



**Old Bunn Road Subdivision**  
Traffic Impact Analysis

November 7, 2024

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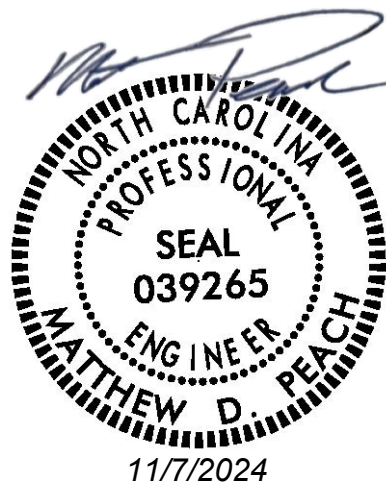
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## Executive Summary

The proposed Old Bunn Road Subdivision is located along Old Bunn Road in Zebulon, NC. Currently, the 159.48-acre site consists of open space. Construction of the site is anticipated to be completed in 2028. At full build-out, the site will consist of 357 single-family detached houses and 260 townhomes. Access to the site is envisioned to be provided by two (2) full-movement access points along Old Bunn Road.

Using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 11<sup>th</sup> Edition<sup>4</sup>, it is estimated that the site will generate 5,185 new daily trips going to and from the site, with 367 trips in the AM peak hour (91 entering, 276 exiting), and 481 trips in the PM peak hour (297 entering, 184 exiting). Traffic analysis was completed for both the AM and PM peak hours during the years 2024 (existing) and 2028 (future no-build and build).

Based on the anticipated operations of the study area network, the following off-site improvements are recommended to be completed as part of the proposed development.

### Old Bunn Road at Parks Village Road

- No improvements are recommended at this intersection

### Old Bunn Road at Barrington Run Boulevard

- No improvements are recommended at this intersection

### US 264 EB Ramps at NC 97

- Monitor the intersection for the installation of a traffic signal. If a signal is found to be warranted before full build-out of the proposed development, it is recommended that the cost of the signal be pro-rata across all known development projects impacting the intersection.

The installation of a traffic signal at the US 264 eastbound ramps at NC 97 are also shown to reduce approach delays and have the intersection operate at an acceptable level of service. These signals are not anticipated to be needed for acceptable operations during the initial phases of development as the intersections operate at LOS F in the PM peak hour but lower delays in the AM peak hour under 2028 no-build traffic conditions. During peak hours, it is not uncommon for unsignalized side street approaches to operate with high delays. The traffic on the main line of NC 97 operates without delay resulting in minimal delay overall at the intersection. In-order to merit the installation of a traffic signal, the Manual on Uniform Traffic Control Devices (MUTCD) establishes nine warrants for the installation of a traffic signal. Three of these nine warrants involve traffic volumes at the intersection that occur over eight, four, and one hour periods. Accordingly, it is recommended that the intersection be monitored to determine the necessity and appropriate time to install a traffic signal as approved by NCDOT.



## US 264 WB Ramps at NC 97

- Monitor the intersection for the installation of a traffic signal. If a signal is found to be warranted before full build-out of the proposed development, it is recommended that the cost of the signal be pro-rata across all known development projects impacting the intersection.

The installation of a traffic signal at the US 264 westbound ramps at NC 97 are also shown to reduce approach delays and have the intersection operate at an acceptable level of service. These signals are not anticipated to be needed for acceptable operations during the initial phases of development as the intersections operate at LOS F in the PM peak hour but lower delays in the AM peak hour under 2028 no-build traffic conditions. During peak hours, it is not uncommon for unsignalized side street approaches to operate with high delays. The traffic on the main line of NC 97 operates without delay resulting in minimal delay overall at the intersection. In-order to merit the installation of a traffic signal, the Manual on Uniform Traffic Control Devices (MUTCD) establishes nine warrants for the installation of a traffic signal. Three of these nine warrants involve traffic volumes at the intersection that occur over eight, four, and one hour periods. Accordingly, it is recommended that the intersection be monitored to determine the necessity and appropriate time to install a traffic signal as approved by NCDOT.

## NC 97 at Old Bunn Road

- Construct an exclusive southbound right-turn lane with 350 feet of full-width storage and appropriate taper
- Construct an exclusive eastbound left-turn lane with 450 feet of full-width storage and appropriate taper
- Install a traffic signal at the intersection

## NC 97 at NC 39

- No improvements are recommended at this intersection

## NC 39 at Old Bunn Road

- No improvements are recommended at this intersection

## Old Bunn Road at Site Access A

- Construct Access A as a full-movement access point with one ingress lane and one egress lane
- Provide Access A with a minimum of 100 feet of internal stem length
- Construct an exclusive westbound right-turn lane with 50' of full-width storage and appropriate taper

## Old Bunn Road at Site Access B

- Construct Access B as a full-movement access point with one ingress lane and one egress lane
- Provide Access B with a minimum of 100 feet of internal stem length
- Construct an exclusive westbound right-turn lane with 50' of full-width storage and appropriate taper

A summary of the level of service and delay for this report is shown in Table ES-1. The recommended improvements are shown in Figure ES-1.



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

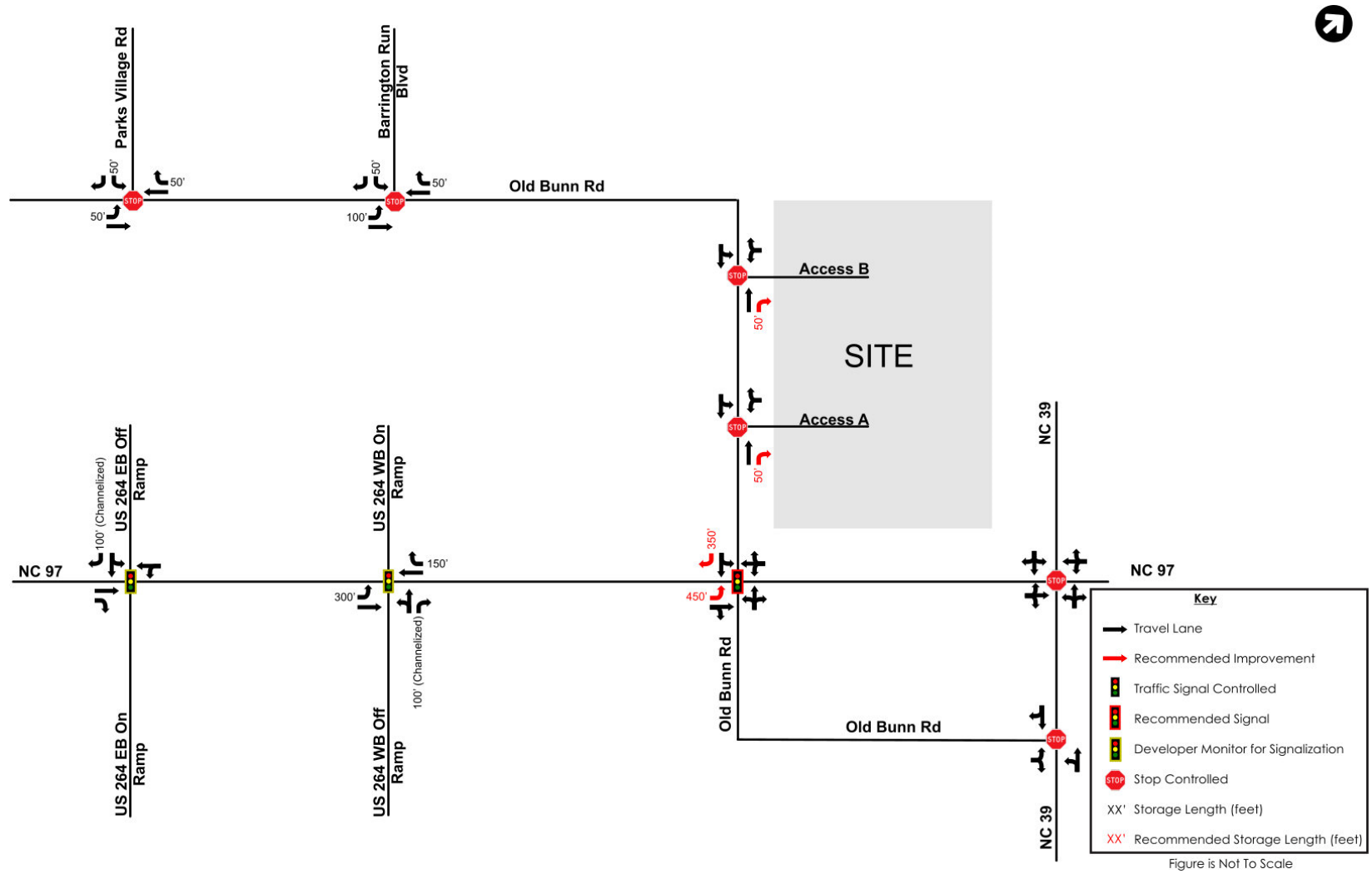
**Table ES-1: Level of Service Summary**

