NOISE IMPACT ANALYSIS

Proposed Development at 5217 Springdale Road
in Louisville, KY

JULY 16, 2021

HMB PROFESSIONAL ENGINEERS, INC.
3 HMB CIRCLE
FRANKFORT, KY 40601

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CHAPTER 1 – PROJECT INTRODUCTION

1.1 PROJECT DESCRIPTION

The proposed project is a new residential development along Springdale Road just south of the Gene Snyder Freeway (I-265/KY-841) in Jefferson County, Kentucky (see Figure 1.1-1). The development would add nine residential structures and would include a total of 302 residential units. Approximately 17.97 acres of undeveloped land that is zoned as "Single Family Residential (R-4)" would be converted to a proposed zone of "Multi-Family Residential (R-7)". A layout plan of the proposed development is included in Appendix A.

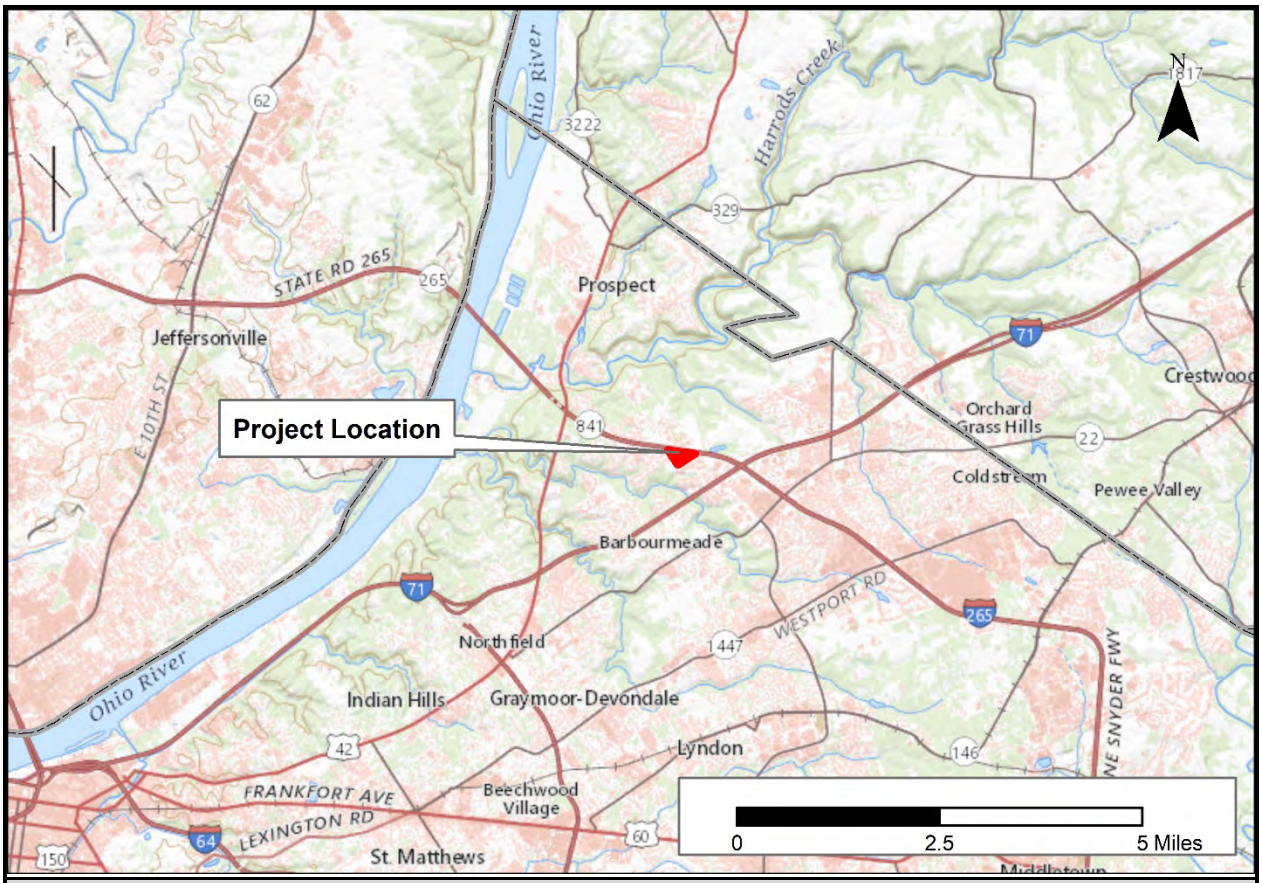


Figure 1.1-1. Location of the Proposed Development

1.2 NOISE IMPACT ANALYSIS

Chapter 5, Part 1 of the Land Development Code (LDC) set forth by the Louisville-Jefferson County Metro Government requires a noise analysis for any new development of residential structures or other noise sensitive use proposed at distances within 250-feet of the edge of pavement of an expressway's nearest travel lane. The noise analysis must be based on future traffic projections and determine if the predicted noise levels at the proposed site is less than 65 dBA. When the predicted noise level exceeds 65 dBA, the analysis shall determine if a barrier or other mitigative measures can be constructed to reduce the noise level to less than the 65 dBA.

This document analyzes the potential traffic noise impacts of a proposed development along Springdale Road and the Gene Snyder Freeway (I-265/KY-841). All evaluations were conducted in accordance with the Louisville Metro's LDC, the Federal Highway Administration's (FHWA) 23 CFR Part 772 – *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, and Kentucky Transportation Cabinet's (KYTC) *Noise Analysis and Abatement Policy* effective July 1, 2020 (KYTC 2020). Noise modeling and barrier analysis (if necessary) were completed using the FHWA Traffic Noise Model (TNM), version 2.5, computer program.

The following tasks were performed:

- Identification of noise-sensitive areas: identify specific areas within the 250-foot noise study area with land uses that are sensitive to highway traffic noise.
- Determination of future sound levels: Prediction of future, design year, and worst-hour sound levels for the proposed development area.
- Determination of traffic noise impacts: Determine if the future sound levels reach or exceed 65 dB(A) within the 250-foot noise study area and at the location(s) of noise sensitive land uses (structures).
- Noise abatement evaluation (if necessary): Evaluation of noise abatement for areas determined to be traffic noise impacts to determine if the predicted noise level can be reduced to levels less than 65 dB(A).

Each of these analytical steps is discussed herein.

CHAPTER 2 – NOISE ANALYSIS RESULTS

2.1 IDENTIFICATION OF NOISE SENSITIVE AREAS

A single Noise Sensitive Area (NSA) was identified in the project corridor and contains all lands within the proposed 250-foot noise study area (per the LDC guidelines). Within this study area the proposed development will be mostly open space and parking lots. However, portions of five proposed residential buildings are also located within this area. Residential Buildings 2, 4, 5, 6, and 9 all have some portion of the proposed structure within 250-feet study area.

2.2 DETERMINATION OF EXISTING SOUND LEVELS

2.2.1 TNM MODEL

Roadway segments were modeled in TNM for each lane of the Gene Snyder Freeway (I-265/KY-841). This includes roadway features such as lane lines, shoulders, and the median barrier. Terrain lines were also added to the model to account for changes in the surrounding landscape, such as drainage ditches or rock cuts. In addition, there are two existing noise barriers along the Gene Snyder Freeway (I-265/KY-841) adjacent to the proposed site that were constructed due to a previous noise study. Their location, ground elevation and height were acquired from the final TNM models and were modeled accordingly. These two walls have a break at the northern part of the property to accommodate drainage from the expressway, their location can be viewed in Figure 2.3–1.

2.2.2 TRAFFIC VOLUMES

A *Traffic Impact Study* (TIS) for Springdale Road was completed on July 13, 2021 by HMB Professional Engineers. The report predicted a 1% annual growth rate for Springdale Road and projected traffic volumes for the proposed completion year of 2023. The TIS can be viewed in Appendix E.

Traffic volume and truck percentages on the Gene Snyder Freeway (I-265/KY-841) were determined by analyzing the traffic count data from the traffic report. A.M. and P.M. peaks and the corresponding truck percentages were determined from the traffic counts on the Gene Snyder Freeway (I-265/KY-841). A copy of these Excel spreadsheets is included in Appendix E.

2.2.3 NOISE MEASUREMENTS

Noise measurements were conducted June 17, 2021 at two representative locations in the proposed development area and within 500 feet of the Gene Snyder Freeway (I-265/KY-841). Short–term, 15-minute noise measurements at all locations were conducted during meteorologically appropriate periods (i.e., no rain, wind less than 10 miles per hour [mph]).

Ambient noise measurements were not applicable for this project since the study area is within 500-feet of the existing roadways. See Figure 2.4–1 for field noise measurement locations and Appendix C for the Field Data Sheets.

A Rion NL–20 sound meter and a Rion NC–73 sound level calibrator were used for all noise measurements. See Appendix F for noise meter calibration certificates.

2.2.4 MODEL VALIDATION

While TNM model uses the traffic volumes for predicting noise level, the field noise measurements are used to “validate” the models. The validation process involved obtaining noise measurements at a few

selected points near the existing roadway while making simultaneous vehicle classification counts and estimating travel speed. The observed traffic counts were then converted to hourly volumes. These volumes, along with the estimated travel speeds, were entered into a TNM model created for the project area. The posted speed limit of 65 miles per hour (mph) on the Gene Snyder Freeway (I-265/KY-841) was used in the model. Modeled noise levels were compared to the field measured noise levels, and if they were within 3 dB(A) of the measured levels, the model is considered validated. The location of field noise measurements can be seen in Figure 2.3–1.

The predicted values for all validation receivers were found to be within 3 dB(A) of the field measured values. A summary of noise level validation results is provided in Table 2.2–1. With validated results, the TNM model was used to predict values for receivers in the immediate vicinity of the roadways based on existing traffic data for the facility.

Table 2.2–1. Noise Level Validation Summary

RECEIVER	DESCRIPTION	START TIME	MEASURED SOUND LEVEL dB(A)	MODELED SOUND LEVEL dB(A)	VALIDATION SUCCESSFUL?
V1	Field	4:00 p.m.	53.5	53.3	Yes
V2	Field	4:16 p.m.	58.3	60.8	Yes

2.3 DETERMINATION OF FUTURE SOUND LEVELS

With the noise measurements validated, the model was used to predict noise levels for all receivers along existing roadways. Using the validated TNM model, a 50-square foot grid of receivers were modeled to create a contour of the existing elevation conditions within the proposed project area (see Figure 2.3–2). Then traffic for build year 2023 was added to the applicable roadways and a noise threshold for 65 dB(A) was mapped.

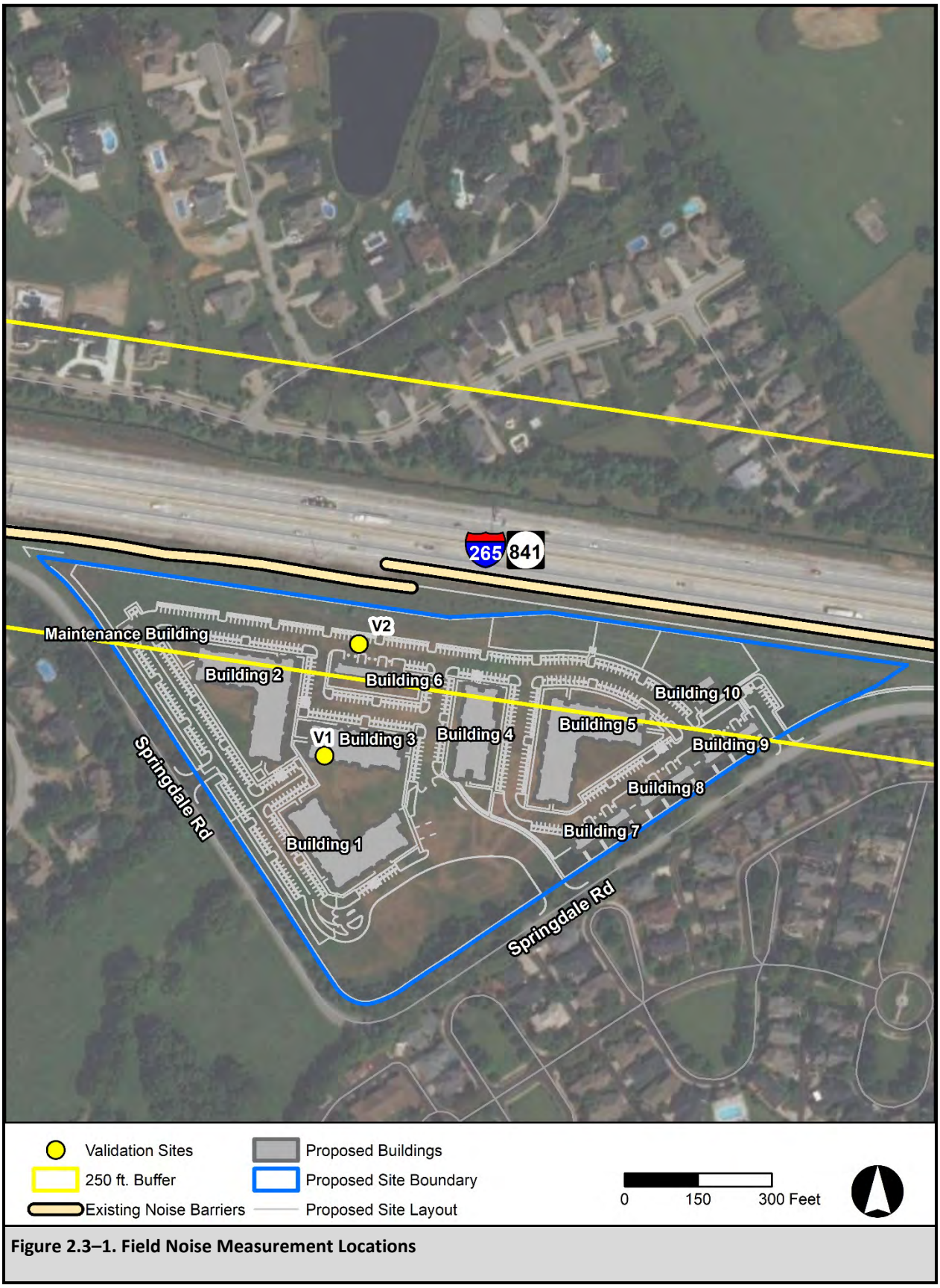


Figure 2.3–1. Field Noise Measurement Locations

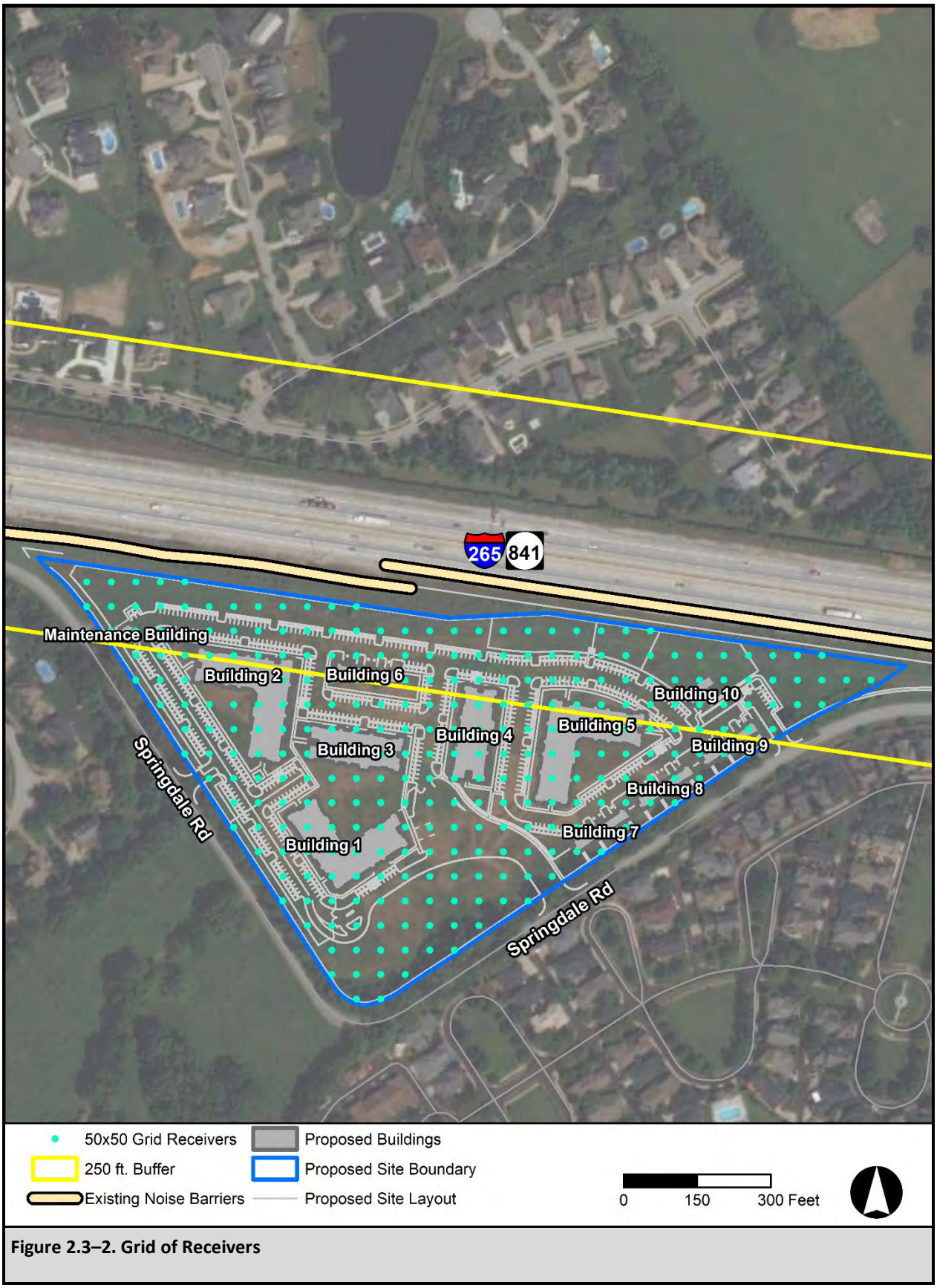


Figure 2.3–2. Grid of Receivers

2.4 DETERMINATION OF TRAFFIC NOISE IMPACTS

Potential noise impacts were determined by comparing the predicted sound levels to the 65 dB(A) criteria set forth by the LDC. The model showed **no** predicted impacts of 65.0 dB(A) to any of the receivers within the site boundary.

For the proposed site development, Buildings 2, 4, 5, 6, and 9 all have some portion of the proposed structure within the 250-foot noise study area. Receivers, AE_07, AF_14, AG_21, and AH_28, modeled in the vicinity of Buildings 2, 4, 5, 6, and 9, along the 250-foot threshold have predicted sound levels of 56.5 dB(A), 57.0 dB(A), 56.6 dB(A) and 57.7 dB(A), respectively. These receivers along with receivers along the site boundary closest to the nearest the Gene Snyder Freeway (I-265/KY-841) travel lane, and a noise level contour of the site are displayed in Figure 2.4—1.

A list of receivers, their distance to roadway, and their predicted sound results for the analysis can be seen in Table 1 of Appendix B, the TNM Output tables are provided in Appendix D. The electronic TNM files used for this analysis will be provided upon request.

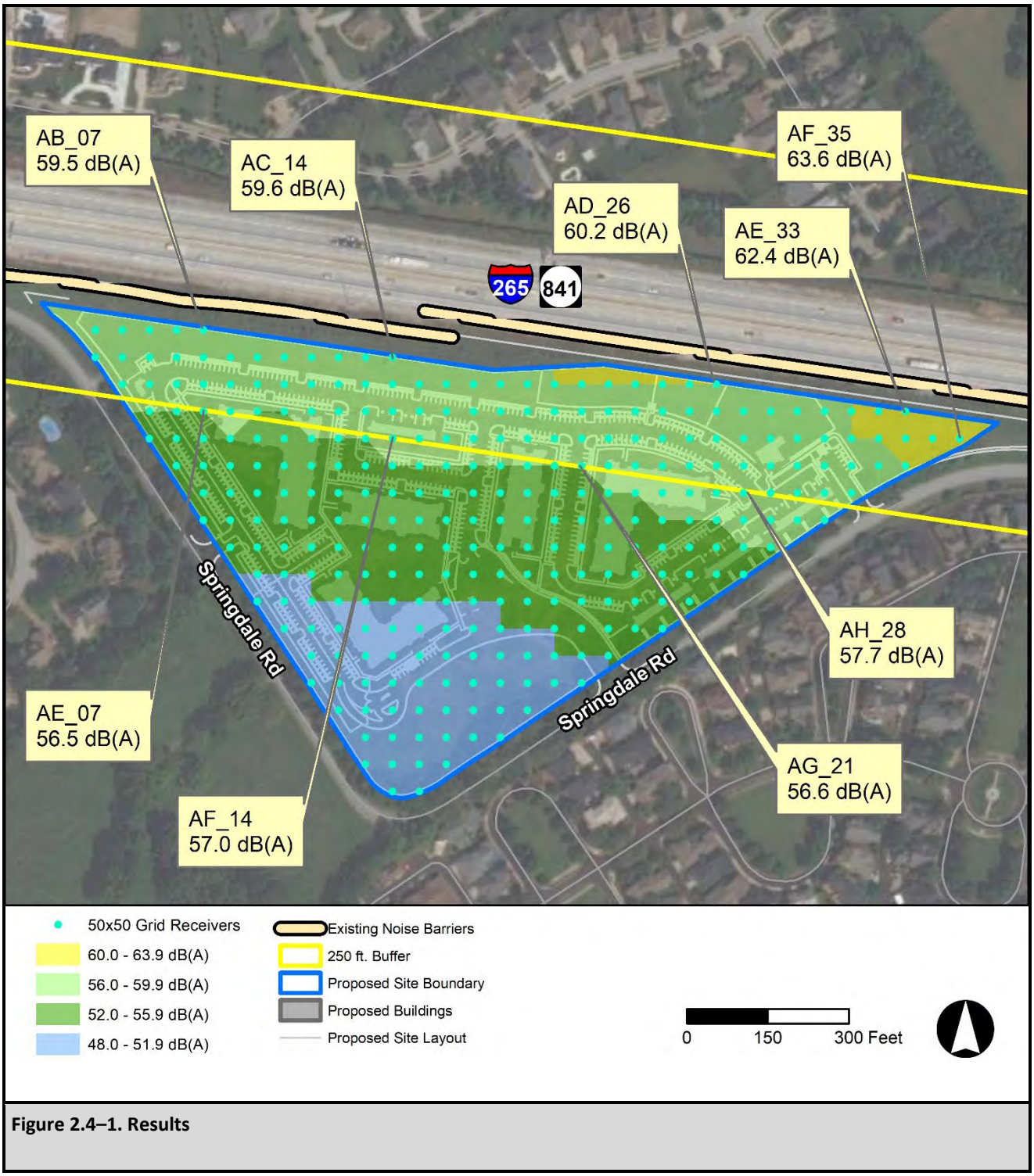


Figure 2.4–1. Results

CHAPTER 3 – SUMMARY

In accordance with the Land Development Code set forth by Louisville Metro, the proposed residential development along Springdale Road was evaluated for traffic noise impacts within 250-feet from the Gene Snyder Freeway (I-265/KY-841). The evaluation utilized the predicted traffic volumes for the design year of 2023 for the Gene Snyder Freeway (I-265/KY-841). The noise model found that there are **no** predicted noise levels within the 250-foot noise study area that are at or above the 65 dB(A) threshold. The predicted noise levels ranged from 48.8 dB(A) to 63.6 dB(A). The structural noise barriers adjacent to the proposed property are attenuating noise from the highway and reducing noise levels at this property to below 65 dB(A) at all locations. No mitigative measures are suggested.

CHAPTER 4 – REFERENCES

Esri

2021 World Imagery [basemap]. Scale Not Given. "World Imagery". July 13, 2021. http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f.

Federal Highway Administration

1974 The Audible Landscape: A Manual for Highway Noise and Land Use https://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/audible_landscape/audible_landscape.pdf.

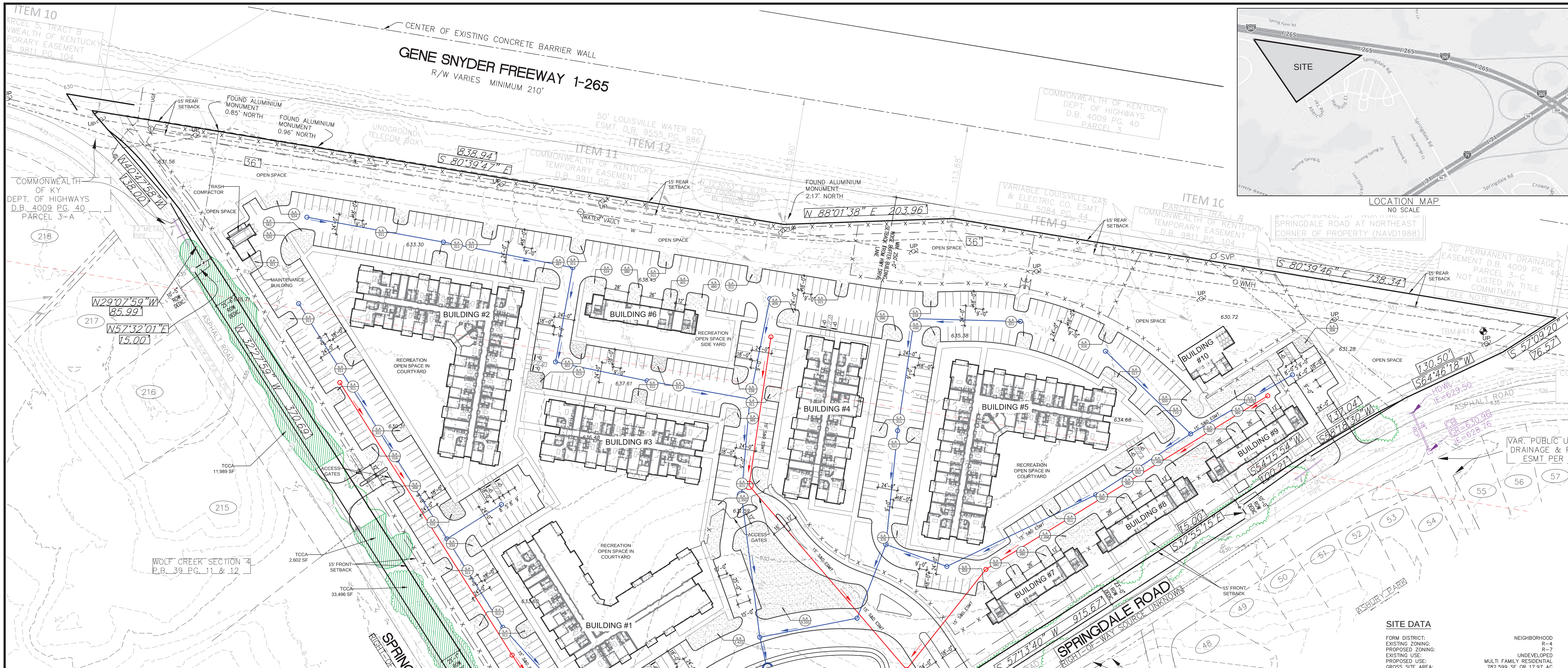
2002 Entering Quiet Zone: Noise Compatibility Land Use Planning https://www.fhwa.dot.gov/Environment/noise/noise_compatible_planning/federal_approach/land_use/quietzone.pdf.

