

20 SOUTH BEAR CREEK TRAFFIC IMPACT ANALYSIS



Submitted to:

CATALYST CAPITAL PARTNERS

1600 Camden Road, Suite 200
Charlotte, NC 28203

Submitted by:



Gannett Fleming

*Excellence Delivered **As Promised***

28 Schenck Parkway
Suite 200
Asheville NC 28803
(828) 771-0871

NC Lic. No. F-0270

July 16, 2020

TRAFFIC IMPACT ANALYSIS

For
20 South Bear Creek
Buncombe County, North Carolina

Prepared For:
Catalyst Capital Properties
1600 Camden Road, Suite 200
Charlotte, NC 28203

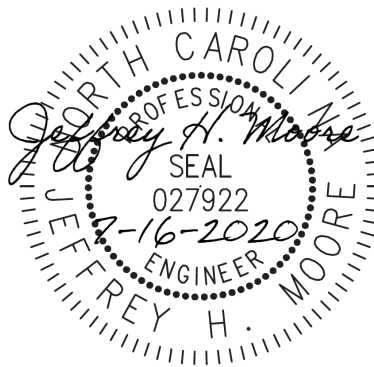
Prepared By:



Gannett Fleming

*Excellence Delivered **As Promised***

28 Schenck Parkway
Suite 200
Asheville, NC 28803
NC Licensure No. F-0270



16 July 2020
(Gannett Fleming Project No. 067445)

CONFIDENTIALITY STATEMENT: The information contained in the document is confidential in nature and not intended for public release prior to approval by the North Carolina Department of Transportation and Buncombe County, NC. This document contains trade secrets and proprietary methods and techniques.

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY	1
II. INTRODUCTION.....	4
III. INVENTORY OF TRAFFIC CONDITIONS.....	7
A. Study Area.....	7
B. Existing Conditions	7
C. Projected Transportation Improvements.....	10
IV. TRAFFIC GENERATION.....	12
V. TRAFFIC DISTRIBUTION	12
VI. PROJECTED TRAFFIC VOLUMES.....	13
A. Existing Traffic	13
B. Historical Traffic Growth.....	13
C. Approved Development Traffic.....	14
D. Total Traffic.....	14
VII. TRAFFIC ANALYSIS.....	21
1. NC 191 (Brevard Road)/I-240 WB Ramps.....	23
2. NC 191 (Brevard Road) / I-240 Eastbound Ramps.....	25
3. NC 191 (Brevard Road)/I-40 Westbound Ramp – SR 3413 (South Bear Creek Road).....	27
4. NC 191 (Brevard Road)/I-40 Eastbound Ramp	29
5. SR 3413 (South Bear Creek Road)/Proposed Site Access.....	31
6. NC 191 (Brevard Road)/SR 3412 (Sand Hill Road)	33
7. SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road.....	35
VIII. RECOMMENDATIONS	37

IX. SIGNAL WARRANT ANALYSIS	39
X. CONCLUSIONS	39
X. REFERENCES	40

APPENDICES

Appendix A – Traffic Data
Appendix B – Capacity Software Output
Appendix C – Signal Warrant Analysis
Appendix D – Figures and Tables
Appendix E – I-2513 Pubic Hearing Maps
Appendix F – Site Plans
Appendix G – NCDOT Checklist and MOA

LIST OF TABLES

Table 1 – Trip Generation Estimate	12
Table 2- Traffic Distribution.....	13
Table 3 - Level of Service Criteria Signalized Intersections	22
Table 3A – Level of Service Criteria Unsignalized Intersections	22
Table 4– NC 191 (Brevard Road)/East Lee Street Extension Traffic Analysis.....	24
Table 5– NC 191 (Brevard Road)/Clovelly Drive Traffic Analysis	26
Table 6– NC 191 (Brevard Road)/I-85 Southbound Ramp Traffic Analysis	28
Table 7– NC 191 (Brevard Road)/I-85 Northbound Ramp Traffic Analysis.....	30
Table 8– East Lee Street Extension/Glen Laurel Drive Traffic Analysis	31
Table 9– NC 191 (Brevard Road)/Site Access #1 Traffic Analysis.....	34
Table 10– East Lee Street Extension/Site Access #2 Traffic Analysis	36

LIST OF FIGURES

Figure 1 – Project Location	5
Figure 1A – Sketch Plan.....	6
Figure 2 – Existing Lane Configurations and Traffic Control.....	11
Figure 3A – 2019 Traffic Volumes	15
Figure 3B – 2020 Existing Peak Hour Traffic.....	16
Figure 4 – 2028 Background AM and PM Peak Hour Traffic Volume	17
Figure 5 – Land Use Traffic Distribution.....	18
Figure 6 – Land Use Traffic Distribution.....	19
Figure 7 – 2028 Future Buildout Volumes.....	20
Figure 8 – Recommended Lane Configuration and Traffic Control.....	38

I. Executive Summary

INTRODUCTION

A project known as *20 South Bear Creek* is proposed in approximately 55 acres of undeveloped land off of South Bear Creek Road in Buncombe County, NC. The project will consist of 520 multifamily units and 140 units of Senior Adult Housing – Attached.

According to the proposed Sketch Plan developed by Civil Design Concepts, LLC, PA, direct access to the development is planned on SR 3413 (South Bear Creek Road) with one driveway. The intersection is planned to be unsignalized and stop controlled.

TRIP GENERATION

The amount of traffic generated by a new development is a function of the size and type of development. Once the proposed land use data for the site are known, the number of trips generated by the development can be estimated. Trip generation data for this report was determined in accordance with the procedures outlined in the Institute of Transportation Engineers (ITE) report entitled *Trip Generation*³. Table 1 below illustrates the number of daily, AM peak hour, and PM peak hour trips expected to be generated by the proposed development.

Table 1 – Trip Generation Estimate

Table 1 - ITE Trip Generation Summary										
LU Code	Description	Density	Units	Daily	AM			PM		
					In	Out	Total	In	Out	Total
221	Multifamily Mid Rise	520	Units	2832	45	127	172	132	84	216
252	Sr Adult Housing - Attached	140	Beds	537	10	18	28	20	16	36
Multifamily Residential/Assisted Living New Trips				3369	55	145	200	152	100	252

Traffic impact is determined by estimating the total number of daily vehicle trips, as well as the number of peak hour vehicle trips. Table 1 indicates the proposed residential development will generate approximately 3,369 total trips per day if it is fully built out. There are projected to be approximately 200 trips entering and exiting the site during the AM peak hour and 252 trips entering and exiting the site during the PM peak hour.

CAPACITY ANALYSIS

Capacity analyses were performed for 2020 existing conditions, 2028 Background, and 2028 Future conditions for the following intersections:

- NC 191 (Brevard Road)/I-240 WB Ramps (signalized)
- NC 191 (Brevard Road)/I-240 EB Ramps (signalized)
- NC 191 (Brevard Road)/I-40 WB Ramps – South Bear Creek Road (signalized)
- NC 191 (Brevard Road)/I-40 EB Ramps (signalized)
- South Bear Creek Road/Sand Hill Road (unsignalized)
- Sand Hill Road/Wendover Street-Bear Creek Road (unsignalized)
- South Creek Road/Proposed Site Access (unsignalized)

The Background and Future conditions were further analyzed to account for the construction or delay of STIP Project I-2513 the Asheville I-26 Connector. A summary of the Highway Capacity Software Analysis analyzed using Synchro version 10/HCM 6 is shown in the following table:

Intersection	2020 Existing		2028 Background No STIP		2028 Background With STIP		2018 Future No STIP With Improvements		2018 Future With STIP	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
NC 191 / I-240 WB Ramps	D (37.9)	D (36.3)	E (61.1)	D (46.0)	C (25.2)	C (29.2)	E (71.4)	D (46.5)	C (23.3)	C (24.0)
NC 191 / I-240 EB Ramps	C (29.8)	B (7.0)	D (53.2)	D (39.1)	B (13.6)	C (20.0)	D (49.9)	D (43.4)	B (13.9)	D (38.5)
NC 191 / I-40 WB-S. Bear Creek	F (152.6)	F (148.6)	F (211.2)	F (185.6)	D (53.2)	E (56.2)	F (149.9)	F (154.8)	D (47.6)	D (51.9)
NC 191 / I-40 EB Ramps	C (20.9)	B (16.6)	C (29.0)	C (21.7)	C (21.8)	C (20.8)	C (23.8)	C (26.7)	C (22.3)	B (18.8)
South Bear Creek Rd / Primary Access	N/A	N/A	N/A	N/A	N/A	N/A	N/A (6.8)	N/A (2.7)	N/A (3.0)	N/A (2.3)
South Bear Creek Rd / Sand Hill Road	N/A (7.2)	N/A (88.5)	N/A (16.9)	N/A (181.0)	N/A (16.9)	N/A (181.0)	C (30.2)	E (74.7)	C (30.2)	E (76.5)
Sand Hill Road / Wendover Road	N/A (13.0)	N/A (16.7)	N/A (16.2)	N/A (25.4)	N/A (16.2)	N/A (25.4)	C (25.2)	D (49.3)	C (25.2)	D (45.9)

Level of Service (Total Intersection Delay in seconds/vehicle/Approach Delay seconds/vehicle)



RECOMMENDED IMPROVEMENTS

To mitigate the traffic-related impacts caused by the 20 South Bear Creek Residential Development and to provide for safe, efficient, and reliable traffic flow, Gannett Fleming recommends the following:

SR 3413 (South Bear Creek Road)/ Proposed Site Access

Improve SR 3413 (South Bear Creek Road) at this intersection to include left and right turn lanes with 100 feet of full storage and appropriate tapers.

SR 3413 (South Bear Creek Road)/SR 3412 (Sand Hill Road)

Install a traffic signal at this intersection with pedestrian phases as appropriate. Coordinate this signal with the proposed signal at SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road. The results of a signal warrant analysis indicate that this intersection meets signal warrants under current conditions.

SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road

Install a traffic signal at this intersection with pedestrian phases as appropriate. Coordinate this signal with the proposed signal at SR 3413 (South Bear Creek Road)/SR 3412 Sand Hill Road. The results of a signal warrant analysis indicate that this intersection meets signal warrants under current conditions.

NC 191 (Brevard Road)/I-240 Eastbound Offramp

If NCDOT STIP Project I-2513 is under construction prior to full buildout of 20 South Bear Creek, no changes are recommended at this intersection. If I-2513 construction does not begin prior to 2028, install a right turn lane with 50 feet of full storage on the offramp.

NC 191 (Brevard Road)/I-40 Eastbound Ramps – SR 3413 South Bear Creek Road

If NCDOT STIP Project I-2513 is under construction prior to full buildout of 20 South Bear Creek, no changes are recommended at this intersection. If I-2513 construction does not begin prior to 2028, install a right turn lane with 100 feet of full storage on SR 3413 (South Bear Creek Road).

CONCLUSIONS

This Traffic Impact Analysis shows that although the proposed 20 South Bear Creek will have an impact on the traffic operations at the study area intersections, the impact will be mitigated by the recommended improvements. With the recommended improvements in place, the proposed development will not negatively impact the health, safety, and welfare of the travelling public.

Note: The traffic signals at the intersections in this analysis should be optimized traffic conditions as they change as part of an ongoing process. Because NCDOT has sole jurisdiction for the operation and maintenance of the signals, this should not be a responsibility of the development.

II. Introduction

A project known as *20 South Bear Creek* is proposed in approximately 55 acres of undeveloped land off of South Bear Creek Road in Buncombe County, NC. The project will consist of 520 multifamily units and a 140-bed Senior Adult facility.

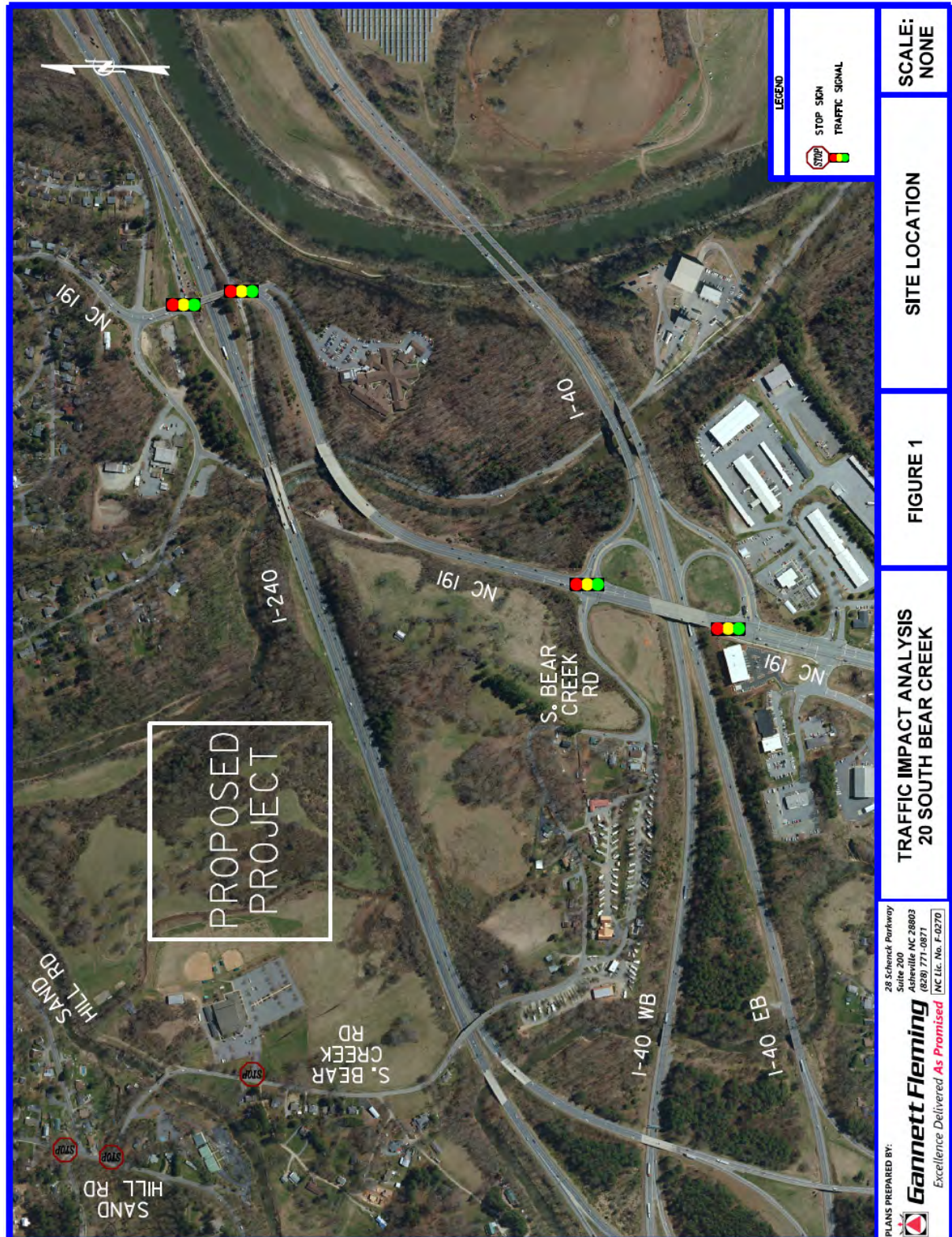
According to the proposed Sketch Plan developed by Civil Design Concepts, LLC, PA and included on page 6 of this report, direct access to the development is planned on SR 3413 (South Bear Creek Road) with one driveway. The intersection is planned to be unsignalized and stop controlled.



Looking eastbound at the proposed site from SR 3413 (South Bear Creek Road)

The purpose of this report is to evaluate the traffic impacts from the proposed 20 South Bear Creek Multi-family and Senior Adult residential development and to recommend transportation improvements needed to mitigate congestion that may result from the additional site traffic. This report presents trip generation, trip distribution, traffic analyses, and recommendations for transportation improvements needed to meet anticipated traffic demands. This report examines existing 2020 existing conditions, 2028 Background conditions, and 2028 Future conditions.

Figure 1 – Project Location



III. Inventory of Traffic Conditions

A. Study Area

The North Carolina Department of Transportation (NCDOT) requested the following intersections be analyzed to determine the associated impacts from the proposed convenience store:

- NC 191 (Brevard Road)/I-240 WB Ramps (signalized)
- NC 191 (Brevard Road)/I-240 EB Ramps (signalized)
- NC 191 (Brevard Road)/I-40 WB Ramps – South Bear Creek Road (signalized)
- NC 191 (Brevard Road)/I-40 EB Ramps (signalized)
- South Bear Creek Road/Sand Hill Road (unsignalized)
- Sand Hill Road/Wendover Street-Bear Creek Road (unsignalized)
- South Creek Road/Proposed Site Access (unsignalized)

B. Existing Conditions

A multifamily residential development is proposed to be located along SR 3413 (South Bear Creek Road) in Buncombe County, NC. A description of transportation facilities in the general vicinity of this proposed development is as follows:



SR 3413 (South Bear Creek Road)
looking northbound toward the bridge
over I-240

SR 3413 (South Bear Creek Road) is a two-lane 18-20' wide roadway which is maintained by NCDOT as a secondary road. It connects NC 191 (Brevard Road) with SR 3412 (Sand Hill Road) and serves as an access to the Malvern Hills Community.



NC 191 (Brevard Road) looking southbound toward SR 3413 (South Bear Creek Road)/I-40 WB

NC 191 (Brevard Road) has a cross section of two to five lanes and varies in width from 24 to 60 feet. It connects Henderson County with US 19-23 Bus (Haywood Road) in West Asheville. It is one of the major north/south routes in Buncombe County. There is currently an NCDOT STIP bridge replacement and interchange upgrade project to the south of the study area. There is also a planned NCDOT STIP interstate upgrade project in the study area that will improve three of the four interstate interchanges that were studied as part of this analysis. NC 191 (Brevard Road) is classified by NCDOT as a minor arterial in the study area. According to the NCDOT AADT maps, NC 191 (Brevard Road) has an ADT of 17,000 north of I-40 and 18,000 south of I-40 in the study area.



Bear Creek Road looking southbound towards SR 3412 (Sand Hill Road)

SR 3412 (Sand Hill Road) is a two-lane facility that is maintained by NCDOT as a secondary roadway. It is generally 20 feet in width. It connects NC 112 (Sardis Road) with US 19-23 Bus (Haywood Road) in West Asheville. The pavement width varies between 20-24 feet. The land uses along SR 3412 (Sand Hill Road) are primarily residential. SR 3412 (Sand Hill Road) is classified by NCDOT as a Major Collector in the study area. In 2016, NCDOT reported an AADT of 2,700 vpd on SR 3412 (Sand Hill Road).



Bear Creek Road looking southbound
towards SR 3412 (Sand Hill Road)

Bear Creek Road is a two-lane residential street which connects SR 3412 (Sand Hill Road) with US 19-23 (Patton Avenue) and serves as an access the Malvern Hills Community. Bear Creek Road is maintained by the City of Asheville. There are sidewalks on at least one side of Bear Creek Road in the study area. A portion of Bear Creek Road has been treated with traffic calming measures. There were no reported AADT on Bear Creek Road.



Wendover Road westbound at SR
3412 (Sand Hill Road)

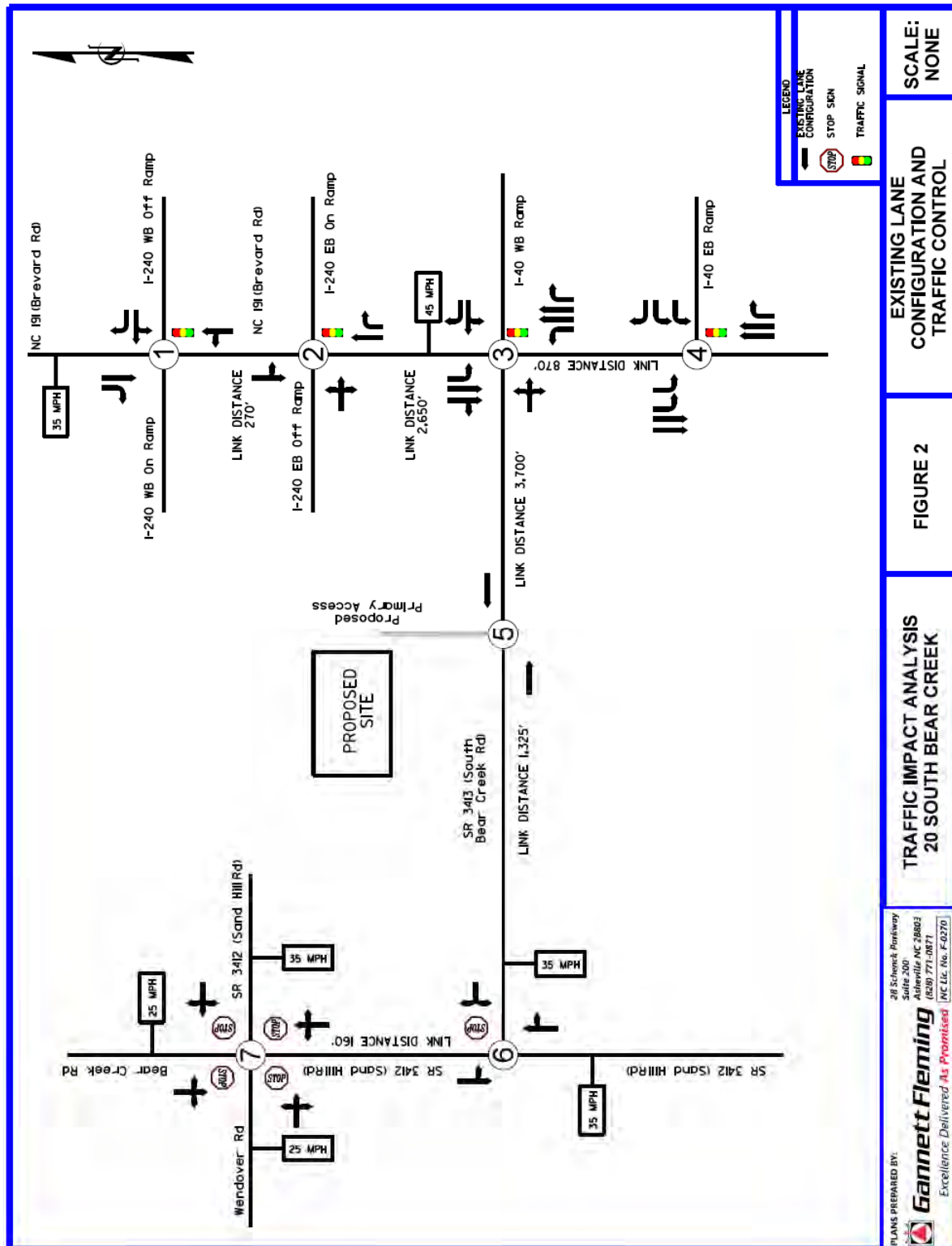
Wendover Road is a two-lane residential street which serves as an access to the Malvern Hills Community. It is maintained by the City of Asheville. There are sidewalks on at least one side of Wendover Road in the study area. There was no reported AADT on Wendover Road.

The existing lane configurations and traffic control for the study area intersections are shown in Figure 2.

C. Projected Transportation Improvements

The North Carolina Department of Transportation's STIP Project I-2513, the Asheville I-26 Connector project is planned for construction prior to the completion of the 20 South Bear Creek project. This project will greatly improve the traffic conditions on the surrounding roadways. The effects of this project are shown in the analyses. The analyses were conducted with scenarios reflecting both the completion and delay of the STIP project. The project is a "Design-Build" project, so the best available current maps showing the proposed lane configurations are the "Public Hearing Maps" posted to the NCDOT project website.

Figure 2 – Existing Lane Configurations and Traffic Control



IV. Traffic Generation

The amount of traffic generated by a new development is a function of the size and type of development. Once the proposed land use data for the site are known, the number of trips generated by the development can be estimated. Trip generation data for this report was determined in accordance with the procedures outlined in the Institute of Transportation Engineers (ITE) report entitled *Trip Generation*³. Table 1 below illustrates the number of daily, AM peak hour, and PM peak hour trips expected to be generated by the proposed development.

Table 1 – Trip Generation Estimate

Table 1 - ITE Trip Generation Summary										
LU Code	Description	Density	Units	AM				PM		
				Daily	In	Out	Total	In	Out	Total
221	Multifamily Mid Rise	520	Units	2832	45	127	172	132	84	216
252	Sr Adult Housing - Attached	140	Beds	537	10	18	28	20	16	36
Multifamily Residential/Assisted Living New Trips				3369	55	145	200	152	100	252

Traffic impact is determined by estimating the total number of daily vehicle trips, as well as the number of peak hour vehicle trips. Table 1 indicates the proposed residential development will generate approximately 3,369 total trips per day if it is fully built out. There are projected to be approximately 200 trips entering and exiting the site during the AM peak hour and 252 trips entering and exiting the site during the PM peak hour.

Pass-by trips are not applicable for multifamily residential and Senior Adult land uses. Therefore, no pass-by trips were considered.

Internal capture is not applicable for multifamily residential and Senior Adult land uses. Therefore, no internal capture was considered.

V. Traffic Distribution

In order to properly determine the impact of the traffic generated by the proposed development, it is necessary to determine the distribution of traffic to and from the development. These percentages are based on the projected traffic patterns and population / employment centers in the area. They are also based on existing ADTs and data obtained from traffic counts.

Table 2- Traffic Distribution

Facility	Directions of Approach and Departure
SR 3413 S. Bear Creek Road (East)	75%
SR 3413 S. Bear Creek Road (West)	25%
SR 3412 Sand Hill Road (North)	20%
SR 3412 Sand Hill Road (South)	5%
NC 191 (North)	45%
NC 191 (South)	20%
I-40 WB Ramp (East)	10%
I-40 EB Ramp (East)	10%
I-240 EB Ramp (East)	20%
NC 191 (North of I-240)	35%

The project traffic distribution is shown in Figure 4.

VI. Projected Traffic Volumes

A. Existing Traffic

The morning and afternoon peak hour turning movement traffic counts at the study area intersections [with the exception of NC 191 (Brevard Road) and I-240 WB Ramps] were provided by the Client and were performed by Mattern & Craig Engineers – Surveyors in May 2019. A growth factor of 1.5% was applied to these counts to derive the 2020 Existing traffic volumes. The 2019 traffic counts are shown in Figure 3A.

Gannett Fleming performed the additional traffic count at the intersection of NC 191 (Brevard Road) and I-240 WB Ramps. Due to the Coronavirus pandemic that existed at the time of the traffic count, the volumes did not accurately reflect the conditions normally observed. Because the closest adjacent intersection, NC 191 (Brevard Road) and I-240 EB Ramps, shared an approach, Gannett Fleming derived factors to modify the observed data and balance the volumes between the intersections on the shared approach. This process was used to obtain 2020 Existing AM and PM Peak Hour traffic volumes at this intersection. The factors used differed for the two intersections. The worksheets used to derive the factors are included in Appendix B. AM Peak Hour traffic was multiplied by a factor of 2.15 and PM Peak Hour traffic was multiplied by a factor of 1.5.

The 2020 existing AM (7-9am) and PM (4-6pm) peak hour traffic volumes are shown in Figure 3B. The turning movement traffic counts are included in Appendix A.

B. Historical Traffic Growth

Historical traffic growth is the increase in traffic volumes due to usage increases and non-specific growth throughout the area. To account for normal increases in traffic as well as smaller, undetermined development, the existing 2020 traffic volumes were grown by 1.5% per

year compounded annually to 2028 to develop Background traffic volumes. The 2028 Background AM and PM peak hour traffic volumes is illustrated in Figure 4.

C. Approved Development Traffic

Approved development traffic is traffic generated by specific approved but not yet constructed, developments within the vicinity of the subject project. Although a hotel project is currently under construction at the intersection of NC 191 (Brevard Road) and I-40 WB/SR 3413 (South Bear Creek Road), it did not trigger a traffic impact study it was assumed that the traffic it will generate is included in the growth rate. No other major developments are approved for construction by 2028 in the immediate vicinity; therefore, no approved developments were included in this analysis.

D. Total Traffic

To obtain total 2028 Future traffic volumes, the development traffic was added to the 2028 Background traffic volumes. The AM and PM peak-hour turning movements for the studied intersections were then calculated and analyzed for the build-out years. The 2028 Future traffic volumes for the AM and PM peak hours are illustrated in Figure 7.

Figure 3B - 2020 Existing Peak Hour Traffic

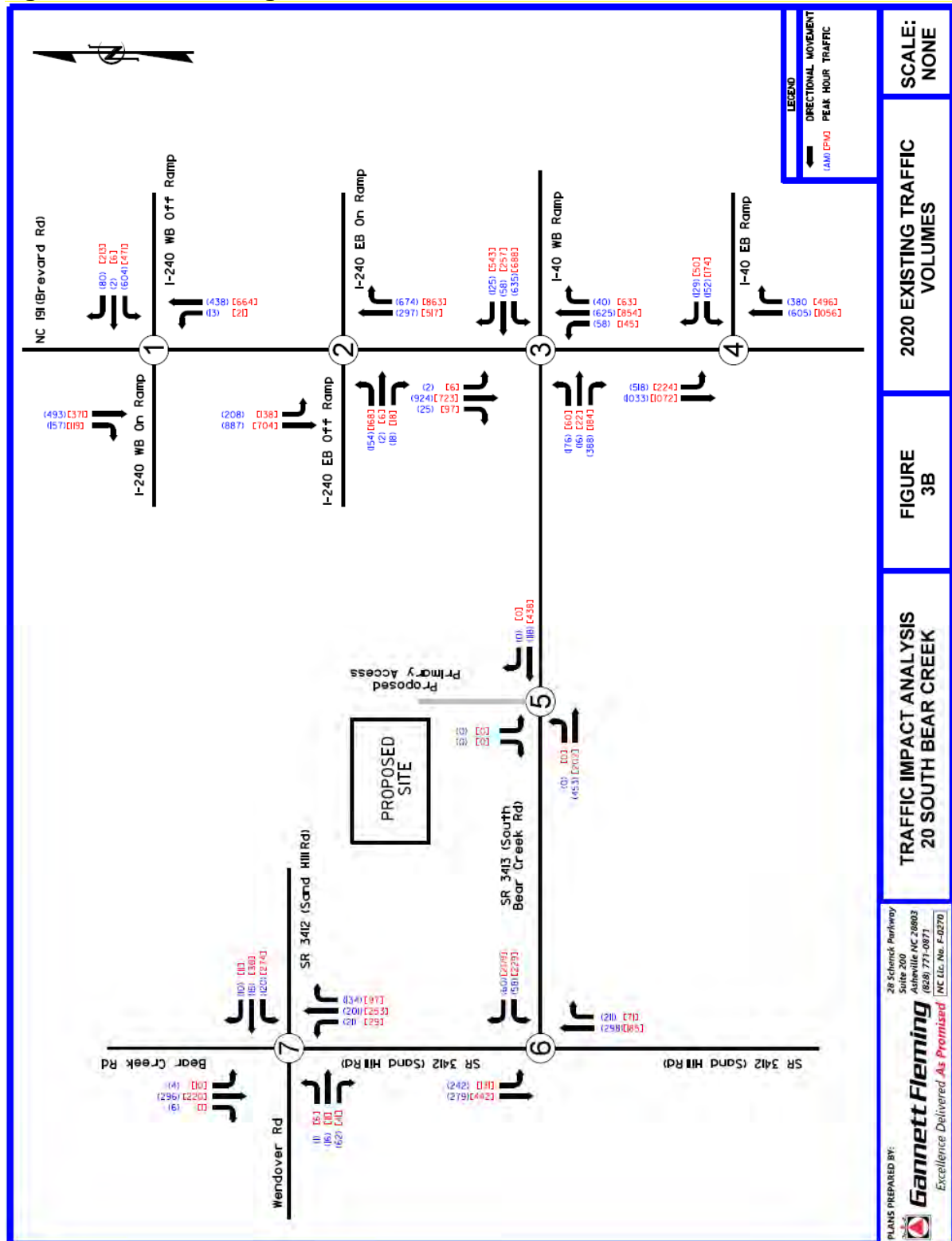


Figure 4 - 2028 Background AM and PM Peak Hour Traffic Volumes

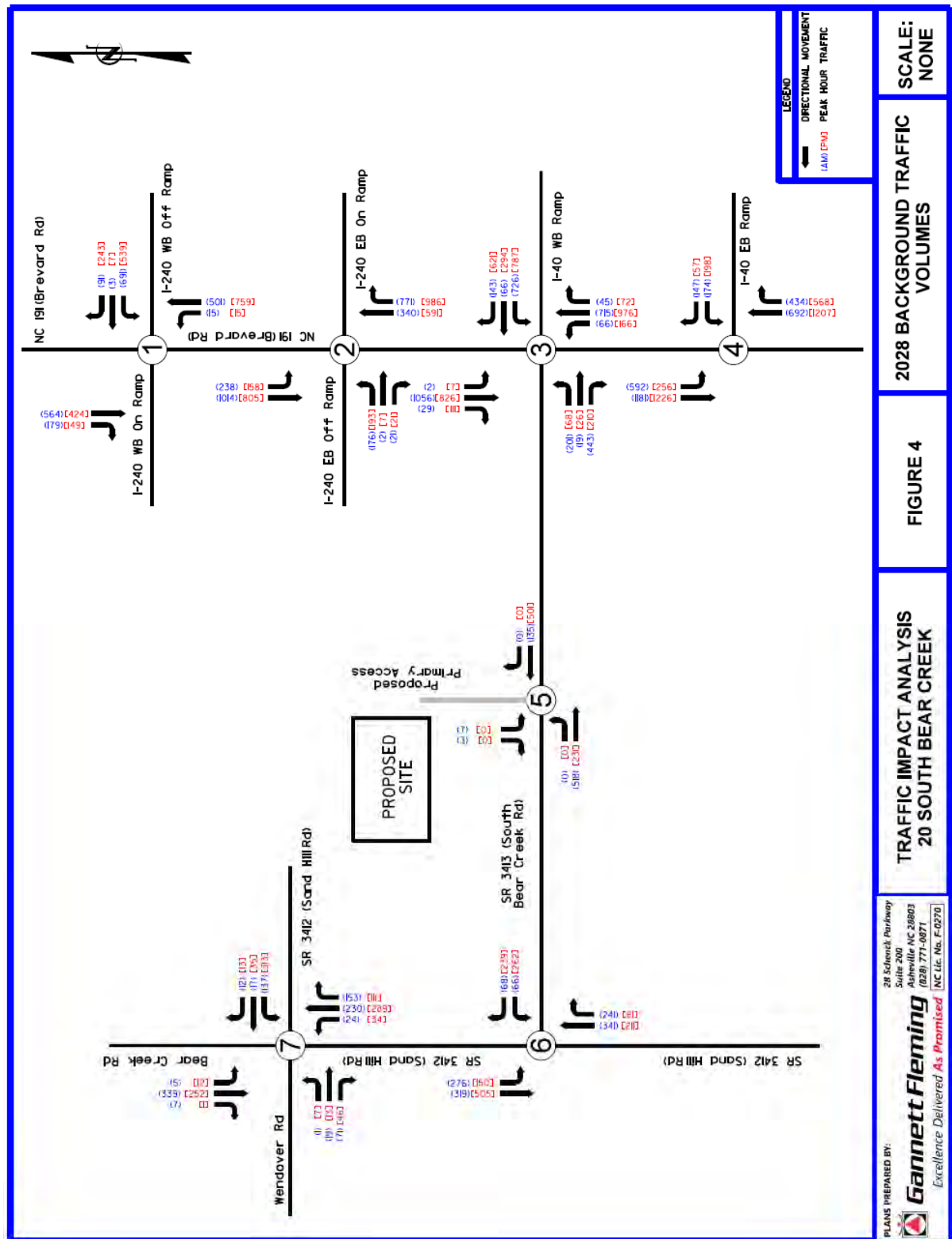


Figure 5 – Land Use Traffic Distribution

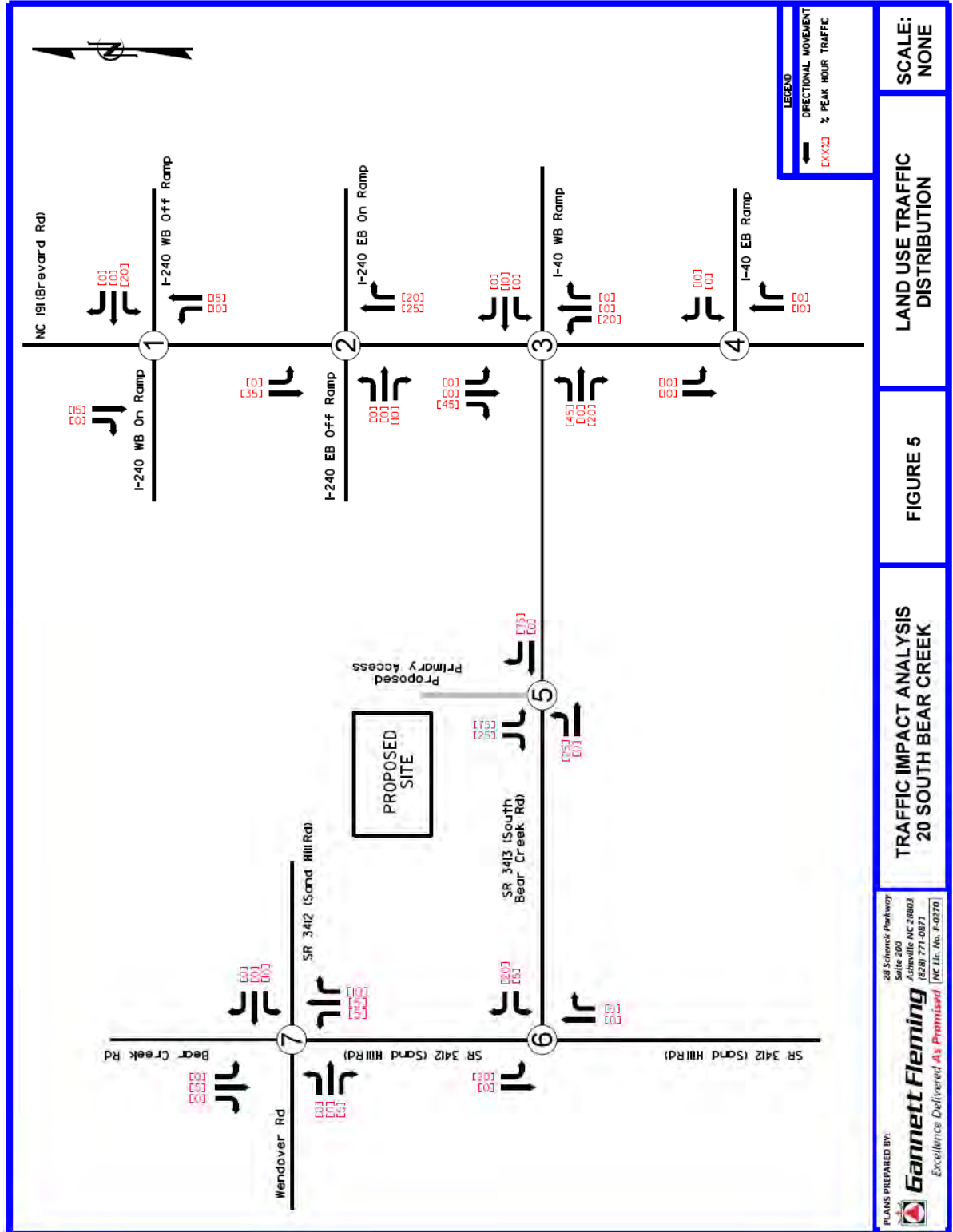


Figure 6 - Land Use Traffic Distribution

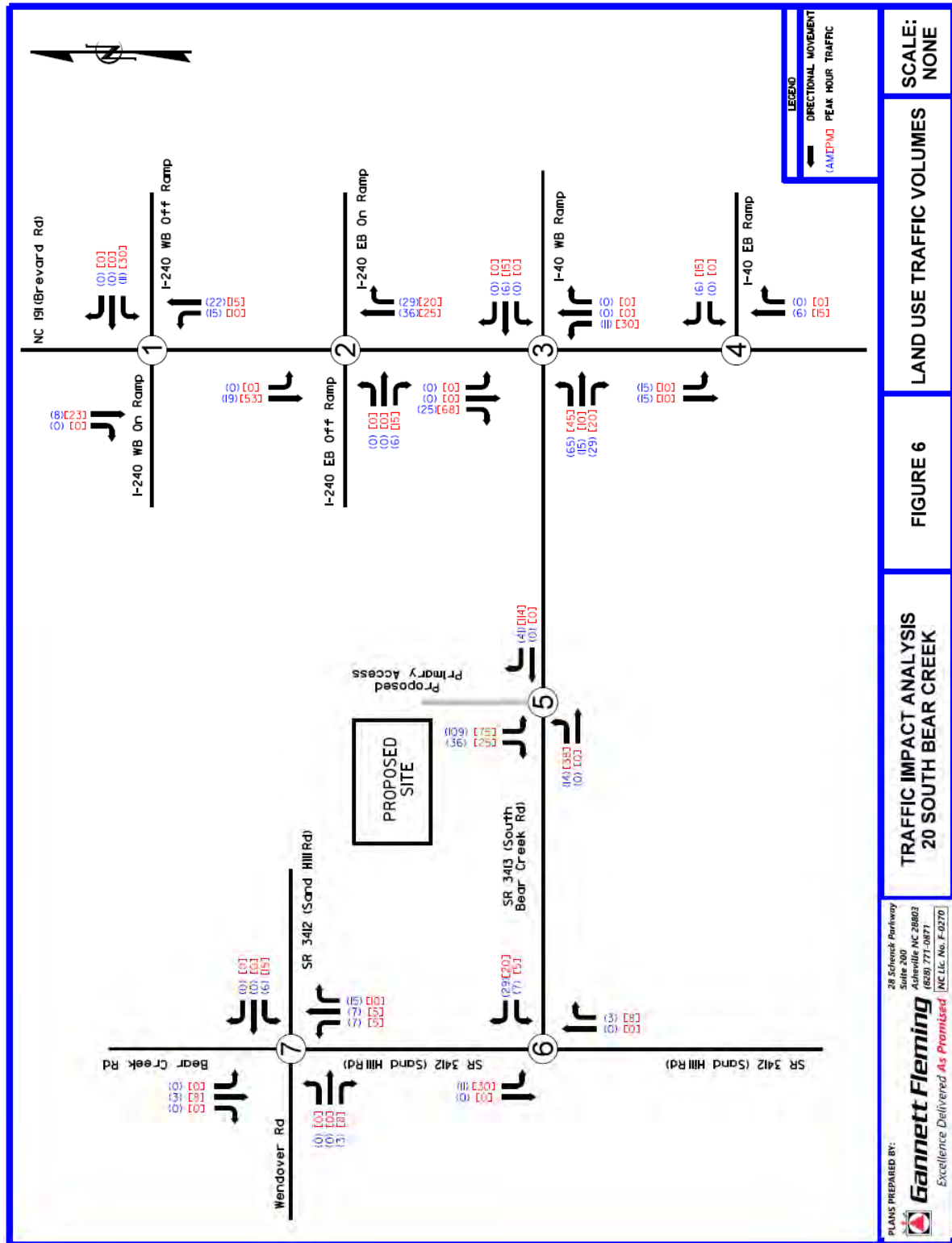
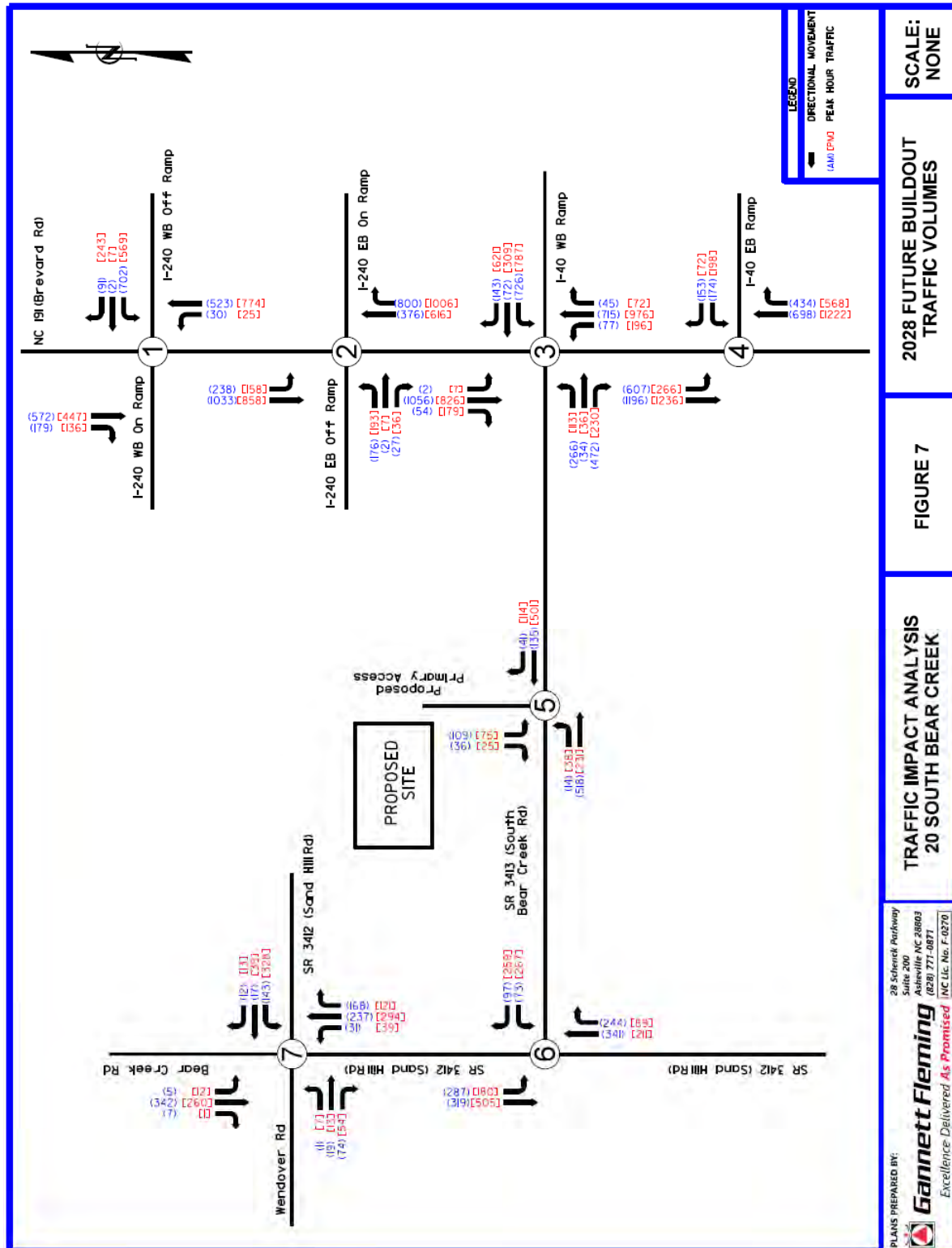


Figure 7 - 2028 Future Buildout Volumes



VII. Traffic Analysis

The study area intersections were analyzed using the methods outlined in the **Highway Capacity Manual**¹ and Synchro Version 7.0 Software. The **Highway Capacity Manual**¹ defines capacity as “the maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform section of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per hour or persons per hour”.

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

For signalized intersections, service levels pertain to each approach as well as an overall value. The unsignalized intersection analysis method in the **Highway Capacity Manual**¹ assigns LOS values for each movement that yields the right-of-way, but not to the overall intersection. This movement is generally a secondary movement from a minor street. At an unsignalized intersection, the primary traffic on the main roadway is virtually uninterrupted. Therefore, the overall level of service is usually much greater than what is represented by the results of the minor street movements. Synchro Version 7.0 will calculate an amount of delay for the overall intersection but will not assign a LOS value. Therefore, the overall intersection delay as well as the amount of delay on the minor street is reported in the summary tables of this report. Generally, Level of Service D is acceptable for signalized intersections in suburban areas during peak periods. With the current method of reporting levels of service for unsignalized intersections, it is not uncommon for some of the minor street movements to be operating at a LOS F during the peak hours.

Note: In accordance with NCDOT Guidelines, right turn on red movements were prohibited for each scenario. Additionally, all left turns from exclusive left turn lanes were modeled as “protected only”. The minimum cycle length for a traffic signal was set as 90 seconds for a three-phase and 129 seconds for a four-phase signal. Synchro modeling software may predict that cycle lengths greater than 180 seconds may be most efficient for coordinated signal systems.

Table 3 and 3A present criteria of each level of service as indicated in the **Highway Capacity Manual**¹.

Table 3 - Level of Service Criteria Signalized Intersections	
Level of Service	Stopped Delay Per Vehicle (sec)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

Table 3A – Level of Service Criteria Unsignalized Intersections	
Level of Service	Average Total Delay (sec/veh)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Capacity analyses were performed for 2020 existing conditions, 2028 Background, and 2028 Future conditions for the following intersection:

- NC 191 (Brevard Road)/I-240 WB Ramps (signalized)
- NC 191 (Brevard Road)/I-240 EB Ramps (signalized)
- NC 191 (Brevard Road)/I-40 WB Ramps – South Bear Creek Road (signalized)
- NC 191 (Brevard Road)/I-40 EB Ramps (signalized)
- South Bear Creek Road/Sand Hill Road (unsignalized)
- Sand Hill Road/Wendover Street-Bear Creek Road (unsignalized)
- South Creek Road/Proposed Site Access (unsignalized)

Synchro 10 calculated the AM and PM peak hour level of service and delay for the study area intersections using methods outlined in the **Highway Capacity Manual**¹. All capacity analyses are included in Appendix B and are briefly summarized in the following sub-sections. *It should be noted that under coordinated traffic signal operations, levels of service and delays may change in counterintuitive manners, with individual approaches or intersections experiencing less delay with increased volumes due to the “system” approach taken by Synchro, where an individual intersection or approach may benefit from an increase or decrease in coordinated cycle lengths.*

1. NC 191 (Brevard Road)/I-240 WB Ramps

NC 191 (Brevard Road)/I-240 WB Ramps intersection is currently a signalized four-legged intersection. It is an interstate interchange with the east and west approaches being one-way in traffic flow, both westbound. The capacity analysis for the existing 2020 traffic condition revealed the intersection is currently operating at a Level of Service (LOS) D in both the AM and PM peak hours with a total intersection delay of 37.9 during the AM Peak Hour and 36.3 seconds in the PM Peak Hour. The I-240 Westbound offramp approach is operating at LOS D with an overall approach delay of 52.1 seconds/vehicle during AM Peak Hour and D during the PM Peak Hour with an approach delay of 59.3 seconds.

With normal traffic growth at 1.5% per year compounded annually, the total intersection and approach delays are only expected to increase by 2028. If the STIP project is delayed, during the 2028 Background traffic conditions, the intersection is predicted to operate at LOS E with an overall delay of 61.1 seconds/vehicle during the AM Peak Hour and at LOS D with an overall delay of 46.0 seconds/vehicle during the PM Peak Hour. If the STIP project is constructed, the intersection should operate at an LOS of C during the AM and PM Peak Hours, with an intersection delay of 25.2 seconds during the AM Peak Hour and 29.2 seconds during the PM Peak Hour. Gannett Fleming understands that the construction of the STIP project will divert some traffic from the WB offramp to the direct interchange from I-240 to I-40 Eastbound. Gannett Fleming was unable to obtain accurate forecast data for this change in volume, so it was not taken into consideration. It should be noted that with this traffic still in the intersection, the LOS is greatly improved over current, background, and future conditions with the STIP project delayed.

The proposed multifamily and Senior Adult residential development will add traffic to this intersection when it is constructed and operational. Under the 2028 Future NO STIP condition, the intersection is predicted to operate at an LOS of E in the AM Peak Hour, with a total delay of 71.4 seconds, and LOS D with an overall lane delay of 46.5 seconds/vehicle during the PM Peak Hour. The northbound NC 191 approach is expected to experience an LOS of F during the AM Peak Hour with 110.3 seconds of delay, an increase of 36.6 seconds from the Background conditions. The STIP project makes a substantial improvement to the capacity of the intersection. The expected LOS remains C with delays of 23.3 and 24.0 seconds for the AM and PM Peak Hours respectively.

Gannett Fleming recommends no changes to this intersection as a result of the 20 South Bear Creek development.

Table 4 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 4– NC 191 (Brevard Road)/I-240 Westbound Ramps Traffic Analysis

TABLE 4

NC 191 at I-240 WB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
AM Peak Hour				With STIP	No STIP, With Improvements	With STIP
Intersection Level of Service (LOS)		D	E	C	E	C
Total Intersection Delay (Seconds)		37.9	61.1	25.2	71.4	23.3
NC 191 (Brevard Road) Northbound	LOS	D	E	B	F	A
	Approach Delay	36.7	73.7	15.6	110.3	6.3
NC 191 (Brevard Road) Southbound	LOS	C	D	B	D	B
	Approach Delay	23.7	49.3	16.9	34.9	19.0
I-240 WB Offramp	LOS	D	E	D	E	D
	Approach Delay	52.1	64.0	39.2	78.8	39.0

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

NC 191 at I-240 WB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
PM Peak Hour				With STIP	No STIP, With Improvements	With STIP
Intersection Level of Service (LOS)		D	D	C	D	C
Total Intersection Delay (Seconds)		36.3	46.0	29.2	46.5	24.0
NC 191 (Brevard Road) Northbound	LOS	C	D	B	D	A
	Approach Delay	27.9	46.4	10.6	51.5	5.8
NC 191 (Brevard Road) Southbound	LOS	B	B	B	C	B
	Approach Delay	15.5	19.2	10.7	19.7	11.6
I-240 WB Offramp	LOS	D	E	E	E	D
	Approach Delay	59.3	64.7	60.5	61.1	50.5

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

2. NC 191 (Brevard Road) / I-240 Eastbound Ramps

NC 191 (Brevard Road)/I-240 Eastbound Ramps intersection is currently a signalized four-legged intersection. Like its counterpart, NC 191 (Brevard Road)/I-240 WB Ramps, the eastern and western approaches are one-way in the eastbound direction. The capacity analysis for the existing 2020 traffic condition revealed the intersection is currently operating at a LOS C in the AM Peak Hour and LOS B in the PM Peak Hours. The eastbound offramp approach is operating at LOS F during the AM and PM Peak Hours with an overall approach delay of 94.6 seconds/vehicle during AM Peak Hour and 101.6 seconds/vehicle during the PM Peak Hour.

With normal traffic growth at 1.5% per year compounded annually, the eastbound approach delays are only expected to increase by 2028. If Project I-2513 is not constructed by the 2028 Background traffic condition, the eastbound I-240 offramp approach is predicted to operate at LOS F during the AM and PM Peak Hours with an overall approach delay of 206.3 seconds/vehicle during AM Peak Hour and 154.7 seconds/vehicle during the PM Peak Hour. The construction of I-2513 makes a significant positive difference in the operation of the signal by allowing the intersection to operate at a LOS of B during the AM Peak Hour and C in the PM Peak Hour with total delays of 13.6 and 20.0 seconds respectively. The Eastbound I-240 Ramp approach is expected to operate at an LOS F with a delay of 113.7 seconds in the PM Peak Hour.

The proposed multifamily and Senior Adult residential development will add traffic to this intersection when it is constructed and operational. If I-2513 is not constructed, under the 2028 Future condition, the intersection is expected to operate LOS D during the AM and PM Peak Hours with an overall approach delay of 49.9 and 43.4 seconds/vehicle respectively. With the recommended improvement, the eastbound I-240 Offramp approach will still operate at an LOS F, but will have less delays during AM Peak Hour (134.8 seconds/vehicle) and PM Peak Hour (86.7 seconds/vehicle). If I-2513 is constructed, the intersections are predicted to operate at LOS B for the AM Peak Hour and D for the PM Peak Hour, with delays of 13.9 and 38.5 seconds respectively. The I-240 eastbound offramp approach is predicted to operate at LOS E with a delay of 61.0 seconds/vehicle during the morning peak hour and at LOS F with an overall lane delay of 83.2 seconds/vehicle during the afternoon peak hour.

If I-2513 is not under construction prior to buildout of 20 South Bear Creek, Gannett Fleming recommends the construction of a right turn lane on the I-240 Eastbound Offramp with 50 feet of full storage. Although this improvement was not modeled in absence of site traffic, Gannett Fleming is of the opinion that it would improve existing and background traffic conditions. *Should NCDOT install this dedicated right turn lane prior to the buildout of 20 South Bear Creek and the construction of I-2513, the Developer should be relieved of the responsibility.*

Table 5 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 5- NC 191 (Brevard Road)/I-240 Eastbound Ramps

TABLE 5

NC 191 at I-240 EB Ramps AM Peak Hour		2020 Existing	2028 Background	2028 Background With STIP	2028 Future No STIP, With Improvements	2028 Future With STIP
Intersection Level of Service (LOS)		C	D	B	D	B
Total Intersection Delay (Seconds)		29.8	53.2	13.6	49.9	13.9
NC 191 (Brevard Road) Northbound	LOS	A	A	B	A	B
Approach Delay		7.4	8.7	14.0	6.2	15.6
NC 191 (Brevard Road) Southbound	LOS	D	E	A	E	A
Approach Delay		39.3	68.2	5.5	76.5	4.7
I-240 EB Offramp Eastbound	LOS	F	F	E	F	E
Approach Delay		94.6	206.3	61.2	134.8	61.0

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

NC 191 at I-240 EB Ramps PM Peak Hour		2020 Existing	2028 Background	2028 Background With STIP	2028 Future No STIP, With Improvements	2028 Future With STIP
Intersection Level of Service (LOS)		B	D	C	D	D
Total Intersection Delay (Seconds)		7.0	39.1	20.0	43.4	38.5
NC 191 (Brevard Road) Northbound	LOS	A	B	B	B	D
Approach Delay		8.6	15.4	17.6	16.8	40.9
NC 191 (Brevard Road) Southbound	LOS	B	D	A	E	C
Approach Delay		19.0	51.6	2.5	75.8	24.4
I-240 EB Offramp Eastbound	LOS	F	F	F	F	F
Approach Delay		101.6	154.7	113.7	86.7	83.2

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"



3. NC 191 (Brevard Road)/I-40 Westbound Ramp – SR 3413 (South Bear Creek Road)

NC 191 (Brevard Road)/I-40 Westbound Ramp – SR 3413 (South Bear Creek Road) is signalized four-legged intersection. The capacity analysis for the existing 2020 traffic condition revealed the intersection is currently operating at a LOS F in both the AM and PM Peak Hours. All approaches are operating at a LOS F during the AM and PM Peak Hours, except for the northbound NC 191 (Brevard Road) approach which operated at LOS D during the AM Peak Hour.

In the 2028 Background traffic condition, if NCDOT STIP Project I-2513 is not constructed, the northbound approach LOS will fall to E with a delay of 71.3 seconds with all other approaches remaining at LOS F. If I-2513 is constructed, the intersection is expected to operate at LOS D and E with delays of 53.2 and 56.2 seconds respectively. No approach would be expected to operate at LOS F.

The proposed multifamily and Senior Adult residential development will add traffic to this intersection when it is constructed and operational. Under the 2028 Future condition, with I-2513 not constructed, the recommended improvements to the eastbound SR 3413 (South Bear Creek Road) approach are predicted to allow the intersection to operate at LOS F for the AM and PM Peak Hours, but with less overall delay. The LOS of the northbound NC 191 (Brevard Road) approach is expected to improve to C with a delay of 33.4 seconds during the AM Peak Hour, but remain F during the PM Peak with the approach delay decreasing from 152.8 to 112.7 seconds. If I-2513 is constructed, the intersection is expected to operate during both peak hours at LOS D with delays of 47.6 and 51.9 seconds respectively. No approach would be expected to operate at LOS F.

If I-2513 is not under construction prior to buildout of 20 South Bear Creek, Gannett Fleming recommends the construction of a right turn lane on the SR 3413 (South Bear Creek Road) approach with 100 feet of full storage. Although this improvement was not modeled in absence of site traffic, Gannett Fleming is of the opinion that it would improve existing and background traffic conditions. *Should NCDOT install this dedicated right turn lane prior to the buildout of 20 South Bear Creek and the construction of I-2513, the Developer should be relieved of the responsibility.*

Table 6 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 6– NC 191 (Brevard Road)/I-40 Westbound Ramp Traffic Analysis

TABLE 6

NC 191 at I-40 WB Ramps	2020 Existing	2028 Background	2028 Background With STIP	2028 Future No STIP, With Improvements	2028 Future With STIP
AM Peak Hour					
Intersection Level of Service (LOS)	F	F	D	F	D
Total Intersection Delay (Seconds)	152.6	211.2	53.2	149.9	47.6
NC 191 (Brevard Road) Northbound	D	E	C	C	C
Approach Delay	45.0	71.3	26.5	33.4	28.6
NC 191 (Brevard Road) Southbound	F	F	D	F	D
Approach Delay	118.4	228.1	42.0	165.2	48.9
South Bear Creek Road Eastbound	F	F	E	F	D
Approach Delay	238.8	300.9	68.9	190.9	53.1
I-40 WB Offramp Westbound	F	F	E	F	E
Approach Delay	226.4	251.6	78.5	201.8	58.4

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

NC 191 at I-40 WB Ramps	2020 Existing	2028 Background	2028 Background With STIP	2028 Future No STIP, With Improvements	2028 Future With STIP
PM Peak Hour					
Intersection Level of Service (LOS)	F	F	E	F	D
Total Intersection Delay (Seconds)	148.6	185.6	56.2	154.8	51.9
NC 191 (Brevard Road) Northbound	F	F	D	F	D
Approach Delay	155.4	152.8	53.5	112.7	52.1
NC 191 (Brevard Road) Southbound	F	F	D	F	E
Approach Delay	106.0	173.8	48.7	185.2	60.3
South Bear Creek Road Eastbound	F	F	E	F	D
Approach Delay	117.9	235.6	62.6	110.6	39.9
I-40 WB Offramp Westbound	F	F	E	F	D
Approach Delay	172.8	206.6	61.1	177.1	49.4

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"



4. NC 191 (Brevard Road)/I-40 Eastbound Ramp

NC 191 (Brevard Road)/I-40 Eastbound Ramp is signalized “T” intersection. The capacity analysis for the existing 2020 traffic condition revealed the intersection is currently operating at a level of service in the AM Peak Hour of C and LOS B in the PM Peak Hour with delays of 20.9 and 16.6 seconds respectively. The westbound approach is operating at LOS E with an approach delay of 59.3 seconds/vehicle during the PM Peak Hour.

With normal traffic growth at 1.5% per year compounded annually, the northbound approach delays are only expected to increase slightly by 2028. In the 2028 Background traffic condition, the westbound ramp approach is predicted to operate at LOS E with an overall approach delay of 69.3 seconds/vehicle during the AM Peak Hour and at LOS E with an overall approach delay of 67.4 seconds/vehicle during the afternoon peak hour. The construction of I-2513 does make an overall positive difference in LOS and delays though this intersection is outside of the scope of the project.

The proposed multifamily and Senior Adult residential development will add traffic to this intersection when it is constructed and operational. Under the 2028 Future condition, the northbound approach is predicted to operate at LOS C during the AM and PM Peak Hours with overall delays of 29.8 and 26.7 seconds respectively if I-2513 is not constructed. Constructing I-2513 reduces the AM Peak Hour delay to 22.3 seconds, with the LOS remaining at C and the PM Peak Hour delay to 18.8 seconds, giving an of LOS B.

Gannett Fleming recommends no changes to this intersection as a result of the 20 South Bear Creek development.

Table 7 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 7– NC 191 (Brevard Road)/I-40 Eastbound Ramp Traffic Analysis

TABLE 7

NC 191 at I-40 EB Ramps		2020 Existing	2028 Background	2028 Background With STIP	2028 Future No STIP, With Improvements	2028 Future With STIP
AM Peak Hour						
Intersection Level of Service (LOS)		C	C	C	C	C
Total Intersection Delay (Seconds)		20.9	29.0	21.8	29.8	22.3
NC 191 (Brevard Road) Northbound	LOS	B	C	C	C	C
	Approach Delay	19.3	26.0	23.4	26.1	22.9
NC 191 (Brevard Road) Southbound	LOS	C	C	B	C	B
	Approach Delay	20.6	23.6	16.9	25.4	18.0
I-240 EB Offramp Westbound	LOS	C	E	D	E	D
	Approach Delay	28.9	69.3	43.8	66.4	44.0

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

NC 191 at I-40 EB Ramps		2020 Existing	2028 Background	2028 Background With STIP	2028 Future No STIP, With Improvements	2028 Future With STIP
PM Peak Hour						
Intersection Level of Service (LOS)		B	C	C	C	B
Total Intersection Delay (Seconds)		16.6	21.7	20.8	26.7	18.8
NC 191 (Brevard Road) Northbound	LOS	B	B	B	C	B
	Approach Delay	13.3	18.2	15.8	24.0	18.8
NC 191 (Brevard Road) Southbound	LOS	B	B	B	C	B
	Approach Delay	13.1	18.2	18.0	22.5	13.4
I-240 EB Offramp Westbound	LOS	E	E	E	E	D
	Approach Delay	59.3	67.4	65.5	68.5	49.4

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"



5. SR 3413 (South Bear Creek Road)/Proposed Site Access

This access is the main driveway for 20 South Bear Creek. It is proposed as an unsignalized, stop controlled “T” intersection with left and right turn lanes on the driveway. Additionally, in accordance with the NCDOT Policy on Street and Driveway Access, both left and right turn lanes with 100 feet of full storage and appropriate tapers are warranted (See Appendix D).

The southbound driveway approach to this intersection is predicted to experience a delay of 39.0 seconds in the AM Peak Hour with a LOS E and 16.3 seconds and LOS C in the PM Peak Hour. The construction of I-2513 has no affect on this intersection. As a result, it was not modeled separately for I-2513 build and no-build conditions.

Table 8 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 8- SR 3413 (South Bear Creek Road) at Proposed Site Access

TABLE 8

S. Bear Creek at Proposed Access	AM Peak Hour	2020 Existing	2028 Background	2028 Future Buildout
Intersection Level of Service (LOS)		N/A	N/A	N/A
Total Intersection Delay (Seconds)		0.0	0.0	6.8
S. Bear Creek Eastbound	LOS	A	A	A
	Approach Delay	0.0	0.0	0.2
S. Bear Creek Westbound	LOS	A	A	A
	Approach Delay	0.1	0.0	0.0
Proposed Access Southbound	LOS	N/A	N/A	E
	Approach Delay	N/A	N/A	39.0

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

S. Bear Creek at Proposed Access	PM Peak Hour	2020 Existing	2028 Background	2028 Future Buildout
Intersection Level of Service (LOS)		N/A	N/A	N/A
Total Intersection Delay (Seconds)		0.0	0.0	2.7
S. Bear Creek Eastbound	LOS	A	A	A
	Approach Delay	0.0	0.0	5.5
S. Bear Creek Westbound	LOS	A	A	A
	Approach Delay	0.0	0.0	0.0
Proposed Access Southbound	LOS	N/A	N/A	C
	Approach Delay	N/A	N/A	16.3

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

6. NC 191 (Brevard Road)/SR 3412 (Sand Hill Road)

This intersection is currently operating as an unsignalized “T” intersection. It operates under 2020 Existing conditions with an intersection delay of 7.2 seconds in the AM Peak Hour and 88.5 seconds in the PM Peak Hour. The SR 3413 (South Bear Creek Road) approach experiences a LOS of E with 49.8 seconds in the AM Peak Hour and a LOS of F and delay of 253.4 seconds in the PM Peak Hour.

The delays increase during 2028 Background conditions, with the intersection predicted to experience 16.9 seconds of total delay during the AM Peak Hour and 181.0 seconds in the PM Peak Hour. The SR 3413 (South Bear Creek Road) approach is predicted to experience a LOS of F for both the AM and PM Peak Hour with delays of 143.1 and 520.7 seconds respectively.

The intersection was modeled as signalized and coordinated for 2028 Future conditions. The traffic signal was modeled as coordinated with a second signal at the intersection of SR 3412 (Sand Hill Road) and Wendover Road. Signalizing and coordinating this intersection decrease the intersection delays to 30.2 seconds in the AM Peak Hour, with a LOS of C, and 76.5 seconds in the PM Peak Hour with a LOS of E. The SR 3413 (South Bear Creek Road) approach remains at a LOS of F, but the delays decrease to 93.0 and 108.0 seconds for the AM and PM Peak Hours respectively.

In addition to decreasing the delays and raising the levels of service of this intersection, signalizing this intersection will increase the pedestrian accessibility and safety in the two intersections.

The construction of I-2513 has no effect on this intersection. As a result, it was not modeled separately for I-2513 build and no-build conditions.

Gannett Fleming recommends the installation of a traffic signal at this intersection with pedestrian phases as appropriate. Coordinate this signal with the proposed signal at SR 3412 Sand Hill Road and Wendover Road – Bear Creek Road. The results of a signal warrant analysis indicate that this intersection meets signal warrants under current conditions.

