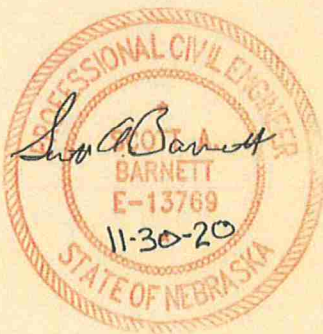


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REPORT OF GEOTECHNICAL INVESTIGATION

NORTH PLATTE RAIL PARK
18488 WEST HIGHWAY 30
NORTH PLATTE, NEBRASKA

M.S. PROJECT NO. 200-07-27
NOVEMBER 30, 2020
A-6492



Prepared for:

North Platte Area Chamber of Commerce
& Development Corporation
500 South Dewey Street
North Platte, NE 69101

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INTRODUCTION

This report presents the results of a geotechnical investigation performed for the proposed North Platte Rail Park to be located at 18488 West Highway 30 east of Hershey, Nebraska. This investigation was authorized by Mr. Gary Peterson, President, of the North Platte Area Chamber of Commerce and Development Corporation based on Mid-State Engineering and Testing's proposal dated July 8, 2020.

Included in this investigation were twenty-eight (28) soil borings, lab evaluation, data analysis, and a report of findings and recommendations. The scope of our report was limited to the following:

- Evaluating the engineering properties of the soils encountered
- Recommending types and depths of foundation elements
- Evaluate soil bearing capacity and settlement
- Evaluating soil support characteristics for pavement design
- Providing recommendations for earthwork and soil related construction with respect to the soils encountered

This report was prepared by Mid-State Engineering and Testing, Inc., under the guidance of a professional engineer registered in the State of Nebraska. Recommendations are based

on the applicable standards of the profession at the time of this study. This report was prepared for the exclusive use of the owner and their representatives for specific application to the planned development. All work was conducted in accordance with generally accepted soil and foundation engineering practices.

PROJECT DESCRIPTION

Project development is planned to be two commercial parcels with light rail connection to the Union Pacific Railroad to the south. Due to the preliminary nature of this report, at this time, there is no indication of the specific type of development planned for each parcel. However, we anticipate construction within these lots to consist of light to heavy commercial/industrial construction with rail connection. The proposed parcels cover approximately 100 acres in total. We anticipate new utilities will be installed along with new road and parking lot pavement.

While actual structural design has not been provided, it is expected most foundations will be supported on conventional shallow foundations and soils rafts or intermediate foundations. Due to the preliminary approach to this study, deep foundation exploration was not desired or completed at this time as these requirements would require detailed locations and loads of structures for pile determinations. This can be completed if needed on a lot by lot basis if such foundations are deemed necessary.

As with this type of construction (light to heavy commercial industry), generally, typical loading conditions are anticipated to be on the order of 50 – 150 kips for isolated columns and 3 – 5 klf for walls. While recommendations are provided in the study, we recommend each lot be evaluated regarding each location's needs.

Based on the topography of the development, we anticipate each lot will be elevated 2 to 4 feet above existing grade, depending on specific need. Currently, the site is relatively level with very little elevation differential to facilitate drainage.

FIELD WORK

A geotechnical field exploration was performed in two phases due to the site having agricultural crops to the east and west of building structures in the middle of the site. Phase one of the field exploration was performed within natural grass fields in the vicinity of the structures and along the south edge of a grass air strip bordering the agricultural crops east of the structures. Phase one was performed September 2, 2020 thru September 3, 2020 and consisted of drilling ten (10) soil borings (DH-9 thru DH-13 and DH-24 thru DH-28). Phase two was performed October 28, 2020 thru October 30, 2020 after the harvesting of the agricultural crops and consisted of drilling eighteen (18) soil borings (DH-1 thru DH-8 and DH-14 thru DH-23). Boring locations are indicated on the included Boring Location Plan (Appendix A). A total of twenty-eight (28) soil borings were drilled for the investigation.

