed elevator location
- Active earth pressures design values for the proposed soldier piles to be placed to shore the excavation of the elevator pit
- Recommendations for site coefficient for use in seismic design (IBC 2009)
- Size and bearing depths of the existing foundations near the proposed elevator pit

PSI understands that a new elevator pit area will be approximately 8½ feet by 7 feet in dimension and will extended down to a depth of about 5 to 6 feet below the existing lower level floor slab elevation.

Prior to PSI mobilization to the site, the existing basement floor slab in the proposed elevator pit location had been removed by others. The exposed soils within the elevator pit area consisted of brown fat clay and was saturated at the surface. Some areas within the pit area had 1 to 2 inches of standing water at the surface.

The north face of the column footing to the southeast of the proposed pit was excavated (see Figure 1 below). The column footing was observed to extend 3 feet from the center of the column to the west edge of the column footing (see Figures 2 and 3). Based on the column being square in dimension PSI estimates that dimension of the column footing is approximately 6 feet by 6 feet. The column footing was found to extend to a depth of approximately 20 inches below the bottom of the existing floor slab (see Figure 4) and was bearing on clay.

Figure 1: Measuring the exposed column footing for dimensions.

Figure 2: The dimension from center of column to edge of column footing

Figure 3: The distance from the edge of column footing to the center of column

Figure 4: Depth to bottom of column footing

The area below the wall located just west of the elevator pit was excavated to document the conditions of what was expected to be supported on a strip footing. However, after excavating this area no strip footing was observed. A borehole was augered underneath the existing floor slab and a probe was used to push deeper into the augered borehole but yet no footing was observed (see Figure 5).

Figure 5: Excavation along the west edge (auger and tile probe holes seen above)

Hand augering was also performed within the center of the proposed elevator pit area to verify whether bedrock should be anticipated during the excavation and installation process of the elevator pit and soldiers piles. The borehole was hand augered to approximately 11 feet below the existing ground surface (bottom of floor slab) and proceeded through native clays and did not encounter bedrock at terminal depth.

Upon completion of the hand augered borehole, water was recorded at approximately 1 foot below the existing ground surface. This, along with the wet conditions upon arrival would indicate a ground water table that is near the basement floor elevation in this area. This could be problematic during excavation and pumping should be expected to keep the excavation clear of water during construction

Earthquake and Seismic Design Consideration

The 2009 International Building Code requires a site class for the calculation of earthquake design forces. This class is a function of soil type (i.e., depth of soil and strata types). Based on the depth to rock and the estimated shear strength of the soil at the boring locations, Site Class “D” is recommended. The USGS-NEHRP probabilistic ground motion values near latitude 39.0924° and longitude -94.4164° are as follows:

Period (Seconds)	2% Probability of Event in 50 years (%g)	Site Coefficient F_a	Site Coefficient F_v
PGA	5.66	---	---
0.2 (S_s)	13.5	1.6	---
1.0 (S_1)	9.6	---	2.4

The Site Coefficients, F_a and F_v were interpolated from IBC 2009 Tables 1613.5.3(1) and 1613.5.3(2) as a function of the site classifications and the mapped spectral response acceleration at the short (S_s) and 1 second (S_1) periods.

Below-Grade Soldier Pile Wall

The below-grade soldier pile system should be designed to resist lateral earth pressures. Lateral earth pressure is developed from the soils present within a wedge formed by the vertical below-grade retaining wall and an imaginary line extending up and away from the bottom of the wall at an approximate 45° angle. The lateral earth pressures are determined by multiplying the vertical applied pressure by the appropriate lateral earth pressure coefficient K. If the walls are rigidly attached to the structure and not free to rotate or deflect at the top, PSI recommends designing the walls for the "at-rest" lateral earth pressure condition using K_o. Walls that are permitted to rotate and deflect at the top can be designed for the active lateral earth pressure condition using K_a. Passive pressure can be determined using K_p, with a factor of safety of 2.0. Recommended parameters for use in below grade walls are as follows:

Recommended Parameters for use in Below-Grade Wall Design		
Material Type	Drained Friction Angle (ϕ')	
1) Fat Clay (in-situ)	20°	
2) Granular Soils (clean crushed limestone)	35°	
Total Soil Density (pcf)	125	
Cohesion for Clay Soils (psf) (undrained, ϕ = 0)	750	
Groundwater Elevation	At bottom of the wall	
Parameters specific to soil type	**1**	**2***
Friction Factor for Base	0.24	0.47
Coefficient of Active Pressure (K_a) **	0.49	0.27
Coefficient of Passive Pressure (K_p) **	2.04	3.69
Coefficient of At-Rest Pressure (K_o) **	0.66	0.43

* These values may be used for design only if the crushed limestone backfill extends back from the wall certain distances. These are a horizontal distance approximately equal to or greater than the total height of the wall at the surface, and at least one-foot beyond the heel of the wall footing.

