GEOTECHNICAL INVESTIGATION

FOR

APARTMENT COMMUNITY

SOUTH PARK ROAD

LOUISVILLE, KENTUCKY

FOR

LDG DEVELOPMENT, LLC

1473 SOUTH FOURTH STREET

LOUISVILLE, KY 40208

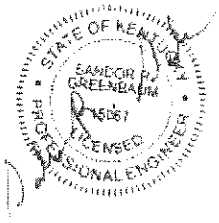
BY

GREENBAUM ASSOCIATES, INC.

994 LONGFIELD AVENUE

LOUISVILLE, KENTUCKY 40215

DECEMBER 26, 2019



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APPENDIX

1.0 Introduction

LDG Development, LLC intends to build a new 312-unit apartment community on a ±18.64-acre tract located at 4011 South Park Road in Louisville, Kentucky. This property consists of two large residential tracts fronting on South Park Road and one parcel fronting on Blue Lick Road. The area is relatively level with the north central portion of the property being overgrown and partially wooded. The new development is to consist of thirteen three-story apartment buildings, a clubhouse, and a pool. A boring location plan is included in the appendix of this report that shows the approximate locations of the borings and the proposed construction. A site location plan is also included in the appendix.

It is our understanding that limestone has been mined from below the property via horizonal mineshafts that extend from the above-ground quarry present on the opposite side of South Park Road. Geotechnical study relating to mining activities below the property was not performed since that is beyond the scope of this investigation. A geophysical survey could be used to determine the presence of mineshafts with rock core borings used to determine the thickness of the overlying bedrock (roof). Such a study could determine the possibility of catastrophic collapse of the mineshaft roof.

No subsidence or erosion feature was observed on the property. Were such a feature present, it could be due to erosion into a karst feature or into a mineshaft.

We were contracted by LDG Development, LLC to carry out a geotechnical investigation directed at determining the foundation support characteristics of the materials upon which these buildings and associated pavement will be supported. Work was coordinated through Ms. Ramona Vasta of LDG Development, LLC.

2.0 General Geology

Soils at this site are shown by the Kentucky Geological Survey to be residuum, the residual product of weathering of the local bedrock. Bedrock is shown to be the New Albany Shale and Beechwood Limestone, undifferentiated. This property is near the contact with the underlying Louisville Limestone, so the bedrock below the eastern portion of the development is probably the Beechwood Limestone and the New Albany Shale may be present below the western portion of the development.

The Kentucky Geological Survey describes the New Albany Shale as:

Shale, silty, olive black to grayish black, weathers pale yellowish brown or very light gray; massive; dense where fresh, fissile in thin brittle chips where weathered. Pyrite abundant as veinlets or spherules that weather to stain outcrops with brown and yellow iron oxides and sulfates. Phosphate nodules as much as 2 inches in diameter in upper 10 feet; calcareous, clayey and sandy in lower part; quartz in dike like geodiferous fracture fillings in upper 10 to 20 feet. Fossils include conodonts, silicified wood, spores, fish remains, worm markings, and linguloid brachiopods.

The Kentucky Geological Survey describes the Beechwood Limestone as:

Limestone, light gray to light greenish gray, weathers moderate yellowish brown to dark yellowish orange; fossil fragmental, with coarse to very coarse fossil fragments and whole fossils in a very fine grained matrix; very thin to thin bedded, locally cross-bedded, stylolitic; weathers to rounded massive slabs on which slightly resistant dull white fossil remains stand out in sharp relief from brownish matrix. Remains of the crinoid commonly called Dolatocrinus are distinctive. Pyrite common at top and base. Basal contact marked by zone of fossil trash. Contact with underlying unit unconformable. Unit commonly poorly exposed owing to solution by recent weathering or cover by terrace deposits of Quaternary age.

3.0 Investigation

Thirty-six borings were carried out across the site by standard penetration procedures to auger refusal. Diedrich D-25 and GeoProbe 66DT track-mounted drill rigs were used to carry out the borings through the use of 2 ¼-inch inside diameter hollow stem augers and an automatic hammer. The boring locations were staked using a nylon tape from existing topography, so boring locations are only as accurate at this method allows.

The standard penetration procedure involves driving a standard 2-inch diameter split spoon in the formation at selected intervals using a 140-pound hammer falling through 30 inches. The blow counts for each 6 inches of drive, to a total of 18 inches, are recorded and the number of blows for the 12 inches after the first 6 inches is a standard measure of the condition of the soil. As the split spoon is removed from the ground, it retrieves a sample of the soil in a disturbed

condition. Nevertheless, this sample is suitable for certain classification tests and is representative of the soils at the depth tested.

Soil samples were returned to the laboratory where a program of testing was carried out. This testing included a grain size analysis, an Atterberg Limits' test and a number of natural moisture determinations.

Grain size determination arrives at a curve of grain size against that fraction of the soil that is finer than that particular grain size. It also allows the determination of the clay fraction, silt fraction, sand fraction, etc. in any particular soil sample. Based on this division of grain sizes, the field soils classifications are refined and the boring logs adjusted. In the case of fine grained soils, the soils are largely silt and clay; thus requiring that the soils be suspended in an aqueous medium and the rate at which the particles drop out is measured in order to arrive at the grain size distribution. Silt and clay grains are so fine that sieve analysis alone will not function in this range. The coarse fraction of this sample is separated from the fine and run through a nest of sieves in order to further detail the grain size distribution in the coarse range. In this case only the sieve analysis portion of the test was performed since little sand and silt was present in the soil samples selected for testing.

The natural moisture determination arrives at the in-situ moisture content of the soil and is useful for correlating the strength of various samples of like texture and in conjunction with the Atterberg limits, gives a strong measure of the strength range the soils are likely to be found in.

4.0 Findings

4.1 Boring Results

This site is covered by 6- to 8-inches of topsoil, for the most part, but one boring found 10 inches of topsoil. Below this soil is moist, soft to very stiff, brown or reddish brown, lean clay, sometimes containing ferromagnesian nodules and sometimes a trace of organics in the top three feet. Deeper soils, below 5- to 6-feet depth, frequently contain chert and/or weathered limestone. Soils are generally very stiff below 5- to 6-feet depth. Auger refusal on apparent bedrock was encountered between 5.5- and 14.8-feet depth.

The soils are softest in the portion of the property that appears as a panhandle extending westward from the main property to Blue Lick Road, This

area is planned for the clubhouse, pool and one apartment building. Elsewhere, shallow soils at the probable foundation bearing level were found to be soft only in borings B-15 and B-33, though there were areas where soils are soft above 2.5 feet depth, possibly the foundation bearing level if these areas are to be filled. However, the vertical extent of these softer soils is limited allowing these soils to be removed and replaced by means of undercut and refill where encountered in foundation bearing surfaces. The more extensive soft soils in borings B-01 through B-05 will limit bearing capacity in this area.

The table below, and continued at the top of the following page, provides a tabulation of N-values as measured by the standard penetration test and corrected for the energy of the automatic hammer. Depth to auger refusal is also provided.

Depth	B-01	B-02	B-03	B-04	B-05	B-06	B-07	B-08	B-09
1 – 2.5 feet	4	5	3	4	5	2	5	7	7
3 – 4.5 feet	7	7	9	7	8	17	27	14	12
6 – 7.5 ft	10	21	17	21	18	17	29	18	29
8.5 – 10 ft	50/2"	8		13	50/2"	50/3"	50/3"		25
Refusal	9.8'	10.3'	8.5'	10.5'	8.6'	9.8'	9.8'	8.0'	11.3'

Depth	B-10	B-11	B-12	B-13	B-14	B-15	B-16	B-17	B-18
1 – 2.5 feet	40	13	10	17	9				7
2 – 3.5 feet						7	18	18	
3 – 4.5 feet	16	36	20	21	12				17
5 – 6.5 feet						9	26	25	
6 – 7.5 feet									16
Refusal	6.6'	8.4'	9.3'	7.2'	8.4'	5.5'	7.7'	7.8'	8.0'

Depth	B-19	B-20	B-21	B-22	B-23	B-24	B-25	B-26	B-27
1 – 2.5 feet	4	5	7	7	4				
2 – 3.5 feet						14	21	23	20
3 – 4.5 feet	20	10	27	18	13				
5 – 6.5 feet						16	27	29	26
6 – 7.5 feet	21	20	17	22	50/4"				
8.5 – 10 feet	5	15	13	22					
Refusal	11.0'	14.8'	10.8'	11.0'	7.5'	7.7'	6.8'	6.9'	8.1'

Depth	B-28	B-29	B-30	B-31	B-32	B-33	B-34	B-35	B-36
1 – 2.5 feet	20	13		13	18	4	7	5	
2 – 3.5 feet			12						21
3 – 4.5 feet	46	31		30	20	8	17	13	
5 – 6.5 feet			9						48
6 – 7.5 feet						23	27	26	
8.5 – 10 feet						14	25		
10 – 11.5 ft.			9						
Refusal	8.0'	7.5'	13.1'	7.8'	6.6'	10.5'	10.3'	8.5'	7.9'

No groundwater was encountered in any of the borings, but water is known to have flooded the mineshafts present below the property.

4.2 Laboratory Results

A sample of soil from shallow depth was tested and classified and was found to be lean clay. The result of this testing is summarized in the table below with more detailed results provided in the appendix of this report. Moisture content is shown graphically on the boring logs.

Soil Sample	Grain Size Distribution			Atterberg Limits			Soil Classification	
	Percent Sand	Percent Silt	Percent Clay	Liquid Limit	Plastic Limit	Plasticity Index	Unified	AASHTO
B-24 @ 2' – 3.5'	10	45	45	37	19	18	CL	A-6

4.3 Historic Aerial Photographs

Aerial photographs, available on Google Earth, dating back to 1993 are available. The portion of the property that is overgrown was relatively clear through 2006, at which point it was allowed to become overgrown. There was a house or barn on the east side of the property near its north-south center through 2017, but that structure is not present in the most recement image.

4.4 Seismicity

By the 2018 edition of the Kentucky/2015 International Building Code, this is a Very Dense Soil and Soft Rock Profile, Site Class C. The Spectral Response Acceleration Coefficients, for this area, as provided by U.S.G.S., FEMA Design Parameters are:

$S_S = 0.204$ g	$S_{MS} = 0.245$ g	$S_{DS} = 0.164$ g
$S_1 = 0.106$ g	$S_{M1} = 0.180$ g	$S_{D1} = 0.120$ g

5.0 Recommendations

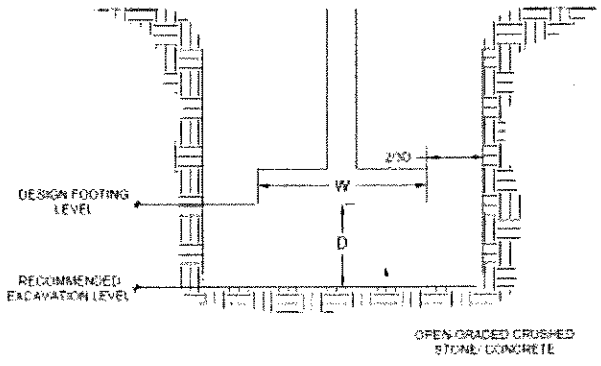
5.1 Foundations

Soil conditions vary across the site, so foundations for these buildings are discussed in two subsections to cover these varying soil conditions.

5.1.1 Panhandle with frontage on Blue Lick Road (Boring B-01 to B-05)

The proposed buildings in this area may be supported on spread footings bearing on shallow soil or structural fill placed in accordance with section 5.3 of this report. These foundations may be designed based on an allowable net bearing capacity of up to 2,000 pounds per square foot.

Undercut and refill below foundations should be under the direction of a Geotechnical Engineer and should be refilled with Kentucky Number 57 stone in a manner as illustrated in the diagram below. Depth of undercut, D, should be 2 feet unless the Geotechnical Engineer determines that greater depth of undercut is necessary.



Soil bearing foundations exposed to weather must bear at least 30 inches below finished grade in order to insulate the bearing strata from freezing. Interior foundations protected from freezing are exempt from this requirement. Continuous footings must be at least 16 inches wide and isolated footings must be at least 24 inches wide.

Settlement of foundations designed based on the above criteria should be below that which is considered acceptable for this type of construction; that is total settlement should be less than one inch and differential settlement should be less than three quarters of an inch.

For shallow foundations, friction along the base of the footing can be used to resist lateral forces. A friction coefficient of 0.35 may be used, which assumes that the footing concrete is placed directly against the natural cut faces. The coefficient of friction value recommended is an ultimate value and a minimum factor of safety of 1.5 must be applied when determining the allowable sliding resistance.

5.1.2 Main Body of Property

Theses proposed apartment buildings may be supported on spread footings bearing on shallow soil or structural fill placed in accordance with section 5.3 of this report. These foundations may be designed based on an allowable net bearing capacity of up to 2,500 pounds per square foot.

Once foundation bearing surfaces are exposed, an engineer or senior engineering technician from this office should be present to view all bearing surfaces to determine the presence of soft soils. Where soft soils are encountered, undercut will need to extend to firm material or to a level determined to be acceptable by the geotechnical engineer and should be refilled with either lean concrete (fc' = 2,000 psi) or open-graded stone such as Number 57 stone.

Where the building was present on the east side of the property, any foundations that remain must be removed entirely to a level at least two feet below foundation bearing surfaces. Any basements or cellars must be filled with engineered fill as discussed in section 5.3 of this report. If the basement slab is below the foundation bearing level, it may be left in place if perforated with two-inch or larger perforations on four-foot centers.

Soil bearing foundations exposed to weather must bear at least 30 inches below finished grade in order to insulate the bearing strata from freezing. Interior foundations protected from freezing are exempt from this requirement. Continuous

footings must be at least 16 inches wide and isolated footings must be at least 24 inches wide.

Settlement of foundations designed based on the above criteria should be below that which is considered acceptable for this type of construction; that is total settlement should be less than one inch and differential settlement should be less than three quarters of an inch. Settlement of rock bearing foundations will be negligible.

For shallow foundations, friction along the base of the footing can be used to resist lateral forces. A friction coefficient of 0.35 may be used, which assumes that the footing concrete is placed directly against the natural cut faces. The coefficient of friction value recommended is an ultimate value and a minimum factor of safety of 1.5 must be applied when determining the allowable sliding resistance.

5.2 Slab-On-Grade

Prior to placement of the fill in the slab area, the subgrade must be proofrolled and carefully examined by a geotechnical engineer for areas of soft or loose soil. If soft or loose soils are encountered, they must be undercut and refilled in accordance with instructions given by the geotechnical engineer's on-site representative. Undercut and refill in soft areas consists of excavating to a depth up to two feet below subgrade elevation and refill should be with "Surge Rock", 6-inch minus or Number 3 stone. Large rock should not be used in areas where trenching will be required to install piping or conduit.

Some of the soils at this site are relatively silty, so if construction is to take place other than during mid-June to mid-September, shallow soils are likely to be soft. Undercut and refill can be kept to a minimum if construction vehicles traveling over the building pad is kept to a minimum, perhaps delineating areas where construction traffic is acceptable and areas where it is not. Control of construction traffic can prove difficult but has been found to work in some cases.

A slab-on-grade that is structurally separated from the walls, columns and foundations is preferable, though thickened slab may be used. Separation of slab-on-grade from foundations will minimize the stress caused by possible differential settlement between the slabs and the foundations and between adjacent slabs. A vapor barrier must be incorporated into the design and at least four inches of Dense Graded Aggregate (DGA) should underlie the slab. The floor slab may be designed based on a Modulus of Subgrade Reaction of 75 pounds per cubic inch

in the area of borings B-01 through B-06 and 100 pounds per cubic inch over the rest of the site.

5.3 Site Preparation and Earthwork

Prior to fill placement all vegetation and topsoil (soil containing more than 4 percent organic content) must be removed from below the area to be filled. Where trees or bushes have been present, the entire rootball should be removed and the resulting excavation should be refilled with soil compacted as described in this section of the report. Then, prior to placement of fill, the exposed subgrade should be proofrolled by a fully loaded tri-axle truck to delineate any yielding or rutting areas that may require treatment such as undercut and refill or drying.

All fill should be placed in lifts not exceeding 8 inches in uncompacted thickness and must be compacted to at least 98 percent of the soils maximum dry density as determined by the Standard Proctor (ASTM D-698). Soil moisture content should be within 2 percent of optimum as determined from the Standard Proctor.

Soil from any off-site borrow sources should be tested and approved by this office prior to being used on the site. Satisfactory borrow materials are those falling in one of the following classifications: GC, SM, SC, ML, or CL. Soil types MH, CH and OH soils and peat are unsatisfactory borrow materials.

The site should be maintained in a well-drained condition both during and after construction. Site grading should provide for drainage of surface run-off away from proposed buildings and pavement.

The placement of compacted fill should be carried out by an experienced excavator with the proper materials. The excavator must be prepared to adapt his procedures, equipment and materials to the type of project, to weather conditions, and the structural requirements of the engineer. Methods and materials used in summer may not be applicable in winter; soil used in proposed fill may require wetting or drying for proper placement and compaction. Conditions may also vary during the course of a project or in different areas of this site. These needs should be addressed in the project drawings and specifications.

During freezing conditions, the fill must **not** be frozen when delivered to the site. It also must not be allowed to freeze during or after compaction. Since the ability to work the soil while keeping it from freezing depends in part on the soil type, the specifications should require the contractor to submit a sample of his proposed fill before construction starts, for laboratory testing. If the soil engineer

determines that it is not suitable, it should be rejected. In general, silty sand, clayey sand, and cohesive/semi-cohesive soils should not be used as fill under freezing conditions. All frozen soil of any type should be rejected for use as compacted fill.

It is important that compacted fill be protected from freezing after it is placed. The excavator should be required to submit a plan for protecting the soil. The plan should include details on the type and amount of material (straw, blankets, extra loose fill, topsoil, etc.) proposed for use as frost protection. The need to protect the soil from freezing is ongoing throughout construction and applies both before **and** after concrete is placed, until backfilling for final frost protection is completed. Foundations placed on frozen soil can experience heaving and significant settlement, rotation, or other movement as the soil thaws. Such movement can also occur if the soil is allowed to freeze **after** the concrete is placed and then allowed to thaw. The higher the percentage of fines (clay and silt) in the fill, the more critical is the need for protection from freezing.

The contractor should be required to adjust the moisture content of the soil to within a narrow range near the optimum moisture content (as defined by the applicable Proctor or AASHTO Test). In general, fill should be placed within 2% of optimum moisture. The need for moisture control is more critical as the percentage of fines increases. Naturally occurring cohesive/semi-cohesive soil are often much wetter than the optimum. Placing and attempting to compact such soils to the specified density may be difficult. Even if compacted to the specified density, excessively wet soils may not be suitable as pavement subgrades due to pumping under applied load. This is especially true when wet cohesive/semi-cohesive soil is used as backfill in utility trenches and like situations. Excessively wet soil in thick fill sections may cause post-construction settlement beyond that estimated for fill placed at or near (±2%) the optimum moisture content.

5.4 Earth Pressures

Any retaining walls should be constructed with a drainage blanket of sand or a synthetic drainage material. Synthetic drainage media should be available from suppliers of geotextile. The wall should be drained at its base by a perforated PVC underdrain or weepholes at a spacing of not more than 10 feet. Where a relatively thin drainage blanket is used, the retaining wall should be designed based on a coefficient of active earth pressure (K_a) of 0.36 and a soil unit weight (γ_w) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 47 pounds per cubic foot. Where granular backfill completely fills the area defined by a plane extending upward from the base of the wall at a 45-degree angle, the retaining wall may be designed based on a coefficient of active earth pressure (K_a)

of 0.27 and a soil unit weight (γ_w) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 35 pounds per cubic foot.

However, where the wall is restrained from movement, as in the case of building basement walls bearing against the basement slab or building frame, the wall must be designed based on the "at rest" earth pressure. The coefficient of "at rest" earth pressure (K_0) is 0.47 with a soil unit weight (γ_w) of 130 pounds per cubic foot in the case of a thin drainage blanket behind the wall, resulting in an equivalent fluid of 61 pounds per cubic foot unit weight. Where granular backfill completely fills the area defined by a plane extending upward from the base of the wall at a 45 degree angle, the retaining wall may be designed based on a coefficient of "at rest" earth pressure (K_0) of 0.43 and a soil unit weight (γ_w) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 56 pounds per cubic foot.

The table below summarizes the design earth pressures.

	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	Coefficient of Earth Pressure at Rest (K_0)	Equivalent Fluid Pressure on Cantilever Walls	Equivalent Fluid Pressure on Braced Walls
Fill Material/Local Soils	0.36	2.77	0.47	47 pcf	61 pcf
Granular Backfill	0.27	3.69	0.43	35 pcf	56 pcf

Surcharge above the wall will add additional load. A uniform surcharge must be multiplied by the appropriate coefficient of earth pressure to determine the additional load applied to the wall.

Any retaining wall design must use appropriate factors of safety. It is critical that drainage be provided as mentioned earlier in this section in order to avoid hydrostatic pressure. Hydrostatic pressure would increase pressure against the wall substantially.

5.5 Light- and Heavy-Duty Pavement

Pavement subgrade should be examined and proofrolled as described under "Floor Slabs". If soft areas are encountered, the soft soils will need to be undercut and refilled in accordance with the instructions of the geotechnical engineer's on-site representative. Subgrade stabilization was discussed in section

5.2 for slab-on-grade. The same approach should be taken for pavement subgrade, but the requirement for a stable, non-yielding subgrade is even more important in the case of asphalt pavement.

The soils at this site are very silty, making the soils very sensitive to moisture. It is very likely that extensive undercut and refill or chemical stabilization of the building and pavement subgrades will be required. If earthwork and paving is preformed during the normally dry, warm months of mid-June through mid-September, the need for soil stabilization may be minimized. However, budgeting should take into account the need for either extensive undercut and refill with stone or cement stabilization. These soils are too silty for lime stabilization to be effective.

A pavement analysis was conducted using a life cycle of 20 years and a cumulative 18-kip equivalent single axle load of 20,000 for light traffic loads and 160,000 for moderate traffic loads. Recommendations are provided for both flexible and rigid pavement systems. However, rigid pavement should be used in special truck traffic areas, such as those areas which receive frequent traffic by garbage trucks. The concrete pavement should extend throughout the areas that require extensive turning and maneuvering of garbage trucks or other heavy trucks. Heavily loaded pavement areas that are not designed to accommodate these conditions often experience localized pavement failures, particularly if flexible pavement sections are used.

The minimum recommended thickness for both hot mixed asphalt concrete (HMAC) and reinforced Portland cement concrete (PCC) pavement sections are presented in the table below for the described light, moderate and special traffic condition.

Recommended Pavement Section					
Component	Light		Moderate		Special
	Rigid	Flexible	Rigid	Flexible	Rigid
Reinforced Portland Cement Concrete (PCC)	5 inches		6 inches		7 inches
Hot Mixed Asphalt Concrete (HMAC)		3 inches		4 inches	
Crushed Limestone Base (Dense Graded Aggregate)	4 inches	8 inches	4 inches	8 inches	4 inches
Prepared Subgrade	6 inches	6 inches	6 inches	6 inches	6 inches

The Portland cement concrete should be air-entrained and conform to ASTM C-94 (Standard Specifications for Ready-Mixed Concrete) and have a minimum compressive strength of 4,000 pounds per square inch. Reinforcing should meet the requirements of ACI.

Hot mix asphalt concrete and Dense Graded Aggregate should meet the requirements of the Kentucky Transportation Cabinet. The top inch of asphalt should be a surface mix, the remainder being a base mix.

5.6 Temporary Earth Slopes or Cuts

Temporary earth cuts necessary to construct foundations or utility lines should be no deeper than 4 feet without benching or sloping. Cuts deeper than this should be sloped no steeper than one horizontal to one vertical or should have benches every 2 feet of height equating to this slope. If vertical faces deeper than 4 feet are used, bracing designed for short term loads may be used. Excavations should comply with OSHA regulations.

