NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STATE TRANSPORTATION IMPROVEMENT PROGRAM (STIP) PROJECT I-5719

I-85 WIDENING FROM EXIT 17 (US 321) TO EXIT 27 (NC 273)

TRAFFIC OPERATIONS ANALYSIS TECHNICAL MEMORANDUM 2045 NO-BUILD AND BUILD PHASE III

FINAL

October 2021

Submitted to:

North Carolina Department of Transportation
Raleigh, North Carolina

Federal Highway Administration
Raleigh, North Carolina

Submitted for:

North Carolina Department of Transportation
Raleigh, North Carolina

Submitted by:

HNTB North Carolina, PC
343 E. Six Forks Road, Suite 200
Raleigh, NC 27609
NCBELS License #: C-1554

Elizabeth Harris
Elizabeth A. Harris 2021.10.13
17:06:27 -04'00'

EXECUTIVE SUMMARY

North Carolina Department of Transportation (NCDOT) State Transportation Improvement Program (STIP) Project I-5719 proposes to provide additional roadway capacity along the section of I-85 in Gaston County from US 321 in Gastonia to NC 273 in Belmont. A project study area was also defined that would satisfy the requirements of the National Environmental Policy Act (NEPA) and Interstate Access Report (IAR) requirements for FHWA.

An existing conditions analysis for the 2016 base year and a 2040 future year No-Build traffic capacity analysis were conducted as the first phase (Phase I) of the traffic analysis that will be incorporated into the overall IAR for I-5719. The existing I-85 corridor in eastern Gaston County currently experiences considerable peak hour congestion and queuing along various portions of I-85 in the project study area and at the interchange ramp terminals.

The Phase III analysis evaluates traffic operations for the 2045 Future Year No-Build and 2045 Future Year Build scenarios using the preferred interchange designs. The FREEVAL-NC analysis program is used to compare I-85 mainline operations for the 2045 Future Year No-Build and 2045 Future Year Build scenarios. The TransModeler microsimulation analysis software is used to analyze the 2045 Future Year Build operations for all intersections and freeway segments in the traffic study area.

Figure 1 in ***Appendix A*** shows the traffic analysis study area at each interchange y-line location along I-85, which includes the portion of the y-line near the interchange ramp termini and the I-85 freeway and ramps.

Analysis Methodology

The traffic simulation models were developed using the TransModeler microsimulation software, Version 4.0, Build 6275. The selected microsimulation software and analysis parameters were determined in collaboration with NCDOT and FHWA. HNTB created the 2045 Future Year Build microsimulation models using the 2040 Future Year No-Build model, which was based on the calibrated 2016 Base Year No-Build model. The y-line models developed during the Phase II and III analyses were merged into the 2040 Future Year No-Build model, and future year STIP projects within the study area were updated based on the latest design concepts available in the Spring of 2021.

The TransModeler Version 4.0 signal optimization function was used to evaluate optimal cycle lengths, splits, and offsets based on the projected volumes. All traffic signals were reoptimized through the development of corridor networks and the use of TransModeler signal optimization protocols.

The freeway segment analysis tool FREEVAL-NC, a North Carolina specific version of FREEVAL (FREeway EVALuation), provides freeway planning-level capacity analyses based on the *Highway Capacity Manual, Sixth Edition* (HCM6) for undersaturated and oversaturated conditions. This analysis used FREEVAL-NC 20210105 (Version 1.02) to perform the 2045 FYNB and FYB analyses. The initial procedure for freeway analysis input into FREVAL involved the segmentation of the 2045 FYNB and FYB I-85 freeway facility. After segmentation, geometric and traffic flow inputs were entered into FREEVAL-NC for each segment.

Measures of Effectiveness

TransModeler vehicular delay and density results for AM and PM peak hour time frames are converted to an "equivalent" simulated Level-of-Service (LOS_s) for freeway segments and intersections that correspond to a letter grade of LOS A through LOS F, as defined by the HCM6. In general, LOS D is the

minimum threshold for acceptable peak hour traffic operations on the freeway segments and study area intersections. Other microsimulation measure-of-effectiveness (MOE) results depend on the scope of the network being analyzed (network-wide, corridor, individual intersection) and conform to standard measures of operational performance (vehicular throughput, travel times, speeds, delays, queues). Details for each analysis type are included in **Table ES-1**.

Table ES-1. Microsimulation Capacity Analysis Details

Analysis Type	Details
Network	Created a TransModeler microsimulation model of the existing project study area freeway and arterial surface street system Adjusted the network to analyze Future Year 2045 Build with fiscally-constrained projects in the study area.
Corridor	Used TransModeler travel time and speed statistical output to determine directional traffic performance along I-85 for the 2045 Build scenario.
Freeway Segment	Segmented the I-85 network into separate basic freeway, merge, and diverge segments, calculated individual segment vehicular density and LOS_s per HCM methods in TransModeler, using the software's ability to delineate HCM-based freeway segmentation.
Signalized Intersection	The Intersection LOS, Lane Queue by Intersection, and Spillback Queue by Link reports were utilized to produce overall average vehicular control delay and LOS_s at all ramp terminal intersections, 95th percentile maximum queue lengths by lane group and spillback rate by lane group.

FREEVAL-NC evaluation of I-85 freeway segments is included in this traffic analysis study to serve as a deterministic confirmation of the microsimulation freeway analysis results. Based on the HCM, the freeway segment density and density-based Level of Service from FREEVAL-NC were reported based on the peak 15-minute period within the peak hour.

Traffic Volume Development

The *2045 Project-Level Traffic Forecast Report for STIP Project I-5719* developed by HNTB in July 2019 includes widening of I-85 as an 8-lane interstate from US 321 (Exit 17) to NC 273 (Exit 27) in Gaston County. The forecast included three scenarios: 2016 Base Year No-Build (unchanged from 2017 original I-5719 forecast), 2045 Future Year No-Build, and 2045 Future Year Build. The 2045 Future Year No-Build and Build volumes were used in the FREEVAL-NC analysis for Phase III. The 2045 Future Year Build volumes were developed into Origin-Destination Matrices to be input in TransModeler for the 2045 Future Year Build microsimulation traffic analysis.

The AM/PM peak raw volumes were converted from Average Annual Daily Traffic (AADT) data included in the 2045 No-Build and 2045 Build traffic forecast scenarios to peak hour turning movements utilizing the NCDOT Intersection Analysis Utility (IAU). The raw peak hour turning movements from the IAU output were then balanced throughout the network. The peak hour balanced volumes along I-85 and the interchange ramps were input into FREEVAL-NC as 15-min demands using the same demand adjustment factors as the TransModeler analysis. The 2045 Future Year Build balanced volumes used in the FREEVAL-NC analysis were also used as a basis for the 2045 Future Year Build origin-destination matrices developed for the 2045 Build TransModeler analysis. The O-D matrices developed from the IAU volumes were divided into three separate matrices, one for Passenger Vehicles (PC1, PC2, PC3, PU, B and M), one for Dual Trucks (ST) and one for Tractor Trailers/TTSTs (TT).

Microsimulation Calibration and Adjustments

The 2016 Base Year No-Build model was calibrated using TransModeler version 4.0 Build 6275, and this model was used as the base model for the 2040 Future Year No-Build network. The 2045 Future Year

Build analysis network was developed from the 2040 Future Year No-Build network. The *I-5719 Phase I Traffic Analysis Technical Memorandum* (October 2018) includes further details about the calibration methodology and results. No adjustments were made to the microsimulation parameters in the 2045 Future Year Build model.

2045 Future Year No-Build FREEVAL-NC Analysis

The operations on I-85 in the 2045 Future Year No-Build scenario were evaluated using FREEVAL-NC. In the off-peak directions along I-85, all the segments along I-85 northbound in the PM peak and I-85 southbound in the AM peak perform at LOS E or better.

The peak directions in the AM and PM periods experience poor LOS and congestion. I-85 northbound in the AM peak has 21 segments operating at LOS F, located between the NC 274 interchange and the lane addition between Exits 26 and 27. Twelve of the segments operating at LOS D, E or F also have a demand that is equal to or greater than the segment capacity.

Similarly, I-85 southbound in the PM peak has 7 segments operating at LOS F and 9 at LOS E, with congestion from US 321 upstream to NC 273. Fourteen of the segments operating at LOS D, E or F have a demand that is equal to or greater than the segment capacity.

2045 Future Year Build FREEVAL-NC Analysis

In the off-peak directions along I-85, all the segments within the I-5719 project limits along I-85 northbound in the PM peak and I-85 southbound in the AM peak perform at LOS D or better in the 2045 Future Year Build FREEVAL-NC Analysis.

The peak directions in the AM and PM periods experience some congestion and LOS E conditions near the eastern end of the I-5719 project due to minor congestion near the Sam Wilson Rd and I-485 interchanges.

I-85 northbound in the AM peak has 4 segments operating at LOS E, with three of those segments located between where the NC 273 on-ramp merges into I-85 northbound and the diverge to I-485 at the northern (eastern) end of the I-5719 project. Within the I-5719 project limits, the basic segment between the NC 7 (McAdenville Rd / N. Main St) and the SR 2093 (Belmont-Mt. Holly Rd) interchanges operates at LOS E in the AM peak on I-85 northbound.

Similarly, I-85 southbound in the PM peak has 3 segments operating at LOS E, with LOS E conditions existing at the merge with the I-485 and Sam Wilson Rd on ramps, the basic segment between the SR 2093 (Belmont-Mt. Holly Rd) and NC 7 (McAdenville Rd / N. Main St) interchanges, and the diverge to the US 321 northbound off-ramp. All freeway segments in the 2045 FYB FREEVAL-NC analysis have a demand that is less than the segment capacity.

Comparing the 2045 Future Year No-Build and Future Year Build FREEVAL-NC freeway segment density and LOS results, the I-5719 project widening and interchange improvements is anticipated to improve freeway operations along I-85 in both directions. **Table ES-2** shows a decrease from 28 segments between the AM and PM peaks operating at LOS F in the 2045 FYNB scenario to zero segments at LOS F in the 2045 FYB scenario. The segments operating in the AM and PM peaks at LOS E decrease from 15 in the 2045 FYNB scenario to seven in the 2045 FYB scenario.

Table ES-2: 2045 FYNB / 2045 FYB I-85 FREEVAL-NC Analysis LOS Summary

Analysis Year	Scenario	Number of Freeway Segments Operating at Given LOS During AM and PM Peak Hours					
		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
AM Peak							
2045	Future Year No-Build	2	11	28	23	5	21
2045	Future Year Build	3	8	47	19	4	0
PM Peak							
2045	Future Year No-Build	0	15	28	30	10	7
2045	Future Year Build	0	15	43	20	3	0

2045 Future Year Build TransModeler Analysis

Table ES-3 presents travel time and average speed results for operations along I-85 for vehicles making a complete trip through the study area along the interstate corridor. Corridor speeds for I-85 show decreases for southbound I-85 in the PM peak hour, but traffic flows in both directions experience near free-flow speed conditions for both peak hours. The posted speed limit on I-85 in the project limits is 60 mph.

Table ES-3: Corridor Measures of Effectiveness

2045 Future Year Build	Corridor	Direction of Travel		MOE			
				Travel Time (min)		Speed (mph)	
		From	To	AM	PM	AM	PM
	I-85 Northbound	NC 274	NC 273 (Beatty Road)	13.26	12.84	58.6	60.5
	I-85 Southbound	NC 273 (Beatty Road)	NC 274	13.27	13.64	58.6	56.9

Table ES-4 provides the 2045 Build 95th percentile worst result overall intersection control delay results for all ramp termini within the traffic study area. The ramp termini that are **bolded** in **Table ES-3** are within the I-5719 project limits. LOSs equivalents for each peak hour are also given. All ramp termini within the I-5719 project limits operate at an overall intersection LOSs D or better in the 2045 FYB scenario.

The overall intersection delay reported in **Table ES-4** for the Diverging Diamond interchange ramp terminals at NC 279 and NC 273 have been calculated using a weighted average of the lane group delay for all signalized lane groups at each ramp terminal.

Overall intersection LOSs and Delay Data is not reported for unsignalized intersections per the HCM6. At the unsignalized intersection at SR 2093 (Belmont-Mt Holly Rd) and the I-85 northbound off-loop, the right turn from the I-85 northbound off-loop to SR 2093 northbound operates at LOSs E in the PM peak, with a 95th queue length of 79 feet and a 0% spillback rate. The maximum queue length observed in the PM peak was 294 feet, which is less than the off-loop length of 525 feet.

Table ES-4: 2045 Build Intersection Control Delay Results – Ramp Terminal Intersections

	ID	Intersection Name	95th % Worst Control Delay (sec/veh)		Equivalent LOSs	
			AM	PM	AM	PM
2045 Future Year Build	2	NC 274 & I-85 SB Ramps	23.2	25.9	C	C
	3	NC 274 & I-85 NB Ramps	7.1	11.0	A	B
	5	SR 1327 (Fairview Dr) / W Davidson Ave & I-85 SB Ramps	13.7	12.9	B	B
	6	SR 1327 (Fairview Dr) / W Davidson Ave & I-85 NB Ramps	19.4	15.2	B	B
	9	**US 321 & I-85 Fly-under Ramp**	25.8	21.5	C	C
	10	**US 321 & I-85 SB Ramps**	6.5	5.5	A	A
	11	**US 321 & I-85 NB Off-Ramp**	9.3	8.3	A	A
	14	**NC 7 (Ozark) & I-85 SB Ramps**	16.6	14.1	B	B
	15	**NC 7 (Ozark) & I-85 NB Ramps**	9.1	6.8	A	A
	21	**NC 279 (New Hope) & I-85 SB Ramps**	29.7	36.6	C	D
	22	**NC 279 (New Hope) & I-85 NB Ramps**	23.5	38.7	C	D
	30	**SR 2200 (Cox) & I-85 SB Ramps**	30.2	29.5	C	C
	31	**SR 2200 (Cox) & I-85 NB Ramps**	26.4	21.0	C	C
	37	**SR 2329 (S Main) & I-85 SB Ramps**	10.3	10.3	B	B
	38	**SR 2329 (S Main) & I-85 NB Ramps**	8.1	8.6	A	A
	49	**NC 7 (McAdenville) & I-85 SB Ramps**	15.1	23.3	B	C
	50	**NC 7 (Main) / NC 7 (McAdenville) & I-85 NB Ramps**	32.0	41.3	C	D
	55	**SR 2093 (Belmont - Mt Holly) & I-85 SB Ramps**	27.8	31.5	C	C
	56	**SR 2093 (Belmont - Mt Holly) & I-85 NB Ramp** *	N/A	N/A	N/A	N/A
	57	**SR 2093 (Belmont - Mt Holly) & I-85 NB Loop** *	N/A	N/A	N/A	N/A
	70	**NC 273 & I-85 SB Ramps**	29.8	30.3	C	C
	71	**NC 273 & I-85 NB Ramps**	35.0	30.8	C	C
	76	SR 1625 (Sam Wilson Rd) & I-85 SB Ramps	14.0	29.4	B	C
	77	SR 1625 (Sam Wilson Rd) & I-85 NB Ramps	10.1	19.8	B	B

BOLD/ITALIC = Intersection/Approach/Movement that has Operational Deficiencies (HCM Equivalent LOSs E or F)
* - Unsignalized Intersection – LOSs/Delay Data not reported (N/A) for overall intersection or intersection approach
Note: The I-5719 traffic analysis study area includes the eighteen (18) ramp terminal intersections along I-85 within the project (in **BOLD**) and six (6) neighboring ramp terminal intersections.

Table ES-5 summarizes the 2045 FYB TransModeler freeway segment analysis results along I-85 northbound and southbound. All the segments within the I-5719 project limits along I-85 southbound in the AM peak perform at LOSs D or better. In the PM peak, the basic segment between the ramps at Exit 26, NC 7 (McAdenville), is the only freeway segment that does not operate at LOSs D or better in the I-5719 project limits along I-85 southbound. This segment operates at a 95th percentile worst freeway density of 35.0 pc/mi/ln, narrowly exceeding the 35 pc/mi/ln density threshold for LOSs E operations.

I-85 northbound in the AM peak has three segments operating at LOSs F and one at LOSs E, located between where the NC 273 on-ramp merges into I-85 northbound and the diverge to I-485 at the northern (eastern) end of the I-5719 project. In the PM peak, I-85 northbound has one segment operating at LOSs

F and three at LOSs E in this same area. In both peak hours, all freeway segments within the I-5719 project limits along I-85 northbound operate at LOSs D or better in the 2045 FYB scenario.

Table ES-5: 2045 Future Year Build TransModeler Freeway Operations LOSs Summary

	Corridor	Number of Freeway Segments Operating at Given LOSs During AM and PM Peak Hours					
		LOSs A	LOSs B	LOSs C	LOSs D	LOSs E	LOSs F
2045 Future Year Build	**AM (7:15 – 8:15)**						
	I-85 Northbound	0	7	17	14	1[a]	3[a]
	I-85 Southbound	3	7	28	2	0	0
	PM (16:30 -17:30)						
	I-85 Northbound	1	17	19	1	3[a]	1[a]
	I-85 Southbound	0	5	12	22	1[b]	0

[a] *The I-85 Northbound segments operating at LOSs E or F in 2045 are outside of the I-5719 project limits and result from congestion due to vehicles maneuvering to exit I-85 NB to go to I-485*
[b] *The I-85 Southbound segment operating at LOSs E in the PM Peak is within the I-5719 project limits.*

Crash Analysis

As part of the traffic analysis, HNTB conducted a section crash analysis along the I-85 corridor from 3,500 feet west of US 321 (Chester Street) in Gaston County to I-485 (Western Loop) in Mecklenburg County. The analysis included mainline crashes and excluded crashes that occurred on ramps, on side streets, or at ramp intersections.

There were 5,237 total crashes reported along the I-85 corridor between the designated study limits over the five-year analysis period (6/1/2016 to 5/31/2021). In this 13.85-mile section, crash types were primarily rear end crashes (2,656) or lane departure crashes (1,341), which include run-off road and sideswipe crashes. There were 12 fatal crashes and 25 serious injury crashes (Class A) reported. This section also experienced one (1) head-on collision involving a wrong-way drivers resulting in a fatal injury. The crash rates along I-85 in the project study area are all higher than the statewide critical crash rates except for fatal crashes.

Three (3) curves between the interchanges of US 321 (Chester Street) and NC 7 (Ozark Avenue) were identified as potentially having horizontal stopping sight distance (HSSD) deficiencies. A special analysis of the section between these two interchanges was conducted to identify if any crash patterns existed that could possibly be attributed to the HSSD in the curves.

There were 652 total crashes reported along the I-85 segment between US 321 and NC 7 over the five-year analysis period (6/1/2016 to 5/31/2021). In this 1.98-mile segment, 204 crashes (31%) occurred in one of the three (3) curves, which make up approximately 1.08 miles of the total segment length (52%). Of the 204 identified curve crashes, crash types were primarily lane departure crashes (160) or rear end crashes (34). The head-on crash involving a wrong way driver that resulted in a fatal injury mentioned previously occurred in the curve just east of US 321 (Chester Street).

Based on the results, it appears crash patterns do exist in the curves, as 31% of total crashes are occurring in one of the three curves and 19% are occurring specifically in the curve just west of Modena Street. It also appears that HSSD does impact the curves as well, as each of the curves sees approximately twice as many crashes or more in the direction of concern.

TABLE OF CONTENTS

APPENDICES

A. Figures
B. I-5719 Project Meeting Minutes
C. Traffic Forecast Diagrams *(Digital)*
D. 2045 No-Build and Build Peak Hour Breakouts *(Digital)*
E. 2045 No-Build and Build Volume Development Methodology
F. 2045 Build ODME Matrices Volume Development Spreadsheet *(Digital)*
G. 2045 No-Build FREEVAL-NC Output Reports
H. 2045 Build FREEVAL-NC Output Reports
I. I-5719 I-85 Crash Analysis *(Digital)*

LIST OF FIGURES

LIST OF TABLES

Page

1 PROJECT BACKGROUND

State Transportation Improvement Project (STIP) Project I-5719 proposes to widen I-85 from US 321 to NC 273 in Gaston County. The traffic analysis study area includes the I-85 corridor from Exit 14 (NC 274) in Gaston County to Exit 30 (I-485) in Mecklenburg County. While I-85 is signed as a north/south interstate route, I-85 runs east/west through the analysis study area.

1.1 Project Purpose

For the purposes of the environmental documentation, it was decided during project scoping through coordination with NCDOT and the Federal Highway Administration (FHWA) that the base year scenario would use a base year of 2016 and the future year scenarios would be for the year 2040. In this meeting held on August 10, 2016, a project study area was also defined that would satisfy the requirements of the National Environmental Policy Act (NEPA) and Interstate Access Report (IAR) requirements for FHWA. An existing conditions analysis for the 2016 base year and a 2040 future year No-Build traffic capacity analysis were conducted as the first phase (Phase I) of the traffic analysis that will be incorporated into the overall IAR for I-5719. The existing I-85 corridor in eastern Gaston County currently experiences considerable peak hour congestion and queuing along various portions of I-85 in the project study area and at the interchange ramp terminals.

The Phase II analysis was limited to evaluation of 2040 Build conditions for various interchange form options along the I-85 corridor for the I-5719 project, as discussed and agreed upon by HNTB and NCDOT in a project scoping meeting held on January 22, 2018. A separate TransModeler microsimulation model was developed for each y-line and design option, resulting in a total of 18 models developed for the 2040 Build interchange form analysis.

In 2019, the project traffic forecast was updated to have a future year of 2045 to accommodate a later construction date for the project. The *2045 Project-Level Traffic Forecast Report for STIP Project I-5719* developed by HNTB in July 2019 includes widening of I-85 as an 8-lane interstate from US 321 (Exit 17) to NC 273 (Exit 27) in Gaston County. The forecast included three scenarios: 2016 Base Year No-Build (unchanged from 2017 original I-5719 forecast), 2045 Future Year No-Build, and 2045 Future Year Build. The Phase II analyses along with additional analyses using the 2045 Future Year Build volumes were used to inform the selection of preferred interchange forms at each project interchange.

The Phase III analysis evaluates traffic operations for the 2045 Future Year No-Build and 2045 Future Year Build scenarios using the preferred interchange designs. The FREEVAL-NC analysis program is used to compare I-85 mainline operations for the 2045 Future Year No-Build and 2045 Future Year Build scenarios. The TransModeler microsimulation analysis software is used to analyze the 2045 Future Year Build operations for all intersections and freeway segments in the traffic study area.

The purpose of the proposed improvements to I-85 is to reduce congestion and improve mobility in this growing area of Gaston County. The project purpose is based on the following needs identified within the project study area:

- Need to address capacity deficiencies and improve east-west mobility in central/eastern Gaston County.
- Need to improve traffic flow on I-85 for high-speed, regional travel.
- Need to address roadway deficiencies, including substandard design elements.
- Another desirable outcome for the project is to enhance the overall travel safety in the project study area.

1.2 Project Location

The traffic analysis study area includes the interchanges that comprise the I-85 corridor from Exit 17 (US 321) to Exit 27 (NC 273) in Gaston County. While I-85 is signed as a north/south interstate route, I-85 runs east/west through the analysis study area. Each interchange y-line has been assigned a number Y1-Y8 for this project as a reference:

- Y1: Exit 17: US 321 (North Chester Street) & I-85
- Y2: Exit 19: NC 7 (East Ozark Avenue) & I-85
- Y3: Exit 20: NC 279 (New Hope Road) & I-85
- Y4: Exit 21: SR 2200 (Cox Road) & I-85
- Y5: Exit 22: SR 2329 (South Main Street) & I-85
- Y6: Exit 23: NC 7 (McAdenville Road) & I-85
- Y7: Exit 26: SR 2093 (Belmont-Mt. Holly Road) & I-85
- Y8: Exit 27: NC 273 (Beatty Drive) & I-85

Figure 1 in ***Appendix A*** shows the traffic analysis study area at each interchange y-line location along I-85, which includes the portion of the y-line near the interchange ramp termini and the I-85 freeway and ramps. ***Appendix A*** contains all figures described in this report.

1.3 Project Coordination

The following key coordination activities occurred during the development of this memorandum:

- A project meeting with NCDOT Division 12, NCDOT Project Management Unit, NCDOT Roadway Design, NCDOT Rail, NCDOT Congestion Management and FHWA was held on February 27, 2020 to discuss the mainline widening of I-85 and the design options at each interchange, overpass, and intersection. Design options were chosen at Exits 17 (US 321, I-5000 design with I-85 NB fly-under ramp widened to two lanes), 19 (NC 7 Ozark, improve existing), and 27 (NC 273, diverging diamond interchange).
- A project meeting with NCDOT Division 12, NCDOT Project Management Unit, NCDOT Roadway Design, NCDOT Rail, NCDOT Congestion Management and FHWA was held on May 18, 2021 to discuss the design options at the five remaining interchange locations along the project. Design options were chosen at Exits 20 (NC 279, diverging diamond interchange with full movement intersection at Remount Rd), 21 (Cox Rd, improve existing), 22 (S Main St, improve existing with roundabouts), 23 (improve existing with tight diamond on I-85 SB side), and 26 (Montcross option with tight diamond on I-85 SB side and roundabouts at Belmont Abbey College entrances).

The meeting minutes for these two project meetings are included in ***Appendix B***.

1.4 Field Visits

The initial field visit by HNTB to support the Phase I traffic analysis occurred on September 7-8, 2016 during the traffic volume data collection for the *2016/2040 Project-Level Traffic Forecast for STIP I-5719*. While mainline I-85 volumes were being collected for the forecast, HNTB completed floating car runs during the AM and PM peak periods. The data from these floating car runs were used in the Phase I traffic analysis to determine corridor travel times to use for model calibration.

HNTB also visited the project site during the AM and PM peak periods on August 16-17, 2017 to observe traffic patterns, note any congestion and verify that collected data is consistent with actual operations.

2 DESCRIPTION OF SCENARIOS ANALYZED

This traffic analysis study includes the following scenarios:

1. 2045 Future Year No-Build (FYNB)
2. 2045 Future Year Build (FYB)

2.1 2045 Future Year No-Build Network

Traffic demand for the 2045 Future Year No-Build (FYNB) scenario was based upon the 2045 Future Year No-Build scenario included in the *2045 Project-Level Traffic Forecast Report for STIP Project I-5719*. ***Appendix C*** contains the 2045 FYNB and 2045 FYB scenario traffic forecast diagrams. The 2045 FYNB scenario assumes that the I-5719 project is not constructed, but that all other fiscally constrained projects in the area (as shown in the Gaston-Cleveland-Lincoln Metropolitan Planning Organization [GCLMPO] 2045 MTP dated March 2018) would be constructed by the year 2045.

The following STIP and local transportation projects are located within the project study area limits. Since the FYNB analysis in this memorandum is only concerned with the I-85 mainline, the projects expected to affect mainline laneage are show in bold text and the projects not expected to affect the mainline are shown in gray:

- **STIP I-5985B, I-85 widening from US 321 (Exit 17) to US 74 (Exit 10).**
- **STIP I-5000, Interchange modification (fly-under) at I-85 and US 321 (Exit 17).**
- STIP I-5713, Interchange modification at I-85 and SR 2200 (Cox Rd) (Exit 21).
- STIP U-6044, Cox Rd improvements, possible grade separation at US 29-74 and Cox Rd.
- STIP U-6043, US 29-74 widening eastbound direction from two to three lanes from SR 2200 (Cox Road) to 400 ft. east of Lineberger Rd
- STIP U-5959, Intersection Improvements at US 29-74 and NC 273 (Park St)
- Gaston Mall Drive Extension from Cox Rd to US 29-74.
- Spot Safety project 12-17-204, Signal improvements (addition of flashing yellow arrow) at SR 2200 (Cox Rd) and Aberdeen Blvd.
- Spot Safety project 12-15-200, Westbound left turn lane storage extension at US 29-74 and SR 2329
- WBS 47859 project, Signalization of SR 2093 (Belmont-Mt Holly Rd) and Belmont Abbey College Entrance intersection.
- **Elimination of I-85 northbound weigh station just east of Catawba River, between exits 27 and 29.**
- **HPR9 – New interchange at I-85 and Davidson Ave, with new two-lane alignment connecting Tulip Drive to Fairview Dr**
- HPS1 – Cox Rd at I-85 SB Ramps – add southbound right turn lane and signalization timing improvements
- HPD23 – Aberdeen Blvd Extension – extend four-lane divided Aberdeen Blvd from Cox Rd to Main St in Lowell
- HPD 28 – Lineberger Rd Extension – extend Lineberger Rd as a three-lane facility from Franklin Square to Aberdeen Blvd Extension, including grade separation over I-85.
- HPD3 – Redbud Dr Connector Improvements – Traffic Circles, grade separation and ramp relocation at Redbud Dr

- HPS3 – S Main St / I-85 southbound ramp improvements – restripe (and add pavement/minimize concrete median) for a two-lane westbound approach with exclusive left turn lane and shared left/right lane
- HPS2 - S Main St / I-85 eastbound ramp improvements – restripe (and add pavement/minimize concrete median) for a two-lane westbound approach with exclusive left turn lane and shared left/right lane
- HPD9 – 3rd St Extension – Extend 3rd St as a two-lane facility from NC 7 (Main St) to NC 7 (First St). This includes a traffic circle at NC 7 (First St) with a connection to Potts St and improvements to Ash St.
- HPR21 – Intersection improvements at NC 273 and Beatty Rd. Turn lanes on every approach.
- U-6138 – Add southbound RT lane at NC 279 (New Hope Rd) and US 29/74.
- **I-6016 – Improvements to I-85 and I-485 system interchange west of Charlotte (Exit 30).**

For the HPR9 (Davidson Ave Interchange), the future interchange form was assumed to be a diamond, and the ramp locations were estimated. The I-85 northbound weigh station east of the Catawba River has been removed, while the weigh station along I-85 southbound remains. The I-85 southbound segment between the weigh station and NC 273 (Beatty Drive) is technically a weaving segment; however, the length of this weaving segment is at or very near the maximum weaving length for the segment to be operating as a weaving segment. As a result, this area has been analyzed as successive basic segments in FREEVAL-NC and TransModeler. In the FREEVAL-NC analysis, the weigh station ramps were not included. **Figures 2.1** and **2.2** present the 2045 FYNB laneage and segment identification scheme used in the FREEVAL-NC analysis.

2.2 2045 Future Year Build Network

Traffic demand for the 2045 Future Year No-Build (FYB) scenario was based upon the 2045 Future Year Build scenario included in the *2045 Project-Level Traffic Forecast Report for STIP Project I-5719*. The 2045 FYB scenario assumes that the I-5719 project is constructed as well as the other fiscally constrained projects in the area listed in Section 2.1. **Figures 4.1** and **4.2** present the 2045 FYB FREEVAL-NC analysis laneage and segment identifiers.

The 2045 FYB network in FREEVAL-NC and TransModeler was based on the functional roadway designs for the selected design option at each interchange. Auxiliary lanes on I-85 exist in the 2045 FYB network between NC 7 (Ozark) and NC 279 (New Hope), NC 279 (New Hope) and Cox Rd, S Main St and NC 7 (McAdenville), and Belmont Mt-Holly Rd and NC 273 interchanges. These auxiliary lane locations concur with either the roadway designs or were agreed to by the Project Team due to the proximity of the acceleration and deceleration lanes between these interchanges. The auxiliary lane between Belmont Mt-Holly Rd and NC 273 interchanges was not committed to until the designs selected for these two interchanges were put side by side and the acceleration and deceleration lanes between these interchanges were close enough for the Project Team to recommend auxiliary lanes on both directions of I-85 between Exits 26 and 27.

3 ANALYSIS METHODOLOGY

The Phase III analysis evaluates traffic operations for the 2045 Future Year No-Build and 2045 Future Year Build scenarios using the selected interchange designs. The TransModeler microsimulation analysis software was used to analyze the 2045 Future Year Build operations for all intersections and freeway segments in the traffic study area. The FREEVAL-NC analysis program was used to compare I-85 mainline operations for the 2045 Future Year No-Build and 2045 Future Year Build scenarios.

3.1 2045 Future Year Build TransModeler Model Development

The traffic simulation models were developed using the TransModeler microsimulation software, Version 4.0, Build 6275. The selected microsimulation software and analysis parameters were determined in collaboration with NCDOT and FHWA. HNTB created the 2045 Future Year Build microsimulation models using the 2040 Future Year No-Build model, which was based on the calibrated 2016 Base Year No-Build model. The y-line models developed during the Phase II and III analyses were merged into the 2040 Future Year No-Build model, and future year STIP projects within the study area were updated based on the latest design concepts available in the Spring of 2021.

3.1.1 Network Geometry

The rolling terrain set of default NCDOT TransModeler parameters were selected for this model, based on the *I-5719 Geometric Conditions Tech Memorandum* by HNTB on 2/16/2016. This memo stated that "the terrain along I-85 is relatively rolling throughout the corridor," with maximum vertical grades of 4 percent. Elevations were assigned based on digital elevation models. **Figures 6.1-6.3** present the laneage analyzed in the 2045 FYB TransModeler microsimulation model.

The following modifications were made to the 2045 Build network geometry:

- The SR 1327 (Fairview Dr) and W. Davidson Ave interchange was added to the network. This interchange is included in the GCLMPO 2045 MTP. A diamond service interchange with typical geometry was assumed since there is no design for this interchange currently. Signals were added at each ramp terminal along with exclusive turning lanes based on the turning movements and signal operations.
- The Phase II model at the US 321 interchange was updated with realigned ramps based on the 2019 roadway design file, and the fly-under ramp to I-85 southbound was widened from one to two lanes.
- The STIP U-5959 project was not included at NC 279 (New Hope Rd) and US 29/74 per guidance from Division 12.
- The Duhart and Eastridge Mall 1 driveway connections to NC 279 were removed as part of the diverging diamond concept design. These boundary nodes were connected through existing roadways to access NC 279 via the signalized intersection at Pearl/Eastridge Mall 2 and NC 279 at Intersection 23.
- The laneage at the intersection of Cox Rd and N Aberdeen Blvd (Intersection 28) was updated and the signal phasing revised to enable all the entering demand from N Aberdeen Blvd to load into the network. The increase in traffic & turning movements to/from N Aberdeen Blvd are due to the future Lineberger development.
- At Intersection 31 (Cox Rd at I-85 northbound ramps) the dual southbound left was reintroduced to the 2045 Build design since the I-85 overpass at Cox Rd can be widened to accommodate seven lanes if necessary. The southern leg at intersection 30 (Cox Rd at I-85 southbound ramps)

is a six-lane cross-section in the model but can be widened to seven to add a full storage lane for the southbound left turn at Intersection 31 if required.

- The storage for the northbound left turn at Intersection 30 (Cox Rd at I-85 southbound ramps) has been extended south (upstream) beyond Intersection 31 and into the wide median to accommodate longer queues.
- The STIP U-6044 project has been incorporated at US 29/74 and Cox Rd (Intersections 33 and 34). The concept has a U-turn at Intersection 34 to accommodate the northbound left turns at Node 908. This concept replaces the previous U-6044 concept modeled in the 2040 No-Build TransModeler model (Phase I) which provided a grade separation for the US 29/74 through movements.
- Turn Prohibitions were added at SR 2329 (S Main St) I-85 northbound roundabout (Intersection 38) to prevent vehicles making the northbound right turn from circulating in the roundabout to make the northbound right turn movement.
- Roundabout locations along SR 2329 (S Main St) were placed based on assumed locations since a roadway design for this section has not been developed yet.
- The STIP U-6141 project is included in the model with an at-grade quadrant concept.
- Intersection 39 (Crausby Ave and SR 2329) is modeled as a right in, right out (RIRO) intersection. Vehicles traveling north on SR 2329 can access Crausby Ave via the roundabout at Intersection 38. Left turns from Crausby to reach I-85 are assumed to take a path outside of the network.
- An exclusive southwest-bound right turn lane was added at Intersection 44 to accommodate increased volumes from the Lineberger development that was causing long queues.
- An exclusive southbound left turn lane was added on Power Dr at Intersection 48.
- The project team decided in the May 2021 meeting to have the two intersections on Belmont-Mt Holly Rd that provide access to Belmont Abbey College be roundabouts and to signalize the I-85 ramp terminals at Exit 26 (Belmont-Mt Holly Rd).
- At Intersection 56 (I-85 northbound ramp to Belmont-Mt Holly Rd southbound) the ramp was brought closer to I-85 and yield control was added per a request from NCDOT. This would eliminate the added southbound lane through Intersections 56 and 57 that previously allowed this ramp to free flow onto Belmont-Mt Holly Rd southbound.
- Two lanes northbound on Belmont Mt-Holly Rd between intersections 58 and 57 have been added to improve traffic operations at Intersection 58. The I-85 northbound loop ramp at Intersection 57 was converted from a free-flow add lane to stop control.
- Intersections 64 and 65 along the former alignment of NC 7 (N Main St) were added to the model based on the roadway design. These intersections provide access to commercial/retail sites and Caldwell Farm Rd.
- The reduced conflict intersection (RCI) concept, functioning as a Michigan Left, was added at the intersection of NC 7 (N Main St) and US 29/74 (Intersections 60-62) as part of the STIP U-5800 project.
- Access for the CaroMont medical development was added at Intersections 68 and 69 along NC 273 north of the I-85 interchange. NCDOT has discussed allowing emergency vehicles only to make the northbound left turn at Intersection 69 per future arrangements with CaroMont.
- The diverging diamond interchange at NC 273 and I-85 is modeled with a six-lane overpass instead of the original eight lane overpass in the roadway designs. This change was made so

NCDOT can evaluate the traffic operations at the interchange if the existing I-85 overpass is maintained.

- The diverging diamond concept at NC 273 and I-85 prevents southbound NC 273 vehicles from making a southbound left turn onto Browntown Rd (near Intersection 72). The vehicles travelling southbound on NC 273 that desire to make a left turn onto Browntown are assumed now to make a southbound left turn at Intersection 75 to reach Browntown Rd via US 29/74. The intersection of Browntown Rd and US 29/74 is not included in the model.
- The future year laneage at NC 273 and US 29/74 (Intersection 75) was maintained from the earlier 2040 No-Build model (Phase I) since the STIP U-5959 project has not moved forward at this time and may only consist of adding some turn lanes.
- The acceleration lane from the I-85 SB Weigh Station continues over the Catawba River as an auxiliary lane in the 2045 Build model until it is dropped at the I-85 SB off ramp to NC 273. Because the distance between the gores are over 4,000 feet apart, which is near the maximum weaving length for this configuration, this segment of I-85 southbound is evaluated as a basic segment instead of a weave.
- The latest express design iteration of the I-6016 project (May 2021) has been included in the 2045 Build model.

3.1.2 Traffic Control

The signalized control at each signalized intersection was set up to conform to the NCDOT Congestion Management Simulation Guidelines effective October 2016. The TransModeler Version 4.0 signal optimization function was used to evaluate optimal cycle lengths, splits, and offsets based on the projected volumes. Each signal that is part of a coordinated system or within one-half mile of an adjacent signal was coordinated and the offsets optimized in TransModeler utilizing the corridor optimization feature. The turning movement table (.bin file) attached to the 2045 FYB model is derived from the AM and PM peak hour demand from the OD matrices. The turning movement volumes are shown in **Figures 7.1-7.3**. These turning movements were used to optimize isolated signals.

The following signal modifications were made during the analysis of the 2045 Build Scenario:

- Min Gap and Extension increased to 10 seconds for Phase 4 at Intersection 2 to limit Phase 4 from gapping out, which was resulting in queues spilling back onto I-85 southbound in the PM peak.
- The cycle length at Intersection 34 was set to be half of the cycle length at Intersection 33 to reduce the delay for the U-turning movement at Intersection 34.
- Intersection 35 functions as an isolated signal due to the surrounding roundabouts and has the same cycle length as Intersections 44 and 46 along Main St (Lowell).
- Intersection 43 was converted from an unsignalized to signalized intersection to allow vehicles on Phillips St to be able to turn left or right onto NC 7. Volumes on Phillips St increased in the 2045 Build scenario due to the inclusion of the Lineberger development in the 2045 MTP and traffic demand model.
- A change in turning movement distribution and increased volumes at Intersection 44 due to the Lineberger development resulted in very long queues that were metering traffic. Protected left turn phases for phases 5 and 7 were added at Intersection 44 to improve traffic operations.
- Similarly, Intersection 46 had similar operational issues as Intersection 44, with long queues that were metering traffic that was headed for the McAdenville interchange area and I-85. Protected left turn phases were added to Phases 1 and 3 at Intersection 46.

- Intersections 49 and 50 operate on a single signal controller with a cycle length of 120 seconds due to the tight spacing between the interchange ramp terminals.
- The I-85 northbound loop ramp at Intersection 57 was converted from a free-flow add lane to stop control, with Intersection 58 set up as an unsignalized intersection.
- Access to the CaroMont development along NC 273 includes an unsignalized RIRO intersection at Intersection 69 and a fourth leg to the existing signal at Intersection 68, with accommodations for northbound U-turns due to access restrictions at Intersection 69 and the diverging diamond interchange with I-85.
- At Intersection 69 access to Caldwell Drive is unsignalized with left in, right in, right out access in the model.
- A half-signal was added at intersection 72 (NC 273 at Browntown Rd) to allow the right turns onto NC 273 from Browntown Rd to find sufficient gaps on NC 273 and reduce queue blockage at the I-85 northbound on-ramp from NC 273 northbound.

3.2 FREEVAL-NC Analysis

The freeway segment analysis tool FREEVAL-NC, a North Carolina specific version of FREEVAL (FREeway EVALuation), provides freeway planning-level capacity analyses based on the *Highway Capacity Manual, Sixth Edition* (HCM6) for undersaturated and oversaturated conditions. This analysis used FREEVAL-NC 20210105 (Version 1.02) to perform the 2045 FYNB and FYB analyses. The initial procedure for freeway analysis input into FREVAL involved the segmentation of the 2045 FYNB and FYB I-85 freeway facility. Segments fall into the following categories defined in the *Highway Capacity Manual, Sixth Edition (HCM6)* – basic freeway segments, merge areas, diverge areas, overlap areas and weaving segments. After segmentation, geometric and traffic flow inputs were entered into FREEVAL-NC for each segment.

For a basic freeway segment, inputs and typical values used in this analysis include:

- The number of lanes varies depending on existing geometrics and planned MTP improvements to existing freeway facilities.
- The terrain type is assumed to be "*Rolling*" for this area per the *I-5719 Geometric Conditions Technical Memorandum*, HNTB, February 2016.
- The Base Free Flow Speed was assumed to be 5 mph greater than posted speed limits.
- The heavy vehicle percentages were calculated from the Traffic Forecast as being equal to the percent duals plus the percent TTST divided by two for all the peak hour mainline study area entry segments only. The heavy vehicle percentages for all other mainline segments were calculated based on on/off-ramp percentages.
- FREEVAL-NC balances heavy vehicle percentages based on first segment input and downstream ramp percentages. Large amounts of TTSTs can have a substantial impact on LOS depending on how these values are input. Ramp heavy vehicle percentages were averaged from their y-line forecast values.
- Segment Lengths were based on the FREEVAL-NC segmentation database for I-85 and confirmed by aerial photography or functional designs between upstream/downstream merge/diverge points.
- The location of Ramp Relative to Freeway was set to Right for all segments.
- Acceleration/Deceleration Lane Lengths were based on the FREEVAL-NC segmentation database for I-85 and confirmed by aerial photography or functional designs.
- The Free Flow Speeds on Ramps were set to 45 mph for cloverleaf/flyover on/off ramps/diamond on/off ramps and 25 mph for loop ramps.

4 MEASURES OF EFFECTIVENESS

4.1 Level of Service Description

Evaluating traffic operations on surface streets and uninterrupted flow freeway facilities is generally done by the determination of LOS criteria. The LOS on a freeway segment, arterial corridor, or individual intersection correlates qualitative aspects of traffic flow to quantitative terms. This enables transportation professionals to take the qualitative issues, such as congestion and substandard geometrics, and translate them into measurable quantities, such as operating speeds, flow densities, and vehicular delays. The HCM 6 characterizes LOS by letter designations A through F. LOS A represents ideal low-volume traffic operations, and LOS F represents over-saturated, high-volume traffic operations.

LOS for intersections is determined by average delay per vehicle, while LOS for freeway facilities is primarily determined by vehicular density of a defined freeway segment, merge/diverge area or weaving section. LOS letter designations and criteria for arterial intersections (seconds of delay per vehicle) and for freeway facilities (average density in passenger cars per mile per lane (pc/mi/ln)) are described in **Table 4-1**. The term LOSs is used in this study to denote that the LOS is a simulation-based LOS result. If a segment or intersection operated at LOSs E or LOSs F, it was boldfaced in all tabular results in the following report sections.

To simplify the process of organizing all operational results for all scenarios, an identification scheme was developed for HCM-compatible freeway segments. Each identification also includes a preceding letter designation for basic freeways (B), diverge ramp areas (D), merge ramp areas (M), overlap areas (O), and weave areas (W).

Additional measures of effectiveness (MOEs) were compiled in the microsimulation model analysis process, beyond the derivation of LOSs and estimation of vehicular delay, to provide additional system-wide and corridor-specific comparisons. These MOEs are detailed in the following methodology sections.

4.2 Microsimulation Evaluation Parameters

TransModeler vehicular delay results for AM and PM peak hours are converted to an "equivalent" simulated Level-of-Service (LOSs) for intersections that correspond to a letter grade of LOS A through LOS F, as defined by the HCM6. Other MOE results depend on the scope of the network being analyzed (network-wide, corridor, individual intersection) and conform to standard measures of operational performance (vehicular throughput, travel times, speeds, delays, queues). If a lane group or intersection operated at LOSs E or LOSs F, it was highlighted in all tabular results in the following report sections.

The MOEs for each scenario were compiled from the simulation program and include the following:

Network MOEs

Network MOEs were collected using Trip Statistics Trip Data and Delay Data reports produced by the TransModeler software. These reports were utilized to produce the following MOE data:

- Trips Completed
- Trips Queued
- Vehicle Miles Traveled (VMT)
- Vehicle Hours Traveled (VHT)
- Network Average Speed (mph)
- Network Delay (hours)
- Delay per Vehicle (seconds)

Table 4-1. Intersection & Freeway Segment Level-of-Service (LOS) Characteristics

Level-of-Service Description	Intersection		Freeway		
	Per Vehicle Delay Signal Control	Per Vehicle Delay Stop Control	Basic Freeway Segment Density (pc/mi/ln)	Weave Segment Density (pc/mi/ln)	Merge, Overlap and Diverge Segment Density (pc/mi/ln)
1. LOS A ➢ Free flow ➢ Freedom to select desired speed / maneuver is extremely high ➢ General level of comfort and convenience for motorists is excellent	**< 10.0 seconds**	**< 10.0 seconds**	**0 – 11.0**	**<= 10.0**	**<= 10.0**
2. LOS B ➢ Stable flow ➢ Other vehicles in the traffic stream become noticeable ➢ Reduction in freedom to maneuver from LOS A	**10.0 – 20.0 seconds**	**10.0 – 15.0 seconds**	**>11.0 – 18.0**	**>10.0 – 20.0**	**>10.0 – 20.0**
3. LOS C ➢ Stable flow ➢ Maneuverability/operating speed are significantly affected by other vehicles ➢ General level of comfort and convenience declines noticeably	**20.0 – 35.0 seconds**	**15.0 – 25.0 seconds**	**>18.0 – 26.0**	**>20.0 – 28.0**	**>20.0 – 28.0**
4. LOS D ➢ High density but stable flow ➢ Speed and freedom to maneuver are severely restricted ➢ General level of comfort / convenience is poor ➢ Small increases in traffic will generally cause operational problems	**35.0 – 55.0 seconds**	**25.0 – 35.0 seconds**	**>26.0 – 35.0**	**>28.0 – 35.0**	**>28.0 – 35.0**
5. LOS E ➢ Unstable flow ➢ Speed reduced to lower but relatively uniform value ➢ Volumes at or near capacity level ➢ Comfort and convenience are extremely poor ➢ Small flow increases/minor traffic disturbances will cause breakdowns	**55.0 – 80.0 seconds**	**35.0 – 50.0 seconds**	**>35.0 – 45.0**	**>35.0 – 43.0**	**>35.0**
6. LOS F ➢ Forced or breakdown flow ➢ Volumes exceed roadway capacity ➢ Formation of unstable queues ➢ Stoppages for long periods of time because of traffic congestion	**> 80.0 seconds**	**> 50.0 seconds**	**> 45.0 or demand exceeds capacity**	**> 43.0 or demand exceeds capacity**	**Demand exceeds capacity**

LOS Threshold Data from Transportation Research Board, *Highway Capacity Manual Sixth Edition*. Washington, D.C.: National Research Council, 2016.

