GEOTECHNICAL ENGINEERING REPORT

PROPOSED NOMAR OUTDOOR MARKET
21ST STREET NORTH AND MARKET
WICHITA, KANSAS

Terracon Project No. 01095120
July 31, 2009

Prepared for:

LAW KINGDON, INC
WICHITA, KANSAS

Prepared by:

Terracon
Wichita, Kansas

Terracon

July 31, 2009

Law-Kingdon, Inc
345 Riverview, Suite 200
Wichita, KS 67203

Attention: Mr. Jeff Best, ASLA

Telephone: 316-268-0230, Ext. 297
Email: jbest@law-kingdon.com

Reference: Geotechnical Engineering Report
Proposed Nomar Outdoor Market
21st Street North and Market
Wichita, Kansas
Terracon Project No. 01095120

Dear Mr. Best:

Terracon has completed a subsurface exploration for the proposed Nomar Outdoor Market to be constructed at the 21st Street North and Market in Wichita, Kansas. This study was performed in general accordance with our proposal number G0108293 (Revised) dated June 30, 2009.

We have enclosed the results of our engineering study, including the boring location diagram, laboratory test results, boring logs, and geotechnical recommendations needed to aid in the design and construction of foundations, floor slabs, pavements, and other earth-connected phases of this project.

We appreciate the opportunity to be of service to you on this project, and we are prepared to provide the recommended construction observation and testing services. If you have any questions regarding this report, or if we may be of further service to you in other ways, please let us know.

Sincerely,

Terracon Consultants, Inc.

KENT J. SCHWIEGER LICENSED 6606 7/31/09 KANSAS PROFESSIONAL ENGINEER

Kent J. Schwieger, P.E.
Kansas No. 6606

Michael G. Ehss, P.E.
Kansas No. 14381

TABLE OF CONTENTS

Page

GEOTECHNICAL ENGINEERING REPORT

PROPOSED NOMAR OUTDOOR MARKET
21ST STREET NORTH AND MARKET
WICHITA, KANSAS

Terracon Project No. 01095120
July 31, 2009

1.0 INTRODUCTION

Terracon has completed a program of subsurface exploration and geotechnical engineering analyses for the proposed Nomar Outdoor Market you plan to build at 21st Street North and Market in Wichita, Kansas. We performed the six borings at the site that you authorized to obtain information on subsurface conditions. The results of these borings and a diagram showing their approximate locations are included with this report.

In this report, we describe the subsurface conditions encountered in the borings, present the laboratory data obtained, and provide geotechnical recommendations for the design and construction of foundations. We are also presenting recommendations related to subgrade preparation for the support of slabs-on-grade, pavement subgrade preparation, and typical pavement thickness values.

We based the recommendations contained in this report upon the results of field and laboratory testing, engineering analyses, experience with similar soil conditions, structures and our understanding of the proposed project.

2.0 PROJECT DESCRIPTION

The proposed project will involve the construction of single-story (possibly with a mezzanine), slab-on-grade (non-basement) building with a 40-foot high tower element. The building will have nominal footprint of about 1,000 ft^2. Building loads were not provided to us, but we anticipate maximum column loads of less than 75 kips, continuous wall loads of less than 3 kips per lineal foot, and light floor loads. Fountains and statuary may also be included in the proposed construction. Pavements are planned for the plaza area and access drives.

3.0 SITE EXPLORATION

3.1 Field Exploration

Terracon's drill crew used a calibrated measuring wheel and a hand-held GPS unit to establish the boring locations in the field. We estimated the right angles for the boring location measurements. We obtained the approximate ground surface elevations indicated on the boring logs by differential leveling techniques using a tripod-mounted level and rod. We referenced the ground surface elevations shown on the boring logs to the top of the fire hydrant at the southwest corner of 21st Street North and Market. We assigned this reference point an arbitrary elevation of 100.0 feet. We rounded the elevations on the boring logs to the nearest one-half foot. Consider the approximate locations and ground surface elevations of the borings accurate only to the degree implied by the methods used to make these measurements.

We conducted our drilling activities on July 23, 2009. We drilled the borings with a truck-mounted drill rig using continuous flight augers to advance the boreholes. We obtained representative samples primarily by the split-barrel sampling procedure. In the split-barrel sampling procedure, a standard, 2-inch O.D., split-barrel sampling spoon is driven into the boring with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of an 18-inch sampling interval is recorded as the standard penetration resistance value, N. We used an automatic SPT hammer to advance the split-barrel. The automatic hammer achieves a significantly greater efficiency compared with the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the standard penetration resistance blow count (N) values. We considered the effect of the automatic hammer's efficiency in our interpretation and analysis.