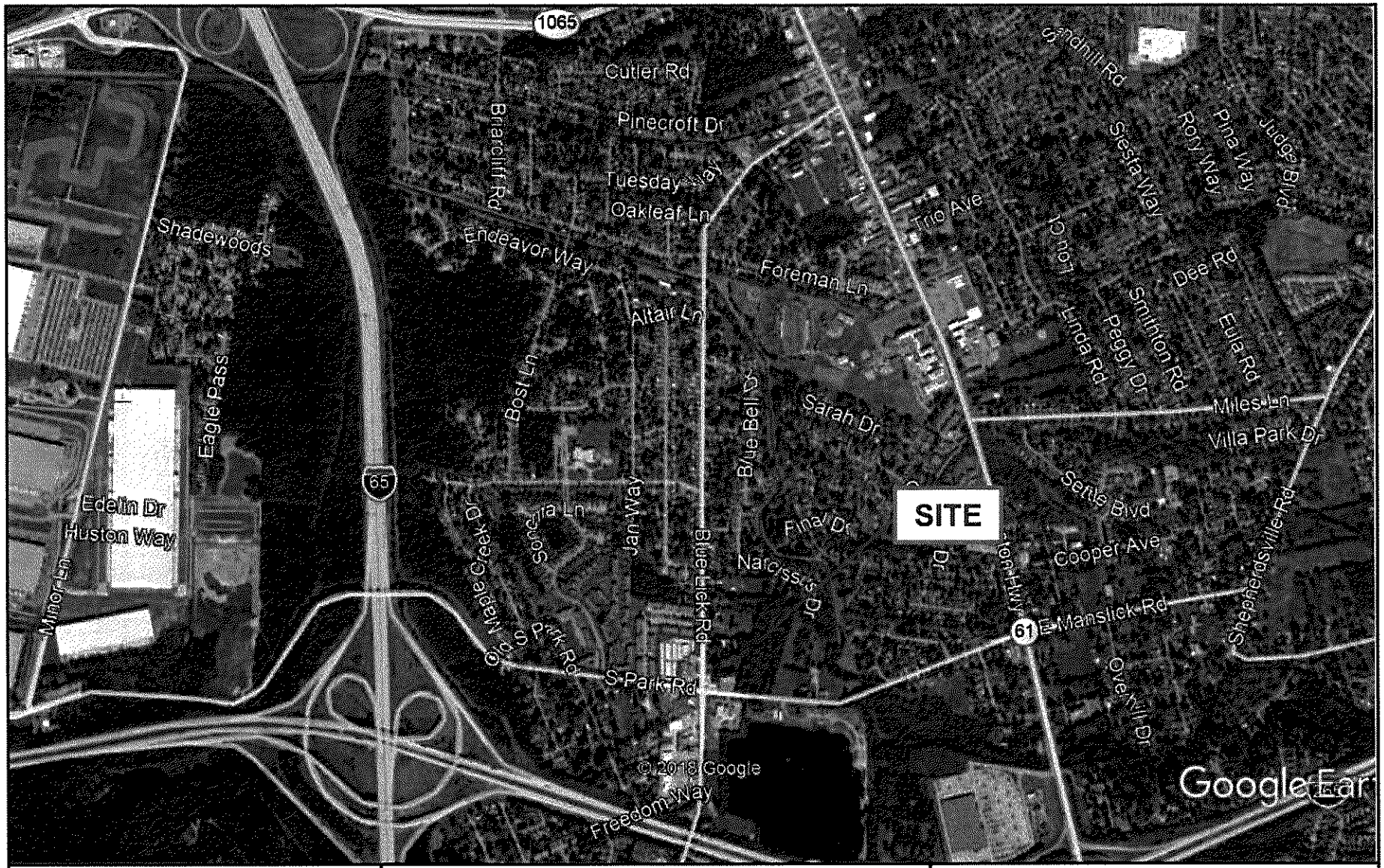
5.7 Limitations

We strongly recommend that bearing surfaces and compaction be monitored by Greenbaum Associates, Inc. Our technicians will be available to further assist you in providing these and other normally specified quality control services. The report is preliminary until such time as these examinations are completed to confirm conditions consistent with those discovered in the investigation.

The conclusions and recommendations offered in this report are based on the subsurface conditions encountered in the borings. No warranties can be made regarding the continuity of conditions between or beyond borings. If, during construction, soil conditions are encountered that differ from those indicated in this report, a representative of Greenbaum Associates, Inc. should inspect the site to determining if design modification is required.

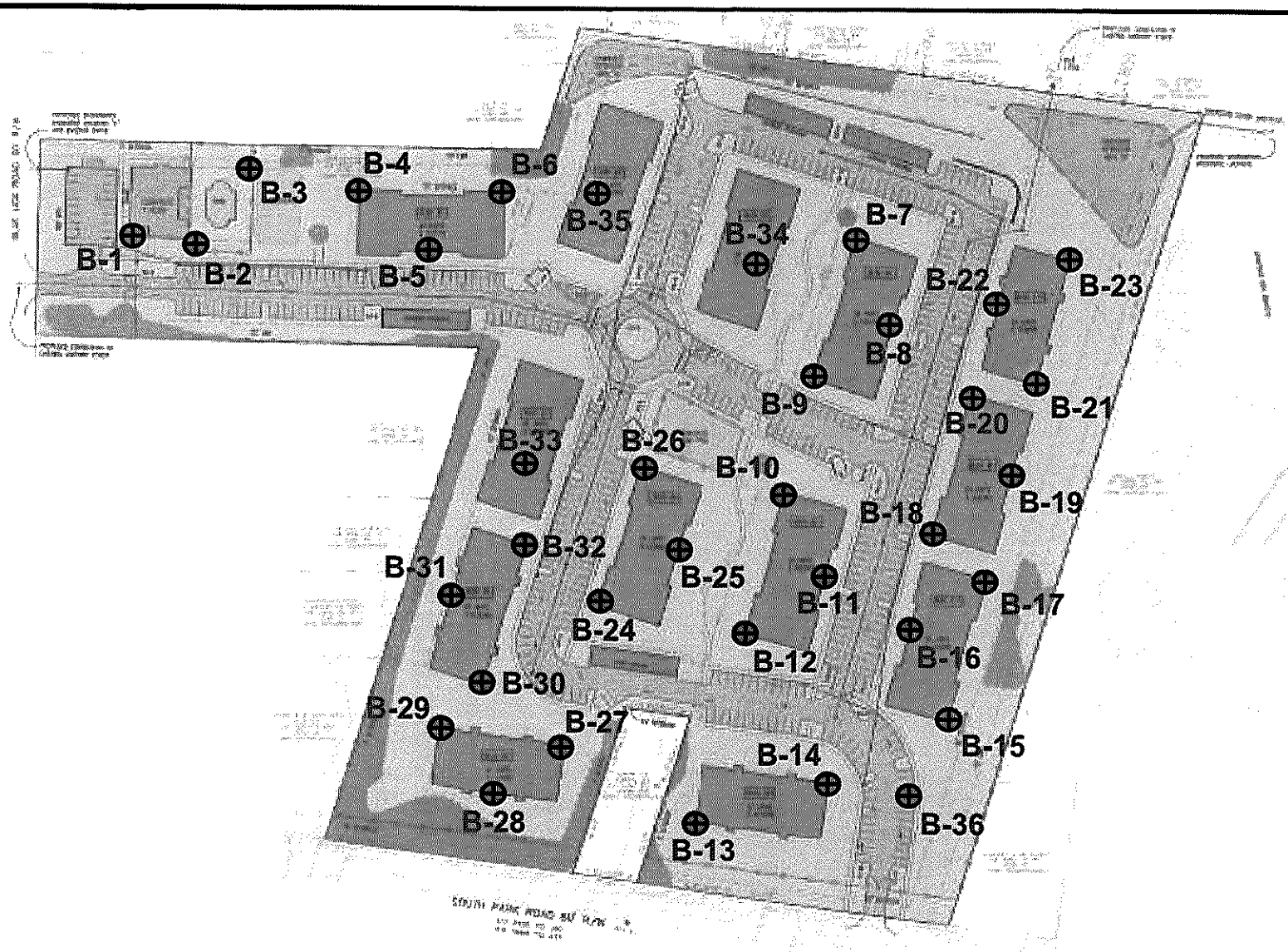
This study was directed at specific buildings and associated pavement at this location to be constructed within a reasonably short period after this study. Use for any other location, structures or substantial changes in construction period may invalidate the recommendations. The geotechnical engineer should be consulted relative to any substantial change in these.

This study is directed at mechanical properties of the soils and includes no sampling, testing or evaluation for environmental considerations.



LDG Development, LLC	Greenbaum Associates, Inc.	**Site Location Plan** Apartment Community South Park Road, Louisville, Kentucky Greenbaum Project Number: 19-285G

19-ZONE-0086



LDG Development, LLC	Greenbaum Associates, Inc.	**Boring Location Plan** Apartment Community South Park Road, Louisville, KY Greenbaum Project Number: 19-285G

SOIL DESCRIPTION TERMINOLOGY

Soils are identified and classified in this report according the the Unified Classification System with the following modifiers:

RELATIVE DENSITY OF GRANULAR SOILS

Description	Blows/Foot
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	50 to 80
Extremely Dense	80+

CONSISTENCY OF COHESIVE SOILS

Description	N-value	q_u (tsf)
Very Soft	0 to 2	0 to 0.25
Soft	3 to 4	0.26 to 0.50
Medium Stiff	5 to 8	0.51 to 1.0
Stiff	9 to 15	1.1 to 2.0
Very Stiff	16 to 30	2.1 to 4.0
Hard	>30	4.1 to 8.0
Very Hard		8.1+

PARTICAL SIZES

Components		Size or Sieve No.
Boulders		over 12 inches
Cobbles		3 to 12 inches
Gravel -	Coarse	$^3/_4$ to 3 inches
	Fine	No. 4 to $^3/_4$ inch
Sand -	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40
Fines (silt and clay)		Finer than No. 200

SOIL MOISTURE

	Descriptive Term
Dry	Dry of Standard Proctor Optimum
Damp	Moist (sand only)
Moist	Near Standard Proctor Optimum
Wet	Wet of Standard Proctor Optimum
Saturated	Free Water in Sample

ROCK DESCRIPTION TERMINOLOGY

The Rock Quality Determination (Deere et. Al., 1969) method of determining rock quality as reported here was obtained by summing up the total length of core recovered in each run, counting only those pieces of core which are four inches (10 cm.) in length or longer and which are hard and sound. The sum is then represented as a percentage over the length of the run. If the core is broken by handling or by the drilling process, the fresh broken pieces are fitted together and counted as one piece provided that they the requisite length of four inches (10 cm.). RQD is reported as a percentage.

RELATIONSHIP BETWEEN RQD AND ROCK QUALITY

RQD (%)	Description of Rock Quality
0 to 25	Very Poor
26 to 50	Poor
51 to 75	Fair
76 to 90	Good
91 to 100	Excellent

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-01

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **9.8** Rock: **0** Total Depth: **9.8**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (6 inches)	OL	Ground		
		SPT			Moist, Soft, Brown, Lean Clay	CL			3
		SPT			Same, Medium Stiff	CL			5
5		SPT			Same, Stiff, with Chert	CL			8
		SPT			AUGER REFUSAL @ 9.8 FEET			>>	50/2"

PL — MC — LL
10 20 30 40 50 60 70 80 90

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-01**

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-02

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **10.3** Rock: **0** Total Depth: **10.3**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (10 inches)	OL	Ground	
		SPT			Moist, Medium Stiff, Brown, Lean Clay	CL		4
		SPT						5
5		SPT			Same, Stiff, with Chert	CH		16
		SPT			Same, Medium Stiff	CL		6
10					AUGER REFUSAL @ 10.3 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
PL ▲ MC LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-02**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE -0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-03

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8.7** Rock: **0** Total Depth: **8.7**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (7 inches)	OL	Ground	
		SPT			Moist, Soft, Brown, Lean Clay with a trace of Organics	CL		2
		SPT			Moist, Stiff, Brown, Lean Clay	CL		7
5		SPT			Same, Very Stiff	CL		13
		SPT			AUGER REFUSAL @ 8.7 FEET			50/2"

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-03**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-04

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **10.5** Rock: **0** Total Depth: **10.5**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (6 inches)	OL	Ground	
		SPT			Moist, Soft, Brown, Lean Clay	CL		3
					Same, Medium Stiff	CL		
5		SPT						5
					Same, Very Stiff, with Chert	CL		
		SPT						16
					Same, Stiff	CL		
10		SPT						10
					AUGER REFUSAL @ 10.5 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
PL ▲ MC LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-04**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE -0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC	**HOLE No. B-05**
Project: South Park Road Apartments, Louisville, KY	Sheet 1 of 1
Project No.: 19-285G	

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8.6** Rock: **0** Total Depth: **8.6**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	OL	Ground		
		SPT			Moist, Medium Stiff, Reddish Brown, Lean Clay	CL			4
		SPT							6
5									
		SPT			Same, Stiff, with Chert	CL			14
		SPT			AUGER REFUSAL @ 8.6 FEET			>>	-

PL — MC — LL

10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-05**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-06

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **9.8** Rock: **0** Total Depth: **9.8**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (6 inches)	OL	Ground		
		SPT			Moist, Soft, Brown, Lean Clay with a trace of Organics	CL			1
		SPT			Moist, Very Stiff, Brown, Lean Clay	CL			13
5		SPT			Same, with Chert	CL			13
		SPT						>>	50/3"
					AUGER REFUSAL @ 9.8 FEET				

PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-06**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-07

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **9.8** Rock: **0** Total Depth: **9.8**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/13/19 - 12/13/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches)	OL	Ground		
		SPT			Moist, Medium Stiff, Reddish Brown, Lean Clay	CL			4
		SPT			Same, Very Stiff, with Chert	CL			21
5		SPT							22
		SPT							50/3"
					AUGER REFUSAL @ 9.8 FEET				

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-07**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-08

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8** Rock: **0** Total Depth: **8.0**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/13/19 - 12/13/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (6 inches)	OL	Ground	
		SPT			Moist, Medium Stiff, Brown, Lean Clay with a trace of Organics	CL		5
		SPT			Moist, Stiff, Brown, Lean Clay with Chert	CL		11
5		SPT			Same, Very Stiff	CL		14
					AUGER REFUSAL @ 8.0 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
PL ▲ MC LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-08**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE -0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-09

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **11.3** Rock: **0** Total Depth: **11.3**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/14/19 - 12/14/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	N VALUE
					Topsoil (6 inches) OL	Ground	
		SPT			Moist, Medium Stiff, Brown, Lean Clay with a trace of Organics CL		5
		SPT			Moist, Stiff, Brown, Lean Clay CL		9
5		SPT			Moist, Very Stiff, Light Brown, Lean Clay with Ferromagnesian Nodules and Chert CL		22
		SPT					19
10					AUGER REFUSAL @ 11.3 FEET		

STANDARD PENETRATION TEST
● (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-09**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-10

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **6.6** Rock: **0** Total Depth: **6.6**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (7 inches)	OL	Ground	
					Moist, Hard, Brown, Lean Clay with Chert	CL		
		SPT						31
					Same, Very Stiff	CL		
5								
		SPT			Same, with Weathered Limestone	CL		12
					AUGER REFUSAL @ 6.6 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-10**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-11

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8.4** Rock: **0** Total Depth: **8.4**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 12/30/99**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (6 inches)	OL	Ground		
					Moist, Stiff, Brown, Lean Clay with Ferromagnesian Nodules	CL			
		SPT							10
5					Same, Hard	CL			
		SPT							28
					AUGER REFUSAL @ 8.4 FEET				

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-11**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-12

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **9.3** Rock: **0** Total Depth: **9.3**
Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches) OL	Ground		
		SPT			Moist, Stiff, Brown, Lean Clay with Ferromagnesian Nodules CL			8
5		SPT			Same, Very Stiff CL			15
					AUGER REFUSAL @ 9.3 FEET			

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-12**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - < ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-13

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.2** Rock: **0** Total Depth: **7.2**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (7 inches) OL	Ground		
					Moist, Very Stiff, Brown, Lean Clay CL			
		SPT						13
5		SPT						16
					AUGER REFUSAL @ 7.2 FEET			

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-13**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - [illegible] - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC	**HOLE No. B-14**
Project: South Park Road Apartments, Louisville, KY	Sheet 1 of 1
Project No.: 19-285G	

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8.4** Rock: **0** Total Depth: **8.4**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches) OL	Ground		
					Moist, Stiff, Brown, Lean Clay CL			
		SPT						7
5		SPT						9
					AUGER REFUSAL @ 8.4 FEET			

STANDARD PENETRATION TEST (blows/ft)
MC
PL LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-14**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19-1 ZONE -0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-15

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **5.5** Rock: **0** Total Depth: **5.5**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/14/19 - 12/14/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches)	OL	Ground		
					Moist, Very Soft, Brown, Lean Clay with a trace of Organics	CL			
		SPT							5
					Moist, Stiff, Brown, Lean Clay with Chert	CL			
		SPT							7
5					AUGER REFUSAL @ 5.5 FEET				

STANDARD PENETRATION TEST (blows/ft)
MC
PL LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-15**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-16

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.7** Rock: **0** Total Depth: **7.7**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (6 inches) OL	Ground		
					Moist, Very Stiff, Brown, Lean Clay with Ferromagnesian Nodules CL			
		SPT						14
5		SPT						20
					Same, with Weathered Limestone CL			
					AUGER REFUSAL @ 7.7 FEET			

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-16**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 06-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-17

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.8** Rock: **0** Total Depth: **7.8**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (8 inches)	OL	Ground		
					Moist, Very Stiff, Brown, Lean Clay with Ferromagnesian Nodules	CL			
		SPT							14
5		SPT							19
					Same, with Weathered Limestone	CL			
					AUGER REFUSAL @ 7.8 FEET				

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-17**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ' ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-18

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **8** Rock: **0** Total Depth: **8.0**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/12/19 - 12/12/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (7 inches)	OL	Ground	
		SPT			Moist, Medium Stiff, Reddish Brown, Lean Clay	CL		5
		SPT			Same, Very Stiff, with a little Gravel	CL		13
5		SPT			Moist, Very Stiff, Reddish Brown, Fat Clay with a little Gravel	CH		12
					AUGER REFUSAL @ 8.0 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
PL MC LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-18**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-19

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **11** Rock: **0** Total Depth: **11.0**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/12/19 - 12/12/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (8 inches)	OL	Ground		
		SPT			Moist, Soft, Brown, Lean Clay with a tract of Organics	CL			3
		SPT			Moist, Stiff, Reddish Brown, Fat Clay with Chert	CH			15
5		SPT			Same, Very Stiff	CH			16
		SPT			Same, Medium Stiff	CH			4
10					AUGER REFUSAL @ 11.0 FEET				

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-19**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC	**HOLE No. B-20**
Project: South Park Road Apartments, Louisville, KY	Sheet 1 of 1
Project No.: 19-285G	

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **14.8** Rock: **0** Total Depth: **14.8**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/12/19 - 12/12/19**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)
	SPT			Topsoil (4 inches) OL Moist, Medium Stiff, Reddish Brown, Lean Clay CL	Ground
	SPT			Moist, Stiff, Reddish Brown, Fat Clay CH	
5	SPT			Same, Very Stiff, with Chert CH	
	SPT			Same, with Gravel (hard drilling) CH	
10				AUGER REFUSAL @ 14.8 FEET	

STANDARD PENETRATION TEST (blows/ft)

MC: PL — LL; 10 20 30 40 50 60 70 80 90

N VALUE: 4, 8, 15, 13

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-20**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-21

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **10.8** Rock: **0** Total Depth: **10.8**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/12/19 - 12/12/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)
					Topsoil (6 inches)	OL	Ground
		SPT			Moist, Medium Stiff, Reddish Brown, Lean Clay	CL	
		SPT			Same, Very Stiff, with Chert	CL	
5		SPT			Moist, Very Stiff, Reddish Brown, Fat Clay with Chert	CH	
		SPT			Same, Stiff	CH	
10					AUGER REFUSAL @ 10.8 FEET		

STANDARD PENETRATION TEST
● (blows/ft)
PL ▲ MC LL
10 20 30 40 50 60 70 80 90

N VALUE: 5, 21, 13, 10

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-21**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-22

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **11** Rock: **0** Total Depth: **11.0**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/13/19 - 12/13/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (4 inches)	OL	Ground		
		SPT			Moist, Medium Stiff, Reddish Brown, Lean Clay	CL			5
					Same, Very Stiff	CL			
		SPT							14
5					Same, with Chert	CL			
		SPT							17
		SPT							17
10					AUGER REFUSAL @ 11.0 FEET				

STANDARD PENETRATION TEST (blows/ft)
PL MC LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-22**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC	**HOLE No. B-23**
Project: South Park Road Apartments, Louisville, KY	
Project No.: 19-285G	Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.5** Rock: **0** Total Depth: **7.5**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/13/19 - 12/13/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	OL	Ground		
		SPT			Moist, Soft, Reddish Brown, Lean Clay with a trace of Organics	CL			3
5		SPT			Moist, Stiff, Reddish Brown, Lean Clay with Chert	CL			10
		SPT			Same, Very Stiff	CL		>>	50/4"
					AUGER REFUSAL @ 7.5 FEET				

PL — MC — LL

10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-23**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-24

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.6** Rock: **0** Total Depth: **7.6**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (7 inches)	OL	Ground		
		SPT			Moist, Stiff, Reddish Brown, Lean Clay with Ferromagnesian Nodules	CL			11
5		SPT			Same, Very Stiff	CL			12
					Same, with Weathered Limestone	CL			
					AUGER REFUSAL @ 7.7 FEET				

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-24**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-25

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **6.8** Rock: **0** Total Depth: **6.8**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (8 inches)	OL	Ground		
		SPT			Moist, Very Stiff, Brown, Lean Clay	CL		16	16
5		SPT			Same, with Weathered Limestone	CL		21	21
					AUGER REFUSAL @ 6.8 FEET				

STANDARD PENETRATION TEST
● (blows/ft)
MC
PL ▲ LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-25**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC	**HOLE No. B-26**
Project: South Park Road Apartments, Louisville, KY	
Project No.: 19-285G	Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **6.9** Rock: **0** Total Depth: **6.9**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches)	OL	Ground		
		SPT			Moist, Very Stiff, Brown, Lean Clay	CL			18
5		SPT			Same, with Ferromagnesian Nodules and Weathered Limestone	CL			22
					AUGER REFUSAL @ 6.9 FEET				

STANDARD PENETRATION TEST (blows/ft)
MC
PL — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon	NX - Rock Core, 2-1/8"
ST - Shelby Tube	CU - Cuttings
HQ - Rock Core, 2-1/2"	CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	

Hole No. **B-26**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-27

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8.1** Rock: **0** Total Depth: **8.1**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (6 inches) OL	Ground		
					Moist, Very Stiff, Reddish Brown, Lean Clay CL			
		SPT						15
5					Same, with Ferromagnesian Nodules and Weathered Limestone CL			
		SPT						20
					AUGER REFUSAL @ 8.1 FEET			

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-27**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086.

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-28

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **8** Rock: **0** Total Depth: **8.0**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (6 inches) OL	Ground		
		SPT			Moist, Very Stiff, Reddish Brown, Lean Clay with Ferromagnesian Nodules CL			15
5		SPT			Same, Hard, with Weathered Limestone CL			35
					AUGER REFUSAL @ 8.0 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
MC
PL ⊢▲⊣ LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-28**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - " ZONE " - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-29

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **7.5** Rock: **0** Total Depth: **7.5**
Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches)	OL	Ground		
		SPT			Moist, Stiff, Reddish Brown, Lean Clay with Ferromagnesian Nodules	CL			10
5		SPT			Same, Very Stiff, with Weathered Limestone	CL			24
					AUGER REFUSAL @ 7.5 FEET				

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-29**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-30

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **13.1** Rock: **0** Total Depth: **13.1**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (6 inches) OL	Ground		
					Moist, Stiff, Brown, Lean Clay CL			
		SPT						9
5		SPT						7
10		SPT			Same, Brown and Gray Mottled CL			7
					AUGER REFUSAL @ 13.1 FEET			

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-30**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-31

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.8** Rock: **0** Total Depth: **7.8**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft) PL MC LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (6 inches) OL	Ground		
		SPT			Moist, Stiff, Reddish Brown, Lean Clay with Ferromagnesian Nodules CL			10
5		SPT			Same, Hard, with Weathered Limestone CL			23
					AUGER REFUSAL @ 7.8 FEET			

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-31**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-32

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **6.6** Rock: **0** Total Depth: **6.6**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/25/19 - 11/25/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (7 inches) OL	Ground		
					Moist, Very Stiff, Reddish Brown, Lean Clay with Ferromagnesian Nodules CL			
		SPT						14
5		SPT						15
					AUGER REFUSAL @ 6.6 FEET			

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-32**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-33

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **10.5** Rock: **0** Total Depth: **10.5**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/14/19 - 12/14/19**

DEPTH (feet)	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
				Topsoil (7 inches)	OL	Ground	
	SPT			Moist, Soft, Brown, Lean Clay with a trace of Organics	CL		3
	SPT			Moist, Medium Stiff, Brown, Lean Clay	CL		6
5	SPT			Same, Very Stiff, with Chert	CL		18
	SPT			Same, Stiff	CL		11
10				AUGER REFUSAL @ 10.5 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-33**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-34

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **10.3** Rock: **0** Total Depth: **10.3**

Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/14/19 - 12/14/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N VALUE
					Topsoil (8 inches)	OL	Ground	
		SPT			Moist, Medium Stiff, Brown, Lean Clay with a trace of Organics	CL		5
		SPT			Moist, Very Stiff, Reddish Brown and Tan Mottled, Lean Clay	CL		13
5		SPT						21
		SPT						19
10					AUGER REFUSAL @ 10.3 FEET			

STANDARD PENETRATION TEST
● (blows/ft)
MC
PL ⊢▲⊣ LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-34**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC
Project: South Park Road Apartments, Louisville, KY
Project No.: 19-285G

HOLE No. B-35

Sheet 1 of 1

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**
Drilling Equipment: **Geoprobe 66DT Track-Mounted Drill** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**
Depth to water immediately: **Dry** Overburden: **8.5** Rock: **0** Total Depth: **8.5**
Logged By: **S. Greenbaum** Driller: **J. Kinderman** Date Logged: **12/15/19 - 12/15/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)
					Topsoil (7 inches)	OL	Ground
		SPT			Moist, Medium Stiff, Brown, Lean Clay with a trace of Organics	CL	
		SPT			Moist, Stiff, Brown and Tan Mottled, Lean Clay	CL	
5		SPT			Same, Very Stiff, with Chert	CL	
					AUGER REFUSAL @ 8.5 FEET		

STANDARD PENETRATION TEST
● (blows/ft)
PL ▲ MC LL
10 20 30 40 50 60 70 80 90

N VALUE
4
10
20

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
HQ - Rock Core, 2-1/2"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-35**

LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

Greenbaum Associates, Inc.
Louisville, KY 40215 (502) 361-8447

Client: LDG Development, LLC	**HOLE No. B-36**
Project: South Park Road Apartments, Louisville, KY	Sheet 1 of 1
Project No.: 19-285G	

Boring Location: **See Boring Location Plan** Surface Elevation: **Ground** Station: **n/a**

Drilling Equipment: **D-25 Track-Mounted Drill w/Auto Hammer** Drilling Method: **2 1/4 Inch ID Hollow Stem Augers**

Depth to water immediately: **Dry** Overburden: **7.9** Rock: **0** Total Depth: **7.9**

Logged By: **S. Greenbaum** Driller: **B. Sumler** Date Logged: **11/27/19 - 11/27/19**

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (6 inches) OL	Ground		
					Moist, Very Stiff, Brown, Lean Clay with Ferromagnesian Nodules CL			
		SPT						16
5					Same, Hard CL			
		SPT						37
					AUGER REFUSAL @ 7.9 FEET			

STANDARD PENETRATION TEST (blows/ft)
PL — MC — LL
10 20 30 40 50 60 70 80 90

SAMPLER TYPE

SS - Split Spoon	NX - Rock Core, 2-1/8"
ST - Shelby Tube	CU - Cuttings
HQ - Rock Core, 2-1/2"	CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	

Hole No. **B-36**

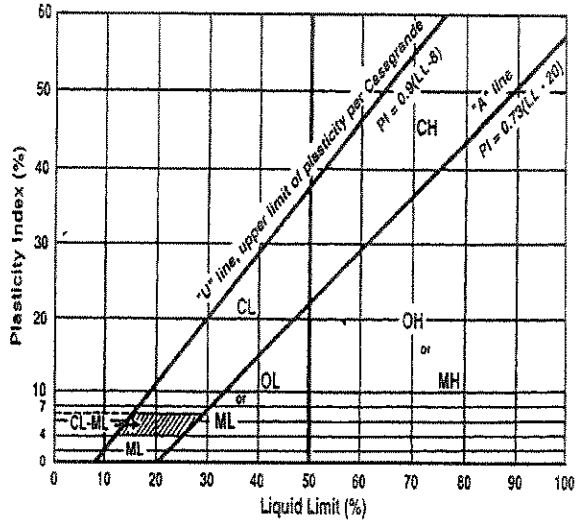
LOG WITH WELL AND SPT GRAPH 19-285.GPJ 08-053.GPJ 12/26/19

19 - ZONE - 0086

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM D2487 and D2488

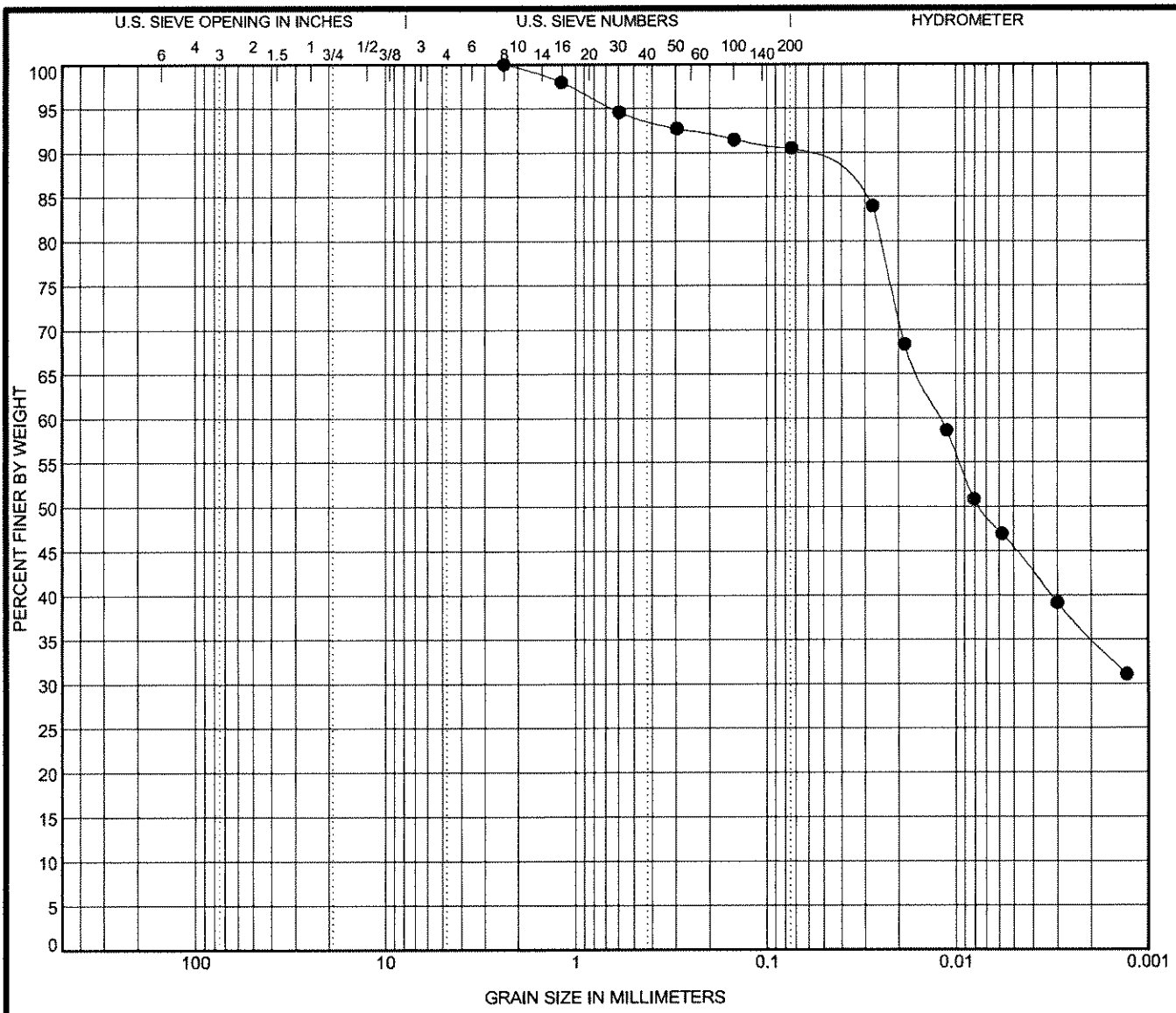
Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	**Gravels** (More than half of coarse fraction larger than No. 4 sieve)	**Clean Gravels** (Little or no fines)	**GW**	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller that No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent *Borderline* cases requiring dual symbols[b]	$C_u=D_{60}/D_{10}$ greater than 4 $C_u=(D_{30})^2/(D_{10}\times D_{60})$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	**GM**[a] d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line with P. I. less than 4	Above "A" line with P. I. between 4 and 7 are *borderline* cases requireing us of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line with P. I. greater than 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		$C_u=D_{60}/D_{10}$ greater than 6 $C_u=(D_{30})^2/(D_{10}\times D_{60})$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	**SM**[a] d / u	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. < 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requireing use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" lime with P.I. > 7	
Fine-grained soils (More than half meterial is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		**ML**	Inorganic silts and very fine sands, 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 siltyclays of low plasticity		
	Silts and clays (Liquid limit less that 50)		**MH**	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts		
			CH	Inorganic slays of 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

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits :suffix d used when L. L. is 28 or less and the P. I. is 6 or les; the suffix u used when L. L. is greater than 28.

[b] Borderline classifications, used for soils possessing characeristics of two groups, are sesignated by combinations of group symbols. For exampls: GW-GC, well-graded gravel-sand misture with clay binder.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-24	2.5	LEAN CLAY(CL)	37	19	18		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-24	2.5	2.38	0.012			0.0	9.5	45.3	45.2

Greenbaum Associates, Inc.
Louisville, KY 40215
(502) 361-8447

GRAIN SIZE DISTRIBUTION

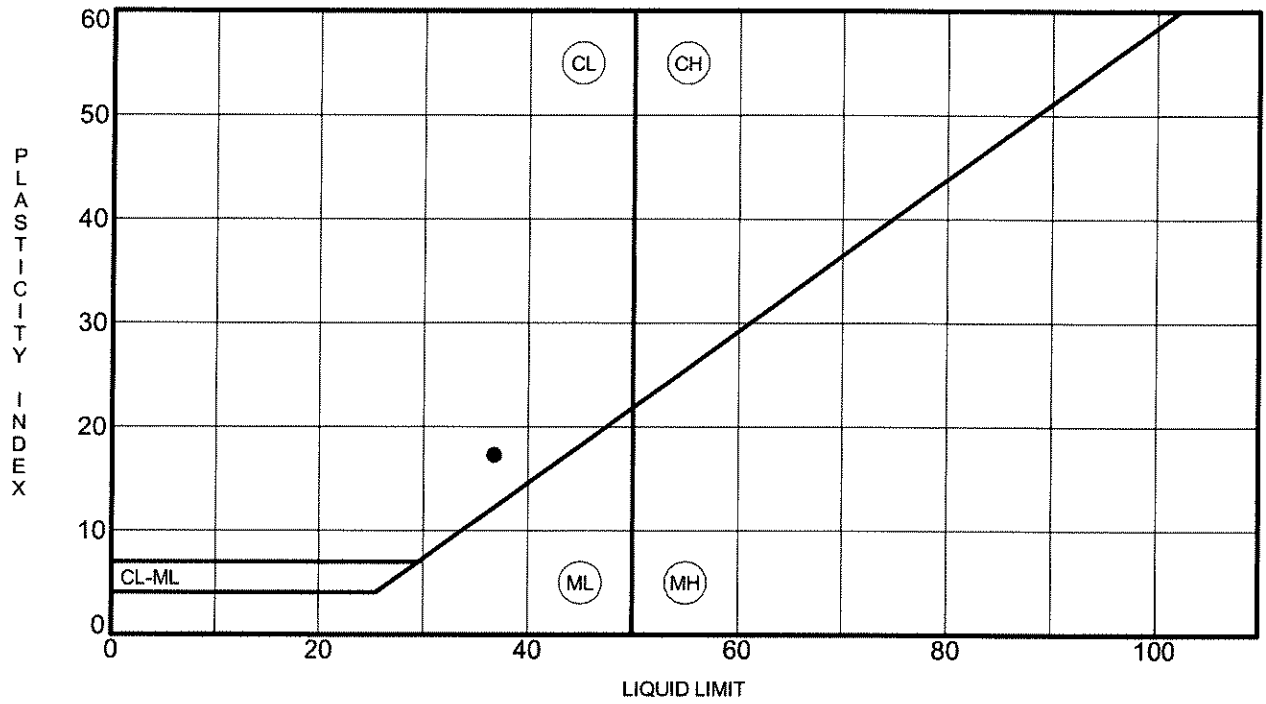
Project: South Park Road Apartments,

Location: Louisville, KY

Number: 19-285G

US GRAIN SIZE 19-285.GPJ GREENBAUM.GDT 12/26/19

19 - ZONE - 0086



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-24**	**2.5**	**37**	**19**	**18**	**91**	**LEAN CLAY(CL)**

Greenbaum Associates, Inc.
Louisville, KY 40215
(502) 361-8447

ATTERBERG LIMITS' RESULTS

Project: South Park Road Apartments,

Location: Louisville, KY

Number: 19-285G

US ATTERBERG LIMITS 19-285.GPJ GREENBAUM.GDT 12/24/19

19 - ZONE - 0086

GREENBAUM ASSOCIATES, INC.
GEOTECHNICAL & MATERIALS ENGINEERS

994 Longfield Avenue
Louisville, Kentucky 40215
502/361-8447
FAX 502/361-4793

February 27, 2020

Ms. Ramona Vasta
LDG Development, LLC
1469 S. 4th Street
Louisville, KY 40208

Re: Karst Survey
Apartment Community
South Park Road
Louisville, Kentucky
Project Number 19-285G

Dear Ms. Vasta:

On December 29, 2020, we provided the report of a geotechnical investigation that included a study of the geology, soils survey, and historic aerial photos along with the results of a program of drilling and laboratory testing. As part of that investigation, we walked the entire property and found no subsidence features that would result from karst development. We did note the possibility that shafts could have been excavated below the property as part of a quarrying operation that is exposed across South Park Road from the site. However, as a result of our concern, a seismic survey was performed by Dr. Kalinski and found that no mining has occurred below this property.

I will not elaborate more on the geology of the site here since that is discussed in detail in the geotechnical report referenced above, but no surface manifestation of karst development is present at this site, which includes the absence of:

- Sinkhole collapse features
- Sinkholes
- Surface drainage that flows into ground
- Ephemeral lakes
- Cave entrances
- Subsurface cave passages (verified by seismic survey)
- Springs
- Sinking streams

If you have any questions in regard to either the geotechnical or karst surveys, please call.

Sincerely,

GREENBAUM ASSOCIATES, INC.

Sandor R. Greenbaum

Digitally signed by Sandor R. Greenbaum
DN: cn=Sandor R. Greenbaum, o=Greenbaum Associates, Inc., ou, email=srg@geo-engineers.com, c=US
Date: 2020.02.27 11:18:37 -05'00'

Sandor R. Greenbaum, P.E.
Principal Engineer

19 - L ZONE - 0086

February 21, 2020

Ms. Ramona Vasta
LDG Development, LLC
1469 S. 4th St.
Louisville, KY 40208

RE: Report of findings of geophysical DC resistivity survey to identify and delineate tunnels under the LDG Development site in Louisville, Kentucky

Dear Ms. Vasta,

SUMMARY

I am pleased to provide this report describing the results of my geophysical direct-current (DC) resistivity survey at the LDG Development site in Louisville, Kentucky. The site is situated on an 18.64-acre tract of land adjacent to a water-filled quarry near the intersection of South Park Road and Blue Lick Road in Louisville, Kentucky. The site covers the following addresses in Louisville:

- 4011 South Park Rd.;
- 4201 South Park Rd.; and
- 9007 Blue Lick Rd.

The geophysical survey consisted of a grid of survey lines along which the direct-current (DC) electrical resistivity method was applied. The survey revealed the presence of a thin layer of soil over limestone. Values for electrical resistivity derived from analysis of the field data reveal that some of the limestone is weathered and contains some moisture. However, none of the zones in the limestone possessed unusually low electrical resistivity that could be associated with a water-filled cavity. Therefore, there was no indication on the geophysical data of the presence of any underground quarry workings beneath the site.

SURVEY DESCRIPTION

Prior to the survey, I conducted research to identify any information that may exist regarding the location of quarry workings at the site. Sources of information that I explored included the Kentucky Geological Survey, the University of Kentucky Department of Mining Engineering, the United States Geological

Survey, the Mine Safety and Health Administration and the Mining Division of the Kentucky Energy and Environment Cabinet. Unfortunately, none of these sources yielded any information regarding the presence of existing mine workings at the site. I also spoke to the owner of the quarry, Jason Stanford, about the possibility of exploring an existing tunnel at the quarry. After discussing the matter with Jason, I concluded that entering the cave was too risky.

The geophysical survey was carried out in early February 2020 at the site. Field activities consisted of clearing brush and surveying the individual lines using a handheld GPS on February 3 and 7 and acquiring geophysical data on February 8, 14, 15 and 19. Line locations were selected to provide a uniform distribution of coverage over the entire site. It was also necessary to position the lines in the survey to maintain a reasonable distance between the survey lines and the existing metal fences at the site because the presence of the metal fences can negatively affect the quality of the field data. The locations of the lines (labeled A through E) are summarized in Table 1 and depicted on Fig. 1.

Direct-current (DC) electrical resistivity geophysical testing (Appendix A) was performed using an 84-electrode Advanced Geosciences Inc. (AGI) Sting-Swift data acquisition system (Fig. 2). Field acquisition includes installing a row of 84 steel electrodes into the ground and injecting current into the ground using a 12-volt car battery. Current is injected using different pairs of electrodes along the line and voltage is measured across separate pairs of electrodes. The magnitude of the measured voltage is a function of the position of the electrodes being used for the measurement and the electrical resistivity of the ground beneath the electrodes. Data are automatically acquired by computer and a dataset consisting of hundreds of individual measurements along the line is acquired. These measurements contain information about how the electrical resistivity varies in the ground beneath the line. By analyzing the data, a two-dimensional profile showing variations in electrical resistivity is generated. This profile is interpreted to infer subsurface conditions at the site. For this site, zones of low (less than 10 ohm-meters) electrical resistivity were considered to be indicative of water-filled tunnels.

RESULTS

Direct-current resistivity testing was performed along five profile lines as described in the previous section. Data were acquired using an 84-electrode AGI Sting-Swift data acquisition system and analyzed using the AGI EarthImager 2D software. Results from analysis of the data are shown in Figs. 3-8. Each figure contains three profiles that depict the field data (top), the modeled data (middle) and the model that was used to calculate the modeled data (bottom). The x-axis

of the profiles depicts the distance along the line on the ground surface in units of feet, and the y-axis depicts depth below the ground surface in units of feet. The colors on the profiles indicate values of electrical resistivity as shown in the attached legends, with red colors indicating high resistivity and blue colors indicating low resistivity.

The bottom profile in each figure (the model) is the one that most directly illustrates subsurface conditions in Figs. 3-8. The model profiles reveal the presence of a thin (a few feet) layer of soil with relatively low resistivity underlain by limestone. The electrical resistivity of the limestone varies from 100s to 1000s of ohm-meters, which indicates varying levels of weathering and moisture content within the limestone as expected. Cavities filled with groundwater, including karst features and flooded tunnels, typically possess electrical resistivity of around 10 ohm-meters or less as shown in the example from Thailand in Fig. 9. On the profiles acquired at the Louisville site, water-filled tunnels would appear as deep blue in color with dimensions on the order of tens of feet across. There are no anomalies on the profiles acquired in Louisville that indicate the presence of water-filled tunnels beneath the LDG site in Louisville. Moreover, an air-filled tunnel would possess an electrical resistivity in the hundreds of thousands of ohm-meters on the profiles. There is no evidence to indicate the presence of air-filled tunnels.

Thank you very much for providing me with the opportunity to provide geophysical services on this project. Please do not hesitate to contact me if you have any questions or require any additional information.

Sincerely,

Michael E. Kalinski

Michael E. Kalinski, Ph.D., P.E.
University of Kentucky
Department of Civil Engineering
161 Raymond Bldg.
Lexington, KY 40506-0281
tel: (859) 321-3057
email: michael.kalinski@uky.edu

Exp. 6/30/2021

Attachment: Table 1
Figures 1-9
Appendix A

Line	Date Acquired	Electrode Spacing (ft)	Number of Electrodes	Total Length (ft)
A	Feb. 8, 2020	10	84	830
B	Feb. 14, 2020	6	84	498
C	Feb. 14, 2020	12	84	996
D	Feb. 15, 2020	15	84	1,245
E	Feb. 19, 2020	8	84	664

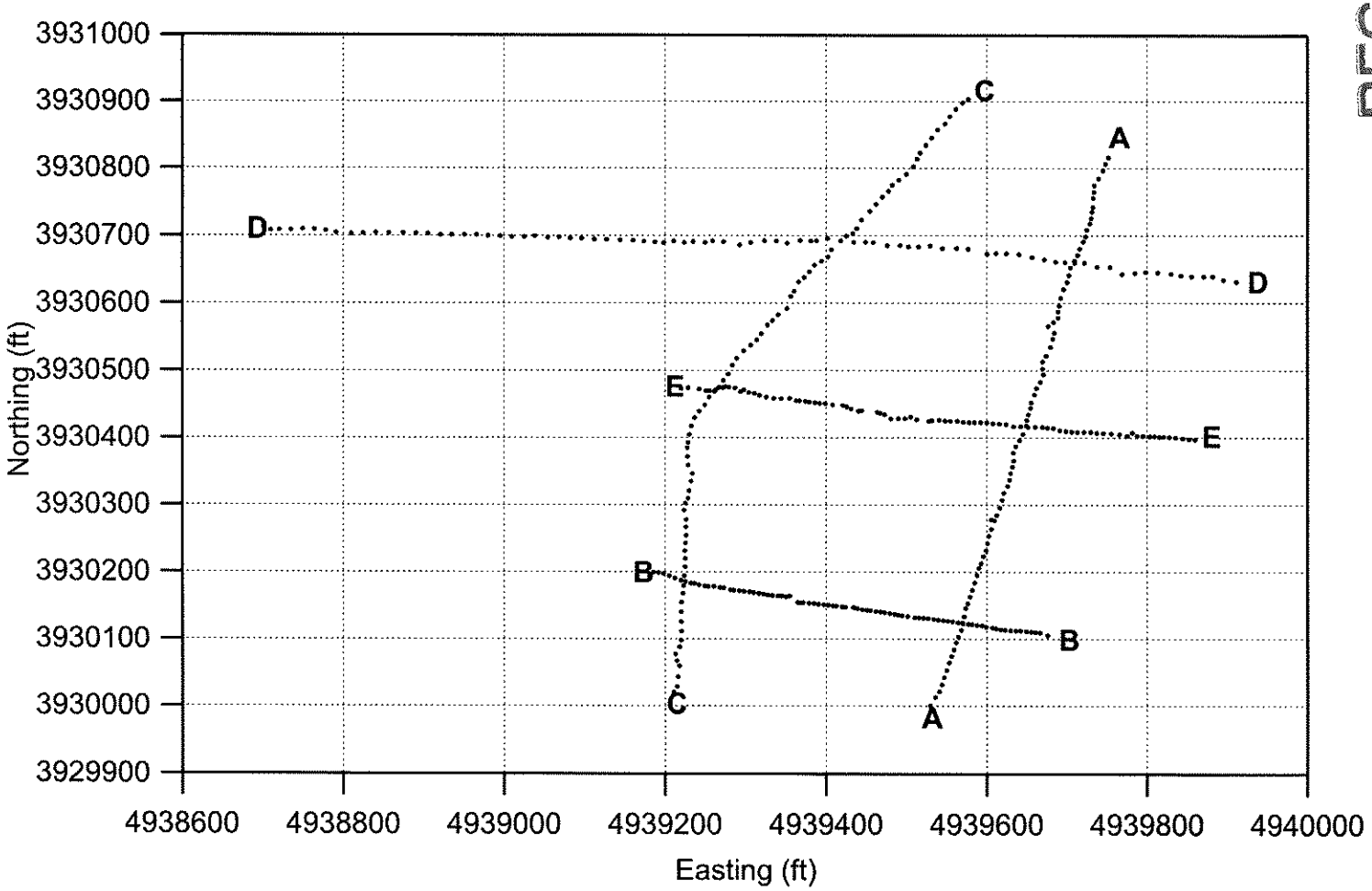


Figure 1. Location of DC resistivity lines (A through E) used for this investigation.

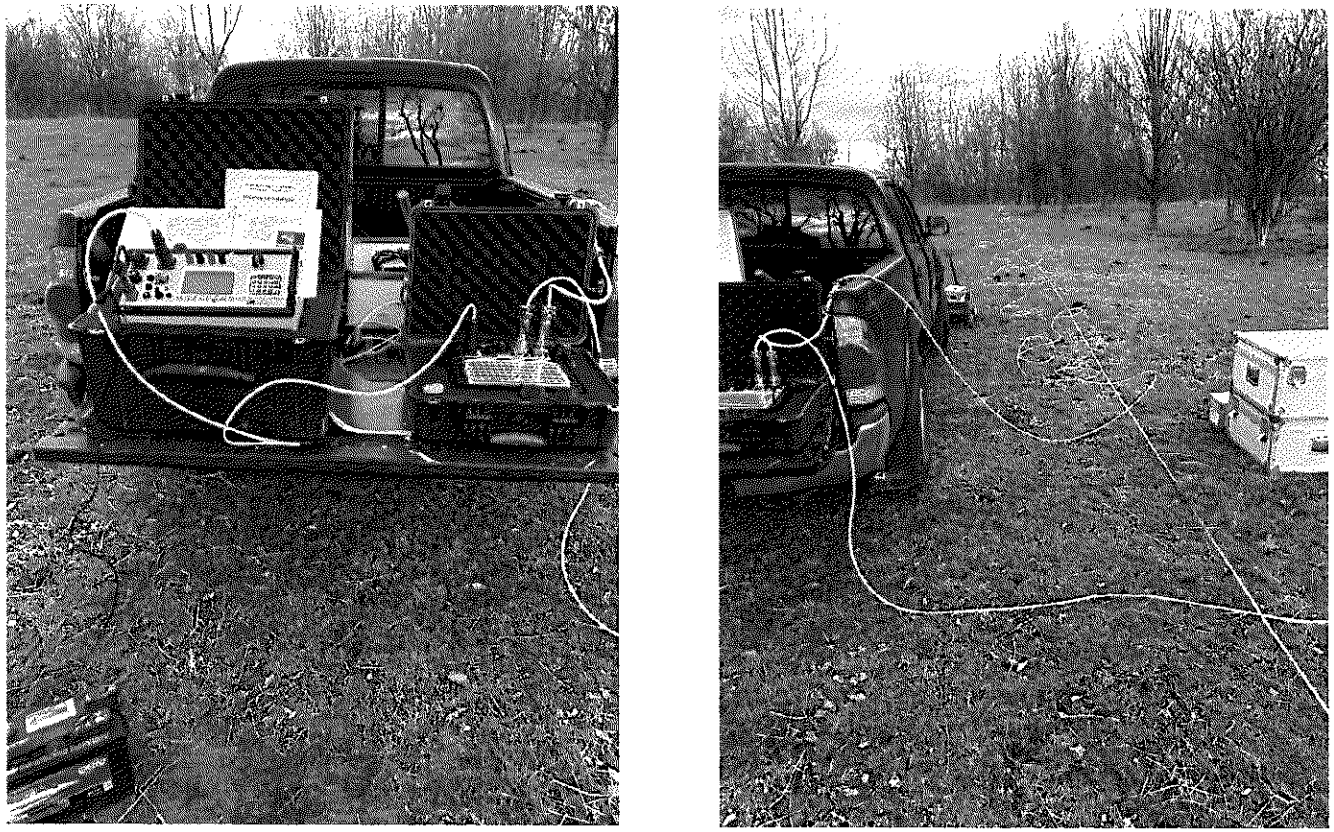


Figure 2. Photograph of DC resistivity data acquisition activities along Line A showing Sting data acquisition system and electrical source (left) and electrode array (right).

