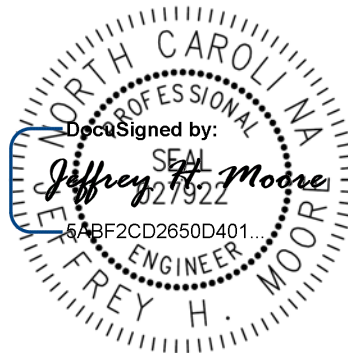


TRAFFIC IMPACT ANALYSIS
FOR
CROSSROADS AT WEST ASHEVILLE
ASHEVILLE, NC

Prepared For

Civil Design Concepts, LLC
168 Patton Ave
Asheville, NC 28801

October 30, 2019
Commission No: 3968



MATTERN & CRAIG, INC.
ENGINEERS – SURVEYORS
12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201
FAX: (828) 254-4562

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Executive Summary

A multi-use development, known as “Crossroads at West Asheville” is proposed on SR 3413 (South Bear Creek Road) in Buncombe County, NC. The development is expected to be built out in the year 2028. At the time the analysis was performed, the Crossroads at West Asheville development was proposing 601 mid-rise apartment units, 42 vacation rental units or apartment units, 147 senior housing units, 80,000 SF of self-storage space, 14,400 SF of retail space, and 63,000 SF of office space. This land use breakdown was part of the approved NCDOT checklist. The final proposed land use and densities have changed and now are as follows: 655 mid-rise apartment units, 147 senior housing units, 64,000 SF of self-storage space, 14,400 SF of retail space, and 50,400 SF of office space.

The net difference between the trips generated by the analyzed land use, and the final proposed uses will be a reduction of 28 AM peak hour trips and 69 PM peak hour trips; therefore, this analysis examines a more conservative condition (See Tables 1a and 1b).

SR 3413 (South Bear Creek Road) is maintained by NCDOT as a secondary roadway and runs east to west from NC 191 (Brevard Road) to SR 3412 (Sand Hill Road). Access to the site is provided by two (2) connections on SR 3413 (South Bear Creek Road). One (1) access is south of the Hominy Creek bridge and one (1) access is on the north of the I-240 overpass.

In accordance with NCDOT TIA Guidelines, the signalized intersections were modeled as being part of a

coordinated system. During the analyses, levels of service may change in unexpected fashions due to coordination of the system as a whole. Certain intersections may have a change in Level of Service grade to show a decrease in delay even with additional traffic in the background or future time periods. This is usually the result of cycle length optimization. The minimum cycle length allowed was 90 seconds for a three-phase signal and 120 for a 4 phase. Synchro modeling software predicted that certain cycle lengths greater than 180 seconds would be the most efficient for the system during several peak hour time periods.

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

Note: An NCDOT STIP project, I-2513, is planned in the area of this project. It will affect the intersections of NC 191 and I-40 and NC 191 and I-240. Since no formal plans were available, intersection improvements were obtained from public hearing plans. The Level of Service of these intersections should be greatly improved by the increased capacity of the intersections resulting from the construction of the project. (See Appendix H)

For modeling purposes, right turns on red were prohibited. Additionally, all left turns with dedicated left turn lanes were modeled as protected only. The signalized intersections were modeled as being part of a coordinated system.

This traffic impact study (TIS) has demonstrated that it is reasonable to conclude that the construction of Crossroads at West Asheville should not have a significant adverse impact on the surrounding roadway network.

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

- The traffic signal at this intersection should be optimized for traffic conditions as they change. Because NCDOT has sole jurisdiction for the operation and maintenance of the signal, this should not be a responsibility of the development.
- This intersection was modeled as an “actuated-coordinated” intersection.
- During the *Existing* AM peak hour condition, this intersection is experiencing a delay of 24.6 seconds and an Level of Service (LOS) of “C”. The intersection is expected to experience a delay of 35.2 seconds and an LOS of “D” during the *2028 Background* AM peak hour condition and 36.9 seconds and an LOS of “D” for *2028 Future* AM peak hour condition.
- During the *Existing* PM peak hour, this intersection currently experiences a delay of 47.5 seconds and an LOS of “D”. The delay is expected to be 57.6 seconds and the LOS will be “E” during the *2028 Background* PM peak hour condition. The delay will decrease to 44.8 seconds and the LOS will improve to “D”, during *2028 Future* PM peak hour condition.

- Therefore, no changes are recommended based on this Traffic Impact Study.

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

- The traffic signal at this intersection should be optimized for traffic conditions as they change. Because NCDOT has sole jurisdiction for the operation and maintenance of the signal, this should not be a responsibility of the development.
- This intersection was modeled as an “actuated-coordinated” intersection.
- The *Existing* AM peak hour intersection delay experienced by this intersection is currently 187.1 seconds and it is currently operating at an LOS of “F”. With the NCDOT intersection improvements in place, the intersection is expected to experience a delay of 36.8 seconds and an LOS of “D” during the *2028 Background* AM peak hour condition and 46.5 seconds and an LOS of “D” for *2028 Future* conditions.
- During the *Existing* PM peak hour, the intersection experiences an intersection delay of 150.2 seconds and an LOS of “F”. With the NCDOT intersection improvements in place, the delay is expected to be 36.0 seconds and the LOS will be “D” during the *2028 Background* PM peak hour condition. For the *2028 Future* PM peak hour condition, the delay will be 38.2 seconds and the LOS will remain “D”.

- Therefore, no additional geometric changes to this intersection, beyond the NCDOT STIP project, are recommended based on this Traffic Impact Study.

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

- The traffic signal at this intersection should be optimized for traffic conditions as they change.
- This intersection was modeled as an “actuated-coordinated” intersection.
- The **Existing** AM peak hour intersection delay experienced by this intersection is currently 29.1 seconds and it is currently operating at an LOS of “C”. The intersection is expected to experience a delay of 20.3 seconds and an LOS of “C” during the **2028 Background** AM peak hour condition and 20.6 seconds and an LOS of “C” for **2028 Future** conditions.
- During the **Existing** PM peak hour, the intersection experiences an intersection delay of 19.2 seconds and an LOS of “B”. The delay is expected to be 16.5 seconds and the LOS will be “B” during the **2028 Background** PM peak hour condition. For the **2028 Future** PM peak hour condition, the delay will be 17.9 seconds and the LOS will remain “B”.
- Therefore, no geometric changes to this intersection are recommended based on this Traffic Impact Study.

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

- This intersection is a three (3) legged intersection. It was modeled as an “Two-Way Stop Controlled” intersection, with a Stop sign on SR 3413 (South Bear Creek Road).
- During the **Existing** AM peak hour, the westbound South Bear Creek Road approach experiences 45.2 seconds of delay and an LOS of “E”. During the **2028 Background** AM peak hour condition, the westbound approach is expected to experience a delay of 124.7 seconds with an LOS of “F”. During the **2028 Future** AM peak hour condition, the westbound approach is expected to experience a delay of 463.1 seconds and an LOS of “F” if the intersection stays unsignalized. Assuming a traffic signal were to be installed in the Future condition, the AM peak hour LOS of the intersection is predicted to be “E” and the delay will be 55.8 seconds. The westbound approach level of service is expected to be 81.9 seconds with an LOS of “F”, but that is less delay than is predicted for the background condition.
- During the **Existing** PM peak hour, the westbound South Bear Creek Road approach experiences 226.6 seconds of delay and an LOS of “F”. During the **2028 Background** PM peak hour condition, the westbound approach is predicted to experience a delay of 474.8

seconds and an LOS of “F”. During the **2028 Future** PM peak hour condition, the unsignalized intersection westbound approach is expected to experience a delay of 782.8 seconds and an LOS of “F”. Assuming a traffic signal is installed in the Future condition, the PM peak hour LOS is predicted to be “E” and the delay will be 78.6 seconds. The westbound approach is predicted to experience a delay of 97.4 seconds with an LOS of “F”, which is less than the delay predicted to be experienced by the approach during background conditions.

- Mattern & Craig acknowledges the delay added to the westbound approach to this intersection. There are serious obstacles to installing turn lanes in this approach to the intersection, including a live stream with large box culvert on the northern side of SR 3413 and limited right of way with a rather steep grade on the southern side of SR 3413.
- As discussed above, the current and background conditions at this intersection is over capacity with significant delays. It is the position of Mattern & Craig that a traffic signal would improve the delays and queues. (See Table 9) This traffic signal would need to be coordinated with the recommended signal to the north and installed prior to the first certificate of occupancy. A signal warrant analysis has been performed assuming 12-hour volumes, and the analysis has determined that a signal is warrant, in the existing condition.

Warrants 2 (Four Hour Volumes) and 3 (Peak Hour) were met. (See Appendix F)

Intersection of SR 3412 Sand Hill Road and Wendover Road / Bear Creek Road

- This intersection was modeled as an “All-Way Stop Controlled” intersection.
- The **Existing** AM peak hour delay experienced by the northbound approach is 14.1 seconds and it is currently operating at an LOS of “B”. The northbound approach to the intersection is expected to experience a delay of 18.6 seconds and an LOS of “C” during the **2028 Background** AM peak hour condition and 32.3 seconds and an LOS of “D” for **2028 Future** conditions. Assuming a traffic signal is installed in the Future condition, the LOS of the northbound approach will improve to “C” and the delay will be 25.8 seconds. The delay experienced by the intersection as a whole is expected to be 32.7 seconds with an LOS of “C”.
- During the **Existing** PM peak hour, the northbound approach experiences a delay of 24.1 seconds and an LOS of “C”. The delay is expected to be 48.1 seconds and the LOS will be “E” during the **2028 Background** PM peak hour condition. For the **2028 Future** PM peak hour condition, the delay will be 99.9 seconds and the LOS will be “F” assuming the existing unsignalized condition. Assuming the installation of a traffic signal, the LOS of the

- northbound approach will decrease to 98.4 seconds, and the LOS would be “F”. The LOS of the intersection as a whole is predicted to be “E” and the delay will be 59.2 seconds.
- It is the opinion of Mattern & Craig that it should not be the responsibility of this project to bring the intersection approaches to a passing LOS, but rather to mitigate the additional traffic created by the project. Some approaches to this intersection will experience drops in LOS and additional delay due to the addition of a coordinated traffic signal. This is because the coordination plan considers both signals in the system, and may add delay for some approaches to one signal in order to minimize the delay for the system as a whole.
 - As discussed above, the current and background conditions at this intersection are over capacity with significant delays. It is the opinion of Mattern & Craig that a traffic signal would improve the delays and queues. (See Table 10) This signal should be coordinated with the recommended signal to the south and installed prior to the first certificate of occupancy. A signal warrant analysis was performed using 13-hour volumes. It was determined that a signal is currently warranted. Warrants 2 (Four Hour Volumes) and 3 (Peak Hour) were met. (See Appendix F)
 - This future intersection will serve the development as the primary access for ingress and egress. It will also serve as the primary access to the Crossroads Church.
 - This southbound approach to this future intersection is expected to operate at an LOS of “F” and “F” under the **2028 Future** conditions with a delay of 55.0 and 67.6 seconds for the AM and PM peak hours, respectively.
 - Mattern & Craig recommends the installation of dedicated right and left turn lanes with appropriate tapers and 100 feet of full storage. The recommended intersection improvements should be in place at the time of the approval of the first certificate of occupancy. A signal warrant analysis has been performed assuming the only the peak periods, since only peak hour trips were generated for the site traffic. The results of the warrant analysis indicate that a traffic signal would not be warranted at this location. (See Appendix F)

Intersection of SR 3413 (South Bear Creek Road) and Proposed Primary Site Access

Intersection of SR 3413 (South Bear Creek Road) and Proposed Secondary Site Access

- This future intersection will serve the development as the secondary access for ingress and egress. This intersection is a three (3) legged intersection. It was modeled as an “Two-Way Stop Controlled” intersection, with a Stop sign on southbound (Site Access). The eastbound left turn movement will not be permitted.

