rubino
ENGINEERING INC.

REPORT TRANSMITTAL

January 19th, 2017

To: Brian J. Dusak, P.E., CFM
Engineering Resource Associates, Inc.
3s701 West Avenue, Suite 150
Warrenville, IL 60555
Phone: 630.393.3060

Re: **Geotechnical Engineering Services Report**
87th & Woodward Street Reconstruction
87th Street and Woodward Avenue
Woodridge, Illinois

Rubino Report No. G16.152

Via email: bdusak@eraconsultants.com

Dear Mr. Dusak,

Rubino Engineering, Inc. (Rubino) is pleased to submit our Geotechnical Engineering Services Report for the proposed 87th & Woodward Design Engineering in Woodridge, Illinois.

Report Description

Enclosed is the Geotechnical Services Report including results of field and laboratory testing, as well as recommendations for pavement design, and general site development.

Authorization and Correspondence History

- Rubino Proposal No. Q14.232g dated September 12th, 2014; Signed and authorized by Brian J. Dusak of Engineering Resource Associates, Inc. on October 31st, 2016.

Closing

Rubino appreciates the opportunity to provide geotechnical services for this project and we look forward to continued participation during the design and in future construction phases of this project.

If you have questions pertaining to this report, or if Rubino may be of further service, please contact our office at (847) 931-1555.

Respectfully submitted,
RUBINO ENGINEERING, INC.

Michelle A. Lipinski, PE
President

michelle.lipinski@rubinoeng.com

MAL/file/ Enclosures

Geotechnical Engineering Services Report

Drilling
Laboratory Testing
Geotechnical Analysis

87TH & WOODWARD STREET RECONSTRUCTION

87TH STREET AND WOODWARD AVENUE

WOODRIDGE, ILLINOIS

RUBINO PROJECT NO. G16.152

PREPARED BY:

rubino ENGINEERING INC.

Michelle A. Lipinski, PE
President
IL No. 062-061241, Exp. 11/30/17

PREPARED FOR:

ENGINEERING RESOURCE ASSOCIATES, INC.

3S701 WEST AVENUE, SUITE 150

WARRENVILLE, IL 60555

JANUARY 19TH, 2017

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PROJECT INFORMATION

Rubino understands that DuPage County Division of Transportation is planning to reconstruct 87th Street at Woodward Avenue in Woodridge, Illinois

Documents received:

- "87th Woodward Proposed Boring Locations" – prepared by Engineering Resource Associates, Inc.

Project Correspondence:

- RFP Email from Brian J. Dusak of Engineering Resource Associates, Inc. on September 9th, 2014.

The geotechnical recommendations presented in this report are based on the available project information, and the subsurface materials described in this report. If any of the information on which this report is based is incorrect, please inform Rubino in writing so that we may amend the recommendations presented in this report (if appropriate, and if desired by the client). Rubino will not be responsible for the implementation of our recommendations if we are not notified of changes in the project.

Purpose / Scope of Services

The purpose of this study was to explore the subsurface conditions at the site in order to prepare geotechnical recommendations for the 87th & Woodward Street Reconstruction in Woodridge, Illinois.

Rubino's scope of services included the following drilling program:

Table 1: Drilling Scope

NUMBER OF BORINGS	DEPTH (FEET BEG*)	LOCATION
1	15	87th Street (B-01)
3	10	87th Street (B-02, B-03 and B-04)
3	10	Woodward Avenue (B-05, B-07 and B-08)
1	15	Woodward Avenue (B-06)

*BEG = below existing grade

Representative soil samples obtained during the field exploration program were transported to the laboratory for additional classification and laboratory testing.

This report briefly outlines the following:

- *Summary of client-provided project information and report basis.*
- *Overview of encountered subsurface conditions.*
- *Overview of field and laboratory tests performed including results.*
  - *Geotechnical recommendations pertaining to subgrade preparation and stability.*
- *Construction considerations, including temporary excavation and construction control of water.*

DRILLING, FIELD, AND LABORATORY TEST PROCEDURES

Engineering Resource Associates, Inc. selected the number of borings and the boring depths. Rubino located the borings in the field by using a Garmin GPSMap 64s. The borings were advanced utilizing 3 ¼ inch inside-diameter, hollow stem auger drilling methods and soil samples were routinely obtained during the drilling process.

Selected soil samples were tested in the laboratory to determine material properties for this report. Drilling, sampling, and laboratory tests were accomplished in general accordance with ASTM procedures. The following items are further described in the Appendix of this report.

- *Field Penetration Tests and Split-Barrel Sampling of Soils*
- *Field Water Level Measurements*
- *Laboratory Determination of Water (Moisture) Content of Soil by Mass (ASTM D2216)*
- *Laboratory Organic Content by Loss on Ignition (ASTM D2974)*

The laboratory testing program was conducted in general accordance with applicable ASTM specifications. The results of these tests are to be found on the accompanying boring logs located in the Appendix.

EXECUTIVE SUMMARY OF GEOTECHNICAL CONSIDERATIONS

The main geotechnical design and construction considerations at this site are:

- **Asphalt** thicknesses ranged between 11 and 14 inches. **Subbase Stone** thicknesses ranged between 4 and 5 inches. See *Surface Conditions* section for more detailed information.
  - **Subbase stone** is an important part of the pavement structure and an increase in subbase stone should be incorporated into the new pavement design. See *Subbase Stone Recommendations* section for more detailed information.
- **Subgrade soils** generally consisted of silty clay soils to a depth of approximately 15 feet below existing grade. See *Subsurface Conditions* section for more detailed information.

  - Subgrade soils were classified as silty clay or clayey silt and based on laboratory testing, generally fall into the high to very high "frost susceptible" category.
  - Tree roots were encountered in boring B-04; however, there is a possibility that the roots could be encountered at other locations on the site. See Boring Logs in the Appendix for more detailed information.

- **Subgrade soils** may **not** pass a proofroll if exposed at the time of construction. Rubino recommends that the DuPage County Division of Transportation plan for a 12 inch undercut with fabric as a contingency for failed proofrolls. See *Pavement Subgrade Preparation* and *Subgrade Stability Recommendations* section for more detailed information.

The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The general site locations of exploration included 87th Street from Havens Drive to the DuPage County Limits and Woodward Avenue from 83rd Street to Union Street in Woodridge, Illinois.