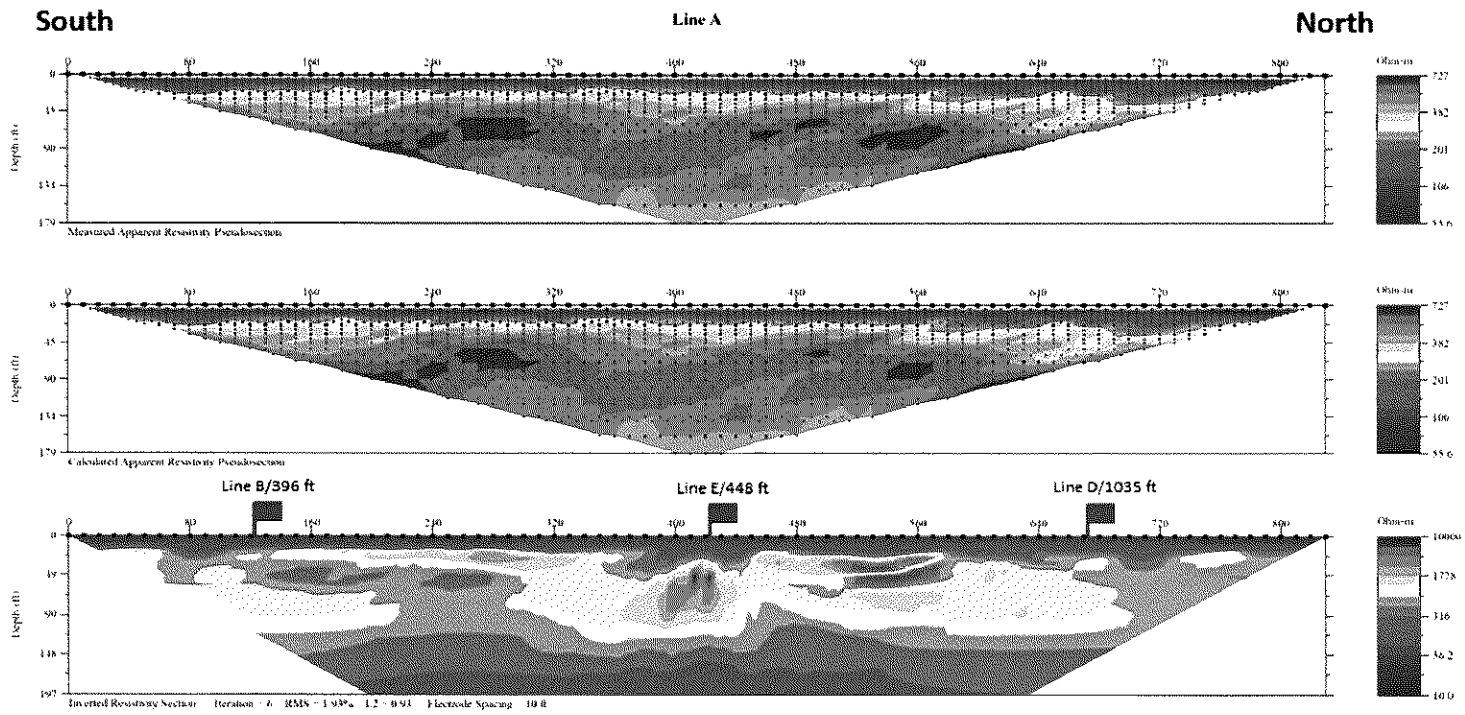


Figure 3. Data and model from Line A.

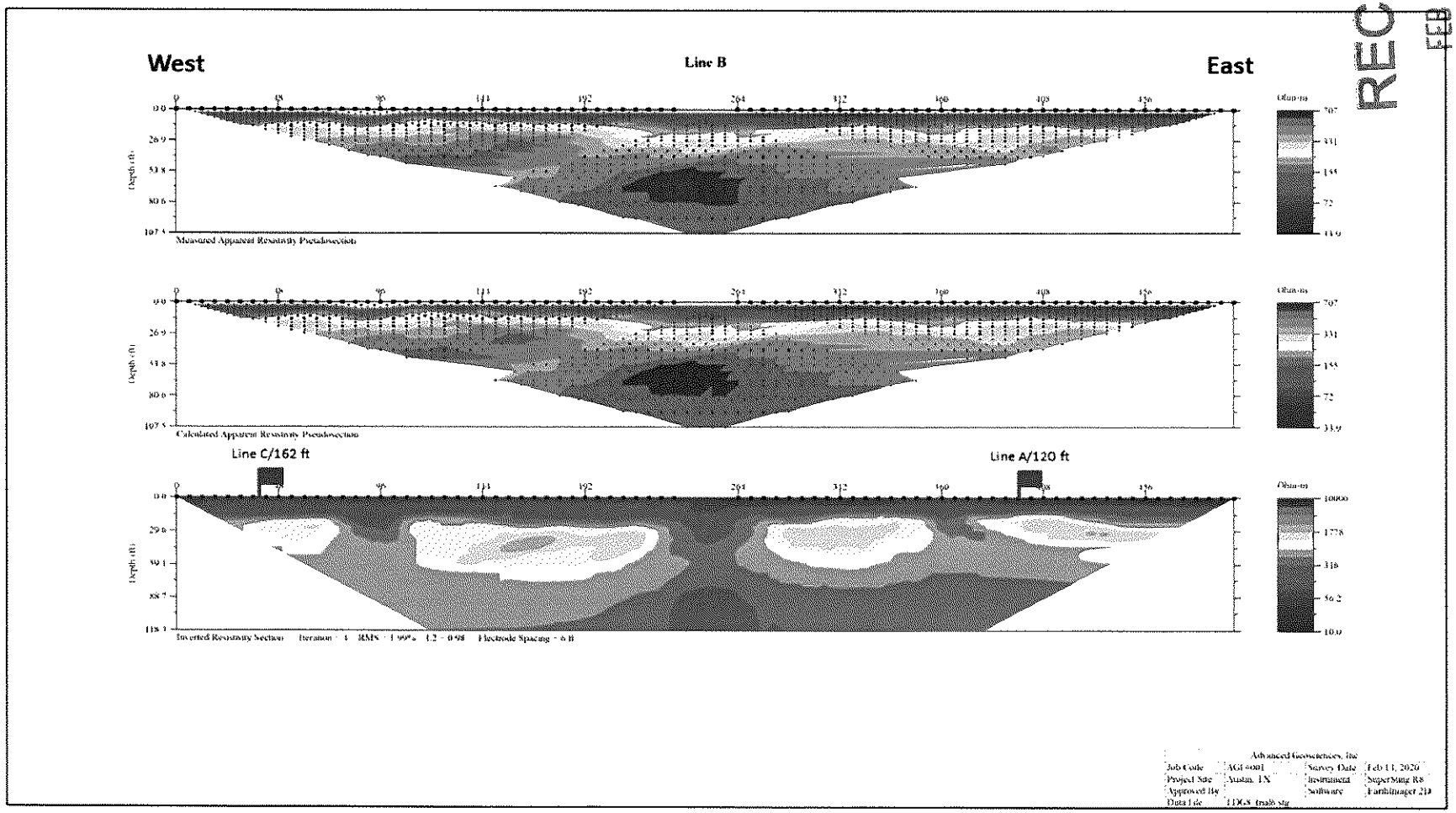


Figure 4. Data and model from Line B.

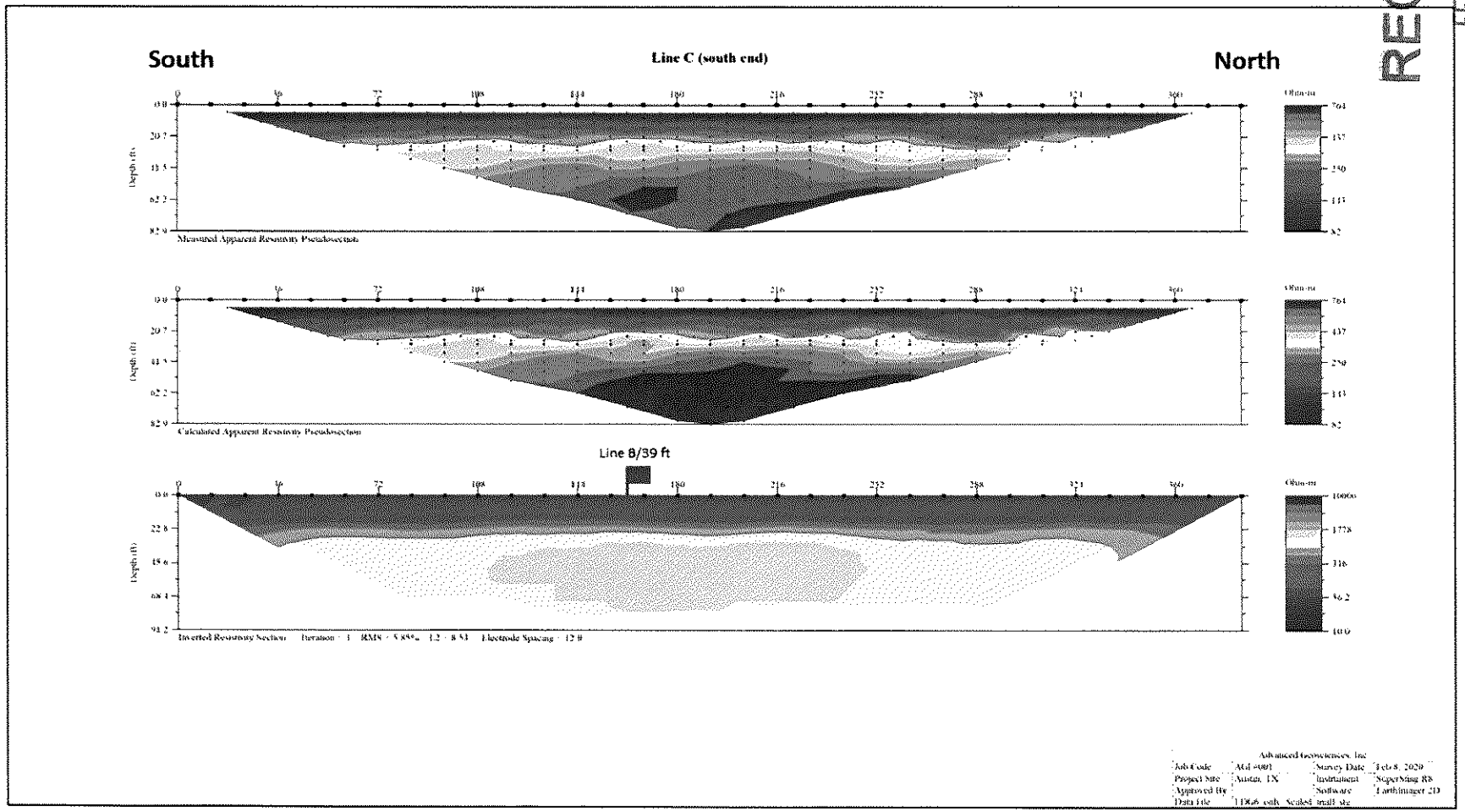


Figure 5. Data and model from Line C (south end).

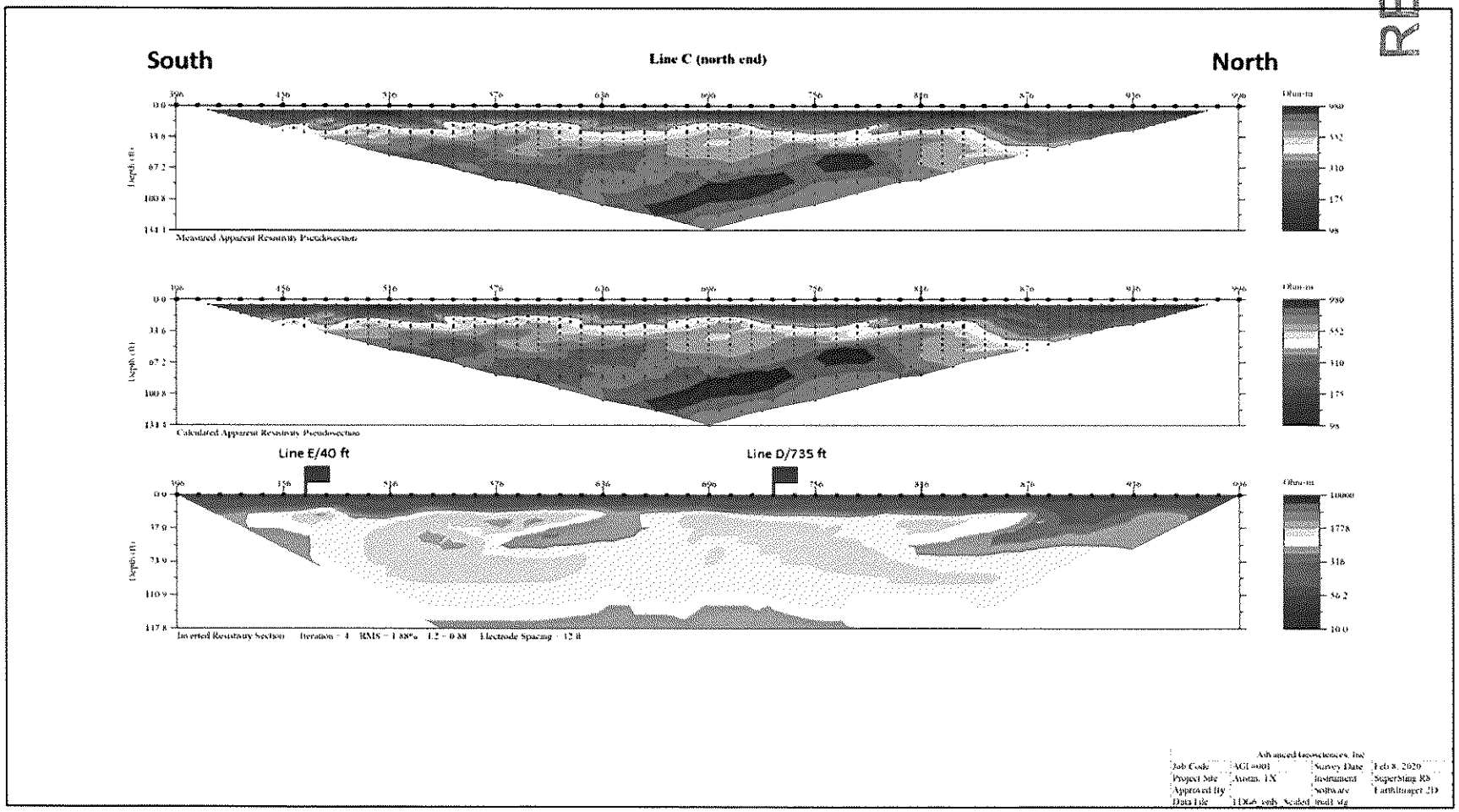


Figure 6. Data and model from Line C (north end).

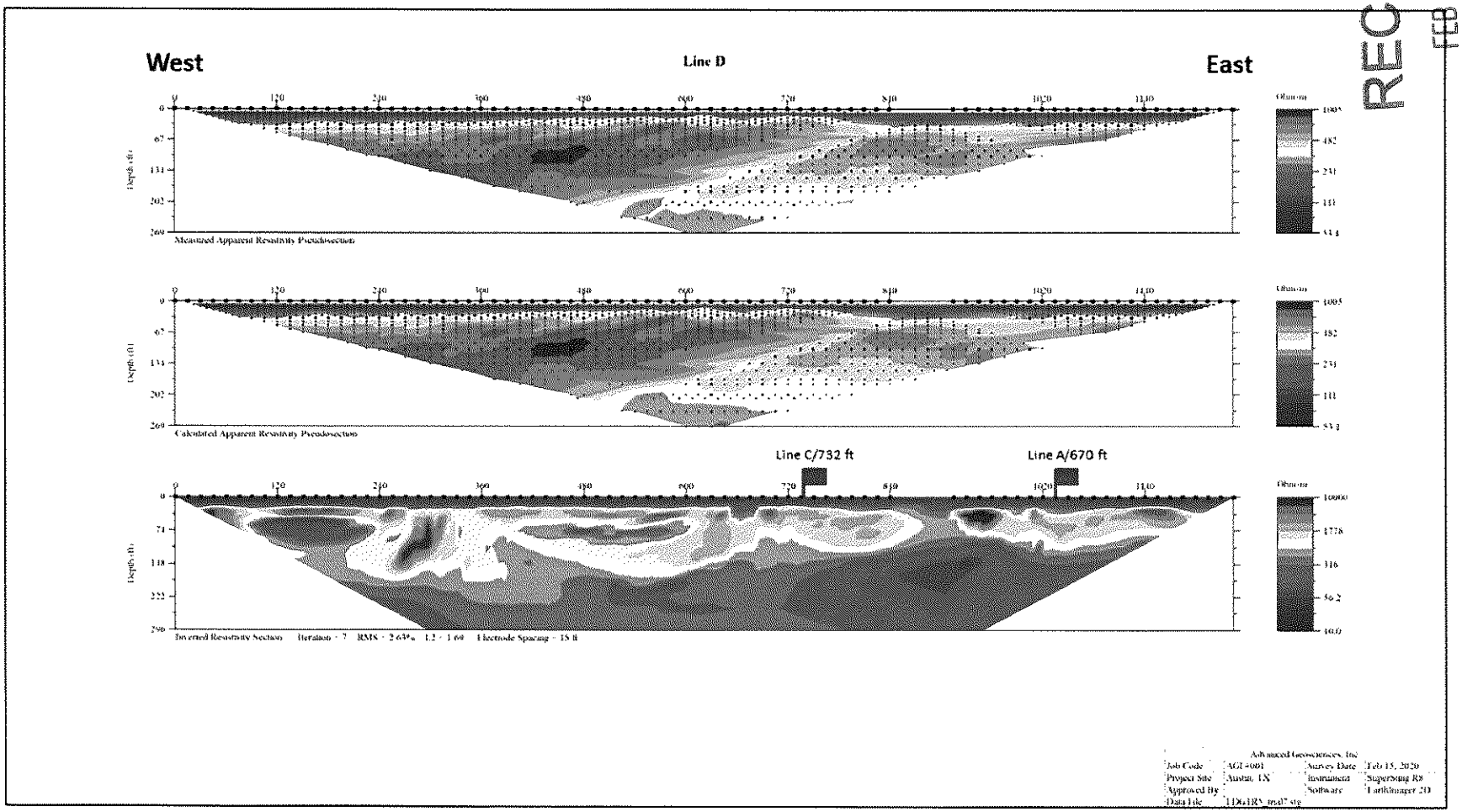


Figure 7. Data and model from Line D.

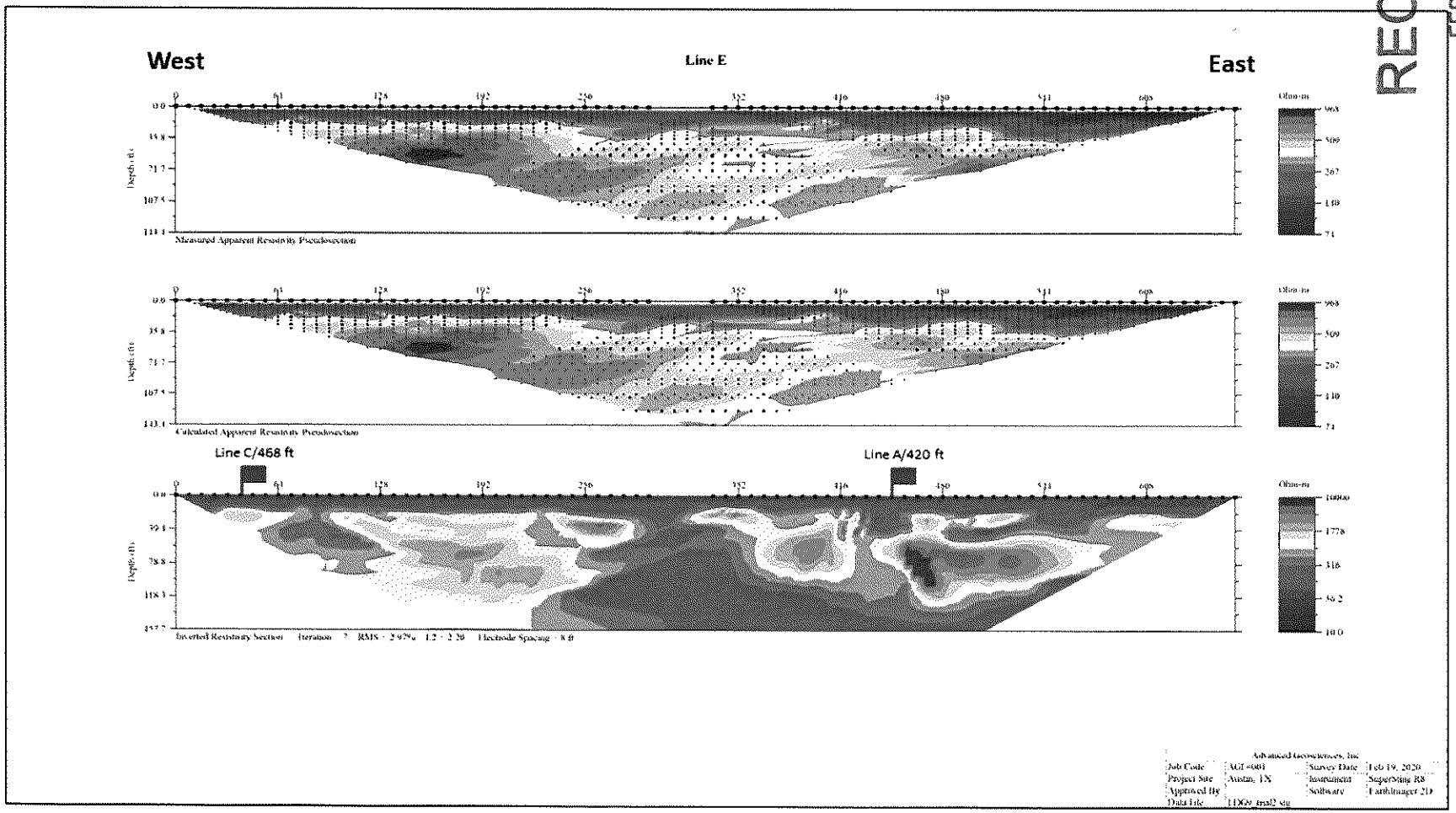


Figure 8. Data and model from Line E.

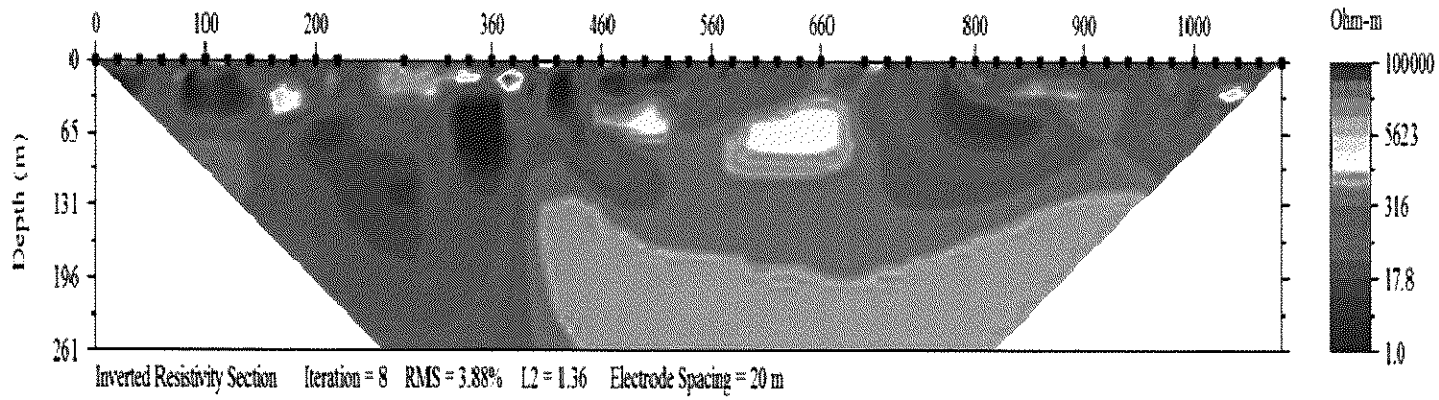


Fig. 9. Example of an inverted resistivity profile from a site in Thailand revealing a water-filled void at Station 360 with resistivity less than 10 ohm-meters .