Kentucky Transportation Cabinet

2020 Policy on Highway Traffic Noise Abatement

2012 Standard Specifications for Road and Bridge Construction

APPENDIX A – PROPOSED LAYOUT



GENERAL NOTES

1. CONSTRUCTION PLANS AND DOCUMENTS SHALL COMPLY WITH LOUISVILLE AND JEFFERSON COUNTY METROPOLITAN SEWER DISTRICT'S DESIGN MANUAL AND STANDARD SPECIFICATIONS AND OTHER LOCAL, STATE AND FEDERAL ORDINANCES.
2. WASTEWATER: SANITARY SEWER CAPACITY IS ONLY AVAILABLE FOR 73,000 GPD, CONSTRUCTION OF LATERAL EXTENSION REQUIRED, FLOW METER MAY BE INSTALLED TO INCREASE CAPACITY. CAPACITY CAN BE SECURED BY PAYING SANITARY SEWER IMPACT FEES. SANITARY SEWER PATTERN DEPICTED FOR CONCEPTUAL PURPOSES ONLY. FINAL CONFIGURATION AND SIZE OF SEWER PIPES SHALL BE DETERMINED DURING THE CONSTRUCTION PLAN DESIGN PROCESS. SANITARY SEWER FACILITIES SHALL CONFORM TO MSD REQUIREMENTS.
3. STORMWATER: FINAL CONFIGURATION AND SIZE OF DETENTION PONDS, DRAINAGE PIPES, CHANNELS, AND PERMANENT WATER QUALITY FEATURES TO BE DETERMINED DURING THE CONSTRUCTION PLAN DESIGN PROCESS. DRAINAGE FACILITIES SHALL CONFORM TO MSD REQUIREMENTS.
4. DRAINAGE / STORMWATER DETENTION: DETENTION WILL BE PROVIDED AS SHOWN ON THIS PLAN. THE OUTLET FOR THE DETENTION POND SHALL DISCHARGE TO THE EXISTING 24" HEADWALL IN THE SOUTHEAST CORNER ALONG SPRINGDALE ROAD. THE DRAINAGE OUTLET WILL BE DESIGNED TO LIMIT POST-DEVELOPED PEAK FLOWS TO PRE-DEVELOPED PEAK FLOWS FOR THE 2, 10, 25, AND 100-YEAR STORMS OR TO THE CAPACITY OF THE DOWNSTREAM SYSTEM, WHICHEVER IS MORE RESTRICTIVE.
   APPROXIMATE OVERALL TOTAL DETENTION VOLUME REQUIRED:
   (2.8 X 0.60 X 17.95) / 12 = 2.51 Ac-Ft
5. THE DEVELOPMENT SHALL BE IN ACCORDANCE WITH THE APPROVED PRELIMINARY PLAN.
6. COMPATIBLE UTILITY LINES (ELECTRIC, PHONE, CABLE) SHALL BE PLACED IN A COMMON TRENCH UNLESS OTHERWISE REQUIRED BY APPROPRIATE AGENCIES.
7. TREES SHALL BE PLANTED IN A MANNER THAT DOES NOT AFFECT PUBLIC SAFETY AND MAINTAINS PROPER SIGHT DISTANCE. FINAL LOCATION WILL BE DETERMINED DURING THE CONSTRUCTION APPROVAL PROCESS.
8. MITIGATION MEASURES FOR DUST CONTROL SHALL BE IN PLACE DURING CONSTRUCTION TO PREVENT FUGITIVE PARTICULATE EMISSIONS FROM REACHING EXISTING ROADS AND NEIGHBORING PROPERTIES.
9. THE FINAL DESIGN OF THIS PROJECT MUST MEET ALL MS4 WATER QUALITY REGULATIONS ESTABLISHED BY MSD.
10. ALL STREET NAME SIGNS AND PAVEMENT MARKING SHALL CONFORM WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) REQUIREMENTS AND BE INSTALLED PRIOR TO CONSTRUCTION OF THE FIRST PHASE AND SHALL BE IN PLACE AT THE TIME OF THE BOND RELEASE/PRIOR TO RECEIVING A CERTIFICATE OF OCCUPANCY.
11. ALL RADIUSES, SIDEWALK LOCATIONS AND OFFSETS SHALL BE IN ACCORDANCE WITH METRO PUBLIC WORKS STANDARDS AND APPROVED AT THE TIME OF CONSTRUCTION.
12. ALL ROADWAY AND ENTRANCE INTERSECTIONS SHALL MEET THE REQUIREMENTS FOR LANDING AREAS AS SET BY METRO PUBLIC WORKS.
13. TREE CANOPY CREDIT AREAS (TCCA'S) IDENTIFIED ON THIS PLAN REPRESENT PORTIONS OF THE SITE THE DEVELOPER HAS AGREED TO PRESERVE. THESE ARE PERMANENT PRESERVATION AREAS. ALL CLEARING, GRADING, AND FILL ACTIVITY IN THESE AREAS MUST BE IN KEEPING THE RESTRICTIONS ESTABLISHED AT THE TIME OF PLAN APPROVAL. NO FURTHER CLEARING, GRADING, CONSTRUCTION, OR OTHER LAND DISTURBING ACTIVITY SHALL TAKE PLACE BEYOND PRUNING TO IMPROVE THE GENERAL HEALTH OF THE TREE OR TO REMOVE DEAD OR DECLINING TREES THAT MAY POSE A PUBLIC HEALTH AND SAFETY THREAT.
14. SIDEWALK CONSTRUCTION SHALL BE REQUIRED, TO MEET CURRENT MPW STANDARDS AND SHALL BE INSPECTED PRIOR TO FINAL BOND RELEASE.
15. CONSTRUCTION PLANS. BOND AND PERMIT ARE REQUIRED BY METRO PUBLIC WORKS PRIOR TO CONSTRUCTION APPROVAL.
16. MSD DRAINAGE BOND REQUIRED PRIOR TO CONSTRUCTION PLAN APPROVAL.
17. ALL PARKING AND DRIVE AISLES TO BE HARD AND DURABLE SURFACE.

BENCH MARKS (1983 NAVD)

BM#1062 X-CUT ON CONCRETE WALK 175' NORTHWEST OF THE EASTERNMOST CORNER OF TRACT AND 34.5' FROM CENTERLINE OF CHAMBERLAIN LANE. ELEVATION 709.30

BM#1063 X-CUT ON CONCRETE WALK 345' SOUTH OF THE CENTERLINE OF THE ENTRANCE TO CHAMBERLAIN LANE OFFICE CENTER AND 4' SOUTH OF FIRE HYDRANT. ELEVATION 712.01

BM#1064 X-CUT ON CONCRETE WALK 56' SOUTH OF THE CENTERLINE OF THE ENTRANCE TO CHAMBERLAIN LANE OFFICE CENTER AND 23 FEET WEST OF CENTERLINE OF CHAMBERLAIN LANE. ELEVATION 713.50

BM#1 X-CUT ON TOP OF CONCRETE CURB AT THE ENTRANCE OF CONDO'S ELEVATION 713.89

BM#2 X-CUT ON BACK OF CONCRETE WALK ON CHARTER OAKS DRIVE. ELEVATION 706.52

SWPP NOTES

1) THE APPROVED EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) PLAN SHALL BE IMPLEMENTED PRIOR TO ANY LAND-DISTURBING ACTIVITY ON THE CONSTRUCTION SITE. ANY MODIFICATIONS TO THE APPROVED EPSC PLAN MUST BE REVIEWED AND APPROVED BY M.S.D.'S PRIVATE DEVELOPMENT REVIEW OFFICE. EPSC BMPs SHALL BE INSTALLED PER THE PLAN AND M.S.D. STANDARDS.

2) DETENTION BASINS, IF APPLICABLE, SHALL BE CONSTRUCTED FIRST AND SHALL PERFORM AS SEDIMENT BASINS DURING CONSTRUCTION UNTIL THE CONTRIBUTING DRAINAGE AREAS ARE SEEDED AND STABILIZED.

3) ACTIONS MUST BE TAKEN TO MINIMIZE THE TRACKING OF MUD AND SOIL FROM CONSTRUCTION AREAS ONTO PUBLIC ROADWAYS. SOILS TRACKED ONTO THE ROADWAY SHALL BE REMOVED DAILY.

4) SOIL STOCKPILES SHALL BE LOCATED AWAY FROM STREAMS, PONDS, SWALES, AND CATCH BASINS. STOCKPILES SHALL BE SEEDED, MULCHED, AND ADEQUATELY CONTAINED THROUGH THE USE OF SILT FENCING.

5) ALL STREAM CROSSINGS MUST UTILIZE LOW-WATER CROSSING STRUCTURES PER M.S.D. STANDARD DRAWING ER-02.

6) WHERE CONSTRUCTION OR LAND DISTURBANCE ACTIVITY WILL OR HAS TEMPORARILY CEASED ON ANY PORTION OF A SITE, TEMPORARY SITE STABILIZATION MEASURES SHALL BE REQUIRED AS SOON AS PRACTICABLE, BUT NOT LATER THAN 14 CALENDAR DAYS AFTER THE ACTIVITY HAS CEASED.

7) SEDIMENT-LADEN GROUNDWATER ENCOUNTERED DURING TRENCHING, BORING, OR OTHER EXCAVATION ACTIVITIES SHALL BE PUMPED TO A SEDIMENT TRAPPING DEVICE PRIOR TO BEING DISCHARGED INTO A STREAM, POND, SWALE, OR CATCH BASIN.

EROSION PREVENTION PLAN

ALL STORM WATER RUNOFF FROM DISTURBED AREAS WILL BE DIRECTED TO DITCH CHECKS OR SILT FENCE PERIMETER CONTROLS UNTIL STORM SEWERS ARE INSTALLED. AFTER STORM SEWER INSTALLATION, ALL STORM INLETS SHALL BE PROTECTED WITH STONE BAGS, SILT SACKS OR OTHER MSD APPROVED INLET CONTROLS. SILT FENCE SHALL BE UTILIZED AS PERIMETER CONTROLS AROUND SENSITIVE AREAS DURING CONSTRUCTION. SMALL WATERSHED AREAS MAY BE PROTECTED WITH SILT FENCE AND/OR DITCH CHECKS BASED ON FINAL GRADING.

UTILITY NOTE

ALL UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE. INDIVIDUAL SERVICE LINES ARE NOT SHOWN. THE CONTRACTOR OR SUBCONTRACTOR SHALL NOTIFY THE UTILITY PROTECTION CENTER "B.U.D." (TOLL FREE PHONE NO. 1-800-752-6007) FORTY-EIGHT HOURS IN ADVANCE OF ANY CONSTRUCTION ON THIS PROJECT. THIS NUMBER WAS ESTABLISHED TO PROVIDE ACCURATE LOCATIONS OF EXISTING BELOW, GROUND UTILITIES i.e. CABLES, ELECTRIC WIRES, GAS, AND WATERLINES. WHEN CONTACTING THE "B.U.D." CALL CENTER, PLEASE STATE THAT THE WORK TO BE DONE IS FOR A PROPOSED M.S.D. SEWER OR DRAINAGE FACILITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR BECOMING FAMILIAR WITH ALL UTILITY REQUIREMENTS SET FORTH ON THE PLANS, IN THE TECHNICAL SPECIFICATIONS, AND SPECIAL PROVISIONS.

LEGEND

EXISTING STORM SEWER
EXISTING STORM DIRECTIONAL FLOW ARROWS
EXISTING SANITARY SEWER
SCHEMATIC STORM SEWER
SEWER DIRECTIONAL FLOW ARROWS
SCHEMATIC SANITARY SEWER
SANITARY DIRECTIONAL FLOW ARROWS
EXISTING TREE CANOPY
PROPOSED TCCA AREA
W — WATER VALVE
—W— WATER LINE
CB — CATCH BASIN
LSA — LANDSCAPE AREA
OHE — OVERHEAD ELECTRIC
UGT — UNDERGROUND TELECOMS
UP — UTILITY POLE
T — TELEPHONE PEDESTAL
GUY WIRE
SVP (SERVICE POLE)
UFU — UNIDENTIFIED UTILITY -UNDERGROUND
S — SANITARY SEWER MANHOLE
M — MANHOLE - UNKNOWN TYPE
E — ELECTRIC MANHOLE
G — GAS VALVE
—G— GAS LINE
BM#1 — BENCHMARK

DEVELOPER
LIV DEVELOPMENT
2204 LAKESHORE DRIVE, SUITE 450
BIRMINGHAM, AL 35209

NORTH

0 25' 50' 100'
SCALE: 1"=50'-0"

SITE DATA

FORM DISTRICT:	NEIGHBORHOOD
EXISTING ZONING:	R-4
PROPOSED ZONING:	R-7
EXISTING USE:	UNDEVELOPED
PROPOSED USE:	MULTI FAMILY RESIDENTIAL
GROSS SITE AREA:	782,599 SF OR 17.97 AC
NET SITE AREA :	730,050 SF OR 16.75 AC
(AFTER ROW DEDICATION AT SPRINGDALE ROAD)	
TOTAL UNITS:	302 UNITS
1 BEDROOM UNITS:	133 UNITS
2 BEDROOM UNITS:	129 UNITS
3 BEDROOM UNITS:	40 UNITS
GROSS DENSITY:	16.8 DU/AC
NET DENSITY:	18.03 DU/AC
GROSS BUILDING FOOTPRINT AREA:	113,134 SF
BUILDING #1:	21,364 SF
BUILDING #2:	24,055 SF
BUILDING #3:	13,679 SF
BUILDING #4:	13,679 SF
BUILDING #51:	24,055 SF
BUILDING #6:	3,334 SF
BUILDING #7:	3,334 SF
BUILDING #8:	3,334 SF
BUILDING #9:	3,334 SF
BUILDING #10:	2,586 SF
MAINTENANCE BUILDING:	380 SF
GROSS FLOOR AREA OF ALL BUILDINGS:	430,302 SF
TALLEST STRUCTURE HEIGHT:	49"-9" FROM GRADE TO MIDPOINT OF ROOF

PARKING CALCULATIONS

MINIMUM REQUIRED PARKING (1/UNIT)	302 SPACES
MAXIMUM REQUIRED PARKING (2/UNIT)	604 SPACES
PARKING PROVIDED:	518 SPACES
GARAGE PARKING:	20 SPACES
TANDEM GARAGE PARKING:	20 SPACES
ADA / HANDICAPPED PARKING: (1 IS VAN ACCESSIBLE)	11 SPACES
STANDARD PARKING:	461 SPACES
PARALLEL SPACES	6 SPACES

OPEN SPACE CALCULATIONS

MINIMUM REQUIRED OPEN SPACE (5% OF NET AREA)	.84 AC
RECREATIONAL OPEN SPACE REQUIRED:	.42 AC
OPEN SPACE PROVIDED:	3.96 AC
RECREATIONAL OPEN SPACE PROVIDED:	.9 AC

(BUILDING 1 COURTYARD: .44 AC)
(BUILDING 2 COURTYARD: .21 AC)
(BUILDING 5 COURTYARD: .19 AC)
(BUILDING 6 SIDE YARD: .06 AC)

ILA/VUA CALCULATIONS

VUA TOTAL:	199,633 SF
ILA REQUIRED: (7.5% of VUA)	14,972 SF
ILA PROVIDED:	40,549 SF
TREES REQUIRED:	64 TREES

TREE CANOPY CALCULATIONS

GROSS SITE AREA*:	782,599 SF OR 17.97 AC
EXISTING TREE CANOPY:	81,760 SF (10.4%)
TREE CANOPY AT DRIPLINE TO BE PRESERVED:	48,087 SF (6.1%)
TCCA CREDIT FOR PRESERVED CANOPY:	96,174 SF (12.2%)
TOTAL TREE CANOPY REQUIRED (35%):	273,909 SF (35%)
ADDITIONAL TREE CANOPY REQUIRED:	177,735 SF (22.8%)

CASE#
WM #
TAX BLOCK 0060
PARCEL ID: W00600070000
SEWER TREATMENT PLANT: MORRIS FOREMAN
IMPERVIOUS INCREASE: 360,608 +/- SF

OWNER:
ROY F. MCMAHAN
3034 R HUNSINGER LANE
LOUISVILLE, KY 40220
D.B. 9656 PG. 96

SABAK, WILSON & LINGO, INC
ENGINEERS, LANDSCAPE ARCHITECTS & PLANNERS
THE HENRY CLAY 608 S. THIRD STREET, LOUISVILLE, KENTUCKY 40202 (502) 584 - 6271

NO. | REVISION | DATE

SHEET TITLE:
DISTRICT DEVELOPMENT PLAN

PROJECT TITLE:
SPRINGDALE APARTMENTS
5217 SPRINGDALE ROADD
LOUISVILLE, KY 40241

JOB NO.	3285
SCALE:	1"=50'
DATE:	05/28/21
DRAWING NO:	DDP

SHEET 1 OF 1

APPENDIX B – TABLES

Grid Receiver Names

Springdale Road and I-265/KY-841
Jefferson County, KY

50x50 Grid Receivers
Existing Noise Barriers
250 ft. Buffer
Proposed Site Boundary

Feet
0 125 250

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AB_03	138	58.5
AB_04	131	58.4
AB_05	124	58.8
AB_06	116	59.5
AB_07	109	59.5
AC_03	188	57.4
AC_04	180	57.5
AC_05	173	57.8
AC_06	166	58.2
AC_07	159	58.2
AC_08	151	58.1
AC_09	144	58.1
AC_10	136	58.3
AC_11	129	58.7
AC_12	122	59.1
AC_13	114	59.8
AC_14	107	59.6
AD_04	230	56.9
AD_05	223	57.2
AD_06	215	57.4
AD_07	208	57.5
AD_08	201	57.4
AD_09	193	57.4
AD_10	186	57.6
AD_11	178	57.9
AD_12	171	58.2
AD_13	164	58.5
AD_14	156	58.7
AD_15	149	58.6
AD_16	142	58.6
AD_17	134	58.8
AD_18	127	58.8
AD_19	120	59.5
AD_20	112	59.9
AD_21	105	60.1
AD_22	98	60.3
AD_23	90	60.5
AD_24	83	60.7
AD_25	76	60.7

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AD_26	68	60.2
AE_05	272	56.6
AE_06	265	56.6
AE_07	257	56.5
AE_08	250	56.5
AE_09	243	56.6
AE_10	235	56.7
AE_11	228	56.9
AE_12	221	57.6
AE_13	213	57.8
AE_14	206	58.0
AE_15	198	58.0
AE_16	191	57.8
AE_17	184	57.6
AE_18	176	57.6
AE_19	169	57.9
AE_20	162	58.3
AE_21	154	58.6
AE_22	147	58.8
AE_23	140	59.2
AE_24	132	59.4
AE_25	125	59.5
AE_26	118	59.1
AE_27	110	58.8
AE_28	103	58.9
AE_29	96	59.2
AE_30	88	59.6
AE_31	81	60.8
AE_32	74	62.0
AE_33	67	62.4
AF_05	322	55.9
AF_06	314	55.6
AF_07	307	55.4
AF_08	300	56.0
AF_09	292	55.5
AF_10	285	55.8
AF_11	277	56.0
AF_12	270	56.4
AF_13	263	56.7

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AF_14	255	57.0
AF_15	248	57.2
AF_16	241	57.2
AF_17	233	56.9
AF_18	226	56.9
AF_19	218	57.1
AF_20	211	57.2
AF_21	204	57.5
AF_22	197	57.7
AF_23	189	58.0
AF_24	182	58.4
AF_25	175	58.6
AF_26	167	58.4
AF_27	160	58.3
AF_28	153	58.4
AF_29	145	58.6
AF_30	138	59.1
AF_31	131	59.6
AF_32	123	60.6
AF_33	116	61.2
AF_34	109	62.1
AF_35	101	63.6
AG_06	364	54.6
AG_07	356	54.4
AG_08	349	54.5
AG_09	342	54.6
AG_10	334	54.8
AG_11	327	55.0
AG_12	319	55.6
AG_13	312	55.8
AG_14	305	56.0
AG_15	297	56.1
AG_16	290	56.0
AG_17	283	56.1
AG_18	275	56.1
AG_19	268	56.2
AG_20	261	56.4
AG_21	253	56.6
AG_22	246	56.8

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AG_23	239	57.1
AG_24	231	57.5
AG_25	224	57.8
AG_26	217	57.9
AG_27	209	58.0
AG_28	202	58.1
AG_29	195	58.5
AG_30	187	59.1
AG_31	180	59.4
AG_32	173	59.6
AG_33	165	60.7
AH_07	406	53.6
AH_08	398	53.7
AH_09	391	53.9
AH_10	384	54.0
AH_11	376	54.1
AH_12	369	55.0
AH_13	362	55.0
AH_14	354	55.1
AH_15	347	55.1
AH_16	339	55.0
AH_17	332	55.0
AH_18	325	55.1
AH_19	317	55.2
AH_20	310	55.4
AH_21	303	55.7
AH_22	295	56.0
AH_23	288	56.5
AH_24	281	56.8
AH_25	273	57.1
AH_26	266	57.4
AH_27	259	57.6
AH_28	252	57.7
AH_29	244	58.2
AH_30	237	58.4
AH_31	230	59.1
AI_07	455	52.9
AI_08	448	52.9
AI_09	440	53.0

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AI_10	433	53.1
AI_11	426	53.4
AI_12	418	53.8
AI_13	411	54.1
AI_14	404	54.1
AI_15	396	54.0
AI_16	389	54.0
AI_17	382	54.0
AI_18	374	54.1
AI_19	367	54.2
AI_20	360	54.5
AI_21	352	54.8
AI_22	345	55.3
AI_23	338	55.9
AI_24	330	56.1
AI_25	323	56.3
AI_26	316	56.6
AI_27	308	56.8
AI_28	301	57.1
AI_29	294	57.5
AI_30	286	58.0
AJ_08	497	52.3
AJ_09	490	52.3
AJ_10	483	52.4
AJ_11	475	52.7
AJ_12	468	53.1
AJ_13	460	53.2
AJ_14	453	53.1
AJ_15	446	53.1
AJ_16	438	53.1
AJ_17	431	53.2
AJ_18	424	53.4
AJ_19	416	53.5
AJ_20	409	53.7
AJ_21	402	54.1
AJ_22	394	54.8
AJ_23	387	55.2
AJ_24	380	55.4
AJ_25	372	55.5

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AJ_26	365	55.7
AJ_27	358	56.1
AJ_28	350	56.6
AK_09	539	51.7
AK_10	532	51.9
AK_11	525	52.2
AK_12	517	52.4
AK_13	510	52.3
AK_14	503	52.2
AK_15	495	52.2
AK_16	488	52.3
AK_17	480	52.4
AK_18	473	52.6
AK_19	466	53.0
AK_20	458	53.5
AK_21	451	53.8
AK_22	444	54.1
AK_23	436	54.3
AK_24	429	54.5
AK_25	422	54.8
AK_26	415	55.1
AK_27	407	55.4
AL_09	589	51.3
AL_10	581	51.4
AL_11	574	51.6
AL_12	567	51.8
AL_13	559	51.7
AL_14	552	51.6
AL_15	545	51.6
AL_16	537	51.6
AL_17	530	51.9
AL_18	523	52.2
AL_19	515	52.5
AL_20	508	52.9
AL_21	501	53.1
AL_22	493	53.5
AL_23	486	53.5
AL_24	479	53.9
AL_25	471	54.2

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AM_10	631	50.8
AM_11	624	51.2
AM_12	616	51.2
AM_13	609	51.1
AM_14	601	51.2
AM_15	594	51.3
AM_16	587	51.0
AM_17	579	51.3
AM_18	572	51.9
AM_19	565	52.0
AM_20	557	52.3
AM_21	550	52.5
AM_22	543	52.8
AM_23	535	53.1
AM_24	528	53.3
AN_11	673	50.7
AN_12	666	50.8
AN_13	658	50.7
AN_14	651	50.7
AN_15	644	50.7
AN_16	636	50.8
AN_17	629	50.4
AN_18	621	50.9
AN_19	614	51.5
AN_20	607	51.8
AN_21	600	51.9
AN_22	592	52.4
AO_11	722	50.2
AO_12	715	50.3
AO_13	708	50.3
AO_14	700	50.3
AO_15	693	50.3
AO_16	686	50.3
AO_17	678	50.7
AO_18	671	50.6
AO_19	664	50.7
AO_20	656	51.3
AO_21	649	51.4
AP_12	765	49.8

Table 1: 2023 Build Year Noise Levels

LEGEND	
	Sound Level Impact 65 dB(A) or Greater

RECEPTOR	2023 BUILD YEAR	
	DIST. TO ROAD (FT)	SOUND LEVELS dB(A)
AP_13	757	49.9
AP_14	750	50.0
AP_15	742	50.0
AP_16	735	50.0
AP_17	728	50.1
AP_18	720	50.8
AP_19	713	50.6
AQ_13	807	49.5
AQ_14	799	49.6
AQ_15	792	49.7
AQ_16	785	49.9
AQ_17	777	49.6
AQ_18	770	49.6
AR_13	856	49.1
AR_14	849	49.1
AR_15	841	49.1
AR_16	834	50.1
AS_14	898	48.8
AS_15	891	49.0

