Report of Geotechnical Engineering Investigation

Truck Terminal – R&L Carriers
250 East 800 North
Edinburgh, Indiana

Patriot Project No.: 20-0986-01G

Prepared For:

Neil Mullins
R&L Carriers
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Prepared By:

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September 9, 2020

PATRIOT ENGINEERING
and ENVIRONMENTAL, Inc.

Engineering Value for Project Success

September 9, 2020

Mr. Neil Mullins
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Re: Report of Geotechnical Engineering Investigation
Truck Terminal – R&L Carriers
250 East 800 North
Edinburgh, Indiana
Patriot Project No.: 20-0986-01G

Dear Neil:

Attached is the report of our subsurface investigation for the above referenced project. This investigation was completed in general accordance with our Proposal No. P20-1119-01G dated August 3, 2020.

This report includes detailed and graphic logs of nineteen (19) soil borings drilled at the proposed project site. Also included in the report are the results of laboratory tests performed on samples obtained from the site, and geotechnical recommendations pertinent to the site development, foundation design, and construction.

We appreciate the opportunity to perform this geotechnical engineering investigation and are looking forward to working with you during the construction phase of the project. If you have any questions regarding this report or if we may be of any additional assistance regarding any geotechnical aspect of the project, please do not hesitate to contact our office.

Respectfully submitted,
Patriot Engineering and Environmental, Inc.

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REPORT OF GEOTECHNICAL ENGINEERING INVESTIGATION

Truck Terminal – R&L Carriers
250 East 800 North
Edinburgh, Indiana
Patriot Project No.: 20-0986-01G

1.0 INTRODUCTION

1.1 General

R&L Carriers is planning the construction of a new truck terminal to be located near 250 East 800 North in Edinburgh, Indiana. The results of our geotechnical engineering investigation for the project are presented in this report.

1.2 Purpose and Scope

The purpose of this investigation is to determine the general near surface and subsurface conditions within the project area and to develop the geotechnical engineering recommendations necessary for the design and construction of the proposed truck terminal. This was achieved by drilling soil borings, and by conducting laboratory tests on samples taken from the borings. This report contains the results of our findings, an engineering interpretation of these results with respect to the available project information, and recommendations to aid in the design and construction of the proposed facility.

2.0 PROJECT INFORMATION

The proposed project is located near 250 East 800 North in Edinburgh, Indiana. The project consists of a truck terminal with a pre-engineered metal building. The structures will be slab on grade. The passenger vehicle parking lot will consist of 183 car parking spaces. The truck terminal is 986 feet long with 153 dock plates and a 5,000 square foot office attached. There is a tractor parking lot with 168 parking spaces on the southwestern corner of the building pad. There will be detention basins located south of the proposed structure. The building pad location will need to be raised using the excavated soil from the detention ponds.

No structural loading information was provided to us at the time of this report. We assume that the proposed structure will have wall loads not exceeding 3,000 pounds per lineal feet (plf), isolated column loads not exceeding 120 kips, and that floor loads will not exceed 150 pounds per square foot (psf). Additionally, based on visual observations of the existing site, it is assumed that any grade raise fill to complete the construction of building pads, finished pavement subgrades, etc., will not exceed 5 feet above the existing ground surface.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The project site is presently an approximately 75-acre parcel used for agricultural purposes. The surrounding area is generally an area of commercial and agricultural development. The topography in the area proposed for construction is generally flat, with a gentle slope rising to the west.

3.2 General Subsurface Conditions

Our interpretation of the subsurface conditions is based upon nineteen (19) soil borings drilled at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix “A”. All depths discussed below refer to depths below the existing ground surface. Based on the results of the soil borings completed at the site, the following subsurface profile is presented. A description of each general soil unit has been identified and is described below:

Topsoil – Topsoil, a surficial layer of material that is a blend of silts, sands, and clays, with varying amounts of organic matter, was encountered at the ground surface at the nineteen (19) boring locations. The topsoil layer was about 12 inches thick in the borings. ***Please note since the project site is utilized as farmland, we anticipate that the thickness of the topsoil in the cultivated areas could be thicker than noted at the borings.***

Silty Clay (CL) - The topsoil layer is generally underlain slightly moist to moist, soft to stiff, silty clay. The silty clay layers typically extend to depths of 2.0 to 8.5 feet below the existing ground surface when encountered. The natural moisture content of this material ranges from 14 to 24 percent (%). The silty clay layers have unconfined compressive strengths, as determined by a hand penetrometer, of 1.75 to greater than 4.5 tons per square foot (tsf). Standard Penetration Test N-values (blow counts) in this material varied from 4 to 15 blows per foot (bpf). ***Please note soft clays were encountered at four (4) borings (B-5, B-7, IT-4 and IT-5) at a depth range of 1-8.5 feet (Refer Table 1 and boring logs).***

Sand (SP-SM) – Below the silty clay layers or the topsoil layer, slightly moist to saturated, very loose to medium dense, sand was encountered to the termination of the borings (approximately 10 to 25 feet) below existing grade at nineteen (19) boring locations. Standard Penetration Test N-values in this sand varied from 0 to 32 bpf. ***Very loose sand was encountered in ten (10) of the nineteen (19) borings. Please see Table No. 1 for locations of the very loose sand.***

As previously mentioned, unsuitable very soft to soft clays and very loose sands were encountered in thirteen (13) of the nineteen (19) borings, at depths between 1 to 23.5 feet. The following table presents the extent of the unsuitable soils encountered in the borings:

Table No. 1: Summary of Unsuitable Soils Encountered in Borings

Boring Number	Soil Classification	Approximate Depth of Unsuitable Soils (feet)$^{(1)}$
B-2	Very Loose Sand (SP-SM)	3.5 to 6
B-3	Very Loose Sand (SP-SM)	3.5 to 8.5
B-4	Very Loose Sand (SP-SM)	3.5 to 13.5
B-5	Soft Silty Clay (CL)	1 to 6
B-6	Very Loose Sand (SP-SM)	3.5 to 6
B-7	Soft Silty Clay (CL)	1 to 3.5
	Soft Silty Clay (CL)	6 to 8.5
	Very Loose Sand (SP-SM)	8.5 to 13.5
B-8	Very Loose Sand (SP-SM)	6 to 13.5
B-10	Very Loose Sand (SP-SM)	3.5 to 6
	Very Loose Sand (SP-SM)	18.5 to 23.5
IT-1	Very Loose Sand (SP-SM)	6 to 13.5
IT-2	Very Loose Sand (SP-SM)	3.5 to 6
IT-3	Very Loose Sand (SP-SM)	1 to 3.5
IT-4	Soft Silty Clay	3.5 to 6
IT-5	Soft Silty Clay	3.5 to 8.5

(1) Represents depth below existing ground surface.

The soil conditions described above are general, and some variations in the descriptions should be expected; for more specific information, please refer to the boring logs presented in Appendix “A”. It should be noted that the dashed stratification lines shown on the soil boring logs indicate approximate transitions between soil types. In-situ stratification changes could occur gradually or at different depths.

3.3 Groundwater Conditions

The term groundwater pertains to any water that percolates through the soil found on site. This includes any overland flow that permeates through a given depth of soil, perched water, and water that occurs below the “water table”, a zone that remains saturated and water-bearing year-round.

Groundwater was observed during drilling in fourteen (14) of the nineteen (19) soil borings performed at the site at depths of 13.5 to 19 feet below the existing ground surface. Groundwater was not observed in the remaining borings during drilling. Immediately after the borings were completed and the augers were removed from the boreholes, the soil borings were dry at the cave-in depths.

It should be recognized that fluctuations in the groundwater level should be expected over time due to variations in rainfall and other environmental or physical factors. ***The true static groundwater level can only be determined through observations made in cased holes over a long period of time, the installation of which was beyond the scope of this investigation.***

3.4 Field Infiltration Testing

Per the Client’s request, we performed infiltration tests at a depth of approximately 5 to 10 feet below the existing ground surface at soil borings IT-1, IT-2, IT-3, IT-4, IT-5, IT-6, and IT-7. The infiltration testing was requested to determine infiltration characteristics of soils within the proposed basin areas. The soils encountered in these soil borings at the specified depths were between very loose to medium dense sand (SP-SM). Due to the dry conditions and the high permeability of the sand, the sands were not able to be saturated during the tests. Based on our experience, an infiltration rate of 0.5 to 2 inches per hour can be used for the sands encountered at the site.

4.0 DESIGN RECOMMENDATIONS

4.1 Basis

Our recommendations are based on data presented in this report, which include soil borings, laboratory testing, and our experience with similar projects. Subsurface variations that may not be indicated by a dispersive exploratory boring program can exist on any site. If such variations or unexpected conditions are encountered during construction, or if the project information is incorrect or changed, we should be informed immediately since the validity of our recommendations may be affected.