Corridor-Level MOEs

Corridor-level MOEs were compiled using sensors placed in the study area TransModeler networks that record vehicular travel times and speeds between pairs of sensors over specified durations. MOE data were collected from TransModeler output matrices for a specific defined peak hour to include the following:

- Average travel time (minutes) between selected points on I-85
- Average speed (mph) between selected points on I-85

Freeway Segment MOEs

Freeway segment MOEs were collected using flow and travel time reports produced by the TransModeler software. The Freeway Segment LOS report was utilized to produce the following MOE data.

- Density and corresponding HCM LOSs equivalent for freeway segments along the I-85 corridor
  - Density is the 95th percentile of the 10 runs aggregated over the one-hour peak period.

Intersection Capacity MOEs

Intersection capacity MOEs were collected using delay and queue reports produced by the TransModeler software. The Intersection LOS by Intersection, Lane Queue by Intersection, and Spillback Queue by Link reports were utilized to produce the following MOE data.

- Overall Intersection Control Delay and LOSs, Control Delay and LOSs by Lane Group, 95th percentile average Lane Queue lengths by Lane Group, Spillback Rate by Lane Group, and Maximum Queue Length (95th percentile) by approach for signalized intersections.
- Control Delay and LOSs by Lane Group and 95th percentile average Lane Queue lengths by Lane Group, Spillback Rate by Lane Group, and Maximum Queue Length (95th percentile) by approach for unsignalized intersections.
- Overall Intersection Control Delay and LOSs, Control Delay and LOSs by Lane Group, 95th percentile average Lane Queue lengths by Lane Group, Spillback Rate by Lane Group, and Maximum Queue Length (95th percentile) by approach for roundabout intersections.

Definition of Queue Types

TransModeler, reports queues in two ways: as *lane queues* and as *spillback queues*. These separate queue definitions are related to superlinks, which are a collection of links defined in TransModeler during the model development process. The superlink includes all links approaching a signal, but not past any upstream signals. Lane queues are measured in each lane at the downstream end of a superlink, but they are not measured beyond the upstream end of the superlink. If the lane queue spills back beyond the end of the superlink, this spillback is reported as the spillback rate. Lane queues are reported as the 95th percentile average Lane Queue length by Lane Group, and the spillback rate is reported as a percentage representing what percent of lane queues during the peak hour extended beyond the upstream end of the superlink. Lane queues do not branch and are not measured if a stopped vehicle (i.e., the head vehicle in the queue) is not found near the downstream end of the superlink.

Spillback queues capture the full and dynamic nature of queues. In contrast with lane queues, the head of a spillback queue need not be at the downstream end of a superlink to be observed. In other words, TransModeler tracks the head of the queue as it propagates upstream, and spillback queues can branch and spread like a tree in different directions at intersections upstream. TransModeler measures spillback queues to the ends of all branches in such a tree. Additionally, spillback queue measurements account for the fact that the heads of queues can move. Spillback queues are not measured per lane, but per

intersection approach and are unbound by link or superlink boundaries. When queues dissipate from the downstream end, which is often the case at a bottleneck or traffic signal, the head of the queue will move upstream as vehicles at the downstream end accelerate and leave the queue.

The model has a 15-minute warm-up period using a scaling factor of 0.85 and was run for both the AM and PM peak hour for 10 repetitions each. All MOE data was compiled for ten simulation runs, and all runs used random number seeds that were held constant for each simulation. All MOE data was compiled for a single designated AM and PM peak hour. The reported delay is the 95th percentile of the 10 runs aggregated over the one-hour peak period.

4.3 FREEVAL-NC Evaluation Parameters

FREEVAL-NC evaluation of I-85 freeway segments is included in this traffic analysis study to serve as a deterministic confirmation of the microsimulation freeway analysis results. Based on the HCM, the freeway segment density and density-based Level of Service from FREEVAL-NC were reported based on the peak 15-minute period within the peak hour. For merge and diverge segments, LOS is determined by the density within the ramp influence area that only includes the outer two freeway lanes. The reported segment densities for merge and diverge segments correspond to the ramp density values provided in the FREEVAL-NC output tables. FREEVAL-NC reports LOS F for merge and diverge segments when d/c is greater than one or the reported freeway density is greater than 45 pc/mi/ln. Freeway segments that have a demand/capacity (d/c) ratio greater than one in the FREEVAL-NC output have been noted in the tabular results.

5 TRAFFIC VOLUME DEVELOPMENT

The latest NCDOT-approved traffic forecast information was used as a basis for developing AM and PM peak hour traffic volume demand data for the 2045 design year. The *2045 Project-Level Traffic Forecast Report for STIP Project I-5719* developed by HNTB in July 2019 includes widening of I-85 as an 8-lane interstate from US 321 (Exit 17) to NC 273 (Exit 27) in Gaston County. This report can be found in ***Appendix C*** of this memorandum. The forecast included three scenarios: 2016 Base Year No-Build (unchanged from 2017 original I-5719 forecast), 2045 Future Year No-Build, and 2045 Future Year Build.

The 2045 Future Year No-Build and Build volumes were used in the FREEVAL-NC analysis for Phase III. The 2045 Future Year Build volumes were developed into Origin-Destination Matrices to be input in TransModeler for the 2045 Future Year Build microsimulation traffic analysis.

5.1 2045 FYNB and 2045 FYB FREEVAL-NC Analysis Volume Development

Discussion with NCDOT resulted in a decision that the traffic demand in the 2045 FREEVAL-NC FYNB and FYB analysis should have the same peak hour factoring as the 2045 Build TransModeler microsimulation analysis. The peak hour factoring used in the TransModeler analysis was based upon 15-minute mainline I-85 traffic counts in the base year (2016) during the AM and PM peak period. **Table 5-1** provides the 15-minute demand adjustment factors used in FREEVAL-NC for the FYNB and FYB analyses to get equivalent peak hour factoring to what was used in the TransModeler analysis.

As part of the volume development process for this project, the Average Annual Daily Traffic (AADT) data included in the 2045 Future Year No-Build and Build traffic forecasts was converted to peak hour turning movements utilizing the NCDOT Intersection Analysis Utility (IAU). ***Appendix D*** contains the NCDOT IAU peak hour volume breakouts for the 2045 No-Build and 2045 Build scenarios. The raw peak hour turning movements from the IAU output were then balanced throughout the network. The peak hour balanced volumes along I-85 and the interchange ramps were input into FREEVAL-NC as 15-min demands using the demand adjustment factors in **Table 5-1**. The 2045 FYNB volumes used in the

FREEVAL-NC analysis are shown in **Figures 3.1-3.2** and the 2045 FYB FREEVAL-NC volumes are shown in **Figures 5.1-5.2**.

The number of time periods analyzed for each peak period and freeway direction are shown in **Table 5-1**. Based on HCM methodology, FREEVAL-NC results in this analysis are reported based on the peak 15-minute period within the peak hour. The peak one-hour is shaded in the table, with the peak 15-minute period within the peak hour shaded darker. In the 2045 FYB, the I-85 Northbound and Southbound directions both required the same number of time periods.

Table 5-1 HCS Analysis 15-Minute Time Periods and Demand Adjustment Factors

2045 FYNB Time Period				2045 FYB Time Period		15-min Count Intervals		15-min Base Year Count Volumes		Demand Adjustment Factor	
AM NB	AM SB	PM NB	PM SB	AM	PM	AM	PM	AM	PM	AM	PM
		1	1		1		3:00-3:15		10367		0.931
		2	2		2		3:15-3:30		10743		0.965
1	1	3	3	1	3	6:15-6:30	3:30-3:45	9166	10920	0.848	0.981
2	2	4	4	2	4	6:30-6:45	3:45-4:00	10103	11136	0.934	1.000
3	3	5	5	3	5	6:45-7:00	4:00-4:15	9712	11151	0.898	1.001
4	4	6	6	4	6	7:00-7:15	4:15-4:30	9822	11071	0.909	0.994
5	5	7	7	5	7	**7:15-7:30**	**4:30-4:45**	10756	11279	0.995	1.013
6	6	8	8	6	8	**7:30-7:45**	**4:45-5:00**	11014	10908	1.019	0.979
7	7	9	9	7	9	**7:45 - 8:00**	**5:00-5:15**	11087	11184	1.025	1.004
8	8	10	10	8	10	**8:00 - 8:15**	**5:15-5:30**	10388	11178	0.961	1.004
9	9	11	11	9	11	8:15-8:30	5:30-5:45	10121	10198	0.936	0.916
10	10	12	12	10	12	8:30-8:45	5:45-6:00	9517	9665	0.880	0.868
		13	13		13		6:00-6:15		9236		0.829
		14	14		14		6:15-6:30		8796		0.790
		15	15		15		6:30-6:45		8212		0.737
		16	16		16		6:45-7:00		7800		0.700
			17				7:00-7:15		7641		0.686
			18				7:15-7:30		7581		0.681

5.2 2045 Future Year Volume Development for TransModeler Microsimulation Analysis

The 2045 FYB balanced volumes used in the FREEVAL-NC analysis were also used as a basis for the 2045 FYB origin-destination matrices developed for the 2045 Build TransModeler analysis. The Average Annual Daily Traffic (AADT) data included in the traffic forecast was converted to peak hour volumes utilizing the NCDOT Intersection Analysis Utility (IAU) spreadsheet. The 2045 Future Year Build volumes were developed into Origin-Destination Matrices to be input in TransModeler for the 2045 Future Year Build microsimulation traffic analysis. Additional detail about the 2045 Build Origin-Destination (O-D) Matrices volume development methodology can be found in ***Appendix E***. This information was included in a previous project submittal for the larger I-5719 project on February 26, 2021.

Since February 2021 two adjustments were made to the original 2045 FYB O-D matrices due to changes in assumed traffic patterns in the study area. The first adjustment was made near the SR 2329 (S Main St) interchange and the intersection of SR 2329 and Crausby Ave (Intersection 39). The Original STIP U-6141 project in the 2045 MTP and in the regional traffic demand model had a grade separation at Redbud Dr/SR 2329 (S Main St) and US 29/74. This grade separation would have allowed the traffic to/from Redbud Dr to use a grade separated overpass over US 29/74 and then access S Main St via Crausby Ave near the I-85 NB ramp terminal. When the 2045 Build forecast was created, this grade-

separation resulted in Crausby Ave carrying traffic meant for Redbud Dr south of US 29/74. An updated volume development spreadsheet is provided in ***Appendix F*** that documents the calculations used to reassign the Crausby demand from the original ODs to create new OD matrices with the Crausby traffic reassigned. The total demand in the network is unchanged. The traffic forecasting team who generated the 2019 forecast looked at the supporting information and concluded that about 1/3 of the traffic on Crausby in the forecast originates from Crausby Ave and the rest is from the previous U-6141 design with the grade separation. Left turns from Crausby Ave to reach I-85 are assumed to take a path outside of the network. The "Crausby Redistribution" tab of the updated volume development spreadsheet documents the calculations. The remaining tabs implement those redistributed volumes in the OD matrices, with red text indicating where changes were made.

The second adjustment made to the original 2045 FYB O-D matrices was to reroute vehicles travelling southbound on NC 273 south of the I-85 interchange that desire to make a left turn onto Browntown Rd to instead make a southbound left turn at Intersection 75 to reach Browntown Rd via US 29/74. The diverging diamond concept at NC 273 and I-85 prevents southbound NC 273 vehicles from making a southbound left turn onto Browntown Rd (near Intersection 72). The Browntown redistribution tabs in the volume development spreadsheet document how the Browntown Rd O-D matrices redistribution was made in addition to the Crausby redistribution.

6 MICROSIMULATION CALIBRATION AND ADJUSTMENTS

The 2016 Base Year No-Build model was calibrated using TransModeler version 4.0 Build 6275, and this model was used as the base model for the 2040 Future Year No-Build network. The 2045 Future Year Build analysis network was developed from the 2040 Future Year No-Build network. The *I-5719 Phase I Traffic Analysis Technical Memorandum* (October 2018) includes further details about the calibration methodology and results. No adjustments were made to the microsimulation parameters in the 2045 Future Year Build model.

7 2045 FUTURE YEAR NO-BUILD FREEVAL-NC ANALYSIS

Figures 2.1 - 2.2 present the 2045 FYNB laneage, segment lengths and segment identification scheme used in the FREEVAL-NC analysis.

Table 7-1 and **Table 7-2** present the 2045 Future Year No-Build segment density and LOS results for I-85 northbound and southbound directions, respectively. The analysis results are also presented diagrammatically in Figures 3.1 and 3.2. Detailed 2045 FYNB output from FREEVAL-NC can be found in ***Appendix G***.

In the off-peak directions along I-85, all the segments along I-85 northbound in the PM peak and I-85 southbound in the AM peak perform at LOS E or better.

The peak directions in the AM and PM periods experience poor LOS and congestion. I-85 northbound in the AM peak has 21 segments operating at LOS F, located between the NC 274 interchange and the lane addition between Exits 26 and 27. Twelve of the segments operating at LOS D, E or F also have a demand that is equal to or greater than the segment capacity.

Similarly, I-85 southbound in the PM peak has 7 segments operating at LOS F and 9 at LOS E, with congestion from US 321 upstream to NC 273. Fourteen of the segments operating at LOS D, E or F have a demand that is equal to or greater than the segment capacity.

Table 7-1 2045 Future Year No-Build Freeway Density and LOS for I-85 Northbound

2045 No-Build NB AM Peak				2045 No-Build NB PM Peak		
Density (pc/mi/ln)	LOS	Segment	Interchange	Segment	LOS	Density (pc/mi/ln)
20.0	C	B1	Begin of I-85 NB	B1	B	13.2
20.6	C	D2	NC 274	D2	B	13.5
19.1	C	B3		B3	B	12.4
23.4	B	M4		M4	B	15.7
21.5	C	B5		B5	B	14.5
22.1	C	D6	SR 1327 (Fairview Dr / Davidson Ave)	D6	B	14.9
20.1	C	B7		B7	B	13.6
23.1	C	M8		M8	B	16.1
22.9	C	B9		B9	B	14.9
40.8	E	B10	US 321	B10	B	16.1
73.1	F	B11		B11	C	18.5
70.4	F	M12		M12	C	29.5
60.2	F	B13		B13	D	26.8
55.5	F	D14	NC 7 (E. Ozark Ave)	D14	D	30.9
53.9	F	B15		B15	C	24.6
60.1	F	W16		W16	C	27.2
84.2	F	B17	NC 279 (New Hope Rd)	B17	C	24.5
58.9	F	M18		M18	C	30.2
58.9	F	O19		O19	D	30.2
43.3	F	D20	SR 2200 (Cox Rd)	D20	C	29.0
53.9	F	B21		B21	C	23.7
54.7	F	M22		M22	D	31.5
55.5	F	B23		B23	D	28.7
66.8	F	D24	SR 2329 (S. Main St)	D24	C	31.9
86.8	F	B25		B25	D	26.6
55.4	F	M26		M26	D	36.0
55.5	F	O27		O27	E	36.0
55.5	F	D28	NC 7 (McAdenville Rd / N. Main St)	D28	D	33.6
72.6	F	B29		B29	D	30.5
39.7	D	M30		M30	D	34.6
39.0	E	B31		B31	D	32.6
57.0	F	D32	SR 2093 (Belmont-Mt. Holly Rd)	D32	D	32.8
74.9	F	B33		B33	D	28.3
40.2	D	M34		M34	D	34.8
25.5	C	B35		B35	C	22.6
26.1	C	D36	NC 273 (Beatty Dr / Park St)	D36	C	23.5
24.1	C	B37		B37	C	20.0
33.8	D	M38		M38	C	25.4
31.6	D	B39		B39	C	23.4
31.6	D	D40	Sam Wilson Rd	D40	C	24.1
30.1	D	B41		B41	C	22.0
30.8	C	D42	I-485	D42	C	24.4
21.1	C	B43		B43	B	11.9
25.3	C	M44	Sam Wilson Rd	M44	B	15.5
23.3	C	B45	End of I-85 NB	B45	B	14.6

D/C (demand-to-capacity) greater than or equal to 1.00

Table 7-2 2045 Future Year No-Build Freeway Density and LOS for I-85 Southbound

2045 No-Build SB AM Peak				2045 No-Build SB PM Peak		
Density (pc/mi/ln)	LOS	Segment	Interchange	Segment	LOS	Density (pc/mi/ln)
9.9	A	B46	Begin of I-85 SB	B46	C	24.0
10.3	B	D47	Sam Wilson Rd	D47	C	26.7
7.8	A	B48	I-485	B48	E	41.8
27.0	D	M49	Sam Wilson Rd / I-485	M49	F	67.4
17.9	B	B50		B50	F	86.5
22.4	C	B51		B51	F	69.5
23.3	C	D52	NC 273 (Beatty Dr / Park St)	D52	F	73.5
19.7	C	B53		B53	F	106.7
24.4	B	M54		M54	F	100.0
22.5	C	B55		B55	F	100.0
35.5	E	D56	SR 2093 (Belmont-Mt. Holly Rd)	D56	D	***39.2***
28.6	D	B57		B57	D	33.5
35.0	C	M58		M58	D	***39.9***
33.1	D	B59		B59	E	***39.6***
33.1	D	D60	NC 7 (McAdenville Rd / N. Main St)	D60	D	***39.6***
31.4	D	B61		B61	D	***35.0***
36.6	D	M62		M62	D	***39.0***
36.6	E	O63		O63	E	***39.0***
34.9	E	D64	SR 2329 (S. Main St)	D64	E	***38.1***
28.8	D	B65		B65	D	30.9
34.8	C	M66		M66	C	36.3
32.5	D	B67		B67	D	34.2
32.8	D	D68	SR 2200 (Cox Rd)	D68	D	34.2
27.3	D	B69		B69	D	29.6
33.8	C	M70		M70	D	***39.7***
33.8	D	O71		O71	E	***39.7***
32.1	D	D72	NC 279 (New Hope Rd)	D72	D	***38.2***
28.6	D	B73		B73	D	33.4
30.3	D	W74		W74	E	35.1
29.0	D	B75	NC 7 (E. Ozark Ave)	B75	E	35.6
33.7	C	M76		M76	D	***41.8***
31.7	D	B77		B77	E	***41.7***
32.6	C	D78	US 321 (N. Chester St)	D78	D	***41.7***
27.4	D	D79		D79	E	31.4
22.5	C	B80		B80	D	26.7
18.8	C	B81		B81	C	22.0
17.5	B	B82		B82	C	20.6
18.1	C	D83	SR 1327 (Fairview Dr / Davidson Ave)	D83	C	21.2
16.1	B	B84		B84	C	19.1
18.3	B	M85		M85	C	22.1
16.8	B	B86		B86	C	20.2
18.9	C	D87	NC 274	D87	C	22.7
14.8	B	B88		B88	B	17.9
16.8	B	M89		M89	B	20.5
15.6	B	B90	End of I-85 SB	B90	C	18.8

D/C (demand-to-capacity) greater than or equal to 1.00

8 2045 FUTURE YEAR BUILD ANALYSES

8.1 2045 Build FREEVAL-NC Analysis

Figures 4.1 - 4.2 present the 2045 FYB laneage, segment lengths and segment identification scheme used in the FREEVAL-NC analysis.

Table 8-1 and **Table 8-2** present the 2045 Future Year Build segment density and LOS results for I-85 northbound and southbound directions, respectively. The analysis results are also presented diagrammatically in **Figures 5.1 and 5.2**. The ramp terminal intersection LOS values shown in **Figures 5.1 and 5.2** are from the 2045 FYB TransModeler analysis results presented in Section 8.2.2. Detailed 2045 FYB output from FREEVAL-NC can be found in ***Appendix H***.

In the off-peak directions along I-85, all the segments within the I-5719 project limits along I-85 northbound in the PM peak and I-85 southbound in the AM peak perform at LOS D or better.

The peak directions in the AM and PM periods experience some congestion and LOS E conditions near the eastern end of the I-5719 project due to minor congestion near the Sam Wilson Rd and I-485 interchanges.

I-85 northbound in the AM peak has 4 segments operating at LOS E, with three of those segments located between where the NC 273 on-ramp merges into I-85 northbound and the diverge to I-485 at the northern (eastern) end of the I-5719 project. Within the I-5719 project limits, the basic segment between the NC 7 (McAdenville Rd / N. Main St) and the SR 2093 (Belmont-Mt. Holly Rd) interchanges [Segment 69] operates at LOS E in the AM peak on I-85 northbound.

Similarly, I-85 southbound in the PM peak has 3 segments operating at LOS E, with LOS E conditions existing at the merge with the I-485 and Same Wilson Rd on ramps [Segment 46], the basic segment between the SR 2093 (Belmont-Mt. Holly Rd) and NC 7 (McAdenville Rd / N. Main St) [Segment 54] interchanges, and the diverge to the US 321 northbound off-ramp [Segment 69]. Segments 54 and 69 are within the I-5719 project limits.

All freeway segments in the 2045 FYB FREEVAL-NC analysis have a demand that is less than the segment capacity.

Table 8-1 2045 Future Year Build Freeway Density and LOS for I-85 Northbound

2045 Build NB AM Peak				2045 Build NB PM Peak		
Density (pc/mi/ln)	LOS	Segment	Interchange	Segment	LOS	Density (pc/mi/ln)
19.6	C	B1	Begin of I-85 NB	B1	B	12.9
20.2	B	D2	NC 274	D2	B	13.2
18.7	C	B3		B3	B	12.1
23.3	B	M4		M4	B	15.7
21.4	C	B5		B5	B	14.5
21.9	C	D6	SR 1327 (Fairview Dr / Davidson Ave)	D6	B	14.9
20.1	C	B7		B7	B	13.7
23.4	C	M8		M8	B	16.5
21.6	C	B9		B9	B	15.3
23.8	C	D10	US 321	D10	B	17.0
21.1	C	B11		B11	B	14.5
31.9	C	M12		M12	C	22.6
22.6	C	B13		B13	B	16.7
29.4	D	B14		B14	C	20.9
31.2	D	D15	NC 7 (E. Ozark Ave)	D15	C	22.8
27.2	D	B16		B16	C	19.6
31.5	D	W17		W17	C	23.4
26.6	D	B18	NC 279 (New Hope Rd)	B18	C	19.6
30.3	D	W19		W19	C	21.9
25.3	C	B20	SR 2200 (Cox Rd)	B20	C	19.4
30.8	C	M21		M21	C	25.2
28.5	D	B22		B22	C	23.0
30.4	C	D23	SR 2329 (S. Main St)	D23	C	25.1
26.4	D	B24		B24	C	21.6
34.6	D	W25		W25	C	26.6
32.0	D	B26	NC 7 (McAdenville Rd / N. Main St)	B26	C	24.0
36.4	D	M27		M27	C	27.4
35.5	E	B28		B28	C	25.2
25.7	D	D29	SR 2093 (Belmont-Mt. Holly Rd)	D29	C	20.0
23.6	C	B30		B30	C	18.0
24.5	C	B31		B31	C	18.6
31.2	D	B32		B32	C	22.4
32.8	D	W33		W33	C	25.1
31.5	D	B34	NC 273 (Beatty Dr / Park St)	B34	C	21.1
41.9	D	M35		M35	C	26.5
41.9	E	B36		B36	C	24.4
41.9	E	D37	Sam Wilson Rd	D37	C	25.0
39.2	E	B38		B38	C	22.9
39.2	C	D39	I-485	D39	C	25.4
25.2	C	B40		B40	B	12.5
29.3	C	M41	Sam Wilson Rd	M41	B	15.4
27.2	D	B42	End of I-85 NB	B42	B	14.5

D/C (demand-to-capacity) greater than or equal to 1.00

Table 8-2 2045 Future Year Build Freeway Density and LOS for I-85 Southbound

2045 Build SB AM Peak				2045 Build SB PM Peak		
Density (pc/mi/ln)	LOS	Segment	Interchange	Segment	LOS	Density (pc/mi/ln)
9.9	A	B43	Begin of I-85 SB	B43	C	24.6
10.2	A	D44	Sam Wilson Rd	D44	C	25.4
8.3	A	B45		B45	C	22.2
28.8	D	M46	Sam Wilson Rd / I-485	M46	E	50.7
18.6	C	B47		B47	D	28.5
18.6	C	B48		B48	D	28.5
18.6	C	B49	NC 273 (Beatty Dr / Park St)	B49	D	28.5
20.7	C	B50		B50	D	30.9
25.0	C	W51		W51	D	33.7
22.6	C	B52	SR 2093 (Belmont-Mt. Holly Rd)	B52	D	31.0
27.7	C	M53		M53	D	36.3
25.5	C	B54		B54	E	35.4
26.0	C	D55	NC 7 (McAdenville Rd / N. Main St)	D55	D	35.4
24.5	C	B56		B56	D	31.9
26.9	C	W57		W57	D	33.5
22.9	C	B58	SR 2329 (S. Main St)	B58	D	28.4
27.7	C	M59		M59	C	33.0
25.3	C	B60		B60	D	31.0
26.3	C	D61	SR 2200 (Cox Rd)	D61	D	31.0
21.9	C	B62		B62	D	27.0
24.5	C	W63		W63	D	33.1
22.2	C	B64	NC 279 (New Hope Rd)	B64	D	28.5
25.7	C	W65		W65	D	33.1
23.0	C	B66	NC 7 (E. Ozark Ave)	B66	D	29.6
26.7	C	M67		M67	C	33.9
24.7	C	B68		B68	D	32.7
26.1	D	D69	US 321 (N. Chester St)	D69	E	33.1
21.3	C	D70		D70	D	25.8
18.5	C	B71		B71	C	22.7
22.1	C	M72		M72	C	27.3
18.9	C	B73		B73	C	23.6
19.6	C	D74	SR 1327 (Fairview Dr / Davidson Ave)	D74	C	24.1
17.1	B	B75		B75	C	21.5
19.4	B	M76		M76	C	24.6
17.8	B	B77		B77	C	22.7
20.1	C	D78	NC 274	D78	C	25.3
15.5	B	B79		B79	C	19.7
17.6	B	M80		M80	C	22.4
16.3	B	B81	End of I-85 SB	B81	C	20.6

D/C (demand-to-capacity) greater than or equal to 1.00

8.2 2045 Build TransModeler Analysis

This section presents the TransModeler microsimulation capacity analysis results for the 2045 Future Year Build scenario. **Figures 6.1-6.3** present the intersection and y-line geometry, traffic control, and laneage analyzed in the 2045 FYB TransModeler model. The demand volumes used in the 2045 Future Year Build TransModeler analysis are shown in **Figures 7.1-7.3**.

8.2.1 TransModeler Network and Corridor-Level Results

Table 8-3 presents trips completed, trips queued outside the network, VMT, VHT, network overall speed, network overall delay, and delay per vehicle for vehicles traveling through the network in the AM and PM peak hours. Network speed is slightly greater in the AM peak while the delay per vehicle is slightly less in the PM peak. There were no trips queued outside the network in either peak hour.

Table 8-3 2045 Build Network Measures of Effectiveness

MOE	2045 Future Year Build
	AM (7:15 – 8:15)
Trips Completed	53,010
Trips Queued	0
Vehicle Miles Traveled (VMT)	253,480
Vehicle Hours Traveled (VHT)	5,630
Network Speed (mph)	45.0
Network Delay (Hours)	1,554
Delay Per Vehicle (Seconds)	106
MOE	**PM (16:30 -17:30)**
Trips Completed	61,905
Trips Queued	0
Vehicle Miles Traveled (VMT)	265,313
Vehicle Hours Traveled (VHT)	6,098
Network Speed (mph)	43.5
Network Delay (Hours)	1,803
Delay Per Vehicle (Seconds)	105

Table 8-4 presents travel time and average speed results for operations along I-85 for vehicles making a complete trip through the study area along the interstate corridor. Corridor speeds for I-85 show decreases for southbound I-85 in the PM peak hour, but traffic flows in both directions experience near free-flow speed conditions for both peak hours. The posted speed limit on I-85 in the project limits is 60 mph.

Table 8-4 2045 Build I-85 Corridor Travel Time and Speed

2045 Future Year Build	Corridor	Direction of Travel		MOE			
				Travel Time (min)		Speed (mph)	
		From	To	AM	PM	AM	PM
	I-85 Northbound	NC 274	NC 273 (Beatty Road)	13.26	12.84	58.6	60.5
	I-85 Southbound	NC 273 (Beatty Road)	NC 274	13.27	13.64	58.6	56.9

8.2.2 TransModeler Intersection Capacity and Queuing Analysis Results

Table 8-5 provides the 2045 Build 95th percentile worst result overall intersection control delay results for all ramp termini within the traffic study area. The ramp termini that are **bolded** in **Table 8-5** are within the I-5719 project limits. LOSs equivalents for each peak hour are also given. Overall 2045 Build intersection LOSs results are also shown for ramp termini only in **Figures 5.1-5.2** and for all intersections within the project study area in **Figures 7.1-7.3**. All ramp termini within the I-5719 project limits operate at an overall intersection LOSs D or better in the 2045 FYB scenario.

Table 8-5 2045 FYB Intersection Control Delay Results – Ramp Terminal Intersections

	ID	Intersection Name	95th % Worst Control Delay (sec/veh)		Equivalent LOSs	
			AM	PM	AM	PM
2045 Future Year Build	2	NC 274 & I-85 SB Ramps	23.2	25.9	C	C
	3	NC 274 & I-85 NB Ramps	7.1	11.0	A	B
	5	SR 1327 (Fairview Dr) / W Davidson Ave & I-85 SB Ramps	13.7	12.9	B	B
	6	SR 1327 (Fairview Dr) / W Davidson Ave & I-85 NB Ramps	19.4	15.2	B	B
	9	**US 321 & I-85 Fly-under Ramp**	25.8	21.5	C	C
	10	**US 321 & I-85 SB Ramps**	6.5	5.5	A	A
	11	**US 321 & I-85 NB Off-Ramp**	9.3	8.3	A	A
	14	**NC 7 (Ozark) & I-85 SB Ramps**	16.6	14.1	B	B
	15	**NC 7 (Ozark) & I-85 NB Ramps**	9.1	6.8	A	A
	21	**NC 279 (New Hope) & I-85 SB Ramps**	29.7	36.6	C	D
	22	**NC 279 (New Hope) & I-85 NB Ramps**	23.5	38.7	C	D
	30	**SR 2200 (Cox) & I-85 SB Ramps**	30.2	29.5	C	C
	31	**SR 2200 (Cox) & I-85 NB Ramps**	26.4	21.0	C	C
	37	**SR 2329 (S Main) & I-85 SB Ramps**	10.3	10.3	B	B
	38	**SR 2329 (S Main) & I-85 NB Ramps**	8.1	8.6	A	A
	49	**NC 7 (McAdenville) & I-85 SB Ramps**	15.1	23.3	B	C
	50	**NC 7 (Main) / NC 7 (McAdenville) & I-85 NB Ramps**	32.0	41.3	C	D
	55	**SR 2093 (Belmont - Mt Holly) & I-85 SB Ramps**	27.8	31.5	C	C
	56	**SR 2093 (Belmont - Mt Holly) & I-85 NB Ramp** *	N/A	N/A	N/A	N/A
	57	**SR 2093 (Belmont - Mt Holly) & I-85 NB Loop** *	N/A	N/A	N/A	N/A
	70	**NC 273 & I-85 SB Ramps**	29.8	30.3	C	C
	71	**NC 273 & I-85 NB Ramps**	35.0	30.8	C	C
	76	SR 1625 (Sam Wilson Rd) & I-85 SB Ramps	14.0	29.4	B	C
	77	SR 1625 (Sam Wilson Rd) & I-85 NB Ramps	10.1	19.8	B	B

* - Unsignalized Intersection – LOSs/Delay Data not reported (N/A) for overall intersection or intersection approach
Note: The I-5719 traffic analysis study area includes the eighteen (18) ramp terminal intersections along I-85 within the project (in **BOLD**) and six (6) neighboring ramp terminal intersections.

The overall intersection delay reported in **Table 8-5** for the Diverging Diamond interchange ramp terminals at NC 279 and NC 273 have been calculated using a weighted average of the lane group delay for all signalized lane groups at each ramp terminal. This includes the signalized movements at the crossover intersection (through movements in both directions and the off-ramp right turn) and the delay from the signalized off-ramp left turns. The average was weighted using the number of vehicles completing each movement in the peak hour.

Table 8-6 provides 95th percentile worst overall intersection control delay and LOSs, 95th percentile worst control delay and LOSs by lane group, 95th percentile average lane queue lengths by lane group, spillback rate by lane group, and maximum queue length (95th percentile) by approach for all intersections in the traffic study area. In **Table 8-6**, storage lengths are provided and correspond to the length of the storage in the TransModeler model, which aligns with the latest roadway designs. **Table 8-6** is divided into sub-tables by y-line, and the unsignalized intersections are presented below the signalized intersections in the sub-tables.

As mentioned previously, all ramp termini within the I-5719 project limits operate at an overall LOS D or better in the 2045 FYB scenario. Overall intersection LOSs and Delay Data is not reported for unsignalized intersections per the HCM6. At the unsignalized intersection at SR 2093 (Belmont-Mt Holly Rd) and the I-85 northbound off-loop, the right turn from the I-85 northbound off-loop to SR 2093 northbound operates at LOSs E in the PM peak, with a 95th queue length of 79 feet and a 0% spillback rate. The maximum queue length observed in the PM peak was 294 feet, which is less than the off-loop length of 525 feet.

Along the NC 273 corridor, two signalized intersections that are not ramp termini operate at LOSs E. Intersection 72, the half signal at NC 273 and Browntown Rd, operates at an overall LOSs E in the PM peak. The 95th queue length in the PM peak along Browntown Rd for the westbound right turn is near 350 feet with a maximum queue length of just over 1000 feet. If the Diverging Diamond interchange is built at NC 273, additional improvements at Intersection 72, such as providing dual right turn lanes on Browntown Rd, should be considered. The intersection of NC 273 and US 29/74 operates at an overall LOSs E in the AM peak, driven by high demand for the southbound left turn movement and on the eastbound approach heading towards the Catawba River bridge and the City of Charlotte.

Table 8-6 2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Exit 14: NC 274

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
1	NC 274 & Shannon Bradley, Jenkins Dairy	*Overall*		*22.1*	*23.6*	*C*	*C*							
		Jenkins Dairy SWB	L	48.1	52.0	D	D	45.0	0%	70.5	0%	204.1	281.4	50
		Jenkins Dairy SWB	T	53.2	58.4	D	E	30.3	0%	17.7	0%	204.1	281.4	
		Jenkins Dairy SWB	R	45.9	46.3	D	D	19.7	0%	13.9	0%	204.1	281.4	50
		NC 274 NWB	L	21.7	23.1	C	C	15.9	0%	21.1	0%	318.7	309.0	200
		NC 274 NWB	T	20.5	18.8	C	B	102.7	0%	95.3	0%	318.7	309.0	
		NC 274 NWB	TR	22.8	21.1	C	C	99.5	0%	107.9	0%	318.7	309.0	
		Shannon Bradley EB	L	47.1	48.3	D	D	24.2	0%	23.5	0%	165.5	221.0	100
		Shannon Bradley EB	TR	56.2	62.7	E	E	44.6	0%	55.4	0%	165.5	221.0	
		NC 274 SEB	L	16.6	18.5	B	B	18.8	0%	16.2	0%	293.1	275.5	275
		NC 274 SEB	T	13.0	15.4	B	B	60.4	0%	68.4	0%	293.1	275.5	
		NC 274 SEB	TR	14.5	18.2	B	B	103.9	0%	116.1	0%	293.1	275.5	
2	NC 274 & I-85 SB Ramps	*Overall*		*23.2*	*25.9*	*C*	*C*							
		NC 274 NWB	L	19.2	27.9	B	C	26.9	0%	33.5	0%	191.8	155.4	650
		NC 274 NWB	T	17.9	16.3	B	B	57.9	0%	46.2	0%	191.8	155.4	
		I-85 SB RAMP NEB	L	59.1	58.8	E	E	192.4	2%	221.7	7%	564.2	816.3	
		NC 274 SEB	T	15.0	22.1	B	C	79.4	0%	124.0	0%	296.2	475.4	
		NC 274 SEB	R	8.2	14.0	A	B	59.7	0%	48.1	0%	296.2	475.4	50
3	NC 274 & I-85 NB Ramps	*Overall*		*7.1*	*11.0*	*A*	*B*							
		NC 274 NWB	L	9.8	10.1	A	B	43.3	0%	35.4	0%	181.8	183.1	150
		NC 274 NWB	T	2.6	2.1	A	A	32.0	0%	33.5	0%	181.8	183.1	
		I-85 NB RAMP NEB	L	64.5	68.9	E	E	50.3	0%	38.0	0%	227.9	205.2	
		I-85 NB RAMP NEB	R	16.7	18.0	B	B	38.8	0%	36.5	0%	227.9	205.2	25
		NC 274 SEB	T	4.5	13.0	A	B	33.7	0%	123.3	0%	133.9	442.8	
		NC 274 SEB	R	3.1	14.1	A	B	42.2	0%	118.4	0%	133.9	442.8	
4 *	NC 274 & Raeford	Raeford SWB	LTR	83.3	257.3	F	F	54.1	0%	85.1	0%	101.7	185.6	
		NC 274 NWB	L	--	--	--	--	--	--	--	--	#N/A	#N/A	150
		NC 274 NWB	T	0.1	0.2	A	A	--	--	--	--	#N/A	#N/A	
		NC 274 NWB	TR	0.1	0.2	A	A	--	--	--	--	#N/A	#N/A	
		Raeford NEB	LTR	38.0	72.5	E	F	28.6	0%	42.1	0%	68.2	118.6	
		NC 274 SEB	L	16.8	12.2	C	B	--	0%	33.4	0%	#N/A	#N/A	150
		NC 274 SEB	T	0.1	0.2	A	A	--	--	--	--	#N/A	#N/A	
		NC 274 SEB	TR	0.0	0.1	A	A	--	--	--	--	#N/A	#N/A	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

	Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
					AM	PM	AM	PM	AM		PM		AM	PM	
2045 Future Year Build SR 1327 (Fairview Dr) / W. Davidson Ave	5	SR 1327 (Fairview Dr) & I-85 SB Ramps		***Overall***	***13.7***	***12.9***	***B***	***B***							
			SR 1327 (Fairview Dr) SB	TR	6.6	7.3	A	A	46.7	0%	59.8	0%	189.4	212.1	
			I-85 SB Off-Ramp to SR 1327 WB	LT	22.9	23.2	C	C	46.5	0%	50.0	0%	190.5	252.4	
			I-85 SB Off-Ramp to SR 1327 WB	R	25.8	25.5	C	C	53.0	0%	53.5	0%	190.5	252.4	200
			SR 1327 (Fairview Dr) NB	LT	9.8	10.3	A	B	47.4	0%	62.4	0%	184.1	301.6	
	6	SR 1327 (Fairview Dr), W. Davidson Ave & I-85 NB Ramps		***Overall***	***19.4***	***15.2***	***B***	***B***							
			SR 1327 (Fairview Dr) SB	L	33.4	23.7	C	C	44.8	0%	54.1	0%	214.6	183.4	150
			SR 1327 (Fairview Dr) SB	T	15.5	3.5	B	A	78.8	0%	32.3	0%	214.6	183.4	
			W. Davidson Ave NB	TR	14.1	13.9	B	B	57.1	0%	61.1	0%	171.3	189.5	
			I-85 NB Off-Ramp to SR 1327 EB	LTR	24.4	31.2	C	C	62.2	0%	61.1	0%	225.9	237.5	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations

[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y1: Exit 17: US 321 (North Chester Street)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
7	US 321 & Tulip, Bulb	***Overall***		***37.0***	***21.3***	***D***	***C***							
		US 321 SB	L	87.0	79.8	F	E	53.7	0%	19.8	0%	908.2	635.6	175
		US 321 SB	T	40.4	20.6	D	C	267.5	0%	149.3	0%	908.2	635.6	
		US 321 SB	TR	42.9	22.7	D	C	146.6	0%	108.5	0%	908.2	635.6	125
		Bulb WB	L	81.3	77.0	F	E	21.0	0%	34.9	0%	118.5	152.0	150
		Bulb WB	TR	51.0	42.6	D	D	34.0	0%	33.3	0%	118.5	152.0	
		US 321 NB	L	73.4	63.0	E	E	115.1	0%	77.5	0%	546.9	547.5	250
		US 321 NB	T	20.9	12.7	C	B	188.4	8%	189.1	8%	546.9	547.5	
		US 321 NB	TR	19.2	11.9	B	B	117.8	1%	121.2	2%	546.9	547.5	250
		Tulip EB	L	64.7	59.4	E	E	70.7	0%	71.0	0%	570.4	303.1	100
		Tulip EB	TR	60.0	49.6	E	D	135.0	0%	96.2	0%	570.4	303.1	
8	US 321 SB & US 321 NB Left Turn, Rankin Lake	***Overall***		***8.2***	***8.1***	***A***	***A***							
		US 321 SB	T	3.9	4.7	A	A	30.7	0%	36.4	0%	176.3	248.3	
		US 321 SB	TR	4.2	5.0	A	A	50.3	0%	51.5	0%	176.3	248.3	
		US 321 NB Left Turn NB	L	38.3	24.2	D	C	35.6	0%	25.2	0%	101.4	90.2	450
		Rankin Lake SEB	R	34.6	28.4	C	C	30.5	0%	33.4	0%	88.4	99.3	
9	US 321 NB & I-85 Ramp, US 321 SB Left Turn	***Overall***		***25.8***	***21.5***	***C***	***C***							
		US 321 SB Left Turn SB	L	34.5	25.3	C	C	188.2	0%	134.0	0%	717.5	568.9	800, 1150
		I-85 Ramp NWB	R	15.8	16.2	B	B	88.1	0%	100.7	0%	380.3	384.6	525
		US 321 NB	T	26.4	27.9	C	C	77.7	0%	75.0	0%	252.8	299.5	
		US 321 NB	R	25.7	19.3	C	B	51.8	0%	33.8	0%	252.8	299.5	
10	US 321 & I-85 SB Ramps	***Overall***		***6.5***	***5.5***	***A***	***A***							
		US 321 SB	T	5.2	8.0	A	A	28.2	0%	34.2	0%	132.9	203.3	
		US 321 SB	R	5.2	7.8	A	A	48.3	0%	68.4	0%	132.9	203.3	
		US 321 NB	L	30.3	20.8	C	C	39.6	0%	34.4	0%	125.1	121.2	350
		US 321 NB	T	0.1	0.1	A	A	--	--	--	--	125.1	121.2	
		I-85 SB Off Loop SEB	R	28.3	23.3	C	C	38.3	0%	31.7	0%	155.6	108.3	
11	US 321 & I-85 NB Off-Ramp	***Overall***		***9.3***	***8.3***	***A***	***A***							
		US 321 SB	T	4.8	5.0	A	A	40.6	0%	34.6	0%	167.5	179.7	
		US 321 NB	T	6.2	4.7	A	A	50.8	0%	35.4	0%	209.5	127.0	
		I-85 NB Off Ramp EB	L	28.4	22.7	C	C	47.8	0%	50.8	0%	171.9	202.7	
		I-85 NB Off Ramp EB	R	10.5	7.7	B	A	31.9	0%	34.0	0%	171.9	202.7	325
12	US 321 & Radio	***Overall***		***14.8***	***16.0***	***B***	***B***							
		US 321 SB	L	0.0	22.4	A	C	--	0%	116.1	0%	298.1	238.5	175
		US 321 SB	T	10.7	14.7	B	B	100.2	0%	71.2	0%	298.1	238.5	
		US 321 SB	TR	14.2	15.1	B	B	135.8	0%	73.4	0%	298.1	238.5	
		US 321 NB	L	7.5	10.5	A	B	14.3	0%	22.1	0%	145.2	173.8	150
		US 321 NB	T	5.4	6.8	A	A	49.2	0%	56.0	0%	145.2	173.8	
		Radio EB	LR	60.0	49.0	E	D	112.3	0%	112.7	0%	310.8	322.0	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y2: Exit 19: NC 7 (East Ozark Avenue)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s) AM	Delay [1] (s) PM	Level of Service [2] AM	Level of Service [2] PM	95th Queue (ft)/Spillback Rate AM		95th Queue (ft)/Spillback Rate PM		Maximum Queue Length (ft) AM	Maximum Queue Length (ft) PM	Storage Length (ft)
14	NC 7 (Ozark) & I-85 SB Ramps	***Overall***		***16.6***	***14.1***	***B***	***B***							
		NC 7 (Ozark) SWB	T	9.1	11.1	A	B	33.9	0%	39.1	0%	112.5	124.2	
		NC 7 (Ozark) SWB	R	3.4	3.8	A	A	34.5	0%	38.8	0%	112.5	124.2	200
		NC 7 (Ozark) NEB	L	70.0	47.3	E	D	91.0	0%	86.0	0%	252.0	224.1	
		NC 7 (Ozark) NEB	T	6.4	3.3	A	A	52.2	0%	36.1	0%	252.0	224.1	225
		I-85 SB RAMP SEB	L	37.6	38.5	D	D	29.2	0%	24.1	0%	229.0	246.0	350
		I-85 SB RAMP SEB	R	26.2	23.0	C	C	55.7	0%	65.3	0%	229.0	246.0	
15	NC 7 (Ozark) & I-85 NB Ramps	***Overall***		***9.1***	***6.8***	***A***	***A***							
		NC 7 (Ozark) SWB	L	49.8	50.8	D	D	35.0	0%	27.6	0%	139.9	87.2	225
		NC 7 (Ozark) SWB	T	4.2	1.4	A	A	40.1	0%	27.1	0%	139.9	87.2	
		I-85 NB RAMP NWB	L	37.7	43.4	D	D	65.2	0%	53.4	0%	262.8	236.0	300
		I-85 NB RAMP NWB	R	30.8	45.2	C	D	55.1	0%	61.9	0%	262.8	236.0	
		NC 7 (Ozark) NEB	T	5.4	3.8	A	A	35.1	0%	44.4	0%	125.8	130.0	
		NC 7 (Ozark) NEB	R	0.8	1.1	A	A	39.8	0%	53.2	0%	125.8	130.0	175
17	NC 7 (Ozark) & Modena	***Overall***		***15.8***	***16.3***	***B***	***B***							
		Modena SB	L	45.7	53.3	D	D	47.1	0%	52.9	0%	174.3	143.9	100
		Modena SB	R	24.8	25.8	C	C	21.2	0%	15.1	0%	174.3	143.9	
		NC 7 (Ozark) SWB	T	15.2	16.5	B	B	83.2	0%	85.7	0%	251.7	269.0	
		NC 7 (Ozark) SWB	R	13.0	14.4	B	B	26.1	0%	27.1	0%	251.7	269.0	50
		Modena NB	L	46.5	49.3	D	D	21.6	0%	20.0	0%	77.5	112.5	175
		Modena NB	T	43.5	42.9	D	D	15.2	0%	28.0	0%	77.5	112.5	
		Modena NB	R	39.1	40.0	D	D	14.9	0%	13.9	0%	77.5	112.5	
		NC 7 (Ozark) NEB	L	13.3	16.3	B	B	17.8	0%	21.0	0%	172.4	216.2	150
		NC 7 (Ozark) NEB	T	8.9	8.9	A	A	57.3	0%	68.4	0%	172.4	216.2	
13 *	NC 7 (Ozark) & Pear	NC 7 (Ozark) SWB	T	0.1	0.1	A	A	--	--	--	--	#N/A	#N/A	
		NC 7 (Ozark) SWB	TR	0.1	0.2	A	A	--	--	--	0%	#N/A	#N/A	
		NC 7 (Ozark) NEB	LT	0.4	1.2	A	A	15.8	0%	11.6	0%	--	#N/A	
		NC 7 (Ozark) NEB	T	0.2	0.3	A	A	--	0%	--	--	--	#N/A	
		Pear SEB	LR	11.8	15.8	B	C	23.8	0%	27.2	0%	59.1	93.3	
16 *	NC 7 (Ozark) & Piedmont	NC 7 (Ozark) SWB	L	17.5	13.4	C	B	6.5	0%	21.4	0%	#N/A	--	75
		NC 7 (Ozark) SWB	T	0.1	0.2	A	A	--	--	--	--	#N/A	--	
		NC 7 (Ozark) SWB	TR	0.1	0.1	A	A	--	--	--	--	#N/A	--	
		Piedmont NWB	LTR	23.3	25.3	C	D	33.7	0%	37.2	0%	102.1	110.5	
		NC 7 (Ozark) NEB	L	9.1	10.8	A	B	10.5	0%	6.0	0%	--	#N/A	175
		NC 7 (Ozark) NEB	T	0.4	0.5	A	A	--	--	--	--	--	#N/A	
		NC 7 (Ozark) NEB	TR	0.7	0.7	A	A	--	--	--	0%	--	#N/A	
		Piedmont SEB	LTR	58.0	170.3	F	F	22.3	0%	48.0	0%	49.7	112.1	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations