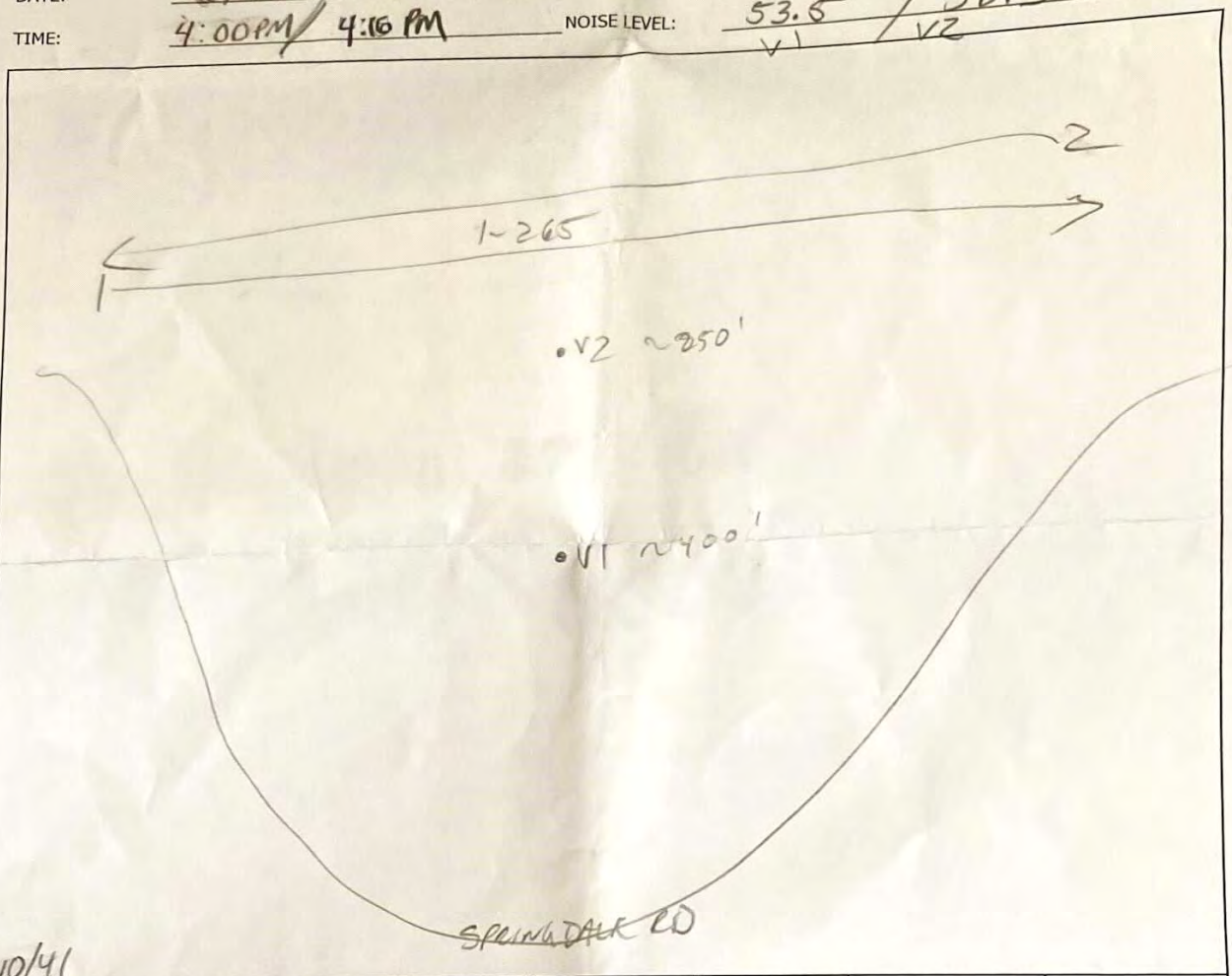
APPENDIX C – FIELD DATA SHEETS

NOISE FIELD MEASUREMENT DATA SHEET

PROFESSIONAL ENGINEERS, INC

PROJECT: SPRINGDALE
SITE: V1 / V2
JOB NUMBER: 1389.00
DATE: 6/17/21
TIME: 4:00PM / 4:16 PM

TECHNICIAN(S): MJG, MJM
SPEED LIMIT: 70 mph
TEMPERATURE: 72°F WIND SPEED: ~5MPH
DURATION: 15-1 / 15'
NOISE LEVEL: 53.5 / 58.3 dBA Leq
V1 V2



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SEGMENT	AUTOMOBILES	MEDIUM TRUCKS	HEAVY TRUCKS	BUSES	MOTORCYCLES	DIRECTION
V1 1	1408	8	108			
2	1280	16	144			
V2 #1	1680	20	108			
V2 #2	1060	20	152			

NOTES: * LOCATIONS MARKED VIA GPS

APPENDIX D – TNM OUTPUT

HMB Professional Engineers
Mark Gavula

14 July 2021
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 1389.00
RUN: Springdale Noise Analysis - Grid
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
AB_03	4	1	0.0	65.6	66	65.6	10	----	58.5	7.1	8	-0.9
AB_04	5	1	0.0	65.7	66	65.7	10	----	58.4	7.3	8	-0.7
AB_05	6	1	0.0	66.3	66	66.3	10	Snd Lvl	58.8	7.5	8	-0.5
AB_06	7	1	0.0	67.1	66	67.1	10	Snd Lvl	59.5	7.6	8	-0.4
AB_07	8	1	0.0	67.4	66	67.4	10	Snd Lvl	59.5	7.9	8	-0.1
AC_03	9	1	0.0	63.6	66	63.6	10	----	57.4	6.2	8	-1.8
AC_04	10	1	0.0	63.8	66	63.8	10	----	57.5	6.3	8	-1.7
AC_05	11	1	0.0	64.5	66	64.5	10	----	57.8	6.7	8	-1.3
AC_06	12	1	0.0	65.0	66	65.0	10	----	58.2	6.8	8	-1.2
AC_07	13	1	0.0	65.3	66	65.3	10	----	58.2	7.1	8	-0.9
AC_08	14	1	0.0	64.8	66	64.8	10	----	58.1	6.7	8	-1.3
AC_09	15	1	0.0	64.9	66	64.9	10	----	58.1	6.8	8	-1.2
AC_10	16	1	0.0	65.2	66	65.2	10	----	58.3	6.9	8	-1.1
AC_11	17	1	0.0	66.2	66	66.2	10	Snd Lvl	58.7	7.5	8	-0.5
AC_12	18	1	0.0	66.9	66	66.9	10	Snd Lvl	59.1	7.8	8	-0.2
AC_13	19	1	0.0	68.8	66	68.8	10	Snd Lvl	59.8	9.0	8	1.0
AC_14	20	1	0.0	69.7	66	69.7	10	Snd Lvl	59.6	10.1	8	2.1
AD_04	21	1	0.0	62.8	66	62.8	10	----	56.9	5.9	8	-2.1
AD_05	22	1	0.0	63.2	66	63.2	10	----	57.2	6.0	8	-2.0
AD_06	23	1	0.0	63.7	66	63.7	10	----	57.4	6.3	8	-1.7
AD_07	24	1	0.0	63.9	66	63.9	10	----	57.5	6.4	8	-1.6
AD_08	25	1	0.0	63.8	66	63.8	10	----	57.4	6.4	8	-1.6
AD_09	26	1	0.0	63.7	66	63.7	10	----	57.4	6.3	8	-1.7
AD_10	27	1	0.0	64.1	66	64.1	10	----	57.6	6.5	8	-1.5

AD_11	28	1	0.0	64.7	66	64.7	10	----	57.9	6.8	8	-1.2
AD_12	29	1	0.0	65.2	66	65.2	10	----	58.2	7.0	8	-1.0
AD_13	30	1	0.0	65.8	66	65.8	10	----	58.5	7.3	8	-0.7
AD_14	31	1	0.0	66.3	66	66.3	10	Snd Lvl	58.7	7.6	8	-0.4
AD_15	32	1	0.0	67.0	66	67.0	10	Snd Lvl	58.6	8.4	8	0.4
AD_16	33	1	0.0	67.7	66	67.7	10	Snd Lvl	58.6	9.1	8	1.1
AD_17	34	1	0.0	68.5	66	68.5	10	Snd Lvl	58.8	9.7	8	1.7
AD_18	35	1	0.0	69.1	66	69.1	10	Snd Lvl	58.8	10.3	8	2.3
AD_19	36	1	0.0	69.7	66	69.7	10	Snd Lvl	59.5	10.2	8	2.2
AD_20	37	1	0.0	70.3	66	70.3	10	Snd Lvl	59.9	10.4	8	2.4
AD_21	38	1	0.0	70.9	66	70.9	10	Snd Lvl	60.1	10.8	8	2.8
AD_22	39	1	0.0	71.4	66	71.4	10	Snd Lvl	60.3	11.1	8	3.1
AD_23	40	1	0.0	72.0	66	72.0	10	Snd Lvl	60.5	11.5	8	3.5
AD_24	41	1	0.0	72.6	66	72.6	10	Snd Lvl	60.7	11.9	8	3.9
AD_25	42	1	0.0	73.2	66	73.2	10	Snd Lvl	60.7	12.5	8	4.5
AD_26	43	1	0.0	73.2	66	73.2	10	Snd Lvl	60.2	13.0	8	5.0
AE_05	44	1	0.0	62.2	66	62.2	10	----	56.6	5.6	8	-2.4
AE_06	45	1	0.0	62.3	66	62.3	10	----	56.6	5.7	8	-2.3
AE_07	46	1	0.0	62.2	66	62.2	10	----	56.5	5.7	8	-2.3
AE_08	47	1	0.0	62.1	66	62.1	10	----	56.5	5.6	8	-2.4
AE_09	48	1	0.0	62.3	66	62.3	10	----	56.6	5.7	8	-2.3
AE_10	49	1	0.0	62.6	66	62.6	10	----	56.7	5.9	8	-2.1
AE_11	50	1	0.0	63.1	66	63.1	10	----	56.9	6.2	8	-1.8
AE_12	51	1	0.0	63.6	66	63.6	10	----	57.6	6.0	8	-2.0
AE_13	52	1	0.0	64.3	66	64.3	10	----	57.8	6.5	8	-1.5
AE_14	53	1	0.0	64.8	66	64.8	10	----	58.0	6.8	8	-1.2
AE_15	54	1	0.0	65.2	66	65.2	10	----	58.0	7.2	8	-0.8
AE_16	55	1	0.0	65.6	66	65.6	10	----	57.8	7.8	8	-0.2
AE_17	56	1	0.0	65.9	66	65.9	10	----	57.6	8.3	8	0.3
AE_18	57	1	0.0	66.4	66	66.4	10	Snd Lvl	57.6	8.8	8	0.8
AE_19	58	1	0.0	66.9	66	66.9	10	Snd Lvl	57.9	9.0	8	1.0
AE_20	59	1	0.0	67.5	66	67.5	10	Snd Lvl	58.3	9.2	8	1.2
AE_21	60	1	0.0	68.0	66	68.0	10	Snd Lvl	58.6	9.4	8	1.4
AE_22	61	1	0.0	68.4	66	68.4	10	Snd Lvl	58.8	9.6	8	1.6
AE_23	62	1	0.0	68.9	66	68.9	10	Snd Lvl	59.2	9.7	8	1.7
AE_24	63	1	0.0	69.6	66	69.6	10	Snd Lvl	59.4	10.2	8	2.2
AE_25	64	1	0.0	70.1	66	70.1	10	Snd Lvl	59.5	10.6	8	2.6
AE_26	65	1	0.0	69.3	66	69.3	10	Snd Lvl	59.1	10.2	8	2.2
AE_27	66	1	0.0	68.7	66	68.7	10	Snd Lvl	58.8	9.9	8	1.9
AE_28	67	1	0.0	68.5	66	68.5	10	Snd Lvl	58.9	9.6	8	1.6
AE_29	68	1	0.0	68.9	66	68.9	10	Snd Lvl	59.2	9.7	8	1.7

AE_30	69	1	0.0	69.6	66	69.6	10	Snd Lvl	59.6	10.0	8	2.0
AE_31	70	1	0.0	71.9	66	71.9	10	Snd Lvl	60.8	11.1	8	3.1
AE_32	71	1	0.0	73.1	66	73.1	10	Snd Lvl	62.0	11.1	8	3.1
AE_33	72	1	0.0	73.5	66	73.5	10	Snd Lvl	62.4	11.1	8	3.1
AF_05	73	1	0.0	61.1	66	61.1	10	----	55.9	5.2	8	-2.8
AF_06	74	1	0.0	60.8	66	60.8	10	----	55.6	5.2	8	-2.8
AF_07	75	1	0.0	60.5	66	60.5	10	----	55.4	5.1	8	-2.9
AF_08	76	1	0.0	60.8	66	60.8	10	----	56.0	4.8	8	-3.2
AF_09	77	1	0.0	60.8	66	60.8	10	----	55.5	5.3	8	-2.7
AF_10	78	1	0.0	61.1	66	61.1	10	----	55.8	5.3	8	-2.7
AF_11	79	1	0.0	61.5	66	61.5	10	----	56.0	5.5	8	-2.5
AF_12	80	1	0.0	62.2	66	62.2	10	----	56.4	5.8	8	-2.2
AF_13	81	1	0.0	62.8	66	62.8	10	----	56.7	6.1	8	-1.9
AF_14	82	1	0.0	63.3	66	63.3	10	----	57.0	6.3	8	-1.7
AF_15	83	1	0.0	63.6	66	63.6	10	----	57.2	6.4	8	-1.6
AF_16	84	1	0.0	64.0	66	64.0	10	----	57.2	6.8	8	-1.2
AF_17	85	1	0.0	64.3	66	64.3	10	----	56.9	7.4	8	-0.6
AF_18	86	1	0.0	64.6	66	64.6	10	----	56.9	7.7	8	-0.3
AF_19	87	1	0.0	65.0	66	65.0	10	----	57.1	7.9	8	-0.1
AF_20	88	1	0.0	65.4	66	65.4	10	----	57.2	8.2	8	0.2
AF_21	89	1	0.0	65.8	66	65.8	10	----	57.5	8.3	8	0.3
AF_22	90	1	0.0	66.2	66	66.2	10	Snd Lvl	57.7	8.5	8	0.5
AF_23	91	1	0.0	66.6	66	66.6	10	Snd Lvl	58.0	8.6	8	0.6
AF_24	92	1	0.0	67.2	66	67.2	10	Snd Lvl	58.4	8.8	8	0.8
AF_25	93	1	0.0	67.7	66	67.7	10	Snd Lvl	58.6	9.1	8	1.1
AF_26	94	1	0.0	67.6	66	67.6	10	Snd Lvl	58.4	9.2	8	1.2
AF_27	95	1	0.0	67.3	66	67.3	10	Snd Lvl	58.3	9.0	8	1.0
AF_28	96	1	0.0	67.2	66	67.2	10	Snd Lvl	58.4	8.8	8	0.8
AF_29	97	1	0.0	67.6	66	67.6	10	Snd Lvl	58.6	9.0	8	1.0
AF_30	98	1	0.0	68.1	66	68.1	10	Snd Lvl	59.1	9.0	8	1.0
AF_31	99	1	0.0	68.0	66	68.0	10	Snd Lvl	59.6	8.4	8	0.4
AF_32	100	1	0.0	69.1	66	69.1	10	Snd Lvl	60.6	8.5	8	0.5
AF_33	101	1	0.0	68.7	66	68.7	10	Snd Lvl	61.2	7.5	8	-0.5
AF_34	102	1	0.0	69.1	66	69.1	10	Snd Lvl	62.1	7.0	8	-1.0
AF_35	103	1	0.0	69.0	66	69.0	10	Snd Lvl	63.6	5.4	8	-2.6
AG_06	104	1	0.0	59.4	66	59.4	10	----	54.6	4.8	8	-3.2
AG_07	105	1	0.0	59.4	66	59.4	10	----	54.4	5.0	8	-3.0
AG_08	106	1	0.0	59.4	66	59.4	10	----	54.5	4.9	8	-3.1
AG_09	107	1	0.0	59.7	66	59.7	10	----	54.6	5.1	8	-2.9
AG_10	108	1	0.0	59.8	66	59.8	10	----	54.8	5.0	8	-3.0
AG_11	109	1	0.0	60.1	66	60.1	10	----	55.0	5.1	8	-2.9

AG_12	110	1	0.0	60.8	66	60.8	10	----	55.6	5.2	8	-2.8
AG_13	111	1	0.0	61.5	66	61.5	10	----	55.8	5.7	8	-2.3
AG_14	112	1	0.0	61.9	66	61.9	10	----	56.0	5.9	8	-2.1
AG_15	113	1	0.0	62.2	66	62.2	10	----	56.1	6.1	8	-1.9
AG_16	114	1	0.0	62.5	66	62.5	10	----	56.0	6.5	8	-1.5
AG_17	115	1	0.0	62.8	66	62.8	10	----	56.1	6.7	8	-1.3
AG_18	116	1	0.0	63.1	66	63.1	10	----	56.1	7.0	8	-1.0
AG_19	117	1	0.0	63.4	66	63.4	10	----	56.2	7.2	8	-0.8
AG_20	118	1	0.0	63.7	66	63.7	10	----	56.4	7.3	8	-0.7
AG_21	119	1	0.0	64.1	66	64.1	10	----	56.6	7.5	8	-0.5
AG_22	120	1	0.0	64.4	66	64.4	10	----	56.8	7.6	8	-0.4
AG_23	121	1	0.0	64.7	66	64.7	10	----	57.1	7.6	8	-0.4
AG_24	122	1	0.0	65.3	66	65.3	10	----	57.5	7.8	8	-0.2
AG_25	123	1	0.0	65.8	66	65.8	10	----	57.8	8.0	8	0.0
AG_26	124	1	0.0	66.1	66	66.1	10	Snd Lvl	57.9	8.2	8	0.2
AG_27	125	1	0.0	66.0	66	66.0	10	Snd Lvl	58.0	8.0	8	0.0
AG_28	126	1	0.0	66.0	66	66.0	10	Snd Lvl	58.1	7.9	8	-0.1
AG_29	127	1	0.0	66.5	66	66.5	10	Snd Lvl	58.5	8.0	8	0.0
AG_30	128	1	0.0	66.9	66	66.9	10	Snd Lvl	59.1	7.8	8	-0.2
AG_31	129	1	0.0	66.8	66	66.8	10	Snd Lvl	59.4	7.4	8	-0.6
AG_32	130	1	0.0	66.3	66	66.3	10	Snd Lvl	59.6	6.7	8	-1.3
AG_33	131	1	0.0	66.5	66	66.5	10	Snd Lvl	60.7	5.8	8	-2.2
AH_07	132	1	0.0	58.4	66	58.4	10	----	53.6	4.8	8	-3.2
AH_08	133	1	0.0	58.4	66	58.4	10	----	53.7	4.7	8	-3.3
AH_09	134	1	0.0	58.6	66	58.6	10	----	53.9	4.7	8	-3.3
AH_10	135	1	0.0	58.7	66	58.7	10	----	54.0	4.7	8	-3.3
AH_11	136	1	0.0	59.0	66	59.0	10	----	54.1	4.9	8	-3.1
AH_12	137	1	0.0	59.7	66	59.7	10	----	55.0	4.7	8	-3.3
AH_13	138	1	0.0	60.4	66	60.4	10	----	55.0	5.4	8	-2.6
AH_14	139	1	0.0	60.7	66	60.7	10	----	55.1	5.6	8	-2.4
AH_15	140	1	0.0	60.9	66	60.9	10	----	55.1	5.8	8	-2.2
AH_16	141	1	0.0	61.1	66	61.1	10	----	55.0	6.1	8	-1.9
AH_17	142	1	0.0	61.3	66	61.3	10	----	55.0	6.3	8	-1.7
AH_18	143	1	0.0	61.6	66	61.6	10	----	55.1	6.5	8	-1.5
AH_19	144	1	0.0	61.8	66	61.8	10	----	55.2	6.6	8	-1.4
AH_20	145	1	0.0	62.2	66	62.2	10	----	55.4	6.8	8	-1.2
AH_21	146	1	0.0	62.6	66	62.6	10	----	55.7	6.9	8	-1.1
AH_22	147	1	0.0	62.9	66	62.9	10	----	56.0	6.9	8	-1.1
AH_23	148	1	0.0	63.4	66	63.4	10	----	56.5	6.9	8	-1.1
AH_24	149	1	0.0	63.8	66	63.8	10	----	56.8	7.0	8	-1.0
AH_25	150	1	0.0	64.1	66	64.1	10	----	57.1	7.0	8	-1.0

AH_26	151	1	0.0	64.5	66	64.5	10	----	57.4	7.1	8	-0.9
AH_27	152	1	0.0	64.7	66	64.7	10	----	57.6	7.1	8	-0.9
AH_28	153	1	0.0	64.9	66	64.9	10	----	57.7	7.2	8	-0.8
AH_29	154	1	0.0	65.1	66	65.1	10	----	58.2	6.9	8	-1.1
AH_30	155	1	0.0	65.1	66	65.1	10	----	58.4	6.7	8	-1.3
AH_31	156	1	0.0	65.0	66	65.0	10	----	59.1	5.9	8	-2.1
AI_07	157	1	0.0	57.5	66	57.5	10	----	52.9	4.6	8	-3.4
AI_08	158	1	0.0	57.6	66	57.6	10	----	52.9	4.7	8	-3.3
AI_09	159	1	0.0	57.7	66	57.7	10	----	53.0	4.7	8	-3.3
AI_10	160	1	0.0	57.7	66	57.7	10	----	53.1	4.6	8	-3.4
AI_11	161	1	0.0	58.0	66	58.0	10	----	53.4	4.6	8	-3.4
AI_12	162	1	0.0	58.9	66	58.9	10	----	53.8	5.1	8	-2.9
AI_13	163	1	0.0	59.4	66	59.4	10	----	54.1	5.3	8	-2.7
AI_14	164	1	0.0	59.5	66	59.5	10	----	54.1	5.4	8	-2.6
AI_15	165	1	0.0	59.6	66	59.6	10	----	54.0	5.6	8	-2.4
AI_16	166	1	0.0	59.9	66	59.9	10	----	54.0	5.9	8	-2.1
AI_17	167	1	0.0	59.9	66	59.9	10	----	54.0	5.9	8	-2.1
AI_18	168	1	0.0	60.1	66	60.1	10	----	54.1	6.0	8	-2.0
AI_19	169	1	0.0	60.3	66	60.3	10	----	54.2	6.1	8	-1.9
AI_20	170	1	0.0	60.8	66	60.8	10	----	54.5	6.3	8	-1.7
AI_21	171	1	0.0	61.2	66	61.2	10	----	54.8	6.4	8	-1.6
AI_22	172	1	0.0	61.8	66	61.8	10	----	55.3	6.5	8	-1.5
AI_23	173	1	0.0	62.1	66	62.1	10	----	55.9	6.2	8	-1.8
AI_24	174	1	0.0	62.4	66	62.4	10	----	56.1	6.3	8	-1.7
AI_25	175	1	0.0	62.6	66	62.6	10	----	56.3	6.3	8	-1.7
AI_26	176	1	0.0	62.9	66	62.9	10	----	56.6	6.3	8	-1.7
AI_27	177	1	0.0	63.1	66	63.1	10	----	56.8	6.3	8	-1.7
AI_28	178	1	0.0	63.4	66	63.4	10	----	57.1	6.3	8	-1.7
AI_29	179	1	0.0	63.5	66	63.5	10	----	57.5	6.0	8	-2.0
AI_30	180	1	0.0	63.7	66	63.7	10	----	58.0	5.7	8	-2.3
AJ_08	181	1	0.0	56.8	66	56.8	10	----	52.3	4.5	8	-3.5
AJ_09	182	1	0.0	56.8	66	56.8	10	----	52.3	4.5	8	-3.5
AJ_10	183	1	0.0	56.8	66	56.8	10	----	52.4	4.4	8	-3.6
AJ_11	184	1	0.0	57.2	66	57.2	10	----	52.7	4.5	8	-3.5
AJ_12	185	1	0.0	58.0	66	58.0	10	----	53.1	4.9	8	-3.1
AJ_13	186	1	0.0	58.3	66	58.3	10	----	53.2	5.1	8	-2.9
AJ_14	187	1	0.0	58.3	66	58.3	10	----	53.1	5.2	8	-2.8
AJ_15	188	1	0.0	58.3	66	58.3	10	----	53.1	5.2	8	-2.8
AJ_16	189	1	0.0	58.4	66	58.4	10	----	53.1	5.3	8	-2.7
AJ_17	190	1	0.0	58.6	66	58.6	10	----	53.2	5.4	8	-2.6
AJ_18	191	1	0.0	58.9	66	58.9	10	----	53.4	5.5	8	-2.5

AJ_19	192	1	0.0	59.2	66	59.2	10	----	53.5	5.7	8	-2.3
AJ_20	193	1	0.0	59.6	66	59.6	10	----	53.7	5.9	8	-2.1
AJ_21	194	1	0.0	60.1	66	60.1	10	----	54.1	6.0	8	-2.0
AJ_22	195	1	0.0	60.7	66	60.7	10	----	54.8	5.9	8	-2.1
AJ_23	196	1	0.0	61.0	66	61.0	10	----	55.2	5.8	8	-2.2
AJ_24	197	1	0.0	61.2	66	61.2	10	----	55.4	5.8	8	-2.2
AJ_25	198	1	0.0	61.2	66	61.2	10	----	55.5	5.7	8	-2.3
AJ_26	199	1	0.0	61.4	66	61.4	10	----	55.7	5.7	8	-2.3
AJ_27	200	1	0.0	61.6	66	61.6	10	----	56.1	5.5	8	-2.5
AJ_28	201	1	0.0	62.0	66	62.0	10	----	56.6	5.4	8	-2.6
AK_09	202	1	0.0	56.1	66	56.1	10	----	51.7	4.4	8	-3.6
AK_10	203	1	0.0	56.1	66	56.1	10	----	51.9	4.2	8	-3.8
AK_11	204	1	0.0	56.7	66	56.7	10	----	52.2	4.5	8	-3.5
AK_12	205	1	0.0	57.2	66	57.2	10	----	52.4	4.8	8	-3.2
AK_13	206	1	0.0	57.2	66	57.2	10	----	52.3	4.9	8	-3.1
AK_14	207	1	0.0	57.1	66	57.1	10	----	52.2	4.9	8	-3.1
AK_15	208	1	0.0	56.9	66	56.9	10	----	52.2	4.7	8	-3.3
AK_16	209	1	0.0	57.2	66	57.2	10	----	52.3	4.9	8	-3.1
AK_17	210	1	0.0	57.5	66	57.5	10	----	52.4	5.1	8	-2.9
AK_18	211	1	0.0	57.9	66	57.9	10	----	52.6	5.3	8	-2.7
AK_19	212	1	0.0	58.2	66	58.2	10	----	53.0	5.2	8	-2.8
AK_20	213	1	0.0	58.7	66	58.7	10	----	53.5	5.2	8	-2.8
AK_21	214	1	0.0	59.3	66	59.3	10	----	53.8	5.5	8	-2.5
AK_22	215	1	0.0	59.6	66	59.6	10	----	54.1	5.5	8	-2.5
AK_23	216	1	0.0	59.8	66	59.8	10	----	54.3	5.5	8	-2.5
AK_24	217	1	0.0	59.9	66	59.9	10	----	54.5	5.4	8	-2.6
AK_25	218	1	0.0	59.9	66	59.9	10	----	54.8	5.1	8	-2.9
AK_26	219	1	0.0	60.2	66	60.2	10	----	55.1	5.1	8	-2.9
AK_27	220	1	0.0	60.5	66	60.5	10	----	55.4	5.1	8	-2.9
AL_09	221	1	0.0	55.3	66	55.3	10	----	51.3	4.0	8	-4.0
AL_10	222	1	0.0	55.5	66	55.5	10	----	51.4	4.1	8	-3.9
AL_11	223	1	0.0	56.2	66	56.2	10	----	51.6	4.6	8	-3.4
AL_12	224	1	0.0	56.4	66	56.4	10	----	51.8	4.6	8	-3.4
AL_13	225	1	0.0	56.4	66	56.4	10	----	51.7	4.7	8	-3.3
AL_14	226	1	0.0	56.3	66	56.3	10	----	51.6	4.7	8	-3.3
AL_15	227	1	0.0	56.2	66	56.2	10	----	51.6	4.6	8	-3.4
AL_16	228	1	0.0	56.5	66	56.5	10	----	51.6	4.9	8	-3.1
AL_17	229	1	0.0	56.8	66	56.8	10	----	51.9	4.9	8	-3.1
AL_18	230	1	0.0	57.1	66	57.1	10	----	52.2	4.9	8	-3.1
AL_19	231	1	0.0	57.4	66	57.4	10	----	52.5	4.9	8	-3.1
AL_20	232	1	0.0	57.9	66	57.9	10	----	52.9	5.0	8	-3.0