87th Street from the Havens Drive to DuPage County limits:

- Eastern Project Limit Latitude / Longitude (Havens Drive): 41° 43' 43.87"N / 88° 01' 26.13"W
- Western Project Limit Latitude / Longitude (DuPage County Limits): 41° 43' 36.21"N / 88° 01' 49.77"W

Woodward Avenue from the 83rd Street to Union Street:

- Northern Project Limit Latitude / Longitude (83rd Street): 41° 44' 10.07"N / 88° 01' 50.03"W
- Southern Project Limit Latitude / Longitude (Union Street): 41° 43' 31.97"N / 88° 01' 38.74"W

The soil borings were taken within the existing pavement and the map below shows the general site location:

Surface Conditions

The borings were performed within the existing pavement and the surface conditions generally consisted of the following:

Table 2: Surface Conditions Summary

Boring – 01 (87th Street)	Boring – 02 (87th Street)	Boring – 03 (87th Street)
Total Thickness = 12 inches	Total Thickness = 12 inches	Total Thickness = 14 inches
Hot Mix Asphalt = 12 in.	Hot Mix Asphalt = 12 in.	Hot Mix Asphalt = 14 in.
Subbase Stone = 4 inches	Subbase Stone = 4 inches	Subbase Stone = 4 inches

Boring – 04 (87th Street)	Boring – 05 (Woodward Avenue)	Boring – 06 (Woodward Avenue)
Total Thickness = 11 inches	Total Thickness = 11 inches	Total Thickness = 12 inches
Hot Mix Asphalt = 11 in.	Hot Mix Asphalt = 11 in.	Hot Mix Asphalt = 12 in.
Subbase Stone = 4 inches	Subbase Stone = 5 inches	Subbase Stone = 5 inches

Boring – 07 (Woodward Avenue)	Boring – 08 (Woodward Avenue)
Total Thickness = 13 inches	Total Thickness = 11 inches
Hot Mix Asphalt = 13 in.	Hot Mix Asphalt = 11 in.
Subbase Stone = 5 inches	Subbase Stone = 5 inches

The above referenced thicknesses are considered approximate and based on visual classifications. Pavement and sub-base type and thickness may vary between boring locations.

Subsurface Conditions

Beneath the existing surficial pavement, subsurface conditions generally consisted of brown to gray, silty clay soils.

- The native **silty clay** soils were generally medium stiff to hard in consistency with softer soils observed in some borings.

Table 3: Subsurface Conditions Summary

Depth Range (ft)	Soil Description	SPT N-values (blows per foot)	Moisture Content (%)	Estimated Shear Strength (psf)
87th Street / Borings B-01 to B-04				
1 – 5 ft.	Medium stiff to very stiff silty CLAY	5 - 20	14 – 31	700 – 3,000 psf
5 – 15 ft.	Medium stiff to very stiff silty CLAY	7 - 22	13 - 27	1,000 – 3,300 psf

DEPTH RANGE (FT)	SOIL DESCRIPTION	SPT N-VALUES (BLOWS PER FOOT)	MOISTURE CONTENT (%)	ESTIMATED SHEAR STRENGTH (PSF)
Woodward Avenue / Borings B-05 to B-08				
1 – 5 ft.	Medium stiff to stiff silty CLAY	6 – 14	16 - 20	900 – 2,100 psf
5 – 15 ft.	Stiff to hard silty CLAY	4	32	600 psf
8 ½ - 13 ½ ft.	Soft to medium stiff silty CLAY (B-06)	10 - 31	13 – 24	1,500 – 3,500 psf

The native soils were visually classified as silty clay (CL) according to the Unified Soil Classification System (USCS). The above table is a general summary of subsurface conditions. Please refer to the boring logs for more detailed information.

Estimated shear strength of clay soils is based on empirical correlations using N-values, moisture content, and unconfined compressive strength.

Groundwater Conditions

Free groundwater was not observed to collect in the borehole during the drilling operations. However, the moisture contents of the fine-grained soils indicate that the soils are at or near saturation. Additionally, the transition of soil color from brown to gray can sometimes indicate a "seasonal high" groundwater within plus or minus 3 feet. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project.

EVALUATION AND RECOMMENDATIONS

The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

Subgrade Stability Recommendations

Potentially unstable soil should be tested with a static cone penetrometer and treated in accordance with Article 301.04 of the standard specifications and undercut guidelines in the IDOT Subgrade Stability Manual.

If unsuitable soils are removed and the area is still wet or unstable, the underlying soils may be stabilized by "walking-in" consecutive layers of approximately 6 inches of 3-inch stone placed on the subgrade until the voids of the 3-inch stone are filled with the soft soil. Construction grades may then be established using CA-6 stone, or the native soils following moisture conditioning. A layer of geotextile should be placed between the 3-inch stone / clay mixture and an open-graded stone, if applicable.

Dewatering Recommendations

Groundwater was not encountered in the borings; however, dewatering may be necessary during trench excavation of saturated clay soils. Shoring or trench boxes may be required where the soils are saturated.

Subgrade Stability Recommendations

The recommendations located in this report are based on the data obtained at each particular soil boring location. Soil subgrade stability may vary in the field between the borings and could be affected by the weather at the time of construction.

- Subgrade with an **IBV value of 5 or less** is a candidate for remediation.
- Optional remedial activities are specified for subgrade with an IBV values between 6 and 8.
- Subgrade with a moisture content exceeding 18% and an organic content exceeding 8% may be a candidate for remedial action.
- Remedial work for unstable subgrade should be performed in accordance with Section 301 of the IDOT Standard Specifications for Road and Bridge Construction (2016). Rubino recommends that the removal of unstable/unsuitable soils be replaced with coarse aggregate.
- See the IBV Based Remedial Action Chart from the IDOT Subgrade Stability Manual (2005) below.

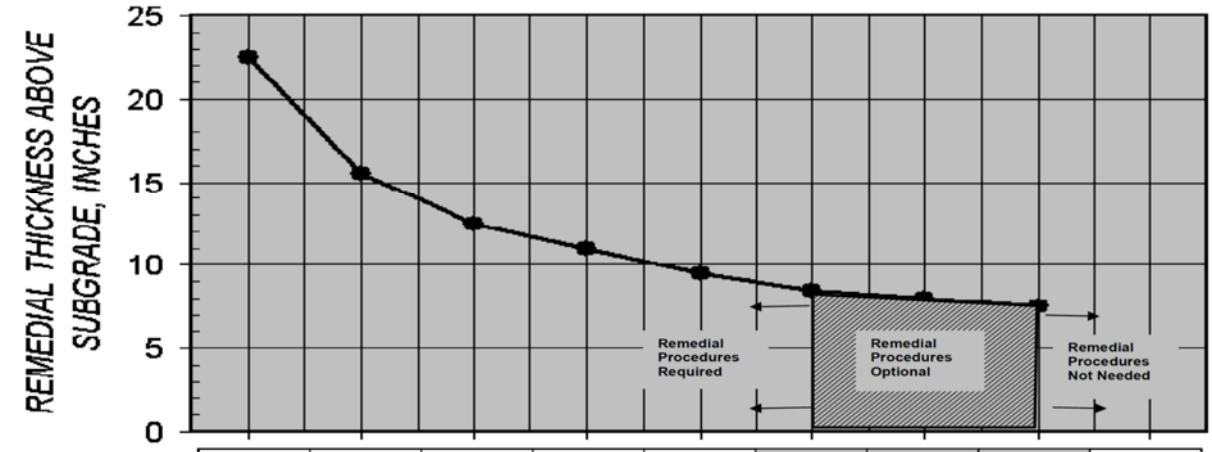
Based on the above criteria, the following boring locations have been highlighted for potential subgrade stabilization:

LOCATION	BORING NO.	ESTIMATED UNDERCUT THICKNESS (IN)*	IBV VALUE	GEOTECHNICAL CONSIDERATIONS FOR REMEDIAL ACTION
87th Street	B-01	0 – 12	4 – 6	Remedial action optional
87th Street	B-02	0 – 12	4 – 5	Remedial action optional
87th Street	B-03	6 – 12	4 – 5	**Moisture content exceeding 18%**
87th Street	B-04	0 – 24	1 – 8	**Moisture content exceeding 18%**
Woodward Avenue	B-05	6 – 12	3 – 4	**Moisture content exceeding 18%**
Woodward Avenue	B-06	0 – 12	4	Remedial action optional
Woodward Avenue	B-07	12 – 18	2 – 3	**Moisture content exceeding 18%**
Woodward Avenue	B-08	6 - 18	2 - 5	**Moisture content exceeding 18%**

*Estimated undercut thickness is intended to be in addition to the IDOT-recommended 12 inches of subbase stone or improved subgrade layer.

If the subgrade soils will be exposed as part of a reconstruction project, the following table summarizes estimated undercut thicknesses based on the IDOT Subgrade Stability Manual (2005). Final undercut thicknesses should be determined in the field by performing penetrometer testing and a proofroll testing once the soils are exposed during construction.

Rubino recommends that undercuts be performed in as uniform a manner a possible so as to not create pockets of stone that could collect water with no drainage. Positive drainage should be maintained at both the subgrade and surface elevations.



IBV	1	2	3	4	5	6	7	8	9
Cone Index(CI)	40	80	120	160	200	240	280	320	360
Shear Strength (psi)	2.25	4.50	6.75	9.00	11.25	13.50	15.75	18.00	20.25
Qu (tsf)	0.32	0.64	1.00	1.28	1.60	1.94	2.24	2.56	2.88
Rate (in./Blow)	4.6	2.6	2.0	1.5	1.3	1.1	1.0	0.9	0.8
Rate (Blows/6")	1.3	2.3	3.0	4.0	4.6	5.5	6.0	6.7	7.5
Treatment Thickness	22.5	15.5	12.5	11	9.5	8.5	8	7.5	0

Figure A-2. Thickness design as a function of IBV, CI, Shear Strength, and Q_u for subgrade treatment (granular backfill or modified soil).

Pavement Subgrade Preparation

Rubino recommends that unsuitable soils or deleterious materials be removed from the construction area, as applicable. Unsuitable soils or deleterious materials can be described as, but are not limited to:

- Organic soil / topsoil / plants / trees / shrubs / grass
- Frozen soil
- Existing asphalt or concrete pavement sections
- Concrete curb & gutter

Stripping operations should extend a minimum of 5 feet beyond proposed pavement limits where property limits allow. The geotechnical engineer should be notified if there are property boundary limitations. Stripping operations should be monitored and documented by a representative of the geotechnical engineer at the time of construction

Prior to paving, the prepared subgrade should be proofrolled using a loaded tandem axle dump truck or similar type of pneumatic tired equipment with a minimum gross weight of 9 tons per single axle. Localized soft areas identified should be repaired prior to paving. Moisture content of the subgrade be maintained between -2% and +3% of the optimum at the time of paving. It may require rework when the subgrade is either desiccated or wet.

Areas of low support or soft spots should be tested with either a Static Cone Penetrometer (SCP) or Dynamic Cone Penetrometer (DCP). The results of the DCP or SCP tests should be evaluated according to the IDOT Subgrade Stability Manual (2005), to determine the necessary depth of corrective action.

Please note that clay subgrade soils are sensitive to moisture and can be easily disturbed by precipitation, groundwater, or construction equipment. Therefore, extra care should be used to avoid disturbing these soils during construction activities.

If cohesive soils become wet or unstable during construction, or if near surface soft subgrade soils are encountered, it is recommended that coarse aggregate be placed on the subgrade until a stable base for compaction of fill is achieved. The coarse aggregate should consist of clean, crushed stone or gravel between ¼ and 3 inches in size. The coarse aggregate should be spread in a maximum of 6-inch layers and consolidated with compaction equipment until it is worked as much as possible into the existing soft or loose soil. This will "lock" up the unstable soil and create a bridging-type affect.

Subbase Stone Recommendations

Due to the current variability of subgrade stone along the parking areas, Rubino recommends that a more consistent subbase thickness of 12 inches of subgrade stone be placed as part of the reconstruction. Where the soil needs to be amended, additional stone can be placed which would increase the subbase stone thickness.

The granular base course should be built at least 2 feet wider than the pavement on each side to support the tracks of the slipform paver. This extra width is structurally beneficial for wheel loads applied at pavement edge.

An IDOT CA-6 aggregate base (IDOT Specifications Handbook, Sec. 1004.1) can be used under the asphalt or concrete pavements. The material should be placed and compacted as discussed in the Appendix of this report.

As an alternative, an open-grade stone, such as CA-7 could be placed and capped with 3 inches of CA-6. When using an open-graded stone, a geotextile should be placed between the subbase stone and the soil subgrade. A drainage system will also aid in increasing the life of the pavement. More information regarding Geotextiles can be found in the Geotechnical Manual, Sections 3.13 and 4.10.

Rubino recommends a drainage system be designed to keep water out of the base material since CA-6 contains fines which could become unstable when saturated. The subbase should be graded to drain water fast to mitigate loss of fines through cracks and pavement. See the *Roadway Drainage and Maintenance* section for more information.