Table 9 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 9– SR 3413 (South Bear Creek Road)/SR 3412 (Sand Hill Road) Traffic Analysis

TABLE 9

S. Bear Creek at Sand Hill Road						
AM Peak Hour						
Intersection Level of Service (LOS)						
Total Intersection Delay (Seconds)						
Sand Hill Road Northbound	LOS					
Sand Hill Road Southbound	Approach Delay					
	LOS					
	Approach Delay					
	LOS					
S. Bear Creek Westbound	Approach Delay					

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

S. Bear Creek at Sand Hill Road						
PM Peak Hour						
Intersection Level of Service (LOS)						
Total Intersection Delay (Seconds)						
Sand Hill Road Northbound	LOS					
Sand Hill Road Southbound	Approach Delay					
	LOS					
	Approach Delay					
	LOS					
S. Bear Creek Westbound	Approach Delay					

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"



7. SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road

The intersection of SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road is currently operating as an unsignalized four -legged intersection. It operates under 2020 Existing conditions with an intersection delay of 13.0 seconds in the AM Peak Hour and 16.7 seconds in the PM Peak Hour. The SR 3412 (Sand Hill Road) northbound approach experiences a LOS of B with 14.0 seconds in the AM Peak Hour and a LOS of C and a delay of 18.6 seconds in the PM Peak Hour.

During the 2028 Background conditions, the intersection is predicted to operate with an intersection delay of 16.2 seconds in the AM Peak Hour and 25.4 seconds in the PM Peak Hour. The SR 3412 (Sand Hill Road) northbound approach is expected to experience LOS of C with 16.2 seconds in the AM Peak Hour and a LOS of D and a delay of 31.3 seconds in the PM Peak Hour.

During 2028 Future conditions, the intersection is predicted to operate with an intersection delay of 25.2 seconds and LOS of C in the AM Peak Hour and 45.9 seconds and a LOS of D in the PM Peak Hour. The SR 3412 (Sand Hill Road) westbound approach is expected to experience a delay of 85.4 seconds and an LOS of F during the AM Peak Hour. During the PM Peak Hour, the westbound SR 3412 (Sand Hill Road) approach is predicted to experience a delay of 54.4 seconds and an LOS of E. Although the westbound approach deteriorates to LOS F, the overall functioning of the two intersections and the increase in pedestrian accessibility and safety are mitigating factors.

Gannett Fleming recommends the installation of a traffic signal at this intersection with pedestrian phases as appropriate. Coordinate this signal with the proposed signal at SR 3413 (South Bear Creek Road)/SR 3412 Sand Hill Road. The results of a signal warrant analysis indicate that this intersection meets signal warrants under current conditions. Pedestrian phasing should be installed crossing SR 3412 (Sand Hill Road) and Wendover Road.

The construction of I-2513 has no effect on this intersection. As a result, it was not modeled separately for I-2513 build and no-build conditions.

Table 10 displays the Level of Service and Delay for the subject intersection for the 2020 Existing conditions, 2028 Background conditions, and 2028 Future conditions.

Table 10– SR 3412 (Sand Hill Road)/Wendover Road Traffic Analysis

TABLE 10

S. Bear Creek at Wendover Road			2020 Existing	2028 Background	2028 Future Buildout
AM Peak Hour			N/A	N/A	C
Intersection Level of Service (LOS)			13.0	16.2	25.2
Total Intersection Delay (Seconds)					A
Sand Hill Road Northbound	LOS		B	C	9.0
	Approach Delay		14.0	18.3	A
Bear Creek Road Southbound	LOS		B	C	8.8
	Approach Delay		13.4	16.8	D
Wendover Road Eastbound	LOS		A	B	51.2
	Approach Delay		9.7	10.7	F
Sand Hill Road Westbound	LOS		B	B	85.4
	Approach Delay		11.4	12.9	

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

S. Bear Creek at Wendover Road			2020 Existing	2028 Background	2028 Future Buildout
PM Peak Hour			N/A	N/A	D
Intersection Level of Service (LOS)			16.7	25.4	45.9
Total Intersection Delay (Seconds)					E
Sand Hill Road Northbound	LOS		C	D	57.2
	Approach Delay		18.6	31.3	C
Bear Creek Road Southbound	LOS		B	C	21.0
	Approach Delay		13.6	17.5	26.4
Wendover Road Eastbound	LOS		C	B	E
	Approach Delay		18.6	11.5	54.4
Sand Hill Road Westbound	LOS		B	D	
	Approach Delay		10.2	26.7	

 Delay Decrease or LOS Improvement
 Delay Increase > 25% or LOS Decrease by 1 Letter Grade
 LOS "F"

Queue Discussion: The STIP project vastly decreases the queue lengths for the intersections along NC 191, for both the AM and PM Peak Hours as would be expected. The queues predicted by Sim Traffic increase for the intersections of SR 3412 (Sand Hill Road) with SR 3413 (South

Bear Creek Road) and Wendover Road – Bear Creek Roads from the 2020 Existing to the 2028 Future conditions. The 2020 existing queues seem to be much less than anecdotal evidence suggests. Gannett Fleming employees have witnessed PM Peak Hour queues that seem far in excess of those predicted. It is Gannett Fleming's opinion that the overall improvements in level of service and decreases in intersection delay will far outweigh potential queue length increases.

Note: It is the opinion of Gannett Fleming that even though this scenario was not modeled, experience shows that the ultimate improvement to traffic conditions at the intersections of SR 3412 (Sand Hill Road) / SR 3413 (South Bear Creek Road) and SR 3412 (Sand Hill Road) / Wendover Road - Bear Creek Road would likely be to install a roundabout that encompasses both intersections. This would be very difficult because of right of way and topographic constraints and a live stream with a box culvert that would require a significant modification/extension. The magnitude of a project of this sort is cost prohibitive for a development to undertake. The installation of traffic signals improves the 2028 Future traffic, which includes projected site traffic, to better than existing conditions. Should NCDOT develop and construct this roundabout prior to the installation of the traffic signals, the developer should be relieved of the responsibility.

VIII. Recommendations

To mitigate the traffic-related impacts caused by the multifamily and Senior Adult residential development and to provide for safe, efficient, and reliable traffic flow, Gannett Fleming recommends the following

NC 191 (Brevard Road)/I-240 Eastbound Offramp

Improve the I-240 Eastbound Offramp by adding an exclusive right turn lane with 50 feet of full storage.

NC 191 (Brevard Road)/SR 3413 (South Bear Creek Road)

Improve the SR 3413 (South Bear Creek Road) approach by adding an exclusive right turn lane with 100 feet of full storage.

SR 3413 (South Bear Creek Road)/SR 3412 (Sand Hill Road)

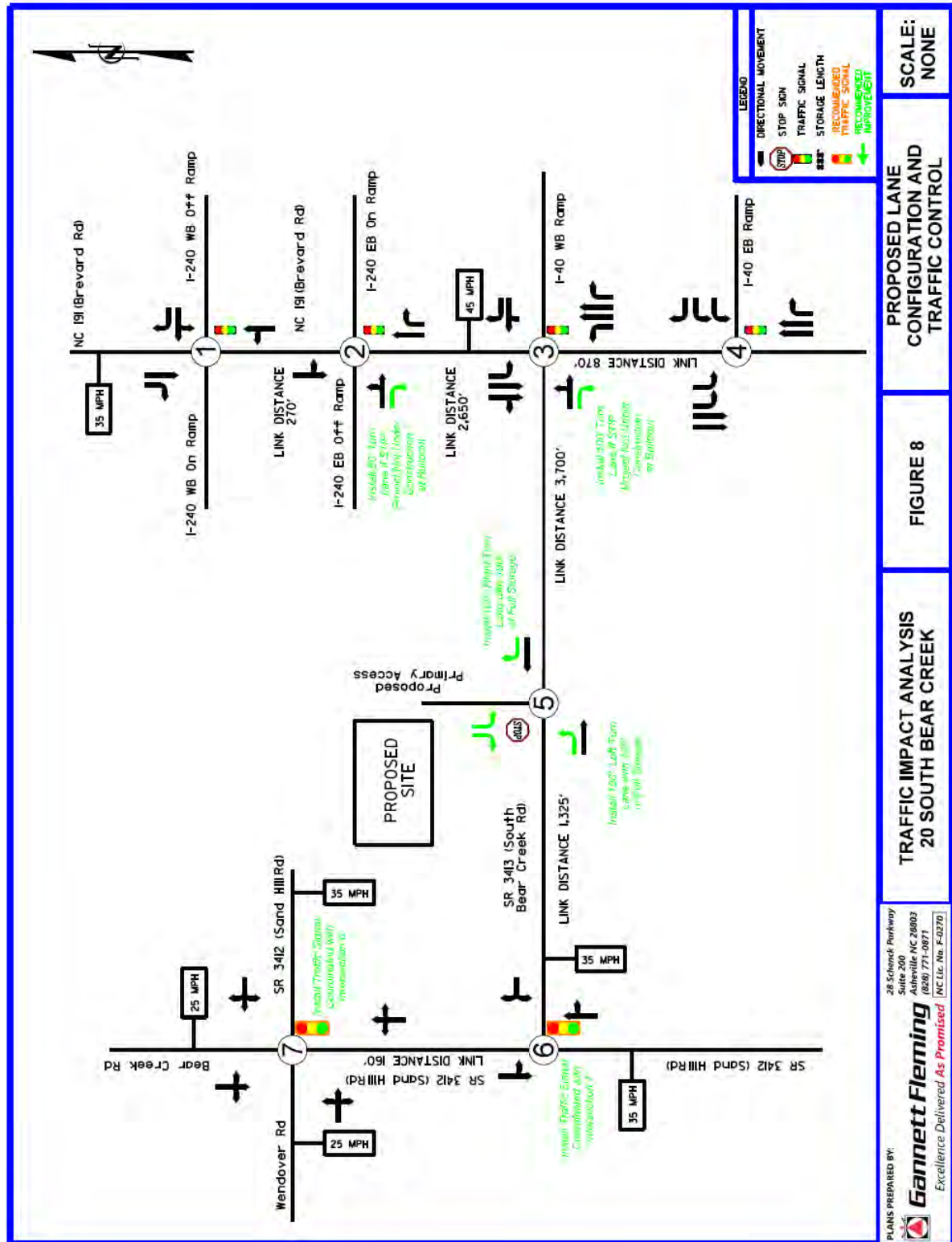
Install a traffic signal at this intersection with pedestrian phases as appropriate. Coordinate this signal with the proposed signal at SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road. Because the traffic conditions in this intersection currently meet traffic signal warrants, the traffic signal should be allowed to be installed prior to the buildout of the development.

SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road

Install a traffic signal at this intersection with pedestrian phases as appropriate. Coordinate this signal with the proposed signal at SR 3413 (South Bear Creek Road)/SR 3412 (Sand Hill Road). Pedestrian phasing should be installed crossing SR 3412 (Sand Hill Road) and Wendover Road. Because the traffic conditions in this intersection currently meet traffic signal warrants, the traffic signal should be allowed to be installed prior to the buildout of the development.

The recommended lane configurations and traffic control are shown on Figure 8.

Figure 8 – Recommended Lane Configuration and Traffic Control



IX. Signal Warrant Analysis

To determine whether a traffic signal is warranted at the intersections of SR 3412 (Sand Hill Road)/SR 3413 (South Bear Creek Road) and SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road, Gannett Fleming conducted a Signal Warrant Analysis at each intersection. The results of the Analyses indicate that each intersection meets one or more traffic signal warrants at both 2020 Present and 2028 Background conditions. The reports from analyses are attached as Appendix C.

SR 3413 (South Bear Creek Road)/SR 3412 (Sand Hill Road)

This intersection meets Warrant #3, Peak Hour Volumes, and Warrants #3A and #3B for 2020 Existing conditions. The intersection meets Warrant #2, Four Hour Volumes and Warrant #3 Peak Hour volumes, as well as Warrants #3A and #3B for 2028 Background conditions.

SR 3412 (Sand Hill Road)/Wendover Road – Bear Creek Road

This intersection meets Warrant #3, Peak Hour Volumes, and Warrants #3A 2020 Existing conditions. The intersection meets Warrant #3 Peak Hour volumes, as well as Warrants #3A and #3B for 2028 Background conditions.

X. Conclusions

This Traffic Impact Analysis shows that although the proposed 20 South Bear Creek will have an impact on the traffic operations at the study area intersections, the impact will be mitigated by the recommended improvements. With the recommended improvements in place, the proposed development will not negatively impact the health, safety, and welfare of the travelling public.

X. References

¹ *Highway Capacity Manual*, Special Report 209, Transportation Research Board, National Research Council, Washington, D.C., 1998.

NCDOT Interactive Traffic Volume Map:

<http://ncdot.maps.arcgis.com/apps/webappviewer/index.html?id=5f6fe58c1d90482ab9107ccc03026280>

NCDOT STIP I-2513:

<https://www.ncdot.gov/projects/asheville-i-26-connector/Pages/default.aspx>

Appendix A: Traffic Data

A



Count Type: Turning Movement (Classification) - Intersection

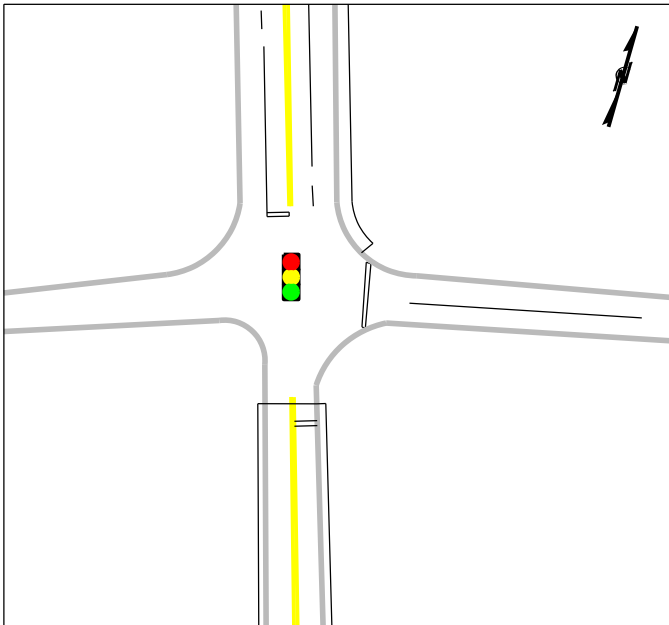
Crossroads at West Asheville TIA

Duration: 2-Hour per AM/PM Peak

Buncombe County, NC

Division 13

6/17/20 4:00 PM to 6:00 PM; 6/18/20 6:00 AM to 8:00 AM, Clear, High 71, Low 57



Notes:

1. Counted and Processed By: Jeffrey H. Moore
2. Method: CountCam 200 / CountPro Software
3. School in Session: *No
4. Street / Area Lighting: Yes
5. Construction Zone: No
6. Traffic Control: Signalized
7. Nearest Stop Sign > 100 Feet: Yes
8. Nearest Signal > 300 Feet: No South
9. Nearest At Grade RR Crossing > 200 Feet: Yes

* NOTE: School was not in session due to Covid 19 Pandemic.

PLANS PREPARED BY:



Gannett Fleming
Excellence Delivered *As Promised*

28 Schenck Parkway
Suite 200
Asheville NC 28803
(828) 771-0871
NC Lic. No. F-0270

**INTERSECTION OF NC 191
(BREVARD ROAD) AND I-240
WB RAMPS**

**TURNING MOVEMENT
COUNT**

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: AM Peak Hour
Location: NC 191 @ I-240 WB
 Buncombe County

Cars and Peds

Site Code:
Study Date: 06/18/2020

	NC 191 Southbound						I-240 WB Offramp Westbound						NC 191 Northbound						I-240 WB Onramp Eastbound						
Time	Peds	Right	Thru	Left	U-Turn	Appr Total	Peds	Right	Thru	Left	U-Turn	Appr Total	Peds	Right	Thru	Left	U-Turn	Appr Total	Peds	Right	Thru	Left	U-Turn	Appr Total	Int Total
07:00		23	49	0		72		6	0	51		57		0	18	1		19		0	0	0		0	148
07:15		16	40	0		56		5	0	71		76		0	28	0		28		0	0	0		0	160
07:30		15	73	0		88		12	0	81		93		0	25	0		25		0	0	0		0	206
07:45		24	55	0		79		8	0	84		92		0	42	1		43		0	0	0		0	214
Total	0	78	217	0	0	295	0	31	0	287	0	318	0	0	113	2	0	115	0	0	0	0	0	0	728
08:00		13	62	0		75		5	0	59		64		0	42	0		42		0	0	0		0	181
08:15		20	42	0		62		9	0	61		70		0	51	2		53		0	0	0		0	185
08:30		11	39	0		50		15	1	48		64		0	47	1		48		0	0	0		0	162
08:45		19	82	0		101		12	0	74		86		0	63	0		63		0	0	0		0	250
Total	0	63	225	0	0	288	0	41	1	242	0	284	0	0	203	3	0	206	0	0	0	0	0	0	778
Grand Total	0	141	442	0	0	583	0	72	1	529	0	602	0	0	316	5	0	321	0	0	0	0	0	0	1506
Appr %		24.2	75.8	0	0			12	0.2	87.9	0			0	98.4	1.6	0			-2	-2	-2	-2		
Total %		9.4	29.3	0	0			4.8	0.1	35.1	0			0	21	0.3	0			0	0	0	0		
AM Pk Hr		07:30	07:30	07:30	07:30	07:30		07:30	07:30	07:30	07:30	07:30		07:30	07:30	07:30	07:30	07:30		07:30	07:30	07:30	07:30	07:30	07:30
AM Pk Vol		72	232	0	0	304		34	0	285	0	319		0	160	3	0	163		0	0	0	0	0	786
AM PHF		0.750	0.795	NaN	NaN	0.864		0.708	NaN	0.848	NaN	0.858		NaN	0.784	0.375	NaN	0.769		NaN	NaN	NaN	NaN	NaN	0.918

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: AM Peak redo
Location: NC 191 @ I-240 WB
 Buncombe County

Trucks and Bikes

Site Code:
Study Date: 06/18/2020

	NC 191 Southbound						I-240 WB Offramp Westbound						NC 191 Northbound						I-240 WB Onramp Eastbound						
Time	Bikes	Right	Thru	Left	U-Turn	Appr Total	Bikes	Right	Thru	Left	U-Turn	Appr Total	Bikes	Right	Thru	Left	U-Turn	Appr Total	Bikes	Right	Thru	Left	U-Turn	Appr Total	Int Total
07:00		0	2	0		2		0	0	1		1		0	1	0		1		0	0	0		0	4
07:15		1	3	0		4		5	0	1		6		0	2	1		3		0	0	0		0	13
07:30		0	3	0		3		0	1	3		4		0	0	1		1		0	0	0		0	8
07:45		0	3	0		3		1	0	1		2		0	2	1		3		0	0	0		0	8
Total	0	1	11	0	0	12	0	6	1	6	0	13	0	0	5	3	0	8	0	0	0	0	0	0	33
08:00		0	2	0		2		1	0	2		3		0	3	0		3		0	0	0		0	8
08:15		1	1	0		2		1	0	4		5		0	1	0		1		0	0	0		0	8
08:30		0	0	0		0		1	0	3		4		0	1	0		1		0	0	0		0	5
08:45		0	3	0		3		1	0	3		4		0	2	0		2		0	0	0		0	9
Total	0	1	6	0	0	7	0	4	0	12	0	16	0	0	7	0	0	7	0	0	0	0	0	0	30
Grand Total	0	2	17	0	0	19	0	10	1	18	0	29	0	0	12	3	0	15	0	0	0	0	0	0	63
Appr %		10.5	89.5	0	0			34.5	3.4	62.1	0			0	80	20	0			-2	-2	-2	-2		
Total %		3.2	27	0	0			15.9	1.6	28.6	0			0	19	4.8	0			0	0	0	0		
AM Pk Hr		07:15	07:15	07:15	07:15	07:15		07:15	07:15	07:15	07:15	07:15		07:15	07:15	07:15	07:15	07:15		07:15	07:15	07:15	07:15	07:15	07:15
AM Pk Vol		1	11	0	0	12		7	1	7	0	15		0	7	3	0	10		0	0	0	0	0	37
AM PHF		0.250	0.917	NaN	NaN	0.750		0.350	0.250	0.583	NaN	0.625		NaN	0.583	0.750	NaN	0.833		NaN	NaN	NaN	NaN	NaN	0.712

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: AM Peak redo
Location: NC 191 @ I-240 WB
 Buncombe County

All Vehicles

Site Code:
Study Date: 06/18/2020

	NC 191 Southbound					I-240 WB Offramp Westbound					NC 191 Northbound					I-240 WB Onramp Eastbound					
Time	Right	Thru	Left	U-Turn	Appr Total	Right	Thru	Left	U-Turn	Appr Total	Right	Thru	Left	U-Turn	Appr Total	Right	Thru	Left	U-Turn	Appr Total	Int Total
07:00	23	51	0	0	74	6	0	52	0	58	0	19	1	0	20	0	0	0	0	0	152
07:15	17	43	0	0	60	10	0	72	0	82	0	30	1	0	31	0	0	0	0	0	173
07:30	15	76	0	0	91	12	1	84	0	97	0	25	1	0	26	0	0	0	0	0	214
07:45	24	58	0	0	82	9	0	85	0	94	0	44	2	0	46	0	0	0	0	0	222
Total	79	228	0	0	307	37	1	293	0	331	0	118	5	0	123	0	0	0	0	0	761
08:00	13	64	0	0	77	6	0	61	0	67	0	45	0	0	45	0	0	0	0	0	189
08:15	21	43	0	0	64	10	0	65	0	75	0	52	2	0	54	0	0	0	0	0	193
08:30	11	39	0	0	50	16	1	51	0	68	0	48	1	0	49	0	0	0	0	0	167
08:45	19	85	0	0	104	13	0	77	0	90	0	65	0	0	65	0	0	0	0	0	259
Total	64	231	0	0	295	45	1	254	0	300	0	210	3	0	213	0	0	0	0	0	808
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	143	459	0	0	602	82	2	547	0	631	0	328	8	0	336	0	0	0	0	0	1569
Appr %	23.8	76.2	00.0	00.0		13.0	00.3	86.7	00.0		00.0	97.6	02.4	00.0		NaN	NaN	NaN	NaN		
Total %	09.1	29.3	00.0	00.0		05.2	00.1	34.9	00.0		00.0	20.9	00.5	00.0		00.0	00.0	00.0	00.0		
% Trucks	01.4	03.7	-	-	03.2	12.2	50.0	03.3	-	04.6	-	03.7	37.5	-	04.5	-	-	-	-	-	04.0
AM Pk Hr	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30	07:30
AM Pk Vol	73	241	0	0	314	37	1	295	0	333	0	166	5	0	171	0	0	0	0	0	818
AM PHF	0.760	0.793	NaN	NaN	0.863	0.771	0.250	0.868	NaN	0.858	NaN	0.798	0.625	NaN	0.792	NaN	NaN	NaN	NaN	NaN	0.921

Gannett Fleming
 28 Schenck Parkway, Suite 200
 Asheville, NC 28803

File Name: AM Peak redo
Location: NC 191 @ I-240 WB
 Buncombe County

Site Code:
Study Date: 06/18/2020

All Vehicles

I-240 WB Onramp			
In = 153		Out = 0	
0	Right	0	U-Turn
0	Thru	0	Left
0	Left	0	U-Turn
0	U-Turn	0	Left

NC 191			
In = 410		Out = 602	
143	Right	0	U-Turn
459	Thru	0	Left
0	Left	0	U-Turn
0	U-Turn	0	Left

Total Volumes
 07:00 to 09:00
 Volume = 1569

I-240 WB Offramp			
In = 0		Out = 631	
82	Right	0	U-Turn
2	Thru	0	Left
547	Left	0	U-Turn
0	U-Turn	0	Left

NC 191			
In = 1006		Out = 336	
0	U-Turn	0	Right
8	Left	0	Thru
328	Thru	0	Left
0	Right	0	U-Turn

Gannett Fleming
 28 Schenck Parkway, Suite 200
 Asheville, NC 28803

File Name: AM Peak redo
Location: NC 191 @ I-240 WB
 Buncombe County

All Vehicles

Site Code:
Study Date: 06/18/2020

I-240 WB Onramp	0	U-Turn	
	0	Left	
	0	Thru	
	0	Right	

NC 191			
73	241	0	0
Right	Thru	Left	U-Turn
			

AM Peak Hour Statistics
 AM Peak Hour Begins: 07:30
 AM Peak Hour Volume: 818
 AM Peak Hour Factor: 0.921

			
U-Turn	Left	Thru	Right
0	5	166	0
NC 191			

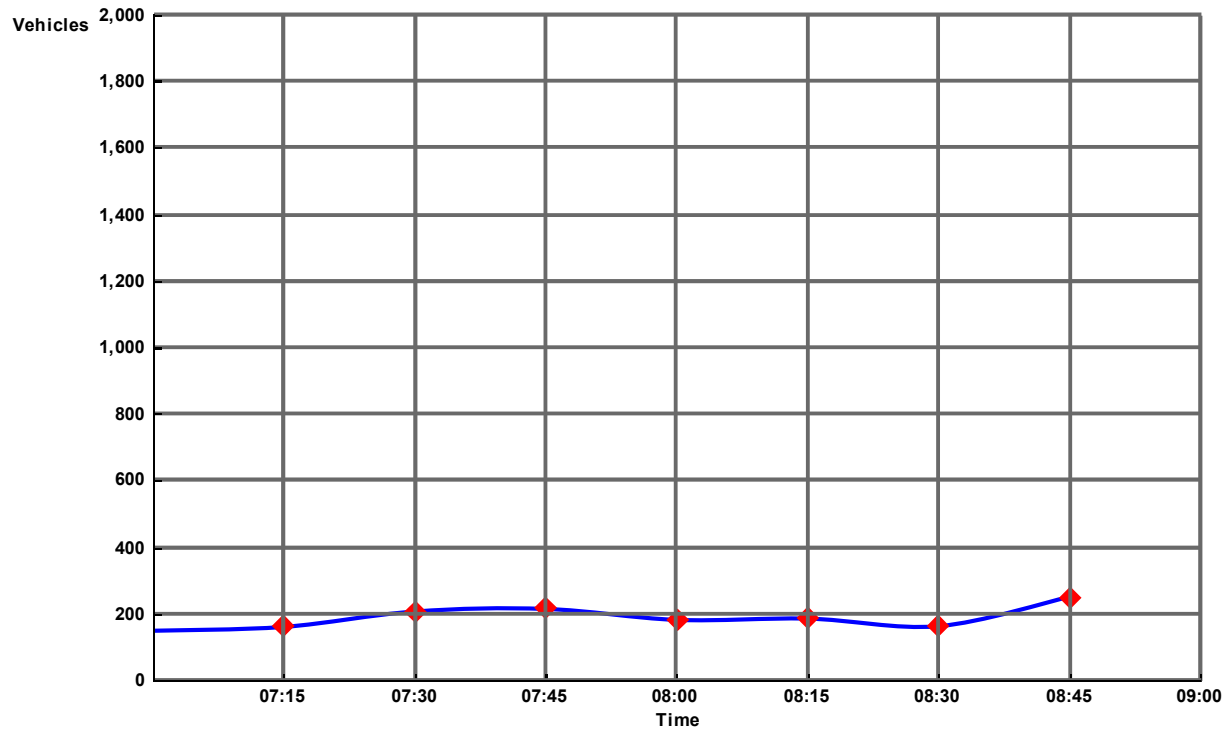
I-240 WB Offramp	37	Right	
	1	Thru	
	295	Left	
	0	U-Turn	

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: AM Peak redo
Location: NC 191 @ I-240 WB
Buncombe County

Cars

Site Code:
Study Date: 06/18/2020

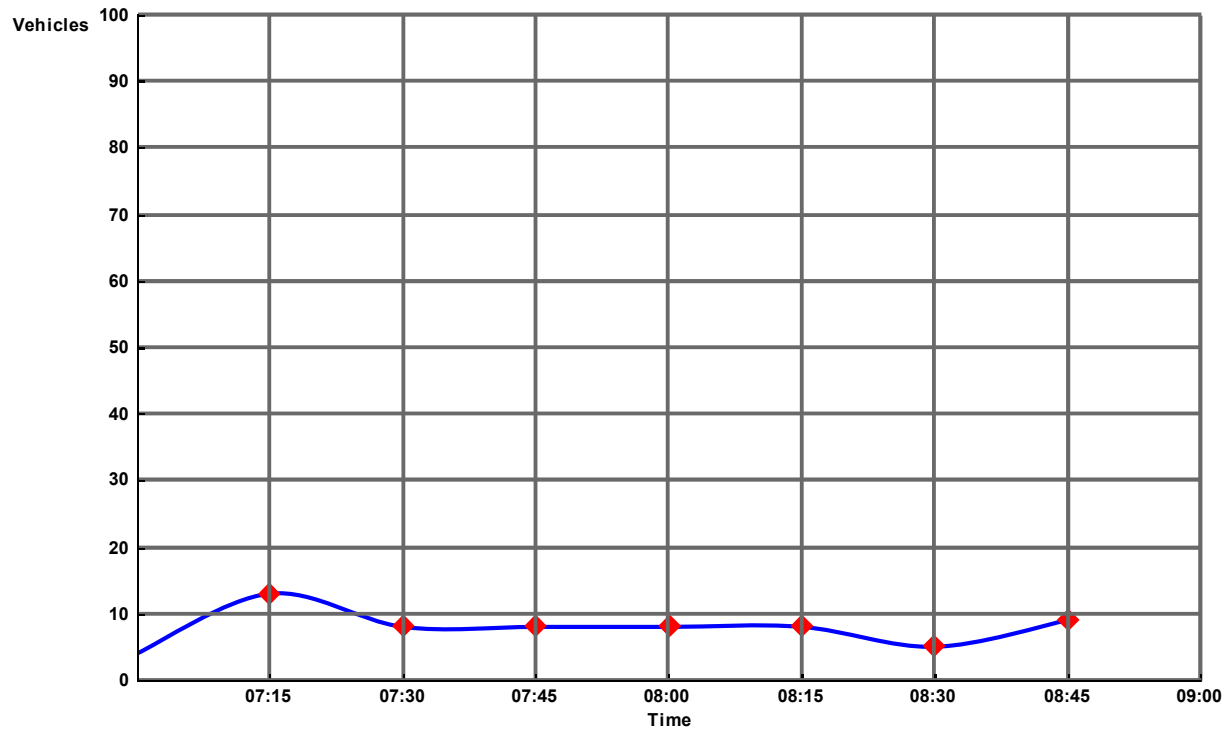


Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: AM Peak redo
Location: NC 191 @ I-240 WB
Buncombe County

Trucks

Site Code:
Study Date: 06/18/2020



Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
 Buncombe County

Cars and Peds

Site Code:
Study Date: 06/30/2020

	NC 191 Southbound						I-240 WB Offramp Westbound						NC 191 Northbound						I-240 WB Onramp Eastbound						
Time	Peds	Right	Thru	Left	U-Turn	Appr Total	Peds	Right	Thru	Left	U-Turn	Appr Total	Peds	Right	Thru	Left	U-Turn	Appr Total	Peds	Right	Thru	Left	U-Turn	Appr Total	Int Total
16:00		15	76	0		91		24	1	83		108		0	101	2		103		0	0	0		0	302
16:15		17	71	0		88		36	1	73		110		0	107	5		112		0	0	0		0	310
16:30		19	67	0		86		28	1	85		114		0	106	2		108		0	0	0		0	308
16:45		23	54	0		77		29	1	72		102		0	108	1		109		0	0	0		0	288
Total	0	74	268	0	0	342	0	117	4	313	0	434	0	0	422	10	0	432	0	0	0	0	0	0	1208
17:00		18	57	0		75		48	1	80		129		0	102	4		106		0	0	0		0	310
17:15		20	36	0		56		32	0	83		115		0	124	2		126		0	0	0		0	297
17:30		9	55	0		64		17	0	52		69		0	92	0		92		0	0	0		0	225
17:45		15	53	0		68		16	0	53		69		0	93	0		93		0	0	0		0	230
Total	0	62	201	0	0	263	0	113	1	268	0	382	0	0	411	6	0	417	0	0	0	0	0	0	1062
Grand Total	0	136	469	0	0	605	0	230	5	581	0	816	0	0	833	16	0	849	0	0	0	0	0	0	2270
Appr %		22.5	77.5	0	0			28.2	0.6	71.2	0			0	98.1	1.9	0			-2	-2	-2	-2		
Total %		6	20.7	0	0			10.1	0.2	25.6	0			0	36.7	0.7	0			0	0	0	0		
PM Pk Hr		16:15	16:15	16:15	16:15	16:15		16:15	16:15	16:15	16:15	16:15		16:15	16:15	16:15	16:15	16:15		16:15	16:15	16:15	16:15	16:15	16:15
PM Pk Vol		77	249	0	0	326		141	4	310	0	455		0	423	12	0	435		0	0	0	0	0	1216
PM PHF		0.837	0.877	NaN	NaN	0.926		0.734	1.000	0.912	NaN	0.882		NaN	0.979	0.600	NaN	0.971		NaN	NaN	NaN	NaN	NaN	0.981

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
 Buncombe County

Trucks and Bikes

Site Code:
Study Date: 06/30/2020

	NC 191 Southbound						I-240 WB Offramp Westbound						NC 191 Northbound						I-240 WB Onramp Eastbound						
Time	Bikes	Right	Thru	Left	U-Turn	Appr Total	Bikes	Right	Thru	Left	U-Turn	Appr Total	Bikes	Right	Thru	Left	U-Turn	Appr Total	Bikes	Right	Thru	Left	U-Turn	Appr Total	Int Total
16:00		0	0	0		0		2	0	2		4		0	2	0		2		0	0	0		0	6
16:15		0	1	0		1		0	0	3		3		0	1	0		1		0	0	0		0	5
16:30		1	1	0		2		0	0	2		2		0	1	1		2		0	0	0		0	6
16:45		1	2	0		3		0	0	4		4		0	0	0		0		0	0	0		0	7
Total	0	2	4	0	0	6	0	2	0	11	0	13	0	0	4	1	0	5	0	0	0	0	0	0	24
17:00		0	0	0		0		0	0	2		2		0	1	0		1		0	0	0		0	3
17:15		0	0	0		0		0	0	0		0		0	0	1		1		0	0	0		0	1
17:30		0	0	0		0		0	0	3		3		0	0	1		1		0	0	0		0	4
17:45		0	1	0		1		0	0	2		2		0	1	2		3		0	0	0		0	6
Total	0	0	1	0	0	1	0	0	0	7	0	7	0	0	2	4	0	6	0	0	0	0	0	0	14
Grand Total	0	2	5	0	0	7	0	2	0	18	0	20	0	0	6	5	0	11	0	0	0	0	0	0	38
Appr %		28.6	71.4	0	0			10	0	90	0			0	54.5	45.5	0			-2	-2	-2	-2		
Total %		5.3	13.2	0	0			5.3	0	47.4	0			0	15.8	13.2	0			0	0	0	0		
PM Pk Hr		16:00	16:00	16:00	16:00	16:00		16:00	16:00	16:00	16:00	16:00		16:00	16:00	16:00	16:00	16:00		16:00	16:00	16:00	16:00	16:00	16:00
PM Pk Vol		2	4	0	0	6		2	0	11	0	13		0	4	1	0	5		0	0	0	0	0	24
PM PHF		0.500	0.500	NaN	NaN	0.500		0.250	NaN	0.688	NaN	0.813		NaN	0.500	0.250	NaN	0.625		NaN	NaN	NaN	NaN	NaN	0.857

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
 Buncombe County

All Vehicles

Site Code:
Study Date: 06/30/2020

	NC 191 Southbound					I-240 WB Offramp Westbound					NC 191 Northbound					I-240 WB Onramp Eastbound					
Time	Right	Thru	Left	U-Turn	Appr Total	Right	Thru	Left	U-Turn	Appr Total	Right	Thru	Left	U-Turn	Appr Total	Right	Thru	Left	U-Turn	Appr Total	Int Total
16:00	15	76	0	0	91	26	1	85	0	112	0	103	2	0	105	0	0	0	0	0	308
16:15	17	72	0	0	89	36	1	76	0	113	0	108	5	0	113	0	0	0	0	0	315
16:30	20	68	0	0	88	28	1	87	0	116	0	107	3	0	110	0	0	0	0	0	314
16:45	24	56	0	0	80	29	1	76	0	106	0	108	1	0	109	0	0	0	0	0	295
Total	76	272	0	0	348	119	4	324	0	447	0	426	11	0	437	0	0	0	0	0	1232
17:00	18	57	0	0	75	48	1	82	0	131	0	103	4	0	107	0	0	0	0	0	313
17:15	20	36	0	0	56	32	0	83	0	115	0	124	3	0	127	0	0	0	0	0	298
17:30	9	55	0	0	64	17	0	55	0	72	0	92	1	0	93	0	0	0	0	0	229
17:45	15	54	0	0	69	16	0	55	0	71	0	94	2	0	96	0	0	0	0	0	236
Total	62	202	0	0	264	113	1	275	0	389	0	413	10	0	423	0	0	0	0	0	1076
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	138	474	0	0	612	232	5	599	0	836	0	839	21	0	860	0	0	0	0	0	2308
Appr %	22.5	77.5	00.0	00.0		27.8	00.6	71.7	00.0		00.0	97.6	02.4	00.0		NaN	NaN	NaN	NaN		
Total %	06.0	20.5	00.0	00.0		10.1	00.2	26.0	00.0		00.0	36.4	00.9	00.0		00.0	00.0	00.0	00.0		
% Trucks	01.4	01.1	-	-	01.1	00.9	00.0	03.0	-	02.4	-	00.7	23.8	-	01.3	-	-	-	-	-	01.6
PM Pk Hr	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15	16:15
PM Pk Vol	79	253	0	0	332	141	4	321	0	466	0	426	13	0	439	0	0	0	0	0	1237
PM PHF	0.823	0.878	NaN	NaN	0.933	0.734	1.000	0.922	NaN	0.889	NaN	0.986	0.650	NaN	0.971	NaN	NaN	NaN	NaN	NaN	0.982

Gannett Fleming
 28 Schenck Parkway, Suite 200
 Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
 Buncombe County

All Vehicles

Site Code:
Study Date: 06/30/2020

I-240 WB Onramp			
In = 164	Out = 0		
0	0	U-Turn	
0	0	Left	
0	0	Thru	
0	0	Right	

NC 191			
In = 1071		Out = 612	
138	474	0	0
Right	Thru	Left	U-Turn
			

Total Volumes
 16:00 to 18:00
 Volume = 2308

I-240 WB Offramp			
In = 0	Out = 836		
232	5	Right	
599	0	Thru	
0	0	Left	
0	0	U-Turn	

			
U-Turn	Left	Thru	Right
0	21	839	0
In = 1073		Out = 860	
NC 191			

Gannett Fleming
 28 Schenck Parkway, Suite 200
 Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
 Buncombe County

All Vehicles

Site Code:
Study Date: 06/30/2020

I-240 WB Onramp	0	U-Turn	
	0	Left	
	0	Thru	
	0	Right	

NC 191			
79	253	0	0
Right	Thru	Left	U-Turn
			

PM Peak Hour Statistics
 PM Peak Hour Begins: 16:15
 PM Peak Hour Volume: 1237
 PM Peak Hour Factor: 0.982

			
U-Turn	Left	Thru	Right
0	13	426	0
NC 191			

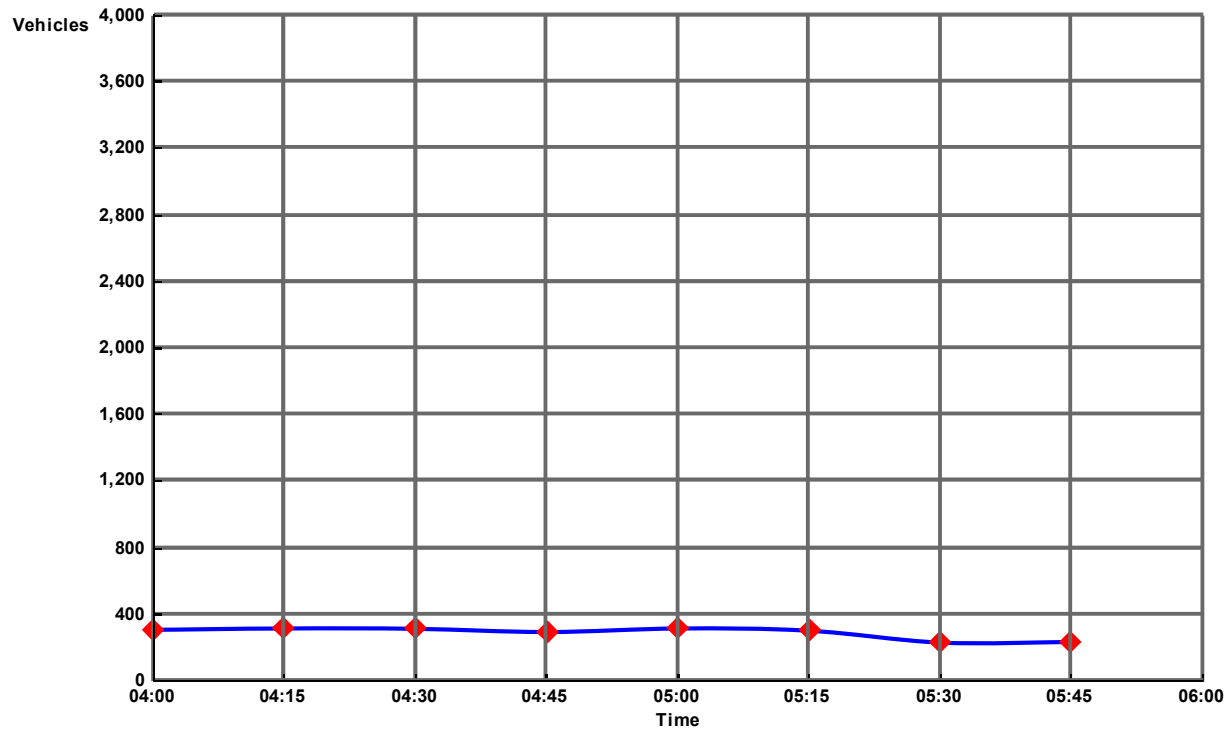
I-240 WB Offramp	141	Right	
	4	Thru	
	321	Left	
	0	U-Turn	

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
Buncombe County

Cars

Site Code:
Study Date: 06/30/2020

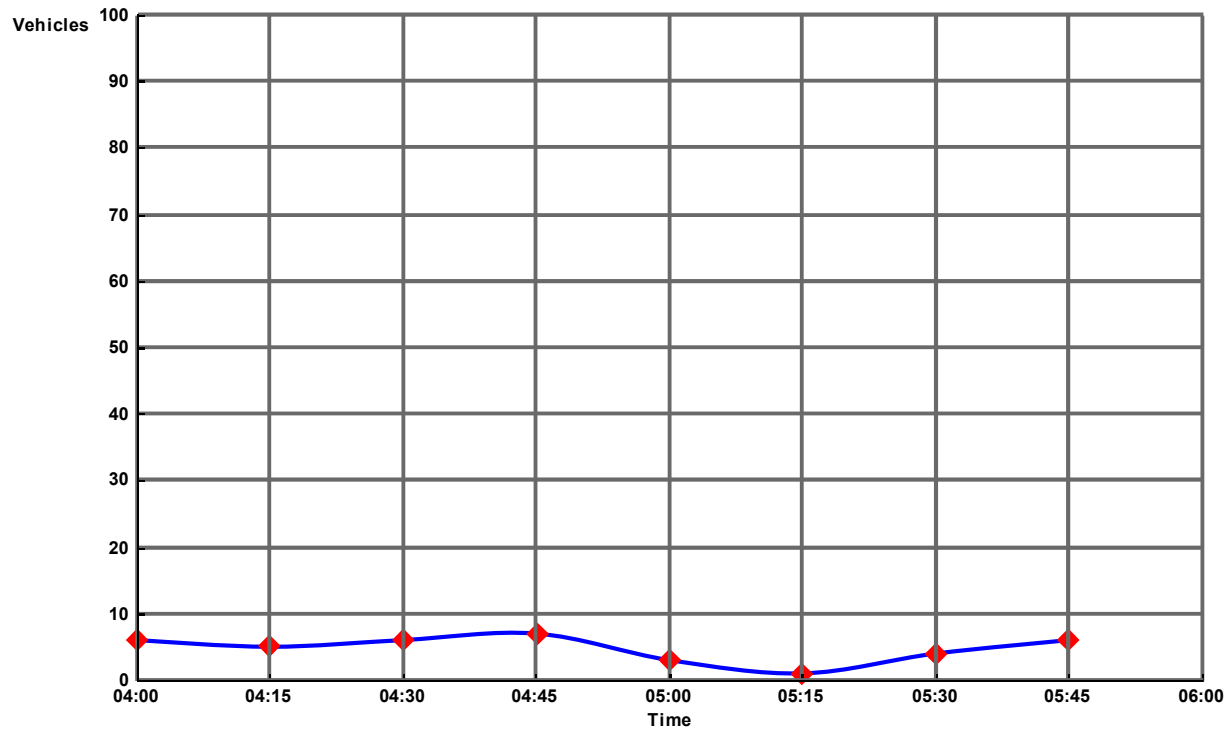


Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

File Name: PM Peak RPT
Location: NC 191 @ I-240 WB Ramps
Buncombe County

Trucks

Site Code:
Study Date: 06/30/2020



2020 Count Adjustment Worksheet

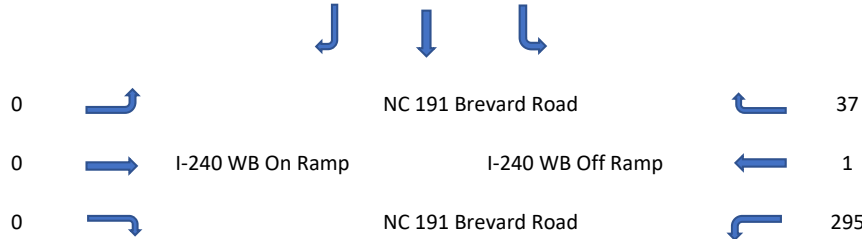
AM Peak I-240 WB Ramps at NC 191

Traffic to I-240 EB	241	295	536
Traffic at I=240 EB	887	208	1095
		Factor=	2.04291

SB Traffic from This Int
plus LT Traffic from WB
have to go to EB interchange

Adjusted Volume	73	241	0	Use Factor of 2
-----------------	----	-----	---	-----------------

Overall Int Factor: AM Factor
 $\frac{536 \times 2 + 171 \times 2.6}{707}$ 2.15



Traffic Counted	5	166	0 Total	171
-----------------	---	-----	---------	-----

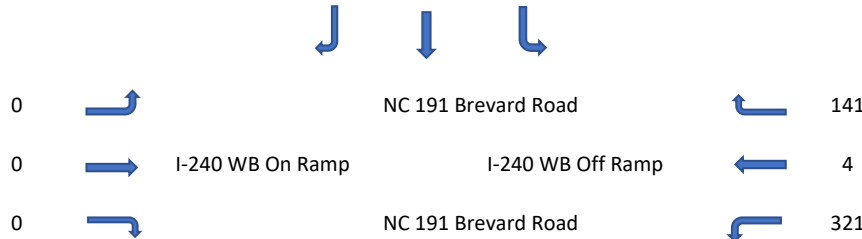
451
171

451 Factor= 2.637427
Use factor of 2.6

Traffic From I-240 EB	I-240	NC 191	0
	154	297	0
	PM Peak I-240 WB Ramps at NC 191		

Traffic to I-240 EB		704	138	842
Traffic at I=240 EB	79	253	0	324

Factor 1.466899



Traffic Counted	13	426	0	439
Traffic From I-240 EB		517	168	685
		Factor	1.560364	

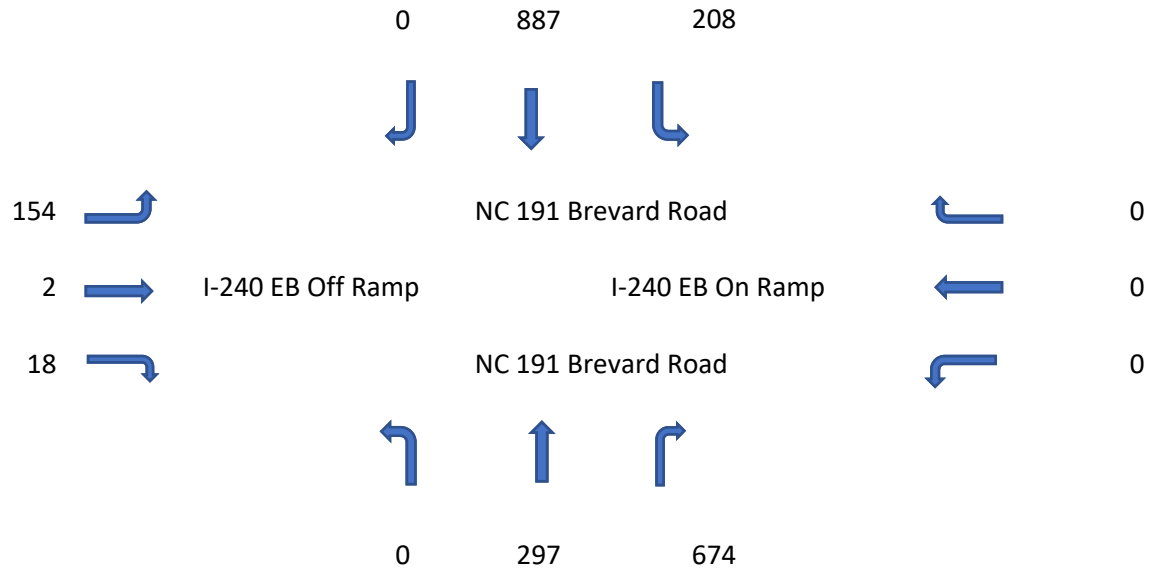
NB Traffic from the EB Int
plus LT Traffic from EB
have to go to WB interchange

Overall Int Factor: PM Factor
 $\frac{1.47 \times 842 + 1.56 \times 685}{1527}$ 1.51

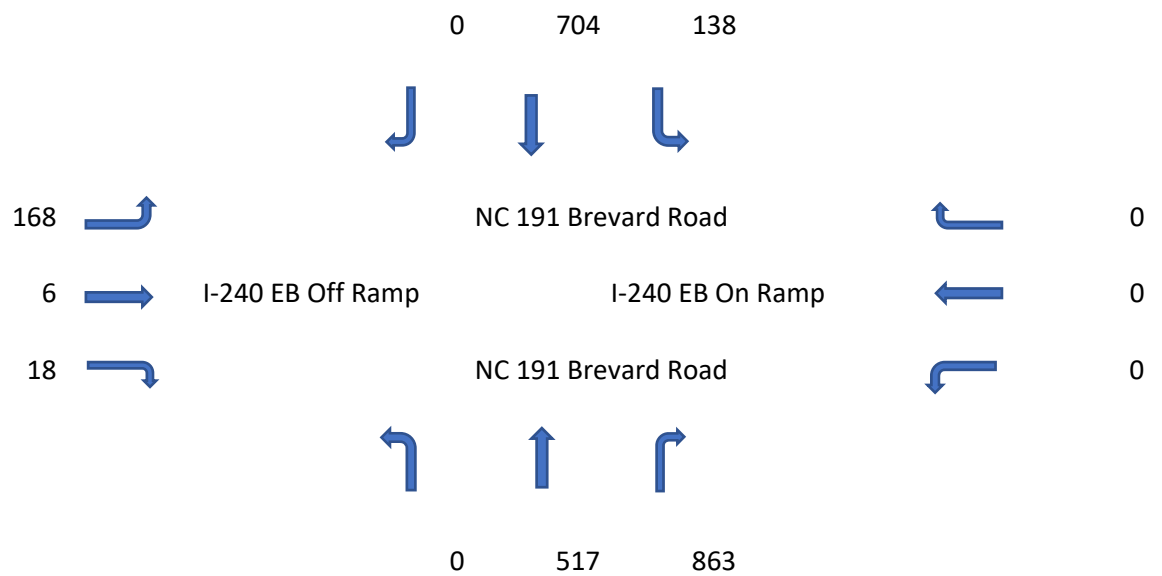
Use 1.5

Street/Approach	Direction	Movement	GROWTH FACTOR TO PRESENT: 1.5% Compounded Annually			
			2020 Coun	2020 Adjus	2020 Balar	2028
AM Peak I-240 WB Ramps at NC 191						
NC 191 Brevard Road	Southbound	Left Turn	0	0	0	0
NC 191 Brevard Road	Southbound	Through	241	518	493	564
NC 191 Brevard Road	Southbound	Right Turn	73	157	157	179
NC 191 Brevard Road	Northbound	Left Turn	5	11	13	15
NC 191 Brevard Road	Northbound	Through	166	357	438	501
NC 191 Brevard Road	Northbound	Right Turn	0	0	0	0
I-240 WB On Ramp	Eastbound	Left Turn	0	0	0	0
I-240 WB On Ramp	Eastbound	Through	0	0	0	0
I-240 WB On Ramp	Eastbound	Right Turn	0	0	0	0
I-240 WB Off Ramp	Westbound	Left Turn	295	634	604	691
I-240 WB Off Ramp	Westbound	Through	1	2	2	2
I-240 WB Off Ramp	Westbound	Right Turn	37	80	80	91
PM Peak I-240 WB Ramps at NC 191						
NC 191 Brevard Road	Southbound	Left Turn	0	0	0	0
NC 191 Brevard Road	Southbound	Through	253	382	371	424
NC 191 Brevard Road	Southbound	Right Turn	79	119	119	136
NC 191 Brevard Road	Northbound	Left Turn	13	20	21	24
NC 191 Brevard Road	Northbound	Through	426	643	664	759
NC 191 Brevard Road	Northbound	Right Turn	0	0	0	0
I-240 WB On Ramp	Eastbound	Left Turn	0	0	0	0
I-240 WB On Ramp	Eastbound	Through	0	0	0	0
I-240 WB On Ramp	Eastbound	Right Turn	0	0	0	0
I-240 WB Off Ramp	Westbound	Left Turn	321	485	471	539
I-240 WB Off Ramp	Westbound	Through	4	6	6	7
I-240 WB Off Ramp	Westbound	Right Turn	141	213	213	243

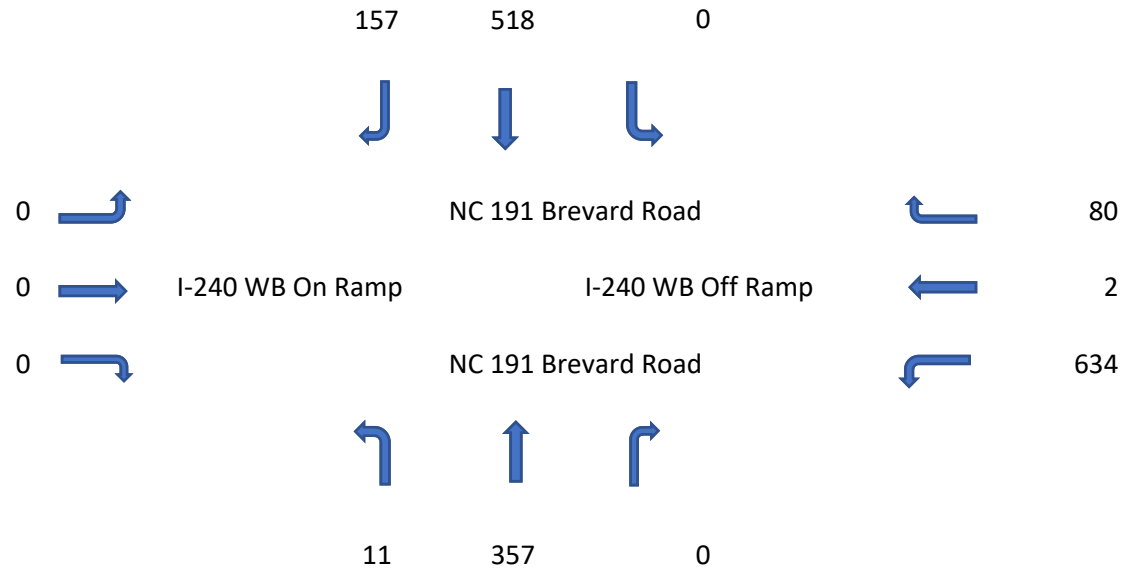
2020 Existing
AM Peak I-240 EB Ramps at NC 191



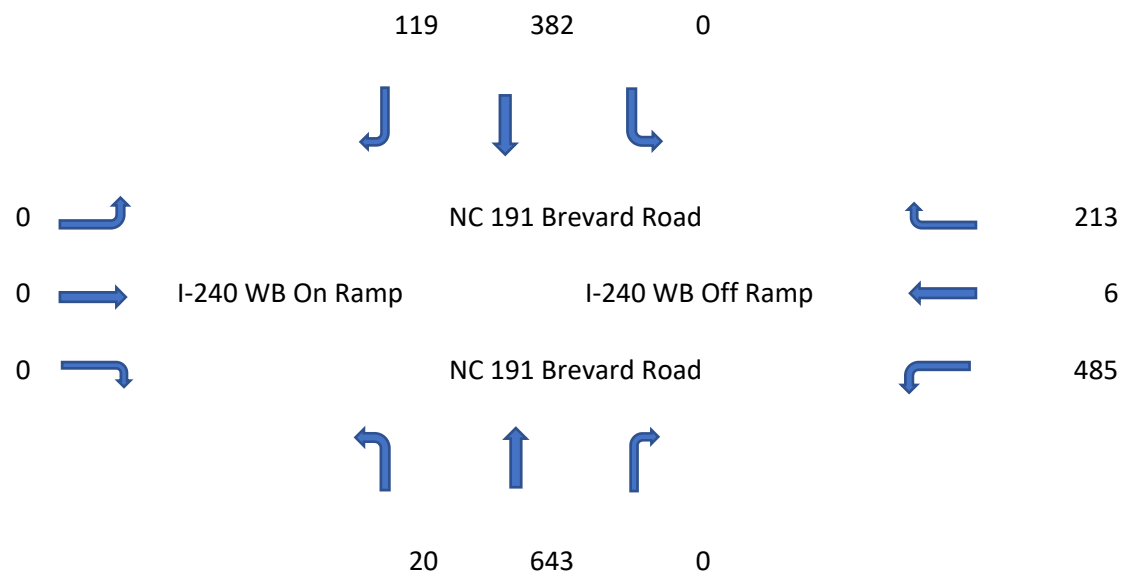
PM Peak I-240 EB Ramps at NC 191



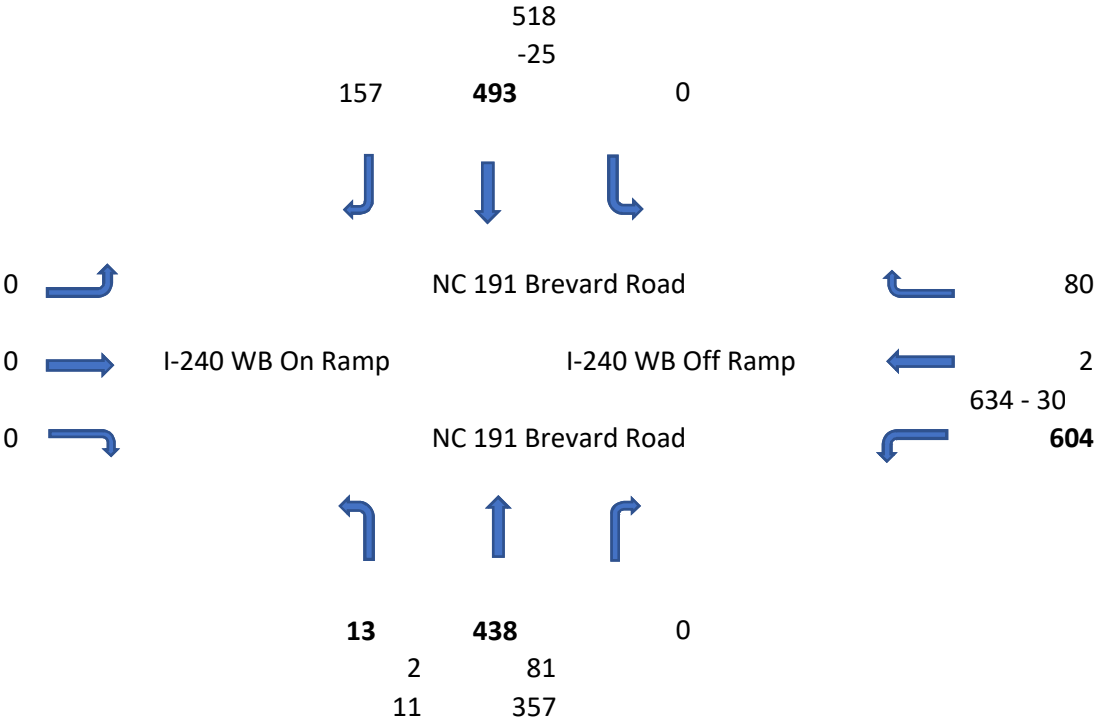
2020 Adjusted
AM Peak I-240 WB Ramps at NC 191



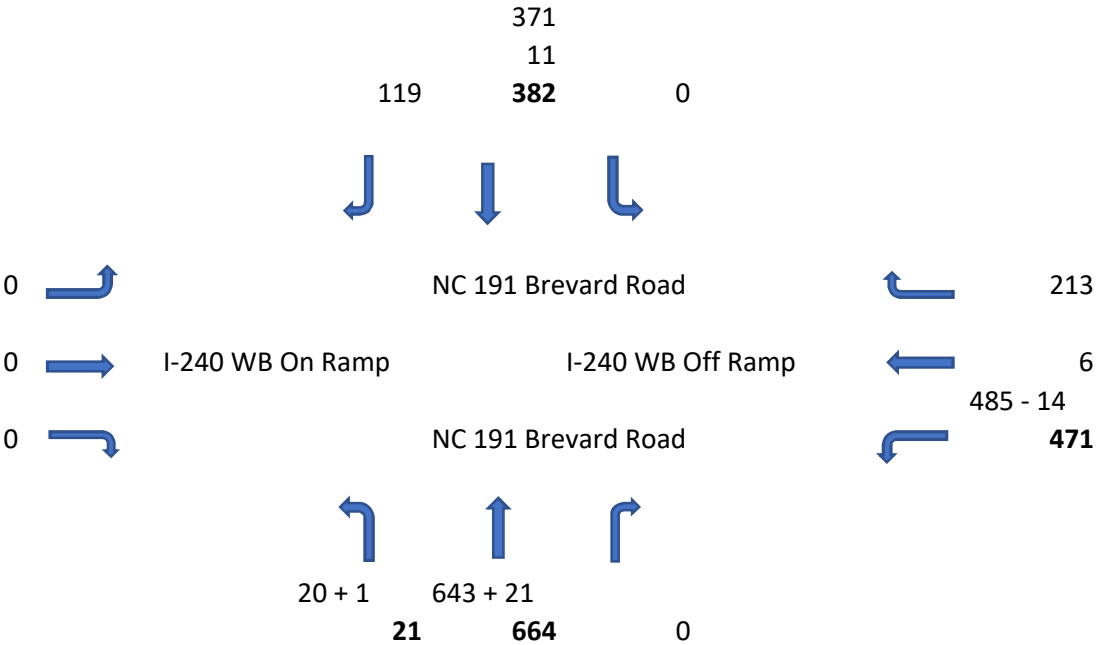
PM Peak I-240 WB Ramps at NC 191



2020 Balanced
AM Peak I-240 WB Ramps at NC 191



PM Peak I-240 WB Ramps at NC 191



Count Type: Turning Movement (Classification) - Intersection

20 South Bear Creek Road TIA

Duration: 2-Hour AM / PM Peaks

Milepost Begin: N/A

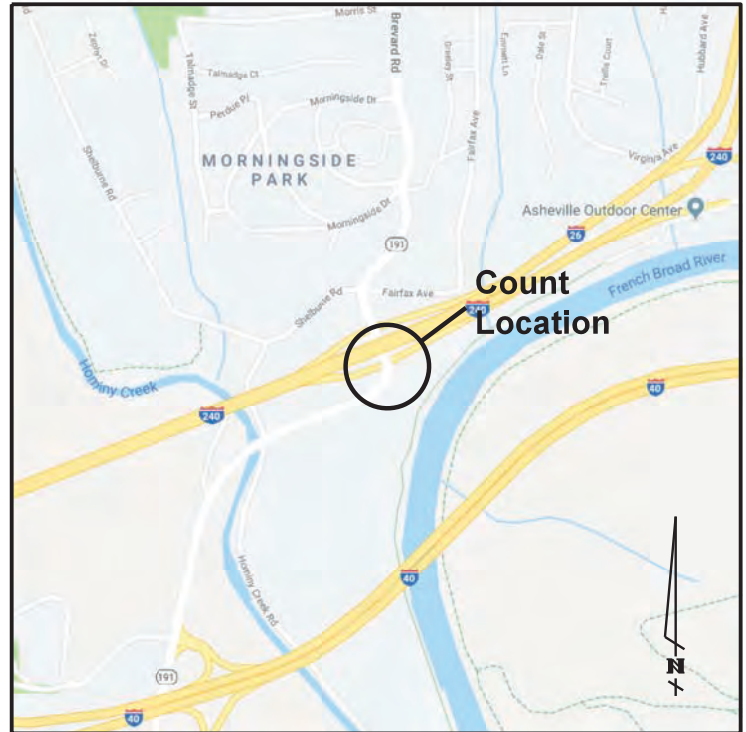
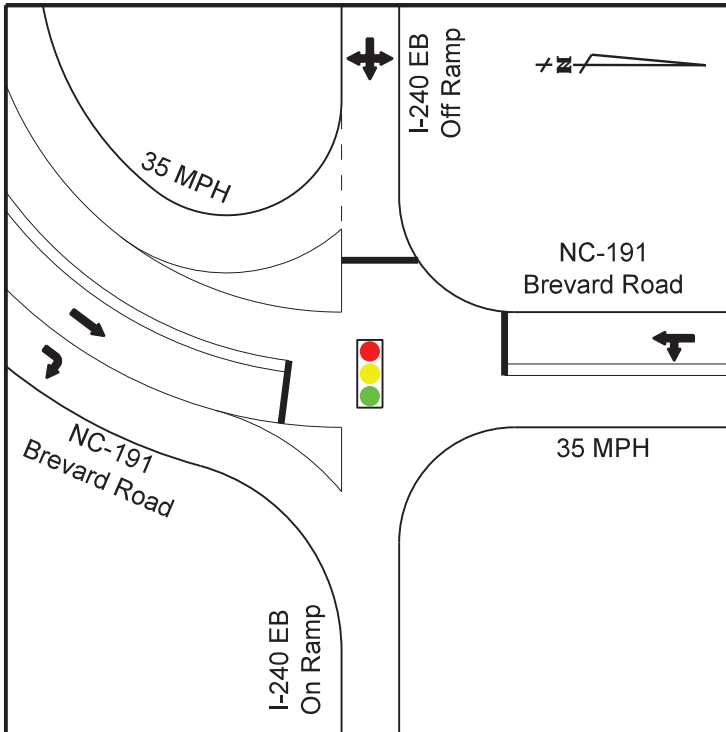
Buncombe County

Volume (ADT): 3,713(AM) / 4,458(PM)

Milepost End: N/A

Division 13

5/7/19 7:00 AM to 9:00 AM; 4:00 PM to 6:00 PM, Lt Rain, 53 F Low, 75 F High, 0.31" Precipitation, Sky Cover 0.3

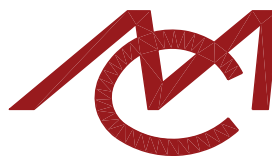


VICINITY MAP - N.T.S.