[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y3: Exit 20: NC 279 (New Hope Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s) AM	Delay [1] (s) PM	Level of Service [2] AM	Level of Service [2] PM	95th Queue (ft)/Spillback Rate AM		95th Queue (ft)/Spillback Rate PM		Maximum Queue Length (ft) AM	Maximum Queue Length (ft) PM	Storage Length (ft)
18	NC 279 (New Hope) & Court	*Overall*		*25.9*	*26.0*	*C*	*C*							
		NC 279 (New Hope) SB	L	59.2	69.9	E	E	124.3	0%	53.5	0%	351.8	248.6	150
		NC 279 (New Hope) SB	T	5.4	16.4	A	B	19.2	0%	83.5	0%	351.8	248.6	
		NC 279 (New Hope) SB	TR	4.8	14.7	A	B	47.9	0%	82.2	0%	351.8	248.6	
		Court WB	L	72.0	53.4	E	D	63.3	0%	160.8	0%	170.5	437.8	
		Court WB	TR	62.7	43.6	E	D	35.0	0%	94.9	0%	170.5	437.8	
		NC 279 (New Hope) NB	L	135.1	105.7	F	F	21.5	0%	25.3	0%	614.6	343.8	125
		NC 279 (New Hope) NB	T	24.4	15.7	C	B	117.9	0%	81.9	0%	614.6	343.8	
		NC 279 (New Hope) NB	TR	31.5	17.0	C	B	193.9	0%	102.9	0%	614.6	343.8	
		Court EB	LTR	90.2	49.8	F	D	19.5	0%	29.8	0%	--	85.9	
20	NC 279 (New Hope) & Goforth, Remount	*Overall*		*20.0*	*26.9*	*B*	*C*							
		NC 279 (New Hope) SB	L	61.9	79.0	E	E	77.6	0%	95.7	0%	234.2	426.3	175
		NC 279 (New Hope) SB	T	12.9	23.3	B	C	73.1	0%	152.3	8%	234.2	426.3	
		NC 279 (New Hope) SB	TR	15.5	18.1	B	B	63.5	0%	66.8	1%	234.2	426.3	75
		Remount WB	L	61.5	61.8	E	E	106.0	0%	133.1	0%	285.0	367.9	750
		Remount WB	T	66.7	52.6	E	D	15.2	0%	14.6	0%	285.0	367.9	
		Remount WB	R	31.0	28.9	C	C	27.5	0%	50.2	0%	285.0	367.9	350
		NC 279 (New Hope) NB	L	86.8	73.8	F	E	51.3	0%	51.2	0%	431.4	589.6	125
		NC 279 (New Hope) NB	T	7.1	14.3	A	B	53.8	1%	79.3	7%	431.4	589.6	
		NC 279 (New Hope) NB	R	2.6	6.0	A	A	30.4	0%	36.1	0%	431.4	589.6	50
		Goforth EB	L	56.4	55.4	E	E	26.2	0%	25.0	0%	106.2	161.9	175
		Goforth EB	TR	55.5	48.2	E	D	30.4	0%	35.2	0%	106.2	161.9	
21	NC 279 (New Hope) & I-85 SB Ramps	*Overall*		*29.7*	*36.6*	*C*	*D*							
		NC 279 (New Hope) SB	T	9.4	7.5	A	A	79.8	2%	92.9	2%	378.6	413.7	
		I-85 SB RAMP SWB	T	53.4	52.3	D	D	30.7	4%	69.1	52%	109.1	264.6	
		I-85 SB RAMP NB	T	12.9	13.2	B	B	85.1	0%	79.3	0%	245.9	329.2	800
		NC 279 (New Hope) NEB	T	58.2	87.0	E	F	161.1	0%	259.3	2%	485.4	624.3	
22	NC 279 (New Hope) & I-85 NB Ramps	*Overall*		*23.5*	*38.7*	*C*	*D*							
		I-85 NB RAMP SB	T	5.1	11.8	A	B	86.3	0%	112.7	2%	277.2	357.6	
		NC 279 (New Hope) SWB	T	63.8	62.6	E	E	129.1	0%	210.5	1%	342.6	742.8	
		NC 279 (New Hope) NB	T	5.4	23.4	A	C	76.6	0%	211.6	0%	169.2	425.8	
		I-85 NB RAMP NEB	T	64.7	55.7	E	E	53.1	0%	60.9	0%	161.0	218.3	225, 550

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y3: Exit 20: NC 279 (New Hope Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
23	NC 279 (New Hope) & Pearl, Eastridge Mall 2	*Overall*		*25.6*	*26.6*	*C*	*C*							
		NC 279 (New Hope) SWB	L	55.3	73.9	E	E	54.6	0%	123.0	0%	371.8	380.0	325
		NC 279 (New Hope) SWB	T	26.4	17.9	C	B	167.5	0%	120.1	0%	371.8	380.0	
		NC 279 (New Hope) SWB	TR	28.4	14.8	C	B	202.2	0%	144.8	0%	371.8	380.0	
		Eastridge Mall 2 NWB	L	90.5	87.4	F	F	24.6	0%	30.1	0%	50.9	94.6	250
		Eastridge Mall 2 NWB	LT	93.2	85.1	F	F	27.7	0%	35.5	0%	50.9	94.6	
		NC 279 (New Hope) NEB	L	88.0	158.2	F	F	20.6	0%	21.7	0%	220.9	312.7	75
		NC 279 (New Hope) NEB	T	15.2	21.5	B	C	108.8	0%	171.9	0%	220.9	312.7	
		Pearl SEB	LTR	67.0	78.1	E	E	50.8	0%	63.9	1%	162.7	193.1	
25	NC 279 (New Hope) & US 29-74 (Franklin)	*Overall*		*42.3*	*52.6*	*D*	*D*							
		NC 279 (New Hope) SB	L	98.4	87.8	F	F	108.6	0%	109.6	0%	259.9	626.0	500
		NC 279 (New Hope) SB	T	21.2	44.6	C	D	48.3	0%	160.9	0%	259.9	626.0	
		NC 279 (New Hope) SB	TR	25.9	59.5	C	E	66.5	0%	214.8	0%	259.9	626.0	
		US 29-74 (Franklin) WB	L	68.6	75.5	E	E	46.5	0%	75.1	0%	239.6	354.8	200, 275
		US 29-74 (Franklin) WB	T	47.9	53.2	D	D	63.0	0%	124.9	0%	239.6	354.8	
		US 29-74 (Franklin) WB	TR	50.6	56.9	D	E	83.9	0%	139.6	0%	239.6	354.8	
		NC 279 (New Hope) NB	L	66.1	67.6	E	E	77.2	0%	98.0	0%	392.1	369.6	
		NC 279 (New Hope) NB	T	34.4	34.5	C	C	158.3	0%	131.9	0%	392.1	369.6	
		NC 279 (New Hope) NB	R	26.6	24.6	C	C	28.4	0%	35.2	0%	392.1	369.6	50
		US 29-74 (Franklin) EB	L	66.0	78.4	E	E	78.4	0%	91.7	0%	311.1	369.0	
		US 29-74 (Franklin) EB	T	44.6	54.6	D	D	122.9	0%	151.3	0%	311.1	369.0	
		US 29-74 (Franklin) EB	R	42.1	53.4	D	D	62.6	0%	88.0	0%	311.1	369.0	150
19 *	NC 279 (New Hope) & Bethlehem	NC 279 (New Hope) SB	T	0.4	1.1	A	A	--	--	113.5	0%	#N/A	203.6	
		NC 279 (New Hope) SB	TR	0.3	0.9	A	A	--	0%	71.9	0%	#N/A	203.6	
		NC 279 (New Hope) NB	L	14.2	21.1	B	C	8.5	0%	7.6	0%	#N/A	#N/A	100
		NC 279 (New Hope) NB	T	0.1	0.1	A	A	--	--	--	--	#N/A	#N/A	
		Bethlehem EB	LR	27.5	32.7	D	D	19.9	0%	25.2	0%	--	82.8	
24 *	NC 279 (New Hope) & Eastridge Mall 3, Wayside	NC 279 (New Hope) SWB	L	18.9	11.9	C	B	3.3	0%	0.2	0%	#N/A	104.1	325
		NC 279 (New Hope) SWB	T	0.2	0.4	A	A	--	--	85.9	0%	#N/A	104.1	
		NC 279 (New Hope) SWB	TR	0.3	0.6	A	A	--	--	100.3	0%	#N/A	104.1	
		NC 279 (New Hope) NEB	T	0.3	0.3	A	A	--	--	--	--	#N/A	#N/A	
		Wayside SEB	R	11.6	19.1	B	C	23.9	0%	23.2	0%	#N/A	--	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y4: Exit 21: SR 2200 (Cox Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
26	Remount & Aberdeen	*Overall*		*19.4*	*17.4*	*B*	*B*							
		Aberdeen SWB	L	--	17.5	--	B	--	--	14.8	0%	188.0	252.2	100
		Aberdeen SWB	TR	23.3	12.2	C	B	60.5	0%	73.6	0%	188.0	252.2	
		Remount NWB	L	16.6	44.0	B	D	21.9	0%	33.4	0%	43.3	99.6	150
		Remount NWB	TR	50.2	41.4	D	D	17.3	0%	20.3	0%	43.3	99.6	
		Aberdeen NEB	L	51.2	32.9	D	C	27.4	0%	22.8	0%	147.3	180.6	150
		Aberdeen NEB	TR	19.2	16.7	B	B	34.2	0%	60.1	0%	147.3	180.6	
		Remount SEB	L	15.1	42.6	B	D	55.8	0%	52.5	0%	179.1	160.5	150
		Remount SEB	T	--	--	--	--	--	--	--	--	179.1	160.5	
		Remount SEB	R	6.0	10.2	A	B	14.4	0%	11.4	0%	179.1	160.5	
27	W Club & Aberdeen	*Overall*		*36.4*	*35.1*	*D*	*D*							
		Aberdeen SWB	L	71.6	56.5	E	E	38.7	0%	90.2	0%	112.3	250.9	225
		Aberdeen SWB	T	5.5	13.6	A	B	23.6	0%	24.0	0%	112.3	250.9	
		Aberdeen SWB	R	12.1	21.6	B	C	20.3	0%	29.4	0%	112.3	250.9	225
		W Club NWB	LT	59.5	43.1	E	D	37.2	0%	33.9	0%	244.8	157.8	250
		W Club NWB	TR	63.6	41.5	E	D	77.2	0%	52.0	0%	244.8	157.8	
		Aberdeen NEB	L	59.8	68.9	E	E	15.8	0%	14.6	0%	64.3	133.4	
		Aberdeen NEB	T	11.9	16.8	B	B	28.6	0%	47.3	0%	64.3	133.4	
		Aberdeen NEB	R	11.4	20.5	B	C	22.1	0%	22.7	0%	64.3	133.4	75
		W Club SEB	L	79.4	55.7	E	E	27.0	0%	29.1	0%	125.7	222.9	
		W Club SEB	R	56.4	40.0	E	D	51.8	0%	98.2	0%	125.7	222.9	175
28	SR 2200 (Cox) & Aberdeen	*Overall*		*36.1*	*47.6*	*D*	*D*							
		SR 2200 (Cox) SB	L	68.8	67.1	E	E	98.1	0%	92.8	0%	325.3	504.0	175
		SR 2200 (Cox) SB	T	20.1	31.0	C	C	84.8	0%	154.3	0%	325.3	504.0	
		SR 2200 (Cox) SB	TR	19.8	33.4	B	C	106.9	0%	178.3	0%	325.3	504.0	
		Aberdeen WB	L	71.9	90.5	E	F	51.2	0%	180.0	0%	190.7	580.6	
		Aberdeen WB	TR	74.1	71.0	E	E	50.2	0%	98.4	0%	190.7	580.6	125
		SR 2200 (Cox) NB	L	92.1	72.6	F	E	115.1	0%	107.1	0%	552.3	523.6	175
		SR 2200 (Cox) NB	T	20.3	33.6	C	C	126.9	0%	163.5	0%	552.3	523.6	
		SR 2200 (Cox) NB	R	18.1	18.5	B	B	79.1	0%	44.3	0%	552.3	523.6	175
		Aberdeen EB	L	118.8	91.3	F	F	143.6	0%	141.8	0%	454.7	537.3	100
		Aberdeen EB	TR	82.0	74.3	F	E	75.3	0%	87.3	0%	454.7	537.3	
30	SR 2200 (Cox) & I-85 SB Ramps	*Overall*		*30.2*	*29.5*	*C*	*C*							
		SR 2200 (Cox) SB	T	23.3	35.2	C	D	107.8	0%	236.0	0%	342.6	758.3	
		SR 2200 (Cox) SB	R	7.7	14.7	A	B	40.7	0%	61.4	0%	342.6	758.3	275
		I-85 SB RAMP WB	L	54.4	47.9	D	D	67.1	0%	52.7	0%	528.4	266.7	
		I-85 SB RAMP WB	LT	55.0	47.6	D	D	67.2	0%	60.3	0%	528.4	266.7	
		I-85 SB RAMP WB	R	45.5	25.1	D	C	180.1	0%	84.2	0%	528.4	266.7	250
		SR 2200 (Cox) NB	L	76.2	66.5	E	E	144.5	5%	168.1	11%	1013.5	712.3	125, 375
		SR 2200 (Cox) NB	T	12.1	10.5	B	B	151.0	1%	107.6	0%	1013.5	712.3	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y4: Exit 21: SR 2200 (Cox Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s) AM	Delay [1] (s) PM	Level of Service [2] AM	Level of Service [2] PM	95th Queue (ft)/Spillback Rate AM		95th Queue (ft)/Spillback Rate PM		Maximum Queue Length (ft) AM	Maximum Queue Length (ft) PM	Storage Length (ft)
31	SR 2200 (Cox) & I-85 NB Ramps	***Overall***		***26.4***	***21.0***	***C***	***C***							
		SR 2200 (Cox) SB	L	56.3	74.2	E	E	60.8	0%	186.4	3%	511.6	848.8	150, 200
		SR 2200 (Cox) SB	T	17.7	8.8	B	A	169.9	1%	93.7	0%	511.6	848.8	
		SR 2200 (Cox) NB	T	19.0	14.2	B	B	123.7	2%	114.5	2%	790.7	594.6	
		SR 2200 (Cox) NB	R	3.0	5.5	A	A	35.7	0%	54.6	0%	790.7	594.6	
		I-85 NB RAMP EB	L	57.7	51.3	E	D	111.3	0%	47.6	0%	412.1	277.3	375
		I-85 NB RAMP EB	R	59.0	55.4	E	E	125.8	0%	92.0	0%	412.1	277.3	
		I-85 NB RAMP EB	LTR	59.1	50.7	E	D	135.9	0%	85.0	0%	412.1	277.3	600
32	SR 2200 (Cox) & Gaston Mall	***Overall***		***26.2***	***27.9***	***C***	***C***							
		SR 2200 (Cox) SB	L	119.6	86.4	F	F	44.7	0%	55.5	0%	659.0	570.5	100
		SR 2200 (Cox) SB	T	15.6	24.0	B	C	174.7	2%	161.7	6%	659.0	570.5	
		SR 2200 (Cox) SB	R	5.2	12.4	A	B	76.9	0%	64.4	0%	659.0	570.5	175
		Gaston Mall WB	L	70.4	60.0	E	E	47.8	0%	32.1	0%	359.1	218.8	175
		Gaston Mall WB	TR	77.8	68.3	E	E	84.7	0%	75.6	0%	359.1	218.8	
		SR 2200 (Cox) NB	L	50.5	52.7	D	D	33.5	0%	60.5	0%	455.0	341.3	250
		SR 2200 (Cox) NB	T	21.2	17.6	C	B	155.9	0%	100.9	0%	455.0	341.3	
		SR 2200 (Cox) NB	TR	17.1	19.2	B	B	112.1	0%	102.3	0%	455.0	341.3	
		Gaston Mall EB	L	76.1	73.3	E	E	69.8	0%	109.2	0%	273.1	406.8	
		Gaston Mall EB	LT	73.2	60.5	E	E	88.2	0%	92.6	0%	273.1	406.8	
		Gaston Mall EB	R	39.2	26.5	D	C	25.7	0%	29.4	0%	273.1	406.8	275
33	SR 2200 (Cox) & US 29-74 (Franklin), SR 2200 (Armstrong Park)	***Overall***		***45.2***	***37.2***	***D***	***D***							
		SR 2200 (Cox) SB	L	73.2	60.6	E	E	175.6	0%	145.3	0%	583.3	455.6	375, 650
		SR 2200 (Cox) SB	T	15.4	37.7	B	D	24.4	0%	108.4	0%	583.3	455.6	
		SR 2200 (Cox) SB	R	3.8	32.9	A	C	30.5	0%	97.8	0%	583.3	455.6	250
		US 29-74 (Franklin) WB	L	68.7	52.0	E	D	34.1	0%	51.0	0%	296.0	473.0	425, 475
		US 29-74 (Franklin) WB	T	34.0	27.6	C	C	101.1	0%	134.7	0%	296.0	473.0	
		US 29-74 (Franklin) WB	R	14.8	23.9	B	C	102.5	0%	230.4	0%	296.0	473.0	425
		SR 2200 (Armstrong Park) NB	T	72.7	57.9	E	E	160.8	0%	98.5	0%	564.3	348.2	
		SR 2200 (Armstrong Park) NB	R	55.8	41.1	E	D	191.1	0%	129.8	0%	564.3	348.2	500
		US 29-74 (Franklin) EB	L	115.3	74.8	F	E	91.6	0%	62.5	0%	297.2	235.6	450, 575
		US 29-74 (Franklin) EB	T	30.6	26.7	C	C	84.4	0%	72.1	0%	297.2	235.6	
		US 29-74 (Franklin) EB	R	33.1	28.7	C	C	18.9	0%	22.5	0%	297.2	235.6	450
34	US 29-74 (Franklin) & US 29-74 (Franklin) EB U-Turn	***Overall***		***10.6***	***8.5***	***B***	***A***							
		US 29-74 (Franklin) WB	T	4.4	5.3	A	A	47.6	0%	55.4	0%	122.9	127.6	
		US 29-74 (Franklin) EB U-Turn NEB	L	69.7	64.8	E	E	103.6	0%	83.5	0%	207.1	168.6	325
29 *	SR 2200 (Cox) & Pembroke	SR 2200 (Cox) SB	L	31.1	20.2	D	C	7.7	0%	9.6	0%	#N/A	229.1	175
		SR 2200 (Cox) SB	T	0.8	0.3	A	A	--	--	131.3	0%	#N/A	229.1	
		Pembroke WB	LR	36.4	129.1	E	F	30.1	0%	81.0	0%	90.2	250.2	
		SR 2200 (Cox) NB	T	0.2	0.2	A	A	97.2	0%	37.7	0%	176.9	118.4	
		SR 2200 (Cox) NB	TR	0.6	0.5	A	A	90.1	0%	78.8	0%	176.9	118.4	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y5: Exit 22: SR 2329 (South Main Street)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
35	SR 2329 (S Main) & Lineberger/ Aberdeen Extension	***Overall***	***Overall***	***22.1***	***21.5***	***C***	***C***							
		SR 2329 (S Main) SWB	T	22.6	21.3	C	C	31.0	0%	29.0	0%	206.2	223.9	175
		SR 2329 (S Main) SWB	TR	19.1	15.8	B	B	65.6	0%	70.4	1%	206.2	223.9	
		SR 2329 (S Main) NB	L	38.0	36.0	D	D	71.9	0%	92.8	0%	230.1	292.2	
		SR 2329 (S Main) NB	T	9.0	5.1	A	A	31.0	0%	29.1	0%	230.1	292.2	
		Lineberger/ Aberdeen Extension EB	L	28.6	34.1	C	C	85.4	0%	65.6	0%	284.4	204.5	
		Lineberger/ Aberdeen Extension EB	R	16.8	16.8	B	B	69.0	0%	50.1	0%	284.4	204.5	
36	SR 2329 (S Main) & Kenworthy, Reid	***Overall***	***Overall***	***10.1***	***10.0***	***B***	***B***							
		SR 2329 (S Main) SB	T	11.0	10.9	B	B	35.5	0%	30.4	0%	67.8	101.3	
		Reid NWB	T	11.2	12.4	B	B	41.5	0%	25.8	0%	--	--	
		SR 2329 (S Main) NB	T	9.8	10.2	A	B	48.3	0%	42.1	0%	--	57.7	
		Kenworthy EB	T	9.8	9.3	A	A	45.0	0%	34.4	25%	130.8	72.9	
37	SR 2329 (S Main) & I-85 SB Ramps	***Overall***	***Overall***	***10.3***	***10.3***	***B***	***B***							
		SR 2329 (S Main) SB	T	12.6	15.9	B	C	48.6	0%	40.6	0%	100.0	122.8	
		I-85 SB Off RAMP NWB	T	7.8	8.6	A	A	49.8	0%	46.8	0%	131.5	203.2	
		SR 2329 (S Main) NEB	T	13.0	13.0	B	B	61.9	0%	56.7	0%	85.2	223.9	
38	SR 2329 (S Main) & I-85 NB Ramps	***Overall***	***Overall***	***8.1***	***8.6***	***A***	***A***							
		SR 2329 (S Main) SB	T	17.0	17.4	C	C	59.8	0%	67.8	0%	304.9	240.4	
		I-85 NB Off Loop WB	T	15.0	13.6	C	B	59.8	17%	51.6	17%	208.6	177.4	
		SR 2329 (S Main) NEB	T	8.9	8.7	A	A	43.9	0%	39.7	0%	57.6	--	
40	SR 2329 (S Main) & US 29-74 (Wilkinson), SR 2329 (Redbud)	***Overall***	***Overall***	***21.2***	***19.3***	***C***	***B***							
		SR 2329 (S Main) SB	T	24.7	23.8	C	C	183.0	0%	153.7	0%	618.9	512.6	
		SR 2329 (S Main) SB	R	12.6	17.9	B	B	50.5	0%	63.1	0%	618.9	512.6	275
		US 29-74 (Wilkinson) WB	T	20.3	16.3	C	B	47.5	0%	66.6	0%	361.3	340.7	
		US 29-74 (Wilkinson) WB	R	25.9	17.0	C	B	97.3	0%	77.6	0%	361.3	340.7	350
		SR 2329 (Redbud) NB	T	18.6	23.5	B	C	199.2	4%	233.0	2%	690.6	529.5	
		US 29-74 (Wilkinson) EB	T	24.1	19.0	C	B	116.1	0%	98.8	0%	365.2	310.7	
		US 29-74 (Wilkinson) EB	R	26.2	20.3	C	C	32.4	0%	38.7	0%	365.2	310.7	325

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations

[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

	Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
					AM	PM	AM	PM	AM		PM		AM	PM	
2045 Future Year Build Y5: Exit 22: SR 2329 (South Main Street)	41	SR 2329 (Redbud) & RedBud Dr Quadrant	***Overall***		***34.1***	***22.6***	***C***	***C***							
			SR 2329 (Redbud) SB	L	32.5	25.5	C	C	161.7	3%	123.7	1%	865.9	760.9	325
			SR 2329 (Redbud) SB	T	18.9	13.3	B	B	165.2	0%	135.8	0%	865.9	760.9	
			RedBud Dr Quadrant WB	L	57.8	52.5	E	D	106.4	0%	186.5	0%	379.7	330.3	
			RedBud Dr Quadrant WB	R	25.7	22.2	C	C	160.0	0%	114.7	0%	379.7	330.3	
			SR 2329 (Redbud) NB	T	51.6	27.0	D	C	209.5	0%	111.5	0%	799.3	413.2	
			SR 2329 (Redbud) NB	R	27.9	13.1	C	B	53.9	0%	73.9	0%	799.3	413.2	200
	42	US 29-74 (Wilkinson) & RedBud Dr Quadrant	***Overall***		***13.8***	***14.5***	***B***	***B***							
			US 29-74 (Wilkinson) WB	L	49.2	47.9	D	D	64.8	0%	115.0	0%	260.1	322.4	925, 975
			US 29-74 (Wilkinson) WB	T	8.7	8.9	A	A	66.3	0%	95.9	0%	260.1	322.4	
			RedBud Dr Quadrant NB	L	26.4	27.8	C	C	57.8	0%	59.5	0%	283.9	317.3	475
			RedBud Dr Quadrant NB	R	31.9	32.4	C	C	121.6	0%	121.3	0%	283.9	317.3	
			US 29-74 (Wilkinson) EB	T	0.6	1.4	A	A	20.7	0%	24.3	0%	--	259.5	
			US 29-74 (Wilkinson) EB	R	0.0	2.4	A	A	--	0%	--	--	--	259.5	400
	39 *	SR 2329 (S Main) & Crausby Ave	SR 2329 (S Main) SWB	T	0.4	0.3	A	A	86.3	10%	--	0%	--	--	
			SR 2329 (S Main) SWB	TR	0.6	0.4	A	A	--	--	--	--	--	--	
			SR 2329 (S Main) NEB	T	0.7	0.7	A	A	--	0%	--	--	--	#N/A	
			Crausby Ave SEB	R	30.3	19.9	D	C	53.4	0%	29.9	0%	163.8	110.7	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y6: Exit 23: NC 7 (McAdenville Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s) AM	Delay [1] (s) PM	Level of Service [2] AM	Level of Service [2] PM	95th Queue (ft)/Spillback Rate AM		95th Queue (ft)/Spillback Rate PM		Maximum Queue Length (ft) AM	Maximum Queue Length (ft) PM	Storage Length (ft)
43	NC 7 (1st) & Phillips	*Overall*		*7.5*	*8.5*	*A*	*A*							
		NC 7 (1st) NWB	LT	2.9	5.2	A	A	17.9	0%	43.6	0%	68.7	177.9	
		NC 7 (1st) NWB	T	1.6	4.0	A	A	31.8	0%	52.8	0%	68.7	177.9	
		Phillips NEB	LR	36.7	34.3	D	C	61.2	0%	70.9	0%	242.8	232.3	
		NC 7 (1st) SEB	T	4.8	5.2	A	A	44.3	0%	41.8	0%	177.7	153.9	
		NC 7 (1st) SEB	TR	5.2	5.6	A	A	52.5	0%	46.0	0%	177.7	153.9	
44	NC 7 (Main) & Groves, NC 7 (1st), SR 2329 (S Main)	*Overall*		*26.4*	*33.2*	*C*	*C*							
		NC 7 (Main) SWB	L	37.8	28.0	D	C	28.7	0%	27.7	0%	298.6	253.7	50
		NC 7 (Main) SWB	T	29.7	28.5	C	C	75.4	0%	62.7	0%	298.6	253.7	
		NC 7 (Main) SWB	R	15.3	11.5	B	B	49.8	0%	36.8	0%	298.6	253.7	150
		Groves NWB	L	45.8	63.6	D	E	27.3	0%	48.8	0%	180.8	559.7	75
		Groves NWB	TR	46.5	63.8	D	E	55.4	0%	183.6	0%	180.8	559.7	
		SR 2329 (S Main) NEB	L	46.4	59.0	D	E	52.0	0%	71.2	0%	203.3	244.1	150
		SR 2329 (S Main) NEB	T	18.1	17.7	B	B	63.4	0%	41.6	0%	203.3	244.1	
		SR 2329 (S Main) NEB	R	16.3	18.6	B	B	17.4	0%	16.3	0%	203.3	244.1	
		NC 7 (1st) SEB	L	41.7	63.1	D	E	113.1	0%	127.5	0%	360.3	359.6	
		NC 7 (1st) SEB	TR	16.8	14.6	B	B	55.5	0%	44.1	0%	360.3	359.6	
45	US 29-74 (Wilkinson Blvd) & Car Dealership, Groves	*Overall*		*13.6*	*15.1*	*B*	*B*							
		Groves SB	LT	36.1	51.9	D	D	82.2	0%	87.2	0%	330.2	322.8	
		Groves SB	R	16.2	26.4	B	C	35.3	0%	36.1	0%	330.2	322.8	50
		US 29-74 (Wilkinson) WB	L	73.3	79.2	E	E	18.8	0%	17.9	0%	191.7	344.6	150
		US 29-74 (Wilkinson) WB	T	11.9	12.7	B	B	39.8	0%	97.0	0%	191.7	344.6	
		US 29-74 (Wilkinson) WB	TR	12.5	14.1	B	B	55.0	0%	119.3	0%	191.7	344.6	
		Car Dealership NB	LTR	62.4	69.9	E	E	20.1	0%	23.6	0%	--	47.9	
		US 29-74 (Wilkinson) EB	L	48.2	59.5	D	E	40.3	0%	58.8	0%	186.6	188.3	100
		US 29-74 (Wilkinson) EB	T	6.8	5.9	A	A	44.1	0%	44.1	0%	186.6	188.3	
		US 29-74 (Wilkinson) EB	TR	6.4	5.4	A	A	42.2	0%	47.1	0%	186.6	188.3	
46	NC 7 (Main) & NC 7 (McAdenville), SR 2201 (N Main), W 3rd Street	*Overall*		*25.9*	*28.4*	*C*	*C*							
		SR 2201 (N Main) SWB	L	39.5	47.6	D	D	94.3	0%	62.1	0%	241.4	201.9	
		SR 2201 (N Main) SWB	TR	11.0	20.2	B	C	53.3	0%	59.6	0%	241.4	201.9	
		NC 7 (McAdenville) NWB	L	49.1	42.9	D	D	99.8	0%	173.5	0%	283.0	566.1	300
		NC 7 (McAdenville) NWB	TR	27.9	22.5	C	C	54.5	0%	78.7	0%	283.0	566.1	
		NC 7 (Main) NEB	L	24.9	28.9	C	C	22.5	0%	44.8	0%	289.0	172.4	150
		NC 7 (Main) NEB	T	18.5	25.5	B	C	48.2	0%	44.6	0%	289.0	172.4	
		NC 7 (Main) NEB	R	16.6	4.4	B	A	105.9	0%	21.4	0%	289.0	172.4	275
		3rd SEB	LTR	66.1	64.9	E	E	57.1	0%	45.9	0%	194.6	204.2	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y6: Exit 23: NC 7 (McAdenville Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
48	NC 7 (McAdenville) & Power, Gas Station	***Overall***		***21.0***	***9.5***	***C***	***A***							
		Power SWB	L	50.2	54.8	D	D	93.7	0%	74.7	0%	325.1	292.3	125
		Power SWB	TR	44.1	56.0	D	E	33.6	0%	29.9	0%	325.1	292.3	
		NC 7 (McAdenville) WB	L	19.9	4.9	B	A	20.2	0%	16.8	0%	166.9	143.6	150
		NC 7 (McAdenville) WB	T	24.6	1.0	C	A	100.1	0%	42.9	0%	166.9	143.6	
		NC 7 (McAdenville) WB	R	8.6	2.6	A	A	29.2	0%	51.9	0%	166.9	143.6	350
		Gas Station NB	LTR	44.3	47.7	D	D	38.2	0%	39.0	0%	114.3	120.8	
		NC 7 (McAdenville) EB	L	16.7	13.3	B	B	32.8	0%	19.0	0%	246.2	133.6	150
		NC 7 (McAdenville) EB	T	10.3	5.8	B	A	92.3	0%	44.1	0%	246.2	133.6	
		NC 7 (McAdenville) EB	TR	10.6	5.7	B	A	78.1	0%	48.9	0%	246.2	133.6	275
49	NC 7 (McAdenville) & I-85 SB Ramps	***Overall***		***15.1***	***23.3***	***B***	***C***							
		I-85 SB RAMP WB	LT	46.6	39.7	D	D	35.8	0%	48.8	0%	179.5	488.4	
		I-85 SB RAMP WB	R	43.2	42.4	D	D	57.5	0%	150.3	0%	179.5	488.4	225
		NC 7 (McAdenville) NWB	L	12.5	4.4	B	A	102.7	0%	27.6	0%	223.0	133.4	125
		NC 7 (McAdenville) NWB	T	2.8	1.8	A	A	--	0%	81.4	0%	223.0	133.4	
		NC 7 (McAdenville) SEB	T	16.3	50.9	B	D	108.3	3%	132.3	2%	499.8	362.0	
		NC 7 (McAdenville) SEB	R	7.2	12.5	A	B	46.4	0%	47.0	0%	499.8	362.0	275
50	NC 7 (Main), NC 7 (McAdenville) & I-85 NB Ramps	***Overall***		***32.0***	***41.3***	***C***	***D***							
		NC 7 (Main) WB	T	90.4	70.4	F	E	188.9	0%	191.1	0%	360.5	580.3	
		NC 7 (Main) WB	R	32.4	53.2	C	D	33.0	0%	33.3	0%	360.5	580.3	50
		I-85 NB RAMP NEB	LT	40.9	41.1	D	D	44.3	0%	46.3	0%	257.4	331.4	
		I-85 NB RAMP NEB	R	35.6	38.7	D	D	68.9	0%	102.6	0%	257.4	331.4	425
		NC 7 (McAdenville) SEB	L	1.9	8.3	A	A	--	0%	105.0	0%	--	224.9	275
		NC 7 (McAdenville) SEB	T	1.9	6.5	A	A	5.1	0%	51.5	0%	--	224.9	
52	NC 7 (Main) & Dickson	***Overall***		***3.7***	***4.2***	***A***	***A***							
		Dickson SB	LR	66.6	65.4	E	E	32.5	0%	39.7	0%	116.4	129.4	
		NC 7 (Main) WB	TR	2.1	2.5	A	A	56.6	0%	71.5	0%	144.0	297.4	
		NC 7 (Main) EB	L	5.1	13.3	A	B	24.7	100%	31.7	99%	205.2	90.9	100
		NC 7 (Main) EB	T	0.6	0.3	A	A	35.2	89%	43.7	96%	205.2	90.9	
47 *	NC 7 (McAdenville) & Stowe	Stowe SB	LR	12.1	15.5	B	C	30.5	0%	24.0	0%	83.8	50.2	
		NC 7 (McAdenville) WB	TR	0.2	0.2	A	A	--	--	--	--	#N/A	#N/A	
		NC 7 (McAdenville) EB	LT	0.3	1.2	A	A	259.3	0%	46.3	0%	--	122.1	
51 *	NC 7 (Main) & Ford	NC 7 (Main) WB	LT	0.1	0.0	A	A	--	100%	39.3	50%	#N/A	#N/A	
		Ford NB	LR	19.1	28.8	C	D	22.5	0%	27.9	0%	79.8	48.4	
		NC 7 (Main) EB	T	1.1	1.7	A	A	--	0%	19.5	0%	152.8	--	175
		NC 7 (Main) EB	TR	0.8	0.7	A	A	75.7	0%	94.3	0%	152.8	--	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y7: Exit 26: SR 2093 (Belmont-Mt. Holly Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
53	SR 2093 (Belmont - Mt Holly) & Woodlawn, Wimmer 1	***Overall***		***14.6***	***14.7***	***B***	***B***							
		Woodlawn SB	T	16.2	15.0	C	B	53.0	0%	37.7	0%	145.2	152.3	
		SR 2093 (Belmont - Mt Holly) SWB	T	14.7	15.0	B	C	34.2	9%	34.1	5%	91.8	98.4	
		Wimmer 1 NB	T	15.6	19.3	C	C	31.3	0%	40.3	0%	80.3	121.4	
		SR 2093 (Belmont - Mt Holly) NEB	T	14.1	14.2	B	B	47.0	0%	48.5	10%	130.2	149.7	
54	SR 2093 (Belmont - Mt Holly) & Wimmer 2	***Overall***		***14.2***	***15.0***	***B***	***B***							
		SR 2093 (Belmont - Mt Holly) SWB	T	14.2	14.5	B	B	53.4	0%	65.3	0%	186.6	141.8	
		Wimmer 2 NWB	T	15.5	20.9	C	C	35.6	9%	41.0	17%	--	140.9	
		SR 2093 (Belmont - Mt Holly) NEB	T	15.3	16.2	C	C	50.8	10%	66.5	12%	168.0	339.0	
55	I-85 SB Ramp & SR 2093 (Belmont - Mt Holly)	***Overall***		***27.8***	***31.5***	***C***	***C***							
		SR 2093 (Belmont - Mt Holly) SB	T	24.1	28.4	C	C	119.9	0%	108.6	0%	414.8	415.4	
		SR 2093 (Belmont - Mt Holly) SB	R	28.6	37.5	C	D	93.4	0%	126.3	0%	414.8	415.4	375
		I-85 SB Ramp NWB	LT	58.3	51.0	E	D	133.7	0%	188.8	0%	426.1	595.0	
		I-85 SB Ramp NWB	R	44.5	36.0	D	D	51.7	0%	53.3	0%	426.1	595.0	375
		SR 2093 (Belmont - Mt Holly) NB	L	64.1	69.3	E	E	181.0	3%	148.1	0%	636.5	424.9	500
		SR 2093 (Belmont - Mt Holly) NB	T	4.4	12.7	A	B	52.4	0%	112.1	0%	636.5	424.9	
58	SR 2093 (Belmont - Mt Holly), NC 7 (Main) & NC 7 (McAdenville)	***Overall***		***33.9***	***41.8***	***C***	***D***							
		McAdenville Road WB	L	69.1	67.4	E	E	43.3	0%	91.3	0%	193.1	383.0	200
		McAdenville Road WB	T	57.3	52.1	E	D	19.6	0%	23.5	0%	193.1	383.0	
		McAdenville Road WB	R	30.5	27.7	C	C	60.4	0%	101.1	0%	193.1	383.0	250
		NC 7 (Main) NWB	L	73.9	85.0	E	F	59.8	0%	80.3	0%	540.6	524.6	200
		NC 7 (Main) NWB	T	33.3	39.4	C	D	120.6	0%	132.5	0%	540.6	524.6	
		NC 7 (Main) NWB	TR	36.8	42.8	D	D	135.9	0%	148.8	0%	540.6	524.6	
		NC 7 (McAdenville) EB	L	57.6	56.3	E	E	89.0	0%	73.3	0%	249.9	207.1	
		NC 7 (McAdenville) EB	TR	38.2	36.5	D	D	53.9	0%	49.9	0%	249.9	207.1	300
		SR 2093 (Belmont - Mt Holly) SEB	L	61.0	62.9	E	E	148.7	1%	134.1	0%	440.1	449.3	450
		SR 2093 (Belmont - Mt Holly) SEB	T	21.7	40.1	C	D	83.1	0%	184.1	0%	440.1	449.3	
		SR 2093 (Belmont - Mt Holly) SEB	R	12.7	26.1	B	C	73.6	0%	98.4	0%	440.1	449.3	400
60	NC 7 (Main) & US 29-74 (Wilkinson)	***Overall***		***22.7***	***25.6***	***C***	***C***							
		NC 7 (Main) SB	T	41.3	36.7	D	D	179.7	4%	193.9	14%	385.0	606.7	425
		NC 7 (Main) SB	R	35.6	31.0	D	C	123.7	0%	82.0	0%	385.0	606.7	
		US 29-74 (Wilkinson) WB	T	21.8	31.3	C	C	62.1	0%	207.5	0%	144.9	508.3	
		US 29-74 (Wilkinson) WB	R	2.5	14.4	A	B	#N/A	#N/A	#N/A	#N/A	144.9	508.3	125
		NC 7 (Main) NB	T	37.4	27.9	D	C	211.0	0%	127.5	0%	641.9	531.2	275, 675
		NC 7 (Main) NB	R	25.5	22.7	C	C	69.9	0%	67.4	0%	641.9	531.2	
		US 29-74 (Wilkinson) EB	T	14.9	14.1	B	B	125.5	0%	68.2	0%	381.9	404.8	
		US 29-74 (Wilkinson) EB	TR	17.5	24.1	B	C	113.4	0%	106.9	0%	381.9	404.8	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y7: Exit 26: SR 2093 (Belmont-Mt. Holly Road)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
61	US 29-74 (Wilkinson) & US 29-74 WB U-turn	*Overall*		***13.2***	***17.3***	***B***	***B***							
		US 29-74 WB U-turn SB	L	41.9	48.1	D	D	82.6	0%	121.0	0%	355.7	342.8	750
		US 29-74 (Wilkinson) EB	T	7.8	8.6	A	A	71.3	0%	62.2	0%	246.0	216.4	
62	US 29-74 (Wilkinson) & US 29-74 EB U-turn	*Overall*		***27.6***	***20.7***	***C***	***C***							
		US 29-74 (Wilkinson) WB	T	7.7	12.8	A	B	33.7	0%	108.0	0%	119.1	394.3	
		US 29-74 EB U-turn NB	L	58.2	57.6	E	E	139.4	0%	171.8	0%	381.5	435.2	500
63	NC 7 (Main) & Central	*Overall*		***22.5***	***15.8***	***C***	***B***							
		NC 7 (Main) SB	T	2.9	2.5	A	A	38.0	0%	49.4	0%	121.1	128.3	
		NC 7 (Main) NWB	LT	14.6	9.0	B	A	76.3	0%	65.7	0%	249.7	248.7	
		Central NB	TR	50.2	55.5	D	E	216.2	0%	178.1	0%	960.1	658.8	
56 *	SR 2093 (Belmont - Mt Holly) & I-85 NB Ramp	SR 2093 (Belmont - Mt Holly) SB	T	0.0	0.0	A	A	52.6	0%	--	--	#N/A	#N/A	
		SR 2093 (Belmont - Mt Holly) NB	T	1.7	0.0	A	A	195.3	0%	--	--	276.9	#N/A	
		I-85 NB Ramp EB	R	0.0	0.0	A	A	58.7	0%	61.6	0%	266.2	280.6	
57 *	SR 2093 (Belmont - Mt Holly) & I-85 NB Loop	I-85 NB Loop SWB	R	24.5	37.9	C	E	53.4	0%	78.8	0%	260.7	293.9	525
		SR 2093 (Belmont - Mt Holly) NWB	T	0.8	1.0	A	A	148.7	0%	15.2	0%	--	--	
		SR 2093 (Belmont - Mt Holly) NWB	TR	1.7	2.2	A	A	--	0%	87.0	0%	--	--	
		SR 2093 (Belmont - Mt Holly) SEB	L	12.8	30.8	B	D	23.3	0%	26.3	0%	172.4	162.4	300
		SR 2093 (Belmont - Mt Holly) SEB	T	0.1	0.1	A	A	62.4	0%	43.9	0%	172.4	162.4	
59 *	NC 7 (Main) & Hardees, Old NC 7	Old NC 7 WB	R	11.8	10.7	B	B	25.0	0%	25.1	1%	46.4	78.0	
		NC 7 (Main) NWB	T	0.1	0.1	A	A	--	--	--	--	#N/A	#N/A	
		NC 7 (Main) NWB	TR	0.1	0.2	A	A	--	--	--	--	#N/A	#N/A	
		Hardees NEB	R	12.6	20.7	B	C	27.8	0%	24.2	0%	71.2	56.8	
		NC 7 (Main) SEB	T	0.2	0.4	A	A	75.9	0%	75.7	0%	48.9	267.8	
		NC 7 (Main) SEB	TR	0.1	0.1	A	A	--	--	--	--	48.9	267.8	50
64 *	McAdenville Road & Caldwell Farm Rd, Old NC 7	Caldwell Farm Rd WB	LT	0.1	0.5	A	A	--	0%	24.2	0%	#N/A	--	
		Old NC 7 NB	LR	16.8	16.7	C	C	32.8	0%	34.3	0%	95.7	123.3	
		McAdenville Road EB	TR	1.5	1.2	A	A	61.7	0%	20.4	0%	--	--	
65 *	Old NC 7 & Bi-Lo	Old NC 7 SB	LT	1.8	2.2	A	A	5.8	0%	0.0	0%	#N/A	--	
		Bi-Lo WB	LR	7.5	8.1	A	A	28.3	0%	25.2	0%	--	67.4	
		Old NC 7 NEB	TR	0.0	0.0	A	A	--	--	--	--	#N/A	#N/A	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y8: Exit 27: NC 273 (Beatty Drive)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
66	NC 273 & Ferstl Ave	*Overall*		*14.8*	*16.5*	*B*	*B*							
		NC 273 SB	T	11.5	15.2	B	B	117.2	0%	84.0	0%	378.0	246.3	
		NC 273 SB	R	9.7	9.2	A	A	--	0%	23.2	0%	378.0	246.3	200
		NC 273 NB	L	76.1	66.5	E	E	84.9	0%	179.8	0%	208.8	377.7	250
		NC 273 NB	T	2.3	2.8	A	A	37.9	0%	42.8	0%	208.8	377.7	
		Ferstl Ave EB	L	53.0	60.7	D	E	20.5	0%	20.8	0%	287.6	150.3	
		Ferstl Ave EB	R	43.1	29.8	D	C	87.4	0%	52.4	0%	287.6	150.3	100
68	NC 273 & YMCA Dr, CaroMont 2	*Overall*		*12.7*	*21.2*	*B*	*C*							
		NC 273 SB	L	64.1	59.5	E	E	26.0	0%	33.4	0%	321.8	275.3	150
		NC 273 SB	T	8.3	13.6	A	B	102.2	0%	88.1	0%	321.8	275.3	
		NC 273 SB	TR	7.5	12.3	A	B	114.5	0%	98.0	0%	321.8	275.3	
		YMCA Dr WB	L	94.6	63.8	F	E	52.3	0%	54.6	0%	169.8	180.9	150
		YMCA Dr WB	TR	70.6	56.0	E	E	30.1	0%	34.3	0%	169.8	180.9	
		NC 273 NB	L	73.2	69.5	E	E	80.6	0%	102.7	0%	234.2	690.5	150
		NC 273 NB	T	2.7	15.0	A	B	24.2	0%	77.6	0%	234.2	690.5	
		NC 273 NB	TR	1.7	15.9	A	B	23.1	0%	109.2	0%	234.2	690.5	
		CaroMont 2 EB	L	100.4	79.0	F	E	26.7	0%	40.5	0%	60.4	115.8	150
		CaroMont 2 EB	TR	68.7	52.9	E	D	24.6	0%	24.8	0%	60.4	115.8	
70	NC 273 & I-85 SB Ramps	*Overall*		*29.8*	*30.3*	*C*	*C*							
		I-85 SB Ramps SWB	T	51.4	40.6	D	D	112.0	0%	151.6	0%	328.9	489.8	
		I-85 SB Ramps NWB	R	14.5	22.3	B	C	23.0	0%	59.1	0%	47.8	182.3	625
		NC 273 NB	T	41.5	28.7	D	C	127.1	0%	146.7	0%	450.3	536.4	
		NC 273 SEB	T	15.7	30.1	B	C	97.2	0%	121.9	0%	351.4	336.3	
71	NC 273 & I-85 NB Ramps	*Overall*		*35.0*	*30.8*	*C*	*C*							
		NC 273 SB	T	52.5	39.8	D	D	243.5	0%	224.9	0%	633.5	785.0	
		NC 273 NWB	T	12.5	21.1	B	C	91.2	5%	152.3	15%	359.6	700.8	
		I-85 NB Off RAMP LT NEB	T	49.5	36.1	D	D	52.2	0%	88.8	0%	161.9	244.2	
		I-85 NB Off RAMP RT SEB	R	15.1	21.2	B	C	67.7	0%	90.8	1%	189.1	268.4	575
72	NC 273 & SR 2094 (Browntown Rd)	*Overall*		*20.8*	*75.4*	*C*	*E*							
		SR 2094 (Browntown Rd) WB	R	59.3	108.1	E	F	114.6	0%	350.9	0%	327.7	1009.1	
		NC 273 NB	T	14.0	59.4	B	E	119.4	0%	268.2	4%	522.3	1015.6	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