APPENDIX A
DESCRIPTION OF THE DC RESISTIVITY GEOPHYSICAL METHOD

Geophysical exploration is the practice of performing physical measurements at the surface of the earth in order to ascertain subsurface properties and conditions. Geophysics can be used for many different specific purposes, including mineral exploration, prediction of dynamic behavior, or characterization of groundwater resources. Geophysical methods allow measurement of the physical properties of soil and rock, including elastic properties and electrical properties[1]. Electrical properties include parameters such as resistivity, conductivity, inductance, and capacitance. Once these properties are measured, they must be interpreted to infer subsurface conditions. Ultimately, such interpretations must be validated, and validation is typically achieved through exploratory drilling. However, the use of geophysical data as an interpretive aid allows a site investigation to be performed using fewer borings, which reduces the cost of the investigation and increases the likelihood of producing an accurate depiction of subsurface conditions.

Groundwater can exist in the pore spaces of soil or rock under saturated conditions (i.e. all of the pores, voids, and fractures are filled with water) or unsaturated conditions. It can also exist as underground rivers and lakes in karst environments. Since electricity can move more easily through water than soil or rock, the bulk electrical resistivity of the earth is highly dependent on the presence of water, as well as the salinity of the water. In general, the electrical resistivity of carbonate rock is on the order of thousands of ohm-meters. The electrical resistivity of soil is on the order of hundreds of ohm-meters, and the electrical resistivity of groundwater is on the order of ten ohm-meters. These ranges are general estimates, but illustrate the relative difference in electrical resistivity of earth materials. Other factors also play a role, including:

- Rock petrology: rocks containing large amounts of ferrous minerals tend to be less resistive;
- Soil mineralogy: clayey soils tend to be less resistive than sandy soils;
- Water content: saturated soils with more water tend to be less resistive than unsaturated soils; and

[1] Reynolds, J. M., 1997, *An Introduction to Applied and Environmental Geophysics*, John Wiley & Sons, New York.

- Ground water salinity: groundwater with a large amount of dissolved salts tends to be less resistive.

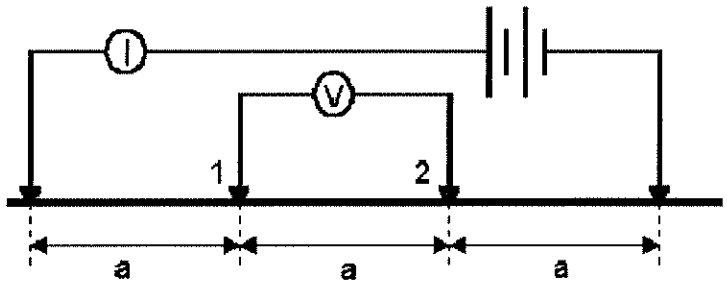
The dependence of soil petrology, rock mineralogy, water content, and ground water salinity on the bulk electrical resistivity of the earth is exploited using the direct-current (DC) resistivity geophysical method. With the DC resistivity method, variations in the bulk electrical resistivity of the earth are quantified. These values are then interpreted to infer groundwater conditions.

Traditional DC resistivity testing has been performed using the DC sounding method. To perform a sounding, a single stationary point is set at the center of the array. Two different types of arrays have been most commonly used as illustrated in Fig. A1. To perform a measurement, current (I) is passed through the current electrodes, while voltage (V) is measured across the potential electrodes. To use the Wenner array, electrodes are placed using a uniform spacing (*a*). After a measurement is made, the electrodes are moved further apart from each other. Larger electrode spacings correspond to deeper depth of investigation. The Wenner array is easy to deploy and provides good data in noisy environments. To use the Schlumberger array, the potential electrodes are kept at a fixed location with spacing (*M*), while the current electrodes are moved further and further apart as (*L*) is increased for successive measurements. The Schlumberger array is easier to deploy than the Wenner array, but the Schlumberger array is not as good as the Wenner array in noisy environments.

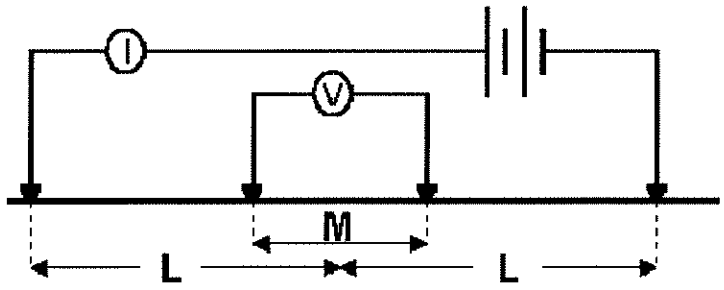
The Wenner and Schlumberger arrays are both effective for quantifying variations in resistivity with depth. Apparent resistivity is calculated for each electrode spacing and is a function of electrode spacing, current, and voltage. Plots of apparent resistivity versus electrode spacing are inverted to calculate a sounding of true resistivity versus depth for a single point as illustrated schematically in Fig A2.

Traditional four-electrode DC resistivity surveys using the Wenner or Schlumberger arrays were widely used in the past because data acquisition was very simple. These methods provided one-dimensional soundings showing variations in electrical resistivity with depth. However, the development of multiple-channel, multiple-electrode systems with automatic electrode switching capabilities has led to the practice of resistivity profiling, where electrical resistivity is calculated in two dimensions as a function of depth and lateral position. Dipole-dipole arrays (Fig. A3) are often used for resistivity profiling and are beneficial for resolving lateral variations in resistivity. To perform a surface resistivity survey, an array of electrodes (typically 56 or more) is deployed along a line with a uniform

spacing. Readings are taken by using various combinations of current and potential electrodes, and the multiple channel array is used to perform a series of four-electrode measurements. The lateral position of the electrodes and the electrode spacing are varied between measurements so that the zone of earth material sampled in the measurement varies with lateral position and depth (Fig. A4). A pseudo section of apparent conductivity is generated, where apparent resistivity is displayed as a function of dipole spacing and lateral position as seen in Fig. A5. The pseudo section is inverted to delineate zones of anomalously high or low electrical conductivity indicative of water-filled or air-filled subsurface voids, such as mine workings or karst features. Inversion is typically performed using commercially available computer software.



Wenner array



Schlumberger array

Figure A1. Wenner and Schlumberger arrays commonly used for DC resistivity sounding.

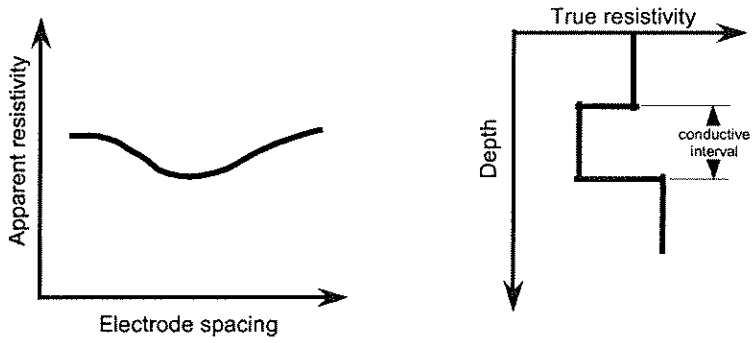


Figure A2. Apparent resistivity curve and inverted profile of true resistivity versus depth

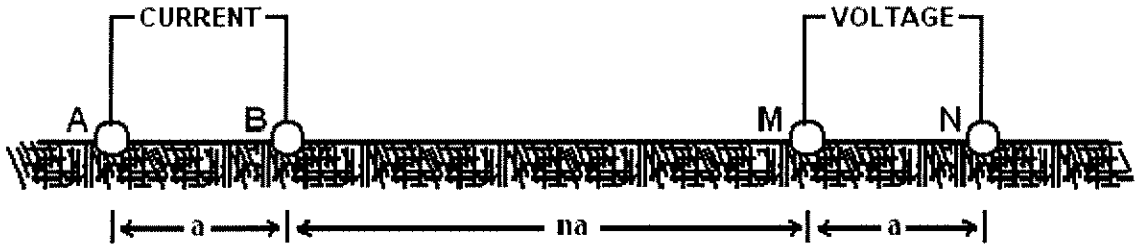


Figure A3. Dipole-dipole array used for surface resistivity prospecting.

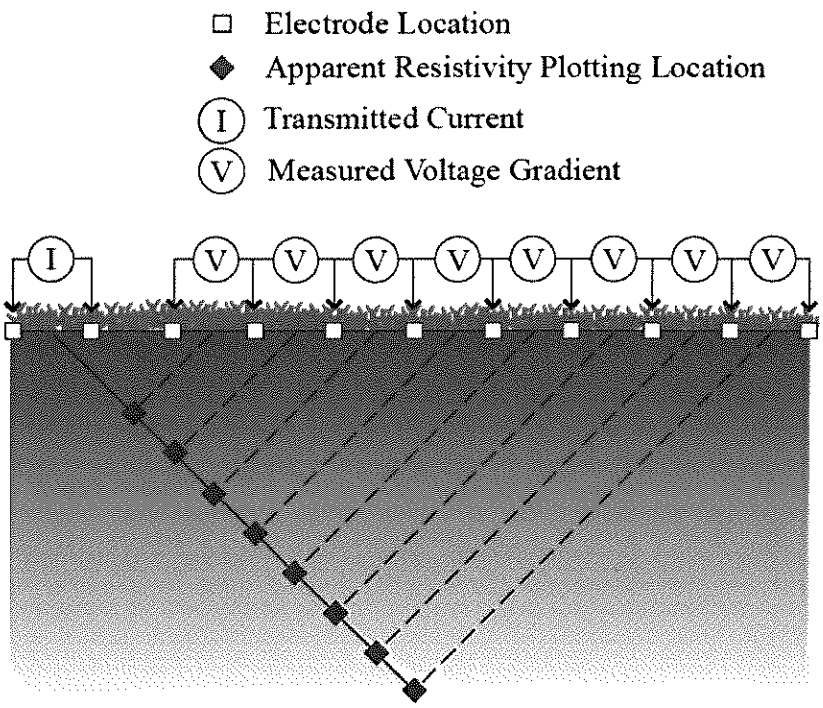


Fig. A4. Two-dimensional resistivity profiling using the dipole-dipole array.

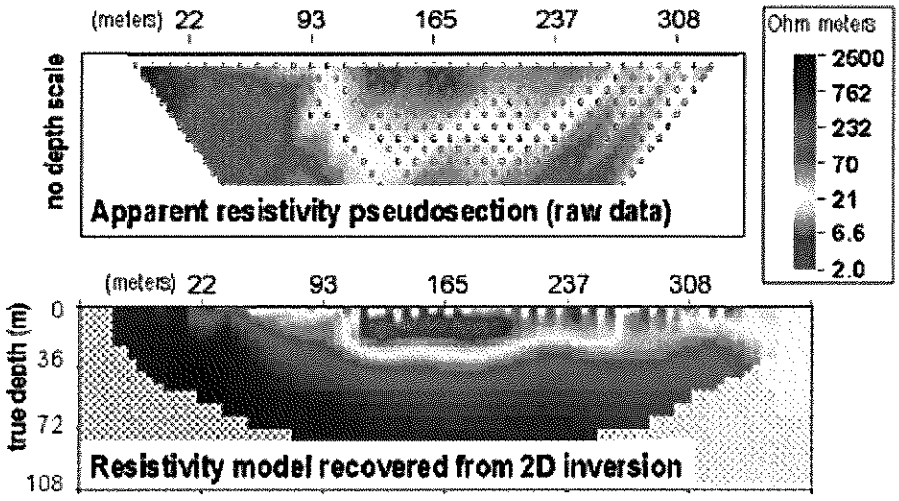


Figure A5. Pseudosection and inverted 2D resistivity profile derived from multiple-electrode DC resistivity measurement.

The current state-of-practice method used today for DC resistivity data acquisition employs the use of an AGI Sting/Swift data acquisition system (Fig. A6). This system typically employs the use of 56 or more electrode with electrode spacings ranging from 5-20 ft. Using this system, dipole-dipole data are rapidly and automatically acquired along the entire line so that lateral variations in electrical resistivity indicative of tunnels or karst features be resolved. The resulting pseudosections are typically inverted using the RES2DINV software.

Figure A6. Typical data acquisition activities using the Sting/Swift system.

final report

February 3, 2020

Traffic Impact Study

South Park Road Apartments
4011 South Park Road
Louisville, KY

Prepared for

Louisville Metro Planning Commission
Kentucky Transportation Cabinet

DIANE B. ZIMMERMAN
Traffic Engineering, LLC

Table of Contents

INTRODUCTION

The development plan for an apartment community on South Park Road in Louisville, KY shows 312 apartment units. **Figure 1** displays a map of the site. Access to the community will be from an entrance on Blue Lick Road (KY 1450) opposite White Oak Park Road and South Park Road. The purpose of this study is to examine the traffic impacts of the development upon the adjacent highway system. For this study, the impact area was defined to be the intersections of Blue Lick Road and South Park Road and the proposed entrances.

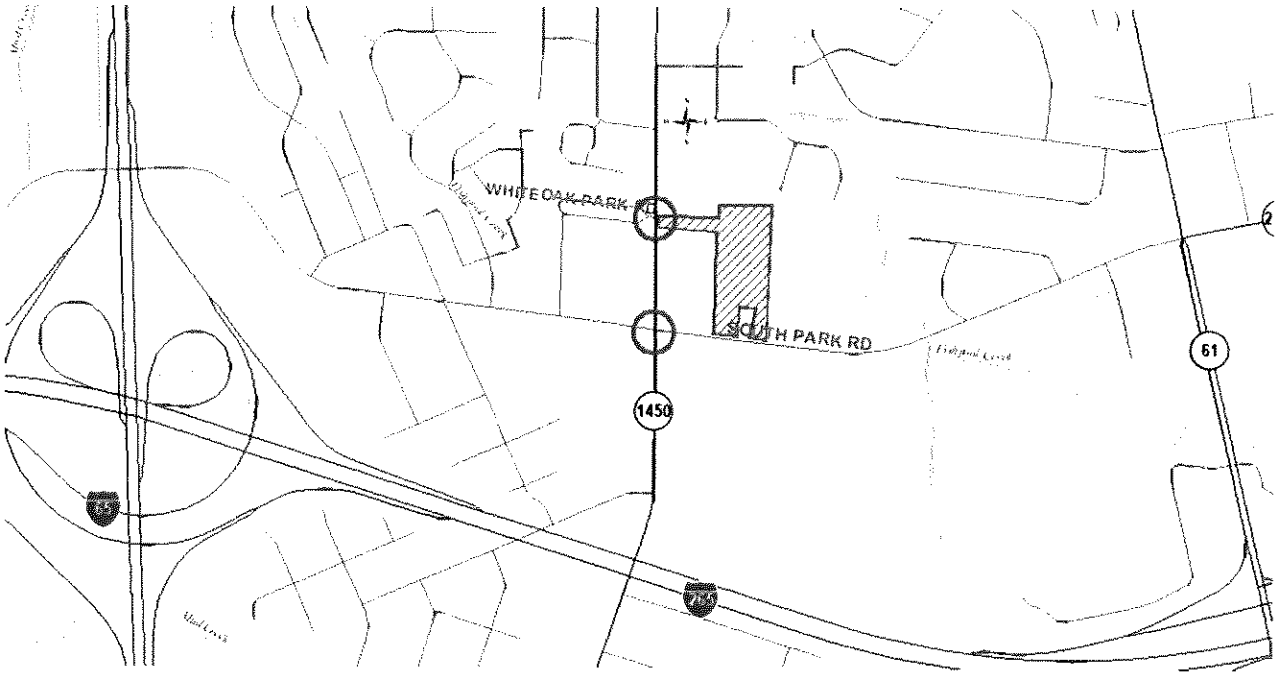


Figure 1. Site Map

EXISTING CONDITIONS

Blue Lick Road, KY 1450, is a state-maintained road with an estimated 2020 ADT of 10,800 vehicles per day between South Park Road and Preston Highway (KY 61), as estimated from the 2018 Kentucky Transportation Cabinet count at station 584. The road is a two-lane highway with ten-foot lanes with two-foot shoulders through the study area. The speed limit is 35 mph. There are no sidewalks. The intersection with South Park Road, is controlled with a traffic signal. There are dedicated left-turn lanes on all approaches, and dedicated right-turn lanes on all approaches except westbound.

South Park Road is a maintained by Louisville Metro with an estimated 2020 ADT of 15,800 vehicles per day between Blue Lick Road and Preston Highway (KY 61), as estimated from the 2017 Kentucky Transportation Cabinet count at station 586. The road is a two-lane highway with eleven-foot lanes with two-foot shoulders through the study area. The speed limit is 35 mph. There are no sidewalks.

Peak hour traffic counts for the intersections were obtained on Thursday, November 21, 2019. The a.m. peak hour is 7:00 to 8:00 and the p.m. peak hour is 4:45 to 5:00. **Figure 2** illustrates the existing a.m. and p.m. peak hour traffic volumes. The Appendix contains the full count data for each intersection.

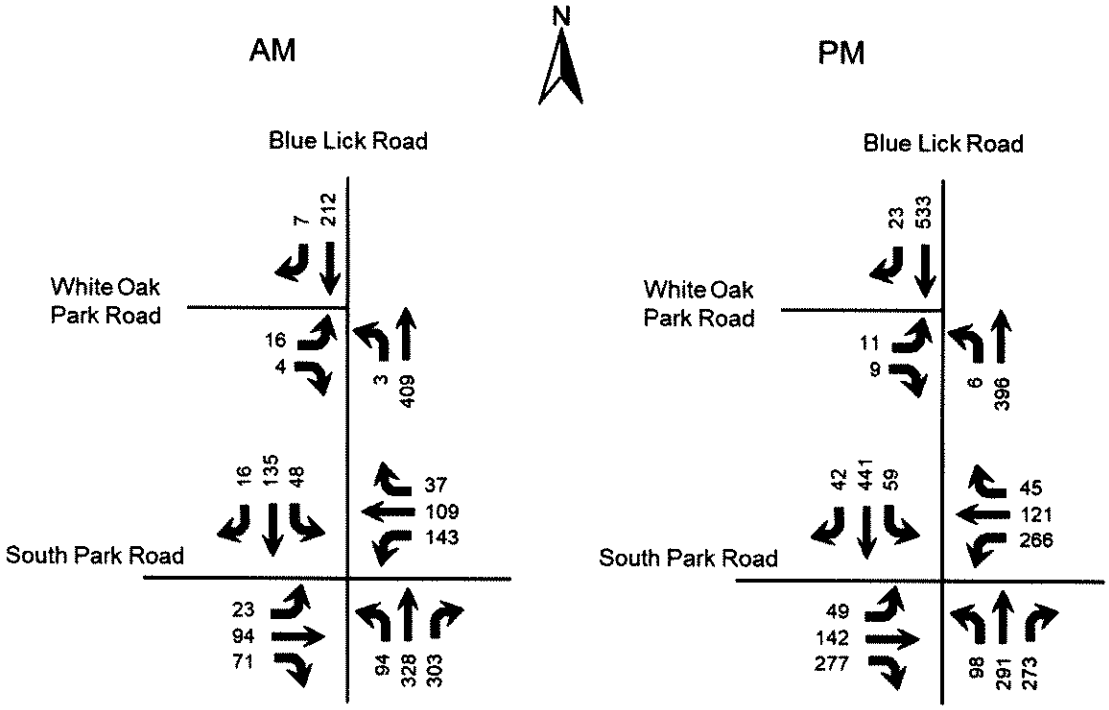


Figure 2. Existing Peak Hour Volumes

FUTURE CONDITIONS

The project completion date is 2022. An annual growth rate of 1.0 percent was applied to all 2019 volumes. This was determined by the historical growth at KYTC station 584 and 586. The Kentucky Transportation Cabinet will be widening Blue Lick Road to include a two-way left turn lane beginning in the summer of 2020. This project should be completed with occupancy of this project. **Figure 3** displays the 2022 No Build peak hour volumes.

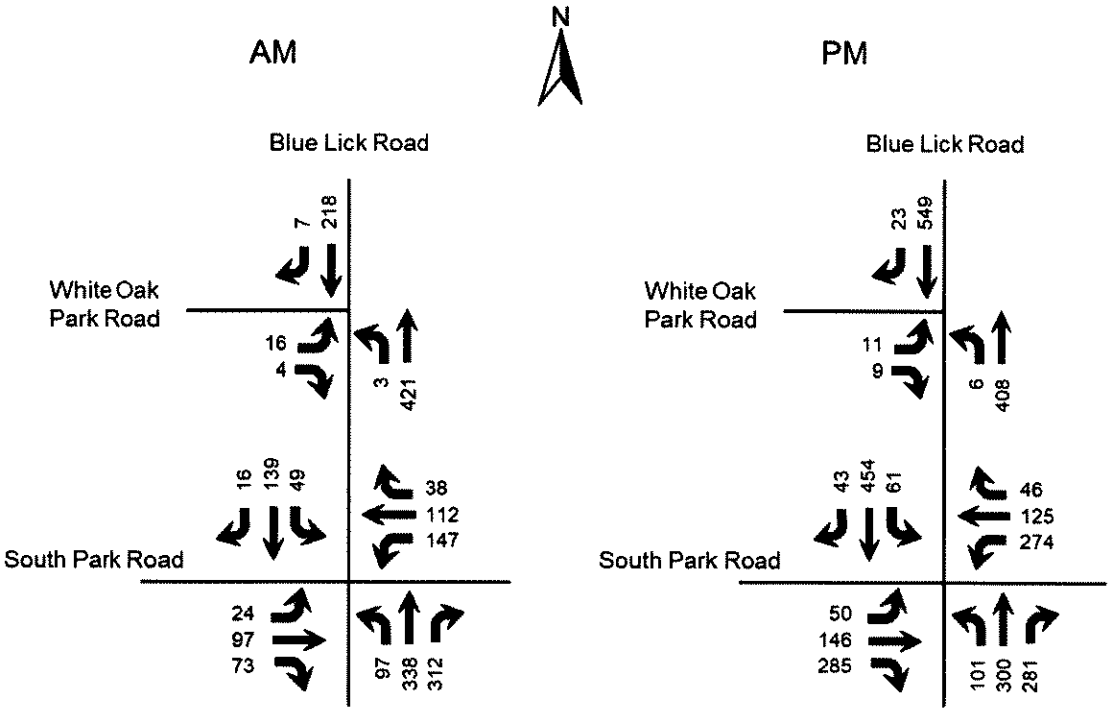


Figure 3. 2022 No Build Peak Hour Volumes

TRIP GENERATION

The Institute of Transportation Engineers Trip Generation Manual, 10th Edition contains trip generation rates for a wide range of developments. The land use of "Multifamily Housing Mid-Rise (221)" was reviewed and determined to be the best match. The trip generation results are listed in **Table 1**. The trips were assigned to the highway network with the percentages shown in **Figure 4**. **Figure 5** shows the trips generated by this development and distributed throughout the road network during the peak hours. **Figure 6** displays the individual turning movements for the peak hours when the development is completed.