AL_21	233	1	0.0	58.3	66	58.3	10	----	53.1	5.2	8	-2.8
AL_22	234	1	0.0	58.5	66	58.5	10	----	53.5	5.0	8	-3.0
AL_23	235	1	0.0	58.5	66	58.5	10	----	53.5	5.0	8	-3.0
AL_24	236	1	0.0	58.7	66	58.7	10	----	53.9	4.8	8	-3.2
AL_25	237	1	0.0	58.9	66	58.9	10	----	54.2	4.7	8	-3.3
AM_10	238	1	0.0	55.1	66	55.1	10	----	50.8	4.3	8	-3.7
AM_11	239	1	0.0	55.5	66	55.5	10	----	51.2	4.3	8	-3.7
AM_12	240	1	0.0	55.7	66	55.7	10	----	51.2	4.5	8	-3.5
AM_13	241	1	0.0	55.7	66	55.7	10	----	51.1	4.6	8	-3.4
AM_14	242	1	0.0	55.6	66	55.6	10	----	51.2	4.4	8	-3.6
AM_15	243	1	0.0	55.7	66	55.7	10	----	51.3	4.4	8	-3.6
AM_16	244	1	0.0	55.6	66	55.6	10	----	51.0	4.6	8	-3.4
AM_17	245	1	0.0	55.7	66	55.7	10	----	51.3	4.4	8	-3.6
AM_18	246	1	0.0	56.2	66	56.2	10	----	51.9	4.3	8	-3.7
AM_19	247	1	0.0	56.4	66	56.4	10	----	52.0	4.4	8	-3.6
AM_20	248	1	0.0	56.9	66	56.9	10	----	52.3	4.6	8	-3.4
AM_21	249	1	0.0	57.2	66	57.2	10	----	52.5	4.7	8	-3.3
AM_22	250	1	0.0	57.3	66	57.3	10	----	52.8	4.5	8	-3.5
AM_23	251	1	0.0	57.6	66	57.6	10	----	53.1	4.5	8	-3.5
AM_24	252	1	0.0	57.8	66	57.8	10	----	53.3	4.5	8	-3.5
AN_11	253	1	0.0	54.8	66	54.8	10	----	50.7	4.1	8	-3.9
AN_12	254	1	0.0	55.0	66	55.0	10	----	50.8	4.2	8	-3.8
AN_13	255	1	0.0	55.0	66	55.0	10	----	50.7	4.3	8	-3.7
AN_14	256	1	0.0	54.9	66	54.9	10	----	50.7	4.2	8	-3.8
AN_15	257	1	0.0	55.1	66	55.1	10	----	50.7	4.4	8	-3.6
AN_16	258	1	0.0	55.2	66	55.2	10	----	50.8	4.4	8	-3.6
AN_17	259	1	0.0	54.9	66	54.9	10	----	50.4	4.5	8	-3.5
AN_18	260	1	0.0	55.0	66	55.0	10	----	50.9	4.1	8	-3.9
AN_19	261	1	0.0	55.4	66	55.4	10	----	51.5	3.9	8	-4.1
AN_20	262	1	0.0	56.0	66	56.0	10	----	51.8	4.2	8	-3.8
AN_21	263	1	0.0	56.3	66	56.3	10	----	51.9	4.4	8	-3.6
AN_22	264	1	0.0	56.6	66	56.6	10	----	52.4	4.2	8	-3.8
AO_11	265	1	0.0	54.2	66	54.2	10	----	50.2	4.0	8	-4.0
AO_12	266	1	0.0	54.4	66	54.4	10	----	50.3	4.1	8	-3.9
AO_13	267	1	0.0	54.4	66	54.4	10	----	50.3	4.1	8	-3.9
AO_14	268	1	0.0	54.4	66	54.4	10	----	50.3	4.1	8	-3.9
AO_15	269	1	0.0	54.6	66	54.6	10	----	50.3	4.3	8	-3.7
AO_16	270	1	0.0	54.4	66	54.4	10	----	50.3	4.1	8	-3.9
AO_17	271	1	0.0	54.3	66	54.3	10	----	50.7	3.6	8	-4.4
AO_18	272	1	0.0	54.2	66	54.2	10	----	50.6	3.6	8	-4.4
AO_19	273	1	0.0	54.3	66	54.3	10	----	50.7	3.6	8	-4.4

AO_20	274	1	0.0	54.7	66	54.7	10	----	51.3	3.4	8	-4.6
AO_21	275	1	0.0	55.2	66	55.2	10	----	51.4	3.8	8	-4.2
AP_12	276	1	0.0	53.8	66	53.8	10	----	49.8	4.0	8	-4.0
AP_13	277	1	0.0	53.9	66	53.9	10	----	49.9	4.0	8	-4.0
AP_14	278	1	0.0	53.9	66	53.9	10	----	50.0	3.9	8	-4.1
AP_15	279	1	0.0	54.1	66	54.1	10	----	50.0	4.1	8	-3.9
AP_16	280	1	0.0	54.0	66	54.0	10	----	50.0	4.0	8	-4.0
AP_17	281	1	0.0	53.8	66	53.8	10	----	50.1	3.7	8	-4.3
AP_18	282	1	0.0	53.7	66	53.7	10	----	50.8	2.9	8	-5.1
AP_19	283	1	0.0	54.0	66	54.0	10	----	50.6	3.4	8	-4.6
AQ_13	284	1	0.0	53.4	66	53.4	10	----	49.5	3.9	8	-4.1
AQ_14	285	1	0.0	53.5	66	53.5	10	----	49.6	3.9	8	-4.1
AQ_15	286	1	0.0	53.6	66	53.6	10	----	49.7	3.9	8	-4.1
AQ_16	287	1	0.0	53.4	66	53.4	10	----	49.9	3.5	8	-4.5
AQ_17	288	1	0.0	53.4	66	53.4	10	----	49.6	3.8	8	-4.2
AQ_18	289	1	0.0	53.1	66	53.1	10	----	49.6	3.5	8	-4.5
AR_13	290	1	0.0	52.9	66	52.9	10	----	49.1	3.8	8	-4.2
AR_14	291	1	0.0	53.0	66	53.0	10	----	49.1	3.9	8	-4.1
AR_15	292	1	0.0	53.0	66	53.0	10	----	49.1	3.9	8	-4.1
AR_16	293	1	0.0	53.0	66	53.0	10	----	50.1	2.9	8	-5.1
AS_14	294	1	0.0	52.5	66	52.5	10	----	48.8	3.7	8	-4.3
AS_15	295	1	0.0	52.3	66	52.3	10	----	49.0	3.3	8	-4.7

Dwelling Units	**# DUs**	**Noise Reduction**		
		Min	**Avg**	**Max**
		dB	**dB**	**dB**
All Selected	292	2.9	6.1	13.0
All Impacted	58	5.4	9.1	13.0
All that meet NR Goal	48	8.0	9.6	13.0

HMB Professional Engineers
Mark Gavula

14 July 2021
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 1389.00
RUN: Springdale Noise Analysis V1
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Noise Reduction Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
V1	1	1	0.0	58.5	66	58.5	10	----	53.3	5.2	8	-2.8
V2	2	1	0.0	0.0	66	0.0	10	inactive	0.0	0.0	8	0.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	2	0.0	2.6	5.2
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

HMB Professional Engineers
Mark Gavula

14 July 2021
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 1389.00
RUN: Springdale Noise Analysis V2
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Noise Reduction Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
V1	1	1	0.0	0.0	66	0.0	10	inactive	0.0	0.0	8	0.0
V2	2	1	0.0	68.1	66	68.1	10	Snd Lvl	60.8	7.3	8	-0.7

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	2	0.0	3.6	7.3
All Impacted	1	7.3	7.3	7.3
All that meet NR Goal	0	0.0	0.0	0.0

APPENDIX E – TRAFFIC DATA

Springdale Apartments Multi-Family Housing Traffic Impact Study

Submitted to:

Kentucky Transportation Cabinet, District 3

Jefferson County, County Engineer

City of Louisville, City Engineer

Prepared by:
HMB Professional Engineers
3 HMB Circle
Frankfort, KY 40601

July 13, 2021

Executive Summary

This report presents the Traffic Impact Study for the proposed Springdale Apartments Multi-Family Housing in Louisville, Jefferson County, Kentucky. The new development will be located just south of Gene Snyder Freeway along the northern side of Springdale Road.

Study Area

Traffic data was collected at the following study intersection:

1) Springdale Road at Asbury Park Boulevard – Unsignalized

Traffic data was collected on a typical weekday (Wednesday, June 23, 2021) for the peak hours of 7:00 – 9:00 AM and 4:00 – 6:00 PM to determine the AM and PM peak period volumes. The AM peak period was determined to be from 7:45 – 8:45 AM and the PM peak period was from 5:00 – 6:00 PM.

Trip Generation and Traffic Assignment

Trip generation was conducted using the *ITE Trip Generation Manual (10th Edition, Institute of Transportation Engineers)* and information from the applicant. A conceptual site layout was provided by the applicant. Information from the site layout was used to determine the number of units to be used for the trip generation analysis. The generated new site trips are detailed in **Table 4-1**. In total, the development is projected to generate 109 AM peak hour trips and 133 PM peak hour trips.

Table ES-1 – Trip Generation Summary

ITE Land Use		Size	Daily Trips	AM Peak			PM Peak		
Code	Description			Total	Entering	Exiting	Total	Entering	Exiting
221	Multifamily Housing (Mid-Rise)	302 Dwelling Units	1,643	109	28	81	133	81	52

Capacity Analysis Results

Traffic operations analysis was performed at all the study intersections under the following analysis scenarios:

- Open Year (2023) No Build and Build Conditions
- Design Year (2033) No Build and Build Conditions

Synchro 11 was used to conduct intersection capacity analysis for each intersection and time period based on the *KYTC Traffic Impact Study Requirements (2012 Policy)*, and the software outputs were evaluated to determine if any roadway improvements (additional or lengthened turn lanes, installation of traffic signals, etc.) are warranted in order to maintain an acceptable level of service. Additional traffic operations analysis was conducted to analyze performance with the added roadway improvements. Open and Design Year LOS and delay results are summarized in **Table ES-2**.

Conclusions

With and without the new development, LOS for all intersections and scenarios was B or better. The addition of the facility and associated traffic will add additional trips to the network, but not substantially to result in the recommendation for any improvements. No turn lanes were found to be warranted for any scenario.

Table ES-2. 2023 (Open Year) and 2033 (Design Year) Intersection Level of Service and Delay Summary

Intersections and Movements / Approaches	2023 No Build				2023 Build			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd								
Westbound Left	A	7.5	A	7.6	A	7.6	A	7.7
Northbound	A	9.5	A	9.6	B	10.0	B	10.0
2-Springdale Rd / Entrance 1								
Eastbound Left	-	-	-	-	A	7.5	A	7.9
Southbound	-	-	-	-	B	10.3	B	11.9
3-Springdale Rd / Entrance 2								
Eastbound Left	-	-	-	-	A	7.4	A	7.8
Southbound	-	-	-	-	A	9.3	A	10.3

Intersections and Movements / Approaches	2033 No Build				2033 Build			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd								
Westbound Left	A	7.5	A	7.7	A	7.7	A	7.8
Northbound	A	9.7	A	9.8	B	10.2	B	10.1
2-Springdale Rd / Entrance 1								
Eastbound Left	-	-	-	-	A	7.5	A	7.9
Southbound	-	-	-	-	B	10.4	B	12.4
3-Springdale Rd / Entrance 2								
Eastbound Left	-	-	-	-	A	7.5	A	7.9
Southbound	-	-	-	-	A	9.4	B	10.6

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Section 1
Project Background

The consultant team was contracted by Sabak, Wilson & Lingo, Inc. to prepare a Traffic Impact Study for the proposed Springdale Apartments Multi-Family Housing in Louisville, Jefferson County, Kentucky. The purpose of this report is to document the study area, site conditions, analysis, and findings. Kentucky Transportation Cabinet (KYTC) Traffic Impact Study Requirements (2012 Policy) was followed.

1.1 Site Description

The new development will be located along Springdale Road between Gene Snyder Freeway and I-71, near Asbury Park Boulevard. The conceptual site plan is shown in **Appendix A**. There are two main proposed site entrances for the development located along the northern side of Springdale Road. A third access location is located on the eastern edge of the development, but it is disconnected from the other parking lots and was not evaluated given the low utilization of this parking lot.

1.2 Study Area

The study area is illustrated in **Figure 1-1**. Traffic data was collected at the following study intersection:

1. Springdale Road at Asbury Park Boulevard – Unsignalized

Figure 1-1 Study Area

Section 2
Existing (2021) Condition Analysis

This section describes the existing roadways in the vicinity of the proposed development.

2.1 Existing Roadway Conditions

The consultant team collected intersection geometry as required for capacity analysis including approach lane configurations, departure lane configurations, number and length of turn lanes, presence of channelizing devices, and type of traffic control.

2.1.1 Springdale Road

- Springdale Road is a two-lane urban major collector running east-west in the study area with a posted speed limit of 35 miles per hour (mph). The road ends at the intersections with Brownsboro Road in the east and Wolf Pen Branch Road in the west near Green Spring Drive.
- The last AADT collected by KYTC for Springdale Road between Brownsboro Road and Wolf Pen Branch Road was 4,000 vehicles per day (vpd) in 2016.
- There are 10-foot lanes, no median, no turn lanes, and one-foot paved shoulders within the study area.

2.1.2 Asbury Park Boulevard

- Asbury Park Boulevard is a neighborhood roadway for a small subdivision with no additional outlets.

2.2 Existing Turning Movement Data

Traffic data was collected on a typical weekday (Wednesday, June 23, 2021) for the peak hours of 7:00 – 9:00 AM and 4:00 – 6:00 PM to determine the AM and PM peak period volumes. The AM peak period was determined to be from 7:45 – 8:45 AM and the PM peak period was from 5:00 – 6:00 PM. The peak hour data collected is presented in **Appendix B.**

Figure 2-1. 2021 Turn Movement Volumes

2.3 Level of Service Criteria

Level of Service (LOS) is a term used to represent different traffic conditions and is defined as a "qualitative measure describing operational conditions within a traffic stream, and their perception by motorists or passengers". Level of Service varies from Level A, representing free flow, to Level F, where traffic breakdown conditions are evident. Level B represents good progression with minimal congestion. At Level C, the number of vehicles stopping is significant, although many still pass through the intersection without stopping. Level D represents more congestion, but the overall operations are generally considered acceptable by most agencies. At Level E, freedom to maneuver within the traffic stream is more difficult with driver frustration being higher.

For signalized intersections, service levels pertain to each approach as well as an overall intersection. The unsignalized intersection analysis method in the ***Highway Capacity Manual 6th Edition*** assigns LOS values for each movement that yields the right-of-way, but not to the overall intersection. This movement is generally a secondary movement from a minor street. At an unsignalized intersection, the primary traffic on the main roadway is virtually uninterrupted. Therefore, the overall level of service is usually much better than what is represented by the results of the minor street movements. With the current method of reporting levels of service for unsignalized intersections, it is not uncommon for some of the minor street movements to be operating at LOS F during the peak hours. The delay thresholds for Level of Service are higher for signalized intersections since drivers know that their turn is coming and are willing to wait longer. They also don't have the decision making involved in looking for a gap to proceed through the intersection.

Level of Service and delay for each intersection using methods outlined in the ***Highway Capacity Manual*** were calculated using Synchro 11. **Table 2-1** displays the current Level of Service criteria for signalized and unsignalized intersections.

Table 2-1 Level of Service Criteria for Signalized and Unsignalized Intersections

Level of Service	Description	Control Delay Per Vehicle (sec/veh)	
		Signalized Intersections	Unsignalized Intersections
A	Little or no delay	<10	<10
B	Short traffic delay	>10 and <20	>10 and <15
C	Average traffic delay	>20 and <35	>15 and <25
D	Long traffic delay	>35 and <55	>25 and <35
E	Very long traffic delay	>55 and <80	>35 and <50
F	Unacceptable delay	>80	>50

Source: Highway Capacity Manual, 6th Edition, Transportation Research Board

2.4 Existing Conditions Analysis

Table 2-2 displays the 2021 Existing LOS and delay for the existing study intersection. The full Existing and No Build Synchro outputs can be found in **Appendix C**. Since the intersection of Springdale Road and Asbury Park Boulevard is aligned at a skewed angle from the cardinal direction of Springdale Road, it should be noted that Asbury Park Boulevard was chosen to be the north-south road in the analysis so that Springdale Road could have a coordinated direction amongst intersections.

The intersection of Springdale Road and Asbury Park Boulevard currently operates at LOS A for all movements and approaches for both AM and PM peaks.

Table 2-2. Intersection Level of Service and Delay Summary – 2021 Existing Conditions

Intersections and Movements / Approaches	2021 Existing			
	AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd				
Westbound Left	A	7.5	A	7.6
Northbound	A	9.5	A	9.6

Section 3
2023 and 2033 No Build Scenario Analysis

3.1 Traffic Volume Projections

The expected future analysis open year for the proposed Springdale Apartments Multi-Family Housing is 2023. Based on historical KYTC count data near the study area, an annual growth factor of one percent (1%) was applied to existing traffic volumes to account for the expected ambient traffic growth between the base year (2021), open year (2023) and design year (2033).

Figure 3-1 displays the 2023 No Build turning movement volumes and **Figure 3-2** displays the 2033 No Build conditions.

3.2 Level of Service Analysis

Intersection level of service analysis was performed for a typical weekday peak hour using Synchro 11. **Tables 3-1** and **3-2** display the 2023 and 2033 LOS and delay for the study intersection. The full No Build HCS output can be found in **Appendix C** which includes 95th percentile queueing in addition to the LOS and delays presented in the following tables. LOS did not change between any No Build scenarios which were all LOS A.

Table 3-1. Intersection Level of Service and Delay Summary – 2023 No Build Conditions

Intersections and Movements / Approaches	2023 No Build			
	AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd				
Westbound Left	A	7.5	A	7.6
Northbound	A	9.5	A	9.6

Table 3-2. Intersection Level of Service and Delay Summary – 2033 No Build Conditions

Intersections and Movements / Approaches	2033 No Build			
	AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd				
Westbound Left	A	7.5	A	7.7
Northbound	A	9.7	A	9.8

Figure 3-1. 2023 No Build AM and PM Turning Movement Volumes

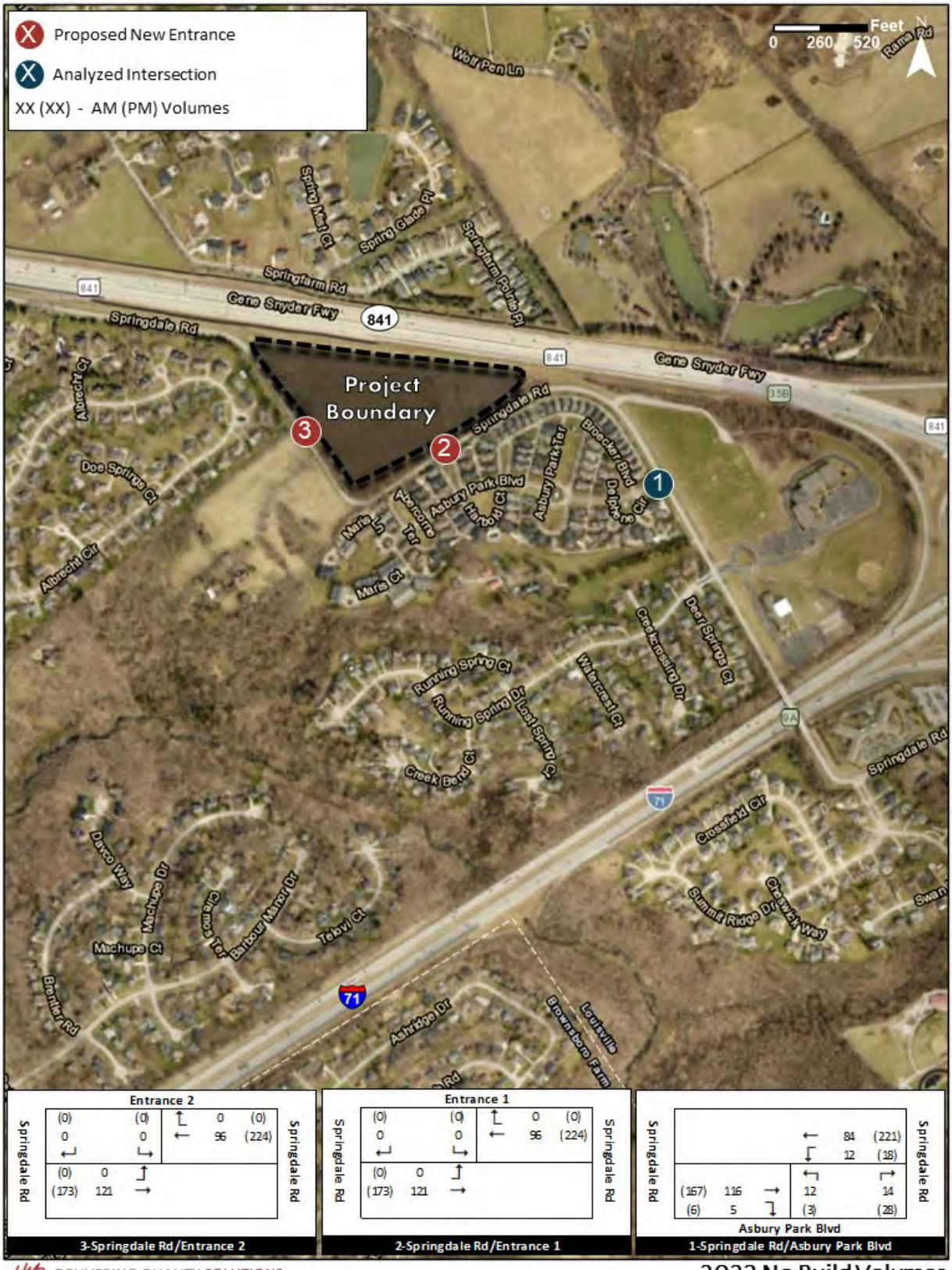


Figure 3-2. 2033 No Build AM and PM Turning Movement Volumes

DELIVERING QUALITY SOLUTIONS

2033 No Build Volumes

Section 4
Trip Generation and Traffic Assignment

There are two main proposed access points for the Springdale Apartments Multi-Family Housing along Springdale Road. A third access location is located on the eastern edge of the development, but it is disconnected from the other parking lots and was not evaluated given the low utilization of this parking lot. Trip generation and distribution were developed based on information from the applicant and conceptual site plan presented in **Appendix A** and as described below.

4.1 Trip Generation

Trip generation was conducted using the *ITE Trip Generation Manual (10th Edition, Institute of Transportation Engineers)* and information from the applicant. A conceptual site layout was provided by the applicant. Information from the site layout was used to determine the number of units to be used for the trip generation analysis. The generated new site trips are detailed in **Table 4-1**. In total, the development is projected to generate 109 AM peak hour trips and 133 PM peak hour trips.

Table 4-1. Site Generated Trips

ITE Land Use		Size	Daily Trips	AM Peak			PM Peak		
Code	Description			Total	Entering	Exiting	Total	Entering	Exiting
221	Multifamily Housing (Mid-Rise)	302 Dwelling Units	1,643	109	28	81	133	81	52

4.2 Trip Distribution and Assignment

Figure 4-1 depicts the peak hour trip distribution percentages. The existing trip distribution derived from the Asbury Park Boulevard subdivision was used as a starting point for the estimated trip distribution for the development and then refined based on analyzing the network. **Figure 4-2** presents the number of expected new trips derived from the estimated trip generation and distribution.

Figure 4-1. Trip Distribution Percentages

Figure 4-2. AM and PM Peak Site Generated Trips

Section 5
2023 and 2033 Build Condition Analysis

The 2023 Build Condition analysis included the 2023 No Build traffic as described in Section 3 as well as site generated trips from the proposed Springdale Apartments Multi-Family Housing as described in Section 4.

5.1 Level of Service Analysis

As shown in **Table 5-1** and **Table 5-2**, LOS is B or better for all scenarios and intersections. The Asbury Park Boulevard northbound approach changes from LOS A in the No Build to LOS B in the Build scenario with a maximum increase in delay of 0.5 seconds.

5.2 Turn Lane Warrants

KYTC turn lane warrants were evaluated at the proposed entrances and Asbury Park Boulevard. No turn lanes were warranted for any scenario analyzed. The turn lane warrant results are presented in **Appendix E**. While each scenario was analyzed, the appendix only includes the worst-case scenarios.