- The southbound approach to this future intersection is expected to operate at an LOS of “B” with 13.2 seconds of delay under the **2028 Future** AM peak hour conditions and an LOS of “C” with 15.9 seconds of delay under **2028 Future** PM peak hour conditions.

A more detailed description / discussion of each intersection and its traffic conditions can be found in the Capacity/Level of Service and Conclusions/Suggestions Sections of this report.

Introduction

A multi-use development, known as “Crossroads at West Asheville” is proposed on SR 3413 (South Bear Creek Road) in Buncombe County, NC. The development is expected to be built out in the year 2028. At the time the analysis was performed, the Crossroads at West Asheville development was proposing 601 mid-rise apartment units, 42 vacation rental units or apartment units, 147 senior housing units, 80,000 SF of self-storage space, 14,400 SF of retail space, and 63,000 SF of office space. This land use breakdown was part of the approved NCDOT checklist. The final proposed land use and densities have changed and now are as follows: 655 mid-rise apartment units, 147 senior housing units, 64,000 SF of self-storage space, 14,400 SF of retail space, and 50,400 SF of office space. The development is expected to be built out in the year 2028. (See Appendix A for proposed Site Plan)

Access to the site is provided by two (2) connections on South Bear Creek Road. The main site access will be shared with the Crossroads Church,

The scope of work (*study area*) for the traffic impact study was identified by Mattern & Craig with concurrence of NCDOT. Six (6) existing intersections were studied per instructions provided by NCDOT. Peak hour (7:00 am – 9:00 am and 4:00 pm – 6:00 pm) traffic counts were obtained at the study intersections on Tuesdays, Wednesdays, and Thursdays, during the months of May and June 2019. These counts were used to determine the actual peak hours and their existing traffic volumes. (See Appendix B for traffic counts)

The AM and PM Peak Hours were determined from these traffic counts and are based on the existing traffic conditions at each of the six (6) intersections. Although there are variations between intersections in the exact times for the peak hours, each actual peak hour was used, for a “worst case scenario”. Background and future volume projections were based on an historical growth rate of one and half (1.5) percent; therefore, no 2028 background scenario was analyzed.

The intersections that were studied are:

- NC 191 (Brevard Road) at I 240 EB Ramps
- NC 191 (Brevard Road) at I 40 EB Ramps
- NC 191 (Brevard Road) at SR 3413 (South Bear Creek Road)/I 40 WB Ramps
- SR 3413 (South Bear Creek Road) at Primary Entrance (Crossroads Church Driveway)
- SR 3413 (South Bear Creek Road) at SR 3412 (Sand Hill Road)
- SR 3412 (Sand Hill Road) at Bear Creek Road/Wendover Road

This study is based on information obtained during a typical weekday. According to the ***Traffic Control Devices Handbook*** published by the Institute of Transportation Engineers (ITE), a typical weekday is interpreted to be during a normal work week representing traffic that is usually and repeatedly found at the intersection.

Background

The subject site is located in Buncombe County, NC. Primary access to the site is provided by a loop driveway that connects to SR 3413 (South Bear Creek Road) in two locations. The primary access is proposed to be a full access driveway and the secondary access is proposed to be full access out, but restricted to right in only.

NC 191 (Brevard Road) is one of three major north/south corridors in Buncombe County. NC 191 (Brevard Road) connects US 25 (Asheville Highway) in Henderson County to US 19-23 Bus (Haywood Road) in Buncombe County. NC 191 (Brevard Road) also intersects with I-26, I-40, and I-240 in Buncombe County.

NC 191 (Brevard Road) varies in cross section throughout its length, from 2 to 5 lanes. There is a future NCDOT STIP project that will widen I-26 and improve the interchanges of NC 191 (Brevard Road) and I-40 Westbound and NC 191 (Brevard Road) and I-240 Eastbound.

The AADT for NC 191 (Brevard Road) in the area of this TIA is given by the NCDOT 2016 AADT Map as 18,000 south of SR 3413 (South Bear Creek Road) and 17,000 north of SR 3413 (South Bear Creek Road). (See Appendix C).



NC 191 (Brevard Road)



NC 191 (Brevard Road)



NC 191 (Brevard Road)

SR 3413 (South Bear Creek Road) is maintained by NCDOT as a secondary road. It connects NC 191 (Brevard Road) with SR 3412 (Sand Hill Road), and provides access to a recreational vehicle park. It has a two (2) lane cross section with grass shoulders for the majority of its length.



SR 3413 (South Bear Creek Road)



SR 3412 (Sand Hill Road)



SR 3413 (South Bear Creek Road)

SR 3412 (Sand Hill Road) is maintained by NCDOT as a secondary road. It connects NC 112 (Sand Hill/Sardis Road) with US 19-23 Bus (Haywood Road). It serves as a collector road, with residential uses.



Bear Creek Road

Wendover Road is maintained by the City of Asheville. It mainly serves residential uses.

See Figure 2 for existing lane geometry, intersection spacing, and existing traffic control treatments.

Full-turning movement traffic counts (7:00 am until 9:00 am and 4:00 pm until 6:00 pm) were collected at the intersections of:

- NC 191 (Brevard Road) at I 240 EB Ramps

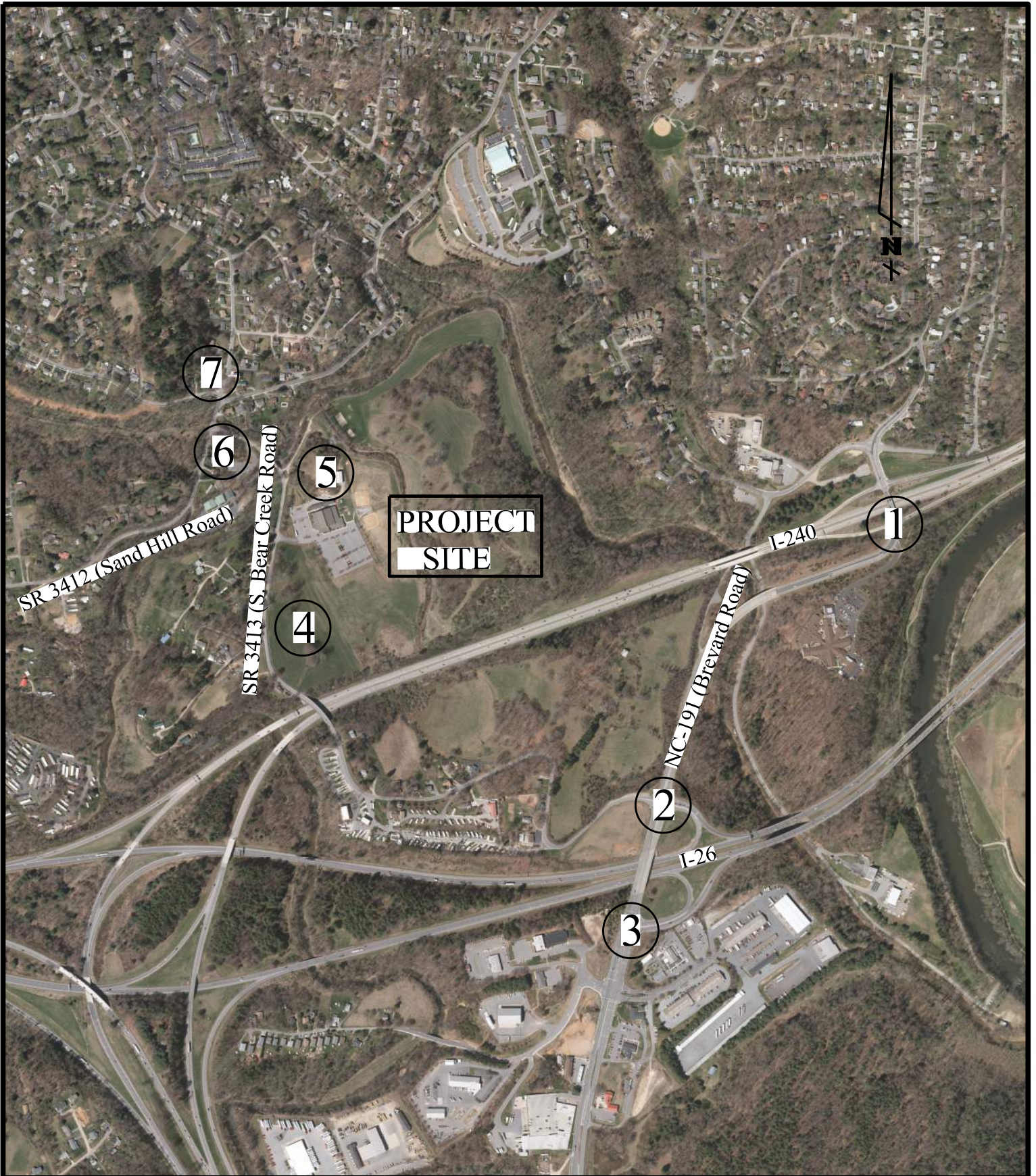


SR 3412 (Sand Hill Road)

- NC 191 (Brevard Road) at I 40 EB Ramps
- NC 191 (Brevard Road) at SR 3413 (South Bear Creek Road)/I 40 WB Ramps
- SR 3413 (South Bear Creek Road) at Primary Entrance (Crossroads Church Driveway)
- SR 3413 (South Bear Creek Road) at SR 3412 (Sand Hill Road)
- SR 3412 (Sand Hill Road) at Bear Creek Road/Wendover Road

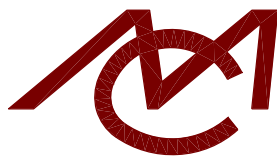
These counts were used to determine the actual peak hours and their existing traffic volumes. Counts were conducted on Tuesday, May 7, 2019 and Wednesday May 8. An additional volume only tube count was taken in the existing driveway to Crossroads Church.

Individual peak hour volumes at each intersection were used in the analyses to present a worst-case scenario. As such, some volume imbalances may exist between adjacent intersections.