We also obtained thin-walled tube samples. In the thin-walled tube sampling procedure, a seamless steel tube with a sharpened cutting edge is pushed hydraulically into the boring to obtain a relatively undisturbed sample of cohesive soil. We reported the sampling depths, penetration distances, and the standard penetration resistance values on the boring logs. We sealed the samples in the field and returned them to the laboratory for testing and classification.

The drill crew prepared field boring logs as part of the drilling operations. These boring logs include visual classifications of the materials encountered during drilling and the driller's interpretation of the subsurface conditions between samples. The final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in the laboratory.

3.2 Laboratory Testing

We tested the samples to determine their moisture contents. We estimated their unconfined compressive strength with a hand penetrometer. The hand penetrometer test values can be correlated with the unconfined compressive strengths of cohesive samples and provide a better estimate of soil consistency than visual and tactual examination alone. Also, we tested the thin-walled tube samples to determine their dry density. We performed Atterberg limits tests on representative portions of the near-surface soils to aid in classification and to evaluate the near-surface soils' shrink/swell characteristics.

An engineer examined the soil samples in the laboratory as part of the testing program. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the attached General Notes and the Unified Soil Classification System, respectively. The estimated group symbols using the Unified Soil Classification System are shown in the appropriate column on the boring logs. We have included a brief description of the Unified System in Appendix C.

4.0 SITE CONDITIONS

The Nomar Outdoor Market site is located northwest of 21st Street North and Market in the north-central portion of Wichita. The site is relatively flat, although soil/material stockpiles are on the surface from recent demolition of retail/commercial buildings razed to allow for the proposed construction. The site is presently void of trees and buildings, although some pavements and/or remnants occur in portions of the site. Subsurface conditions encountered at the boring locations are described below.

5.0 SUBSURFACE CONDITIONS

5.1 Geology

The site is situated within the Arkansas River flood-plain. The native site soils encountered in our borings were alluvial clays and sands. The alluvial/colluvial soils mantle Permian shale bedrock that was not encountered within our shallow boring depths. We have described the soil conditions encountered in our borings in more detail below.

5.2 Soil Conditions

At our boring locations B-1 and B-2 in the proposed building area, we found asphalt pavement about 4 inches thick. We logged existing fill comprised of lean clay to depths of about 1.5 to 3 feet in the remaining borings. Below the asphalt pavement and existing fill we encountered medium stiff or stiff, lean clay or sandy lean clay to depths of about 3 to 7 feet where we found loose or medium dense fine sand that continued to the bottom of our 10 to 15-foot deep borings. Exceptions were borings B-5 and B-6, where we logged stiff or very stiff lean clay, sandy lean clay, or fat or lean to fat clay to the bottom of these 10-foot deep borings.

We have indicated the subsurface conditions encountered at each boring location on the boring logs. The stratification boundaries shown on the borings logs represent the approximate locations of changes in soil type; in situ, the transition between material types may be gradual.

5.3 Field and Laboratory Test Results

Our field standard penetration test results (N-values) in the fill soils were generally about 2 to 4. The N-values in the underlying native lean and lean to fat clays were generally within the range of 5 to 17. The N-values, unconfined compressive strengths/estimates (by calibrated hand penetrometer) typically indicating 2,000 psf to 7,000 psf for the native clay soils generally correlate with medium stiff or stiff consistencies. The N-values in the underlying fine sand were generally within the range of 6 to 12 indicating loose or medium dense relative density.

The moisture test results of the samples of the clay subgrade soils were generally within the range of 6% to 27%, indicating the clay soils were in a relatively wide range from dry to moist condition at the time of our drilling operations. The test results of the thin-walled tube samples (Sample 1 from borings B-1 and B-2) indicate dry density values of 109 pcf to 108 pcf, respectively.

The Atterberg limits test results determined for portions of samples of the subgrade soils from borings B-3 and B-5 indicated liquid limits of 32 and 70 and plasticity indices of 17 and 46, respectively. These test results indicate these subgrade soils are lean and fat clays with moderate or high shrink-swell characteristics. Clays with high density, moderate to high plasticity, and low moisture content have a high potential for post-construction floor slab heave.

We show the results of our laboratory tests in Appendix B and/or on the boring logs adjacent to their respective sample locations.