Level of Service (Delay, sec/veh)	2024 Existing		2028 No Build		2028 Build		2028 Build with Improvements	
	AM	PM	AM	PM	AM	PM	AM	PM
Old Bunn Road at Parks Village Road	A (9.6)	B (10.2)	B (10.7)	B (12.0)	B (11.0)	B (12.5)		
Old Bunn Road at Barrington Run Boulevard	A (9.8)	B (10.3)	B (13.4)	C (16.9)	B (14.1)	C (18.3)		
US 264 EB Ramps at NC 97	C (15.3)	C (21.0)	C (20.4)	F (66.2)	E (40.8)	F (#)	B (10.3)	B (14.5)
US 264 WB Ramps at NC 97	C (17.9)	D (27.4)	D (27.4)	F (64.4)	F (53.8)	F (211.4)	A (8.9)	A (9.3)
NC 97 at Old Bunn Road	B (14.0)	C (16.4)	C (20.4)	F (105.1)	F (123.6)	F (#)	C (21.2)	C (23.8)
NC 97 at NC 39	B (10.5)	C (15.1)	B (11.1)	C (16.9)	B (10.8)	C (15.2)		
NC 39 at Old Bunn Road	A (9.9)	A (9.9)	A (9.9)	B (10.0)	B (10.0)	B (10.0)		
Old Bunn Road at Site Access A					C (19.0)	D (26.7)	C (18.4)	C (23.6)
Old Bunn Road at Site Access B					C (15.4)	C (19.2)	B (14.9)	C (17.4)

# delay exceeding 400 seconds per vehicle was noted on the lane group



Figure ES-1: Recommended Improvements





# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Introduction

November 7, 2024

## 1.0 INTRODUCTION

The proposed Old Bunn Road Subdivision is located along Old Bunn Road in Zebulon, Wake County, NC. Currently, the 159.48-acre site consists of open space. The development's location is illustrated in Figure 1. Construction of the site is anticipated to be completed in 2028.

The traffic analysis will consider future build conditions at the build-out year (i.e. 2028). The AM and PM peak hours will be analyzed for each scenario. These scenarios are provided below:

- 2024 Existing;
- 2028 No-Build;
- 2028 Build; and
- 2028 Build with Improvements.

At full build-out, the site is envisioned to consist of 357 single-family detached homes and 260 townhomes. An annotated site plan prepared by Pabst Design Group, PA can be found in Figure 2. A full-sized and unedited copy of the site plan can be found in the appendix.

The purpose of this report is to evaluate the development in terms of projected vehicular traffic conditions, evaluate the ability of the adjacent roadways to accommodate the additional traffic, and to recommend transportation improvements needed to mitigate congestion that may result from additional site traffic. This report presents trip generation, trip distribution, traffic analyses, and recommendations for improvements needed to meet anticipated traffic demands.

## 2.0 INVENTORY OF TRAFFIC CONDITIONS

### 2.1 STUDY AREA

Stantec coordinated with Town of Zebulon and North Carolina Department of Transportation (NCDOT) representatives to determine the appropriate study area and discuss design assumptions. Correspondence regarding the scoping of this study is included in the appendix. It was agreed that the following existing intersections will be analyzed to determine the impacts associated with the proposed development:

- Old Bunn Road at Parks Village Road
- Old Bunn Road at Barrington Run Boulevard
- US 264 Eastbound On / Off Ramps at NC 97
- US 264 Westbound On / Off Ramps at NC 97
- NC 97 at Old Bunn Road
- NC 97 at NC 39
- NC 39 at Old Bunn Road



# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Inventory of Traffic Conditions  
November 7, 2024

## 2.2 PROPOSED ACCESS

Access to the site is envisioned to be provided by two (2) access points along Old Bunn Road as shown on the site plan in Figure 2. A description of each site access is provided in Table 1.

**Table 1: Proposed Access**

Proposed Access	Level of Access	Intersection Control	Direction of Travel	Adjacent Intersection	Distance and Direction from Adj. Intersection
Access A	Full-Movement	Two-Way Stop Control	Ingress and Egress	NC 97 at Old Bunn Road	600 feet West
Access B	Full-Movement	Two-Way Stop Control	Ingress and Egress	NC 97 at Old Bunn Road	1,200 feet West

## 2.3 EXISTING ROADWAY CONDITIONS

Table 2 provides a detailed description of the existing study area roadway network. All functional classification and average annual daily traffic (AADT) information, where available, was obtained from NCDOT from the Go! NC GIS database. The existing roadway laneage is illustrated in Figure 3.