4.2 Foundations

B-1 through B-7 were drilled in the truck terminal's dock platesAs previously mentioned, very loose sand was generally encountered in thirteen (13) of the nineteen (19) soil borings extending to depth of 3.5 to 23.5 feet below existing grade **(Refer to Table No. 1 and Boring Logs)*. If encountered during construction, these soft clays and very loose sands are unsuitable for supporting foundations, and therefore must be undercut and replaced with well-compacted structural fill or improved in-place prior to construction of footings.*** Since thirteen (13) out of the nineteen (19) borings encountered these unsuitable materials, extensive undercutting should be anticipated. Therefore, we believe that a ground improvement system such as Geopiers® Rammed Aggregate Piers may be an alternative option for the project structures. In addition, undercutting of unsuitable soils and replacement with compacted new structural fills can also be considered if the client wishes. These foundation recommendations are discussed below.

4.2.1 Geopier Rammed Aggregate Piers

Based on the soil conditions at this site, a properly installed Geopier Rammed Aggregate Piers™ (open hole with compacted crushed stone layers) system could be the economical option to support the project structure. This option will minimize potential deeper undercuts during construction. The Geopier Foundation System not only allows for the use of a shallow spread footing foundation using conventional construction methods, but also allows for some improvement of the soils within the project area due to the construction methods involved in placing the Geopiers.

Rammed Aggregate Piers are constructed by drilling 24 to 30-inch diameter holes within the shallow foundation footprint, and then backfilling the holes with compacted crushed stone to form a dense aggregate pier. The footings are then constructed directly on the Geopier reinforced subgrade using conventional construction methods. The Geopier Foundation Company retains the responsibility for the final pier designs. Geopier can provide estimated foundation settlements along with warranting the performance of the footings supported by Geopier elements.

Patriot recommends that the Geopiers should be installed and extended adequately into suitable sands encountered in the soil borings. Additionally, we recommend that *Patriot* be retained to observe the installation process. Although the Geopier Foundation Company warrants the performance of their work, it is their standard practice to have quality assurance during installation of the Geopiers.

Based on our past experience with similar projects, it is estimated that by reinforcing the weaker fill layers with Geopier foundation elements, an allowable soil bearing pressure on the order of 3,000 to 5,000 pounds per square foot (psf) could be utilized for the design of the spread footing foundations. ***However, the actual allowable bearing capacity and estimated settlements can only be determined by the Geopier Foundation Company. Our estimates should only be considered as a guide for preliminary design.***

4.2.2 Undercutting Unsuitable Soils and Replacement with Structural Fills

If soft clays, very loose sands or other unsuitable materials are encountered at the footing level or below, they must be undercut and replaced with well-compacted structural fill or improved in-place prior to construction of foundations or the footings can be extended to suitable natural soils. Following the excavation of the footing areas, the foundations subgrade should be visually inspected by a *Patriot* representative and probed at multiple locations at isolated footings and at every 10 feet (maximum) along wall footings using a Dynamic Cone Penetrometer (DCP) to a minimum depth of 5 feet below the footing subgrade to verify that the underlying soil has a SPT blow count of 7 or more or unconfined compressive strength of 1.0 tsf or more. Any unsuitable soils encountered at the footing subgrade or below should be removed and replaced with well-compacted structural fill.

Provided the above recommendations are followed, the proposed structures can be supported on spread footings bearing on the medium stiff silty clays or loose to medium dense sands encountered at shallow depths or on new well-compacted structural fill overlying the same. These footings should be proportioned using a net allowable soil bearing pressure not exceeding 2,000 pounds per square foot (psf) for column footings or 1,500 psf for wall (strip) footings. For proper performance at the recommended design bearing pressure, foundations must be constructed in compliance with the recommendations for footing excavation inspection that are discussed in Section 5.0 *"Construction Considerations"*.

We estimate that the total foundation settlement should not exceed approximately 1 inch and that differential settlement should not exceed about ¾ inch. Careful field control during construction is necessary to minimize the actual settlement that will occur.

4.2.3 General Foundation Recommendations

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant pressure on adjacent foundations; otherwise the stress overlap must be considered in the design.

All exterior foundations and foundations in unheated areas should be located at a depth of at least 30 inches below final exterior grade for frost protection. However, interior foundations in heated areas can bear at depths of approximately 24 inches below the finished floor. We recommend that wall (strip) footings be at least 18 inches wide and column footings be at least 24 inches wide for bearing capacity considerations.

Positive drainage of surface water, including downspout discharge, should be maintained away from structure foundations to avoid wetting and weakening of the foundation soils both <u>during</u> construction and <u>after</u> construction is complete.

4.3 Floor Slabs

The near surface or shallow subgrade soils encountered within the proposed building footprints generally consist of medium stiff to stiff silty clays, which if properly prepared are suitable for floor slab support. ***However, depending on the proposed site grading, soft or very loose materials may be encountered at or near the proposed slab level or grade raise fill may be placed prior to construction of the floor slabs. Therefore the soft compressive layers should be undercut prior to placement of fills or the floor slab subgrade could be improved using a rammed aggregate pier system similarly used for foundations.***

We recommend that all floor slabs be designed as "floating", that is, fully ground supported and not structurally connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation. Although the movements are estimated to be within the tolerable limits for the structural safety, such movements could be detrimental to the slabs if they were rigidly connected to the foundations. Additionally, we recommend that all slabs should be liberally jointed and designed with the appropriate reinforcement for the anticipated loading conditions.

The building floor slabs should be supported on a minimum 6 inch thick well-compacted granular base course (i.e. Indiana Department of Transportation (INDOT) No. 53 crushed stone) bearing on a suitably prepared subgrade (Refer to Section 5.0 *"Construction Considerations"*). The granular base course is expected to help distribute loads and equalize moisture conditions beneath the slab.

Provided that the recommendations above for floor slab design and construction are followed, a modulus of subgrade reaction, "K_{30}" value of 75 pounds per cubic inch (pci), is recommended for the design of ground supported floor slabs. It should be noted that the "K_{30}" modulus is based on a 30 inch diameter plate load empirical relationship.

4.4 Seismic Considerations

For structural design purposes, we recommend using a ***Site Classification of "D"*** as defined by the 2014 Indiana Building Code (modified 2012 International Building Code (IBC)). Furthermore, along with using a Site Classification of D, we recommend the use of the maximum considered spectral response acceleration and design spectral response acceleration coefficients provided in Table No. 2 below. Refer to Appendix "B" for *"Seismic Site Class Evaluation"* report summary.

Table No. 2: Seismic Design Spectral Response Acceleration Coefficients

Period (seconds)	Maximum Considered Spectral Response Acceleration Coefficient	Soil Factor	Design Spectral Response Acceleration Coefficient
0.2	$S_S = 0.171$ g	1.6	$S_{DS} = 0.182$ g
1.0	$S_1 = 0.092$ g	2.4	$S_{D1} = 0.146$ g

These values were obtained from the *"Earthquake Ground Motion Parameters"* program for seismic design, developed by the United States Geological Survey (USGS) Earthquake Hazard Program, utilizing latitude 39.3224° north and longitude 85.9666°

west as the designation for identifying the location of the parcel. Other earthquake resistant design parameters should be applied consistent with the minimum requirements of the 2014 Indiana Building Code.

4.5 Pavements

The near surface or shallow subgrade soils encountered within the proposed pavement areas generally consist of medium stiff to stiff silty clays or loose to medium dense sands, which if properly prepared are suitable for pavement support. ***However, soft clays and very loose sands were encountered at or near existing ground surface at some of the boring locations. If encountered during construction or if grade raise fills are planned for these areas, the soft and very loose unsuitable soils should be undercut and replaced with well compacted structural fill prior to construction of pavements or placement of grade raise fills.***

If construction is performed during a wet or cold period, the contractor will need to exercise care during the grading and fill placement activities in order to achieve the necessary subgrade soil support for the pavement section (Refer to Section 5.0 "Construction Considerations"). The base soil for the pavement section will need to be firm and dry. The subgrade should be sloped properly in order to provide good base drainage. To minimize the effects of groundwater or surface water conditions, the base section for the pavement system should be sufficiently high above adjacent ditches and properly graded to provide pavement surface and pavement base drainage.