Figure 5-1. 2023 Build AM and PM Turning Movement Volumes

Figure 5-2. 2033 Build AM and PM Turning Movement Volumes

Table 5-1. Intersection Level of Service and Delay Summary – 2023 Build Conditions

Intersections and Movements / Approaches	2023 Build			
	AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd				
Westbound Left	A	7.6	A	7.7
Northbound	B	10.0	B	10.0
2-Springdale Rd / Entrance 1				
Eastbound Left	A	7.5	A	7.9
Southbound	B	10.3	B	11.9
3-Springdale Rd / Entrance 2				
Eastbound Left	A	7.4	A	7.8
Southbound	A	9.3	A	10.3

Table 5-2. Intersection Level of Service and Delay Summary – 2033 Build Conditions

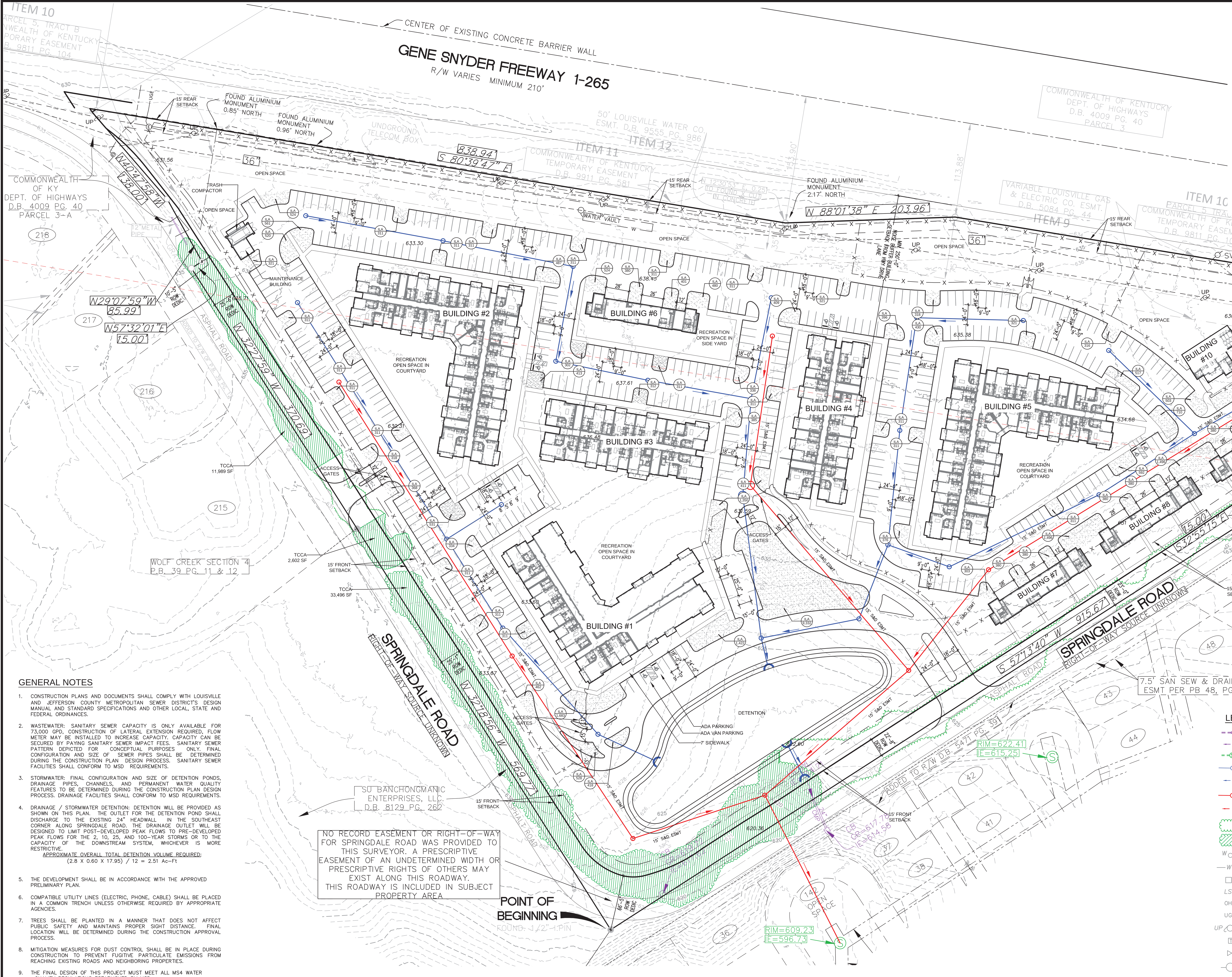
Intersections and Movements / Approaches	2033 Build			
	AM Peak		PM Peak	
	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
1-Asbury Park Blvd / Springdale Rd				
Westbound Left	A	7.7	A	7.8
Northbound	B	10.2	B	10.1
2-Springdale Rd / Entrance 1				
Eastbound Left	A	7.5	A	7.9
Southbound	B	10.4	B	12.4
3-Springdale Rd / Entrance 2				
Eastbound Left	A	7.5	A	7.9
Southbound	A	9.4	B	10.6

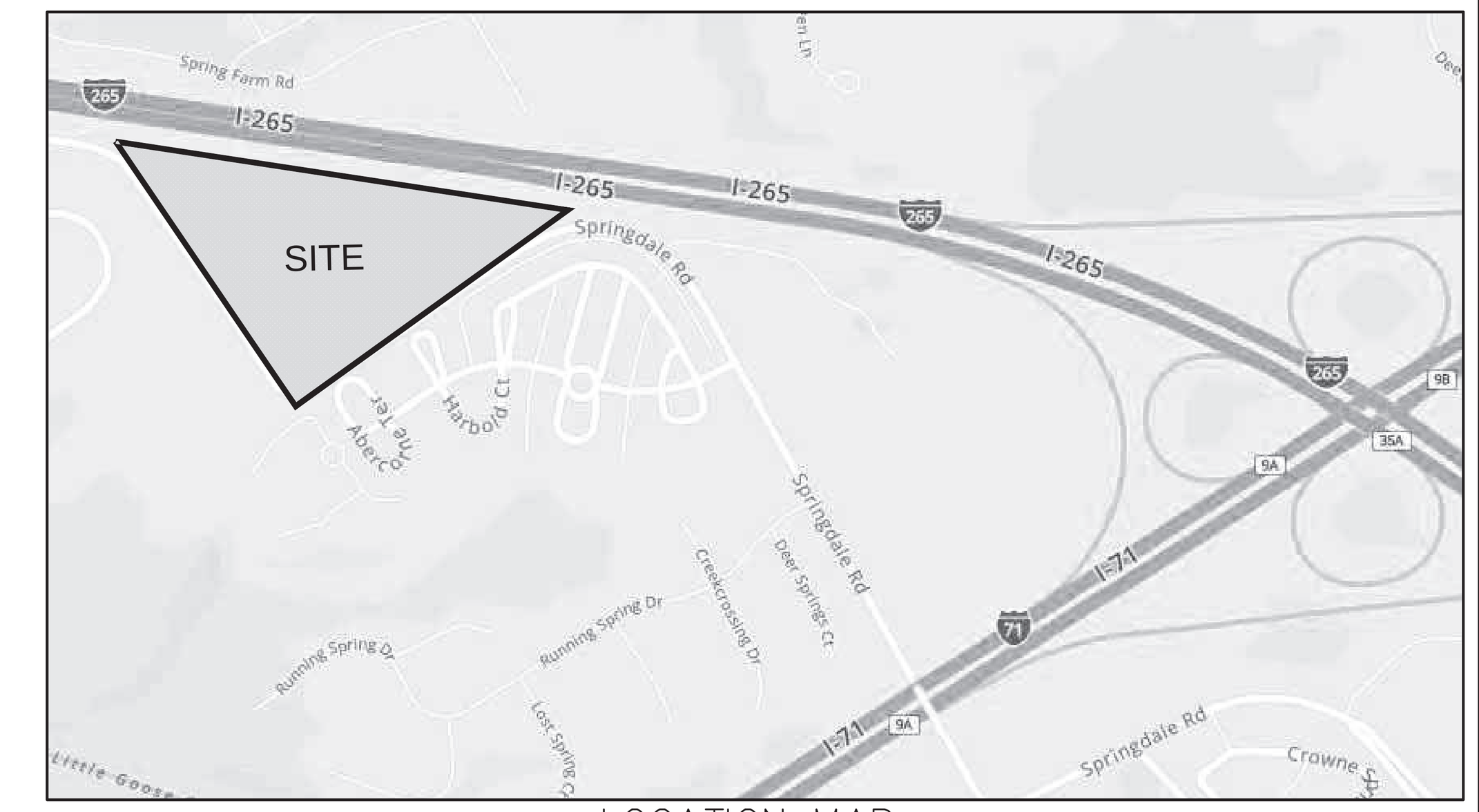
Section 6
Conclusions

With and without the new development, LOS for all intersections and scenarios was B or better. The addition of the facility and associated traffic will add additional trips to the network, but not substantially to result in the recommendation for any improvements. No turn lanes were found to be warranted for any scenario.

The analysis and conclusions from this traffic study are for the development plan and site use as currently provided by the developer. If substantial alterations to either the development plan or site use change, additional study may be required.

Appendix A:
Conceptual Site Plan





LOCATION MAP
NO SCALE

GENERAL NOTES

1. CONSTRUCTION PLANS AND DOCUMENTS SHALL COMPLY WITH LOUISVILLE AND JEFFERSON COUNTY METROPOLITAN SEWER DISTRICT'S DESIGN MANUAL AND STANDARD SPECIFICATIONS AND OTHER LOCAL, STATE AND FEDERAL ORDINANCES.
2. WASTEWATER: SANITARY SEWER CAPACITY IS ONLY AVAILABLE FOR 73,000 GPD, CONSTRUCTION OF LATERAL EXTENSION REQUIRED, FLOW METER MAY BE INSTALLED TO INCREASE CAPACITY. CAPACITY CAN BE SECURED BY PAYING SANITARY SEWER IMPACT FEES. SANITARY SEWER PATTERN DEPICTED FOR CONCEPTUAL PURPOSES ONLY. FINAL CONFIGURATION AND SIZE OF SEWER PIPES SHALL BE DETERMINED DURING THE CONSTRUCTION PLAN DESIGN PROCESS. SANITARY SEWER FACILITIES SHALL CONFORM TO MSD REQUIREMENTS.
3. STORMWATER: FINAL CONFIGURATION AND SIZE OF DETENTION PONDS, DRAINAGE PIPES, CHANNELS, AND PERMANENT WATER QUALITY FEATURES TO BE DETERMINED DURING THE CONSTRUCTION PLAN DESIGN PROCESS. DRAINAGE FACILITIES SHALL CONFORM TO MSD REQUIREMENTS.
4. DRAINAGE / STORMWATER DETENTION: DETENTION WILL BE PROVIDED AS SHOWN ON THIS PLAN. THE OUTLET FOR THE DETENTION POND SHALL DISCHARGE TO THE EXISTING 24" HEADWALL IN THE SOUTHEAST CORNER ALONG SPRINGDALE ROAD. THE DRAINAGE OUTLET WILL BE DESIGNED TO LIMIT POST-DEVELOPED PEAK FLOWS TO PRE-DEVELOPED PEAK FLOWS FOR THE 2, 10, 25, AND 100-YEAR STORMS OR TO THE CAPACITY OF THE DOWNSTREAM SYSTEM, WHICHEVER IS MORE RESTRICTIVE.
   APPROXIMATE OVERALL TOTAL DETENTION VOLUME REQUIRED:
   (2.8 X 0.60 X 17.95) / 12 = 2.51 Ac-Ft
5. THE DEVELOPMENT SHALL BE IN ACCORDANCE WITH THE APPROVED PRELIMINARY PLAN.
6. COMPATIBLE UTILITY LINES (ELECTRIC, PHONE, CABLE) SHALL BE PLACED IN A COMMON TRENCH UNLESS OTHERWISE REQUIRED BY APPROPRIATE AGENCIES.
7. TREES SHALL BE PLANTED IN A MANNER THAT DOES NOT AFFECT PUBLIC SAFETY AND MAINTAINS PROPER SIGHT DISTANCE. FINAL LOCATION WILL BE DETERMINED DURING THE CONSTRUCTION APPROVAL PROCESS.
8. MITIGATION MEASURES FOR DUST CONTROL SHALL BE IN PLACE DURING CONSTRUCTION TO PREVENT FUGITIVE PARTICULATE EMISSIONS FROM REACHING EXISTING ROADS AND NEIGHBORING PROPERTIES.
9. THE FINAL DESIGN OF THIS PROJECT MUST MEET ALL MS4 WATER QUALITY REGULATIONS ESTABLISHED BY MSD.
10. ALL STREET NAME SIGNS AND PAVEMENT MARKING SHALL CONFORM WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) REQUIREMENTS AND BE INSTALLED PRIOR TO CONSTRUCTION OF THE FIRST PHASE AND SHALL BE IN PLACE AT THE TIME OF THE BOND RELEASE/PRIOR TO RECEIVING A CERTIFICATE OF OCCUPANCY.
11. ALL RADIUSES, SIDEWALK LOCATIONS AND OFFSETS SHALL BE IN ACCORDANCE WITH METRO PUBLIC WORKS STANDARDS AND APPROVED AT THE TIME OF CONSTRUCTION.
12. ALL ROADWAY AND ENTRANCE INTERSECTIONS SHALL MEET THE REQUIREMENTS FOR LANDING AREAS AS SET BY METRO PUBLIC WORKS.
13. TREE CANOPY CREDIT AREAS (TCCA'S) IDENTIFIED ON THIS PLAN REPRESENT PORTIONS OF THE SITE THE DEVELOPER HAS AGREED TO PRESERVE. THESE ARE PERMANENT PRESERVATION AREAS. ALL CLEARING, GRADING, AND FILL ACTIVITY IN THESE AREAS MUST BE IN KEEPING THE RESTRICTIONS ESTABLISHED AT THE TIME OF PLAN APPROVAL. NO FURTHER CLEARING, GRADING, CONSTRUCTION, OR OTHER LAND DISTURBING ACTIVITY SHALL TAKE PLACE BEYOND PRUNING TO IMPROVE THE GENERAL HEALTH OF THE TREE OR TO REMOVE DEAD OR DECLINING TREES THAT MAY POSE A PUBLIC HEALTH AND SAFETY THREAT.
14. SIDEWALK CONSTRUCTION SHALL BE REQUIRED, TO MEET CURRENT MPW STANDARDS AND SHALL BE INSPECTED PRIOR TO FINAL BOND RELEASE.
15. CONSTRUCTION PLANS. BOND AND PERMIT ARE REQUIRED BY METRO PUBLIC WORKS PRIOR TO CONSTRUCTION APPROVAL.
16. MSD DRAINAGE BOND REQUIRED PRIOR TO CONSTRUCTION PLAN APPROVAL.
17. ALL PARKING AND DRIVE AISLES TO BE HARD AND DURABLE SURFACE.

BENCH MARKS (1983 NAVD)

BM#1062 X-CUT ON CONCRETE WALK 175' NORTHWEST OF THE EASTERNMOST CORNER OF TRACT AND 34.5' FROM CENTERLINE OF CHAMBERLAIN LANE. ELEVATION 709.30

BM#1063 X-CUT ON CONCRETE WALK 345' SOUTH OF THE CENTERLINE OF THE ENTRANCE TO CHAMBERLAIN LANE OFFICE CENTER AND 4' SOUTH OF FIRE HYDRANT. ELEVATION 712.01

BM#1064 X-CUT ON CONCRETE WALK 56' SOUTH OF THE CENTERLINE OF THE ENTRANCE TO CHAMBERLAIN LANE OFFICE CENTER AND 23 FEET WEST OF CENTERLINE OF CHAMBERLAIN LANE. ELEVATION 713.50

BM#1 X-CUT ON TOP OF CONCRETE CURB AT THE ENTRANCE OF CONDO'S ELEVATION 713.89

BM#2 X-CUT ON BACK OF CONCRETE WALK ON CHARTER OAKS DRIVE. ELEVATION 706.52

SWPP NOTES

1) THE APPROVED EROSION PREVENTION AND SEDIMENT CONTROL (EPSC) PLAN SHALL BE IMPLEMENTED PRIOR TO ANY LAND-DISTURBING ACTIVITY ON THE CONSTRUCTION SITE. ANY MODIFICATIONS TO THE APPROVED EPSC PLAN MUST BE REVIEWED AND APPROVED BY M.S.D.'S PRIVATE DEVELOPMENT REVIEW OFFICE. EPSC BMPs SHALL BE INSTALLED PER THE PLAN AND M.S.D. STANDARDS.

2) DETENTION BASINS, IF APPLICABLE, SHALL BE CONSTRUCTED FIRST AND SHALL PERFORM AS SEDIMENT BASINS DURING CONSTRUCTION UNTIL THE CONTRIBUTING DRAINAGE AREAS ARE SEEDED AND STABILIZED.

3) ACTIONS MUST BE TAKEN TO MINIMIZE THE TRACKING OF MUD AND SOIL FROM CONSTRUCTION AREAS ONTO PUBLIC ROADWAYS. SOILS TRACKED ONTO THE ROADWAY SHALL BE REMOVED DAILY.

4) SOIL STOCKPILES SHALL BE LOCATED AWAY FROM STREAMS, PONDS, SWALES, AND CATCH BASINS. STOCKPILES SHALL BE SEEDED, MULCHED, AND ADEQUATELY CONTAINED THROUGH THE USE OF SILT FENCING.

5) ALL STREAM CROSSINGS MUST UTILIZE LOW-WATER CROSSING STRUCTURES PER M.S.D. STANDARD DRAWING ER-02.

6) WHERE CONSTRUCTION OR LAND DISTURBANCE ACTIVITY WILL OR HAS TEMPORARILY CEASED ON ANY PORTION OF A SITE, TEMPORARY SITE STABILIZATION MEASURES SHALL BE REQUIRED AS SOON AS PRACTICABLE, BUT NOT LATER THAN 14 CALENDAR DAYS AFTER THE ACTIVITY HAS CEASED.

7) SEDIMENT-LADEN GROUNDWATER ENCOUNTERED DURING TRENCHING, BORING, OR OTHER EXCAVATION ACTIVITIES SHALL BE PUMPED TO A SEDIMENT TRAPPING DEVICE PRIOR TO BEING DISCHARGED INTO A STREAM, POND, SWALE, OR CATCH BASIN.

EROSION PREVENTION PLAN

ALL STORM WATER RUNOFF FROM DISTURBED AREAS WILL BE DIRECTED TO DITCH CHECKS OR SILT FENCE PERIMETER CONTROLS UNTIL STORM SEWERS ARE INSTALLED. AFTER STORM SEWER INSTALLATION, ALL STORM INLETS SHALL BE PROTECTED WITH STONE BAGS, SILT SACKS OR OTHER MSD APPROVED INLET CONTROLS. SILT FENCE SHALL BE UTILIZED AS PERIMETER CONTROLS AROUND SENSITIVE AREAS DURING CONSTRUCTION. SMALL WATERSHED AREAS MAY BE PROTECTED WITH SILT FENCE AND/OR DITCH CHECKS BASED ON FINAL GRADING.

UTILITY NOTE

ALL UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE. INDIVIDUAL SERVICE LINES ARE NOT SHOWN. THE CONTRACTOR OR SUBCONTRACTOR SHALL NOTIFY THE UTILITY PROTECTION CENTER "B.U.D." (TOLL FREE PHONE NO. 1-800-752-6007) FORTY-EIGHT HOURS IN ADVANCE OF ANY CONSTRUCTION ON THIS PROJECT. THIS NUMBER WAS ESTABLISHED TO PROVIDE ACCURATE LOCATIONS OF EXISTING BELOW, GROUND UTILITIES i.e. CABLES, ELECTRIC WIRES, GAS, AND WATERLINES. WHEN CONTACTING THE "B.U.D." CALL CENTER, PLEASE STATE THAT THE WORK TO BE DONE IS FOR A PROPOSED M.S.D. SEWER OR DRAINAGE FACILITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR BECOMING FAMILIAR WITH ALL UTILITY REQUIREMENTS SET FORTH ON THE PLANS, IN THE TECHNICAL SPECIFICATIONS, AND SPECIAL PROVISIONS.

LEGEND

- EXISTING STORM SEWER
- EXISTING STORM DIRECTIONAL FLOW ARROWS
- EXISTING SANITARY SEWER
- SCHEMATIC STORM SEWER
- SEWER DIRECTIONAL FLOW ARROWS
- SCHEMATIC SANITARY SEWER
- SANITARY DIRECTIONAL FLOW ARROWS
- EXISTING TREE CANOPY
- PROPOSED TCCA AREA
- W — WATER VALVE
- —W— WATER LINE
- CB — CATCH BASIN
- LSA — LANDSCAPE AREA
- OHE — OVERHEAD ELECTRIC
- UGT — UNDERGROUND TELECOMS
- UP — UTILITY POLE
- T — TELEPHONE PEDESTAL
- GUY WIRE
- SVP (SERVICE POLE)
- UFU — UNIDENTIFIED UTILITY -UNDERGROUND
- S — SANITARY SEWER MANHOLE
- M — MANHOLE - UNKNOWN TYPE
- E — ELECTRIC MANHOLE
- G — GAS VALVE
- —G— GAS LINE
- BM#1 — BENCHMARK

DEVELOPER
LIV DEVELOPMENT
2204 LAKESHORE DRIVE, SUITE 450
BIRMINGHAM, AL 35209

NORTH
0 25' 50' 100'
SCALE: 1"=50'-0"

SITE DATA

FORM DISTRICT:	NEIGHBORHOOD
EXISTING ZONING:	R-4
PROPOSED ZONING:	R-7
EXISTING USE:	UNDEVELOPED
PROPOSED USE:	MULTI FAMILY RESIDENTIAL
GROSS SITE AREA:	782,599 SF OR 17.97 AC
NET SITE AREA :	730,050 SF OR 16.75 AC
(AFTER ROW DEDICATION AT SPRINGDALE ROAD)	
TOTAL UNITS:	302 UNITS
1 BEDROOM UNITS:	133 UNITS
2 BEDROOM UNITS:	129 UNITS
3 BEDROOM UNITS:	40 UNITS
GROSS DENSITY:	16.8 DU/AC
NET DENSITY:	18.03 DU/AC
GROSS BUILDING FOOTPRINT AREA:	113,134 SF
BUILDING #1:	21,364 SF
BUILDING #2:	24,055 SF
BUILDING #3:	13,679 SF
BUILDING #4:	13,679 SF
BUILDING #51:	24,055 SF
BUILDING #6:	3,334 SF
BUILDING #7:	3,334 SF
BUILDING #8:	3,334 SF
BUILDING #9:	3,334 SF
BUILDING #10:	2,586 SF
MAINTENANCE BUILDING:	380 SF
GROSS FLOOR AREA OF ALL BUILDINGS:	430,302 SF
TALLEST STRUCTURE HEIGHT:	49"-9" FROM GRADE TO MIDPOINT OF ROOF

PARKING CALCULATIONS

MINIMUM REQUIRED PARKING (1/UNIT)	302 SPACES
MAXIMUM REQUIRED PARKING (2/UNIT)	604 SPACES
PARKING PROVIDED:	518 SPACES
GARAGE PARKING:	20 SPACES
TANDEM GARAGE PARKING:	20 SPACES
ADA / HANDICAPPED PARKING: (1 IS VAN ACCESSIBLE)	11 SPACES
STANDARD PARKING:	461 SPACES
PARALLEL SPACES	6 SPACES

OPEN SPACE CALCULATIONS

MINIMUM REQUIRED OPEN SPACE (5% OF NET AREA)	.84 AC
RECREATIONAL OPEN SPACE REQUIRED:	.42 AC
OPEN SPACE PROVIDED:	3.96 AC
RECREATIONAL OPEN SPACE PROVIDED:	.9 AC
(BUILDING 1 COURTYARD: .44 AC)	
(BUILDING 2 COURTYARD: .21 AC)	
(BUILDING 5 COURTYARD: .19 AC)	
(BUILDING 6 SIDE YARD: .06 AC)	

ILA/VUA CALCULATIONS

VUA TOTAL:	199,633 SF
ILA REQUIRED: (7.5% of VUA)	14,972 SF
ILA PROVIDED:	40,549 SF
TREES REQUIRED:	64 TREES

TREE CANOPY CALCULATIONS

GROSS SITE AREA*:	782,599 SF OR 17.97 AC
EXISTING TREE CANOPY:	81,760 SF (10.4%)
TREE CANOPY AT DRIPLINE TO BE PRESERVED:	48,087 SF (6.1%)
TCCA CREDIT FOR PRESERVED CANOPY:	96,174 SF (12.2%)
TOTAL TREE CANOPY REQUIRED (35%):	273,909 SF (35%)
ADDITIONAL TREE CANOPY REQUIRED:	177,735 SF (22.8%)

CASE#
WM #
TAX BLOCK 0060
PARCEL ID: W00600070000
SEWER TREATMENT PLANT: MORRIS FOREMAN
IMPERVIOUS INCREASE: 360,608 +/- SF

OWNER:
ROY F. MCMAHAN
3034 R HUNSINGER LANE
LOUISVILLE, KY 40220
D.B. 9656 PG. 96

SABAK, WILSON & LINGO, INC
ENGINEERS, LANDSCAPE ARCHITECTS & PLANNERS
THE HENRY CLAY 608 S. THIRD STREET, LOUISVILLE, KENTUCKY 40202 (502) 584 - 6271

NO.	REVISION	DATE

SHEET TITLE:
DISTRICT DEVELOPMENT PLAN

PROJECT TITLE:
SPRINGDALE APARTMENTS
5217 SPRINGDALE ROADD
LOUISVILLE, KY 40241

JOB NO.	3285
SCALE:	1"=50'
DATE:	05/28/21
DRAWING NO:	DDP

Appendix B:

Intersection Turning Movement Counts

Cummins Consulting Services, PLLC
2216 Young Drive, Suite 1, Lexington, KY 40505
www.ccsdata.com <http://www.ccsdata.com>
Office Number: (859) 7851502
"2021- Data Collection Re-Loaded"

File Name : Springdale_Road_at_Asbury_Park_Boulevard_850043_06-23-2021
80 Degrees - Site Code : Site 1 - Wednesday
Start Date : 6/23/2021
Page No : 1

