STRATUM ENGINEERING, LLC
Geotechnical Engineering ◆ Testing and Inspection Services

April 6, 2016

Dammon Engineering, Inc.
554 Old Spanish Trail
Slidell, Louisiana 70458

Attn: Mr. Chuck Dammon

Re: Additional Geotechnical Recommendations
Proposed SSC Facility Improvements
Textron Marine & Land Systems
New Orleans, Louisiana
SE Project No. G16-010
Addendum No. 1

Dear Chuck:

Stratum Engineering (SE) is pleased to submit supplemental foundation recommendations for the proposed landing pads at the above referenced project site. SE conducted a geotechnical investigation for the project and our recommendations were provided in SE Report G16-010, dated March 18, 2016. The report provided deep foundation recommendations for a proposed new pre-engineered metal building and pavement recommendations for replacement of the existing asphaltic concrete tarmac. However, subsequent to the completion of the report, additional foundation recommendations were requested for the concrete landing pads located within the tarmac area.

We understand the facility currently has two (2) sets of 4 concrete landing pads which are used in the production of the new Ship to Shore Connector (SSC) vehicles. The fully constructed SSC vehicles weigh approximately 200 tons which is supported by 3 to 4 jacks contacting the landing pads through 26 inch square jack plates. The fully loaded vehicles could be supported by the landing pads for a period of up to one (1) year. Based on information provided to us by Dammon Engineering and Textron, we understand that the 6 foot thick reinforced concrete landing pads are about 16 feet long by 8 feet wide. Over the course of time, several of the landing pads have settled and are now unlevel. Consequently, SE was requested to evaluate a suitable foundation system for the replacement of four (4) of the existing concrete landing pads.

Based on the results of the previous exploration, both shallow and deep foundation systems were evaluated for the landing pads. Taking into consideration the anticipated structural loads and subsurface soil conditions, the landing pads could experience long term settlement on the order of 2 ½ to 3 inches. Provided this settlement can be tolerated, the pads may be supported on shallow foundations. Otherwise, a deep pile foundation system is recommended for support of the new landing pads.

Shallow Foundations

It is understood that the existing 16 foot by 8 foot landing pads are placed at a depth of approximately 6 feet below the existing tarmac surface. Based on the borings drilled in the general vicinity of the landing pads in the tarmac area, soft to firm fat clay was encountered below the surficial sand beginning around 6 feet and extending to a depth of approximately 35 feet. These soils at landing pads bottom elevation are estimated to have an allowable bearing pressure of about 1,200 psf which includes a factor of safety of 3.0.

Since wet conditions may be encountered at the bottom of the excavations, the landing pads should bear on a minimum of 24 inches of #57 limestone to distribute the load and minimize initial subsidence.

Groundwater was encountered at approximately 3 ½ feet at the time of the field exploration. Therefore, dewatering of the excavation areas will be necessary to allow proper installation of the landing pads. Based on the laboratory test results, a Coefficient of Permeability (k) for the sands encountered in the upper 6 feet of the borings were estimated to be on the order of 1×10^{-5}, while a k value of 1×10^{-8} to 1×10^{-9} cm/sec should be used for the fat clays encountered below 6 feet. Due to shallow groundwater encountered at the site, dewatering the area will likely be necessary to allow installation of the landing pads. Dewatering is anticipated to be accomplished using a sump/pump system or by well points and/or other means of forced withdrawal. Braced excavations will likely be necessary to maintain a safe access to the landing pad areas. The design of the dewatering system and bulkhead for the braced excavations should be the responsibility of the contractor who should maintain both systems, as necessary, throughout the installation.

The uplift resistance of footings formed in open excavations should be limited to the weight of the foundation concrete. For preliminary design purposes, the uplift resistance can be computed by using a total unit weight of 150 pcf for the concrete. The friction resistance of footings bearing in clay can be computed by multiplying the footing contact area by a friction factor of 0.38. The concrete reinforcing steel should be properly sized to resist uplift forces. We recommend that a factor of safety of at least 1.5 be used when determining the allowable uplift resistance of the landing pad foundations.

The foundation excavations should be observed by a representative of Stratum Engineering prior to placement of the landing pads to assess that the foundation materials are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the excavations should be removed to the level of firm, suitable bearing soils or adequately compacted fill as directed by the Geotechnical Engineer. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with compacted structural fill or crushed stone, as determined by the Geotechnical Engineer.

The foundation excavations should be observed and the pads installed as quickly as possible to avoid exposure of the excavation bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If it is required that the excavation be left open for more than one day, it should be protected to reduce changes in moisture content of the bearing soils.