SITE LOCATION

20 South Bear Creek Road
Asheville, NC



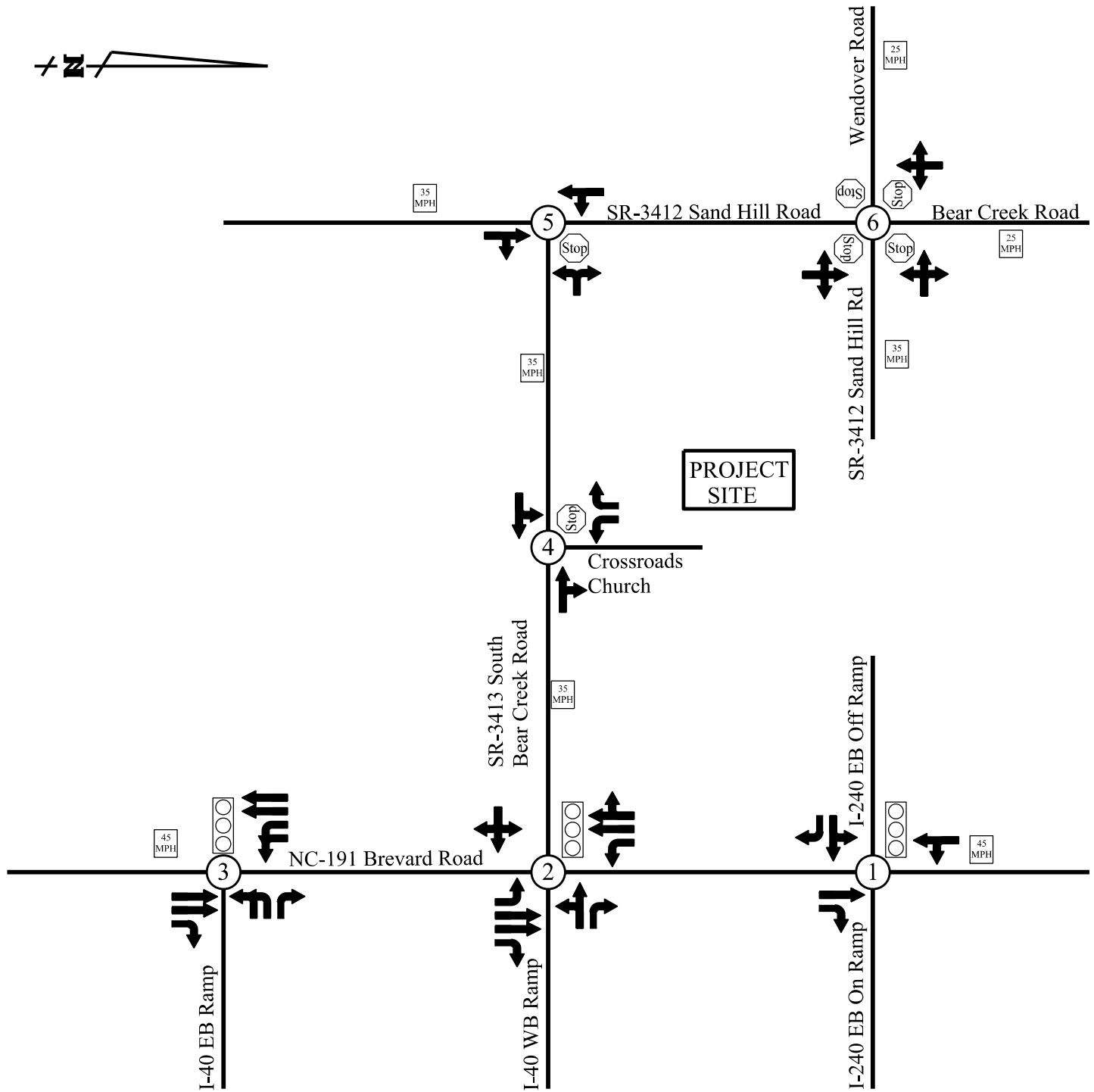
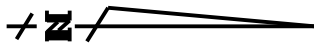
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Mattern & Craig

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

Figure:

1



LEGEND:

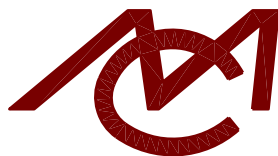
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 = EXISTING TRAFFIC SIGNAL

 = EXISTING LANE CONFIGURATION

EXISTING LANE GEOMETRY

20 South Bear Creek Road
Asheville, NC



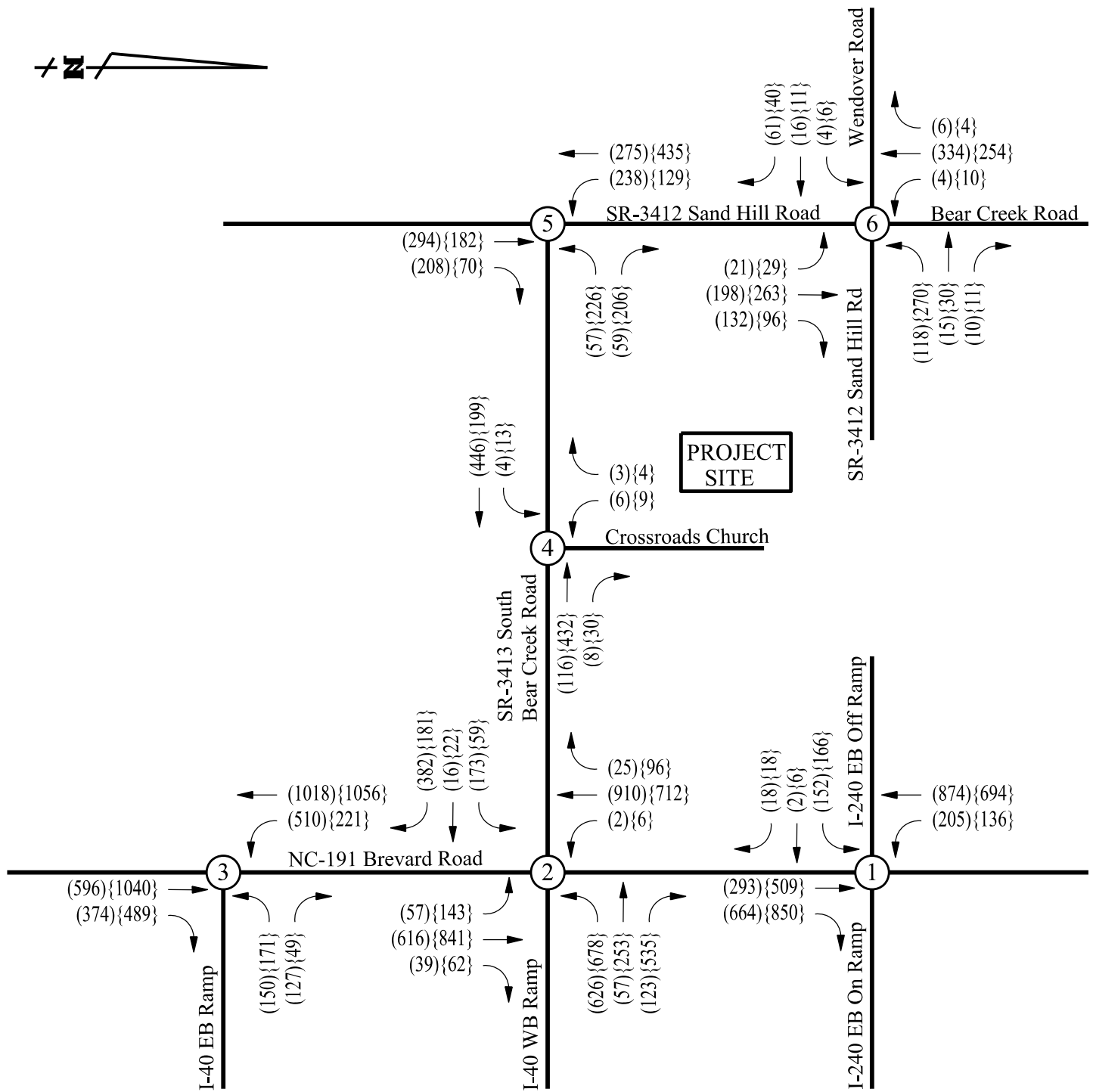
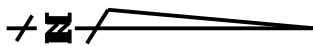
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Figure:

2

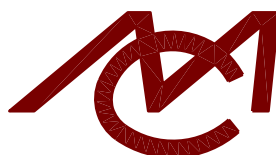


LEGEND:

(XX) = AM Traffic
{XX} = PM Traffic

EXISTING TRAFFIC VOLUMES

20 South Bear Creek Road
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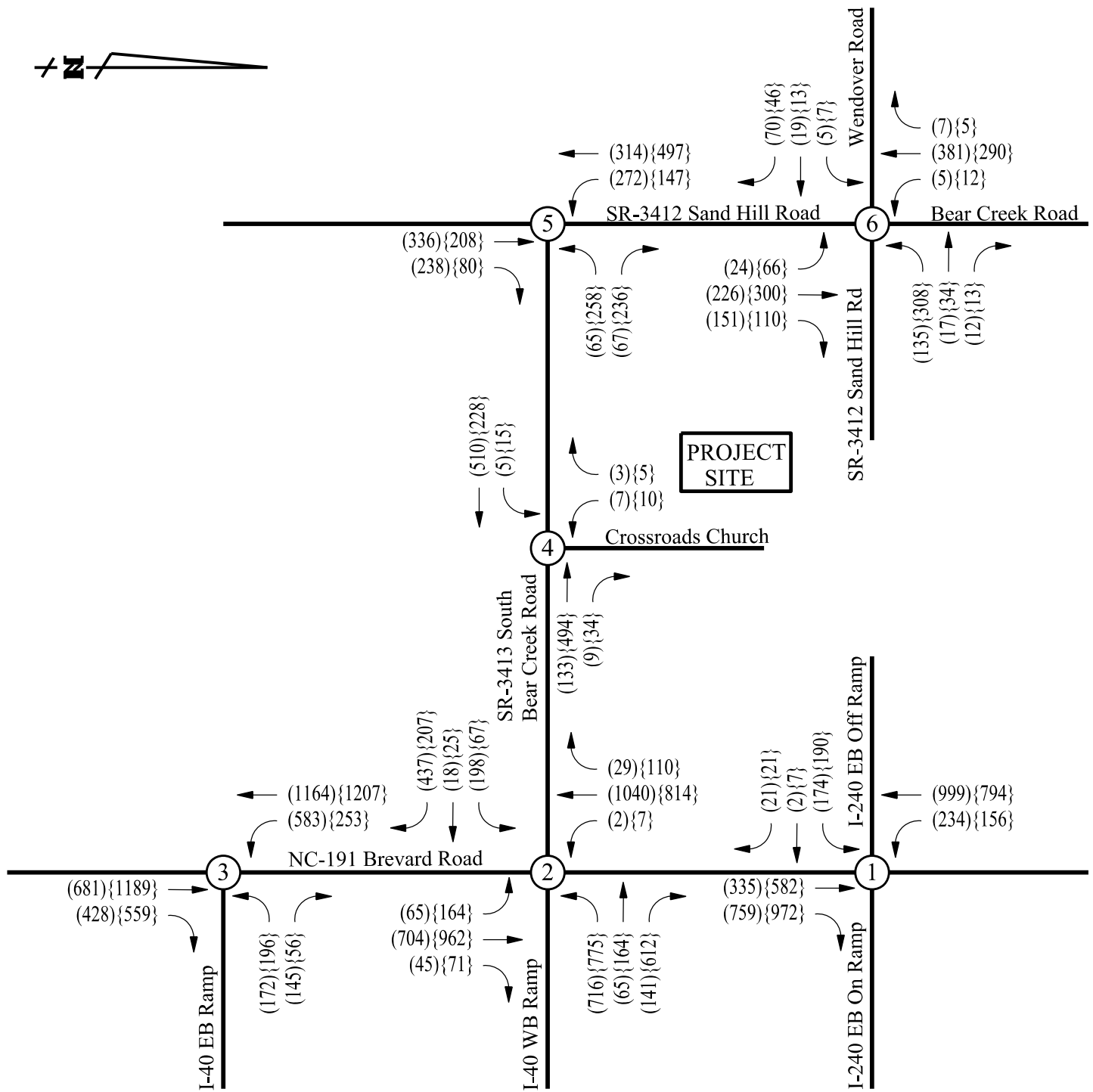
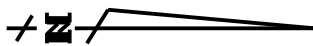
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Figure:

3



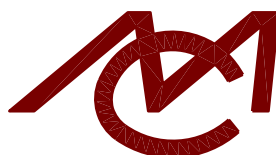
LEGEND:

(XX) = AM Traffic

{XX} = PM Traffic

2028 Background Traffic Volumes

20 South Bear Creek Road
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Figure:

4

Trip Generation

A multi-use development, known as “Crossroads at West Asheville” is proposed on SR 3413 (South Bear Creek Road) in Buncombe County, NC. The development is expected to be built out in the year 2028. At the time the analysis was performed, the Crossroads at West Asheville development was proposing 601 mid-rise apartment units, 42 vacation rental units or apartment units, 147 senior housing units, 80,000 SF of self-storage space, 14,400 SF of retail space, and 63,000 SF of office space. This land use breakdown was part of the approved NCDOT checklist. The final proposed land use and densities have changed and now are as follows: 655 mid-rise apartment units, 147 senior housing units, 64,000 SF of self-storage space, 14,400 SF of retail space, and 50,400 SF of office space.