Roadway Drainage and Maintenance

Fine-grained soils can be sensitive to remolding in the presence of water. In the areas of surficial clays, the surface should be maintained in a graded condition to prevent standing water on the subgrade. Appropriate measures may include, but are not limited to:

1. Shaping/pitching the sub-grade to drain toward side drainage ditch along the roadway.
2. Providing proper filtration for runoff waters. Proper drainage of the roadway is mandated by Article 202.05 of the IDOT Standard Specifications for Road and Bridge Construction (2016).
3. Rubino recommends pavements and subgrade be sloped to provide rapid surface and subsurface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature deterioration of pavements, and removal and replacement may be required.
4. Consideration could be given to the use of an interceptor drain to collect and remove water collecting in the granular base.
5. Periodic maintenance of the pavement should be anticipated. This should include sealing of cracks and joints and by maintaining proper surface drainage to avoid ponding of water on or near the pavement area.

CLOSING

The recommendations submitted are based on the available subsurface information obtained by Rubino Engineering, Inc. and design details furnished by Engineering Resource Associates, Inc. for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Rubino should be notified immediately to determine if changes in the foundation recommendations are required. If Rubino is not retained to perform these functions, we will not be responsible for the impact of those conditions on the project.

The scope of services did not include an environmental assessment to determine the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on, or below or around this site. Any statements in this report and/or on the boring logs regarding odors, colors, and/or unusual or suspicious items or conditions are strictly for informational purposes.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Engineering Resource Associates, Inc. and their consultants for the specific application to the proposed 87th & Woodward Street Reconstruction in Woodridge Illinois.

APPENDIX A - *DRILLING, FIELD, AND LABORATORY TEST PROCEDURES*

Penetration Tests and Split-Barrel Sampling of Soils

During the sampling procedure, Standard Penetration Tests (SPT's) were performed at regular intervals to obtain the standard penetration (N-value) of the soil. The results of the standard penetration test are used to estimate the relative strength and compressibility of the soil profile components through empirical correlations to the soils' relative density and consistency. The split-barrel sampler obtains a soil sample for classification purposes and laboratory testing, as appropriate for the type of soil obtained.

Water Level Measurements

Water level observations were attempted during and upon completion of the drilling operation using a 100-foot tape measure. The depths of observed water levels in the boreholes are noted on the boring logs presented in the appendix of this report. In the borings where water is unable to be observed during the field activities, in relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Ground Surface Elevations

At this time, no site-specific elevations were available to Rubino. The depths indicated on the attached boring logs are relative to the existing ground surface for each individual boring at the time of the exploration. Copies of the boring logs are located in the Appendix of this report.

Water (Moisture) Content of Soil by Mass (Laboratory)

The water content is an important index property used in expressing the phase relationship of solids, water, and air in a given volume of material and can be used to correlate soil behavior with its index properties. In fine grained cohesive soils, the behavior of a given soil type often depends on its natural water content. The water content of a cohesive soil along with its liquid and plastic limits as determined by Atterberg Limit testing are used to express the soil's relative consistency or liquidity index.

APPENDIX B - *SITE PREPARATION – CLEARING & GRUBBING*

Rubino recommends that unsuitable soils or fill be removed from the site, as applicable. Unsuitable soils or fills can be described as, but are not limited to:

- organic soil / topsoil / plants / trees / shrubs / grass
- frozen soil
- existing asphalt or concrete pavement sections
- existing foundations
- building debris
- existing curbs

Stripping operations should extend a minimum of: **5** feet beyond proposed pavement limits

Exceptions: where property limits allow. Notify geotechnical engineer if there are property boundary limitations. Stripping operations should be monitored and documented by a representative of the geotechnical engineer at the time of construction.

Proofrolling:

After stripping and excavating to the proposed subgrade level, as required, the paved parking area should be proof-rolled and scarified and compacted to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8 inches below the surface during a period of dry weather.

Proofrolling Equipment:

Tandem-axle dump truck or similar rubber-tired vehicles are acceptable and should be loaded with at least 9 tons per axle.

Benefits of Proofrolling:

- Aids in providing a firm base for compaction of fill soils
- Helps to delineate soft, loose, or disturbed areas that may exist below subgrade level.

Soils which are observed to rut or deflect excessively (typically greater than 1 inch) under the moving load should either be scarified and re-compacted, or undercut and replaced.

- Scarify and re-compact to 95% with a smooth drum vibratory roller for granular soils, a sheepsfoot roller for cohesive soils or
- Undercut in 6 to 12 inch increments and replace with properly compacted and documented structural fill.
    - Clean, 3-inch stone can be worked and incorporated into soft soils to bridge soft areas due to high moisture content.
    - The 3-inch stone should then be capped with a well-graded granular fill (3/4” with fines or CA-6 in Illinois) or compacted and documented fill soils as described in the Fill Placement section of the Appendix.
- The site may require another proofroll and rework when the subgrade becomes either desiccated, wet, or frozen.

APPENDIX C - *FILL RECOMMENDATIONS*

In general, fill materials should meet the following:

- Standard Proctor maximum dry density >100 pcf
- Free of organic or other deleterious materials
- Have a maximum particle size no greater than 3 inches
- Have a liquid limit <45 and plasticity index <25
- Testing should include areas at least 5 feet outside the parking area perimeters, if applicable
- Each lift of compacted, engineered fill should be tested and documented by a representative of the geotechnical engineer prior to placement of subsequent lifts
- If a fine-grained silt or clay soil is used for fill (CL or ML), close moisture content control will be essential to achieve the recommended degree of compaction
- If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying

Suitable Soil Classifications:

CL, SC, GW, and SW will generally be suitable for use as structural fill under pavements.

Unsuitable Soil Classifications:

OL, OH, MH, ML, SM, CH and PT should be considered unsuitable.

Structural fill added to the site shall be evaluated in accordance with the following table:

MATERIAL TESTED	PROCTOR TYPE*-1	MIN % DRY DENSITY	PLACEMENT MOISTURE CONTENT RANGE	FREQUENCY OF TESTING*-2	MAXIMUM LOOSE LIFT HEIGHT
Structural Fill (Cohesive & Well-graded Granular) – Parking	Standard	98%	-2 to +3 %	1 per 2,500 yd^2 of fill placed	8 inches
Random Fill (non-load bearing)	Standard	95%	-3 to +3 %	1 per 5,000 yd^2 of fill placed	8 inches
Utility Trench Backfill	Standard	95%	-2 to +2 %	1 per 50 LF of fill placed	6 inches

*-1 The test frequency for the laboratory reference shall be one laboratory Proctor or Relative Density test for each material used on the site. If the borrow or source of fill material changes, a new reference moisture/density test should be performed.

*-2A minimum of one test per lift is recommended unless otherwise specified.

Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures. The above test frequencies should be discussed with the contractor prior to starting the work.

The geotechnical engineer of record can only certify work that was performed under their direct observation, or under the observation of a competent person under their specific direction.

