MEMO

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TO:	Eric Galley, P.E., Olsson Associates
FROM:	Tim Jensen, P.E., Olsson Associates Edward Schnackenberg P.E., Olsson Associates
RE:	City Centre Lot 14 Geotechnical Design Memo
DATE:	1/19/2017
PROJECT #:	016-0546

BUILDING PAD LOCATION AND PROJECT DESCRIPTION

This memo provides additional design recommendations specific to the proposed building located on Lot 14 within the City Centre development in La Vista, Nebraska. Olsson understands the proposed building is a five-story structure that consists of residential space over a lower level retail space. The lower level retail portion is planned to be constructed from concrete and steel, while the upper four floors will utilize wood framing. The building has an open air courtyard with a swimming pool and patio space located within the building. The depth of the pool is unknown at this time.

The structural building loads provided by Mr. Troy Nissen of TD2 indicated a maximum column load of 400 kips and a maximum wall load of 12k/ft. Finish floor elevations for this structure are anticipated to range from 1,124 feet in the west half and step down to 1,122 feet in the east half of the building. The northeast corner is anticipated to have an exposed foundation wall retaining up to about 2 to 3 feet of soil. The existing grades across Lot 14 range from about 1,097 feet near the northeast corner to 1,126 feet near the southwest corner. Up to 2 feet of new cut and 25 feet of new fill are anticipated across Lot 14.

This memo was prepared under the direct supervision of a Professional Engineer registered in the State of Nebraska with the firm of Olsson Associates (Olsson). The conclusions and recommendations contained herein are based on generally accepted, professional, geotechnical engineering practices at the time of this report, within this geographic area. The recommendations provided in this geotechnical design memo should be used in conjunction with the

recommendations provided in Olsson Associate's Report of Geotechnical Exploration titled La Vista City Centre Project and dated September 9th 2016.

ADDITIONAL SITE PREPARATION

Given the variable amount of earthwork planned across Lot 14, it is recommended a preload be implemented to allow time for the onsite compressible soils to consolidate from the loading of the new structural fill materials. All structural fill placed on and around Lot 14 should be placed and allowed to settle in accordance with *Section D.1.c* of the original geotechnical report prepared by Olsson. Overall settlement of around 8 inches was predicted in this area as a result of the new fill placement. The preload is recommended to be completed below and within 25 feet of the new building per the geotechnical report. This is primarily applicable to permanent structural fill placement. Where the new building will have exposed foundation walls, it is recommended that the preload extend beyond the building pad at least 10 feet at the upper FFE before transitioning back to existing site grades at a 1H:1V. It is recommended the building pad be overbuilt by 1 to 2 feet with structural fill to account for any settlement that occurs during the preload period. When the settlement monitoring program is complete, the excess structural fill can be removed to design FFE exposing what should be a construction ready surface.

SHALLOW FOUNDATION DESIGN CONSIDERATIONS

To provide uniform support for the new building and reduce total and differential building settlement to within tolerable limits, it is recommended that the new shallow spread foundations be supported by a minimum 3-foot thickness of structural fill. The structural fill should extend at least 1.5 feet beyond each side of the spread foundations before transitioning back to existing site grades at a minimum slope of 1H:1V. To allow for larger, more efficient equipment to be utilized during the overexcavation operations, the contractor could consider overexcavating the entire building pad to a uniform depth of 3 feet below the deepest foundation elevation. This approach allows larger areas to be overexcavated and reworked which typically provides a more uniform end product. Regardless of the overexcavation approach utilized, it is recommended the overexcavation extend at least 5 feet outside the edges of perimeter foundations (or 10 feet beyond the building footprint) before transitioning back to existing site grades at a 1H:1V slope. This additional overexcavation around the building (perimeter and interior courtyard areas) will provide a densified, less permeable, soil zone around building foundations that will be less susceptible to future moisture infiltration. All new structural fill should be field tested by a representative of Olsson's geotechnical engineers for compaction and moisture content at the time of placement. After the overexcavation has been completed and new structural fill has been

placed and compacted back to design grades, the new shallow spread foundation can be designed using a net allowable soil bearing pressure of 3,000 psf. To expedite construction, the overexcavation and structural fill placement below and around building foundations should be completed before the site is preloaded as recommended in this memo and the original geotechnical report.

SHALLOW FOUNDATION DESIGN – OPTION 1

If the recommendations provided in the original geotechnical report and this memo are followed, this site will be suitable for supporting the new building foundations in Lot 14 on conventional shallow spread foundations bearing on a minimum 3 feet of compacted structural fill. Foundations supported by the recommended thickness and lateral extent of structural fill may be designed utilizing a net allowable soil bearing pressure of up to 3,000 pounds per square foot (psf). Refer to the *Shallow Foundation Design Considerations* section of this memo for more information. The use of the recommended design bearing pressure is contingent on having the foundation subgrades observed by an Olsson geotechnical engineer or his authorized field representative at the time of overexcavation and prior to placing new structural fill, reinforcing steel, or concrete to document that the subgrade soils are consistent with those encountered during this exploration.