Comments:

- Counted by: Walter Baker
- Data processor: Sarah Greene
- Method Used: CountCam 100. Petra Pro software.
- Equipment Operating Properly: Yes.
- School in session: Yes.
- Area lighting present: Yes.
- Construction present: No.
- Disabled pedestrians: No.
- Pedestrian movements: Yes.
- Break times: N/A
- Traffic flow disruption: No.
- Traffic control: Traffic Signal.
- Signal Inventory number: 13-0073
- Distance to nearest stop sign less than 300 ft?
NB: N SB: N EB: N WB: N
- Distance to nearest traffic signal less than 300 ft?
NB: N SB: N EB: N WB: Y
- Distance to nearest at-grade RR crossing less than 200 ft?
NB: N SB: N EB: N WB: N

Intersection of NC 191 (Brevard Road)
and I-240 EB Ramps



Mattern & Craig

ENGINEERS - SURVEYORS

FIRM LICENSE No. C-1154

12 BROAD STREET

ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201

FAX (828) 254-4562

Comm. No. 3968

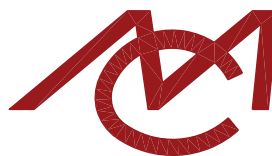


Northbound Approach looking North



Northbound Approach looking South

Intersection of NC 191 (Brevard Road)
and I-240 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

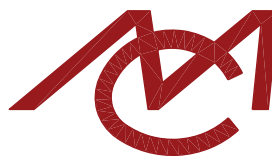


Southbound Approach looking South



Southbound Approach looking North

Intersection of NC 191 (Brevard Road)
and I-240 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

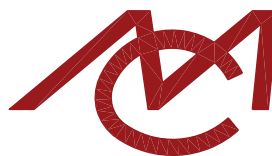


Eastbound Approach looking East



Eastbound Approach looking West

Intersection of NC 191 (Brevard Road)
and I-240 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

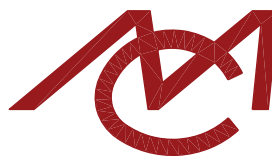


Westbound Approach looking West



Westbound Approach looking East

Intersection of NC 191 (Brevard Road)
and I-240 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 1-AM
Site Code : 3968-1
Start Date : 5/7/2019
Page No : 1

Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	I-240 EB Off Ramp Southbound					NC-191 Brevard Road Westbound					I-240 EB On Ramp Northbound					NC-191 Brevard Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	5	0	15	0	20	0	121	19	0	140	0	0	0	0	0	65	34	0	2	99	2	259	261
07:15 AM	1	0	23	0	24	0	198	33	0	231	0	0	0	0	0	111	42	0	0	153	0	408	408
07:30 AM	2	1	35	0	38	0	234	56	0	290	0	0	0	0	0	181	71	0	0	252	0	580	580
07:45 AM	8	0	34	0	42	0	221	58	0	279	0	0	0	0	0	176	91	0	0	267	0	588	588
Total	16	1	107	0	124	0	774	166	0	940	0	0	0	0	0	533	238	0	2	771	2	1835	1837
08:00 AM	3	1	43	0	47	0	197	49	0	246	0	0	0	0	0	157	77	0	2	234	2	527	529
08:15 AM	5	0	40	0	45	0	222	42	0	264	0	0	0	0	0	150	54	0	1	204	1	513	514
08:30 AM	2	0	21	2	23	0	169	45	0	214	0	0	0	0	0	147	53	0	1	200	3	437	440
08:45 AM	4	1	26	0	31	0	152	36	0	188	0	0	0	0	0	136	46	0	0	182	0	401	401
Total	14	2	130	2	146	0	740	172	0	912	0	0	0	0	0	590	230	0	4	820	6	1878	1884
Grand Total	30	3	237	2	270	0	1514	338	0	1852	0	0	0	0	0	1123	468	0	6	1591	8	3713	3721
Apprch %	11.1	1.1	87.8			0	81.7	18.3			0	0	0			70.6	29.4	0					
Total %	0.8	0.1	6.4		7.3	0	40.8	9.1		49.9	0	0	0		0	30.2	12.6	0		42.8	0.2	99.8	
PV	26	2	222		250	0	1444	310		1754	0	0	0		0	1051	431	0		1482	0	0	3486
% PV	86.7	66.7	93.7	0	91.9	0	95.4	91.7	0	94.7	0	0	0	0	0	93.6	92.1	0	0	92.8	0	0	93.7
Duals	4	1	15		20	0	68	22		90	0	0	0		0	70	36	0		106	0	0	216
% Duals	13.3	33.3	6.3	0	7.4	0	4.5	6.5	0	4.9	0	0	0	0	0	6.2	7.7	0	0	6.6	0	0	5.8
TTST	0	0	0		0	0	2	6		8	0	0	0		0	2	0	0		2	0	0	10
% TTST	0	0	0	0	0	0	0.1	1.8	0	0.4	0	0	0	0	0	0.2	0	0	0	0.1	0	0	0.3
Twins	0	0	0		0	0	0	0		0	0	0	0		0	0	1	0		1	0	0	1
% Twins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.1	0	0	0
Pedestrians	0	0	0		2	0	0	0		0	0	0	0		0	0	0	0		6	0	0	8
% Pedestrians	0	0	0	100	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.4	0	0	0.2

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

The diagram illustrates the traffic flow and volume data for the I-240 EB Off Ramp. It includes a north arrow and a scale bar (0 to 100 feet). The diagram shows the intersection of NC-191 Brevard Road and I-240 EB On Ramp. Traffic flow is indicated by arrows, and volume data is provided in tables for each approach.

NC-191 Brevard Road

Out	In	Total
1470	1482	2952
72	106	178
2	2	4
0	1	1
0	0	0
0	1591	3135

I-240 EB Off Ramp

Out	In	Total
0	250	250
0	20	20
0	0	0
0	0	0
0	0	0
0	270	270

I-240 EB On Ramp

Out	In	Total
1363	0	1363
93	0	93
8	0	8
0	0	0
0	0	0
1464	0	1464

Intersection Data

Right	Thru	Left
26	2	222
4	1	15
0	0	0
0	0	0
0	0	0
0	3	237
30		

NC-191 Brevard Road (Continued)

Out	In	Total
653	1754	2407
51	90	141
0	8	8
1	0	1
0	0	0
705	1852	2557

Intersection Data (Continued)

Right	Thru	Left
0	1444	310
0	68	22
0	2	6
0	0	0
0	0	0
0	1514	338

Legend

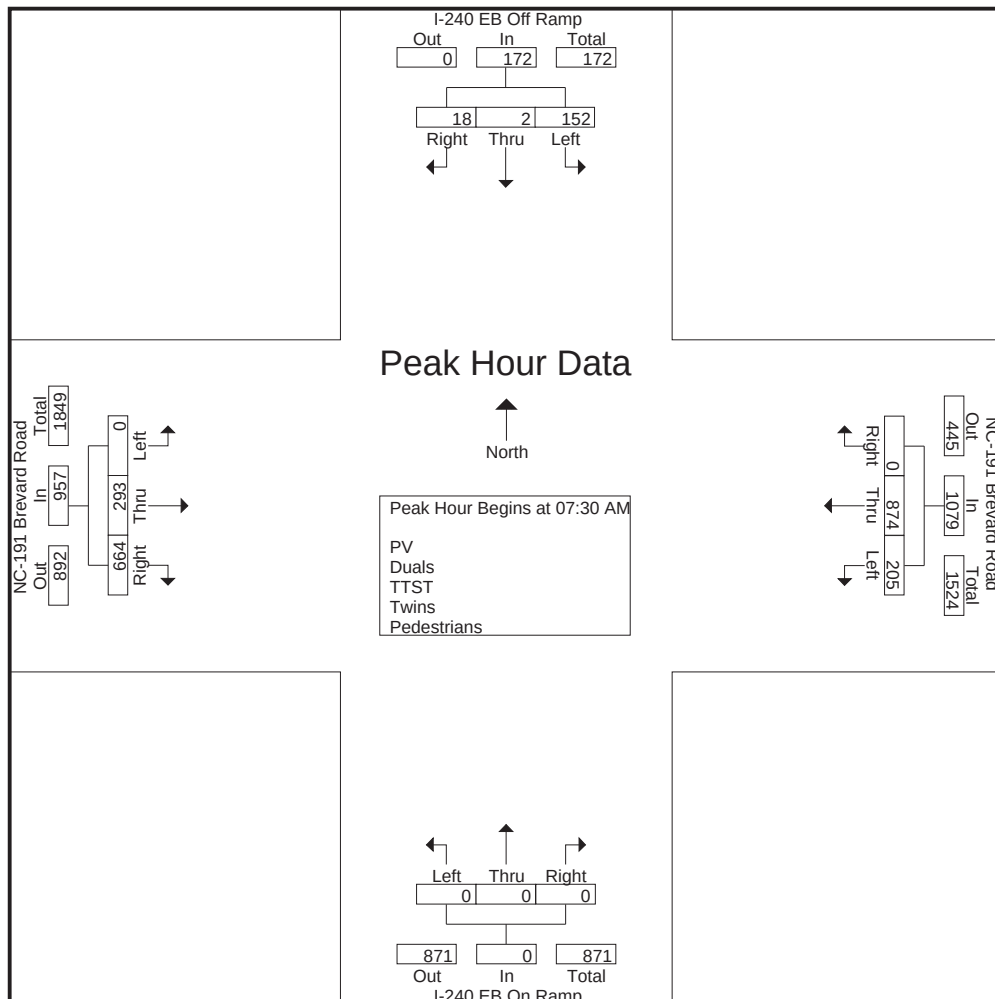
- 5/7/2019 07:00 AM
- 5/7/2019 08:45 AM
- PV
- Duals
- TTST
- Twins
- Pedestrians

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 1-AM
Site Code : 3968-1
Start Date : 5/7/2019
Page No : 3

	I-240 EB Off Ramp Southbound				NC-191 Brevard Road Westbound				I-240 EB On Ramp Northbound				NC-191 Brevard Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	2	1	35	38	0	234	56	290	0	0	0	0	181	71	0	252	580
07:45 AM	8	0	34	42	0	221	58	279	0	0	0	0	176	91	0	267	588
08:00 AM	3	1	43	47	0	197	49	246	0	0	0	0	157	77	0	234	527
08:15 AM	5	0	40	45	0	222	42	264	0	0	0	0	150	54	0	204	513
Total Volume	18	2	152	172	0	874	205	1079	0	0	0	0	664	293	0	957	2208
% App. Total	10.5	1.2	88.4		0	81	19		0	0	0		69.4	30.6	0		
PHF	.563	.500	.884	.915	.000	.934	.884	.930	.000	.000	.000	.000	.917	.805	.000	.896	.939



Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 1-PM
Site Code : 3968-1
Start Date : 5/7/2019
Page No : 1

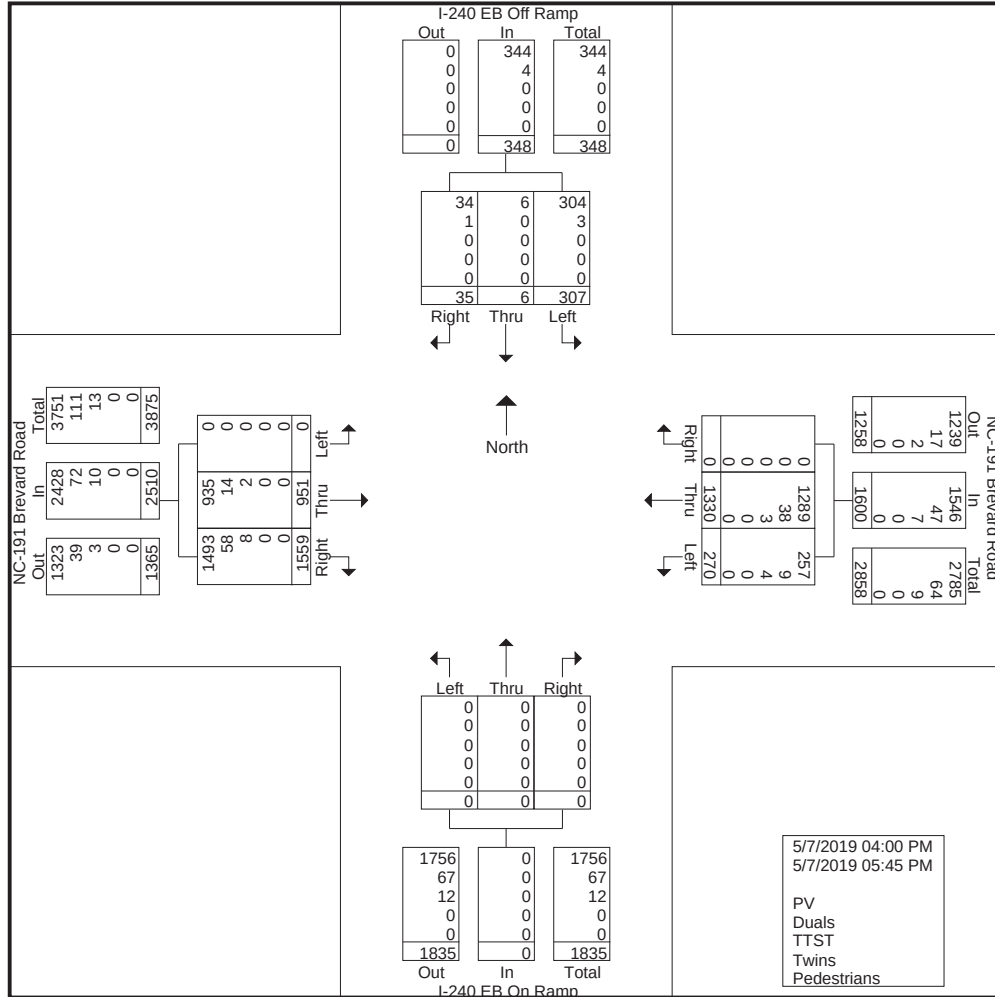
Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	I-240 EB Off Ramp Southbound					NC-191 Brevard Road Westbound					I-240 EB On Ramp Northbound					NC-191 Brevard Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	7	0	19	0	26	0	178	43	0	221	0	0	0	0	0	173	117	0	0	290	0	537	537
04:15 PM	6	0	37	0	43	0	154	28	0	182	0	0	0	0	0	170	106	0	0	276	0	501	501
04:30 PM	1	0	42	0	43	0	171	30	0	201	0	0	0	0	0	205	105	0	0	310	0	554	554
04:45 PM	7	5	51	0	63	0	196	34	0	230	0	0	0	0	0	210	120	0	1	330	1	623	624
Total	21	5	149	0	175	0	699	135	0	834	0	0	0	0	0	758	448	0	1	1206	1	2215	2216
05:00 PM	7	0	35	0	42	0	145	34	0	179	0	0	0	0	0	204	129	0	0	333	0	554	554
05:15 PM	1	1	31	0	33	0	207	35	0	242	0	0	0	0	0	213	115	0	0	328	0	603	603
05:30 PM	3	0	49	0	52	0	146	33	0	179	0	0	0	0	0	223	145	0	0	368	0	599	599
05:45 PM	3	0	43	0	46	0	133	33	0	166	0	0	0	0	0	161	114	0	0	275	0	487	487
Total	14	1	158	0	173	0	631	135	0	766	0	0	0	0	0	801	503	0	0	1304	0	2243	2243
Grand Total	35	6	307	0	348	0	1330	270	0	1600	0	0	0	0	0	1559	951	0	1	2510	1	4458	4459
Apprch %	10.1	1.7	88.2			0	83.1	16.9			0	0	0			62.1	37.9	0					
Total %	0.8	0.1	6.9		7.8	0	29.8	6.1		35.9	0	0	0		0	35	21.3	0		56.3	0	100	
PV	34	6	304		344	0	1289	257		1546	0	0	0		0	1493	935	0		2428	0	0	4318
% PV	97.1	100	99	0	98.9	0	96.9	95.2	0	96.6	0	0	0	0	0	95.8	98.3	0	0	96.7	0	0	96.8
Duals	1	0	3		4	0	38	9		47	0	0	0		0	58	14	0		72	0	0	123
% Duals	2.9	0	1	0	1.1	0	2.9	3.3	0	2.9	0	0	0	0	0	3.7	1.5	0	0	2.9	0	0	2.8
TTST	0	0	0		0	0	3	4		7	0	0	0		0	8	2	0		10	0	0	17
% TTST	0	0	0	0	0	0	0.2	1.5	0	0.4	0	0	0	0	0	0.5	0.2	0	0	0.4	0	0	0.4
Twins	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
% Twins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		1	0	0	1
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 1-PM
Site Code : 3968-1
Start Date : 5/7/2019
Page No : 2

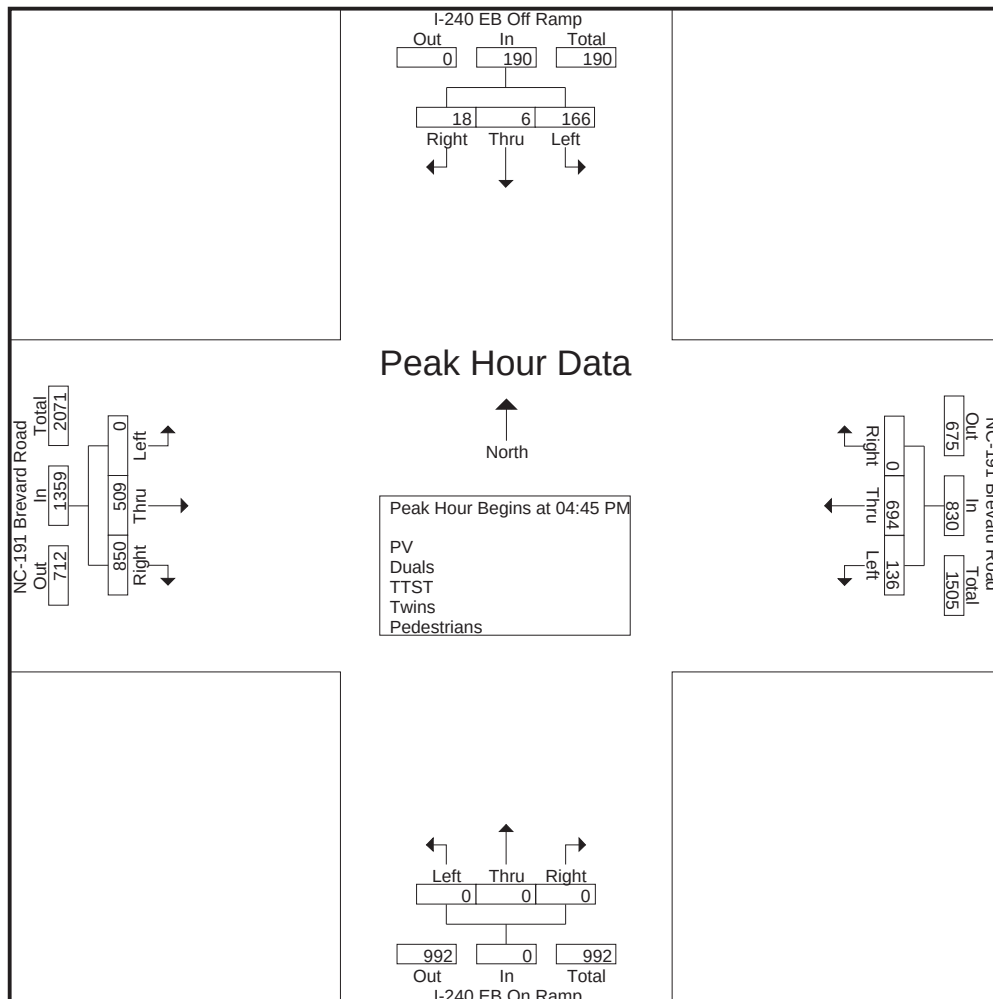


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 1-PM
Site Code : 3968-1
Start Date : 5/7/2019
Page No : 3

	I-240 EB Off Ramp Southbound				NC-191 Brevard Road Westbound				I-240 EB On Ramp Northbound				NC-191 Brevard Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	7	5	51	63	0	196	34	230	0	0	0	0	210	120	0	330	623
05:00 PM	7	0	35	42	0	145	34	179	0	0	0	0	204	129	0	333	554
05:15 PM	1	1	31	33	0	207	35	242	0	0	0	0	213	115	0	328	603
05:30 PM	3	0	49	52	0	146	33	179	0	0	0	0	223	145	0	368	599
Total Volume	18	6	166	190	0	694	136	830	0	0	0	0	850	509	0	1359	2379
% App. Total	9.5	3.2	87.4		0	83.6	16.4		0	0	0		62.5	37.5	0		
PHF	.643	.300	.814	.754	.000	.838	.971	.857	.000	.000	.000	.000	.953	.878	.000	.923	.955



Count Type: Turning Movement (Classification) - Intersection

Duration: 2-Hour AM / PM Peaks

Milepost Begin: N/A

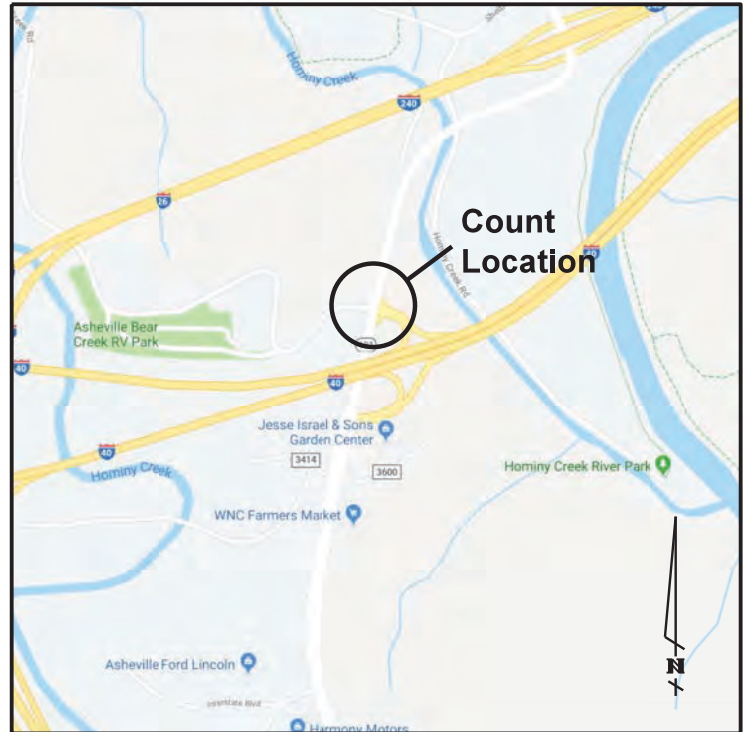
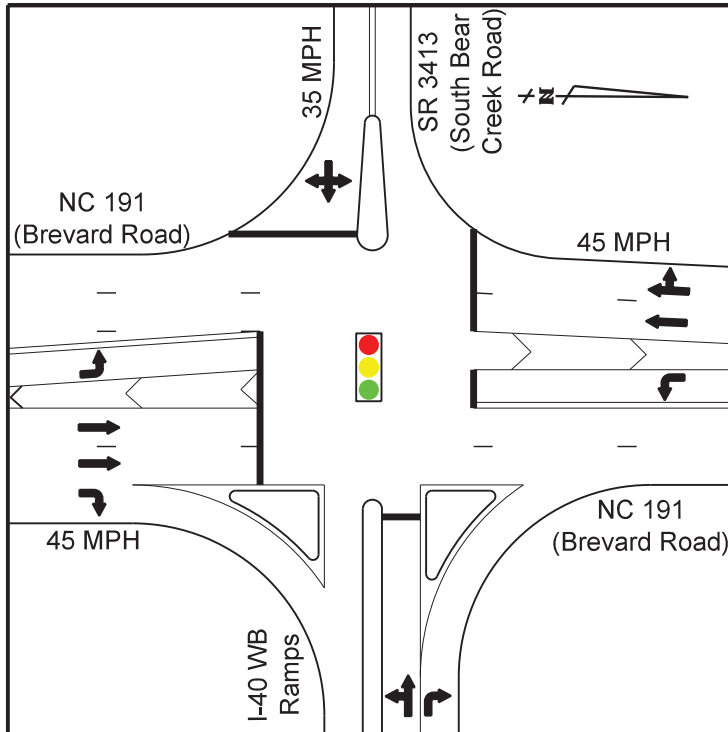
Volume (ADT): 5,091(AM) / 6,484(PM) Milepost End: N/A

20 South Bear Creek Road TIA

Buncombe County

Division 13

5/7/19 7:00 AM to 9:00 AM; 4:00 PM to 6:00 PM, Lt Rain, 53 F Low, 75 F High, 0.31" Precipitation, Sky Cover 0.3

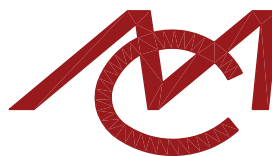


VICINITY MAP - N.T.S.

Comments:

1. Counted by: Walter Baker
2. Data processor: Sarah Greene
3. Method Used: TDC-12 Electronic Count Board. Petra Pro software.
4. Equipment Operating Properly: Yes.
5. School in session: Yes.
6. Area lighting present: No.
7. Construction present: No.
8. Disabled pedestrians: No.
9. Pedestrian movements: Yes.
10. Break times: N/A
11. Traffic flow disruption: No.
12. Traffic control: Traffic Signal.
13. Signal Inventory number: 13-0802
14. Distance to nearest stop sign less than 300 ft?
NB: N SB: N EB: N WB: N
15. Distance to nearest traffic signal less than 300 ft?
NB: N SB: N EB: N WB: N
16. Distance to nearest at-grade RR crossing less than 200 ft?
NB: N SB: N EB: N WB: N

Intersection of NC 191 (Brevard Road)
and SR 3413 (South Bear Creek Road)/
I-40 WB Ramps



Mattern & Craig

ENGINEERS - SURVEYORS

FIRM LICENSE No. C-1154

12 BROAD STREET

ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201

FAX (828) 254-4562

Comm. No. 3968

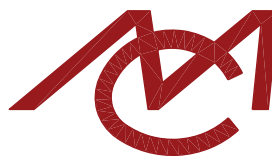


Northbound Approach looking North



Northbound Approach looking South

Intersection of NC 191 (Brevard Road)
and SR 3413 (South Bear Creek Road)/
I-40 WB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

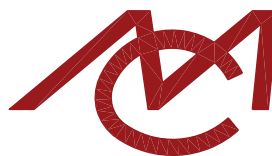


Southbound Approach looking South



Southbound Approach looking North

Intersection of NC 191 (Brevard Road)
and SR 3413 (South Bear Creek Road)/
I-40 WB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

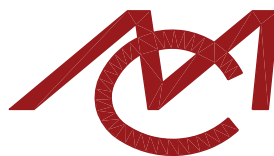


Eastbound Approach looking East



Eastbound Approach looking West

Intersection of NC 191 (Brevard Road)
and SR 3413 (South Bear Creek Road)/
I-40 WB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS – SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

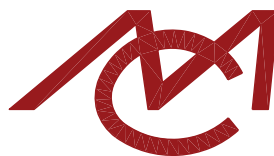


Westbound Approach looking West



Westbound Approach looking East

Intersection of NC 191 (Brevard Road)
and SR 3413 (South Bear Creek Road)/
I-40 WB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 2-AM
Site Code : 3968-2
Start Date : 5/7/2019
Page No : 1

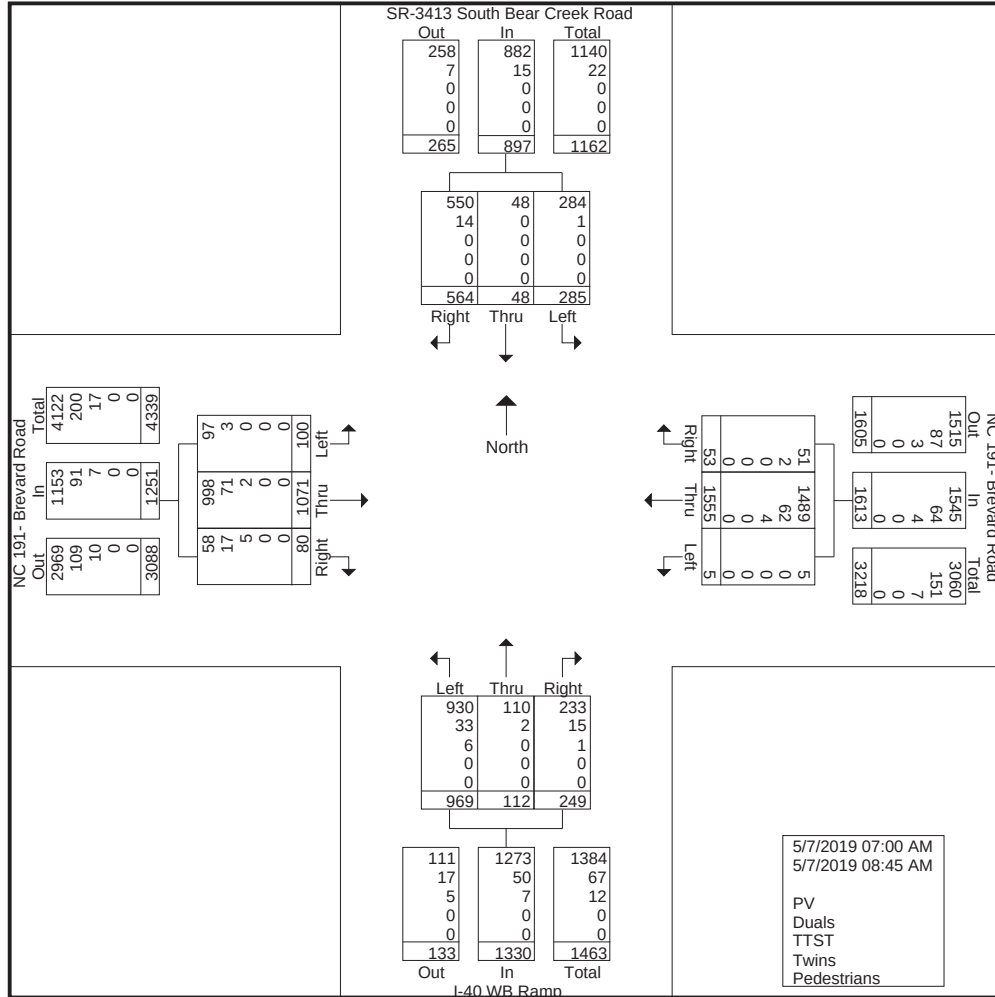
Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	SR-3413 South Bear Creek Road Southbound						NC 191- Brevard Road Westbound					I-40 WB Ramp Northbound					NC 191- Brevard Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total	
07:00 AM	29	5	12	0	46	6	123	1	0	130	24	5	87	0	116	6	73	6	0	85	0	377	377	
07:15 AM	51	14	32	0	97	6	210	2	0	218	29	18	104	0	151	14	129	6	0	149	0	615	615	
07:30 AM	99	7	51	0	157	7	247	0	0	254	26	7	156	0	189	10	147	11	0	168	0	768	768	
07:45 AM	85	4	53	0	142	5	218	0	0	223	28	24	203	0	255	5	173	19	0	197	0	817	817	
Total	264	30	148	0	442	24	798	3	0	825	107	54	550	0	711	35	522	42	0	599	0	2577	2577	
08:00 AM	107	4	36	0	147	10	210	0	0	220	31	13	149	0	193	12	154	10	0	176	0	736	736	
08:15 AM	91	1	33	0	125	3	235	2	0	240	38	13	118	0	169	12	142	17	0	171	0	705	705	
08:30 AM	63	4	41	0	108	10	163	0	0	173	31	9	69	0	109	13	130	11	1	154	1	544	545	
08:45 AM	39	9	27	0	75	6	149	0	0	155	42	23	83	0	148	8	123	20	0	151	0	529	529	
Total	300	18	137	0	455	29	757	2	0	788	142	58	419	0	619	45	549	58	1	652	1	2514	2515	
Grand Total	564	48	285	0	897	53	1555	5	0	1613	249	112	969	0	1330	80	1071	100	1	1251	1	5091	5092	
Apprch %	62.9	5.4	31.8			3.3	96.4	0.3			18.7	8.4	72.9			6.4	85.6	8						
Total %	11.1	0.9	5.6		17.6	1	30.5	0.1		31.7	4.9	2.2	19		26.1	1.6	21	2		24.6	0	100		
PV	550	48	284		882	51	1489	5		1545	233	110	930		1273	58	998	97		1153	0	0	4853	
% PV	97.5	100	99.6	0	98.3	96.2	95.8	100	0	95.8	93.6	98.2	96	0	95.7	72.5	93.2	97	0	92.1	0	0	95.3	
Duals	14	0	1		15	2	62	0		64	15	2	33		50	17	71	3		91	0	0	220	
% Duals	2.5	0	0.4	0	1.7	3.8	4	0	0	4	6	1.8	3.4	0	3.8	21.2	6.6	3	0	7.3	0	0	4.3	
TTST	0	0	0		0	0	4	0		4	1	0	6		7	5	2	0		7	0	0	18	
% TTST	0	0	0	0	0	0	0.3	0	0	0.2	0.4	0	0.6	0	0.5	6.2	0.2	0	0	0.6	0	0	0.4	
Twins	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
% Twins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pedestrians	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		1	0	0	1	
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.1	0	0	0	

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 2-AM
Site Code : 3968-2
Start Date : 5/7/2019
Page No : 2

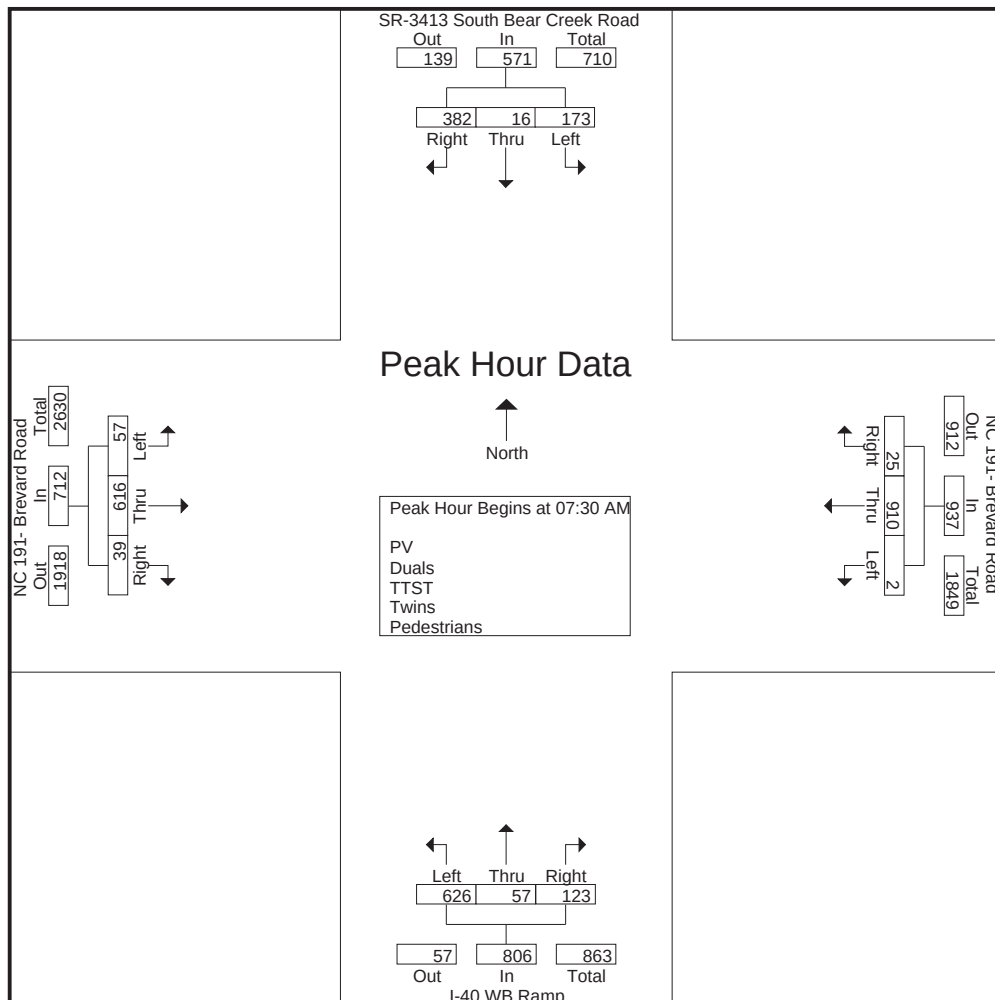


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 2-AM
Site Code : 3968-2
Start Date : 5/7/2019
Page No : 3

	SR-3413 South Bear Creek Road Southbound				NC 191- Brevard Road Westbound				I-40 WB Ramp Northbound				NC 191- Brevard Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	99	7	51	157	7	247	0	254	26	7	156	189	10	147	11	168	768
07:45 AM	85	4	53	142	5	218	0	223	28	24	203	255	5	173	19	197	817
08:00 AM	107	4	36	147	10	210	0	220	31	13	149	193	12	154	10	176	736
08:15 AM	91	1	33	125	3	235	2	240	38	13	118	169	12	142	17	171	705
Total Volume	382	16	173	571	25	910	2	937	123	57	626	806	39	616	57	712	3026
% App. Total	66.9	2.8	30.3		2.7	97.1	0.2		15.3	7.1	77.7		5.5	86.5	8		
PHF	.893	.571	.816	.909	.625	.921	.250	.922	.809	.594	.771	.790	.813	.890	.750	.904	.926



12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 2-PM
Site Code : 3968-2
Start Date : 5/7/2019
Page No : 1

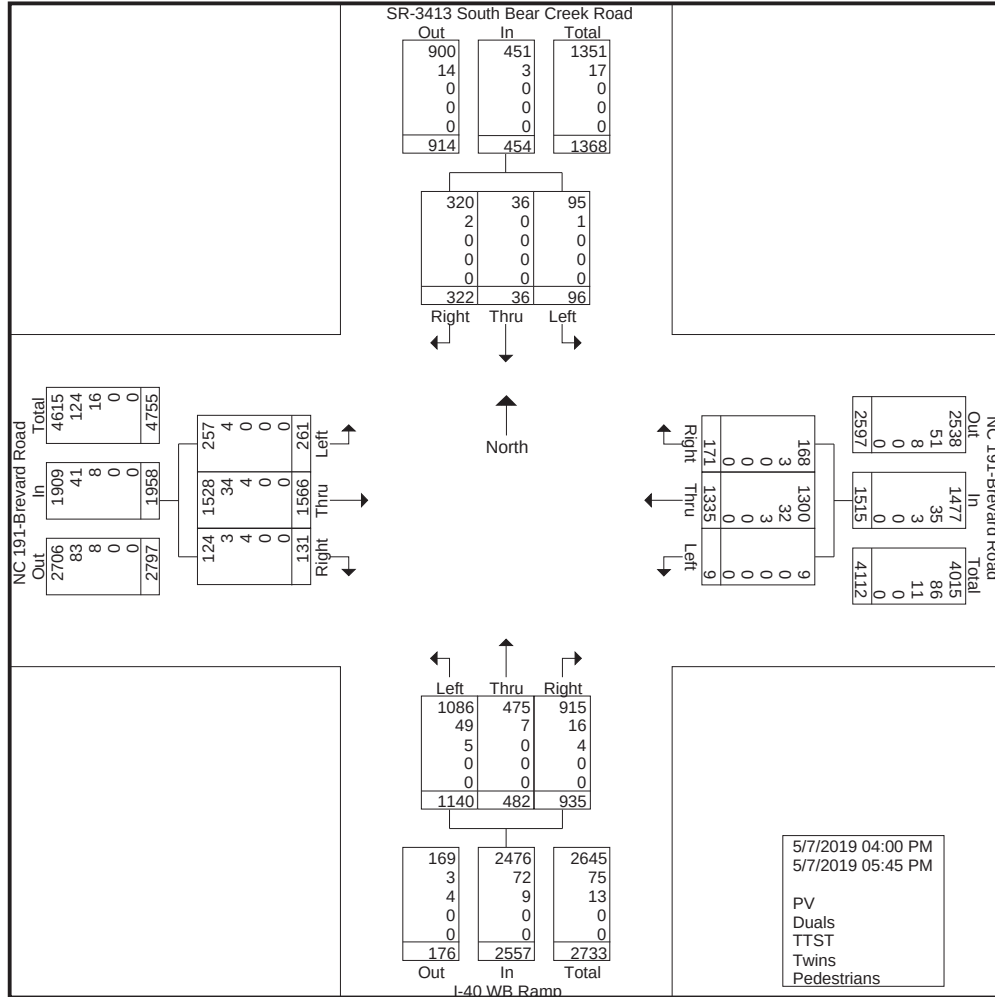
Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	SR-3413 South Bear Creek Road Southbound						NC 191-Brevard Road Westbound					I-40 WB Ramp Northbound					NC 191-Brevard Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total	
04:00 PM	34	0	8	0	42	19	175	1	0	195	90	42	123	0	255	15	176	23	0	214	0	706	706	
04:15 PM	28	3	8	0	39	16	137	1	0	154	111	49	147	0	307	25	151	33	0	209	0	709	709	
04:30 PM	43	6	12	0	61	30	177	1	0	208	116	65	103	0	284	12	204	27	0	243	0	796	796	
04:45 PM	34	3	10	0	47	25	204	2	0	231	112	79	144	0	335	12	201	30	0	243	0	856	856	
Total	139	12	38	0	189	90	693	5	0	788	429	235	517	0	1181	64	732	113	0	909	0	3067	3067	
05:00 PM	53	7	21	0	81	28	151	3	0	182	149	67	191	0	407	15	220	49	0	284	0	954	954	
05:15 PM	57	5	9	0	71	24	212	0	0	236	143	59	187	0	389	16	209	22	0	247	0	943	943	
05:30 PM	37	7	19	0	63	19	145	1	0	165	131	48	156	0	335	19	211	42	0	272	0	835	835	
05:45 PM	36	5	9	0	50	10	134	0	0	144	83	73	89	0	245	17	194	35	0	246	0	685	685	
Total	183	24	58	0	265	81	642	4	0	727	506	247	623	0	1376	67	834	148	0	1049	0	3417	3417	
Grand Total	322	36	96	0	454	171	1335	9	0	1515	935	482	1140	0	2557	131	1566	261	0	1958	0	6484	6484	
Apprch %	70.9	7.9	21.1			11.3	88.1	0.6			36.6	18.9	44.6			6.7	80	13.3						
Total %	5	0.6	1.5		7	2.6	20.6	0.1		23.4	14.4	7.4	17.6		39.4	2	24.2	4		30.2	0	100		
PV	320	36	95		451	168	1300	9		1477	915	475	1086		2476	124	1528	257		1909	0	0	6313	
% PV	99.4	100	99	0	99.3	98.2	97.4	100	0	97.5	97.9	98.5	95.3	0	96.8	94.7	97.6	98.5	0	97.5	0	0	97.4	
Duals	2	0	1		3	3	32	0		35	16	7	49		72	3	34	4		41	0	0	151	
% Duals	0.6	0	1	0	0.7	1.8	2.4	0	0	2.3	1.7	1.5	4.3	0	2.8	2.3	2.2	1.5	0	2.1	0	0	2.3	
TTST	0	0	0		0	0	3	0		3	4	0	5		9	4	4	0		8	0	0	20	
% TTST	0	0	0	0	0	0	0.2	0	0	0.2	0.4	0	0.4	0	0.4	3.1	0.3	0	0	0.4	0	0	0.3	
Twins	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
% Twins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pedestrians	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 2-PM
Site Code : 3968-2
Start Date : 5/7/2019
Page No : 2

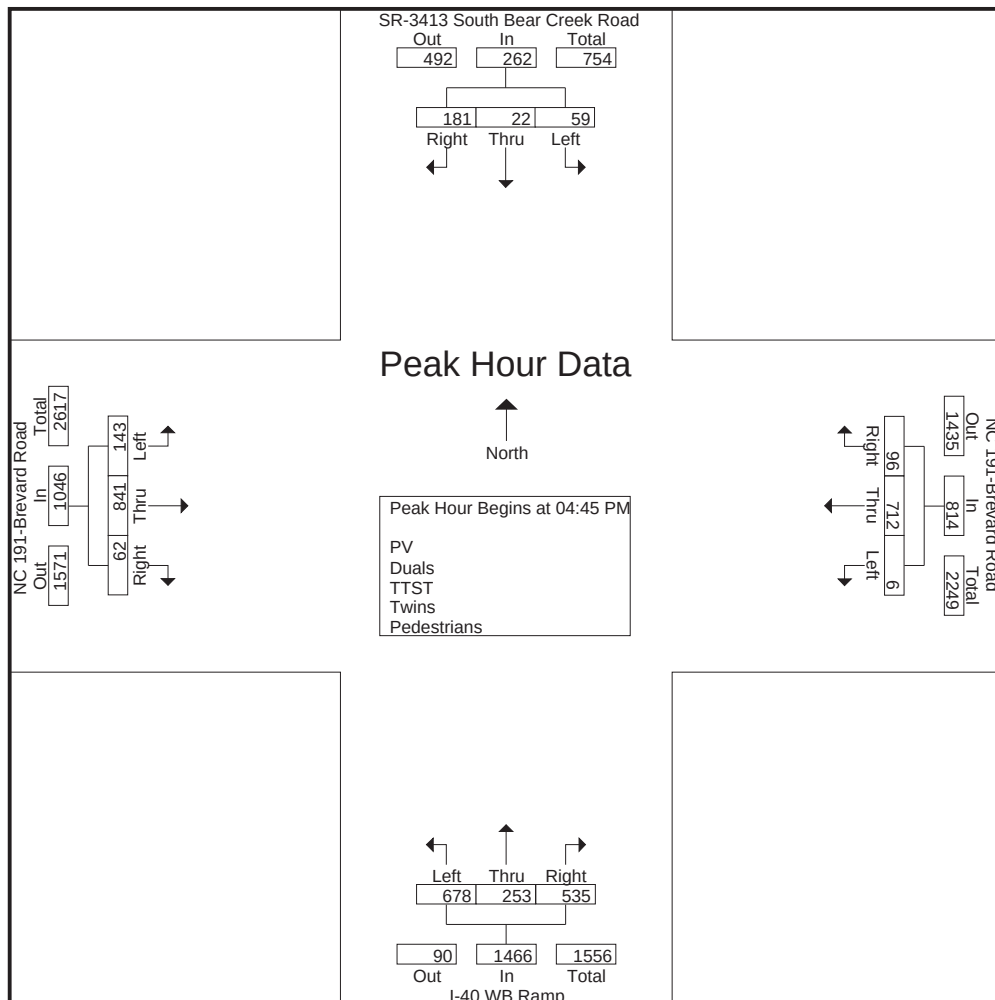


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 2-PM
Site Code : 3968-2
Start Date : 5/7/2019
Page No : 3

	SR-3413 South Bear Creek Road Southbound				NC 191-Brevard Road Westbound				I-40 WB Ramp Northbound				NC 191-Brevard Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	34	3	10	47	25	204	2	231	112	79	144	335	12	201	30	243	856
05:00 PM	53	7	21	81	28	151	3	182	149	67	191	407	15	220	49	284	954
05:15 PM	57	5	9	71	24	212	0	236	143	59	187	389	16	209	22	247	943
05:30 PM	37	7	19	63	19	145	1	165	131	48	156	335	19	211	42	272	835
Total Volume	181	22	59	262	96	712	6	814	535	253	678	1466	62	841	143	1046	3588
% App. Total	69.1	8.4	22.5		11.8	87.5	0.7		36.5	17.3	46.2		5.9	80.4	13.7		
PHF	.794	.786	.702	.809	.857	.840	.500	.862	.898	.801	.887	.900	.816	.956	.730	.921	.940



Count Type: Turning Movement (Classification) - Intersection

Duration: 2-Hour AM / PM Peaks

Milepost Begin: N/A

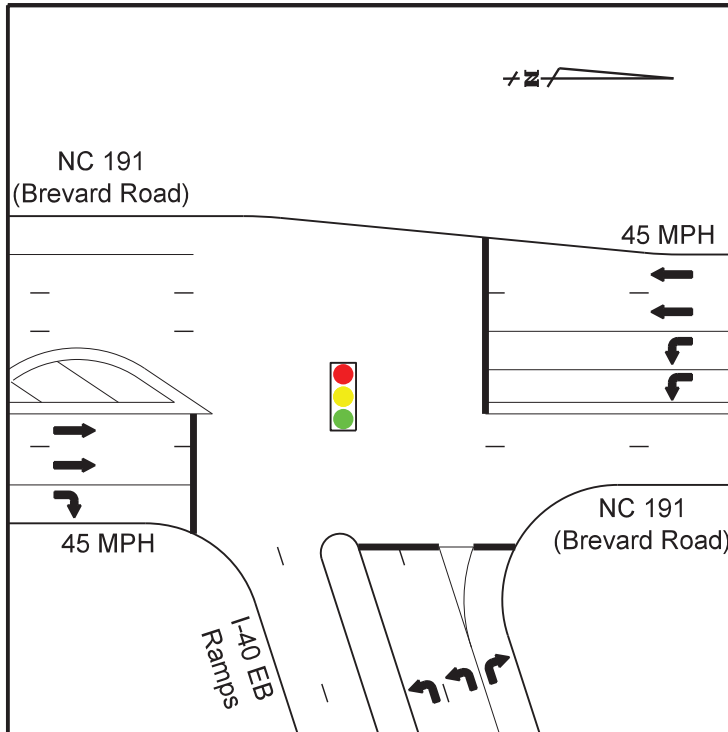
Volume (ADT): 4,862(AM) / 5,754(PM) Milepost End: N/A

20 South Bear Creek Road

Buncombe County

Division 13

5/8/19 7:00 AM to 9:00 AM; 4:00 PM to 6:00 PM, Clear, 58 F Low, 80 F High, 0.00" Precipitation, Sky Cover 0.4

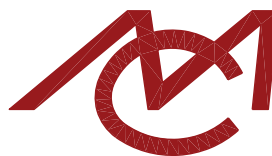


VICINITY MAP - N.T.S.

Comments:

- Counted by: Walter Baker
- Data processor: Sarah Greene
- Method Used: TDC-12 Electronic Count Board.
Petra Pro software.
- Equipment Operating Properly: Yes.
- School in session: Yes.
- Area lighting present: No.
- Construction present: No.
- Disabled pedestrians: No.
- Pedestrian movements: Yes.
- Break times: N/A
- Traffic flow disruption: No.
- Traffic control: Traffic Signal.
- Signal Inventory number: 13-0801
- Distance to nearest stop sign less than 300 ft?
NB: N SB: N EB: N WB: N
- Distance to nearest traffic signal less than 300 ft?
NB: N SB: N EB: N WB: N
- Distance to nearest at-grade RR crossing less than 200 ft?
NB: N SB: N EB: N WB: N

Intersection of NC 191 (Brevard Road)
and I-40 EB Ramps



Mattern & Craig

ENGINEERS - SURVEYORS

FIRM LICENSE No. C-1154

12 BROAD STREET

ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201

FAX (828) 254-4562

Comm. No. 3968

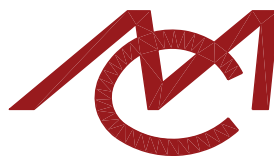


Northbound Approach looking North



Northbound Approach looking South

Intersection of NC 191 (Brevard Road)
and I-40 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

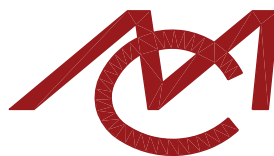


Eastbound Approach looking East



Eastbound Approach looking West

Intersection of NC 191 (Brevard Road)
and I-40 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

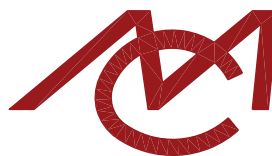


Westbound Approach looking West



Westbound Approach looking East

Intersection of NC 191 (Brevard Road)
and I-40 EB Ramps



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 3-AM
Site Code : 3968-3
Start Date : 5/8/2019
Page No : 1

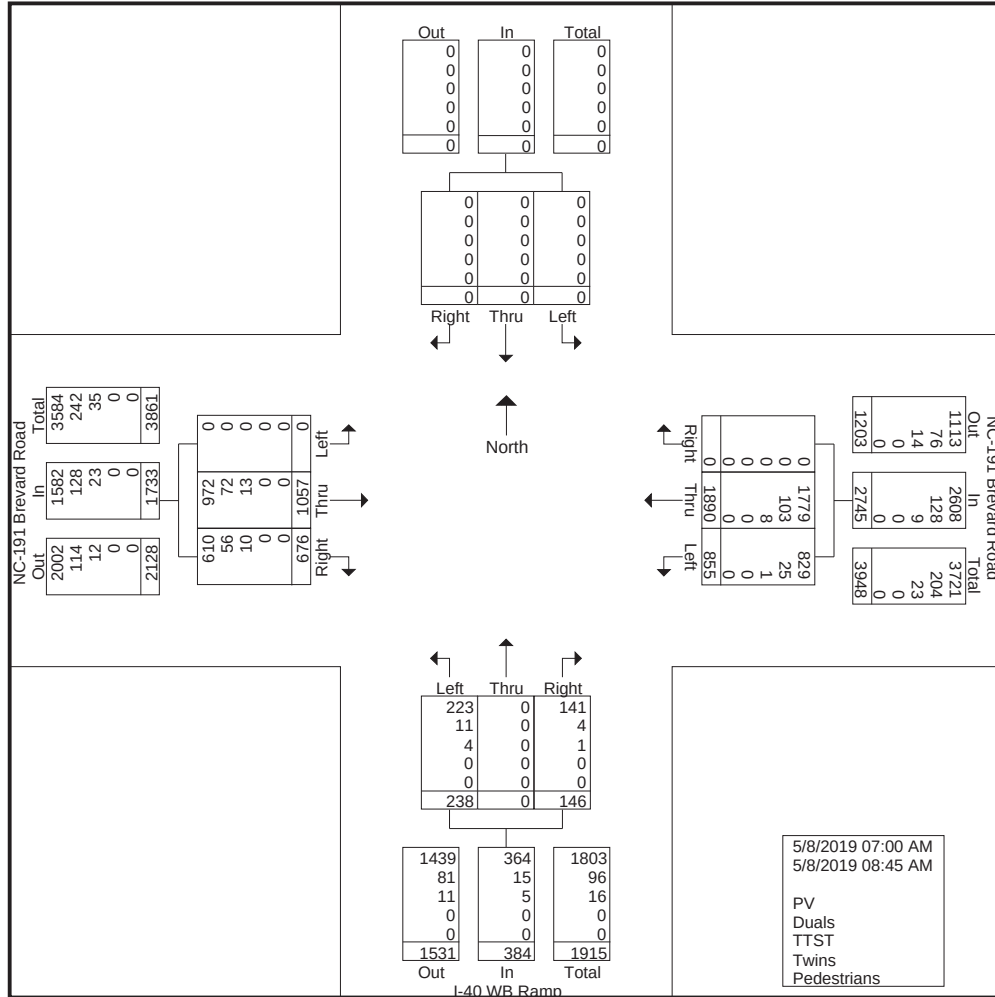
Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	Southbound					NC-191 Brevard Road Westbound					I-40 WB Ramp Northbound					NC-191 Brevard Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	153	56	0	209	5	0	27	0	32	72	98	0	0	170	0	411	411
07:15 AM	0	0	0	0	0	0	222	102	0	324	3	0	19	0	22	83	101	0	0	184	0	530	530
07:30 AM	0	0	0	0	0	0	253	128	0	381	70	0	46	0	116	98	154	0	1	252	1	749	750
07:45 AM	0	0	0	0	0	0	295	116	0	411	45	0	55	0	100	104	160	0	0	264	0	775	775
Total	0	0	0	0	0	0	923	402	0	1325	123	0	147	0	270	357	513	0	1	870	1	2465	2466
08:00 AM	0	0	0	0	0	0	268	130	0	398	3	0	25	0	28	86	155	0	0	241	0	667	667
08:15 AM	0	0	0	0	0	0	202	136	0	338	9	0	24	0	33	86	127	0	0	213	0	584	584
08:30 AM	0	0	0	0	0	0	218	107	0	325	4	0	25	0	29	74	133	0	0	207	0	561	561
08:45 AM	0	0	0	0	0	0	279	80	0	359	7	0	17	0	24	73	129	0	1	202	1	585	586
Total	0	0	0	0	0	0	967	453	0	1420	23	0	91	0	114	319	544	0	1	863	1	2397	2398
Grand Total	0	0	0	0	0	0	1890	855	0	2745	146	0	238	0	384	676	1057	0	2	1733	2	4862	4864
Apprch %	0	0	0			0	68.9	31.1			38	0	62			39	61	0					
Total %	0	0	0			0	38.9	17.6		56.5	3	0	4.9		7.9	13.9	21.7	0		35.6	0	100	
PV	0	0	0			0	1779	829		2608	141	0	223		364	610	972	0		1582	0	0	4554
% PV	0	0	0	0	0	0	94.1	97	0	95	96.6	0	93.7	0	94.8	90.2	92	0	0	91.2	0	0	93.6
Duals	0	0	0			0	103	25		128	4	0	11		15	56	72	0		128	0	0	271
% Duals	0	0	0	0	0	0	5.4	2.9	0	4.7	2.7	0	4.6	0	3.9	8.3	6.8	0	0	7.4	0	0	5.6
TTST	0	0	0			0	8	1		9	1	0	4		5	10	13	0		23	0	0	37
% TTST	0	0	0	0	0	0	0.4	0.1	0	0.3	0.7	0	1.7	0	1.3	1.5	1.2	0	0	1.3	0	0	0.8
Twins	0	0	0			0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
% Twins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0			0	0	0		0	0	0	0		0	0	0	0		2	0	0	2
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.1	0	0	0

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 3-AM
Site Code : 3968-3
Start Date : 5/8/2019
Page No : 2

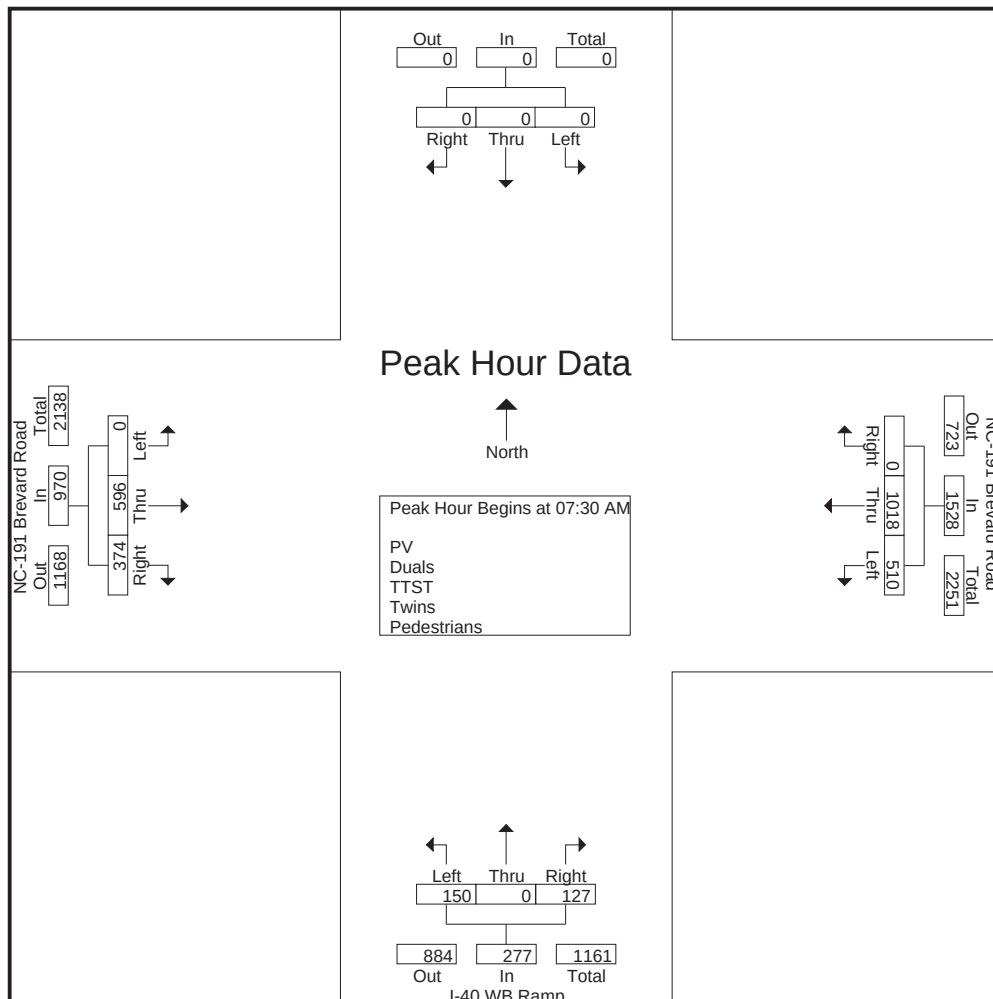


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 3-AM
Site Code : 3968-3
Start Date : 5/8/2019
Page No : 3

	Southbound				NC-191 Brevard Road Westbound				I-40 WB Ramp Northbound				NC-191 Brevard Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	0	0	0	0	0	253	128	381	70	0	46	116	98	154	0	252	749
07:45 AM	0	0	0	0	0	295	116	411	45	0	55	100	104	160	0	264	775
08:00 AM	0	0	0	0	0	268	130	398	3	0	25	28	86	155	0	241	667
08:15 AM	0	0	0	0	0	202	136	338	9	0	24	33	86	127	0	213	584
Total Volume	0	0	0	0	0	1018	510	1528	127	0	150	277	374	596	0	970	2775
% App. Total	0	0	0		0	66.6	33.4		45.8	0	54.2		38.6	61.4	0		
PHF	.000	.000	.000	.000	.000	.863	.938	.929	.454	.000	.682	.597	.899	.931	.000	.919	.895



Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 3-PM
Site Code : 3968-3
Start Date : 5/8/2019
Page No : 1

Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	Southbound					NC-191 Brevard Road Westbound					I-40 WB Ramp Northbound					NC-191 Brevard Road Eastbound							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	254	55	0	309	4	0	14	0	18	124	215	0	1	339	1	666	667
04:15 PM	0	0	0	0	0	0	285	58	0	343	13	0	22	0	35	96	238	0	1	334	1	712	713
04:30 PM	0	0	0	0	0	0	264	41	0	305	7	0	40	0	47	107	275	0	0	382	0	734	734
04:45 PM	0	0	0	0	0	0	271	51	0	322	9	0	45	0	54	120	233	0	0	353	0	729	729
Total	0	0	0	0	0	0	1074	205	0	1279	33	0	121	0	154	447	961	0	2	1408	2	2841	2843
05:00 PM	0	0	0	0	0	0	237	56	0	293	11	0	39	0	50	125	279	0	0	404	0	747	747
05:15 PM	0	0	0	0	0	0	284	73	0	357	22	0	47	0	69	137	253	0	0	390	0	816	816
05:30 PM	0	0	0	0	0	0	258	52	0	310	5	0	43	0	48	104	238	0	0	342	0	700	700
05:45 PM	0	0	0	0	0	0	228	51	0	279	18	0	48	0	66	81	224	0	0	305	0	650	650
Total	0	0	0	0	0	0	1007	232	0	1239	56	0	177	0	233	447	994	0	0	1441	0	2913	2913
Grand Total	0	0	0	0	0	0	2081	437	0	2518	89	0	298	0	387	894	1955	0	2	2849	2	5754	5756
Apprch %	0	0	0			0	82.6	17.4			23	0	77			31.4	68.6	0					
Total %	0	0	0		0	0	36.2	7.6		43.8	1.5	0	5.2		6.7	15.5	34	0		49.5	0	100	
PV	0	0	0		0	0	1980	431		2411	73	0	257		330	877	1899	0		2776	0	0	5517
% PV	0	0	0	0	0	0	95.1	98.6	0	95.8	82	0	86.2	0	85.3	98.1	97.1	0	0	97.4	0	0	95.8
Duals	0	0	0		0	0	85	6		91	4	0	19		23	15	48	0		63	0	0	177
% Duals	0	0	0	0	0	0	4.1	1.4	0	3.6	4.5	0	6.4	0	5.9	1.7	2.5	0	0	2.2	0	0	3.1
TTST	0	0	0		0	0	8	0		8	6	0	11		17	1	4	0		5	0	0	30
% TTST	0	0	0	0	0	0	0.4	0	0	0.3	6.7	0	3.7	0	4.4	0.1	0.2	0	0	0.2	0	0	0.5
Twins	0	0	0		0	0	8	0		8	6	0	11		17	1	4	0		5	0	0	30
% Twins	0	0	0	0	0	0	0.4	0	0	0.3	6.7	0	3.7	0	4.4	0.1	0.2	0	0	0.2	0	0	0.5
Pedestrians	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		2	0	0	2
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.1	0	0	0

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

Diagram illustrating traffic flow at the intersection of NC-191 Brevard Road and I-40 WB Ramp. The diagram shows traffic flow from the north, south, and west, with detailed volume data for each direction and lane. A north arrow points towards the top of the diagram. A timestamp box in the bottom right corner indicates the data was collected on 5/8/2019 at 04:00 PM and 5/8/2019 at 05:45 PM. The data includes PV (Passenger Vehicles), Duals, TTST (Total Travel Time), Twins, and Pedestrians.