**Table 2: Existing Roadway Conditions**

Road Name	Road Number	Primary Cross-Section	NCDOT Functional Classification <sup>1</sup>	2021 AADT <sup>2</sup> (vpd)	Speed Limit (mph)	Maintenance Agency <sup>3</sup>
Old Bunn Road	SR 2320	2-Lane Undivided	Major Collector	1,400	Unposted*	NCDOT
Parks Village Road	SR 2341	2-Lane Undivided	Local	-	45	NCDOT
Barrington Run Boulevard	-	2-Lane Divided	Local	-	25	Town of Zebulon
US 264	US 264	4-Lane Divided	Other Principal Arterial	30,500	70	NCDOT
NC 97	NC 97	2-Lane Undivided	Minor Arterial	4,300	55	NCDOT
NC 39	NC 39	2-Lane Undivided	Minor Arterial	4,400	55	NCDOT

\*For Synchro analysis, used 55 mph

\*\*For Synchro analysis, used 35 mph



# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Inventory of Traffic Conditions  
November 7, 2024

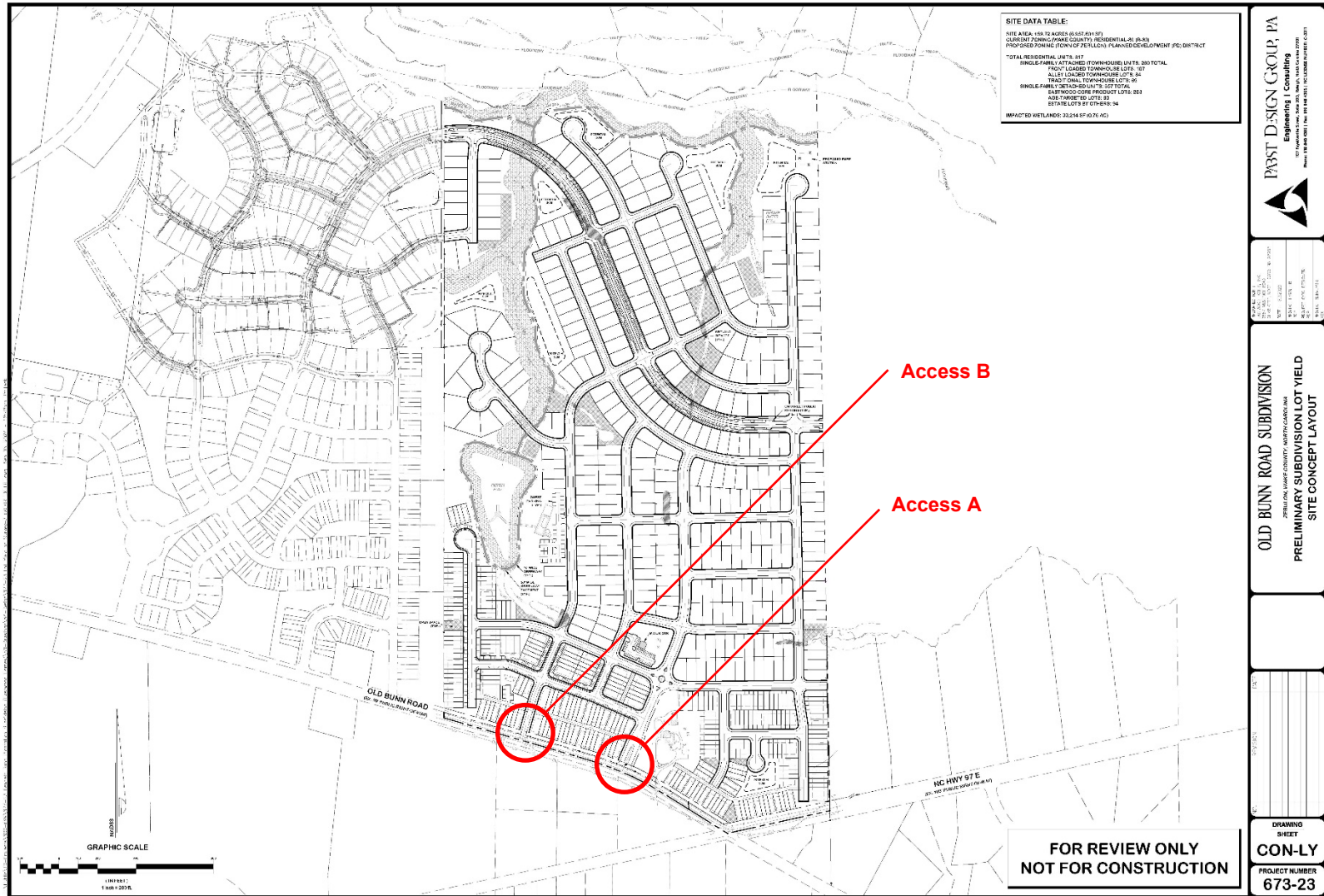
Figure 1: Study Area



# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Inventory of Traffic Conditions  
November 7, 2024