APPENDIX D - *REPORT LIMITATIONS*

Subsurface Conditions:

The subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data as well as water level information. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur, and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition between layers may be gradual. The samples, which were not altered by laboratory testing, will be retained for up to 60 days from the date of this report and then will be discarded.

Geotechnical Risk:

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools that geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free, and more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations, presented in the preceding section, constitute Rubino's professional estimate of the necessary measures for the proposed structure to perform according to the proposed design based on the information generated and reference during this evaluation, and Rubino's experience in working with these conditions.

Warranty:

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

Federal Excavation Regulations:

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. This federal regulation mandates that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person," as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Rubino is providing this information solely as a service to our client. Rubino is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

APPENDIX E - *SOIL CLASSIFICATION GENERAL NOTES*

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1 3/8" I.D., 2" O.D., unless otherwise noted	PS:	Piston Sample
ST:	Thin-Walled Tube - 3" O.D., Unless otherwise noted	WS:	Wash Sample
PM:	Pressuremeter	HA:	Hand Auger
RB:	Rock Bit	HS:	Hollow Stem Auger
DB:	Diamond Bit - 4", N, B	BS:	Bulk Sample

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler (SS), except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System as defined in ASTM D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu (tsf)			N-Blows/ft.			Consistency
	<	0.25	< 2			Very Soft
0.25	-	0.5	2	-	4	Soft
0.5	-	1	4	-	8	Medium Stiff
1	-	2	8	-	15	Stiff
2	-	4	15	-	30	Very Stiff
4	-	8	30	-	50	Hard
>	-	8	> 50			Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

N-Blows/ft.			Relative Density
0	-	3	Very Loose
4	-	9	Loose
10	-	29	Medium Dense
30	-	49	Dense
50	-	80	Very Dense
		80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND & GRAVEL

Descriptive Term	% of Dry Weight		
Trace		<	15
With	15	-	29
Modifier		>	30

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% of Dry Weight		
Trace		<	5
With	5	-	12
Modifier		>	12

*Descriptive Terms apply to components also present in sample

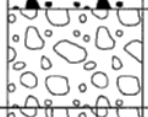
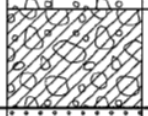
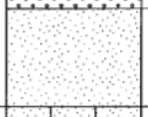
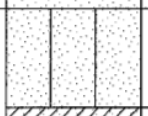
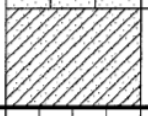
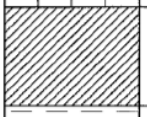
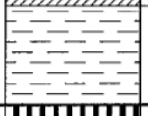
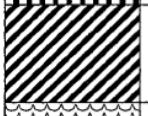
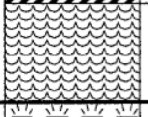
GRAIN SIZE TERMINOLOGY

Major Component	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. To 3 in. (300mm to 75mm)
Gravel	3 in. To #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.75mm)

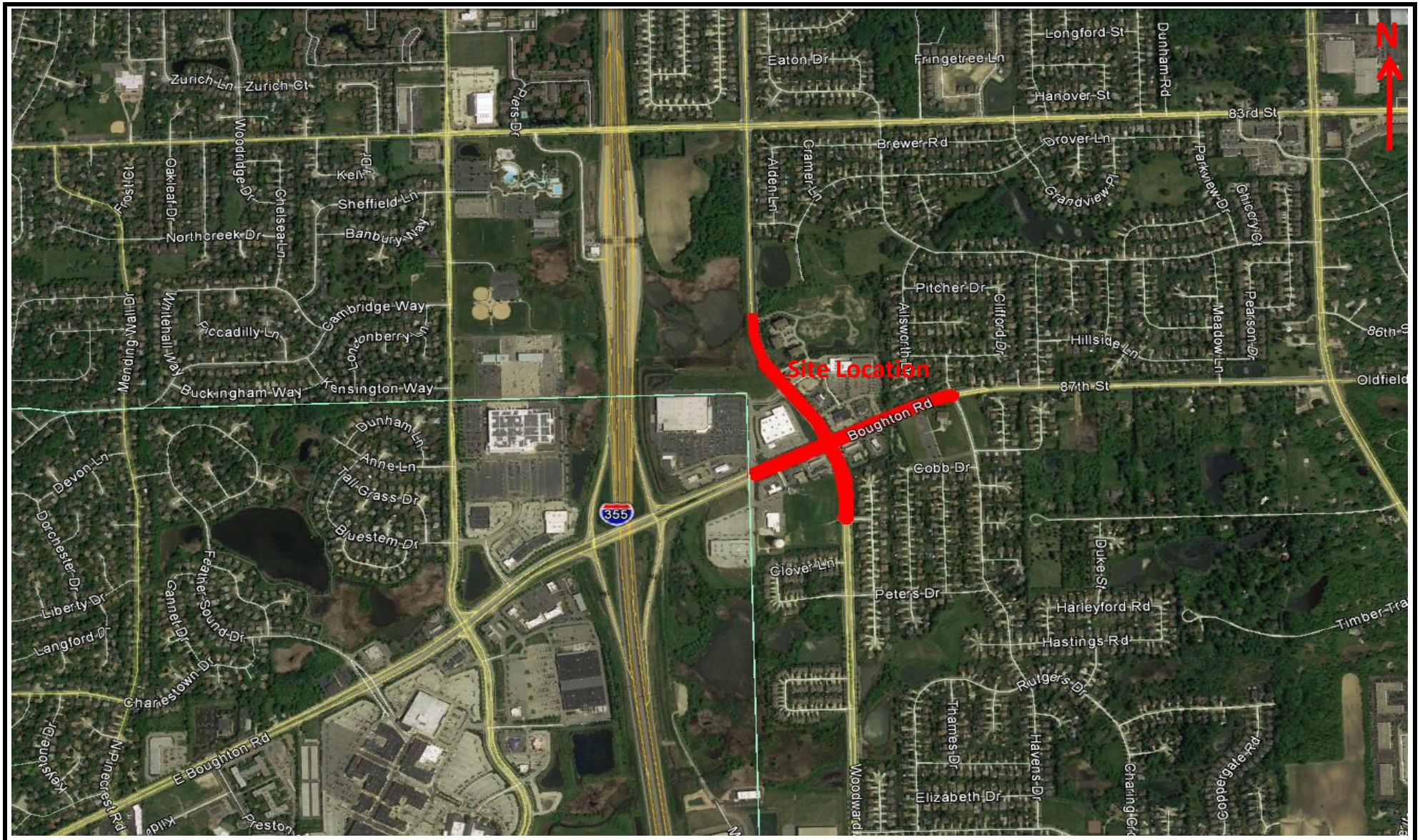
APPENDIX F - *SOIL CLASSIFICATION CHART*

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

APPENDIX G – *SITE VICINITY MAP & BORING LOCATION PLAN*



rubino ENGINEERING INC.