2045 Build Intersection Control Delay and Queue by Lane Group Results

2045 Future Year Build
Y8: Exit 27: NC 273 (Beatty Drive)

Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
				AM	PM	AM	PM	AM		PM		AM	PM	
74	NC 273 & Hawley Ave, Wendy's		*Overall*	***19.8***	***31.8***	***B***	***C***							
		NC 273 SB	L	92.4	88.4	F	F	37.2	0%	47.2	0%	236.7	470.7	150
		NC 273 SB	T	9.9	20.9	A	C	30.3	0%	135.2	0%	236.7	470.7	
		NC 273 SB	R	7.1	13.9	A	B	12.2	0%	36.1	0%	236.7	470.7	400
		Wendy's NWB	LTR	45.6	46.2	D	D	38.0	0%	39.7	0%	115.4	153.0	
		NC 273 NEB	L	64.5	68.2	E	E	43.6	0%	53.6	0%	339.5	559.1	125
		NC 273 NEB	T	15.9	24.6	B	C	67.4	0%	93.3	0%	339.5	559.1	
		NC 273 NEB	TR	16.2	52.5	B	D	150.0	0%	256.7	1%	339.5	559.1	
		Hawley Ave SEB	LT	60.7	60.4	E	E	140.9	0%	120.8	0%	498.9	461.6	275
		Hawley Ave SEB	R	40.4	36.7	D	D	26.7	0%	33.8	0%	498.9	461.6	
75	NC 273 & US 29-74 (Wilkinson Blvd)		*Overall*	***73.4***	***47.7***	***E***	***D***							
		NC 273 SWB	L	94.5	86.8	F	F	278.9	0%	176.1	0%	517.3	354.3	475
		NC 273 SWB	T	15.3	29.4	B	C	40.4	0%	94.2	0%	517.3	354.3	
		NC 273 SWB	R	4.9	12.8	A	B	22.1	0%	37.8	0%	517.3	354.3	300
		US 29-74 (Wilkinson Blvd) WB	L	68.1	77.9	E	E	48.9	0%	119.3	0%	230.1	535.7	200
		US 29-74 (Wilkinson Blvd) WB	T	45.6	46.9	D	D	59.3	0%	205.2	0%	230.1	535.7	
		US 29-74 (Wilkinson Blvd) WB	TR	56.9	69.2	E	E	83.7	0%	254.3	0%	230.1	535.7	
		NC 273 NEB	L	67.6	58.6	E	E	37.5	0%	51.6	0%	796.2	309.4	350
		NC 273 NEB	T	85.2	49.1	F	D	376.9	0%	122.3	0%	796.2	309.4	
		NC 273 NEB	TR	90.6	47.7	F	D	415.9	0%	124.8	0%	796.2	309.4	
		US 29-74 (Wilkinson Blvd) EB	L	92.8	73.0	F	E	128.8	0%	106.7	0%	668.2	295.0	325
		US 29-74 (Wilkinson Blvd) EB	T	89.3	32.5	F	C	290.9	0%	85.2	0%	668.2	295.0	
		US 29-74 (Wilkinson Blvd) EB	TR	126.8	40.2	F	D	344.9	0%	108.4	0%	668.2	295.0	
67 *	NC 273 & Pearl Beatty Rd, Carolinas Rehab Center Dr	NC 273 SB	L	18.5	21.3	C	C	7.2	0%	12.0	0%	--	#N/A	150
		NC 273 SB	T	0.3	0.3	A	A	18.3	0%	--	--	--	#N/A	
		NC 273 SB	R	1.6	0.0	A	A	--	--	--	--	--	#N/A	150
		Pearl Beatty Rd WB	LTR	48.8	64.1	E	F	39.1	0%	55.3	0%	152.0	171.6	
		NC 273 NB	L	29.7	15.6	D	C	17.9	0%	16.7	0%	97.5	--	100
		NC 273 NB	T	1.1	0.9	A	A	--	--	--	0%	97.5	--	
		NC 273 NB	TR	0.6	0.6	A	A	--	--	--	0%	97.5	--	
		Carolinas Rehab Center Dr EB	LT	65.9	53.0	F	F	24.0	0%	20.3	0%	70.8	93.9	125
69 *	NC 273 & CaroMont 1, Caldwell Dr	NC 273 SB	L	3.4	22.3	A	C	--	--	12.6	0%	429.8	--	125
		NC 273 SB	T	0.3	0.2	A	A	--	0%	--	--	429.8	--	
		NC 273 SB	TR	0.6	0.2	A	A	67.9	0%	110.2	0%	429.8	--	50
		Caldwell Dr WB	R	13.1	21.5	B	C	27.6	0%	30.1	0%	75.9	102.5	
		NC 273 NB	T	0.0	0.0	A	A	--	--	--	--	#N/A	#N/A	
		NC 273 NB	TR	0.0	0.0	A	A	--	--	--	--	#N/A	#N/A	
		CaroMont 1 EB	R	25.0	15.3	C	C	23.6	0%	21.9	0%	63.9	53.2	
73 *	NC 273 & Hawley Ave	NC 273 SB	T	0.0	0.0	A	A	--	--	100.2	0%	#N/A	215.7	
		Hawley Ave SEB	T	12.6	13.3	B	B	27.3	0%	32.4	0%	91.0	135.0	

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies
* - Unsignalized Intersection – LOSs/Delay Data not reported for overall intersection or intersection approach

2045 Build Intersection Control Delay and Queue by Lane Group Results

	Intersection No.	Intersection	Approach	Lane Group	Delay [1] (s)		Level of Service [2]		95th Queue (ft)/Spillback Rate				Maximum Queue Length (ft)		Storage Length (ft)
					AM	PM	AM	PM	AM		PM		AM	PM	
2045 Future Year Build Exit 29: Sam Wilson Rd	76	SR 1625 (Sam Wilson Rd) & I-85 SB Ramps		*Overall*	***14.0***	***29.4***	***B***	***C***							
			SR 1625 (Sam Wilson Rd) SWB	TR	6.9	21.5	A	C	61.1	0%	154.2	0%	291.5	720.7	
			I-85 SB RAMP NWB	LT	36.4	49.0	D	D	64.2	0%	98.2	0%	190.5	401.9	
			I-85 SB RAMP NWB	R	29.1	45.9	C	D	41.6	0%	92.1	0%	190.5	401.9	125
			SR 1625 (Sam Wilson Rd) NB	L	31.0	101.9	C	F	35.0	0%	102.5	0%	156.2	480.4	175
			SR 1625 (Sam Wilson Rd) NB	T	6.1	16.3	A	B	40.8	0%	109.9	0%	156.2	480.4	
	77	SR 1625 (Sam Wilson Rd) & I-85 NB Ramps		*Overall*	***10.1***	***19.8***	***B***	***B***							
			SR 1625 (Sam Wilson Rd) SB	L	20.1	74.3	C	E	33.9	0%	120.4	0%	189.6	685.0	175
			SR 1625 (Sam Wilson Rd) SB	T	4.9	10.4	A	B	43.5	0%	60.3	0%	189.6	685.0	
			SR 1625 (Sam Wilson Rd) NB	T	4.4	11.5	A	B	32.9	0%	90.5	0%	134.3	304.1	
			SR 1625 (Sam Wilson Rd) NB	R	5.9	9.4	A	A	32.1	0%	39.3	0%	134.3	304.1	125
			I-85 NB RAMP EB	LT	28.7	35.8	C	D	47.6	0%	70.4	0%	218.5	332.8	
			I-85 NB RAMP EB	R	29.6	33.0	C	C	42.5	0%	42.0	0%	218.5	332.8	50

[1] Delay shown is the 95th percentile worst case control delay for the full 60-minute simulation period as derived from the 10 random seed simulations
[2] Level of Service shown is Simulation based and calculated in a manner that is consistent with the HCM 6 Methodologies

8.2.3 TransModeler Freeway Segment Analysis Results

TransModeler creates freeway analysis segments that are comparable to HCM defined freeway segmentation for basic freeway segments, merge and diverge areas. The freeway analysis tables in this section list each successive segment ID in each direction and the resulting density output from TransModeler that is converted to a comparable HCM defined LOSs. The freeway segments defined in TransModeler differ slightly from the segments in FREEVAL-NC due to differences in how each program segments the freeway.

Table 8-7 summarizes the 2045 FYB TransModeler freeway segment analysis results along I-85 northbound and southbound. **Table 8-8** presents 2045 Build 95th percentile worst freeway density and LOSs results from TransModeler output for freeway segments along I-85 northbound and southbound in the traffic study area. Y-line names in **bold** in **Table 8-8** are within the I-5719 project limits.

All the segments within the I-5719 project limits along I-85 southbound in the AM peak perform at LOSs D or better. In the PM peak, the basic segment 56 between the ramps at Exit 26, NC 7 (McAdenville), is the only freeway segment that does not operate at LOSs D or better in the I-5719 project limits along I-85 southbound. Segment 56 operates at a 95th percentile worst freeway density of 35.0 pc/mi/ln, narrowly exceeding the 35 pc/mi/ln density threshold for LOSs E operations.

I-85 northbound in the AM peak has three segments operating at LOSs F and one at LOSs E, located between where the NC 273 on-ramp merges into I-85 northbound and the diverge to I-485 at the northern (eastern) end of the I-5719 project. In the PM peak, I-85 northbound has one segment operating at LOSs F and three at LOSs E in this same area, which spans segments 35-38. In both peak hours, all freeway segments within the I-5719 project limits along I-85 northbound operate at LOSs D or better in the 2045 FYB scenario.

Table 8-7 2045 Future Year Build TransModeler Freeway Operations LOSs Summary

2045 Future Year Build	Corridor	Number of Freeway Segments Operating at Given LOSs During AM and PM Peak Hours					
		LOSs A	LOSs B	LOSs C	LOSs D	LOSs E	LOSs F
	AM (7:15 – 8:15)						
	I-85 Northbound	0	7	17	14	1[a]	3[a]
	I-85 Southbound	3	7	28	2	0	0
	PM (16:30 -17:30)						
	I-85 Northbound	1	17	19	1	3[a]	1[a]
	I-85 Southbound	0	5	12	22	1[b]	0

[a] *The I-85 Northbound segments operating at LOSs E or F in 2045 are outside of the I-5719 project limits and result from congestion due to vehicles maneuvering to exit I-85 NB to go to I-485*
[b] *The I-85 Southbound segment operating at LOSs E in the PM Peak is within the I-5719 project limits.*

Table 8-8 2045 Future Year Build Freeway Segment Analysis Results

Density		LOS		ID#	Seg ID	Type	2045 Future Year Build	ID#	Seg ID	Type	Density		LOS	
AM	PM	AM	PM								AM	PM	AM	PM
I-85 Northbound							Y-Line	I-85 Southbound						
20.6	13.5	C	B	**B1**	2452	Basic		**B82**	2445	Basic	15.7	19.9	B	C
18.9	12.7	B	B	**D2**	2451	Diverge	Exit 14 - NC 274	**M81**	2444	Merge	11.2	13.9	B	B
19.0	12.8	C	B	**B3**	2459	Basic		**B80**	2457	Basic	18.3	23.9	C	C
16.4	12.0	B	B	**M4**	2461	Merge		**D79**	2460	Diverge	14.4	18.9	B	B
21.0	14.6	C	B	**B5**	13703	Basic		**B78**	13699	Basic	18.9	23.7	C	C
17.1	12.5	B	B	**D6**	13853	Diverge		**M77**	13849	Merge	14.6	19.1	B	B
20.2	14.0	C	B	**B7**	13847	Basic		**B76**	13851	Basic	20.4	26.1	C	D
14.2	11.0	B	B	**M8**	13696	Merge	SR 1327 (Fairview Dr / Davidson Ave)	**D75**	13856	Diverge	17.1	20.3	B	C
23.5	16.2	C	B	**B9**	13772	Basic	<- Speed Limit Drop / Speed Limit Increase ->	**B74**	13771	Basic	21.1	26.7	C	D
23.6	16.8	C	B	**B10**	2470	Basic		**B73**	13691	Basic	21.0	26.1	C	D
18.0	14.7	B	B	**D11**	2469	Diverge	**Exit 17 - US 321**	**M72**	2463	Merge	15.7	18.2	B	B
20.9	14.2	C	B	**B12**	2475	Basic		**B71**	2478	Basic	19.3	24.0	C	C
								D70	13871	Diverge	13.4	15.0	B	B
17.7	15.9	B	B	**M13**	13686	Merge		**D69**	14188	Diverge	23.1	31.0	C	D
23.9	19.7	C	C	**B14**	13872	Basic	<- Acceleration Lane Drop	**B68**	2487	Basic	24.8	32.8	C	D
30.1	21.8	D	C	**B15**	13877	Basic								
26.2	22.0	C	C	**D16**	13264	Diverge	**Exit 19 - NC 7**	**M67**	2488	Merge	23.5	31.1	C	D
34.1	24.4	D	C	**B17**	2499	Basic		**B66**	2495	Basic	25.9	31.6	C	D
23.8	18.5	C	B	**W18**	13671	Weaving		**W65**	13885	Weaving	21.9	28.1	C	D
26.4	20.0	D	C	**B19**	13886	Basic	**Exit 20 - NC 279**	**B64**	2512	Basic	23.3	30.0	C	D
22.6	17.6	C	B	**B20**	13892	Basic		**W63**	13934	Weaving	20.6	25.4	C	C
26.0	21.2	C	C	**B21**	2533	Basic	**Exit 21 - SR 2200 (Cox Rd)**	**B62**	2529	Basic	21.7	26.7	C	D
23.0	24.0	C	C	**M22**	13414	Merge		**D61**	13852	Diverge	22.8	24.5	C	C

Density		LOS		ID#	Seg ID	Type	2045 Future Year Build	ID#	Seg ID	Type	Density		LOS	
AM	PM	AM	PM								AM	PM	AM	PM
I-85 Northbound							Y-Line	I-85 Southbound						
27.0	22.8	D	C	**B23**	14122	Basic		**B60**	14121	Basic	25.0	29.8	C	D
21.7	21.9	C	C	**D24**	2540	Diverge	**Exit 22 - SR 2329 (S. Main St)**	**M59**	2545	Merge	22.5	23.8	C	C
27.7	23.2	D	C	**B25**	14129	Basic		**B58**	2547	Basic	23.9	28.8	C	D
26.5	22.3	C	C	**W26**	2555	Weaving		**W57**	2559	Weaving	21.1	25.8	C	C
30.4	24.7	D	C	**B27**	13964	Basic	**Exit 23 - NC 7 (McAdenville Rd / N. Main St)**	**B56**	2568	Basic	27.5	35.0	D	***E***
29.2	24.5	D	C	**M28**	13965	Merge		**D55**	13968	Diverge	23.2	29.4	C	D
33.5	26.4	D	D	**B29**	13641	Basic		**B54**	13642	Basic	26.0	34.4	D	D
29.3	25.7	D	C	**D30**	13838	Diverge	**Exit 26 - SR 2093 (Belmont-Mt. Holly Rd)**	**M53**	14052	Merge	22.3	28.3	C	D
28.2	21.8	D	C	**B31**	2577	Basic		**B52**	14066	Basic	22.5	30.1	C	D
33.9	25.5	D	C	**B32**	2585	Basic								
26.5	20.2	D	C	**B33**	2593	Basic		**B51**	2596	Basic	19.4	26.3	C	D
31.4	22.0	D	C	**B34**	13625	Basic	**Exit 27 - NC 273 (Beatty Dr / Park St)**	**B50**	2610	Basic	23.2	34.9	C	D
47.0	41.9	***F***	***E***	**M35**	2612	Merge		**B49**	14011	Basic	19.5	30.6	C	D
51.2	37.0	***F***	***E***	**B36**	13980	Basic	**Lane Drop and Add (Weigh Station) ->**	**B48**	2618	Basic	21.1	34.9	C	D
								B47	2626	Basic	18.8	31.4	C	D
51.2	67.1	***F***	***F***	**D37**	13569	Diverge	Exit 29-30 - Sam Wilson Rd / I-485	**M46**	13724	Merge	21.9	32.4	C	D
37.5	37.5	***E***	***E***	**B38**	2641	Basic		**B45**	2649	Basic	7.9	23.1	A	C
21.3	25.3	C	C	**D39**	2646	Diverge								
25.5	12.9	C	B	**B40**	2648	Basic								
14.7	7.8	B	A	**M41**	2655	Merge		**D44**	2650	Diverge	9.9	22.6	A	C
27.8	15.1	D	B	**B42**	13731	Basic		**B43**	13730	Basic	9.3	24.3	A	C

BOLD/ITALIC – Freeway Segment that has Operational Deficiencies (HCM Equivalent LOS$_s$ E or F)

9 CRASH ANALYSIS

As part of the traffic analysis, HNTB conducted a section crash analysis along the I-85 corridor from 3,500 feet west of US 321 (Chester Street) in Gaston County to I-485 (Western Loop) in Mecklenburg County. The crash analysis output report is included in ***Appendix I.*** The analysis included mainline crashes and excluded crashes that occurred on ramps, on side streets, or at ramp intersections. The following section provides a summary of crash analysis statistics for the entire study corridor, as well as for the section between US 321 (Chester Street) and NC 7 (Ozark Avenue).

9.1 Section Crash Analysis

There were 5,237 total crashes reported along the I-85 corridor between the designated study limits over the five-year analysis period (6/1/2016 to 5/31/2021). In this 13.85-mile section, crash types were primarily rear end crashes (2,656) or lane departure crashes (1,341), which include run-off road and sideswipe crashes. There were 12 fatal crashes and 25 serious injury crashes (Class A) reported. This section also experienced one (1) head-on collision involving a wrong-way drivers resulting in a fatal injury. **Table 9-1** presents a summary of crash severity and conditions for the study area section crash analysis.

Table 9-1 Study Area Section Crash Summary

Crash Type	Total Crashes (#)	Total Crashes (%)
Total Crashes	5,237	100%
Fatal Crashes	12	<1%
Non-Fatal Injury Crashes	1,007	19%
Total Injury Crashes	1,019	19%
Property Damage Only Crashes	4,218	81%
Night Crashes	1,320	25%
Wet Crashes	1,085	21%

HNTB calculated critical crash rates from the crash analysis to compare against the latest North Carolina statewide crash rates for comparable facilities. Critical crash rates are crash rates that have been statistically adjusted, based on other roads with similar characteristics, to remove the elements of chance and randomness. This method can be used to determine if the rate at a particular location is significantly higher than a predetermined average rate for locations with similar characteristics.

Table 9-2 presents a comparison between the I-85 corridor study area crash rates to the latest North Carolina statewide average crash rates for the five-year period 2016-2020 (compiled by NCDOT Traffic Safety Unit) for urban interstate facilities. The crash rates along I-85 in the project study area are all higher than the statewide critical crash rates except for fatal crashes.

Table 9-2 Study Area Section Crash Rate Comparison

Crash Type	Total Crashes (#)	Crash Rate	2016-2020 Statewide Crash Rates for Urban Interstate Facilities	
			4+ Lanes Divided with Full Control Access Crash Rate	4+ Lanes Divided with Full Control Access Critical Crash Rate
Total Crashes	5,237	**158.34**	127.51	130.76
Fatal Crashes	12	0.36	0.41	0.61
Non-Fatal Injury Crashes	1,007	**30.45**	28.61	30.16
Night Crashes	1,320	**39.91**	31.46	33.08
Wet Crashes	1,085	**32.80**	25.92	27.39

9.2 Curve Section Crash Analysis

Three (3) curves between the interchanges of US 321 (Chester Street) and NC 7 (Ozark Avenue) were identified as potentially having horizontal stopping sight distance (HSSD) deficiencies. A special analysis of the section between these two interchanges was conducted to identify if any crash patterns existed that could possibly be attributed to the HSSD in the curves.

There were 652 total crashes reported along the I-85 segment between US 321 and NC 7 over the five-year analysis period (6/1/2016 to 5/31/2021). In this 1.98-mile segment, 204 crashes (31%) occurred in one of the three (3) curves, which make up approximately 1.08 miles of the total segment length (52%). Of the 204 identified curve crashes, crash types were primarily lane departure crashes (160) or rear end crashes (34). The head-on crash involving a wrong way driver that resulted in a fatal injury mentioned previously occurred in the curve just east of US 321 (Chester Street).

Table 9-3 below presents a summary of total crashes based on direction of travel and the specific curve that they occurred in. Red denotes the direction of travel of concern for that particular curve. As shown in the results, the direction of concern for each curve produced the higher crash total.

Table 9-3 Total Crash Summary

Crash Location	Eastbound	Westbound	Total
Curve #1 (East of US 321)	**37**	17	54
Curve #2 (West of Modena St)	34	**90**	124
Curve #3 (West of NC 7)	**17**	9	26

The crash types most likely to be affected by a HSSD concern are lane departure crashes (avoidance maneuvers) and rear end crashes. **Table 9-4** on the following page presents a summary of these crash types based on direction of travel and the specific curve that they occurred in. Red denotes the direction of concern for that particular curve. As shown in the results, the direction of travel of concern for each curve produced the higher crash total.

Table 9-4 Target Crash Summary

Crash Location	Eastbound	Westbound	Total
Curve #1 (East of US 321)	**33**	16	49
Curve #2 (West of Modena St)	34	**85**	119
Curve #3 (West of NC 7)	**17**	9	26

Based on the results, it appears crash patterns do exist in the curves, as 31% of total crashes are occurring in one of the three curves and 19% are occurring specifically in the curve just west of Modena Street. It also appears that HSSD does impact the curves as well, as each of the curves sees approximately twice as many crashes or more in the direction of concern.

10 CONCLUSIONS

Comparing the 2045 Future Year No-Build and Future Year Build FREEVAL-NC freeway segment density and LOS results, the I-5719 project widening and interchange improvements is anticipated to improve freeway operations along I-85 in both directions. **Table 10-1** shows a decrease from 28 segments between the AM and PM peaks operating at LOS F in the 2045 FYNB scenario to zero segments at LOS F in the 2045 FYB scenario. The segments operating in the AM and PM peaks at LOS E decrease from 15 in the 2045 FYNB scenario to seven in the 2045 FYB scenario.

Table 10-1 2045 FYNB / 2045 FYB I-85 FREEVAL-NC Analysis LOS Summary

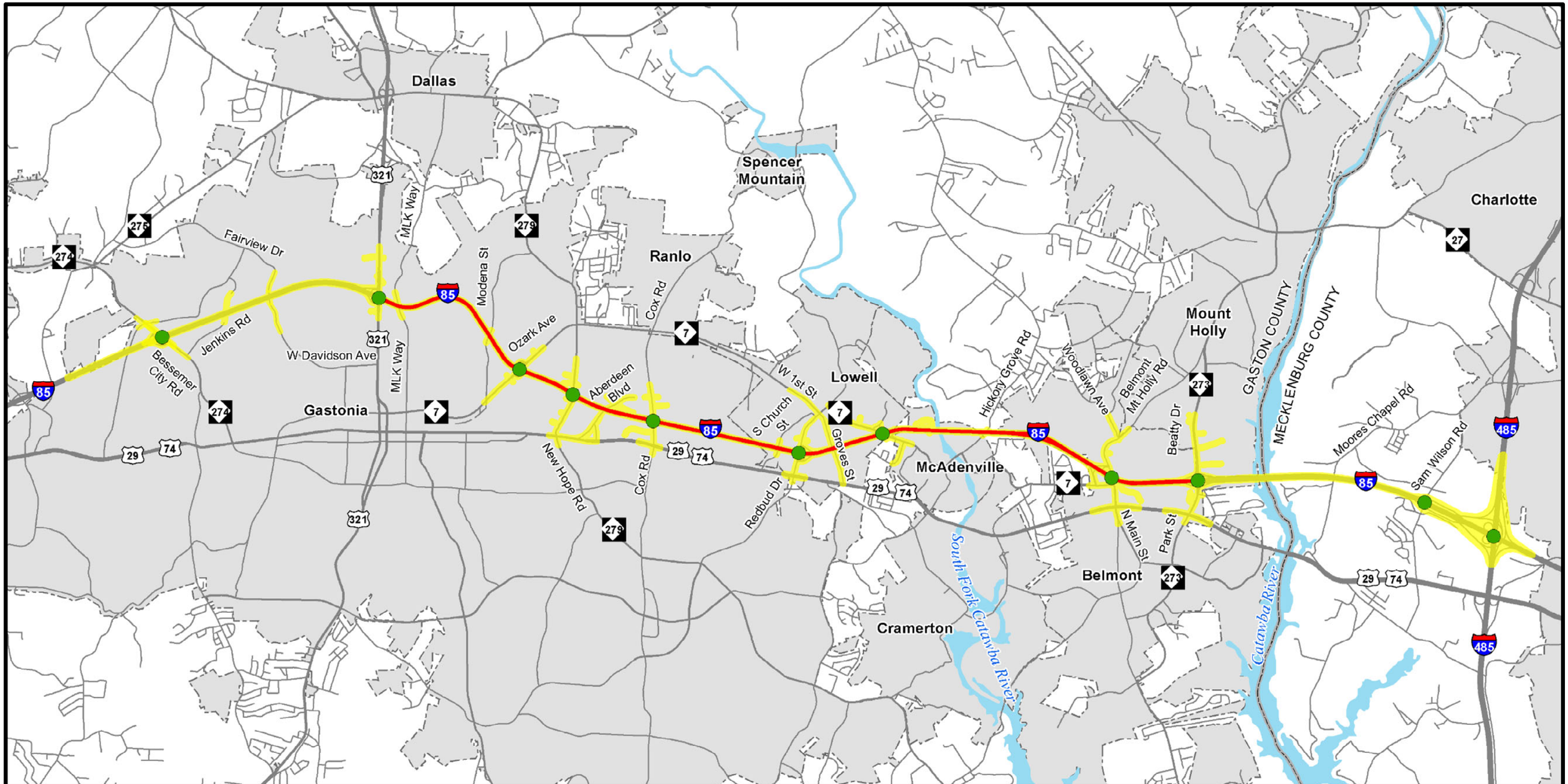
Analysis Year	Scenario	Number of Freeway Segments Operating at Given LOS During AM and PM Peak Hours					
		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
AM Peak							
2045	Future Year No-Build	2	11	28	23	5	21
2045	Future Year Build	3	8	47	19	4	0
PM Peak							
2045	Future Year No-Build	0	15	28	30	10	7
2045	Future Year Build	0	15	43	20	3	0

The 2045 Future Year Build TransModeler network and corridor analysis found that there were no trips queued outside the network in either peak hour and traffic flows in both directions on I-85 experience near free-flow speed conditions for both peak hours. All ramp termini within the I-5719 project limits operate at an overall intersection LOSs D or better in the AM and PM peak hours. At the unsignalized intersection at SR 2093 (Belmont-Mt Holly Rd) and the I-85 northbound off-loop, the right turn from the I-85 northbound off-loop to SR 2093 northbound operates at LOSs E in the PM peak, with a 95th queue length of 79 feet and a 0% spillback rate, indicating that the ramp queue is not spilling back onto I-85 northbound.

The 2045 Future Year Build TransModeler freeway segment analysis found that all the segments within the I-5719 project limits along I-85 southbound in the AM peak perform at LOSs D or better. In the PM peak, the basic segment 56 between the ramps at Exit 26, NC 7 (McAdenville), is the only freeway segment that does not operate at LOSs D or better in the I-5719 project limits. Segment 56 operates at a 95th percentile worst freeway density of 35.0 pc/mi/ln, narrowly exceeding the 35 pc/mi/ln density threshold for LOSs E operations. In both peak hours, all freeway segments within the I-5719 project limits along I-85 northbound operate at LOSs D or better in the 2045 FYB scenario.

APPENDIX

Appendix A – Figures
FINAL



LEGEND

- Study Area Intersection
- Traffic Capacity Analysis Study Area
- County Boundary
- Municipality Boundary
- I-5719 Improvement Section
- Interstate
- US Route
- NC Route
- Local Road

N

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	STIP PROJECT NO.
Gaston	I-5719
DIVISION	WBS NO.
12	50135.1.FS1

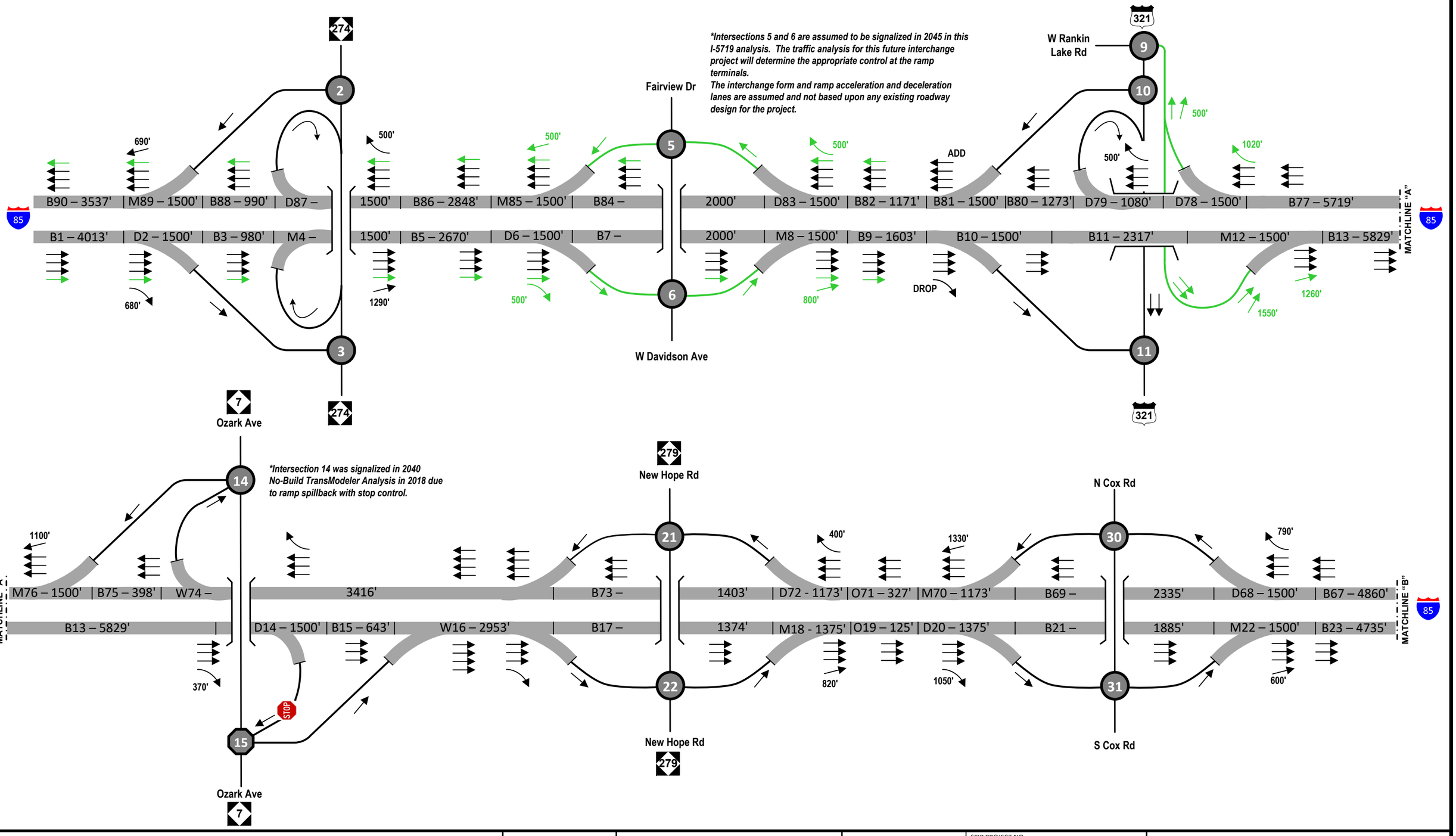
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

TRAFFIC CAPACITY ANALYSIS STUDY AREA

DATE
October 2021

FIGURE 1



LEGEND

- # Signalized Intersection ID
- # Unsignalized Intersection ID
- XXX – XXXX' Freeway Segment ID – Segment Length (ft)
- Roadway
- Existing Laneage
- Laneage added by Future Projects
- XXX' Acceleration/Deceleration Lane Length

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

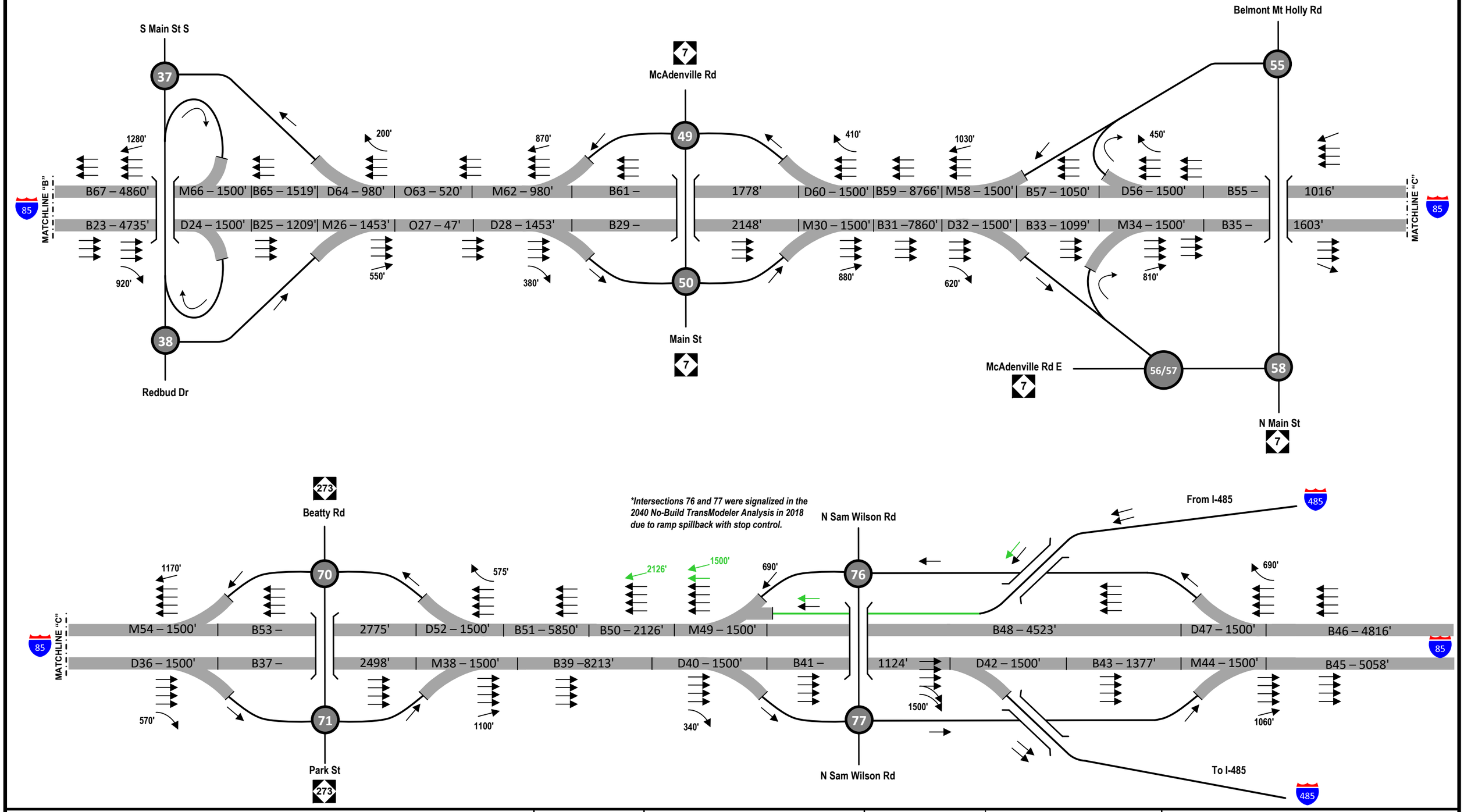
HNTB

Gaston	STIP PROJECT NO. I-5719
DIVISION 12	WBS NO. 50135.1.FS1
PROJECT DESCRIPTION: I-85 Widening from US 321 to NC 273	

2045 NO-BUILD FREEWAY LANEAGE, FREEVAL SEGMENT ID & LENGTH

DATE: October 2021

FIGURE 2.1



LEGEND

- # — Signalized Intersection ID
- # — Unsignalized Intersection ID
- XXX – XXXX' — Freeway Segment ID – Segment Length (ft)
- Roadway
- Existing Laneage
- Laneage added by Future Projects
- XXX' — Acceleration/Deceleration Lane Length

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

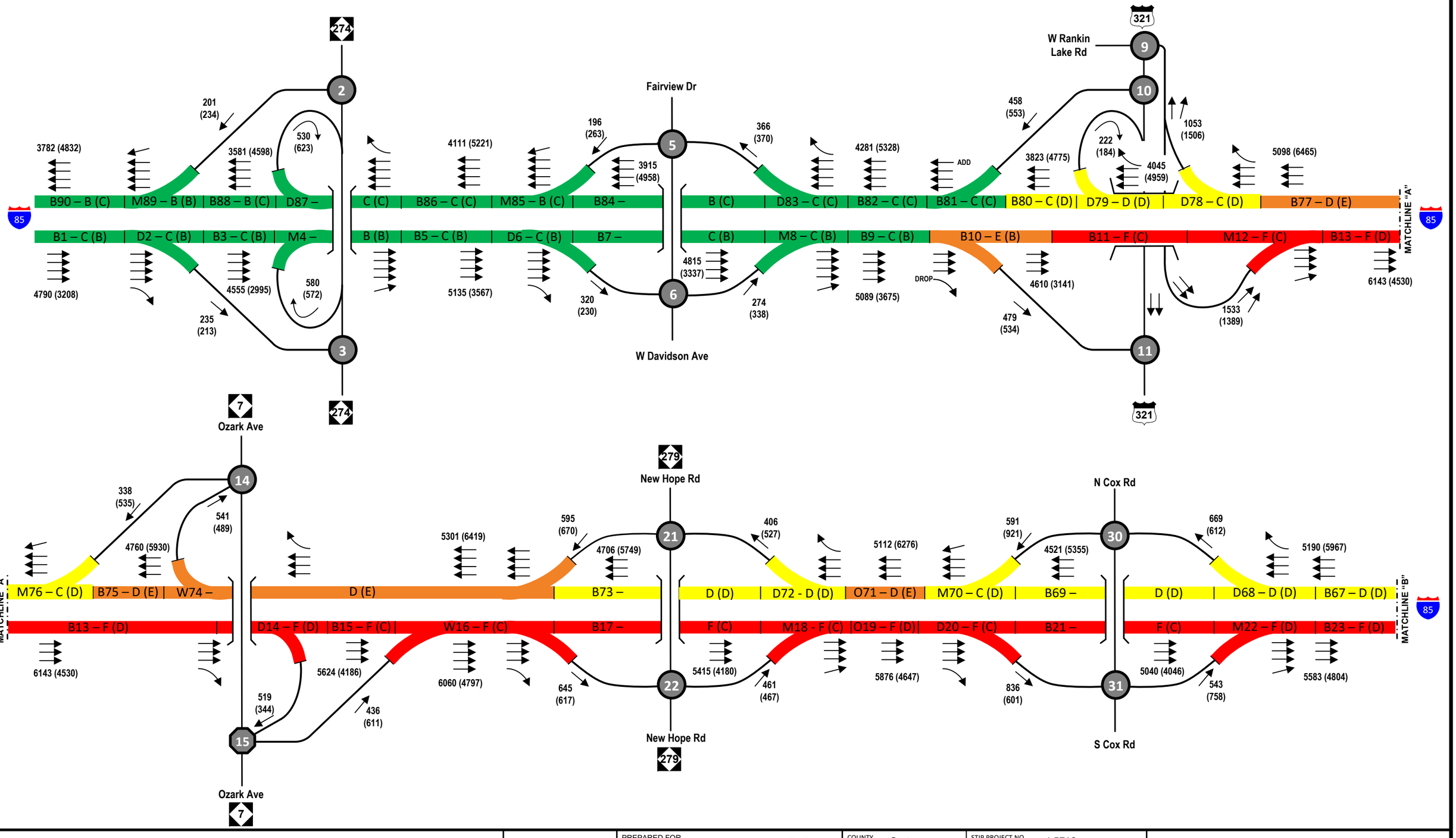
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 NO-BUILD FREEWAY LANEAGE, FREEVAL SEGMENT ID & LENGTH

DATE
October 2021

FIGURE 2.2



LEGEND

Roadway

Vehicular Movement

XXX – X(X) Freeway Segment ID – AM(PM) LOS

Signalized Intersection ID

Unsignalized Intersection ID

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service

- LOS A – C
- LOS D
- LOS E
- LOS F

N

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

HNTB

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

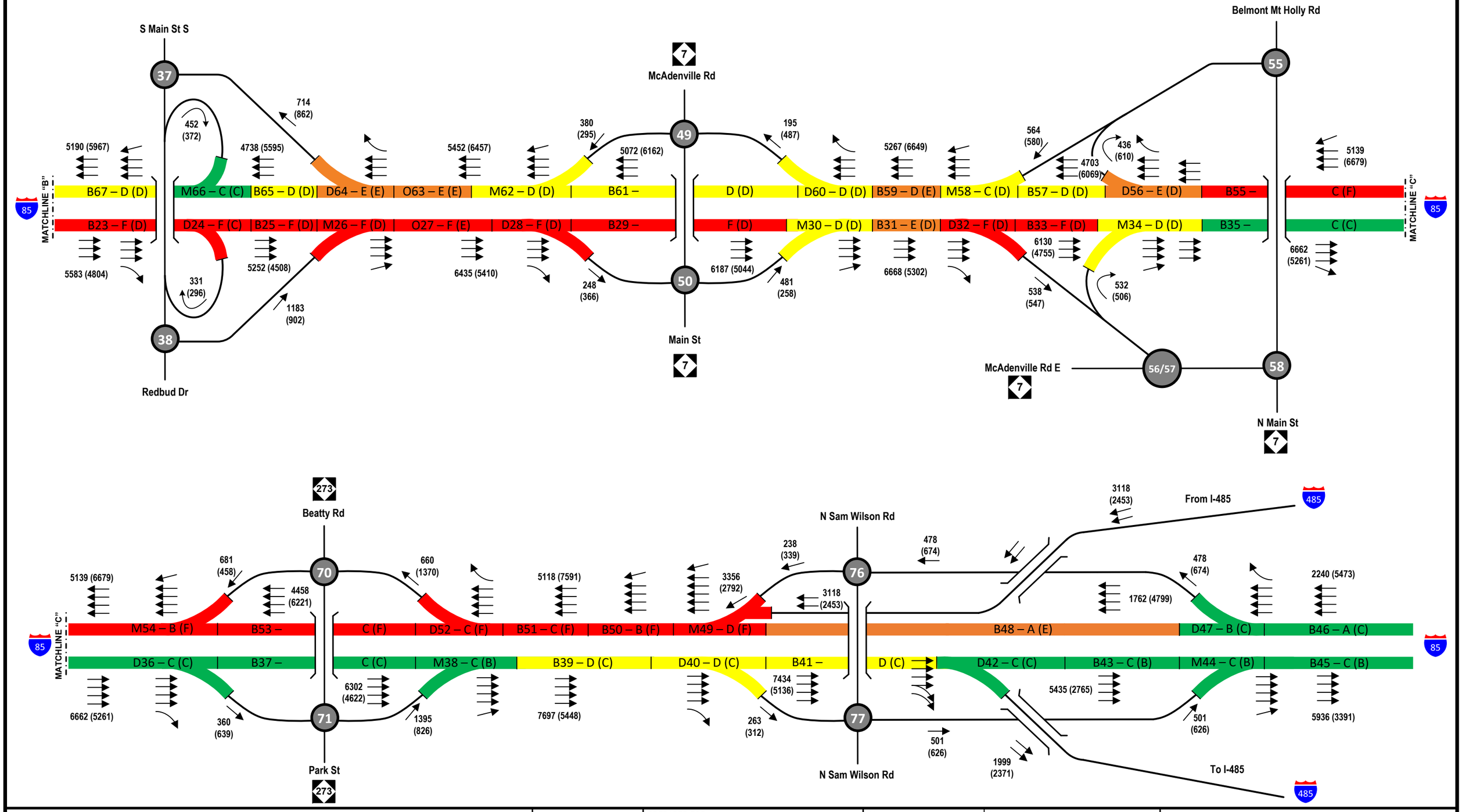
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 NO-BUILD FREEWAY PEAK HOUR VOLUMES, FREEVAL SEGMENT ID & LOS

DATE
October 2021

FIGURE 3.1



LEGEND

- Roadway
- Vehicular Movement
- XXX – X(X) Freeway Segment ID – AM(PM) LOS
- # Signalized Intersection ID
- # Unsignalized Intersection ID

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service

- LOS A – C
- LOS D
- LOS E
- LOS F

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

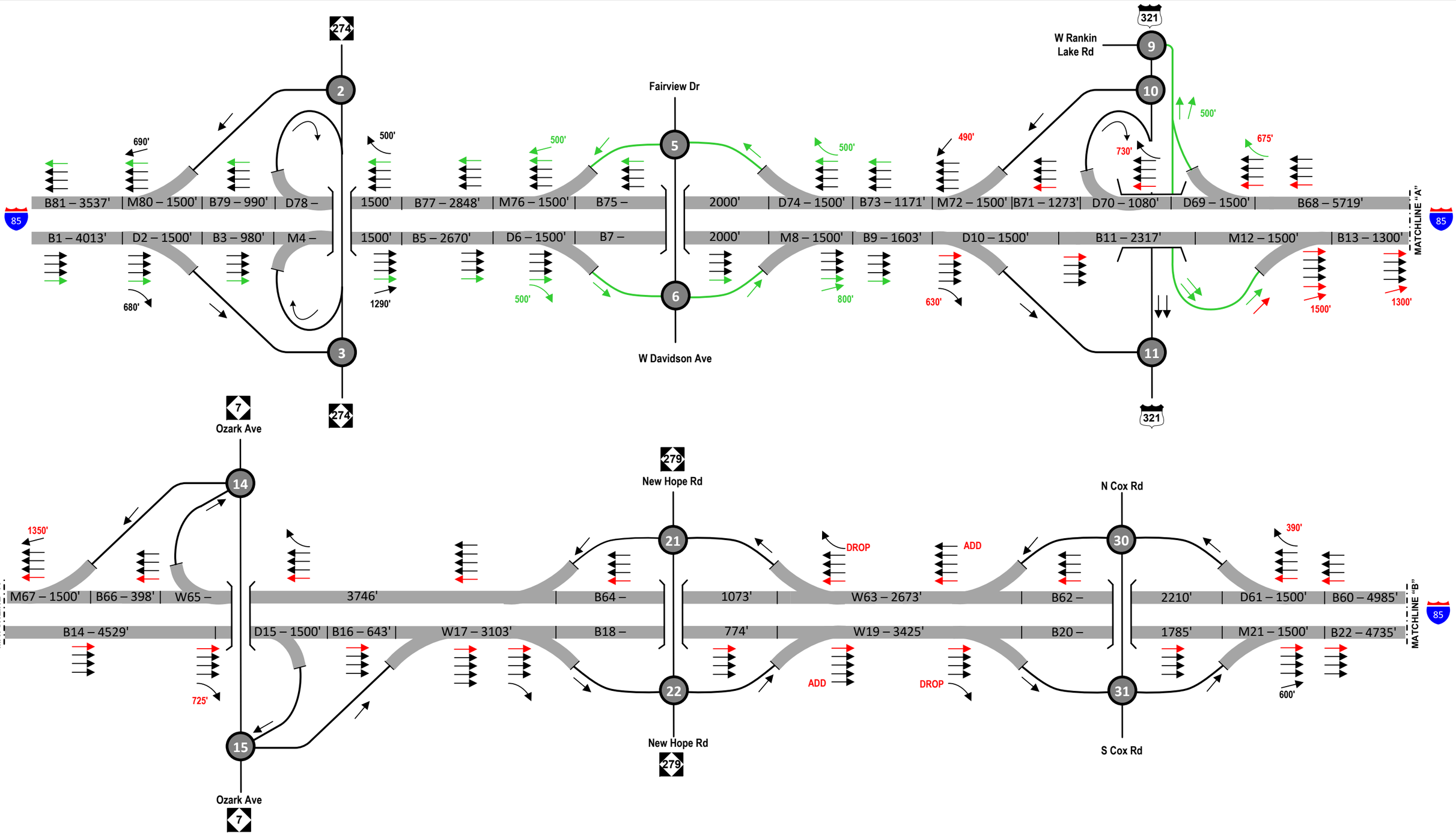
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 NO-BUILD FREEWAY PEAK HOUR VOLUMES, FREEVAL SEGMENT ID & LOS