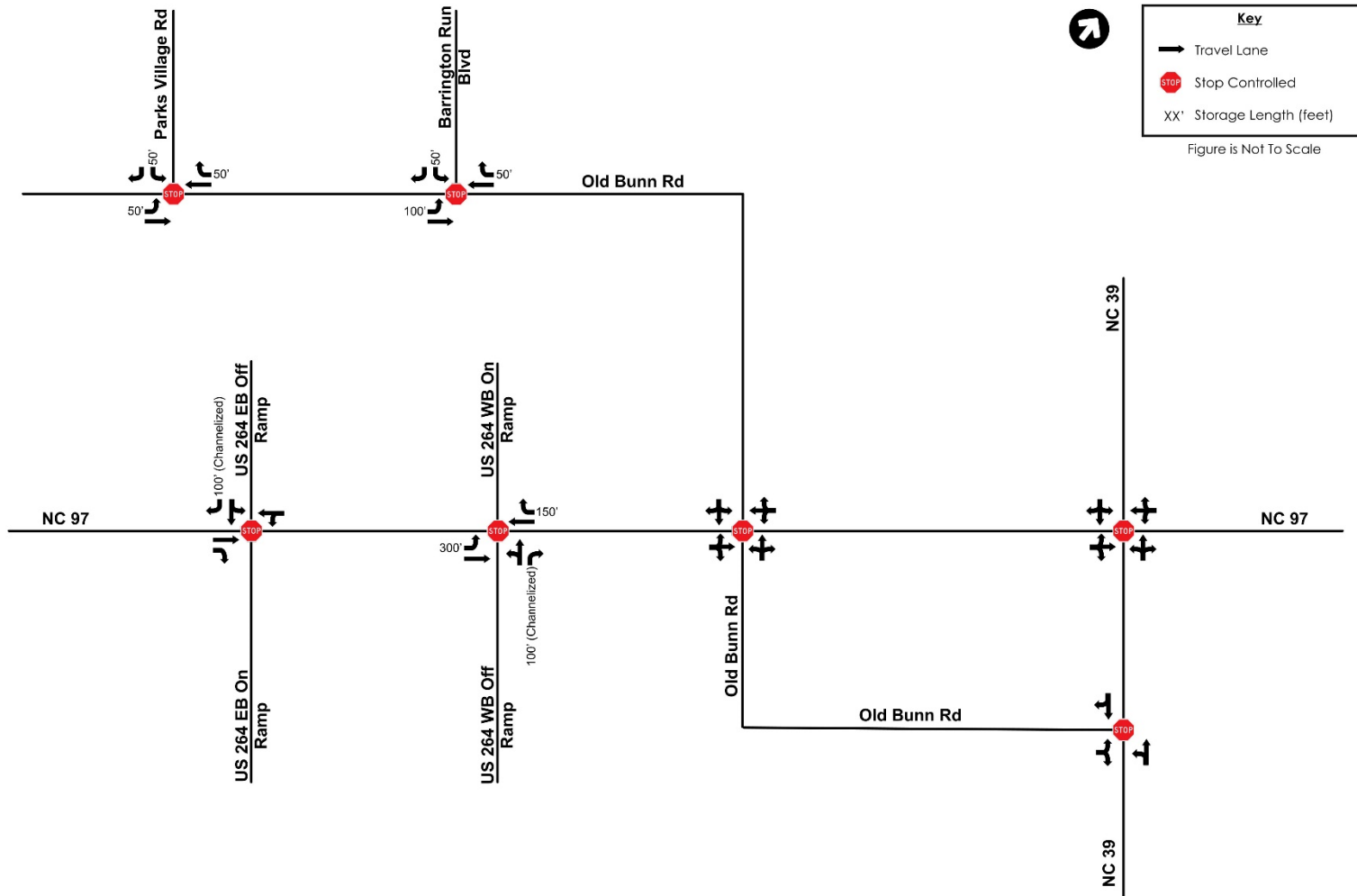
## Figure 2: Annotated Site Plan



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

Inventory of Traffic Conditions  
November 7, 2024

**Figure 3: Existing Roadway Laneage**



### 3.0 TRIP GENERATION

Trip generation for the proposed development was performed using the 11<sup>th</sup> Edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual<sup>4</sup>. The suggested methods contained in the Rate versus Equation spreadsheet published by NCDOT<sup>5</sup> was also consulted prior to performing trip generation. The trip generation for the proposed development is shown in Table 3.

**Table 3: Trip Generation**

Land Use	ITE LUC	Size	Daily Trips	AM Peak Hour Trips			PM Peak Hour Trips		
			Total	Total	Enter	Exit	Total	Enter	Exit
Single Family Detached Housing	210	357 d.u.	3254	237	59	178	329	207	122
Single Family Attached Housing	215	260 d.u.	1951	130	32	98	152	90	62
Total			5185	367	91	276	481	297	184

### 4.0 TRIP DISTRIBUTION

To accurately determine the effect of the proposed development on the surrounding roadway network, an estimate of the expected distribution of traffic entering and exiting the site is needed. These percentages were developed using a combination of existing traffic volume counts, historic AADTs provided by NCDOT, and engineering judgement. This trip distribution was submitted as part of NCDOT’s TIA Scoping Checklist contained in the appendix. All traffic volume calculations can be found in the appendix.

The following percentages were used in the AM and PM peak hours. These percentages are also shown in Figure 4.

- 40% to/from the west on US 264;
- 20% to/from the east on US 264;
- 20% to/from the south on NC 97;
- 10% to/from the west on Old Bunn Road;
- 5% to/from the south on NC 39;
- 3% to/from the north on NC 39; and
- 2% to/from the north on NC 97.

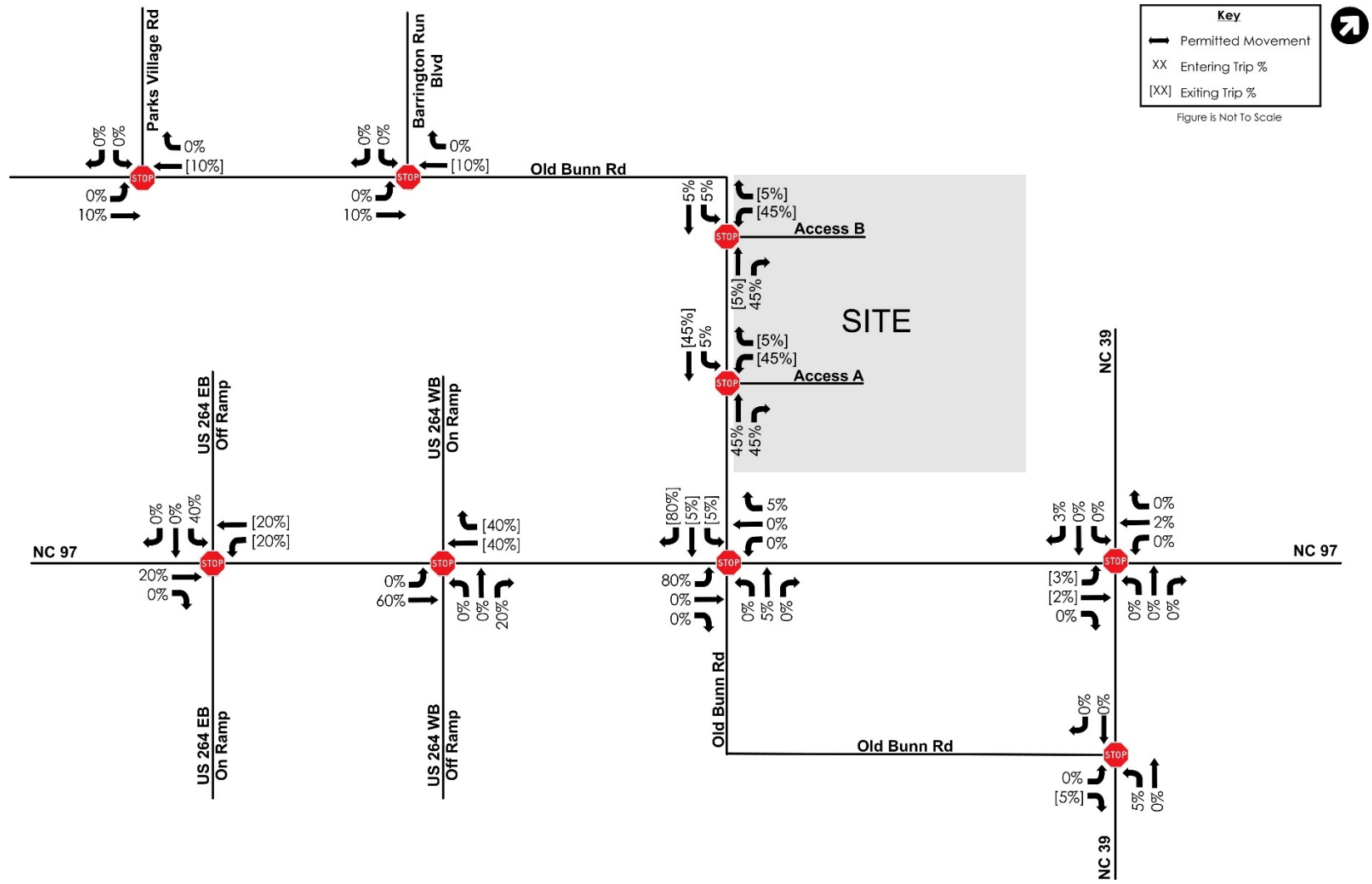
The trip generation volumes in Table 3 were applied to the network according to the trip distribution percentages above. The resulting site trip turning movement volumes are shown in Figure 5.