As requested, *Patriot* is providing minimum design recommendations for a light-duty flexible (asphalt) pavement section and a heavy-duty rigid (concrete) pavement section. These design recommendations have been evaluated and based on the estimated design criteria provided below, along with our evaluation of the subsurface conditions. Our recommended minimum pavement design sections provided below are based on a soil support evaluation performed in accordance with generally accepted procedures set forth by the American Association of State Highway and Transportation Officials (AASHTO) "*Guide for Design of Pavement Structures, 1993*". ***The Client has provided required traffic loading for the passenger vehicles and tuck traffic. The pavement design is based on the required specifications and the following design assumptions:***

- Design Life of 20 years
- Traffic Loading Conditions:
  - Light-Duty Traffic Loading Passenger Vehicles (400 per day)
  - Heavy-Duty Traffic Loading Semi-trucks (280 per day)

- 18-kips Equivalent Single Axle Loading (ESAL) estimated design value:
  - Light-Duty Traffic Loading Flexible Pavement = 50,000
  - Heavy-Duty Traffic Loading Rigid Pavement = 16,800,000
- Initial Serviceability:
  - Flexible Pavement = 4.2
  - Rigid Pavement = 4.5
- Terminal Serviceability of 2.0 (for both flexible pavement)
- Reliability of 80 percent (%) (for both flexible and rigid pavement)
- Standard Deviation
  - Flexible Pavement = 0.45
  - Rigid Pavement = 0.35
- Estimated California Bearing Ratio (CBR) of 2.5 (or MR = 3,750 psi)
- Estimated Subgrade Modulus of Subgrade Reaction value of 75 pounds per cubic inch (pci)
- The crushed stone base course will not contain more than 10 percent (%) fines and will be compacted to at least 100 percent (%) of the maximum Standard Proctor dry density.
- Asphalt will be placed and compacted in accordance with the INDOT 2016 Standard Specification Requirements.
- Periodic Maintenance: We recommend that cracking should be filled and sealed according to INDOT Standard Specification Section 408 periodically after the installation of the pavement. Inspection can also be performed at these times for any isolated areas of excessive fatigue cracking, which could necessitate full-depth patching. Underdrain outlets shall be inspected annually to ensure that there are no man-made or natural obstructions to the flow.

Based on the above design parameters, provided below are the calculated minimum pavement design thicknesses for a flexible (asphalt) pavement section.

Table No. 1: Flexible Pavement Design (Minimum Thicknesses)
(Light-Duty - For Passenger Vehicle Parking Lot Only)

Traffic Loading Conditions(1)	**Asphalt Surface Course HMA 9.5 mm (Inches)(2)**	**Asphalt Base Course HMA 19 mm (Inches)(2)**	**Aggregate Sub-Base (Inches)(3)**	**Design Life (Years)**
50,000 ESAL's	1.5	3.5	6	20

(1) Estimated ESAL based on estimated number of truck passes per day
(2) Indiana Department of Transportation (INDOT) Specified Hot Mix Asphalt (HMA)
(3) Indiana Department of Transportation (INDOT) No. 53 Crushed Stone, containing no more than 10 percent (%) fines.

Table No. 2: Rigid Pavement Design (Minimum Thicknesses)
(Heavy-Duty – Truck Terminal Pavements)

Traffic Loading Conditions(1)	Concrete Surface Course (Inches)(2)	Aggregate Sub-Base Course INDOT No. 53 (Inches)(3)	Effective Modulus of Subgrade Reaction (k-value)(4)
16,800,000 ESAL's	11	8	75 pci

(1) Estimated ESAL based on estimated number of truck passes per day
(2) Minimum of 4,000 pounds per square inch (psi) concrete strength.
(3) The aggregate base course should contain no more than 10 percent (%) fines.
(4) AASHTO Guide for Design of Pavement Structures 1993.

4.6 Storm-Water Management Basin

The soils encountered in the area of the proposed storm-water management basin (Borings IT-1, IT-2, IT-3, IT-4, IT-5, IT-6, and IT-7) consist of silty clays which extend to depths between 3.5 and 8.5 feet below the existing ground surface. The silty clays are underlaid by sands that extend to the termination of the soil borings. The clays are considered relatively favorable for a retention basin, due to the estimated moderate permeability characteristics of the clays. However, the sand layers generally encountered underlying the clays would not be favorable for retention of storm-water, as the sand layers are estimated to have relatively high permeability characteristics. In addition, based on our experience, pockets and layers of sands are anticipated within the clay layer. Therefore, if a retention capacity is required for the detention pond, the pond will require the installation of a clay liner, and/or a synthetic liner. However, if percolation of water into the underlying soil is allowed and maintaining a long-term pond level is not a concern, a liner may not be required.

The soils encountered in our borings should be readily excavated using conventional earthwork equipment. ***Additionally, depending on the invert elevation of the proposed detention basin, sand layers and seams could be encountered which are expected to be free-flowing and will tend to readily cave and/or slough into excavations; therefore, over-excavation, benching and/or shoring should be expected in order to maintain the side slopes of the excavations.***

Depending on seasonal conditions and the invert elevation of the proposed detention basin, localized and sporadic groundwater infiltration should be expected to be encountered in the detention basin excavation. Furthermore, it should also be noted that there may be the potential for encountering heaving of sand layers near the groundwater elevations during construction.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

All areas that will support foundations, floors, pavements, or newly placed structural fill must be properly prepared. All loose surficial soil or "topsoil" and other unsuitable materials must be removed. Unsuitable materials include: frozen soil, relatively soft material, relatively wet soils, deleterious material, or soils that exhibit a high organic content.

Approximately 12 inches of loose surficial topsoil was encountered in the borings. The topsoil was measured at discrete locations as shown on the Boring Location Map (Figure No. 2) in Appendix "A". The topsoil thickness measured at the boring locations may or may not be representative of the overall average topsoil thickness at the site. Thicker layers of material may be found in areas due to the use of the property for agricultural cultivation. Therefore, it is possible that the actual stripping depth could significantly vary from this data. The data presented should be viewed only as a guide to the minimum stripping depth that will be required to remove organic material at the surface. Additional field exploration by *Patriot* would be required to provide an accurate estimate of the stripping depth. This limited data indicates that a minimum stripping depth will be required to remove the organic material at the surface, followed by the potential for additional stripping and/or scarification and recompaction as may be required to achieve suitable subgrade support. ***Additionally, if saturated conditions exist with the surface soils, light tracked equipment could be required to avoid pushing organics deeper into the suitable subgrade soils.*** A *Patriot* representative should verify the stripping depth at the time grading operations occur.

Prior to construction of floor slabs, pavements or the placement of new structural fill, the exposed subgrade must be evaluated by a Patriot representative; which will include proofrolling of the subgrade. Proofrolling should consist of repeated passes of a loaded, pneumatic-tired vehicle such as a tandem-axle dump-truck or scraper. The proofrolling operations should be observed by a *Patriot* representative, and the proofrolling vehicle should be loaded as directed by *Patriot*. Any area found to rut, pump, or deflect excessively should be compacted in-place or, if necessary, undercut and replaced with structural fill, compacted as specified in Section 5.3 *"Structural Fill and Fill Placement Control"*.

Care must be exercised during grading and fill placement operations. ***The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils. The severity of this potential***

problem depends to a great extent on the weather conditions prevailing during construction. The contractor must exercise discretion when selecting equipment sizes and also make a concerted effort to control construction traffic and surface water while the subgrade soils are exposed. We recommend that heavy construction equipment (i.e. dump trucks, scrapers, etc.) be rerouted away from the building and pavement areas. If such problems do arise, the operations in the affected area should be halted and the *Patriot* representative contacted to evaluate the condition.

5.2 Foundation Excavations

Excavation will be performed on sandy soils that can be easily disturbed. If the subgrade soil is disturbed, it should be re-compacted or a crushed stone layer should be placed at the subgrade level.

Upon completion of the foundation excavations and prior to the placement of reinforcing steel, a *Patriot* representative should check the exposed subgrade to confirm that a bearing surface of adequate strength has been reached. Any localized soft soil zones encountered at the bearing elevations should be further excavated until adequate support soils are encountered. The cavity should be backfilled with structural fill as defined below, or the footing can be poured at the excavated depth. Structural fill used as backfill beneath footings should be limited to lean concrete, well-graded sand and gravel, or crushed stone placed and compacted in accordance with Section 5.3 *"Structural Fill and Fill Placement Control"*.

If it is necessary to support spread footings on structural fill, the fill pad must extend laterally a minimum distance beyond the edge of the footing. The minimum structural pad width would correspond with a point at which an imaginary line extending downward from the outside edge of the footing at a 1H:2V (horizontal: vertical) slope intersects the surface of the natural soils. For example, if the depth to the bottom of excavation is 4 feet below the bottom of the foundation, the excavation would need to extend laterally beyond the edge of the footing at least 2 feet, as shown in Illustration "A" found at the conclusion of this report.

Excavation slopes should be maintained within all requirements set-forth by the Occupational Safety and Health Standards (OSHA), but specifically Section 1926 Subpart "P" – *"Excavations"*. We recommend that any surcharge fill or heavy equipment be kept at least 5 feet away from the edge of the excavation.

Construction traffic on the exposed surface of the bearing soil will potentially cause some disturbance of the subgrade and consequently loss of bearing capacity. However, the degree of disturbance can be minimized by proper protection of the exposed surface.

5.3 Structural Fill and Fill Placement Control

Structural fill, defined as any fill which will support structural loads, should be clean and free of organic material, debris, deleterious materials and frozen soils. Samples of the proposed fill materials should be tested prior to initiating the earthwork and backfilling operations to determine the classification, the natural and optimum moisture contents and maximum dry density and overall suitability as a structural fill. ***Structural fill should have a liquid limit less than 40 and a plasticity index less than 20.***

All structural fill beneath floor slabs, adjacent to foundations and over foundations, should be compacted to at least 95 percent (%) of its maximum Standard Proctor dry density (ASTM D-698). This minimum compaction requirement should be increased to 100 percent (%) of the maximum Standard Proctor dry density for fill supporting footings, provided these are designed as outlined Section 4.0 *"Design Recommendations"*.