5.4 Groundwater Conditions

We monitored the borings for water while sampling and upon completion of drilling operations. Water was encountered upon completion of drilling operations only in borings B-3 and B-5, at depths of about 13 feet and 10 feet, respectively,. Based on this information and the subsurface conditions encountered at the boring locations, in our opinion the groundwater table was located at depths as shallow as 10 feet at some of our boring locations at the time of our subsurface exploration. We based this conclusion, in part, on short-term observations. Fluctuations in groundwater levels can occur (as much as a few feet) due to seasonal variations in the amount of rainfall, runoff, altered natural drainage paths, and other factors not evident at the time the borings were drilled. It also is possible that groundwater could temporarily perch seasonally at shallow depth. To obtain more accurate groundwater level information, longer-term observations in deeper wells or piezometers that are sealed from the influence of surface water would be needed.

6.0 ENGINEERING RECOMMENDATIONS

6.1 Geotechnical Considerations

You did not provide us with a grading plan but we anticipate that you may need up to 2 feet of fill from present grade to develop final subgrade elevation for the proposed market building. We analyzed the foundation support conditions based on the data obtained from the field and laboratory testing programs. In our opinion, it is feasible to support the proposed Nomar Outdoor Market building on footing foundations bearing on the stiff native clay, loose to medium dense sand, and/or new engineered fill. We present below our geotechnical recommendations related to foundations, building pad and pavement subgrade preparation, and other geotechnical aspects of the project.

This site contains existing fill materials. The depth and composition of the existing fill materials can vary greatly over relatively small lateral and vertical distances. Because of this variability, it may not be possible (until site grading is underway) to accurately predict the amount of fill that will need to be removed and replaced to develop suitable support for the proposed improvements. Because it is unlikely that the depth and composition of the fill observed at the discrete boring locations represents subsurface conditions across the site, caution should be exercised when applying this information for estimating purposes. The fill observed in our borings generally appears suitable for re-use as new controlled fill, provided it is properly moisture conditioned and compacted. However, the fill could contain unobserved materials (such as organic matter/debris) that would render it unsuitable for re-use as new controlled fill. We encourage the owner to secure a base bid for removing and replacing a specified quantity of the existing fill. The owner should also secure unit rates for adding or deducting quantities from the base bid that include costs for exporting unsuitable materials and importing approved replacement materials, if required.

6.2 Earthwork

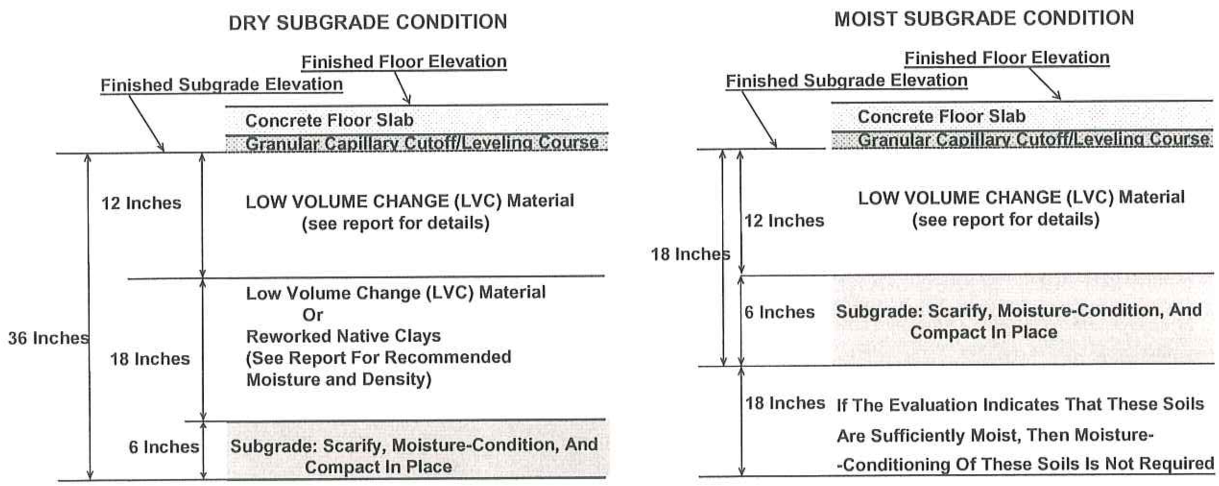
Site Preparation: We recommend all vegetation, organic topsoil, and any existing fill, foundation remnants, and pavements be removed from within at least 5 feet beyond the proposed building location and areas to be paved. After completing these operations, we recommend the exposed subgrade be proofrolled (under the observation of Terracon personnel) with a loaded tandem-axle dump truck or other heavy, rubber-tired construction equipment weighing at least 20 tons, to locate any zones that are soft or unstable. The subgrade in the building area where excessive rutting or pumping occurs during proofrolling should be removed and replaced or aerated/reworked/moisture adjusted and recompacted in place to our recommendations for engineered fill (see below for details) prior to placement of areal fill.