Northbound Traffic (I-40 WB Ramp to NC-191 Brevard Road):

Direction	Lane	Volume
Left	Left	257
	Thru	0
	Right	73
Thru	Left	19
	Thru	0
	Right	4
Right	Left	11
	Thru	0
	Right	6
Total	Left	11
	Thru	0
	Right	6
Total	Left	0
	Thru	0
	Right	0
Total	Left	298
	Thru	0
	Right	89

Westbound Traffic (NC-191 Brevard Road to I-40 WB Ramp):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Eastbound Traffic (I-40 WB Ramp to NC-191 Brevard Road):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Southbound Traffic (NC-191 Brevard Road to I-40 WB Ramp):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Northbound Traffic (I-40 WB Ramp to NC-191 Brevard Road):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Westbound Traffic (NC-191 Brevard Road to I-40 WB Ramp):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Eastbound Traffic (I-40 WB Ramp to NC-191 Brevard Road):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Southbound Traffic (NC-191 Brevard Road to I-40 WB Ramp):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Northbound Traffic (I-40 WB Ramp to NC-191 Brevard Road):

Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right	Left	0
	Thru	0
	Right	0
Total	Left	0
	Thru	0
	Right	0

Westbound Traffic (NC-191 Brevard Road to I-40 WB Ramp):

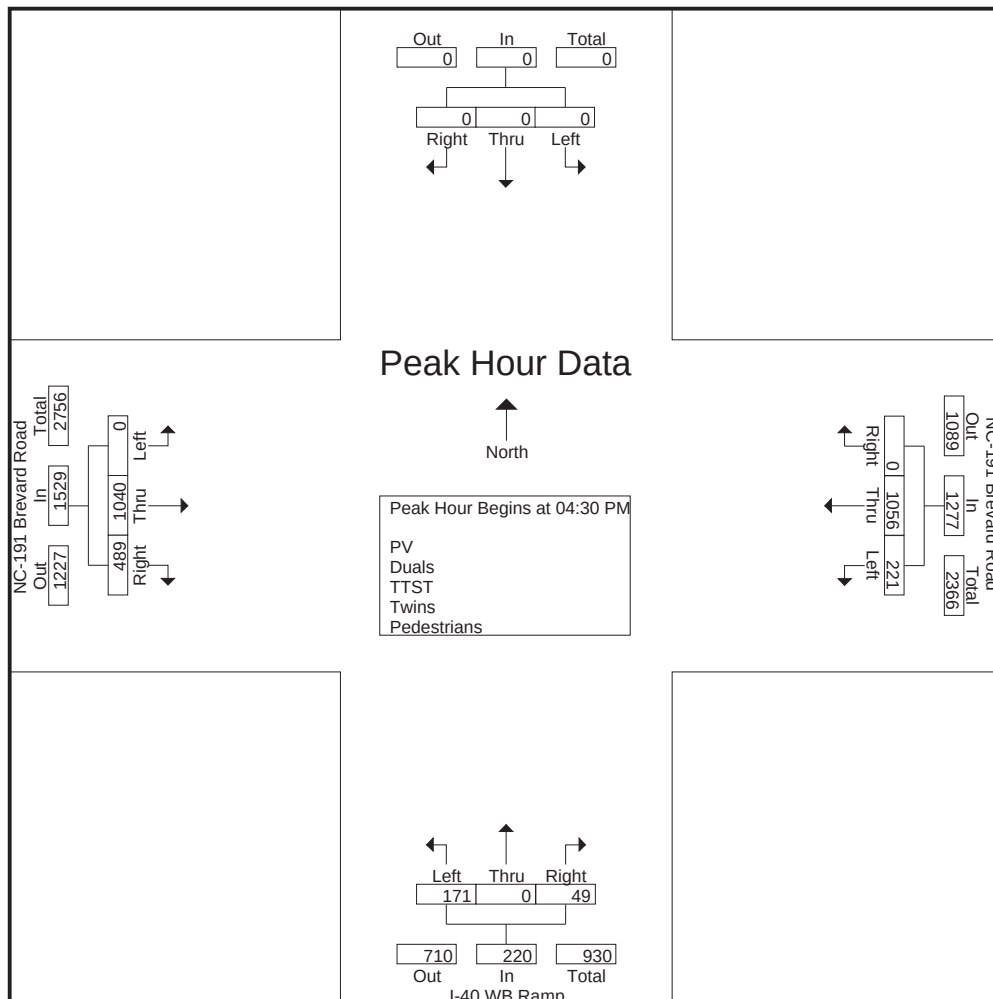
Direction	Lane	Volume
Left	Left	0
	Thru	0
	Right	0
Thru	Left	0
	Thru	0
	Right	0
Right		

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 3-PM
Site Code : 3968-3
Start Date : 5/8/2019
Page No : 3

	Southbound				NC-191 Brevard Road Westbound				I-40 WB Ramp Northbound				NC-191 Brevard Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	0	0	0	0	0	264	41	305	7	0	40	47	107	275	0	382	734
04:45 PM	0	0	0	0	0	271	51	322	9	0	45	54	120	233	0	353	729
05:00 PM	0	0	0	0	0	237	56	293	11	0	39	50	125	279	0	404	747
05:15 PM	0	0	0	0	0	284	73	357	22	0	47	69	137	253	0	390	816
Total Volume	0	0	0	0	0	1056	221	1277	49	0	171	220	489	1040	0	1529	3026
% App. Total	0	0	0		0	82.7	17.3		22.3	0	77.7		32	68	0		
PHF	.000	.000	.000	.000	.000	.930	.757	.894	.557	.000	.910	.797	.892	.932	.000	.946	.927



Count Type: Turning Movement (Classification) - Intersection

Duration: 2-Hour AM / PM Peaks

Milepost Begin: N/A

Volume (ADT): 1,804(AM) / 2,231(PM)

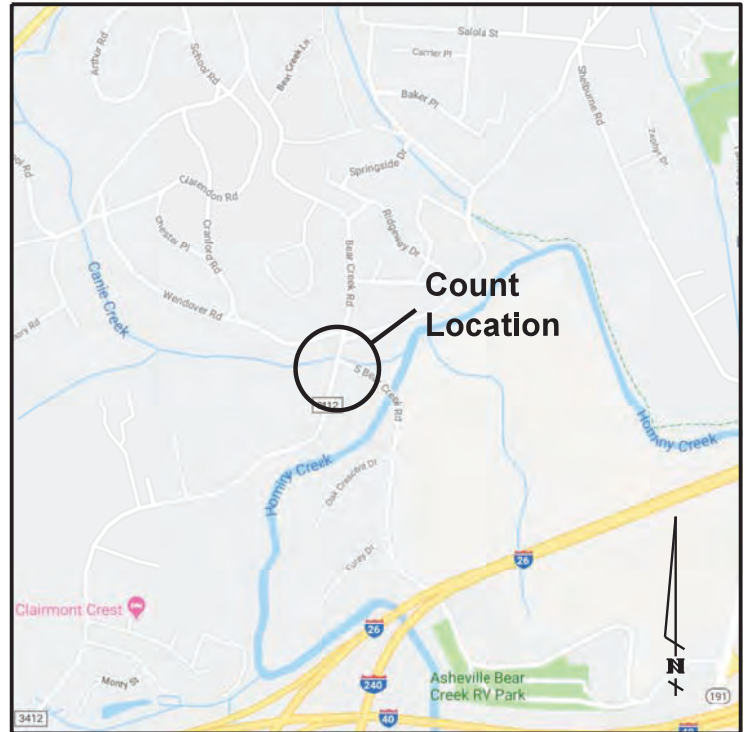
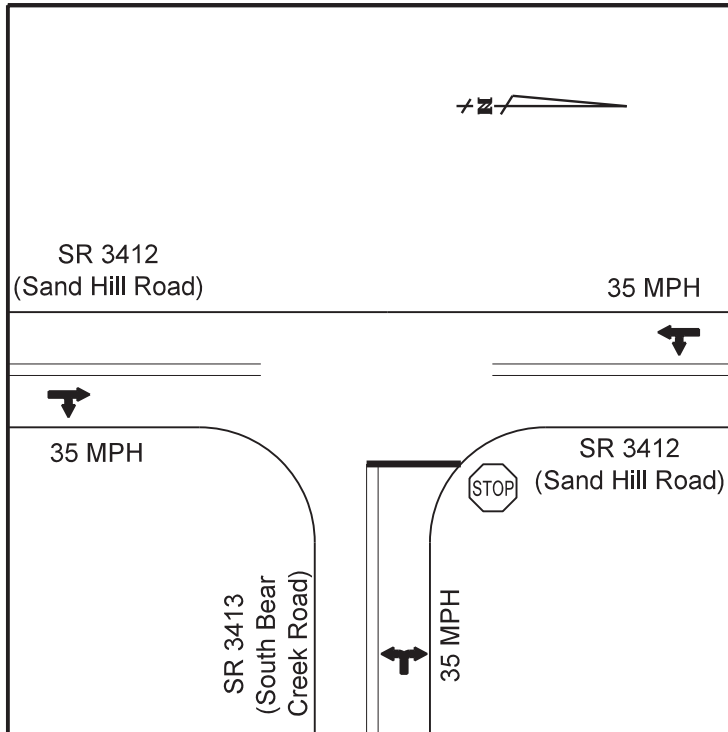
Milepost End: N/A

20 South Bear Creek Road TIA

Buncombe County

Division 13

5/7/19 7:00 AM to 9:00 AM; 4:00 PM to 6:00 PM, Lt Rain, 53 F Low, 75 F High, 0.31" Precipitation, Sky Cover 0.3

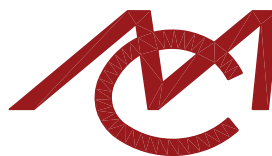


VICINITY MAP - N.T.S.

Comments:

- Counted by: Walter Baker
- Data processor: Sarah Greene
- Method Used: CountCam 100.
Petra Pro software.
- Equipment Operating Properly: Yes.
- School in session: Yes.
- Area lighting present: Yes.
- Construction present: No.
- Disabled pedestrians: No.
- Pedestrian movements: Yes.
- Break times: N/A
- Traffic flow disruption: No.
- Traffic control: Stop Sign.
- Signal Inventory number: N/A
- Distance to nearest stop sign less than 300 ft?
NB: N SB: N EB: N WB: Y
- Distance to nearest traffic signal less than 300 ft?
NB: N SB: N EB: N WB: N
- Distance to nearest at-grade RR crossing less than 200 ft?
NB: N SB: N EB: N WB: N

Intersection of SR 3413
(South Bear Creek Road)
and SR 3412 (Sand Hill Road)



Mattern & Craig

ENGINEERS - SURVEYORS

FIRM LICENSE No. C-1154

12 BROAD STREET

ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201

FAX (828) 254-4562

Comm. No. 3968

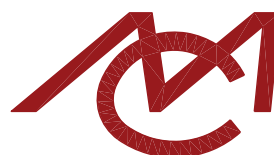


Northbound Approach looking North



Northbound Approach looking South

Intersection of SR 3413
(South Bear Creek Road)
and SR 3412 (Sand Hill Road)



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

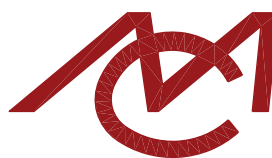


Eastbound Approach looking East



Eastbound Approach looking West

Intersection of SR 3413
(South Bear Creek Road)
and SR 3412 (Sand Hill Road)



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562



Mattern & Craig, Inc.

12 Broad St.

Asheville, NC, 28801

Phone: (828) 254-2201

Fax: (828) 254-4562

File Name : 5-12 hour count

Site Code : 3968-5

Start Date : 5/7/2019

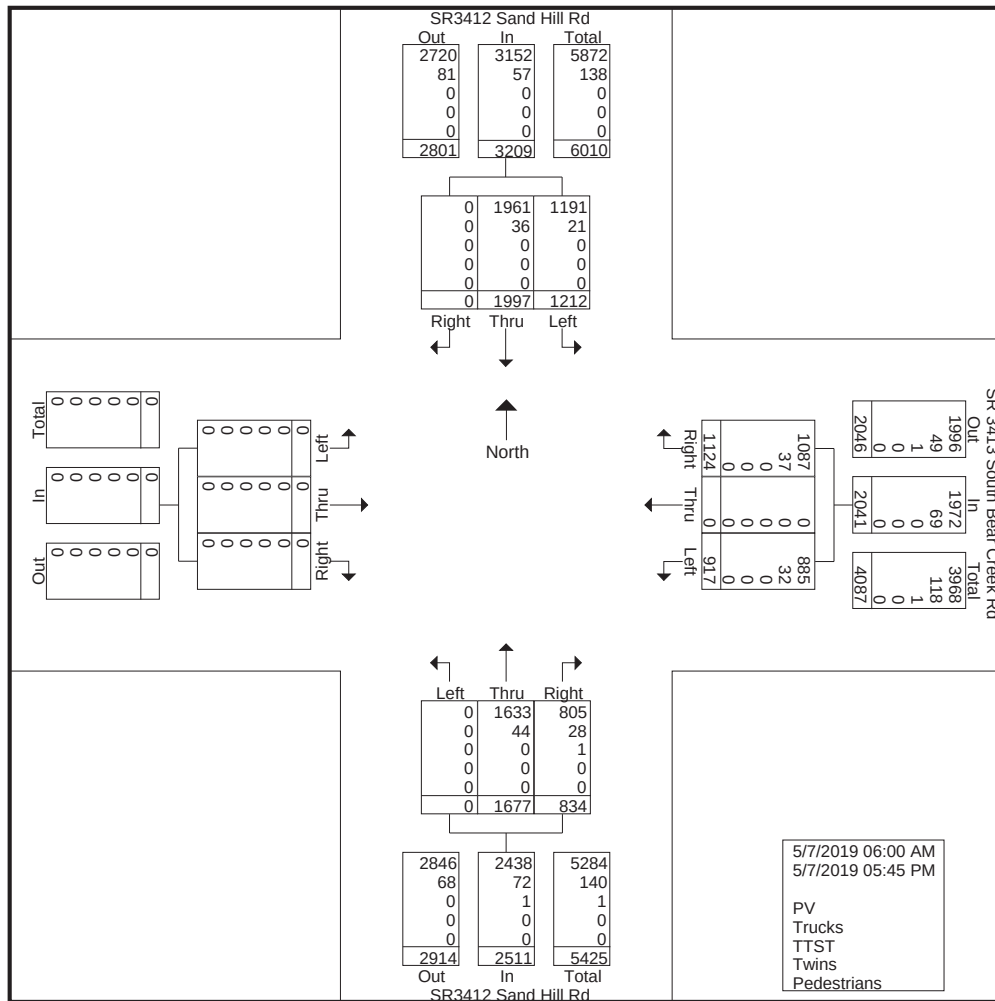
Page No : 1

Groups Printed- PV - Trucks - TTST - Twins - Pedestrians

	SR3412 Sand Hill Rd Southbound				SR 3413 South Bear Creek Rd Westbound				SR3412 Sand Hill Rd Northbound				Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
06:00 AM	0	7	7	14	4	0	1	5	4	6	0	10	0	0	0	0	29
06:15 AM	0	7	12	19	1	0	5	6	6	7	0	13	0	0	0	0	38
06:30 AM	0	19	37	56	7	0	7	14	13	11	0	24	0	0	0	0	94
06:45 AM	0	23	21	44	7	0	9	16	15	15	0	30	0	0	0	0	90
Total	0	56	77	133	19	0	22	41	38	39	0	77	0	0	0	0	251
07:00 AM	0	36	17	53	6	0	6	12	26	20	0	46	0	0	0	0	111
07:15 AM	0	46	40	86	14	0	15	29	39	52	0	91	0	0	0	0	206
07:30 AM	0	76	63	139	10	0	7	17	67	63	0	130	0	0	0	0	286
07:45 AM	0	78	67	145	18	0	16	34	51	78	0	129	0	0	0	0	308
Total	0	236	187	423	48	0	44	92	183	213	0	396	0	0	0	0	911
08:00 AM	0	73	57	130	17	0	22	39	49	80	0	129	0	0	0	0	298
08:15 AM	0	48	51	99	14	0	12	26	41	73	0	114	0	0	0	0	239
08:30 AM	0	41	37	78	13	0	13	26	34	43	0	77	0	0	0	0	181
08:45 AM	0	39	27	66	21	0	14	35	29	45	0	74	0	0	0	0	175
Total	0	201	172	373	65	0	61	126	153	241	0	394	0	0	0	0	893
09:00 AM	0	14	12	26	8	0	6	14	5	14	0	19	0	0	0	0	59
09:15 AM	0	3	10	13	4	0	4	8	4	12	0	16	0	0	0	0	37
09:30 AM	0	16	21	37	12	0	7	19	14	28	0	42	0	0	0	0	98
09:45 AM	0	19	21	40	25	0	11	36	15	27	0	42	0	0	0	0	118
Total	0	52	64	116	49	0	28	77	38	81	0	119	0	0	0	0	312
10:00 AM	0	19	15	34	16	0	13	29	15	18	0	33	0	0	0	0	96
10:15 AM	0	20	17	37	16	0	15	31	9	21	0	30	0	0	0	0	98
10:30 AM	0	26	14	40	12	0	10	22	9	21	0	30	0	0	0	0	92
10:45 AM	0	22	14	36	21	0	14	35	8	33	0	41	0	0	0	0	112
Total	0	87	60	147	65	0	52	117	41	93	0	134	0	0	0	0	398
11:00 AM	0	21	17	38	24	0	14	38	9	27	0	36	0	0	0	0	112
11:15 AM	0	18	11	29	8	0	12	20	9	27	0	36	0	0	0	0	85
11:30 AM	0	33	19	52	22	0	5	27	13	32	0	45	0	0	0	0	124
11:45 AM	0	33	12	45	13	0	12	25	6	26	0	32	0	0	0	0	102
Total	0	105	59	164	67	0	43	110	37	112	0	149	0	0	0	0	423
12:00 PM	0	30	22	52	21	0	9	30	9	36	0	45	0	0	0	0	127
12:15 PM	0	17	23	40	19	0	16	35	3	36	0	39	0	0	0	0	114
12:30 PM	0	26	19	45	16	0	11	27	13	31	0	44	0	0	0	0	116
12:45 PM	0	30	17	47	21	0	8	29	8	30	0	38	0	0	0	0	114
Total	0	103	81	184	77	0	44	121	33	133	0	166	0	0	0	0	471
01:00 PM	0	42	24	66	20	0	16	36	9	30	0	39	0	0	0	0	141
01:15 PM	0	30	22	52	19	0	10	29	13	20	0	33	0	0	0	0	114
01:30 PM	0	35	20	55	31	0	8	39	11	29	0	40	0	0	0	0	134
01:45 PM	0	25	32	57	28	0	19	47	9	32	0	41	0	0	0	0	145
Total	0	132	98	230	98	0	53	151	42	111	0	153	0	0	0	0	534
02:00 PM	0	44	32	76	21	0	20	41	10	29	0	39	0	0	0	0	156
02:15 PM	0	44	23	67	30	0	13	43	17	33	0	50	0	0	0	0	160
02:30 PM	0	41	26	67	29	0	18	47	17	31	0	48	0	0	0	0	162
02:45 PM	0	44	14	58	20	0	33	53	24	31	0	55	0	0	0	0	166
Total	0	173	95	268	100	0	84	184	68	124	0	192	0	0	0	0	644
03:00 PM	0	42	14	56	28	0	24	52	19	39	0	58	0	0	0	0	166

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 5-12 hour count
Site Code : 3968-5
Start Date : 5/7/2019
Page No : 3

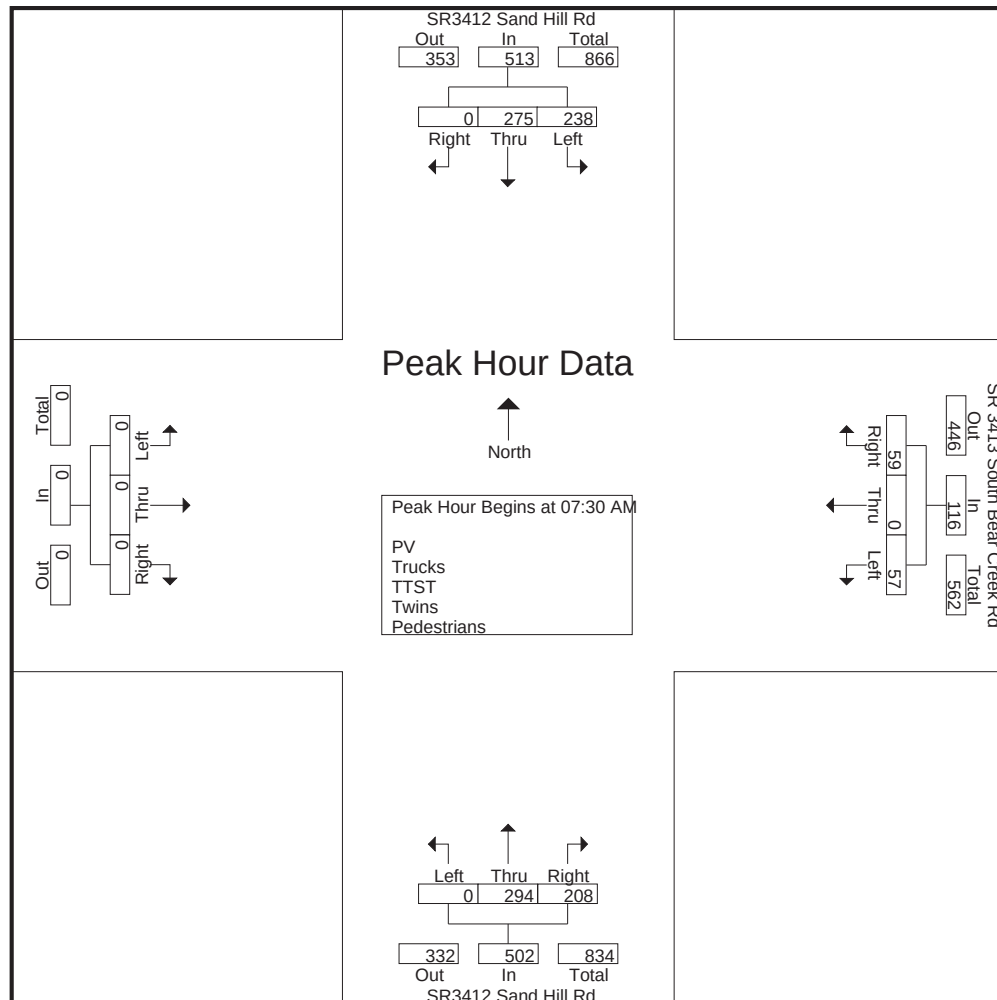


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 5-12 hour count
Site Code : 3968-5
Start Date : 5/7/2019
Page No : 4

	SR3412 Sand Hill Rd Southbound				SR 3413 South Bear Creek Rd Westbound				SR3412 Sand Hill Rd Northbound				Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	0	76	63	139	10	0	7	17	67	63	0	130	0	0	0	0	286
07:45 AM	0	78	67	145	18	0	16	34	51	78	0	129	0	0	0	0	308
08:00 AM	0	73	57	130	17	0	22	39	49	80	0	129	0	0	0	0	298
08:15 AM	0	48	51	99	14	0	12	26	41	73	0	114	0	0	0	0	239
Total Volume	0	275	238	513	59	0	57	116	208	294	0	502	0	0	0	0	1131
% App. Total	0	53.6	46.4		50.9	0	49.1		41.4	58.6	0		0	0	0		
PHF	.000	.881	.888	.884	.819	.000	.648	.744	.776	.919	.000	.965	.000	.000	.000	.000	.918

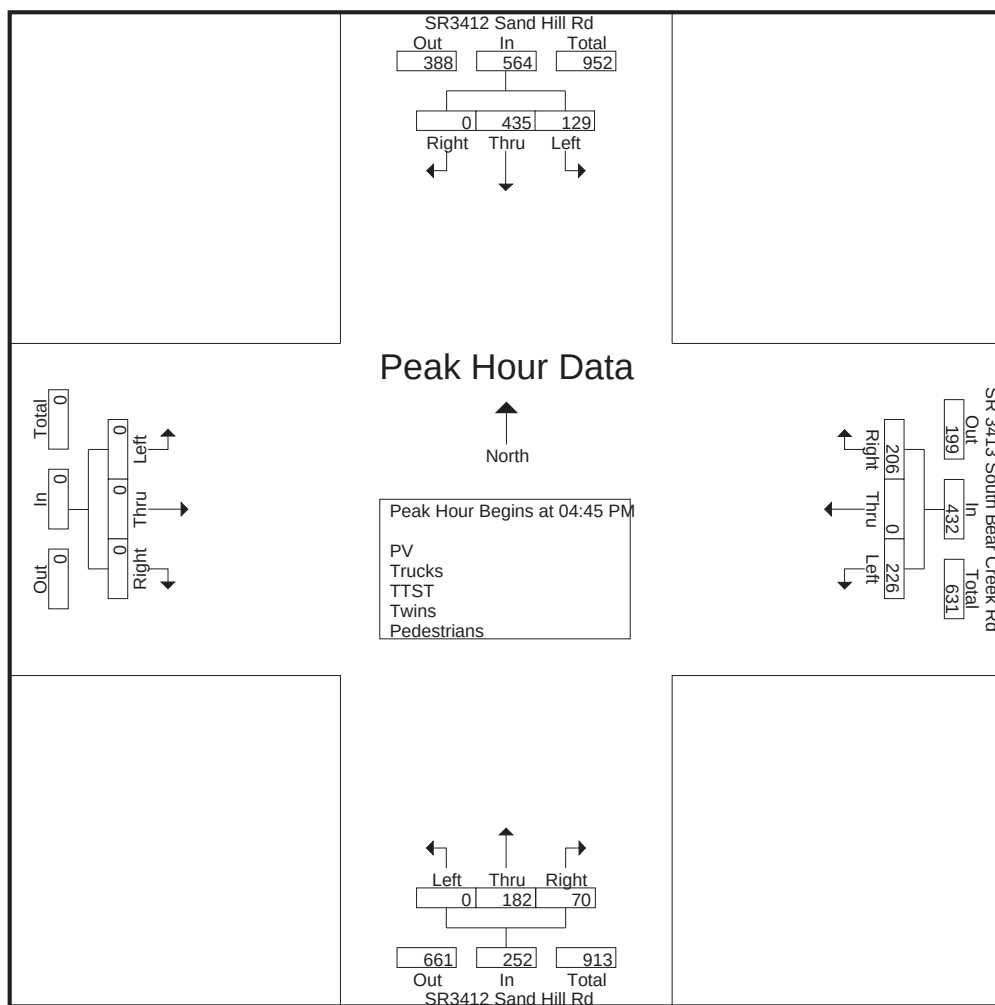


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 5-12 hour count
Site Code : 3968-5
Start Date : 5/7/2019
Page No : 5

	SR3412 Sand Hill Rd Southbound				SR 3413 South Bear Creek Rd Westbound				SR3412 Sand Hill Rd Northbound				Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	117	25	142	47	0	55	102	13	44	0	57	0	0	0	0	301
05:00 PM	0	97	38	135	68	0	55	123	15	49	0	64	0	0	0	0	322
05:15 PM	0	129	32	161	43	0	60	103	26	43	0	69	0	0	0	0	333
05:30 PM	0	92	34	126	48	0	56	104	16	46	0	62	0	0	0	0	292
Total Volume	0	435	129	564	206	0	226	432	70	182	0	252	0	0	0	0	1248
% App. Total	0	77.1	22.9		47.7	0	52.3		27.8	72.2	0		0	0	0		
PHF	.000	.843	.849	.876	.757	.000	.942	.878	.673	.929	.000	.913	.000	.000	.000	.000	.937



Count Type: Turning Movement (Classification) - Intersection

20 South Bear Creek Road TIA

Duration: 2-Hour AM / PM Peaks

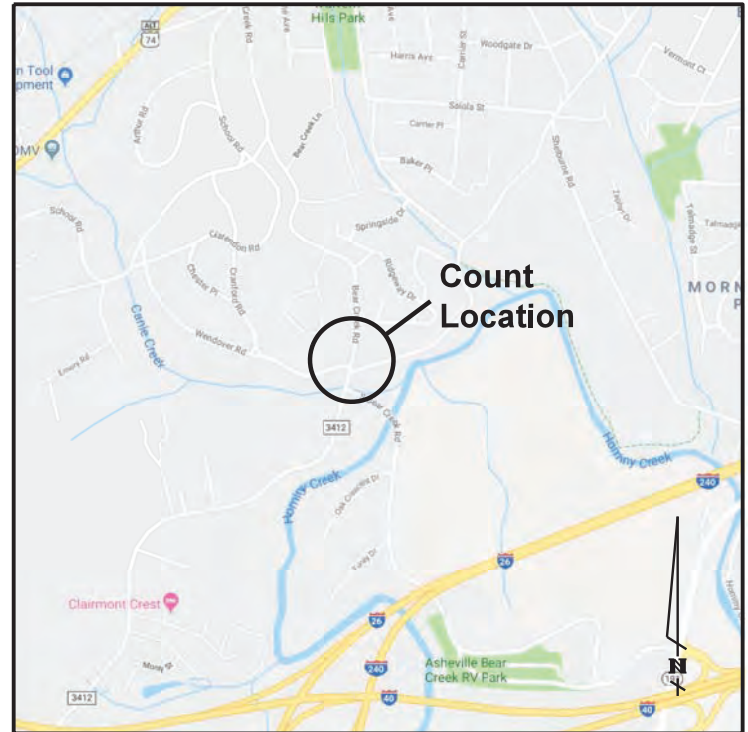
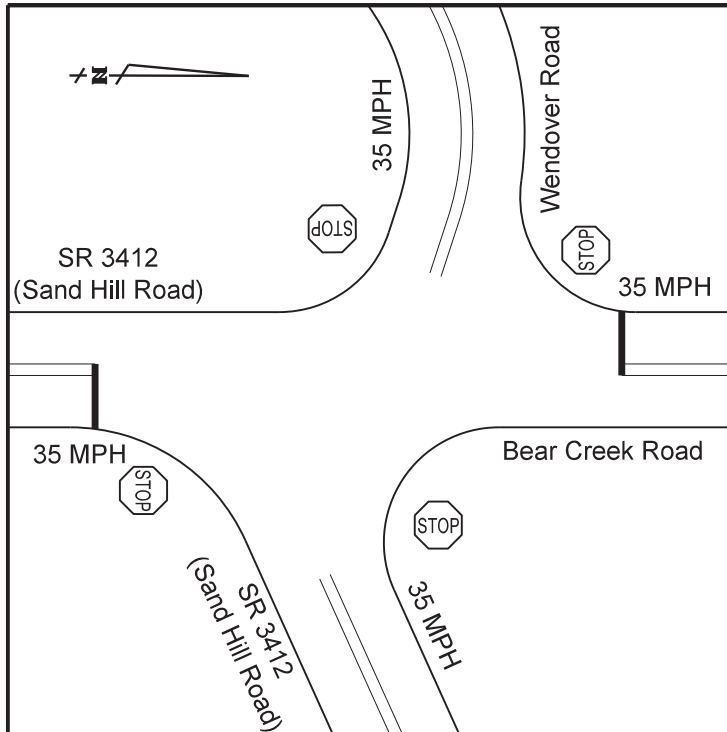
Milepost Begin: N/A

Buncombe County

Volume (ADT): 2,642(AM) / 3,402(PM) Milepost End: N/A

Division 13

5/7/19 7:00 AM to 9:00 AM; 4:00 PM to 6:00 PM, Lt Rain, 53 F Low, 75 F High, 0.31" Precipitation, Sky Cover 0.3

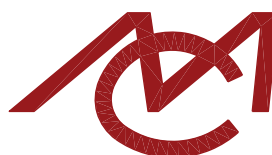


VICINITY MAP - N.T.S.

Comments:

1. Counted by: Walter Baker
2. Data processor: Sarah Greene
3. Method Used: TDC-12 Electronic Count Board. Petra Pro software.
4. Equipment Operating Properly: Yes.
5. School in session: Yes.
6. Area lighting present: Yes.
7. Construction present: No.
8. Disabled pedestrians: No.
9. Pedestrian movements: Yes.
10. Break times: N/A
11. Traffic flow disruption: No.
12. Traffic control: Stop Sign.
13. Signal Inventory number: N/A
14. Distance to nearest stop sign less than 300 ft?
NB: N SB: N EB: Y WB: N
15. Distance to nearest traffic signal less than 300 ft?
NB: N SB: N EB: N WB: N
16. Distance to nearest at-grade RR crossing less than 200 ft?
NB: N SB: N EB: N WB: N

Intersection of SR 3412
(Sand Hill Road)
and Bear Creek Road
and Wendover Road



Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

Comm. No. 3968

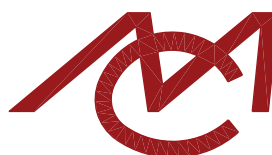


Northbound Approach looking North



Northbound Approach looking South

Intersection of SR 3412
(Sand Hill Road)
and Bear Creek Road
and Wendover Road



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

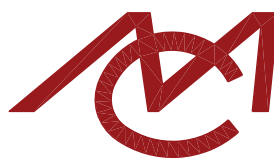


Southbound Approach looking South



Southbound Approach looking North

Intersection of SR 3412
(Sand Hill Road)
and Bear Creek Road
and Wendover Road



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

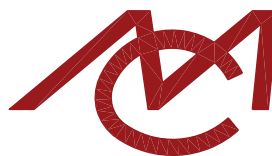


Eastbound Approach looking East



Eastbound Approach looking West

Intersection of SR 3412
(Sand Hill Road)
and Bear Creek Road
and Wendover Road



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

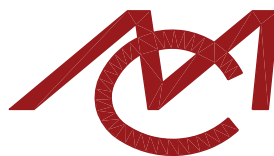


Westbound Approach looking West



Westbound Approach looking East

Intersection of SR 3412
(Sand Hill Road)
and Bear Creek Road
and Wendover Road



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS
FIRM LICENSE No. C-1154
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801
(828) 254-2201
FAX (828) 254-4562

Mattern & Craig, Inc.

12 Broad St.

Asheville, NC, 28801

Phone: (828) 254-2201

Fax: (828) 254-4562

File Name : 12 Hour

Site Code : 3968-6

Start Date : 5/7/2019

Page No : 1

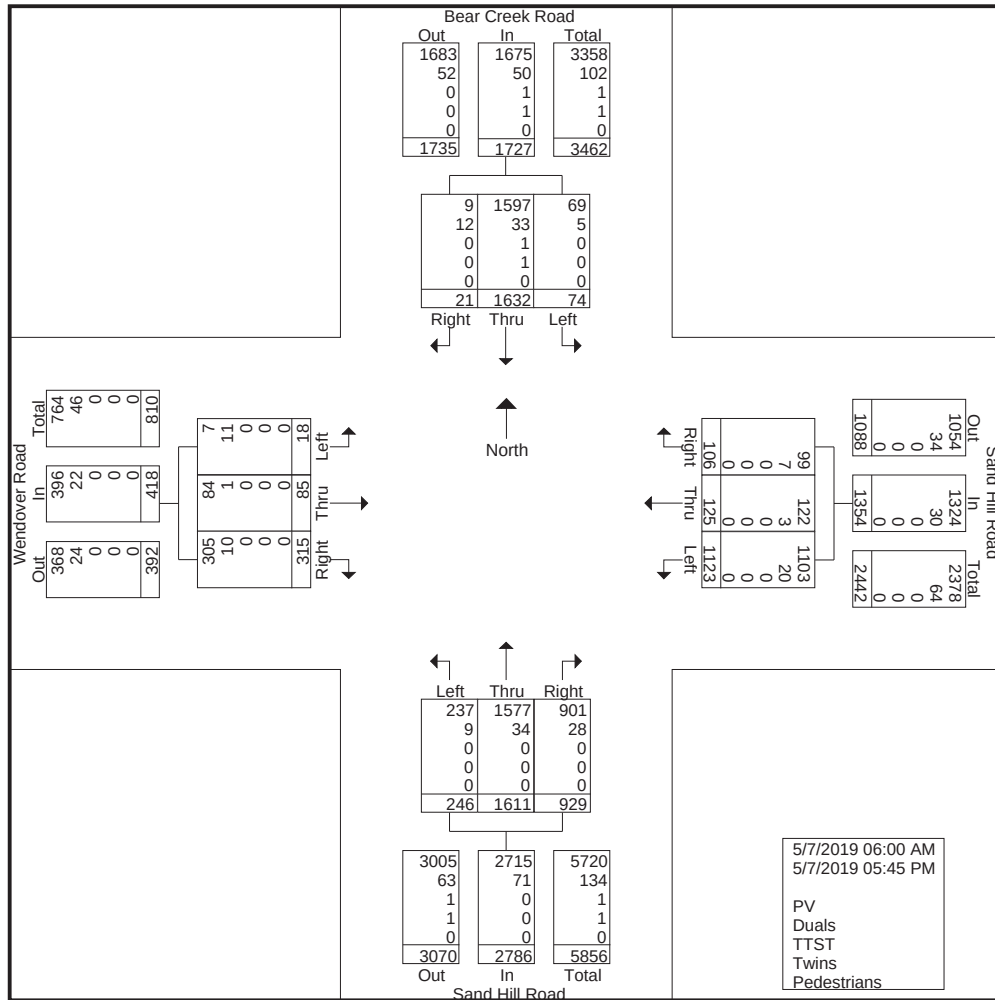
Groups Printed- PV - Duals - TTST - Twins - Pedestrians

	Bear Creek Road Southbound				Sand Hill Road Westbound				Sand Hill Road Northbound				Wendover Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
06:00 AM	0	10	1	11	1	0	2	3	4	5	0	9	2	0	0	2	25
06:15 AM	0	12	0	12	1	0	2	3	2	6	0	8	4	0	0	4	27
06:30 AM	0	17	0	17	0	0	6	6	3	4	1	8	0	0	0	0	31
06:45 AM	0	30	1	31	0	0	8	8	3	21	1	25	9	1	0	10	74
Total	0	69	2	71	2	0	18	20	12	36	2	50	15	1	0	16	157
07:00 AM	1	22	1	24	0	1	9	10	4	10	0	14	1	0	0	1	49
07:15 AM	0	49	1	50	1	4	17	22	22	39	6	67	7	2	1	10	149
07:30 AM	2	85	0	87	3	3	30	36	31	39	5	75	14	6	1	21	219
07:45 AM	1	78	1	80	6	8	35	49	36	46	8	90	18	4	0	22	241
Total	4	234	3	241	10	16	91	117	93	134	19	246	40	12	2	54	658
08:00 AM	2	74	3	79	1	3	32	36	34	51	5	90	12	5	0	17	222
08:15 AM	1	55	0	56	0	1	21	22	31	62	3	96	17	1	0	18	192
08:30 AM	0	44	1	45	2	3	23	28	27	26	4	57	5	1	0	6	136
08:45 AM	1	44	2	47	1	3	10	14	18	27	5	50	12	4	0	16	127
Total	4	217	6	227	4	10	86	100	110	166	17	293	46	11	0	57	677
09:00 AM	0	28	1	29	1	1	10	12	15	28	3	46	7	0	0	7	94
09:15 AM	0	20	2	22	2	1	10	13	16	22	1	39	2	2	0	4	78
09:30 AM	0	19	3	22	5	0	10	15	11	24	2	37	5	2	0	7	81
09:45 AM	1	26	2	29	2	1	11	14	21	26	6	53	5	1	0	6	102
Total	1	93	8	102	10	3	41	54	63	100	12	175	19	5	0	24	355
10:00 AM	0	18	3	21	1	0	14	15	13	23	6	42	1	1	0	2	80
10:15 AM	0	13	0	13	4	1	19	24	12	18	3	33	5	1	0	6	76
10:30 AM	0	23	2	25	3	3	11	17	13	17	2	32	5	0	0	5	79
10:45 AM	0	17	0	17	0	0	20	20	18	30	9	57	3	2	0	5	99
Total	0	71	5	76	8	4	64	76	56	88	20	164	14	4	0	18	334
11:00 AM	0	19	1	20	3	3	14	20	20	30	4	54	6	1	0	7	101
11:15 AM	1	24	2	27	4	1	12	17	23	16	2	41	5	0	0	5	90
11:30 AM	0	27	1	28	2	1	16	19	18	33	6	57	6	1	0	7	111
11:45 AM	0	22	0	22	1	2	16	19	18	15	7	40	6	0	0	6	87
Total	1	92	4	97	10	7	58	75	79	94	19	192	23	2	0	25	389
12:00 PM	1	18	3	22	1	2	7	10	14	21	6	41	4	2	0	6	79
12:15 PM	0	24	0	24	7	0	10	17	17	36	3	56	9	3	0	12	109
12:30 PM	0	20	2	22	2	2	19	23	21	30	4	55	5	3	0	8	108
12:45 PM	1	29	2	32	6	0	16	22	16	30	8	54	4	1	0	5	113
Total	2	91	7	100	16	4	52	72	68	117	21	206	22	9	0	31	409
01:00 PM	1	35	1	37	0	2	22	24	19	25	6	50	5	1	0	6	117
01:15 PM	0	30	0	30	0	1	22	23	13	19	8	40	4	4	0	8	101
01:30 PM	0	18	2	20	1	1	19	21	16	26	6	48	3	3	1	7	96
01:45 PM	0	29	0	29	2	1	13	16	18	39	3	60	8	1	0	9	114
Total	1	112	3	116	3	5	76	84	66	109	23	198	20	9	1	30	428
02:00 PM	0	35	1	36	0	0	30	30	15	27	2	44	9	0	0	9	119
02:15 PM	0	40	2	42	5	1	29	35	21	36	5	62	5	2	0	7	146
02:30 PM	0	37	1	38	2	2	20	24	26	36	4	66	6	3	0	9	137
02:45 PM	2	29	3	34	1	4	20	25	21	24	5	50	9	2	1	12	121
Total	2	141	7	150	8	7	99	114	83	123	16	222	29	7	1	37	523

Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 12 Hour
Site Code : 3968-6
Start Date : 5/7/2019
Page No : 3

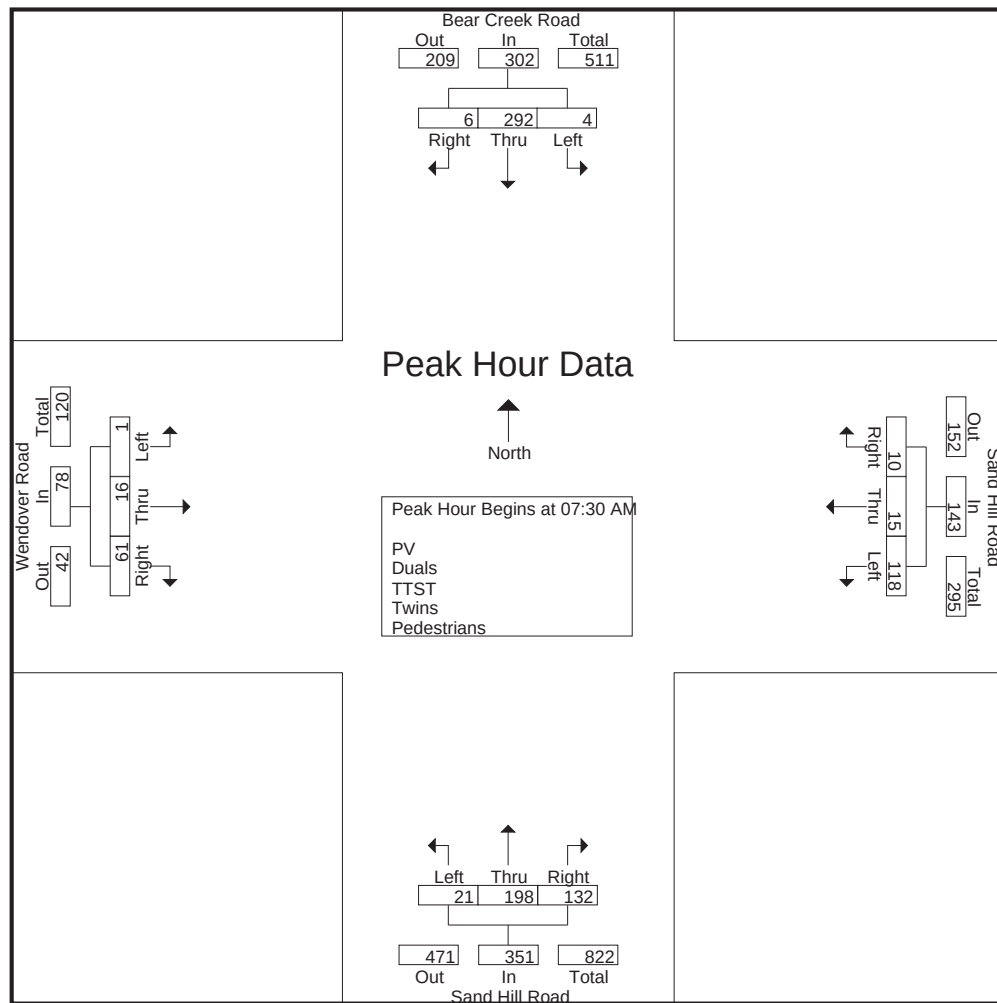


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 12 Hour
Site Code : 3968-6
Start Date : 5/7/2019
Page No : 4

	Bear Creek Road Southbound				Sand Hill Road Westbound				Sand Hill Road Northbound				Wendover Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	2	85	0	87	3	3	30	36	31	39	5	75	14	6	1	21	219
07:45 AM	1	78	1	80	6	8	35	49	36	46	8	90	18	4	0	22	241
08:00 AM	2	74	3	79	1	3	32	36	34	51	5	90	12	5	0	17	222
08:15 AM	1	55	0	56	0	1	21	22	31	62	3	96	17	1	0	18	192
Total Volume	6	292	4	302	10	15	118	143	132	198	21	351	61	16	1	78	874
% App. Total	2	96.7	1.3		7	10.5	82.5		37.6	56.4	6		78.2	20.5	1.3		
PHF	.750	.859	.333	.868	.417	.469	.843	.730	.917	.798	.656	.914	.847	.667	.250	.886	.907

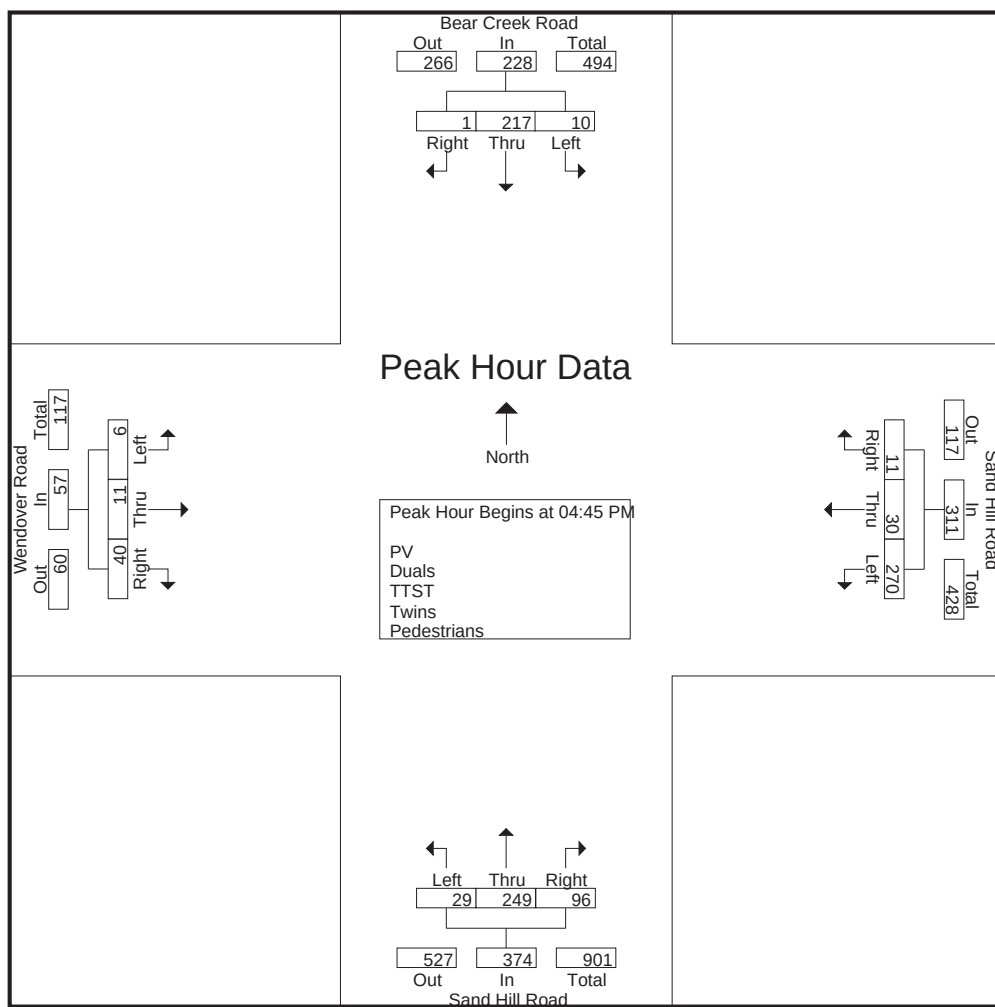


Mattern & Craig, Inc.

12 Broad St.
Asheville, NC, 28801
Phone: (828) 254-2201
Fax: (828) 254-4562

File Name : 12 Hour
Site Code : 3968-6
Start Date : 5/7/2019
Page No : 5

	Bear Creek Road Southbound				Sand Hill Road Westbound				Sand Hill Road Northbound				Wendover Road Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	47	1	48	1	9	77	87	29	58	11	98	7	0	2	9	242
05:00 PM	0	56	4	60	0	5	59	64	19	75	4	98	11	3	2	16	238
05:15 PM	1	67	3	71	6	7	77	90	18	58	8	84	9	6	2	17	262
05:30 PM	0	47	2	49	4	9	57	70	30	58	6	94	13	2	0	15	228
Total Volume	1	217	10	228	11	30	270	311	96	249	29	374	40	11	6	57	970
% App. Total	0.4	95.2	4.4		3.5	9.6	86.8		25.7	66.6	7.8		70.2	19.3	10.5		
PHF	.250	.810	.625	.803	.458	.833	.877	.864	.800	.830	.659	.954	.769	.458	.750	.838	.926



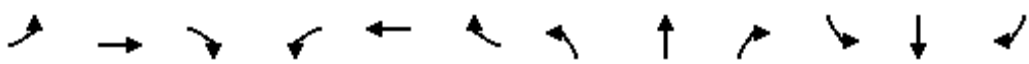
Appendix B: Capacity Output

B

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↶	↶		↶			↶	↶
Traffic Volume (vph)	0	0	0	604	4	80	13	438	0	0	493	157
Future Volume (vph)	0	0	0	604	4	80	13	438	0	0	493	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected					0.953			0.999				
Satd. Flow (prot)	0	0	0	0	1775	1583	0	1861	0	0	1863	1583
Flt Permitted					0.953			0.980				
Satd. Flow (perm)	0	0	0	0	1775	1583	0	1825	0	0	1863	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1001			1007			267			1004	
Travel Time (s)		22.8			22.9			5.2			19.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	671	4	89	14	487	0	0	548	174
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	675	89	0	501	0	0	548	174
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Free
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					Free
Detector Phase				8	8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	
Minimum Split (s)				25.0	25.0	25.0	14.0	25.0			25.0	
Total Split (s)				74.0	74.0	74.0	14.0	76.0			62.0	
Total Split (%)				49.3%	49.3%	49.3%	9.3%	50.7%			41.3%	
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	
Lost Time Adjust (s)					-2.0	-2.0		-2.0			-2.0	
Total Lost Time (s)					5.0	5.0		5.0			5.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Recall Mode				None	None	None	None	C-Min			C-Min	
Act Effect Green (s)					64.7	64.7		75.3			75.3	150.0
Actuated g/C Ratio					0.43	0.43		0.50			0.50	1.00
v/c Ratio					0.88	0.13		0.55			0.59	0.11
Control Delay					52.9	24.9		28.8			30.7	0.1
Queue Delay					2.8	0.0		7.9			0.5	0.0
Total Delay					55.7	24.9		36.7			31.2	0.1
LOS					E	C		D			C	A
Approach Delay					52.1			36.7			23.7	
Approach LOS					D			D			C	
Queue Length 50th (ft)					587	51		351			380	0
Queue Length 95th (ft)					752	86		m366			522	0

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		921			927			187			924	
Turn Bay Length (ft)						150						
Base Capacity (vph)					822	734		922			935	1583
Starvation Cap Reductn					0	0		374			0	0
Spillback Cap Reductn					71	0		0			114	0
Storage Cap Reductn					0	0		0			0	0
Reduced v/c Ratio					0.90	0.12		0.91			0.67	0.11

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 94 (63%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 37.9

Intersection LOS: D

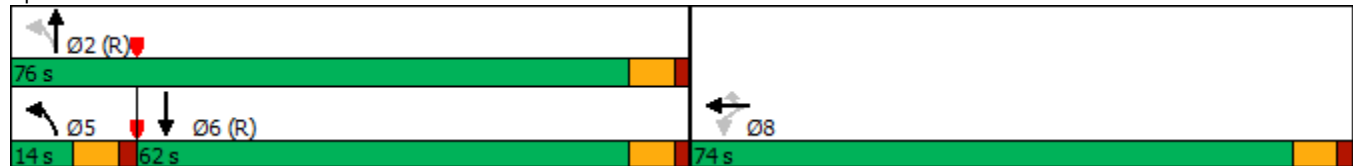
Intersection Capacity Utilization 75.5%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	154	4	18	0	0	0	0	297	674	208	887	0
Future Volume (vph)	154	4	18	0	0	0	0	297	674	208	887	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.986							0.850			
Flt Protected		0.958									0.991	
Satd. Flow (prot)	0	1760	0	0	0	0	0	1863	1583	0	1846	0
Flt Permitted		0.958									0.837	
Satd. Flow (perm)	0	1760	0	0	0	0	0	1863	1583	0	1559	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2645			267	
Travel Time (s)		22.7			23.0			51.5			5.2	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	171	4	20	0	0	0	0	330	749	231	986	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	195	0	0	0	0	0	330	749	0	1217	0
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Detector Phase	4	4						2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0						10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0						25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0						111.0	111.0	14.0	125.0	
Total Split (%)	16.7%	16.7%						74.0%	74.0%	9.3%	83.3%	
Yellow Time (s)	5.0	5.0						5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	-2.0		-2.0	
Total Lost Time (s)		5.0						5.0	5.0		5.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None						C-Min	C-Min	None	C-Min	
Act Effct Green (s)		19.5						120.5	120.5		120.5	
Actuated g/C Ratio		0.13						0.80	0.80		0.80	
v/c Ratio		0.85						0.22	0.59		0.97	
Control Delay		94.6						2.3	9.6		29.5	
Queue Delay		0.0						0.1	0.0		9.8	
Total Delay		94.6						2.5	9.6		39.3	
LOS		F						A	A		D	
Approach Delay		94.6						7.4			39.3	
Approach LOS		F						A			D	
Queue Length 50th (ft)		189						37	205		1217	
Queue Length 95th (ft)		#324						m43	m181		#1467	
Internal Link Dist (ft)		920			931			2565			187	
Turn Bay Length (ft)												
Base Capacity (vph)		234						1496	1271		1252	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0						0	0		55	
Spillback Cap Reductn		0						411	0		0	
Storage Cap Reductn		0						0	0		0	
Reduced v/c Ratio		0.83						0.30	0.59		1.02	

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 8 (5%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.97

Intersection Signal Delay: 29.8

Intersection LOS: C

Intersection Capacity Utilization 122.3%

ICU Level of Service H

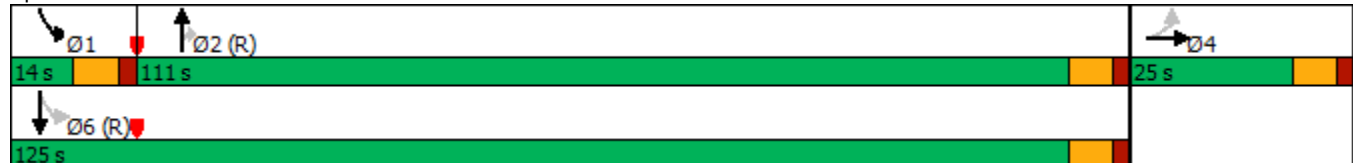
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance



Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	176	16	388	635	58	125	58	625	40	4	924	25
Future Volume (vph)	176	16	388	635	58	125	58	625	40	4	924	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	125		40	200		0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.910				0.850			0.850		0.996	
Flt Protected		0.985			0.956		0.950			0.950		
Satd. Flow (prot)	0	1670	0	0	1781	1583	1770	3539	1583	1770	3525	0
Flt Permitted		0.985			0.956		0.950			0.950		
Satd. Flow (perm)	0	1670	0	0	1781	1583	1770	3539	1583	1770	3525	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		3676			998			873			2645	
Travel Time (s)		83.5			22.7			13.2			40.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	196	18	431	706	64	139	64	694	44	4	1027	28
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	645	0	0	770	139	64	694	44	4	1055	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8	1	5	2		1	6	
Permitted Phases						8			2			
Detector Phase	4	4		8	8	1	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	7.0	12.0	12.0	7.0	12.0	
Minimum Split (s)	25.0	25.0		25.0	25.0	19.0	14.0	25.0	25.0	19.0	25.0	
Total Split (s)	46.0	46.0		49.0	49.0	19.0	14.0	36.0	36.0	19.0	41.0	
Total Split (%)	30.7%	30.7%		32.7%	32.7%	12.7%	9.3%	24.0%	24.0%	12.7%	27.3%	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag						Lead	Lag	Lag	Lag	Lead	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Min	C-Min	None	C-Min	
Act Effect Green (s)		41.0			44.0	58.0	9.0	36.0	36.0	9.0	38.8	
Actuated g/C Ratio		0.27			0.29	0.39	0.06	0.24	0.24	0.06	0.26	
v/c Ratio		1.41			1.48	0.23	0.60	0.82	0.12	0.04	1.16	
Control Delay		238.8			261.5	32.2	71.0	43.9	23.7	60.8	118.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		238.8			261.5	32.2	71.0	43.9	23.7	60.8	118.6	
LOS		F			F	C	E	D	C	E	F	
Approach Delay		238.8			226.4			45.0			118.4	
Approach LOS		F			F			D			F	
Queue Length 50th (ft)		~845			~1032	91	62	343	34	4	~684	
Queue Length 95th (ft)		#1089			#1286	145	#126	418	43	m5	m#714	

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3596			918			793			2565		
Turn Bay Length (ft)							150	125	40	200		
Base Capacity (vph)	456			522			664	106	849	379	165	912
Starvation Cap Reductn	0			0			0	0	0	0	0	0
Spillback Cap Reductn	0			0			0	0	0	0	0	0
Storage Cap Reductn	0			0			0	0	0	0	0	0
Reduced v/c Ratio	1.41			1.48			0.21	0.60	0.82	0.12	0.02	1.16

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 136 (91%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 145

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.48

Intersection Signal Delay: 152.6

Intersection LOS: F

Intersection Capacity Utilization 121.5%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

											
Ø1	Ø2 (R)	Ø4	Ø6 (R)	Ø5	Ø8						
19 s	36 s	46 s	41 s	14 s	49 s						

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/09/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	152	129	605	380	518	1033
Future Volume (vph)	152	129	605	380	518	1033
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	236		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	169	143	672	422	576	1148
Shared Lane Traffic (%)						
Lane Group Flow (vph)	169	143	672	422	576	1148
Turn Type	Prot	Free	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		Free		2		
Detector Phase	8		2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0		12.0	7.0	12.0	5.0
Minimum Split (s)	25.0		25.0	25.0	19.0	25.0
Total Split (s)	40.0		60.0	40.0	50.0	110.0
Total Split (%)	26.7%		40.0%	26.7%	33.3%	73.3%
Yellow Time (s)	5.0		5.0	5.0	5.0	5.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0		5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		C-Min	None	None	C-Min
Act Effct Green (s)	26.8	150.0	75.6	107.4	32.6	113.2
Actuated g/C Ratio	0.18	1.00	0.50	0.72	0.22	0.75
v/c Ratio	0.28	0.09	0.38	0.37	0.77	0.43
Control Delay	53.3	0.1	25.1	9.9	52.1	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.3	0.1	25.1	9.9	52.1	4.7
LOS	D	A	C	A	D	A
Approach Delay	28.9		19.3			20.6
Approach LOS	C		B			C
Queue Length 50th (ft)	74	0	208	147	301	108
Queue Length 95th (ft)	104	0	308	237	m211	m138

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/09/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	156		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	801	1583	1783	1123	1029	2670
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.09	0.38	0.38	0.56	0.43

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 130 (87%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 20.9

Intersection LOS: C

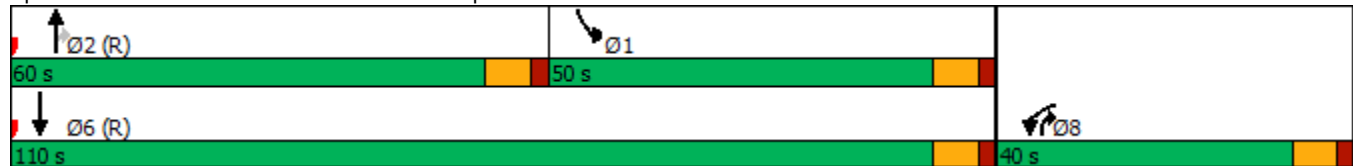
Intersection Capacity Utilization 49.8%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/07/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	453	118	0	0	0
Future Vol, veh/h	0	453	118	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	503	131	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	131	0	-	0	634	131
Stage 1	-	-	-	-	131	-
Stage 2	-	-	-	-	503	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1454	-	-	-	443	919
Stage 1	-	-	-	-	895	-
Stage 2	-	-	-	-	607	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1454	-	-	-	443	919
Mov Cap-2 Maneuver	-	-	-	-	443	-
Stage 1	-	-	-	-	895	-
Stage 2	-	-	-	-	607	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1454	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

HCM 6th TWSC
6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/07/2020

Intersection						
Int Delay, s/veh	7.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	58	60	298	211	242	279
Future Vol, veh/h	58	60	298	211	242	279
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	64	67	331	234	269	310
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1296	448	0	0	565	0
Stage 1	448	-	-	-	-	-
Stage 2	848	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	179	611	-	-	1007	-
Stage 1	644	-	-	-	-	-
Stage 2	420	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	121	611	-	-	1007	-
Mov Cap-2 Maneuver	121	-	-	-	-	-
Stage 1	644	-	-	-	-	-
Stage 2	284	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	49.8	0		4.6		
HCM LOS	E					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	204	1007	-	
HCM Lane V/C Ratio	-	-	0.643	0.267	-	
HCM Control Delay (s)	-	-	49.8	9.9	0	
HCM Lane LOS	-	-	E	A	A	
HCM 95th %tile Q(veh)	-	-	3.8	1.1	-	

Intersection	
Intersection Delay, s/veh	13
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	16	62	120	15	10	21	201	134	4	296	6
Future Vol, veh/h	4	16	62	120	15	10	21	201	134	4	296	6
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	18	69	133	17	11	23	223	149	4	329	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

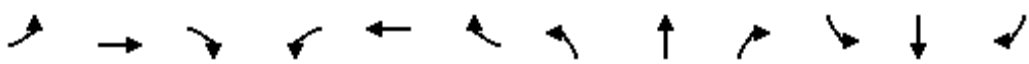
Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.7	11.4	14	13.4
HCM LOS	A	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	5%	83%	1%
Vol Thru, %	56%	20%	10%	97%
Vol Right, %	38%	76%	7%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	356	82	145	306
LT Vol	21	4	120	4
Through Vol	201	16	15	296
RT Vol	134	62	10	6
Lane Flow Rate	396	91	161	340
Geometry Grp	1	1	1	1
Degree of Util (X)	0.548	0.144	0.272	0.496
Departure Headway (Hd)	4.989	5.701	6.088	5.249
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	724	626	588	687
Service Time	3.028	3.761	4.143	3.29
HCM Lane V/C Ratio	0.547	0.145	0.274	0.495
HCM Control Delay	14	9.7	11.4	13.4
HCM Lane LOS	B	A	B	B
HCM 95th-tile Q	3.4	0.5	1.1	2.8

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↶	↷		↶			↷	↶
Traffic Volume (vph)	0	0	0	471	6	213	21	664	0	0	371	119
Future Volume (vph)	0	0	0	471	6	213	21	664	0	0	371	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	0		0	0		175
Storage Lanes	0		0	0		1	0		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected					0.953			0.998				
Satd. Flow (prot)	0	0	0	0	1775	1583	0	1859	0	0	1863	1583
Flt Permitted					0.953			0.979				
Satd. Flow (perm)	0	0	0	0	1775	1583	0	1824	0	0	1863	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1002			1007			268			1038	
Travel Time (s)		22.8			22.9			6.1			23.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	523	7	237	23	738	0	0	412	132
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	530	237	0	761	0	0	412	132
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Free
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					Free
Detector Phase				8	8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	
Minimum Split (s)				25.0	25.0	25.0	14.0	25.0			25.0	
Total Split (s)				72.0	72.0	72.0	14.0	98.0			84.0	
Total Split (%)				42.4%	42.4%	42.4%	8.2%	57.6%			49.4%	
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	
Lost Time Adjust (s)					-2.0	-2.0		-2.0			-2.0	
Total Lost Time (s)					5.0	5.0		5.0			5.0	
Lead/Lag							Lag				Lead	
Lead-Lag Optimize?							Yes				Yes	
Recall Mode				None	None	None	None	C-Min			C-Min	
Act Effect Green (s)					59.0	59.0		101.0			101.0	170.0
Actuated g/C Ratio					0.35	0.35		0.59			0.59	1.00
v/c Ratio					0.86	0.43		0.70			0.37	0.08
Control Delay					66.0	44.2		22.8			20.3	0.1
Queue Delay					0.0	0.0		5.1			0.1	0.0
Total Delay					66.0	44.2		27.9			20.4	0.1
LOS					E	D		C			C	A
Approach Delay					59.3			27.9			15.5	
Approach LOS					E			C			B	
Queue Length 50th (ft)					545	201		485			236	0
Queue Length 95th (ft)					665	269		211			346	0

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		922			927			188			958	
Turn Bay Length (ft)						150						175
Base Capacity (vph)					699	623		1084			1107	1583
Starvation Cap Reductn					0	0		256			0	0
Spillback Cap Reductn					0	0		0			149	0
Storage Cap Reductn					0	0		0			0	0
Reduced v/c Ratio					0.76	0.38		0.92			0.43	0.08

Intersection Summary

Area Type: Other

Cycle Length: 170

Actuated Cycle Length: 170

Offset: 158 (93%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.86

Intersection Signal Delay: 36.3

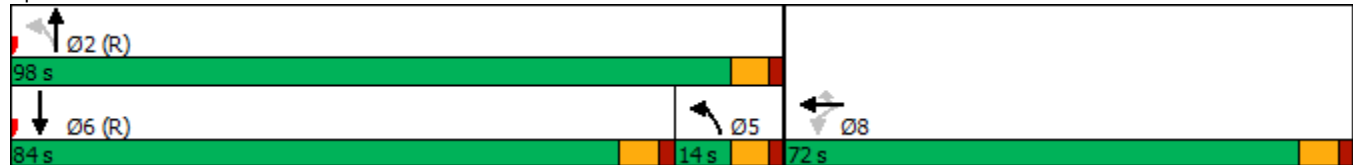
Intersection LOS: D

Intersection Capacity Utilization 86.6%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗		↖	
Traffic Volume (vph)	168	6	18	0	0	0	0	517	863	138	704	0
Future Volume (vph)	168	6	18	0	0	0	0	517	863	138	704	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987							0.850			
Flt Protected		0.958									0.992	
Satd. Flow (prot)	0	1761	0	0	0	0	0	1863	1583	0	1848	0
Flt Permitted		0.958									0.754	
Satd. Flow (perm)	0	1761	0	0	0	0	0	1863	1583	0	1405	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2645			268	
Travel Time (s)		22.7			23.0			51.5			5.2	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	187	7	20	0	0	0	0	574	959	153	782	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	214	0	0	0	0	0	574	959	0	935	0
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Detector Phase	4	4						2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0						10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0						25.0	25.0	14.0	25.0	
Total Split (s)	30.0	30.0						126.0	126.0	14.0	140.0	
Total Split (%)	17.6%	17.6%						74.1%	74.1%	8.2%	82.4%	
Yellow Time (s)	5.0	5.0						5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	-2.0		-2.0	
Total Lost Time (s)		5.0						5.0	5.0		5.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None						C-Min	C-Min	None	C-Min	
Act Effct Green (s)		24.1						135.9	135.9		135.9	
Actuated g/C Ratio		0.14						0.80	0.80		0.80	
v/c Ratio		0.86						0.39	0.76		0.83	
Control Delay		100.5						2.4	12.1		17.5	
Queue Delay		1.1						0.4	0.0		1.5	
Total Delay		101.6						2.8	12.1		19.0	
LOS		F						A	B		B	
Approach Delay		101.6						8.6			19.0	
Approach LOS		F						A			B	
Queue Length 50th (ft)		235						49	234		146	
Queue Length 95th (ft)		#377						m92	m836		535	
Internal Link Dist (ft)		920			931			2565			188	
Turn Bay Length (ft)												
Base Capacity (vph)		258						1488	1265		1122	

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Intersection Summary

Cycle Length: 170

Offset: 38 (22%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Control Type: Actuated-Coordinated

Intersection Signal Delay: 19.7 Intersection LOS: B

Intersection LOS: B

ICU Level of Service H

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

		
---	---	---



Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/07/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕	↕	↕	↕	↕	↕	↕
Traffic Volume (vph)	60	22	184	688	257	543	145	854	63	97	723	6
Future Volume (vph)	60	22	184	688	257	543	145	854	63	97	723	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	125		40	200		0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.907				0.850			0.850		0.999	
Flt Protected		0.989			0.965		0.950			0.950		
Satd. Flow (prot)	0	1671	0	0	1798	1583	1770	3539	1583	1770	3536	0
Flt Permitted		0.254			0.600		0.950			0.950		
Satd. Flow (perm)	0	429	0	0	1118	1583	1770	3539	1583	1770	3536	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2645	
Travel Time (s)		91.0			22.7			13.2			40.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	67	24	204	764	286	603	161	949	70	108	803	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	295	0	0	1050	603	161	949	70	108	810	0
Turn Type	Perm	NA		Perm	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases		4			8	1	5	2		1	6	
Permitted Phases	4			8		8			2			
Detector Phase	4	4		8	8	1	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	5.0	12.0	12.0	7.0	7.0	
Minimum Split (s)	25.0	25.0		25.0	25.0	14.0	12.0	25.0	25.0	14.0	25.0	
Total Split (s)	98.0	98.0		98.0	98.0	14.0	15.0	38.0	38.0	14.0	37.0	
Total Split (%)	65.3%	65.3%		65.3%	65.3%	9.3%	10.0%	25.3%	25.3%	9.3%	24.7%	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag						Lead	Lag	Lag	Lag	Lead	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Min	C-Min	None	C-Min	
Act Effect Green (s)		93.0			93.0	107.0	10.0	33.0	33.0	9.0	32.0	
Actuated g/C Ratio		0.62			0.62	0.71	0.07	0.22	0.22	0.06	0.21	
v/c Ratio		1.11			1.52	0.53	1.36	1.22	0.20	1.02	1.07	
Control Delay		117.9			265.1	12.1	246.5	148.8	35.4	137.1	101.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		117.9			265.1	12.1	246.5	148.8	35.4	137.1	101.8	
LOS		F			F	B	F	F	D	F	F	
Approach Delay		117.9			172.8			155.4			106.0	
Approach LOS		F			F			F			F	
Queue Length 50th (ft)		~329			~1427	250	~209	~601	57	~108	~468	
Queue Length 95th (ft)		#521			#1691	340	#366	#740	99	m#168	#594	

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/07/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		3922			918			793				2565
Turn Bay Length (ft)						150	125		40	200		
Base Capacity (vph)		265			693	1129	118	778	348	106	754	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		1.11			1.52	0.53	1.36	1.22	0.20	1.02	1.07	

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 6 (4%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.52

Intersection Signal Delay: 148.6

Intersection LOS: F

Intersection Capacity Utilization 113.5%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

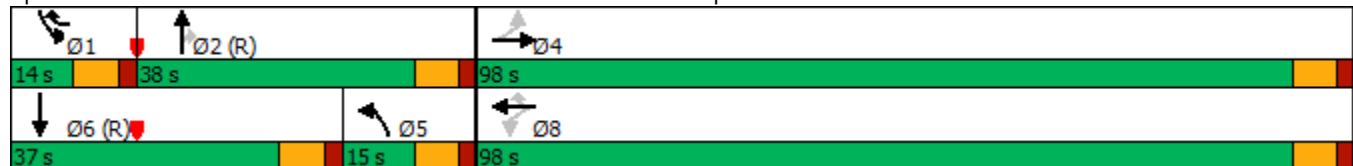
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps



Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/07/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	174	50	1056	496	224	1072
Future Volume (vph)	174	50	1056	496	224	1072
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	286		1003			873
Travel Time (s)	5.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	193	56	1173	551	249	1191
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	56	1173	551	249	1191
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	12.0	7.0	7.0	12.0
Minimum Split (s)	25.0	25.0	25.0	25.0	14.0	25.0
Total Split (s)	40.0	40.0	84.0	40.0	26.0	110.0
Total Split (%)	26.7%	26.7%	56.0%	26.7%	17.3%	73.3%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effct Green (s)	22.7	22.7	94.2	121.9	18.1	117.3
Actuated g/C Ratio	0.15	0.15	0.63	0.81	0.12	0.78
v/c Ratio	0.37	0.23	0.53	0.43	0.60	0.43
Control Delay	59.5	58.8	17.0	5.5	65.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.5	58.8	17.0	5.5	65.1	2.3
LOS	E	E	B	A	E	A
Approach Delay	59.3		13.3			13.1
Approach LOS	E		B			B
Queue Length 50th (ft)	87	48	333	130	122	51
Queue Length 95th (ft)	130	95	398	210	m95	m88

