GEOTECHNIQUES
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June 14, 2024
Project No. 1003.049

Moorpark College
Department of Maintenance and Operations
7075 Campus Drive
Moorpark, California 93021
Attention: Mr. John Sinutko

Subject: Geotechnical Update, Presentation Area Bleachers and Animal Shelter at Moorpark College Zoo, 7075 Campus Road, Moorpark, California, Moorpark College, Moorpark, California

Dear Mr. Sinutko:

This geotechnical letter report summarizes site conditions and provides recommendations for the proposed bleachers and animal shelter at the Presentation Area of the Zoo at Moorpark College.

PROPOSED PROJECT

The Presentation Area bleachers, with an approximate footprint of 2,730 square feet, will be constructed in a relatively level area at the current bleacher site located approximately 100 feet west/northwest of the zoo entrance. The bleachers will incorporate a metal canopy. The proposed 3,000 square-foot animal shelter will have a concrete floor. Support for both the bleachers and the animal shelter is anticipated to consist of cast-in-drilled-hole pile foundations. Minor grading is planned in order to achieve ADA access gradients and positive surface drainage. CMU walls up to 8 feet in height also are planned around the improved Presentation Area.

SITE CONDITIONS

The Presentation Area site is underlain by native fine sandy silt with clay from the Saugus Formation (Ts), and as encountered during construction of the adjacent Tiger Habitat, alligator water habitat and Exotic Animal Training and Management (EATM) classrooms and facility improvements[1].

Past Grading

No previous site grading is known to have occurred other than minor surficial contouring to accommodate prior use in the Presentation Area.

Subsurface Conditions

Native earth materials encountered during previous exploration for and during construction of the nearby EATM classroom structure[2] and excavations observed for the adjacent alligator pit[3] and Tiger Habitat[4] typically consisted of fine sandy silt with clay derived from the Saugus Formation. Calcium

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[1] Arroyo Geotechnical (2006), "Report of Geotechnical Study, Exotic Animal Training and Management Facility, Moorpark College, California," Project No. 12149-4000, dated September 29, see boring logs.
[2] *Id.*, see boring logs in Appendix and Geotechniques' field dailies for shoring pile excavation observation between February 22 and 24, 2010.
[3] From Geotechniques' field observations during alligator pit excavation in January 2010.
[4] From Geotechniques' field observations during drilled foundation shaft observations in March/April 2022.
[5] Arroyo Geotechnical (2006), "Report of Geotechnical Study, Exotic Animal Training and Management Facility, Moorpark College, California," Project No. 12149-4000,p.14, Sec. 4.9, dated September 29

carbonate ("caliche") inclusions are common in the native earth materials which are known to be corrosive to underground steel[5].

Groundwater

Groundwater was not encountered to a maximum exploration depth of about elevation 700 feet, or about 46 feet below the ground surface at the western end of the adjacent EATM site[1]. Additionally, no groundwater or seeps were encountered in excavations extending to a depth of up to about 12 feet during construction of the adjacent Tiger Habitat[4] and alligator pit[3] nor in the 25- to 40-foot deep shoring piling excavations for the EATM site located immediately southeast of the Presentation Area site[2].

FAULT RUPTURE AND LIQUEFACTION HAZARD POTENTIAL

The Presentation Area is not located within the Alquist-Priolo Special Studies Zone nor lies within a Liquefaction Hazards Zone. Furthermore, the absence of groundwater to an elevation of about El. 700 feet precludes the potential for liquefaction-induced settlement or lateral movement.

SITE SUBGRADE PREPARATION AND FOUNDATION RECOMMENDATIONS

SITE SUBGRADE PREPARATION

Prior to excavation operations, vegetation including root mat, and all organics, deleterious material, and demolition debris should be stripped from the surface and wasted offsite.

Demolition of Existing Improvements

Removal and demolition of existing improvements should be performed in the presence of the geotechnical representative. **Depressions resulting from such removals should not be filled in or smoothed over until the exposed subgrade is observed by the geotechnical representative. Fill should be placed and compacted in accordance with recommendations presented subsequently** ("Fill Placement and Compaction").

Excavations and Cut Surfaces

Exposed surfaces from all cuts/excavation bottoms should be observed by the Geotechnical representative prior to scarification, compaction, or fill placement. Excavations adjacent to existing below-grade improvements should be wide enough to accommodate compacting equipment or alternatively be backfilled with a 1½-sack cement/sand slurry.