The exploratory borings were advanced to depths of 20 to 25 feet below existing site elevations as recorded on the Boring Logs (Appendix B) with a truck-mounted rotary drilling rig using hollow-stem augers.

Soil samples were obtained at the sampling intervals noted on the Boring Logs (Appendix B). Recovered samples were extruded in the field, sealed in plastic containers, labeled, and protected for transportation to the laboratory for testing. Undisturbed samples, designated "U" samples, were obtained with a 3.0-inch (outside diameter), thin-walled, tube samplers hydraulically pushed in general accordance with ASTM D1587 (Thin walled Sampling of Soils). Split-barrel samples, designated "S" samples, were obtained while performing Standard Penetration Tests (SPT) with a 1.50-inch (inside diameter), thick-walled sampler driven in accordance with ASTM D1586 (Penetration Test and Split-Barrel Sampling of Soils). The N-value, reported in blows per foot, equals the number of blows required to drive the split-barrel sampler over the last 12-inches of a normal 18-inch sampling interval.

The field Boring Logs were prepared by an experienced Geotechnical Engineer in general accordance with ASTM D2488, (Description of Soils by the Visual-Manual Procedure). Stratification lines represent the approximate boundary between soil types. In-Situ, the transition between sediments may be gradual. Water level readings were made in the drill holes at the times and under conditions noted on the boring logs.

LABORATORY TESTING

Based on site stratigraphy and the construction proposed, a testing program was established to evaluate the engineering properties of the bearing strata. Specific tests performed include:

- Soil Moisture Content
- Unit Weight Determination
- Atterberg Limits Tests
- Percent Passing #200 Sieve
- Grain Sieve Analysis
- Unconfined Compression Test
- Field SPT Blow Counts

All tests were conducted in general accordance with current ASTM or state-of-the-art test procedures. Laboratory test results are provided on the Boring Logs (Appendix B) and Summary of Soil Testing (Appendix C).

Soil moisture content, unit weight, unconfined compression tests, grain sieve analysis and sand content along with field SPT blow counts were used to determine the overall uniformity/variability of the site soils for evaluation of bearing capacity and settlement.

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Atterberg limit testing and grain sieve analysis were used to classify the soils based on the Unified Soils Classification System, and to determine the plasticity characteristics of the site soils.

Unconfined compression tests define the stress/strain characteristics and related shear strengths of the soils.

Based on the results of the testing program, the field logs were reviewed and supplemented as shown in Appendix B. These final logs are a summation of visual evaluations performed in the field and lab, and the additional information gained through the laboratory testing program.

SITE CONDITIONS

The proposed commercial development consists of an agricultural field currently being used for row crop productions and a residential lot with numerous small building structures. It is not known at this time the layout or type of construction to be developed. The parcel has little elevation difference with approximately 1 to 2 feet of elevation variance across the site with drainage slightly in a southerly direction.

SOIL CONDITIONS

This site is situated just above the historic Platte River floodplain east of Hershey, Nebraska bordered by U.S. Highway 30 on the north and Union Pacific Railroad tracks to the south. The generalized subsurface profile for this region consists of water deposited sediments (alluvium) of various ages. Within the depths investigated, the soils encountered at this site consist of Alluvial Terrace deposits overlying Alluvial Sand deposits (clean Alluvial sands with gravel and variable clays and silts). A thin topsoil layer (6-8") was noted at the boring locations.

Alluvial Terrace deposits were encountered below the topsoil in all boring locations generally extending to a depth of approximately 3 feet with three exceptions (DH-13 - 2 feet, DH-24 - 6 feet and DH-25 - 8 feet) below existing site elevations. These deposits were described as brown, slightly moist to moist, firm, sandy lean clays. These deposits exhibit the following ranges of in-situ engineering properties:

Moisture Content (%).....	6 – 25
Dry Unit Weight (pcf).....	93 – 120
Unconfined Compression Strength (tsf)	1.1 – 8.9
Material Finer than #200 Sieve (%).....	15 – 72
Plastic Index	15 – 22

Based on lab and visual evaluation these soils range in classification from low to moderately plastic sandy lean clays (CL).