Structural fill supporting, around and over utilities should be compacted to at least 95 percent (%) of its maximum Standard Proctor dry density (ASTM D-698) for utilities underlying structural areas (i.e. buildings, pavements, sidewalks, etc.). However, the minimum compaction requirement can be reduced for backfill around and over the utilities to 90 percent (%) of the maximum Standard Proctor dry density where utilities underlie greenbelt areas (i.e. grassy lawns, landscaping, etc.). It is recommended that a clean well-grade granular material be utilized as the bedding material, as well as the backfill material around and over the utility lines.

In cut areas, where pavement sections are planned, the upper 10 inches of subgrade should be scarified and compacted to a dry density of at least 100 percent (%) of the Standard Proctor maximum dry density (ASTM D-698). Any grade-raise fill placed within 1 foot of the base of the pavement section should also be compacted to at least 100 percent (%) of the Standard Proctor maximum dry density. This can be reduced to 95 percent (%) for structural fill placed more than 1 foot below the base of the pavement section.

To achieve the recommended compaction of the structural fill, we suggest that the fill be placed and compacted in layers not exceeding 8 inches in loose thickness (the loose lift thickness should be reduced to 6 inches when utilizing small hand compactors) and within the range of 2 percentage (%) points below or above the optimum moisture content value. All fill placement should be monitored by a *Patriot* representative. ***Each lift should be tested for proper compaction at a frequency of at least one (1) test every 2,500 square feet (ft^2) per lift for the building areas, at least one (1) test every 10,000 square feet (ft^2) per lift for the parking and roadway areas, and at a frequency of at least one (1) test for every 50 lineal feet of utility installation*.**

5.4 Groundwater Considerations

Groundwater was observed during our field activities at depths between about 13.5 to 19 feet below the existing ground surface; which is expected to be below the anticipated foundation excavation depths. However, depending on seasonal conditions, localized or sporadic grouindwater infiltration may occur into the excavations.

Groundwater inflow into shallow excavations **above** the groundwater table is expected to be adequately controlled by conventional methods such as gravity drainage and/or pumping from sumps. More significant inflow can be expected in deeper excavations **below** the groundwater table requiring more aggressive dewatering techniques, such as well or wellpoint systems. For groundwater to have minimal effects on the construction, foundation excavations should be constructed and poured in the same day, if possible.

6.0 INVESTIGATIONAL PROCEDURES

6.1 Field Work

A total of nineteen (19) soil borings were drilled, sampled, and tested at the project site between August 17 and 20, 2020 at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix “A”. The depths that the soil borings were advanced to are shown on the Boring Logs in Appendix “A”.

The borings were advanced using 3¼ inch inside diameter hollow-stem augers. Samples were recovered in the undisturbed material below the bottom of the augers using the standard drive sample technique in accordance with ASTM D 1586-74. A 2 inch outside diameter by 1$^3/_8$ inch inside diameter split-spoon sampler was driven a total of 18 inches with the number of blows of a 140 pound hammer falling 30 inches recorded for each 6 inches of penetration. The sum of blows for the final 12 inches of penetration is the

Standard Penetration Test result commonly referred to as the N-value (or blow-count). Split-spoon samples were recovered at 2.5 feet intervals, beginning at a depth of 1 foot below the existing surface grade, extending to a depth of 10 feet, and at 5 feet intervals thereafter to the termination of the boring.

Water levels were monitored at each borehole location during drilling and upon completion of the boring. The boreholes were backfilled with auger cuttings prior to demobilization for safety considerations.

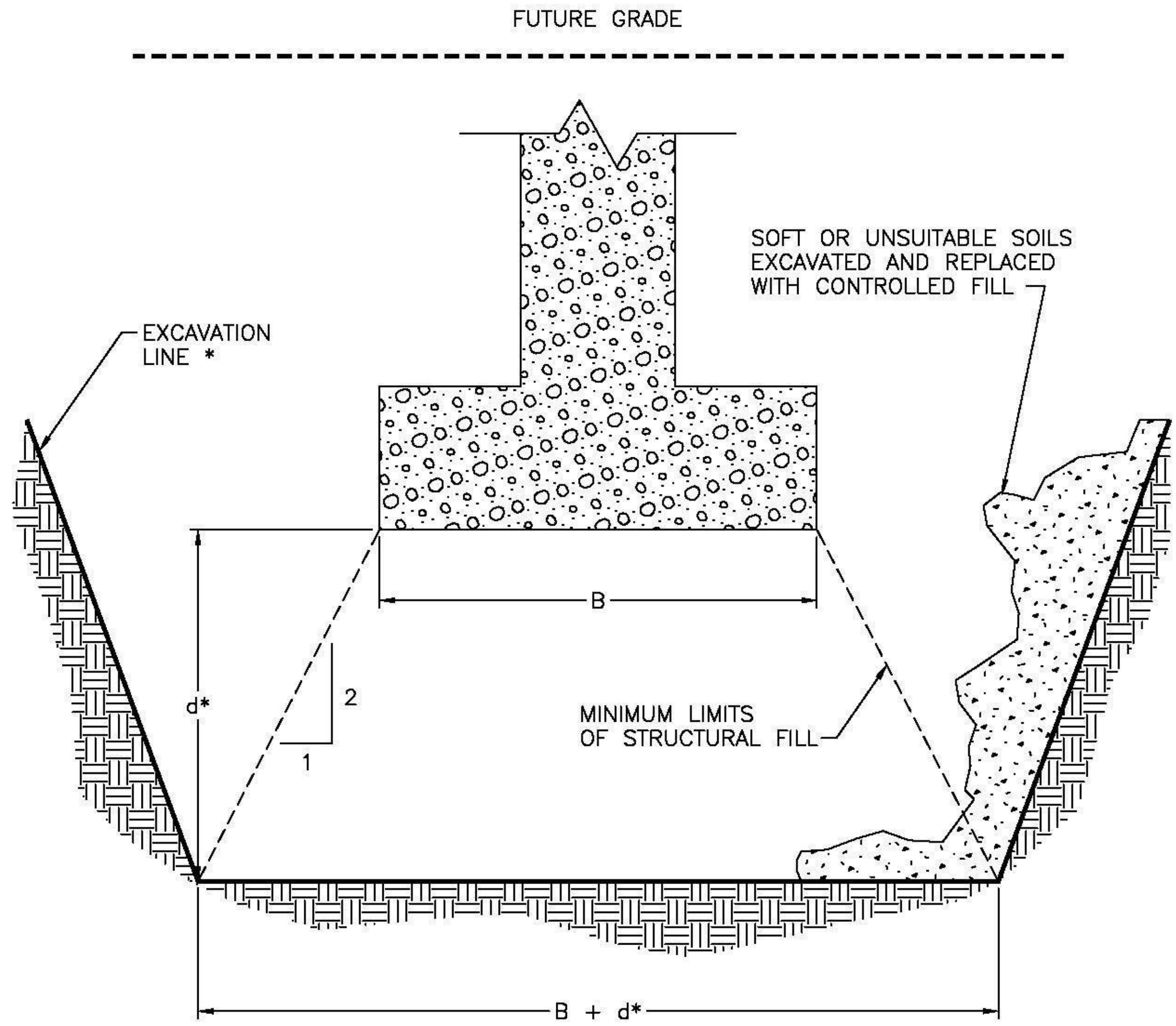
Upon completion of the boring program, all of the samples retrieved during drilling were returned to *Patriot*'s soil testing laboratory where they were visually examined and classified. A laboratory-generated log of each boring was prepared based upon the driller's field log, laboratory test results, and our visual examination. Test boring logs and a description of the classification system are included in Appendix "A" in this report. Indicated on each log are: the primary strata encountered, the depth of each stratum change, the depth of each sample, the Standard Penetration Test results, groundwater conditions, and selected laboratory test data. The laboratory logs were prepared for each boring giving the appropriate sample data and the textural description and classification.

6.2 Laboratory Testing

Representative samples recovered in the borings were selected for testing in the laboratory to evaluate their physical properties and engineering characteristics. Laboratory analysis included Natural Moisture Content Analysis (ASTM D 2216) and an estimate of the unconfined compressive strength (q_u) of the cohesive soil samples utilizing a calibrated hand penetrometer (q_p) were obtained. The results of laboratory tests are summarized in Section 3.2 "*General Subsurface* Conditions". Soil descriptions on the boring logs are in accordance with the Unified Soil Classification System (USCS).

7.0 ILLUSTRATIONS

See Illustrations "A" and "B" on the following pages. These illustrations are presented to further visually clarify several of the construction considerations presented in Section 5.2 *"Foundation Excavations"*.



*d IS DEPTH TO SUITABLE SOILS

* IN COMPLIANCE WITH OSHA STANDARDS

PATRIOT ENGINEERING and Environmental, Inc.