The net difference between the trips generated by the analyzed land use, and the final proposed uses will be a reduction of 28 AM peak hour trips and 69 PM peak hour trips; therefore, this analysis examines a more conservative condition (See Tables 1a and 1b).

The estimated trips that would be generated by the development were determined using methodology contained in the ***Trip Generation Manual – 9th Edition*** that is published by the Institute of Transportation Engineers (ITE) and the ***Trip Generation Handbook – 3rd Edition*** (August 2014) also published by the Institute of Transportation Engineers (ITE). Specifically, the software program ***OTISS by Transoft*** was used to calculate the trips (See Tables 1a and 1b and Appendix D).

Based on the full-turning movement traffic counts collected on Tuesday and Wednesday, May 07-08, 2019, the AM peak hour occurred between 7:30 am and 8:30 am at all the study intersections. The PM peak hour occurred between 4:45 and 5:45 pm for all the study intersections with the exception of the intersection of NC 191 (Brevard Road) and I-40 Eastbound ramps, which has the PM peak hour at 4:30 pm to 5:30 pm. (See Appendix A). The actual peak hours at each intersection were evaluated in this study.

An annual traffic growth rate of one and half (1.5) percent was used for the background traffic volumes. For purposes of this study, the anticipated completion date is 2028; therefore, the one and half (1.5) percent growth rate is applicable for nine (9) years (See Figure 4).

Table 1a – Analyzed Land Use Trip Generation (Typical Weekday)

Land Use (ITE Code)	Intensity	Unit	ADT (vpd)	AM (vph)		PM (vph)	
				In	Out	In	Out
Self-Storage (151)	80,000	SF	121	5	3	6	8
Apartment (221)	296	Units	1,611	26	73	77	49
Apartment (221)	305	Units	1,661	26	76	79	50
Senior Adult Housing (252)	147	Units	566	10	19	21	17
Vacation Rentals (265)	42	Units	397	11	7	12	19
Office (710)	63,000	SF	646	93	13	23	108
Retail/Commercial (820)	7,360	SF	1,020	96	59	38	41
Retail/Commercial (820)	7,040	SF	989	96	59	36	40
Unadjusted Trips =				672		624	
Internal Capture Trips =				28		86	
Peak Hour New (Primary) Totals =				644		538	

Table 1b – Final Proposed Land Use Trip Generation (Typical Weekday)

Land Use (ITE Code)	Intensity	Unit	ADT (vpd)	AM (vph)		PM (vph)	
				In	Out	In	Out
Self-Storage (151)	64,000	SF	97	3	3	5	6
Apartment (221)	350	Units	1906	30	87	89	58
Apartment (221)	305	Units	1,661	26	76	79	50
Senior Adult Housing (252)	147	Units	566	10	19	21	17
Office (710)	50,400	SF	546	10	13	16	24
Retail/Commercial (820)	7,360	SF	1,020	96	59	38	41
Retail/Commercial (820)	7,040	SF	989	96	59	36	40
Unadjusted Trips =				638		538	
Internal Capture Trips =				22		84	
Peak Hour New (Primary) Totals =				616		455	
Net Difference in Trips =				-28		-69	

Land use code 151 is defined and described as a building in which a number of storage units or vaults are rented for the storage of goods. They are typically referred to as “self-storage” facilities. Each unit is physically separated from other units, and access is usually provided through an overhead door or other common access point.

Land use code 221 is defined and described as rental dwelling units that include apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have between three and 10 levels (floors).

Land use code 252 defined and described as senior adult housing consists of attached independent living developments, including retirement communities, age-restricted housing, and active adult communities. These developments may include limited social or recreational services. However, they generally lack centralized dining and onsite medical facilities. Residents in these communities live independently, are typically active (requiring little to no medical supervision) and may or may not be retired.

Land use code 710 is defined and described as a general office building houses multiple tenants; it is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services, insurance companies, investment brokers, and tenant services, such as a bank or savings and loan institution, a

restaurant, or cafeteria and service retail facilities.

Land use code 820 is defined and described as a shopping center is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center’s composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands.

Given the anticipated land use types, internal capture rates were used in this study (See Appendix D). However, pass-by trips rates are not applicable and therefore not included in this study.

Trip Distribution

Crossroads at West Asheville will be served by two (2) access points on South Bear Creek Road. The main site access will be shared with the Crossroads Church (See conceptual site plan in Appendix E of this report).

Traffic was distributed with respect to population centers and transportation corridors nearby to the site. It is expected that the majority of traffic will utilize NC 191 (Brevard Road), I-40 and I-240 for commuting purposes.

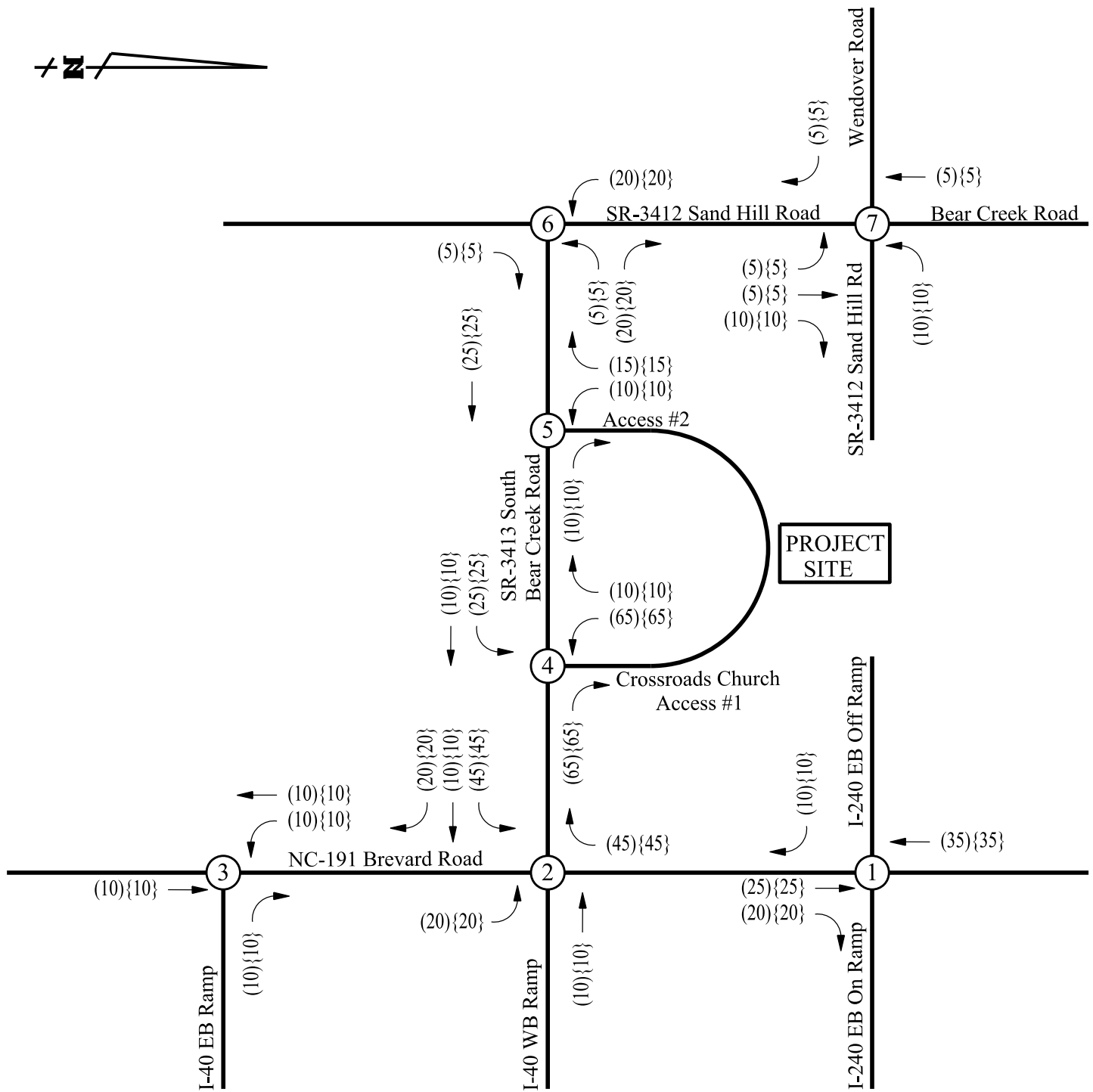
The site traffic was distributed throughout the surrounding roadways for all peak hours as follows:

- A majority of the traffic generated by Bear Creek Crossroads will utilize the primary access (75 percent) and twenty-five (25) percent using the secondary access.
- Twenty (20) percent of the site traffic is expected to utilize Bear Creek Road and Sand Hill Road to and from the north.
- Ten (10) percent of the traffic oriented to the south of the project will be via Brevard Road. Of the remaining southern oriented traffic, five (5) percent is expected to use Sand Hill Road.
- Ten (10) percent of the traffic oriented to the east will utilize I-40.
- Ten (10) percent of the traffic oriented to the west will utilize I-40.
- Fifty-five (55) percent of the traffic oriented northeast towards Asheville will utilize Brevard Road and I-240.

The AM and PM peak hour inbound and outbound trip distribution percentages for the trips are depicted on Figure 5.

Using the trip distribution rates from Figure 5, the traffic generated by Bear Creek Crossroads during the AM and PM peak hours is shown on Figure 6.

Figure 7 depicts the projected traffic from Bear Creek Crossroads added to the 2028 background traffic. This yields the build out traffic predicted for the year 2028 (2028 Future).

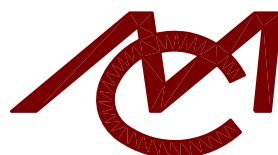


LEGEND:

(XX) = Percentage AM Traffic
{XX} = Percentage PM Traffic

TRIP DISTRIBUTION

20 South Bear Creek Road
Asheville, NC



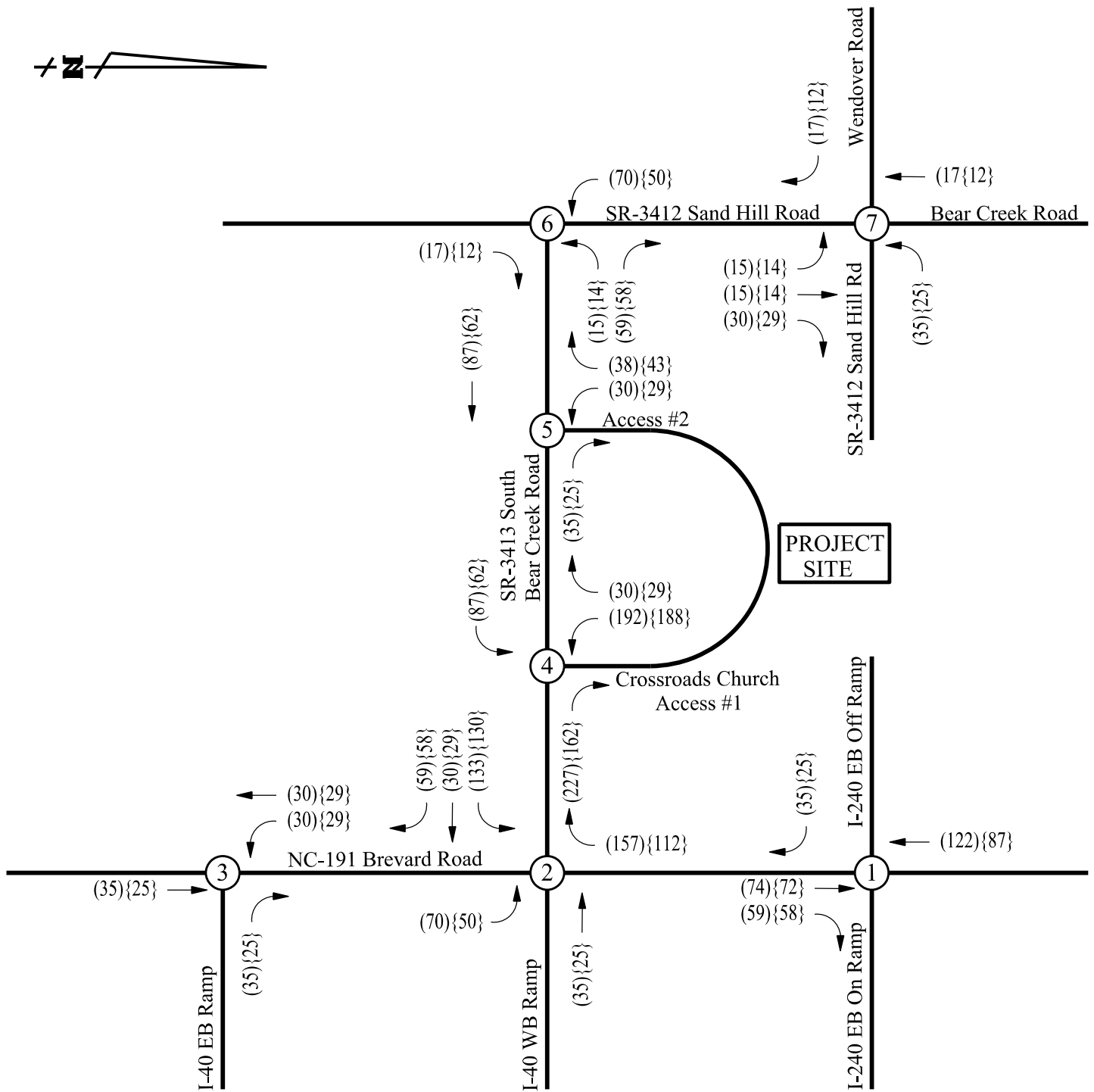
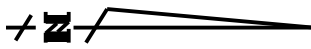
Mattern & Craig