Footing Excavations

Shallow footings for site CMU walls, or similar, should be bottomed a minimum of 21 inches below lowest adjacent grade into undisturbed native sandy silt with clay. Footing excavations should be deepened, as needed, so to be bottomed into native, very firm undisturbed soil and to maintain a minimum horizontal setback of 5 feet to daylight on any descending slope face, where applicable. Footing bottoms should be compacted with a wacker (jumping jack).

Slab-on-Grade and Pavement Subgrade

Subgrade for on-grade and floor slab concrete, and asphalt concrete pavement should be scarified to a depth of 9 inches (below any aggregate base course, where applicable), moisture conditioned to between 0 and 3 percent over optimum moisture content, and compacted to a minimum of 95 percent of the maximum dry density determined by ASTM D1557, latest edition. Scarification

should be thorough enough to pulverize the soil into a pea-sized or finer consistency prior to applying compactive effort. Alternatively, the subgrade should be overexcavated, moisture-conditioned and processed, and re-placed and compacted as above.

Areas to Receive Fill

No fill, including slurry, should be placed unless the exposed subgrade is observed by the Geotechnical representative.

After clearing vegetation and root mat, areas to receive fill should be scarified to a depth of 9 inches so that the material is reduced to pea-sized or finer consistency, moisture conditioned and compacted to a minimum of 95 percent of the maximum dry density.

Fill Placement and Compaction

Onsite soils are anticipated to be used as general fill once cleared of organic material, demolition or other debris, and oversized rock. Fill materials placed immediately beneath floor slab or on-grade concrete should consist of a minimum of 6 inches of Class 2 aggregate base with no recycled asphalt concrete. Aggregate base should be compacted to a minimum of 95 percent of the maximum dry density determined from ASTM D1557.

Fill placement and earthwork operations should be performed according to the recommendations of this report. We recommend that, unless otherwise noted, all fill materials be compacted to at least 95 percent relative compaction, based on the maximum dry density determined from ASTM D1557.

Onsite soils used as fill and imported fill materials should be placed and compacted at a moisture content of between 0 and 3 percent over optimum moisture content. Each layer should be spread evenly in loose lifts no thicker than 8 inches and should be thoroughly blade-mixed during the spreading to provide relative uniformity of material within each layer. Fill and backfill materials may need to be placed in thinner lifts to achieve the recommended compaction with the equipment being used. Soft or yielding materials should be removed and be replaced with properly compacted fill material, prior to placing the next layer.

Rock, gravel and other oversized material greater than 4 inches in diameter, should be removed from the fill material being placed. Rock less than 4 inches in diameter should not be nested and voids caused by inclusion of rock in the fill should be filled with sand or other approved material. All roots larger than ½-inch diameter should be removed and discarded.

All fill materials, including scarified materials, should be thoroughly processed to pea-sized or finer consistency or finer prior to applying compactive effort. When the moisture content of the fill material is below that sufficient to achieve the recommended compaction, water should be added to the fill during processing. While water is being added, the soil should be bladed and mixed to provide relatively uniform moisture content throughout the material. When the moisture content of the fill material is excessive, the fill material should be aerated by blading or other methods

Fill Materials

The expansion index of imported materials used as general fill should be tested, as necessary during earthmoving operations, to verify that the expansion index of the material is less than 20.

Onsite Soils. Onsite soils are generally anticipated to consist of fine sandy silt with clay (ML) that meet the requirements for general fill.

General Fill. General fill may be used in foundation and on-grade concrete areas, and as backfill in utility trenches.

UTILITY TRENCHES

Prior to excavation of utility trenches, grass mat along trench alignment should be stripped and stockpiled and/or wasted offsite. Utility trenches should be braced or sloped in accordance with the requirements of (Cal) OSHA. Trenches should be excavated sufficiently wide to accommodate compacting equipment. Utility trench backfill should be governed by the provisions of this report relating to minimum compaction recommendations. Trench backfill should be moisture conditioned between 0 and 3 percent over optimum moisture content prior to placing in trench. Backfill should be compacted to a minimum of 90 percent relative compaction as determined from ASTM D1557, and to a minimum of 95 percent relative compaction under pavement and on-grade concrete.

Rock larger than 4 inches in maximum dimension should be excluded from trench backfill. Jetting of trench backfill materials should not be permitted.

Trench backfill materials should consist of bedding and pipe zone sand placed 4 inches below the pipe invert and to a height of 12 inches above the top of the pipe. Bedding and pipe zone sand should consist of fine to medium or coarse sand with a minimum sand equivalent (SE) of 30. General fill or pipe zone sand should be placed as backfill above the pipe zone in 8-inch loose lifts and compacted to the minimum relative compaction summarized above. Use of general backfill materials also should meet the preceding recommendations of this letter report, “Fill Placement and Compaction” and “Fill Materials.”