Groups Printed- Cars - Buses - Trucks

	Springdale Road From North				Springdale Road From South				Asbury Park Boulevard From West				
Start Time	Thru	Right	U-Turn	App. Total	Left	Thru	U-Turn	App. Total	Left	Right	U-Turn	App. Total	Int. Total
07:00 AM	18	1	0	19	1	6	0	7	5	1	0	6	32
07:15 AM	20	0	0	20	0	17	0	17	2	1	0	3	40
07:30 AM	19	2	0	21	2	13	0	15	2	5	0	7	43
07:45 AM	31	0	0	31	1	23	0	24	3	4	0	7	62
Total	88	3	0	91	4	59	0	63	12	11	0	23	177
08:00 AM	28	1	0	29	5	19	0	24	3	2	0	5	58
08:15 AM	28	3	0	31	2	24	0	26	2	5	0	7	64
08:30 AM	27	1	0	28	4	16	0	20	4	3	0	7	55
08:45 AM	35	3	0	38	3	12	0	15	0	4	0	4	57
Total	118	8	0	126	14	71	0	85	9	14	0	23	234
04:00 PM	19	3	0	22	2	42	0	44	3	1	0	4	70
04:15 PM	31	2	0	33	8	38	0	46	1	4	0	5	84
04:30 PM	33	5	0	38	3	51	0	54	1	1	0	2	94
04:45 PM	29	2	0	31	1	37	0	38	1	6	0	7	76
Total	112	12	0	124	14	168	0	182	6	12	0	18	324
05:00 PM	30	3	0	33	7	53	0	60	1	8	0	9	102
05:15 PM	39	0	0	39	5	56	0	61	0	7	0	7	107
05:30 PM	50	1	0	51	3	50	0	53	0	3	0	3	107
05:45 PM	45	2	0	47	3	58	0	61	2	9	0	11	119
Total	164	6	0	170	18	217	0	235	3	27	0	30	435
Grand Total	482	29	0	511	50	515	0	565	30	64	0	94	1170
Apprch %	94.3	5.7	0		8.8	91.2	0		31.9	68.1	0		
Total %	41.2	2.5	0	43.7	4.3	44	0	48.3	2.6	5.5	0	8	
Cars	479	29	0	508	49	510	0	559	30	63	0	93	1160
% Cars	99.4	100	0	99.4	98	99	0	98.9	100	98.4	0	98.9	99.1
Buses	1	0	0	1	0	2	0	2	0	0	0	0	3
% Buses	0.2	0	0	0.2	0	0.4	0	0.4	0	0	0	0	0.3
Trucks	2	0	0	2	1	3	0	4	0	1	0	1	7
% Trucks	0.4	0	0	0.4	2	0.6	0	0.7	0	1.6	0	1.1	0.6

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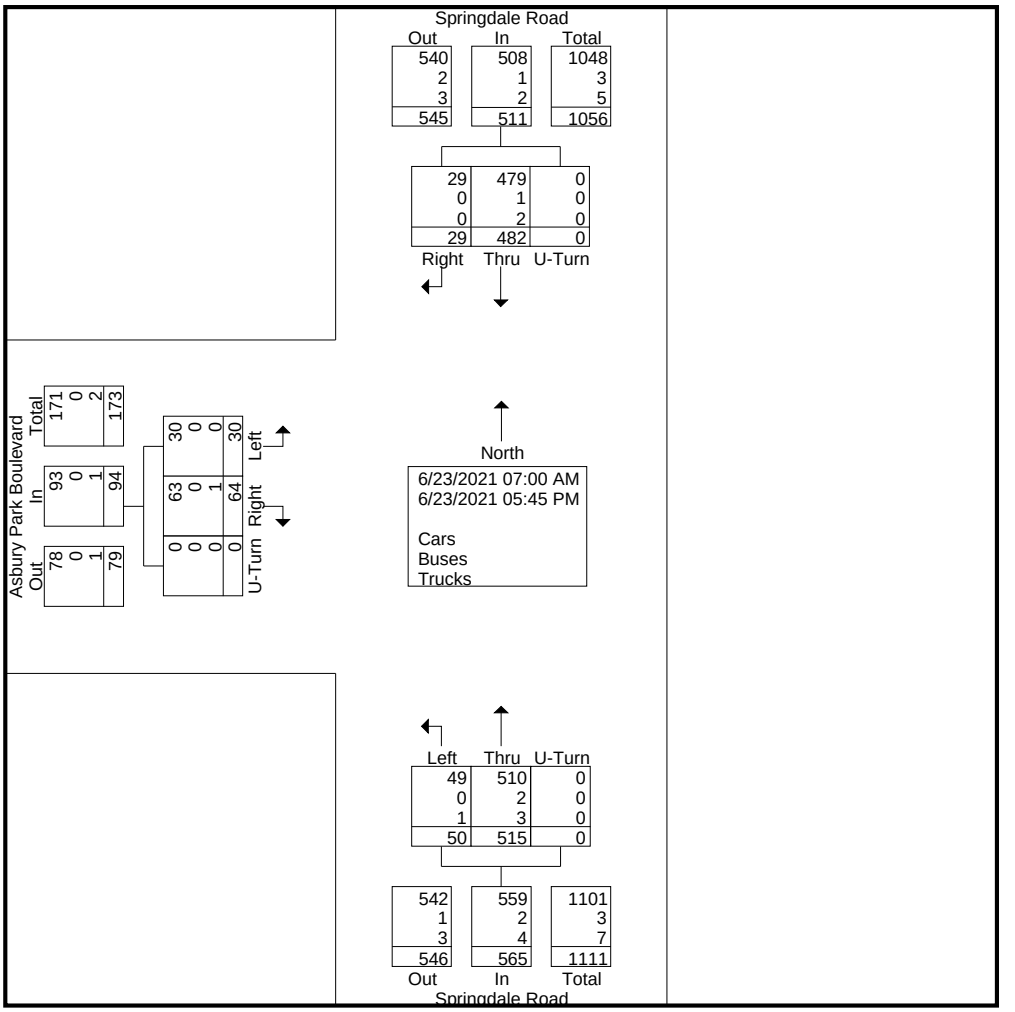
File Name : Springdale_Road_at_Asbury_Park_Boulevard_850043_06-23-2021
Site Code : Site 1 - Wednesday
Start Date : 6/23/2021



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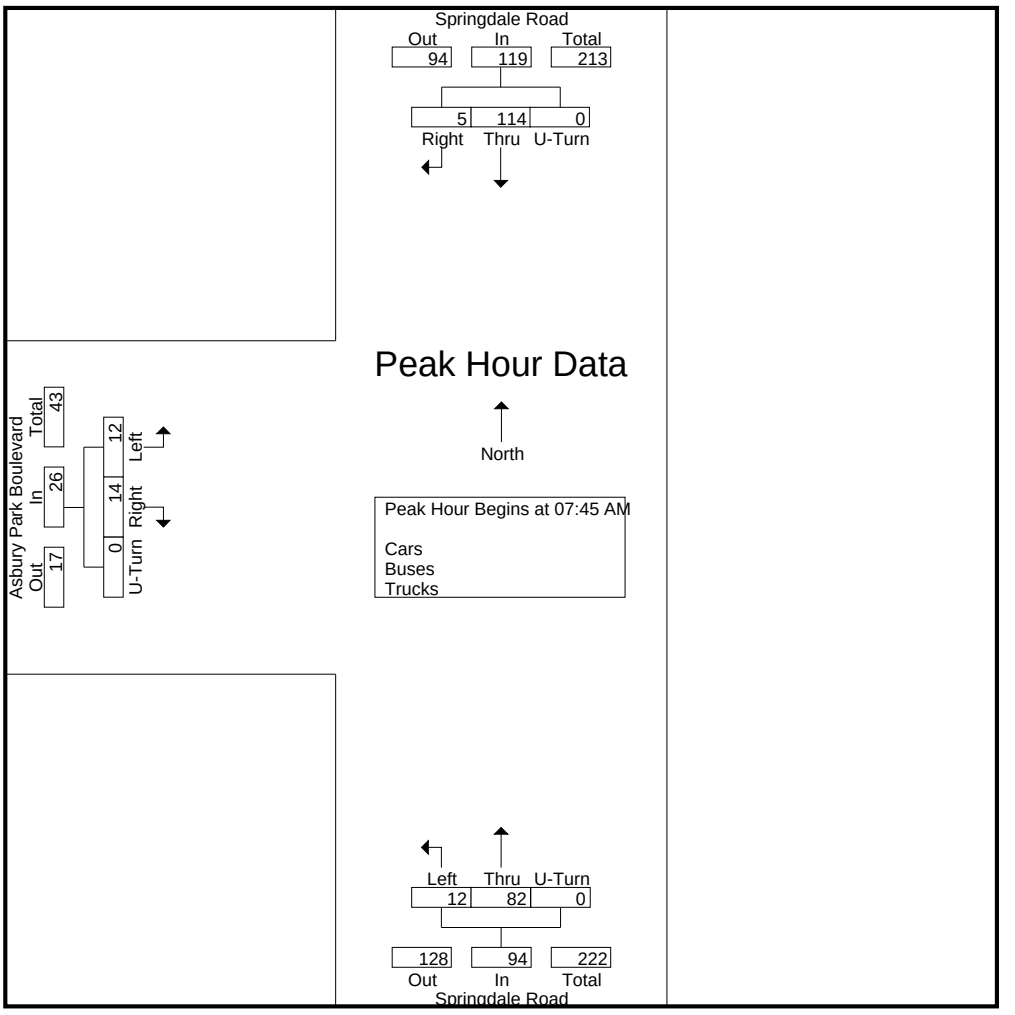
Office Number: (859) 7851502
"2021- Data Collection Re-Loaded"

File Name : Springdale_Road_at_Asbury_Park_Boulevard_850043_06-23-2021
Site Code : Site 1 - Wednesday
Start Date : 6/23/2021

	Springdale Road From North				Springdale Road From South				Asbury Park Boulevard From West				
Start Time	Thru	Right	U-Turn	App. Total	Left	Thru	U-Turn	App. Total	Left	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	**31**	0	0	**31**	1	23	0	24	3	4	0	**7**	62
08:00 AM	28	1	0	29	**5**	19	0	24	3	2	0	5	58
08:15 AM	28	**3**	0	31	2	**24**	0	**26**	2	**5**	0	7	**64**
08:30 AM	27	1	0	28	4	16	0	20	**4**	3	0	7	55
Total Volume	114	5	0	119	12	82	0	94	12	14	0	26	239
% App. Total	95.8	4.2	0		12.8	87.2	0		46.2	53.8	0		
PHF	.919	.417	.000	.960	.600	.854	.000	.904	.750	.700	.000	.929	.934



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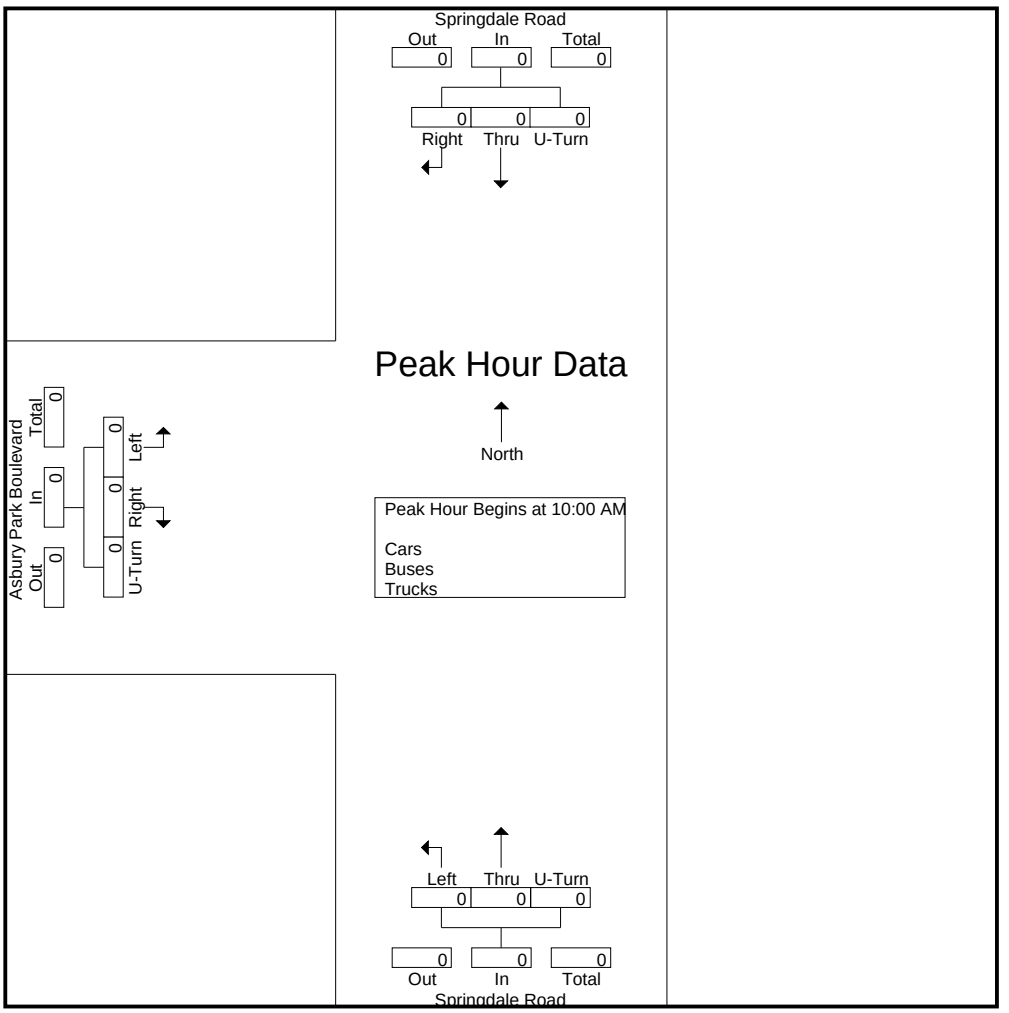
www.ccsdata.com <http://www.ccsdata.com>
Office Number: (859) 7851502
"2021- Data Collection Re-Loaded"

File Name : Springdale_Road_at_Asbury_Park_Boulevard_850043_06-23-2021
Site Code : Site 1 - Wednesday
Start Date : 6/23/2021
Page No : 4

	Springdale Road From North				Springdale Road From South				Asbury Park Boulevard From West				
Start Time	Thru	Right	U-Turn	App. Total	Left	Thru	U-Turn	App. Total	Left	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 10:00 AM													
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



Cummins Consulting Services, PLLC
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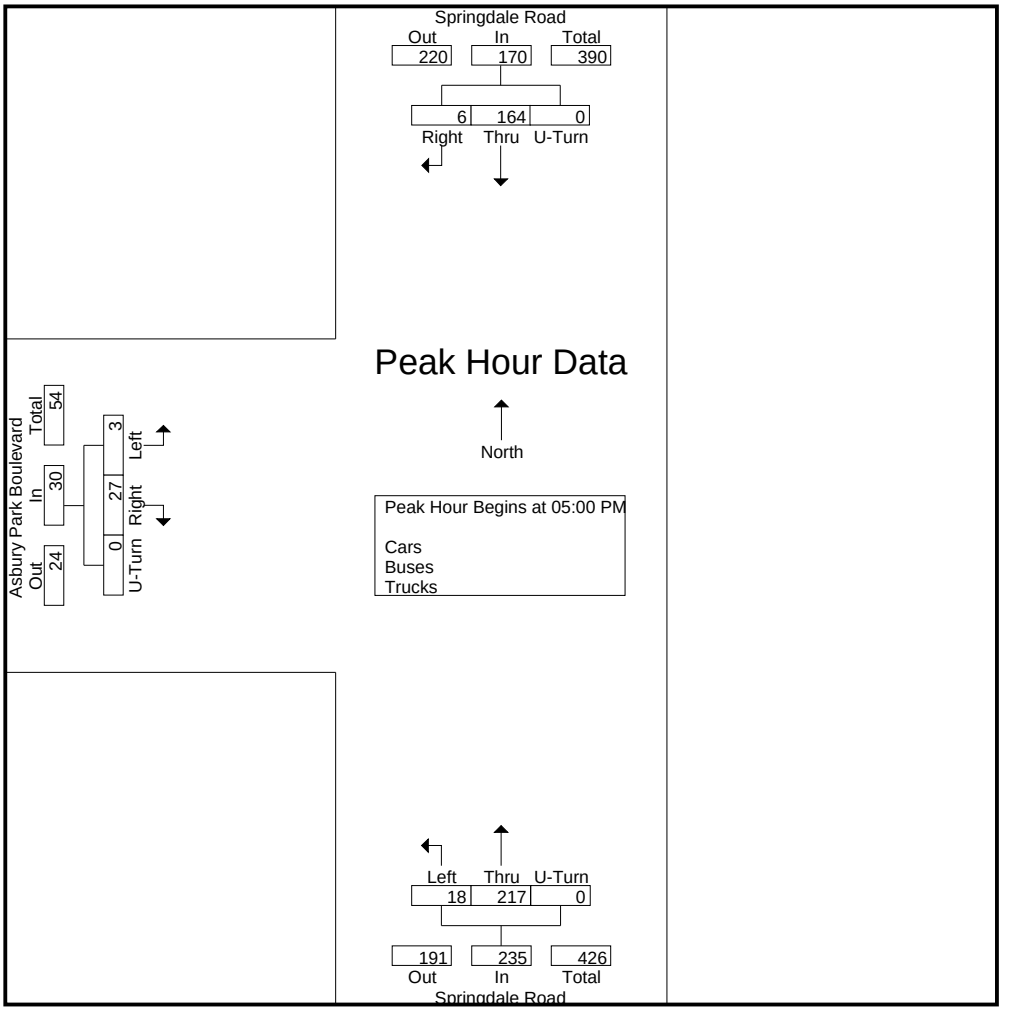
www.ccsdata.com <http://www.ccsdata.com>
Office Number: (859) 7851502
"2021- Data Collection Re-Loaded"

File Name : Springdale_Road_at_Asbury_Park_Boulevard_850043_06-23-2021
Site Code : Site 1 - Wednesday
Start Date : 6/23/2021
Page No : 5

	Springdale Road From North				Springdale Road From South				Asbury Park Boulevard From West				
Start Time	Thru	Right	U-Turn	App. Total	Left	Thru	U-Turn	App. Total	Left	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	30	**3**	0	33	**7**	53	0	60	1	8	0	9	102
05:15 PM	39	0	0	39	5	56	0	**61**	0	7	0	7	107
05:30 PM	**50**	1	0	**51**	3	50	0	53	0	3	0	3	107
05:45 PM	45	2	0	47	3	**58**	0	61	**2**	**9**	0	**11**	**119**
Total Volume	164	6	0	170	18	217	0	235	3	27	0	30	435
% App. Total	96.5	3.5	0		7.7	92.3	0		10	90	0		
PHF	.820	.500	.000	.833	.643	.935	.000	.963	.375	.750	.000	.682	.914



Appendix C:

Synchro HCM 6th Outputs – 2021 Existing, 2023 No Build, and 2033 No Build

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	114	5	12	82	12	14
Future Vol, veh/h	114	5	12	82	12	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	123	5	13	88	13	15

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	128	0	240	126
Stage 1	-	-	-	-	126	-
Stage 2	-	-	-	-	114	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1458	-	748	924
Stage 1	-	-	-	-	900	-
Stage 2	-	-	-	-	911	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1458	-	741	924
Mov Cap-2 Maneuver	-	-	-	-	741	-
Stage 1	-	-	-	-	900	-
Stage 2	-	-	-	-	903	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	829	-	-	1458	-
HCM Lane V/C Ratio	0.034	-	-	0.009	-
HCM Control Delay (s)	9.5	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	164	6	18	217	3	27
Future Vol, veh/h	164	6	18	217	3	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	180	7	20	238	3	30

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	187	0	462	184
Stage 1	-	-	-	-	184	-
Stage 2	-	-	-	-	278	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1387	-	558	858
Stage 1	-	-	-	-	848	-
Stage 2	-	-	-	-	769	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1387	-	549	858
Mov Cap-2 Maneuver	-	-	-	-	549	-
Stage 1	-	-	-	-	848	-
Stage 2	-	-	-	-	756	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	812	-	-	1387	-
HCM Lane V/C Ratio	0.041	-	-	0.014	-
HCM Control Delay (s)	9.6	-	-	7.6	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	116	5	12	84	12	14
Future Vol, veh/h	116	5	12	84	12	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	125	5	13	90	13	15

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	130	0	244	128
Stage 1	-	-	-	-	128	-
Stage 2	-	-	-	-	116	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1455	-	744	922
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	909	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1455	-	737	922
Mov Cap-2 Maneuver	-	-	-	-	737	-
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	901	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	9.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	826	-	-	1455	-
HCM Lane V/C Ratio	0.034	-	-	0.009	-
HCM Control Delay (s)	9.5	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	167	6	18	221	3	28
Future Vol, veh/h	167	6	18	221	3	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	184	7	20	243	3	31

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	191	0	471	188
Stage 1	-	-	-	-	188	-
Stage 2	-	-	-	-	283	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1383	-	551	854
Stage 1	-	-	-	-	844	-
Stage 2	-	-	-	-	765	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1383	-	542	854
Mov Cap-2 Maneuver	-	-	-	-	542	-
Stage 1	-	-	-	-	844	-
Stage 2	-	-	-	-	752	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	809	-	-	1383	-
HCM Lane V/C Ratio	0.042	-	-	0.014	-
HCM Control Delay (s)	9.6	-	-	7.6	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	128	6	14	92	14	16
Future Vol, veh/h	128	6	14	92	14	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	138	6	15	99	15	17

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	144	0	270	141
Stage 1	-	-	-	-	141	-
Stage 2	-	-	-	-	129	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1438	-	719	907
Stage 1	-	-	-	-	886	-
Stage 2	-	-	-	-	897	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1438	-	711	907
Mov Cap-2 Maneuver	-	-	-	-	711	-
Stage 1	-	-	-	-	886	-
Stage 2	-	-	-	-	887	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	9.7
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	804	-	-	1438	-
HCM Lane V/C Ratio	0.04	-	-	0.01	-
HCM Control Delay (s)	9.7	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	185	7	20	245	3	30
Future Vol, veh/h	185	7	20	245	3	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	203	8	22	269	3	33

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	211	0	520	207
Stage 1	-	-	-	-	207	-
Stage 2	-	-	-	-	313	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1360	-	516	833
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	741	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1360	-	506	833
Mov Cap-2 Maneuver	-	-	-	-	506	-
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	727	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	787	-	-	1360	-
HCM Lane V/C Ratio	0.046	-	-	0.016	-
HCM Control Delay (s)	9.8	-	-	7.7	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Appendix D:

Synchro HCM 6th Outputs – 2023 Build and 2033 Build

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	173	5	12	104	12	14
Future Vol, veh/h	173	5	12	104	12	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	186	5	13	112	13	15

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	191	0	327	189
Stage 1	-	-	-	-	189	-
Stage 2	-	-	-	-	138	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1383	-	667	853
Stage 1	-	-	-	-	843	-
Stage 2	-	-	-	-	889	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1383	-	660	853
Mov Cap-2 Maneuver	-	-	-	-	660	-
Stage 1	-	-	-	-	843	-
Stage 2	-	-	-	-	880	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	752	-	-	1383	-
HCM Lane V/C Ratio	0.037	-	-	0.009	-
HCM Control Delay (s)	10	-	-	7.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	129	99	17	49	4
Future Vol, veh/h	1	129	99	17	49	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	140	108	18	53	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	126	0	-	0	259	117
Stage 1	-	-	-	-	117	-
Stage 2	-	-	-	-	142	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1460	-	-	-	730	935
Stage 1	-	-	-	-	908	-
Stage 2	-	-	-	-	885	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1460	-	-	-	729	935
Mov Cap-2 Maneuver	-	-	-	-	729	-
Stage 1	-	-	-	-	907	-
Stage 2	-	-	-	-	885	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1460	-	-	-	741
HCM Lane V/C Ratio	0.001	-	-	-	0.078
HCM Control Delay (s)	7.5	0	-	-	10.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	7	122	100	3	8	20
Future Vol, veh/h	7	122	100	3	8	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	133	109	3	9	22

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	112	0	-	0	260	111
Stage 1	-	-	-	-	111	-
Stage 2	-	-	-	-	149	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1478	-	-	-	729	942
Stage 1	-	-	-	-	914	-
Stage 2	-	-	-	-	879	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1478	-	-	-	725	942
Mov Cap-2 Maneuver	-	-	-	-	725	-
Stage 1	-	-	-	-	909	-
Stage 2	-	-	-	-	879	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1478	-	-	-	868
HCM Lane V/C Ratio	0.005	-	-	-	0.035
HCM Control Delay (s)	7.4	0	-	-	9.3
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	203	6	18	278	3	28
Future Vol, veh/h	203	6	18	278	3	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	223	7	20	305	3	31

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	230	0	572	227
Stage 1	-	-	-	-	227	-
Stage 2	-	-	-	-	345	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1338	-	482	812
Stage 1	-	-	-	-	811	-
Stage 2	-	-	-	-	717	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1338	-	473	812
Mov Cap-2 Maneuver	-	-	-	-	473	-
Stage 1	-	-	-	-	811	-
Stage 2	-	-	-	-	704	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	759	-	-	1338	-
HCM Lane V/C Ratio	0.045	-	-	0.015	-
HCM Control Delay (s)	10	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	178	232	49	31	3
Future Vol, veh/h	4	178	232	49	31	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	193	252	53	34	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	305	0	-	0	480	279
Stage 1	-	-	-	-	279	-
Stage 2	-	-	-	-	201	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1256	-	-	-	545	760
Stage 1	-	-	-	-	768	-
Stage 2	-	-	-	-	833	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1256	-	-	-	543	760
Mov Cap-2 Maneuver	-	-	-	-	543	-
Stage 1	-	-	-	-	765	-
Stage 2	-	-	-	-	833	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	11.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1256	-	-	-	557
HCM Lane V/C Ratio	0.003	-	-	-	0.066
HCM Control Delay (s)	7.9	0	-	-	11.9
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	20	177	227	8	5	13
Future Vol, veh/h	20	177	227	8	5	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	192	247	9	5	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	256	0	-	0	488	252
Stage 1	-	-	-	-	252	-
Stage 2	-	-	-	-	236	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1309	-	-	-	539	787
Stage 1	-	-	-	-	790	-
Stage 2	-	-	-	-	803	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1309	-	-	-	529	787
Mov Cap-2 Maneuver	-	-	-	-	529	-
Stage 1	-	-	-	-	775	-
Stage 2	-	-	-	-	803	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1309	-	-	-	693
HCM Lane V/C Ratio	0.017	-	-	-	0.028
HCM Control Delay (s)	7.8	0	-	-	10.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	185	6	14	112	14	16
Future Vol, veh/h	185	6	14	112	14	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	199	6	15	120	15	17

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	205	0	352	202
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	150	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1366	-	646	839
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	878	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1366	-	638	839
Mov Cap-2 Maneuver	-	-	-	-	638	-
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	867	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	10.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	731	-	-	1366	-
HCM Lane V/C Ratio	0.044	-	-	0.011	-
HCM Control Delay (s)	10.2	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	142	109	17	49	4
Future Vol, veh/h	1	142	109	17	49	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	154	118	18	53	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	136	0	-	0	283	127
Stage 1	-	-	-	-	127	-
Stage 2	-	-	-	-	156	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1448	-	-	-	707	923
Stage 1	-	-	-	-	899	-
Stage 2	-	-	-	-	872	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1448	-	-	-	706	923
Mov Cap-2 Maneuver	-	-	-	-	706	-
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	872	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1448	-	-	-	719
HCM Lane V/C Ratio	0.001	-	-	-	0.08
HCM Control Delay (s)	7.5	0	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	7	135	110	3	8	20
Future Vol, veh/h	7	135	110	3	8	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	147	120	3	9	22