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/07/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	206		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	801	369	2221	1415	486	2767
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.15	0.53	0.39	0.51	0.43

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.60

Intersection Signal Delay: 16.6

Intersection LOS: B

Intersection Capacity Utilization 53.9%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/07/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	202	438	0	0	0
Future Vol, veh/h	0	202	438	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	224	487	0	0	0
Major/Minor	Major1	Major2	Minor2			
Conflicting Flow All	487	0	-	0	711	487
Stage 1	-	-	-	-	487	-
Stage 2	-	-	-	-	224	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1076	-	-	-	400	581
Stage 1	-	-	-	-	618	-
Stage 2	-	-	-	-	813	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1076	-	-	-	400	581
Mov Cap-2 Maneuver	-	-	-	-	400	-
Stage 1	-	-	-	-	618	-
Stage 2	-	-	-	-	813	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1076	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

Intersection						
Int Delay, s/veh	88.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	229	209	185	71	131	442
Future Vol, veh/h	229	209	185	71	131	442
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	254	232	206	79	146	491
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1029	246	0	0	285	0
Stage 1	246	-	-	-	-	-
Stage 2	783	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	259	793	-	-	1277	-
Stage 1	795	-	-	-	-	-
Stage 2	450	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 218	793	-	-	1277	-
Mov Cap-2 Maneuver	~ 218	-	-	-	-	-
Stage 1	795	-	-	-	-	-
Stage 2	379	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	253.4	0		1.9		
HCM LOS	F					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	333	1277	-	
HCM Lane V/C Ratio	-	-	1.461	0.114	-	
HCM Control Delay (s)	-	-	253.4	8.2	0	
HCM Lane LOS	-	-	F	A	A	
HCM 95th %tile Q(veh)	-	-	26.2	0.4	-	
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	16.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	6	11	41	274	30	11	29	253	97	10	220	4
Future Vol, veh/h	6	11	41	274	30	11	29	253	97	10	220	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	12	46	304	33	12	32	281	108	11	244	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

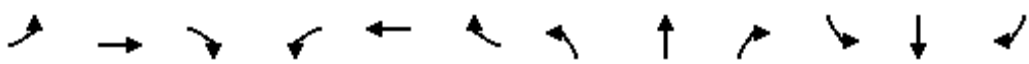
Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.2	17.9	18.6	13.6
HCM LOS	B	C	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	10%	87%	4%
Vol Thru, %	67%	19%	10%	94%
Vol Right, %	26%	71%	3%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	379	58	315	234
LT Vol	29	6	274	10
Through Vol	253	11	30	220
RT Vol	97	41	11	4
Lane Flow Rate	421	64	350	260
Geometry Grp	1	1	1	1
Degree of Util (X)	0.651	0.114	0.594	0.431
Departure Headway (Hd)	5.569	6.383	6.113	5.962
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	644	565	585	598
Service Time	3.655	4.383	4.197	4.06
HCM Lane V/C Ratio	0.654	0.113	0.598	0.435
HCM Control Delay	18.6	10.2	17.9	13.6
HCM Lane LOS	C	B	C	B
HCM 95th-tile Q	4.8	0.4	3.9	2.2

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↶	↶		↶			↶	↶
Traffic Volume (vph)	0	0	0	691	4	91	15	501	0	0	564	179
Future Volume (vph)	0	0	0	691	4	91	15	501	0	0	564	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	0		0	0		175
Storage Lanes	0		0	0		1	0		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected					0.953			0.999				
Satd. Flow (prot)	0	0	0	0	1775	1583	0	1861	0	0	1863	1583
Flt Permitted					0.953			0.849				
Satd. Flow (perm)	0	0	0	0	1775	1583	0	1581	0	0	1863	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1003			1004			268			1004	
Travel Time (s)		22.8			22.8			6.1			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	768	4	101	17	557	0	0	627	199
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	772	101	0	574	0	0	627	199
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	10.0
Minimum Split (s)				25.0	25.0	25.0	14.0	25.0			25.0	25.0
Total Split (s)				95.0	95.0	95.0	14.0	95.0			81.0	81.0
Total Split (%)				50.0%	50.0%	50.0%	7.4%	50.0%			42.6%	42.6%
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)					-2.0	-2.0		-2.0			-2.0	-2.0
Total Lost Time (s)					5.0	5.0		5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?							Yes				Yes	Yes
Recall Mode				None	None	None	None	C-Min			C-Min	C-Min
Act Effect Green (s)					87.8	87.8		92.2			92.2	92.2
Actuated g/C Ratio					0.46	0.46		0.49			0.49	0.49
v/c Ratio					0.94	0.14		0.75			0.69	0.26
Control Delay					68.5	29.4		21.2			43.5	30.5
Queue Delay					0.0	0.0		52.6			11.8	0.0
Total Delay					68.5	29.4		73.7			55.3	30.5
LOS					E	C		E			E	C
Approach Delay					64.0			73.7			49.3	
Approach LOS					E			E			D	
Queue Length 50th (ft)					892	70		400			617	149
Queue Length 95th (ft)					#1172	113		m448			775	213

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		923			924			188			924	
Turn Bay Length (ft)						150						175
Base Capacity (vph)					840	749		767			904	768
Starvation Cap Reductn					0	0		258			0	0
Spillback Cap Reductn					0	0		0			256	0
Storage Cap Reductn					0	0		0			0	0
Reduced v/c Ratio					0.92	0.13		1.13			0.97	0.26

Intersection Summary

Area Type: Other

Cycle Length: 190

Actuated Cycle Length: 190

Offset: 48 (25%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 100

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 61.1

Intersection LOS: E

Intersection Capacity Utilization 89.3%

ICU Level of Service E

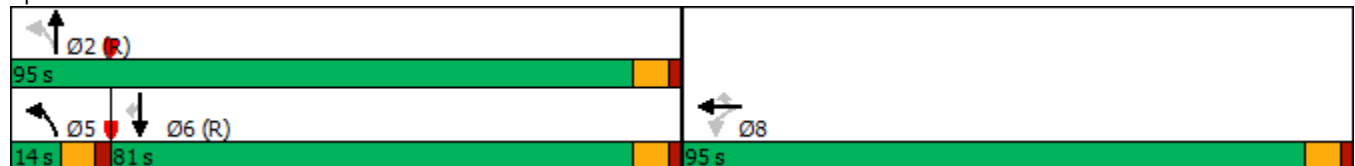
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗		↖	
Traffic Volume (vph)	176	4	21	0	0	0	0	340	771	238	1014	0
Future Volume (vph)	176	4	21	0	0	0	0	340	771	238	1014	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.986							0.850			
Flt Protected		0.958									0.991	
Satd. Flow (prot)	0	1760	0	0	0	0	0	1863	1583	0	1846	0
Flt Permitted		0.958									0.820	
Satd. Flow (perm)	0	1760	0	0	0	0	0	1863	1583	0	1527	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2645			268	
Travel Time (s)		22.7			23.0			51.5			5.2	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	196	4	23	0	0	0	0	378	857	264	1127	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	223	0	0	0	0	0	378	857	0	1391	0
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Detector Phase	4	4						2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0						10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0						25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0						151.0	151.0	14.0	165.0	
Total Split (%)	13.2%	13.2%						79.5%	79.5%	7.4%	86.8%	
Yellow Time (s)	5.0	5.0						5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	-2.0		-2.0	
Total Lost Time (s)		5.0						5.0	5.0		5.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None						C-Min	C-Min	None	C-Min	
Act Effct Green (s)		20.0						160.0	160.0		160.0	
Actuated g/C Ratio		0.11						0.84	0.84		0.84	
v/c Ratio		1.21						0.24	0.64		1.08	
Control Delay		198.2						0.6	12.2		60.9	
Queue Delay		8.1						0.0	0.0		7.4	
Total Delay		206.3						0.6	12.2		68.2	
LOS		F						A	B		E	
Approach Delay		206.3						8.7			68.2	
Approach LOS		F						A			E	
Queue Length 50th (ft)		~337						12	842		~1957	
Queue Length 95th (ft)		#528						m12	m851		#2197	
Internal Link Dist (ft)		920			931			2565			188	
Turn Bay Length (ft)												
Base Capacity (vph)		185						1568	1333		1285	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0						0	0		40	
Spillback Cap Reductn		65						15	0		0	
Storage Cap Reductn		0						0	0		0	
Reduced v/c Ratio		1.86						0.24	0.64		1.12	

Intersection Summary

Area Type: Other

Cycle Length: 190

Actuated Cycle Length: 190

Offset: 74 (39%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.21

Intersection Signal Delay: 53.2

Intersection LOS: D

Intersection Capacity Utilization 138.0%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance



Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	201	19	443	726	66	143	66	715	45	4	1056	29
Future Volume (vph)	201	19	443	726	66	143	66	715	45	4	1056	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	125		40	200		0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.910				0.850			0.850		0.996	
Flt Protected		0.985			0.956		0.950			0.950		
Satd. Flow (prot)	0	1670	0	0	1781	1583	1770	3539	1583	1770	3525	0
Flt Permitted		0.985			0.956		0.950			0.950		
Satd. Flow (perm)	0	1670	0	0	1781	1583	1770	3539	1583	1770	3525	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		3672			998			873			2645	
Travel Time (s)		83.5			22.7			13.2			40.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	223	21	492	807	73	159	73	794	50	4	1173	32
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	736	0	0	880	159	73	794	50	4	1205	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8	1	5	2		1	6	
Permitted Phases						8			2			
Detector Phase	4	4		8	8	1	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	7.0	12.0	12.0	7.0	12.0	
Minimum Split (s)	25.0	25.0		25.0	25.0	14.0	14.0	25.0	25.0	14.0	25.0	
Total Split (s)	59.0	59.0		66.0	66.0	14.0	14.0	51.0	51.0	14.0	51.0	
Total Split (%)	31.1%	31.1%		34.7%	34.7%	7.4%	7.4%	26.8%	26.8%	7.4%	26.8%	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag						Lag	Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Min	C-Min	None	C-Min	
Act Effect Green (s)		54.0			61.0	70.4	9.0	45.6	45.6	9.4	46.0	
Actuated g/C Ratio		0.28			0.32	0.37	0.05	0.24	0.24	0.05	0.24	
v/c Ratio		1.55			1.54	0.27	0.88	0.94	0.13	0.05	1.41	
Control Delay		300.9			293.0	22.8	134.7	67.9	32.0	79.5	228.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		300.9			293.0	22.8	134.7	67.9	32.0	79.5	228.6	
LOS		F			F	C	F	E	C	E	F	
Approach Delay		300.9			251.6			71.3			228.1	
Approach LOS		F			F			E			F	
Queue Length 50th (ft)		~1289			~1535	71	93	524	52	0	~1062	
Queue Length 95th (ft)		#1550			#1801	107	#199	#640	53	m0	m#948	

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		3592			918			793				2565
Turn Bay Length (ft)						150	125		40	200		
Base Capacity (vph)		474			571	587	83	856	383	87		853
Starvation Cap Reductn		0			0	0	0	0	0	0		0
Spillback Cap Reductn		0			0	0	0	0	0	0		0
Storage Cap Reductn		0			0	0	0	0	0	0		0
Reduced v/c Ratio		1.55			1.54	0.27	0.88	0.93	0.13	0.05		1.41

Intersection Summary

Area Type: Other

Cycle Length: 190

Actuated Cycle Length: 190

Offset: 24 (13%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.55

Intersection Signal Delay: 211.2

Intersection LOS: F

Intersection Capacity Utilization 135.7%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

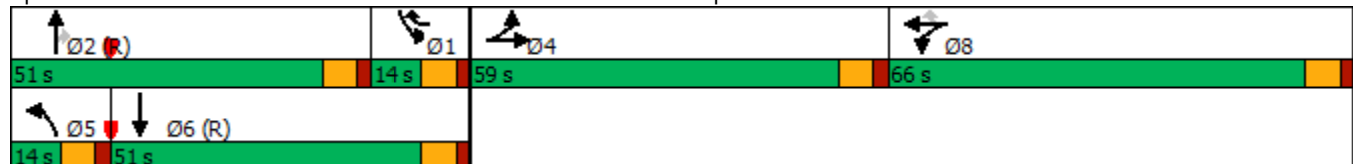
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps



Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/09/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	174	147	692	434	592	1181
Future Volume (vph)	174	147	692	434	592	1181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	236		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	193	163	769	482	658	1312
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	163	769	482	658	1312
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	12.0	7.0	7.0	12.0
Minimum Split (s)	25.0	25.0	25.0	25.0	14.0	25.0
Total Split (s)	50.0	50.0	75.0	50.0	65.0	140.0
Total Split (%)	26.3%	26.3%	39.5%	26.3%	34.2%	73.7%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	37.1	37.1	93.5	135.7	44.3	142.9
Actuated g/C Ratio	0.20	0.20	0.49	0.71	0.23	0.75
v/c Ratio	0.29	0.53	0.44	0.43	0.82	0.49
Control Delay	65.2	74.1	34.0	13.3	56.0	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.9
Total Delay	65.2	74.1	34.0	13.3	56.0	7.3
LOS	E	E	C	B	E	A
Approach Delay	69.3		26.0			23.6
Approach LOS	E		C			C
Queue Length 50th (ft)	108	188	317	232	402	167
Queue Length 95th (ft)	138	252	464	355	m254	m172

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/09/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	156		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	824	379	1742	1130	1084	2672
Starvation Cap Reductn	0	0	0	0	0	973
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.43	0.44	0.43	0.61	0.77

Intersection Summary

Area Type: Other

Cycle Length: 190

Actuated Cycle Length: 190

Offset: 10 (5%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 29.0

Intersection LOS: C

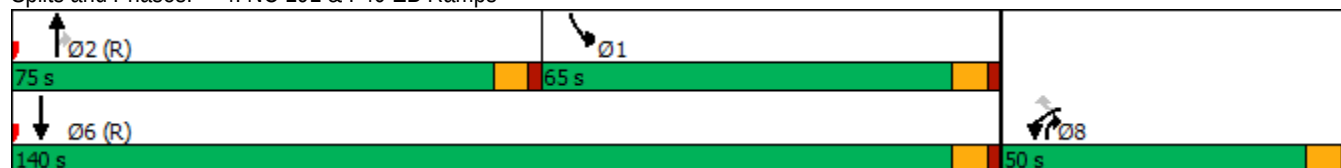
Intersection Capacity Utilization 54.4%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/07/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	518	135	0	0	0
Future Vol, veh/h	0	518	135	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	576	150	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	150	0	-	0	726	150
Stage 1	-	-	-	-	150	-
Stage 2	-	-	-	-	576	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1431	-	-	-	391	896
Stage 1	-	-	-	-	878	-
Stage 2	-	-	-	-	562	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1431	-	-	-	391	896
Mov Cap-2 Maneuver	-	-	-	-	391	-
Stage 1	-	-	-	-	878	-
Stage 2	-	-	-	-	562	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1431	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

HCM 6th TWSC
6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/07/2020

Intersection						
Int Delay, s/veh	16.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	66	68	341	241	276	319
Future Vol, veh/h	66	68	341	241	276	319
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	76	379	268	307	354
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1481	513	0	0	647	0
Stage 1	513	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	138	561	-	-	939	-
Stage 1	601	-	-	-	-	-
Stage 2	368	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	82	561	-	-	939	-
Mov Cap-2 Maneuver	82	-	-	-	-	-
Stage 1	601	-	-	-	-	-
Stage 2	218	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	143.1	0		5		
HCM LOS	F					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	- 145		939	-	
HCM Lane V/C Ratio	-	- 1.027		0.327	-	
HCM Control Delay (s)	-	- 143.1		10.7	0	
HCM Lane LOS	-	- F		B	A	
HCM 95th %tile Q(veh)	-	- 7.7		1.4	-	

Intersection	
Intersection Delay, s/veh	16.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	19	71	137	17	12	24	230	153	5	339	7
Future Vol, veh/h	4	19	71	137	17	12	24	230	153	5	339	7
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	21	79	152	19	13	27	256	170	6	377	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.7	12.9	18.3	16.8
HCM LOS	B	B	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	4%	83%	1%
Vol Thru, %	57%	20%	10%	97%
Vol Right, %	38%	76%	7%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	407	94	166	351
LT Vol	24	4	137	5
Through Vol	230	19	17	339
RT Vol	153	71	12	7
Lane Flow Rate	452	104	184	390
Geometry Grp	1	1	1	1
Degree of Util (X)	0.663	0.182	0.337	0.601
Departure Headway (Hd)	5.274	6.267	6.583	5.548
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	678	575	550	643
Service Time	3.364	4.276	4.583	3.641
HCM Lane V/C Ratio	0.667	0.181	0.335	0.607
HCM Control Delay	18.3	10.7	12.9	16.8
HCM Lane LOS	C	B	B	C
HCM 95th-tile Q	5	0.7	1.5	4

Lanes, Volumes, Timings

1: NC 191

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	539	7	243	15	759	0	0	424	136
Future Volume (vph)	0	0	0	539	7	243	15	759	0	0	424	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	0		0	0		175
Storage Lanes	0		0	0		1	0		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected					0.953			0.999				
Satd. Flow (prot)	0	0	0	0	1775	1583	0	1861	0	0	1863	1583
Flt Permitted					0.953			0.986				
Satd. Flow (perm)	0	0	0	0	1775	1583	0	1837	0	0	1863	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		990			1009			269			1001	
Travel Time (s)		22.5			22.9			6.1			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	599	8	270	17	843	0	0	471	151
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	607	270	0	860	0	0	471	151
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Free
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					Free
Detector Phase				8	8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	
Minimum Split (s)				25.0	25.0	25.0	17.0	25.0			25.0	
Total Split (s)				77.0	77.0	77.0	17.0	103.0			86.0	
Total Split (%)				42.8%	42.8%	42.8%	9.4%	57.2%			47.8%	
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	
Lost Time Adjust (s)					-2.0	-2.0		-2.0			-2.0	
Total Lost Time (s)					5.0	5.0		5.0			5.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Recall Mode				None	None	None	None	C-Min			C-Min	
Act Effect Green (s)					68.0	68.0		102.0			102.0	180.0
Actuated g/C Ratio					0.38	0.38		0.57			0.57	1.00
v/c Ratio					0.90	0.45		0.83			0.45	0.10
Control Delay					70.6	44.1		26.9			25.0	0.1
Queue Delay					3.2	0.0		19.5			0.2	0.0
Total Delay					73.8	44.1		46.4			25.3	0.1
LOS					E	D		D			C	A
Approach Delay					64.7			46.4			19.2	
Approach LOS					E			D			B	
Queue Length 50th (ft)					659	232		362			329	0
Queue Length 95th (ft)					837	321		m636			431	0

Lanes, Volumes, Timings

1: NC 191

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		910			929			189			921	
Turn Bay Length (ft)						150						175
Base Capacity (vph)					710	633		1040			1055	1583
Starvation Cap Reductn					0	0		196			0	0
Spillback Cap Reductn					47	0		0			147	0
Storage Cap Reductn					0	0		0			0	0
Reduced v/c Ratio					0.92	0.43		1.02			0.52	0.10

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 84 (47%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 46.0

Intersection LOS: D

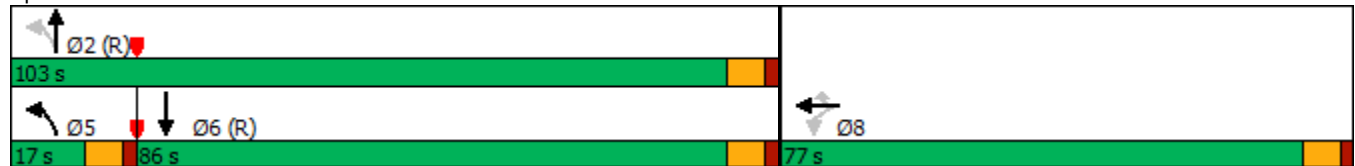
Intersection Capacity Utilization 90.5%

ICU Level of Service E

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗		↖	
Traffic Volume (vph)	193	7	21	0	0	0	0	591	986	158	805	0
Future Volume (vph)	193	7	21	0	0	0	0	591	986	158	805	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987							0.850			
Flt Protected		0.958									0.992	
Satd. Flow (prot)	0	1761	0	0	0	0	0	1863	1583	0	1848	0
Flt Permitted		0.958									0.709	
Satd. Flow (perm)	0	1761	0	0	0	0	0	1863	1583	0	1321	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2645			269	
Travel Time (s)		22.7			23.0			51.5			5.2	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	214	8	23	0	0	0	0	657	1096	176	894	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	245	0	0	0	0	0	657	1096	0	1070	0
Turn Type	Perm	NA						NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4								2	6		
Detector Phase	4	4						2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0						10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0						25.0	25.0	14.0	25.0	
Total Split (s)	28.0	28.0						138.0	138.0	14.0	152.0	
Total Split (%)	15.6%	15.6%						76.7%	76.7%	7.8%	84.4%	
Yellow Time (s)	5.0	5.0						5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0						2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0						-2.0	-2.0		-2.0	
Total Lost Time (s)		5.0						5.0	5.0		5.0	
Lead/Lag								Lead	Lead		Lag	
Lead-Lag Optimize?								Yes	Yes		Yes	
Recall Mode	None	None						C-Min	C-Min	None	C-Min	
Act Effct Green (s)		23.0						147.0	147.0		147.0	
Actuated g/C Ratio		0.13						0.82	0.82		0.82	
v/c Ratio		1.09						0.43	0.85		0.99	
Control Delay		154.7						1.7	23.2		40.4	
Queue Delay		0.0						0.6	0.0		11.2	
Total Delay		154.7						2.3	23.2		51.6	
LOS		F						A	C		D	
Approach Delay		154.7						15.4			51.6	
Approach LOS		F						B			D	
Queue Length 50th (ft)		~324						58	636		1303	
Queue Length 95th (ft)		#517						m50	m425		#1587	
Internal Link Dist (ft)		920			931			2565			189	
Turn Bay Length (ft)												
Base Capacity (vph)		225						1521	1292		1078	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0						0	0		42	
Spillback Cap Reductn		0						490	0		0	
Storage Cap Reductn		0						0	0		0	
Reduced v/c Ratio		1.09						0.64	0.85		1.03	

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 154 (86%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 39.1

Intersection LOS: D

Intersection Capacity Utilization 137.0%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

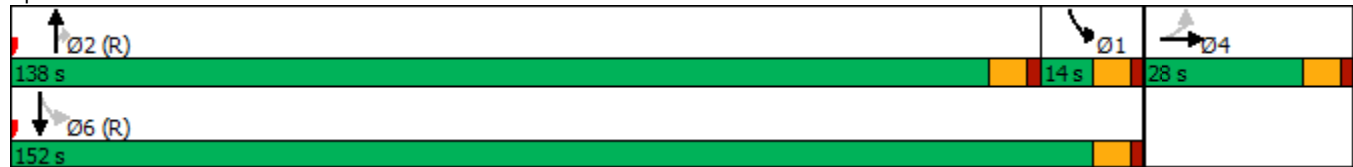
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance



Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕	↕	↕	↕	↕	↕	↕
Traffic Volume (vph)	68	26	210	787	294	621	166	976	72	7	826	111
Future Volume (vph)	68	26	210	787	294	621	166	976	72	7	826	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	125		40	200		0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.907				0.850			0.850		0.982	
Flt Protected		0.989			0.965		0.950			0.950		
Satd. Flow (prot)	0	1671	0	0	1798	1583	1770	3539	1583	1770	3476	0
Flt Permitted		0.989			0.965		0.950			0.950		
Satd. Flow (perm)	0	1671	0	0	1798	1583	1770	3539	1583	1770	3476	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		3669			998			873			2645	
Travel Time (s)		83.4			22.7			13.2			40.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	76	29	233	874	327	690	184	1084	80	8	918	123
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	338	0	0	1201	690	184	1084	80	8	1041	0
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	Perm	Prot	NA	
Protected Phases	4	4		8	8	1	5	2		1	6	
Permitted Phases						8			2			
Detector Phase	4	4		8	8	1	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	7.0	12.0	12.0	7.0	12.0	
Minimum Split (s)	25.0	25.0		25.0	25.0	14.0	14.0	25.0	25.0	14.0	25.0	
Total Split (s)	32.0	32.0		82.0	82.0	15.0	18.0	51.0	51.0	15.0	48.0	
Total Split (%)	17.8%	17.8%		45.6%	45.6%	8.3%	10.0%	28.3%	28.3%	8.3%	26.7%	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)		5.0			5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag						Lag	Lag	Lead	Lead	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Min	C-Min	None	C-Min	
Act Effect Green (s)		27.0			77.0	87.0	13.0	46.0	46.0	10.0	43.0	
Actuated g/C Ratio		0.15			0.43	0.48	0.07	0.26	0.26	0.06	0.24	
v/c Ratio		1.35			1.56	0.90	1.45	1.20	0.20	0.08	1.25	
Control Delay		235.6			294.1	54.2	277.6	140.4	34.9	87.1	174.4	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		235.6			294.1	54.2	277.6	140.4	34.9	87.1	174.4	
LOS		F			F	D	F	F	C	F	F	
Approach Delay		235.6			206.6			152.8			173.8	
Approach LOS		F			F			F			F	
Queue Length 50th (ft)		~520			~1996	570	~296	~817	70	9	~806	
Queue Length 95th (ft)		#735			#2263	#889	#474	#959	m92	m11	m#832	

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3589			918			793			2565		
Turn Bay Length (ft)							150	125	40	200		
Base Capacity (vph)	250			769			765	127	904	404	98	830
Starvation Cap Reductn	0			0			0	0	0	0	0	0
Spillback Cap Reductn	0			0			0	0	0	0	0	0
Storage Cap Reductn	0			0			0	0	0	0	0	0
Reduced v/c Ratio	1.35			1.56			0.90	1.45	1.20	0.20	0.08	1.25

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 24 (13%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.56

Intersection Signal Delay: 185.6

Intersection LOS: F

Intersection Capacity Utilization 129.3%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

 Ø2 (R)	 Ø1	 Ø4	 Ø8
51 s	15 s	32 s	82 s
 Ø6 (R)	 Ø5		
48 s	18 s		

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/09/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↰	↰	↕↕	↰	↰↰	↕↕
Traffic Volume (vph)	198	57	1207	568	267	1237
Future Volume (vph)	198	57	1207	568	267	1237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	235		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	220	63	1341	631	297	1374
Shared Lane Traffic (%)						
Lane Group Flow (vph)	220	63	1341	631	297	1374
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	12.0	7.0	7.0	12.0
Minimum Split (s)	25.0	25.0	25.0	25.0	19.0	25.0
Total Split (s)	46.0	46.0	103.0	46.0	31.0	134.0
Total Split (%)	25.6%	25.6%	57.2%	25.6%	17.2%	74.4%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	32.2	32.2	110.0	147.2	22.8	137.8
Actuated g/C Ratio	0.18	0.18	0.61	0.82	0.13	0.77
v/c Ratio	0.36	0.22	0.62	0.49	0.69	0.51
Control Delay	67.5	66.9	23.6	6.7	82.5	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.7
Total Delay	67.5	66.9	23.6	6.7	82.5	4.3
LOS	E	E	C	A	F	A
Approach Delay	67.4		18.2			18.2
Approach LOS	E		B			B
Queue Length 50th (ft)	117	63	527	196	177	88
Queue Length 95th (ft)	172	121	557	303	m119	m79

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/09/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	155		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	781	360	2163	1372	502	2708
Starvation Cap Reductn	0	0	0	0	0	882
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.17	0.62	0.46	0.59	0.75

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 30 (17%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 21.7

Intersection LOS: C

Intersection Capacity Utilization 59.3%

ICU Level of Service B

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/07/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	231	501	0	0	0
Future Vol, veh/h	0	231	501	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	257	557	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	557	0	-	0	814	557
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	257	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1014	-	-	-	347	530
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	786	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1014	-	-	-	347	530
Mov Cap-2 Maneuver	-	-	-	-	347	-
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	786	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1014	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

Intersection						
Int Delay, s/veh	181					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	262	239	211	81	150	505
Future Vol, veh/h	262	239	211	81	150	505
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	291	266	234	90	167	561
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1174	279	0	0	324	0
Stage 1	279	-	-	-	-	-
Stage 2	895	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	~ 212	760	-	-	1236	-
Stage 1	768	-	-	-	-	-
Stage 2	399	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 170	760	-	-	1236	-
Mov Cap-2 Maneuver	~ 170	-	-	-	-	-
Stage 1	768	-	-	-	-	-
Stage 2	321	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s\$	520.7	0		1.9		
HCM LOS	F					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-	270	1236	-	
HCM Lane V/C Ratio	-	-	2.062	0.135	-	
HCM Control Delay (s)	-	520.7		8.4	0	
HCM Lane LOS	-	-	F	A	A	
HCM 95th %tile Q(veh)	-	-	40.9	0.5	-	
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	25.4
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	13	46	313	35	13	34	289	111	12	252	4
Future Vol, veh/h	7	13	46	313	35	13	34	289	111	12	252	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	14	51	348	39	14	38	321	123	13	280	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB	WB		NB		SB						
Opposing Approach	WB	EB		SB		NB						
Opposing Lanes	1	1		1		1						
Conflicting Approach Left	SB	NB		EB		WB						
Conflicting Lanes Left	1	1		1		1						
Conflicting Approach Right	NB	SB		WB		EB						
Conflicting Lanes Right	1	1		1		1						
HCM Control Delay	11.5	26.7		31.3		17.5						
HCM LOS	B	D		D		C						

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	11%	87%	4%
Vol Thru, %	67%	20%	10%	94%
Vol Right, %	26%	70%	4%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	434	66	361	268
LT Vol	34	7	313	12
Through Vol	289	13	35	252
RT Vol	111	46	13	4
Lane Flow Rate	482	73	401	298
Geometry Grp	1	1	1	1
Degree of Util (X)	0.82	0.148	0.743	0.547
Departure Headway (Hd)	6.123	7.275	6.667	6.615
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	588	496	542	542
Service Time	4.19	5.275	4.735	4.694
HCM Lane V/C Ratio	0.82	0.147	0.74	0.55
HCM Control Delay	31.3	11.5	26.7	17.5
HCM Lane LOS	D	B	D	C
HCM 95th-tile Q	8.3	0.5	6.3	3.3

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	691	4	91	15	501	0	0	564	179
Future Volume (vph)	0	0	0	691	4	91	15	501	0	0	564	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	400		175	0		0	0		225
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt						0.850						0.850
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3433	1863	1583	1770	3539	0	0	3539	1583
Flt Permitted				0.950			0.336					
Satd. Flow (perm)	0	0	0	3433	1863	1583	626	3539	0	0	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1003			1004			311			1004	
Travel Time (s)		22.8			22.8			7.1			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	768	4	101	17	557	0	0	627	199
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	768	4	101	17	557	0	0	627	199
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	10.0
Minimum Split (s)				25.0	25.0	25.0	14.0	25.0			25.0	25.0
Total Split (s)				56.0	56.0	56.0	16.0	64.0			48.0	48.0
Total Split (%)				46.7%	46.7%	46.7%	13.3%	53.3%			40.0%	40.0%
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)				-2.0	-2.0	-2.0	-2.0	-2.0			-2.0	-2.0
Total Lost Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?							Yes				Yes	Yes
Recall Mode				None	None	None	None	C-Min			C-Min	C-Min
Act Effect Green (s)				37.2	37.2	37.2	72.8	72.8			67.2	67.2
Actuated g/C Ratio				0.31	0.31	0.31	0.61	0.61			0.56	0.56
v/c Ratio				0.72	0.01	0.21	0.04	0.26			0.32	0.22
Control Delay				40.5	25.0	30.0	13.9	15.1			16.9	17.2
Queue Delay				0.0	0.0	0.0	0.0	0.5			0.0	0.0
Total Delay				40.5	25.0	30.0	13.9	15.6			16.9	17.2
LOS				D	C	C	B	B			B	B
Approach Delay					39.2			15.6			16.9	
Approach LOS					D			B			B	
Queue Length 50th (ft)				272	2	58	6	114			114	65
Queue Length 95th (ft)				305	10	92	m13	126			227	159

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/09/2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group												
Internal Link Dist (ft)		923			924			231			924	
Turn Bay Length (ft)				400		175						225
Base Capacity (vph)				1459	791	672	484	2148			1982	886
Starvation Cap Reductn				0	0	0	0	1123			0	0
Spillback Cap Reductn				0	0	0	0	0			1	0
Storage Cap Reductn				0	0	0	0	0			0	0
Reduced v/c Ratio				0.53	0.01	0.15	0.04	0.54			0.32	0.22

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 14 (12%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.72

Intersection Signal Delay: 25.2

Intersection LOS: C

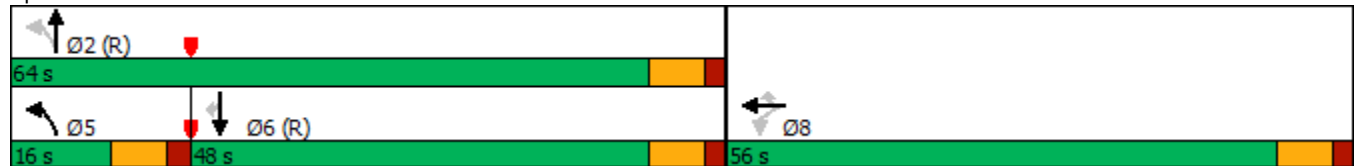
Intersection Capacity Utilization 97.6%

ICU Level of Service F

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	176	4	21	0	0	0	0	340	771	238	1014	0
Future Volume (vph)	176	4	21	0	0	0	0	340	771	238	1014	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	0		0	0		400	0		0
Storage Lanes	1		1	0		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850							0.850		
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1770	3539	1583	0	0	0	0	3539	1583	1770	3539	0
Flt Permitted	0.950									0.526		
Satd. Flow (perm)	1770	3539	1583	0	0	0	0	3539	1583	980	3539	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2602			311	
Travel Time (s)		22.7			23.0			50.7			6.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	196	4	23	0	0	0	0	378	857	264	1127	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	196	4	23	0	0	0	0	378	857	264	1127	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Detector Phase	4	4	4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0	25.0					25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0	25.0					81.0	81.0	14.0	95.0	
Total Split (%)	20.8%	20.8%	20.8%					67.5%	67.5%	11.7%	79.2%	
Yellow Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0					-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lead/Lag								Lead	Lead	Lag		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None	None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)	18.4	18.4	18.4					77.6	77.6	91.6	91.6	
Actuated g/C Ratio	0.15	0.15	0.15					0.65	0.65	0.76	0.76	
v/c Ratio	0.72	0.01	0.09					0.17	0.84	0.33	0.42	
Control Delay	63.7	41.8	43.6					3.5	18.7	5.8	5.0	
Queue Delay	0.0	0.0	0.0					0.0	0.0	0.7	0.3	
Total Delay	63.7	41.8	43.6					3.5	18.7	6.4	5.3	
LOS	E	D	D					A	B	A	A	
Approach Delay		61.2						14.0			5.5	
Approach LOS		E						B			A	
Queue Length 50th (ft)	143	1	15					14	553	22	52	
Queue Length 95th (ft)	226	6	40					19	#697	104	206	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			931			2522			231	
Turn Bay Length (ft)	400		300						400			
Base Capacity (vph)	296	591	264					2289	1024	807	2702	
Starvation Cap Reductn	0	0	0					0	0	273	882	
Spillback Cap Reductn	0	0	0					0	0	0	0	
Storage Cap Reductn	0	0	0					0	0	0	0	
Reduced v/c Ratio	0.66	0.01	0.09					0.17	0.84	0.49	0.62	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 22 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 13.6

Intersection LOS: B

Intersection Capacity Utilization 99.3%

ICU Level of Service F

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

 Ø2 (R)	 Ø1	 Ø4
81 s	14 s	25 s
 Ø6 (R)		
95 s		

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	201	19	443	726	66	143	66	715	45	4	1056	29
Future Volume (vph)	201	19	443	726	66	143	66	715	45	4	1056	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		300	300		400	300		100	175		275
Storage Lanes	2		1	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	0.95	0.95	0.95	0.88	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.862	0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950	0.960		0.950			0.950		
Satd. Flow (prot)	3433	1525	1504	1681	1699	2787	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950	0.960		0.950			0.950		
Satd. Flow (perm)	3433	1525	1504	1681	1699	2787	1770	3539	1583	1770	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2602	
Travel Time (s)		91.0			22.7			13.2			39.4	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	223	21	492	807	73	159	73	794	50	4	1173	32
Shared Lane Traffic (%)			48%	46%								
Lane Group Flow (vph)	223	257	256	436	444	159	73	794	50	4	1173	32
Turn Type	Split	NA	pm+ov	Split	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	4
Permitted Phases			4			8			2			6
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	4
Switch Phase												
Minimum Initial (s)	7.0	7.0	5.0	7.0	7.0	5.0	5.0	10.0	7.0	5.0	5.0	7.0
Minimum Split (s)	25.0	25.0	12.0	25.0	25.0	12.0	12.0	25.0	25.0	12.0	25.0	25.0
Total Split (s)	25.0	25.0	12.0	36.0	36.0	12.0	12.0	47.0	36.0	12.0	47.0	25.0
Total Split (%)	20.8%	20.8%	10.0%	30.0%	30.0%	10.0%	10.0%	39.2%	30.0%	10.0%	39.2%	20.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag			Lag	Lag	Lead		Lag	Lead	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min	None	None	C-Min	None
Act Effct Green (s)	20.0	20.0	32.0	31.0	31.0	44.5	7.0	35.5	71.5	13.5	42.0	62.0
Actuated g/C Ratio	0.17	0.17	0.27	0.26	0.26	0.37	0.06	0.30	0.60	0.11	0.35	0.52
v/c Ratio	0.39	1.01	0.64	1.00	1.01	0.15	0.71	0.76	0.05	0.02	0.95	0.04
Control Delay	46.9	109.5	47.3	89.2	91.0	14.4	79.9	23.2	0.9	50.0	42.8	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.9	109.5	47.3	89.2	91.0	14.4	79.9	23.2	0.9	50.0	42.8	10.2
LOS	D	F	D	F	F	B	E	C	A	D	D	B
Approach Delay		68.9			78.5			26.5			42.0	
Approach LOS		E			E			C			D	
Queue Length 50th (ft)	80	~215	185	~360	~370	26	61	314	3	3	405	8
Queue Length 95th (ft)	119	#396	283	#585	#596	48	#139	83	m2	m8	#616	27

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3922			918			793			2522		
Turn Bay Length (ft)	200		300	300		400	300		100	175		275
Base Capacity (vph)	572	254	401	434	438	1034	103	1238	942	199	1238	817
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	1.01	0.64	1.00	1.01	0.15	0.71	0.64	0.05	0.02	0.95	0.04

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 96 (80%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.01

Intersection Signal Delay: 53.2

Intersection LOS: D

Intersection Capacity Utilization 82.0%

ICU Level of Service D

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

 Ø2 (R)	 Ø1	 Ø4	 Ø8
47 s	12 s	25 s	36 s
 Ø6 (R)	 Ø5		
47 s	12 s		

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/09/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	174	153	698	434	617	1196
Future Volume (vph)	174	153	698	434	617	1196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	238		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	193	170	776	482	686	1329
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	170	776	482	686	1329
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	5.0	7.0	5.0	5.0
Minimum Split (s)	25.0	25.0	25.0	25.0	12.0	25.0
Total Split (s)	32.0	32.0	47.0	32.0	41.0	88.0
Total Split (%)	26.7%	26.7%	39.2%	26.7%	34.2%	73.3%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	24.6	24.6	49.4	79.0	31.0	85.4
Actuated g/C Ratio	0.20	0.20	0.41	0.66	0.26	0.71
v/c Ratio	0.27	0.52	0.53	0.46	0.77	0.53
Control Delay	40.2	47.8	30.1	12.6	37.4	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.2	47.8	30.1	12.6	37.4	6.3
LOS	D	D	C	B	D	A
Approach Delay	43.8		23.4			16.9
Approach LOS	D		C			B
Queue Length 50th (ft)	63	116	241	169	242	116
Queue Length 95th (ft)	97	186	330	279	m290	m263

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/09/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	158		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	799	368	1474	1030	1030	2546
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.46	0.53	0.47	0.67	0.52

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 86 (72%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 21.8

Intersection LOS: C

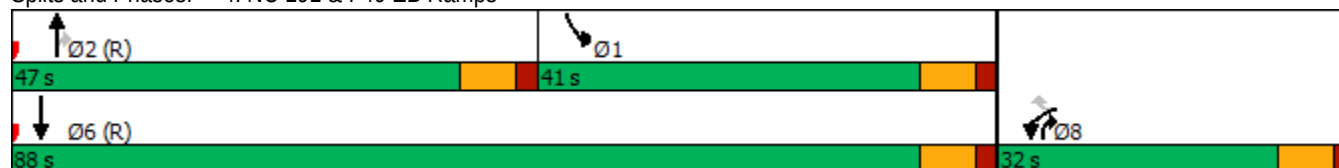
Intersection Capacity Utilization 55.2%

ICU Level of Service B

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/09/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	518	135	0	0	0
Future Vol, veh/h	0	518	135	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	100	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	576	150	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	150	0	-	0	726	150
Stage 1	-	-	-	-	150	-
Stage 2	-	-	-	-	576	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1431	-	-	-	391	896
Stage 1	-	-	-	-	878	-
Stage 2	-	-	-	-	562	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1431	-	-	-	391	896
Mov Cap-2 Maneuver	-	-	-	-	391	-
Stage 1	-	-	-	-	878	-
Stage 2	-	-	-	-	562	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS	A					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1431	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

HCM 6th TWSC
6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/09/2020

Intersection						
Int Delay, s/veh	16.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	66	68	341	241	276	319
Future Vol, veh/h	66	68	341	241	276	319
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	76	379	268	307	354
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1481	513	0	0	647	0
Stage 1	513	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	138	561	-	-	939	-
Stage 1	601	-	-	-	-	-
Stage 2	368	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	82	561	-	-	939	-
Mov Cap-2 Maneuver	82	-	-	-	-	-
Stage 1	601	-	-	-	-	-
Stage 2	218	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	143.1	0		5		
HCM LOS	F					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	- 145		939	-	
HCM Lane V/C Ratio	-	- 1.027		0.327	-	
HCM Control Delay (s)	-	- 143.1		10.7	0	
HCM Lane LOS	-	- F		B	A	
HCM 95th %tile Q(veh)	-	- 7.7		1.4	-	

Intersection	
Intersection Delay, s/veh	16.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	19	71	137	17	12	24	230	153	5	339	7
Future Vol, veh/h	4	19	71	137	17	12	24	230	153	5	339	7
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	21	79	152	19	13	27	256	170	6	377	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.7	12.9	18.3	16.8
HCM LOS	B	B	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	4%	83%	1%
Vol Thru, %	57%	20%	10%	97%
Vol Right, %	38%	76%	7%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	407	94	166	351
LT Vol	24	4	137	5
Through Vol	230	19	17	339
RT Vol	153	71	12	7
Lane Flow Rate	452	104	184	390
Geometry Grp	1	1	1	1
Degree of Util (X)	0.663	0.182	0.337	0.601
Departure Headway (Hd)	5.274	6.267	6.583	5.548
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	678	575	550	643
Service Time	3.364	4.276	4.583	3.641
HCM Lane V/C Ratio	0.667	0.181	0.335	0.607
HCM Control Delay	18.3	10.7	12.9	16.8
HCM Lane LOS	C	B	B	C
HCM 95th-tile Q	5	0.7	1.5	4

HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/09/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	231	501	0	0	0
Future Vol, veh/h	0	231	501	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	257	557	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	557	0	-	0	814	557
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	257	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1014	-	-	-	347	530
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	786	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1014	-	-	-	347	530
Mov Cap-2 Maneuver	-	-	-	-	347	-
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	786	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1014	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	539	7	243	15	759	0	0	424	136
Future Volume (vph)	0	0	0	539	7	243	15	759	0	0	424	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	400		175	0		0	0		225
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt						0.850						0.850
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3433	1863	1583	1770	3539	0	0	3539	1583
Flt Permitted				0.950			0.437					
Satd. Flow (perm)	0	0	0	3433	1863	1583	814	3539	0	0	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		993			1009			310			1001	
Travel Time (s)		22.6			22.9			7.0			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	599	8	270	17	843	0	0	471	151
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	599	8	270	17	843	0	0	471	151
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Free
Protected Phases					8		5	2				6
Permitted Phases				8		8	2					Free
Detector Phase				8	8	8	5	2				6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	
Minimum Split (s)				25.0	25.0	25.0	17.0	25.0			25.0	
Total Split (s)				73.0	73.0	73.0	19.0	87.0			68.0	
Total Split (%)				45.6%	45.6%	45.6%	11.9%	54.4%			42.5%	
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	
Lost Time Adjust (s)				-2.0	-2.0	-2.0	-2.0	-2.0			-2.0	
Total Lost Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Recall Mode				None	None	None	None	C-Min			C-Min	
Act Effect Green (s)				39.4	39.4	39.4	110.6	110.6			102.2	160.0
Actuated g/C Ratio				0.25	0.25	0.25	0.69	0.69			0.64	1.00
v/c Ratio				0.71	0.02	0.69	0.03	0.34			0.21	0.10
Control Delay				59.3	41.1	63.7	9.1	10.2			14.1	0.1
Queue Delay				0.0	0.0	0.0	0.0	0.5			0.0	0.0
Total Delay				59.3	41.1	63.7	9.1	10.7			14.1	0.1
LOS				E	D	E	A	B			B	A
Approach Delay					60.5			10.6			10.7	
Approach LOS					E			B			B	
Queue Length 50th (ft)				299	6	261	6	154			112	0
Queue Length 95th (ft)				332	20	333	m11	m191			172	0

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/09/2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group												
Internal Link Dist (ft)		913			929			230			921	
Turn Bay Length (ft)				400		175						225
Base Capacity (vph)				1459	791	672	646	2446			2260	1583
Starvation Cap Reductn				0	0	0	0	1065			0	0
Spillback Cap Reductn				0	0	0	0	0			0	0
Storage Cap Reductn				0	0	0	0	0			0	0
Reduced v/c Ratio				0.41	0.01	0.40	0.03	0.61			0.21	0.10

Intersection Summary

Area Type: Other

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 128 (80%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 29.2

Intersection LOS: C

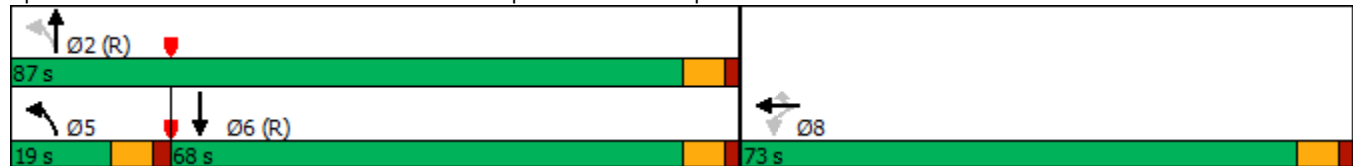
Intersection Capacity Utilization 103.8%

ICU Level of Service G

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

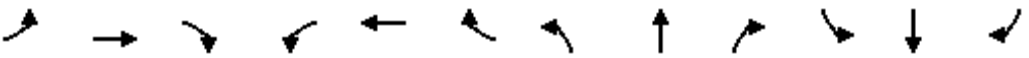
07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						 			 	
Traffic Volume (vph)	193	7	21	0	0	0	0	591	986	158	805	0
Future Volume (vph)	193	7	21	0	0	0	0	591	986	158	805	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	0		0	0		400	0		0
Storage Lanes	1		1	0		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850						0.850			
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1770	3539	1583	0	0	0	0	3539	1583	1770	3539	0
Flt Permitted	0.950									0.367		
Satd. Flow (perm)	1770	3539	1583	0	0	0	0	3539	1583	684	3539	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2604			310	
Travel Time (s)		22.7			23.0			50.7			6.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	214	8	23	0	0	0	0	657	1096	176	894	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	214	8	23	0	0	0	0	657	1096	176	894	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Detector Phase	4	4	4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0	25.0					25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0	25.0					121.0	121.0	14.0	135.0	
Total Split (%)	15.6%	15.6%	15.6%					75.6%	75.6%	8.8%	84.4%	
Yellow Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0					-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None	None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)	20.0	20.0	20.0					116.0	116.0	130.0	130.0	
Actuated g/C Ratio	0.12	0.12	0.12					0.72	0.72	0.81	0.81	
v/c Ratio	0.97	0.02	0.12					0.26	0.96	0.29	0.31	
Control Delay	120.9	61.6	64.0					3.6	26.0	2.4	1.9	
Queue Delay	0.0	0.0	0.0					0.0	0.0	1.0	0.5	
Total Delay	120.9	61.6	64.0					3.6	26.0	3.5	2.4	
LOS	F	E	E					A	C	A	A	
Approach Delay		113.7						17.6			2.5	
Approach LOS		F						B			A	
Queue Length 50th (ft)	227	4	22					86	345	14	38	
Queue Length 95th (ft)	#400	13	52					m85	#1399	20	44	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			931			2524			230	
Turn Bay Length (ft)	400		300						400			
Base Capacity (vph)	221	442	197					2565	1147	616	2875	
Starvation Cap Reductn	0	0	0					0	0	253	1417	
Spillback Cap Reductn	0	0	0					17	0	0	0	
Storage Cap Reductn	0	0	0					0	0	0	0	
Reduced v/c Ratio	0.97	0.02	0.12					0.26	0.96	0.48	0.61	

Intersection Summary

Area Type: Other

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 6 (4%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.97

Intersection Signal Delay: 20.0

Intersection LOS: C

Intersection Capacity Utilization 105.5%

ICU Level of Service G

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance



Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	26	210	787	294	621	166	976	72	7	826	111
Future Volume (vph)	68	26	210	787	294	621	166	976	72	7	826	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		300	300		400	300		100	175		275
Storage Lanes	2		1	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	0.95	0.95	0.95	0.88	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.882	0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950	0.977		0.950			0.950		
Satd. Flow (prot)	3433	1561	1504	1681	1729	2787	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950	0.977		0.950			0.950		
Satd. Flow (perm)	3433	1561	1504	1681	1729	2787	1770	3539	1583	1770	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2604	
Travel Time (s)		91.0			22.7			13.2			39.5	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	76	29	233	874	327	690	184	1084	80	8	918	123
Shared Lane Traffic (%)			45%	32%								
Lane Group Flow (vph)	76	134	128	594	607	690	184	1084	80	8	918	123
Turn Type	Split	NA	pm+ov	Split	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	4
Permitted Phases			4			8			2			6
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	4
Switch Phase												
Minimum Initial (s)	7.0	7.0	5.0	7.0	7.0	5.0	5.0	10.0	7.0	5.0	5.0	7.0
Minimum Split (s)	25.0	25.0	12.0	25.0	25.0	12.0	12.0	25.0	25.0	12.0	25.0	25.0
Total Split (s)	25.0	25.0	22.0	62.0	62.0	13.0	22.0	60.0	62.0	13.0	51.0	25.0
Total Split (%)	15.6%	15.6%	13.8%	38.8%	38.8%	8.1%	13.8%	37.5%	38.8%	8.1%	31.9%	15.6%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead			Lag	Lead	Lead		Lag	Lag	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min	None	None	C-Min	None
Act Effect Green (s)	18.5	18.5	35.5	58.5	58.5	67.6	17.0	53.9	117.4	9.1	46.0	69.5
Actuated g/C Ratio	0.12	0.12	0.22	0.37	0.37	0.42	0.11	0.34	0.73	0.06	0.29	0.43
v/c Ratio	0.19	0.74	0.38	0.97	0.96	0.59	0.98	0.91	0.07	0.08	0.90	0.18
Control Delay	64.6	92.4	30.1	78.6	76.8	32.1	119.5	45.8	5.3	65.3	52.3	20.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.6	92.4	30.1	78.6	76.8	32.1	119.5	45.8	5.3	65.3	52.3	20.5
LOS	E	F	C	E	E	C	F	D	A	E	D	C
Approach Delay		62.6			61.1			53.5			48.7	
Approach LOS		E			E			D			D	
Queue Length 50th (ft)	37	143	62	651	663	213	187	571	16	7	250	54
Queue Length 95th (ft)	64	#237	98	#927	#937	270	#356	495	m35	m24	#514	84

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/09/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3922			918			793			2524		
Turn Bay Length (ft)	200		300	300		400	300		100	175		275
Base Capacity (vph)	429	195	333	614	632	1178	188	1216	1161	100	1017	702
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.69	0.38	0.97	0.96	0.59	0.98	0.89	0.07	0.08	0.90	0.18

Intersection Summary

Area Type: Other

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 16 (10%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 130

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.98

Intersection Signal Delay: 56.2

Intersection LOS: E

Intersection Capacity Utilization 80.7%

ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

 Ø2 (R)	 Ø1	 Ø4	 Ø8
60 s	13 s	25 s	62 s
 Ø5	 Ø6 (R)		
22 s	51 s		

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/09/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	198	73	1223	568	267	1237
Future Volume (vph)	198	73	1223	568	267	1237
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	238		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	220	81	1359	631	297	1374
Shared Lane Traffic (%)						
Lane Group Flow (vph)	220	81	1359	631	297	1374
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	5.0	7.0	5.0	5.0
Minimum Split (s)	25.0	25.0	25.0	25.0	12.0	25.0
Total Split (s)	40.0	40.0	92.0	40.0	28.0	120.0
Total Split (%)	25.0%	25.0%	57.5%	25.0%	17.5%	75.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	23.7	23.7	100.3	129.0	21.0	126.3
Actuated g/C Ratio	0.15	0.15	0.63	0.81	0.13	0.79
v/c Ratio	0.43	0.35	0.61	0.49	0.66	0.49
Control Delay	65.3	66.3	19.9	6.9	71.4	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.4
Total Delay	65.3	66.3	19.9	6.9	71.4	6.5
LOS	E	E	B	A	E	A
Approach Delay	65.5		15.8			18.0
Approach LOS	E		B			B
Queue Length 50th (ft)	109	77	434	183	160	182
Queue Length 95th (ft)	154	135	544	291	m160	m167

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/09/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	158		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	750	346	2217	1387	505	2793
Starvation Cap Reductn	0	0	0	0	0	773
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.23	0.61	0.45	0.59	0.68

Intersection Summary

Area Type: Other

Cycle Length: 160

Actuated Cycle Length: 160

Offset: 8 (5%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.66

Intersection Signal Delay: 20.5

Intersection LOS: C

Intersection Capacity Utilization 59.8%

ICU Level of Service B

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/09/2020

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	231	501	0	0	0
Future Vol, veh/h	0	231	501	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	257	557	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	557	0	-	0	814	557
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	257	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1014	-	-	-	347	530
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	786	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1014	-	-	-	347	530
Mov Cap-2 Maneuver	-	-	-	-	347	-
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	786	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1014	-	-	-	-	
HCM Lane V/C Ratio	-	-	-	-	-	
HCM Control Delay (s)	0	-	-	-	0	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	-	

HCM 6th TWSC
6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/09/2020

Intersection						
Int Delay, s/veh	181					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	262	239	211	81	150	505
Future Vol, veh/h	262	239	211	81	150	505
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	291	266	234	90	167	561
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	1174	279	0	0	324	0
Stage 1	279	-	-	-	-	-
Stage 2	895	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	~ 212	760	-	-	1236	-
Stage 1	768	-	-	-	-	-
Stage 2	399	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 170	760	-	-	1236	-
Mov Cap-2 Maneuver	~ 170	-	-	-	-	-
Stage 1	768	-	-	-	-	-
Stage 2	321	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s\$	520.7	0		1.9		
HCM LOS	F					
Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	270	1236	-	
HCM Lane V/C Ratio	-	-	2.062	0.135	-	
HCM Control Delay (s)	-	-	\$ 520.7	8.4	0	
HCM Lane LOS	-	-	F	A	A	
HCM 95th %tile Q(veh)	-	-	40.9	0.5	-	
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	25.4
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	7	13	46	313	35	13	34	289	111	12	252	4
Future Vol, veh/h	7	13	46	313	35	13	34	289	111	12	252	4
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	14	51	348	39	14	38	321	123	13	280	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	11.5	26.7	31.3	17.5
HCM LOS	B	D	D	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	8%	11%	87%	4%
Vol Thru, %	67%	20%	10%	94%
Vol Right, %	26%	70%	4%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	434	66	361	268
LT Vol	34	7	313	12
Through Vol	289	13	35	252
RT Vol	111	46	13	4
Lane Flow Rate	482	73	401	298
Geometry Grp	1	1	1	1
Degree of Util (X)	0.82	0.148	0.743	0.547
Departure Headway (Hd)	6.123	7.275	6.667	6.615
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	588	496	542	542
Service Time	4.19	5.275	4.735	4.694
HCM Lane V/C Ratio	0.82	0.147	0.74	0.55
HCM Control Delay	31.3	11.5	26.7	17.5
HCM Lane LOS	D	B	D	C
HCM 95th-tile Q	8.3	0.5	6.3	3.3

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↶	↶		↶			↶	↶
Traffic Volume (vph)	0	0	0	702	4	91	30	524	0	0	572	179
Future Volume (vph)	0	0	0	702	4	91	30	524	0	0	572	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	0		0	0		175
Storage Lanes	0		0	0		1	0		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected					0.953			0.997				
Satd. Flow (prot)	0	0	0	0	1775	1583	0	1857	0	0	1863	1583
Flt Permitted					0.953			0.730				
Satd. Flow (perm)	0	0	0	0	1775	1583	0	1360	0	0	1863	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1003			1004			268			1004	
Travel Time (s)		22.8			22.8			6.1			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	780	4	101	33	582	0	0	636	199
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	784	101	0	615	0	0	636	199
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	10.0
Minimum Split (s)				25.0	25.0	25.0	14.0	25.0			25.0	25.0
Total Split (s)				82.0	82.0	82.0	14.0	98.0			84.0	84.0
Total Split (%)				45.6%	45.6%	45.6%	7.8%	54.4%			46.7%	46.7%
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)					-2.0	-2.0		-2.0			-2.0	-2.0
Total Lost Time (s)					5.0	5.0		5.0			5.0	5.0
Lead/Lag							Lag				Lead	Lead
Lead-Lag Optimize?							Yes				Yes	Yes
Recall Mode				None	None	None	None	C-Min			C-Min	C-Min
Act Effect Green (s)					78.5	78.5		91.5			91.5	91.5
Actuated g/C Ratio					0.44	0.44		0.51			0.51	0.51
v/c Ratio					1.01	0.15		0.89			0.67	0.25
Control Delay					84.8	31.9		61.1			37.1	25.6
Queue Delay					0.0	0.0		49.2			0.7	0.0
Total Delay					84.8	31.9		110.3			37.9	25.6
LOS					F	C		F			D	C
Approach Delay					78.8			110.3			34.9	
Approach LOS					E			F			C	
Queue Length 50th (ft)					~989	73		519			543	128
Queue Length 95th (ft)					#1250	118		m606			691	186

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Entrance/I-240 WB Exit

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		923			924			188			924	
Turn Bay Length (ft)						150						175
Base Capacity (vph)					774	690		702			946	804
Starvation Cap Reductn					0	0		166			0	0
Spillback Cap Reductn					0	0		0			100	0
Storage Cap Reductn					0	0		0			0	0
Reduced v/c Ratio					1.01	0.15		1.15			0.75	0.25

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 112 (62%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 120

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.01

Intersection Signal Delay: 71.4

Intersection LOS: E

Intersection Capacity Utilization 99.5%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

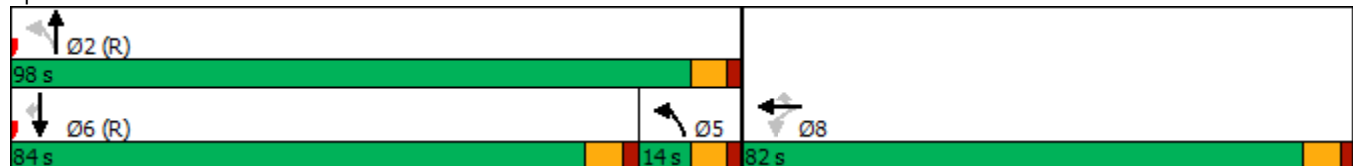
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	176	4	27	0	0	0	0	376	800	238	1033	0
Future Volume (vph)	176	4	27	0	0	0	0	376	800	238	1033	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		50	0		0	0		0	0		0
Storage Lanes	0		1	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected		0.953									0.991	
Satd. Flow (prot)	0	1775	1583	0	0	0	0	1863	1583	0	1846	0
Flt Permitted		0.953									0.804	
Satd. Flow (perm)	0	1775	1583	0	0	0	0	1863	1583	0	1498	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2645			268	
Travel Time (s)		22.7			23.0			51.5			5.2	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	196	4	30	0	0	0	0	418	889	264	1148	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	200	30	0	0	0	0	418	889	0	1412	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Detector Phase	4	4	4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0	25.0					25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0	25.0					141.0	141.0	14.0	155.0	
Total Split (%)	13.9%	13.9%	13.9%					78.3%	78.3%	7.8%	86.1%	
Yellow Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0	-2.0					-2.0	-2.0		-2.0	
Total Lost Time (s)		5.0	5.0					5.0	5.0		5.0	
Lead/Lag								Lag	Lag	Lead		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None	None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)		20.0	20.0					150.0	150.0		150.0	
Actuated g/C Ratio		0.11	0.11					0.83	0.83		0.83	
v/c Ratio		1.02	0.17					0.27	0.67		1.13	
Control Delay		143.8	75.3					0.7	8.4		76.4	
Queue Delay		0.0	0.0					0.7	0.0		0.1	
Total Delay		143.8	75.3					1.5	8.4		76.5	
LOS		F	E					A	A		E	
Approach Delay		134.8						6.2			76.5	
Approach LOS		F						A			E	
Queue Length 50th (ft)		~245	33					12	278		~1955	
Queue Length 95th (ft)		#429	70					m14	m62		m#2025	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			931			2565			188	
Turn Bay Length (ft)			50									
Base Capacity (vph)		197	175					1552	1319		1248	
Starvation Cap Reductn		0	0					0	0		45	
Spillback Cap Reductn		0	0					795	0		0	
Storage Cap Reductn		0	0					0	0		0	
Reduced v/c Ratio		1.02	0.17					0.55	0.67		1.17	

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 32 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.13

Intersection Signal Delay: 49.9

Intersection LOS: D

Intersection Capacity Utilization 139.5%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

														
Ø1	Ø2 (R)													
14 s	141 s												25 s	
Ø6 (R)														
155 s														

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	34	472	726	72	143	77	715	45	4	1056	54
Future Volume (vph)	266	34	472	726	72	143	77	715	45	4	1056	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		100	0		150	125		40	200		0
Storage Lanes	0		1	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt			0.850			0.850			0.850		0.993	
Flt Protected		0.958			0.956		0.950			0.950		
Satd. Flow (prot)	0	1785	1583	0	1781	1583	1770	3539	1583	1770	3514	0
Flt Permitted		0.958			0.956		0.950			0.950		
Satd. Flow (perm)	0	1785	1583	0	1781	1583	1770	3539	1583	1770	3514	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2645	
Travel Time (s)		91.0			22.7			13.2			40.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	296	38	524	807	80	159	86	794	50	4	1173	60
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	334	524	0	887	159	86	794	50	4	1233	0
Turn Type	Split	NA	pm+ov	Split	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	
Permitted Phases			4			8			2			
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	5.0	7.0	7.0	5.0	5.0	10.0	7.0	5.0	5.0	
Minimum Split (s)	25.0	25.0	12.0	25.0	25.0	12.0	12.0	25.0	25.0	12.0	25.0	
Total Split (s)	32.0	32.0	24.0	69.0	69.0	12.0	24.0	67.0	69.0	12.0	55.0	
Total Split (%)	17.8%	17.8%	13.3%	38.3%	38.3%	6.7%	13.3%	37.2%	38.3%	6.7%	30.6%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0	-2.0		-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag			Lead			Lead	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min	None	None	C-Min	
Act Effect Green (s)		27.0	46.0		64.0	76.0	19.0	62.0	126.0	7.0	50.0	
Actuated g/C Ratio		0.15	0.26		0.36	0.42	0.11	0.34	0.70	0.04	0.28	
v/c Ratio		1.25	1.30		1.40	0.24	0.46	0.65	0.05	0.06	1.26	
Control Delay		198.0	186.4		231.8	34.6	85.3	29.6	3.4	86.0	165.5	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		198.0	186.4		231.8	34.6	85.3	29.6	3.4	86.0	165.5	
LOS		F	F		F	C	F	C	A	F	F	
Approach Delay		190.9			201.8			33.4			165.2	
Approach LOS		F			F			C			F	
Queue Length 50th (ft)		~489	~576		~1395	120	68	442	16	4	~962	
Queue Length 95th (ft)		#702	#900		#1659	180	172	165	12	m4	m#808	

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3922			918			793			2565		
Turn Bay Length (ft)	100			150			125			40		
Base Capacity (vph)	267			404			633			668		
Starvation Cap Reductn	0			0			0			0		
Spillback Cap Reductn	0			0			0			0		
Storage Cap Reductn	0			0			0			0		
Reduced v/c Ratio	1.25			1.30			1.40			0.24		

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 166 (92%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.40

Intersection Signal Delay: 149.9

Intersection LOS: F

Intersection Capacity Utilization 116.6%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

								
Ø1	Ø2(R)		Ø4		Ø8			
12 s	67 s		32 s		69 s			
								
Ø5	Ø6(R)							
24 s	55 s							

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/16/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	174	153	698	434	607	1196
Future Volume (vph)	174	153	698	434	607	1196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	238		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	193	170	776	482	674	1329
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	170	776	482	674	1329
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	5.0	7.0	5.0	5.0
Minimum Split (s)	25.0	25.0	25.0	25.0	12.0	25.0
Total Split (s)	46.0	46.0	72.0	46.0	62.0	134.0
Total Split (%)	25.6%	25.6%	40.0%	25.6%	34.4%	74.4%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	34.8	34.8	87.0	126.8	43.2	135.2
Actuated g/C Ratio	0.19	0.19	0.48	0.70	0.24	0.75
v/c Ratio	0.29	0.56	0.45	0.43	0.82	0.50
Control Delay	61.9	71.6	33.9	13.5	59.7	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.7
Total Delay	61.9	71.6	33.9	13.5	59.7	8.1
LOS	E	E	C	B	E	A
Approach Delay	66.4		26.1			25.4
Approach LOS	E		C			C
Queue Length 50th (ft)	104	188	304	227	402	204
Queue Length 95th (ft)	130	247	464	352	m285	m205

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	158		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	807	372	1715	1113	1087	2684
Starvation Cap Reductn	0	0	0	0	0	915
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.46	0.45	0.43	0.62	0.75

Intersection Summary

Area Type: Other

Cycle Length: 180

Actuated Cycle Length: 180

Offset: 178 (99%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 29.8

Intersection LOS: C

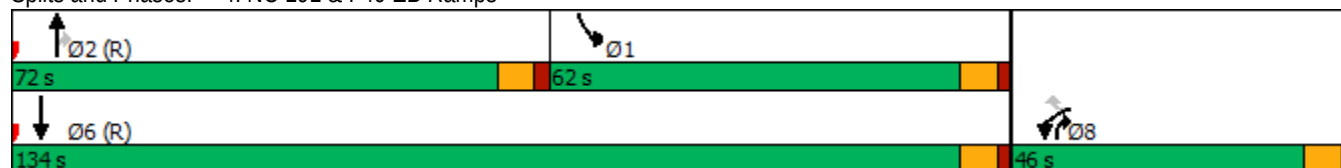
Intersection Capacity Utilization 54.9%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/16/2020

Intersection						
Int Delay, s/veh	6.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	14	518	135	41	109	36
Future Vol, veh/h	14	518	135	41	109	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	100	100	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	15	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	576	150	46	121	40
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	196	0	-	0	758	150
Stage 1	-	-	-	-	150	-
Stage 2	-	-	-	-	608	-
Critical Hdwy	4.12	-	-	-	9.42	7.72
Critical Hdwy Stg 1	-	-	-	-	8.42	-
Critical Hdwy Stg 2	-	-	-	-	8.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1377	-	-	-	199	842
Stage 1	-	-	-	-	775	-
Stage 2	-	-	-	-	327	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1377	-	-	-	197	842
Mov Cap-2 Maneuver	-	-	-	-	197	-
Stage 1	-	-	-	-	766	-
Stage 2	-	-	-	-	327	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.2	0		39		
HCM LOS	E					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1377	-	-	-	197	842
HCM Lane V/C Ratio	0.011	-	-	-	0.615	0.048
HCM Control Delay (s)	7.6	-	-	-	48.7	9.5
HCM Lane LOS	A	-	-	-	E	A
HCM 95th %tile Q(veh)	0	-	-	-	3.5	0.1