DATE
October 2021

FIGURE 3.2



LEGEND

- # Signalized Intersection ID
- # Roundabout ID
- # Unsignalized Intersection ID
- Roadway
- Existing Laneage
- I-5719 Proposed Laneage
- Laneage added by Future Projects
- XXX' Acceleration/Deceleration Lane Length
- XXX – XXXX' Freeway Segment ID – Segment Length

N

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

HNTB

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

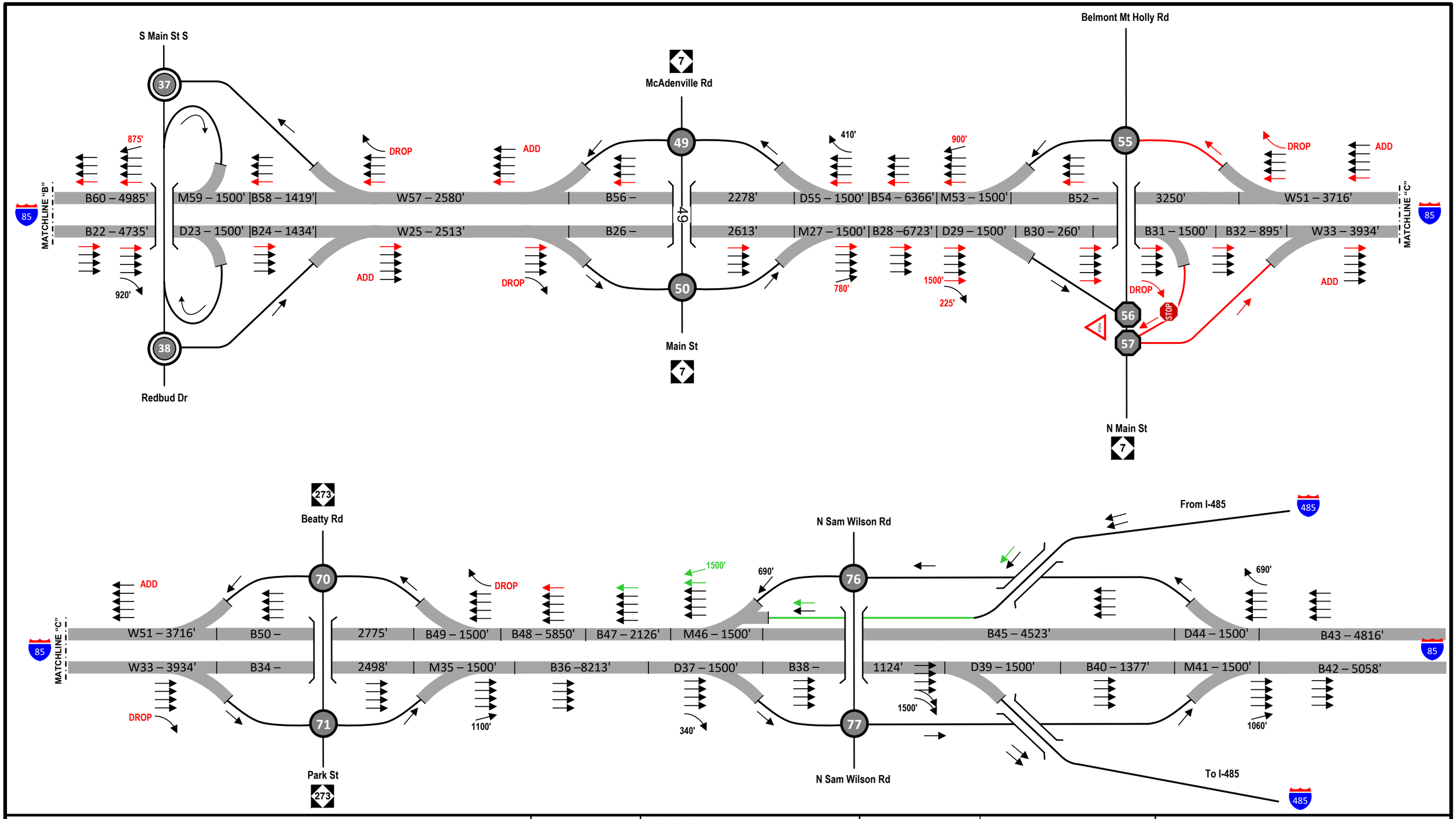
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 BUILD FREEWAY LANEAGE, FREEVAL SEGMENT ID & LENGTH

DATE
October 2021

FIGURE 4.1



LEGEND

- # Signalized Intersection ID
- # Roundabout ID
- # Unsignalized Intersection ID

- Roadway
- Existing Laneage
- I-5719 Proposed Laneage
- Laneage added by Future Projects
- XXX' Acceleration/Deceleration Lane Length
- XXX – XXXX' Freeway Segment ID – Segment Length

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

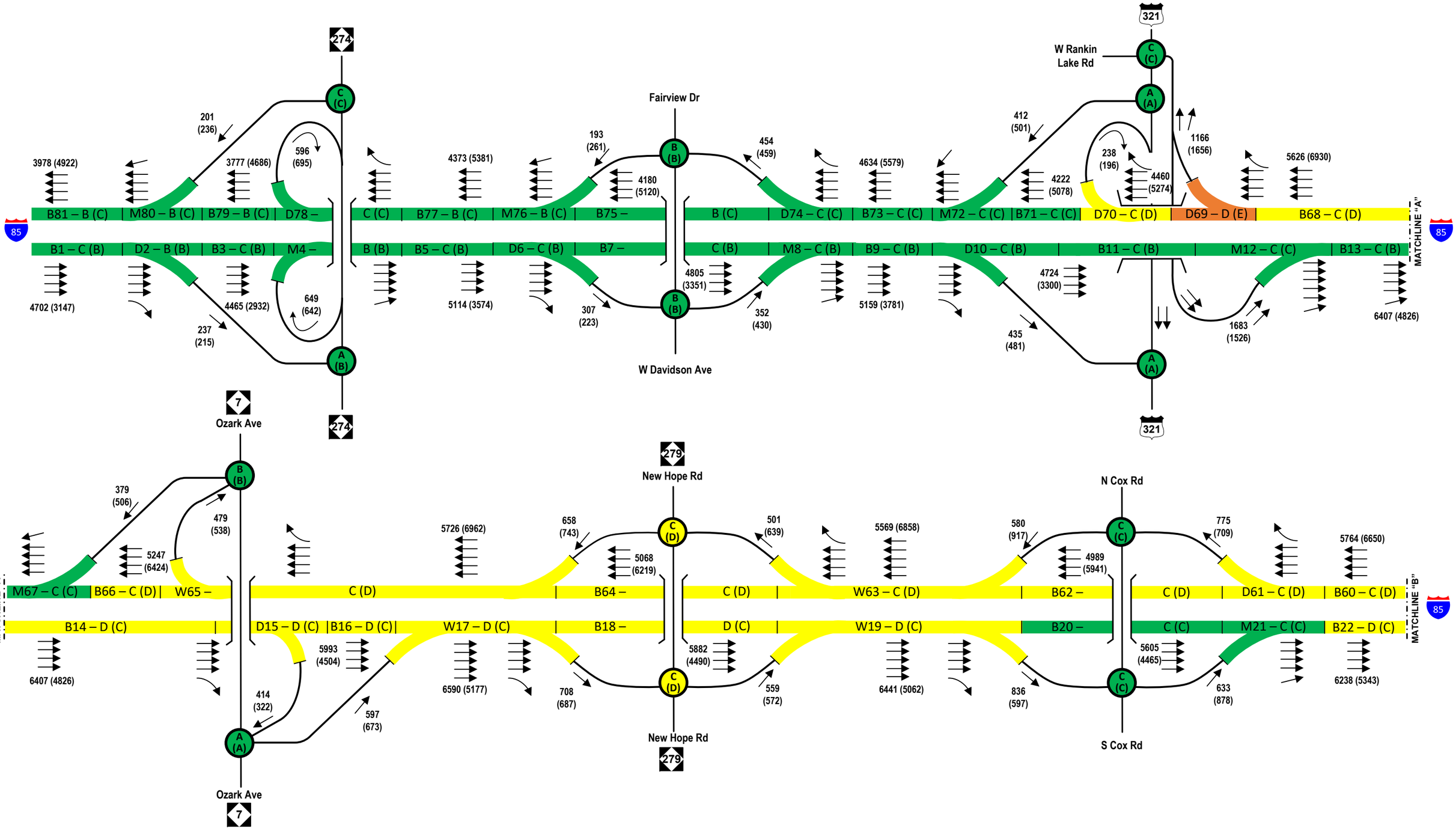
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 BUILD FREEWAY LANEAGE, FREEVAL SEGMENT ID & LENGTH

DATE
October 2021

FIGURE 4.2



LEGEND

- Roadway
- Vehicular Movement
- XXX – X(X) Freeway Segment ID – AM (PM) LOS
- X (X) AM (PM) Peak Hour Signalized Intersection LOS
- X (X) AM (PM) Peak Hour Roundabout LOS

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service

- LOS A – C
- LOS D
- LOS E
- LOS F

N

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

HNTB

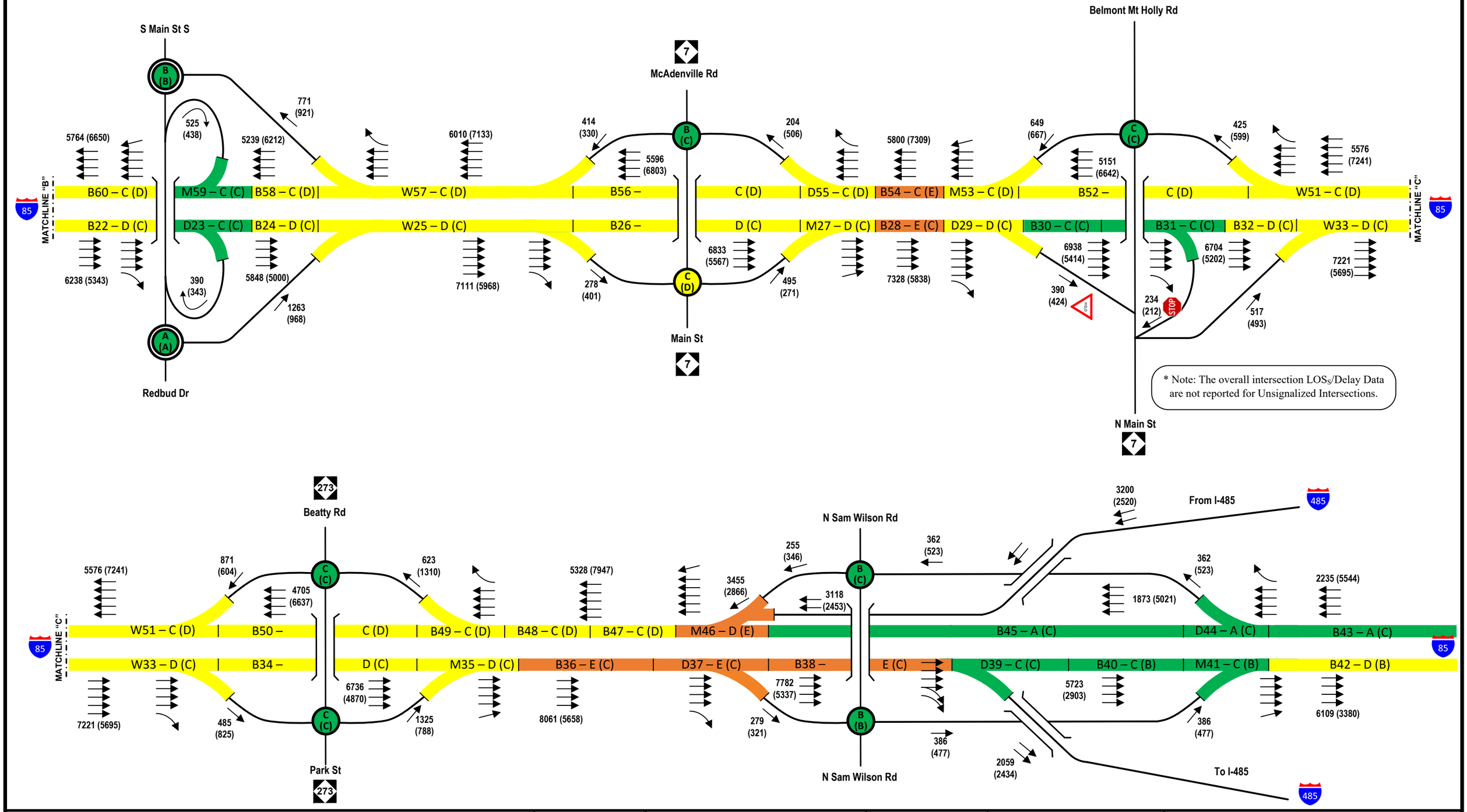
COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

PROJECT DESCRIPTION
I-85 Widening from US 321 to NC 273

2045 BUILD FREEWAY PEAK HOUR VOLUMES, FREEVAL SEGMENT ID & LOS

DATE
October 2021

FIGURE 5.1



LEGEND

- Roadway
- Vehicular Movement
- XXX – X(X) Freeway Segment ID – AM (PM) LOS
- X (X) AM (PM) Peak Hour Signalized Intersection LOS
- X (X) AM (PM) Peak Hour Roundabout LOS

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service *

- LOS A – C
- LOS D
- LOS E
- LOS F

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

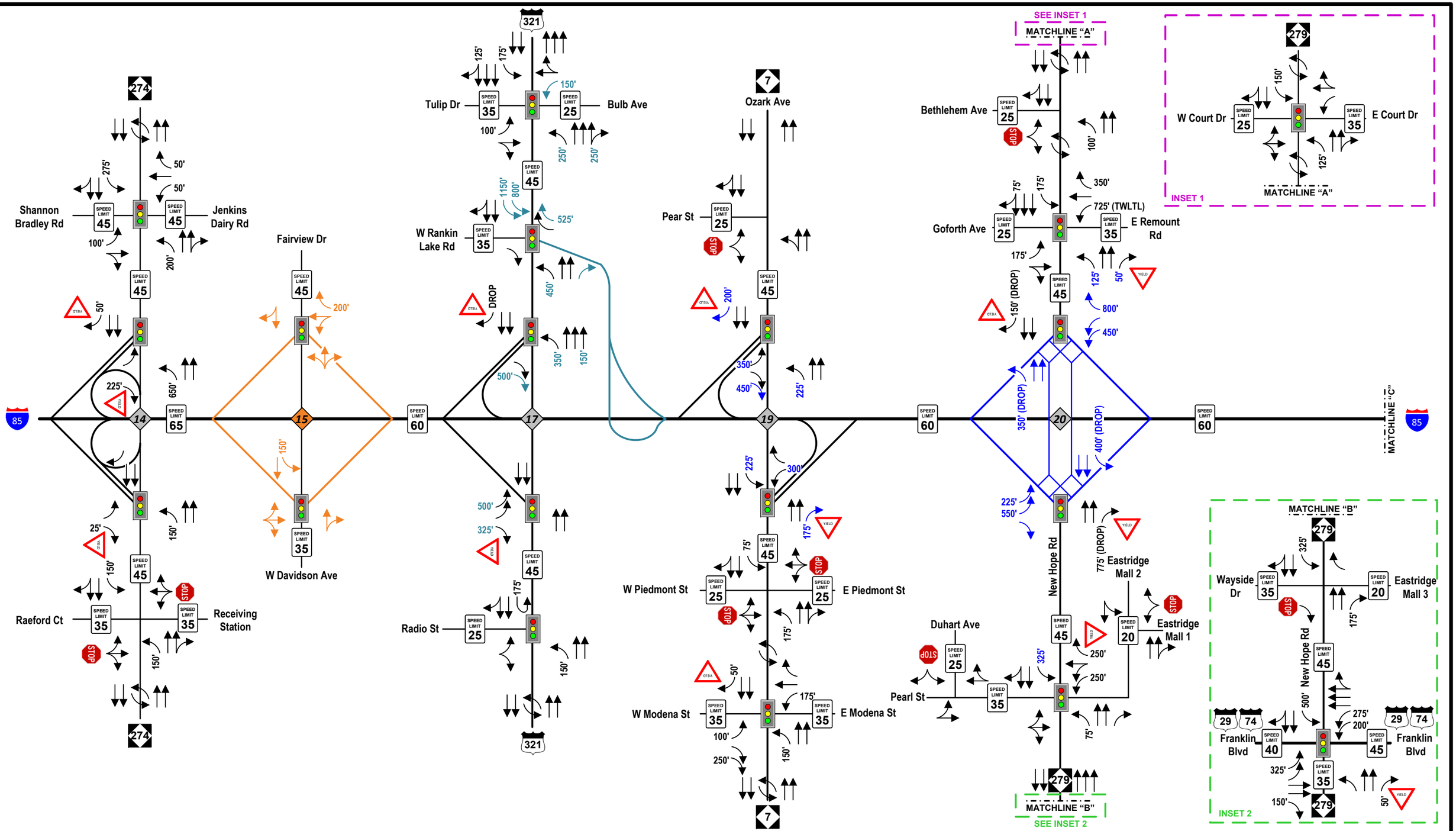
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 BUILD FREEWAY PEAK HOUR VOLUMES, FREEVAL SEGMENT ID & LOS

DATE
October 2021

FIGURE 5.2



LEGEND

- Existing Laneage
- I-5719 Proposed Laneage
- STIP Project I-5000 Improvements
- MTP Project HPR9 Improvements

TWLTL = Two-Way Left Turn Lane

XXX' Storage Bay Length

Roadway

SPEED LIMIT 30 Existing Posted Speed

Interchange Exit

Traffic Control

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

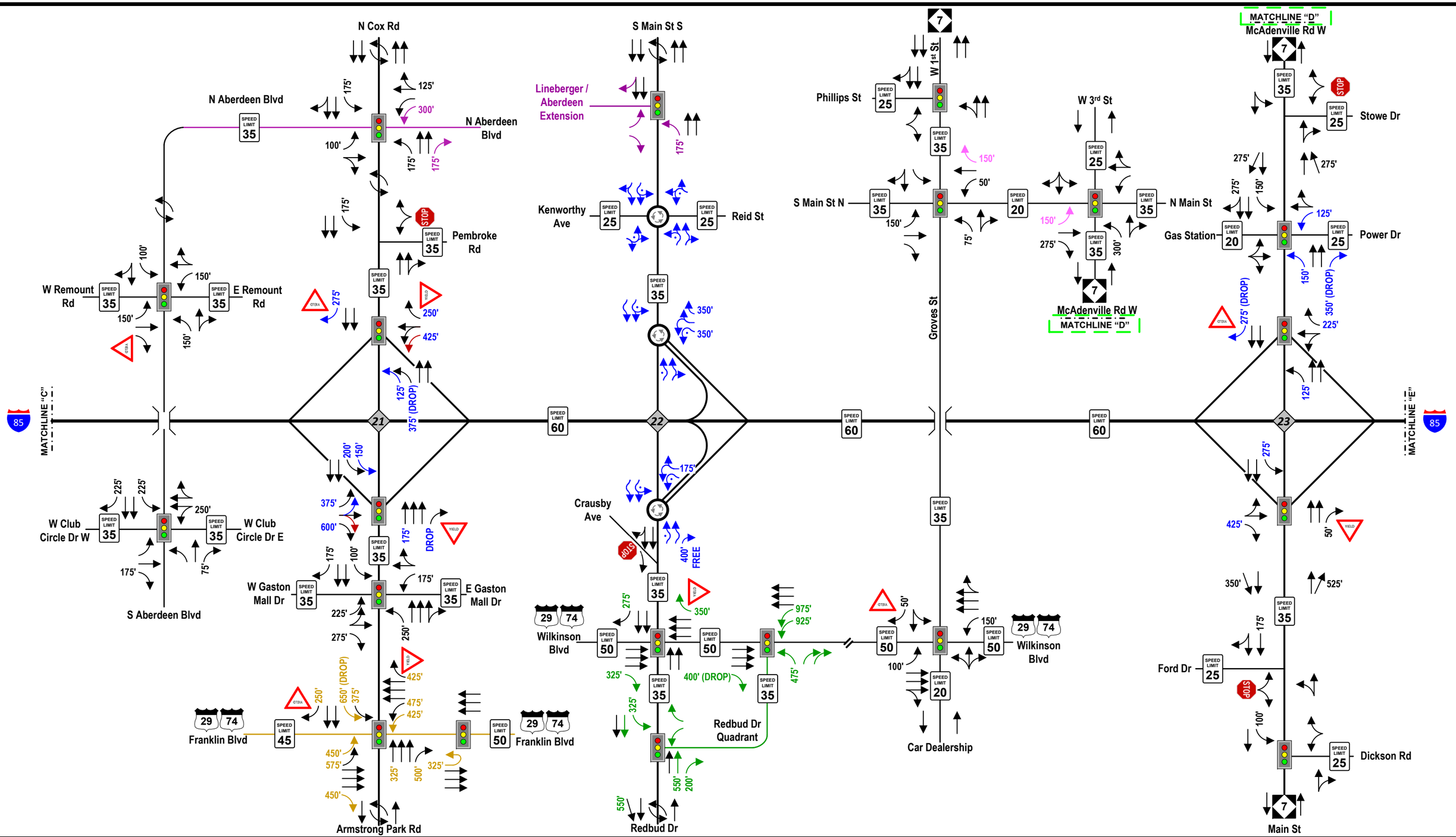
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 BUILD (PROPOSED) INTERSECTION LANEAGE - TRANSMODELER

DATE
October 2021

FIGURE 6.1



LEGEND

- Existing Laneage
- I-5719 Proposed Laneage
- STIP Project I-5713 Improvements
- STIP Project U-6141 Improvements
- Other Project Improvements
- MTP Project HPD23 Improvements
- STIP Project U-6044 Improvements

TWLTL = Two-Way Left Turn Lane
XXX' Storage Bay Length
Roadway

SPEED LIMIT 30 Existing Posted Speed
Interchange Exit
Traffic Control

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

HNTB

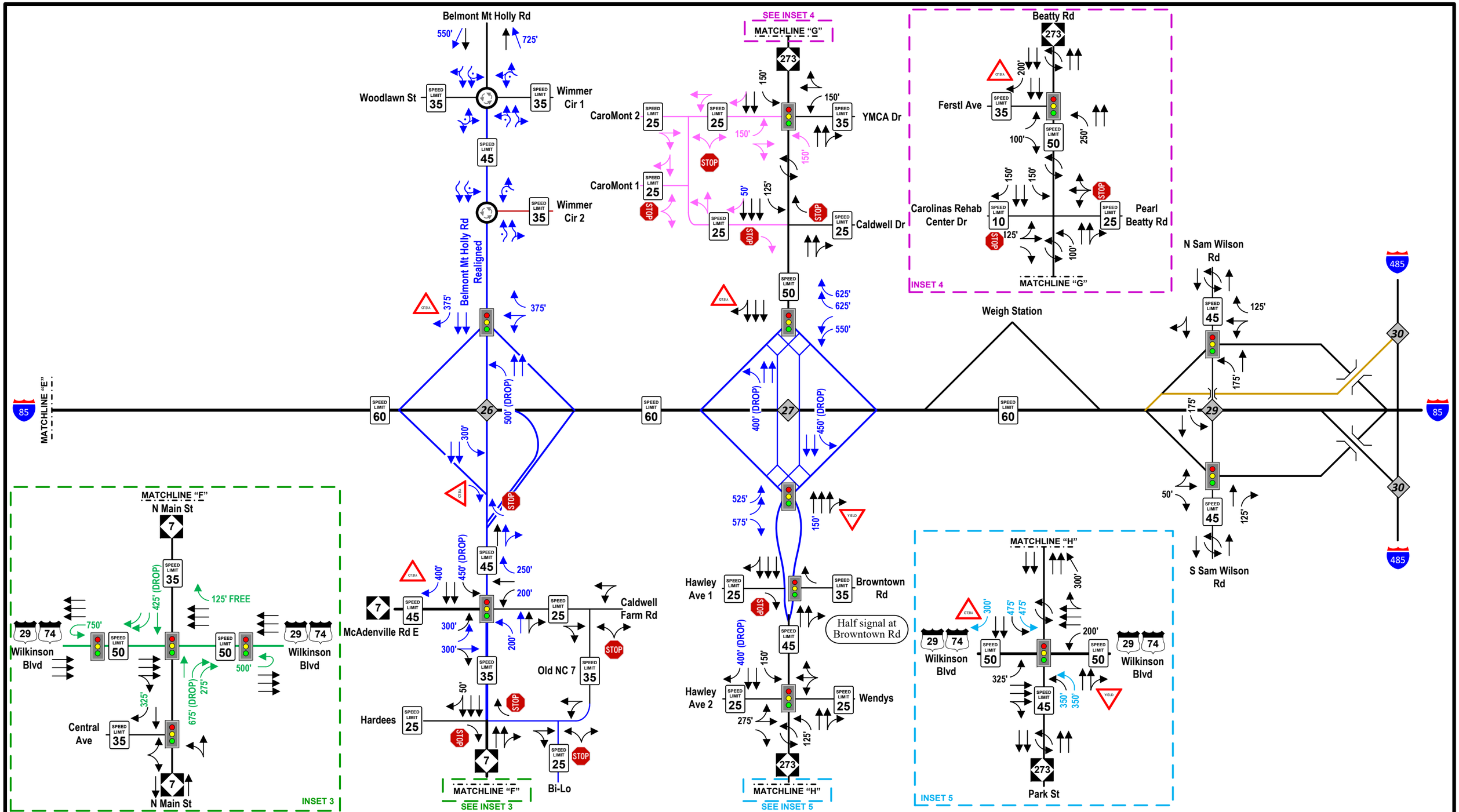
COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

PROJECT DESCRIPTION
I-85 Widening from US 321 to NC 273

2045 BUILD (PROPOSED) INTERSECTION LANEAGE - TRANSMODELER

DATE
October 2021

FIGURE 6.2



LEGEND

- Existing Laneage
- I-5719 Proposed Laneage
- STIP Project U-5800 Improvements
- STIP Project U-5959 Improvements
- STIP Project U-6016 Improvements
- WBS 47859 Project Improvements
- Other Project Improvements

TWLTL = Two-Way Left Turn Lane

XXX' Storage Bay Length

Roadway

Existing Posted Speed

Interchange Exit

Traffic Control

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

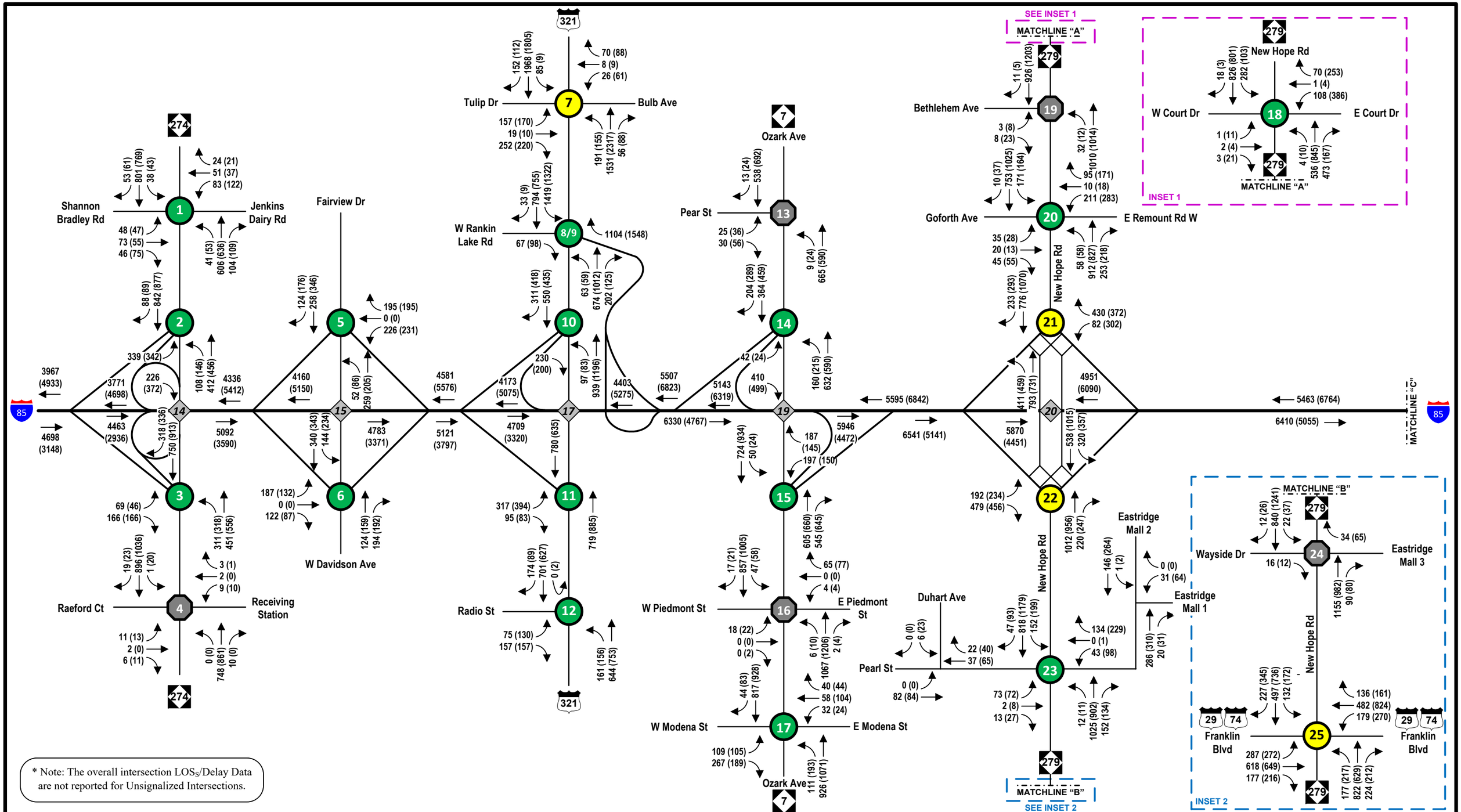
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 BUILD (PROPOSED) INTERSECTION LANEAGE - TRANSMODELER

DATE
October 2021

FIGURE 6.3



* Note: The overall intersection LOS_S/Delay Data are not reported for Unsignalized Intersections.

LEGEND

- Vehicular Movement
- Roadway
- ## Interchange Exit
- # Signalized Intersection ID
- # Roundabout ID
- # Unsignalized Intersection ID

(####) AM (PM) Peak Hour Traffic Volumes

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service *

- LOS A – C
- LOS D
- LOS E
- LOS F

N

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

HNTB

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

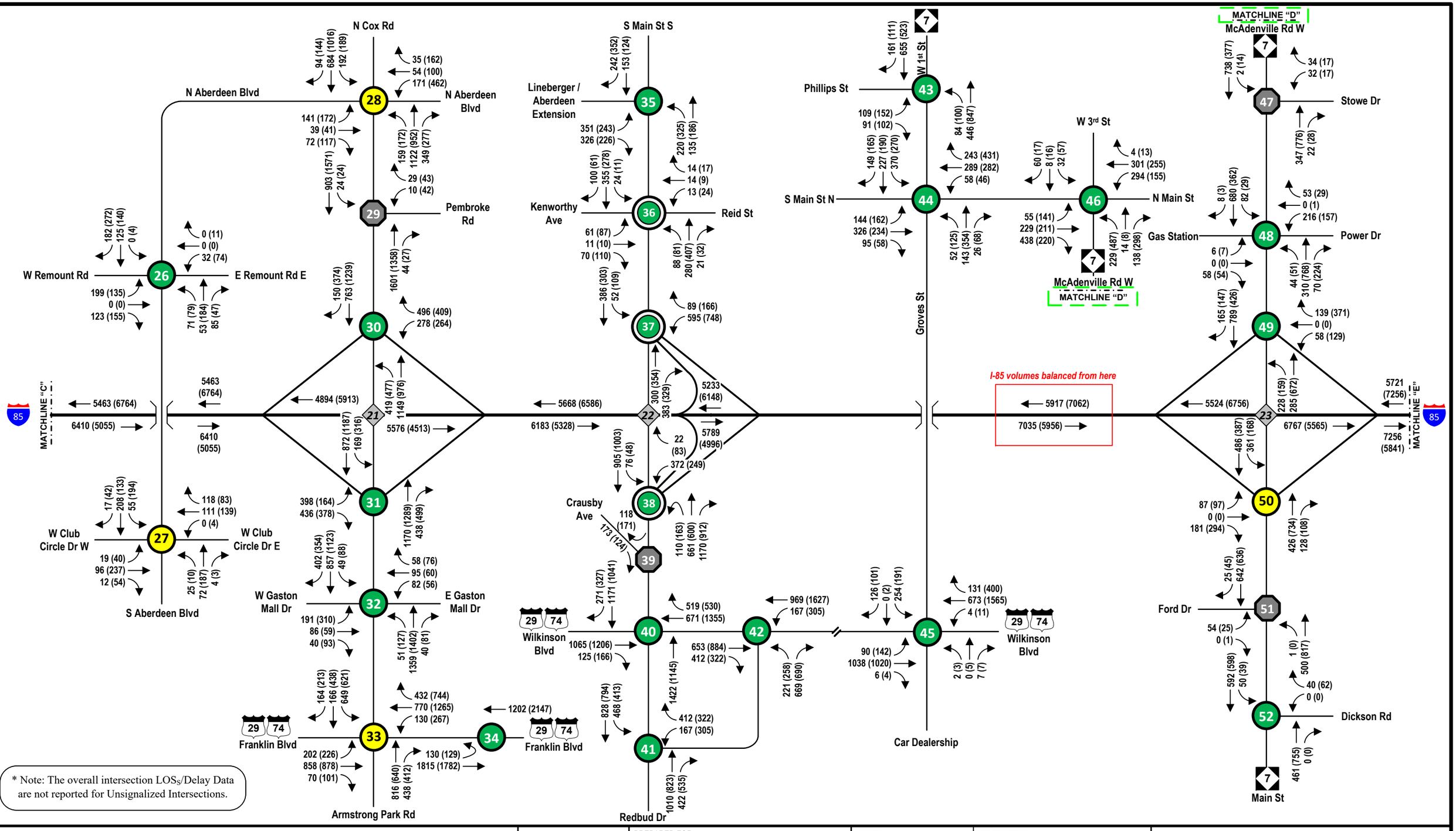
PROJECT DESCRIPTION

I-85 Widening from US 321 to NC 273

2045 BUILD TRANSMODELER PEAK HOUR TRAFFIC VOLUMES AND LOS

DATE
October 2021

FIGURE 7.1



LEGEND

- Vehicular Movement
- Roadway
- Interchange Exit
- Signalized Intersection ID
- Roundabout ID
- Unsignalized Intersection ID

(####) AM (PM) Peak Hour Traffic Volumes

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service *

- LOS A – C
- LOS D
- LOS E
- LOS F

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

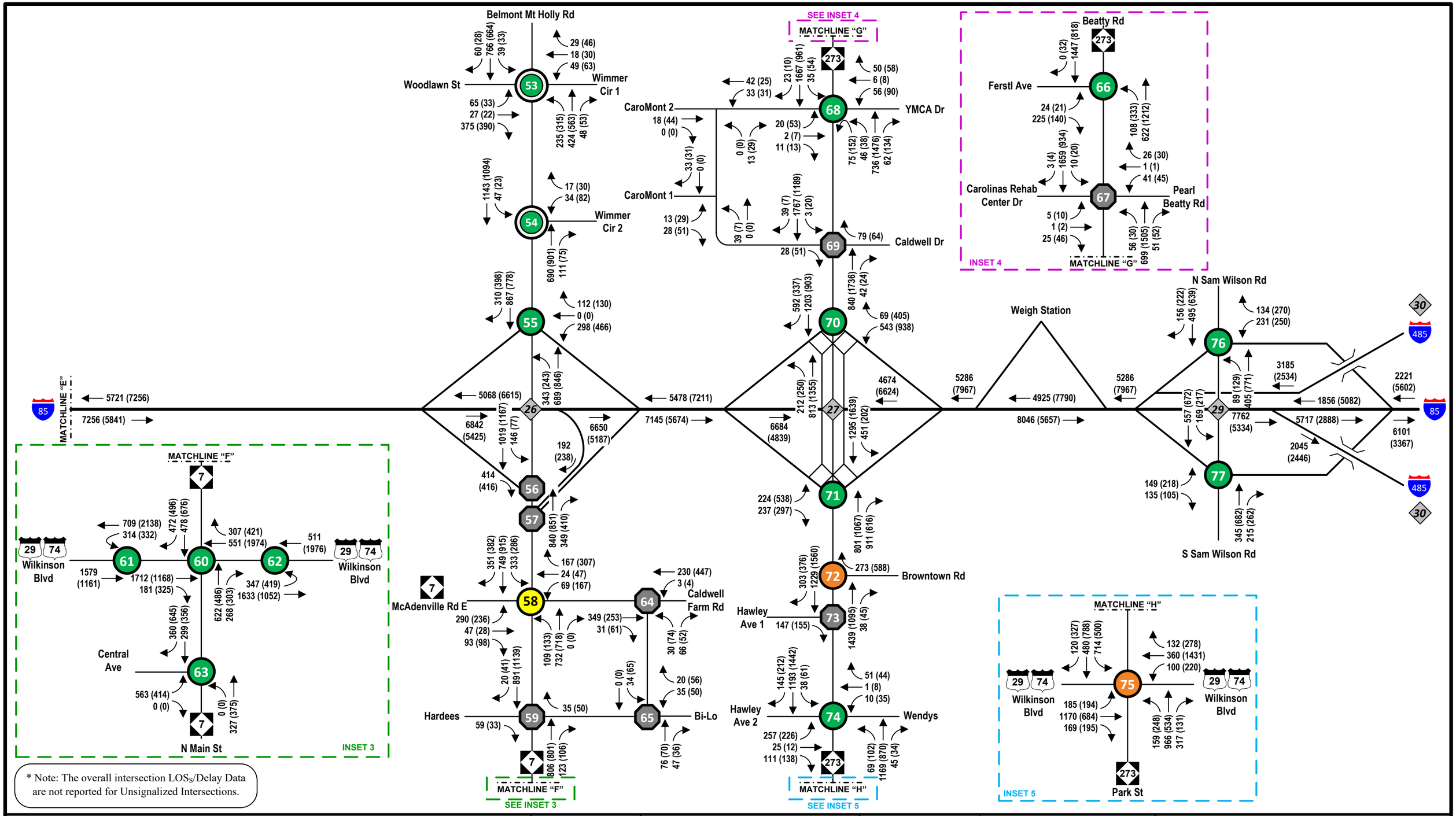
COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

PROJECT DESCRIPTION
I-85 Widening from US 321 to NC 273

2045 BUILD TRANSMODELER PEAK HOUR TRAFFIC VOLUMES AND LOS

DATE
October 2021

FIGURE 7.2



* Note: The overall intersection LOS/Delay Data are not reported for Unsignalized Intersections.

LEGEND

- Vehicular Movement
- Roadway
- Interchange Exit (##)
- Signalized Intersection ID (#)
- Roundabout ID (#)
- Unsignalized Intersection ID (#)

(####) AM (PM) Peak Hour Traffic Volumes

Color Corresponds to Worst-Case Peak Hour Intersection Level of Service *

- LOS A – C
- LOS D
- LOS E
- LOS F

NOT TO SCALE

PREPARED FOR
North Carolina Department of Transportation

PREPARED BY
HNTB North Carolina, P.C.
101 S. Tryon St Suite 3610
Charlotte, NC 28280

COUNTY	Gaston	STIP PROJECT NO.	I-5719
DIVISION	12	WBS NO.	50135.1.FS1

PROJECT DESCRIPTION
I-85 Widening from US 321 to NC 273

2045 BUILD TRANSMODELER PEAK HOUR TRAFFIC VOLUMES AND LOS

DATE
October 2021

FIGURE 7.3

Appendix B – I-5719 Project Meeting Minutes

I-85 Improvements

STIP Project No. I-5719/U-3608/U-5800

Preferred Alternative Discussion
February 27, 2020

Meeting Summary

Attendees:

Beverly Robinson	NCDOT – PMU	brobinson@ncdot.gov
Nora McCann	NCDOT – PMU	namccann@ncdot.gov
Kevin Moore	NCDOT – PMU	kemoore2@ncdot.gov
Kayla Gales	NCDOT – PMU	kagales@ncdot.gov
John Jamison	NCDOT – EPU	johnjamison@ncdot.gov
Tatia White	NCDOT – Roadway Design	tlwhite@ncdot.gov
Douglas Kretchman	NCDOT – Roadway Design	dwkretchman@ncdot.gov
Jim Harris	NCDOT – Rail	jbharris@ncdot.gov
Mike Reese*	NCDOT – Congestion Management	mikereese@ncdot.gov
Elise Groundwater*	NCDOT – Congestion Management	ekgroundwater@ncdot.gov
Jackie McSwain*	NCDOT – Division 12	jmcswain@ncdot.gov
Michael Poe*	NCDOT – Division 12	mlpoe@ncdot.gov
Felix Davila	FHWA	felix.davila@dot.gov
Kat Bukowy	HNTB	kbukowy@hntb.com
Tenecia Jones	HNTB	tgjones@hntb.com
Doug Wheatley	HNTB	dwheatley@hntb.com
Elizabeth Harris*	HNTB	eaharris@hntb.com
Nathan Ratterman*	HNTB	nratterman@hntb.com

*attended by phone

Meeting Summary

Following introductions, the team discussed the main line widening of I-85 and the design options at each interchange, overpass, and intersection. NCDOT confirmed that the project ends at US 321, tying into STIP Project I-5000 as appropriate. The I-85 bridge over US 321 will not be replaced as part of this project.

Interchanges, overpasses, and intersection discussion:

- SR 2278 (Dr. MLK Jr. Way/Marietta Street) Overpass (Y9)
  - Replace to East option confirmed. It will avoid impacts to Sims Legion Park and maintains the state road network during construction.
- SR 2009 (Modena Street) Overpass (Y10)
  - Replace in Place option confirmed.
- Railroad Bridge 350129 (NCDOT – Owned, Piedmont & Northern Railway – Operated)
  - Replace in Place option confirmed.
  - This bridge is part of the historic linear district.
  - Will delay mainline widening because of detour on existing tracks.
- Exit 19 - NC 7 (East Ozark Avenue) Interchange (Y2)
  - Improve Existing option confirmed.

    - Proposed loops are just above the minimum 150-foot radius.
- Railroad Bridge 350132 (Norfolk Southern)
    - Replace in Place option confirmed.
    - This will require phased construction.
    - Coordination will be necessary regarding the Amtrak station platform extension. *Jim Harris, NCDOT – Rail, provided plans on 3/2/2020.*
- Exit 20 – NC 279 (N. New Hope Road) Interchange (Y3)
    - All interchange options are under consideration (DDI, Improve Existing, and Compressed Diamond).
    - DDI operates the best (has half the delay time compared to other design options)
    - DDI cuts off access to a new hotel north of Remount Road across from Bethlehem Avenue. It also cuts off access to the Bojangles and CarMax.
    - Division would prefer not to have a DDI at this interchange.
    - **Remount Road needs to be modeled for all options as a full-movement intersection focusing on the queue interactions.**
    - **Division requested a small group meeting with the landowners east of NC 279 on Remount Road.**
- Aberdeen Overpass (Y11)
    - Replace to East option confirmed.
- Exit 21 – SR 2200 (Cox Road) Interchange (Y4)
    - Looking at Improve Existing and DDI options.
    - DDI is better in terms of delay but has more queueing onto Cox Road and the Southbound ramp.
        - Improve Existing option has a LOS of C or D.
        - DDI option has a LOS of A or C.
    - NCDOT – Congestion Management suggested eliminating the offset and running Gaston Mall Drive on the same controller as the interchange to manage queue spillback.
    - **HNTB will review the queues and storage lengths at the Gaston Mall Drive intersection.**
        - DDI may not work due to close proximity to Gaston Mall Drive, look at putting under one controller to help queuing.
    - U-6044 (suspended) showed Cox Road volumes increasing according to the 2045 Traffic Analysis. Need to address future congestion.
    - Gaston County supports the DDI option.
- SR 2339 (S. Church Street) Overpass (Y12)
    - Replace in Place option confirmed.
- Exit 22 – SR 2339 (S. Main Street) Interchange (Y5)
    - Improve Existing option was confirmed. Question of whether or not roundabouts were appropriate at the interchange terminals and Kenworthy Avenue.
    - **HNTB will analyze Improve Existing option with and without roundabouts.**
    - Kenworthy Avenue access must be maintained.
    - There is potential for a road diet north of the interchange.
    - NCDOT interchange access control policy does not support a “fourth leg” interchange option.
- Railroad Bridge 350142 (Norfolk Southern)
    - Replace to East option confirmed.
- SR 2213 (Grove Street) Overpass (Y13)
    - Replace in Place option confirmed.