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	123	0	-	0	285	122
Stage 1	-	-	-	-	122	-
Stage 2	-	-	-	-	163	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1464	-	-	-	705	929
Stage 1	-	-	-	-	903	-
Stage 2	-	-	-	-	866	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1464	-	-	-	701	929
Mov Cap-2 Maneuver	-	-	-	-	701	-
Stage 1	-	-	-	-	898	-
Stage 2	-	-	-	-	866	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1464	-	-	-	850
HCM Lane V/C Ratio	0.005	-	-	-	0.036
HCM Control Delay (s)	7.5	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	221	7	20	302	3	30
Future Vol, veh/h	221	7	20	302	3	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	243	8	22	332	3	33

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	251	0	623	247
Stage 1	-	-	-	-	247	-
Stage 2	-	-	-	-	376	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1314	-	450	792
Stage 1	-	-	-	-	794	-
Stage 2	-	-	-	-	694	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1314	-	441	792
Mov Cap-2 Maneuver	-	-	-	-	441	-
Stage 1	-	-	-	-	794	-
Stage 2	-	-	-	-	679	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	10.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	739	-	-	1314	-
HCM Lane V/C Ratio	0.049	-	-	0.017	-
HCM Control Delay (s)	10.1	-	-	7.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	197	256	49	31	3
Future Vol, veh/h	4	197	256	49	31	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	214	278	53	34	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	331	0	-	0	527	305
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	222	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1228	-	-	-	512	735
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	815	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1228	-	-	-	510	735
Mov Cap-2 Maneuver	-	-	-	-	510	-
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	815	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1228	-	-	-	524
HCM Lane V/C Ratio	0.004	-	-	-	0.071
HCM Control Delay (s)	7.9	0	-	-	12.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	20	196	251	8	5	13
Future Vol, veh/h	20	196	251	8	5	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	213	273	9	5	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	282	0	-	0	535	278
Stage 1	-	-	-	-	278	-
Stage 2	-	-	-	-	257	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1280	-	-	-	506	761
Stage 1	-	-	-	-	769	-
Stage 2	-	-	-	-	786	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1280	-	-	-	496	761
Mov Cap-2 Maneuver	-	-	-	-	496	-
Stage 1	-	-	-	-	754	-
Stage 2	-	-	-	-	786	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	10.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1280	-	-	-	663
HCM Lane V/C Ratio	0.017	-	-	-	0.03
HCM Control Delay (s)	7.9	0	-	-	10.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

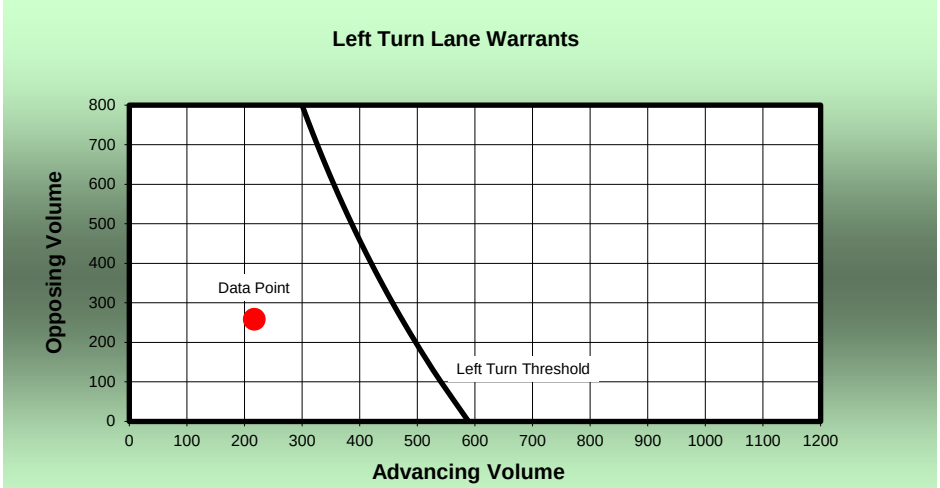
Appendix E:

Turn Lane Warrants

Left Turn Lane Warrants

Input Fields

Left Turn Volume (vph)	20	Speed Limit (mph)	35
Advancing Volume (vph)	216	No. of through lanes	2
Opposing Volume (vph)	259	Percent Heavy Vehicles (decimal percent)	0.02



Left Turn Lane NOT Warranted

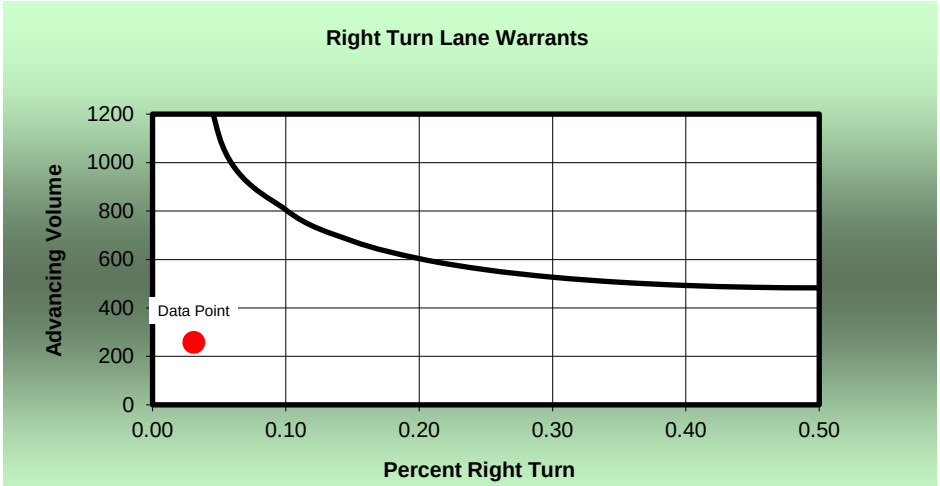
Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

3 - Springdale Rd / Entrance 2
EBL 2033 PM Build

Right Turn Lane Warrants

Input Fields

Right Turn Volume (vph)	8	Speed Limit (mph)	35
Advancing Volume (vph)	259		



Right Turn Lane NOT Warranted

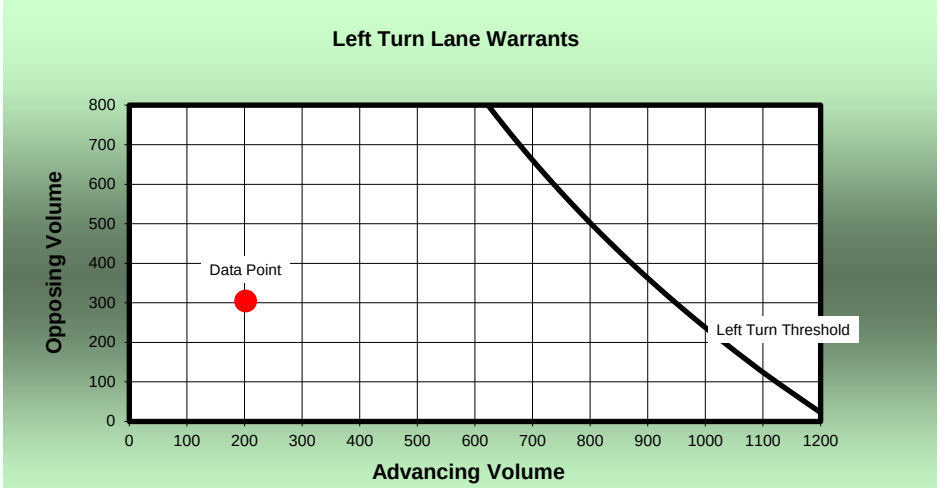
Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

3 - Springdale Rd / Entrance 2
WBR 2033 PM Build

Left Turn Lane Warrants

Input Fields

Left Turn Volume (vph)	4	Speed Limit (mph)	35
Advancing Volume (vph)	201	No. of through lanes	2
Opposing Volume (vph)	305	Percent Heavy Vehicles (decimal percent)	0.02



Left Turn Lane NOT Warranted

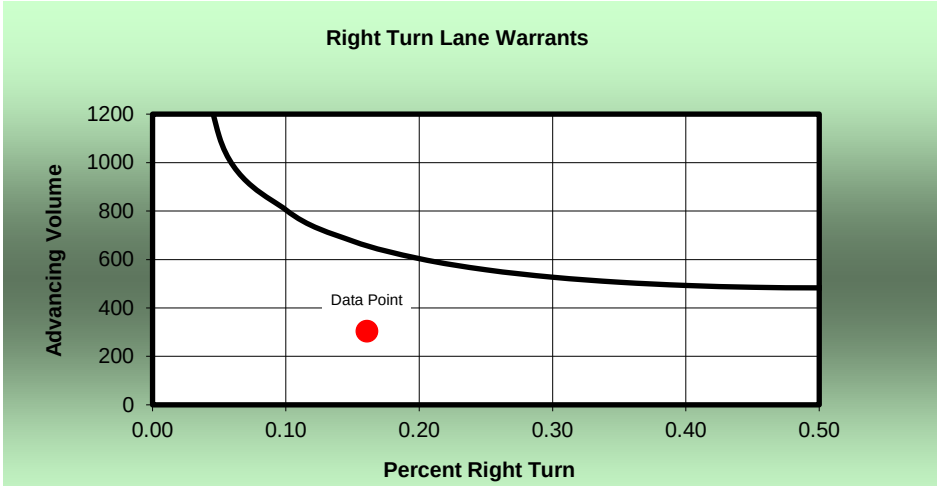
Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

2 - Springdale Rd / Entrance 1
EBL 2033 PM Build

Right Turn Lane Warrants

Input Fields

Right Turn Volume (vph)	49	Speed Limit (mph)	35
Advancing Volume (vph)	305		



Right Turn Lane NOT Warranted

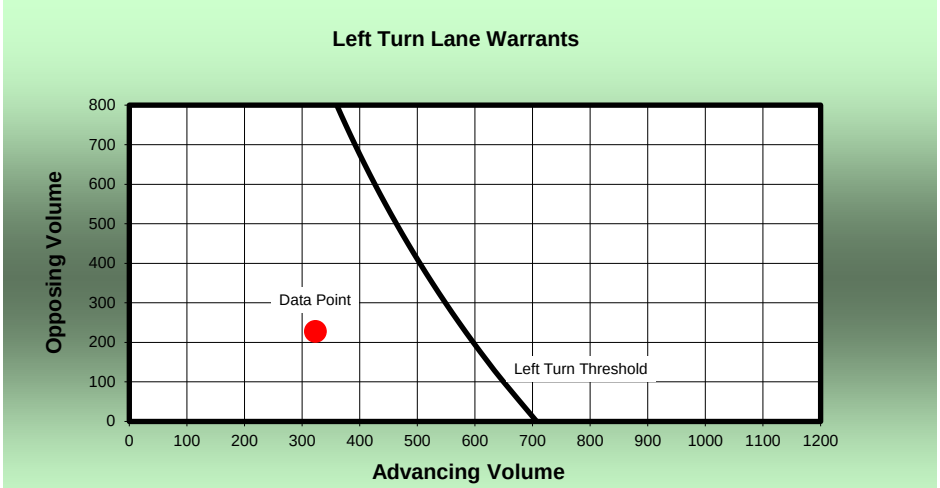
Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

2 - Springdale Rd / Entrance 1
WBR 2033 PM Build

Left Turn Lane Warrants

Input Fields

Left Turn Volume (vph)	20	Speed Limit (mph)	35
Advancing Volume (vph)	322	No. of through lanes	2
Opposing Volume (vph)	228	Percent Heavy Vehicles (decimal percent)	0.02



Left Turn Lane NOT Warranted

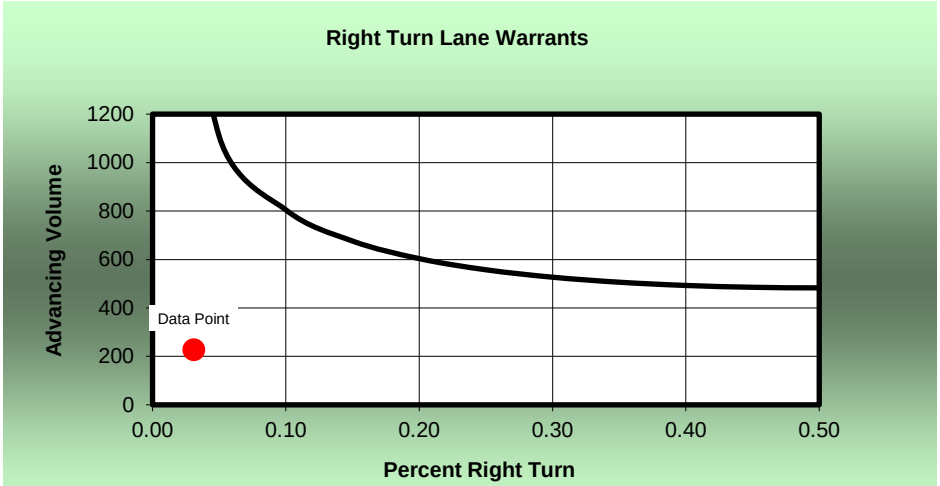
Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

1- Springdale Rd / Asbury Park Blvd
WBL 2033 PM Build

Right Turn Lane Warrants

Input Fields

Right Turn Volume (vph)	7	Speed Limit (mph)	35
Advancing Volume (vph)	228		



Right Turn Lane NOT Warranted

Note: This spreadsheet is intended to supplement the guidance provided in the Auxiliary Turn Lane policy outlined in the KYTC Highway Design Manual. This policy should be fully reviewed and understood prior to using this application.

1- Springdale Rd / Asbury Park Blvd
EBR 2033 PM Build

Study Name I265 EB MP35.5
Start Date 06/23/2021
Start Time 12:00 AM
Site Code Site 3 - Wednesday

Channel	Direction				
Direction	Eastbound				
	CARS	TRUCKS/BUSES	TOTAL	TRUCK/BUS %	HOURLY
12:00 AM	33	11	44	25.0%	
12:15 AM	32	12	44	27.3%	
12:30 AM	21	11	32	34.4%	
12:45 AM	18	15	33	45.5%	153
1:00 AM	14	12	26	46.2%	135
1:15 AM	5	8	13	61.5%	104
1:30 AM	17	18	35	51.4%	107
1:45 AM	15	12	27	44.4%	101
2:00 AM	4	10	14	71.4%	89
2:15 AM	6	10	16	62.5%	92
2:30 AM	13	12	25	48.0%	82
2:45 AM	27	4	31	12.9%	86
3:00 AM	14	12	26	46.2%	98
3:15 AM	15	13	28	46.4%	110
3:30 AM	9	4	13	30.8%	98
3:45 AM	16	13	29	44.8%	96
4:00 AM	18	7	25	28.0%	95
4:15 AM	28	16	44	36.4%	111
4:30 AM	39	17	56	30.4%	154

4:45 AM	75	15	90	16.7%	215
5:00 AM	84	17	101	16.8%	291
5:15 AM	148	15	163	9.2%	410
5:30 AM	173	14	187	7.5%	541
5:45 AM	160	19	179	10.6%	630
6:00 AM	120	21	141	14.9%	670
6:15 AM	193	24	217	11.1%	724
6:30 AM	239	45	284	15.8%	821
6:45 AM	241	23	264	8.7%	906
7:00 AM	294	34	328	10.4%	1093
7:15 AM	426	25	451	5.5%	1327
7:30 AM	450	25	475	5.3%	1518
7:45 AM	459	44	503	8.7%	1757
8:00 AM	354	45	399	11.3%	1828
8:15 AM	404	40	444	9.0%	1821
8:30 AM	444	37	481	7.7%	1827
8:45 AM	423	43	466	9.2%	1790
9:00 AM	284	38	322	11.8%	1713
9:15 AM	315	61	376	16.2%	1645
9:30 AM	312	59	371	15.9%	1535
9:45 AM	333	50	383	13.1%	1452
10:00 AM	289	47	336	14.0%	1466
10:15 AM	298	44	342	12.9%	1432
10:30 AM	279	39	318	12.3%	1379
10:45 AM	297	49	346	14.2%	1342
11:00 AM	299	50	349	14.3%	1355
11:15 AM	312	34	346	9.8%	1359
11:30 AM	313	52	365	14.2%	1406
11:45 AM	296	41	337	12.2%	1397
12:00 PM	270	33	303	10.9%	1351
12:15 PM	283	36	319	11.3%	1324
12:30 PM	294	51	345	14.8%	1304

12:45 PM	308	45	353	12.7%	1320
1:00 PM	307	44	351	12.5%	1368
1:15 PM	324	47	371	12.7%	1420
1:30 PM	291	43	334	12.9%	1409
1:45 PM	318	41	359	11.4%	1415
2:00 PM	305	41	346	11.8%	1410
2:15 PM	306	56	362	15.5%	1401
2:30 PM	343	43	386	11.1%	1453
2:45 PM	332	46	378	12.2%	1472
3:00 PM	318	46	364	12.6%	1490
3:15 PM	306	51	357	14.3%	1485
3:30 PM	367	50	417	12.0%	1516
3:45 PM	398	42	440	9.5%	1578
4:00 PM	384	37	421	8.8%	1635
4:15 PM	367	34	401	8.5%	1679
4:30 PM	488	35	523	6.7%	1785
4:45 PM	491	29	520	5.6%	1865
5:00 PM	450	37	487	7.6%	1931
5:15 PM	538	39	577	6.8%	2107
5:30 PM	512	39	551	7.1%	2135
5:45 PM	442	48	490	9.8%	2105
6:00 PM	359	32	391	8.2%	2009
6:15 PM	387	30	417	7.2%	1849
6:30 PM	286	30	316	9.5%	1614
6:45 PM	284	25	309	8.1%	1433
7:00 PM	254	25	279	9.0%	1321
7:15 PM	239	26	265	9.8%	1169
7:30 PM	214	22	236	9.3%	1089
7:45 PM	171	22	193	11.4%	973
8:00 PM	173	16	189	8.5%	883
8:15 PM	192	29	221	13.1%	839
8:30 PM	152	21	173	12.1%	776

8:45 PM	133	19	152	12.5%	735
9:00 PM	157	18	175	10.3%	721
9:15 PM	167	13	180	7.2%	680
9:30 PM	146	16	162	9.9%	669
9:45 PM	134	19	153	12.4%	670
10:00 PM	108	20	128	15.6%	623
10:15 PM	99	15	114	13.2%	557
10:30 PM	85	11	96	11.5%	491
10:45 PM	62	18	80	22.5%	418
11:00 PM	59	15	74	20.3%	364
11:15 PM	46	11	57	19.3%	307
11:30 PM	28	19	47	40.4%	258
11:45 PM	25	18	43	41.9%	221

AM PEAK HOUR	7:15 to 8:15 AM
PM PEAK HOUR	4:45 to 5:45 PM
TOTAL 24 HR TRAFFIC	24,130
AM PEAK TRAFFIC	1,828
PM PEAK TRAFFIC	2,135
TOTAL 24 HR TRUCK %	11.5%
AM PEAK HOUR TRUCK %	7.6%
PM PEAK HOUR TRUCK %	6.7%

GROWTH ANALYSIS

GROWTH RATE	2.00%	
YEAR	2023	2033
	25,100	30,600
	1,900	2,320
	2,220	2,710

Study Name I265 WB MP35.5
Start Date 06/23/2021
Start Time 12:00 AM
Site Code Site 2 - Wednesday

Channel	Direction				
Direction	Westbound				
	CARS	TRUCKS/BUSES	TOTAL	TRUCK/BUS %	HOURLY
12:00 AM	21	13	34	38.2%	
12:15 AM	18	7	25	28.0%	
12:30 AM	24	10	34	29.4%	
12:45 AM	23	13	36	36.1%	129
1:00 AM	11	17	28	60.7%	123
1:15 AM	15	7	22	31.8%	120
1:30 AM	12	16	28	57.1%	114
1:45 AM	12	12	24	50.0%	102
2:00 AM	21	13	34	38.2%	108
2:15 AM	15	15	30	50.0%	116
2:30 AM	18	13	31	41.9%	119
2:45 AM	13	20	33	60.6%	128
3:00 AM	14	18	32	56.3%	126
3:15 AM	21	11	32	34.4%	128
3:30 AM	42	15	57	26.3%	154
3:45 AM	53	12	65	18.5%	186
4:00 AM	64	16	80	20.0%	234
4:15 AM	36	14	50	28.0%	252
4:30 AM	35	20	55	36.4%	250

4:45 AM	29	14	43	32.6%	228
5:00 AM	35	17	52	32.7%	200
5:15 AM	43	17	60	28.3%	210
5:30 AM	80	21	101	20.8%	256
5:45 AM	88	21	109	19.3%	322
6:00 AM	105	39	144	27.1%	414
6:15 AM	153	25	178	14.0%	532
6:30 AM	177	41	218	18.8%	649
6:45 AM	192	39	231	16.9%	771
7:00 AM	204	45	249	18.1%	876
7:15 AM	270	47	317	14.8%	1015
7:30 AM	320	45	365	12.3%	1162
7:45 AM	366	55	421	13.1%	1352
8:00 AM	285	53	338	15.7%	1441
8:15 AM	322	48	370	13.0%	1494
8:30 AM	298	56	354	15.8%	1483
8:45 AM	295	51	346	14.7%	1408
9:00 AM	283	61	344	17.7%	1414
9:15 AM	277	53	330	16.1%	1374
9:30 AM	267	54	321	16.8%	1341
9:45 AM	276	38	314	12.1%	1309
10:00 AM	266	51	317	16.1%	1282
10:15 AM	262	53	315	16.8%	1267
10:30 AM	296	50	346	14.5%	1292
10:45 AM	254	63	317	19.9%	1295
11:00 AM	267	54	321	16.8%	1299
11:15 AM	266	48	314	15.3%	1298
11:30 AM	254	43	297	14.5%	1249
11:45 AM	291	68	359	18.9%	1291
12:00 PM	274	53	327	16.2%	1297
12:15 PM	305	58	363	16.0%	1346
12:30 PM	268	63	331	19.0%	1380

12:45 PM	349	59	408	14.5%	1429
1:00 PM	331	42	373	11.3%	1475
1:15 PM	307	41	348	11.8%	1460
1:30 PM	271	48	319	15.0%	1448
1:45 PM	291	52	343	15.2%	1383
2:00 PM	296	59	355	16.6%	1365
2:15 PM	359	64	423	15.1%	1440
2:30 PM	363	77	440	17.5%	1561
2:45 PM	353	53	406	13.1%	1624
3:00 PM	381	55	436	12.6%	1705
3:15 PM	409	44	453	9.7%	1735
3:30 PM	453	48	501	9.6%	1796
3:45 PM	414	42	456	9.2%	1846
4:00 PM	475	57	532	10.7%	1942
4:15 PM	492	50	542	9.2%	2031
4:30 PM	478	35	513	6.8%	2043
4:45 PM	500	26	526	4.9%	2113
5:00 PM	532	58	590	9.8%	2171
5:15 PM	513	39	552	7.1%	2181
5:30 PM	437	34	471	7.2%	2139
5:45 PM	438	27	465	5.8%	2078
6:00 PM	401	48	449	10.7%	1937
6:15 PM	386	44	430	10.2%	1815
6:30 PM	353	41	394	10.4%	1738
6:45 PM	303	23	326	7.1%	1599
7:00 PM	301	31	332	9.3%	1482
7:15 PM	242	27	269	10.0%	1321
7:30 PM	250	20	270	7.4%	1197
7:45 PM	235	26	261	10.0%	1132
8:00 PM	226	31	257	12.1%	1057
8:15 PM	175	27	202	13.4%	990
8:30 PM	183	26	209	12.4%	929

8:45 PM	159	23	182	12.6%	850
9:00 PM	186	26	212	12.3%	805
9:15 PM	161	23	184	12.5%	787
9:30 PM	142	22	164	13.4%	742
9:45 PM	150	19	169	11.2%	729
10:00 PM	134	15	149	10.1%	666
10:15 PM	123	20	143	14.0%	625
10:30 PM	86	26	112	23.2%	573
10:45 PM	79	22	101	21.8%	505
11:00 PM	61	20	81	24.7%	437
11:15 PM	49	19	68	27.9%	362
11:30 PM	54	16	70	22.9%	320
11:45 PM	32	19	51	37.3%	270

AM PEAK HOUR	7:30 to 8:30 AM
PM PEAK HOUR	4:30 to 5:30 PM
TOTAL 24 HR TRAFFIC	24,079
AM PEAK TRAFFIC	1,494
PM PEAK TRAFFIC	2,181
TOTAL 24 HR TRUCK %	13.8%
AM PEAK HOUR TRUCK %	13.5%
PM PEAK HOUR TRUCK %	7.2%

GROWTH ANALYSIS

GROWTH RATE	2.00%	
YEAR	2023	2033
	25,050	30,540
	1,550	1,890
	2,270	2,770

APPENDIX F – NOISE METER CERTIFICATIONS

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2017, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.46215

Instrument: **Sound Level Meter**
Model: **NL20**
Manufacturer: **Rion**
Serial number: **00110039**
Tested with: **Microphone UC52 s/n 77412**
Preamplifier NH21 s/n 00177
Type (class): **2**
Customer: **HMB Professional Engineers, Inc.**
Tel/Fax: **502-695-9800 / -9810**

Date Calibrated: **3/25/2021** *Cal Due:* **3/25/2023**

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No
Calibration service: __ Basic _X_ Standard
Address: **3 HMB Circle US 460, Frankfort, KY, 40601**

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 31, 2020	Scantek, Inc./ NVLAP	Jul 31, 2021
DS-360-SRS	Function Generator	61646	Dec 3, 2020	ACR Env./ A2LA	Dec 3, 2022
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Dec 04, 2020	ACR Env./ A2LA	Dec 04, 2021
HM30-Thommen	Meteo Station	1040170/39633	Dec 7, 2021	ACR Env./ A2LA	Dec 7, 2022
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Oct 26, 2020	Scantek, Inc./ NVLAP	Oct 26, 2021
4226-Brüel&Kjær	Multifunction calibrator	2305103	Sep 25, 2019	Brüel&Kjær/ DANAK	Sep 25, 2021

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.4	100.26	45.5

Calibrated by:	Ronnie Buchanan	**Authorized signatory:**	William D. Gallagher
Signature	Ronnie Buchanan	Signature	William D Gallagher
Date	3/25/2021	Date	3/26/2021

Results summary: Device complies with following clauses of mentioned specifications:

CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES:	RESULT[2,3]	EXPANDED UNCERTAINTY (coverage factor 2) [dB]
INDICATION AT THE CALIBRATION CHECK FREQUENCY - IEC61672-3 ED.2 CLAUSE 10	Passed	0.15
SELF-GENERATED NOISE - IEC 61672-3 ED.2 CLAUSE 11	Passed	0.3
ACOUSTICAL TEST OF A FREQUENCY WEIGHTING - IEC 61672-3 ED.2.0 CLAUSE 12	Passed	0.3
FREQUENCY WEIGHTINGS: A NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.2
FREQUENCY WEIGHTINGS: C NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.2
FREQUENCY WEIGHTINGS: Z NETWORK - IEC 61672-3 ED.2.0 CLAUSE 13	Passed	0.2
FREQUENCY AND TIME WEIGHTINGS AT 1 KHZ IEC 61672-3 ED.2.0 CLAUSE 14	Passed	0.2
LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE - IEC 61672-3 ED.2 CLAUSE 16	Passed	0.25
LEVEL LINEARITY INCLUDING THE LEVEL RANGE CONTROL - IEC 61672-3 ED.2.0 CLAUSE 17	Passed	0.25
TONEBURST RESPONSE - IEC 61672-3 ED.2.0 CLAUSE 18	Passed	0.3
OVERLOAD INDICATION - IEC 61672-3 ED.2.0 CLAUSE 20	Passed	0.25
HIGH LEVEL STABILITY TEST - IEC 61672-3 ED.2.0 CLAUSE 21	Passed	0.1
LONG TERM STABILITY TEST - IEC 61672-3 ED.2.0 CLAUSE 15	Passed	0.1

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 Parameters are certified at actual environmental conditions.