ASCE 7-16 / 2022 CALIFORNIA BUILDING CODE SEISMIC DESIGN PARAMETERS

Seismic design parameters for the Presentation Area were generated using site coordinates 34.3016˚ N, -118.8392˚ W, and in accordance with 2022 CBC and ASCE 7-16. The following parameters are recommended for design for Risk Category II and Site Class “D” soil profile:

Seismic Parameter[1]	Value	CBC Source	ASCE 7-10 Source
Mapped Spectral Response Acceleration			
S_S	1.993	Figure 1613.2.1 (1)	Figure 22-1
S_1	0.733g	Figure 1613.2.1 (2)	Figure 22-2
S_{MS}	1.993g	Equation 16-20	Equation 11.4-1
S_{M1}	1.246	Equation 16-21	Equation 11.4-2
Design Spectral Response Acceleration			
S_{DS}	1.329	Equation 16-22	Equation 11.4-3
S_{D1}	0.831	Equation 16-23	Equation 11.4-4
PGA/PGA_M	0.866 /0.952g		Figure 22-9

[1] SM1 , SD1 were calculated per Table 1613.2.3(2) in Section 16.4.4 of the 2022 CBC, using Fv = 1.7 and assuming that a site-specific ground motion hazards analysis is not required per ASCE 7-16 Supplement 3, Sec. 11.4.8.1 exception 1.: site-specific ground motion hazard analysis not required where the above values of SM1 and SD1 are increased by 50%.
Ref: https://hazards.atcouncil.org/

FOUNDATION DESIGN PARAMETERS AND RECOMMENDATIONS

Shallow Footings

The following recommendations are for shallow footing design for CMU walls and conventional shallow foundations.

Footing Depth. Shallow footings should be bottomed a minimum of 21 inches below lowest adjacent grade and should be deepened, as necessary, to bear entirely on undisturbed native soil and maintain a minimum 5 foot horizontal setback to daylight on any descending slope face.

Allowable Bearing Pressure. Shallow continuous or pad footings bearing on undisturbed native sandy silt may be designed for maximum allowable bearing pressure of 1,500 pounds per square foot (psf). The recommended allowable bearing pressure provides a factor of safety against shear failure in excess of 3. A one-third increase in the allowable bearing pressure may be used for transient loads such as seismic or wind forces.

Estimated Settlement. On the basis of the foregoing, we estimate that post-construction settlement from structural loads should be less than 1 inch. For design purposes, foundations should be designed to accommodate differential settlement of about ½ inch over a distance of 30 feet, or a distortion ratio of about 1/720.

Sliding and Passive Resistance

Ultimate sliding resistance generated through a sandy silt/concrete interface may be estimated by multiplying the total dead weight structural loads by a coefficient of 0.4. Ultimate passive resistance developed from lateral bearing of footings bearing against native sandy silt below a depth of 1 foot below the lowest adjacent grade may be estimated using an equivalent fluid weight of 350 pounds per cubic foot (pcf). Sliding and passive resistance may be combined without reduction, when used with the safety factors of 1.5 for overturning and 2.0 for sliding. The safety factor for sliding can be reduced to 1.5 if passive resistance is neglected. The factor of safety for transient conditions should be at least 1.1.

Pile Foundation Recommendations

Drilled cast-in-place concrete piles for the foundations for the bleachers, canopy, and animal shelter should be designed to derive all lateral support from undisturbed native soil encountered below grade. Drilled shafts should be observed by the geotechnical representative during excavation at each foundation location and to confirm design assumptions.

Passive and Frictional Resistance. An allowable passive resistance of 300 pounds per square foot per foot of depth (psf/ft) may be used when designing drilled pile foundations, with a maximum value limited to 3,000 psf. The upper 1 foot of embedment should be neglected for piles excavated in landscape areas, and the upper 2 feet should be neglected for piles on or immediately adjacent to slopes descending at 5h:1v or steeper (up to 3h:1v). A coefficient of friction of 0.4 may be combined with the passive resistance provided a one-third reduction in the total resistance is applied.

Allowable Bearing. An allowable bearing capacity of 3,500 psf is recommended for end-bearing on undisturbed native materials at a depth of at least 8 feet below existing grade. Shaft bottoms shall be clean of slough and disturbed soil.