665 Tollgate Rd. Unit H
Elgin, Illinois 60123

Project Name:	87th & Woodward Street Reconstruction
Project Location:	87th Street and Woodward Avenue Woodridge, Illinois
Client:	Engineering Resource Associates, Inc.
Rubino Project # :	G16.152

Site Vicinity Map

rubino ENGINEERING INC.

665 Tollgate Rd. Unit H
Elgin, Illinois 60123

Project Name:	87th & Woodward Street Reconstruction
Project Location:	87th Street and Woodward Avenue Woodridge, Illinois
Client:	Engineering Resource Associates, Inc.
Rubino Project # :	G16.152

Boring Location Plan

APPENDIX H – *BORING LOGS*

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-01

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	87th Street Woodridge, Illinois	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.				

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA / STRENGTH, tsf	Additional Remarks
	0					Approximately 12 inches of ASPHALT					
						Approximately 4 inches of GRAVEL BASE					
				1	18	Brown silty CLAY, trace sand and gravel; Stiff to very stiff	CL	3,4,6 N=10	17		Qp=3.5 tsf LL = 25 PL = 16
				2	18			4,6,9 N=15	16		Qp=4.0 tsf
	5			3	18			4,8,11 N=19	17		Qp=4.0 tsf
				4	18	Gray silty CLAY, trace sand and gravel; Stiff	CL	3,5,6 N=11	13		Qp=3.5 tsf
	10										
				5	18			3,3,6 N=9	16		Qp=2.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.					

STANDARD PENETRATION TEST DATA: Moisture, PL, LL (0, 25, 50); STRENGTH, tsf: Qu, Qp (0, 2.0, 4.0)

Completion Depth:	15.0 ft	Sample Types:	Latitude: 41°43'37.13"N
Date Boring Started:	11/30/16	Auger Cutting; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Texas Cone	Longitude: 88° 1'48.25"W
Date Boring Completed:	11/30/16		Drill Rig: Geoprobe 7822DT
Logged By:	J.W.		Remarks:
Drilling Contractor:	Rubino Engineering, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-02

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	87th Street Woodridge, Illinois	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.				

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA / STRENGTH, tsf	Additional Remarks
	0					Approximately 12 inches of ASPHALT					
						Aproximately 4 inches of GRAVEL BASE					
				1	14	Brown silty CLAY, trace sand and gravel; Stiff to very stiff		5,5,6 N=11	17		Qp=4.0 tsf LL = 30 PL = 17
				2	18		CL	3,5,8 N=13	16		Qp=4.0 tsf
	5			3	18			3,7,10 N=17	18		Qp=4.0 tsf
						Gray silty CLAY, trace sand and gravel; Stiff					
				4	18		CL	3,6,7 N=13	15		Qp=4.0 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.					

STANDARD PENETRATION TEST DATA: Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf: Qu, Qp (0, 2.0, 4.0)

Completion Depth:	10.0 ft	Sample Types:	Latitude: 41°43'38.13"N
Date Boring Started:	11/30/16	Auger Cutting, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Texas Cone	Longitude: 88° 1'43.06"W
Date Boring Completed:	11/30/16		Drill Rig: Geoprobe 7822DT
Logged By:	J.W.		Remarks:
Drilling Contractor:	Rubino Engineering, Inc.		

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Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-03

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	87th Street Woodridge, Illinois	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.				

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 14 inches of ASPHALT				
						Approximately 4 inches of GRAVEL BASE				
				1	18	Brown silty CLAY, trace sand and gravel; Stiff		4,4,6 N=10	31	Qp=3.5 tsf LL = 36 PL = 19
				2	5		CL	4,5,8 N=13	14	Qp=4.0 tsf
	5			3	16	Gray silty CLAY, trace sand and gravel; Stiff		3,14,8 N=22	26	Qp=2.5 tsf
				4	16		CL	3,4,7 N=11	27	Qp=1.5 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture ◎ PL ◪ LL ✚ (0, 25, 50)
STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)

Completion Depth:	10.0 ft
Date Boring Started:	11/30/16
Date Boring Completed:	11/30/16
Logged By:	J.W.
Drilling Contractor:	Rubino Engineering, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 41°43'40.42"N
Longitude: 88° 1'38.02"W
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-04

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	87th Street Woodridge, Illinois	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.				

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA / STRENGTH, tsf	Additional Remarks
	0					Approximately 11 inches of ASHPALT					
						Approximately 4 inches of GRAVEL BASE					
				1	14	Brown silty CLAY, trace sand and gravel; Very stiff Tree roots encountered during drilling process	CL	3,4,16 N=20	22		Qp=4.0 tsf LL = 41 PL = 22
				2	0	Brown silty CLAY, trace sand and gravel; Medium stiff to stiff Tree roots encountered during drilling process		7,2,3 N=5	20		
	5			3	0		CL	3,4,3 N=7	22		
				4	18			3,5,8 N=13	16		Qp=4.0 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.					

STANDARD PENETRATION TEST DATA: Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf: Qu, Qp (0, 2.0, 4.0)

Completion Depth:	10.0 ft
Date Boring Started:	11/30/16
Date Boring Completed:	11/30/16
Logged By:	J.W.
Drilling Contractor:	Rubino Engineering, Inc.

Sample Types:
Auger Cutting, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Texas Cone

Latitude: 41°43'43.12"N
Longitude: 88° 1'30.39"W
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-05

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	Woodward Avenue	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.		Woodridge, Illinois		

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 11 inches of ASPHALT				
						Approximately 5 inches of GRAVEL BASE				
						Brown silty CLAY, trace sand and gravel; Stiff				
				1	12			2,3,6 N=9	19	Qp=2.5 tsf LL = 38 PL = 19
				2	16			2,5,5 N=10	19	Qp=3.0 tsf
	5						CL			
				3	13			3,3,7 N=10	19	Qp=4.0 tsf
				4	18			3,5,8 N=13	17	Qp=4.0 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture; PL; LL
0 25 50
STRENGTH, tsf
Qu; Qp
0 2.0 4.0

Completion Depth:	10.0 ft	Sample Types:	Latitude: 41°43'33.59"N
Date Boring Started:	11/30/16	Auger Cutting; Shelby Tube	Longitude: 88° 1'38.80"W
Date Boring Completed:	11/30/16	Split-Spoon; Hand Auger	Drill Rig: Geoprobe 7822DT
Logged By:	J.W.	Rock Core; Texas Cone	Remarks:
Drilling Contractor:	Rubino Engineering, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-06

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	Woodward Avenue	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.		Woodridge, Illinois		

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA / STRENGTH, tsf	Additional Remarks
	0					Approximately 12 inches of ASPHALT					
						Approximately 5 inches of GRAVEL BASE					
				1	12	Brown silty CLAY, trace sand and gravel; Stiff		4,5,6 N=11	17		Qp=2.5 tsf LL = 36 PL = 18
				2	12			3,5,7 N=12	16		Qp=4.0 tsf
	5						CL				
				3	16			2,5,5 N=10	24		Qp=2.5 tsf
				4	18	Gray silty CLAY, trace sand and gravel; Soft to medium stiff		1,2,2 N=4	32		Qp=1.0 tsf
	10						CL				
				5	18	Gray silty CLAY, trace sand and gravel; Stiff to very stiff	CL	4,7,8 N=15	16		Qp=3.5 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.					