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

Trip Distribution  
November 7, 2024

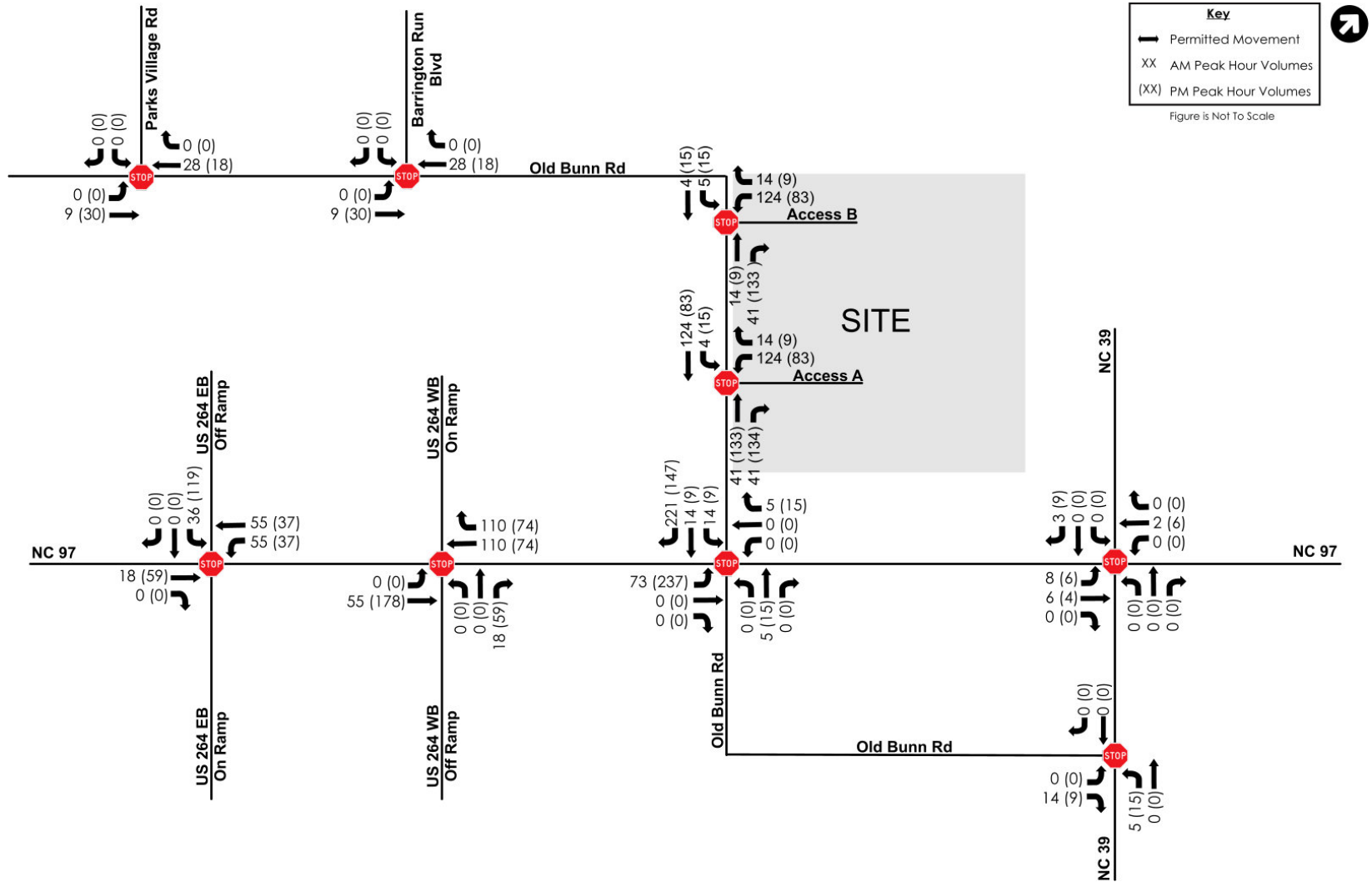
**Figure 4: Site Trip Distribution**



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

Trip Distribution  
November 7, 2024

**Figure 5: Site Trip Assignment**





## OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Traffic Volumes  
November 7, 2024

### 5.0 TRAFFIC VOLUMES

#### 5.1 DATA COLLECTION

Morning (7:00-9:00 AM) and evening (4:00-6:00 PM) turning movement counts were collected by National Data & Surveying Services on Thursday, May 23, 2024, at the following locations:

- Old Bunn Road at Barrington Run Boulevard
- US 264 Eastbound Ramps at NC 97
- US 264 Westbound Ramps at NC 97
- NC 97 at Old Bunn Road

Additionally, the following locations were counted during the morning (7:00-9:00 AM) and evening (4:00-6:00 PM) periods on Thursday, June 5, 2024 by National Data & Surveying Services:

- Old Bunn Road at Parks Village Road
- NC 97 at NC 39
- NC 39 at Old Bunn Road

It should be noted that traditional calendar schools were in session when the counts were performed. The count data is categorized by cars, heavy trucks, bicycles, and pedestrians.

Traffic counts were not balanced due to the low volume roads and distances between study intersections.

The 2024 existing AM and PM peak hour volumes are shown in Figure 6. Raw count data for these locations as well as all traffic volume calculations are included in the appendix.

#### 5.2 APPROVED DEVELOPMENT TRAFFIC

There are two (2) approved developments within the study area. Those are, Barrington Residential and Woodland Crossing.

##### 5.2.1 Barrington Residential

Barrington Residential is to be built west of the proposed development along Old Bunn Road. The development is currently under-construction and at full build-out is expected to consist of 274 single-family homes, 92 duplex units, and 471 townhomes per the Traffic Impact Analysis performed for the development (dated September 26, 2016). A copy of the report is included in the appendix.

##### 5.2.2 Woodland Crossing

This residential development consists of 45 single-family homes along Old Bunn Road to the west of the proposed development. A traffic analysis document was not provided for this study; therefore, for the purposes of this analysis, the trip generation values shown in Table 4 below were used.



## OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Traffic Volumes  
November 7, 2024

**Table 4: Approved Development Trip Generation – Woodland Crossing**

Land Use	ITE LUC	Size	AM Peak Hour Trips			PM Peak Hour Trips		
			Total	Enter	Exit	Total	Enter	Exit
Single Family Homes	210	45 d.u.	36	9	27	47	30	17

The site trip volumes for this development were assigned to the network using the same trip distribution discussed in section 4.0.

### 5.3 BACKGROUND TRAFFIC GROWTH

Background traffic growth is the increase in traffic volumes due to usage increase and non-specific growth throughout the area. The 2024 existing volumes were grown by a 1 percent annual rate to estimate 2028 volumes. The growth in vehicles as a result of this background growth in 2028 for the AM and PM peak hours are shown in Figure 7 and Figure 8; respectively.

### 5.4 NO-BUILD TRAFFIC VOLUMES

Approved development traffic volumes were added to the background traffic to determine the 2028 no-build traffic volumes. The 2028 no-build traffic volumes for the AM and PM peak hours are shown in Figure 7 and Figure 8 respectively.