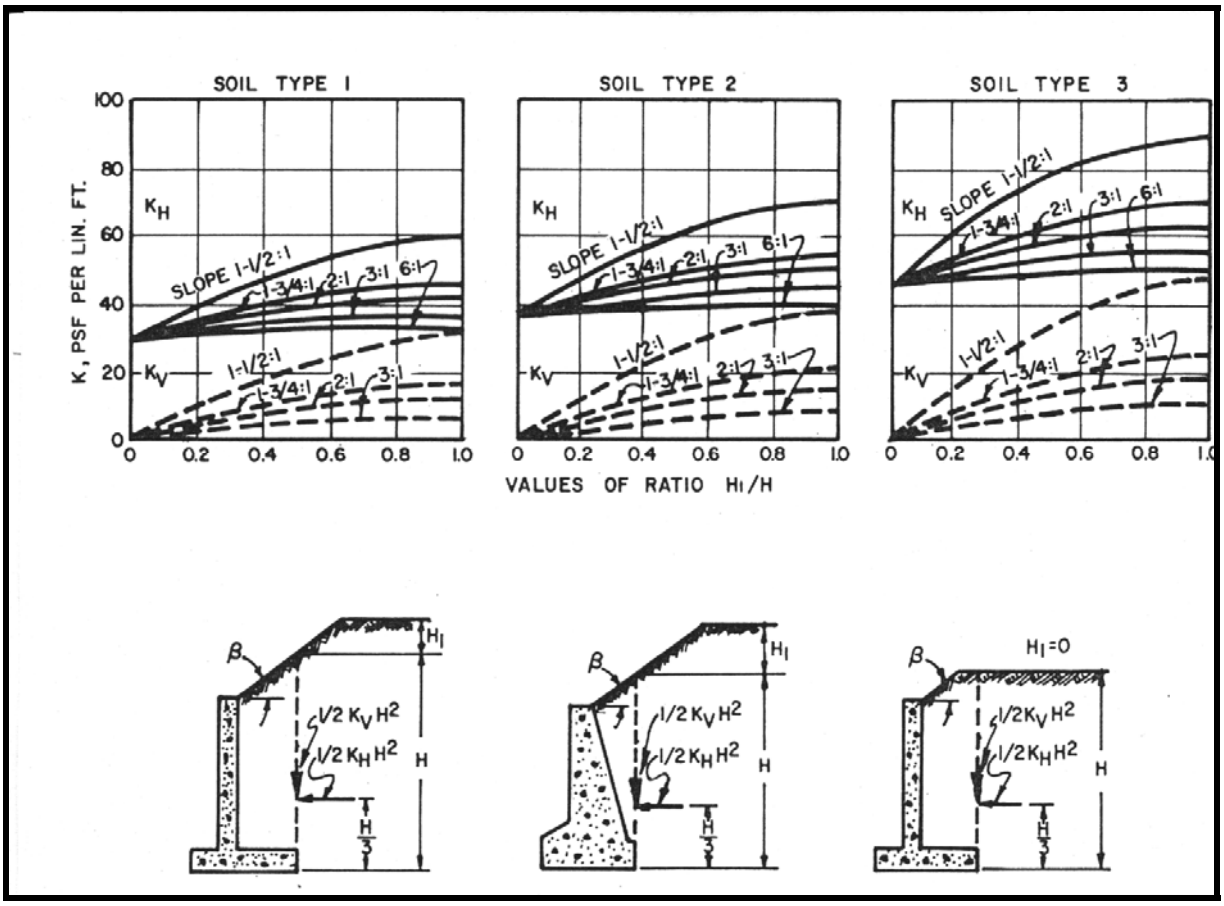
** Earth pressure coefficients valid for level backfill conditions with no surcharge

The values presented above were calculated based on positive foundation drainage being provided to prevent the buildup of hydrostatic pressure. If surface loads are placed near the walls, such as traffic loads, they should be designed to resist an additional uniform lateral load of one-half of the vertical surface loads. An "equivalent fluid" pressure can be obtained from the above chart by multiplying the appropriate K-factor times the total unit weight of the soil. This applies to

unsaturated conditions only. If a saturated "equivalent fluid" pressure is needed, the effective unit weight (total unit weight minus unit weight of water) should be multiplied times the appropriate K-factor and the unit weight of water added to that resultant. However, PSI does not recommend that earth retaining walls be designed with a hydrostatic load and that drainage should be provided to relieve the pressure.

In specific design cases where water is allowed to build up on the below-grade wall structure, the hydrostatic load correlating to the maximum height of the water build up should be added to the lateral loads acting on the wall.

The designs of below grade walls need to take into account the effects of geometry and loading conditions. The following charts have been included from NAVFAC 7.02 concerning slopes in the grade at the top of below grade wall. Depending on the geometry of the site, the lateral loading on the below grade wall should be modified according to these charts.



Soil Type 1 – Clean Sand and Gravel, GW, GP, SW, SP
Soil Type 2 – Dirty Sand and Gravel of Restricted Permeability, GM, GM-GP, SM-SP, SM
Soil Type 3 – Stiff Residual Silts and Clays, Silty Fine Sands, Clayey Sands and Gravels: CL, ML, CH, MH, SM, SC, GC

REPORT LIMITATIONS

The contents of this exploration submitted are based on the available subsurface information obtained by PSI and design details furnished by Jackson County Public Works and their consultants. If there are revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified.

The geotechnical engineer warrants that the findings or professional advice contained herein have been made in accordance with generally accepted professional geotechnical exploration practices in the local area. No other warranties are implied or expressed.

This soils letter report has been prepared for the exclusive use of Jackson County Public Works and their consultants for the specific application to the proposed elevator pit within the Historical Court House located at 112 Wes Maple Street in Independence, MO.

If you should have any questions or concerns pertaining to this addendum, please contact us at 913-310-1600.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

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SDB/KER