Engineering Value for Project Success

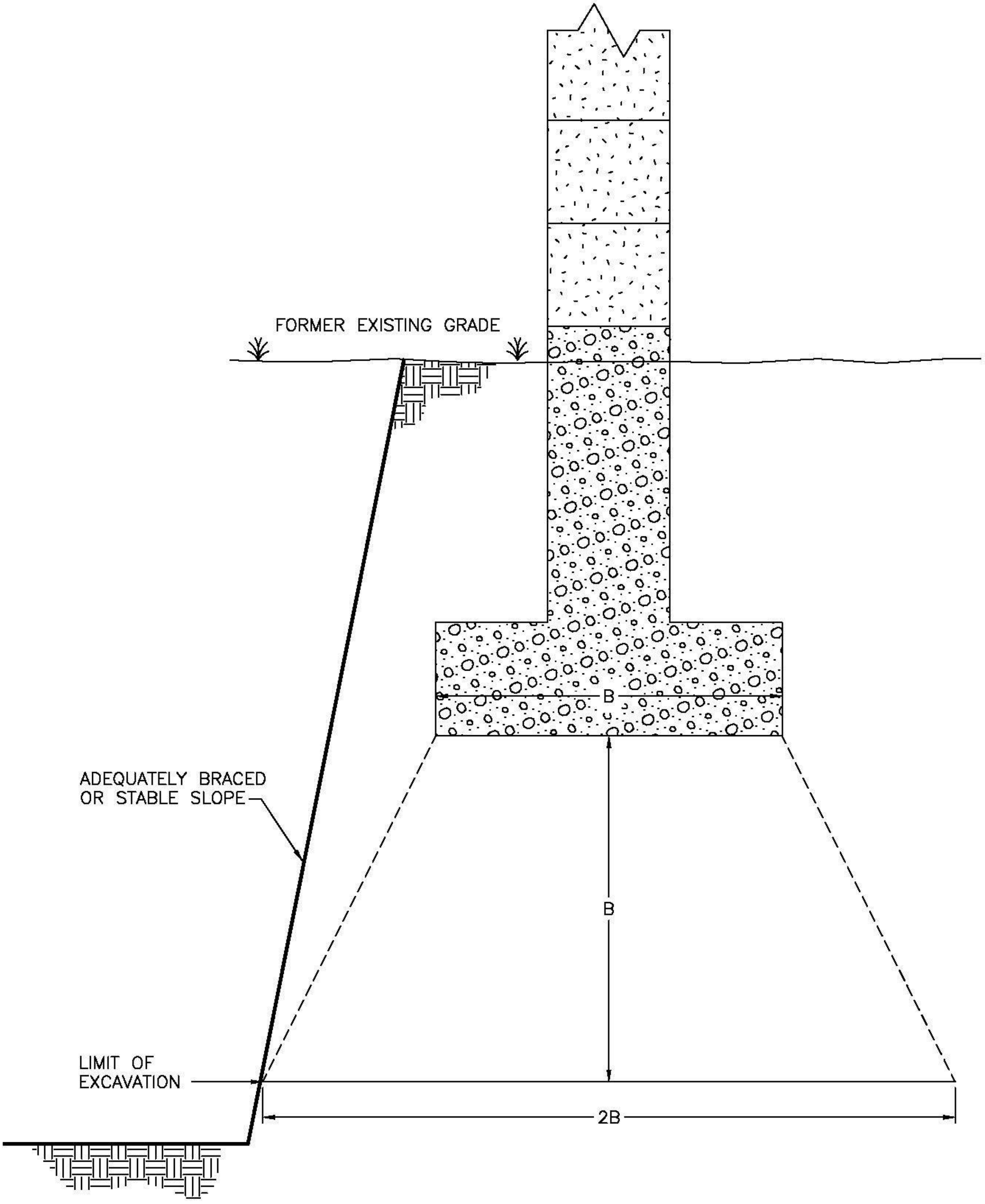
Consulting Environmental, Geotechnical and Materials Engineers

Excavation for Footings In an Area of Fill

ILLUSTRATION A

job. no.:

figure:



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and Materials Engineers

Excavation Near Existing In Use Foundations
ILLUSTRATION B

job. no.:

figure:

APPENDIX A

SITE VICINITY MAP (FIGURE NO. 1)

BORING LOCATION MAP (FIGURE NO. 2)