### 5.5 TOTAL BUILD TRAFFIC

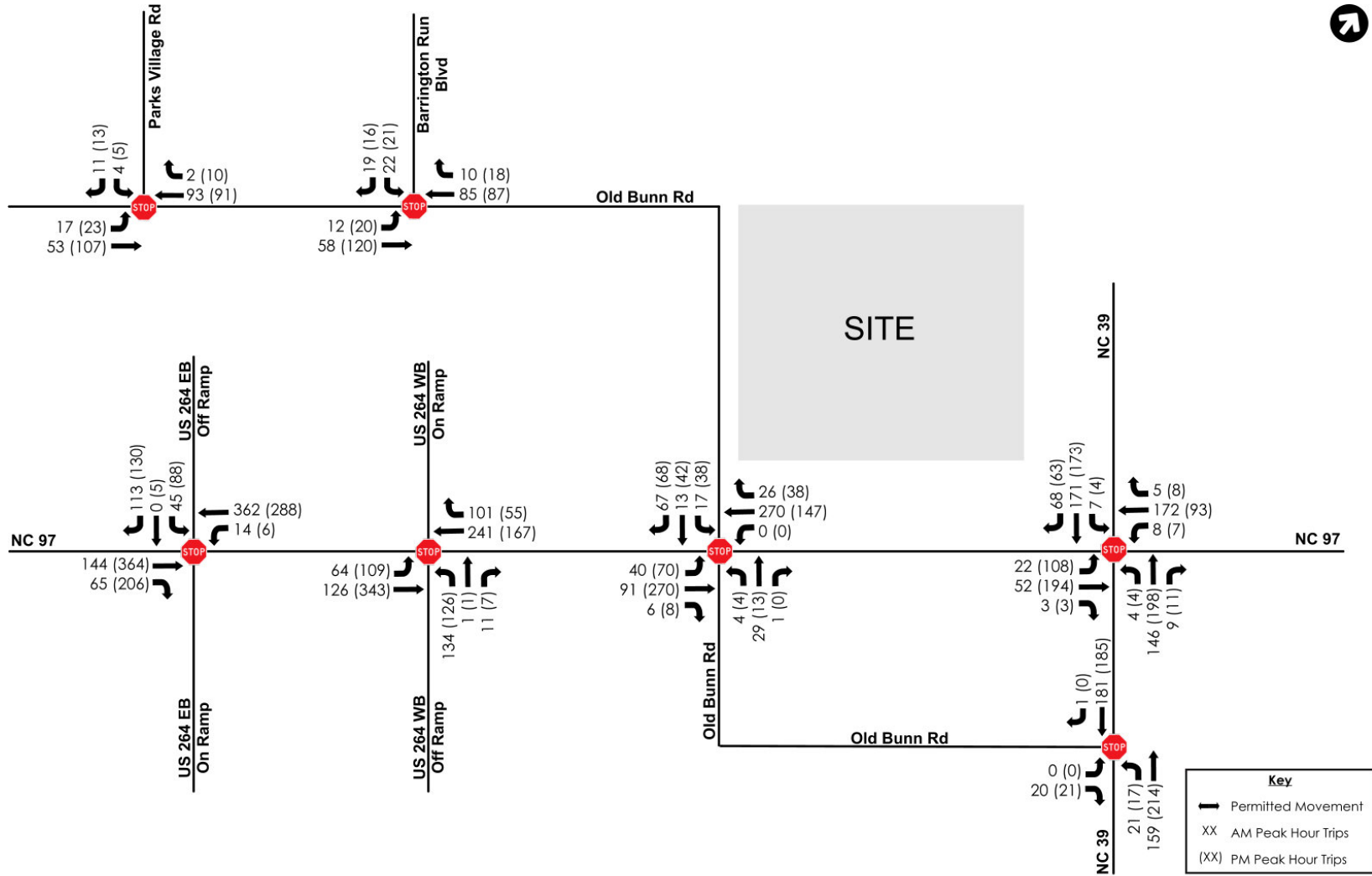
The 2028 build traffic volumes include the 2028 no-build traffic and the proposed development traffic. A discussion of the site trip distribution and assignment is provided in Section 4.0. The site trip distribution and volumes are shown in Figure 4 and Figure 5, respectively. The 2028 peak hour build AM and PM volumes are shown in Figure 9 and Figure 10, respectively.



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

Traffic Volumes  
November 7, 2024

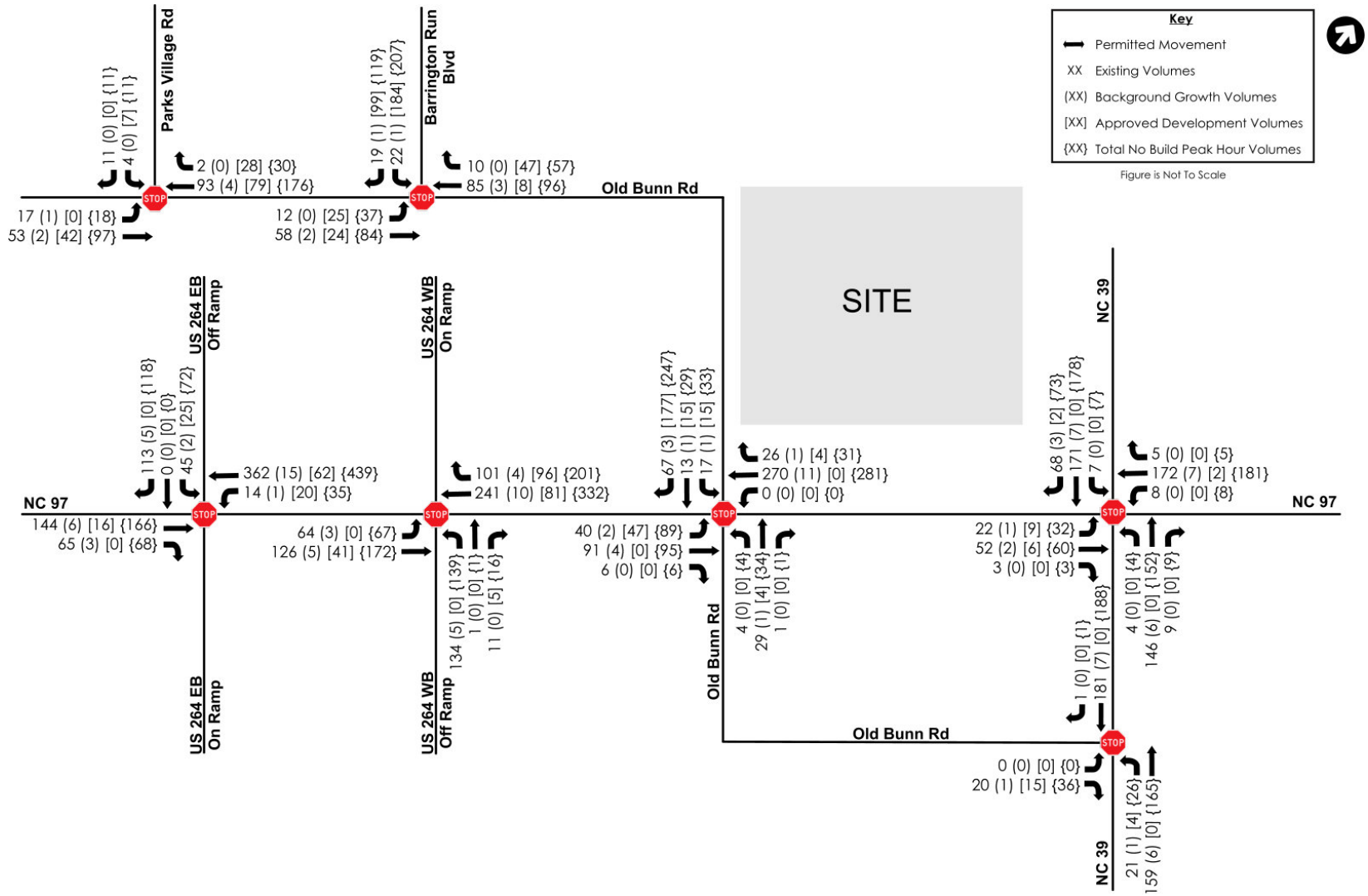
**Figure 6: 2024 Existing Traffic Volumes**