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

Comm. No. 3968

Figure:

5



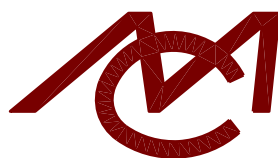
LEGEND:

(XX) = AM Traffic

{XX} = PM Traffic

LAND USE TRAFFIC VOLUMES

20 South Bear Creek Road
Asheville, NC



Comm. No. 3968

Mattern & Craig

ENGINEERS - SURVEYORS

FIRM LICENSE No. C-1154

12 BROAD STREET

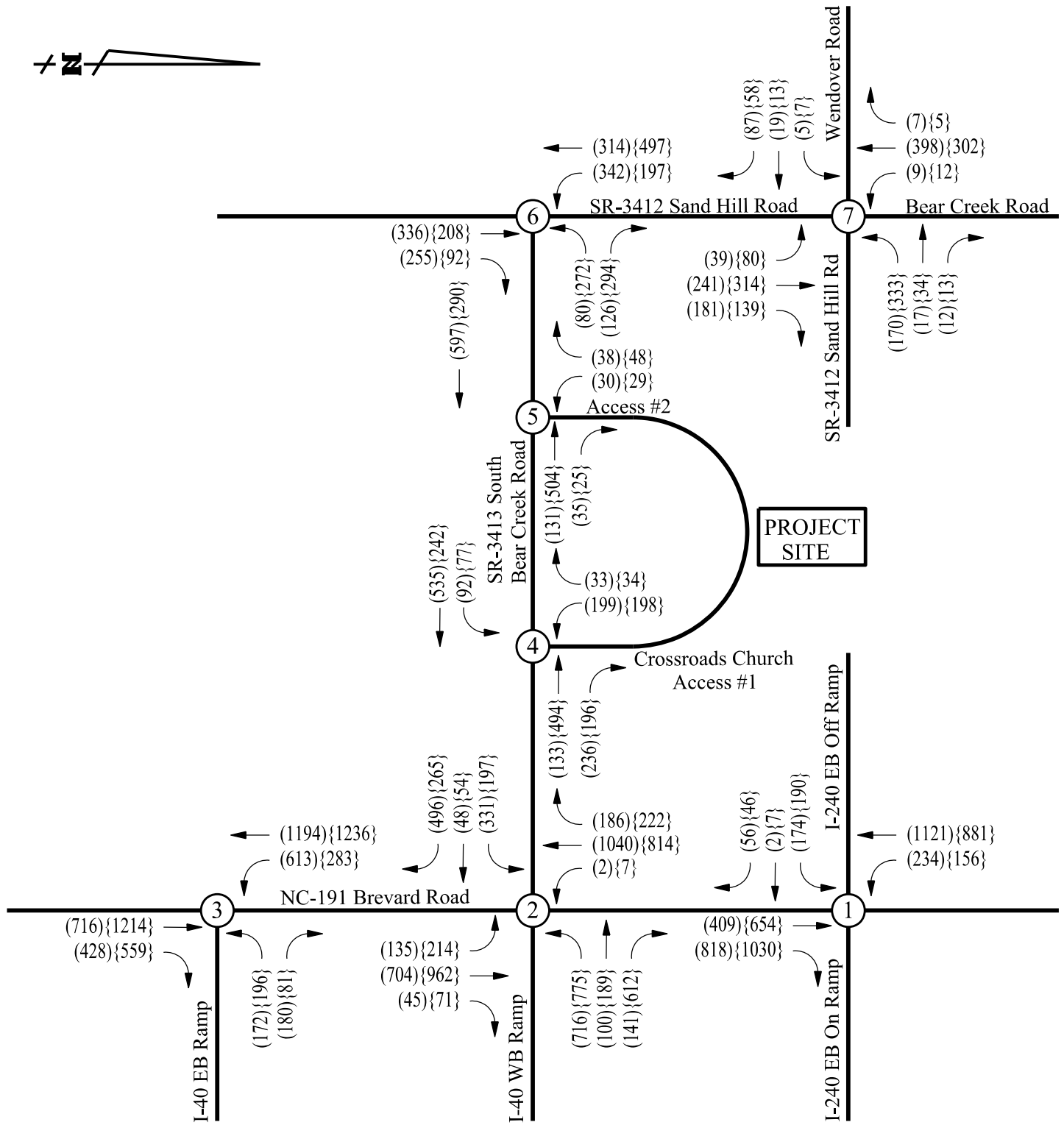
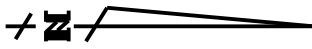
ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201

FAX (828) 254-4562

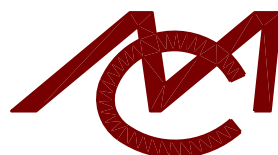
Figure:

6



Future Traffic Volumes

20 South Bear Creek Road
Asheville, NC



Mattern & Craig

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FIRM LICENSE No. C-1154

12 BROAD STREET
ASHEVILLE, NORTH CAROLINA 28801

(828) 254-2201

FAX (828) 254-4562

Comm. No. 3968

Figure:

7

Capacity/Levels of Service (LOS)

Unsignalized Intersections

Capacity, levels of service, and queue length analyses for the unsignalized intersections were completed using methodology contained in the software program *Synchro 10 with SimTraffic* published by Trafficware and the results are included in Appendix E of this report.

Factors affecting the capacity and level of service (LOS) at two-way, stop controlled (TWSC) and four-way stop controlled intersections (AWSC) include number and use of lanes, channelization, two-way left-turn lane (TWLTL) or raised or striped median storage (*or both*), approach grade, and existence of flared approaches on the minor street. Level of service (LOS) for these intersections is defined for each minor movement and not for the intersection as a whole. The LOS criteria are somewhat different from the criteria used for signalized intersections because most drivers expect to find higher traffic volumes and greater delay at signalized intersections. Levels of service still range from “A” describing best operating conditions to “F” describing worst conditions (See Table 2).

**Table 2 Unsignalized
Level of Service Criteria**

LEVEL OF SERVICE	CONTROL DELAY (seconds per vehicle)
	Unsignalized Intersections
A	≤ 10
B	>10 and 15
C	>15 and 25
D	>25 and 35
E	>35 and 50
F	>50

Source: Highway Capacity Manual, 6th Edition

Existing Traffic Conditions

SR 3413 (South Bear Creek Road) and Primary Site Access

The results of the capacity analyses at the TWSC intersection of **SR 3413 (South Bear Creek Road) and Primary Site Access** for the *Existing* AM and PM peak hours indicate that the level of service (LOS) for the southbound approach on the Site Access/Church is “B” with delays of 11.6 and 13.9 seconds, respectively.

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

The results of the capacity analyses at the TWSC intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek)** for the *Existing* AM and PM peak hours indicate that the level of service (LOS) for the westbound approach on the S. Bear Creek Road are “E” and “F” with delays of 45.2 and 226.6 seconds, respectively.

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

The results of the capacity analyses at the AWSC intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek) and Wendover Road** for the *Existing* AM peak hour indicates that the level of service (LOS) for overall intersection LOS is “B” with a delay of 13.6 seconds. The northbound and southbound on Bear Creek Road operate at an LOS of “B” and have delays of 14.1 seconds and 14.7 seconds, respectively.

The *Existing* PM peak hour indicates that the level of service (LOS)

for overall intersection LOS is “C” with a delay of 19.9 seconds. The northbound and southbound on Bear Creek Road operate at an LOS of “C” and have delays of 24.1 seconds and 15.6 seconds, respectively. The westbound approach on Sand Hill Road operates at an LOS of “C” and a delay of 19.5 seconds.

Background Traffic Conditions

SR 3413 (South Bear Creek Road) and Primary Site Access

The results of the capacity analyses for the *2028 Background* AM and PM peak hour conditions (*existing traffic volumes plus a growth rate of one and a half (1.5) percent for nine (9) years*) indicate that the level of service (LOS) for the intersection of **SR 3413 (South Bear Creek Road) and Primary Site Access** indicate that the level of service (LOS) for the southbound approach on the Site Access/Church are “B” and “C” with delays of 12.6 and 15.2 seconds, respectively.

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

The results of the capacity analyses at the TWSC intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek)** for the *2028 Background* AM and PM peak hours indicate that the level of service (LOS) for the westbound approach on the S. Bear Creek Road is “F” with delays of 124.7 and 474.8 seconds, respectively.

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

The results of the capacity analyses at the AWSC intersection of **SR**

3412 (Sand Hill Road) and SR 3413 (South Bear Creek) and Wendover Road for the *2028 Background* AM peak hour indicates that the level of service (LOS) for overall intersection LOS is “C” with a delay of 17.4 seconds. The northbound and southbound on Bear Creek Road operate at an LOS of “C” and have delays of 18.6 seconds and 19.6 seconds, respectively.

The *2028 Background* PM peak hour indicates that the level of service (LOS) for overall intersection LOS is “D” with a delay of 34.2 seconds. The northbound approach on Sand Hill Road will operate at an LOS of “E” with a delay of 48.1 seconds. The southbound approach on Bear Creek Road will operate at an LOS of “C” and experience a delay of 22.2 seconds. The westbound approach on Sand Hill Road operates at an LOS of “D” and a delay of 29.9 seconds.

Future (Build Out) Traffic Conditions

The *2028 Future (Existing traffic plus build-out traffic generated from the proposed development)* traffic volumes were used in the analysis of the *2028 Future* traffic conditions at the intersections in the study area.

SR 3413 (South Bear Creek Road) and Primary Site Access

The results of the capacity analyses for the *2028 Future* AM and PM peak hour conditions indicate that the level of service (LOS) for the intersection of **SR 3413 (South Bear Creek Road) and Primary Site Access** indicate that the level of service (LOS) for the southbound approach on the Site Access/Church is “F” with delays of 55.0 and 67.6 seconds, respectively.

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

The results of the capacity analyses at the TWSC intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek)** for the **2028 Future** AM and PM peak hours indicate that the level of service (LOS) for the westbound approach on the S. Bear Creek Road is “F” with delays of 463.1 and 782.8 seconds, respectively.