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Alluvial Sand deposits were encountered below the Alluvial Terrace sediments in all boring locations extending beyond the bottom of the 20 and 25-foot borings. These deposits were described as light brown, dry to saturated, loose to dense, poorly graded sands with variable amounts of gravel and clay. These deposits exhibit the following ranges of in-situ engineering properties:

Moisture Content (%).....	2 – 22 (Saturated)
Material Finer than #200 Sieve (%).....	2 – 21
SPT Blow Count (N).....	5 – 46

Based on lab and visual evaluation these deposits generally classify as poorly graded fine to medium sands (SP) with trace amounts of fines and poorly graded sand with clays and silt (SP-SC, SP-SM).

GROUNDWATER

Groundwater was encountered at the time of drilling in Phase 1 borings performed on September 2 and September 3, 2020, at approximately 2 to 3 feet below grade along the grass air strip (DH-9 thru DH-13). Groundwater was encountered in all other locations (DH-24 thru DH-28), at approximately 4 ½ - 8 feet below existing grade. This higher groundwater level encountered near the grass runway appear to be contributed to the irrigation canal adjacent to the runway. We anticipated these groundwater levels fluctuate more due to the canal irrigation.

Phase 2 borings (DH-1 thru DH-8 and DH-14 thru DH-23) were conducted approximately 2 months (October 28 – October 30) after Phase 1 borings and indicated groundwater levels at the time of drilling from approximately 5 – 7 feet below existing grade.

Considering structure elevations are anticipated to be 3 – 4 feet above existing grade, groundwater at the encountered depths is not expected to impact slab on grade or shallow foundation construction. However, it is worth noting that groundwater levels will fluctuate depending on weather patterns, irrigations practices, or other factors which may differ from these at the time of drilling. Long term monitoring would be required to verify seasonal high ground water levels.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on the conditions indicated, this site appears well suited for most above ground commercial development. Subgrade soils provide relatively good bearing conditions for most light to moderate structural loads and groundwater was not encountered within a depth that is expected to impact most slab on grade or shallow foundation construction. However, groundwater may become an issue for below grade utility installation and any structures planned to bear greater than 3 feet below existing grades.

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The upper cohesive sediments are low to moderately plastic sandy lean clays and when compacted provide poor vertical drainage. Consequently, it is important good surface drainage is provided off and away from structures and paving. The majority of the upper Alluvial Terrace sandy lean clay site soils are considered well suited for use as structural fill and support for paving and slab-on-grade floor systems.

Based on the information available at this time, results indicate the undisturbed site soils will generally allow for the use of an allowable soil bearing capacity on the order of 2,000 pounds per square foot (psf) for most light to moderate foundation loads (up to about 150 kips for isolated columns and 5 klf for walls). If larger structural loads are required or the use of a higher design bearing capacity is desired, soil support characteristics could be improved (up to about 3,000 psf) with additional site preparation. This is generally accomplished by providing structural fill soil rafts below and around load bearing footings. The greater the lateral and vertical extent of over-excavation provided, the greater the increase in allowable soil bearing capacity and settlement control provided. Due to the sensitivity of heavily loaded structures, any foundation load over 150 kips and greater than 5 klf should be re-evaluated on a site-specific basis and the information provided in this report be considered as preliminary.

In summary, no conditions were encountered which would be considered unusual or expected to pose a problem for most planned commercial development. The site offers relatively good stability with minimal site preparation. The upper sandy lean clay Alluvial Terrace on-site soils (excluding the upper top soil zone of 6 to 12 inches) are considered acceptable for use as structural fill. The Alluvial Sands encountered below the Alluvial Terrace deposits are not considered acceptable material for structural fill unless the upper cohesive Alluvial Terrace deposits are stripped and stockpiled and the clean Alluvial sands are exposed. The removed Alluvial Terrace deposits can be reused as structural fill near final grade to aid in surface water infiltration. In general, this site appears well suited for commercial development.