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	73	97	341	244	287	319
Future Volume (vph)	73	97	341	244	287	319
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.923		0.944			
Flt Protected	0.979					0.977
Satd. Flow (prot)	1683	0	1758	0	0	1820
Flt Permitted	0.979					0.503
Satd. Flow (perm)	1683	0	1758	0	0	937
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		35			35
Link Distance (ft)	1001		983			158
Travel Time (s)	19.5		19.1			3.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	81	108	379	271	319	354
Shared Lane Traffic (%)						
Lane Group Flow (vph)	189	0	650	0	0	673
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Detector Phase	8		2		6	6
Switch Phase						
Minimum Initial (s)	5.0		10.0		10.0	10.0
Minimum Split (s)	25.0		25.0		25.0	25.0
Total Split (s)	25.0		125.0		125.0	125.0
Total Split (%)	16.7%		83.3%		83.3%	83.3%
Yellow Time (s)	5.0		5.0		5.0	5.0
All-Red Time (s)	2.0		2.0		2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0			-2.0
Total Lost Time (s)	5.0		5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		C-Min		C-Min	C-Min
Act Effect Green (s)	20.1		119.9			119.9
Actuated g/C Ratio	0.13		0.80			0.80
v/c Ratio	0.84		0.46			0.90
Control Delay	93.0		6.0			28.3
Queue Delay	0.0		0.3			7.4
Total Delay	93.0		6.4			35.6
LOS	F		A			D
Approach Delay	93.0		6.4			35.6
Approach LOS	F		A			D
Queue Length 50th (ft)	183		172			406
Queue Length 95th (ft)	#320		228			#861
Internal Link Dist (ft)	921		903			78
Turn Bay Length (ft)						
Base Capacity (vph)	229		1411			752

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Starvation Cap Reductn	0		0			58
Spillback Cap Reductn	0		293			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.83		0.58			0.97

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 148 (99%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 30.2

Intersection LOS: C

Intersection Capacity Utilization 88.0%

ICU Level of Service E

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek



Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	4	19	74	143	17	12	31	237	168	5	342	7
Future Volume (vph)	4	19	74	143	17	12	31	237	168	5	342	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.897			0.991			0.948			0.997	
Flt Protected		0.998			0.960			0.996			0.999	
Satd. Flow (prot)	0	1668	0	0	1772	0	0	1759	0	0	1855	0
Flt Permitted		0.989			0.608			0.950			0.993	
Satd. Flow (perm)	0	1653	0	0	1122	0	0	1678	0	0	1844	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			35			35			25	
Link Distance (ft)		1007			767			158			1002	
Travel Time (s)		27.5			14.9			3.1			27.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	4	21	82	159	19	13	34	263	187	6	380	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	107	0	0	191	0	0	484	0	0	394	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	57.0	57.0		57.0	57.0		93.0	93.0		93.0	93.0	
Total Split (%)	38.0%	38.0%		38.0%	38.0%		62.0%	62.0%		62.0%	62.0%	
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		30.9			30.9			109.1			109.1	
Actuated g/C Ratio		0.21			0.21			0.73			0.73	
v/c Ratio		0.31			0.83			0.40			0.29	
Control Delay		51.1			83.8			7.2			8.7	
Queue Delay		0.2			1.7			1.7			0.1	
Total Delay		51.2			85.4			9.0			8.8	
LOS		D			F			A			A	
Approach Delay		51.2			85.4			9.0			8.8	
Approach LOS		D			F			A			A	
Queue Length 50th (ft)		90			181			122			122	
Queue Length 95th (ft)		136			256			m202			216	
Internal Link Dist (ft)		927			687			78			922	
Turn Bay Length (ft)												
Base Capacity (vph)		573			388			1220			1341	

Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0			548			0	
Spillback Cap Reductn		128			86			0			249	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.24			0.63			0.72			0.36	

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 144 (96%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 25.2

Intersection LOS: C

Intersection Capacity Utilization 66.6%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road



Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↶	↶		↶			↶	↶
Traffic Volume (vph)	0	0	0	569	7	243	25	774	0	0	447	149
Future Volume (vph)	0	0	0	569	7	243	25	774	0	0	447	149
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		150	0		0	0		175
Storage Lanes	0		0	0		1	0		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected					0.953			0.998				
Satd. Flow (prot)	0	0	0	0	1775	1583	0	1859	0	0	1863	1583
Flt Permitted					0.953			0.974				
Satd. Flow (perm)	0	0	0	0	1775	1583	0	1814	0	0	1863	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		990			1009			269			1001	
Travel Time (s)		22.5			22.9			6.1			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	632	8	270	28	860	0	0	497	166
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	640	270	0	888	0	0	497	166
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Free
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					Free
Detector Phase				8	8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	
Minimum Split (s)				25.0	25.0	25.0	17.0	25.0			25.0	
Total Split (s)				57.0	57.0	57.0	17.0	83.0			66.0	
Total Split (%)				40.7%	40.7%	40.7%	12.1%	59.3%			47.1%	
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	
Lost Time Adjust (s)					-2.0	-2.0		-2.0			-2.0	
Total Lost Time (s)					5.0	5.0		5.0			5.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Recall Mode				None	None	None	None	C-Min			C-Min	
Act Effect Green (s)					52.1	52.1		77.9			77.9	140.0
Actuated g/C Ratio					0.37	0.37		0.56			0.56	1.00
v/c Ratio					0.97	0.46		0.88			0.48	0.10
Control Delay					71.5	36.5		29.2			20.7	0.1
Queue Delay					0.0	0.0		22.3			5.5	0.0
Total Delay					71.5	36.5		51.5			26.2	0.1
LOS					E	D		D			C	A
Approach Delay					61.1			51.5			19.7	
Approach LOS					E			D			B	
Queue Length 50th (ft)					570	185		550			264	0
Queue Length 95th (ft)					#825	271		m#984			357	0

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		910			929			189			921	
Turn Bay Length (ft)						150						175
Base Capacity (vph)					660	588		1010			1036	1583
Starvation Cap Reductn					0	0		150			0	0
Spillback Cap Reductn					0	0		0			468	0
Storage Cap Reductn					0	0		0			0	0
Reduced v/c Ratio					0.97	0.46		1.03			0.88	0.10

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 110 (79%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.97

Intersection Signal Delay: 46.5

Intersection LOS: D

Intersection Capacity Utilization 101.1%

ICU Level of Service G

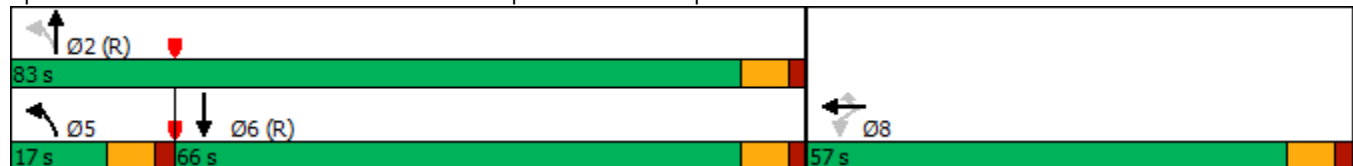
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	193	7	36	0	0	0	0	616	1006	158	858	0
Future Volume (vph)	193	7	36	0	0	0	0	616	1006	158	858	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		50	0		0	0		0	0		0
Storage Lanes	0		1	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected		0.954									0.992	
Satd. Flow (prot)	0	1777	1583	0	0	0	0	1863	1583	0	1848	0
Flt Permitted		0.954									0.700	
Satd. Flow (perm)	0	1777	1583	0	0	0	0	1863	1583	0	1304	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2645			269	
Travel Time (s)		22.7			23.0			51.5			5.2	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	214	8	40	0	0	0	0	684	1118	176	953	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	222	40	0	0	0	0	684	1118	0	1129	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Detector Phase	4	4	4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0	25.0					25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0	25.0					101.0	101.0	14.0	115.0	
Total Split (%)	17.9%	17.9%	17.9%					72.1%	72.1%	10.0%	82.1%	
Yellow Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0	-2.0					-2.0	-2.0		-2.0	
Total Lost Time (s)		5.0	5.0					5.0	5.0		5.0	
Lead/Lag								Lead	Lead		Lag	
Lead-Lag Optimize?								Yes	Yes		Yes	
Recall Mode	None	None	None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)		19.8	19.8					110.2	110.2		110.2	
Actuated g/C Ratio		0.14	0.14					0.79	0.79		0.79	
v/c Ratio		0.88	0.18					0.47	0.90		1.10	
Control Delay		92.4	55.2					6.2	22.6		75.3	
Queue Delay		0.0	0.0					1.1	0.0		0.5	
Total Delay		92.4	55.2					7.3	22.6		75.8	
LOS		F	E					A	C		E	
Approach Delay		86.7						16.8			75.8	
Approach LOS		F						B			E	
Queue Length 50th (ft)		201	33					181	636		~1202	
Queue Length 95th (ft)		#348	70					240	#1074		m#1360	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			931			2565			189	
Turn Bay Length (ft)			50									
Base Capacity (vph)		253	226					1465	1245		1026	
Starvation Cap Reductn		0	0					0	0		91	
Spillback Cap Reductn		0	0					506	0		0	
Storage Cap Reductn		0	0					0	0		0	
Reduced v/c Ratio		0.88	0.18					0.71	0.90		1.21	

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 128 (91%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.10

Intersection Signal Delay: 43.4

Intersection LOS: D

Intersection Capacity Utilization 139.7%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

 Ø2 (R)		
101 s	14 s	25 s
 Ø6 (R)		
115 s		

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗	↘		↗	↘	↘	↗↗	↘	↘	↗↗	
Traffic Volume (vph)	113	36	230	787	309	621	196	976	72	7	826	179
Future Volume (vph)	113	36	230	787	309	621	196	976	72	7	826	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		100	0		150	125		40	200		0
Storage Lanes	0		1	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt			0.850			0.850			0.850		0.973	
Flt Protected		0.963			0.965		0.950			0.950		
Satd. Flow (prot)	0	1794	1583	0	1798	1583	1770	3539	1583	1770	3444	0
Flt Permitted		0.963			0.965		0.950			0.950		
Satd. Flow (perm)	0	1794	1583	0	1798	1583	1770	3539	1583	1770	3444	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2645	
Travel Time (s)		91.0			22.7			13.2			40.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	126	40	256	874	343	690	218	1084	80	8	918	199
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	166	256	0	1217	690	218	1084	80	8	1117	0
Turn Type	Split	NA	pm+ov	Split	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	
Permitted Phases			4			8			2			
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	5.0	7.0	7.0	5.0	5.0	10.0	7.0	5.0	5.0	
Minimum Split (s)	25.0	25.0	12.0	25.0	25.0	12.0	12.0	25.0	25.0	12.0	25.0	
Total Split (s)	25.0	25.0	23.0	103.0	103.0	16.0	23.0	66.0	103.0	16.0	59.0	
Total Split (%)	11.9%	11.9%	11.0%	49.0%	49.0%	7.6%	11.0%	31.4%	49.0%	7.6%	28.1%	
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-2.0	-2.0		-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag			Lead			Lag	Lead	Lead		Lag	Lag	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min	None	None	C-Min	
Act Effect Green (s)		20.0	38.0		98.0	109.0	18.0	61.0	164.0	11.0	54.0	
Actuated g/C Ratio		0.10	0.18		0.47	0.52	0.09	0.29	0.78	0.05	0.26	
v/c Ratio		0.98	0.90		1.45	0.84	1.44	1.06	0.06	0.09	1.26	
Control Delay		153.5	82.8		248.9	50.6	275.4	88.0	2.9	97.0	185.9	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		153.5	82.8		248.9	50.6	275.4	88.0	2.9	97.0	185.9	
LOS		F	F		F	D	F	F	A	F	F	
Approach Delay		110.6			177.1			112.7			185.2	
Approach LOS		F			F			F			F	
Queue Length 50th (ft)		234	216		~2282	591	~409	~861	6	11	~1015	
Queue Length 95th (ft)		#411	#368		#2548	773	#599	#1002	m25	33	#1156	

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3922			918			793			2565		
Turn Bay Length (ft)	100			150			125			40		
Base Capacity (vph)	170			286			839			821		
Starvation Cap Reductn	0			0			0			0		
Spillback Cap Reductn	0			0			0			0		
Storage Cap Reductn	0			0			0			0		
Reduced v/c Ratio	0.98			0.90			1.45			0.84		

Intersection Summary

Area Type: Other

Cycle Length: 210

Actuated Cycle Length: 210

Offset: 16 (8%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.45

Intersection Signal Delay: 154.8

Intersection LOS: F

Intersection Capacity Utilization 124.1%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

 Ø2 (R)	 Ø1	 Ø4	 Ø8
66 s	16 s	25 s	103 s
 Ø5	 Ø6 (R)		
23 s	59 s		

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/16/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	198	72	1222	568	266	1236
Future Volume (vph)	198	72	1222	568	266	1236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	238		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	220	80	1358	631	296	1373
Shared Lane Traffic (%)						
Lane Group Flow (vph)	220	80	1358	631	296	1373
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	5.0	7.0	5.0	5.0
Minimum Split (s)	25.0	25.0	25.0	25.0	12.0	25.0
Total Split (s)	52.0	52.0	122.0	52.0	36.0	158.0
Total Split (%)	24.8%	24.8%	58.1%	24.8%	17.1%	75.2%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	47.1	47.1	122.6	174.7	25.3	152.9
Actuated g/C Ratio	0.22	0.22	0.58	0.83	0.12	0.73
v/c Ratio	0.29	0.23	0.66	0.48	0.71	0.53
Control Delay	68.6	68.4	32.0	6.6	77.1	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	1.1
Total Delay	68.6	68.4	32.0	6.6	77.1	10.7
LOS	E	E	C	A	E	B
Approach Delay	68.5		24.0			22.5
Approach LOS	E		C			C
Queue Length 50th (ft)	130	91	667	214	194	266
Queue Length 95th (ft)	176	150	782	321	m163	m233

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	158		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	777	358	2066	1305	506	2587
Starvation Cap Reductn	0	0	0	0	0	899
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.22	0.66	0.48	0.58	0.81

Intersection Summary

Area Type: Other

Cycle Length: 210

Actuated Cycle Length: 210

Offset: 208 (99%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 26.7

Intersection LOS: C

Intersection Capacity Utilization 59.7%

ICU Level of Service B

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/16/2020

Intersection						
Int Delay, s/veh	2.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	55	38	501	114	75	25
Future Vol, veh/h	55	38	501	114	75	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	100	100	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	61	42	557	127	83	28
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	684	0	-	0	721	557
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	164	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	909	-	-	-	394	530
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	865	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	909	-	-	-	368	530
Mov Cap-2 Maneuver	-	-	-	-	368	-
Stage 1	-	-	-	-	536	-
Stage 2	-	-	-	-	865	-
Approach	EB	WB		SB		
HCM Control Delay, s	5.5	0		16.3		
HCM LOS	C					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	909	-	-	-	368	530
HCM Lane V/C Ratio	0.067	-	-	-	0.226	0.052
HCM Control Delay (s)	9.2	-	-	-	17.6	12.2
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.9	0.2

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	267	259	211	89	180	505
Future Volume (vph)	267	259	211	89	180	505
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.934		0.960			
Flt Protected	0.975					0.987
Satd. Flow (prot)	1696	0	1788	0	0	1839
Flt Permitted	0.975					0.716
Satd. Flow (perm)	1696	0	1788	0	0	1334
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		35			35
Link Distance (ft)	1001		983			158
Travel Time (s)	19.5		19.1			3.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	297	288	234	99	200	561
Shared Lane Traffic (%)						
Lane Group Flow (vph)	585	0	333	0	0	761
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Detector Phase	8		2		6	6
Switch Phase						
Minimum Initial (s)	7.0		7.0		10.0	10.0
Minimum Split (s)	25.0		25.0		25.0	25.0
Total Split (s)	64.0		106.0		106.0	106.0
Total Split (%)	37.6%		62.4%		62.4%	62.4%
Yellow Time (s)	5.0		5.0		5.0	5.0
All-Red Time (s)	2.0		2.0		2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0			-2.0
Total Lost Time (s)	5.0		5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		C-Min		C-Min	C-Min
Act Effect Green (s)	59.0		101.0			101.0
Actuated g/C Ratio	0.35		0.59			0.59
v/c Ratio	0.99		0.31			0.96
Control Delay	90.1		18.2			47.4
Queue Delay	17.0		4.4			25.1
Total Delay	107.1		22.6			72.6
LOS	F		C			E
Approach Delay	107.1		22.6			72.6
Approach LOS	F		C			E
Queue Length 50th (ft)	651		179			676
Queue Length 95th (ft)	#915		243			#1115
Internal Link Dist (ft)	921		903			78
Turn Bay Length (ft)						
Base Capacity (vph)	588		1062			792

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Starvation Cap Reductn	0		0			72
Spillback Cap Reductn	32		641			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	1.05		0.79			1.06

Intersection Summary

Area Type: Other

Cycle Length: 170

Actuated Cycle Length: 170

Offset: 38 (22%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.99

Intersection Signal Delay: 74.7

Intersection LOS: E

Intersection Capacity Utilization 96.2%

ICU Level of Service F

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek



Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	7	13	54	328	35	13	39	294	121	12	260	4
Future Volume (vph)	7	13	54	328	35	13	39	294	121	12	260	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.901			0.995			0.964			0.998	
Flt Protected		0.995			0.958			0.996			0.998	
Satd. Flow (prot)	0	1670	0	0	1776	0	0	1789	0	0	1855	0
Flt Permitted		0.954			0.693			0.944			0.972	
Satd. Flow (perm)	0	1601	0	0	1284	0	0	1695	0	0	1807	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			35			35			25	
Link Distance (ft)		1007			767			158			1002	
Travel Time (s)		27.5			14.9			3.1			27.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	8	14	60	364	39	14	43	327	134	13	289	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	82	0	0	417	0	0	504	0	0	306	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	86.0	86.0		86.0	86.0		84.0	84.0		84.0	84.0	
Total Split (%)	50.6%	50.6%		50.6%	50.6%		49.4%	49.4%		49.4%	49.4%	
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		64.6			64.6			95.4			95.4	
Actuated g/C Ratio		0.38			0.38			0.56			0.56	
v/c Ratio		0.13			0.85			0.53			0.30	
Control Delay		32.4			64.6			20.6			22.6	
Queue Delay		0.0			0.2			34.1			1.1	
Total Delay		32.4			64.8			54.7			23.7	
LOS		C			E			D			C	
Approach Delay		32.4			64.8			54.7			23.7	
Approach LOS		C			E			D			C	
Queue Length 50th (ft)		59			424			242			177	
Queue Length 95th (ft)		88			508			m277			290	
Internal Link Dist (ft)		927			687			78			922	
Turn Bay Length (ft)												
Base Capacity (vph)		762			611			951			1014	

Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0			468			0	
Spillback Cap Reductn		16			12			0			475	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.11			0.70			1.04			0.57	

Intersection Summary

Area Type: Other

Cycle Length: 170

Actuated Cycle Length: 170

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 55

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.85

Intersection Signal Delay: 49.3

Intersection LOS: D

Intersection Capacity Utilization 73.9%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

					
Ø2 (R)					Ø4
84 s					86 s
					
Ø6 (R)					Ø8
84 s					86 s

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖↖	↗	↖	↖	↗↗			↗↗	↖
Traffic Volume (vph)	0	0	0	702	4	91	30	523	0	0	572	179
Future Volume (vph)	0	0	0	702	4	91	30	523	0	0	572	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	400		175	0		0	0		225
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt						0.850						0.850
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3433	1863	1583	1770	3539	0	0	3539	1583
Flt Permitted				0.950			0.327					
Satd. Flow (perm)	0	0	0	3433	1863	1583	609	3539	0	0	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1003			1004			311			1004	
Travel Time (s)		22.8			22.8			7.1			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	780	4	101	33	581	0	0	636	199
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	780	4	101	33	581	0	0	636	199
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					6
Detector Phase				8	8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	10.0
Minimum Split (s)				25.0	25.0	25.0	14.0	25.0			25.0	25.0
Total Split (s)				55.0	55.0	55.0	16.0	65.0			49.0	49.0
Total Split (%)				45.8%	45.8%	45.8%	13.3%	54.2%			40.8%	40.8%
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	2.0
Lost Time Adjust (s)				-2.0	-2.0	-2.0	-2.0	-2.0			-2.0	-2.0
Total Lost Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lead/Lag							Lead				Lag	Lag
Lead-Lag Optimize?							Yes				Yes	Yes
Recall Mode				None	None	None	None	C-Min			C-Min	C-Min
Act Effect Green (s)				37.6	37.6	37.6	72.4	72.4			63.8	63.8
Actuated g/C Ratio				0.31	0.31	0.31	0.60	0.60			0.53	0.53
v/c Ratio				0.73	0.01	0.20	0.07	0.27			0.34	0.24
Control Delay				40.3	24.8	29.6	6.5	5.9			19.0	19.1
Queue Delay				0.0	0.0	0.0	0.0	0.4			0.0	0.0
Total Delay				40.3	24.8	29.6	6.5	6.3			19.0	19.1
LOS				D	C	C	A	A			B	B
Approach Delay					39.0			6.3			19.0	
Approach LOS					D			A			B	
Queue Length 50th (ft)				276	2	57	6	57			157	88
Queue Length 95th (ft)				311	10	92	m13	69			235	161

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/16/2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group												
Internal Link Dist (ft)		923			924			231			924	
Turn Bay Length (ft)				400		175						225
Base Capacity (vph)				1430	776	659	473	2135			1882	841
Starvation Cap Reductn				0	0	0	0	1007			0	0
Spillback Cap Reductn				0	0	0	0	0			0	0
Storage Cap Reductn				0	0	0	0	0			0	0
Reduced v/c Ratio				0.55	0.01	0.15	0.07	0.52			0.34	0.24

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 62 (52%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 65

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 23.3

Intersection LOS: C

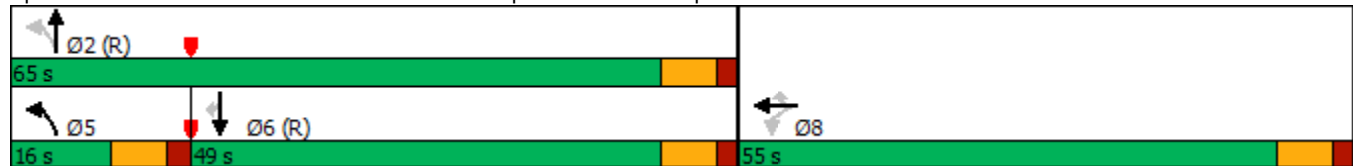
Intersection Capacity Utilization 100.0%

ICU Level of Service F

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						 			 	
Traffic Volume (vph)	176	4	27	0	0	0	0	376	800	238	1033	0
Future Volume (vph)	176	4	27	0	0	0	0	376	800	238	1033	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	0		0	0		400	0		0
Storage Lanes	1		1	0		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850						0.850			
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1770	3539	1583	0	0	0	0	3539	1583	1770	3539	0
Flt Permitted	0.950									0.502		
Satd. Flow (perm)	1770	3539	1583	0	0	0	0	3539	1583	935	3539	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2602			311	
Travel Time (s)		22.7			23.0			50.7			6.1	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	196	4	30	0	0	0	0	418	889	264	1148	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	196	4	30	0	0	0	0	418	889	264	1148	0
Turn Type	Perm	NA	Perm					NA	Perm	pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2	6		
Detector Phase	4	4	4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0	25.0					25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0	25.0					81.0	81.0	14.0	95.0	
Total Split (%)	20.8%	20.8%	20.8%					67.5%	67.5%	11.7%	79.2%	
Yellow Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0					-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lead/Lag								Lead	Lead	Lag		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None	None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)	18.4	18.4	18.4					77.6	77.6	91.6	91.6	
Actuated g/C Ratio	0.15	0.15	0.15					0.65	0.65	0.76	0.76	
v/c Ratio	0.72	0.01	0.12					0.18	0.87	0.34	0.42	
Control Delay	64.0	41.8	44.2					3.2	21.4	4.6	4.3	
Queue Delay	0.0	0.0	0.0					0.0	0.0	0.7	0.3	
Total Delay	64.0	41.8	44.2					3.2	21.4	5.2	4.6	
LOS	E	D	D					A	C	A	A	
Approach Delay		61.0						15.6			4.7	
Approach LOS		E						B			A	
Queue Length 50th (ft)	144	1	20					14	559	65	163	
Queue Length 95th (ft)	226	6	49					18	#894	17	31	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			931			2522			231	
Turn Bay Length (ft)	400		300						400			
Base Capacity (vph)	295	589	263					2289	1024	776	2702	
Starvation Cap Reductn	0	0	0					0	0	247	811	
Spillback Cap Reductn	0	0	0					0	0	0	0	
Storage Cap Reductn	0	0	0					0	0	0	0	
Reduced v/c Ratio	0.66	0.01	0.11					0.18	0.87	0.50	0.61	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 52 (43%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.87

Intersection Signal Delay: 13.9

Intersection LOS: B

Intersection Capacity Utilization 101.6%

ICU Level of Service G

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

		
Ø2 (R)	Ø1	Ø4
81 s	14 s	25 s
		
Ø6 (R)		
95 s		

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	34	472	726	72	143	77	715	45	4	1056	54
Future Volume (vph)	266	34	472	726	72	143	77	715	45	4	1056	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		300	300		400	300		100	175		275
Storage Lanes	2		2	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	1.00	0.88	0.95	0.95	0.88	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950	0.961		0.950			0.950		
Satd. Flow (prot)	3433	1863	2787	1681	1701	2787	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950	0.961		0.950			0.950		
Satd. Flow (perm)	3433	1863	2787	1681	1701	2787	1770	3539	1583	1770	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2602	
Travel Time (s)		91.0			22.7			13.2			39.4	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	296	38	524	807	80	159	86	794	50	4	1173	60
Shared Lane Traffic (%)				45%								
Lane Group Flow (vph)	296	38	524	444	443	159	86	794	50	4	1173	60
Turn Type	Split	NA	pm+ov	Split	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	4
Permitted Phases			4			8			2			6
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	4
Switch Phase												
Minimum Initial (s)	7.0	7.0	5.0	7.0	7.0	5.0	5.0	10.0	7.0	5.0	5.0	7.0
Minimum Split (s)	25.0	25.0	12.0	25.0	25.0	12.0	12.0	25.0	25.0	12.0	25.0	25.0
Total Split (s)	25.0	25.0	12.0	37.0	37.0	12.0	12.0	46.0	37.0	12.0	46.0	25.0
Total Split (%)	20.8%	20.8%	10.0%	30.8%	30.8%	10.0%	10.0%	38.3%	30.8%	10.0%	38.3%	20.8%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead			Lag	Lead	Lead		Lag	Lag	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min	None	None	C-Min	None
Act Effect Green (s)	17.4	17.4	24.5	34.5	34.5	47.4	7.1	35.2	74.8	12.8	41.0	63.4
Actuated g/C Ratio	0.14	0.14	0.20	0.29	0.29	0.40	0.06	0.29	0.62	0.11	0.34	0.53
v/c Ratio	0.60	0.14	0.92	0.92	0.91	0.14	0.83	0.76	0.05	0.02	0.97	0.07
Control Delay	52.9	44.9	53.8	67.5	65.3	13.8	108.6	21.6	2.3	42.5	50.7	14.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.9	44.9	53.8	67.5	65.3	13.8	108.6	21.6	2.3	42.5	50.7	14.0
LOS	D	D	D	E	E	B	F	C	A	D	D	B
Approach Delay		53.1			58.4			28.6			48.9	
Approach LOS		D			E			C			D	
Queue Length 50th (ft)	111	26	146	351	348	26	52	305	1	3	493	21
Queue Length 95th (ft)	155	58	#234	#588	#582	47	#169	105	m7	m6	#604	44

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3922			918			793			2522		
Turn Bay Length (ft)	200		300	300		400	300		100	175		275
Base Capacity (vph)	572	310	568	483	489	1100	104	1209	986	189	1209	870
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.12	0.92	0.92	0.91	0.14	0.83	0.66	0.05	0.02	0.97	0.07

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 12 (10%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.97

Intersection Signal Delay: 47.6

Intersection LOS: D

Intersection Capacity Utilization 80.2%

ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

 Ø2 (R)	 Ø1	 Ø4	 Ø8
46 s	12 s	25 s	37 s
 Ø5	 Ø6 (R)		
12 s	46 s		

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/16/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	174	153	698	434	607	1196
Future Volume (vph)	174	153	698	434	607	1196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	238		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	193	170	776	482	674	1329
Shared Lane Traffic (%)						
Lane Group Flow (vph)	193	170	776	482	674	1329
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	5.0	7.0	5.0	5.0
Minimum Split (s)	25.0	25.0	25.0	25.0	12.0	25.0
Total Split (s)	32.0	32.0	47.0	32.0	41.0	88.0
Total Split (%)	26.7%	26.7%	39.2%	26.7%	34.2%	73.3%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	24.4	24.4	50.0	79.4	30.6	85.6
Actuated g/C Ratio	0.20	0.20	0.42	0.66	0.26	0.71
v/c Ratio	0.28	0.53	0.53	0.46	0.77	0.53
Control Delay	40.4	48.1	29.5	12.3	39.1	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	48.1	29.5	12.3	39.1	7.4
LOS	D	D	C	B	D	A
Approach Delay	44.0		22.9			18.0
Approach LOS	D		C			B
Queue Length 50th (ft)	64	116	240	168	227	176
Queue Length 95th (ft)	97	186	330	279	m263	m248

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	158		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	795	367	1483	1036	1030	2547
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.46	0.52	0.47	0.65	0.52

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 118 (98%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 22.3

Intersection LOS: C

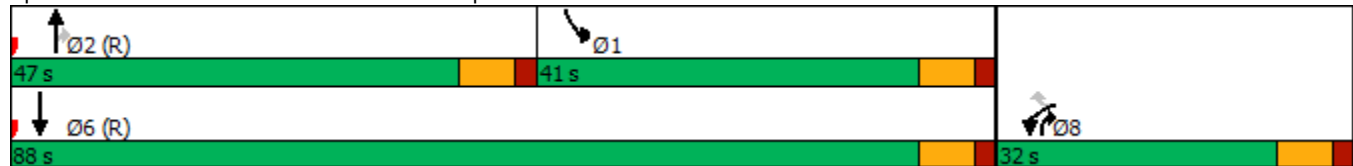
Intersection Capacity Utilization 54.9%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/16/2020

Intersection						
Int Delay, s/veh	3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	14	518	135	41	109	36
Future Vol, veh/h	14	518	135	41	109	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	100	100	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	576	150	46	121	40
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	196	0	-	0	758	150
Stage 1	-	-	-	-	150	-
Stage 2	-	-	-	-	608	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1377	-	-	-	375	896
Stage 1	-	-	-	-	878	-
Stage 2	-	-	-	-	543	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1377	-	-	-	371	896
Mov Cap-2 Maneuver	-	-	-	-	371	-
Stage 1	-	-	-	-	867	-
Stage 2	-	-	-	-	543	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.2	0		16.8		
HCM LOS	C					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1377	-	-	-	371	896
HCM Lane V/C Ratio	0.011	-	-	-	0.326	0.045
HCM Control Delay (s)	7.6	-	-	-	19.3	9.2
HCM Lane LOS	A	-	-	-	C	A
HCM 95th %tile Q(veh)	0	-	-	-	1.4	0.1

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	73	97	341	244	287	319
Future Volume (vph)	73	97	341	244	287	319
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.923		0.944			
Flt Protected	0.979					0.977
Satd. Flow (prot)	1683	0	1758	0	0	1820
Flt Permitted	0.979					0.503
Satd. Flow (perm)	1683	0	1758	0	0	937
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		35			35
Link Distance (ft)	1001		983			158
Travel Time (s)	19.5		19.1			3.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	81	108	379	271	319	354
Shared Lane Traffic (%)						
Lane Group Flow (vph)	189	0	650	0	0	673
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Detector Phase	8		2		6	6
Switch Phase						
Minimum Initial (s)	5.0		10.0		10.0	10.0
Minimum Split (s)	25.0		25.0		25.0	25.0
Total Split (s)	25.0		125.0		125.0	125.0
Total Split (%)	16.7%		83.3%		83.3%	83.3%
Yellow Time (s)	5.0		5.0		5.0	5.0
All-Red Time (s)	2.0		2.0		2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0			-2.0
Total Lost Time (s)	5.0		5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		C-Min		C-Min	C-Min
Act Effect Green (s)	20.1		119.9			119.9
Actuated g/C Ratio	0.13		0.80			0.80
v/c Ratio	0.84		0.46			0.90
Control Delay	93.0		6.0			28.3
Queue Delay	0.0		0.3			7.4
Total Delay	93.0		6.4			35.6
LOS	F		A			D
Approach Delay	93.0		6.4			35.6
Approach LOS	F		A			D
Queue Length 50th (ft)	183		172			406
Queue Length 95th (ft)	#320		228			#861
Internal Link Dist (ft)	921		903			78
Turn Bay Length (ft)						
Base Capacity (vph)	229		1411			752

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Starvation Cap Reductn	0		0			58
Spillback Cap Reductn	0		293			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.83		0.58			0.97

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 148 (99%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 30.2

Intersection LOS: C

Intersection Capacity Utilization 88.0%

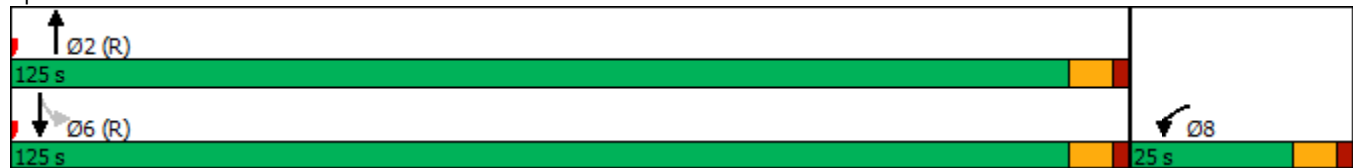
ICU Level of Service E

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek



Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	19	74	143	17	12	31	237	168	5	342	7
Future Volume (vph)	4	19	74	143	17	12	31	237	168	5	342	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.897			0.991			0.948			0.997	
Flt Protected		0.998			0.960			0.996			0.999	
Satd. Flow (prot)	0	1668	0	0	1772	0	0	1759	0	0	1855	0
Flt Permitted		0.989			0.608			0.950			0.993	
Satd. Flow (perm)	0	1653	0	0	1122	0	0	1678	0	0	1844	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			35			35			25	
Link Distance (ft)		1007			767			158			1002	
Travel Time (s)		27.5			14.9			3.1			27.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	4	21	82	159	19	13	34	263	187	6	380	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	107	0	0	191	0	0	484	0	0	394	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	57.0	57.0		57.0	57.0		93.0	93.0		93.0	93.0	
Total Split (%)	38.0%	38.0%		38.0%	38.0%		62.0%	62.0%		62.0%	62.0%	
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		30.9			30.9			109.1			109.1	
Actuated g/C Ratio		0.21			0.21			0.73			0.73	
v/c Ratio		0.31			0.83			0.40			0.29	
Control Delay		51.1			83.8			7.2			8.7	
Queue Delay		0.2			1.7			1.7			0.1	
Total Delay		51.2			85.4			9.0			8.8	
LOS		D			F			A			A	
Approach Delay		51.2			85.4			9.0			8.8	
Approach LOS		D			F			A			A	
Queue Length 50th (ft)		90			181			122			122	
Queue Length 95th (ft)		136			256			m202			216	
Internal Link Dist (ft)		927			687			78			922	
Turn Bay Length (ft)												
Base Capacity (vph)		573			388			1220			1341	

Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0			548			0	
Spillback Cap Reductn		128			86			0			249	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.24			0.63			0.72			0.36	

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 144 (96%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 25.2

Intersection LOS: C

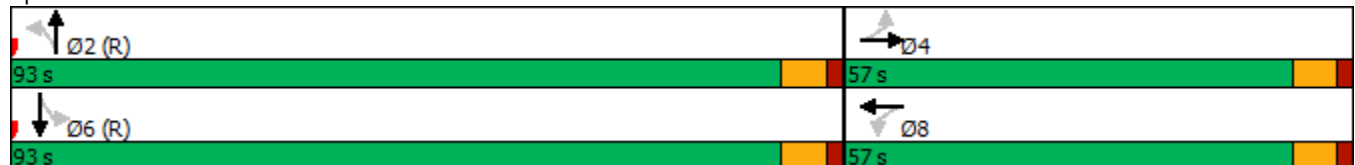
Intersection Capacity Utilization 66.6%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road



Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↔↔	↑	↗	↗	↑↑			↑↑	↗
Traffic Volume (vph)	0	0	0	569	7	243	25	774	0	0	447	136
Future Volume (vph)	0	0	0	569	7	243	25	774	0	0	447	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	400		175	0		0	0		225
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	50			50			25			50		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt						0.850						0.850
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3433	1863	1583	1770	3539	0	0	3539	1583
Flt Permitted				0.950			0.416					
Satd. Flow (perm)	0	0	0	3433	1863	1583	775	3539	0	0	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		993			1009			310			1001	
Travel Time (s)		22.6			22.9			7.0			22.8	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	632	8	270	28	860	0	0	497	151
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	632	8	270	28	860	0	0	497	151
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Free
Protected Phases					8		5	2			6	
Permitted Phases				8		8	2					Free
Detector Phase				8	8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				7.0	7.0	7.0	7.0	10.0			10.0	
Minimum Split (s)				25.0	25.0	25.0	17.0	25.0			25.0	
Total Split (s)				63.0	63.0	63.0	19.0	77.0			58.0	
Total Split (%)				45.0%	45.0%	45.0%	13.6%	55.0%			41.4%	
Yellow Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
All-Red Time (s)				2.0	2.0	2.0	2.0	2.0			2.0	
Lost Time Adjust (s)				-2.0	-2.0	-2.0	-2.0	-2.0			-2.0	
Total Lost Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Recall Mode				None	None	None	None	C-Min			C-Min	
Act Effect Green (s)				37.1	37.1	37.1	92.9	92.9			84.4	140.0
Actuated g/C Ratio				0.26	0.26	0.26	0.66	0.66			0.60	1.00
v/c Ratio				0.70	0.02	0.64	0.05	0.37			0.23	0.10
Control Delay				50.0	34.0	52.2	4.8	5.5			15.2	0.1
Queue Delay				0.0	0.0	0.0	0.0	0.4			0.0	0.0
Total Delay				50.0	34.0	52.2	4.8	5.9			15.2	0.1
LOS				D	C	D	A	A			B	A
Approach Delay					50.5			5.8			11.6	
Approach LOS					D			A			B	
Queue Length 50th (ft)				269	5	219	4	63			116	0
Queue Length 95th (ft)				304	18	289	m9	139			177	0

Lanes, Volumes, Timings

1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

07/16/2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group												
Internal Link Dist (ft)		913			929			230			921	
Turn Bay Length (ft)				400		175						225
Base Capacity (vph)				1422	771	655	613	2348			2133	1583
Starvation Cap Reductn				0	0	0	0	851			0	0
Spillback Cap Reductn				0	0	0	0	0			0	0
Storage Cap Reductn				0	0	0	0	0			0	0
Reduced v/c Ratio				0.44	0.01	0.41	0.05	0.57			0.23	0.10

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 78 (56%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 24.0

Intersection LOS: C

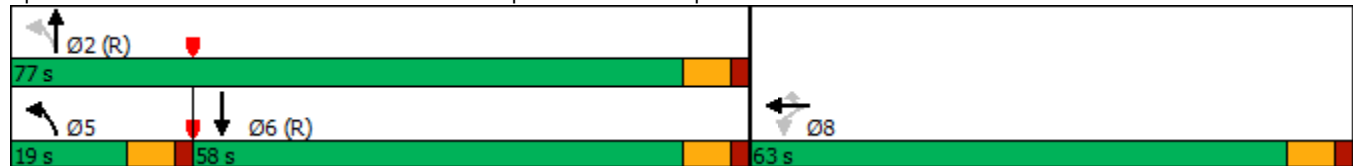
Intersection Capacity Utilization 106.6%

ICU Level of Service G

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp



Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						 			 	
Traffic Volume (vph)	193	7	36	0	0	0	0	616	1006	158	858	0
Future Volume (vph)	193	7	36	0	0	0	0	616	1006	158	858	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	400		300	0		0	0		400	0		0
Storage Lanes	1		1	0		0	0		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850						0.850			
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1770	3539	1583	0	0	0	0	3539	1583	1770	3539	0
Flt Permitted	0.950									0.950		
Satd. Flow (perm)	1770	3539	1583	0	0	0	0	3539	1583	1770	3539	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1000			1011			2604			310	
Travel Time (s)		22.7			23.0			50.7			6.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	214	8	40	0	0	0	0	684	1118	176	953	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	214	8	40	0	0	0	0	684	1118	176	953	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Detector Phase	4	4	4					2	2	1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0	7.0					10.0	10.0	7.0	10.0	
Minimum Split (s)	25.0	25.0	25.0					25.0	25.0	14.0	25.0	
Total Split (s)	25.0	25.0	25.0					97.0	97.0	18.0	115.0	
Total Split (%)	17.9%	17.9%	17.9%					69.3%	69.3%	12.9%	82.1%	
Yellow Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0					2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0	-2.0					-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)	5.0	5.0	5.0					5.0	5.0	5.0	5.0	
Lead/Lag								Lead	Lead	Lag		
Lead-Lag Optimize?								Yes	Yes	Yes		
Recall Mode	None	None	None					C-Min	C-Min	None	C-Min	
Act Effct Green (s)	19.6	19.6	19.6					92.4	92.4	13.0	110.4	
Actuated g/C Ratio	0.14	0.14	0.14					0.66	0.66	0.09	0.79	
v/c Ratio	0.86	0.02	0.18					0.29	1.07	1.07	0.34	
Control Delay	89.6	51.7	55.2					6.8	61.8	135.9	3.4	
Queue Delay	0.0	0.0	0.0					0.0	0.0	0.0	0.3	
Total Delay	89.6	51.7	55.2					6.8	61.8	135.9	3.8	
LOS	F	D	E					A	E	F	A	
Approach Delay		83.2						40.9			24.4	
Approach LOS		F						D			C	
Queue Length 50th (ft)	193	3	33					88	~1108	~180	16	
Queue Length 95th (ft)	#332	12	70					m115	m#1331	#325	100	

Lanes, Volumes, Timings

2: NC 191 & I-240 EB Exit/I-240 EB Entrance

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			931			2524			230	
Turn Bay Length (ft)	400		300						400			
Base Capacity (vph)	252	505	226					2334	1044	164	2789	
Starvation Cap Reductn	0	0	0					0	0	0	1118	
Spillback Cap Reductn	0	0	0					0	0	0	0	
Storage Cap Reductn	0	0	0					0	0	0	0	
Reduced v/c Ratio	0.85	0.02	0.18					0.29	1.07	1.07	0.57	

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 26 (19%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.07

Intersection Signal Delay: 38.5

Intersection LOS: D

Intersection Capacity Utilization 108.2%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

 Ø2 (R)	 Ø1	 Ø4
97 s	18 s	25 s
 Ø6 (R)		
115 s		

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

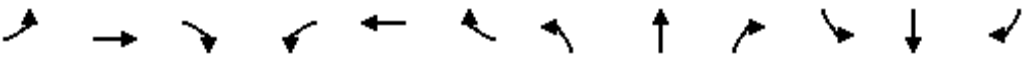
07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	116	37	231	787	310	621	198	976	72	7	826	183
Future Volume (vph)	116	37	231	787	310	621	198	976	72	7	826	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		300	300		400	300		100	175		275
Storage Lanes	2		2	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	1.00	0.88	0.95	0.95	0.88	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950	0.978		0.950			0.950		
Satd. Flow (prot)	3433	1863	2787	1681	1731	2787	1770	3539	1583	1770	3539	1583
Flt Permitted	0.950			0.950	0.978		0.950			0.950		
Satd. Flow (perm)	3433	1863	2787	1681	1731	2787	1770	3539	1583	1770	3539	1583
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			45			45	
Link Distance (ft)		4002			998			873			2604	
Travel Time (s)		91.0			22.7			13.2			39.5	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	129	41	257	874	344	690	220	1084	80	8	918	203
Shared Lane Traffic (%)				31%								
Lane Group Flow (vph)	129	41	257	603	615	690	220	1084	80	8	918	203
Turn Type	Split	NA	pm+ov	Split	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	4	4	5	8	8	1	5	2	8	1	6	4
Permitted Phases			4			8			2			6
Detector Phase	4	4	5	8	8	1	5	2	8	1	6	4
Switch Phase												
Minimum Initial (s)	7.0	7.0	5.0	7.0	7.0	5.0	5.0	10.0	7.0	5.0	5.0	7.0
Minimum Split (s)	25.0	25.0	12.0	25.0	25.0	12.0	12.0	25.0	25.0	12.0	25.0	25.0
Total Split (s)	25.0	25.0	22.0	52.0	52.0	12.0	22.0	51.0	52.0	12.0	41.0	25.0
Total Split (%)	17.9%	17.9%	15.7%	37.1%	37.1%	8.6%	15.7%	36.4%	37.1%	8.6%	29.3%	17.9%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lag			Lag	Lag	Lead		Lag	Lead	
Lead-Lag Optimize?			Yes			Yes	Yes	Yes		Yes	Yes	
Recall Mode	None	None	None	None	None	None	None	C-Min	None	None	C-Min	None
Act Effect Green (s)	12.8	12.8	34.8	54.2	54.2	61.5	17.0	45.7	105.0	7.3	36.0	48.8
Actuated g/C Ratio	0.09	0.09	0.25	0.39	0.39	0.44	0.12	0.33	0.75	0.05	0.26	0.35
v/c Ratio	0.41	0.24	0.37	0.93	0.92	0.56	1.03	0.94	0.07	0.09	1.01	0.37
Control Delay	51.0	49.6	32.8	62.9	61.1	27.2	110.8	43.8	3.4	70.1	70.3	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.0	49.6	32.8	62.9	61.1	27.2	110.8	43.8	3.4	70.1	70.3	14.7
LOS	D	D	C	E	E	C	F	D	A	E	E	B
Approach Delay		39.9			49.4			52.1			60.3	
Approach LOS		D			D			D			E	
Queue Length 50th (ft)	56	34	101	547	554	180	~219	507	1	8	~468	43
Queue Length 95th (ft)	m74	m55	m121	#843	#850	232	#386	#620	m29	m23	#584	118

Lanes, Volumes, Timings

3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)	3922			918			793			2524		
Turn Bay Length (ft)	200		300	300		400	300		100	175		275
Base Capacity (vph)	490	266	692	651	670	1223	214	1162	1186	91	910	633
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.15	0.37	0.93	0.92	0.56	1.03	0.93	0.07	0.09	1.01	0.32

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 51.9

Intersection LOS: D

Intersection Capacity Utilization 86.2%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

 Ø2 (R)		 Ø1		 Ø4		 Ø8	
51 s		12 s		25 s		52 s	
 Ø6 (R)		 Ø5					
41 s		22 s					

Lanes, Volumes, Timings
4: NC 191 & I-40 EB Ramps

07/16/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	198	72	1222	568	266	1236
Future Volume (vph)	198	72	1222	568	266	1236
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	185	40		200	600	
Storage Lanes	1	1		1	2	
Taper Length (ft)	25				25	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		45			45
Link Distance (ft)	238		1003			873
Travel Time (s)	4.6		15.2			13.2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	220	80	1358	631	296	1373
Shared Lane Traffic (%)						
Lane Group Flow (vph)	220	80	1358	631	296	1373
Turn Type	Prot	Perm	NA	pm+ov	Prot	NA
Protected Phases	8		2	8	1	6
Permitted Phases		8		2		
Detector Phase	8	8	2	8	1	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	5.0	7.0	5.0	5.0
Minimum Split (s)	25.0	25.0	25.0	25.0	12.0	25.0
Total Split (s)	35.0	35.0	80.0	35.0	25.0	105.0
Total Split (%)	25.0%	25.0%	57.1%	25.0%	17.9%	75.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None	None	C-Min	None	None	C-Min
Act Effect Green (s)	26.7	26.7	79.7	111.4	18.6	103.3
Actuated g/C Ratio	0.19	0.19	0.57	0.80	0.13	0.74
v/c Ratio	0.34	0.27	0.67	0.50	0.65	0.53
Control Delay	49.5	49.1	24.4	6.7	52.5	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.3
Total Delay	49.5	49.1	24.4	6.7	52.5	5.0
LOS	D	D	C	A	D	A
Approach Delay	49.4		18.8			13.4
Approach LOS	D		B			B
Queue Length 50th (ft)	89	62	453	170	132	72
Queue Length 95th (ft)	126	111	564	245	m157	m277

Lanes, Volumes, Timings

4: NC 191 & I-40 EB Ramps

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Internal Link Dist (ft)	158		923			793
Turn Bay Length (ft)	185	40		200	600	
Base Capacity (vph)	755	348	2042	1253	497	2631
Starvation Cap Reductn	0	0	0	0	0	521
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.23	0.67	0.50	0.60	0.65

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 126 (90%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.67

Intersection Signal Delay: 18.8

Intersection LOS: B

Intersection Capacity Utilization 59.7%

ICU Level of Service B

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 191 & I-40 EB Ramps



HCM 6th TWSC
5: SR 3413 S. Bear Creek & Proposed Entrance

07/16/2020

Intersection						
Int Delay, s/veh	2.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	38	231	501	114	75	25
Future Vol, veh/h	38	231	501	114	75	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	100	100	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	257	557	127	83	28
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	684	0	-	0	898	557
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	341	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	909	-	-	-	310	530
Stage 1	-	-	-	-	574	-
Stage 2	-	-	-	-	720	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	909	-	-	-	296	530
Mov Cap-2 Maneuver	-	-	-	-	296	-
Stage 1	-	-	-	-	548	-
Stage 2	-	-	-	-	720	-
Approach	EB	WB		SB		
HCM Control Delay, s	1.3	0		19.5		
HCM LOS	C					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	909	-	-	-	296	530
HCM Lane V/C Ratio	0.046	-	-	-	0.282	0.052
HCM Control Delay (s)	9.2	-	-	-	21.9	12.2
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.1	-	-	-	1.1	0.2

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	267	259	211	89	180	505
Future Volume (vph)	267	259	211	89	180	505
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.934		0.960			
Flt Protected	0.975					0.987
Satd. Flow (prot)	1696	0	1788	0	0	1839
Flt Permitted	0.975					0.720
Satd. Flow (perm)	1696	0	1788	0	0	1341
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	35		35			35
Link Distance (ft)	1001		983			158
Travel Time (s)	19.5		19.1			3.1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	297	288	234	99	200	561
Shared Lane Traffic (%)						
Lane Group Flow (vph)	585	0	333	0	0	761
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Detector Phase	8		2		6	6
Switch Phase						
Minimum Initial (s)	7.0		7.0		10.0	10.0
Minimum Split (s)	25.0		25.0		25.0	25.0
Total Split (s)	53.0		87.0		87.0	87.0
Total Split (%)	37.9%		62.1%		62.1%	62.1%
Yellow Time (s)	5.0		5.0		5.0	5.0
All-Red Time (s)	2.0		2.0		2.0	2.0
Lost Time Adjust (s)	-2.0		-2.0			-2.0
Total Lost Time (s)	5.0		5.0			5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		C-Min		C-Min	C-Min
Act Effect Green (s)	48.4		81.6			81.6
Actuated g/C Ratio	0.35		0.58			0.58
v/c Ratio	1.00		0.32			0.97
Control Delay	73.9		15.9			47.9
Queue Delay	34.1		3.3			29.5
Total Delay	108.0		19.2			77.3
LOS	F		B			E
Approach Delay	108.0		19.2			77.3
Approach LOS	F		B			E
Queue Length 50th (ft)	~549		148			551
Queue Length 95th (ft)	m#669		209			#942
Internal Link Dist (ft)	921		903			78
Turn Bay Length (ft)						
Base Capacity (vph)	586		1047			785

Lanes, Volumes, Timings

6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

07/16/2020



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Starvation Cap Reductn	0		0			75
Spillback Cap Reductn	54		602			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	1.10		0.75			1.07

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 36 (26%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.00

Intersection Signal Delay: 76.5

Intersection LOS: E

Intersection Capacity Utilization 96.2%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek



Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	13	54	328	35	13	39	294	121	12	260	4
Future Volume (vph)	7	13	54	328	35	13	39	294	121	12	260	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.901			0.995			0.964			0.998	
Flt Protected		0.995			0.958			0.996			0.998	
Satd. Flow (prot)	0	1670	0	0	1776	0	0	1789	0	0	1855	0
Flt Permitted		0.955			0.705			0.946			0.973	
Satd. Flow (perm)	0	1603	0	0	1307	0	0	1699	0	0	1809	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			35			35			25	
Link Distance (ft)		1007			767			158			1002	
Travel Time (s)		27.5			14.9			3.1			27.3	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	8	14	60	364	39	14	43	327	134	13	289	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	82	0	0	417	0	0	504	0	0	306	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	
Total Split (s)	71.0	71.0		71.0	71.0		69.0	69.0		69.0	69.0	
Total Split (%)	50.7%	50.7%		50.7%	50.7%		49.3%	49.3%		49.3%	49.3%	
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Min	C-Min		C-Min	C-Min	
Act Effect Green (s)		53.3			53.3			76.7			76.7	
Actuated g/C Ratio		0.38			0.38			0.55			0.55	
v/c Ratio		0.13			0.84			0.54			0.31	
Control Delay		26.4			54.0			18.7			20.2	
Queue Delay		0.0			0.3			38.5			0.8	
Total Delay		26.4			54.4			57.2			21.0	
LOS		C			D			E			C	
Approach Delay		26.4			54.4			57.2			21.0	
Approach LOS		C			D			E			C	
Queue Length 50th (ft)		48			340			211			149	
Queue Length 95th (ft)		74			421			m263			254	
Internal Link Dist (ft)		927			687			78			922	
Turn Bay Length (ft)												
Base Capacity (vph)		755			616			930			991	

Lanes, Volumes, Timings

7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

07/16/2020

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0			453			0	
Spillback Cap Reductn		29			24			0			417	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.11			0.70			1.06			0.53	

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 55

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 45.9

Intersection LOS: D

Intersection Capacity Utilization 73.9%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

 Ø2 (R)	 Ø4
69 s	71 s
 Ø6 (R)	 Ø8
69 s	71 s

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	T	R
Maximum Queue (ft)	1031	200	252	997	997
Average Queue (ft)	1000	99	215	977	879
95th Queue (ft)	1017	263	276	990	1362
Link Distance (ft)	979		234	963	963
Upstream Blk Time (%)	92		11	97	77
Queuing Penalty (veh)	0		54	0	0
Storage Bay Dist (ft)		150			
Storage Blk Time (%)	81				
Queuing Penalty (veh)	72				

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	NB	NB	SB
Directions Served	LTR	T	R	LT
Maximum Queue (ft)	297	178	74	252
Average Queue (ft)	162	52	35	247
95th Queue (ft)	276	135	66	253
Link Distance (ft)	947	2589	2589	234
Upstream Blk Time (%)				56
Queuing Penalty (veh)				678
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LT	R	L	T	T	R	L	T	TR
Maximum Queue (ft)	3598	998	175	150	373	365	61	29	386	369
Average Queue (ft)	2882	966	74	77	204	208	36	1	212	212
95th Queue (ft)	3910	984	214	155	379	373	74	9	338	337
Link Distance (ft)	3589	946			816	816			2589	2589
Upstream Blk Time (%)	6	80								
Queuing Penalty (veh)	31	0								
Storage Bay Dist (ft)			150	125			40	200		
Storage Blk Time (%)		70	0	0	11	28	0		18	
Queuing Penalty (veh)		97	1	2	7	12	1		1	

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	144	216	65	119	294	283	225	341	297	96	116
Average Queue (ft)	92	138	58	14	186	151	136	233	42	47	47
95th Queue (ft)	170	224	70	67	281	256	218	324	167	90	94
Link Distance (ft)		144		936	952	952				816	816
Upstream Blk Time (%)	0	13									
Queuing Penalty (veh)	0	0									
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	0	56	4			1	1				
Queuing Penalty (veh)	1	127	6			5	2				

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	EB
Directions Served	LT
Maximum Queue (ft)	477
Average Queue (ft)	39
95th Queue (ft)	216
Link Distance (ft)	1277
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	291	39	122
Average Queue (ft)	93	8	104
95th Queue (ft)	197	28	142
Link Distance (ft)	1277	949	108
Upstream Blk Time (%)			12
Queuing Penalty (veh)			66
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	114	187	108	336
Average Queue (ft)	41	55	69	97
95th Queue (ft)	79	110	100	198
Link Distance (ft)	979	738	108	974
Upstream Blk Time (%)				0
Queuing Penalty (veh)				1
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1163

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	T	R
Maximum Queue (ft)	1042	200	247	1049	225
Average Queue (ft)	997	163	170	1016	172
95th Queue (ft)	1014	260	258	1034	329
Link Distance (ft)	979		235	997	
Upstream Blk Time (%)	84		5	98	
Queuing Penalty (veh)	0		37	0	
Storage Bay Dist (ft)		150			175
Storage Blk Time (%)	70	13		90	
Queuing Penalty (veh)	167	70		119	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	NB	NB	SB
Directions Served	LTR	T	R	LT
Maximum Queue (ft)	481	281	195	254
Average Queue (ft)	217	71	84	248
95th Queue (ft)	386	192	171	254
Link Distance (ft)	947	2589	2589	235
Upstream Blk Time (%)				51
Queuing Penalty (veh)				476
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LT	R	L	T	T	R	L	T	TR
Maximum Queue (ft)	2196	1009	175	150	836	856	62	225	613	613
Average Queue (ft)	1529	969	135	129	787	802	39	128	326	316
95th Queue (ft)	2461	991	252	185	960	977	77	245	552	551
Link Distance (ft)	3591	946			816	816			2589	2589
Upstream Blk Time (%)		64			16	29				
Queuing Penalty (veh)		0			101	176				
Storage Bay Dist (ft)			150	125			40	200		
Storage Blk Time (%)		56	3	22	69	70	1	0	39	
Queuing Penalty (veh)		337	33	104	111	49	4	0	42	

Queuing and Blocking Report

20 South Bear Creek

07/09/2020

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	R	L	L	T	T
Maximum Queue (ft)	194	215	65	1004	1015	225	281	143	139	142
Average Queue (ft)	91	127	39	802	811	206	146	6	50	64
95th Queue (ft)	177	198	77	1219	1282	290	223	51	113	130
Link Distance (ft)		194		952	952				816	816
Upstream Blk Time (%)	0	2		21	54					
Queuing Penalty (veh)	0	0		0	0					
Storage Bay Dist (ft)	185		40			200	600	600		
Storage Blk Time (%)	0	60	1		51	5				
Queuing Penalty (veh)	0	92	1		283	29				

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	466	50	122
Average Queue (ft)	277	2	60
95th Queue (ft)	470	18	125
Link Distance (ft)	1276	949	108
Upstream Blk Time (%)			1
Queuing Penalty (veh)			5
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	54	164	118	160
Average Queue (ft)	28	81	75	67
95th Queue (ft)	49	140	114	114
Link Distance (ft)	979	738	108	974
Upstream Blk Time (%)			1	
Queuing Penalty (veh)			3	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 2239

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	T	R
Maximum Queue (ft)	1038	200	247	1002	225
Average Queue (ft)	994	81	131	980	142
95th Queue (ft)	1011	221	218	994	321
Link Distance (ft)	975		234	963	
Upstream Blk Time (%)	86		4	98	
Queuing Penalty (veh)	0		20	0	
Storage Bay Dist (ft)		150			175
Storage Blk Time (%)	78			95	
Queuing Penalty (veh)	79			188	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	NB	NB	SB
Directions Served	LTR	T	R	LT
Maximum Queue (ft)	982	111	74	254
Average Queue (ft)	874	20	29	246
95th Queue (ft)	1079	70	66	254
Link Distance (ft)	947	2588	2588	234
Upstream Blk Time (%)	62			58
Queuing Penalty (veh)	0			814
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LT	R	L	T	T	R	L	T	TR
Maximum Queue (ft)	3601	1009	175	149	654	704	63	224	398	378
Average Queue (ft)	3066	966	23	101	385	405	46	7	202	195
95th Queue (ft)	4110	984	110	169	635	654	76	74	366	361
Link Distance (ft)	3586	946			816	816			2588	2588
Upstream Blk Time (%)	15	74								
Queuing Penalty (veh)	86	0								
Storage Bay Dist (ft)			150	125			40	200		
Storage Blk Time (%)		68	0	29	35	52	1		20	
Queuing Penalty (veh)		108	0	115	25	26	3		1	

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	144	240	65	324	582	638	225	331	267	202	205
Average Queue (ft)	94	172	55	66	299	308	179	228	31	78	80
95th Queue (ft)	182	261	76	220	481	519	291	317	161	165	176
Link Distance (ft)		144		745	952	952				816	816
Upstream Blk Time (%)	1	26									
Queuing Penalty (veh)	0	0									
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	1	55	7			13	9				
Queuing Penalty (veh)	1	144	13			62	36				

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	EB	WB
Directions Served	LT	TR
Maximum Queue (ft)	1040	137
Average Queue (ft)	201	12
95th Queue (ft)	728	71
Link Distance (ft)	1281	3586
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	1281	174	135
Average Queue (ft)	627	25	118
95th Queue (ft)	1331	86	127
Link Distance (ft)	1281	949	108
Upstream Blk Time (%)	8		31
Queuing Penalty (veh)	11		188
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	140	256	120	1026
Average Queue (ft)	56	82	67	824
95th Queue (ft)	97	170	96	1298
Link Distance (ft)	979	738	108	974
Upstream Blk Time (%)			1	55
Queuing Penalty (veh)			4	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1924

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	T	R
Maximum Queue (ft)	1014	200	256	1012	225
Average Queue (ft)	995	143	202	976	97
95th Queue (ft)	1005	274	289	992	281
Link Distance (ft)	980		236	959	
Upstream Blk Time (%)	81		14	93	
Queuing Penalty (veh)	0		119	0	
Storage Bay Dist (ft)		150			175
Storage Blk Time (%)	75	5		87	
Queuing Penalty (veh)	202	32		132	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	NB	NB	SB
Directions Served	LTR	T	R	LT
Maximum Queue (ft)	704	493	1062	257
Average Queue (ft)	357	173	285	247
95th Queue (ft)	606	409	697	256
Link Distance (ft)	947	2589	2589	236
Upstream Blk Time (%)				54
Queuing Penalty (veh)				576
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LT	R	L	T	T	R	L	T	TR
Maximum Queue (ft)	2388	985	175	150	829	888	64	224	570	569
Average Queue (ft)	1618	968	127	138	785	822	47	18	289	299
95th Queue (ft)	2555	984	233	184	881	942	77	92	494	500
Link Distance (ft)	3582	946			816	816			2589	2589
Upstream Blk Time (%)		69			16	41				
Queuing Penalty (veh)		0			110	287				
Storage Bay Dist (ft)			150	125			40	200		
Storage Blk Time (%)		62	4	30	57	61	1		37	
Queuing Penalty (veh)		427	44	162	105	49	5		3	

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	143	228	65	149	967	1015	225	260	168	118	140
Average Queue (ft)	105	154	46	18	710	722	205	148	9	57	70
95th Queue (ft)	183	248	82	78	1196	1261	285	244	62	121	134
Link Distance (ft)		143		780	952	952				816	816
Upstream Blk Time (%)	1	19			10	41					
Queuing Penalty (veh)	0	0			0	0					
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	1	55	13			42	1				
Queuing Penalty (veh)	1	95	28			268	9				

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	WB
Directions Served	TR
Maximum Queue (ft)	223
Average Queue (ft)	14
95th Queue (ft)	89
Link Distance (ft)	3582
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	1297	54	119
Average Queue (ft)	1048	4	74
95th Queue (ft)	1421	23	133
Link Distance (ft)	1284	949	108
Upstream Blk Time (%)	7		2
Queuing Penalty (veh)	37		15
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	57	166	118	128
Average Queue (ft)	34	88	66	78
95th Queue (ft)	52	139	104	123
Link Distance (ft)	979	738	108	974
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			2	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 2709

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit

Movement	WB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	R	L	T	T	T	T	R
Maximum Queue (ft)	424	450	605	158	69	267	273	442	570	275
Average Queue (ft)	188	368	147	52	10	134	137	72	245	122
95th Queue (ft)	451	497	545	117	38	242	241	238	477	266
Link Distance (ft)			958		259	259	259	952	952	
Upstream Blk Time (%)						0	0			
Queuing Penalty (veh)						1	0			
Storage Bay Dist (ft)	400	400		175						225
Storage Blk Time (%)	0	7		0					14	0
Queuing Penalty (veh)	0	7		0					27	1

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	T	R	L	T	T
Maximum Queue (ft)	305	31	30	564	1298	425	267	289	258
Average Queue (ft)	173	2	3	20	201	280	103	114	110
95th Queue (ft)	277	12	17	187	638	472	208	230	212
Link Distance (ft)		953	953	2492	2492		259	259	259
Upstream Blk Time (%)							0	1	0
Queuing Penalty (veh)							2	2	0
Storage Bay Dist (ft)	400					400			
Storage Blk Time (%)					0	6			
Queuing Penalty (veh)					0	11			

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	TR	R	L	LT	R	R	L	T	T	R
Maximum Queue (ft)	197	225	989	325	325	986	425	140	237	121	199	125
Average Queue (ft)	67	173	325	229	321	740	270	55	91	64	102	16
95th Queue (ft)	133	282	675	351	346	1158	578	97	181	121	171	85
Link Distance (ft)			3904			946				792	792	
Upstream Blk Time (%)						30						
Queuing Penalty (veh)						0						
Storage Bay Dist (ft)	200	200		300	300		400	400	300			100
Storage Blk Time (%)	0	0	31	0	23	34	0				12	0
Queuing Penalty (veh)	0	1	146	2	149	192	1				6	0

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	20	2511	2511	300
Average Queue (ft)	1	1334	1314	82
95th Queue (ft)	9	2448	2455	299
Link Distance (ft)		2492	2492	
Upstream Blk Time (%)		1	1	
Queuing Penalty (veh)		5	6	
Storage Bay Dist (ft)	175			275
Storage Blk Time (%)		78	73	0
Queuing Penalty (veh)		3	23	0

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	146	237	76	116	624	721	225	612	625	810	830
Average Queue (ft)	75	152	60	14	258	348	218	604	620	736	461
95th Queue (ft)	174	256	71	65	464	626	252	634	646	1030	1027
Link Distance (ft)		146		802	952	952				792	792
Upstream Blk Time (%)	0	11								13	1
Queuing Penalty (veh)	0	0								164	10
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	0	41	6			11	17	16	37	2	
Queuing Penalty (veh)	1	109	11			55	67	109	244	11	

Queuing and Blocking Report 20 South Bear Creek

07/09/2020

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	WB
Directions Served	T
Maximum Queue (ft)	2969
Average Queue (ft)	1286
95th Queue (ft)	2825
Link Distance (ft)	3904
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	82
Queuing Penalty (veh)	0

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	956	179	133
Average Queue (ft)	904	33	117
95th Queue (ft)	1117	90	126
Link Distance (ft)	951	943	102
Upstream Blk Time (%)	81		39
Queuing Penalty (veh)	121		236
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	118	209	103	1013
Average Queue (ft)	55	94	65	939
95th Queue (ft)	93	168	92	1201
Link Distance (ft)	979	738	102	974
Upstream Blk Time (%)			0	84
Queuing Penalty (veh)			1	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1725

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

Movement	WB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	R	L	T	T	T	T	R
Maximum Queue (ft)	424	450	977	225	48	267	275	260	572	275
Average Queue (ft)	116	347	230	172	13	187	181	37	232	18
95th Queue (ft)	320	470	735	246	40	296	292	121	449	130
Link Distance (ft)			962		258	258	258	948	948	
Upstream Blk Time (%)			1			3	3			
Queuing Penalty (veh)			0			10	9			
Storage Bay Dist (ft)	400	400		175						225
Storage Blk Time (%)	0	8	1	15					10	
Queuing Penalty (veh)	0	22	5	91					15	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	T	R	L	T	T
Maximum Queue (ft)	425	553	28	53	810	425	203	214	203
Average Queue (ft)	233	47	1	8	382	352	71	75	75
95th Queue (ft)	398	260	9	33	818	526	146	163	171
Link Distance (ft)		953	953	2494	2494		258	258	258
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	400					400			
Storage Blk Time (%)	7				0	9			
Queuing Penalty (veh)	0				2	29			