3 The tests marked with (*) are not covered by the current NVLAP accreditation.

Comments: The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3, for the environmental conditions under which the tests were performed. However, No general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1 because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conforms to the requirements of IEC 61672-1:2002, and because the periodic tests of IEC 61672-3 cover only a limited subset of the specifications in IEC 61672-1.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Tests made with the following attachments to the instrument:

Microphone: Rion UC52 s/n 77412 for acoustical test
Preamplifier: Rion NH21 s/n 00177 for all tests
Other: line adaptor ADP005 (18pF) for electrical tests
Accompanying acoustical calibrator: Rion NC-73 s/n 10417585
Windscreen: Rion WS-10

Measured Data: in Test Report # 46215 of 8+1 pages.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Summary of Test Report No.:46215

Rion Type: NL20 Serial no: 00110039

Customer:	**HMB Professional Engineers, Inc.**
Address:	**3 HMB Circle US 460, Frankfort, KY, 40601**
Contact Person:	**Mark Gavula**
Phone No.:	**502-695-9800**
Fax No.:	**-9810**
eMail:	**mgavula@hmbpe.com**

Microphone:	Rion	Type: UC52	Serial no: 77412	Sens:dB
Preamplifier	Rion	Type: NH21	Serial no: 00177	
Calibrator:	Rion	Type: NC-73	Serial no: 10417585	Level:93.89dB
Wind screen	Rion	Type: WS-10		

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.2 Clause 10	Passed
Self-generated noise - IEC 61672-3 Ed.2 Clause 11	Passed
Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.2.0 Clause 13	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.2.0 Clause 13	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 Clause 13	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 Clause 14	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16	Passed
Level linearity including the level range control - IEC 61672-3 Ed.2.0 Clause 17	Passed
Toneburst response - IEC 61672-3 Ed.2.0 Clause 18	Passed
Overload indication - IEC 61672-3 Ed.2.0 Clause 20	Passed
High level stability test - IEC 61672-3 Ed.2.0 Clause 21	Passed
Long term stability test - IEC 61672-3 Ed.2.0 Clause 15	Passed

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
100.26	23.4	45.5

Date of calibration: 3/25/2021
Date of issue: 3/26/2021
Supervisor: Steven E. Marshall
Measurements performed by:

Ronnie Buchanan

Software version: 6.1 T

Scantek, Inc.
6430 Dobbin Rd., Suite C, Columbia, MD 21045
Ph: 410-290-7726 eMail: callab@scantekinc.com

Test Report No.:46215

Manufacturer:	Rion
Instrument type:	NL20
Serial no:	00110039
Customer:	HMB Professional Engineers, Inc.
Department:	
Order No:	
Contact Person:	Mark Gavula
Address:	3 HMB Circle US 460, Frankfort, KY, 40601

Environmental conditions:

Pressure:	100.26
Temperature:	23.4
Relative humidity:	45.5

Supervisor	Steven E. Marshall
Engineer	Ronnie Buchanan
Date:	3/25/2021

Measurement Results:

Indication at the calibration check frequency - IEC61672-3 Ed.2 Clause 10

```
Reference Calibrator: WSC4 - NOR1251-30878
Reference calibrator level: 114.00
Before calibration:
  Environmental corrections: 0.00
  Other corrections: -0.02
  Notional level: 113.98
Reference calibrator level before calibration: 114.0
After calibration:
  Environmental corrections: 0.00
  Other corrections: -0.02
  Notional level: 113.98
Reference calibrator level after calibration: 114.2
Associated Calibrator: Rion - NC-73 - 10417585
Associated calibrator level: 93.89
Initial level check:
  Environmental corrections: 0.00
  Other corrections: -0.02
  Notional level: 93.87
Indicated level: 93.9
Final level statement:
  Environmental corrections after calibration: 0.00
  Other corrections: -0.02
  Notional level: 93.87
Indicated level after calibration: 94.0
This value shall be used for adjusting the sound level meter in the future.
Test Passed
```

Self-generated noise - IEC 61672-3 Ed.2 Clause 11

Network	Level (dB)	Max (dB)	Uncert. (dB)	Result	Comment
A	18.3	20.0	0.3	P	Equivalent capacity
C	25.4	27.0	0.3	P	Equivalent capacity
Z	24.6	32.0	0.3	P	Equivalent capacity

Test Passed

Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12

A-Weighted results: free field response

Frequency	Response (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Result
125 Hz	-0.3	1.5	-1.5	0.1	P
1 kHz	0.0	1.0	-1.0	0.1	P
4 kHz	-1.1	3.0	-3.0	0.2	P
8 kHz	1.6	5.0	-5.0	0.4	P

Test Passed

Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12

The overall frequency response of the sound level meter, nominal case reflections and microphone response has shown to conform with the requirements in IEC 61672-3 for a class 2 sound level meter.
Frequency response test using multi frequency calibrator.
Sources for correction data:
Calibrator levels and uncertainty: B&K
Microphone field corrections and uncertainty:
Case reflections and uncertainty:
Wind screen corrections and uncertainty:
Tabular information
Calibrator = WSC4 at 94dB
txtMFCL125 = 94.06
txtMFCLU125 = 0.10
txtSU125 = 0.20
txtM125_1 = 78.5
txtM125_2 = 78.5
txtM125_3 = 78.5
txtMFCL1k = 94.05
txtMFCLU1k = 0.10
txtSU1k = 0.15
txtM1k_1 = 94.5
txtM1k_2 = 94.5
txtM1k_3 = 94.5
txtMFCL4k = 93.92
txtMFCLU4k = 0.10
txtSU4k = 0.40
txtM4k_1 = 94.5
txtM4k_2 = 94.5
txtM4k_3 = 94.5
txtMFCL8k = 93.88
txtMFCLU8k = 0.11
txtSU8k = 0.50
txtM8k_1 = 92.5
txtM8k_2 = 92.5
txtM8k_3 = 92.5
txtSLM125 = 78.5
txtNC125 = 16.1
txtSLMU125 = 0.1
txtMic125 = 0.0
txtMicU125 = 0.05
txtCR125 = 0.0
txtCRU125 = 0.0
txtWS125 =
txtWSU125 =
txtSLM1k = 94.5
txtNC1k = 0
txtSLMU1k = 0.1
txtMFCL1k = 94.05
txtMFCLU1k = 0.10
txtMic1k = 0.4
txtMicU1k = 0.1
txtCR1k = 0.0
txtCRU1k = 0.0
txtWS1k =
txtWSU1k =
txtSLM4k = 94.5
txtNC4k = -1.0
txtSLMU4k = 0.1
txtMFCL4k = 93.92

Acoustical test of a frequency weighting - IEC 61672-3 Ed.2.0 Clause 12

txtMFCLU4k = 0.10
txtMic4k = 0.2
txtMicU4k = 0.2
txtCR4k = 0.0
txtCRU4k = 0.0
txtWS4k =
txtWSU4k =
txtSLM8k = 92.5
txtNC8k = 1.1
txtSLMU8k = 0.1
txtMFCL8k = 93.88
txtMFCLU8k = 0.11
txtMic8k = 2.7
txtMicU8k = 0.4
txtCR8k = 0.0
txtCRU8k = 0.0
txtWS8k =
txtWSU8k =

Frequency weightings: A Network - IEC 61672-3 Ed.2.0 Clause 13

Freq (Hz)	Ref. (dB)	Meas. (dB)	Tol. (dB)	Tol. (dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	83.0	82.9	2.0	-2.0	0.2	-0.1	P
125.9	83.0	82.8	1.5	-1.5	0.2	-0.2	P
251.2	83.0	82.8	1.5	-1.5	0.2	-0.2	P
501.2	83.0	82.9	1.5	-1.5	0.2	-0.1	P
1000.0	83.0	83.0	1.0	-1.0	0.2	0.0	P
1995.3	83.0	83.0	2.0	-2.0	0.2	0.0	P
3981.1	83.0	83.0	3.0	-3.0	0.2	0.0	P
7943.3	83.0	83.1	5.0	-5.0	0.2	0.1	P

Test Passed

Frequency weightings: C Network - IEC 61672-3 Ed.2.0 Clause 13

Freq (Hz)	Ref. Level (dB)	Meas. Value (dB)	Tol. (dB)	Tol. (dB)	Uncert. (dB)	Dev. (dB)	Result
63.1	83.0	82.9	2.0	-2.0	0.2	-0.1	P
125.9	83.0	82.9	1.5	-1.5	0.2	-0.1	P
251.2	83.0	82.9	1.5	-1.5	0.2	-0.1	P
501.2	83.0	83.0	1.5	-1.5	0.2	0.0	P
1000.0	83.0	83.0	1.0	-1.0	0.2	0.0	P
1995.3	83.0	83.0	2.0	-2.0	0.2	0.0	P
3981.1	83.0	83.0	3.0	-3.0	0.2	0.0	P
7943.3	83.0	83.1	5.0	-5.0	0.2	0.1	P

Test Passed

Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 Clause 13

Freq	Ref. Level	Meas. Value	Tol.		Uncert.	Dev.	Result
(Hz)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
63.1	83.0	82.8	2.0	-2.0	0.2	-0.2	P
125.9	83.0	82.9	1.5	-1.5	0.2	-0.1	P
251.2	83.0	82.9	1.5	-1.5	0.2	-0.1	P
501.2	83.0	83.0	1.5	-1.5	0.2	0.0	P
1000.0	83.0	83.0	1.0	-1.0	0.2	0.0	P
1995.3	83.0	83.1	2.0	-2.0	0.2	0.1	P
3981.1	83.0	83.0	3.0	-3.0	0.2	0.0	P
7943.3	83.0	83.0	5.0	-5.0	0.2	0.0	P

Test Passed

Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 Clause 14

Weightings		Ref.	Measured	Tol.		Uncert.	Dev.	Result
Time	Netw	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	
Fast	A	94.0	94.1	0.1	-0.1	0.2	0.1	P
Fast	C	94.0	94.1	0.1	-0.1	0.2	0.1	P
Fast	Z	94.0	94.1	0.1	-0.1	0.2	0.1	P
Fast	Flat	94.0	94.1	0.1	-0.1	0.2	0.1	P
Slow	A	94.0	94.1	0.1	-0.1	0.2	0.1	P
Leq	A	94.0	94.0	0.1	-0.1	0.2	0.0	P
SEL	A	104.0	104.0	0.1	-0.1	0.2	0.0	P

Test Passed

Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16

Ref. (dB)	Measured (dB)	Tol. (dB)	(dB)	Uncert. (dB)	Dev. (dB)	Result
Full scale setting: 120dB						
The following measurements are SPL measurements						
Measured at 31.5 Hz						
74.0	74.0	1.1	-1.1	0.25	0.0	P
79.0	79.0	1.1	-1.1	0.25	0.0	P
84.6	84.6	1.1	-1.1	0.25	0.0	P
85.6	85.6	1.1	-1.1	0.25	0.0	P
86.6	86.6	1.1	-1.1	0.25	0.0	P
87.6	87.6	1.1	-1.1	0.25	0.0	P
88.6	88.6	1.1	-1.1	0.25	0.0	P
74.0	74.9	1.1	-1.1	0.25	0.9	P
69.0	69.1	1.1	-1.1	0.25	0.1	P
64.0	64.1	1.1	-1.1	0.25	0.1	P
59.0	59.1	1.1	-1.1	0.25	0.1	P
54.0	54.1	1.1	-1.1	0.25	0.1	P
49.0	49.1	1.1	-1.1	0.25	0.1	P
44.0	44.0	1.1	-1.1	0.25	0.0	P
39.0	39.0	1.1	-1.1	0.25	0.0	P
37.0	37.0	1.1	-1.1	0.25	0.0	P
36.0	35.9	1.1	-1.1	0.25	-0.1	P
35.0	35.0	1.1	-1.1	0.25	0.0	P

Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16

Ref. (dB)	Measured (dB)	Tol. (dB)	Tol. (dB)	Uncert. (dB)	Dev. (dB)	Result
34.0	34.1	1.1	-1.1	0.25	0.1	P
33.0	33.0	1.1	-1.1	0.25	0.0	P
Measured at 1 kHz						
94.0	94.0	1.1	-1.1	0.25	0.0	P
99.0	99.0	1.1	-1.1	0.25	0.0	P
104.0	103.9	1.1	-1.1	0.25	-0.1	P
109.0	109.0	1.1	-1.1	0.25	0.0	P
114.0	114.0	1.1	-1.1	0.25	0.0	P
119.0	119.0	1.1	-1.1	0.25	0.0	P
124.0	124.0	1.1	-1.1	0.25	0.0	P
125.0	125.0	1.1	-1.1	0.25	0.0	P
126.0	126.0	1.1	-1.1	0.25	0.0	P
127.0	127.0	1.1	-1.1	0.25	0.0	P
128.0	128.0	1.1	-1.1	0.25	0.0	P
94.0	94.0	1.1	-1.1	0.25	0.0	P
89.0	89.0	1.1	-1.1	0.25	0.0	P
84.0	84.0	1.1	-1.1	0.25	0.0	P
79.0	78.9	1.1	-1.1	0.25	-0.1	P
74.0	73.9	1.1	-1.1	0.25	-0.1	P
69.0	68.9	1.1	-1.1	0.25	-0.1	P
64.0	63.9	1.1	-1.1	0.25	-0.1	P
59.0	58.9	1.1	-1.1	0.25	-0.1	P
54.0	53.9	1.1	-1.1	0.25	-0.1	P
49.0	49.0	1.1	-1.1	0.25	0.0	P
44.0	43.9	1.1	-1.1	0.25	-0.1	P
39.0	38.9	1.1	-1.1	0.25	-0.1	P
37.0	36.9	1.1	-1.1	0.25	-0.1	P
36.0	35.9	1.1	-1.1	0.25	-0.1	P
35.0	34.9	1.1	-1.1	0.25	-0.1	P
34.0	33.8	1.1	-1.1	0.25	-0.2	P
33.0	32.9	1.1	-1.1	0.25	-0.1	P
Measured at 8 kHz						
94.0	94.0	1.1	-1.1	0.25	0.0	P
99.0	99.0	1.1	-1.1	0.25	0.0	P
104.0	104.0	1.1	-1.1	0.25	0.0	P
109.0	109.0	1.1	-1.1	0.25	0.0	P
114.0	114.0	1.1	-1.1	0.25	0.0	P
119.0	119.0	1.1	-1.1	0.25	0.0	P
122.9	123.0	1.1	-1.1	0.25	0.1	P
123.9	124.0	1.1	-1.1	0.25	0.1	P
124.9	125.0	1.1	-1.1	0.25	0.1	P
125.9	126.0	1.1	-1.1	0.25	0.1	P
94.0	94.0	1.1	-1.1	0.25	0.0	P
89.0	89.0	1.1	-1.1	0.25	0.0	P
84.0	84.0	1.1	-1.1	0.25	0.0	P
79.0	79.0	1.1	-1.1	0.25	0.0	P
74.0	74.0	1.1	-1.1	0.25	0.0	P
69.0	69.0	1.1	-1.1	0.25	0.0	P
64.0	64.0	1.1	-1.1	0.25	0.0	P
59.0	59.0	1.1	-1.1	0.25	0.0	P
54.0	54.1	1.1	-1.1	0.25	0.1	P
49.0	49.1	1.1	-1.1	0.25	0.1	P
44.0	44.1	1.1	-1.1	0.25	0.1	P
39.0	39.0	1.1	-1.1	0.25	0.0	P
37.0	37.0	1.1	-1.1	0.25	0.0	P
36.0	36.0	1.1	-1.1	0.25	0.0	P
35.0	35.0	1.1	-1.1	0.25	0.0	P

Level linearity on the reference level range - IEC 61672-3 Ed.2 Clause 16

Ref. (dB)	Measured (dB)	Tol. (dB)	Tol. (dB)	Uncert. (dB)	Dev. (dB)	Result
34.0	34.0	1.1	-1.1	0.25	0.0	P
33.0	33.0	1.1	-1.1	0.25	0.0	P

Test Passed

Level linearity including the level range control - IEC 61672-3 Ed.2.0 Clause 17

Full Scale (dB)	Ref. Value (dB)	Measured Value (dB)	Tol. Value (dB)	Uncert. (dB)	Dev. (dB)	Result
Measured at 1 kHz						
The following measurements are SPL measurements						
Measuring the reference level on the available ranges.						
130	94.0	93.9	1.1	0.25	-0.1	P
120	94.0	93.9	1.1	0.25	-0.1	P
110	94.0	93.9	1.1	0.25	-0.1	P
100	94.0	94.0	1.1	0.25	0.0	P
Measuring 5 dB below full scale on all available ranges.						
130	125.0	125.0	1.1	0.25	0.0	P
120	115.0	115.0	1.1	0.25	0.0	P
110	105.0	105.0	1.1	0.25	0.0	P
100	95.0	95.0	1.1	0.25	0.0	P
90	85.0	85.0	1.1	0.25	0.0	P
80	75.0	75.0	1.1	0.25	0.0	P

Test Passed

Toneburst response - IEC 61672-3 Ed.2.0 Clause 18

Burst type	Ref. (dB)	Measured (dB)	Tol. (dB)	Tol. (dB)	Uncert. (dB)	Dev. (dB)	Result
Fast 200 mSec	125.0	125.0	1.0	-1.0	0.3	0.0	P
Fast 2.0 mSec	108.0	108.0	1.0	-2.5	0.3	0.0	P
Fast 0.25 mSec	99.0	98.9	1.5	-5.0	0.3	-0.1	P
Slow 200 mSec	118.6	118.6	1.0	-1.0	0.3	0.0	P
Slow 2.0 mSec	99.0	99.0	1.0	-5.0	0.3	0.0	P
SEL 200 mSec	119.0	119.0	1.0	-1.0	0.3	0.0	P
SEL 2.0 mSec	99.0	99.0	1.0	-2.5	0.3	0.0	P
SEL 0.25 mSec	90.0	89.9	1.8	-5.0	0.3	-0.1	P

Test Passed

Overload indication - IEC 61672-3 Ed.2.0 Clause 20

	Measured (dB)	Tol. (+/-dB)	Uncert. (dB)	Result
Level difference of positive and negative pulses:	0.1	1.5	0.25	P

Positive 1/2 cycle 4 kHz. Overload occurred at: 139.3
Negative 1/2 cycle 4 kHz. Overload occurred at: 139.2
Test Passed

High level stability test - IEC 61672-3 Ed.2.0 Clause 21

Test signal: Sine wave at 1 kHz

Initial level (dB)	Final level (dB)	Diff. (dB)	Tol. value (dB)	Uncert. (dB)	Result
137.0	137.0	0.0	0.3	0.1	P

Test Passed

Long term stability test - IEC 61672-3 Ed.2.0 Clause 15

Test signal: Sine wave at 1 kHz

Time inteval (mm:SS)	StartLevel (dB)	StopLevel (dB)	Difference (dB)	Tolerence (dB)	Result
25:17	94.0	94.1	0.1	0.3	P

Test Passed
RIONL20.ini
RIONL20.ini

RB

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2017, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.46216

Instrument:	**Acoustical Calibrator**	*Date Calibrated:* **3/25/2021**	*Cal Due:* **3/25/2023**
Model:	**NC-73**	*Status:*	**Received** / **Sent**
Manufacturer:	**Rion**	*In tolerance:*	X / X
Serial number:	**10417585**	*Out of tolerance:*	
Class (IEC 60942):	**2**	*See comments:*	
Barometer type:		*Contains non-accredited tests:*	**__Yes _X_ No**
Barometer s/n:			
Customer:	**HMB Professional Engineers, Inc.**	*Address:*	**3 HMB Circle US 460, Frankfort, KY, 40601**
Tel/Fax:	**502-695-9800 / -9810**		

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 31, 2020	Scantek, Inc./ NVLAP	Jul 31, 2021
DS-360-SRS	Function Generator	61646	Dec 3, 2020	ACR Env./ A2LA	Dec 3, 2022
34401A-Agilent Technologies	Digital Voltmeter	MY41022043	Dec 04, 2020	ACR Env./ A2LA	Dec 04, 2021
HM30-Thommen	Meteo Station	1040170/39633	Dec 7, 2021	ACR Env./ A2LA	Dec 7, 2022
140-Norsonic	Real Time Analyzer	1403978	Mar 25, 2021	Scantek, Inc. / NVLAP	Mar 25, 2022
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4192-Brüel&Kjær	Microphone	2854675	Jan 15, 2021	Scantek, Inc. / NVLAP	Jan 15, 2022
1203-Norsonic	Preamplifier	21270	Jan 15, 2021	Scantek, Inc./ NVLAP	Jan 15, 2022

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Ronnie Buchanan	**Authorized signatory:**	William D. Gallagher
Signature	Ronnie Buchanan	Signature	William D. Gallagher
Date	3/25/2021	Date	3/29/2021

Results summary: Device was tested and complies with following clauses of mentioned specifications:

CLAUSES[1] FROM STANDARDS REFERENCED IN PROCEDURES:	MET[2]	NOT MET	COMMENTS
Manufacturer specifications			
Manufacturer specifications: Sound pressure level	X		
Manufacturer specifications: Frequency	X		
Manufacturer specifications: Total harmonic distortion	X		
Current standards			
ANSI S1.40:2006 B.3 / IEC 60942: 2003 B.2 - Preliminary inspection	X		
ANSI S1.40:2006 B.4.4 / IEC 60942: 2003 B.3.4 - Sound pressure level	X		
ANSI S1.40:2006 A.5.4 / IEC 60942: 2003 A.4.4 - Sound pressure level stability	-	-	
ANSI S1.40:2006 B.4.5 / IEC 60942: 2003 B.3.5 - Frequency	X		
ANSI S1.40:2006 B.4.6 / IEC 60942: 2003 B.3.6 - Total harmonic distortion	X		

1 The results of this calibration apply only to the instrument type with serial number identified in this report.

2 The tests marked with (*) are not covered by the current NVLAP accreditation.

Main measured parameters [3]:

Measured[4]/Acceptable[5] Tone frequency (Hz):	Measured[4]/Acceptable[5] Total Harmonic Distortion (%):	Measured [4]/Acceptable Level[5] (dB):
994.32 ± 0.99/1000.0 ± 20.0	0.18 ± 0.10/ < 4	93.89 ± 0.12/94.0 ± 0.75

3 The stated level is valid at measurement conditions.

4 The above expanded uncertainties for frequency and distortion are calculated with a coverage factor k=2; for level k=2.00

5 Acceptable parameters values are from the current standards

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.6 ± 0.4	100.32 ± 0.000	44.9 ± 0.4

Tests made with following attachments to instrument:

Calibrator ½" Adaptor Type: NC-71-S02
Other:

Adjustments: Unit was not adjusted.
Comments: The instrument was tested and met all specifications found in the referenced procedures.

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger.
Compliance with any standard cannot be claimed based solely on the periodic tests.

Measured Data: in Acoustical Calibrator Test Report # 46216 of one page.

Place of Calibration: Scantek, Inc.
6430 Dobbin Road, Suite C
Columbia, MD 21045 USA
Ph/Fax: 410-290-7726/ -9167
callab@scantekinc.com

Test Report No.:46216

Manufacturer:	**Rion**
Type:	**NC-73**
Serial no:	**10417585**

Customer:	**HMB Professional Engineers, Inc.**
Department:	
Address:	**3 HMB Circle US 460, Frankfort, KY, 40601**
Order No:	
Contact Person:	**Mark Gavula**
Phone No.:	**502-695-9800**
Fax No.:	**-9810**
eMail:	**mgavula@hmbpe.com**

Measurement Results:

	Level: (dB)	P. Stab : (dB)	Frequency: (Hz)	F. Stab : (%)	Distortion: (% TD)
1:	93.90	0.02	994.32	0.00	0.18
2:	93.89	0.01	994.33	0.00	0.18
3:	93.89	0.01	994.32	0.00	0.18
Result (Average):	**93.89**	**0.01**	**994.32**	**0.00**	**0.18**
Expanded Uncertainty:	0.12	0.02	0.99	0.01	0.10
Degree of Freedom:	>100	>100	>100	41	>100
Coverage Factor:	2.00	2.00	2.00	2.13	2.00

The stated levels are relative to 20µPa.

The stated level is valid at measurement conditions.
Reference microphone: 4192-2854675. Volume correction: 0.000 dB
Records:Y:\Calibration Lab\Cal 2021\RIONNC73_10417585_M1.nmf

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Environmental conditions:

Pressure:	Temperature:	Relative humidity:
100.315 ± 0.030 kPa	22.6 ± 0.4 °C	44.9 ± 0.4 %RH

Date of calibration: 3/25/2021
Date of issue: 3/25/2021

Supervisor : Steven E. Marshall
Measurements performed by:

RB

Ronnie Buchanan
Software version: 6.1T

Scantek, Inc.
6430 Dobbin Rd., Suite C, Columbia, MD 21045
Ph: 410-290-7726 eMail: callab@scantekinc.com