After the bearing surfaces for new foundations have been observed and documented by an Olsson representative, concrete should be placed as soon as possible to avoid subjecting the exposed soils to drying, wetting, or freezing conditions. If foundation bearing soils are subjected to such conditions, the geotechnical engineer should be contacted to reevaluate foundation bearing materials.

Footings should have minimum dimensions in accordance with local building codes. Olsson recommends minimum dimensions of 16 inches for continuous footings and 30 inches for isolated column footings to minimize the potential for localized bearing failure. Footings in unheated areas are recommended to bear at a minimum depth of 42 inches below the lowest adjacent final ground surface. It is recommended that interior footings in heated areas bear at a depth as shallow as possible below the lowest adjacent final ground surface.

If the recommendations in this report are followed, total post-construction settlement for the Lot 14 structure is anticipated to be less than 1-inch with differential settlement limited to less than ½-inch between adjacent columns. To reduce the effects of differential settlement, floating floor slabs with expansion joints, independent from wall and column loads, will be important in minimizing the potential cracking that can occur along and around the foundation systems. Floor slab control

joints should be considered to reduce potential damage due to shrinkage cracks.

INTERMEDIATE FOUNDATION DESIGN – OPTION 2

The building on Lot 14 may also be supported by an intermediate foundation system to increase the allowable soil bearing capacity and reduce overall building settlement. The design of specific stone column systems is proprietary and is typically completed by the installing or specialty contractor. The intermediate foundation contractor should design the stone column diameter spacing, depths, and aggregate properties of the foundation system. The stone column foundations should be designed to limit total settlement to 1-inch and differential settlement to ½-inch. The applicable net allowable soil bearing pressure for shallow spread foundations will be determined by the specialty contractor after review of the building loads and FFE's. Based on local experience with similar projects, allowable soil bearing pressures ranging from 3,500 to 5,000 psf can typically be achieved for shallow foundations supported by a stone column system. Contact information is provided below for stone column installers/designers familiar with the soils in the Omaha area and the specific details regarding this project site.

Company	Contact	Phone Number	Email Address
Subsurface Constructors	Lyle Simonton	(314) 421-2460	lsimonton@subsurfaceconstructors.com
Ground Improvement Engineering	Deanna Baker	(402) 651-1673	dbaker@groundimprovementeng.com

The intermediate foundation system should include the total costs associated with design, mobilization, installation, demobilization, and removal or disposal of spoils, as necessary. To establish a final cost estimate for the stone column design, the installer will typically require the final site and grading plans, the original geotechnical report, this design memo, and the applicable foundation plans.

Footings should have minimum dimensions in accordance with local building codes. Olsson recommends minimum dimensions of 16 inches for continuous footings and 30 inches for isolated column footings to minimize the potential for localized bearing failure. Footings in unheated areas should bear at a minimum depth of 42 inches below the lowest adjacent final ground surface. Interior footings in heated areas can bear at a depth as shallow as required below floor slabs.

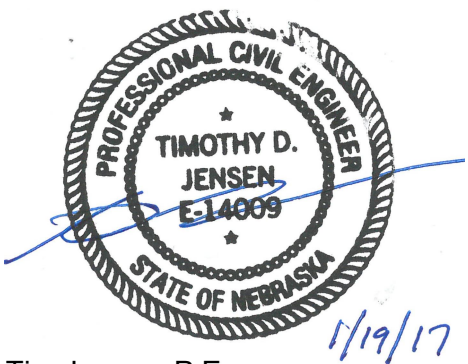
SEISMIC CLASSIFICATION – SOIL PROFILE

According to the International Building Code (IBC), soils within the upper 100 feet determine the seismic structural design criteria for the project site. Based on the soils encountered in the test borings and our experience with the local geology, Olsson estimated the soil properties below the deepest boring to a depth of 100 feet. The soil shear strengths and N values were estimated based on the results of the laboratory testing program and the assumed soil properties on undocumented soils below the lowest boring. For this project site, we recommend the use of Site Class D (Stiff Soil) in accordance with Table 20.3-1 Site Classifications in ASCE 7-10 as referenced within the 2012 IBC.

LIMITATIONS

The conclusions and recommendations presented in this memo are based on the information available regarding the proposed construction, the results obtained from our soil test borings and sampling procedures, the results of the laboratory testing program, and our experience with similar projects. The soil test borings represent a very small statistical sampling of subsurface soils, and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the soil test borings. In these instances, adjustments to design and construction may be necessary. This memo is based on the information provided to Olsson Associates and our understanding of the project as noted in this report. Olsson's Geotechnical engineer may alter the recommendations of this memo at any time depending on the actual field conditions encountered during earthwork or construction.

Respectfully Submitted,



Tim Jensen, P.E.
Geotechnical Engineer

Reviewed By,

Edward Schnackenberg, P.E.
Geotechnical Engineer

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