Queuing and Blocking Report
20 South Bear Creek

07/09/2020

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	L	TR	R	L	LT	R	R	L	T	T	R
Maximum Queue (ft)	74	112	133	122	325	1009	425	276	325	807	844	125
Average Queue (ft)	20	51	65	70	313	825	358	175	309	645	663	50
95th Queue (ft)	57	96	112	112	359	1184	543	245	388	917	927	150
Link Distance (ft)			3904			946				793	793	
Upstream Blk Time (%)						19				1	4	
Queuing Penalty (veh)						0				10	29	
Storage Bay Dist (ft)	200	200		300	300		400	400	300			100
Storage Blk Time (%)					3	30	0		65	20	63	0
Queuing Penalty (veh)					47	337	3		353	38	51	0

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	SB	SB	SB	SB
Directions Served	L	T	T	R
Maximum Queue (ft)	199	1194	1199	300
Average Queue (ft)	13	633	637	182
95th Queue (ft)	95	1067	1060	402
Link Distance (ft)		2494	2494	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	175			275
Storage Blk Time (%)		62	57	0
Queuing Penalty (veh)		5	70	1

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	145	217	65	99	966	967	225	509	504	434	370
Average Queue (ft)	91	142	44	7	665	782	215	290	133	130	125
95th Queue (ft)	156	216	78	39	1015	1133	273	454	410	293	263
Link Distance (ft)		146		741	951	951				793	793
Upstream Blk Time (%)	1	11			1	15					
Queuing Penalty (veh)	0	0			0	0					
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	1	61	1			38	1				
Queuing Penalty (veh)	1	117	2			237	6				

Queuing and Blocking Report 20 South Bear Creek

07/09/2020

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	WB
Directions Served	TR
Maximum Queue (ft)	3916
Average Queue (ft)	2011
95th Queue (ft)	4096
Link Distance (ft)	3904
Upstream Blk Time (%)	2
Queuing Penalty (veh)	11
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	964	22	120
Average Queue (ft)	945	1	69
95th Queue (ft)	1049	7	132
Link Distance (ft)	951	949	108
Upstream Blk Time (%)	52		2
Queuing Penalty (veh)	292		10
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	77	161	108	217
Average Queue (ft)	35	86	67	73
95th Queue (ft)	65	137	94	134
Link Distance (ft)	979	738	108	974
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			2	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1806

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 1: NC 191 & I-240 WB Entrance/I-240 WB Exit

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	T	R
Maximum Queue (ft)	1010	200	250	1015	225
Average Queue (ft)	989	52	241	978	115
95th Queue (ft)	1003	187	255	991	288
Link Distance (ft)	975		234	963	
Upstream Blk Time (%)	98		43	91	
Queuing Penalty (veh)	0		265	0	
Storage Bay Dist (ft)		150			175
Storage Blk Time (%)	94			88	
Queuing Penalty (veh)	95			175	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	EB	NB	NB	SB
Directions Served	LT	R	T	R	LT
Maximum Queue (ft)	718	75	618	148	254
Average Queue (ft)	559	35	305	58	246
95th Queue (ft)	683	88	526	108	255
Link Distance (ft)	947		2588	2588	234
Upstream Blk Time (%)					70
Queuing Penalty (veh)					989
Storage Bay Dist (ft)		50			
Storage Blk Time (%)	88	0			
Queuing Penalty (veh)	26	0			

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	LT	R	L	T	T	R	L	T	TR
Maximum Queue (ft)	3683	125	989	175	149	554	584	76	224	373	317
Average Queue (ft)	2933	122	966	75	81	251	268	38	26	176	161
95th Queue (ft)	3811	135	981	216	139	498	519	74	136	329	314
Link Distance (ft)	3916		946			804	804			2588	2588
Upstream Blk Time (%)			71								
Queuing Penalty (veh)			0								
Storage Bay Dist (ft)		100		150	125			40	200		
Storage Blk Time (%)	47	40	64	0	6	25	41	1		10	
Queuing Penalty (veh)	248	134	101	0	24	22	20	3		0	

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	146	237	65	300	492	472	225	440	432	177	183
Average Queue (ft)	101	172	58	47	268	253	170	263	53	68	78
95th Queue (ft)	191	274	70	167	453	458	283	389	256	162	173
Link Distance (ft)		146		802	952	952				804	804
Upstream Blk Time (%)	1	22									
Queuing Penalty (veh)	0	0									
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	1	55	3			10	8				
Queuing Penalty (veh)	1	146	6			50	30				

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	31	1265	125	124	466
Average Queue (ft)	1	387	20	27	231
95th Queue (ft)	10	1067	96	89	569
Link Distance (ft)		3916			451
Upstream Blk Time (%)					40
Queuing Penalty (veh)					0
Storage Bay Dist (ft)	100		100	100	
Storage Blk Time (%)		55	0	0	53
Queuing Penalty (veh)		25	0	0	64

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	952	667	143
Average Queue (ft)	755	219	121
95th Queue (ft)	1221	458	135
Link Distance (ft)	939	943	102
Upstream Blk Time (%)	57		64
Queuing Penalty (veh)	108		397
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	308	778	121	1037
Average Queue (ft)	126	640	107	983
95th Queue (ft)	253	995	123	1046
Link Distance (ft)	979	738	102	974
Upstream Blk Time (%)		73	18	90
Queuing Penalty (veh)		0	88	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 3021

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	T	R
Maximum Queue (ft)	1043	200	250	1012	225
Average Queue (ft)	1003	130	195	977	194
95th Queue (ft)	1029	268	303	990	320
Link Distance (ft)	980		236	959	
Upstream Blk Time (%)	87		11	93	
Queuing Penalty (veh)	0		103	0	
Storage Bay Dist (ft)		150			175
Storage Blk Time (%)	80	2		85	
Queuing Penalty (veh)	215	14		141	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	EB	NB	NB	SB
Directions Served	LT	R	T	R	LT
Maximum Queue (ft)	520	75	378	443	256
Average Queue (ft)	282	44	184	181	248
95th Queue (ft)	492	85	365	367	254
Link Distance (ft)	947		2588	2588	236
Upstream Blk Time (%)					51
Queuing Penalty (veh)					577
Storage Bay Dist (ft)		50			
Storage Blk Time (%)	75	0			
Queuing Penalty (veh)	30	1			

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	LT	R	L	T	T	R	L	T	TR
Maximum Queue (ft)	2092	125	980	175	150	848	863	65	52	592	619
Average Queue (ft)	1525	116	962	135	145	745	753	42	11	302	320
95th Queue (ft)	2291	147	967	239	155	955	1015	78	34	569	586
Link Distance (ft)	3916		946			805	805			2588	2588
Upstream Blk Time (%)			65			18	33				
Queuing Penalty (veh)			0			131	238				
Storage Bay Dist (ft)		100		150	125			40	200		
Storage Blk Time (%)	71	24	56	7	76	33	55	1		34	
Queuing Penalty (veh)	183	40	386	85	411	71	44	7		3	

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	145	217	65	501	966	990	225	289	50	139	142
Average Queue (ft)	125	204	42	135	684	691	207	155	2	45	55
95th Queue (ft)	187	243	86	412	1218	1276	276	249	17	114	131
Link Distance (ft)		146		741	951	951				805	805
Upstream Blk Time (%)	1	46			11	38					
Queuing Penalty (veh)	0	0			0	0					
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	1	69	11			40	3				
Queuing Penalty (veh)	2	131	25			253	19				

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	50	22	22	73	45
Average Queue (ft)	15	1	1	32	16
95th Queue (ft)	43	7	7	51	37
Link Distance (ft)		3916		451	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100		100	100	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	824	458	141
Average Queue (ft)	400	190	119
95th Queue (ft)	681	372	129
Link Distance (ft)	939	943	102
Upstream Blk Time (%)			52
Queuing Penalty (veh)			370
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	97	773	123	1008
Average Queue (ft)	45	651	99	880
95th Queue (ft)	87	919	136	1246
Link Distance (ft)	979	738	102	974
Upstream Blk Time (%)		59	22	64
Queuing Penalty (veh)		0	114	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 3593

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

Movement	WB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	R	L	T	T	T	T	R
Maximum Queue (ft)	425	449	811	176	67	264	283	269	521	275
Average Queue (ft)	170	341	85	65	21	115	119	92	294	168
95th Queue (ft)	406	458	435	128	54	214	220	199	490	318
Link Distance (ft)			958		259	259	259	952	952	
Upstream Blk Time (%)						0	0			
Queuing Penalty (veh)						0	0			
Storage Bay Dist (ft)	400	400		175						225
Storage Blk Time (%)	0	6		0					20	
Queuing Penalty (veh)	0	6		1					41	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	R	L	T	T
Maximum Queue (ft)	289	31	52	1324	425	264	236	222
Average Queue (ft)	131	4	5	167	279	101	103	96
95th Queue (ft)	223	20	26	612	432	182	195	195
Link Distance (ft)		953	2492	2492		259	259	259
Upstream Blk Time (%)						0		
Queuing Penalty (veh)						1		
Storage Bay Dist (ft)	400				400			
Storage Blk Time (%)					3			
Queuing Penalty (veh)					6			

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	R	R	L	LT	R	R	L	T	T
Maximum Queue (ft)	161	156	87	259	218	325	962	425	116	270	357	439
Average Queue (ft)	93	110	33	112	103	314	607	228	51	145	160	209
95th Queue (ft)	150	159	82	184	168	357	1017	553	103	275	292	375
Link Distance (ft)			3903				946				779	779
Upstream Blk Time (%)							8					
Queuing Penalty (veh)							0					
Storage Bay Dist (ft)	200	200		300	300	300		400	400	300		
Storage Blk Time (%)						8	34	0			0	51
Queuing Penalty (veh)						49	191	1			0	25

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	125	20	1685	1711	300
Average Queue (ft)	24	2	1047	1047	170
95th Queue (ft)	105	12	1779	1786	412
Link Distance (ft)			2492	2492	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100	175			275
Storage Blk Time (%)	0		72	67	0
Queuing Penalty (veh)	0		3	40	0

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	146	218	65	337	664	716	225	612	624	795	819
Average Queue (ft)	96	153	58	21	253	302	205	576	582	447	261
95th Queue (ft)	177	236	69	131	468	545	266	647	668	975	734
Link Distance (ft)		146		802	952	952				779	779
Upstream Blk Time (%)	0	15								3	0
Queuing Penalty (veh)	0	0								44	5
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	0	53	6			15	12	6	14	0	
Queuing Penalty (veh)	1	141	12			74	45	42	92	0	

Queuing and Blocking Report 20 South Bear Creek

07/16/2020

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	31	1851	125	85	454
Average Queue (ft)	2	578	17	19	240
95th Queue (ft)	15	1532	87	58	571
Link Distance (ft)		3903			445
Upstream Blk Time (%)					44
Queuing Penalty (veh)					0
Storage Bay Dist (ft)	100		100	100	
Storage Blk Time (%)		65	0	0	52
Queuing Penalty (veh)		30	0	0	62

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	945	390	141
Average Queue (ft)	819	189	121
95th Queue (ft)	1204	324	131
Link Distance (ft)	939	943	102
Upstream Blk Time (%)	64		55
Queuing Penalty (veh)	121		344
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	244	778	119	1026
Average Queue (ft)	77	657	110	930
95th Queue (ft)	160	952	123	1156
Link Distance (ft)	979	738	102	974
Upstream Blk Time (%)		60	22	74
Queuing Penalty (veh)		0	106	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1485

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 1: NC 191 & I-240 WB Onramp/I-240 WB Offramp

Movement	WB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	R	L	T	T	T	T	R
Maximum Queue (ft)	425	450	890	225	50	271	296	292	325	275
Average Queue (ft)	161	365	194	163	12	181	192	155	189	27
95th Queue (ft)	432	494	606	243	39	265	276	302	310	162
Link Distance (ft)			962		258	258	258	948	948	
Upstream Blk Time (%)						1	1			
Queuing Penalty (veh)						2	3			
Storage Bay Dist (ft)	400	400		175						225
Storage Blk Time (%)	0	9	1	11					6	
Queuing Penalty (veh)	1	24	5	74					8	

Intersection: 2: NC 191 & I-240 EB Exit/I-240 EB Entrance

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	T	R	L	T	T
Maximum Queue (ft)	425	528	30	1863	2003	425	283	153	169
Average Queue (ft)	324	69	3	944	1344	423	265	95	108
95th Queue (ft)	454	347	16	2059	2068	437	275	138	160
Link Distance (ft)		953	953	2494	2494		258	258	258
Upstream Blk Time (%)							47		
Queuing Penalty (veh)							176		
Storage Bay Dist (ft)	400					400			
Storage Blk Time (%)	12				1	27			
Queuing Penalty (veh)	0				8	93			

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	L	T	R	R	L	LT	R	R	L	T	T
Maximum Queue (ft)	114	92	67	110	85	325	1009	425	226	325	818	838
Average Queue (ft)	37	54	28	51	47	317	843	334	151	305	730	731
95th Queue (ft)	83	101	64	86	86	354	1219	549	224	402	912	947
Link Distance (ft)			3903				946				780	780
Upstream Blk Time (%)							23				13	14
Queuing Penalty (veh)							0				91	98
Storage Bay Dist (ft)	200	200		300	300	300		400	400	300		
Storage Blk Time (%)						3	32	0		57	29	66
Queuing Penalty (veh)						39	358	2		309	63	53

Intersection: 3: NC 191 & SR 3413 S. Bear Creek/I-40 WB Ramps

Movement	NB	SB	SB	SB	SB
Directions Served	R	L	T	T	R
Maximum Queue (ft)	125	20	1037	1090	300
Average Queue (ft)	45	7	661	677	261
95th Queue (ft)	144	21	1059	1105	405
Link Distance (ft)			2494	2494	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100	175			275
Storage Blk Time (%)	0		60	52	1
Queuing Penalty (veh)	0		5	106	6

Intersection: 4: NC 191 & I-40 EB Ramps

Movement	WB	WB	WB	B13	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	L	R	T	T	T	R	L	L	T	T
Maximum Queue (ft)	145	217	65	72	968	990	225	538	548	436	138
Average Queue (ft)	91	139	56	4	880	940	224	366	291	69	56
95th Queue (ft)	172	222	70	27	1114	1101	227	555	601	199	124
Link Distance (ft)		146		741	951	951				780	780
Upstream Blk Time (%)	0	9			12	51					
Queuing Penalty (veh)	0	0			0	0					
Storage Bay Dist (ft)	185		40				200	600	600		
Storage Blk Time (%)	0	54	3			44	7				
Queuing Penalty (veh)	1	103	6			277	46				

Queuing and Blocking Report
20 South Bear Creek

07/16/2020

Intersection: 5: SR 3413 S. Bear Creek & Proposed Entrance

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	31	3918	125	124	460
Average Queue (ft)	3	1810	84	36	211
95th Queue (ft)	18	4079	179	108	522
Link Distance (ft)		3903			445
Upstream Blk Time (%)		7			21
Queuing Penalty (veh)		51			0
Storage Bay Dist (ft)	100		100	100	
Storage Blk Time (%)		80	0	1	55
Queuing Penalty (veh)		102	0	0	46

Intersection: 6: SR 3412 Sand Hill Road & SR 3413 S. Bear Creek

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	956	343	127
Average Queue (ft)	915	200	117
95th Queue (ft)	1083	311	127
Link Distance (ft)	939	943	102
Upstream Blk Time (%)	51		54
Queuing Penalty (veh)	298		388
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: SR 3412 Sand Hill Road & Wendover Road & Bear Creek Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	118	790	119	1026
Average Queue (ft)	55	706	107	987
95th Queue (ft)	108	916	119	1017
Link Distance (ft)	979	738	102	974
Upstream Blk Time (%)		68	31	93
Queuing Penalty (veh)		0	160	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 3002

Appendix C: Signal Warrant Analysis

C

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : **Sand Hill at Bear Creek 2019 Existing**
Study Date : **07/07/20**

Signal Warrants - Summary

Major Street Approaches

Northbound: Sand Hill Road

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **2,520**

Southbound: Sand Hill Road

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **3,209**

Minor Street Approaches

Westbound: S. Bear Creek Road

Number of Lanes: **1**

Total Approach Volume: **2,041**

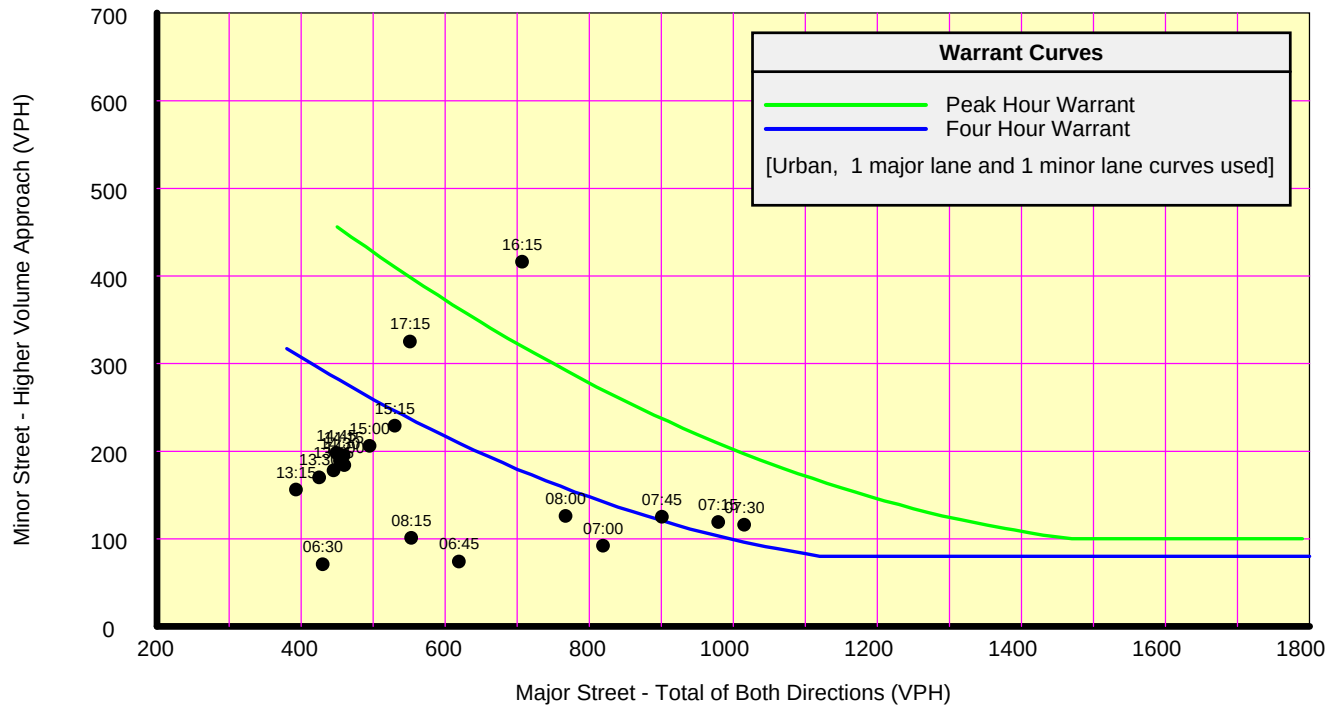
Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes	Not Satisfied
Warrant 1A - Minimum Vehicular Volume	Not Satisfied
Required volumes reached for 3 hours, 8 are needed	
Warrant 1B - Interruption of Continuous Traffic	Not Satisfied
Required volumes reached for 3 hours, 8 are needed	
Warrant 1C - Combination of Warrants	Not Satisfied
Required 1A volumes reached for 5 hours, 8 are needed	
Required 1B volumes reached for 4 hours, 8 are needed	
Warrant 2 - Four Hour Volumes	Not Satisfied
Number of hours (3) volumes exceed minimum < minimum required (4).	
Warrant 3 - Peak Hour	Satisfied
Warrant 3A - Peak Hour Delay	Satisfied
Number of hours (16) volumes exceed minimum >= required (1). Delay data not evaluated.	
Warrant 3B - Peak Hour Volumes	Satisfied
Volumes exceed minimums for at least one hour.	
Warrant 4 - Pedestrian Volumes	Not Evaluated
Warrant 5 - School Crossing	Not Evaluated
Warrant 6 - Coordinated Signal System	Not Satisfied
No adjacent coordinated signals are present	
Warrant 7 - Crash Experience	Not Evaluated
Warrant 8 - Roadway Network	Not Satisfied
Major Route conditions not met. One or more volume requirement met.	
Warrant 9 - Intersection Near a Grade Crossing	Not Evaluated

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : **Sand Hill at Bear Creek 2019 Existing**
Study Date : **07/07/20**

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

War 1A-Minimum Volume

War 1B-Interruption of Traffic

War 1C-Combination of Warrants

Hour Begin	Major Total	Minor Vol Dir	Maj 500	Min 150	Hour Begin	Major Total	Minor Vol Dir	Maj 750	Min 75	Hour Begin	Major Total	Minor Vol Dir	1A Met	1B Met
16:15	707	416 W	Yes	Yes	07:00	819	92 W	Yes	Yes	07:45	901	125 W	Yes	Yes
17:15	551	325 W	Yes	Yes	16:30	811	429 W	Yes	Yes	16:45	816	432 W	-	Yes
15:15	530	229 W	Yes	Yes	08:00	767	126 W	Yes	Yes	16:30	811	429 W	Yes	-
07:30	1,015	116 W	Yes	No	16:15	707	416 W	No	Yes	06:45	619	74 W	No	Yes
07:15	979	119 W	Yes	No	16:00	657	368 W	No	Yes	15:45	617	327 W	-	Yes
07:45	901	125 W	Yes	No	06:45	619	74 W	No	No	15:30	544	282 W	Yes	No
07:00	819	92 W	Yes	No	15:45	617	327 W	No	Yes	14:30	454	189 W	Yes	No
08:00	767	126 W	Yes	No	15:30	544	282 W	No	Yes	13:30	425	170 W	Yes	No
06:45	619	74 W	Yes	No	15:15	530	229 W	No	Yes	07:30	1,015	116 W	No	-
08:15	553	101 W	Yes	No	15:00	495	206 W	No	Yes	07:15	979	119 W	No	-
15:00	495	206 W	No	Yes	14:00	460	184 W	No	Yes	07:00	819	92 W	No	-
14:00	460	184 W	No	Yes	14:15	459	195 W	No	Yes	15:15	530	229 W	-	No
14:15	459	195 W	No	Yes	14:30	454	189 W	No	Yes	15:00	495	206 W	-	No
14:30	454	189 W	No	Yes	14:45	449	198 W	No	Yes	14:00	460	184 W	-	No
14:45	449	198 W	No	Yes	13:45	445	178 W	No	Yes	14:15	459	195 W	-	No
13:45	445	178 W	No	Yes	06:30	430	71 W	No	No	14:45	449	198 W	-	No
06:30	430	71 W	No	No	13:30	425	170 W	No	Yes	13:45	445	178 W	-	No
13:30	425	170 W	No	Yes	13:15	393	156 W	No	Yes	06:30	430	71 W	No	No
13:15	393	156 W	No	Yes	13:00	383	151 W	No	Yes	13:15	393	156 W	No	No
13:00	383	151 W	No	Yes	12:45	370	133 W	No	Yes	13:00	383	151 W	No	No
12:45	370	133 W	No	No	12:30	364	121 W	No	Yes	12:45	370	133 W	No	No
08:30	369	83 W	No	No	12:15	358	127 W	No	Yes	12:30	364	121 W	No	No
12:30	364	121 W	No	No	12:00	350	121 W	No	Yes	12:15	358	127 W	No	No
12:15	358	127 W	No	No	11:30	350	117 W	No	Yes	12:00	350	121 W	No	No

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : Sand Hill at Bear Creek 2028 Background
Study Date : 07/07/20

Signal Warrants - Summary

Major Street Approaches

Northbound: Sand Hill Road

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **2,800**

Southbound: Sand Hill Road

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **3,666**

Minor Street Approaches

Westbound: S. Bear Creek Road

Number of Lanes: **1**

Total Approach Volume: **0**

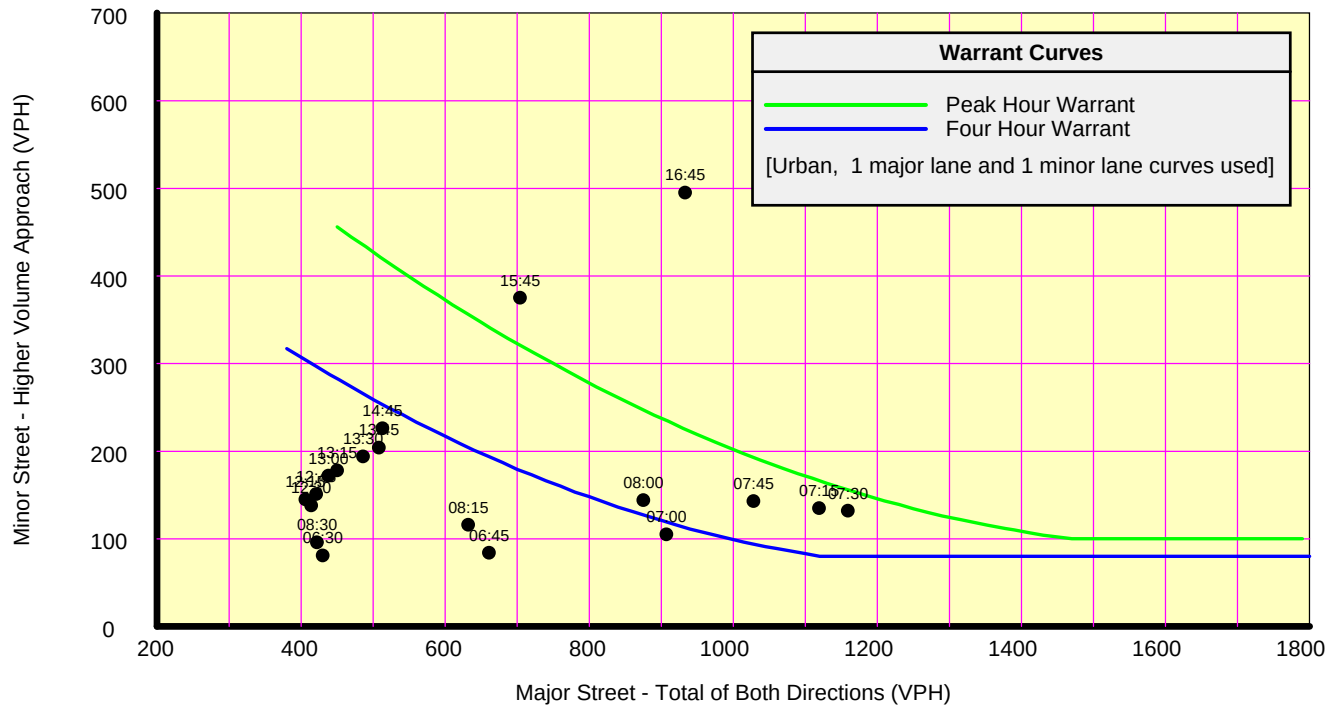
Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes	Not Satisfied
Warrant 1A - Minimum Vehicular Volume	Not Satisfied
Required volumes reached for 4 hours, 8 are needed	
Warrant 1B - Interruption of Continuous Traffic	Not Satisfied
Required volumes reached for 4 hours, 8 are needed	
Warrant 1C - Combination of Warrants	Not Satisfied
Required 1A volumes reached for 7 hours, 8 are needed	
Required 1B volumes reached for 5 hours, 8 are needed	
Warrant 2 - Four Hour Volumes	Satisfied
Number of hours (4) volumes exceed minimum >= minimum required (4).	
Warrant 3 - Peak Hour	Satisfied
Warrant 3A - Peak Hour Delay	Satisfied
Number of hours (22) volumes exceed minimum >= required (1). Delay data not evaluated.	
Warrant 3B - Peak Hour Volumes	Satisfied
Volumes exceed minimums for at least one hour.	
Warrant 4 - Pedestrian Volumes	Not Evaluated
Warrant 5 - School Crossing	Not Evaluated
Warrant 6 - Coordinated Signal System	Not Satisfied
Nearest coordinated signal (100) is less than 1,000 feet away.	
Warrant 7 - Crash Experience	Not Evaluated
Warrant 8 - Roadway Network	Not Satisfied
Major Route conditions not met. One or more volume requirement met.	
Warrant 9 - Intersection Near a Grade Crossing	Not Evaluated

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : Sand Hill at Bear Creek 2028 Background
Study Date : 07/07/20

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

War 1A-Minimum Volume

War 1B-Interruption of Traffic

War 1C-Combination of Warrants

Hour Begin	Major Total	Minor Vol Dir	Maj 500	Min 150	Hour Begin	Major Total	Minor Vol Dir	Maj 750	Min 75	Hour Begin	Major Total	Minor Vol Dir	1A Met	1B Met
16:45	933	495 EB	Yes	Yes	07:00	907	105 EB	Yes	Yes	07:15	1,119	135 EB	Yes	-
15:45	704	375 EB	Yes	Yes	08:00	875	144 EB	Yes	Yes	07:45	1,028	143 EB	-	Yes
14:45	513	226 EB	Yes	Yes	17:00	856	513 EB	Yes	Yes	16:30	927	492 EB	Yes	-
13:45	508	204 EB	Yes	Yes	16:00	751	422 EB	Yes	Yes	16:15	808	477 EB	-	Yes
07:30	1,159	132 EB	Yes	No	15:45	704	375 EB	No	Yes	06:45	661	84 EB	No	Yes
07:15	1,119	135 EB	Yes	No	06:45	661	84 EB	No	Yes	17:15	629	372 EB	-	Yes
07:45	1,028	143 EB	Yes	No	15:30	621	323 EB	No	Yes	15:30	621	323 EB	Yes	-
07:00	907	105 EB	Yes	No	15:15	605	262 EB	No	Yes	15:15	605	262 EB	-	Yes
08:00	875	144 EB	Yes	No	15:00	566	235 EB	No	Yes	14:30	518	216 EB	Yes	No
06:45	661	84 EB	Yes	No	14:15	523	223 EB	No	Yes	13:30	486	194 EB	Yes	No
08:15	632	116 EB	Yes	No	14:00	523	211 EB	No	Yes	12:30	414	138 EB	Yes	No
13:30	486	194 EB	No	Yes	14:30	518	216 EB	No	Yes	11:30	400	134 EB	Yes	No
13:15	450	178 EB	No	Yes	14:45	513	226 EB	No	Yes	07:00	907	105 EB	No	-
13:00	438	172 EB	No	Yes	13:45	508	204 EB	No	Yes	08:15	632	116 EB	No	-
06:30	430	81 EB	No	No	13:30	486	194 EB	No	Yes	15:00	566	235 EB	-	No
08:30	422	96 EB	No	No	13:15	450	178 EB	No	Yes	14:15	523	223 EB	-	No
12:45	421	151 EB	No	Yes	13:00	438	172 EB	No	Yes	14:00	523	211 EB	-	No
12:30	414	138 EB	No	No	06:30	430	81 EB	No	Yes	14:45	513	226 EB	-	No
12:15	406	145 EB	No	No	12:45	421	151 EB	No	Yes	13:45	508	204 EB	-	No
11:30	400	134 EB	No	No	12:30	414	138 EB	No	Yes	13:15	450	178 EB	-	No
12:00	397	138 EB	No	No	12:15	406	145 EB	No	Yes	13:00	438	172 EB	-	No
11:45	390	134 EB	No	No	11:30	400	134 EB	No	Yes	06:30	430	81 EB	No	No
11:15	386	117 EB	No	No	12:00	397	138 EB	No	Yes	08:30	422	96 EB	No	-
11:00	360	126 EB	No	No	11:45	390	134 EB	No	Yes	12:45	421	151 EB	-	No

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : **Sand Hill at Wendover 2019 Existing**
Study Date : **07/07/20**

Signal Warrants - Summary

Major Street Approaches

Northbound: Sand Hill

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **1,728**

Southbound: Bear Creek

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **1,352**

Minor Street Approaches

Eastbound: Wendover

Number of Lanes: **1**

Total Approach Volume: **2,776**

Westbound: Sand Hill

Number of Lanes: **1**

Total Approach Volume: **490**

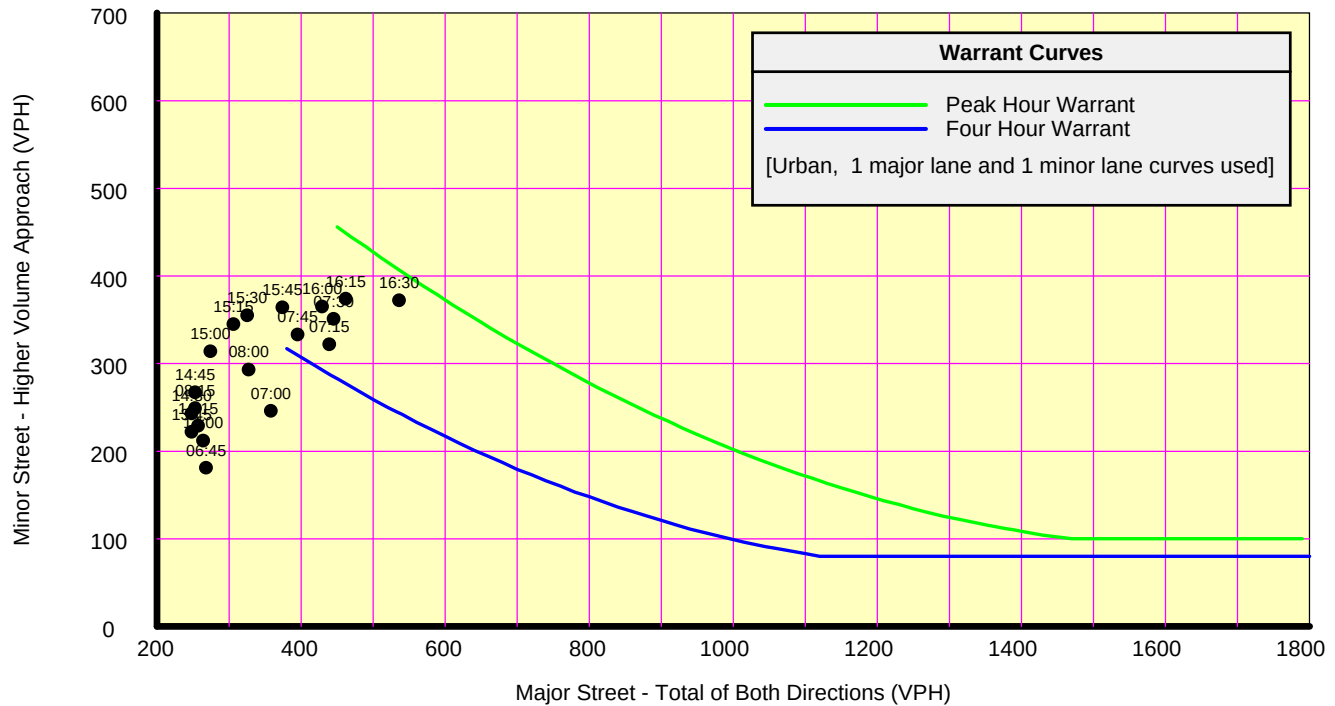
Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes	Not Satisfied
Warrant 1A - Minimum Vehicular Volume Not Satisfied	
Required volumes reached for 1 hours, 8 are needed	
Warrant 1B - Interruption of Continuous Traffic Not Satisfied	
Required volumes reached for 0 hours, 8 are needed	
Warrant 1C - Combination of Warrants Not Satisfied	
Required 1A volumes reached for 2 hours, 8 are needed	
Required 1B volumes reached for 0 hours, 8 are needed	
Warrant 2 - Four Hour Volumes	Not Satisfied
Number of hours (3) volumes exceed minimum < minimum required (4).	
Warrant 3 - Peak Hour	Satisfied
Warrant 3A - Peak Hour Delay Satisfied	
Number of hours (8) volumes exceed minimum >= required (1). Delay data not evaluated.	
Warrant 3B - Peak Hour Volumes Not Satisfied	
Volumes do not exceed minimums for any hour.	
Warrant 4 - Pedestrian Volumes	Not Evaluated
Warrant 5 - School Crossing	Not Evaluated
Warrant 6 - Coordinated Signal System	Not Satisfied
No adjacent coordinated signals are present	
Warrant 7 - Crash Experience	Not Evaluated
Warrant 8 - Roadway Network	Not Satisfied
Major Route conditions not met. No volume requirement met.	
Warrant 9 - Intersection Near a Grade Crossing	Not Evaluated

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : Sand Hill at Wendover 2019 Existing
Study Date : 07/07/20

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

War 1A-Minimum Volume

War 1B-Interruption of Traffic

War 1C-Combination of Warrants

Hour Begin	Major Total	Minor Vol Dir	Maj 500	Min 150	Hour Begin	Major Total	Minor Vol Dir	Maj 750	Min 75	Hour Begin	Major Total	Minor Vol Dir	1A Met	1B Met
16:30	536	372 EB	Yes	Yes	16:45	539	377 EB	No	Yes	17:00	486	364 EB	Yes	No
16:15	462	374 EB	No	Yes	16:30	536	372 EB	No	Yes	07:15	439	322 EB	Yes	No
07:30	445	351 EB	No	Yes	17:00	486	364 EB	No	Yes	16:00	429	365 EB	Yes	No
07:15	439	322 EB	No	Yes	16:15	462	374 EB	No	Yes	16:45	539	377 EB	-	No
16:00	429	365 EB	No	Yes	07:30	445	351 EB	No	Yes	16:30	536	372 EB	-	No
07:45	395	333 EB	No	Yes	07:15	439	322 EB	No	Yes	16:15	462	374 EB	-	No
15:45	374	364 EB	No	Yes	16:00	429	365 EB	No	Yes	07:30	445	351 EB	-	No
07:00	358	246 EB	No	Yes	07:45	395	333 EB	No	Yes	07:45	395	333 EB	-	No
08:00	327	293 EB	No	Yes	15:45	374	364 EB	No	Yes	15:45	374	364 EB	No	No
15:30	325	355 EB	No	Yes	17:15	362	263 EB	No	Yes	17:15	362	263 EB	-	No
15:15	306	345 EB	No	Yes	07:00	358	246 EB	No	Yes	07:00	358	246 EB	No	No
15:00	274	314 EB	No	Yes	08:00	327	293 EB	No	Yes	08:00	327	293 EB	-	No
06:45	268	181 EB	No	Yes	15:30	325	355 EB	No	Yes	15:30	325	355 EB	No	No
14:00	264	212 EB	No	Yes	15:15	306	345 EB	No	Yes	15:15	306	345 EB	No	No
14:15	257	229 EB	No	Yes	15:00	274	314 EB	No	Yes	15:00	274	314 EB	No	No
14:45	253	267 EB	No	Yes	06:45	268	181 EB	No	Yes	06:45	268	181 EB	No	No
08:15	253	249 EB	No	Yes	14:00	264	212 EB	No	Yes	14:00	264	212 EB	No	No
14:30	248	243 EB	No	Yes	14:15	257	229 EB	No	Yes	14:15	257	229 EB	No	No
13:45	248	222 EB	No	Yes	14:45	253	267 EB	No	Yes	14:45	253	267 EB	No	No
13:30	227	214 EB	No	Yes	08:15	253	249 EB	No	Yes	08:15	253	249 EB	No	No
12:30	214	196 EB	No	Yes	14:30	248	243 EB	No	Yes	14:30	248	243 EB	No	No
12:45	210	189 EB	No	Yes	13:45	248	222 EB	No	Yes	13:45	248	222 EB	No	No
08:30	210	192 EB	No	Yes	13:30	227	214 EB	No	Yes	13:30	227	214 EB	No	No
13:15	203	192 EB	No	Yes	12:30	214	196 EB	No	Yes	12:30	214	196 EB	No	No

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : Sand Hill at Wendover 2028 Background
Study Date : 07/07/20

Signal Warrants - Summary

Major Street Approaches

Northbound: Sand Hill Road

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **3,175**

Southbound: Bear Creek Road

Number of Lanes: **1**
85% Speed < 40 MPH.
Total Approach Volume: **1,966**

Minor Street Approaches

Eastbound: Wendover Street

Number of Lanes: **1**

Total Approach Volume: **559**

Westbound: Sand Hill Road

Number of Lanes: **1**

Total Approach Volume: **1,532**

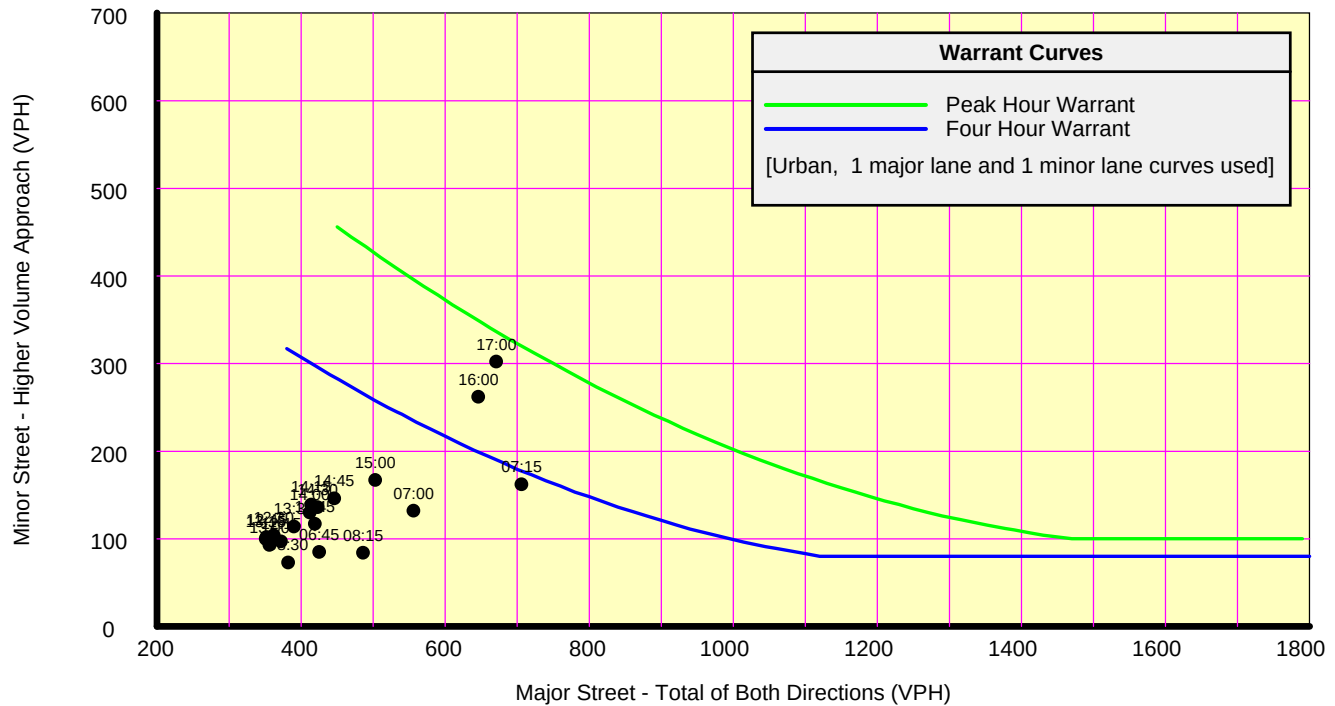
Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes	Not Satisfied
Warrant 1A - Minimum Vehicular Volume Not Satisfied	
Required volumes reached for 4 hours, 8 are needed	
Warrant 1B - Interruption of Continuous Traffic Not Satisfied	
Required volumes reached for 0 hours, 8 are needed	
Warrant 1C - Combination of Warrants Not Satisfied	
Required 1A volumes reached for 5 hours, 8 are needed	
Required 1B volumes reached for 2 hours, 8 are needed	
Warrant 2 - Four Hour Volumes	Not Satisfied
Number of hours (2) volumes exceed minimum < minimum required (4).	
Warrant 3 - Peak Hour	Satisfied
Warrant 3A - Peak Hour Delay Satisfied	
Number of hours (11) volumes exceed minimum >= required (1). Delay data not evaluated.	
Warrant 3B - Peak Hour Volumes Satisfied	
Volumes exceed minimums for at least one hour.	
Warrant 4 - Pedestrian Volumes	Not Evaluated
Warrant 5 - School Crossing	Not Evaluated
Warrant 6 - Coordinated Signal System	Not Satisfied
Nearest coordinated signal (100) is less than 1,000 feet away.	
Warrant 7 - Crash Experience	Not Evaluated
Warrant 8 - Roadway Network	Not Satisfied
Major Route conditions not met. One or more volume requirement met.	
Warrant 9 - Intersection Near a Grade Crossing	Not Evaluated

Gannett Fleming
28 Schenck Parkway, Suite 200
Asheville, NC 28803

Study Name : **Sand Hill at Wendover 2028 Background**
Study Date : **07/07/20**

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

War 1A-Minimum Volume

War 1B-Interruption of Traffic

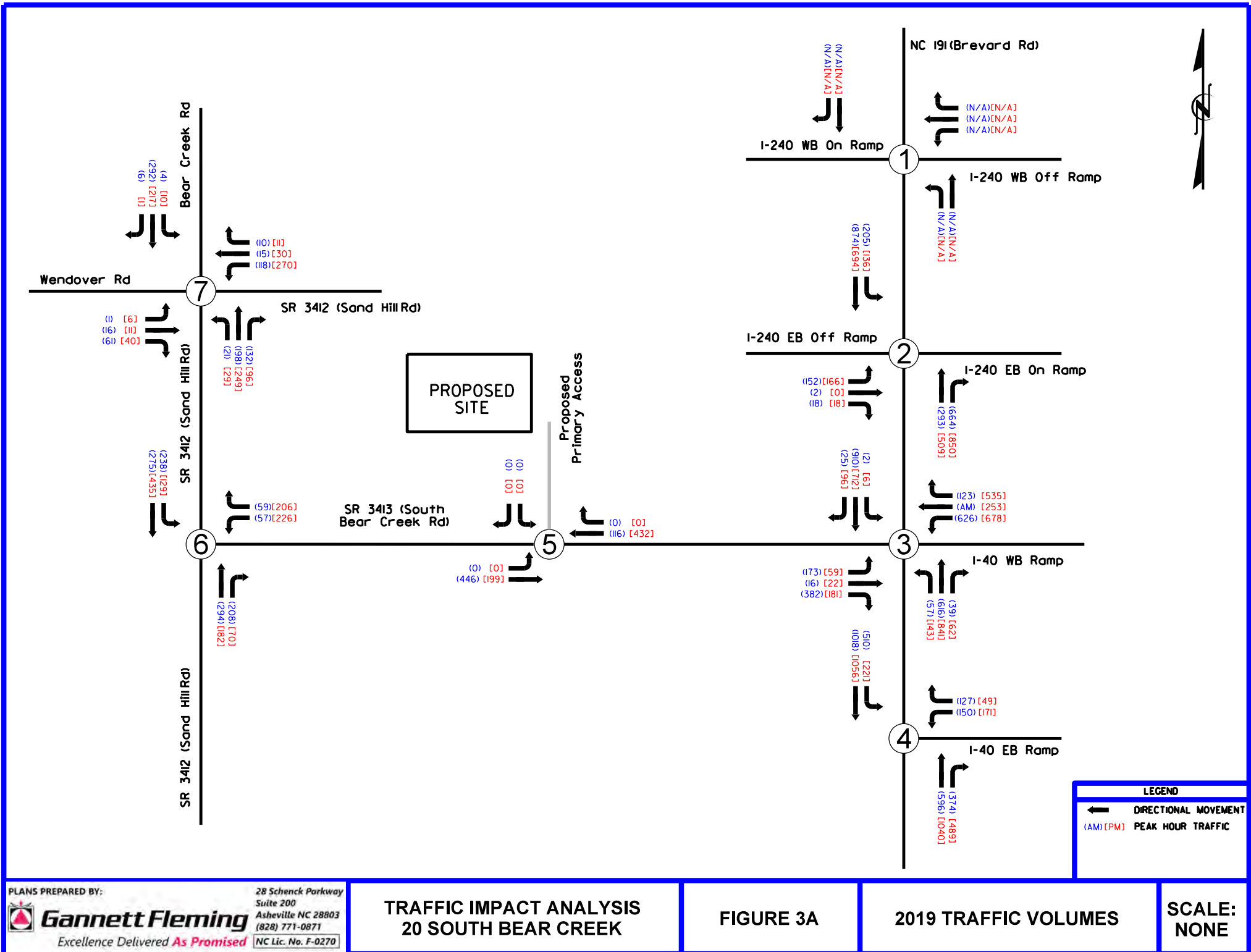
War 1C-Combination of Warrants

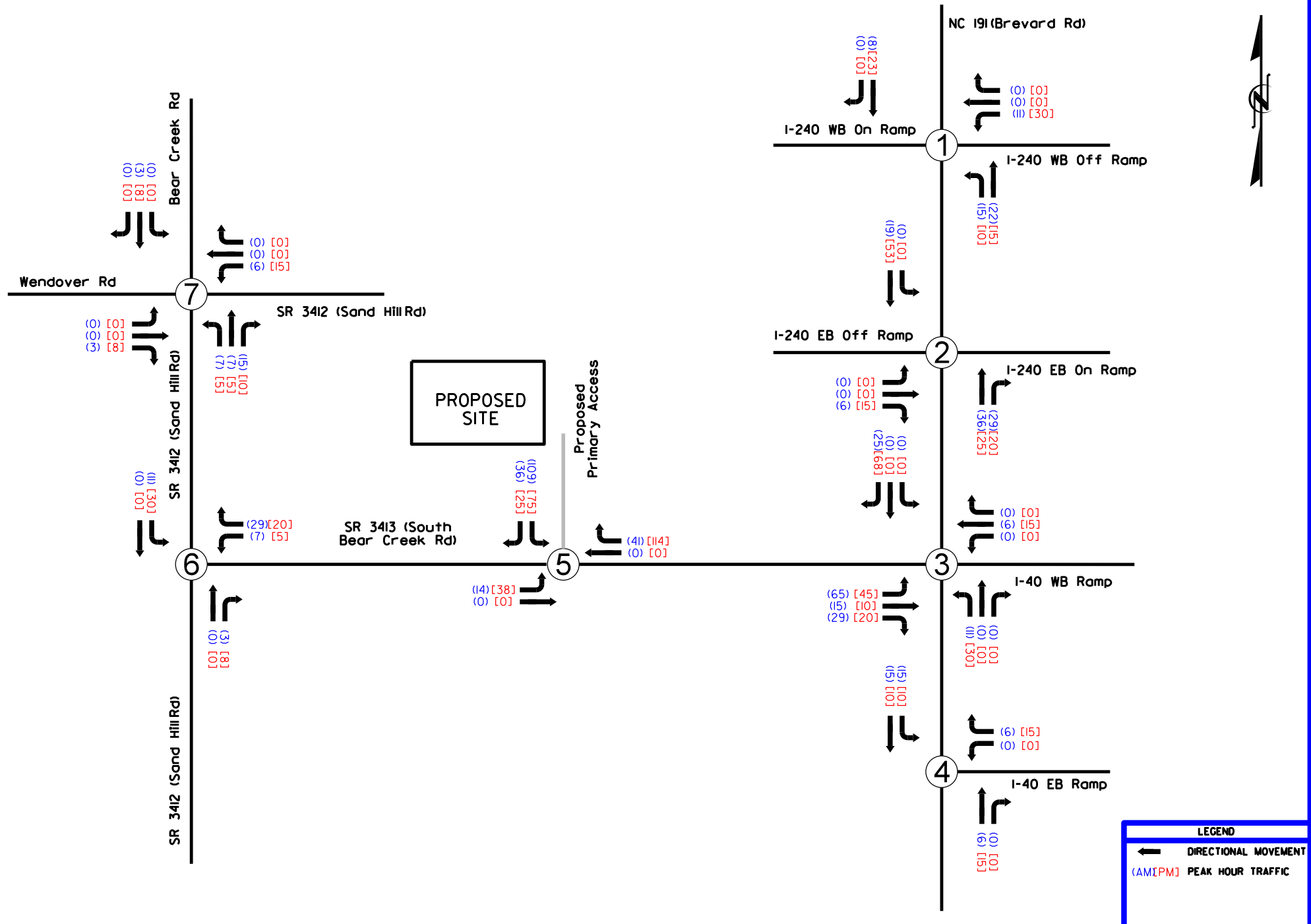
Hour Begin	Major Total	Minor Vol Dir	Maj 500	Min 150	Hour Begin	Major Total	Minor Vol Dir	Maj 750	Min 75	Hour Begin	Major Total	Minor Vol Dir	1A Met	1B Met
07:15	706	162 W	Yes	Yes	07:30	745	162 W	No	Yes	07:15	706	162 W	-	Yes
17:00	671	302 W	Yes	Yes	07:15	706	162 W	No	Yes	16:45	692	355 W	-	Yes
16:00	646	262 W	Yes	Yes	16:30	696	342 W	No	Yes	17:00	671	302 W	Yes	-
15:00	503	167 W	Yes	Yes	16:45	692	355 W	No	Yes	16:00	646	262 W	Yes	-
07:00	556	132 W	Yes	No	07:45	677	153 W	No	Yes	15:45	631	213 W	-	Yes
08:15	486	84 W	No	No	16:15	672	284 W	No	Yes	07:00	556	132 W	Yes	No
14:45	446	146 W	No	No	17:00	671	302 W	No	Yes	15:00	503	167 W	Yes	No
06:45	425	85 W	No	No	16:00	646	262 W	No	Yes	14:00	412	130 W	Yes	No
14:30	423	136 W	No	No	15:45	631	213 W	No	Yes	15:30	594	183 W	-	No
13:45	419	117 W	No	No	15:30	594	183 W	No	Yes	08:00	594	112 W	No	-
14:15	414	139 W	No	No	08:00	594	112 W	No	Yes	15:15	569	175 W	-	No
14:00	412	130 W	No	No	15:15	569	175 W	No	Yes	08:15	486	84 W	No	No
13:30	390	114 W	No	No	07:00	556	132 W	No	Yes	14:45	446	146 W	-	No
08:30	382	73 W	No	No	15:00	503	167 W	No	Yes	06:45	425	85 W	No	No
12:15	372	97 W	No	No	17:15	486	229 W	No	Yes	14:30	423	136 W	-	No
12:30	362	104 W	No	No	08:15	486	84 W	No	Yes	13:45	419	117 W	No	No
13:00	356	93 W	No	No	14:45	446	146 W	No	Yes	14:15	414	139 W	-	No
12:45	352	102 W	No	No	06:45	425	85 W	No	Yes	13:30	390	114 W	No	No
13:15	351	100 W	No	No	14:30	423	136 W	No	Yes	08:30	382	73 W	No	No
12:00	348	81 W	No	No	13:45	419	117 W	No	Yes	12:15	372	97 W	No	No
10:45	343	86 W	No	No	14:15	414	139 W	No	Yes	12:30	362	104 W	No	No
08:45	332	59 W	No	No	14:00	412	130 W	No	Yes	13:00	356	93 W	No	No
11:30	331	72 W	No	No	13:30	390	114 W	No	Yes	12:45	352	102 W	No	No
11:00	330	84 W	No	No	08:30	382	73 W	No	No	13:15	351	100 W	No	No

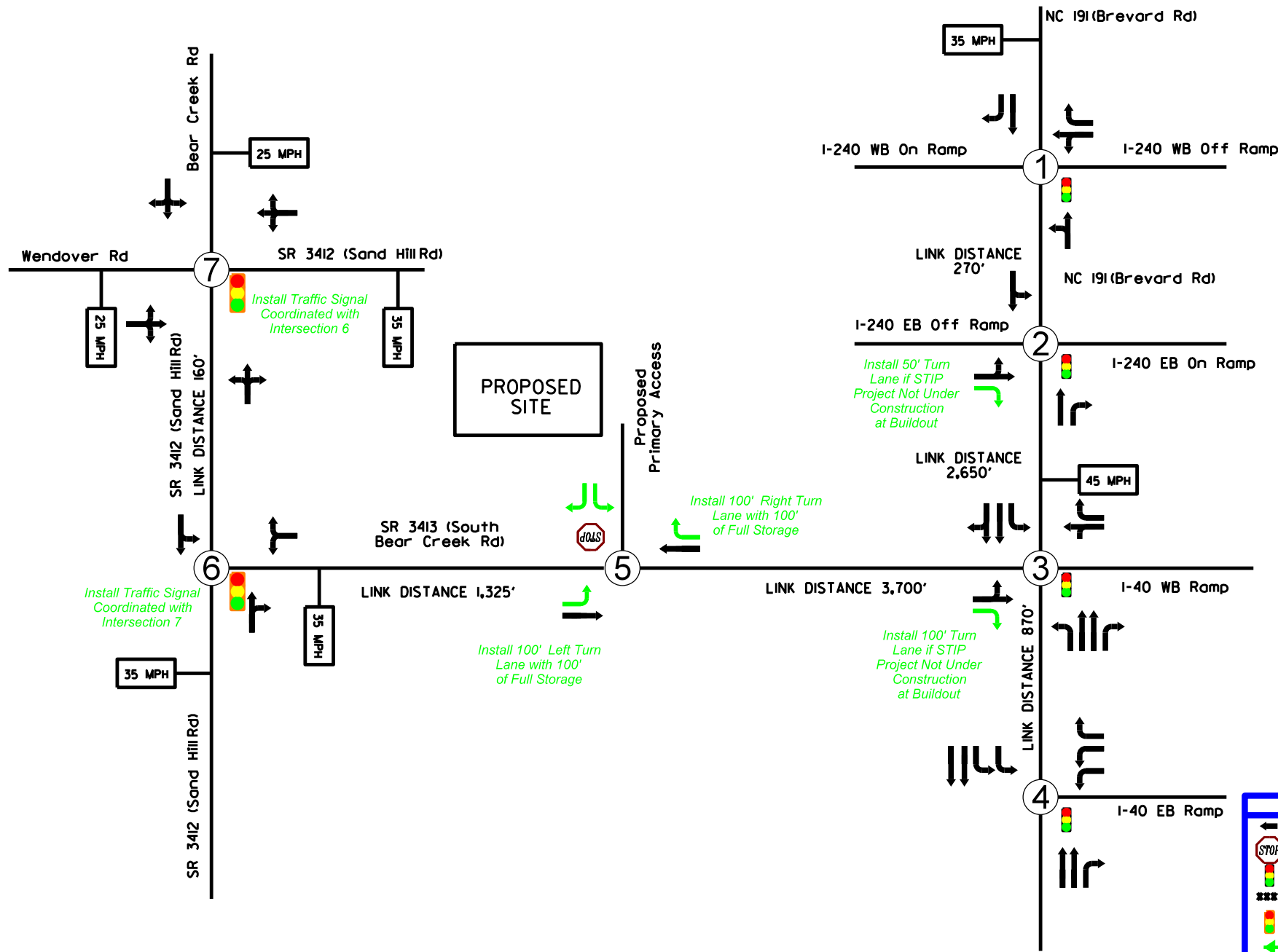
Appendix D: Figures and Tables

D









LEGEND	
	DIRECTIONAL MOVEMENT
	STOP SIGN
	TRAFFIC SIGNAL
	STORAGE LENGTH
	RECOMMENDED TRAFFIC SIGNAL
	RECOMMENDED IMPROVEMENT

TABLE 4

NC 191 at I-240 WB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
AM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		D	E	C	E	C
Total Intersection Delay (Seconds)		37.9	61.1	25.2	71.4	23.3
NC 191 (Brevard Road) Northbound	LOS	D	E	B	F	A
	Approach Delay	36.7	73.7	15.6	110.3	6.3
NC 191 (Brevard Road) Southbound	LOS	C	D	B	D	B
	Approach Delay	23.7	49.3	16.9	34.9	19.0
I-240 WB Offramp	LOS	D	E	D	E	D
	Approach Delay	52.1	64.0	39.2	78.8	39.0

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

NC 191 at I-240 WB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
PM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		D	D	C	D	C
Total Intersection Delay (Seconds)		36.3	46.0	29.2	46.5	24.0
NC 191 (Brevard Road) Northbound	LOS	C	D	B	D	A
	Approach Delay	27.9	46.4	10.6	51.5	5.8
NC 191 (Brevard Road) Southbound	LOS	B	B	B	C	B
	Approach Delay	15.5	19.2	10.7	19.7	11.6
I-240 WB Offramp	LOS	D	E	E	E	D
	Approach Delay	59.3	64.7	60.5	61.1	50.5

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

TABLE 5

NC 191 at I-240 EB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
AM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		C	D	B	D	B
Total Intersection Delay (Seconds)		29.8	53.2	13.6	49.9	13.9
NC 191 (Brevard Road) Northbound	LOS	A	A	B	A	B
	Approach Delay	7.4	8.7	14.0	6.2	15.6
NC 191 (Brevard Road) Southbound	LOS	D	E	A	E	A
	Approach Delay	39.3	68.2	5.5	76.5	4.7
I-240 EB Offramp Eastbound	LOS	F	F	E	F	E
	Approach Delay	94.6	206.3	61.2	134.8	61.0

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

NC 191 at I-240 EB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
PM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		B	D	C	D	D
Total Intersection Delay (Seconds)		7.0	39.1	20.0	43.4	38.5
NC 191 (Brevard Road) Northbound	LOS	A	B	B	B	D
	Approach Delay	8.6	15.4	17.6	16.8	40.9
NC 191 (Brevard Road) Southbound	LOS	B	D	A	E	C
	Approach Delay	19.0	51.6	2.5	75.8	24.4
I-240 EB Offramp Eastbound	LOS	F	F	F	F	F
	Approach Delay	101.6	154.7	113.7	86.7	83.2

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

TABLE 6

NC 191 at I-40 WB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
AM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		F	F	D	F	D
Total Intersection Delay (Seconds)		152.6	211.2	53.2	149.9	47.6
NC 191 (Brevard Road) Northbound	LOS	D	E	C	C	C
	Approach Delay	45.0	71.3	26.5	33.4	28.6
NC 191 (Brevard Road) Southbound	LOS	F	F	D	F	D
	Approach Delay	118.4	228.1	42.0	165.2	48.9
South Bear Creek Road Eastbound	LOS	F	F	E	F	D
	Approach Delay	238.8	300.9	68.9	190.9	53.1
I-40 WB Offramp Westbound	LOS	F	F	E	F	E
	Approach Delay	226.4	251.6	78.5	201.8	58.4

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

NC 191 at I-40 WB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
PM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		F	F	E	F	D
Total Intersection Delay (Seconds)		148.6	185.6	56.2	154.8	51.9
NC 191 (Brevard Road) Northbound	LOS	F	F	D	F	D
	Approach Delay	155.4	152.8	53.5	112.7	52.1
NC 191 (Brevard Road) Southbound	LOS	F	F	D	F	E
	Approach Delay	106.0	173.8	48.7	185.2	60.3
South Bear Creek Road Eastbound	LOS	F	F	E	F	D
	Approach Delay	117.9	235.6	62.6	110.6	39.9
I-40 WB Offramp Westbound	LOS	F	F	E	F	D
	Approach Delay	172.8	206.6	61.1	177.1	49.4

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

TABLE 7

NC 191 at I-40 EB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
AM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		C	C	C	C	C
Total Intersection Delay (Seconds)		20.9	29.0	21.8	29.8	22.3
NC 191 (Brevard Road) Northbound	LOS	B	C	C	C	C
	Approach Delay	19.3	26.0	23.4	26.1	22.9
NC 191 (Brevard Road) Southbound	LOS	C	C	B	C	B
	Approach Delay	20.6	23.6	16.9	25.4	18.0
I-240 EB Offramp Westbound	LOS	C	E	D	E	D
	Approach Delay	28.9	69.3	43.8	66.4	44.0

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

NC 191 at I-40 EB Ramps		2020 Existing	2028 Background	2028 Background	2028 Future	2028 Future
PM Peak Hour				With STIP	No STIP, With	With STIP
					Improvements	
Intersection Level of Service (LOS)		B	C	C	C	B
Total Intersection Delay (Seconds)		16.6	21.7	20.8	26.7	18.8
NC 191 (Brevard Road) Northbound	LOS	B	B	B	C	B
	Approach Delay	13.3	18.2	15.8	24.0	18.8
NC 191 (Brevard Road) Southbound	LOS	B	B	B	C	B
	Approach Delay	13.1	18.2	18.0	22.5	13.4
I-240 EB Offramp Westbound	LOS	E	E	E	E	D
	Approach Delay	59.3	67.4	65.5	68.5	49.4

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

TABLE 8

S. Bear Creek at Proposed Access				
AM Peak Hour		2020 Existing	2028 Background	2028 Future Buildout
Intersection Level of Service (LOS)		N/A	N/A	N/A
Total Intersection Delay (Seconds)		0.0	0.0	6.8
S. Bear Creek Eastbound	LOS	A	A	A
	Approach Delay	0.0	0.0	0.2
S. Bear Creek Westbound	LOS	A	A	A
	Approach Delay	0.1	0.0	0.0
Proposed Access Southbound	LOS	N/A	N/A	E
	Approach Delay	N/A	N/A	39.0

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

S. Bear Creek at Proposed Access				
PM Peak Hour		2020 Existing	2028 Background	2028 Future Buildout
Intersection Level of Service (LOS)		N/A	N/A	N/A
Total Intersection Delay (Seconds)		0.0	0.0	2.7
S. Bear Creek Eastbound	LOS	A	A	A
	Approach Delay	0.0	0.0	5.5
S. Bear Creek Westbound	LOS	A	A	A
	Approach Delay	0.0	0.0	0.0
Proposed Access Southbound	LOS	N/A	N/A	C
	Approach Delay	N/A	N/A	16.3

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

TABLE 9

S. Bear Creek at Sand Hill Road				
AM Peak Hour		2020 Existing	2028 Background	2028 Future
Intersection Level of Service (LOS)		N/A	N/A	C
Total Intersection Delay (Seconds)		7.2	16.9	30.2
Sand Hill Road Northbound	LOS	A	A	A
	Approach Delay	0.0	0.0	6.4
Sand Hill Road Southbound	LOS	A	A	D
	Approach Delay	4.6	5.0	35.6
S. Bear Creek Westbound	LOS	E	F	F
	Approach Delay	49.8	143.1	93.0

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

S. Bear Creek at Sand Hill Road				
PM Peak Hour		2020 Existing	2028 Background	2028 Future
Intersection Level of Service (LOS)		N/A	N/A	E
Total Intersection Delay (Seconds)		88.5	181.0	76.5
Sand Hill Road Northbound	LOS	A	A	B
	Approach Delay	0.0	0.0	19.2
Sand Hill Road Southbound	LOS	A	A	E
	Approach Delay	1.9	1.9	77.3
S. Bear Creek Westbound	LOS	F	F	F
	Approach Delay	253.4	520.7	108.0

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

TABLE 10

S. Bear Creek at Wendover Road				
AM Peak Hour		2020 Existing	2028 Background	2028 Future Buildout
Intersection Level of Service (LOS)		N/A	N/A	C
Total Intersection Delay (Seconds)		13.0	16.2	25.2
Sand Hill Road Northbound	LOS	B	C	A
	Approach Delay	14.0	18.3	9.0
Bear Creek Road Southbound	LOS	B	C	A
	Approach Delay	13.4	16.8	8.8
Wendover Road Eastbound	LOS	A	B	D
	Approach Delay	9.7	10.7	51.2
Sand Hill Road Westbound	LOS	B	B	F
	Approach Delay	11.4	12.9	85.4

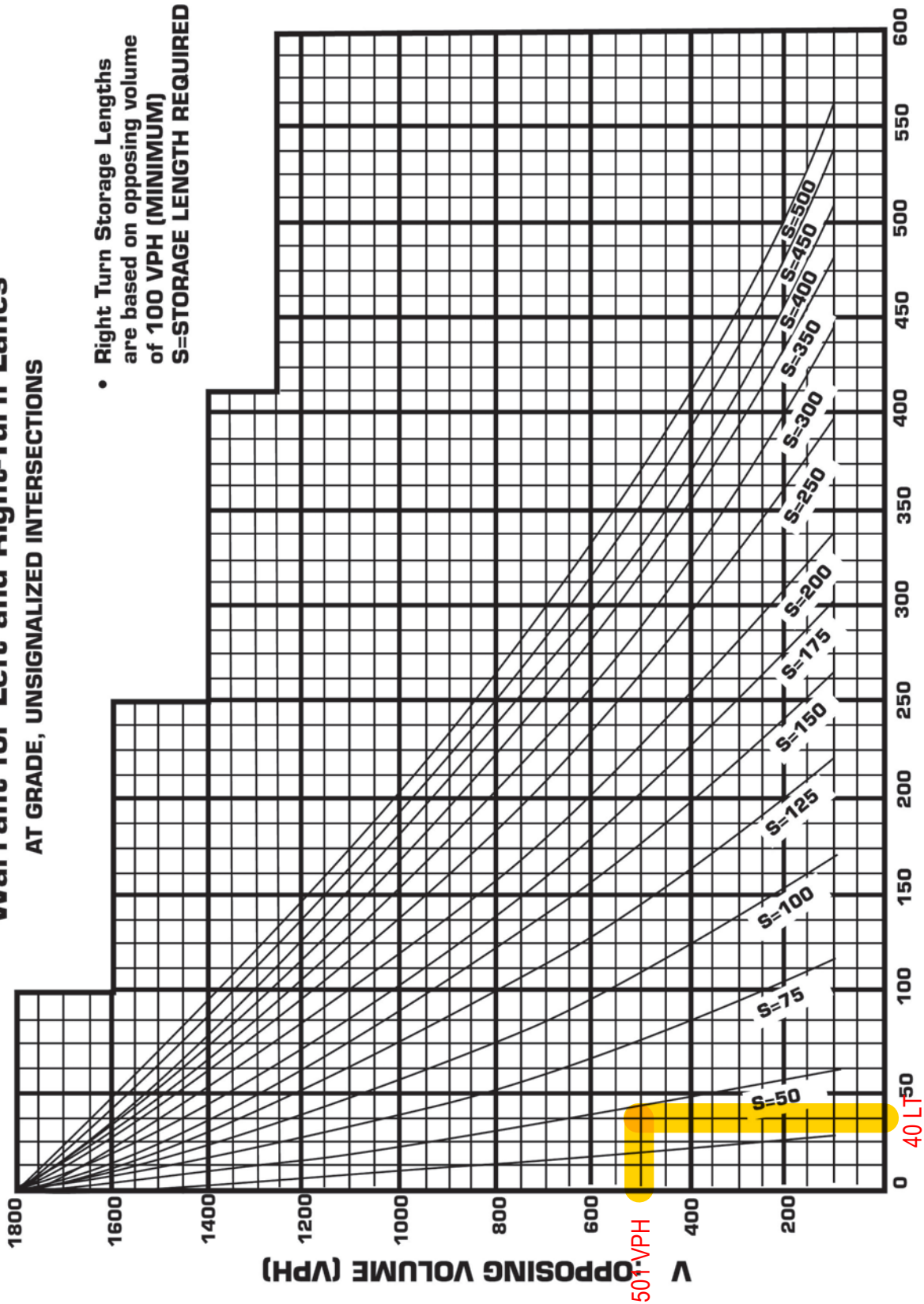
	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

S. Bear Creek at Wendover Road				
PM Peak Hour		2020 Existing	2028 Background	2028 Future Buildout
Intersection Level of Service (LOS)		N/A	N/A	D
Total Intersection Delay (Seconds)		16.7	25.4	45.9
Sand Hill Road Northbound	LOS	C	D	E
	Approach Delay	18.6	31.3	57.2
Bear Creek Road Southbound	LOS	B	C	C
	Approach Delay	13.6	17.5	21.0
Wendover Road Eastbound	LOS	C	B	C
	Approach Delay	18.6	11.5	26.4
Sand Hill Road Westbound	LOS	B	D	E
	Approach Delay	10.2	26.7	54.4

	Delay Decrease or LOS Improvement
	Delay Increase > 25% or LOS Decrease by 1 Letter Grade
	LOS "F"

Warrant for Left and Right-Turn Lanes AT GRADE, UNSIGNALIZED INTERSECTIONS

- Right Turn Storage Lengths are based on opposing volume of 100 VPH (MINIMUM)
S=STORAGE LENGTH REQUIRED



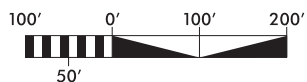
Note: Where adjacent signalization may provide opportunities for gaps in the traffic stream a reduction in the above storage values can be considered on a case by case basis.