Building Pad Subgrade Preparation: A factor affecting floor slab performance is the potential for the subgrade soils to swell due to variations in moisture content. Typically, some increase in the floor slab subgrade moisture content will occur as a result of gradual accumulation of capillary moisture, which would otherwise evaporate if the floor slab had not been constructed. A soil's swell potential is dependent primarily on its plasticity, and moisture content. The confining pressure provided by the weight of the floor slab and the overburden pressure (including the fill required to develop design grade) also effect swell potential. Subgrade soils with higher plasticity, lower moisture content ,and confining pressure generally have greater swell potential.

The clay subgrade soils encountered in our borings have moderate or high plasticity. The moisture contents of these clay soils were relatively dry to moist at the time of our subsurface exploration. Based on the field/laboratory test data and site conditions, it is our opinion that the native clays have a moderate potential to heave floor slabs supported on grade at the moisture contents that occurred at the time of our field exploration operations. To reduce the swell potential to a relatively small amount, less than about 1 inch, we recommend that at least the upper 12 inches of subgrade soils below the floor slab be low volume change (LVC) material (see "Low Volume Change Zone" section for details).

Because we expect that the near-surface moderate and high plasticity soils could have greater swell potential if they become relatively dry at the start of construction, constructing a 12-inch thick LVC zone may not be adequate to limit floor slab heave to a small amount. Thus, some removal and reworking/replacement of the subgrade soils below the LVC may be needed. We recommend that the material within 24 inches of the bottom of the LVC zone be evaluated just prior to placement of any additional fill (see Building Subgrade Preparation Diagram below). Where the existing subgrade soils within this depth range at the start of construction are drier than the minimum moisture requirements stated below for additional fill (typically a minimum of 2 percentage points wet of their optimum moisture content, as determined by ASTM D-698), we recommend corrective procedures be implemented. These procedures would include over-excavating the dried soils and either uniformly increasing their moisture content to the minimum moisture contents stated below for additional fill (typically at least 2 percentage points wet of the optimum moisture content for the on-site clays) and reworking/recompacting the soil in lifts, or replacing them with LVC material. If LVC material is used to replace the dried soils, it should be placed at the moisture content values described in the following section of the report. The reworked on-site materials and LVC material should be placed in lifts not exceeding 9 inches in loose thickness and compacted at the moisture content recommendation below for additional fill to at least 95% but not more than 100% of the materials maximum dry density, as determined by ASTM D-698.

BUILDING SUBGRADE PREPARATION DIAGRAM (NOT TO SCALE)



Prior to placing additional area fill where moisture conditioning (as described above) is not needed, we recommend the upper 6 inches of exposed subgrade be scarified and recompacted to at least 95% of the materials maximum dry density at a moisture content at least 2 percentage points wet of its optimum moisture content.

Any additional fill required to develop design grade below the LVC zone should be approved materials that are free of organic matter, deleterious materials, and contaminants. The fill should be placed in lifts not exceeding 9 inches in loose thickness and compacted to at least 95%, but not more than 100%, of the materials maximum dry density, as determined by ASTM D-698. The zone of fill compacted to meet this criteria should extend at least 5 feet horizontally beyond the building footprint. The minimum moisture content at which the fill below the LVC zone should be placed will depend on the plasticity of the fill material as follows:

- Cohesive soils with a plasticity index (PI) greater than 30 should not be placed within the upper 3 feet of the final subgrade
- Cohesive soils with a plasticity index (PI) greater than 20 should be placed at a moisture content of at least 2 percentage points above their optimum moisture content (ASTM D-698)
- Cohesive soils with a PI less than 20 should be placed at a moisture content above their optimum moisture content
- Granular soils should be placed at workable moisture content

Low Volume Change Zone: As stated previously, we recommend the upper 12 inches of material directly below the floor slabs (excluding any granular leveling course or capillary moisture break) be LVC material. This is primarily to help protect the newly placed fill from moisture fluctuations during construction and provide a layer of soil that will not experience significant volume change as the moisture content fluctuates.