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

The results of the capacity analyses at the AWSC intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek) and Wendover Road** for the **2028 Future** AM peak hour indicates that the level of service (LOS) for overall intersection LOS is “F” with a delay of 348.8 seconds. The northbound and southbound on Bear Creek Road will operate at an LOS of “D” and will have delays of 32.2 seconds and 28.5 seconds, respectively. The westbound approach on Sand Hill Road will operate at an LOS of “C” and a delay of 16.1 seconds.

The **2028 Future** PM peak hour indicates that the level of service (LOS) for overall intersection LOS is “F” with a delay of 59.9 seconds. The northbound approach on Sand Hill Road will operate at an LOS of “F” and have a delay of 99.9 seconds. The southbound approach on Bear Creek Road will operate at an LOS of “D” with a delay of 28.5 seconds. The westbound approach on Sand Hill Road will operate at an LOS of “E” and a delay of 40.7 seconds.

SR 3413 (South Bear Creek Road) and Secondary Site Access

The results of the capacity analyses for the **2028 Future** AM and PM peak hour conditions indicate that the level of service (LOS) for the intersection of **SR 3413 (South Bear Creek Road) and Secondary Site Access** indicate that the level of service (LOS) for the southbound approach on the Site Access/Church are “B” and “C” with delays of 13.2 and 15.9 seconds, respectively.

Signalized Intersections

Performance measures used to analyze the operating conditions at signalized intersections include lane group capacities, critical volume to capacity ratios, average back of queues, and levels of service. The lane group capacity is defined as the maximum hourly rate at which vehicles can reasonably be expected to pass through the intersection under prevailing traffic, roadway, and signalization conditions. The critical v/c ratio, which is the volume to capacity ratio for the intersection as a whole, is an approximate indicator of the overall sufficiency of an intersection. *(It represents an absolute prediction of the total sufficiency of capacity in all critical lane groups – Traffic Engineering, Third Edition, Roess, Prassas, and McShane).* The back of queue is defined as the number of vehicles that are queued depending on arrival patterns of vehicles and vehicles that do not clear the intersection during a given green interval. Levels of service is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Levels of service range from “A” that describes the best operating conditions to “F” that

describes the worst operating conditions (See Table 3).

It is widely accepted in the traffic engineering profession that signalized intersections in urbanized areas be designed to operate at a level of service “D” or better (*Traffic Engineering Handbook, Fifth Edition*).

Table 3
Signalized Level of Service Criteria

LEVEL OF SERVICE	CONTROL DELAY (seconds per vehicle)
	Signalized Intersections
A	≤ 10
B	>10 and 20
C	>20 and 35
D	>35 and 55
E	>55 and 80
F	>80

Source: Highway Capacity Manual, 6th Edition

Capacity, levels of service, and queue length analyses for the signalized intersections were completed using methodology contained in the software program Synchro 10 with SimTraffic by Trafficware and the results are included in Appendix C. The signalized intersection was modeled as actuated, un-coordinated. Individual peak hour traffic volumes at the intersection was used, therefore some volume imbalances may occur. The signal cycle lengths and splits were optimized for all iterations of the analysis. This gives an equal baseline for analyzing the signals.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and I-249 EB Ramps** for the *Existing* AM Peak hour traffic volumes indicate that the level of service

(LOS) for the intersection as a whole is “C” with a delay of 24.6 seconds per vehicle. The LOS of the eastbound approach of the I-240 EB Ramp experiences a delay of 118.7 seconds and an LOS of “F”. Both movements at the eastbound approach operate at an LOS of “F” with delays of 123.0 seconds (EBL) and 81.2 seconds (EBR).

For the PM Peak hour under *Existing* traffic volumes, the level of service (LOS) for the intersection as a whole is “D” with a delay of 47.5 seconds per vehicle. The LOS of the southbound approach on Brevard Road experiences a delay of 87.4 seconds and an LOS of “F”. The LOS of the eastbound approach of the I-240 EB Ramp experiences a delay of 90.6 seconds and an LOS of “F”. The eastbound left turn movement operates at an LOS of “F” with a delay of 93.0 seconds.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and SR 3413 (S Bear Creek Road) and I-40 WB Ramps** for the *Existing* AM Peak hour traffic volumes indicate that the LOS for the intersection as a whole is “F” with a delay of 187.1 seconds per vehicle. The northbound approach on Brevard Road has a delay of 71.7 seconds and an LOS of “E”. The northbound left turn movement experiences an LOS of “F” and a delay of 121.2 seconds. The LOS for the southbound approach on Brevard Road is “F” with a delay of 194.4 seconds. Both southbound movements experience an LOS “F” and delays of 92.2 seconds (SBL) and 194.8 seconds (SBTR). The eastbound approach on S. Bear Creek

Road experiences an LOS “F” with a delay of 220.0 seconds. The westbound approach for the I-40 Ramps operates at an LOS of “F” with a delay of 257.1 seconds. The westbound left turn movement also operates at an LOS of “F” with a delay of 302.0 seconds.

For the PM Peak hour under *Existing* traffic volumes, the LOS for the intersection as a whole is “F” with a delay of 150.2 seconds per vehicle. The northbound approach on Brevard Road has a delay of 162.2 seconds and an LOS of “F”. The northbound left turn and through/right movements experience an LOS of “F” and delays of 243.6 seconds and 156.4 seconds, respectively. The LOS for the southbound approach on Brevard Road is “F” with a delay of 115.9 seconds. The southbound movement experiences an LOS “F” and delay of 116.2 seconds. The eastbound approach on S. Bear Creek Road experiences an LOS “F” with a delay of 117.8 seconds. The westbound approach for the I-40 Ramps operates at an LOS of “F” with a delay of 166.5 seconds. The westbound left turn movement also operates at an LOS of “F” with a delay of 254.5 seconds.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and I-40 EB Ramps** for the *Existing* AM Peak hour traffic volumes indicate that the LOS for the intersection as a whole is “C” with a delay of 29.1 seconds per vehicle. The westbound approach of the I-40 EB Ramps experiences a delay of 75.6 seconds and an LOS of “E”. The westbound left turn movement experiences an LOS of “E” with 71.6 seconds of delay.

For the PM Peak hour under *Existing* traffic volumes, the LOS for the intersection as a whole is “B” with a delay of 19.2 seconds per vehicle. The westbound approach of the I-40 EB Ramps experiences a delay of 89.3 seconds and an LOS of “F”. The westbound left turn movement experiences an LOS of “F” with 90.0 seconds of delay.

Background Conditions:

The *2028 Background* conditions (*existing traffic volumes plus a growth rate of one and a half (1.5) percent for nine (9) years*) were modeled in Synchro and SimTraffic using “worst case” conditions. The traffic signal in the *2028 Background* conditions was set to exclude right turns on red. Additionally, a NCDOT STIP project, I-2513, is planned in the area of this project. It will affect the intersections of NC 191 and I-40 and NC 191 and I-240. Since no formal plans were available, intersection improvements were obtained from public hearing plans. The Level of Service of these intersections should be greatly improved by the increased capacity of the intersections resulting from the construction of the project.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and I-249 EB Ramps** for the *2028 Background* AM Peak hour traffic volumes indicate that the level of service (LOS) for the intersection as a whole will be “D” with a delay of 35.2 seconds per vehicle. The LOS of the southbound approach of Brevard Road will experience a delay of 25.0 seconds

and an LOS of “C”. However, the southbound left turn movement will operate at an LOS of “F” with delays of 104.6 seconds. The northbound approach on Brevard Road will experience an LOS of “D” and a delay of 45.0 seconds. The northbound right turn movement will experience a delay of 59.2 seconds and an LOS of “E”.

For the PM Peak hour under **2028 Background** condition the LOS for the intersection as a whole will be “E” with a delay of 57.6 seconds per vehicle. The LOS of the southbound approach of Brevard Road will experience a delay of 45.0 seconds and an LOS of “D”. However, the southbound left turn movement will operate at an LOS of “F” with delays of 244.8 seconds. The northbound approach on Brevard Road will experience an LOS of “E” and a delay of 66.9 seconds. The northbound right turn movement will experience a delay of 100.7 seconds and an LOS of “F”.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and SR 3413 (S Bear Creek Road) and I-40 WB Ramps** for the **2028 Background** AM Peak hour traffic volumes indicate that the LOS for the intersection as a whole will be “D” with a delay of 36.8 seconds per vehicle. The northbound approach on Brevard Road will have a delay of 27.7 seconds and an LOS of “C”. The northbound left turn movement will experience an LOS of “F” and a delay of 82.1 seconds. The westbound approach for the I-40 Ramps will operate at an LOS of “D” with a delay of 48.5 seconds. The westbound left turn

movement will operate at an LOS of “E” with a delay of 57.5 seconds.

For the PM Peak hour under **2028 Background** traffic volumes the LOS for the intersection as a whole will be “D” with a delay of 36.0 seconds per vehicle. The northbound approach on Brevard Road will have a delay of 32.2 seconds and an LOS of “C”. The northbound left turn movement will experience an LOS of “E” and a delay of 57.8 seconds.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and I-40 EB Ramps** for the **2028 Background** AM Peak hour traffic volumes indicate that the LOS for the intersection as a whole will be “C” with a delay of 20.3 seconds per vehicle. All the approaches will operate at an LOS of “D” or better with a delay no greater than 40.0 seconds.

For the PM Peak hour under **2028 Background** traffic volumes, the LOS for the intersection as a whole will be “B” with a delay of 16.5 seconds per vehicle. All the approaches will operate at an LOS of “D” or better with a delay no greater than 48.0 seconds.

Future Conditions:

The **2028 Future** conditions (*Existing Condition volumes plus traffic generated by the proposed project*) were modeled in Synchro and SimTraffic using “worst case” conditions. The traffic signal in the **2028 Future** conditions was set to exclude right turns on red.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and I-249 EB Ramps** for the **2028 Future** AM Peak hour traffic volumes indicate that the level of service (LOS) for the intersection as a whole will be “D” with a delay of 36.3 seconds per vehicle. The LOS of the southbound approach of Brevard Road will experience a delay of 25.7 seconds and an LOS of “C”. However, the southbound left turn movement will operate at an LOS of “F” with delays of 118.4 seconds. The northbound approach on Brevard Road will experience an LOS of “D” and a delay of 46.5 seconds. The northbound right turn movement will experience a delay of 63.4 seconds and an LOS of “E”.

For the PM Peak hour under **2028 Future** condition the LOS for the intersection as a whole will be “D” with a delay of 44.8 seconds per vehicle. The LOS of the southbound approach of Brevard Road will experience a delay of 25.8 seconds and an LOS of “C”. However, the southbound left turn movement will operate at an LOS of “F” with delays of 146.6 seconds. The northbound approach on Brevard Road will experience an LOS of “D” and a delay of 49.7 seconds. The northbound right turn movement will experience a delay of 74.6 seconds and an LOS of “E”. The eastbound approach of the I-240 EB Ramp will operate at an LOS of “F” with a delay of 92.0 seconds.

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

The results of the capacity analyses at the intersection of **NC 191**

(Brevard Road) and SR 3413 (S Bear Creek Road) and I-40 WB Ramps for the **2028 Future** AM Peak hour traffic volumes indicate that the LOS for the intersection as a whole will be “D” with a delay of 46.5 seconds per vehicle. The northbound approach on Brevard Road will have a delay of 43.0 seconds and an LOS of “D”. The northbound left turn movement will experience an LOS of “F” and a delay of 141.4 seconds. The southbound approach on Brevard Road will experience an LOS of “E” and a delay of 57.5 seconds. The southbound through movement will operate at an LOS of “E” with a delay of 61.8 seconds. The westbound approach for the I-40 Ramps will operate at an LOS of “E” with a delay of 56.8 seconds. The westbound left turn movement will operate at an LOS of “E” with a delay of 70.4 seconds.