Alternate Pile Foundation

Should the estimated settlements not be tolerated, the proposed landing pads should be supported on a deep foundation system. Consideration was given to small treated timber piles for support of the proposed pads. The piles should meet the requirements of ASTM D25 for size and the American Association of Wood Preserver Standard (AAWP) for quality and treatment.

The recommended pile lengths are from the existing ground surface. However, a pile cutoff of up to 5 feet should not have an impact on the recommended capacities. Taking into consideration the field and laboratory data, the estimated allowable single pile compression and tension capacities are presented in the following table:

Estimated Allowable Single Pile Load Capacity in Tons* F.S. = 2.0 in Compression F.S. = 3.0 in Tension		
Pile Length in feet	**Small Treated Timber Pile (6” Tip – 8” Butt)**	
	Compression	**Tension**
±40	8+	6

***Capacities are soil/pile related capacities and consideration should be given to the structural integrity of the pile member.**

The recommended capacity is a soil/pile related capacity and the final design capacity should be governed by the building code for the type of pile used. The above capacities include a factor of safety of 2 in compression and 3 in tension or uplift. Provided the piles are tipped in the sand, drag loads at this site should be insignificant.

Pile Settlement

It is estimated that long term settlement of piles loaded to their allowable capacities will be less than one (1) inch. Differential settlement is anticipated to be on the order of 50 percent of the total settlement.

Spacing and Group Effect

A group of piles subjected to vertical loads may not necessarily have the same capacity as the sum of the capacities of the individual foundation elements. For axially loaded piles, published results indicate that the ratio of capacity per pile in a group to that of a single isolated pile typically ranges from 0.5 to 1.0. This efficiency factor depends on the spacing or distance between each pile. Therefore, a minimum center-to-center spacing of 3D (where D is the pile diameter) is recommended to avoid the reduction in capacity and maximize the group efficiency.

Pile Installation

Pile driving hammers used to drive foundation piles should be selected according to pile type, length, size and weight of pile, as well as potential vibrations resulting from pile driving operations. Care should be taken to assure that the hammer selected is capable of achieving the desired penetration without causing damage to the piles or causing excessive vibrations which could damage existing, nearby structures.

Hammers having a rated energy in the range of 7,000 to 12,000 foot-pounds should be adequate for driving the small timber piles. Each pile should be driven to the desired tip elevation and the driving resistance should be monitored without interruption in the driving operations. Driving of the center piles in the cluster first will better facilitate driving operations. Accurate records of the final tip elevation and driving resistances should be obtained during the pile driving operations.

Since an intermediate sand layer was encountered in the upper 8 to 12 feet, pre-drilling at the site will likely be necessary to advance the piles to the required tip elevation without compromising the integrity of the piles. Pre-drilling should be performed with a “fish-tail” bit no larger than 75 percent of the pile diameter and should extend no deeper than 15 feet from the existing ground surface.

Pile Driving Monitoring

We recommend that the pile driving be monitored by the Geotechnical Engineer or his representative. Sometimes, premature refusal occurs due to poor performance of the hammer rather than from soil resistance. Any changes in hammer blow counts should be carefully examined before making any decisions about the pile penetration.

Pile Load Test

The pile capacity should be verified by a field load test. It is recommended that at least one (1) pile be load tested in accordance with ASTM D1143 Standard Procedure. The pile load test should be performed under the guidance of the Geotechnical Engineer so that the data may be interpreted and the recommended pile capacity adjusted, if necessary, according to the load test results. The pile load test may be waved provided the compression and tension capacity’s factor of safety are increased to 3 and 4, respectively.

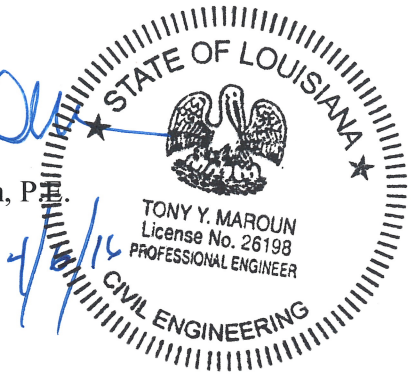
Report Limitations

These additional recommendations have been provided for the exclusive use of Dammon Engineering, Inc. for the specific application to the proposed SSC Facility Improvements to be completed for Textron Marine & Land Systems in New Orleans, Louisiana. Site preparation and other recommendations provided in the initial geotechnical report remain in effect. If you should have any questions, please do not hesitate to call.

Respectfully submitted,
STRATUM ENGINEERING, LLC

William "Dean" McInnis, P.E.
Project Manager

Tony Y. Maroun, P.E.
Principal



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