Again, while conditions appear good, the borings are widely spaced and it is always possible for variable/substandard conditions to exist across such large areas (less than 1 boring per acre). Based on the conditions, we recommend all stripped subgrades and building footings be observed by the Geotechnical Engineer to verify bearing conditions. If substandard conditions are indicated by the geotechnical engineer, it is expected footings can be deepened to penetrate through unsuitable conditions where/if encountered. However, when heavily loaded structures are anticipated some site modification may be required as discussed above.

In addition to the recommendations for foundation support, we recommend the floor slab and pavement subgrades be over-excavated as needed to provide a minimum of eighteen (18) inches of structural fill below floor slabs and pavement sections for the commercial facilities. If traffic loads are considered to be somewhat heavy, the Geotechnical Engineer

should be allowed to review the desired traffic use prior to design. We recommend all stripped and over-excavated subgrades be observed by the Geotechnical Engineer prior to structural fill placement. Any inconsistencies or instability identified at this time will need to be corrected as directed by the Engineer.

Recommendations regarding these and other aspects of this project are included in the following section of this report.

FOUNDATION ANALYSIS

If the recommendations presented in this report are followed, this site appears suitable for use of a conventional shallow foundation system. The selection of an allowable soil bearing pressure for foundation design must fulfill two requirements. First, structural loads must be sufficiently less than the ultimate bearing capacity of the foundation to insure stability. Second, settlement must not exceed an amount, which will produce adverse behavior of the superstructure.

In order to meet the previous criteria, we have explored both the bearing capacity and load settlement characteristics of the on-site soil assuming maximum loads of 5 kips per linear foot for walls and 150 kips for isolated columns. Bearing capacity is based on a factor of safety of 3 against the full dead load plus normal live load. A maximum total settlement of 1 inch and differential settlement on the order of $\frac{3}{4}$ inch are generally considered acceptable and were used in our analyses. The allowable bearing pressure is expressed in terms of the net pressure transferred to the soil.

In the event the recommendations presented in this report are followed and footings bear atop engineer approved site soils or newly placed structural fill as placed previously in the "General Section" and in the following "Earthwork and Excavations" sections of this report, a net allowable soil bearing pressure of up to 2,000 pounds per square foot is recommended for design of shallow foundation elements. Foundation elements designed in this manner will limit maximum total settlement, due to the foundation loads, to approximately 1 inch or less, while limiting differential settlement to approximately $\frac{1}{2}$ inch per 100 lineal feet.

Again, we recommend the Geotechnical Engineer be allowed to review and provide additional borings for any heavily loaded structures not specified in the information above.

We recommend exterior footings and footings in unheated areas be founded at a minimum depth of 42 inches below surrounding grade for frost protection. Interior footings may be placed directly below the floor slab. All footings will require steel reinforcement and should conform to local code sizes.

We recommend concrete for footings be designed utilizing a minimum cement content of 517 lb/yd³ and a minimum compressive strength of 3,000 psi. We also recommend that structural concrete be steel reinforced and conform to local building code requirements.

EARTHWORK AND EXCAVATIONS

Prior to overall site grading, we recommend topsoil and vegetation be stripped and stockpiled. Once stripped, we recommend the site be over-excavated as needed to provide a minimum of 18 inches of structural fill beneath any floor slabs and exterior pavement sections. Once approved, we recommend the over-excavated and/or stripped subgrade be scarified, moisture conditioned, and compacted in the presence of the Geotechnical Engineer prior to fill placement. Any instability detected during performance of this work will need to be addressed as recommended by the Geotechnical Engineer.