Table 1. Peak Hour Trips Generated by Site

	A.M. Peak Hour			P.M. Peak Hour		
Land Use	Trips	In	Out	Trips	In	Out
Multifamily Housing Mid-Rise (312 units)	104	27	77	132	81	51

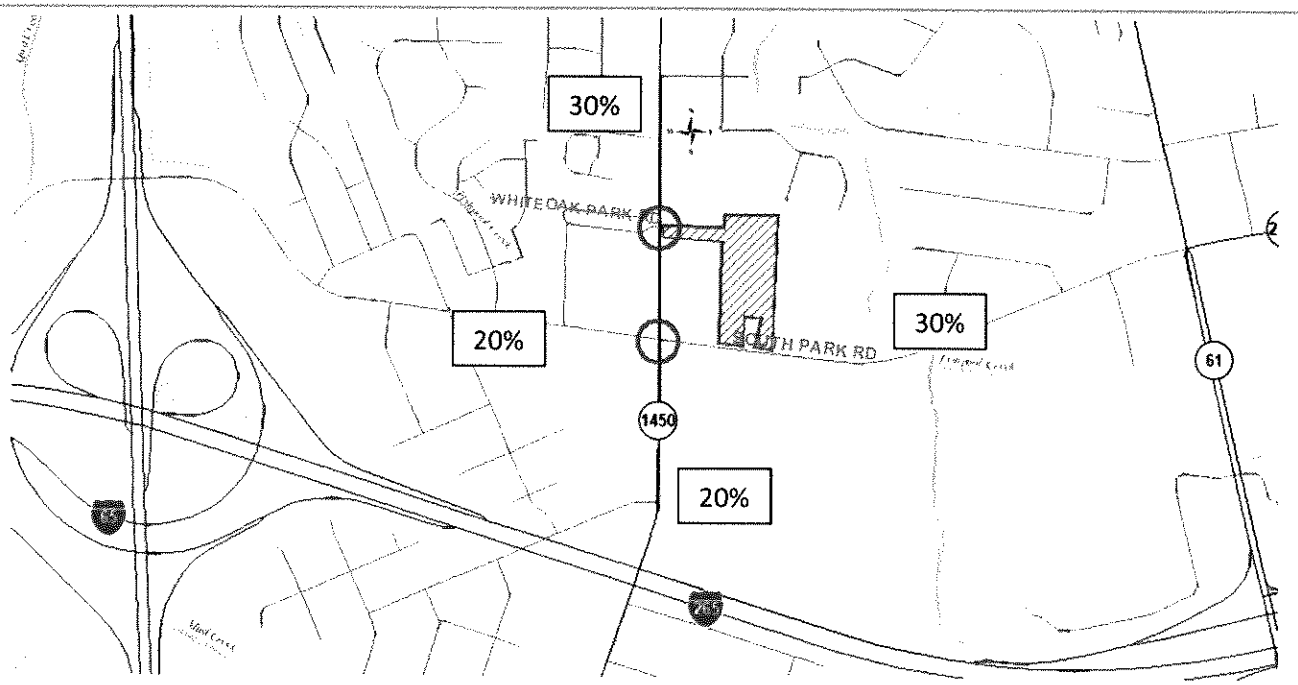


Figure 4. Trip Distribution Percentages

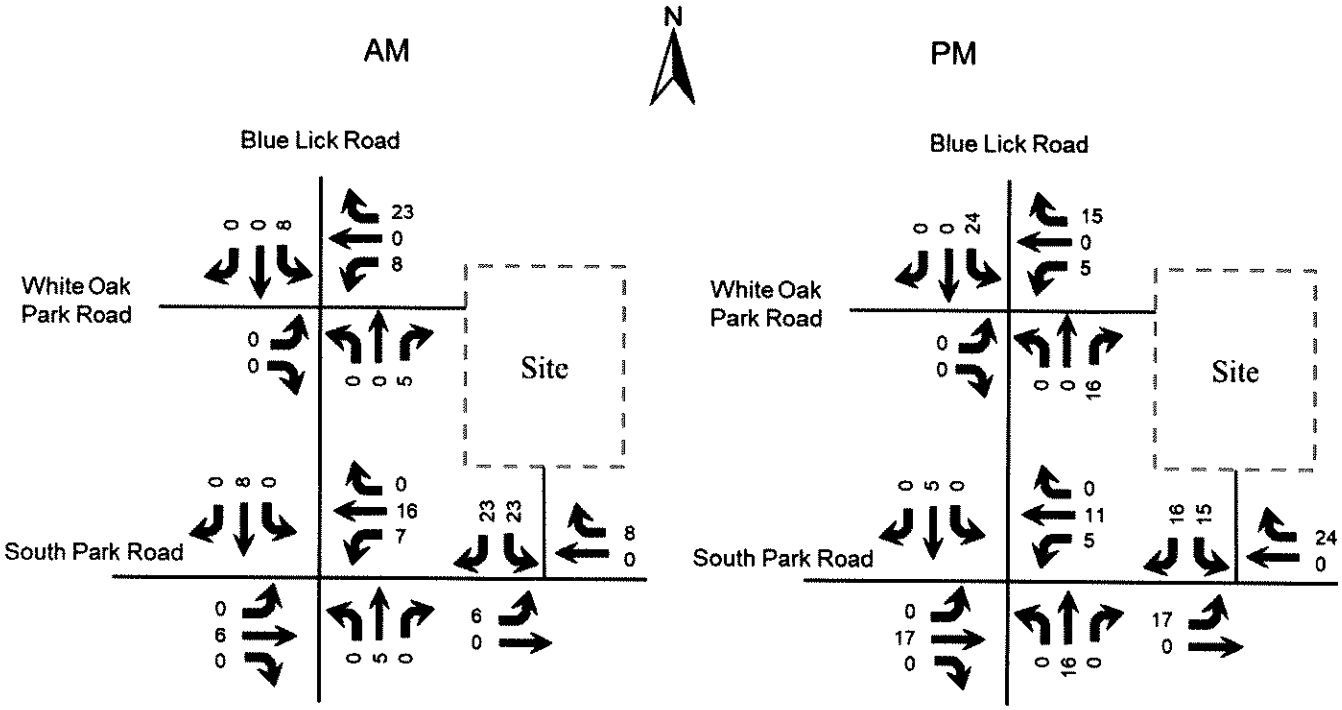


Figure 5. Peak Hour Trips Generated by Site

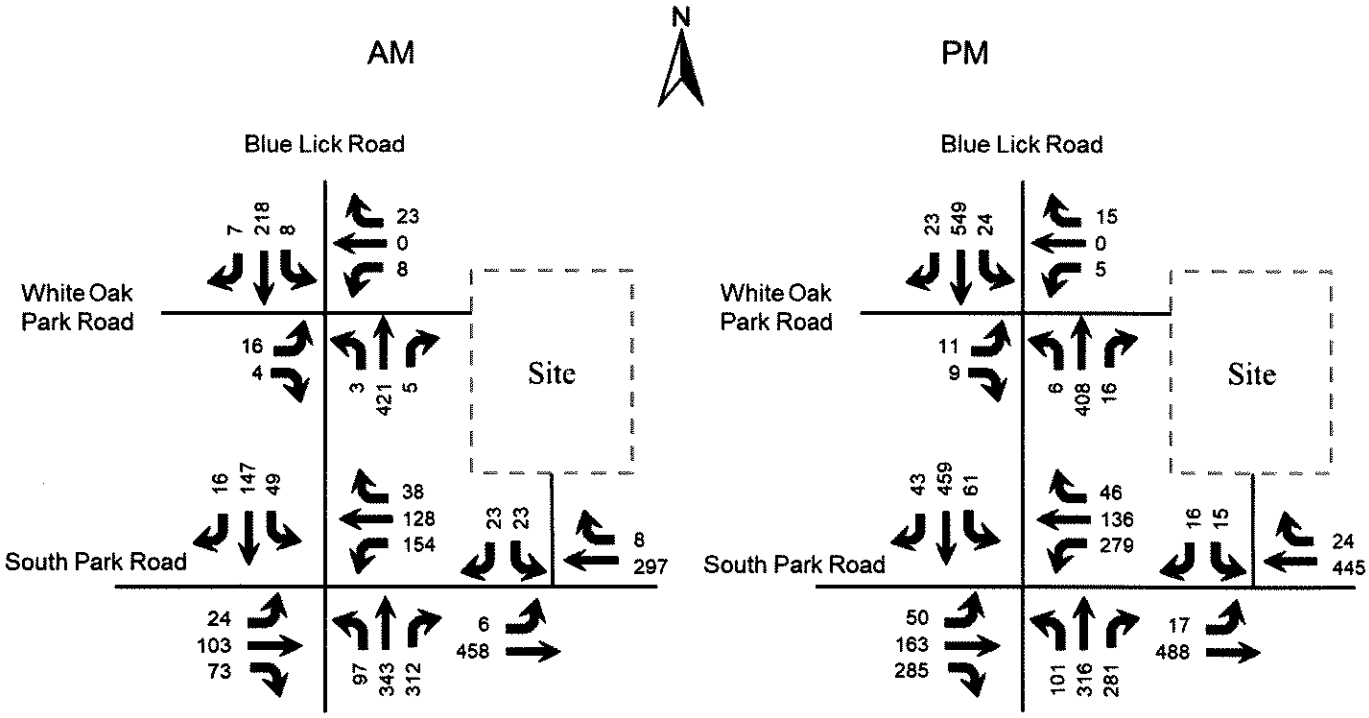


Figure 6. 2022 Build Peak Hour Volumes

ANALYSIS

The qualitative measure of operation for a roadway facility or intersection is evaluated by assigning a "Level of Service". Level of Service is a ranking scale from A through F, "A" is the best operating condition and "F" is the worst. Level of Service results depend upon the facility that is analyzed. In this case, the Level of Service is based upon the total delay experienced at an intersection.

To evaluate the impact of the proposed development, the vehicle delays at the intersections were determined using procedures detailed in the Highway Capacity Manual, 6th edition. Future delays and Level of Service were determined for the intersections using the HCS Streets (version 7.8.5) software. The delays and Level of Service are summarized in **Table 2**.

Table 2. Peak Hour Level of Service

Approach	A.M.			P.M.		
	2019 Existing	2022 No Build	2022 Build	2019 Existing	2022 No Build	2022 Build
Blue Lick Road (KY 1450) at South Park Road	**C 32.3**	**C 32.6**	**C 32.6**	**C 34.2**	**C 34.5**	**C 35.0**
South Park Road Eastbound	C 27.9	C 28.1	C 28.4	D 48.6	D 48.2	D 48.2
South Park Road Westbound	C 24.3	C 24.4	C 24.6	D 37.7	D 37.6	D 38.5
Blue Lick Road Northbound	D 36.2	D 36.6	D 36.6	C 22.8	C 23.5	C 23.9
Blue Lick Road Southbound	C 34.1	C 34.4	C 34.7	C 32.3	C 33.7	C 34.1
Blue Lick Road at White Oak Park Road						
White Oak Park Road Eastbound	B 13.6	B 12.1	B 13.4	C 16.2	B 13.7	C 15.2
Entrance Westbound			B 12.2			B 12.5
Blue Lick Road Northbound (left)	A 7.7	A 7.7	A 7.7	A 8.6	A 8.7	A 8.7
Blue Lick Road Southbound (left)			A 8.4			A 8.3
South Park Road at Entrance						
South Park Road Eastbound (left)			A 7.9			A 8.4
Entrance Southbound			B 14.1			C 16.5

Key: Level of Service, Delay in seconds per vehicle

The entrance was evaluated for turn lanes using the Kentucky Transportation Cabinet Highway Design Guidance Manual dated March, 2017. The traffic impact policy requires using volumes for ten years beyond build-out, or 2032. The 2032 volumes were determined by applying a one percent annual growth rate from 2019. **Figure 7** illustrates the 2032 No Build volumes. **Figure 8** illustrates the 2032 Build Volumes. Using the volumes in Figure 8, no turn lanes are required at the entrances. **Table 3** summarizes the delay and Level of Service for 2032.

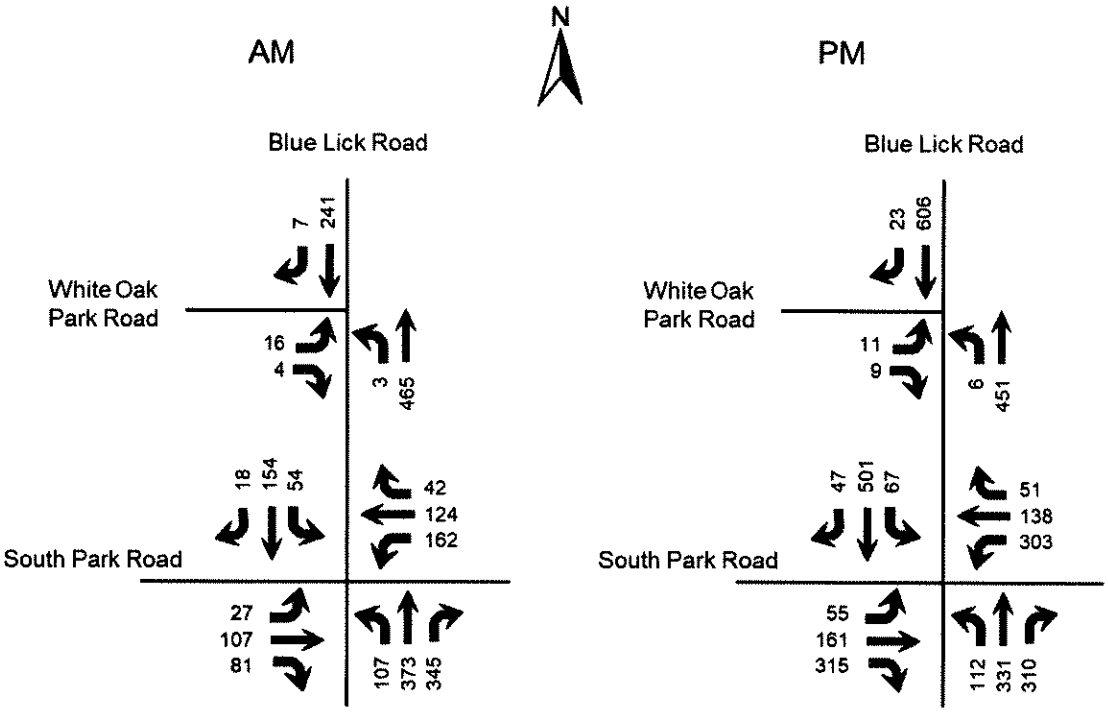


Figure 7. 2032 No Build Peak Hour Volumes

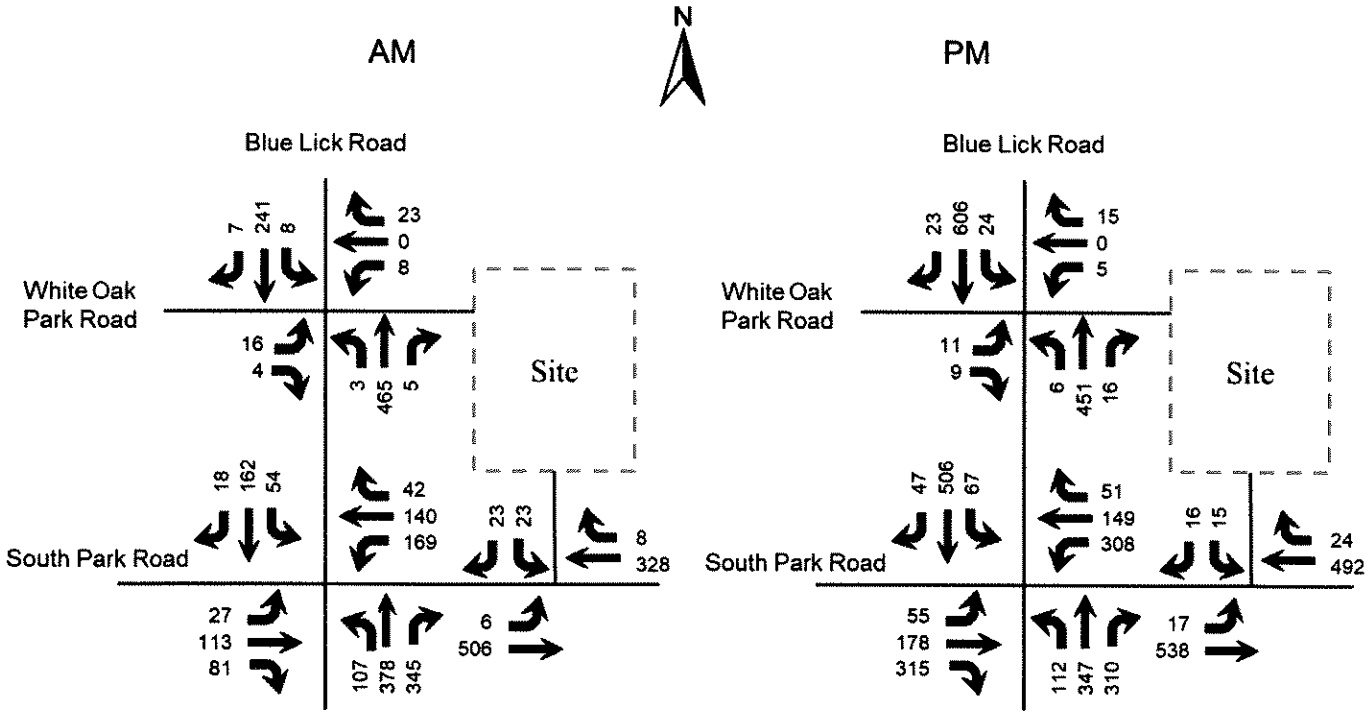


Figure 8. 2032 Build Peak Hour Volumes

Table 3. Peak Hour Level of Service

Approach	A.M.			P.M.		
	2019 Existing	2032 No Build	2032 Build	2019 Existing	2032 No Build	2032 Build
Blue Lick Road (KY 1450) at South Park Road	**C 32.3**	**C 33.7**	**C 33.7**	**C 34.2**	**D 36.8**	**D 37.3**
South Park Road Eastbound	C 27.9	C 28.6	C 29.0	D 48.6	D 46.6	D 46.6
South Park Road Westbound	C 24.3	C 24.8	C 25.0	D 37.7	D 37.8	D 39.0
Blue Lick Road Northbound	D 36.2	D 38.0	D 38.0	C 22.8	C 26.4	C 26.8
Blue Lick Road Southbound	C 34.1	D 35.5	D 35.8	C 32.3	D 40.1	D 40.7
Blue Lick Road at White Oak Park Road						
White Oak Park Road Eastbound	B 13.6	B 12.6	B 14.0	C 16.2	B 14.4	C 16.2
Entrance Westbound			B 12.8			B 13.1
Blue Lick Road Northbound (left)	A 7.7	A 7.8	A 7.8	A 8.6	A 8.9	A 8.9
Blue Lick Road Southbound (left)			A 8.5			A 8.4
South Park Road at Entrance						
South Park Road Eastbound (left)			A 8.0			A 8.6
Entrance Southbound			B 14.9			C 18.2

CONCLUSIONS

Based upon the volume of traffic generated by the development and the amount of traffic forecasted for the year 2022 and 2032, there will be a slight impact to the existing highway network. No improvements are required at the adjacent intersections. No turn lanes are required at the entrance on South Park Road.

APPENDIX

Jefferson County, KY
Classified Turn Movement Cou

Site 1 of 2
Blue Lick Rd (North)
S Park Rd (East)
Blue Lick Rd (South)
S Park Rd (West)

Lat/Long
38.116328°, -85.689493°

Marr Traffic
Transportation Data Collection

Traffic Counts

41 Peabody Street, Nashville, TN 37210
10 Glenlake Parkway, Suite 130, Atlanta, GA 30328
555 Fayetteville Street, Suite 201, Raleigh, NC 27601
1229 South Shelby Street, Louisville, KY 40203
6565 North MacArthur Boulevard, Suite 225, Dallas, TX 75039

hello@marrtraffic.com
www.marrtraffic.com

1 (800) 615-3765

Date
Thursday, November 21, 2019

Weather
Cloudy
52°F

	Southbound						Westbound						Northbound						Eastbound						
	Blue Lick Rd (North)						S Park Rd (East)						Blue Lick Rd (South)						S Park Rd (West)						
	U-Turn	Left	Thru	Right	Peds	App	U-Turn	Left	Thru	Right	Peds	App	U-Turn	Left	Thru	Right	Peds	App	U-Turn	Left	Thru	Right	Peds	App	Int
0700 - 0715	0	8	26	4	0	38	0	35	20	8	0	63	0	24	87	94	0	205	0	9	22	17	0	48	354
0715 - 0730	0	14	41	2	0	57	0	44	38	8	0	90	0	20	88	71	0	179	0	5	19	22	0	46	372
0730 - 0745	0	15	41	4	0	60	0	32	25	13	0	70	0	32	97	79	0	208	0	4	26	18	0	48	386
0745 - 0800	0	11	27	6	0	44	0	32	26	8	0	66	0	18	56	59	0	133	0	5	27	14	0	46	289
0800 - 0815	0	11	36	2	0	49	0	16	12	13	0	41	0	15	57	40	0	112	0	3	16	8	1	28	230
0815 - 0830	0	13	24	5	0	42	0	35	28	16	0	79	0	23	57	59	0	139	0	6	13	17	0	36	296
0830 - 0845	0	17	40	6	0	63	0	29	28	19	0	76	0	36	83	62	0	181	0	12	29	25	1	67	387
0845 - 0900	0	19	46	5	0	70	0	28	15	19	0	62	0	22	72	52	0	146	0	9	24	23	0	56	334
1600 - 1615	0	27	95	3	0	125	0	58	27	11	0	96	0	24	64	49	0	137	0	12	33	54	0	99	457
1615 - 1630	0	20	102	10	0	132	0	58	31	9	0	98	0	22	61	57	0	140	0	8	36	53	0	97	467
1630 - 1645	0	13	116	10	0	139	0	63	33	16	0	112	0	26	74	51	0	151	0	7	41	55	0	103	505
1645 - 1700	**0**	**13**	**105**	**10**	**2**	**130**	**0**	**65**	**40**	**10**	**0**	**115**	**0**	**23**	**60**	**58**	**0**	**141**	**0**	**10**	**34**	**59**	**0**	**103**	**489**
1700 - 1715	**0**	**19**	**116**	**14**	**0**	**149**	**0**	**68**	**24**	**11**	**0**	**103**	**0**	**20**	**58**	**51**	**0**	**129**	**0**	**15**	**33**	**73**	**0**	**121**	**502**
1715 - 1730	0	12	114	7	0	133	0	60	26	7	0	93	0	32	98	73	0	203	0	15	37	79	0	131	560
1730 - 1745	**0**	**15**	**106**	**11**	**0**	**132**	**0**	**73**	**31**	**17**	**0**	**121**	**0**	**23**	**75**	**55**	**0**	**153**	**0**	**9**	**38**	**66**	**0**	**113**	**519**
1745 - 1800	0	7	100	14	0	121	0	65	32	14	0	111	0	35	72	54	0	161	0	10	32	51	0	93	486

0700 - 0715	0	8	26	4	0	38	0	35	20	8	0	63	0	24	87	94	0	205	0	9	22	17	0	48	354
0715 - 0730	0	14	41	2	0	57	0	44	38	8	0	90	0	20	88	71	0	179	0	5	19	22	0	46	372
0730 - 0745	0	15	41	4	0	60	0	32	25	13	0	70	0	32	97	79	0	208	0	4	26	18	0	48	386
0745 - 0800	0	11	27	6	0	44	0	32	26	8	0	66	0	18	56	59	0	133	0	5	27	14	0	46	289
AM TOTAL	**0**	**48**	**135**	**16**	**0**	**199**	**0**	**143**	**109**	**37**	**0**	**289**	**0**	**94**	**328**	**303**	**0**	**725**	**0**	**23**	**94**	**71**	**0**	**188**	**1401**
1645 - 1700	**0**	**13**	**105**	**10**	**2**	**130**	**0**	**65**	**40**	**10**	**0**	**115**	**0**	**23**	**60**	**58**	**0**	**141**	**0**	**10**	**34**	**59**	**0**	**103**	**489**
1700 - 1715	**0**	**19**	**116**	**14**	**0**	**149**	**0**	**68**	**24**	**11**	**0**	**103**	**0**	**20**	**58**	**51**	**0**	**129**	**0**	**15**	**33**	**73**	**0**	**121**	**502**
1715 - 1730	0	12	114	7	0	133	0	60	26	7	0	93	0	32	98	73	0	203	0	15	37	79	0	131	560
1730 - 1745	**0**	**15**	**106**	**11**	**0**	**132**	**0**	**73**	**31**	**17**	**0**	**121**	**0**	**23**	**75**	**55**	**0**	**153**	**0**	**9**	**38**	**66**	**0**	**113**	**519**
PM TOTAL	**0**	**59**	**441**	**42**	**2**	**544**	**0**	**266**	**121**	**45**	**0**	**432**	**0**	**98**	**291**	**237**	**0**	**626**	**0**	**49**	**142**	**277**	**0**	**468**	**2070**

Jefferson County, KY
Classified Turn Movement Count

Site 2 of 2
Blue Lick Rd (North)

Blue Lick Rd (South)
Whiteoak Park Rd (West)

Lat/Long
38.118377°, -85.689484°

Marr Traffic
Transportation Data Collection

41 Peabody Street, Nashville, TN 37210
10 Glenlake Parkway, Suite 130, Atlanta, GA 30328
555 Fayetteville Street, Suite 201, Raleigh, NC 27601
1229 South Shelby Street, Louisville, KY 40203
6565 North MacArthur Boulevard, Suite 225, Dallas, TX 75039

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Date
Thursday, November 21, 2019

Weather
Cloudy
52°F

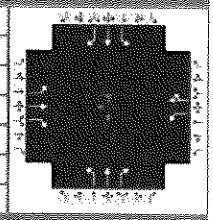
	Southbound					Northbound					Eastbound					
	Blue Lick Rd (North)					Blue Lick Rd (South)					Whiteoak Park Rd (West)					
	U-Turn	Thru	Right	Peds	App	U-Turn	Left	Thru	Peds	App	U-Turn	Left	Right	Peds	App	Int
0700 - 0715	0	40	2	0	42	0	1	113	0	114	0	1	1	0	2	158
0715 - 0730	0	71	2	0	73	0	0	107	0	107	0	5	1	0	6	186
0730 - 0745	0	53	2	0	55	0	2	118	0	120	0	5	1	1	7	182
0745 - 0800	0	48	1	0	49	0	0	71	0	71	0	5	1	0	6	126
0800 - 0815	0	44	7	0	51	0	0	80	0	80	0	4	4	1	9	140
0815 - 0830	0	50	2	0	52	0	2	77	0	79	0	1	2	0	3	134
0830 - 0845	0	68	4	0	72	0	1	112	0	113	0	5	4	0	9	194
0845 - 0900	0	69	4	0	73	0	0	108	0	108	0	5	3	1	9	190
1600 - 1615	0	142	2	0	144	0	5	98	0	103	0	4	3	1	8	255
1615 - 1630	0	133	6	0	139	0	2	80	0	82	0	1	4	0	5	226
1630 - 1645	0	141	8	0	149	0	1	92	0	93	0	7	1	0	8	250
1645 - 1700	0	138	4	0	142	0	0	84	0	84	0	6	3	3	12	238
1700 - 1715	**0**	**145**	**0**	**0**	**145**	**0**	**2**	**84**	**0**	**86**	**0**	**3**	**1**	**0**	**4**	**235**
1715 - 1730	**0**	**132**	**7**	**0**	**139**	**0**	**1**	**120**	**0**	**121**	**0**	**1**	**2**	**1**	**4**	**264**
1730 - 1745	**0**	**141**	**8**	**0**	**149**	**0**	**3**	**96**	**0**	**99**	**1**	**4**	**3**	**0**	**8**	**256**
1745 - 1800	**0**	**135**	**8**	**0**	**143**	**0**	**0**	**96**	**0**	**96**	**0**	**2**	**3**	**0**	**5**	**244**