BORING LOGS

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

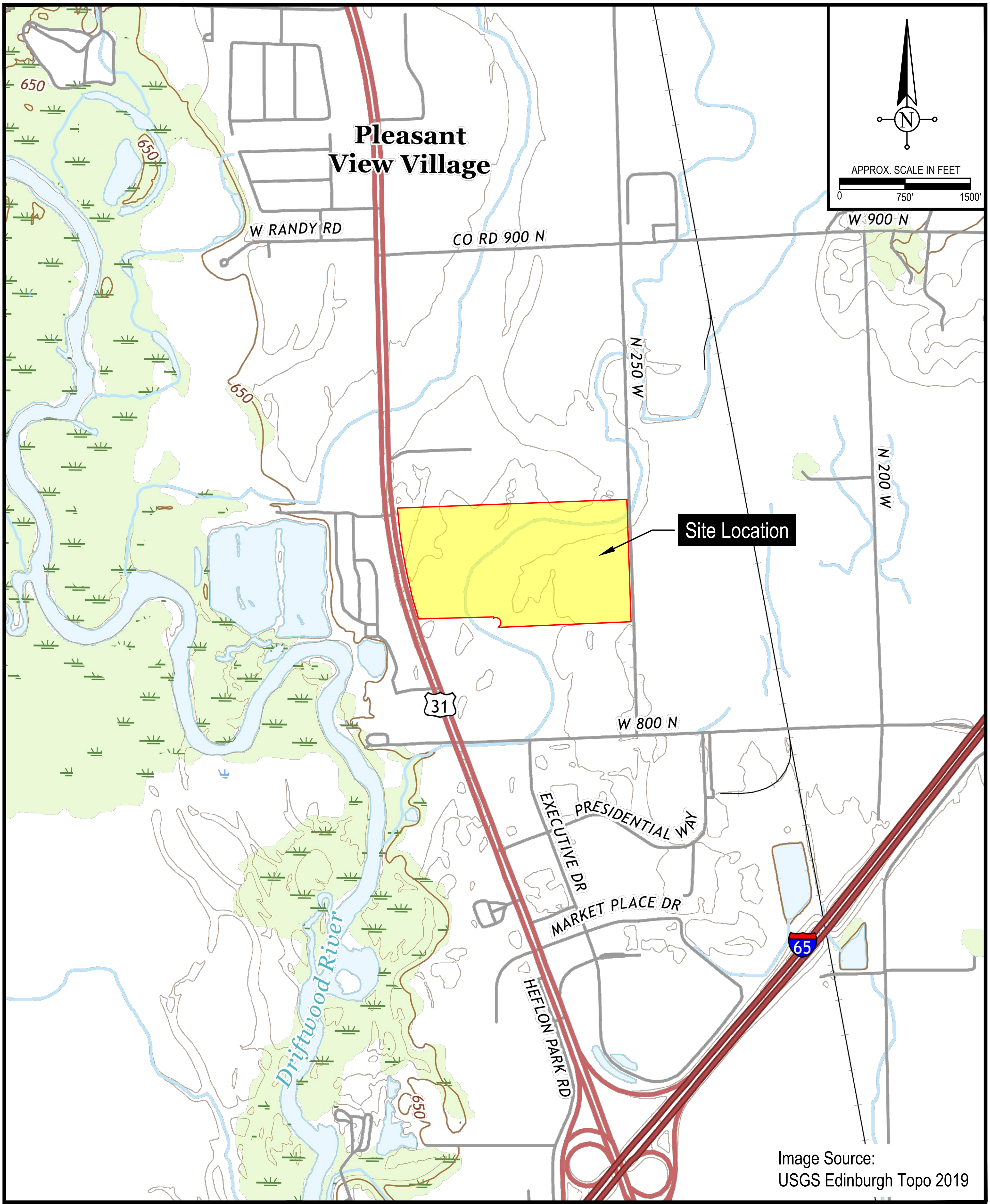


Image Source:
USGS Edinburgh Topo 2019

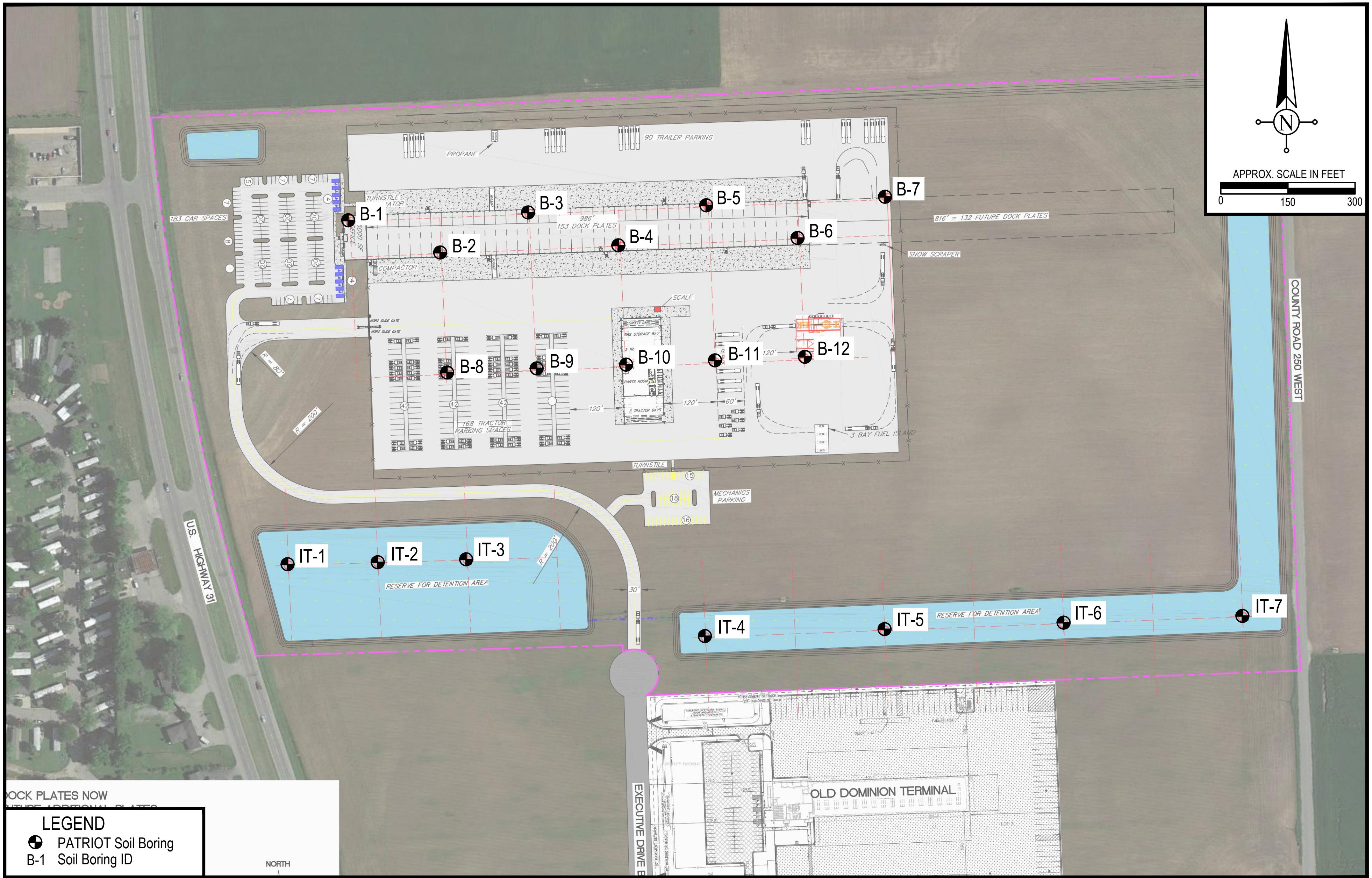
Patriot Engineering &
Environmental, Inc.

Project: Truck Terminal - R&L Carriers
US 31
Edinburgh, Indiana

	Drawn By: J. DuMond
Project Number: 20-0986-01	Approved: L. Young
Date: September 3, 2020	DWG: 20-0986-01_geo

Figure 1

Site Vicinity Map



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NOTES:
1. Boring locations were staked by PATRIOT. All locations are shown as approximate.
2. All locations were determined in the field with references to existing landmarks.
3. Image Source: Google Earth
4. Scale as shown.

Project: Truck Terminal - R&L Carriers
US 31
Edinburgh, Indiana

Project Number: 20-0986-01
Date: September 3, 2020
Drawn By: J. DuMond
Approved: L. Young
DWG: 20-0986-01_geo

Figure 2

Soil Boring Location Map

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LOG OF BORING B-1

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 19.0 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, slightly moist, stiff, SILTY CLAY with some gravel	1	78	4/6/9		14	
5 10		SP-SM		Brown, slightly moist, loose to medium dense, fine to medium grained, SAND with trace siilt and trace gravel	2 3 4	83 78 83	3/4/2 2/3/5 4/8/3			
15		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and little gravel	5	83	14/10/10			
20	▼	SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	22	10/12/11			Boring caved to 19 feet upon auger removal.
25		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	7	72	7/7/6			

Boring terminated at 25 feet.

30

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LOG OF BORING B-2

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
- ▼ During Drilling - 18.5 feet
- ▽ After Completion - Dry
- ◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, slightly moist, medium stiff, SILTY CLAY with trace sand and trace gravel	1	89	2/3/2		15	
5		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	2	50	1/1/WOH			WOH - Weight of Hammer
		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt	3	100	2/2/3			
10		SP-SM		Brown, slightly moist, medium dense, medium grained, SAND with trace silt and trace gravel	4	89	8/8/10			
15					5	89	12/12/11			
20	▼	SP-SM		Brown, saturated, loose to medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	83	3/3/6			Boring caved to 19.0 feet upon auger removal.
25					7	67	18/8/9			
30				Boring terminated at 25 feet.						

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LOG OF BORING B-3

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 18.5 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, moist, stiff, SILTY CLAY with trace sand and trace gravel	1	78	2/4/5	2.25	20	
		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	2	83	2/1/3			
5										
					3	83	3/2/2			
		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	4	83	6/9/12			
10										
					5	94	9/6/8			
15										Boring caved to 17 feet upon auger removal.
	▼	SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	67	8/7/6			
20										
		SP-SM		Brown, saturated, medium dense, medium grained, SAND and gravel with trace silt	7	50	7/9/9			
25				Boring terminated at 25 feet.						
30										

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LOG OF BORING B-4

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 18.5 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (12")						
		CL	Brown, moist, medium stiff to stiff, SILTY CLAY with trace sand	1	67	2/3/4	1.75	21.2	
		SP-SM	Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	2	94	2/1/1			
5				3	89	1/1/1			
				4	78	2/1/3			
10									
		SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	5	89	18/13/10			
15									
	▼								Boring caved to 17.75 feet upon auger removal.
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	67	8/7/6			
20									
				7	61	6/7/8			
25			Boring terminated at 25 feet.						
30									

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LOG OF BORING B-5

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - Dry
▽ After Completion - 16.5 feet
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, moist, soft, SILTY CLAY with little sand	1	33	3/2/2		17	
5					2	33	2/2/2		18	
		SP-SM		Brown, slightly moist, medium dense to dense, fine to medium grained, SAND with trace silt and trace gravel	3	83	15/14/16			
					4	89	15/12/13			
10										
					5	89	19/17/15			
15										
	▽									Boring caved to 16.5 feet upon auger removal.
		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	56	8/7/6			
20										
					7	39	7/9/7			
25										
				Boring terminated at 25 feet.						
30										

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LOG OF BORING B-6

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 13.5 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (12")						
		CL	Brown, slightly moist, medium stiff, SILTY CLAY with trace sand	1	28	3/3/3		14	
5		SP-SM	Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	2	83	1/2/1			
		SP-SM	Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	3	67	4/4/5			
10		SP-SM	Brown, slightly moist, loose, fine to medium grained, SAND with trace silt	4	89	9/5/5			Boring caved to 12 feet upon auger removal.
15	▼	GP-GM	Brown, saturated, medium dense, GRAVEL with trace sand and trace silt	5	78	7/8/8			
20		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	67	11/9/11			
25		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	7	67	10/14/16			
30			Boring terminated at 25 feet.						

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LOG OF BORING B-7

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 13.5 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, moist, soft, SILTY CLAY with trace sand	1	89	1/2/2		21	
5		CL		Brown, moist, stiff, SILTY CLAY with trace sand and trace gravel	2	100	6/7/7		23	
		CL		Brown, moist, soft, SILTY CLAY with trace sand and trace gravel	3	100	2/1/3		16	
10		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	4	83	1/1/2			
15	▼	SP-SM		Brown, saturated, loose, fine to medium grained, SAND with trace silt and trace gravel	5	83	5/4/4			Boring caved to 14 feet upon auger removal.
20		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	61	4/6/10			
					7	56	7/8/8			
25				Boring terminated at 25 feet.						
30										

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LOG OF BORING B-8

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - Dry
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, moist, medium stiff to stiff, SILTY CLAY with trace sand	1	100	1/2/3	2.0	16	
5					2	67	2/3/4	1.75	21	
		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt	3	33	W/O/H			WOH - Weight of Hammer
10		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	4	44	W/O/H			Boring caved to 13.25 feet upon auger removal.
15		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	5	94	7/8/8			
				Boring terminated at 15 feet.						Groundwater was not encountered during drilling, nor upon completion.
20										
25										
30										

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LOG OF BORING B-9

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name	: R&L Carriers	Driller	: C. Dolan
Project Number	: 20-0986-01G	Sampling	: Splitspoon
Logged By	: L. Young		
Start Date	: 8/17/2020		
Drilling Method	: HSA		

Water Levels
▼ During Drilling - Dry
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt	1	83	5/5/4			
5		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	2	89	8/8/10			
					3	100	10/7/10			
					4	83	8/6/6			
10				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15										
20										
25										
30										

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LOG OF BORING B-10

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 13.5 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, moist, medium stiff, SILTY CLAY with trace sand	1	44	2/3/2		19	
5		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	2	56	1/2/2			
		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	3	78	3/4/4			
10		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt	4	89	7/7/8			Boring caved to 12 feet upon auger removal.
15	▼	SP-SM		Brown, saturated, loose, fine to medium grained, SAND with trace silt and trace gravel	5	67	6/3/4			
20		SP-SM		Brown, saturated, very loose, fine to medium grained, SAND with trace silt and trace gravel	6	89	1/WOH/1			WOH - Weight of Hammer
25		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	7	67	7/8/8			
30				Boring terminated at 25 feet.						