    - NCDOT – Rail noted that to get separation between the NS Railroad right of way and Grove Street, would likely need to shift Grove Street to the east.
    - HNTB noted that all detours, including service roads, would need to be studied for impacts.
    - May need to take additional property on both sides of the bridge to keep distance from the railroad right of way.
    - Coordination with the City of Lowell regarding Complete Streets, width of roadway needed, and curb and gutter.
- Exit 23 – NC 7 (McAdenville Road/N. Main Street) Interchange (Y6)
    - Improve Existing to a tight diamond on both sides new option.
    - **HNTB will look at queueing with Power Drive having full access.**
    - DDI eliminated due to access issues at Power Drive.
    - Per FHWA regulations slip lane to Power Drive must be removed.
    - Need to meet with Pharr Yarns to determine traffic on Power Drive.
    - Lowell Minimart may need to be relocated to shift Power Drive to provide more storage.
- SR 2000 (Hickory Grove Road) Overpass (Y14)
    - Both options still open.
    - Concerns raised about the Wat Luangphor PhaNgao Buddharam Buddhist Temple
    - **Division 12 with speak with the GCLMPO to see if they can provide more insight on the temple.**
    - **Nora will call the Temple to get more information about their needs/relocating.**
- Exit 26 – SR 2093 (Belmont-Mount Holly Road) Interchange (Y7)
    - Tight Diamond on the north side and Montcross design on the south side confirmed.
    - NCDOT does not support a "fourth leg" interchange option. Therefore, the ramp terminal will not align with the BAC entrance.
    - **HNTB will analyze roundabouts at SB ramp terminal, the BAC campus entrance, and at Woodlawn Drive.**
        - All or nothing with roundabouts - if any fail, back to signals
    - Notify BAC of the decision at the time of the next public meeting.
- US 29/74 (Wilkinson Boulevard) and NC 7 (N. Main Street) Intersection (Y7A) [U-5800]
    - *In further conversation, Division and NCDOT PMU determined that the traditional intersection would need to be designed and the previously provided RCI design would need to be updated to provide a full comparison of cost and impacts between the two alternatives. HNTB will begin design of the intersection once design of the Belmont-Mt Holly interchange is complete due to NC 7 (N. Main St.) shifting to the west.*
    - ~~Reduced Conflict Intersection (RCI) chosen.~~
    - ~~RCI avoids the Belmont Fabric South Fork Manufacturing Co. Mill Village Historic Area.~~
    - ~~RCI has better overall traffic management as well as reduced crashes, improved safety, and better traffic flow.~~
- Railroad Bridge 350150 (NCDOT – Owned, Piedmont & Northern Railway – Operated)
    - Replace in Place option confirmed.
- Exit 27 - NC 273 (Beatty Drive) Interchange (Y8)
    - DDI option chosen.
    - Improve Existing and DDI options were discussed.
    - DDI offers substantial traffic operations improvements when compared to Improve Existing.
    - Improve Existing option has spillover onto the NB ramp.
    - Existing bridge can be kept under the Improve Existing option.

- Notify Caromont Hospital of the decision at the time of the next public meeting.

Additional comments provided by FHWA, not already included in the above:

- Although NCDOT strives to have 1,000 ft of access control from an interchange ramp terminal, for best traffic operations of the [adjacent] intersections, the very minimum is 100 ft. in urban areas and 300 ft. in rural areas.
- Section 106 and/or Section 4(f) impacts are described in previous handouts as "Avoidance/shifting design to avoid resource may be possible with advanced design". Although this language may be appropriate for early stages of project development, I believe we need to be able to determine that avoidance is possible. Particularly since recommended [design options] are being chosen over other [design options]. In general until this point, I have been presuming we should be able to avoid 4(f) impacts or secure a *de minimis* determination, or not having to do a very detailed avoidance analysis since we are widening the road symmetrically and the 4(f) resource it is in both sides.
- **Provide any new/changed design options to FHWA. This includes the tight diamond on the north side of the Belmont-Mt. Holly interchange.**
- I think that we may benefit from a table of summary of impacts (or range of impacts) in addition to the current individual table of impacts per crossing/interchange. This will help us see the overall picture of impacts of clustering various STIP projects, adding auxiliary lanes and of the railroad work.

I-85 Improvements

STIP Project No. I-5719/U-3608/U-5800

Five Interchanges Design Options

May 18, 2021

Meeting Notes

Attendees:

Nora McCann	NCDOT – PMU	namccann@ncdot.gov
Kevin Moore	NCDOT – PMU	kemoore2@ncdot.gov
Beverly Robinson	NCDOT – PMU	brobinson@ncdot.gov
Douglas Kretchman	NCDOT – Roadway Design	dwkretchman@ncdot.gov
Jackie McSwain	NCDOT – Division 12	jmcswain@ncdot.gov
Michael Poe	NCDOT – Division 12	mlpoe@ncdot.gov
Jim Dunlop	NCDOT – Congestion Management	jldunlop@ncdot.gov
Elise Groundwater	NCDOT – Congestion Management	ekgroundwater@ncdot.gov
Jim Harris	NCDOT – Rail	jbharris@ncdot.gov
Felix Davila	FHWA	felix.davila@dot.gov
Kat Bukowy	HNTB	kbukowy@hntb.com
Doug Wheatley	HNTB	dwheatley@hntb.com
Corey Vernier	HNTB	cvernier@hntb.com
Elizabeth Harris	HNTB	eaharris@hntb.com
Paige Hunter	HNTB	phunter@hntb.com
Andrew Bell	HNTB	aabell@hntb.com

This meeting was held on Tuesday, May 18, 2021 to discuss the traffic analysis of proposed designs on five interchanges leading to decisions on the most appropriate design option for each interchange. The following is a summary of discussion, pertinent decisions (shown with **bold text**), and next steps.

In general, all of the interchanges and road bridges need to account for local and regional bicycle and pedestrian plans and the projects in the State Transportation Improvement Program (STIP).

NC 279 (New Hope Rd.), Exit 20:

The traffic analysis reviewed three options:

- Improve Existing with full-movement signalized intersection at Remount Road.
- Tight (Compressed) Diamond Interchange (TDI) with full-movement signalized intersection at Remount Road.
- Diverging Diamond Interchange (DDI) with full-movement signalized intersection at Remount Road.

The distance from Remount Road to the I-85 southbound ramp terminal intersection varies among the different design options. The primary concern at this interchange is the queues at the New Hope Road northbound approach to Remount Road. The compressed diamond option is the only option where the NC 279 northbound queue Spillback rate was 0% in the AM and PM peak, due that concept having the longest distance (400 ft) between the I-85 SB ramp terminal and the Remount Rd

intersection. In the DDI option, the NC 279 northbound queue Spillback Rate was 0% in the AM peak and 8% in the PM peak due to that concept having the shortest distance (225 feet) between the I-85 SB ramp terminal and the Remount Rd intersection. All three options had similar intersection LOS and delay. There is no spillback from the ramp terminal intersections onto I-85 in any of the design options.

NCDOT – PMU expressed concern regarding constructability of each of the options. HNTB noted that due to spacing needs the DDI would be the easiest to construct, with the improve existing option being harder, and the TDI being the hardest.

NCDOT - CM and Division 12 prefer closing access to Duhart Avenue and the Eastridge Mall Entrance Drive just south of the interchange (NB ramp terminals) for safety reasons. The parcels and neighborhood have alternative access to NC 279 via Pearl Street and the Eastridge Mall Entrance.

NCDOT – PMU asked what the cost difference between the DDI and TDI and HNTB indicated that the DDI would likely be cheaper than the TDI because the TDI would require longer permanent walls and the DDI would not need a temporary bridge.

Based on constructability, cost, and traffic operations, **the DDI option was chosen for NC 279 (New Hope Road), Exit 20**. The DDI option also has lower impacts to the natural environment and requires less right of way and fewer relocations.

SR 2200 (Cox Road), Exit 21:

The Offset Interchange design option was eliminated in March 2020.

The traffic analysis reviewed two options:

- Improve Existing with full-movement signalized intersection at Gaston Mall Drive.
- DDI with full-movement signalized intersection at Gaston Mall Drive.

The volumes that were used in to design the two option were from the 2040 Traffic Forecast and Travel Demand Model, however the 2045 Build Forecast and Travel Demand Model indicates an increase of 33% in the AM peak for the northbound left turn at the I-85 SB ramp terminal intersection and a decrease of 50% in the AM and 25% in the PM for the southbound left turn at the I-85 northbound ramp terminal. The amount of space between the interchange and Gaston Mall Drive is larger for the Improve Existing (~400') than for the DDI (~275'). While both options are expected to operate adequately in the peak hours, the Improve Existing option is expected to operate better than the DDI in the off peak. Both options would need additional storage for the northbound queues. Both options are approximately the same cost.

NCDOT Division 12 expressed concern regarding accommodation for bicyclists and pedestrians. NCDOT – CM prefers that bicyclists and pedestrians be channeled through the middle. However, HNTB noted that the north/south routes have bicycle/pedestrian accommodations, and most are getting sidewalk treatment. The existing condition has provisions on left and right for 6' sidewalk. A DDI usually has accommodations down the center but this would make the bridges closer together and sidewalk would only be on one bridge. Further conversation needs to be had regarding Complete Streets compliance. STIP Project EB-5976 would provide sidewalk along Cox Road from I-85 to Court Drive, however this project has not yet begun.

Based on the similarity of cost and better operations in the off-peak hour, **the Improve Existing option was chosen**. The bridge shown in the 2019 functional design will be widened by one lane to provide more storage for turning lanes based on traffic analysis results.

STIP Project U-6044 is adjacent the I-5719 project and proposes to improve Cox Rd from Gaston Mall Drive south, past the intersection with US 29/74. HNTB requested the design files for incorporation into the traffic model. (HNTB received these design files from PMU on 5/21/2021).

SR 2329 (S Main Street), Exit 22:

The traffic analysis reviewed two options:

- Improve Existing (Signals) with full-movement stop-controlled intersection at Kenworthy Avenue.
- Improve Existing (Roundabouts) with full movement single-lane roundabout intersection at Kenworthy Avenue.

The Measures of Effectiveness (MOEs) show that the Roundabout option is slightly better overall, with a level of service (LOS) of B/B in the peak hours. However, the speed through the roundabouts is slightly slower (27 vs 31 mph) than the signalized option.

NCDOT – Division 12 expressed concern regarding the Roundabout option being able to accommodate higher traffic volumes during the McAdenville Christmas lights. NCDOT – Congestion Management indicated that roundabouts provide good capacity and they do not expect issues at the roundabouts during increased holiday traffic.

The northbound right turn movement at the I-85 southbound ramps will need to be free-flow with an exclusive right turn lane based on the traffic analysis/volumes. The roundabout option provides a slip lane for this movement.

The roundabout locations need to be refined and take into consideration both the historic marker at the intersection of Kenworthy Avenue and S. Main Street and Joe Hudson Park. Roundabout laneage will also be further refined in coordination with Roadway and Congestion Management.

Kenworthy and S Main Street were analyzed as a single lane roundabout in the traffic analysis but will be a two-lane roundabout in design to maintain four lanes on S Main Street.

Crausby Avenue will be converted to a right in right out access. Crausby Avenue will not be added into the roundabout at the I-85 southbound ramp terminal. Median on S Main south of the interchange would not be added with I-5719 but could be added later if needed for traffic access control.

The Improve Existing with Roundabouts option was chosen. This option provides an additional 12 feet on the bridge over I-85, due to an elimination of the center turn lane, which can be used for bicycles and pedestrians. Selecting this alternative also allows the existing bridge to be kept, thereby reducing the cost of this option. The selection of the roundabout option should not have an impact on the dimensions of the Groves Street railroad bridge.

Traffic analysis is needed to confirm that the chosen roundabout option will operate well with the quadrant concept for STIP U-6141.

NC 7 (McAdenville) – Exit 23

The traffic analysis analyzed the partial tight diamond on the north side (I-85 southbound ramps) with increased spacing with Power Drive, including the full movement, signalized intersection at Power Drive. The traffic analysis indicated that this proposed design would operate well and NCDOT chose to **move forward with the tight diamond at the I-85 SB ramps and full signalized access at Power Drive**. An exclusive left turn lane from Power Drive will be added to accommodate vehicles

with WB-67. NCDOT – Division 12 will schedule a meeting with Pharr Yarns to advise them of the proposed design.

Belmont-Mt. Holly Rd – Exit 26

The traffic analysis reviewed two options:

- Montcross (realigned) design with tight diamond on the north side (I-85 southbound ramps); signalized intersections at both ramp terminals, the relocated Belmont Abbey College driveway, and Woodlawn Avenue.
- Montcross (realigned) design with tight diamond on the north side (I-85 southbound ramps); roundabouts at the I-85 southbound ramp terminal, the relocated Belmont Abbey College driveway, and Woodlawn Avenue.

The analysis determined that the roundabout at the I-85 southbound ramps functions at LOS F in PM peak. For this reason, a roundabout at the I-85 SB ramp was eliminated.

There was discussion of the railroad crossing just south of the intersection of Belmont-Mt. Holly Rd and the first entrance to Belmont Abbey College (BAC) and any future of a railroad line in this area. NCDOT – Rail stated that the railroad line in this area, known as the "Belmont Spur", does not have any freight activity and none is expected in the future other than a potential trolley line. NCDOT - Rail likes where the new BAC entrance is shown.

NCDOT – Division 12 asked if it was possible to "mix and match" signals and roundabouts. NCDOT – Congestion management indicated that the interchange could have signals at both I-85 NB and SB ramps and roundabouts at the two Belmont Abbey College entrances. NCDOT preference is to **move forward with the signals and roundabouts option.** NCDOT – Division 12 will schedule a meeting with Belmont Abbey College to discuss the preferred option.

NCDOT – PMU asked if the I-85 northbound off-ramp west of Belmont Mt Holly Road could join Belmont Mt Holly Road closer to I-85 at a yield-controlled intersection, instead of the free flow added lane currently shown in the design. The yield control needs to be compatible with a pedestrian crossing at this location. Another option would be a stop sign, but the yield is preferred.

Following the discussion on the five interchanges, HNTB noted that decisions still need to be made on U-5800, intersection of S Main Street and US 74/29, and the Hickory Grove Road bridge over I-85. NCDOT – PMU requested HNTB document the design decisions and place on SharePoint site under PM/coordination. HNTB referenced the "I-85 Interchange/Overpass/Intersection Concepts – Design Options" document that was already developed to document design decisions and Kevin acknowledged that the existing document would suffice. HNTB will update the design decisions document to reflect the meeting discussions and include any additional decisions that have been made (e.g. design speeds).

Action Items:

- NCDOT – Division 12 will schedule a meeting with Pharr Yarns to advise them of the proposed design.
- NCDOT – Division 12 will schedule a meeting with Belmont Abbey College to discuss the preferred option.
- NCDOT – PMU will provide the STIP Project U-6044 dgn files for HNTB to include in its model.
    - *Nora McCann provided on 5/21*

- HNTB will update the design decisions document to reflect the meeting discussions and include any additional decisions that have been made (e.g. design speeds).

Appendix C – Traffic Forecast Diagrams (DIGITAL)

Appendix D – 2045 No-Build and Build Peak Hour Breakouts (DIGITAL)

Appendix E – 2045 No-Build and Build Volume Development Methodology

FINAL

2045 FUTURE YEAR VOLUME DEVELOPMENT

The latest NCDOT-approved traffic forecast information was used as a basis for developing AM and PM peak hour traffic volume demand data for the 2045 design year. The *2045 Project-Level Traffic Forecast Report for STIP Project I-5719* developed by HNTB in July 2019 includes widening of I-85 as an 8-lane interstate from US 321 (Exit 17) to NC 273 (Exit 27) in Gaston County. The forecast included three scenarios: 2016 Base Year No-Build (unchanged from 2017 original I-5719 forecast), 2045 Future Year No-Build, and 2045 Future Year Build.

The AM/PM peak volumes were converted from Average Annual Daily Traffic (AADT) data included in the 2045 Future Year No-Build and Build traffic forecasts to peak hour turning movements utilizing the NCDOT Intersection Analysis Utility (IAU). The raw peak hour turning movements from the IAU output were then balanced throughout the network. The network was balanced outwards to the north (east) and west (south) from the center of the study area network located on the segment of I-85 between Exits 22 and 23. The volumes were balanced along I-85 and then outwards on each y-line from the I-85 interchanges. The balanced volumes can be found in the **AM Link-Node Balanced** and **PM Link-Node Balanced** tabs of the 2045 Future Year No-Build and Build Volume Development spreadsheets.

The 2045 Future Year No-Build and Build volumes were used in the FREEVAL-NC analysis for Phase III. The 2045 Future Year Build volumes were developed into Origin-Destination Matrices to be input in TransModeler for the 2045 Future Year Build microsimulation traffic analysis.

1.1 Peak Hour Determination and Scaling Factors

It was decided during scoping that the peak hours and scaling factors developed in Phase I of the I-5719 Traffic Analysis from the 2016 Base Year No-Build scenario would be used for the 2045 Future Year No-Build and Build analysis. The Phase 1 analysis has a 30-minute simulation warmup period and a two-hour peak period in both the AM and PM peaks. The collected traffic volumes showed the AM peak hour occurring from 7:15-8:15 am and the peak two hours occurring between 6:30-8:30 am. NCDOT and HNTB agreed to run the AM analysis from 6:15-8:45am scaling the volumes in the network to the observed 15-minute counts.

The collected PM peak traffic volumes showed the peak two hours occurring between 3:30-5:30 pm, with the 3:30-4:30pm and 4:30-5:30pm periods having very similar hourly flows. NCDOT and HNTB agreed to run the PM analysis with 3-3:30pm as the warmup period and 3:30-5:30pm as the two-hour peak period, scaling the volumes in the network to the observed 15-minute counts. In addition, the PM analysis would also be run from 5:30-7:00pm to provide a cool down period to clear out any queues along I-85.

The **I-5719 I-85 Count Summary and Peak Hour Scaling Factors** spreadsheet shows OD matrix scaling factors for the AM and PM peak periods based on the 2016 base year traffic data collection and includes extended peak hour shoulders per NCDOT request. The **HCS demand adj factor** tab in this spreadsheet contains the Demand Adjustment Factors used for the HCS analysis during Phase I and used now in the Phase III FREEVAL-NC analysis.

1.2 Origin-Destination Matrix Estimation Procedure – 2045 Build Scenario

In TransModeler Version 4, Build 6275 64-bit, the 2016 Base Year No-Build ODME model network used for Phase I ODME was edited to add the following anticipated structural network changes:

Project STIP #	Project Description
I-5719	Widen I-85 as an 8-lane interstate from US 321 (Exit 17) to NC 273 (Exit 27)
U-6043	Add additional eastbound lane to US 29 / US 74 corridor from Cox Road (SR 2200) to east of Lineberger Road
U-6146	the widening of US 74 (Wilkinson Boulevard) to a 6-lane facility from Market Street to Alberta Avenue (between McAdenville and Belmont)
I-5000	Geometric safety improvements to the I-85 / US 321 Interchange (the removal of E. Rankin Lake Road)

Additionally, the network was modified for the proposed CaroMont Hospital to be located at Belmont Abbey College (just northwest of the I-85 and NC 273 interchange) and for the recently constructed Sonic Automotive EchoPark call center at S Main Street and Kenworthy Avenue.

The balanced intersection and interchange turning movements were entered into the turning movement table in the 2045 Future Year Build TransModeler ODME model. The newly created balanced turning movement table was checked for any volume imbalances resulting from data entry errors.

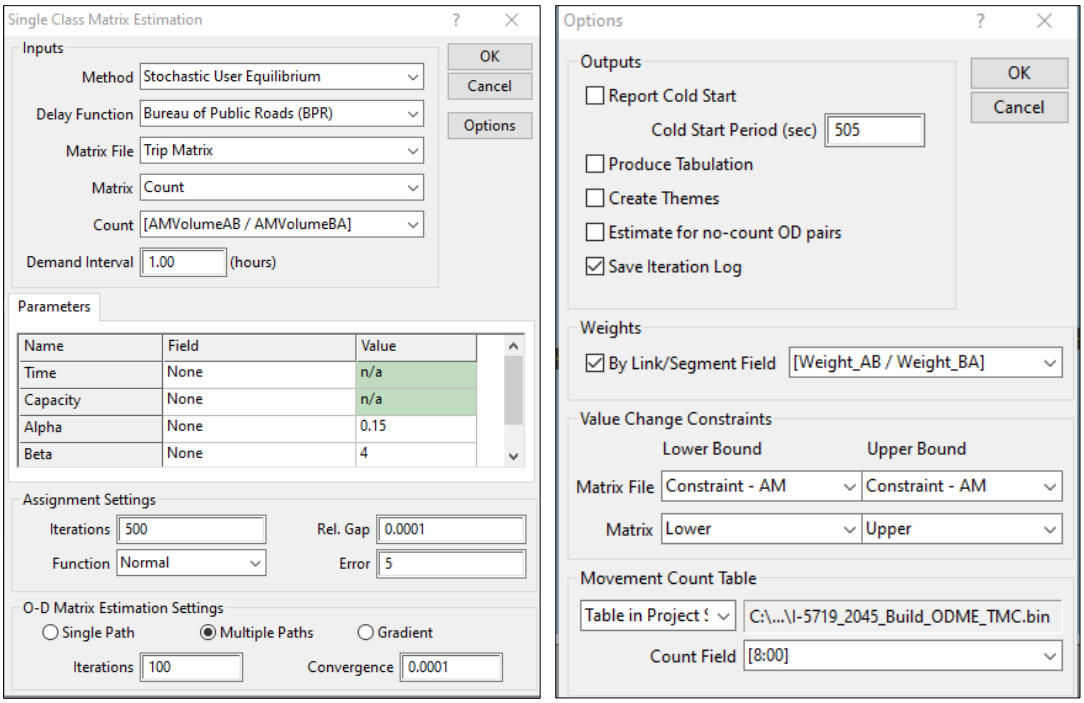
The 2045 Build ODME model was run ten (10) times for both the AM and PM peak hours using the balanced turning movements as the volume input. Trip data from each of the ten runs were converted to an O-D matrix. These ten trip-based O-D matrices were then averaged to create an initial seed matrix for both the AM and PM peak periods. The **Seed & Const. Matrix – AM** and **Seed & Const. Matrix - PM** tabs of the Volume Development spreadsheet contain the ten seed matrices, the average trip-based matrices, and final seed matrices. The final seed matrices include unit values (i.e. 1) for all feasible O-D pairs that were not assigned volumes in the raw iterative 2045 Future Year Build seed matrices. O-D pairs that were determined to not be feasible in the network were assigned zero volume in the seed matrices.

Value Change Constraints matrices were developed from the final seed matrices using the following conversion scheme:

Value Range (OD pair trips)	Constraint Value (%)
Less than 75	±50%
75-149	±30%
150-299	±20%
300-499	±15%
Greater than 500	±10%

The constraints for all defined volumes in seed matrix were set to a null (zero).

Link weights were added to the links dataview, with more weight given to critical links in the network, such as the I-85 mainline and the interchange ramps. Target link flows were developed from the balanced Future Year Build turning movement tables by aggregating turning volumes by link. The ODME procedure was performed utilizing the 2045 Build ODME model. The ODME application settings specified in the *Origin-Destination Matrix Volume Development Techniques for the North Carolina Department of Transportation* (NCDOT, 2019) were used. Below are images of the settings and options tabs used for this ODME procedure.



1.3 2045 Future Year Build ODME Validation

The validation process compared the target aggregate link flows developed from the balanced turning movement tables to the link flows generated by the ODME output OD matrices. The variance targets for the total flow on each link are listed below:

Link Total Flow Target Value (veh)	Variance Target
Less than 100	±15 vehicles for 85% of links
100-249	±50 vehicles for 90% of links
250-499	±50 vehicles for 90% of links
500-1000	±100 vehicles for 90% of links
Greater than 1000	±10% for 90% of links

The ODME validation tables for the future year scenarios are shown in the **ODME Val – AM_0505** and **ODME Val – PM_0505** tabs of the Volume Development spreadsheet. In both the AM and PM analysis periods the O-D volumes throughout the network were all within the variance targets and the overall network flows were within 1% of the balanced forecast peak hour turning movements. The final ODME output OD matrices are shown in the **ODME Matrix - AM_0504_5 edits** and **ODME Matrix - PM_0505_edits** tabs of the Volume Development spreadsheet.

1.4 Vehicle Classification – Future Year Build

The **Vehicle Class Matrices – AM** and **Vehicle Class Matrices - PM** tabs of the Volume Development spreadsheet were used to divide each (AM/PM) overall OD matrix into separate matrices for Passenger vehicles (PC1, PC2, PC3, PU, B and M), Dual trucks (ST) and TTST trucks (TT). The target percent Duals and TTSTs were derived from the I-5719 2045 Future Year

Build forecast. The goal was to get the Duals and TTST volumes in the OD matrices within ± 2 percent of the target percent duals and TTSTs. The AM and PM duals and TTST matrices are within the target range for all vehicle class distributions.

Appendix F – 2045 Build OD Matrices Volume Development Spreadsheet (DIGITAL)
FINAL

Appendix G – 2045 No-Build FREEVAL-NC Output Reports
FINAL

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYNB: I-85 NB AM Peak
Scenario Name	2045 No Build AM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/02/2021

Scope of Analysis:

Facility Name	I85 NB	Analysis Year	2045
Facility Length (mi)	17.9 (45 HCM Segments)	Analysis Period (24 hr Format)	6:15 - 8:45
Start Mile Marker	14.3	# of HCM Analysis Periods	10
End Mile Marker	32.1	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$84,776	Average Travel Time (min)	21.2
Mainline Delay (hr)	1075.0	Average Mainline Speed (mph)	51.0
Ramp Entry Delay (hr)	459.5	Max Queue Length (ft)	26405.2
System Delay (VHD)	1534.5	Max D/C	1.08
TTI Based on Speed Limit	0.79	TTI Based on FFS	0.79

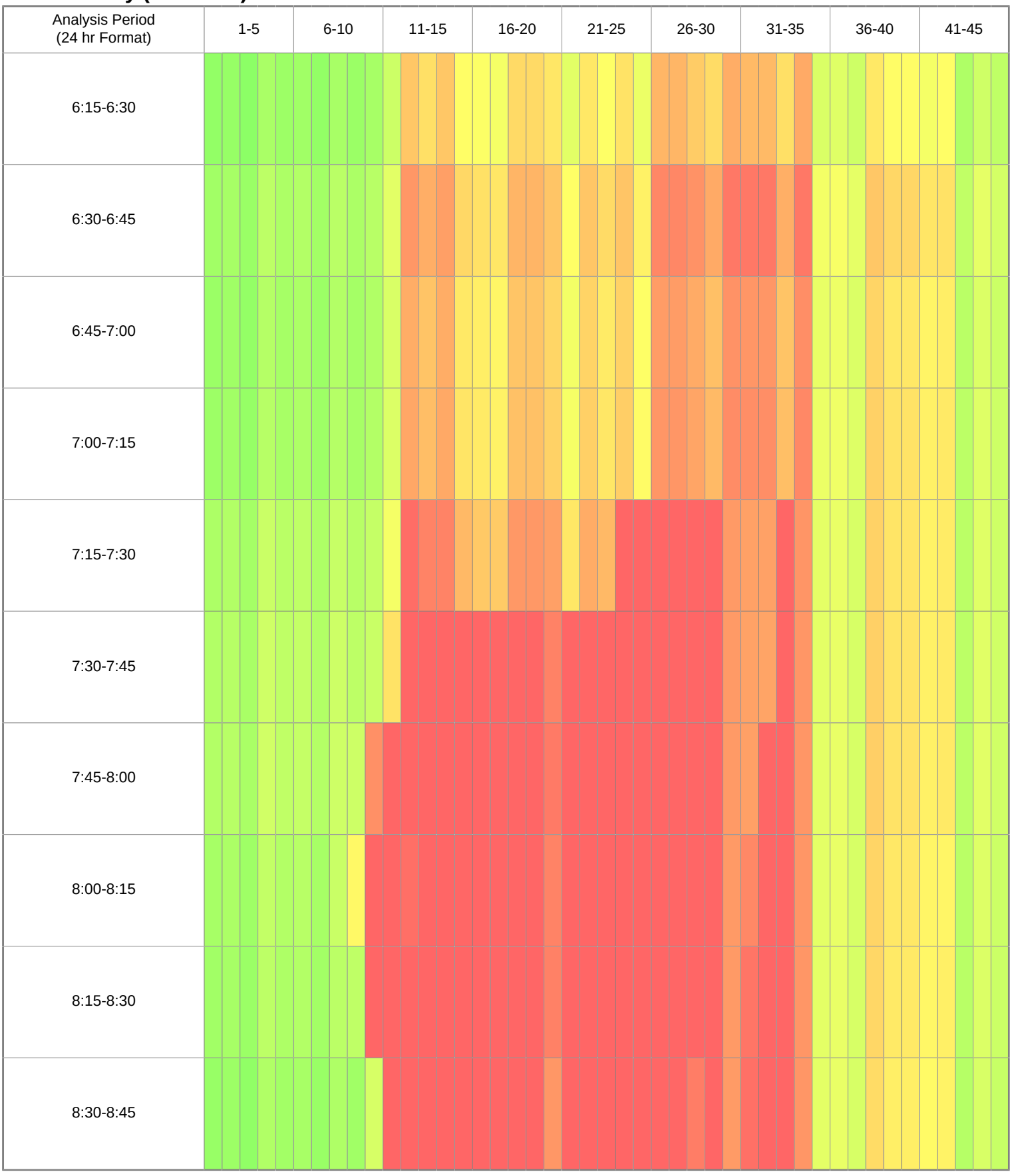
Detailed Segment Geometry Inputs:

#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,013	70	4	-	
2	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
3	Basic	980	70	4	-	
4	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
5	Basic	2,670	70	4	-	
6	Off-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
7	Basic	2,000	70	4	-	
8	On-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
9	Basic	1,603	70	4	-	
10	Off-Ramp	1,500	65	4	1	17 N CHESTER ST
11	Basic	2,317	65	3	-	
12	On-Ramp	1,500	65	3	1	N CHESTER ST
13	Basic	5,829	65	3	-	
14	Off-Ramp	1,500	65	3	1	19 E OZARK AVE
15	Basic	643	65	3	-	
16	Weaving	2,953	65	4	1 ONR / 1 OFR	E OZARK AVE/ 20 N NEW HOPE RD
17	Basic	1,374	65	3	-	
18	On-Ramp	1,375	65	3	1	N NEW HOPE RD
19	Overlap	125	65	3	-	
20	Off-Ramp	1,375	65	3	1	21 COX RD
21	Basic	1,885	65	3	-	
22	On-Ramp	1,500	65	3	1	COX RD
23	Basic	4,735	65	3	-	
24	Off-Ramp	1,500	65	3	1	22 S MAIN ST
25	Basic	1,209	65	3	-	
26	On-Ramp	1,453	65	3	1	S MAIN ST
27	Overlap	47	65	3	-	
28	Off-Ramp	1,453	65	3	1	23 MCADENVILLE RD
29	Basic	2,148	65	3	-	
30	On-Ramp	1,500	65	3	1	MCADENVILLE RD
31	Basic	7,860	65	3	-	
32	Off-Ramp	1,500	65	3	1	26 BELMONT MT HOLLY RD
33	Basic	1,099	65	3	-	
34	On-Ramp	1,500	65	3	1	BELMONT MT HOLLY RD
35	Basic	1,603	65	4	-	
36	Off-Ramp	1,500	65	4	1	27 BEATTY DR
37	Basic	2,498	65	4	-	
38	On-Ramp	1,500	65	4	1	27 BEATTY DR
39	Basic	8,213	65	4	-	
40	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
41	Basic	1,124	65	4	-	
42	Off-Ramp	1,500	65	4	1	30 I-485 OUTER
43	Basic	1,377	65	4	-	
44	On-Ramp	1,500	65	4	1	SAM WILSON RD
45	Basic	5,058	65	4	-	I-485

Detailed Segment Demand Inputs:

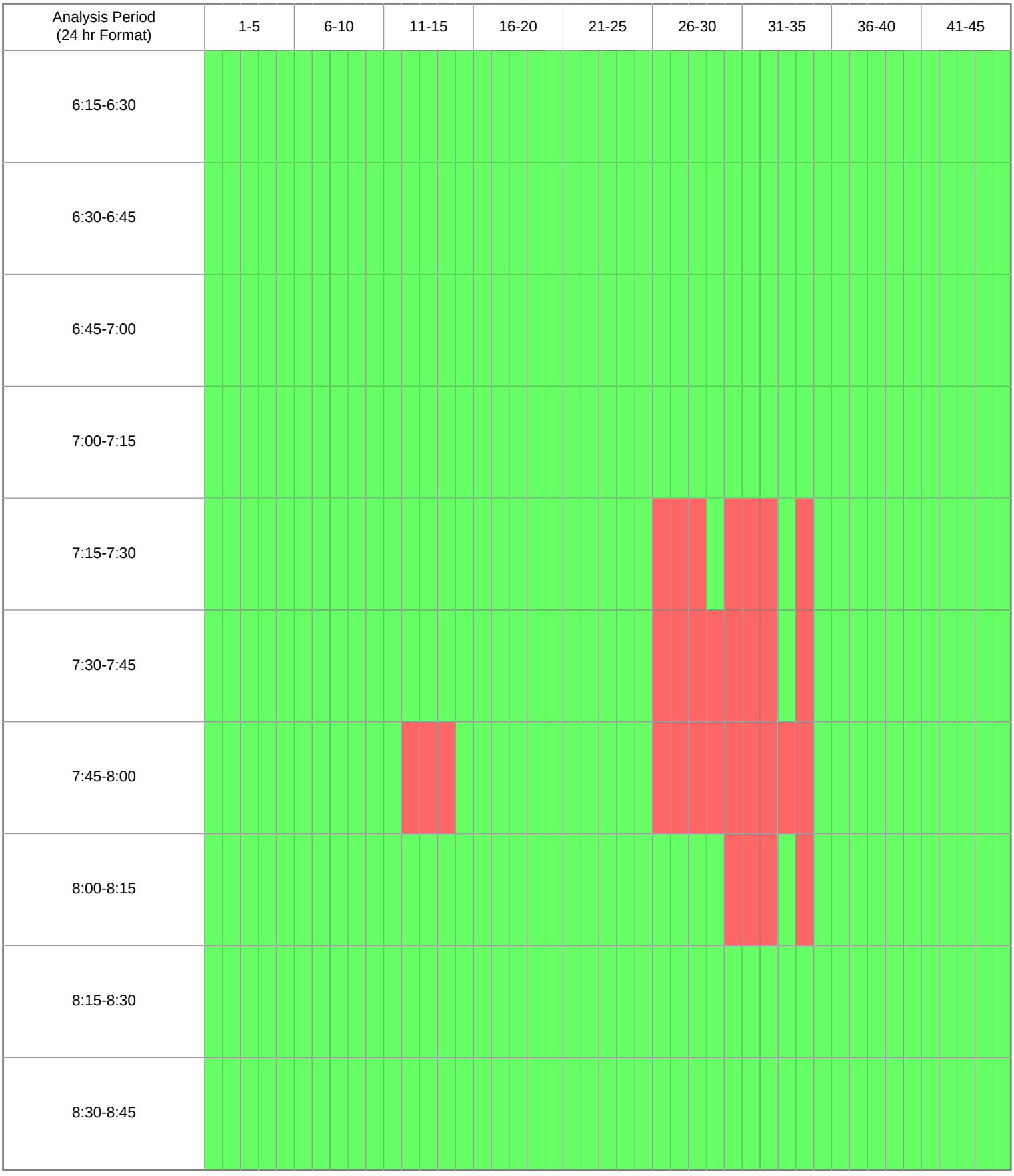
#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	11,265	-	Not Specified	-
2	Off-Ramp	4	1	-	555	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	1,365	-	Not Specified	-
5	Basic	4	-	-	-	-	-
6	Off-Ramp	4	1	-	750	-	Not Specified
7	Basic	4	-	-	-	-	-
8	On-Ramp	4	1	645	-	Not Specified	-
9	Basic	4	-	-	-	-	-
10	Off-Ramp	4	1	-	1,125	-	Not Specified
11	Basic	3	-	-	-	-	-
12	On-Ramp	3	1	3,605	-	Not Specified	-
13	Basic	3	-	-	-	-	-
14	Off-Ramp	3	1	-	1,220	-	Not Specified
15	Basic	3	-	-	-	-	-
16	Weaving	4	1 ONR / 1 OFR	1,025	1,515	Not Specified	Not Specified
17	Basic	3	-	-	-	-	-
18	On-Ramp	3	1	1,085	-	Not Specified	-
19	Overlap	3	-	-	-	-	-
20	Off-Ramp	3	1	-	1,965	-	Not Specified
21	Basic	3	-	-	-	-	-
22	On-Ramp	3	1	1,275	-	Not Specified	-
23	Basic	3	-	-	-	-	-
24	Off-Ramp	3	1	-	780	-	Not Specified
25	Basic	3	-	-	-	-	-
26	On-Ramp	3	1	2,780	-	Not Specified	-
27	Overlap	3	-	-	-	-	-
28	Off-Ramp	3	1	-	585	-	Not Specified
29	Basic	3	-	-	-	-	-
30	On-Ramp	3	1	1,130	-	Not Specified	-
31	Basic	3	-	-	-	-	-
32	Off-Ramp	3	1	-	1,265	-	Not Specified
33	Basic	3	-	-	-	-	-
34	On-Ramp	3	1	1,250	-	Not Specified	-
35	Basic	4	-	-	-	-	-
36	Off-Ramp	4	1	-	845	-	Not Specified
37	Basic	4	-	-	-	-	-
38	On-Ramp	4	1	3,280	-	Not Specified	-
39	Basic	4	-	-	-	-	-
40	Off-Ramp	4	1	-	620	-	Not Specified
41	Basic	4	-	-	-	-	-
42	Off-Ramp	4	1	-	4,700	-	Not Specified
43	Basic	4	-	-	-	-	-
44	On-Ramp	4	1	1,180	-	Not Specified	-
45	Basic	4	-	-	-	-	-

Total Density (PC/Mi/Ln) Contour:



Density Based LOS Contour:

Demand Based LOS Contour:



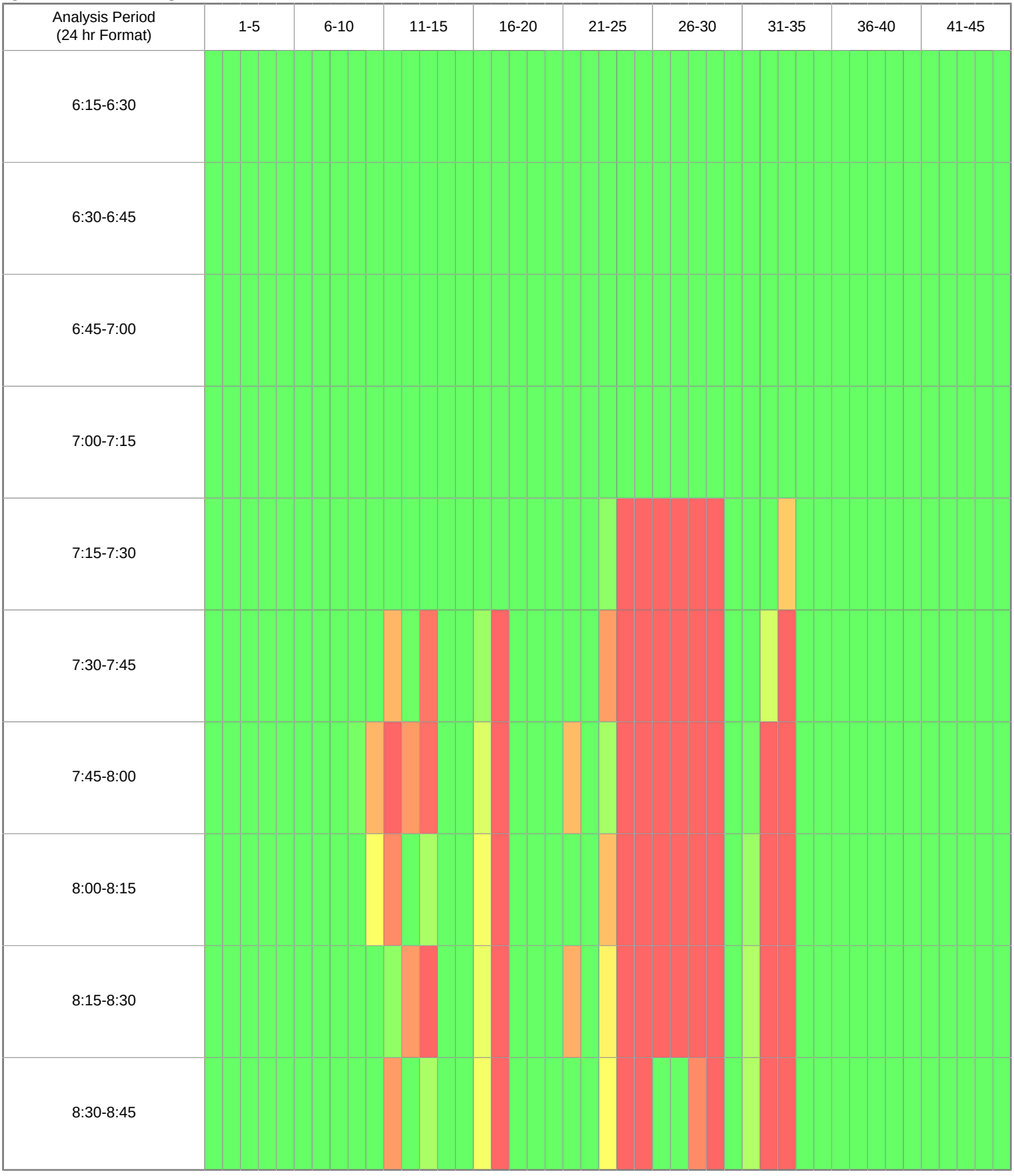
D/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

V/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

Queue Percentage Contour:



Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYNB: I-85 NB PM Peak
Scenario Name	2045 No Build PM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/03/2021

Scope of Analysis:

Facility Name	I85 NB	Analysis Year	2045
Facility Length (mi)	17.9 (45 HCM Segments)	Analysis Period (24 hr Format)	15:00 - 19:00
Start Mile Marker	14.3	# of HCM Analysis Periods	16
End Mile Marker	32.1	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$12,035	Average Travel Time (min)	17.1
Mainline Delay (hr)	221.0	Average Mainline Speed (mph)	62.6
Ramp Entry Delay (hr)	0.0	Max Queue Length (ft)	0.0
System Delay (VHD)	221.0	Max D/C	0.85
TTI Based on Speed Limit	0.96	TTI Based on FFS	0.96

Detailed Segment Geometry Inputs:

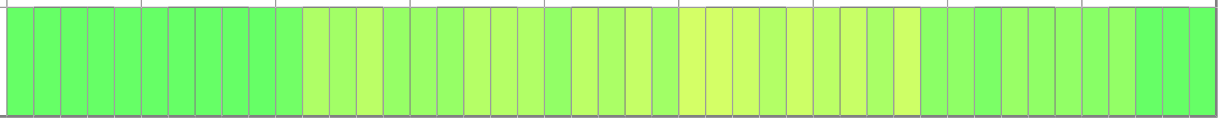
#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,013	70	4	-	
2	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
3	Basic	980	70	4	-	
4	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
5	Basic	2,670	70	4	-	
6	Off-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
7	Basic	2,000	70	4	-	
8	On-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
9	Basic	1,603	70	4	-	
10	Off-Ramp	1,500	65	4	1	17 N CHESTER ST
11	Basic	2,317	65	3	-	
12	On-Ramp	1,500	65	3	1	N CHESTER ST
13	Basic	5,829	65	3	-	
14	Off-Ramp	1,500	65	3	1	19 E OZARK AVE
15	Basic	643	65	3	-	
16	Weaving	2,953	65	4	1 ONR / 1 OFR	E OZARK AVE/ 20 N NEW HOPE RD
17	Basic	1,374	65	3	-	
18	On-Ramp	1,375	65	3	1	N NEW HOPE RD
19	Overlap	125	65	3	-	
20	Off-Ramp	1,375	65	3	1	21 COX RD
21	Basic	1,885	65	3	-	
22	On-Ramp	1,500	65	3	1	COX RD
23	Basic	4,735	65	3	-	
24	Off-Ramp	1,500	65	3	1	22 S MAIN ST
25	Basic	1,209	65	3	-	
26	On-Ramp	1,453	65	3	1	S MAIN ST
27	Overlap	47	65	3	-	
28	Off-Ramp	1,453	65	3	1	23 MCADENVILLE RD
29	Basic	2,148	65	3	-	
30	On-Ramp	1,500	65	3	1	MCADENVILLE RD
31	Basic	7,860	65	3	-	
32	Off-Ramp	1,500	65	3	1	26 BELMONT MT HOLLY RD
33	Basic	1,099	65	3	-	
34	On-Ramp	1,500	65	3	1	BELMONT MT HOLLY RD
35	Basic	1,603	65	4	-	
36	Off-Ramp	1,500	65	4	1	27 BEATTY DR
37	Basic	2,498	65	4	-	
38	On-Ramp	1,500	65	4	1	27 BEATTY DR
39	Basic	8,213	65	4	-	
40	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
41	Basic	1,124	65	4	-	
42	Off-Ramp	1,500	65	4	1	30 I-485 OUTER
43	Basic	1,377	65	4	-	
44	On-Ramp	1,500	65	4	1	SAM WILSON RD
45	Basic	5,058	65	4	-	I-485

Detailed Segment Demand Inputs:

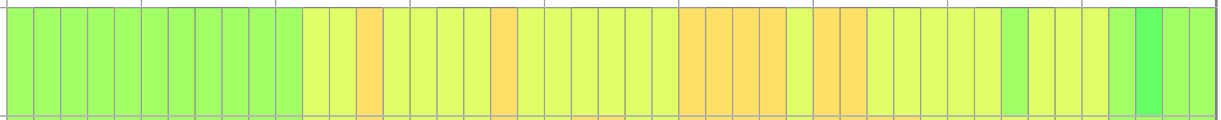
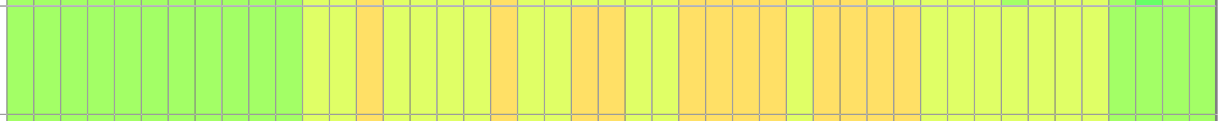
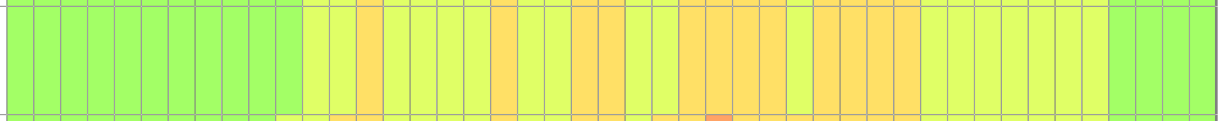
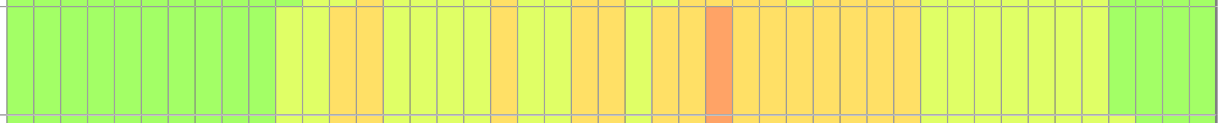
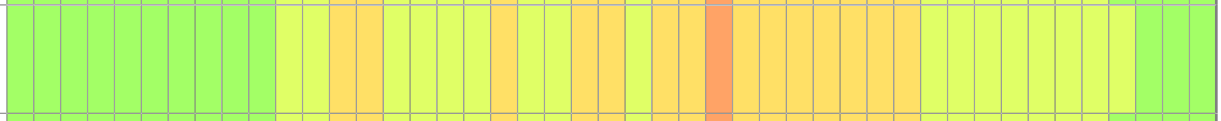
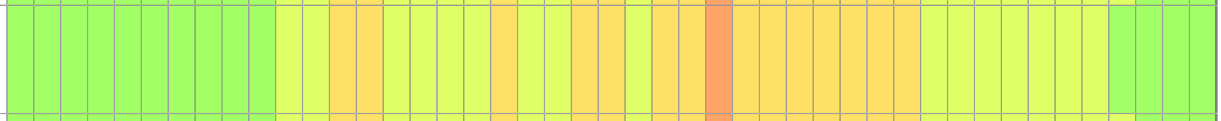
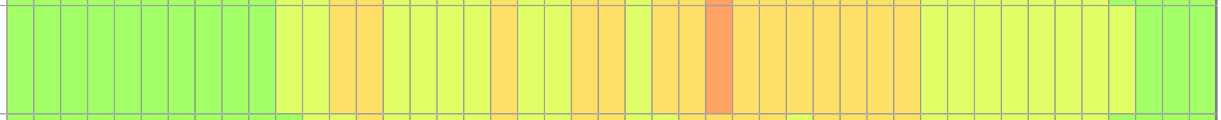
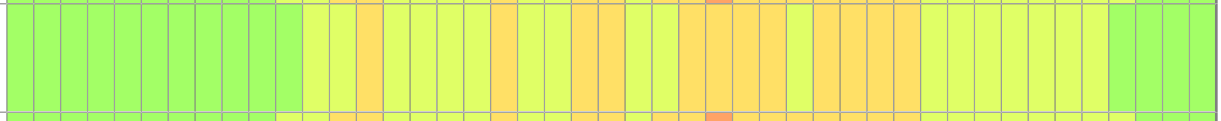
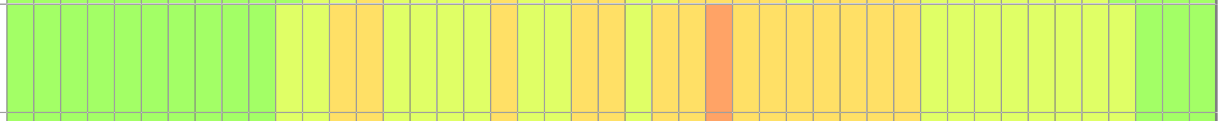
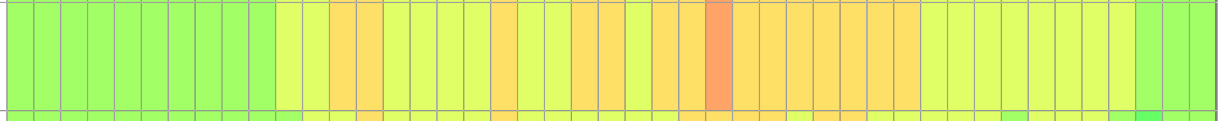
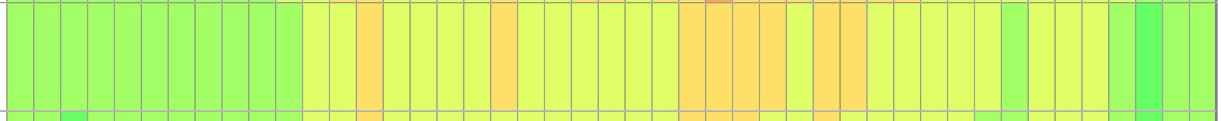
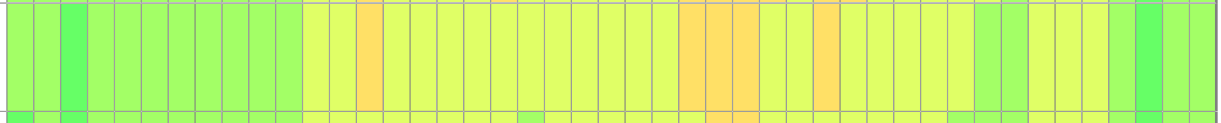
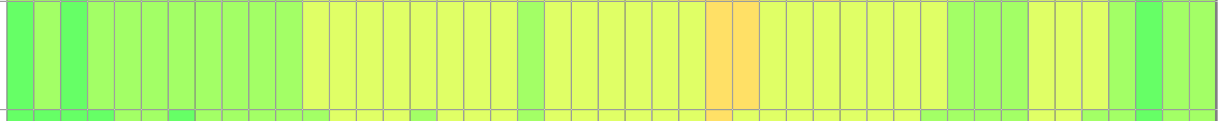
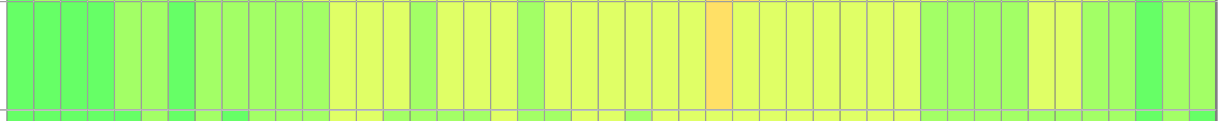
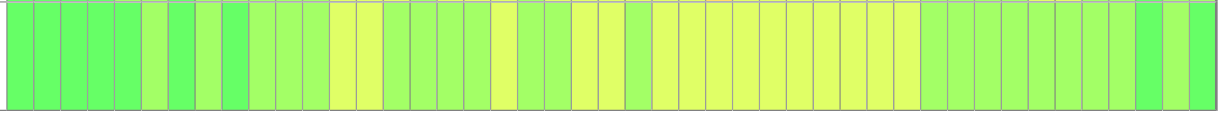
#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	11,800	-	Not Specified	-
2	Off-Ramp	4	1	-	785	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	2,105	-	Not Specified	-
5	Basic	4	-	-	-	-	-
6	Off-Ramp	4	1	-	845	-	Not Specified
7	Basic	4	-	-	-	-	-
8	On-Ramp	4	1	1,245	-	Not Specified	-
9	Basic	4	-	-	-	-	-
10	Off-Ramp	4	1	-	1,965	-	Not Specified
11	Basic	3	-	-	-	-	-
12	On-Ramp	3	1	5,110	-	Not Specified	-
13	Basic	3	-	-	-	-	-
14	Off-Ramp	3	1	-	1,265	-	Not Specified
15	Basic	3	-	-	-	-	-
16	Weaving	4	1 ONR / 1 OFR	2,245	2,270	Not Specified	Not Specified
17	Basic	3	-	-	-	-	-
18	On-Ramp	3	1	1,720	-	Not Specified	-
19	Overlap	3	-	-	-	-	-
20	Off-Ramp	3	1	-	2,210	-	Not Specified
21	Basic	3	-	-	-	-	-
22	On-Ramp	3	1	2,790	-	Not Specified	-
23	Basic	3	-	-	-	-	-
24	Off-Ramp	3	1	-	1,090	-	Not Specified
25	Basic	3	-	-	-	-	-
26	On-Ramp	3	1	3,315	-	Not Specified	-
27	Overlap	3	-	-	-	-	-
28	Off-Ramp	3	1	-	1,345	-	Not Specified
29	Basic	3	-	-	-	-	-
30	On-Ramp	3	1	950	-	Not Specified	-
31	Basic	3	-	-	-	-	-
32	Off-Ramp	3	1	-	2,010	-	Not Specified
33	Basic	3	-	-	-	-	-
34	On-Ramp	3	1	1,860	-	Not Specified	-
35	Basic	4	-	-	-	-	-
36	Off-Ramp	4	1	-	2,350	-	Not Specified
37	Basic	4	-	-	-	-	-
38	On-Ramp	4	1	3,040	-	Not Specified	-
39	Basic	4	-	-	-	-	-
40	Off-Ramp	4	1	-	1,150	-	Not Specified
41	Basic	4	-	-	-	-	-
42	Off-Ramp	4	1	-	8,720	-	Not Specified
43	Basic	4	-	-	-	-	-
44	On-Ramp	4	1	2,300	-	Not Specified	-
45	Basic	4	-	-	-	-	-

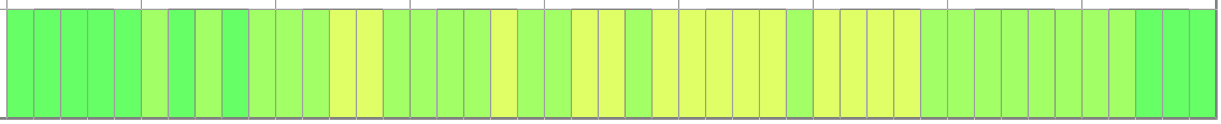
Total Density (PC/Mi/Ln) Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
18:45-19:00									

Density Based LOS Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
18:45-19:00									

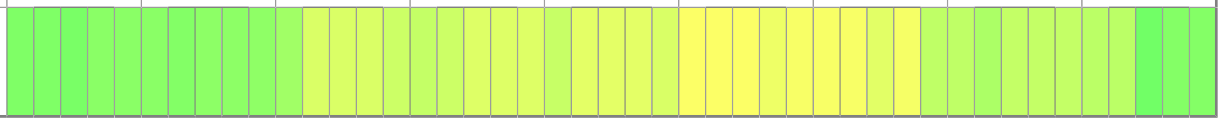
Demand Based LOS Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
18:45-19:00									

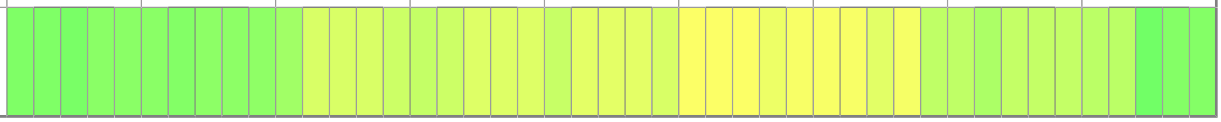
D/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
18:45-19:00									

V/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
18:45-19:00									

Queue Percentage Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
18:45-19:00									

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYNB: I-85 SB AM Peak
Scenario Name	2045 No Build AM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/03/2021

Scope of Analysis:

Facility Name		Analysis Year	2045
Facility Length (mi)	17.8 (45 HCM Segments)	Analysis Period (24 hr Format)	6:15 - 8:45
Start Mile Marker	--	# of HCM Analysis Periods	10
End Mile Marker	--	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$9,052	Average Travel Time (min)	17.1
Mainline Delay (hr)	166.4	Average Mainline Speed (mph)	62.1
Ramp Entry Delay (hr)	0.0	Max Queue Length (ft)	0.0
System Delay (VHD)	166.4	Max D/C	0.87
TTI Based on Speed Limit	0.95	TTI Based on FFS	0.95

Detailed Segment Geometry Inputs:

#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,816	65	4	-	
2	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
3	Basic	4,253	65	4	-	
4	On-Ramp	1,500	65	4	1	SAM WILSON RD
5	Basic	2,126	65	5	-	
6	Basic	5,850	65	4	-	
7	Off-Ramp	1,500	65	4	1	27 BEATTY DR
8	Basic	2,775	65	4	-	
9	On-Ramp	1,500	65	4	1	BEATTY DR
10	Basic	1,016	65	4	-	
11	Off-Ramp	1,500	65	3	1	26 BELMONT MT HOLLY RD
12	Basic	1,050	65	3	-	
13	On-Ramp	1,500	65	3	1	BELMONT MT HOLLY RD
14	Basic	8,766	65	3	-	
15	Off-Ramp	1,500	65	3	1	23 MCADENVILLE RD
16	Basic	1,778	65	3	-	
17	On-Ramp	980	65	3	1	MCADENVILLE RD
18	Overlap	520	65	3	-	
19	Off-Ramp	980	65	3	1	22 S MAIN ST
20	Basic	1,519	65	3	-	
21	On-Ramp	1,500	65	3	1	S MAIN ST
22	Basic	4,860	65	3	-	
23	Off-Ramp	1,500	65	3	1	21 COX RD
24	Basic	2,335	65	3	-	
25	On-Ramp	1,173	65	3	1	COX RD
26	Overlap	327	65	3	-	
27	Off-Ramp	1,173	65	3	1	20 N NEW HOPE RD
28	Basic	1,403	65	3	-	
29	Weaving	3,416	65	4	1 ONR / 1 OFR	N NEW HOPE RD/ 19 E OZARK AVE
30	Basic	398	65	3	-	
31	On-Ramp	1,500	65	3	1	E OZARK AVE
32	Basic	5,719	65	3	-	
33	Off-Ramp	1,500	65	3	1	17 N CHESTER ST
34	Off-Ramp	1,080	65	3	1	
35	Basic	1,273	65	3	-	
36	On-Ramp	1,500	65	4	1	N CHESTER ST
37	Basic	1,171	70	4	-	
38	Off-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
39	Basic	2,000	70	4	-	
40	On-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
41	Basic	2,848	70	4	-	
42	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
43	Basic	990	70	4	-	
44	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
45	Basic	3,537	70	4	-	

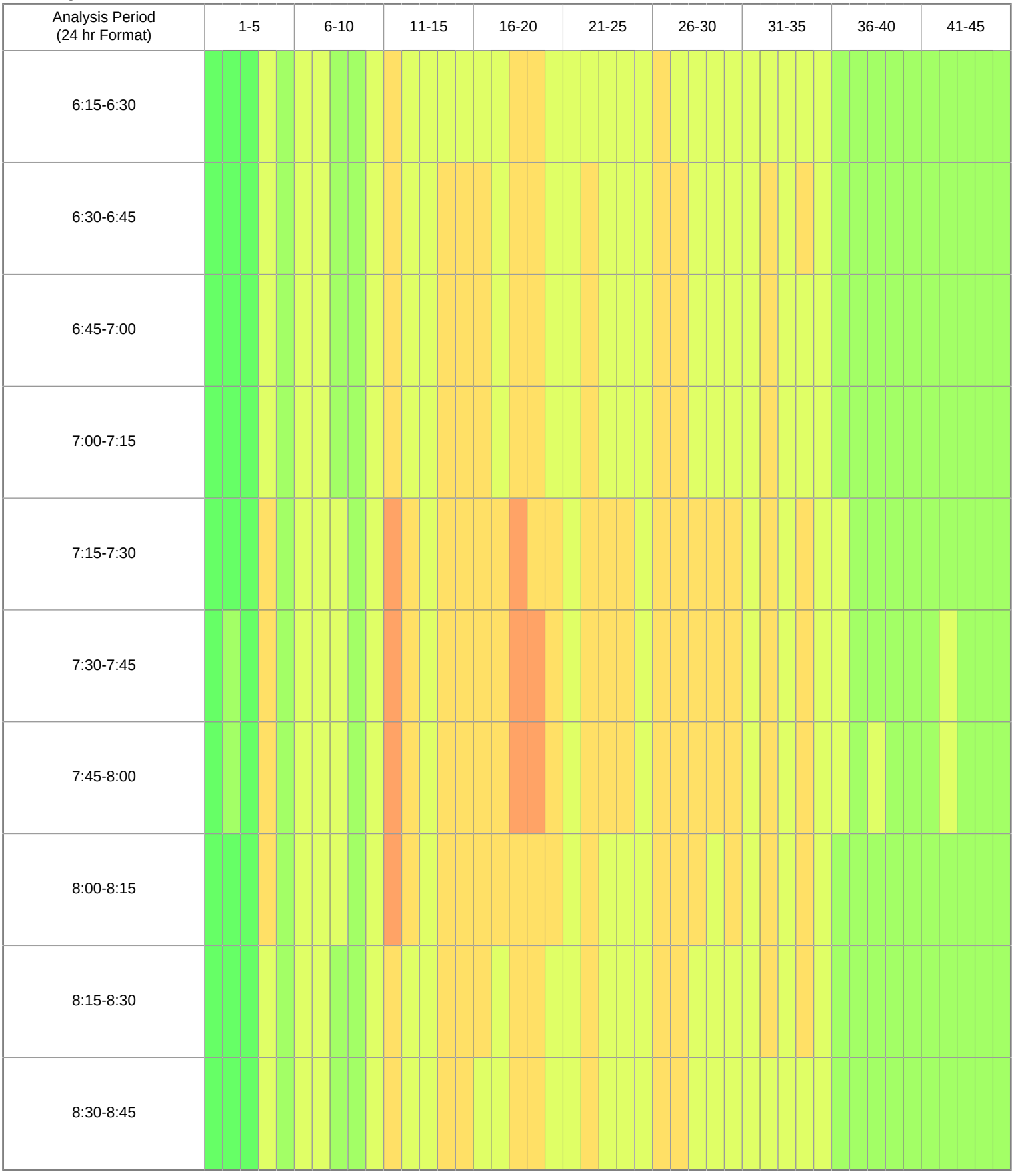
Detailed Segment Demand Inputs:

#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	5,265	-	Not Specified	-
2	Off-Ramp	4	1	-	1,125	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	7,890	-	Not Specified	-
5	Basic	5	-	-	-	-	-
6	Basic	4	-	-	-	-	-
7	Off-Ramp	4	1	-	1,550	-	Not Specified
8	Basic	4	-	-	-	-	-
9	On-Ramp	4	1	1,600	-	Not Specified	-
10	Basic	4	-	-	-	-	-
11	Off-Ramp	3	1	-	1,025	-	Not Specified
12	Basic	3	-	-	-	-	-
13	On-Ramp	3	1	1,325	-	Not Specified	-
14	Basic	3	-	-	-	-	-
15	Off-Ramp	3	1	-	460	-	Not Specified
16	Basic	3	-	-	-	-	-
17	On-Ramp	3	1	895	-	Not Specified	-
18	Overlap	3	-	-	-	-	-
19	Off-Ramp	3	1	-	1,680	-	Not Specified
20	Basic	3	-	-	-	-	-
21	On-Ramp	3	1	1,065	-	Not Specified	-
22	Basic	3	-	-	-	-	-
23	Off-Ramp	3	1	-	1,575	-	Not Specified
24	Basic	3	-	-	-	-	-
25	On-Ramp	3	1	1,390	-	Not Specified	-
26	Overlap	3	-	-	-	-	-
27	Off-Ramp	3	1	-	955	-	Not Specified
28	Basic	3	-	-	-	-	-
29	Weaving	4	1 ONR / 1 OFR	1,400	1,270	Not Specified	Not Specified
30	Basic	3	-	-	-	-	-
31	On-Ramp	3	1	795	-	Not Specified	-
32	Basic	3	-	-	-	-	-
33	Off-Ramp	3	1	-	2,475	-	Not Specified
34	Off-Ramp	3	1	-	520	-	Not Specified
35	Basic	3	-	-	-	-	-
36	On-Ramp	4	1	1,075	-	Not Specified	-
37	Basic	4	-	-	-	-	-
38	Off-Ramp	4	1	-	860	-	Not Specified
39	Basic	4	-	-	-	-	-
40	On-Ramp	4	1	460	-	Not Specified	-
41	Basic	4	-	-	-	-	-
42	Off-Ramp	4	1	-	1,245	-	Not Specified
43	Basic	4	-	-	-	-	-
44	On-Ramp	4	1	475	-	Not Specified	-
45	Basic	4	-	-	-	-	-

Total Density (PC/Mi/Ln) Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

Density Based LOS Contour:



Demand Based LOS Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

D/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

V/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

Queue Percentage Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
6:15-6:30									
6:30-6:45									
6:45-7:00									
7:00-7:15									
7:15-7:30									
7:30-7:45									
7:45-8:00									
8:00-8:15									
8:15-8:30									
8:30-8:45									

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYNB: I-85 SB PM Peak
Scenario Name	2045 No Build PM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/03/2021

Scope of Analysis:

Facility Name		Analysis Year	2045
Facility Length (mi)	17.8 (45 HCM Segments)	Analysis Period (24 hr Format)	15:00 - 19:30
Start Mile Marker	--	# of HCM Analysis Periods	18
End Mile Marker	--	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$362,448	Average Travel Time (min)	22.9
Mainline Delay (hr)	2962.9	Average Mainline Speed (mph)	45.2
Ramp Entry Delay (hr)	3467.5	Max Queue Length (ft)	15577.5
System Delay (VHD)	6430.4	Max D/C	1.08
TTI Based on Speed Limit	0.72	TTI Based on FFS	0.72

Detailed Segment Geometry Inputs:

#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,816	65	4	-	
2	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
3	Basic	4,253	65	4	-	
4	On-Ramp	1,500	65	4	1	SAM WILSON RD
5	Basic	2,126	65	5	-	
6	Basic	5,850	65	4	-	
7	Off-Ramp	1,500	65	4	1	27 BEATTY DR
8	Basic	2,775	65	4	-	
9	On-Ramp	1,500	65	4	1	BEATTY DR
10	Basic	1,016	65	4	-	
11	Off-Ramp	1,500	65	3	1	26 BELMONT MT HOLLY RD
12	Basic	1,050	65	3	-	
13	On-Ramp	1,500	65	3	1	BELMONT MT HOLLY RD
14	Basic	8,766	65	3	-	
15	Off-Ramp	1,500	65	3	1	23 MCADENVILLE RD
16	Basic	1,778	65	3	-	
17	On-Ramp	980	65	3	1	MCADENVILLE RD
18	Overlap	520	65	3	-	
19	Off-Ramp	980	65	3	1	22 S MAIN ST
20	Basic	1,519	65	3	-	
21	On-Ramp	1,500	65	3	1	S MAIN ST
22	Basic	4,860	65	3	-	
23	Off-Ramp	1,500	65	3	1	21 COX RD
24	Basic	2,335	65	3	-	
25	On-Ramp	1,173	65	3	1	COX RD
26	Overlap	327	65	3	-	
27	Off-Ramp	1,173	65	3	1	20 N NEW HOPE RD
28	Basic	1,403	65	3	-	
29	Weaving	3,416	65	4	1 ONR / 1 OFR	N NEW HOPE RD/ 19 E OZARK AVE
30	Basic	398	65	3	-	
31	On-Ramp	1,500	65	3	1	E OZARK AVE
32	Basic	5,719	65	3	-	
33	Off-Ramp	1,500	65	3	1	17 N CHESTER ST
34	Off-Ramp	1,080	65	3	1	
35	Basic	1,273	65	3	-	
36	On-Ramp	1,500	65	4	1	N CHESTER ST
37	Basic	1,171	70	4	-	
38	Off-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
39	Basic	2,000	70	4	-	
40	On-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
41	Basic	2,848	70	4	-	
42	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
43	Basic	990	70	4	-	
44	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
45	Basic	3,537	70	4	-	

Detailed Segment Demand Inputs:

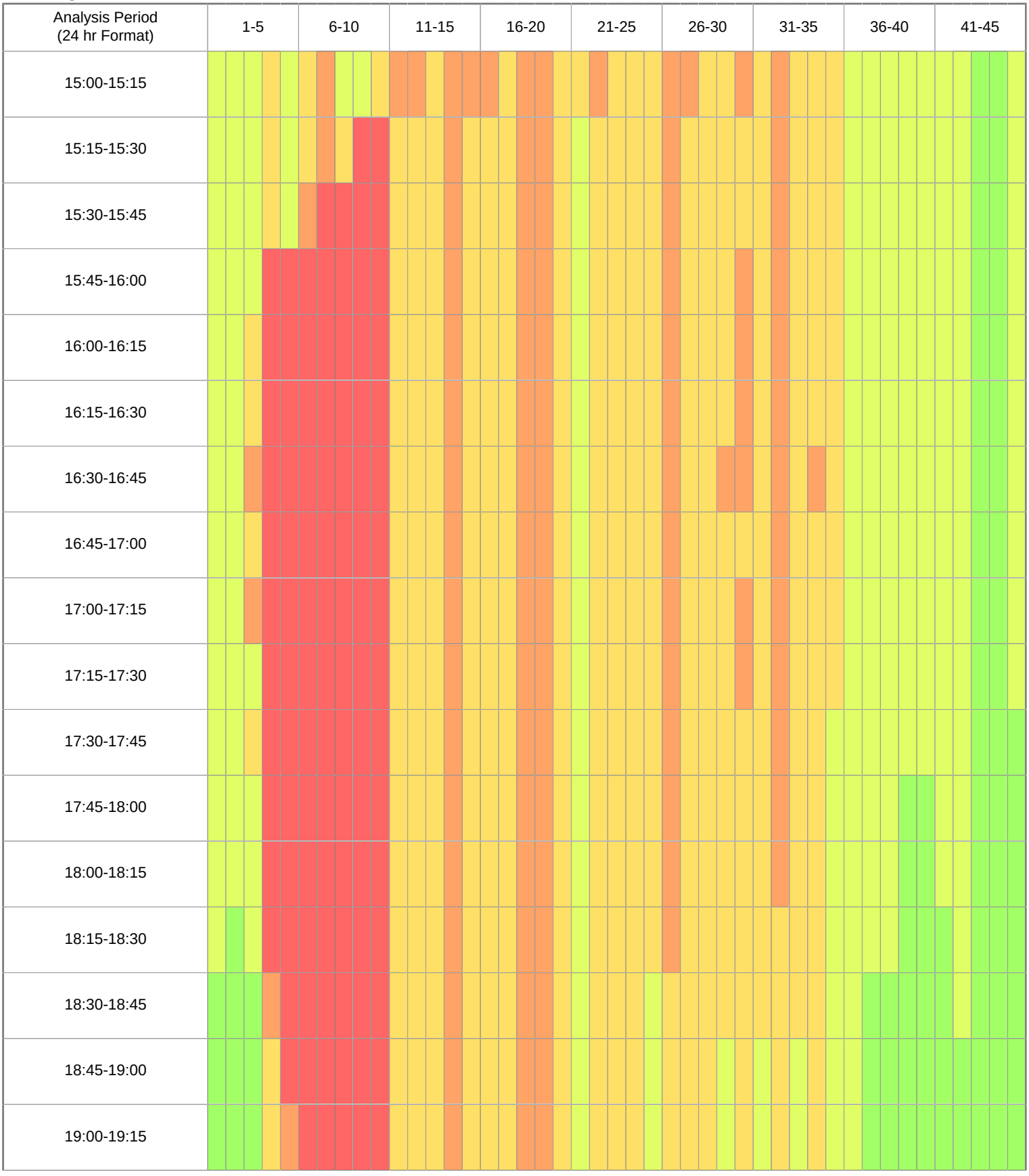
#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	22,000	-	Not Specified	-
2	Off-Ramp	4	1	-	2,710	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	11,225	-	Not Specified	-
5	Basic	5	-	-	-	-	-
6	Basic	4	-	-	-	-	-
7	Off-Ramp	4	1	-	5,505	-	Not Specified
8	Basic	4	-	-	-	-	-
9	On-Ramp	4	1	1,840	-	Not Specified	-
10	Basic	4	-	-	-	-	-
11	Off-Ramp	3	1	-	2,450	-	Not Specified
12	Basic	3	-	-	-	-	-
13	On-Ramp	3	1	2,330	-	Not Specified	-
14	Basic	3	-	-	-	-	-
15	Off-Ramp	3	1	-	1,960	-	Not Specified
16	Basic	3	-	-	-	-	-
17	On-Ramp	3	1	1,185	-	Not Specified	-
18	Overlap	3	-	-	-	-	-
19	Off-Ramp	3	1	-	3,465	-	Not Specified
20	Basic	3	-	-	-	-	-
21	On-Ramp	3	1	1,495	-	Not Specified	-
22	Basic	3	-	-	-	-	-
23	Off-Ramp	3	1	-	2,460	-	Not Specified
24	Basic	3	-	-	-	-	-
25	On-Ramp	3	1	3,700	-	Not Specified	-
26	Overlap	3	-	-	-	-	-
27	Off-Ramp	3	1	-	2,120	-	Not Specified
28	Basic	3	-	-	-	-	-
29	Weaving	4	1 ONR / 1 OFR	2,695	1,965	Not Specified	Not Specified
30	Basic	3	-	-	-	-	-
31	On-Ramp	3	1	2,150	-	Not Specified	-
32	Basic	3	-	-	-	-	-
33	Off-Ramp	3	1	-	6,055	-	Not Specified
34	Off-Ramp	3	1	-	740	-	Not Specified
35	Basic	3	-	-	-	-	-
36	On-Ramp	4	1	2,225	-	Not Specified	-
37	Basic	4	-	-	-	-	-
38	Off-Ramp	4	1	-	1,485	-	Not Specified
39	Basic	4	-	-	-	-	-
40	On-Ramp	4	1	1,055	-	Not Specified	-
41	Basic	4	-	-	-	-	-
42	Off-Ramp	4	1	-	2,505	-	Not Specified
43	Basic	4	-	-	-	-	-
44	On-Ramp	4	1	940	-	Not Specified	-
45	Basic	4	-	-	-	-	-

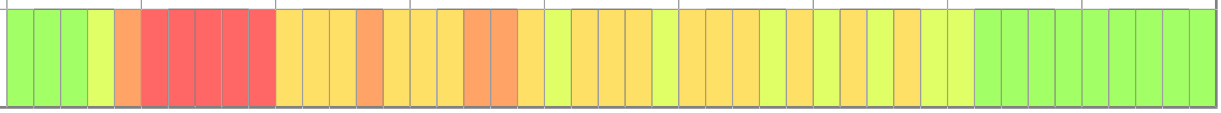
Total Density (PC/Mi/Ln) Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									
18:45-19:00									
19:00-19:15									

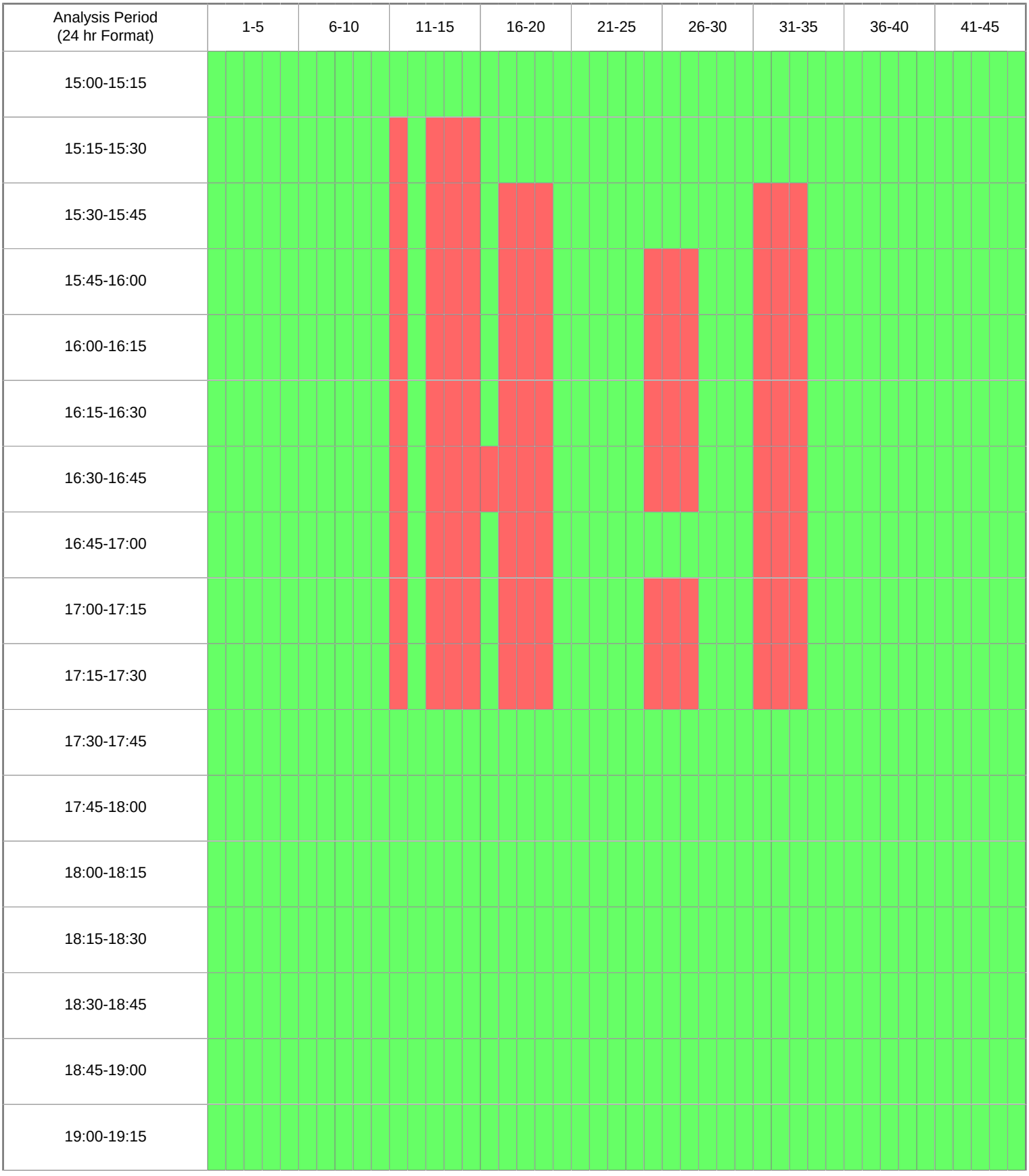
Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
19:15-19:30									

Density Based LOS Contour:



Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
19:15-19:30									

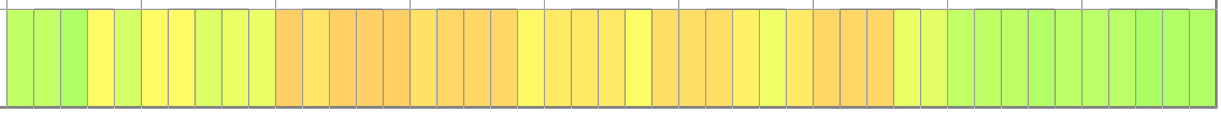
Demand Based LOS Contour:



Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
19:15-19:30									

D/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									
18:45-19:00									
19:00-19:15									

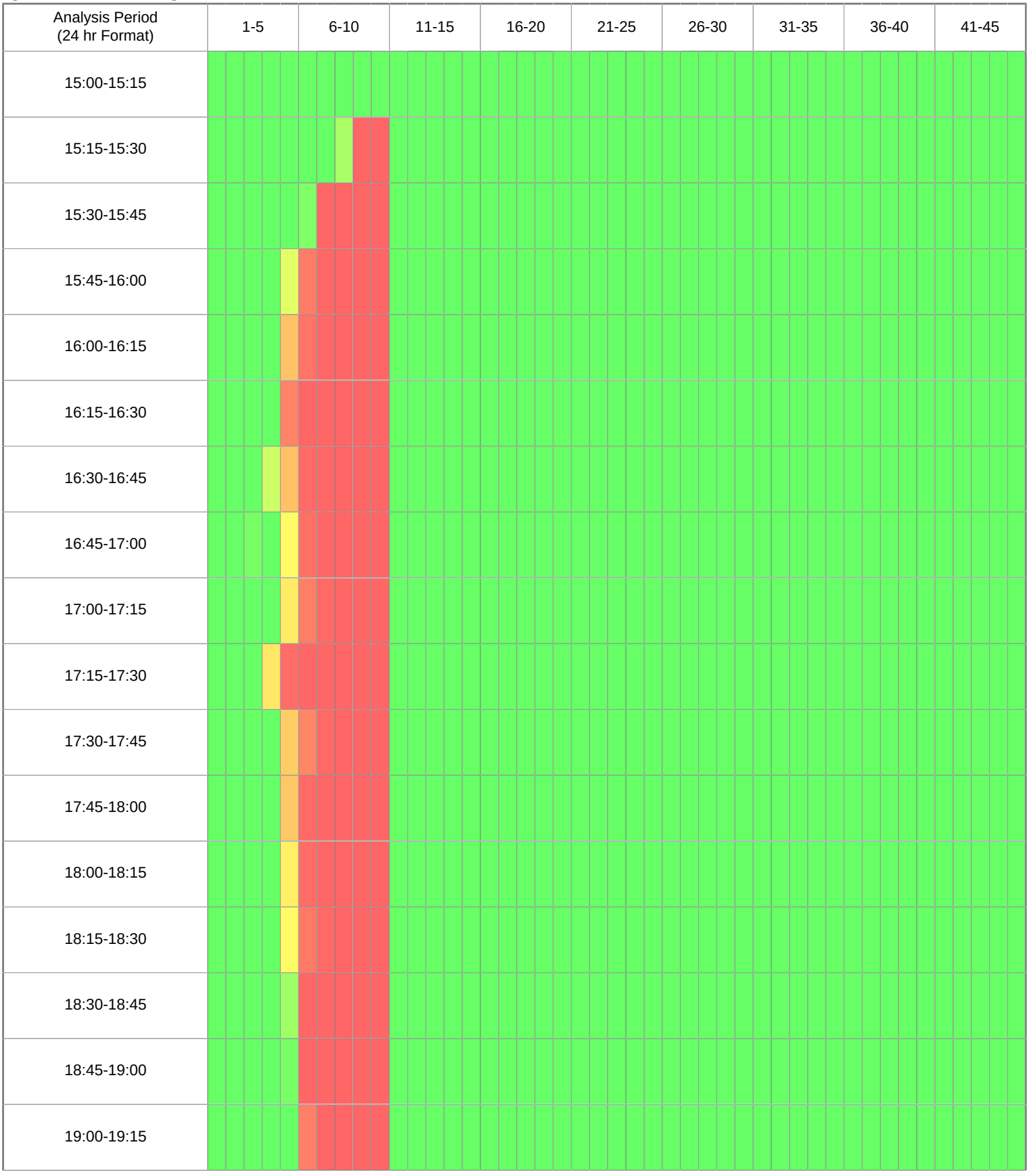
Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
19:15-19:30									

V/C Contour:

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
15:00-15:15									
15:15-15:30									
15:30-15:45									
15:45-16:00									
16:00-16:15									
16:15-16:30									
16:30-16:45									
16:45-17:00									
17:00-17:15									
17:15-17:30									
17:30-17:45									
17:45-18:00									
18:00-18:15									
18:15-18:30									
18:30-18:45									
18:45-19:00									
19:00-19:15									

Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
19:15-19:30									

Queue Percentage Contour:



Analysis Period (24 hr Format)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45
19:15-19:30									

Appendix H – 2045 Build FREEVAL-NC Output Reports
FINAL

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYB: I-85 NB AM Peak
Scenario Name	2045 Build AM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/19/2021

Scope of Analysis:

Facility Name	I85 NB	Analysis Year	2045
Facility Length (mi)	17.9 (42 HCM Segments)	Analysis Period (24 hr Format)	6:15 - 8:45
Start Mile Marker	14.3	# of HCM Analysis Periods	10
End Mile Marker	32.1	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$21,050	Average Travel Time (min)	17.7
Mainline Delay (hr)	384.2	Average Mainline Speed (mph)	60.1
Ramp Entry Delay (hr)	0.0	Max Queue Length (ft)	0.0
System Delay (VHD)	384.2	Max D/C	0.97
TTI Based on Speed Limit	0.92	TTI Based on FFS	0.92

Detailed Segment Geometry Inputs:

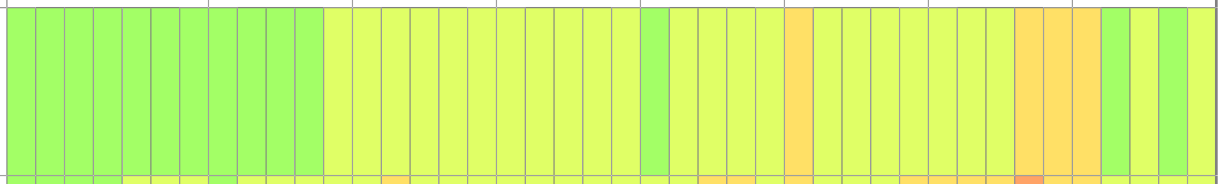
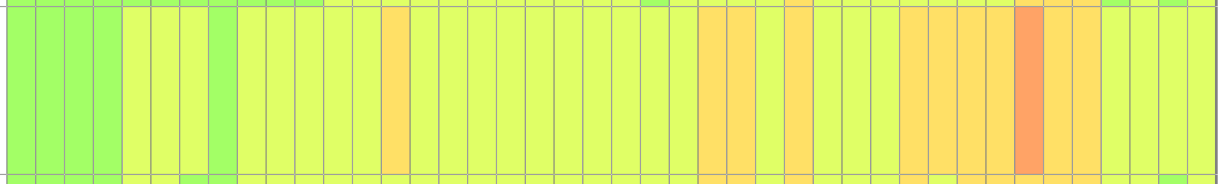
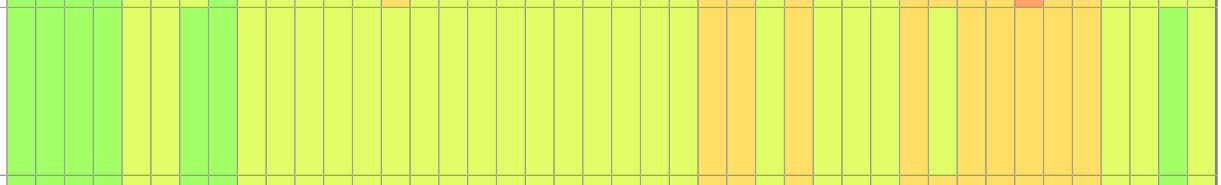
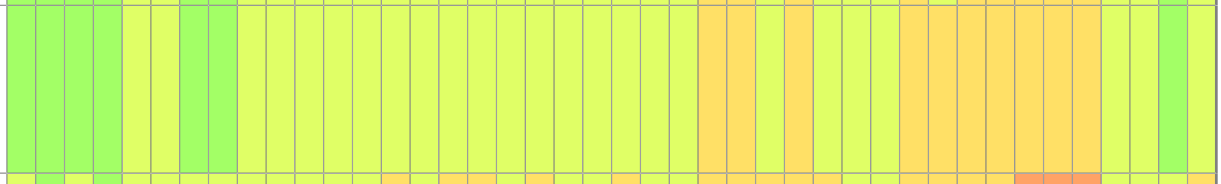
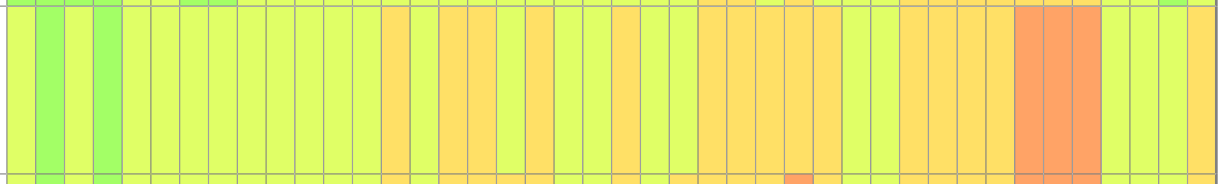
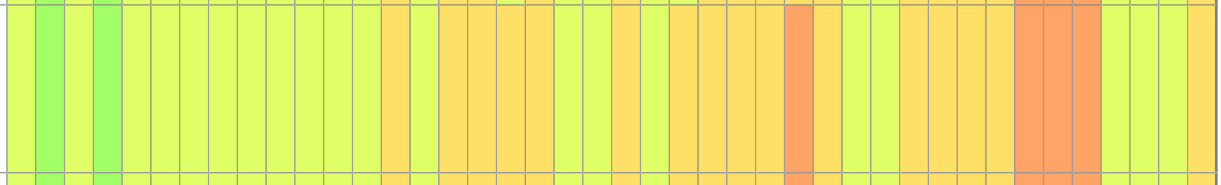
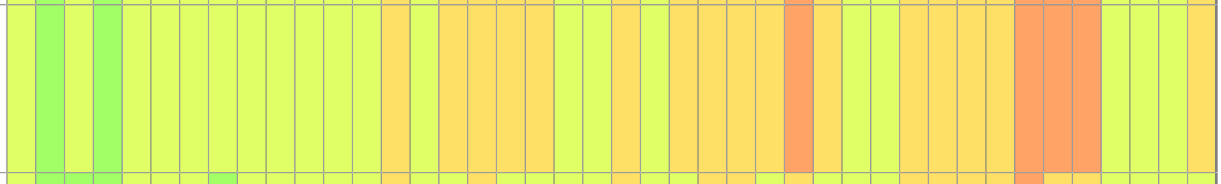
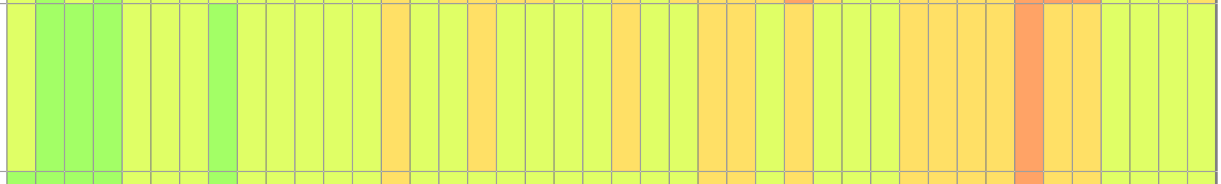
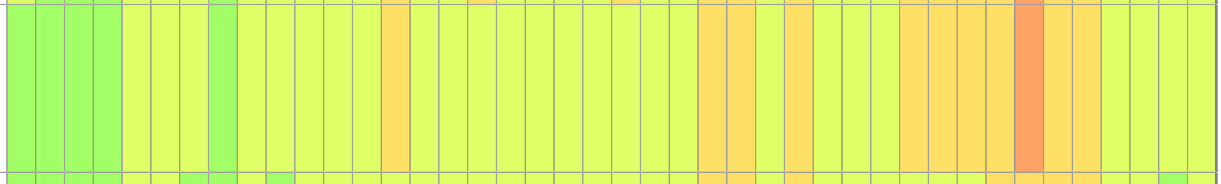
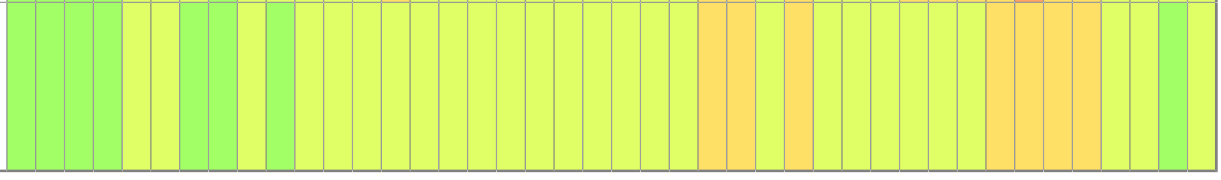
#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,013	70	4	-	
2	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
3	Basic	980	70	4	-	
4	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
5	Basic	2,670	70	4	-	
6	Off-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
7	Basic	2,000	70	4	-	
8	On-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
9	Basic	1,603	70	4	-	
10	Off-Ramp	1,500	65	4	1	17 N CHESTER ST
11	Basic	2,317	65	4	-	
12	On-Ramp	1,500	65	4	1	N CHESTER ST
13	Basic	1,300	65	5	-	
14	Basic	4,529	65	4	-	
15	Off-Ramp	1,500	65	4	1	19 E OZARK AVE
16	Basic	643	65	4	-	
17	Weaving	3,103	65	5	1 ONR / 1 OFR	E OZARK AVE/ 20 N NEW HOPE RD
18	Basic	774	65	4	-	
19	Weaving	3,425	65	5	1 ONR / 1 OFR	N NEW HOPE RD TO 21 COX RD
20	Basic	1,785	65	4	-	
21	On-Ramp	1,500	65	4	1	COX RD
22	Basic	4,735	65	4	-	
23	Off-Ramp	1,500	65	4	1	22 S MAIN ST
24	Basic	1,434	65	4	-	
25	Weaving	2,513	65	5	1 ONR / 1 OFR	S MAIN ST TO 23 MCADENVILLE RD
26	Basic	2,613	65	4	-	
27	On-Ramp	1,500	65	4	1	MCADENVILLE RD
28	Basic	6,723	65	4	-	
29	Off-Ramp	1,500	65	5	1	26 BELMONT MT HOLLY RD
30	Basic	260	65	5	-	
31	Off-Ramp	1,500	65	5	1	26 BELMONT MT HOLLY RD
32	Basic	895	65	4	-	
33	Weaving	3,934	65	5	1 ONR / 1 OFR	BELMONT MT HOLLY RD 27 BEATTY DR
34	Basic	2,498	65	4	-	
35	On-Ramp	1,500	65	4	1	27 BEATTY DR
36	Basic	8,213	65	4	-	
37	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
38	Basic	1,124	65	4	-	
39	Off-Ramp	1,500	65	4	1	30 I-485 OUTER
40	Basic	1,377	65	4	-	
41	On-Ramp	1,500	65	4	1	SAM WILSON RD
42	Basic	5,058	65	4	-	I-485

Detailed Segment Demand Inputs:

#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	11,055	-	Not Specified	-
2	Off-Ramp	4	1	-	555	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	1,525	-	Not Specified	-
5	Basic	4	-	-	-	-	-
6	Off-Ramp	4	1	-	720	-	Not Specified
7	Basic	4	-	-	-	-	-
8	On-Ramp	4	1	830	-	Not Specified	-
9	Basic	4	-	-	-	-	-
10	Off-Ramp	4	1	-	1,025	-	Not Specified
11	Basic	4	-	-	-	-	-
12	On-Ramp	4	1	3,960	-	Not Specified	-
13	Basic	5	-	-	-	-	-
14	Basic	4	-	-	-	-	-
15	Off-Ramp	4	1	-	975	-	Not Specified
16	Basic	4	-	-	-	-	-
17	Weaving	5	1 ONR / 1 OFR	1,405	1,665	Not Specified	Not Specified
18	Basic	4	-	-	-	-	-
19	Weaving	5	1 ONR / 1 OFR	1,315	1,965	Not Specified	Not Specified
20	Basic	4	-	-	-	-	-
21	On-Ramp	4	1	1,490	-	Not Specified	-
22	Basic	4	-	-	-	-	-
23	Off-Ramp	4	1	-	915	-	Not Specified
24	Basic	4	-	-	-	-	-
25	Weaving	5	1 ONR / 1 OFR	2,970	655	Not Specified	Not Specified
26	Basic	4	-	-	-	-	-
27	On-Ramp	4	1	1,165	-	Not Specified	-
28	Basic	4	-	-	-	-	-
29	Off-Ramp	5	1	-	915	-	Not Specified
30	Basic	5	-	-	-	-	-
31	Off-Ramp	5	1	-	550	-	Not Specified
32	Basic	4	-	-	-	-	-
33	Weaving	5	1 ONR / 1 OFR	1,215	1,140	Not Specified	Not Specified
34	Basic	4	-	-	-	-	-
35	On-Ramp	4	1	3,115	-	Not Specified	-
36	Basic	4	-	-	-	-	-
37	Off-Ramp	4	1	-	655	-	Not Specified
38	Basic	4	-	-	-	-	-
39	Off-Ramp	4	1	-	4,840	-	Not Specified
40	Basic	4	-	-	-	-	-
41	On-Ramp	4	1	910	-	Not Specified	-
42	Basic	4	-	-	-	-	-

Total Density (PC/Mi/Ln) Contour:

Density Based LOS Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
6:15-6:30								
6:30-6:45								
6:45-7:00								
7:00-7:15								
7:15-7:30								
7:30-7:45								
7:45-8:00								
8:00-8:15								
8:15-8:30								
8:30-8:45								

Demand Based LOS Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
6:15-6:30								
6:30-6:45								
6:45-7:00								
7:00-7:15								
7:15-7:30								
7:30-7:45								
7:45-8:00								
8:00-8:15								
8:15-8:30								
8:30-8:45								

D/C Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
6:15-6:30								
6:30-6:45								
6:45-7:00								
7:00-7:15								
7:15-7:30								
7:30-7:45								
7:45-8:00								
8:00-8:15								
8:15-8:30								
8:30-8:45								

V/C Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
6:15-6:30								
6:30-6:45								
6:45-7:00								
7:00-7:15								
7:15-7:30								
7:30-7:45								
7:45-8:00								
8:00-8:15								
8:15-8:30								
8:30-8:45								

Queue Percentage Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
6:15-6:30								
6:30-6:45								
6:45-7:00								
7:00-7:15								
7:15-7:30								
7:30-7:45								
7:45-8:00								
8:00-8:15								
8:15-8:30								
8:30-8:45								

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYB: I-85 NB PM Peak
Scenario Name	2045 Build PM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/19/2021

Scope of Analysis:

Facility Name	I85 NB	Analysis Year	2045
Facility Length (mi)	17.9 (42 HCM Segments)	Analysis Period (24 hr Format)	15:00 - 19:00
Start Mile Marker	14.3	# of HCM Analysis Periods	16
End Mile Marker	32.1	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$15,276	Average Travel Time (min)	17.2
Mainline Delay (hr)	281.7	Average Mainline Speed (mph)	62.0
Ramp Entry Delay (hr)	0.0	Max Queue Length (ft)	0.0
System Delay (VHD)	281.7	Max D/C	0.69
TTI Based on Speed Limit	0.95	TTI Based on FFS	0.95

Detailed Segment Geometry Inputs:

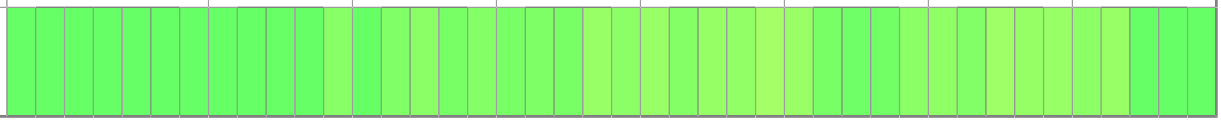
#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,013	70	4	-	
2	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
3	Basic	980	70	4	-	
4	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
5	Basic	2,670	70	4	-	
6	Off-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
7	Basic	2,000	70	4	-	
8	On-Ramp	1,500	70	4	1	DAVIDSON AVE NEW INTERCHANGE
9	Basic	1,603	70	4	-	
10	Off-Ramp	1,500	65	4	1	17 N CHESTER ST
11	Basic	2,317	65	4	-	
12	On-Ramp	1,500	65	4	1	N CHESTER ST
13	Basic	1,300	65	5	-	
14	Basic	4,529	65	4	-	
15	Off-Ramp	1,500	65	4	1	19 E OZARK AVE
16	Basic	643	65	4	-	
17	Weaving	3,103	65	5	1 ONR / 1 OFR	E OZARK AVE/ 20 N NEW HOPE RD
18	Basic	774	65	4	-	
19	Weaving	3,425	65	5	1 ONR / 1 OFR	N NEW HOPE RD TO 21 COX RD
20	Basic	1,785	65	4	-	
21	On-Ramp	1,500	65	4	1	COX RD
22	Basic	4,735	65	4	-	
23	Off-Ramp	1,500	65	4	1	22 S MAIN ST
24	Basic	1,434	65	4	-	
25	Weaving	2,513	65	5	1 ONR / 1 OFR	S MAIN ST TO 23 MCADENVILLE RD
26	Basic	2,613	65	4	-	
27	On-Ramp	1,500	65	4	1	MCADENVILLE RD
28	Basic	6,723	65	4	-	
29	Off-Ramp	1,500	65	5	1	26 BELMONT MT HOLLY RD
30	Basic	260	65	5	-	
31	Off-Ramp	1,500	65	5	1	26 BELMONT MT HOLLY RD
32	Basic	895	65	4	-	
33	Weaving	3,934	65	5	1 ONR / 1 OFR	BELMONT MT HOLLY RD 27 BEATTY DR
34	Basic	2,498	65	4	-	
35	On-Ramp	1,500	65	4	1	27 BEATTY DR
36	Basic	8,213	65	4	-	
37	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
38	Basic	1,124	65	4	-	
39	Off-Ramp	1,500	65	4	1	30 I-485 OUTER
40	Basic	1,377	65	4	-	
41	On-Ramp	1,500	65	4	1	SAM WILSON RD
42	Basic	5,058	65	4	-	I-485

Detailed Segment Demand Inputs:

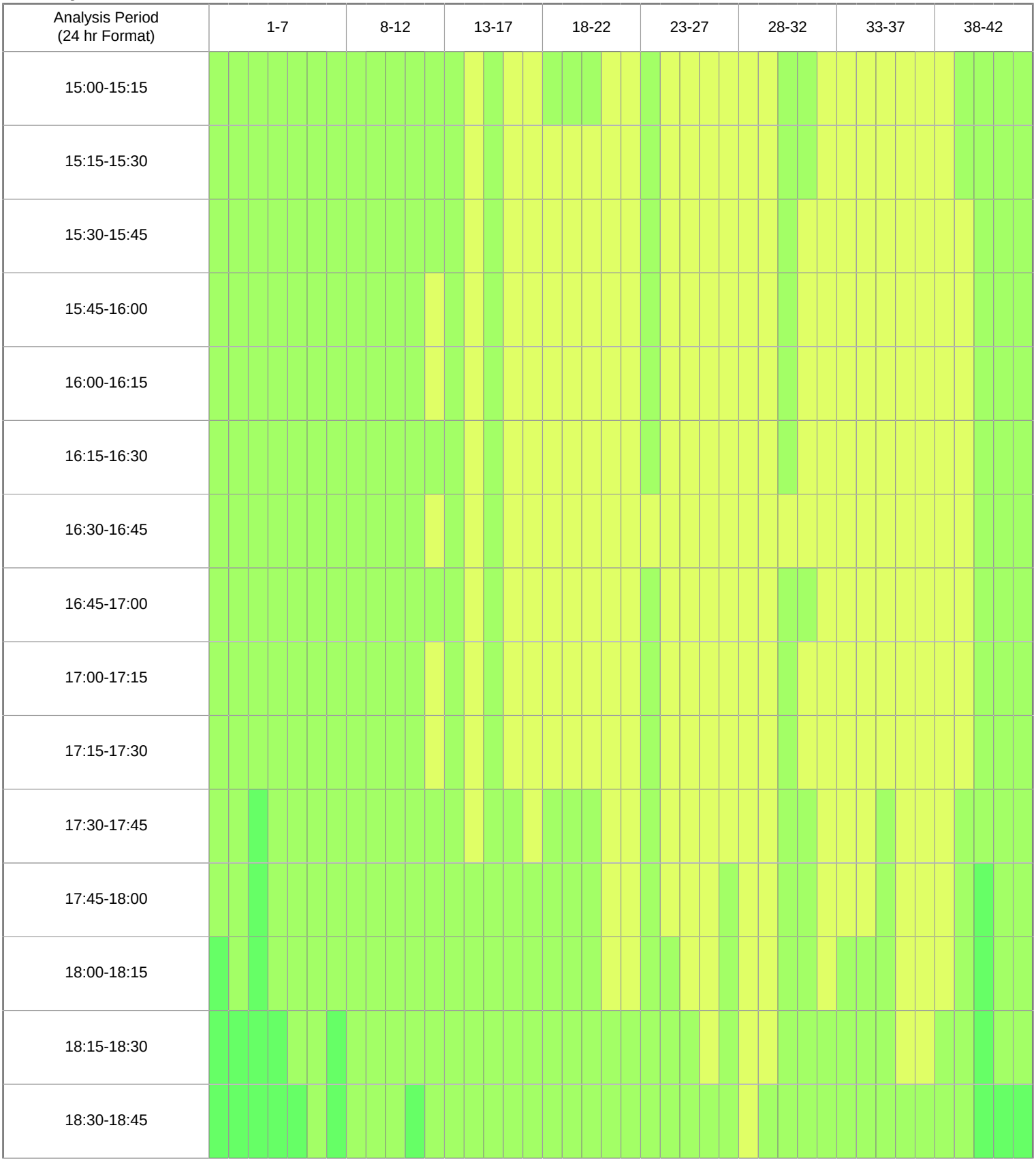
#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	11,575	-	Not Specified	-
2	Off-Ramp	4	1	-	790	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	2,360	-	Not Specified	-
5	Basic	4	-	-	-	-	-
6	Off-Ramp	4	1	-	820	-	Not Specified
7	Basic	4	-	-	-	-	-
8	On-Ramp	4	1	1,580	-	Not Specified	-
9	Basic	4	-	-	-	-	-
10	Off-Ramp	4	1	-	1,770	-	Not Specified
11	Basic	4	-	-	-	-	-
12	On-Ramp	4	1	5,610	-	Not Specified	-
13	Basic	5	-	-	-	-	-
14	Basic	4	-	-	-	-	-
15	Off-Ramp	4	1	-	1,185	-	Not Specified
16	Basic	4	-	-	-	-	-
17	Weaving	5	1 ONR / 1 OFR	2,475	2,525	Not Specified	Not Specified
18	Basic	4	-	-	-	-	-
19	Weaving	5	1 ONR / 1 OFR	2,105	2,195	Not Specified	Not Specified
20	Basic	4	-	-	-	-	-
21	On-Ramp	4	1	3,230	-	Not Specified	-
22	Basic	4	-	-	-	-	-
23	Off-Ramp	4	1	-	1,260	-	Not Specified
24	Basic	4	-	-	-	-	-
25	Weaving	5	1 ONR / 1 OFR	3,560	1,475	Not Specified	Not Specified
26	Basic	4	-	-	-	-	-
27	On-Ramp	4	1	995	-	Not Specified	-
28	Basic	4	-	-	-	-	-
29	Off-Ramp	5	1	-	1,560	-	Not Specified
30	Basic	5	-	-	-	-	-
31	Off-Ramp	5	1	-	780	-	Not Specified
32	Basic	4	-	-	-	-	-
33	Weaving	5	1 ONR / 1 OFR	1,815	3,035	Not Specified	Not Specified
34	Basic	4	-	-	-	-	-
35	On-Ramp	4	1	2,900	-	Not Specified	-
36	Basic	4	-	-	-	-	-
37	Off-Ramp	4	1	-	1,180	-	Not Specified
38	Basic	4	-	-	-	-	-
39	Off-Ramp	4	1	-	8,955	-	Not Specified
40	Basic	4	-	-	-	-	-
41	On-Ramp	4	1	1,755	-	Not Specified	-
42	Basic	4	-	-	-	-	-

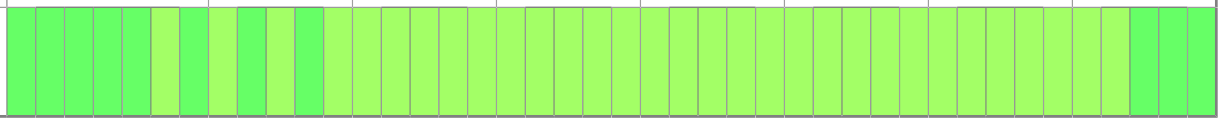
Total Density (PC/Mi/Ln) Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
15:00-15:15								
15:15-15:30								
15:30-15:45								
15:45-16:00								
16:00-16:15								
16:15-16:30								
16:30-16:45								
16:45-17:00								
17:00-17:15								
17:15-17:30								
17:30-17:45								
17:45-18:00								
18:00-18:15								
18:15-18:30								
18:30-18:45								

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
18:45-19:00								

Density Based LOS Contour:



Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
18:45-19:00								

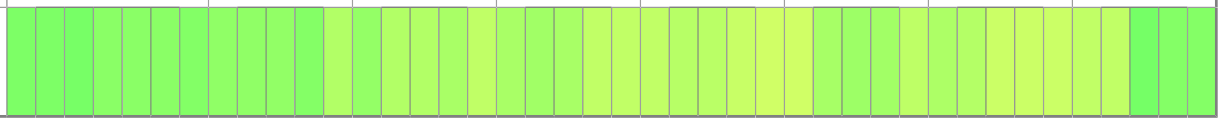
Demand Based LOS Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
15:00-15:15								
15:15-15:30								
15:30-15:45								
15:45-16:00								
16:00-16:15								
16:15-16:30								
16:30-16:45								
16:45-17:00								
17:00-17:15								
17:15-17:30								
17:30-17:45								
17:45-18:00								
18:00-18:15								
18:15-18:30								
18:30-18:45								

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
18:45-19:00								

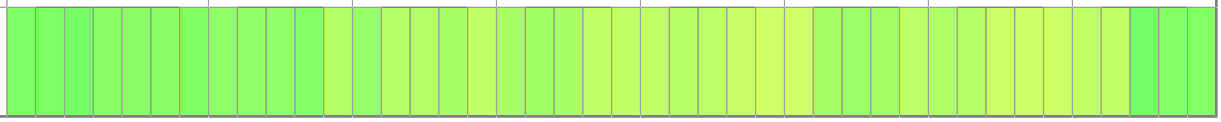
D/C Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
15:00-15:15								
15:15-15:30								
15:30-15:45								
15:45-16:00								
16:00-16:15								
16:15-16:30								
16:30-16:45								
16:45-17:00								
17:00-17:15								
17:15-17:30								
17:30-17:45								
17:45-18:00								
18:00-18:15								
18:15-18:30								
18:30-18:45								

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
18:45-19:00								

V/C Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
15:00-15:15								
15:15-15:30								
15:30-15:45								
15:45-16:00								
16:00-16:15								
16:15-16:30								
16:30-16:45								
16:45-17:00								
17:00-17:15								
17:15-17:30								
17:30-17:45								
17:45-18:00								
18:00-18:15								
18:15-18:30								
18:30-18:45								

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
18:45-19:00								

Queue Percentage Contour:

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
15:00-15:15								
15:15-15:30								
15:30-15:45								
15:45-16:00								
16:00-16:15								
16:15-16:30								
16:30-16:45								
16:45-17:00								
17:00-17:15								
17:15-17:30								
17:30-17:45								
17:45-18:00								
18:00-18:15								
18:15-18:30								
18:30-18:45								

Analysis Period (24 hr Format)	1-7	8-12	13-17	18-22	23-27	28-32	33-37	38-42
18:45-19:00								

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYB: I-85 SB AM Peak
Scenario Name	2045 Build AM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/19/2021

Scope of Analysis:

Facility Name		Analysis Year	2045
Facility Length (mi)	17.8 (39 HCM Segments)	Analysis Period (24 hr Format)	6:15 - 8:45
Start Mile Marker	--	# of HCM Analysis Periods	10
End Mile Marker	--	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$10,238	Average Travel Time (min)	17.1
Mainline Delay (hr)	189.2	Average Mainline Speed (mph)	61.9
Ramp Entry Delay (hr)	0.0	Max Queue Length (ft)	0.0
System Delay (VHD)	189.2	Max D/C	0.70
TTI Based on Speed Limit	0.95	TTI Based on FFS	0.95

Detailed Segment Geometry Inputs:

#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,816	65	4	-	
2	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
3	Basic	4,253	65	4	-	
4	On-Ramp	1,500	65	4	1	SAM WILSON RD
5	Basic	2,126	65	5	-	
6	Basic	5,850	65	5	-	
7	Off-Ramp	1,500	65	5	1	27 BEATTY DR
8	Basic	2,775	65	4	-	
9	Weaving	3,716	65	5	1 ONR / 1 OFR	BEATTY DR TO 26 BELMONT MT HOLLY RD
10	Basic	3,250	65	4	-	
11	On-Ramp	1,500	65	4	1	BELMONT MT HOLLY RD
12	Basic	6,366	65	4	-	
13	Off-Ramp	1,500	65	4	1	23 MCADENVILLE RD
14	Basic	2,278	65	4	-	
15	Weaving	2,580	65	5	1 ONR / 1 OFR	MCADENVILLE RD TO 22 S MAIN ST
16	Basic	1,419	65	4	-	
17	On-Ramp	1,500	65	4	1	S MAIN ST
18	Basic	4,985	65	4	-	
19	Off-Ramp	1,500	65	4	1	21 COX RD
20	Basic	2,210	65	4	-	
21	Weaving	2,673	65	5	1 ONR / 1 OFR	Cox Rd TO 20 N NEW HOPE RD
22	Basic	1,073	65	4	-	
23	Weaving	3,746	65	5	1 ONR / 1 OFR	N NEW HOPE RD/ 19 E OZARK AVE
24	Basic	398	65	4	-	
25	On-Ramp	1,500	65	4	1	E OZARK AVE
26	Basic	5,719	65	4	-	
27	Off-Ramp	1,500	65	4	1	17 N CHESTER ST
28	Off-Ramp	1,080	65	4	1	
29	Basic	1,273	65	4	-	
30	On-Ramp	1,500	65	4	1	N CHESTER ST
31	Basic	1,171	70	4	-	
32	Off-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
33	Basic	2,000	70	4	-	
34	On-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
35	Basic	2,848	70	4	-	
36	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
37	Basic	990	70	4	-	
38	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
39	Basic	3,537	70	4	-	

Detailed Segment Demand Inputs:

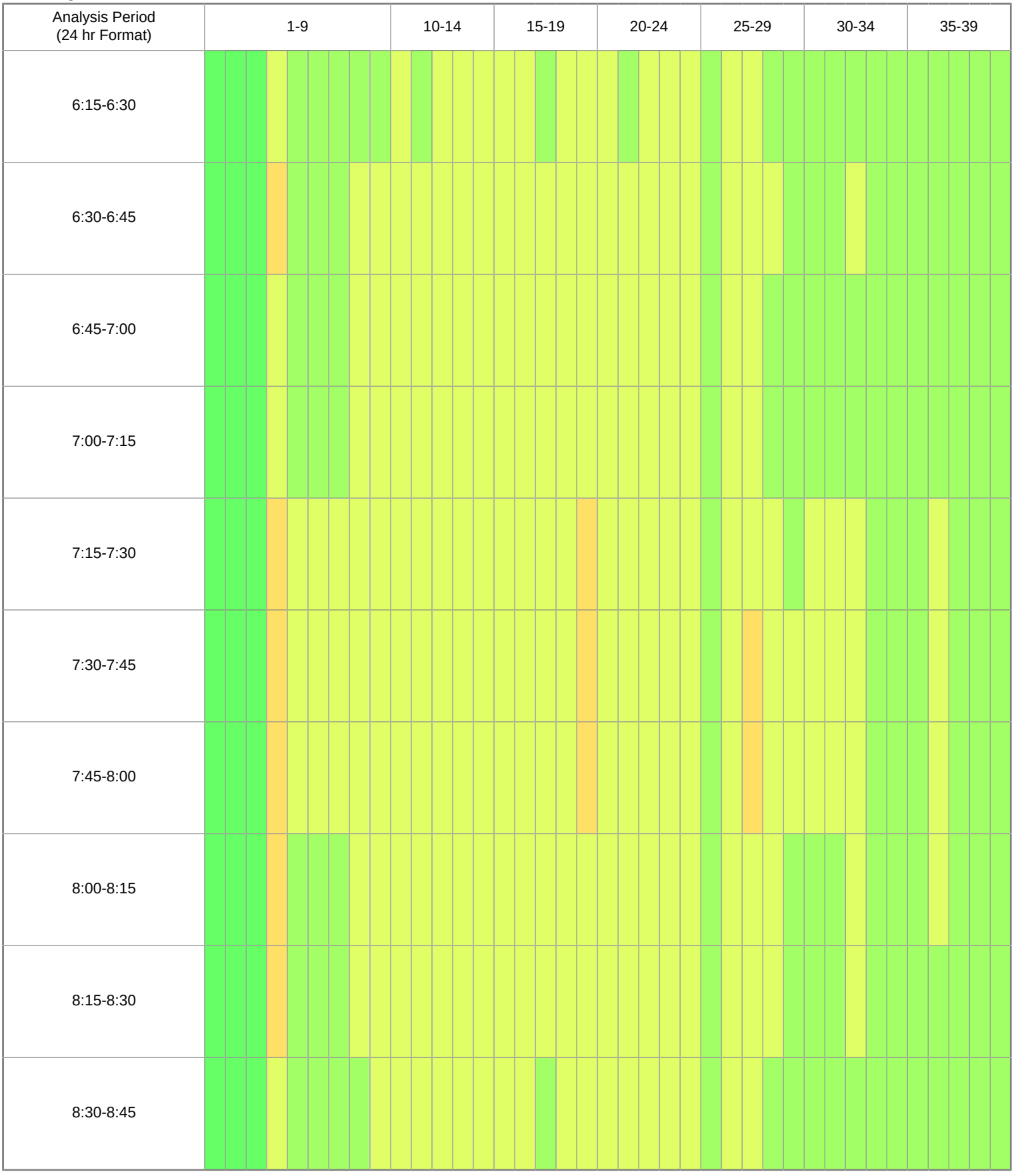
#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	5,255	-	Not Specified	-

#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
2	Off-Ramp	4	1	-	850	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	8,125	-	Not Specified	-
5	Basic	5	-	-	-	-	-
6	Basic	5	-	-	-	-	-
7	Off-Ramp	5	1	-	1,465	-	Not Specified
8	Basic	4	-	-	-	-	-
9	Weaving	5	1 ONR / 1 OFR	2,050	1,000	Not Specified	Not Specified
10	Basic	4	-	-	-	-	-
11	On-Ramp	4	1	1,525	-	Not Specified	-
12	Basic	4	-	-	-	-	-
13	Off-Ramp	4	1	-	480	-	Not Specified
14	Basic	4	-	-	-	-	-
15	Weaving	5	1 ONR / 1 OFR	975	1,815	Not Specified	Not Specified
16	Basic	4	-	-	-	-	-
17	On-Ramp	4	1	1,235	-	Not Specified	-
18	Basic	4	-	-	-	-	-
19	Off-Ramp	4	1	-	1,825	-	Not Specified
20	Basic	4	-	-	-	-	-
21	Weaving	5	1 ONR / 1 OFR	1,365	1,180	Not Specified	Not Specified
22	Basic	4	-	-	-	-	-
23	Weaving	5	1 ONR / 1 OFR	1,545	1,125	Not Specified	Not Specified
24	Basic	4	-	-	-	-	-
25	On-Ramp	4	1	890	-	Not Specified	-
26	Basic	4	-	-	-	-	-
27	Off-Ramp	4	1	-	2,740	-	Not Specified
28	Off-Ramp	4	1	-	560	-	Not Specified
29	Basic	4	-	-	-	-	-
30	On-Ramp	4	1	970	-	Not Specified	-
31	Basic	4	-	-	-	-	-
32	Off-Ramp	4	1	-	1,070	-	Not Specified
33	Basic	4	-	-	-	-	-
34	On-Ramp	4	1	455	-	Not Specified	-
35	Basic	4	-	-	-	-	-
36	Off-Ramp	4	1	-	1,400	-	Not Specified
37	Basic	4	-	-	-	-	-
38	On-Ramp	4	1	475	-	Not Specified	-
39	Basic	4	-	-	-	-	-

Total Density (PC/Mi/Ln) Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
6:15-6:30							
6:30-6:45							
6:45-7:00							
7:00-7:15							
7:15-7:30							
7:30-7:45							
7:45-8:00							
8:00-8:15							
8:15-8:30							
8:30-8:45							

Density Based LOS Contour:



Demand Based LOS Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
6:15-6:30							
6:30-6:45							
6:45-7:00							
7:00-7:15							
7:15-7:30							
7:30-7:45							
7:45-8:00							
8:00-8:15							
8:15-8:30							
8:30-8:45							

D/C Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
6:15-6:30							
6:30-6:45							
6:45-7:00							
7:00-7:15							
7:15-7:30							
7:30-7:45							
7:45-8:00							
8:00-8:15							
8:15-8:30							
8:30-8:45							

V/C Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
6:15-6:30							
6:30-6:45							
6:45-7:00							
7:00-7:15							
7:15-7:30							
7:30-7:45							
7:45-8:00							
8:00-8:15							
8:15-8:30							
8:30-8:45							

Queue Percentage Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
6:15-6:30							
6:30-6:45							
6:45-7:00							
7:00-7:15							
7:15-7:30							
7:30-7:45							
7:45-8:00							
8:00-8:15							
8:15-8:30							
8:30-8:45							

Facility Analysis Summary

Analysis Information:

Project Name	I-5719 FYB: I-85 SB PM Peak
Scenario Name	2045 Build PM Peak
Analyst	Elizabeth Harris
Organization	HNTB
Analysis Date (MM/DD/YYYY)	08/19/2021

Scope of Analysis:

Facility Name		Analysis Year	2045
Facility Length (mi)	17.8 (39 HCM Segments)	Analysis Period (24 hr Format)	15:00 - 19:00
Start Mile Marker	--	# of HCM Analysis Periods	16
End Mile Marker	--	Reference Demand Date	11/03/2020

Performance Measures Summary:

User Delay Cost ($)	$32,115	Average Travel Time (min)	17.6
Mainline Delay (hr)	572.0	Average Mainline Speed (mph)	60.3
Ramp Entry Delay (hr)	0.0	Max Queue Length (ft)	0.0
System Delay (VHD)	572.0	Max D/C	0.95
TTI Based on Speed Limit	0.93	TTI Based on FFS	0.93

Detailed Segment Geometry Inputs:

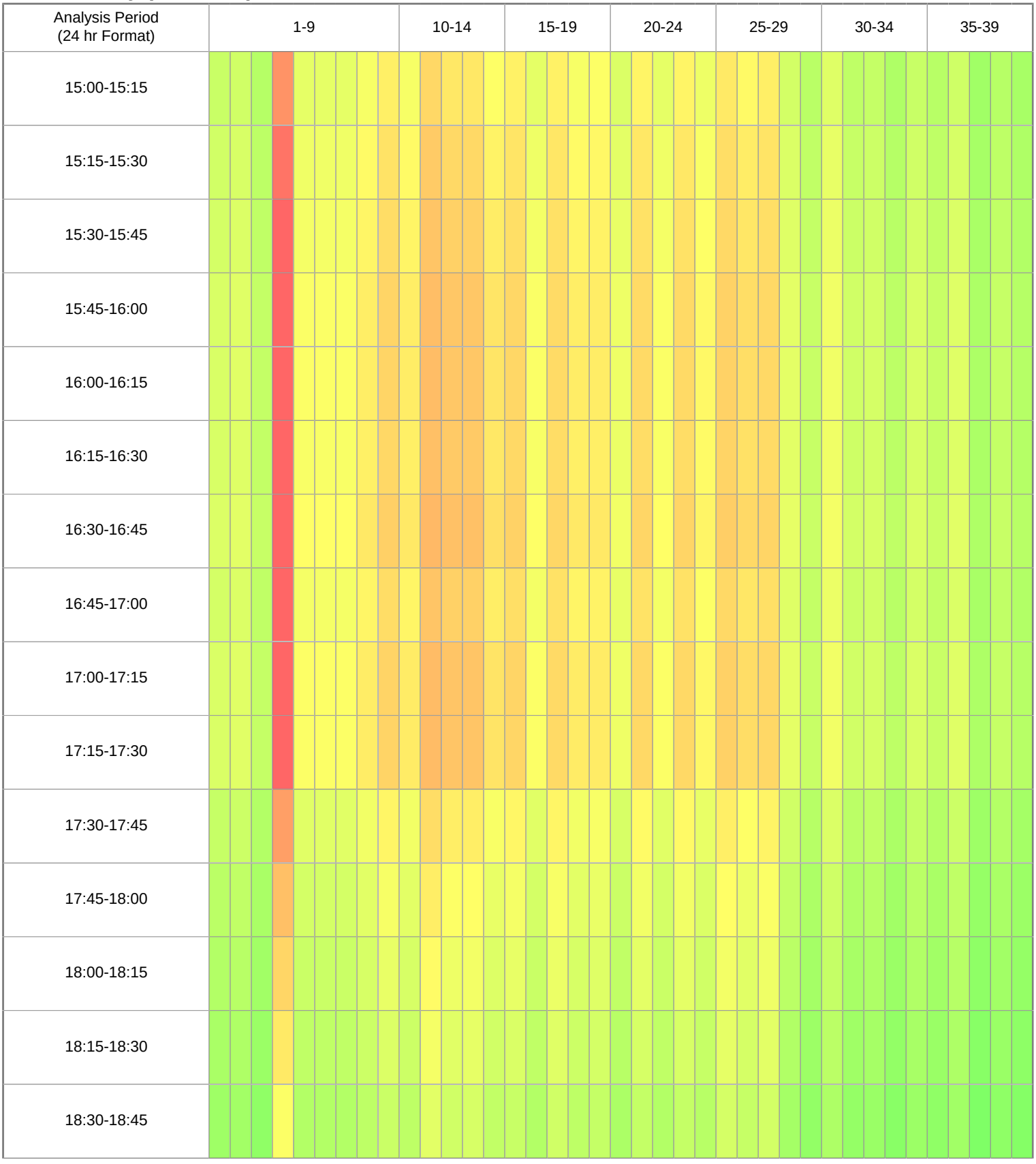
#	Type	Length (ft)	FFS (mph)	Mainline # Lanes	Ramp # Lanes	Segment Name
1	Basic	4,816	65	4	-	
2	Off-Ramp	1,500	65	4	1	29 SAM WILSON RD
3	Basic	4,253	65	4	-	
4	On-Ramp	1,500	65	4	1	SAM WILSON RD
5	Basic	2,126	65	5	-	
6	Basic	5,850	65	5	-	
7	Off-Ramp	1,500	65	5	1	27 BEATTY DR
8	Basic	2,775	65	4	-	
9	Weaving	3,716	65	5	1 ONR / 1 OFR	BEATTY DR TO 26 BELMONT MT HOLLY RD
10	Basic	3,250	65	4	-	
11	On-Ramp	1,500	65	4	1	BELMONT MT HOLLY RD
12	Basic	6,366	65	4	-	
13	Off-Ramp	1,500	65	4	1	23 MCADENVILLE RD
14	Basic	2,278	65	4	-	
15	Weaving	2,580	65	5	1 ONR / 1 OFR	MCADENVILLE RD TO 22 S MAIN ST
16	Basic	1,419	65	4	-	
17	On-Ramp	1,500	65	4	1	S MAIN ST
18	Basic	4,985	65	4	-	
19	Off-Ramp	1,500	65	4	1	21 COX RD
20	Basic	2,210	65	4	-	
21	Weaving	2,673	65	5	1 ONR / 1 OFR	Cox Rd TO 20 N NEW HOPE RD
22	Basic	1,073	65	4	-	
23	Weaving	3,746	65	5	1 ONR / 1 OFR	N NEW HOPE RD/ 19 E OZARK AVE
24	Basic	398	65	4	-	
25	On-Ramp	1,500	65	4	1	E OZARK AVE
26	Basic	5,719	65	4	-	
27	Off-Ramp	1,500	65	4	1	17 N CHESTER ST
28	Off-Ramp	1,080	65	4	1	
29	Basic	1,273	65	4	-	
30	On-Ramp	1,500	65	4	1	N CHESTER ST
31	Basic	1,171	70	4	-	
32	Off-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
33	Basic	2,000	70	4	-	
34	On-Ramp	1,500	70	4	1	DAVISON AVE NEW INTERCHANGE
35	Basic	2,848	70	4	-	
36	Off-Ramp	1,500	70	4	1	14 BESSEMER CITY RD
37	Basic	990	70	4	-	
38	On-Ramp	1,500	70	4	1	BESSEMER CITY RD
39	Basic	3,537	70	4	-	

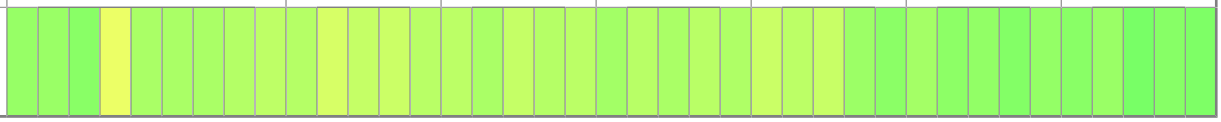
Detailed Segment Demand Inputs:

#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
1	Basic	4	-	20,610	-	Not Specified	-

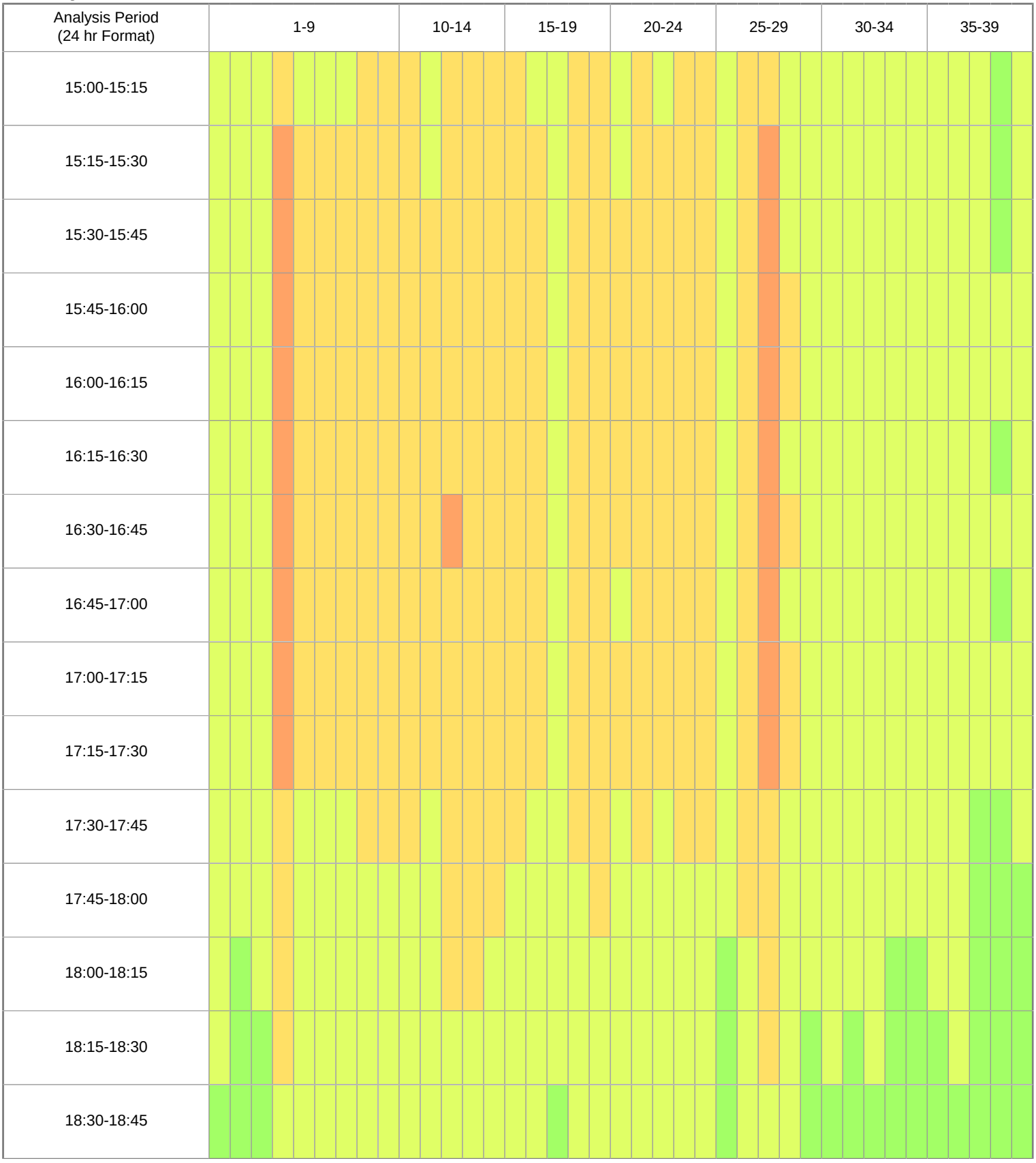
#	Type	Mainline # Lanes	Ramp # Lanes	Study Period Entering Demand	Study Period Exiting Demand	Directional Entering AADT	Directional Exiting AADT
2	Off-Ramp	4	1	-	1,925	-	Not Specified
3	Basic	4	-	-	-	-	-
4	On-Ramp	4	1	10,540	-	Not Specified	-
5	Basic	5	-	-	-	-	-
6	Basic	5	-	-	-	-	-
7	Off-Ramp	5	1	-	4,820	-	Not Specified
8	Basic	4	-	-	-	-	-
9	Weaving	5	1 ONR / 1 OFR	2,220	2,205	Not Specified	Not Specified
10	Basic	4	-	-	-	-	-
11	On-Ramp	4	1	2,455	-	Not Specified	-
12	Basic	4	-	-	-	-	-
13	Off-Ramp	4	1	-	1,860	-	Not Specified
14	Basic	4	-	-	-	-	-
15	Weaving	5	1 ONR / 1 OFR	1,215	3,385	Not Specified	Not Specified
16	Basic	4	-	-	-	-	-
17	On-Ramp	4	1	1,610	-	Not Specified	-
18	Basic	4	-	-	-	-	-
19	Off-Ramp	4	1	-	2,610	-	Not Specified
20	Basic	4	-	-	-	-	-
21	Weaving	5	1 ONR / 1 OFR	3,375	2,350	Not Specified	Not Specified
22	Basic	4	-	-	-	-	-
23	Weaving	5	1 ONR / 1 OFR	2,735	1,980	Not Specified	Not Specified
24	Basic	4	-	-	-	-	-
25	On-Ramp	4	1	1,860	-	Not Specified	-
26	Basic	4	-	-	-	-	-
27	Off-Ramp	4	1	-	6,090	-	Not Specified
28	Off-Ramp	4	1	-	720	-	Not Specified
29	Basic	4	-	-	-	-	-
30	On-Ramp	4	1	1,845	-	Not Specified	-
31	Basic	4	-	-	-	-	-
32	Off-Ramp	4	1	-	1,690	-	Not Specified
33	Basic	4	-	-	-	-	-
34	On-Ramp	4	1	960	-	Not Specified	-
35	Basic	4	-	-	-	-	-
36	Off-Ramp	4	1	-	2,555	-	Not Specified
37	Basic	4	-	-	-	-	-
38	On-Ramp	4	1	870	-	Not Specified	-
39	Basic	4	-	-	-	-	-

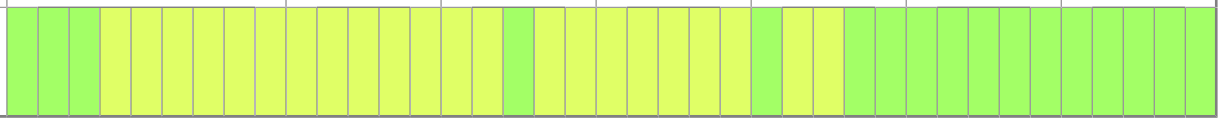
Total Density (PC/Mi/Ln) Contour:



Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
18:45-19:00							

Density Based LOS Contour:



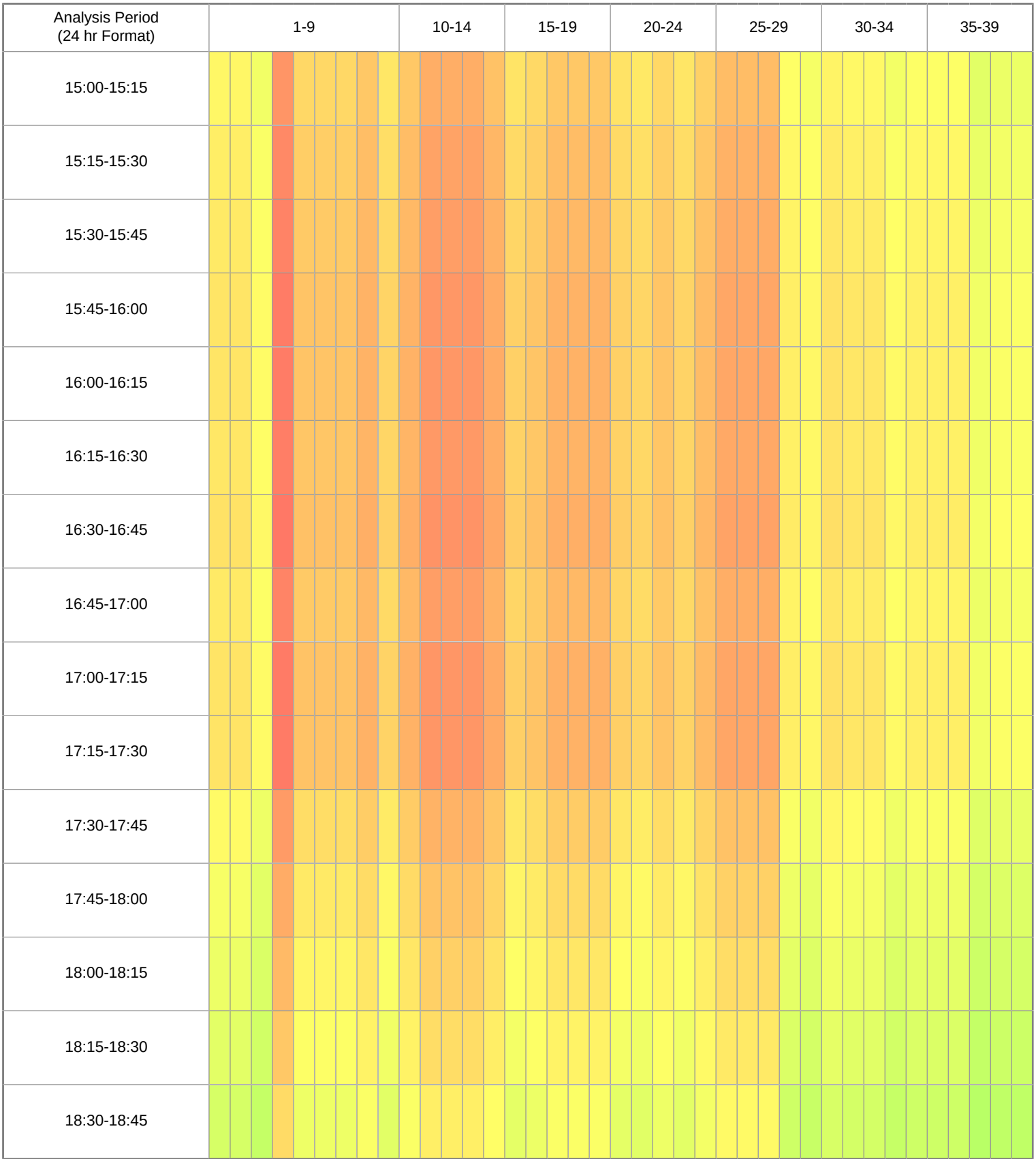
Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
18:45-19:00							

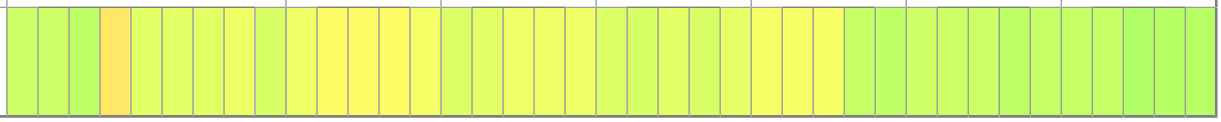
Demand Based LOS Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
15:00-15:15							
15:15-15:30							
15:30-15:45							
15:45-16:00							
16:00-16:15							
16:15-16:30							
16:30-16:45							
16:45-17:00							
17:00-17:15							
17:15-17:30							
17:30-17:45							
17:45-18:00							
18:00-18:15							
18:15-18:30							
18:30-18:45							

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
18:45-19:00							

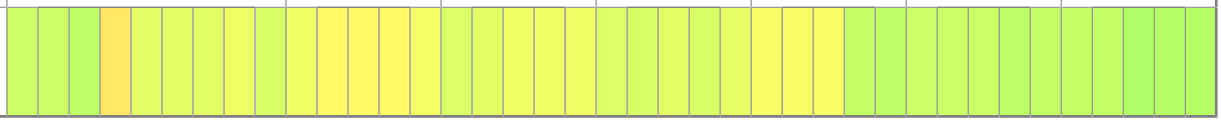
D/C Contour:


Analysis Period (24 hr Format)
1-9
10-14
15-19
20-24
25-29
30-34
35-39
15:00-15:15
15:15-15:30
15:30-15:45
15:45-16:00
16:00-16:15
16:15-16:30
16:30-16:45
16:45-17:00
17:00-17:15
17:15-17:30
17:30-17:45
17:45-18:00
18:00-18:15
18:15-18:30
18:30-18:45

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
18:45-19:00							

V/C Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
15:00-15:15							
15:15-15:30							
15:30-15:45							
15:45-16:00							
16:00-16:15							
16:15-16:30							
16:30-16:45							
16:45-17:00							
17:00-17:15							
17:15-17:30							
17:30-17:45							
17:45-18:00							
18:00-18:15							
18:15-18:30							
18:30-18:45							

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
18:45-19:00							

Queue Percentage Contour:

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
15:00-15:15							
15:15-15:30							
15:30-15:45							
15:45-16:00							
16:00-16:15							
16:15-16:30							
16:30-16:45							
16:45-17:00							
17:00-17:15							
17:15-17:30							
17:30-17:45							
17:45-18:00							
18:00-18:15							
18:15-18:30							
18:30-18:45							

Analysis Period (24 hr Format)	1-9	10-14	15-19	20-24	25-29	30-34	35-39
18:45-19:00							

Appendix I – I-5719 I-85 Crash Analysis (DIGITAL)
FINAL