0700 - 0715	0	40	2	0	42	0	1	113	0	114	0	1	1	0	2	158
0715 - 0730	0	71	2	0	73	0	0	107	0	107	0	5	1	0	6	186
0730 - 0745	0	53	2	0	55	0	2	118	0	120	0	5	1	1	7	182
0745 - 0800	0	48	1	0	49	0	0	71	0	71	0	5	1	0	6	126
AM TOTAL	**0**	**212**	**7**	**0**	**219**	**0**	**3**	**409**	**0**	**412**	**0**	**16**	**4**	**1**	**21**	**652**
1700 - 1715	**0**	**145**	**0**	**0**	**145**	**0**	**2**	**84**	**0**	**86**	**0**	**3**	**1**	**0**	**4**	**235**
1715 - 1730	**0**	**132**	**7**	**0**	**139**	**0**	**1**	**120**	**0**	**121**	**0**	**1**	**2**	**1**	**4**	**264**
1730 - 1745	**0**	**141**	**8**	**0**	**149**	**0**	**3**	**96**	**0**	**99**	**1**	**4**	**3**	**0**	**8**	**256**
1745 - 1800	**0**	**135**	**8**	**0**	**143**	**0**	**0**	**96**	**0**	**96**	**0**	**2**	**3**	**0**	**5**	**244**
PM TOTAL	**0**	**553**	**23**	**0**	**576**	**0**	**6**	**396**	**0**	**402**	**1**	**10**	**9**	**1**	**21**	**999**

HCS Reports

HCS7 Signalized Intersection Results Summary

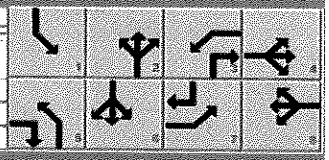
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak	PHF	0.91
Urban Street	Blue Lick Road	Analysis Year	2019	Analysis Period	1> 7:00
Intersection	South Park Road	File Name	Blue Lick 19 AM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	23	94	71	143	109	37	94	328	303	48	135	16

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB			WB			NB			SB		
Green	5.2	2.3		45.6	3.8	6.2	53.1					
Yellow	3.5	0.0		3.5	3.5	0.0	3.5					
Red	3.0	0.0		2.0	2.8	0.0	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	10.1	58.6	16.3	64.9	14.0	53.4	11.7	51.1
Change Period, (*Y+Rc*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.1	5.1	5.1	5.1	0.0	5.1	0.0
Queue Clearance Time (*gs*), s	3.2	7.2	9.5	61.3	7.3		4.8	
Green Extension Time (*ge*), s	0.0	2.0	0.5	0.0	0.3	0.0	0.1	0.0
Phase Call Probability	0.63	1.00	1.00	1.00	0.98		0.87	
Max Out Probability	0.00	0.00	0.09	1.00	0.01		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	25	103	78	157	160		103	360	333	53	148	18
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810	1841	1572	1725	1746		1781	1870	1598	1725	1811	1535
Queue Service Time (*gs*), s	1.2	5.2	4.2	7.5	8.2		5.3	22.0	21.6	2.8	8.4	1.0
Cycle Queue Clearance Time (*gc*), s	1.2	5.2	4.2	7.5	8.2		5.3	22.0	21.6	2.8	8.4	1.0
Green Ratio (*g/C*)	0.41	0.38	0.43	0.46	0.42		0.38	0.34	0.41	0.36	0.33	0.35
Capacity (*c*), veh/h	100	697	679	598	739		481	640	661	289	591	542
Volume-to-Capacity Ratio (*X*)	0.253	0.148	0.115	0.263	0.217		0.215	0.563	0.503	0.183	0.251	0.032
Back of Queue (*Q*), ft/ln (90 th percentile)	25.4	108.2	72.6	140.6	151.7		107.1	377.1	316.6	57	168.4	19.3
Back of Queue (*Q*), veh/ln (90 th percentile)	1.0	4.2	2.8	5.4	5.8		4.2	14.8	12.6	2.2	6.4	0.7
Queue Storage Ratio (*RQ*) (90 th percentile)	0.24	0.00	0.69	0.94	0.00		0.82	0.00	2.28	0.52	0.00	0.15
Uniform Delay (*d1*), s/veh	35.1	28.6	23.8	22.3	25.6		28.8	37.5	30.4	30.9	34.6	29.6
Incremental Delay (*d2*), s/veh	1.9	0.1	0.1	0.3	0.2		0.3	3.6	2.7	0.4	1.0	0.1
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.0	28.8	23.9	22.7	25.8		29.2	41.1	33.1	31.4	35.6	29.7
Level of Service (LOS)	D	C	C	C	C		C	D	C	C	D	C
Approach Delay, s/veh / LOS	27.9	C		24.3	C		36.2	D		34.1	C	
Intersection Delay, s/veh / LOS	32.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	2.11	B	1.93	B	2.13	B
Bicycle LOS Score / LOS	0.83	A	1.01	A	1.80	B	0.85	A

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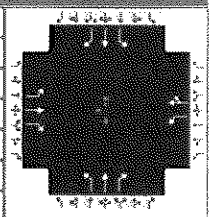
HCS7 Signalized Intersection Results Summary

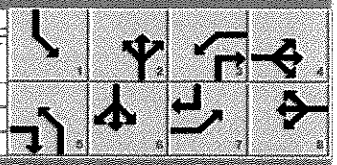
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak	PHF	0.91
Urban Street	Blue Lick Road	Analysis Year	2022	Analysis Period	1> 7:00
Intersection	South Park Road	File Name	Blue Lick 22 NB AM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	24	97	73	147	112	38	97	338	312	49	139	16

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB			WB			NB			SB		
Green	5.3	2.4		45.4	3.8	0.1	52.9					
Yellow	3.5	0.0		3.5	3.5	3.5	3.5					
Red	3.0	0.0		2.0	2.8	2.8	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	10.1	58.4	16.5	64.8	14.2	53.3	11.8	50.9
Change Period, (*Y+Rc*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.1	5.1	5.1	5.1	0.0	5.1	0.0
Queue Clearance Time (*gs*), s	3.2	7.4	9.7	61.2	7.5		4.9	
Green Extension Time (*ge*), s	0.0	2.1	0.5	0.0	0.3	0.0	0.1	0.0
Phase Call Probability	0.64	1.00	1.00	1.00	0.98		0.88	
Max Out Probability	0.00	0.00	0.11	1.00	0.01		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	26	107	80	162	165		107	371	343	54	153	18
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810	1841	1572	1725	1746		1781	1870	1598	1725	1811	1535
Queue Service Time (*gs*), s	1.2	5.4	4.3	7.7	8.4		5.5	22.8	22.4	2.9	8.7	1.1
Cycle Queue Clearance Time (*gc*), s	1.2	5.4	4.3	7.7	8.4		5.5	22.8	22.4	2.9	8.7	1.1
Green Ratio (*g/C*)	0.40	0.38	0.43	0.46	0.42		0.38	0.34	0.41	0.36	0.32	0.35
Capacity (*c*), veh/h	101	694	679	596	739		477	640	664	281	588	541
Volume-to-Capacity Ratio (*X*)	0.261	0.154	0.118	0.271	0.223		0.223	0.581	0.517	0.192	0.260	0.033
Back of Queue (*Q*), ft/ln (90 th percentile)	26.5	112.3	74.8	144.1	155.4		110.9	390.2	326.5	58.5	173.1	19.3
Back of Queue (*Q*), veh/ln (90 th percentile)	1.1	4.4	2.9	5.5	6.0		4.4	15.4	13.0	2.2	6.6	0.7
Queue Storage Ratio (*RQ*) (90 th percentile)	0.25	0.00	0.71	0.96	0.00		0.85	0.00	2.33	0.53	0.00	0.15
Uniform Delay (*d1*), s/veh	35.1	28.8	23.8	22.4	25.7		28.9	37.8	30.5	31.2	34.9	29.7
Incremental Delay (*d2*), s/veh	1.9	0.1	0.1	0.3	0.2		0.3	3.8	2.9	0.5	1.1	0.1
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.1	29.0	23.9	22.7	26.0		29.3	41.6	33.3	31.7	35.9	29.8
Level of Service (LOS)	D	C	C	C	C		C	D	C	C	D	C
Approach Delay, s/veh / LOS	28.1	C		24.4	C		36.6	D		34.4	C	
Intersection Delay, s/veh / LOS	32.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	2.11	B	1.93	B	2.13	B
Bicycle LOS Score / LOS	0.84	A	1.03	A	1.84	B	0.86	A

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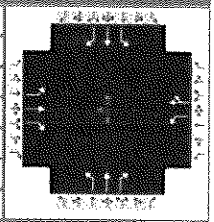
HCS7 Signalized Intersection Results Summary

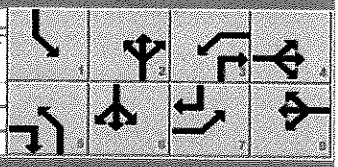
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak	PHF	0.91
Urban Street	Blue Lick Road	Analysis Year	2022	Analysis Period	1> 7:00
Intersection	South Park Road	File Name	Blue Lick 22 B AM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	24	103	73	154	128	38	97	343	312	49	147	16

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB			WB			NB			SB		
Green	5.3	2.4		45.4	3.8	0.5	52.5					
Yellow	3.5	0.0		3.5	3.5	3.5	3.5					
Red	3.0	0.0		2.0	2.8	2.8	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	10.1	58.0	17.0	64.8	14.2	53.3	11.8	50.9
Change Period, (*Y+Rc*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.1	5.1	5.1	5.1	0.0	5.1	0.0
Queue Clearance Time (*gs*), s	3.2	7.7	10.2	61.2	7.5		4.9	
Green Extension Time (*ge*), s	0.0	2.3	0.5	0.0	0.3	0.0	0.1	0.0
Phase Call Probability	0.64	1.00	1.00	1.00	0.98		0.88	
Max Out Probability	0.00	0.00	0.14	1.00	0.01		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	26	113	80	169	182		107	377	343	54	162	18
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810	1841	1572	1725	1754		1781	1870	1598	1725	1811	1535
Queue Service Time (*gs*), s	1.2	5.7	4.3	8.2	9.4		5.5	23.3	22.3	2.9	9.3	1.1
Cycle Queue Clearance Time (*gc*), s	1.2	5.7	4.3	8.2	9.4		5.5	23.3	22.3	2.9	9.3	1.1
Green Ratio (*g/C*)	0.40	0.37	0.43	0.46	0.42		0.38	0.34	0.42	0.36	0.32	0.35
Capacity (*c*), veh/h	101	689	675	592	742		469	639	668	277	588	540
Volume-to-Capacity Ratio (*X*)	0.261	0.164	0.119	0.286	0.246		0.227	0.589	0.513	0.195	0.275	0.033
Back of Queue (*Q*), ft/ln (90 th percentile)	26.7	120.1	75.2	150.2	170		110.9	396.9	324.5	58.5	182	19.3
Back of Queue (*Q*), veh/ln (90 th percentile)	1.1	4.7	2.9	5.7	6.5		4.4	15.6	12.9	2.2	6.9	0.7
Queue Storage Ratio (*RQ*) (90 th percentile)	0.25	0.00	0.72	1.00	0.00		0.85	0.00	2.32	0.53	0.00	0.15
Uniform Delay (*d1*), s/veh	35.2	29.2	24.0	22.5	26.0		29.0	38.0	30.2	31.3	35.1	29.7
Incremental Delay (*d2*), s/veh	1.9	0.2	0.1	0.4	0.2		0.3	4.0	2.8	0.5	1.2	0.1
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.1	29.4	24.2	22.9	26.2		29.3	41.9	33.0	31.8	36.2	29.8
Level of Service (LOS)	D	C	C	C	C		C	D	C	C	D	C
Approach Delay, s/veh / LOS	28.4	C		24.6	C		36.6	D		34.7	C	
Intersection Delay, s/veh / LOS	32.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	2.11	B	1.93	B	2.13	B
Bicycle LOS Score / LOS	0.85	A	1.07	A	1.85	B	0.87	A

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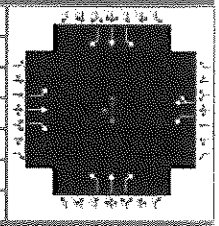
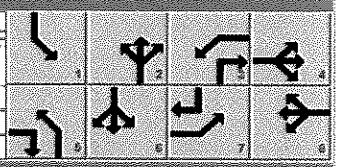
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak No Build	PHF	0.91
Urban Street	Blue Lick Road	Analysis Year	2032	Analysis Period	1> 7:00
Intersection	South Park Road	File Name	Blue Lick 32 NB AM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	27	107	81	162	124	42	107	373	345	54	154	18

Signal Information					EB			WB			NB			SB		
Cycle, s	140.0	Reference Phase	2													
Offset, s	0	Reference Point	End	Green	5.4	3.0		44.7	4.1	0.7	52.0					
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	0.0		3.5	3.5	3.5	3.5					
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.0	0.0		2.0	2.8	2.8	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	10.4	57.5	17.4	64.5	14.9	53.2	11.9	50.2
Change Period, (*Y+R c*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.1	5.1	5.1	5.1	0.0	5.1	0.0
Queue Clearance Time (*g s*), s	3.4	8.0	10.6	61.0	8.1		5.2	
Green Extension Time (*g e*), s	0.1	2.3	0.5	0.0	0.3	0.0	0.2	0.0
Phase Call Probability	0.68	1.00	1.00	1.00	0.99		0.90	
Max Out Probability	0.00	0.00	0.20	1.00	0.03		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	30	118	89	178	182		118	410	379	59	169	20
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810	1841	1572	1725	1746		1781	1870	1598	1725	1811	1535
Queue Service Time (*g s*), s	1.4	6.0	4.8	8.6	9.4		6.1	25.9	25.2	3.2	9.8	1.2
Cycle Queue Clearance Time (*g c*), s	1.4	6.0	4.8	8.6	9.4		6.1	25.9	25.2	3.2	9.8	1.2
Green Ratio (*g/C*)	0.40	0.37	0.43	0.46	0.42		0.38	0.34	0.42	0.36	0.32	0.35
Capacity (*c*), veh/h	105	683	677	590	736		464	637	672	255	579	536
Volume-to-Capacity Ratio (*X*)	0.284	0.172	0.131	0.302	0.248		0.253	0.643	0.564	0.233	0.292	0.037
Back of Queue (*Q*), ft/ln (90 th percentile)	30.1	124.4	83.8	157	170.7		121.8	438.2	362.6	65.3	191.2	21.9
Back of Queue (*Q*), veh/ln (90 th percentile)	1.2	4.8	3.3	6.0	6.6		4.8	17.3	14.4	2.5	7.3	0.8
Queue Storage Ratio (*RQ*) (90 th percentile)	0.29	0.00	0.80	1.05	0.00		0.94	0.00	2.59	0.59	0.00	0.17
Uniform Delay (*d 1*), s/veh	35.2	29.6	24.1	22.6	26.2		29.2	39.0	30.8	32.2	35.7	30.1
Incremental Delay (*d 2*), s/veh	2.1	0.2	0.1	0.4	0.2		0.4	4.9	3.4	0.7	1.3	0.1
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.3	29.8	24.2	23.0	26.4		29.6	43.9	34.2	32.8	37.0	30.2
Level of Service (LOS)	D	C	C	C	C		C	D	C	C	D	C
Approach Delay, s/veh / LOS	28.6	C		24.8	C		38.0	D		35.5	D	
Intersection Delay, s/veh / LOS	33.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	2.11	B	1.93	B	2.13	B
Bicycle LOS Score / LOS	0.88	A	1.08	A	1.98	B	0.90	A

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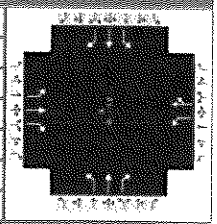
HCS7 Signalized Intersection Results Summary

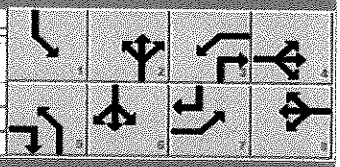
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	AM Peak Build	PHF	0.91
Urban Street	Blue Lick Road	Analysis Year	2032	Analysis Period	1> 7:00
Intersection	South Park Road	File Name	Blue Lick 32 B AM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	27	113	81	169	140	42	107	378	345	54	162	18

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB			WB			NB			SB		
Green	5.4	3.0		44.7	4.1	1.2	51.6					
Yellow	3.5	0.0		3.5	3.5	3.5	3.5					
Red	3.0	0.0		2.0	2.8	2.8	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	10.4	57.1	17.9	64.5	14.9	53.1	11.9	50.2
Change Period, (*Y+Rc*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.1	5.1	5.1	5.1	0.0	5.1	0.0
Queue Clearance Time (*gs*), s	3.4	8.4	11.0	61.0	8.1		5.2	
Green Extension Time (*ge*), s	0.1	2.5	0.5	0.0	0.3	0.0	0.2	0.0
Phase Call Probability	0.68	1.00	1.00	1.00	0.99		0.90	
Max Out Probability	0.00	0.00	0.26	1.00	0.03		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	30	124	89	186	200		118	415	379	59	178	20
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1810	1841	1572	1725	1753		1781	1870	1598	1725	1811	1535
Queue Service Time (*gs*), s	1.4	6.4	4.8	9.0	10.4		6.1	26.4	25.1	3.2	10.4	1.2
Cycle Queue Clearance Time (*gc*), s	1.4	6.4	4.8	9.0	10.4		6.1	26.4	25.1	3.2	10.4	1.2
Green Ratio (*g/C*)	0.40	0.37	0.43	0.46	0.42		0.38	0.34	0.42	0.36	0.32	0.35
Capacity (*c*), veh/h	105	677	673	586	739		457	637	677	251	579	535
Volume-to-Capacity Ratio (*X*)	0.284	0.183	0.132	0.317	0.271		0.257	0.652	0.560	0.237	0.308	0.037
Back of Queue (*Q*), ft/ln (90 th percentile)	30.2	130.7	84.3	163	185.6		121.8	445.7	360.7	65.4	200.2	21.9
Back of Queue (*Q*), veh/ln (90 th percentile)	1.2	5.1	3.3	6.2	7.1		4.8	17.5	14.3	2.5	7.6	0.8
Queue Storage Ratio (*RQ*) (90 th percentile)	0.29	0.00	0.80	1.09	0.00		0.94	0.00	2.58	0.59	0.00	0.17
Uniform Delay (*d1*), s/veh	35.3	30.0	24.3	22.8	26.5		29.3	39.1	30.5	32.3	36.0	30.1
Incremental Delay (*d2*), s/veh	2.1	0.2	0.1	0.4	0.3		0.4	5.1	3.3	0.7	1.4	0.1
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.4	30.2	24.4	23.2	26.7		29.7	44.2	33.8	32.9	37.3	30.2
Level of Service (LOS)	D	C	C	C	C		C	D	C	C	D	C
Approach Delay, s/veh / LOS	29.0	C		25.0	C		38.0	D		35.8	D	
Intersection Delay, s/veh / LOS	33.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.12	B	2.11	B	1.93	B	2.13	B
Bicycle LOS Score / LOS	0.89	A	1.12	A	1.99	B	0.91	A

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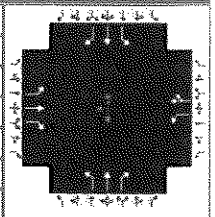
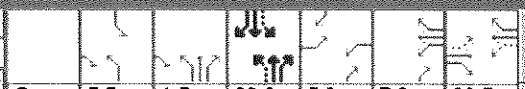
HCS7 Signalized Intersection Results Summary

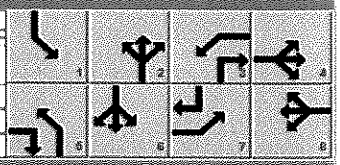
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Blue Lick Road	Analysis Year	2019	Analysis Period	1> 4:45
Intersection	South Park Road	File Name	Blue Lick 19 PM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	49	142	277	266	121	45	98	291	237	59	441	42

Signal Information										
Cycle, s	140.0	Reference Phase	2							
Offset, s	0	Reference Point	End							
Uncoordinated	No	Simult. Gap E/W	On							
Force Mode	Fixed	Simult. Gap N/S	On							





Green	5.5	1.5	60.0	5.2	7.2	30.5
Yellow	3.5	0.0	3.5	3.5	3.5	3.5
Red	3.0	0.0	2.0	2.8	2.8	2.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	11.5	36.0	25.0	49.5	13.5	67.0	12.0	65.5
Change Period, (*Y+R c*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.2	5.1	5.2	5.1	0.0	5.1	0.0
Queue Clearance Time (g_s), s	5.3	27.0	20.2	13.1	6.6		4.7	
Green Extension Time (g_e), s	0.1	3.5	0.0	4.2	0.5	0.0	0.3	0.0
Phase Call Probability	0.87	1.00	1.00	1.00	0.98		0.92	
Max Out Probability	0.00	0.08	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	53	154	301	289	180		107	316	258	64	479	46
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1753	1900	1535	1697	1741		1795	1870	1598	1810	1811	1547
Queue Service Time (g_s), s	3.3	9.7	25.0	18.2	11.1		4.6	16.0	11.5	2.7	28.8	2.3
Cycle Queue Clearance Time (g_c), s	3.3	9.7	25.0	18.2	11.1		4.6	16.0	11.5	2.7	28.8	2.3
Green Ratio (*g/C*)	0.26	0.22	0.27	0.37	0.31		0.48	0.44	0.57	0.47	0.43	0.47
Capacity (*c*), veh/h	375	414	411	453	547		346	821	915	458	776	721
Volume-to-Capacity Ratio (*X*)	0.142	0.372	0.732	0.638	0.330		0.308	0.385	0.282	0.140	0.618	0.063
Back of Queue (*Q*), ft/ln (90 th percentile)	67	186	366.7	306.9	198.5		91.1	277.6	176.6	53.6	469.8	40.4
Back of Queue (*Q*), veh/ln (90 th percentile)	2.6	7.4	14.0	11.5	7.6		3.6	10.9	7.0	2.1	17.9	1.6
Queue Storage Ratio (*RQ*) (90 th percentile)	0.64	0.00	3.49	2.05	0.00		0.70	0.00	1.26	0.49	0.00	0.32
Uniform Delay (d_1), s/veh	40.0	46.6	46.7	34.6	36.7		23.6	26.5	15.2	21.6	31.1	20.6
Incremental Delay (d_2), s/veh	0.2	0.8	4.1	3.4	0.5		0.7	1.4	0.8	0.2	3.7	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	40.2	47.4	50.7	38.0	37.2		24.3	27.9	16.0	21.8	34.8	20.8
Level of Service (LOS)	D	D	D	D	D		C	C	B	C	C	C
Approach Delay, s/veh / LOS	48.6	D		37.7	D		22.8	C		32.3	C	
Intersection Delay, s/veh / LOS	34.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.13	B	1.92	B	2.11	B
Bicycle LOS Score / LOS	1.33	A	1.26	A	1.61	B	1.46	A

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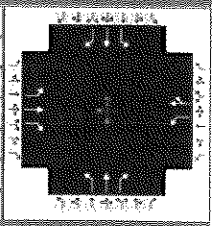
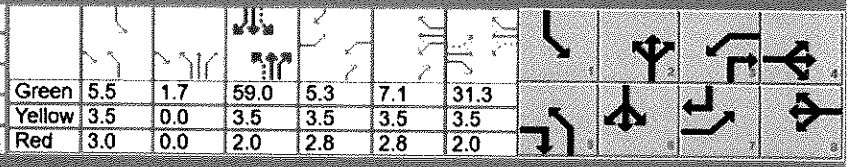
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Blue Lick Road	Analysis Year	2022 No Build	Analysis Period	1> 4:45
Intersection	South Park Road	File Name	Blue Lick 22 NB PM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	50	146	285	274	125	46	101	300	281	61	454	43

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.5	1.7	59.0	5.3	7.1	31.3		
Yellow	3.5	0.0	3.5	3.5	3.5	3.5		
Red	3.0	0.0	2.0	2.8	2.8	2.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	11.6	36.8	25.0	50.2	13.7	66.2	12.0	64.5
Change Period, (Y+R c), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (MAH), s	5.1	5.2	5.1	5.2	5.1	0.0	5.1	0.0
Queue Clearance Time (g s), s	5.3	27.7	20.7	13.4	6.8		4.9	
Green Extension Time (g e), s	0.1	3.6	0.0	4.4	0.5	0.0	0.3	0.0
Phase Call Probability	0.88	1.00	1.00	1.00	0.99		0.92	
Max Out Probability	0.00	0.10	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	54	159	310	298	186		110	326	305	66	493	47
Adjusted Saturation Flow Rate (s), veh/h/ln	1753	1900	1535	1697	1742		1795	1870	1598	1810	1811	1547
Queue Service Time (g s), s	3.3	9.9	25.7	18.7	11.4		4.8	16.7	14.3	2.9	30.3	2.4
Cycle Queue Clearance Time (g c), s	3.3	9.9	25.7	18.7	11.4		4.8	16.7	14.3	2.9	30.3	2.4
Green Ratio (g/C)	0.26	0.22	0.27	0.37	0.32		0.47	0.43	0.57	0.46	0.42	0.46
Capacity (c), veh/h	381	424	422	456	556		331	811	906	444	764	711
Volume-to-Capacity Ratio (X)	0.143	0.374	0.734	0.653	0.334		0.332	0.402	0.337	0.149	0.646	0.066
Back of Queue (Q), ft/ln (90 th percentile)	67.9	189.5	375.3	314.9	202.4		95.3	289.4	212	56.3	493.4	42.1
Back of Queue (Q), veh/ln (90 th percentile)	2.6	7.6	14.3	11.8	7.8		3.8	11.4	8.4	2.3	18.8	1.6
Queue Storage Ratio (RQ) (90 th percentile)	0.65	0.00	3.57	2.10	0.00		0.73	0.00	1.51	0.51	0.00	0.34
Uniform Delay (d 1), s/veh	39.4	46.1	46.1	34.3	36.3		24.4	27.2	16.2	22.2	32.2	21.1
Incremental Delay (d 2), s/veh	0.2	0.8	4.2	3.8	0.5		0.8	1.5	1.0	0.2	4.2	0.2
Initial Queue Delay (d 3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	39.7	46.9	50.4	38.0	36.8		25.3	28.7	17.2	22.4	36.4	21.3
Level of Service (LOS)	D	D	D	D	D		C	C	B	C	D	C
Approach Delay, s/veh / LOS	48.2	D		37.6	D		23.5	C		33.7	C	
Intersection Delay, s/veh / LOS	34.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.13	B	1.92	B	2.11	B
Bicycle LOS Score / LOS	1.35	A	1.29	A	1.71	B	1.49	A