V: LEFT TURNING VOLUME (VPH)
VR: RIGHT TURNING VOLUME (VPH)

Appendix E: I-2513 Public Hearing Maps

E





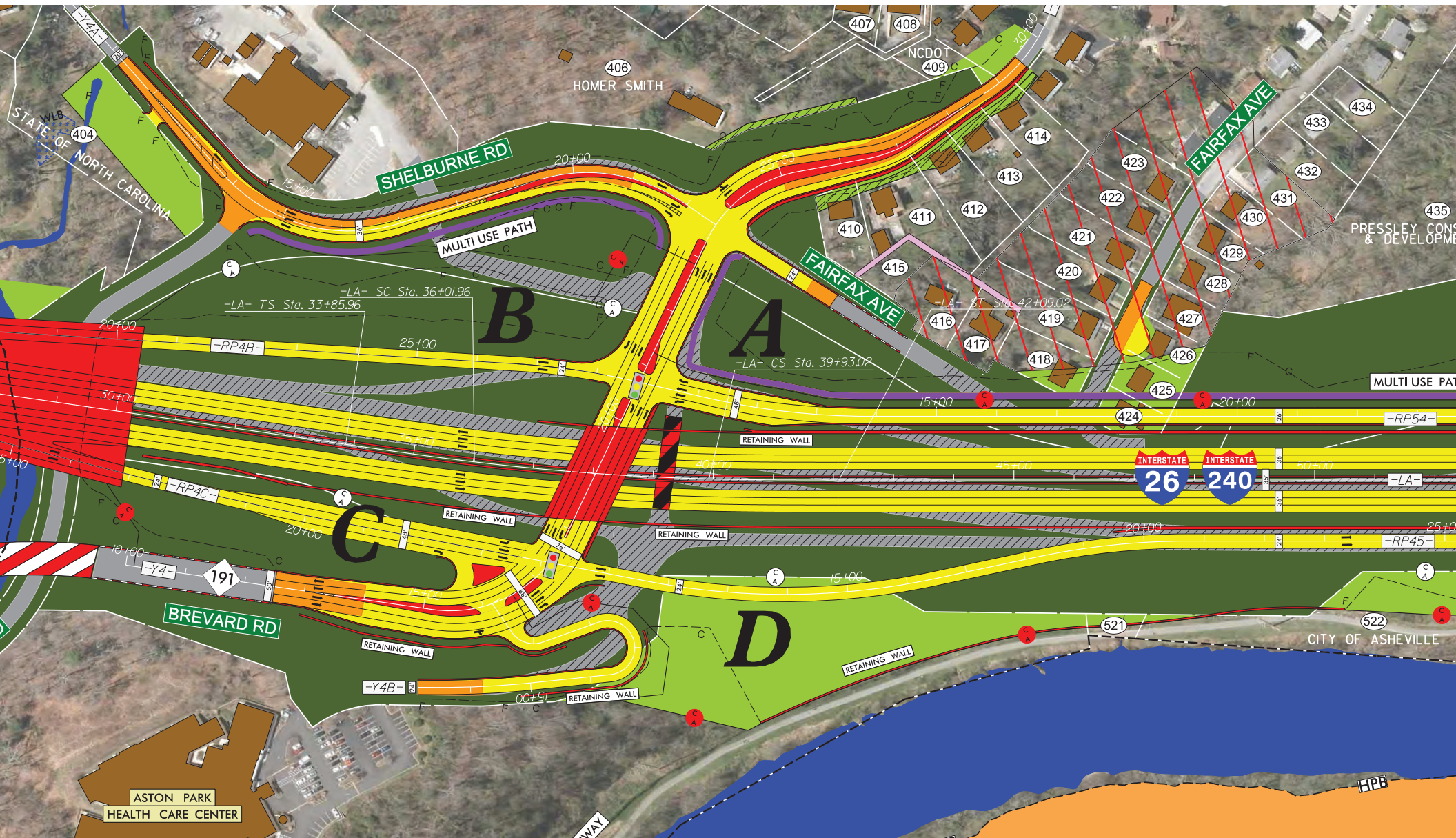
(ENGLISH)

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

19,600
21,600
BREVARD RD
NC-191





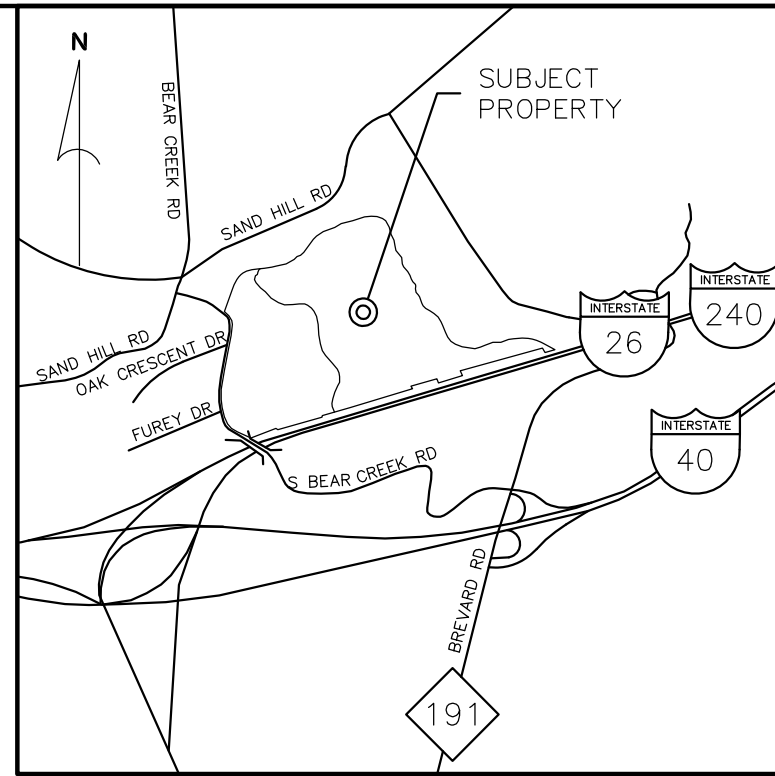
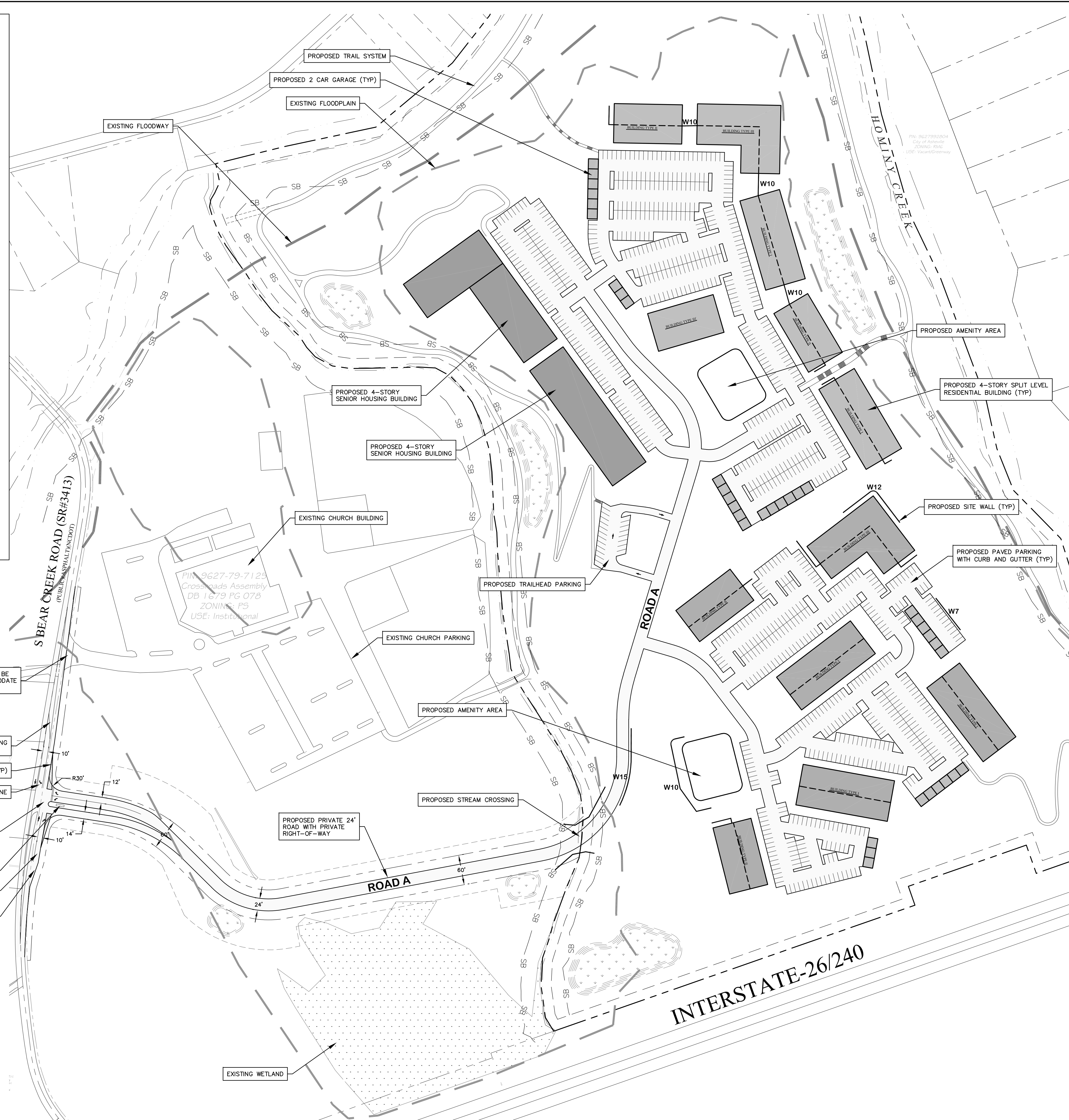


Appendix F: Site Plans

F



- NOTES**
1. ALL SITEWORK SHALL BE IN ACCORDANCE WITH ALL LOCAL, STATE, AND NATIONAL REGULATORY STANDARDS AND ALL REQUIREMENTS IN THE PROJECT TECHNICAL SPECIFICATIONS.
 2. **MULTI-PHASE CONSTRUCTION.**
 3. ALL WORK MUST BE PERFORMED BY A NORTH CAROLINA LICENSED CONTRACTOR.
 4. PROPOSED DEVELOPMENT WILL BE PROVIDED WITH UTILITIES VIA EXISTING RIGHT-OF-WAYS AND PROPOSED UTILITY EASEMENTS. CONTRACTOR IS RESPONSIBLE FOR LOCATING AND VERIFYING THE EXACT LOCATION AND ELEVATION FOR ALL UTILITIES PRIOR TO CONSTRUCTION; AND TO NOTIFY ENGINEER OF ANY CONFLICTS OR DISCREPANCIES. THE LOCATION OF SOME UTILITIES SHOWN ON THE PLANS HAVE BEEN APPROXIMATED. ALL BURIED UTILITIES HAVE NOT BEEN SHOWN ON THE PLANS AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THEIR LOCATION PRIOR TO CONSTRUCTION.
 5. CONTRACTOR SHALL PROTECT EXISTING SITE FEATURES AND NEWLY COMPLETED WORK DURING CONSTRUCTION. ANY DAMAGE INCURRED DURING OR RESULTING FROM CONSTRUCTION ACTIVITY IS THE RESPONSIBILITY OF THE CONTRACTOR AND IS TO BE REPAIRED IN ACCORDANCE WITH APPLICABLE STANDARDS OF APPROPRIATE AGENCIES AT THE CONTRACTOR'S EXPENSE.
 6. PROPOSED DRIVES WITHIN THE DEVELOPMENT TO BE PRIVATE INTERNAL DRIVES. ALL STRIPING AND SIGNAGE SHALL BE IN ACCORDANCE WITH THE LATEST MANUAL ON UNIFORM TRAFFIC CONTROL DEVICE (MUTCD). DRIVEWAY MAINTENANCE IS THE FINANCIAL RESPONSIBILITY OF THE DEVELOPER.
 7. SUBDIVISION IS NOT A HILLSIDE DEVELOPMENT AS DEFINED BY SECTION 70-68. SUBDIVISION IS NOT A DRASTIC VARIATION HILLSIDE DEVELOPMENT.
 8. TOPOGRAPHICAL INFORMATION SHOWN PROPOSED FROM PHOTOGRAMMETRIC METHODS.
 9. THE DEVELOPMENT SHOWN ON THIS PLAN WILL BE SERVED BY MSD SEWER AND CITY OF ASHEVILLE WATER (SEE UTILITY PLAN FOR PRELIMINARY WATER AND SEWER LAYOUTS). PROVISIONS WILL BE MADE BY THE DEVELOPER FOR ELECTRICAL, TELEPHONE, CABLE, AND/OR NATURAL GAS SERVICE.
 10. APPROVED EROSION CONTROL AND STORMWATER MANAGEMENT PLAN TO BE OBTAINED PRIOR TO BEGINNING ANY PHASE OF CONSTRUCTION. EROSION CONTROL DEVICES WILL BE MAINTAINED FOR THE DEVELOPMENT OF THE DEVELOPMENT PERIOD BY THE RESPONSIBLE PARTY.
 11. A PORTION OF THE SITE LIES WITHIN THE 100-YR FEMA FLOODPLAIN.
 12. CONSTRUCTION LIKELY TO BEGIN IN THE SPRING OF 2020; AND FIRST PHASE TO BE COMPLETED IN APPROXIMATELY 24 MONTHS.
 13. SUBDIVISION ROADS WILL NOT BE GATED. STREETLIGHTS ARE NOT PROPOSED FOR THIS PROJECT.
 14. ROAD CORRIDOR HEIGHT IS CONTAINED WITHIN A CORRIDOR THAT SHALL NOT EXCEED 90 FEET IN WIDTH ALONG 80% OF ITS TOTAL LENGTH; AND THE CORRIDOR HEIGHT SHALL NOT EXCEED 90 FEET.
 15. NO RETAINING WALLS GREATER THAN 20' TO BE PROPOSED FOR PROJECT.



VICINITY MAP
(NOT TO SCALE)

DEVELOPMENT DATA

OWNER/DEVELOPER: CATALYST CAPITAL PARTNERS
1600 CAMDEN ROAD, SUITE 200
CHARLOTTE, NC 28203
BEAU MCINTOSH
(704) 877-5681

CONTACT:

CIVIL ENGINEER: CIVIL DESIGN CONCEPTS, P.A.
188 PATTON AVENUE
ASHEVILLE, NC 28801
WARREN SUGG, P.E.
(828) 252-5388

CONTACT:

SURVEYOR: ED HOLMES & ASSOCIATES, P.A.
300 RIDGEFIELD COURT, SUITE 301
ASHEVILLE, NC 28806
JOSHUA E. HOLMES
(828) 225-6562

CONTACT:

PROJECT DATA

PIN: 9627-89-6780
ADDRESS: 20 S. BEAR CREEK ROAD
DEED BOOK/PAGE: 5453/963
SITE ACREAGE: 55.32 ACRES
ZONING: PS - PUBLIC SERVICE

SETBACKS:
FRONT: 20'
SIDES: 10'
REAR: 20'

DISTURBED AREA: 32 AC

PROPOSED UNITS: 520 MULTI-FAMILY RESIDENTIAL UNITS
140 SENIOR HOUSING RESIDENTIAL UNITS
660 TOTAL UNITS

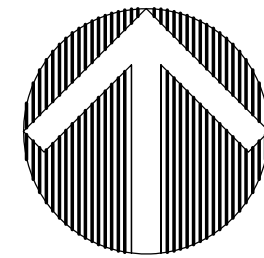
DENSITY SUMMARY:
ALLOWED: 12.0 UNITS/ACRE
PROPOSED: 11.9 UNITS/ACRE = 660 UNITS

EXISTING USE: RESIDENTIAL/VACANT
PROPOSED USE: MULTI-FAMILY RESIDENTIAL

PARKING CALCULATIONS: 1.75:1 MULTI-FAMILY RESIDENTIAL
1.10:1 SENIOR HOUSING RESIDENTIAL



Know what's below.
Call before you dig.



NORTH

MASTER SITE PLAN

GRAPHIC SCALE



(IN FEET)
1 inch = 100 ft.

FOR REVIEW ONLY

PRELIMINARY
NOT RELEASED
FOR
CONSTRUCTION

20 SOUTH BEAR CREEK

MASTER SITE PLAN FOR:

DRAWN BY: AMP
CDC PROJECT NO.: 11925
BC PERMIT NO. N/A

SHEET

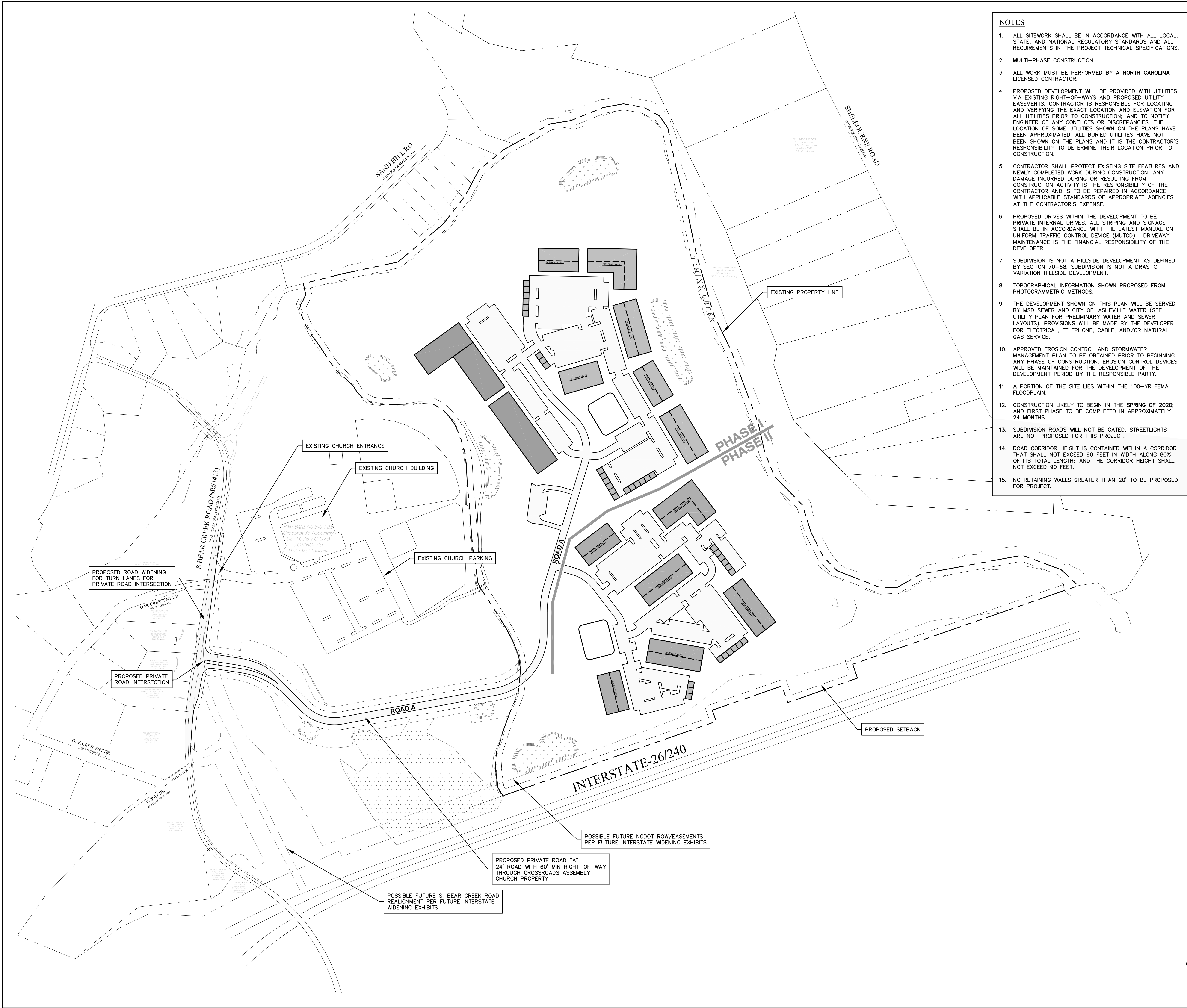
C201

188 PATTON AVENUE
ASHEVILLE, NC 28801
PHONE (828) 252-5388
FAX (828) 252-5385

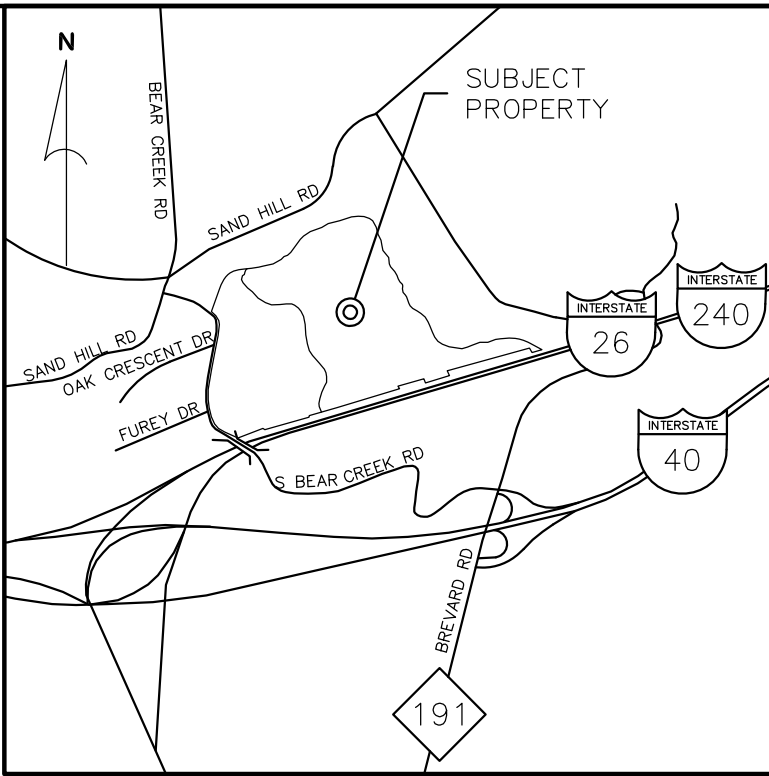
52 WALNUT STREET - SUITE 9
WAYNESVILLE, NC 28786
PHONE (828) 252-5388
FAX (828) 459-5455

Civil Design Concepts, PA
www.civildesignconcepts.com

NCBCE LICENSE # C-2184



- NOTES**
1. ALL SITEWORK SHALL BE IN ACCORDANCE WITH ALL LOCAL, STATE, AND NATIONAL REGULATORY STANDARDS AND ALL REQUIREMENTS IN THE PROJECT TECHNICAL SPECIFICATIONS.
 2. MULTI-PHASE CONSTRUCTION.
 3. ALL WORK MUST BE PERFORMED BY A NORTH CAROLINA LICENSED CONTRACTOR.
 4. PROPOSED DEVELOPMENT WILL BE PROVIDED WITH UTILITIES VIA EXISTING RIGHT-OF-WAYS AND PROPOSED UTILITY EASEMENTS. CONTRACTOR IS RESPONSIBLE FOR LOCATING AND VERIFYING THE EXACT LOCATION AND ELEVATION FOR ALL UTILITIES PRIOR TO CONSTRUCTION; AND TO NOTIFY ENGINEER OF ANY CONFLICTS OR DISCREPANCIES. THE LOCATION OF SOME UTILITIES SHOWN ON THE PLANS HAVE BEEN APPROXIMATED. ALL BURIED UTILITIES HAVE NOT BEEN SHOWN ON THE PLANS AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THEIR LOCATION PRIOR TO CONSTRUCTION.
 5. CONTRACTOR SHALL PROTECT EXISTING SITE FEATURES AND NEWLY COMPLETED WORK DURING CONSTRUCTION. ANY DAMAGE INCURRED DURING OR RESULTING FROM CONSTRUCTION ACTIVITY IS THE RESPONSIBILITY OF THE CONTRACTOR AND IS TO BE REPAIRED IN ACCORDANCE WITH APPLICABLE STANDARDS OF APPROPRIATE AGENCIES AT THE CONTRACTOR'S EXPENSE.
 6. PROPOSED DRIVES WITHIN THE DEVELOPMENT TO BE PRIVATE INTERNAL DRIVES. ALL STRIPING AND SIGNAGE SHALL BE IN ACCORDANCE WITH THE LATEST MANUAL ON UNIFORM TRAFFIC CONTROL DEVICE (MUTCD). DRIVEWAY MAINTENANCE IS THE FINANCIAL RESPONSIBILITY OF THE DEVELOPER.
 7. SUBDIVISION IS NOT A HILLSIDE DEVELOPMENT AS DEFINED BY SECTION 70-68. SUBDIVISION IS NOT A DRASTIC VARIATION HILLSIDE DEVELOPMENT.
 8. TOPOGRAPHICAL INFORMATION SHOWN PROPOSED FROM PHOTOGRAMMETRIC METHODS.
 9. THE DEVELOPMENT SHOWN ON THIS PLAN WILL BE SERVED BY MSD SEWER AND CITY OF ASHEVILLE WATER (SEE UTILITY PLAN FOR PRELIMINARY WATER AND SEWER LAYOUTS). PROVISIONS WILL BE MADE BY THE DEVELOPER FOR ELECTRICAL, TELEPHONE, CABLE, AND/OR NATURAL GAS SERVICE.
 10. APPROVED EROSION CONTROL AND STORMWATER MANAGEMENT PLAN TO BE OBTAINED PRIOR TO BEGINNING ANY PHASE OF CONSTRUCTION. EROSION CONTROL DEVICES WILL BE MAINTAINED FOR THE DEVELOPMENT OF THE DEVELOPMENT PERIOD BY THE RESPONSIBLE PARTY.
 11. A PORTION OF THE SITE LIES WITHIN THE 100-YR FEMA FLOODPLAIN.
 12. CONSTRUCTION LIKELY TO BEGIN IN THE SPRING OF 2020; AND FIRST PHASE TO BE COMPLETED IN APPROXIMATELY 24 MONTHS.
 13. SUBDIVISION ROADS WILL NOT BE GATED. STREETLIGHTS ARE NOT PROPOSED FOR THIS PROJECT.
 14. ROAD CORRIDOR HEIGHT IS CONTAINED WITHIN A CORRIDOR THAT SHALL NOT EXCEED 90 FEET IN WIDTH ALONG 80% OF ITS TOTAL LENGTH; AND THE CORRIDOR HEIGHT SHALL NOT EXCEED 90 FEET.
 15. NO RETAINING WALLS GREATER THAN 20' TO BE PROPOSED FOR PROJECT.



VICINITY MAP
(NOT TO SCALE)

DEVELOPMENT DATA	
OWNER/DEVELOPER:	CATALYST CAPITAL PARTNERS 1600 CAMDEN ROAD, SUITE 200 CHARLOTTE, NC 28203 BEAU MCINTOSH (704) 877-5681
CONTACT:	
CIVIL ENGINEER:	CIVIL DESIGN CONCEPTS, P.A. 188 PATTON AVENUE ASHEVILLE, NC 28801 WARREN SUGG, P.E. (828) 252-5388
CONTACT:	
SURVEYOR:	ED HOLMES & ASSOCIATES, P.A. 300 RIDGEFIELD COURT, SUITE 301 ASHEVILLE, NC 28806 JOSHUA E. HOLMES (828) 225-6562
CONTACT:	
PROJECT DATA	
PIN:	9627-89-6780
ADDRESS:	20 S. BEAR CREEK ROAD
DEED BOOK/PAGE:	5453/963
SITE ACREAGE:	55.32 ACRES
ZONING:	PS - PUBLIC SERVICE
SETBACKS:	
FRONT:	20'
SIDES:	10'
REAR:	20'
DISTURBED AREA:	32 AC
PROPOSED UNITS:	520 MULTI-FAMILY RESIDENTIAL UNITS 140 SENIOR HOUSING RESIDENTIAL UNITS *660 TOTAL UNITS
DENSITY SUMMARY:	
ALLOWED:	12.0 UNITS/ACRE
PROPOSED:	11.9 UNITS/ACRE = 660 UNITS
EXISTING USE:	RESIDENTIAL/VACANT
PROPOSED USE:	MULTI-FAMILY RESIDENTIAL
PARKING CALCULATIONS:	1.75:1 MULTI-FAMILY RESIDENTIAL 1.10:1 SENIOR HOUSING RESIDENTIAL



FOR REVIEW ONLY

**PRELIMINARY
NOT RELEASED
FOR
CONSTRUCTION**

811
Know what's below.
Call before you dig.

NORTH

MASTER PHASE PLAN

GRAPHIC SCALE

150 0 75 150 300 600
(IN FEET)
1 inch = 150 ft.

20 SOUTH BEAR CREEK

CATALYST CAPITAL PARTNERS - BUNCOMBE COUNTY, NORTH CAROLINA

DRAWN BY: AMP
CDC PROJECT NO.: 11925
BC PERMIT NO.: N/A

SHEET
C200

CDC Civil Design Concepts, PA
www.civildesignconcepts.com

188 PATTON AVENUE
ASHEVILLE, NC 28801
PHONE (828) 252-5388
FAX (828) 252-5385

52 WALNUT STREET - SUITE 9
WAYNESVILLE, NC 28786
PHONE (828) 252-5388
FAX (828) 455-5455

NCBELS LICENSE # C-2184

Appendix G: NCDOT TIA Checklist

G



Revised Crossroads at West Asheville
TIA SCOPING REVIEW
BULLET LIST OF NCDOT COMMENTS AND CONCERNS
(SC-2019-180R1)
June 11, 2020

The NCDOT has performed a review of the scoping document for the proposed Revised Crossroads at West Asheville development prepared by Gannet Fleming, Incorporated (received June 5, 2020). According to the document, the proposed development is to be located east of SR 3413 (S Bear Creek Rd). The scoping document states that the full build-out of the development is to be constructed by 2028 and is to consist of residential land use. Based on our review, we have the following comments at this time:

General

- TIP project I-2513 is in the immediate area of this project. The scoping documents indicate that TIP Design Year Analyses will not be provided and that a rezoning request will not be made for this project.

Trip Generation

- The Trip Generation appears reasonable.

Trip Distribution and Growth Rate

- Trip distribution appears reasonable.
- Growth factor of 1.5 percent appears reasonable.

Study Intersections

- Study intersections appear reasonable; **however, please ensure to include the intersection of NC 191 (Brevard Rd) and the I-240 WB On/Off Ramps in the analysis.**

Site Plan and Proposed Driveways

- Site plan appears reasonable; **however, please ensure that the land use type and number of dwelling units from the building footprints match with the data shown in the trip generation table.**
- Proposed full movement site access appears reasonable; **however please ensure that there is at least a 600' minimum distance between the proposed driveway and the adjacent study intersections.**

NOTE: This list should not be considered all-inclusive. Further review may identify additional areas of concern.

Revised Crossroads at West Asheville
TIA SCOPING REVIEW
BULLET LIST OF NCDOT COMMENTS AND CONCERNS
(SC-2019-180R1)
June 11, 2020

The NCDOT has performed a review of the scoping document for the proposed Revised Crossroads at West Asheville development prepared by Gannet Fleming, Incorporated (received June 5, 2020). According to the document, the proposed development is to be located east of SR 3413 (S Bear Creek Rd). The scoping document states that the full build-out of the development is to be constructed by 2028 and is to consist of residential land use. Based on our review, we have the following comments at this time:

General

- TIP project I-2513 is in the immediate area of this project. The scoping documents indicate that TIP Design Year Analyses will not be provided and that a rezoning request will not be made for this project.

Trip Generation

- The Trip Generation appears reasonable.

Trip Distribution and Growth Rate

- Trip distribution appears reasonable.
- Growth factor of 1.5 percent appears reasonable.

Study Intersections

- Study intersections appear reasonable; **however, please ensure to include the intersection of NC 191 (Brevard Rd) and the I-240 WB On/Off Ramps in the analysis.**

Site Plan and Proposed Driveways

- Site plan appears reasonable; **however, please ensure that the land use type and number of dwelling units from the building footprints match with the data shown in the trip generation table.**
- Proposed full movement site access appears reasonable; **however please ensure that there is at least a 600' minimum distance between the proposed driveway and the adjacent study intersections.**

NOTE: This list should not be considered all-inclusive. Further review may identify additional areas of concern.



NCDOT Traffic Impact Analysis Need Screening / Scoping Request

TIA Need
Screening



TIA
Scoping



TIA
Submittal



A Traffic Impact Analysis (TIA) may be required for developments based on the site trip generation estimates, site context, or at the discretion of the NCDOT District Engineer. The Applicant or the TIA Consultant shall submit this form along with the site plan to the District Engineer to determine the TIA need and, if a TIA is required, initiate the TIA scoping process. Without an approved scope, the TIA is incomplete and will be rejected until the study is revised to conform to NCDOT's TIA requirements.

Project Name: Crossroads At West Asheville Previous Name: If Applicable _____
 Location: 20 South Bear Creek Road County: Buncombe Municipality: Asheville
 Project Description: Residential Development consisting of 600 Mid-Rise units and 60 beds of assisted Living

Project Contact: Applicant
 Company Name Catalyst Capital Partners
 Contact Person A. J. Klenk
 Phone Number 704-231-4882
 Email aj@catalystcp.com
 Mailing Address 1600 Camden Road, Suite 200
Charlotte, NC 28203

TIA Consultant
 Gannett Fleming, Inc.
 Jeffrey H. Moore, P. E.
 828-674-0229
 jemoore@gfnet.com
 28 Schenck Parkway, Suite 200
 Asheville, NC 28803

Site Plan Prepared By: Civil Design Concepts
 See site plan/vicinity map requirements on page 2.
 Parcel Size: 67 Acre(s)

Site Plan Date: 03/2020
 Anticipated Build-Out Year: 2028

Weekday Site Trip Generation - Do NOT adjust for mode split, pass-by, internal capture, or diverted trips.

ITE LUC	Proposed Land Use	Size	Unit	Daily Trips	Peak Hour Type	AM Peak Hour Trips			PM Peak Hour Trips			Data Source
						Enter	Exit	Total	Enter	Exit	Total	
221	Apts Mid-Rise	600	Units	3268	Adj. Street	51	147	198	151	96	247	ITE Equation
254	Assisted Living	60	Beds	156	Generator	7	4	11	9	11	20	ITE Rate
Total				3424		58	151	209	160	107	267	

Refer to the current [NCDOT Congestion Management Capacity Analysis Guidelines](#) for acceptable trip calculation methods and data sources.

**Explain local or other data sources, if used: _____

☒ The estimated site trips meet NCDOT's TIA trip threshold of 3,000 daily trips.

☒ The estimated site trips meet the municipal TIA trip threshold of 75 Units

☒ This project is located in a known [STIP](#) and/ or local CIP project # I-2513

☐ This project includes a rezoning request.



NCDOT Traffic Impact Analysis Need Screening / Scoping Request

TIA Need
Screening



TIA
Scoping



TIA
Submittal



- ☐ The proposed site access is located within 1,000 feet of an interchange.
- ☐ The Applicant requests for a new or modified control-of-access break.
- ☐ The Applicant requests for a new or modified median break.


Applicant's Signature

Chris Day for A. J. Klenk

Print Name

6/5/20

Date

Site Plan/Vicinity Map Requirement for TIA Need Screening: While the site plan may not be finalized during the TIA scoping stage, the graphic representation of the proposed development shall provide adequate details on the development scope and context. More specifically, the site plan/map shall clearly show the location and type of each access point, spacing to adjacent and opposing driveways or intersections, internal street network, proposed buildings/parcels with their anticipated uses and sizes at full build-out and, if applicable, any nearby interstate, US, NC or Secondary Roads (SR).

Project Name: Crossroads At West Asheville

Project Reference Number: _____

- ☒ **A TIA is Required by the Local Government.** In addition, the study area is expected to include NCDOT maintained transportation facilities.
- ☒ **A TIA is Required by NCDOT,** per the [Policy on Street and Driveway Access to North Carolina Highways](#).

If either or both of the boxes above are checked, the Applicant/TIA Consultant is hereby requested to fill out as much as possible of the following TIA scoping checklist, and return it along with the supporting documents to NCDOT prior to the scoping meeting.

- ☐ **A TIA is NOT required.** This decision is based on the development information presented above. Changes in the development plan will require re-evaluation of the TIA need, and may necessitate a TIA. The Applicant should inform the District Engineer of any significant changes in a timely fashion to avoid delays or rejections of the driveway permit / encroachment agreement applications.



NCDOT Traffic Impact Analysis Need Screening / Scoping Request



Additional Comments:

The TIA need decision is made by the NCDOT Division 13 District 2 on _____.

NCDOT District Representative's Signature

Email concurrence may be used in lieu of the signature.

Print Name



NCDOT TIA Scoping Checklist



Project Name: Crossroads At West Asheville

TIA Scoping Date: _____

☒ **TIA Need Screening Forms are Attached.** Project Reference #: _____ Decision Date: _____

☒ **Site Plan and Access**

☒ Provide a site plan illustrating site access, internal and external roadways, buildings and land uses.

Refer to NCDOT's [Policy on Street and Driveway Access to North Carolina Highways](#) pages 14 and 15 for site plan requirements.

☒ Identify site access.

New Access	On Road	Access Type		Driveway Spacing		
	Road Name	Permitted Movements	Traffic Control	Distance (ft)	Direction	Nearest Intersection / Access
Access A	S. Bear Creek	Conventional Full-Mvmt	2-Way Stop	300	North	Oak Crescent Dr
Access B						
Access C						
Access D						
Access E						
Access F						
Access G						
Access H						
Existing Access	Existing Intersection of		Access Modification	Proposed Interconnectivity (If Applicable)		
	Road A	Road B		Connector #	Road Connected	Adjacent Development
Access 1			Please Select	Connector 1		
Access 2				Connector 2		
Access 3				Connector 3		
Access 4				Connector 4		

☐ Additional access clarifications and provisions (e.g., proposed control-of-access or median breaks, modifications of existing access, loading/unloading area access, bike/pedestrian accommodation).

☐

Proposed K-12 School Site

- ☐ NCDOT [MSTA School Traffic Calculator](#) for Select School Type shall be used.
- ☐ Peak Hour Factors (PHFs) shall be adjusted/weighted for new school trips (0.5 PHF by default).
- ☐ Internal school circulation analysis is required, and should be submitted in advance or concurrent with the TIA submittal.
- ☐ Clarify traffic operation plans (e.g. traffic circulation pattern, pedestrian access, drop-off/pick-up zone location and configuration, queue storage area and, if applicable, staggered start times).



NCDOT TIA Scoping Checklist

TIA Need
Screening



TIA
Scoping



TIA
Submittal



☒ Trip Generation

The TIA Consultant shall prepare trip generation estimates following the current [NCDOT Congestion Management Capacity Analysis Guidelines](#), and submit the calculation sheets and supporting information to the District Engineer for approval prior to capacity analysis.

ITE LUC	Proposed Land Use	Size	Unit	Daily Trips	Peak Hour Type	AM Peak Hour Trips			PM Peak Hour Trips			Data Source
						Enter	Exit	Total	Enter	Exit	Total	
221	Apts Mid-Rise	600	Units	3268	Adj. Street	51	147	198	151	96	247	ITE Equation
254	Assisted Living	60	Beds	156	Generator	7	4	11	9	11	20	ITE Rate
Unadjusted Site Trips				3424		58	151	209	160	107	267	
Internal Capture Trips (Attach Calculation Sheets)				0		0	0	0	0	0	0	Please Select
Internal Capture % of Unadjusted Site Trips				0 %		0 %			0 %			
LUC	Proposed Land Use	Any Internal Trips?		Pass-By % of External Trips								
221	Apts Mid-Rise	Not Applicable		0 %		0 %			0 %			
254	Assisted Living	Not Applicable		0 %		0 %			0 %			
				%		%			%			
				%		%			%			
				%		%			%			
Pass-By Trips (Attach Calculation Sheets)				0		0	0	0	0	0	0	
Adjacent Street Volumes												Please Select
Non-Pass-By Primary Trips				3424		58	151	209	160	107	267	
Diverted Trips, if Applicable and Justifiable				0								Please Select

**Explain local or other data sources, if used:

☐ Existing Site Trip Information for Redevelopment Projects (Attach separate sheets as needed)

ITE LUC	Existing Land Use	Size	Unit	Daily Trips	Peak Hour Type	AM Peak Hour Trips			PM Peak Hour Trips			Data Source
						Enter	Exit	Total	Enter	Exit	Total	
					Please Select							Please Select
Total Existing Site Trips												



NCDOT TIA Scoping Checklist



☒ Trip Distribution

- ☒ Trip distribution diagrams are submitted concurrently with this document (attach separate sheets).
- ☐ Trip distribution diagrams will be submitted separately, along with supporting information, to the District Engineer for review and approval prior to capacity analysis. The trip distribution shall be based on the current and anticipated traffic patterns, as well as instructions noted below.

If required by the District Engineer, the following additional diagrams shall also be submitted:

- ☐ Mixed-Use Developments (separate diagrams for residential, commercial, and office trips)
- ☐ Inter-Development Trips (if 'internal' trips cross public streets)
- ☐ Pass-By Trips
- ☐ Diverted Trips
- ☐ Each Analysis Period

☐ Mode Split

- ☐ Provide Data Source and Justification

Mode Period	Auto		
AM Peak	%	%	%
PM Peak	%	%	%
Daily	%	%	%
	%	%	%

- ☐ Identify proper infrastructure and accommodation for other modes of travel.

☒ Analysis Peak Periods:

- ☒ Weekday AM Peak 7-9 AM
- ☒ Weekday PM Peak 4-6 PM
- ☐ Weekday Midday Peak _____
- ☐ Weekday PM School Peak _____
- ☐ Weekend _____ Peak _____
- ☐ Other _____



NCDOT TIA Scoping Checklist



☒ Study Area Intersections and Data Collection

The study area shall include the site access intersections (both new and existing) identified under “Site Plan and Access” on page 1, as well as the following external and, if applicable, internal intersections.

External Intersection	Intersection of		Traffic Control	Intersection Turning Movement Counts			Notes
	Road A	Road B		New / Existing	Date of Counts	Growth Adjustment	
#1	NC 191	I-40 WB Ramp	Signal	Use Existing Counts	5-7-2019	1.5%	
#2	NC 191	I-40 EB Ramp	Signal	Use Existing Counts	5-8-2019	1.5%	
#3	NC 191	I-240 EB Ramp	Signal	Use Existing Counts	5-7-2019	1.5%	
#4	SR 3413	SR 3412	2-Way Stop	Use Existing Counts	5-7-2019	1.5%	
#5	SR 3412	Wendover Road	All-Way Stop	Use Existing Counts	5-7-2019	1.5%	
#6	SR 3413	Crossroads Ch	2-Way Stop				
#7							
#8							
#9							
#10							
#11							
#12							

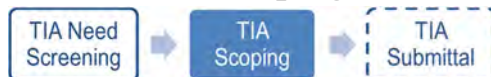
Internal Intersection	Intersection of		Access Type		Intersection Spacing		
	Road A	Road B	Traffic Control	Permitted Movements	Distance (ft)	Direction	Nearest Intersection
#101			Please Select	Please Select		Please Select	
#102							
#103							
#104							
#105							

The following data will be collected:

- ☐ New traffic turning movement counts in ☐ 15-min intervals ☐ 5-min intervals (near schools)
 Unless otherwise noted above, new traffic counts shall be collected at the existing study intersections during the analysis periods. Weekday counts shall avoid Mondays, Fridays, holidays, school breaks, road closures, and major weather events.
- ☐ To account for the impact of existing and/or proposed school traffic, PHFs will be adjusted for:
 intersections numbered: _____
 and access points numbered: _____
- ☒ Traffic Forecast Data for TIP: I-2513
- ☒ Roadway/Intersection Configuration & Traffic Control
- ☒ Traffic Signal Phasing & Timing Data
- ☐ Crash Data: _____ Period: _____
- ☒ Other:
- This project does not require rezoning.



NCDOT TIA Scoping Checklist



☒ Future Year Conditions

☒ Project Build-Out Year: 2028

☐ Future Analysis Year(s): _____

☒ Identify below any funded/committed future transportation improvements, as well as any approved but incomplete developments near the site.

Funded STIP / Local CIP Project	Project Description		Year Complete
I-2513	Asheville I-26 Connector		
Nearby Approved Development	Location	Future Land Use (exclude any completed phases)	Committed Improvements

☒ Annual Growth Factor: 1.5 %

Justification/Data Source: <http://NCDOT.maps.arcgis.com/apps/webapviewer/index.html>

☐ Local Comprehensive Transportation Plan Compliance

☐ Identify Applicable Local Transportation Planning Documents

☐ Identify Applicable Roadways inside the Study Area

Road Name	Classification	Speed Limit	Proposed Cross-Section	Proposed Right-of-Way	Compliance Requirements	Affect Study Intersection #



NCDOT TIA Scoping Checklist



☒ Study Method

The traffic analysis shall follow the current [NCDOT Congestion Management Capacity Analysis Guidelines](#), [Policy on Street and Driveway Access to North Carolina Highways](#), and use the current approved version of analysis software (e.g. Synchro/SimTraffic, HCS, Sidra Intersection, TransModeler).

The study shall include the following analysis scenarios for each analysis period.

1. Existing Conditions
2. Future No-Build Conditions (existing + background growth + approved developments + committed or funded improvements)
3. Future Build Conditions (future no-build + site trips)
4. Future Build with Improvements Conditions (future build traffic with improvements to mitigate the proposed development's impacts) and, if applicable:
- ☐ 5. TIP Design Year Analysis N/A - No rezoning required by this project.
- ☐ 6. Alternative Access Scenario (without proposed control-of-access or median break / modification)

The following additional analysis/outputs should be provided as warranted:

- ☐ Signal Warrant Analysis for accesses/intersections _____
- ☐ Multi-Modal Level of Service Analysis
- ☐ School Loading Zone Traffic Simulation
- ☐ Phasing Analysis (scope separately as needed)
- ☐ Safety/Crash Analysis
- ☐ Control-of-Access Modification Justification
- ☐ Median Break / Modification Justification
- ☐ Other _____

☒ Submittals

In addition to the hardcopies required below, the TIA Consultant shall provide the District Engineer and, if required, the local government an electronic copy of the study documents, including the latest site plan, figures and appendices, in searchable PDF files and the original traffic analysis files (e.g., Synchro, HCS). To expedite review, the NCDOT electronic submittals shall also be delivered concurrently to:

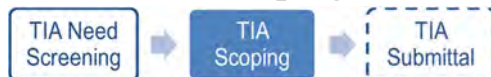
☐ Div. Traffic Engr ☐ Regional Traffic Engr ☐ Congestion Management ☐ Other _____

Submittals	NCDOT		Local Government	
	Electronic	Hardcopy	Electronic	Hardcopy
Trip Generation & Distribution	Required		Required	
Draft TIA Report	Required		Required	
Final Sealed TIA Report	Required		Required	

☐ **Additional Comments** (municipal TIA requirements, approved variations from NCDOT guidelines)



NCDOT TIA Scoping Checklist



Agreement by All Parties

The undersigned agree to the contents and methodology described above for completing the required traffic impact analysis for the proposed development identified herein. Any changes to the above methodology contemplated by the Applicant or the TIA Consultant must be submitted to the District Engineer in writing. If approved by NCDOT, then such changes may be accepted for the TIA report. Subsequent revisions to the development plan (e.g. land use, density, site access, or schedule) may require additional scoping and analysis, and may modify the TIA requirements.

This agreement shall become effective on the date approved by NCDOT, and shall expire ____ months after the effective date or upon significant changes to the roadway network and/or development assumptions, whichever occurs first. Once expired, renewal or re-scoping will be required for subsequent TIA submittals.

APPLICANT



Signature

Chris Day, P. E. for A. J. Klenk

Print Name

6/5/20

Date

TIA CONSULTANT



Signature

Jeffrey H. Moore, P. E.

Print Name

6-5-2020

Date

LOCAL GOVERNMENT REPRESENTATIVE (If Applicable)

Signature

Print Name

Date

Email concurrence may be used in lieu of the signature.

NCDOT DISTRICT REPRESENTATIVE

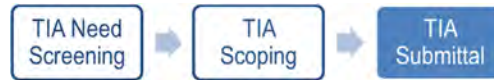
Reviewed and approved by the NCDOT Division 13 District 2 on _____.

Signature
Email concurrence may be used in lieu of the signature.

Print Name



NCDOT TIA Submittal Checklist



Submittal: Draft TIA Report Document Date: _____
Project Name: Crossroads At West Asheville Previous Name: If Applicable _____
NCDOT Division: 13 District: 2 County: Buncombe Municipality: _____
TIA Consultant: Gannett Fleming Submitted By: Jeffrey H. Moore
Phone Number: 828-674-0229 Email: jemoore@gfnet.com
TIA Scoping Checklist Approval Date: _____ Unadjusted Daily Site Trips: 3424

- ☒ The approved TIA Scoping Checklist is included in this submittal.
- ☒ LOS D or better is expected at all study intersections after proposed mitigations.
- ☒ The study report is sealed by a NC Professional Engineer with expertise in traffic engineering.
- ☒ This study has identified all known deficiencies with and without the proposed development.
- ☒ This study has identified mitigation measures to adequately accommodate the site trips.

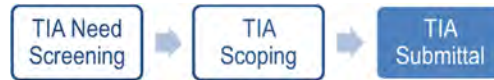
Explain here if any of the boxes above are unchecked:

The undersigned affirms that, except for the deviations noted below, the TIA submittal conforms to the current [NCDOT Congestion Management Capacity Analysis Guidelines](#), [Policy on Street and Driveway Access to North Carolina Highways](#), and the TIA Scoping Checklist approved by the NCDOT District Office. The undersigned also acknowledges that the TIA will be rejected if the deviations and justifications are not properly documented and approved by NCDOT.

Deviations and Justifications (e.g., changes in site plan, development schedule, site trip and off-site trip estimates, study area, data collection, analysis period and method. Attached separate sheets if needed.)



NCDOT TIA Submittal Checklist



TIA Consultant's Signature
(Professional Engineer of TIA Record)

Jeffrey H. Moore, P. E.
Print Name

Date



June 5, 2020

To: Nicholas Dorato, NCDOT, Transportation Technician
Nathan Pennington, Buncombe County, Director of Planning and Development
A. J. Klenk, Owner, Catalyst Capital Projects, LLC
Chris Day, P. E., Civil Design Concepts, P. A.

From: Jeffrey H. Moore, PE

Subject: **MEMORANDUM OF ASSUMPTIONS** for Crossroads at West Asheville
Traffic Impact Analysis (TIA), South Bear Creek Road, Buncombe County, NC
(Gannett Fleming Project No. 066529)

INTRODUCTION

Crossroads at West Asheville, a proposed multifamily subdivision, is planned to be constructed on the east side of SR 3413 (South Bear Creek Road in Buncombe County, NC (refer to Figure 1 - Vicinity Map).

The proposed residential development is planned to consist of 600 multifamily apartments and an assisted living facility with 60 beds.

The **Site Plan**, prepared by Civil Design Concepts, dated XX/XX/XXXX, illustrates one proposed access on SR 3413 (South Bear Creek Road). The access is generally opposite Oak Crescent and Furey Drive. The **Site Plan**, dated 10/22/19, is illustrated on Figure 2.

Study Area Intersections

To determine the potential impact of Crossroads at West Asheville, the following intersections will be studied:

1. NC 191 (Brevard Road) at I-40 WB Ramps (signalized intersection)
2. NC 191 (Brevard Road) at I-40 EB Ramps (un-signalized intersection)
3. NC 191 (Brevard Road) at I-240 EB Ramps (un-signalized intersection)
4. SR 3413 (South Bear Creek Road) at SR 3412 (Sand Hill Road) (un-signalized intersection)
5. SR 3412 (Sand Hill Road) at Wendover Street (un-signalized intersection)
6. SR 3413 (South Bear Creek Road) at Crossroads Church Entrance (un-signalized intersection)

The proposed study area intersections are illustrated on Figure 3.

AM & PM Peak Hour Turning Movement Counts

Gannett Fleming was provided with existing AM and PM Peak Hour Turning Movement Counts. The counts were obtained in May 2019 and were contained in a previous TIA submitted in 2019. Gannett

Fleming will utilize the data contained in the counts during the AM (7-9am) and PM (4-6pm) peak hours at the following study area intersections:

1. NC 191 (Brevard Road) at I-40 WB Ramps (signalized intersection)
2. NC 191 (Brevard Road) at I-40 EB Ramps (un-signalized intersection)
3. NC 191 (Brevard Road) at I-240 EB Ramps (un-signalized intersection)
4. SR 3413 (South Bear Creek Road) at SR 3412 (Sand Hill Road) (un-signalized intersection)
5. SR 3412 (Sand Hill Road) at Wendover Street (un-signalized intersection)
6. SR 3413 (South Bear Creek Road) at Crossroads Church Entrance (un-signalized intersection)

Study Year Scenarios

- 2020 Existing Condition
- 2028 No-Build Condition
- 2028 Buildout Condition

Capacity Analysis

Capacity analysis, using Synchro/SimTraffic, will be performed for the AM and PM peak hours at the following intersections for each study year scenario:

1. NC 191 (Brevard Road) at I-40 WB Ramps (signalized intersection)
2. NC 191 (Brevard Road) at I-40 EB Ramps (un-signalized intersection)
3. NC 191 (Brevard Road) at I-240 EB Ramps (un-signalized intersection)
4. SR 3413 (South Bear Creek Road) at SR 3412 (Sand Hill Road) (un-signalized intersection)
5. SR 3412 (Sand Hill Road) at Wendover Street (un-signalized intersection)
6. SR 3413 (South Bear Creek Road) at Crossroads Church Entrance (un-signalized intersection)

Trip Generation

Preliminary trip generation estimates for the proposed 375 single family residential detached dwellings has been developed using the *ITE Trip Generation Manual, 10th Edition*. The table below illustrates the trip generation estimates:

Table 1 - ITE Trip Generation Summary										
LU Code	Description	Density	Units	Daily	AM			PM		
					In	Out	Total	In	Out	Total
221	Multifamily Mid Rise	600	Units	3268	51	147	198	151	96	247
254	Assisted Living	60	Beds	156	7	4	11	9	11	20
Multifamily Residential/Assisted Living New Trips				3424	58	151	209	160	107	267

The trip generation noted in Table 1 was developed using the suggested method as outlined in the *NCDOT Congestion Management Rate vs Equation Spreadsheet*, dated July 1, 2018 with the following parameters:

Land Use	Equations vs Rates	Peak Hour Type
Multifamily Mid Rise (221)	Equation	Adjacent Street Traffic
Assisted Living (254)	Rate	Generator

Pass-by

Pass-by trips are not applicable for multifamily residential and assisted living land uses. Therefore, no pass-by trips will be considered.

Internal Capture

Internal capture is not applicable for multifamily residential and assisted living land uses. Therefore, no internal capture will be considered.

Growth Rates

According to NCDOT AADT Volumes

(<http://ncdot.maps.arcgis.com/apps/webappviewer/index.html?id=5f6fe58c1d90482ab9107ccc03026280>), the following are the historical annual daily traffic (AADT) on study area roadways.

Facility	2018	2016	2014	2012
NC 191 (North of I-240)	8,900	9,300	8,300	7,900
NC 191 (North of I-40)	17,000	15,000	12,000	13,000
NC 191 (South of I-40)	18,000	18,000	14,000	14,000
SR 3412 (Sand Hill Road)	No Data	2,700	2,300	2,000
Shelburne Road	No Data	4,400	3,500	3,100
I-240 East of NC 191	73,500	73,000	69,000	64,000

As illustrated in the table above, the traffic on study area roadways have stayed virtually the same or increased slightly over the past six years. Gannett Fleming recommends a 1.5% compounded annual growth rate is to be used on study area and intersections. This annual growth rate is typical for suburban areas in North Carolina.

Approved Developments

No major approved developments have been identified in the study area.

Approved Transportation Projects

No major approved transportation projects have been identified in the study area.

Directions of Approach and Departure

The proposed AM and PM entering and exiting distributions are as follows:

Facility	Directions of Approach and Departure
SR 3413 S. Bear Creek Road (East)	75%
SR 3413 S. Bear Creek Road (West)	25%
SR 3412 Sand Hill Road (North)	20%
SR 3412 Sand Hill Road (South)	5%
NC 191 (North)	45%
NC 191 (South)	20%
I-40 WB Ramp (East)	10%
I-40 EB Ramp (East)	10%
I-240 EB Ramp (East)	20%
NC 191 (North of I-240)	35%

Traffic distribution above is based on review of NCDOT AADT Volumes (<http://ncdot.maps.arcgis.com/apps/webappviewer/index.html?id=5f6fe58c1d90482ab9107ccc03026280>), review of previous TIA's, and Gannett Fleming's local knowledge of the area. When Gannett Fleming obtains the existing traffic counts for the study area intersections, the directions of approach and departure will be reviewed and adjusted as necessary before submitting to City of Concord and NCDOT for concurrence. The proposed directions of approach and departure are illustrated in Figure 4.

Auxiliary Turn Lane Analysis

NCDOT Left and Right Turn Lane Warrants will be used to determine the need for left and right-turn lanes are the proposed access on SR 3413 (South Bear Creek Road) and other study area roadways.

Other Issues

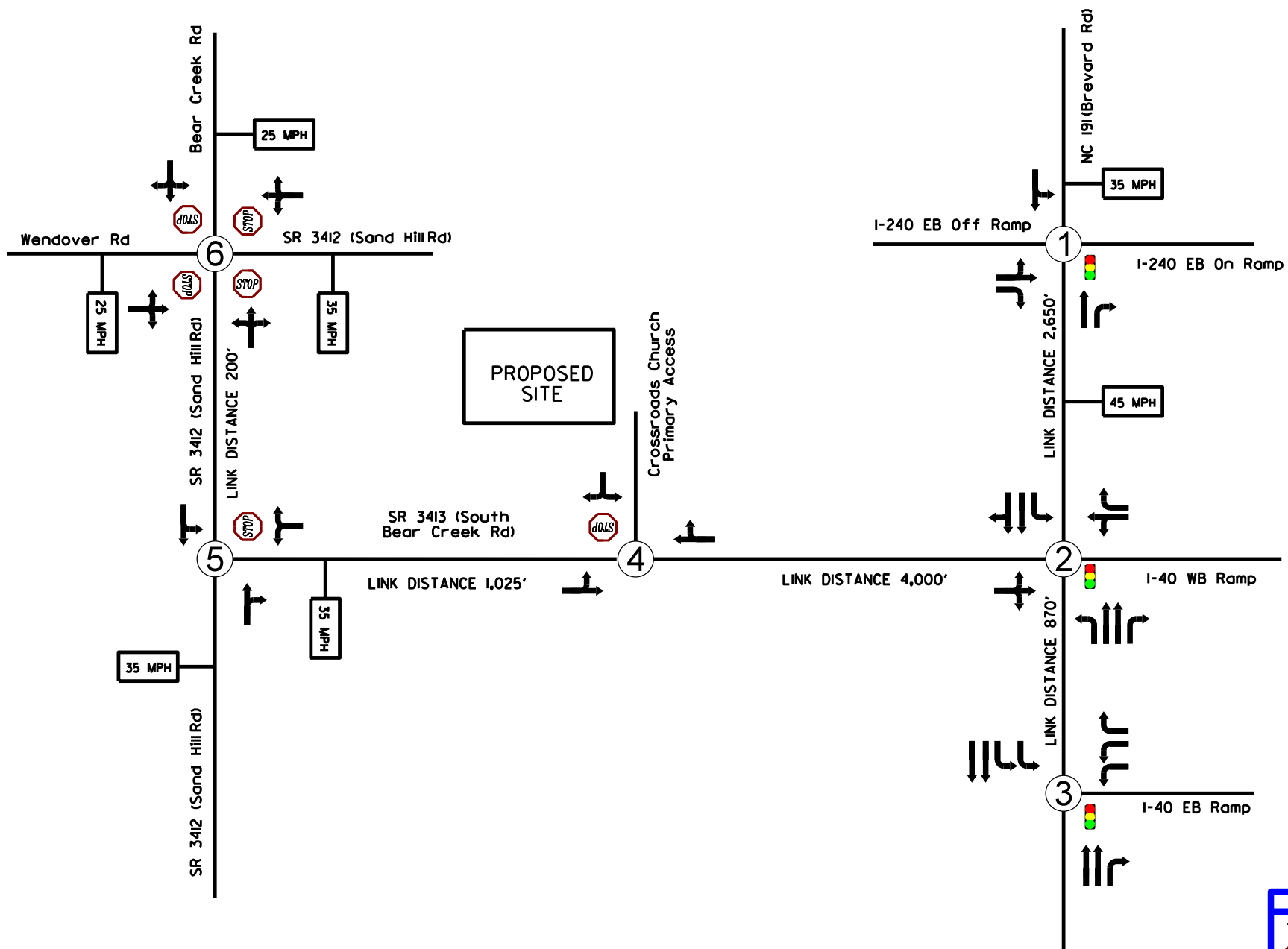
The TIA will address Finding of Fact in the Conclusion section.

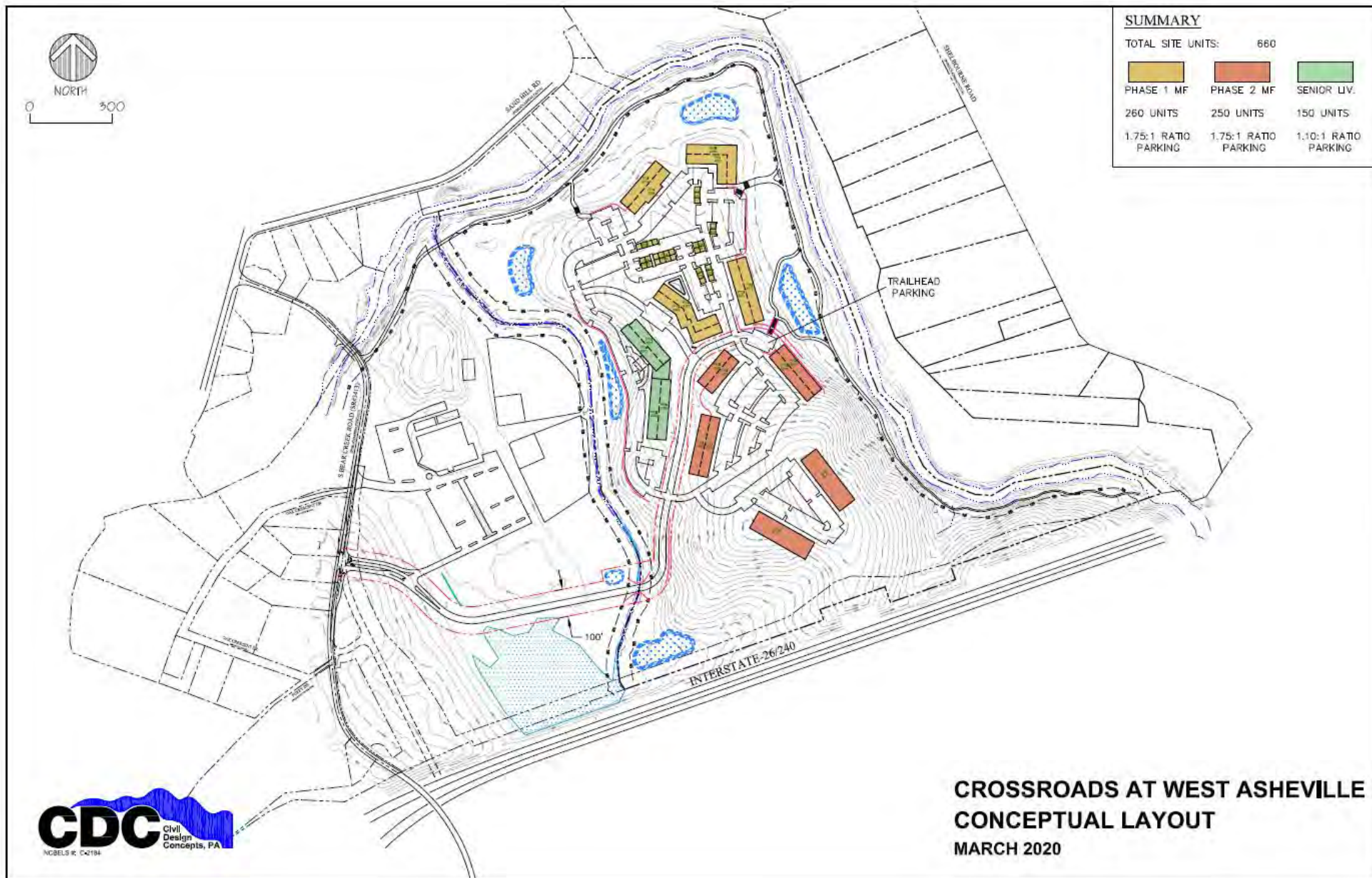
This concludes the **Memorandum of Understanding**. Please review and provide your concurrence at our earliest convenience. If you have any questions, please feel free to contact me at jemoore@gfnet.com or 828.674.0229.

Attachments – As noted

cc: Project File







PLANS PREPARED BY:



Gannett Fleming

Excellence Delivered *As Promised*

28 Schenck Parkway
Suite 200
Asheville NC 28803
(828) 771-0871
NC Lic. No. F-0270

**TRAFFIC IMPACT ANALYSIS
CROSSROADS AT WEST
ASHEVILLE**

FIGURE 3

SITE PLAN

**SCALE:
NONE**