By our definition, LVC materials have a liquid limit (LL) less than 40 and a plasticity index (PI) of at least 5, but less than 15. LVC materials that meet this requirement may include granular soils (such as limestone/concrete screenings or clayey sand) or possibly silty, sandy or lean clays, although laboratory testing of prospective LVC materials proposed for use by the contractor should be conducted to confirm their suitability prior to bidding/construction. Cohesive LVC soils may need extensive "wetting maintenance" by the contractor to maintain the required above optimum moisture content in the cohesive LVC material until construction of the floors. Based on the soils encountered in the borings, the near-surface clays would not meet the criteria for LVC material.

A low volume change soil can be developed with the on-site clay soils by modifying them with hydrated lime or Class C fly ash. Subgrade modification with hydrated lime or Class C fly ash would also be expected to provide a more stable working surface under construction traffic and following inclement weather during construction. It has been our experience that lime contents of 4% to 6% and fly ash contents of 14% to 16%, based on dry weight of the soil, would be required to appreciably reduce the shrink/swell characteristics of the soils not meeting the previously-described plasticity requirements for low volume change materials. A more precise application rate could be developed based on additional laboratory testing. If hydrated lime is used to modify the subgrade soils, it would be necessary to allow at least 48 hours for the lime reactions to proceed prior to final compaction of the modified zone. The hydrated lime could be in slurry form to reduce the adverse affects of dusting during mixing. Recognized guidelines, such as those specified by the City of Wichita or KDOT, should be followed in the mixing and/or blending of lime-or fly ash-modified material, including minimum temperature restrictions at the time of mixing. If fly ash soils are disturbed or become wetted excessively after the initial set has occurred, it may be necessary for additional amounts (8% to 10%) of fly ash to be mixed into the disturbed subgrade, and then moistened and recompacted. The modified zone should extend at least 3 feet beyond the edges of the proposed building. Soils mixed with Class C fly ash should be compacted within 2 hours following blending operations.

The LVC soils should be placed in lifts not exceeding 9 inches in loose thickness and compacted to at least 95%, but not more than 100%, of its maximum dry density. Cohesive soils should be placed and maintained at moisture contents above their optimum moisture content. Granular soils should be placed at workable moisture content. If lime- or fly ash-modified soils are used, they should be placed and maintained at moisture contents above their optimum moisture content.

Cohesive, LVC materials, including lime- or fly ash-treated material, can be swell susceptible if allowed to dry before constructing the floor slab; therefore, it is important that the recommended moisture content of the cohesive LVC material be maintained. As a check, we recommend the subgrade moisture content be evaluated about 3 to 4 days before placing concrete. If drying of the subgrade materials has occurred at this time, measures should be taken to increase the moisture content of the subgrade soils before placing the sand leveling course or concrete, which may also include recompaction. If the subgrade was previously modified with fly ash and recompaction is required, additional fly ash would likely be needed.

We recommend constructing the upper 4 to 6 inches of the LVC zone using crushed limestone silty gravel similar to KDOT AB-3-Type material, crushed limestone/concrete screenings, or asphalt millings to reduce the above stated swell potential associated with cohesive LVC materials or hydrated lime/fly ash modified on-site soils that are allowed to dry excessively. This granular zone would reduce the moisture fluctuations in the bottom portion of the LVC zone and also provide a more stable working surface during construction following inclement weather.

General Drainage Recommendations: All grades must provide effective drainage away from the building during and after construction. Water permitted to pond next to the building can result in greater soil movements than those discussed in this report. These greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. Estimated movements described in this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained.

Exposed ground should be sloped and maintained at a minimum 10 percent (5 percent where pavement will abut the building) away from the building for at least 10 feet beyond the perimeter of the building. After building construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, we recommend a maintenance program to effectively seal and maintain joints to prevent surface water infiltration.

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building. We recommend constructing an effective clay "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soil's optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

6.3 Foundations

We recommend locating the base of all perimeter footings at least 3 feet below final outside grade to provide protection from frost heave and to reduce the magnitude of shrinking and swelling of the bearing materials that could occur due to seasonal variations in subgrade moisture content. Those footings where new pavements will abut the building could be located at a depth of at least 2.5 feet to provide minimum confining pressure and protection from frost.