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LOG OF BORING B-11

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name	: R&L Carriers	Driller	: C. Dolan
Project Number	: 20-0986-01G	Sampling	: Splitspoon
Logged By	: L. Young		
Start Date	: 8/17/2020		
Drilling Method	: HSA		

Water Levels
▼ During Drilling - Dry
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	1	78	3/3/3			
5		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	2	94	7/10/10			
					3	89	14/10/7			
					4	89	10/10/9			
10				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15										
20										
25										
30										

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LOG OF BORING B-12

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - Dry
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			▤	TOPSOIL (12")						
		CL	▨	Brown, moist, stiff, SILTY CLAY with trace sand	1	78	3/2/3		22.3	
		SP-SM	░	Brown, slightly moist, loose to medium dense, fine to medium grained, SAND with trace silt and trace gravel	2	94	5/5/4			
5					3	83	7/9/11			
					4	94	13/9/9			
10				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15										
20										
25										
30										

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LOG OF BORING IT-1

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Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - Dry
▽ After Completion - 18.0 feet
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			▤	TOPSOIL (12")						
		CL	▨	Brown, moist, medium stiff, SILTY CLAY with trace sand	1	78	2/3/5		16	
5		SP-SM	▥	Brown, slightly moist, loose to very loose, fine to medium grained, SAND with silt and trace gravel	2	89	2/3/3			
					3	22	W/O/H			WOH - Weight of Hammer
10					4	78	W/O/H			
15	▽	SP-SM	▥	Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	5	78	2/4/8			
20		SP-SM	▥	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	67	5/5/6			Boring caved to 18.5 feet upon auger removal.
25										
30										

Boring terminated at 20 feet.

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LOG OF BORING IT-2

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name	: R&L Carriers	Driller	: C. Dolan
Project Number	: 20-0986-01G	Sampling	: Splitspoon
Logged By	: L. Young		
Start Date	: 8/17/2020		
Drilling Method	: HSA		

Water Levels
▼ During Drilling - Dry
▽ After Completion - 18.0 feet
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, moist, medium stiff, SILTY CLAY with trace silt and trace gravel	1	33	2/4/3		19	
5		SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	2	37	1WOH/1			WOH - Weight of Hammer
10		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	3 4	37 78	4/3/2 4/5/5			
15	▽	SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	5	72	13/12/15			
20		SP-SM		Brown, saturated, loose, fine to medium grained, SAND with little gravel and trace silt	6	67	7/4/6			Boring caved to 18.5 feet upon auger removal.
				Boring terminated at 20 feet.						
25										
30										

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LOG OF BORING IT-3

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - Dry
▽ After Completion - 15.0 feet
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (12")						
		SP-SM	Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	1	67	1/2/1			
5		SP-SM	Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	2	89	3/4/3			
		SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	3	83	7/6/6			
10				4	83	4/5/6			
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	5	78	4/5/6			
15	▽								Boring caved to 15.5 feet upon auger removal.
20				6	83	8/9/6			

Boring terminated at 20 feet.

25

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LOG OF BORING IT-4

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name	: R&L Carriers	Driller	: C. Dolan
Project Number	: 20-0986-01G	Sampling	: Splitspoon
Logged By	: L. Young		
Start Date	: 8/17/2020		
Drilling Method	: HSA		

Water Levels
▼ During Drilling - Dry
▽ After Completion - 18.0 feet
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, slightly moist, medium stiff, SILTY CLAY with trace sand and trace gravel	1	61	4/4/3		12	
5		CL		Brown, moist, soft, SILTY CLAY with trace sand and trace gravel	2	100	3/1/1		24	
		SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace sand and trace gravel	3	78	4/8/9			
10					4	78	9/8/11			
15					5	78	18/12/13			
	▽									Boring caved to 18 feet upon auger removal.
20		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	78	8/8/8			
				Boring terminated at 20 feet.						
25										
30										

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LOG OF BORING IT-5

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name : R&L Carriers
Project Number : 20-0986-01G
Logged By : L. Young
Start Date : 8/17/2020
Drilling Method : HSA
Driller : C. Dolan
Sampling : Splitspoon

Water Levels
▼ During Drilling - 17.0 feet
▽ After Completion - Dry
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (12")						
		CL	Brown, slightly moist, stiff, SILTY CLAY with trace sand and trace gravel	1	67	2/5/6		15	
5		CL	Brown, moist, soft to very soft, SILTY CLAY with trace sand and trace gravel	2	78	3/3/1		17	
				3	28	WOH/1/3		22	WOH - Weight of Hammer
10		SP-SM	Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	4	50	7/7/6			
15				5	83	20/16/9			
	▼								Boring caved to 17 feet upon auger removal.
		SP-SM	Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	33	1/4/7			
20			Boring terminated at 20 feet.						
25									
30									

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LOG OF BORING IT-6

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name	: R&L Carriers	Driller	: C. Dolan
Project Number	: 20-0986-01G	Sampling	: Splitspoon
Logged By	: L. Young		
Start Date	: 8/17/2020		
Drilling Method	: HSA		

Water Levels
▼ During Drilling - Dry
▽ After Completion - 17.0 feet
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, slightly moist, medium stiff, SILTY CLAY with trace sand and trace gravel	1	67	3/4/3		15	
				Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	2	67	4/6/7			
5					3	67	6/6/7			
					4	83	12/13/13			
10		SP-SM								
15					5	67	9/8/9			
	▽									Boring caved to 17 feet upon auger removal.
		SP-SM		Brown, saturated, loose, fine to medium grained, SAND with trace silt and trace gravel	6	67	5/3/5			
20										

Boring terminated at 20 feet.

25

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LOG OF BORING IT-7

(Page 1 of 1)

Truck Terminal - R&L Carriers
Edinburgh, IN

Client Name	: R&L Carriers	Driller	: C. Dolan
Project Number	: 20-0986-01G	Sampling	: Splitspoon
Logged By	: L. Young		
Start Date	: 8/17/2020		
Drilling Method	: HSA		

Water Levels
▼ During Drilling - Dry
▽ After Completion - 18.0
◆ After 24 Hours - N/A

Depth (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (12")						
		CL		Brown, slightly moist, medium stiff, SILTY CLAY with trace sand and trace gravel	1	56	3/3/2		15	
5		SP-SM		Brown, slightly moist, loose to medium dense, fine to medium grained, SAND with trace silt and trace gravel	2	72	4/4/4			
					3	72	7/5/5			
10					4	67	5/7/10			
15					5	83	15/15/13			
	▽									Boring caved to 18 feet upon auger removal.
20		SP-SM		Brown, saturated, medium dense, fine to medium grained, SAND with trace silt and trace gravel	6	83	7/7/10			

Boring terminated at 20 feet.

25

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BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM
FIELD CLASSIFICATION SYSTEM
FOR SOIL EXPLORATION

NON COHESIVE SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	-4 blows/ft. or less
Loose	-5 to 10 blows/ft.
Medium Dense	-11 to 30 blows/ft.
Dense	-31 to 50 blows/ft.
Very Dense	-51 blows/ft. or more

Grain Size Terminology

Soil Fraction	**Particle Size**	**US Standard Sieve Size**
Boulders	Larger than 12”	Larger than 12”
Cobbles	3” to12”	3” to 12”
Gravel: Coarse	¾” to 3”	¾” to 3”
Small	4.76mm to ¾”	#4 to ¾”
Sand: Coarse	2.00mm to 4.76mm	#10 to #4
Medium	0.42mm to 2.00mm	#40 to #10
Fine	0.074mm to 0.42mm	#200 to #40
Silt	0.005mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005mm	Smaller than #200

RELATIVE PROPORTIONS FOR SOILS

Descriptive Term	**Percent**
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency	**Unconfined Compressive Strength (tons/sq. ft.)**	**Field Identification (Approx.) SPT Blows/ft.**
Very Soft	Less than 0.25	0 - 2
Soft	0.25 – < 0.5	3 - 4
Medium Stiff	0.5 - < 1.0	5 - 8
Stiff	1.0 - < 2.0	9 -15
Very Stiff	2.0 - < 4.0	16 - 30
Hard	Over 4.0	> 30

Classification on logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0” O.D., $1^{3/8}$” I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for **Patriot** to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.).