We recommend new fill and backfill material consist of cohesive or semi cohesive soils having a maximum plastic index of 25 and sand content less than 50%. Excluding topsoil and vegetation, it is expected most of the upper 3 feet of Alluvial Terrace on-site soils will be suitable for reuse as structural fill especially if utilized to cap or mix with the underlying clean Alluvial sands. Clean sands shall not be used as structural fill or for over-lot grading below buildings or paving, except for excavations which extend into natural clean Alluvial Sands. Completion of this work will provide a drainable base as well as provide substantial compacted structural fill. It should be noted the upper Alluvial Terrace sediments are suitable for trench footing.

We recommend structural fill be placed in loose lifts of 8 inches or less in thickness, with each lift compacted to a minimum of 95 percent of the material's standard Proctor maximum dry density (ASTM D698). We recommend soil moisture content at the time of compaction be controlled to between -3 and +3 percent of optimum (ASTM D698).

We recommend backfill soils for utility trenches below footings and floor slabs be placed in 6 inch loose lifts with each lift compacted to a minimum of 95 percent of the material's standard Proctor maximum dry density (ASTM D698). Backfill in grassy areas should be compacted to a minimum of 90 percent of the material's standard Proctor maximum dry density (ASTM D698). Due to the cohesive nature of the on-site Alluvial Terrace deposits, clean granular fill and backfill which can provide an avenue for water reaching the bearing soils is not recommended within 10 feet of the structure unless clean sands are exposed to drain any surface water that may infiltrate the clean sand fill.

We recommend a technician, working under the supervision of an experienced soils engineer, periodically monitor earthwork operations to evaluate compliance with the above recommendations.

Trenching and excavation activities should conform to federal and local regulations at a minimum. Based on the cohesive and semi-cohesive soils encountered across the site we anticipate trench type footings being suitable for construction.

FLOOR SLAB SUBGRADES

To provide uniform support for floor slabs, the subgrade should be reworked and compacted immediately prior to concrete placement. As a minimum, we recommend 18 inches of lean clay or sandy lean clay structural fill be provided below building floors. We recommend over-excavated subgrades be scarified, moisture conditioned, and compacted in the presence of the Geotechnical Engineer. Corrective action will need to be taken with any unsuitable or unstable soil conditions identified at that time.

We recommend fill below floor slabs be compacted to a minimum of 95 percent of the material's standard Proctor maximum dry density (ASTM D698). If a granular cushion is used beneath the floor slab, this layer should have a uniform thickness and be compacted by vibration prior to concrete placement.

We recommend concrete for floor slabs have a minimum cement content of 564 lb/yd³ and a minimum compressive strength of 3,500 psi. An entrained air content of 3 to 5 percent is recommended for strength and workability. This mix can also be used for exterior sidewalks by increasing the entrained air content to 5 to 8 percent.

PAVEMENT SUBGRADES

At this time, it is unknown whether parking and drive areas will consist of concrete or asphalt construction. Pavement performance is directly affected by the degree of compaction, uniformity, and stability of the subgrade soils. This is particularly important where heavy traffic is expected. With regards to the site, based on the soil conditions encountered and traffic consisting primarily of cars, light trucks and heavy truck, we recommend the upper 18 inches of pavement subgrades be compacted to a minimum of 95 percent of the material's standard Proctor maximum dry density (ASTM D698). Where traffic collects from all lots or main drive Rail Park entrances, we recommend the upper 18 inches of pavement subgrades be compacted to a minimum of 98 percent of the material's standard Proctor maximum dry density (ASTM D698). We recommend soil moisture be controlled within -3 and +3 percent of optimum.

If recommendations presented in this report are followed and structural fill as recommend is provided below the individual lots concrete paving, a soaked CBR of 4 and a modulus of subgrade reaction (k for pavements) of 135 pci may be used for pavement design. If completed as stated a soaked CBR of 5 and a modulus of subgrade reaction (k for pavements) of 150 pci may be utilized for pavement design. Pavement thickness should be determined based on traffic volume and standard pavement design procedures. If an asphalt (flexible) pavement is considered we recommend the 18 inches of structural fill be

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compacted to a minimum of 100 percent of the material's standard Proctor maximum dry density (ASTM D698) with moisture controlled to within -3 and +3 percent of optimum.