Allowable Uplift Capacity. Allowable uplift capacity of drilled cast-in-place concrete piles should be taken as 300 psf from shaft resistance, plus the weight of the concrete pile. The upper 1 foot of embedment should be neglected in calculating uplift capacity for piles excavated in landscape areas, and the upper 2 feet should be neglected for piles on or immediately adjacent to slopes descending at 5h:1v or steeper (up to 3h:1v).

Drilled Shaft Construction Considerations. The bottom of the drilled shaft should consist of native sandy silt with clay that is not disturbed by the drilling auger. This should be achieved by using a bucket auger and/or clean-out bucket for excavating and cleaning the final 18 inches of native undisturbed materials from the shaft excavation bottom. Note that backspinning of flight auger is not an acceptable alternative to use of a bucket auger/clean-out bucket.

All loose slough and disturbed materials accumulated on the shaft bottom should be removed prior to setting column base or reinforcement cage and prior to concrete placement. Column base /reinforcement cage should be centered securely in shaft to maintain necessary clearances prior to concrete placement.

Caving sidewall conditions should be anticipated during drilling of shafts. Drilled shafts should be concreted the same day as excavation and **should not be left open overnight**. The drilling Contractor should have casing on hand during drilling to help mitigate sidewall caving of any sand layers. The outer diameter of the casing should be at least as large as the diameter of the drilled shaft so that the casing is in contact with the shaft sidewall. Casing should be withdrawn during concrete placement and should not be left in place. Drilled pile construction should be performed in accordance with the latest edition of ACI 336.1, "Standard Specifications for Construction of Drilled Piles."

Drilled pile excavation and construction should be observed by the Geotechnical representative during both drilling and concreting operations.

ASPHALT CONCRETE AND ON-GRADE CONCRETE SECTION THICKNESS

Subgrade for asphalt concrete and on-grade concrete to receive rare fire truck traffic should be prepared as recommended previously (see "**SITE SUBGRADE PREPARATION RECOMMENDATIONS**"). Subgrade and aggregate base courses shall be firm and unyielding and proof-rolled with a full water truck or equivalent in the presence of the Geotechnical representative prior to placement of the successive structural section course (i.e., aggregate base or asphalt concrete or concrete).

Surfaces shall be finished to uniform grades and slopes in accordance with contract documents and in such a manner to drain properly, convey runoff to existing and new drainage improvements, and be free from depressions that may cause areas of standing water or concentrates runoff on finished surface.

Asphalt Concrete Pavement. Asphalt concrete pavement to receive potential fire and delivery truck access and in non-vehicular areas, such as beneath bleachers shall, at a minimum, consist of the following:

Pavement Area	Asphalt Concrete Thickness (inches)	Aggregate Base Thickness (inches)
Fire truck access	3	6

Pavement Area	Asphalt Concrete Thickness (inches)	Aggregate Base Thickness (inches)
Non-vehicular areas	2½	4

Aggregate base should be compacted to a minimum of 95 percent of the maximum dry density. The base course should be firm and unyielding when proof-rolled with a full water truck in the presence of the Geotechnical representative prior to asphalt concrete laydown. Asphalt concrete should be compacted to a minimum of 95 percent of the maximum density.

ON-GRADE CONCRETE AND CONCRETE PAVEMENT

On-grade concrete section thickness for exclusively pedestrian use such as shade structures or sidewalks, should consist, at a minimum, of 4 inches of concrete over 4 inches of aggregate base compacted to a minimum of 95 percent of the maximum dry density.

Concrete Pavement Structural Sections. On-grade concrete to receive vehicular traffic, including pavement that may be used for fire truck access, should consist of a minimum of 6 inches of concrete over a minimum of 6 inches of aggregate base compacted to 95 percent of the maximum dry density. (Note that concrete to receive fork-lift traffic and routine truck traffic for deliveries or in trash dumpster areas should be at least 7 inches thick, depending on traffic index [TI].) Concrete should have a minimum 28-day compressive strength of 3,500 psi, a minimum Modulus of Rupture of 530 psi, and should be reinforced with No. 4 bars at 18 inches each way. Reinforcement should be supported at mid-slab at time of concrete pour. (Note that this structural section is not intended for exclusively pedestrian use.)

CLOSURE

The recommendations in this letter are specific to the scope of the proposed Presentation Bleachers and Animal Shelter. We appreciate the opportunity to be of service to Moorpark College. Please call if you have any questions concerning this letter.

Sincerely,

Geotechniques

Carole Wockner, P.E.
Principal Engineer
R.C. E. No. 74407, exp 09/30/25

Attachments: Referenced Report for EATM Classroom Building by Arroyo Geotechnical