STANDARD PENETRATION TEST DATA: Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf: Qu, Qp (0, 2.0, 4.0)

Completion Depth:	15.0 ft	Sample Types:	Latitude: 41°43'44.17"N
Date Boring Started:	11/30/16	Auger Cutting; Shelby Tube	Longitude: 88° 1'44.30"W
Date Boring Completed:	11/30/16	Split-Spoon; Hand Auger	Drill Rig: Geoprobe 7822DT
Logged By:	J.W.	Rock Core; Texas Cone	Remarks:
Drilling Contractor:	Rubino Engineering, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-07

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	Woodward Avenue Woodridge, Illinois	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.				

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA / STRENGTH, tsf	Additional Remarks
	0					Approximately 13 inches of ASPHALT					
						Approximately 5 inches of GRAVEL BASE					
				1	14	Brown silty CLAY, trace sand and gravel; Medium stiff to stiff	CL	6,4,4 N=8	19		Qp=3.0 tsf LL = 34 PL = 18
				2	18			2,3,3 N=6	19		Qp=2.5 tsf
	5					Brown silty CLAY, trace sand and gravel; Hard					
				3	0		CL	14.14.17 N=31	15		Qp=4.0 tsf
						Gray silty CLAY, trace sand and gravel; Very stiff					
				4	18		CL	5,7,11 N=18	16		Qp=4.0 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.					

STANDARD PENETRATION TEST DATA: Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf: Qu, Qp (0, 2.0, 4.0)

Completion Depth:	10.0 ft	Sample Types:	Latitude: 41°43'38.14"N
Date Boring Started:	11/30/16	Auger Cutting, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Texas Cone	Longitude: 88° 1'38.93"W
Date Boring Completed:	11/30/16		Drill Rig: Geoprobe 7822DT
Logged By:	J.W.		Remarks:
Drilling Contractor:	Rubino Engineering, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

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Elgin, IL 60123
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Fax: 847-931-1560

LOG OF BORING B-08

Rubino Job No.:	G16.152	Drilling Method:	3 ¼" Hollow Stem Auger	WATER LEVELS	
Project:	87th & Woodward Street Reconstruction	Sampling Method:	Split Spoon	While Drilling	N/A FT
Location:	87th Street and Woodward Avenue	Hammer Type:	Automatic	Upon Completion	N/A FT
City, State:	Woodridge, Illinois	Boring Location:	Woodward Avenue Woodridge, Illinois	Delay	N/A FT
Client:	Engineering Resource Associates, Inc.				

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 11 inches of ASPHALT				
						Approximately 5 inches of GRAVEL BASE				
				1	16	Brown silty CLAY, trace sand and gravel; Medium stiff to stiff		3,4,3 N=7	17	Qp=3.5 tsf LL = 31 PL = 17
				2	18		CL	3,6,8 N=14	20	Qp=4.0 tsf
	5									
				3	18	Brown silty CLAY, trace sand and gravel; Very stiff	CL	6,8,12 N=20	19	Qp=4.0 tsf
				4	18	Gray silty CLAY, trace sand and gravel; Stiff to very stiff	CL	3,6,9 N=15	13	Qp=3.5 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf: Qu, Qp (0, 2.0, 4.0)

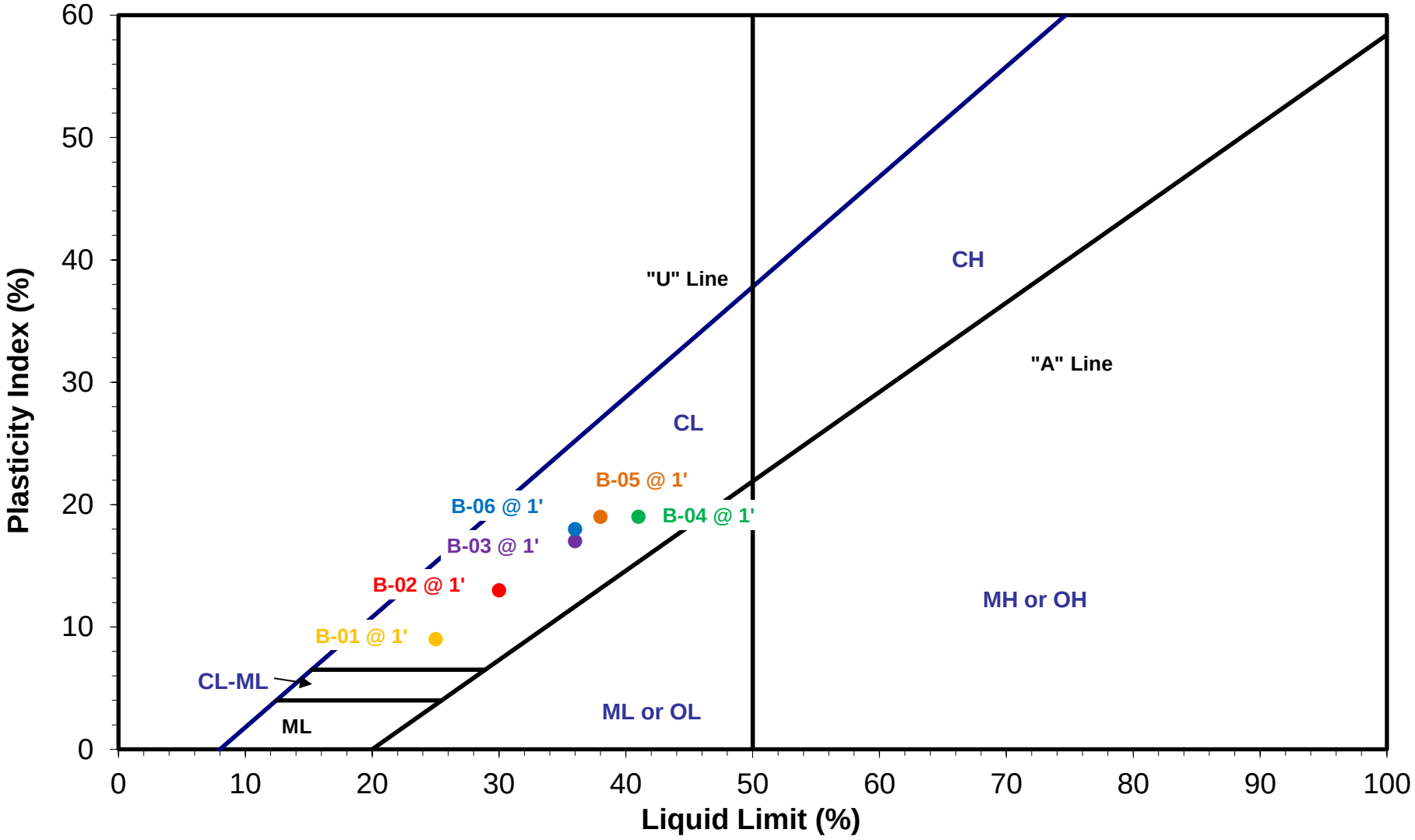
Completion Depth:	10.0 ft	Sample Types:	Latitude: 41°43'37.92"N
Date Boring Started:	11/30/16	Auger Cutting, Shelby Tube	Longitude: 88° 1'39.89"W
Date Boring Completed:	11/30/16	Split-Spoon, Hand Auger	Drill Rig: Geoprobe 7822DT
Logged By:	J.W.	Rock Core, Texas Cone	Remarks:
Drilling Contractor:	Rubino Engineering, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX I – *LABORATORY TESTS*