LATERAL EARTH PRESSURES

Depending on the utilization of on-site soils and depth of excavation, potential for multiple soil types could be used on this site. Based on our analysis of the on-site soils (variable sands with clays/silts and gravels in the flood plain), the following range in parameters are recommended for determining below grade earth pressures:

	COHESIVE (Alluvial Terrace)	COHESIONLESS (Alluvial Sands)
• Angle of internal soil friction (ϕ)	18°	26°
• Passive earth pressure coefficient (K_p)	1.89	2.56
• Active earth pressure coefficient (K_a)	0.53	0.39
• At rest earth pressure coefficient (K_o)	0.69	0.56
• Coefficient of friction.....	0.30	0.35
• Average total soil unit weight (in situ).....	120 pcf	120 pcf

Please refer to the following table for Equivalent Fluid Pressures in both drained and undrained conditions.

Equivalent Fluid Pressure (PCF)				
<u>Phi Angle</u>	<u>Condition</u>	<u>At Rest</u>	<u>Active</u>	<u>Passive</u>
18	drained	83	63	227
	undrained	102	93	171
<u>Phi Angle</u>	<u>Condition</u>	<u>At Rest</u>	<u>Active</u>	<u>Passive</u>
26	drained	67	47	307
	undrained	95	85	210

We recommend backfill be properly compacted to reduce future subsidence, and proper surface drainage be provided to reduce moisture infiltration. We recommend this work be completed following the guidelines outlined in the "Earthwork and Excavations" section of this report.

SURFACE DRAINAGE AND LANDSCAPING

The success of the shallow foundations and slab-on-grade floor systems is contingent upon keeping the subgrade soils at relative constant moisture content and not allowing surface drainage an avenue to reach the bearing soils. Positive surface drainage away from the structure must be maintained at all times. Landscaped areas should be designed and built in such a way that irrigation and other surface water will be collected and carried away from foundation elements.

The final grade of the foundation backfill and any overlying pavement should have a positive slope away from foundation walls on all sides. A minimum slope of 1 inch per foot for the first 5 to 10 feet is recommended. However, the slope may be decreased if the ground surface next to foundations is covered with concrete slabs or asphalt pavements. A minimum slope of 2 percent is recommended for all other areas. Pavement and exterior slabs next to structures should be carefully sealed against moisture intrusion at the joints.

All downspouts and faucets should discharge onto splash blocks that slope away from foundation walls and extend a minimum of 3 feet from the building foundation.

GENERAL COMMENTS

If any changes in the nature, design, or location of this project are planned, the conclusions and recommendations contained in this report shall not be considered valid unless those changes are reviewed and the conclusions of this report either modified or verified in writing by the geotechnical engineer.

The analysis and recommendations submitted in this report are based in part upon the data obtained from twenty-eight (28) soil borings. The nature and extent of variations of the on-site soils between borings may not become evident until construction. If variations appear, it will be necessary to re-evaluate the recommendations of this report.

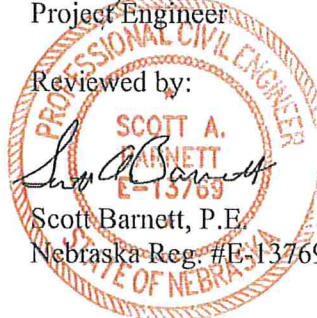
It is recommended the Geotechnical Engineer be allowed to review the final design and specifications to verify compliance with respect to the recommendation of this study. It is also recommended the geotechnical engineer be retained to provide QA/QC Engineering and testing services during the earthwork, excavation, and foundation construction phase of the project to verify site suitability and to provide recommendations if subsurface conditions differ from those expected.

Respectfully Prepared by:
Mid-State Engineering & Testing, Inc.



James A. Kostal, E.I.T.
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APPENDIX A

BORING LOCATION PLAN