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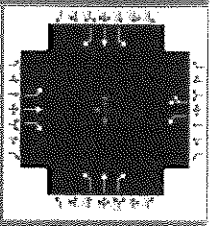
HCS7 Signalized Intersection Results Summary

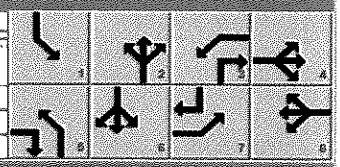
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Blue Lick Road	Analysis Year	2022 Build	Analysis Period	1> 4:45
Intersection	South Park Road	File Name	Blue Lick 22 B PM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	163	285	279	136	46	101	316	281	61	459	43

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB			WB			NB			SB		
Green	5.5	1.7		58.9	5.3	7.1	31.4					
Yellow	3.5	0.0		3.5	3.5	3.5	3.5					
Red	3.0	0.0		2.0	2.8	2.8	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	11.6	36.9	25.0	50.3	13.7	66.0	12.0	64.4
Change Period, (*Y+Rc*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.2	5.1	5.2	5.1	0.0	5.1	0.0
Queue Clearance Time (*gs*), s	5.3	27.6	20.7	14.2	6.8		4.9	
Green Extension Time (*ge*), s	0.1	3.8	0.0	4.6	0.5	0.0	0.3	0.0
Phase Call Probability	0.88	1.00	1.00	1.00	0.99		0.92	
Max Out Probability	0.00	0.11	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	54	177	310	303	198		110	343	305	66	499	47
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1753	1900	1535	1697	1746		1795	1870	1598	1810	1811	1547
Queue Service Time (*gs*), s	3.3	11.2	25.6	18.7	12.2		4.8	17.9	14.4	2.9	30.8	2.4
Cycle Queue Clearance Time (*gc*), s	3.3	11.2	25.6	18.7	12.2		4.8	17.9	14.4	2.9	30.8	2.4
Green Ratio (*g/C*)	0.26	0.22	0.28	0.37	0.32		0.47	0.43	0.57	0.46	0.42	0.46
Capacity (*c*), veh/h	373	426	423	444	559		325	809	904	429	762	709
Volume-to-Capacity Ratio (*X*)	0.146	0.416	0.732	0.683	0.354		0.337	0.425	0.338	0.154	0.655	0.066
Back of Queue (*Q*), ft/ln (90 th percentile)	67.8	209.2	374.7	323	214		95.7	305.8	212.7	56.5	501.8	42.1
Back of Queue (*Q*), veh/ln (90 th percentile)	2.6	8.4	14.3	12.1	8.2		3.8	12.0	8.4	2.3	19.2	1.6
Queue Storage Ratio (*RQ*) (90 th percentile)	0.65	0.00	3.57	2.15	0.00		0.74	0.00	1.52	0.51	0.00	0.34
Uniform Delay (*d1*), s/veh	39.3	46.4	46.0	34.7	36.5		24.6	27.6	16.3	22.4	32.4	21.2
Incremental Delay (*d2*), s/veh	0.3	0.9	4.2	4.7	0.5		0.9	1.6	1.0	0.2	4.4	0.2
Initial Queue Delay (*d3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.6	47.4	50.2	39.4	37.0		25.5	29.2	17.3	22.7	36.8	21.4
Level of Service (LOS)	D	D	D	D	D		C	C	B	C	D	C
Approach Delay, s/veh / LOS	48.2	D		38.5	D		23.9	C		34.1	C	
Intersection Delay, s/veh / LOS	35.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.13	B	1.92	B	2.11	B
Bicycle LOS Score / LOS	1.38	A	1.31	A	1.74	B	1.50	A

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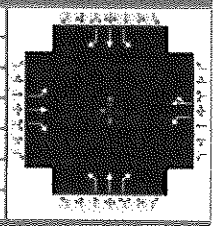
HCS7 Signalized Intersection Results Summary

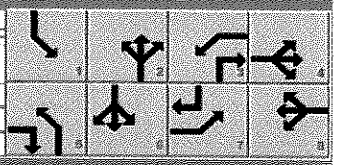
General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Blue Lick Road	Analysis Year	2032 No Build	Analysis Period	1> 4:45
Intersection	South Park Road	File Name	Blue Lick 32 NB PM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	161	315	303	138	51	112	331	310	67	501	47

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

	EB		WB			NB
Green	5.6	2.4	55.6	5.4	7.0	33.9
Yellow	3.5	0.0	3.5	3.5	3.5	3.5
Red	3.0	0.0	2.0	2.8	2.8	2.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	11.7	39.4	25.0	52.7	14.5	63.4	12.1	61.1
Change Period, ($Y+R_c$), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.2	5.1	5.2	5.1	0.0	5.1	0.0
Queue Clearance Time (g_s), s	5.6	30.2	20.7	14.4	7.6		5.3	
Green Extension Time (g_e), s	0.2	3.8	0.0	4.9	0.5	0.0	0.3	0.0
Phase Call Probability	0.90	1.00	1.00	1.00	0.99		0.94	
Max Out Probability	0.00	0.20	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	60	175	342	329	205		122	360	337	73	545	51
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1753	1900	1535	1697	1741		1795	1870	1598	1810	1811	1547
Queue Service Time (g_s), s	3.6	10.8	28.2	18.7	12.4		5.6	19.5	16.9	3.3	36.3	2.7
Cycle Queue Clearance Time (g_c), s	3.6	10.8	28.2	18.7	12.4		5.6	19.5	16.9	3.3	36.3	2.7
Green Ratio (*g/C*)	0.28	0.24	0.30	0.39	0.34		0.45	0.41	0.55	0.44	0.40	0.44
Capacity (*c*), veh/h	390	460	460	469	587		274	774	875	394	719	674
Volume-to-Capacity Ratio (*X*)	0.153	0.380	0.745	0.703	0.350		0.445	0.465	0.385	0.185	0.758	0.076
Back of Queue (*Q*), ft/ln (90 th percentile)	72.6	202.1	407	343.8	216.6		112.6	332.2	245.9	65.6	593.3	48.5
Back of Queue (*Q*), veh/ln (90 th percentile)	2.8	8.1	15.5	12.9	8.3		4.5	13.1	9.8	2.6	22.6	1.9
Queue Storage Ratio (*RQ*) (90 th percentile)	0.69	0.00	3.88	2.29	0.00		0.87	0.00	1.76	0.60	0.00	0.39
Uniform Delay (d_1), s/veh	37.5	44.3	44.2	34.2	34.9		27.8	29.8	18.2	24.5	36.4	23.1
Incremental Delay (d_2), s/veh	0.3	0.7	4.8	5.2	0.5		1.6	2.0	1.3	0.3	7.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.7	45.0	49.0	39.3	35.4		29.5	31.8	19.5	24.8	43.8	23.3
Level of Service (LOS)	D	D	D	D	D		C	C	B	C	D	C
Approach Delay, s/veh / LOS	46.6	D		37.8	D		26.4	C		40.1	D	
Intersection Delay, s/veh / LOS	36.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.13	B	1.93	B	2.12	B
Bicycle LOS Score / LOS	1.44	A	1.37	A	1.84	B	1.59	B

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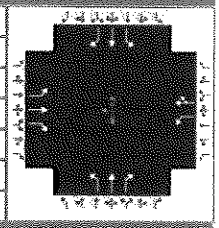
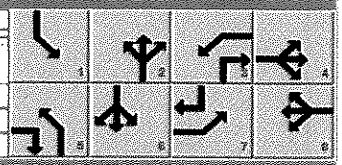
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Diane B. Zimmerman Traffic Engineering			Duration, h	0.250
Analyst	DBZ	Analysis Date	2/3/2020	Area Type	Other
Jurisdiction		Time Period	PM Peak	PHF	0.92
Urban Street	Blue Lick Road	Analysis Year	2032 Build	Analysis Period	1> 4:45
Intersection	South Park Road	File Name	Blue Lick 32 B PM.xus		
Project Description	Apartments				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	178	315	308	149	51	112	347	310	67	506	47

Signal Information					EB			WB			NB			SB		
Cycle, s	140.0	Reference Phase	2													
Offset, s	0	Reference Point	End	Green	5.6	2.4		55.4	5.4	7.0	34.0					
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	0.0		3.5	3.5	3.5	3.5					
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.0	0.0		2.0	2.8	2.8	2.0					



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	4.0	1.1	3.0	1.1	3.0
Phase Duration, s	11.7	39.5	25.0	52.8	14.5	63.3	12.1	60.9
Change Period, (*Y+R c*), s	6.3	5.5	6.3	5.5	6.5	5.5	6.5	5.5
Max Allow Headway (*MAH*), s	5.1	5.2	5.1	5.2	5.1	0.0	5.1	0.0
Queue Clearance Time (*g s*), s	5.5	30.1	20.7	15.2	7.6		5.3	
Green Extension Time (*g e*), s	0.2	3.9	0.0	5.2	0.5	0.0	0.3	0.0
Phase Call Probability	0.90	1.00	1.00	1.00	0.99		0.94	
Max Out Probability	0.00	0.21	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	60	193	342	335	217		122	377	337	73	550	51
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1753	1900	1535	1697	1746		1795	1870	1598	1810	1811	1547
Queue Service Time (*g s*), s	3.5	12.0	28.1	18.7	13.2		5.6	20.8	17.0	3.3	36.9	2.7
Cycle Queue Clearance Time (*g c*), s	3.5	12.0	28.1	18.7	13.2		5.6	20.8	17.0	3.3	36.9	2.7
Green Ratio (*g/C*)	0.28	0.24	0.30	0.39	0.34		0.45	0.41	0.55	0.44	0.40	0.43
Capacity (*c*), veh/h	382	462	461	456	590		269	772	873	380	717	672
Volume-to-Capacity Ratio (*X*)	0.156	0.419	0.742	0.734	0.368		0.453	0.488	0.386	0.192	0.767	0.076
Back of Queue (*Q*), ft/ln (90 th percentile)	72.5	221.5	406.4	353.8	227.8		113	350.3	246.3	65.7	602.9	48.5
Back of Queue (*Q*), veh/ln (90 th percentile)	2.8	8.9	15.5	13.3	8.8		4.5	13.8	9.8	2.6	23.0	1.9
Queue Storage Ratio (*RQ*) (90 th percentile)	0.69	0.00	3.67	2.36	0.00		0.87	0.00	1.76	0.60	0.00	0.39
Uniform Delay (*d 1*), s/veh	37.4	44.6	44.1	34.7	35.0		28.1	30.2	18.2	24.8	36.7	23.1
Incremental Delay (*d 2*), s/veh	0.3	0.9	4.7	6.5	0.5		1.7	2.2	1.3	0.3	7.7	0.2
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	37.7	45.5	48.8	41.2	35.6		29.8	32.4	19.5	25.1	44.4	23.4
Level of Service (LOS)	D	D	D	D	D		C	C	B	C	D	C
Approach Delay, s/veh / LOS	46.6	D		39.0	D		26.8	C		40.7	D	
Intersection Delay, s/veh / LOS	37.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.13	B	1.93	B	2.12	B
Bicycle LOS Score / LOS	1.47	A	1.40	A	1.87	B	1.60	B

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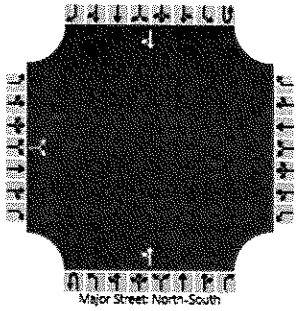
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Blue Lick at White Oak
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/3/2020	East/West Street	White Oak Park Road
Analysis Year	2019	North/South Street	Blue Lick Road
Time Analyzed	AM Peak	Peak Hour Factor	0.88
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	South Park Apartments		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		16		4						3	409				212	7
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			23							3						
Capacity, c (veh/h)			443							1329						
v/c Ratio			0.05							0.00						
95% Queue Length, Q_{95} (veh)			0.2							0.0						
Control Delay (s/veh)			13.6							7.7						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		13.6								0.1						
Approach LOS		B														

HCS™ TWSC Version 7.8.5
White Oak AM 19.xtw

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HCS7 Two-Way Stop-Control Report

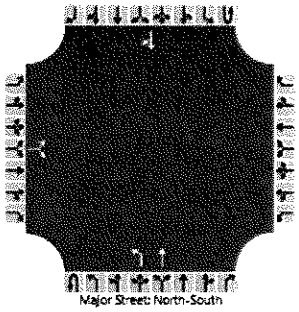
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2022
Time Analyzed	AM Peak No Build
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		16		4						3	421				218	7
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			23							3						
Capacity, c (veh/h)			530							1321						
v/c Ratio			0.04							0.00						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			12.1							7.7						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		12.1								0.1						
Approach LOS		B														

HCS™ TWSC Version 7.8.5
White Oak AM 22 NB.xtw

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HCS7 Two-Way Stop-Control Report

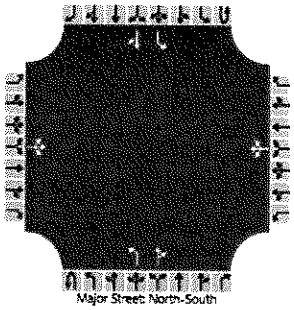
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2022
Time Analyzed	AM Peak Build
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	0	0	1	1	0
Configuration			LTR				LTR			L		TR		L		TR
Volume (veh/h)		16	0	4		8	0	23		3	421	5		8	218	7
Percent Heavy Vehicles (%)		0	3	0		3	3	3		0				3		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.53	6.20		7.13	6.53	6.23		4.10				4.13		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.03	3.30		3.53	4.03	3.33		2.20				2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			23				35			3				9		
Capacity, c (veh/h)			452				532			1321				1073		
v/c Ratio			0.05				0.07			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.2				0.2			0.0				0.0		
Control Delay (s/veh)			13.4				12.2			7.7				8.4		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)		13.4				12.2				0.1				0.3		
Approach LOS		B				B										

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HCS7 Two-Way Stop-Control Report

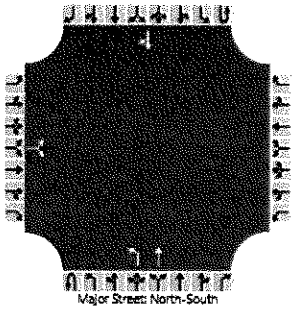
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2032
Time Analyzed	AM Peak No Build
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		16		4						3	465				241	7
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			23							3						
Capacity, c (veh/h)			499							1292						
v/c Ratio			0.05							0.00						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			12.6							7.8						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		12.6								0.0						
Approach LOS		B														

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HCS7 Two-Way Stop-Control Report

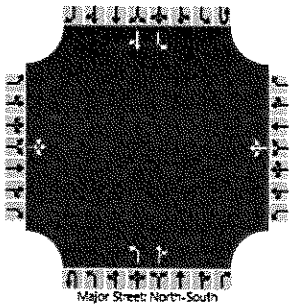
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2032
Time Analyzed	AM Peak Build
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	0	0	1	1	0
Configuration			LTR				LTR			L		TR		L		TR
Volume (veh/h)		16	0	4		8	0	23		3	465	5		8	241	7
Percent Heavy Vehicles (%)		0	3	0		3	3	3		0				3		
Proportion Time Blocked																
Percent Grade (%)			0				0									
Right Turn Channelized																
Median Type | Storage			Left Only								1					

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.53	6.20		7.13	6.53	6.23		4.10				4.13		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.03	3.30		3.53	4.03	3.33		2.20				2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			23				35			3				9		
Capacity, c (veh/h)			421				498			1292				1029		
v/c Ratio			0.05				0.07			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.2				0.2			0.0				0.0		
Control Delay (s/veh)			14.0				12.8			7.8				8.5		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)		14.0				12.8				0.0				0.3		
Approach LOS		B				B										

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HCS7 Two-Way Stop-Control Report

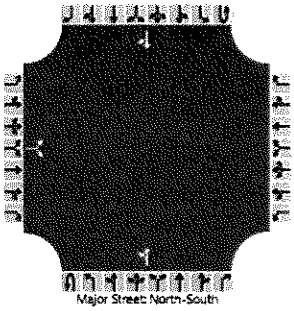
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2019
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		11		9						6	396				533	23
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			21							6						
Capacity, c (veh/h)			344							999						
v/c Ratio			0.06							0.01						
95% Queue Length, Q_{95} (veh)			0.2							0.0						
Control Delay (s/veh)			16.2							8.6						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		16.2								0.2						
Approach LOS		C														

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HCS7 Two-Way Stop-Control Report

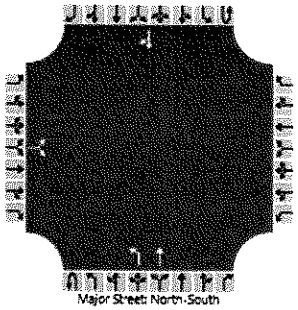
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2022
Time Analyzed	PM Peak No Build
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		11		9						6	408				549	23
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			21							6						
Capacity, c (veh/h)			437							985						
v/c Ratio			0.05							0.01						
95% Queue Length, Q_{95} (veh)			0.2							0.0						
Control Delay (s/veh)			13.7							8.7						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		13.7								0.1						
Approach LOS		B														

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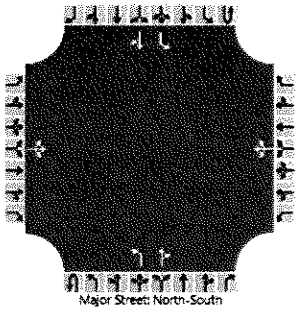
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Blue Lick at White Oak
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/3/2020	East/West Street	White Oak Park Road
Analysis Year	2022	North/South Street	Blue Lick Road
Time Analyzed	PM Peak Build	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	South Park Apartments		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	0	0	1	1	0
Configuration			LTR				LTR			L		TR		L		TR
Volume (veh/h)		11	0	9		5	0	15		6	408	16		24	549	23
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			21				21			6				25		
Capacity, c (veh/h)			376				498			985				1125		
v/c Ratio			0.06				0.04			0.01				0.02		
95% Queue Length, Q_{95} (veh)			0.2				0.1			0.0				0.1		
Control Delay (s/veh)			15.2				12.5			8.7				8.3		
Level of Service (LOS)			C				B			A				A		
Approach Delay (s/veh)		15.2				12.5				0.1				0.3		
Approach LOS		C				B										

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HCS7 Two-Way Stop-Control Report

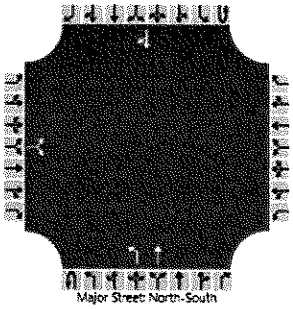
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2032
Time Analyzed	PM Peak No Build
Intersection Orientation	North-South
Project Description	South Park Apartments

Site Information

Intersection	Blue Lick at White Oak
Jurisdiction	
East/West Street	White Oak Park Road
North/South Street	Blue Lick Road
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		11		9						6	451				606	23
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			21							6						
Capacity, c (veh/h)			403							936						
v/c Ratio			0.05							0.01						
95% Queue Length, Q_{95} (veh)			0.2							0.0						
Control Delay (s/veh)			14.4							8.9						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)		14.4								0.1						
Approach LOS		B														

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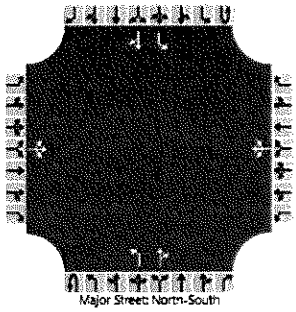
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	Blue Lick at White Oak
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/3/2020	East/West Street	White Oak Park Road
Analysis Year	2032	North/South Street	Blue Lick Road
Time Analyzed	PM Peak Build	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	South Park Apartments		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	1	1	0	0	1	1	0
Configuration			LTR				LTR			L		TR		L		TR
Volume (veh/h)		11	0	9		5	0	15		6	451	16		24	606	23
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			21				21			6				25		
Capacity, c (veh/h)			343				463			936				1082		
v/c Ratio			0.06				0.05			0.01				0.02		
95% Queue Length, Q_{95} (veh)			0.2				0.1			0.0				0.1		
Control Delay (s/veh)			16.2				13.1			8.9				8.4		
Level of Service (LOS)			C				B			A				A		
Approach Delay (s/veh)		16.2				13.1				0.1				0.3		
Approach LOS		C				B										

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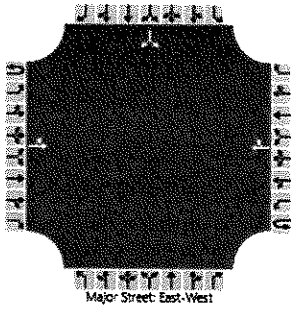
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	S Park at Entrance
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/3/2020	East/West Street	South Park Road
Analysis Year	2022	North/South Street	Entrance
Time Analyzed	AM Peak	Peak Hour Factor	0.91
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	South Park Apartments		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		6	458				297	8						23		23
Percent Heavy Vehicles (%)		0												0		0
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.10												6.40		6.20
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.20												3.50		3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7													51	
Capacity, c (veh/h)		1235													454	
v/c Ratio		0.01													0.11	
95% Queue Length, Q_{95} (veh)		0.0													0.4	
Control Delay (s/veh)		7.9													13.9	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.2												13.9			
Approach LOS													B			

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S Park 22 AM.xtw

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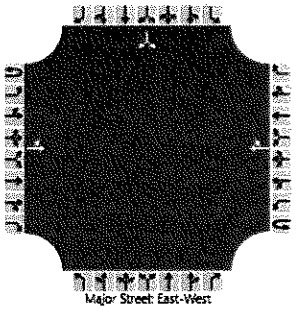
HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	DBZ	Intersection	S Park at Entrance
Agency/Co.	Diane B Zimmerman Traffic Engineering	Jurisdiction	
Date Performed	2/3/2020	East/West Street	South Park Road
Analysis Year	2032	North/South Street	Entrance
Time Analyzed	AM Peak	Peak Hour Factor	0.91
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	South Park Apartments		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		6	506				328	8						23		23
Percent Heavy Vehicles (%)		0												0		0
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.10												6.40		6.20
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.20												3.50		3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7													51	
Capacity, c (veh/h)		1200													412	
v/c Ratio		0.01													0.12	
95% Queue Length, Q_{95} (veh)		0.0													0.4	
Control Delay (s/veh)		8.0													14.9	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.2												14.9			
Approach LOS													B			

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S Park 32 AM.xtw
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HCS7 Two-Way Stop-Control Report

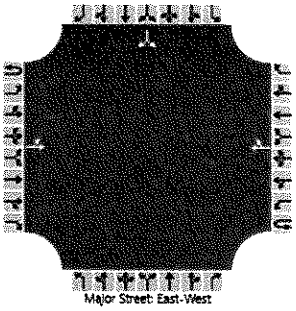
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2022
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	South Park Apartments

Site Information

Intersection	S Park at Entrance
Jurisdiction	
East/West Street	South Park Road
North/South Street	Entrance
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		17	488				445	24						15		16
Percent Heavy Vehicles (%)		0												0		0
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.10												6.40		6.20
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.20												3.50		3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		18													34	
Capacity, c (veh/h)		1066													346	
v/c Ratio		0.02													0.10	
95% Queue Length, Q_{95} (veh)		0.1													0.3	
Control Delay (s/veh)		8.4													16.5	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	0.5												16.5			
Approach LOS													C			

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HCS7 Two-Way Stop-Control Report

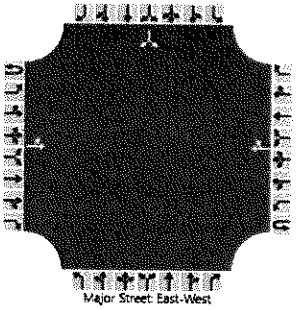
General Information

Analyst	DBZ
Agency/Co.	Diane B Zimmerman Traffic Engineering
Date Performed	2/3/2020
Analysis Year	2032
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	South Park Apartments

Site Information

Intersection	S Park at Entrance
Jurisdiction	
East/West Street	South Park Road
North/South Street	Entrance
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		17	538				492	24						15		16
Percent Heavy Vehicles (%)		0												0		0
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.10												6.40		6.20
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.20												3.50		3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		18													34	
Capacity, c (veh/h)		1020													306	
v/c Ratio		0.02													0.11	
95% Queue Length, Q_{95} (veh)		0.1													0.4	
Control Delay (s/veh)		8.6													18.2	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	0.5												18.2			
Approach LOS													C			

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