For the PM Peak hour under **2028 Future** traffic volumes the LOS for the intersection as a whole will be “D” with a delay of 38.2 seconds per vehicle. The northbound approach on Brevard Road will have a delay of 33.9 seconds and an LOS of “C”. The northbound left turn movement will experience an LOS of “E” and a delay of 68.9 seconds.

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

The results of the capacity analyses at the intersection of **NC 191 (Brevard Road) and I-40 EB Ramps** for the **2028 Future** AM Peak hour traffic volumes indicate that the LOS for the intersection as a whole will be “C” with a delay of 20.6 seconds per vehicle. All the approaches will operate at an LOS of “D” or better with a delay no greater than 38.5 seconds.

For the PM Peak hour under **2028 Future** traffic volumes, the LOS for the intersection as a whole will be “B” with a delay of 17.9 seconds per vehicle. All the approaches will operate at an LOS of “D” or better with a delay no greater than 46.4 seconds.

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

The results of the capacity analyses at the recommended signalized intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek)** for the **2028 Future** AM peak hour indicates that the level of service (LOS) for overall intersection LOS is “E” with a delay of 55.8 seconds. The southbound approach of Sand Hill Road and the westbound approach on South Bear Creek Road will operate an LOS of “F” with delays of 85.6 seconds and 81.9 seconds, respectively.

The **2028 Future** PM peak hour indicates that the level of service (LOS) for overall intersection LOS is “E” with a delay of 78.6 seconds. The southbound approach of Sand Hill Road and the westbound approach on South Bear Creek Road will operate an LOS of “F” with delays of 92.5 seconds and 97.4 seconds, respectively.

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

The results of the capacity analyses at the recommended signalized intersection of **SR 3412 (Sand Hill Road) and SR 3413 (South Bear Creek) and Wendover Road** for the **2028 Future** AM peak hour indicates that the level of service (LOS) for overall intersection LOS is “C” with a delay of 32.7 seconds. The westbound approach on Sand Hill Road

and westbound approach on Wendover Road will operate at an LOS of “E” and will have delays of 58.6 seconds and 63.3 seconds, respectively.

The **2028 Future** PM peak hour indicates that the level of service (LOS) for overall intersection LOS is “E” with a delay of 59.2 seconds. The northbound approach on Sand Hill Road will operate at an LOS of “F” and have a delay of 98.4 seconds. The southbound approach on Bear Creek Road will operate at an LOS of “C” with a delay of 23.6 seconds. The westbound approach on Sand Hill Road will operate at an LOS of “D” and a delay of 39.3 seconds. The eastbound approach on Wendover Road will operate at an LOS of “D” with a delay of 39.7 seconds.

**NC 191 (Brevard Road) at
I-240 EB Ramp
Table 4**

Approach	Peak Hour	Existing		Background		Future	
		LOS	Delay	LOS	Delay	LOS	Delay
Northbound (NC 191)	AM	A	7.8	D	45.0	D	46.5
	PM	A	9.7	E	66.9	D	49.7
Southbound (NC 191)	AM	C	24.4	C	25.0	C	25.7
	PM	F	87.4	D	45.0	C	25.8
Eastbound (I-250 EB Ramp)	AM	F	118.7	D	45.0	D	51.0
	PM	F	90.6	D	46.3	F	92.0



Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

Control delay is measured in seconds per vehicle

**NC 191 (Brevard Road) at
S. Bear Creek Road (SR 3413)/I-40 WB Ramps
Table 5**

Approach	Peak Hour	Existing		Background		Future	
		LOS	Delay	LOS	Delay	LOS	Delay
Northbound (NC 191)	AM	E	71.7	C	27.7	D	43.0
	PM	F	162.2	C	32.2	C	33.9
Southbound (NC 191)	AM	F	194.4	D	41.5	E	57.5
	PM	F	115.9	D	42.6	D	45.8
Eastbound (Bear Creek Road)	AM	F	220.0	C	23.7	C	23.5
	PM	F	117.8	C	23.8	C	26.4
Westbound (I-40 WB Ramps)	AM	F	257.1	D	48.5	D	56.8
	PM	F	166.5	D	37.5	D	40.4



Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

Control delay is measured in seconds per vehicle

**NC 191 (Brevard Road) at
I-40 EB Ramps
Table 6**

Approach	Peak Hour	Existing		Background		Future	
		LOS	Delay	LOS	Delay	LOS	Delay
Northbound (NC 191)	AM	C	20.8	C	21.6	C	22.7
	PM	B	13.0	B	16.9	B	18.3
Southbound (NC 191)	AM	C	26.0	B	15.8	B	15.8
	PM	B	14.5	B	10.5	B	12.1
Westbound (I-40 EM Ramps)	AM	E	75.6	D	40.0	D	38.5
	PM	F	89.3	D	48.0	D	46.4



Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

Control delay is measured in seconds per vehicle

**SR 3413 (South Bear Creek Road) at
Access #1
Table 7**

Approach	Peak Hour	Existing		Background		Future	
		LOS	Delay	LOS	Delay	LOS	Delay
Southbound (Access #1)	AM	B	11.6	B	12.6	F	55.0
	PM	B	13.9	C	15.2	F	67.6
Eastbound (SR 3413)	AM	A	0.1	A	0.1	A	1.2
	PM	A	0.5	A	0.5	A	2.3
Westbound (SR 3413)	AM	A	0.0	A	0.0	A	0.0
	PM	A	0.0	A	0.0	A	0.0



Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

Control delay is measured in seconds per vehicle

**SR 3413 (South Bear Creek Road) at
Access #2
Table 8**

Approach	Peak Hour	Future	
		LOS	Delay
Southbound (Access #1)	AM	B	13.2
	PM	C	15.9
Eastbound (SR 3413)	AM	A	0.0
	PM	A	0.0
Westbound (SR 3413)	AM	A	0.0
	PM	A	0.0

Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

Control delay is measured in seconds per vehicle

**SR 3413 (S Bear Creek Road) at
SR 3412 (Sand Hill Road)
Table 9**

Approach	Peak Hour	Existing		2028 Background		2028 Future		2028 Future	
		Stop Condition		Stop Condition		Stop Condition		Signal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Northbound (SR 3412)	AM	A	0.0	A	0.0	A	0.0	B	13.4
	PM	A	0.0	A	0.0	A	0.0	B	10.8
Southbound (SR 3412)	AM	A	4.5	A	0.1	A	6.0	F	85.6
	PM	A	1.9	A	1.9	A	2.4	F	92.5
Westbound (SR 3413)	AM	E	45.2	F	124.7	F	463.1	F	81.9
	PM	F	226.6	F	474.8	F	782.8	F	97.4



Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

**SR 3412 (Sand Hill Road)/ Wendover Road
at SR 3413 (Bear Creek Road)
Table 10**

Approach	Peak Hour	Existing		2028 Background		2028 Future		2028 Future	
		Stop Condition		Stop Condition		Stop Condition		Signal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Northbound (SR 3412)	AM	B	14.1	C	18.6	D	32.3	C	25.8
	PM	C	24.1	E	48.1	F	99.9	F	98.4
Southbound (SR 3413)	AM	B	14.7	C	19.6	D	28.5	B	19.9
	PM	C	15.6	C	22.2	D	28.5	C	23.6
Eastbound (Wendover Rd)	AM	A	9.9	B	10.9	B	12.4	E	63.3
	PM	B	10.7	B	12.3	B	13.7	D	39.7
Westbound (SR 3412)	AM	B	11.6	B	13.1	C	16.1	E	58.6
	PM	C	19.5	D	29.9	E	40.7	D	39.3



Exceeds NCDOT Thresholds

*Delay increases by 25% or greater while maintaining the same LOS, or
LOS degrades by at least one level, or
LOS is "F"*

Conclusion/Suggestions

A multi-use development, known as “Crossroads at West Asheville” is proposed on SR 3413 (South Bear Creek Road) in Buncombe County, NC. The development is expected to be built out in the year 2028. At the time the analysis was performed, the Crossroads at West Asheville development was proposing 601 mid-rise apartment units, 42 vacation rental units or apartment units, 147 senior housing units, 80,000 SF of self-storage space, 14,400 SF of retail space, and 63,000 SF of office space. This land use breakdown was part of the approved NCDOT checklist. The final proposed land use and densities have changed and now are as follows: 655 mid-rise apartment units, 147 senior housing units, 64,000 SF of self-storage space, 14,400 SF of retail space, and 50,400 SF of office space.

The net difference between the trips generated by the analyzed land use, and the final proposed uses will be a reduction of 28 AM peak hour trips and 69 PM peak hour trips; therefore, this analysis examines a more conservative condition (See Tables 1a and 1b).

SR 3413 (South Bear Creek Road) is maintained by NCDOT as a secondary roadway and runs east to west from NC 191 (Brevard Road) to SR 3412 (Sand Hill Road). Access to the site is provided by two (2) connections on SR 3413 (South Bear Creek Road). One (1) access is south of the Hominy Creek bridge and one (1) access is on the north of the I-240 overpass.

In accordance with NCDOT TIA Guidelines, the signalized intersections were modeled as being part of a

coordinated system. During the analyses, levels of service may change in unexpected fashions due to coordination of the system as a whole. Certain intersections may have a change in Level of Service grade to show a decrease in delay even with additional traffic in the background or future time periods. This is usually the result of cycle length optimization. The minimum cycle length allowed was 90 seconds for a three-phase signal and 120 for a 4 phase. Synchro modeling software predicted that certain cycle lengths greater than 180 seconds would be the most efficient for the system during several peak hour time periods.

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

Note: An NCDOT STIP project, I-2513, is planned in the area of this project. It will affect the intersections of NC 191 and I-40 and NC 191 and I-240. The Level of Service of these intersections should be greatly improved by the increased capacity of the intersections resulting from the construction of the project. (See Appendix H)

For modeling purposes, right turns on red were prohibited. Additionally, all left turns with dedicated left turn lanes were modeled as protected only. The signalized intersections were modeled as being part of a coordinated system.

This traffic impact study (TIS) has demonstrated that it is reasonable to

conclude that the construction of Crossroads at West Asheville should not have a significant adverse impact on the surrounding roadway network.

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

- The traffic signal at this intersection should be optimized for traffic conditions as they change. Because NCDOT has sole jurisdiction for the operation and maintenance of the signal, this should not be a responsibility of the development.
- This intersection was modeled as an “actuated-coordinated” intersection.
- During the *Existing* AM peak hour condition, this intersection is experiencing a delay of 24.6 seconds and an Level of Service (LOS) of “C”. The intersection is expected to experience a delay of 35.2 seconds and an LOS of “D” during the **2028 Background** AM peak hour condition and 36.9 seconds and an LOS of “D” for **2028 Future** AM peak hour condition.
- During the *Existing* PM peak hour, this intersection currently experiences a delay of 47.5 seconds and an LOS of “D”. The delay is expected to be 57.6 seconds and the LOS will be “E” during the **2028 Background** PM peak hour condition. The delay will decrease to 44.8 seconds and the LOS will improve to “D”, during **2028 Future** PM peak hour condition.
- Therefore, no changes are recommended based on this Traffic Impact Study.

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

- The traffic signal at this intersection should be optimized for traffic conditions as they change. Because NCDOT has sole jurisdiction for the operation and maintenance of the signal, this should not be a responsibility of the development.
- This intersection was modeled as an “actuated-coordinated” intersection.
- The *Existing* AM peak hour intersection delay experienced by this intersection is currently 187.1 seconds and it is currently operating at an LOS of “F”. With the NCDOT intersection improvements in place, the intersection is expected to experience a delay of 36.8 seconds and an LOS of “D” during the **2028 Background** AM peak hour condition and 46.5 seconds and an LOS of “D” for **2028 Future** conditions.
- During the *Existing* PM peak hour, the intersection experiences an intersection delay of 150.2 seconds and an LOS of “F”. With the NCDOT intersection improvements in place, the delay is expected to be 36.0 seconds and the LOS will be “D” during the **2028 Background** PM peak hour condition. For the **2028 Future** PM peak hour condition, the delay will be 38.2 seconds and the LOS will remain “D”.
- Therefore, no additional geometric changes to this intersection, beyond the NCDOT

STIP project, are recommended based on this Traffic Impact Study.