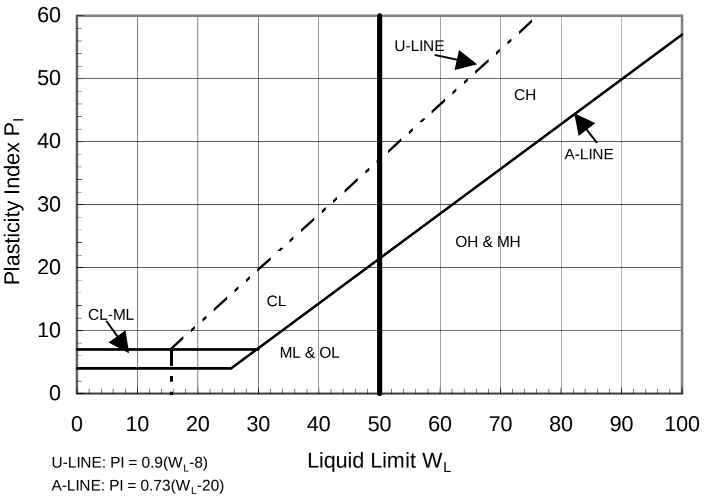
Strata Changes - In the column “Soil Descriptions” on the drill log the horizontal lines represent strata changes. A solid line (———) represents an actually observed change, a dashed line (- - - - - -) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

Groundwater symbols: ▼-observed groundwater elevation, encountered during drilling; ∇-observed groundwater elevation upon completion of boring.

Unified Soil Classification System

Major Divisions			Group Symbol		Typical Names	Classification Criteria for Coarse-Grained Soils		
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U \geq 4$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{D^2_{30}}{D_{10} D_{60}}$
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW (C_U < 4 or 1 > C_C > 3)		
		Gravels with fines (appreciable amount of fines)	GM	d u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or P_I< 4	Above A line with 4 < P_I < 7 are borderline cases requiring use of dual symbols	
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above A line or P_I > 7		
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_U \geq 6$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{(D_{30})^2}{D_{10} D_{60}}$
			SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW (C_U < 6 or 1 > C_c > 3)		
		Sands with fines (appreciable amount of fines)	SM	d u	Silty sands, sand-silt mixtures	Atterberg limits below A line or P_I < 4	Limits plotting in hatched zone with 4 ≤ P_I ≤ 7 are borderline cases requiring use of dual symbols	
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above A line with P_I > 7		
Fine-grained soils (more than half of material is smaller than No. 200)	Silt and clays (liquid limit <50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP More than 12% - GM, GC, SM, SC 5-12% - Borderline cases requiring dual symbols		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (liquid limit >50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays or high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		PT		Peat and other highly organic soils			



Plasticity Chart

APPENDIX B

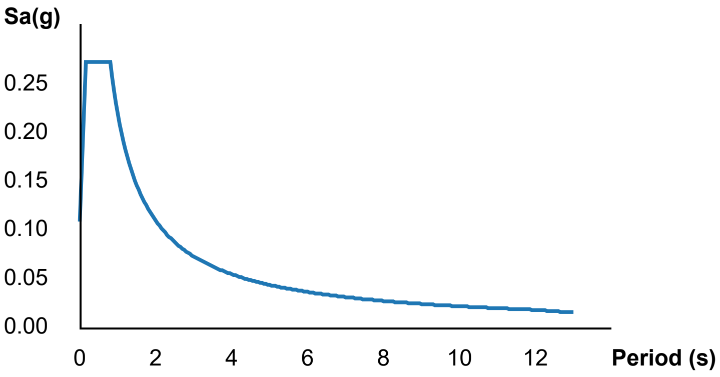
SEISMIC SITE CLASS EVALUATION

ATC Hazards by Location

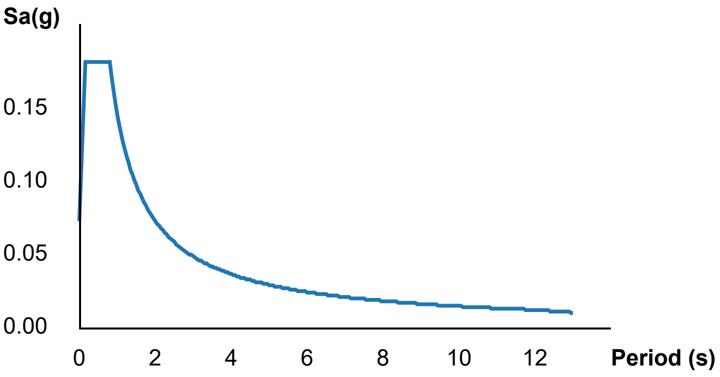
Search Information

Coordinates:	39.32236981541132, -85.96660910644528
Elevation:	658 ft
Timestamp:	2020-09-02T15:05:34.310Z
Hazard Type:	Seismic
Reference Document:	IBC-2012
Risk Category:	II
Site Class:	D

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.171	MCE_R ground motion (period=0.2s)
S_1	0.092	MCE_R ground motion (period=1.0s)
S_{MS}	0.273	Site-modified spectral acceleration value
S_{M1}	0.22	Site-modified spectral acceleration value
S_{DS}	0.182	Numeric seismic design value at 0.2s SA
S_{D1}	0.146	Numeric seismic design value at 1.0s SA

▾Additional Information

Name	Value	Description
SDC	C	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.904	Coefficient of risk (0.2s)

CR_1	0.864	Coefficient of risk (1.0s)
PGA	0.078	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.125	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.171	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.189	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.092	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.106	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.6	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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APPENDIX C

Pavement Design Evaluation and Design Sections

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: Truck Terminal - R&L Carriers
Route:
Location: Edinburgh, Indiana
Owner/Agency:
Design Engineer:

Flexible Pavement Design/Evaluation

Structural Number	2.51		**Subgrade Resilient Modulus**	3,750.00	**psi**
Total Flexible ESALs	50,000		**Initial Serviceability**	4.20	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	**Layer Coefficient**	**Drainage Coefficient**	**Layer Thickness**	**Layer SN**
Asphalt Cement Concrete	0.39	0.40	1.50	0.23
Asphalt Cement Concrete	0.36	0.40	3.50	0.50
Crushed Stone Base	0.34	0.40	6.00	0.82
			ΣSN	1.55

Wednesday, September 9, 2020 9:55:27AM

Engineer: ____________________

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Rigid Design Inputs

Project Name: Truck Terminal - R&L Carriers
Route:
Location: Edinburgh, Indiana
Owner/Agency:
Design Engineer:

Rigid Pavement Design/Evaluation

Concrete Thickness	10.85	**inches**	**Load Transfer Coefficient**	3.20	
Total Rigid ESALs	16,800,000		**Modulus of Subgrade Reaction**	75	**psi/in.**
Reliability	80.00	**percent**	**Drainage Coefficient**	1.00	
Overall Standard Deviation	0.35		**Initial Serviceability**	4.50	
Flexural Strength	580	**psi**	**Terminal Serviceability**	2.00	
Modulus of Elasticity	3,600,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	0.0
Unadjusted Modulus of Subgrade Reaction	0
Depth to Rigid Foundation	0.00
Loss of Support Value (0,1,2,3)	0.0

Modulus of Subgrade Reaction	75	**psi/in.**

Vednesday, September 9, 2020 9:55:26AM

Engineer: ______________________

APPENDIX D

GENERAL QUALIFICATIONS

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

GENERAL QUALIFICATIONS

of Patriot Engineering's Geotechnical Engineering Investigation

This report has been prepared at the request of our client for his use on this project. Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test borings logs regarding vegetation types, odors or staining of soils, or other unusual conditions observed are strictly for the information of our client and the owner.

This report may not contain sufficient information for purposes of other parties or other uses. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field and laboratory data presented in this report. Should there be any significant differences in structural arrangement, loading or location of the structure, our analysis should be reviewed.

The recommendations provided herein were developed from the information obtained in the test borings, which depict subsurface conditions only at specific locations. The analysis, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our exploration. Subsurface conditions at other locations may differ from those occurring at the specific drill sites. The nature and extent of variations between borings may not become evident until the time of construction. If, after performing on-site observations during construction and noting the characteristics of any variation, substantially different subsurface conditions from those encountered during our explorations are observed or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

We urge that Patriot be retained to review those portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of the foundations, and such other field observations as may be necessary.

In order to fairly consider changed or unexpected conditions that might arise during construction, we recommend the following verbiage (Standard Clause for Unanticipated Subsurface Conditions) be included in the project contract.

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

"The owner has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during construction operations that the contractor encounters conditions that are different than those anticipated by the soils consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contract agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in <u>ASCE Construction Division Journal</u>, No. CO2, September 1964, page 37.