rubino ENGINEERING INC.

Report of Atterberg Limits Test (ASTM D4318 / AASHTO T89 / AASHTO T90)

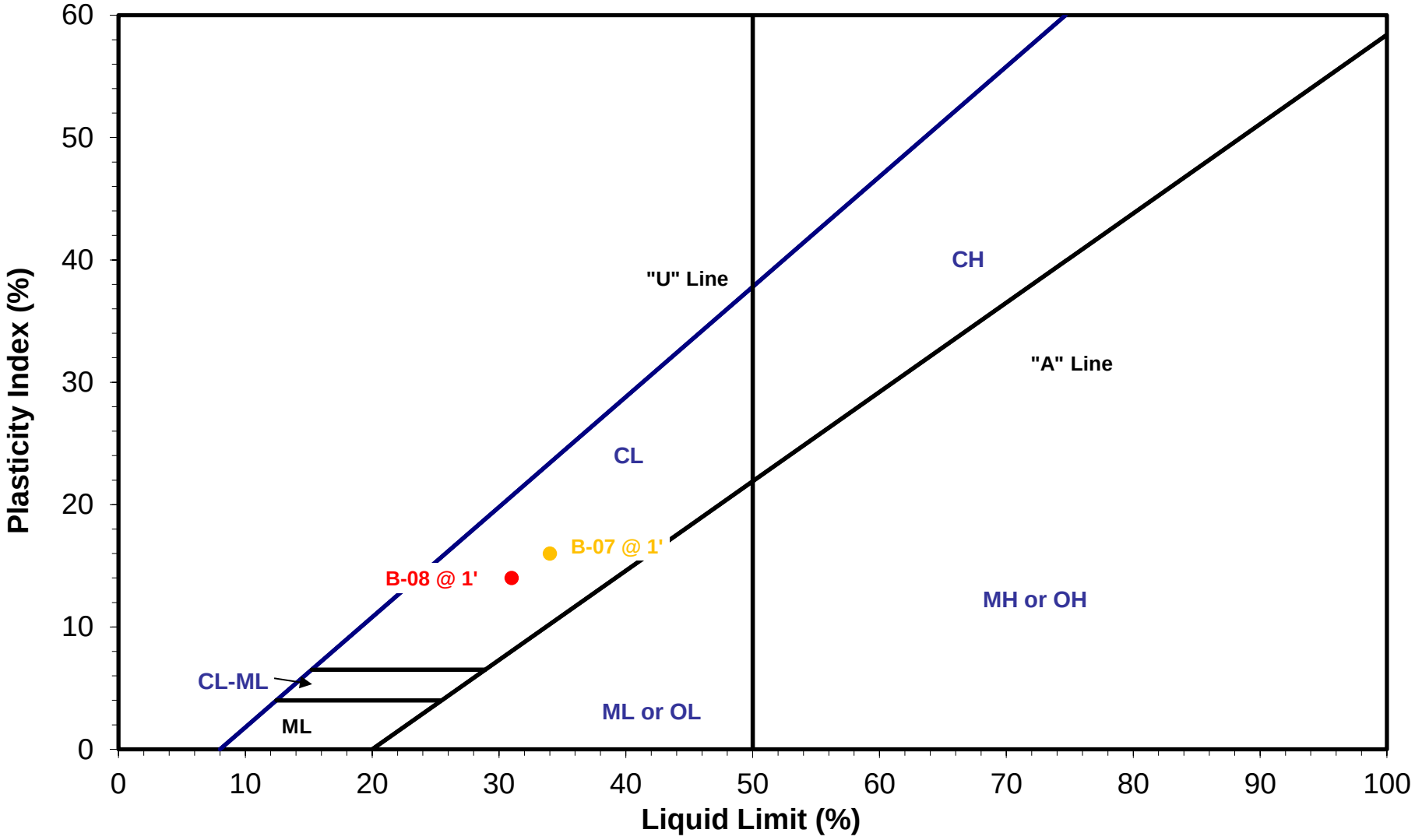


Boring #	B-01 @ 1'	B-02 @ 1'	B-03 @ 1'	B-04 @ 1'	B-05 @ 1'	B-06 @ 1'
LL	25	30	36	41	38	36
PL	16	17	19	22	19	18
PI	9	13	17	19	19	18

Project: 87th & Woodward Street Reconstruction
Location: Woodridge, Illinois
Client: Engineering Resource Associates, Inc.
Project #: G16.152

rubino ENGINEERING INC.

Report of Atterberg Limits Test (ASTM D4318 / AASHTO T89 / AASHTO T90)



Boring #	B-07 @ 1'	B-08 @ 1'
LL	34	31
PL	18	17
PI	16	14

Project: 87th & Woodward Street Reconstruction
Location: Woodridge, Illinois
Client: Engineering Resource Associates, Inc.
Project #: G16.152