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

- The traffic signal at this intersection should be optimized for traffic conditions as they change. Because NCDOT has sole jurisdiction for the operation and maintenance of the signal, this should not be a responsibility of the development.
- This intersection was modeled as an “actuated-coordinated” intersection.
- The **Existing** AM peak hour intersection delay experienced by this intersection is currently 29.1 seconds and it is currently operating at an LOS of “C”. The intersection is expected to experience a delay of 20.3 seconds and an LOS of “C” during the **2028 Background** AM peak hour condition and 20.6 seconds and an LOS of “C” for **2028 Future** conditions.
- During the **Existing** PM peak hour, the intersection experiences an intersection delay of 19.2 seconds and an LOS of “B”. The delay is expected to be 16.5 seconds and the LOS will be “B” during the **2028 Background** PM peak hour condition. For the **2028 Future** PM peak hour condition, the delay will be 17.9 seconds and the LOS will remain “B”.
- Therefore, no geometric changes to this intersection are recommended based on this Traffic Impact Study.

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

- This intersection is a three (3) legged intersection. It was modeled as an “Two-Way Stop Controlled” intersection, with a Stop sign on SR 3413 (South Bear Creek Road)
- During the **Existing** AM peak hour, the westbound South Bear Creek Road approach experiences 45.2 seconds of delay and an LOS of “E”. During the **2028 Background** AM peak hour condition, the westbound approach is expected to experience a delay of 124.7 seconds with an LOS of “F”. During the **2028 Future** AM peak hour condition, the westbound approach is expected to experience a delay of 463.1 seconds and an LOS of “F” if the intersection remains unsignalized. Assuming a traffic signal to be installed in the Future condition, the AM peak hour LOS of the intersection is predicted to be “E” and the delay will be 55.8 seconds. The westbound approach level of service is expected to be 81.9 seconds with an LOS of “F”, but that is less delay than is predicted for the background condition.
- During the **Existing** PM peak hour, the westbound South Bear Creek Road approach experiences 226.6 seconds of delay and an LOS of “F”. During the **2028 Background** PM peak hour condition, the westbound approach is predicted to experience a delay of 474.8

seconds and an LOS of “F”. During the **2028 Future** PM peak hour condition, the unsignalized intersection westbound approach is expected to experience a delay of 782.8 seconds and an LOS of “F”. Assuming a traffic signal to be installed in the Future condition, the PM peak hour LOS is predicted to be “E” and the delay will be 78.6 seconds. The westbound approach is predicted to experience a delay of 97.4 seconds with an LOS of “F”, which is less than the delay predicted to be experienced by the approach during background conditions.

- Mattern & Craig acknowledges the delay added to the westbound approach to this intersection. There are serious obstacles to installing turn lanes in this approach to the intersection, including a live stream with large box culvert on the northern side of SR 3413 and limited right of way with a rather steep grade on the southern side of SR 3413.
- As discussed above, the current and background conditions at this intersection is over capacity with significant delays. It is the position of Mattern & Craig that a traffic signal would improve the delays and queues. (See Table 9) This traffic signal would need to be coordinated with the recommended signal to the north and installed prior to the first certificate of occupancy. A signal warrant analysis has been performed assuming 12-hour volumes, and the analysis has determined that a signal is warrant, in the existing condition.

Warrants 2 (Four Hour Volumes) and 3 (Peak Hour) were met. (See Appendix F)

Intersection of SR 3412 Sand Hill Road and Wendover Road / Bear Creek Road

- This intersection was modeled as an “All-Way Stop Controlled” intersection.
- The **Existing** AM peak hour delay experienced by the northbound approach is 14.1 seconds and it is currently operating at an LOS of “B”. The northbound approach to the intersection is expected to experience a delay of 18.6 seconds and an LOS of “C” during the **2028 Background** AM peak hour condition and 32.3 seconds and an LOS of “D” for **2028 Future** conditions. Assuming a traffic signal to be installed in the Future condition, the LOS of the northbound approach will improve to “C” and the delay will be 25.8 seconds. The delay experienced by the intersection as a whole is expected to be 32.7 seconds with an LOS of “C”.
- During the **Existing** PM peak hour, the northbound approach experiences a delay of 24.1 seconds and an LOS of “C”. The delay is expected to be 48.1 seconds and the LOS will be “E” during the **2028 Background** PM peak hour condition. For the **2028 Future** PM peak hour condition, the delay will be 99.9 seconds and the LOS will be “F” assuming the existing unsignalized condition. Assuming the installation of a traffic signal, the LOS of the

- northbound approach will decrease to 98.4 seconds, and the LOS would be “F”. The LOS of the intersection as a whole is predicted to be “E” and the delay will be 59.2 seconds.
- It is the opinion of Mattern & Craig that it should not be the responsibility of this project to bring the intersection approaches to a passing LOS, but rather to mitigate the additional traffic created by the project. Some approaches to this intersection will experience drops in LOS and additional delay due to the addition of a coordinated traffic signal. This is because the coordination plan considers both signals in the system, and may add delay for some approaches to one signal in order to minimize the delay for the system as a whole.
 - As discussed above, the current and background conditions at this intersection are over capacity with significant delays at times during the day. It is the position of Mattern & Craig that a traffic signal would improve the overall delays and queues. (See Table 10) This traffic signal would need to be coordinated with the recommended signal to the south and installed prior to the first certificate of occupancy. A signal warrant analysis has been performed assuming 12-hour volumes, and the analysis has determined that a signal is warranted, in the existing condition. Warrants 2 (Four Hour Volumes) and 3 (Peak Hour) were met. (See Appendix F)

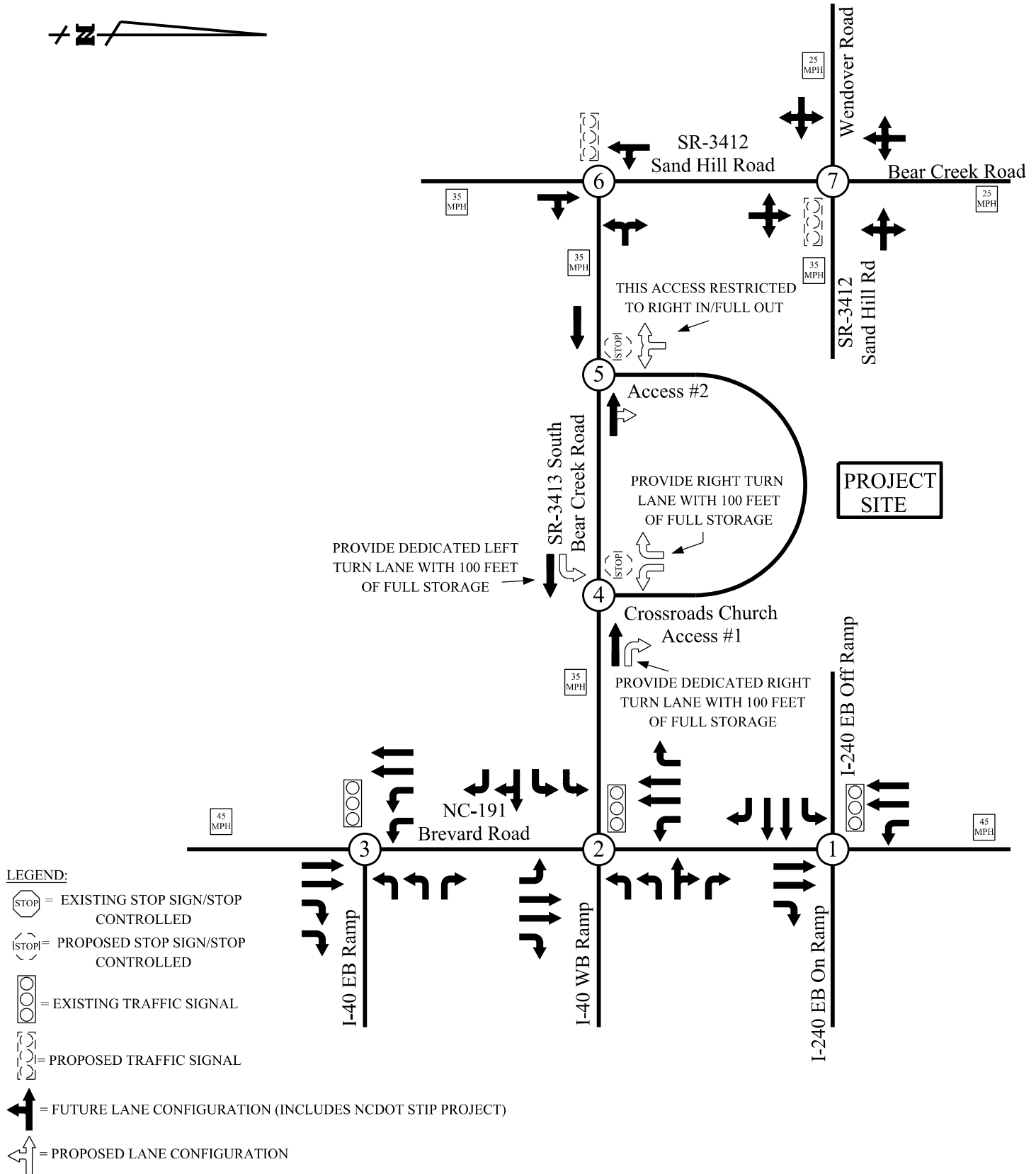
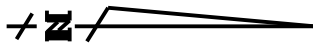
Intersection of SR 3413 (South Bear Creek Road) and Proposed Primary Site Access

- This future intersection will serve the development as the primary access for ingress and egress. It will also serve as the primary access to the Crossroads Church.
- This southbound approach to this future intersection is expected to operate at an LOS of “F” and “F” under the **2028 Future** conditions with a delay of 55.0 and 67.6 seconds for the AM and PM peak hours, respectively.
- Mattern & Craig recommends the installation of dedicated right and left turn lanes with appropriate tapers and 100 feet of full storage. The stated intersection improvements should be in place at the time of the approval of the first certificate of occupancy. A signal warrant analysis has been performed assuming the only the peak periods, since only peak hour trips were generated for the site traffic. The results of the warrant analysis indicate that a traffic signal would not be warranted at this location. (See Appendix F)

Intersection of SR 3413 (South Bear Creek Road) and Proposed Secondary Site Access

- This future intersection will serve the development as the secondary access for ingress and egress. This intersection is a three (3) legged intersection. It was modeled as an “Two-Way Stop Controlled” intersection, with a Stop sign on southbound (Site

- Access). The eastbound left turn movement will not be permitted.
- The southbound approach to this future intersection is expected to operate at an LOS of “B” with 13.2 seconds of delay under the **2028 Future** AM peak hour conditions and an LOS of “C” with 15.9 seconds of delay under **2028 Future** PM peak hour conditions.



LEGEND:

 = EXISTING STOP SIGN/STOP CONTROLLED

 = PROPOSED STOP SIGN/STOP CONTROLLED

 = EXISTING TRAFFIC SIGNAL

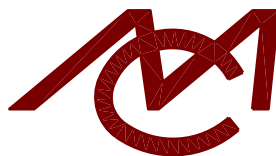
 = PROPOSED TRAFFIC SIGNAL

 = FUTURE LANE CONFIGURATION (INCLUDES NCDOT STIP PROJECT)

 = PROPOSED LANE CONFIGURATION

Future Lane Configuration

20 South Bear Creek Road
Asheville, NC



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

Figure:

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