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

Traffic Volumes  
November 7, 2024

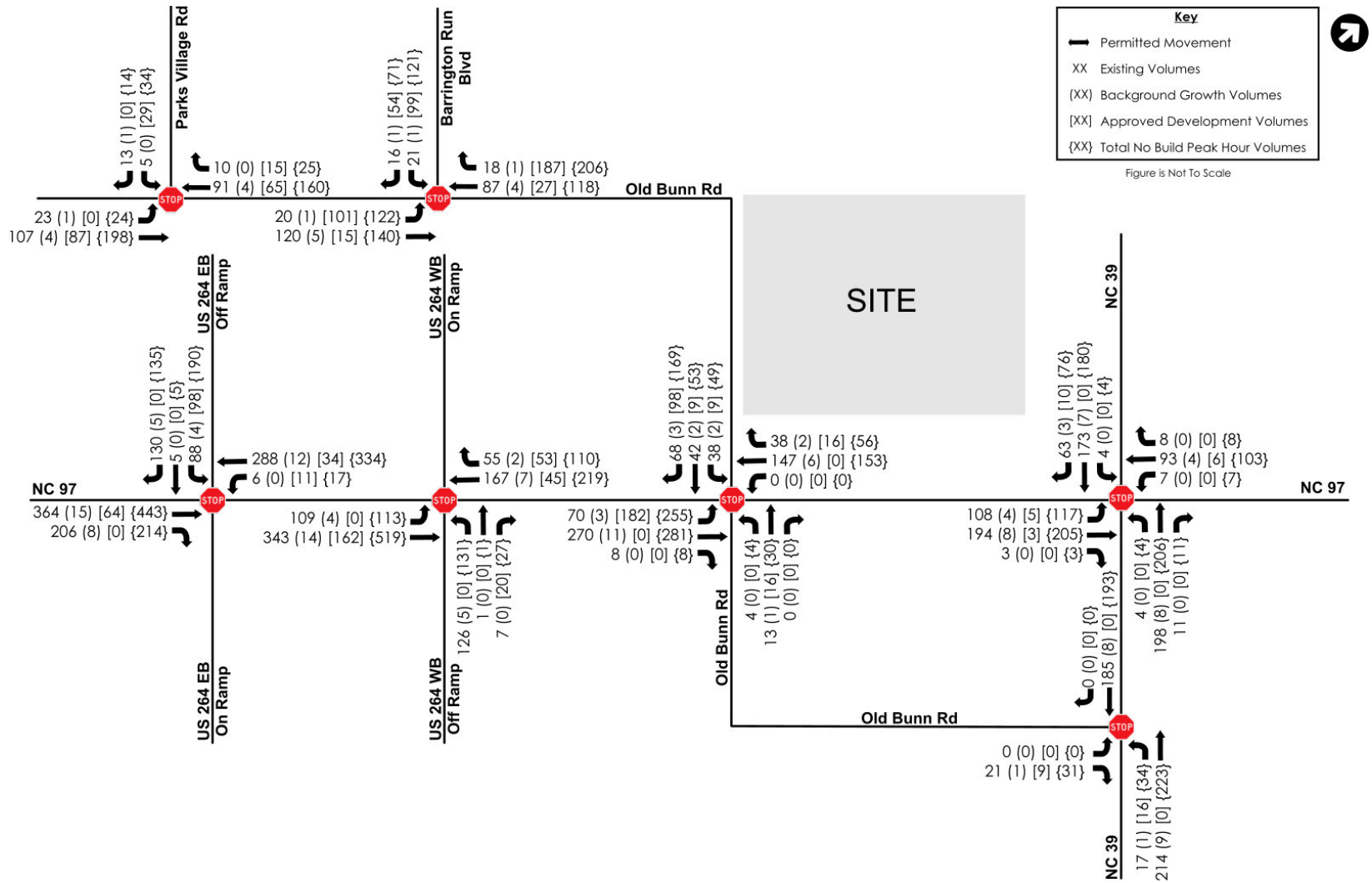
**Figure 7: 2028 No-Build AM Volumes**



**OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS**

Traffic Volumes  
November 7, 2024

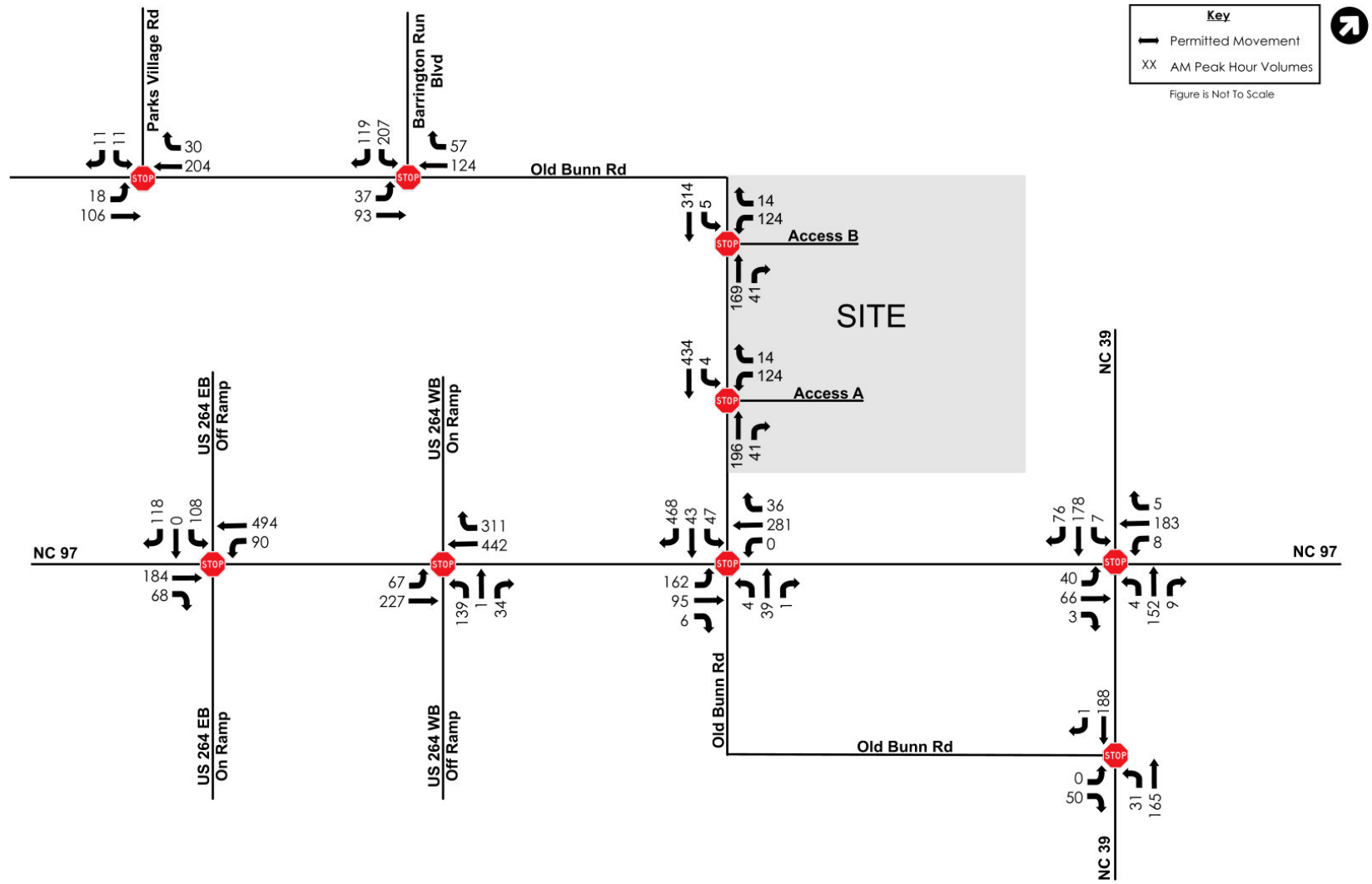
**Figure 8: 2028 No-Build PM Volumes**



# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Traffic Volumes  
November 7, 2024

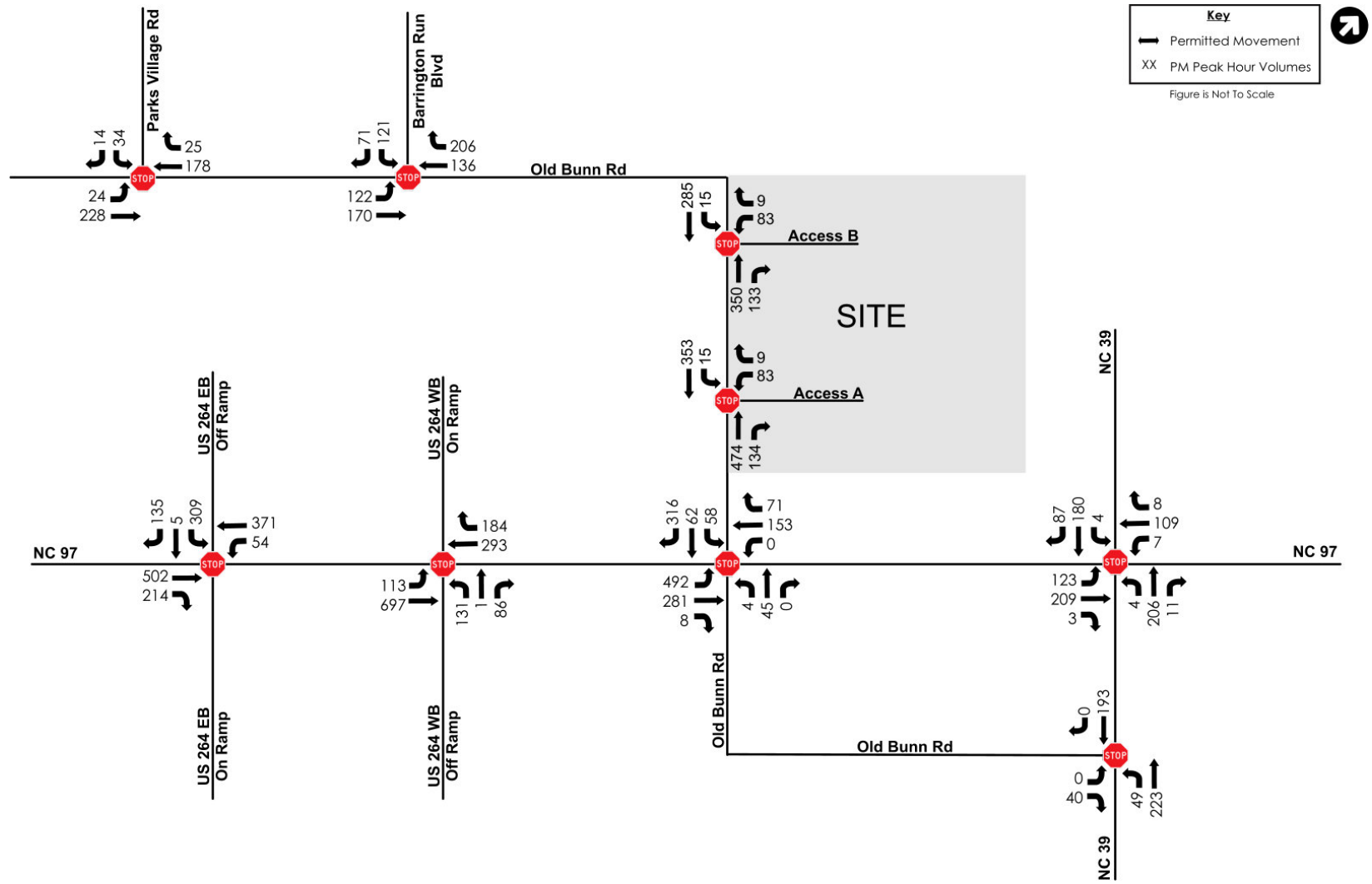
## Figure 9: 2028 Build AM Volumes



# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Traffic Volumes  
November 7, 2024

## Figure 10: 2028 Build PM Volumes



## 6.0 CAPACITY ANALYSIS

Capacity analyses were performed for the roadway network in the study area. The traffic analysis program Synchro, Version 11, was used to analyze all signalized and stop-controlled. The program analyzes intersections according to methods put forth by the Transportation Research Board’s Highway Capacity Manual<sup>6</sup> (HCM). The HCM defines capacity as the “maximum rate or flow at which persons or vehicles can be reasonably expected to traverse a point or uniform section of a line or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per lane per hour.”

Level of service (LOS) is a term used to describe different traffic conditions and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists or passengers.” LOS varies from Level A, representing free flow, to Level F where traffic breakdown conditions are evident. At an unsignalized intersection, the primary traffic on the main roadway is virtually uninterrupted. Therefore, the overall delay for the intersection is usually less than what is calculated for the minor street movements. The overall intersection delay and the delay for the intersections’ minor movement(s) are reported in the summary tables of this report. Generally, LOS D is acceptable for signalized intersections in suburban areas during peak periods. For unsignalized intersections, it is not uncommon for some of the minor street movements or approaches to be operating at LOS F during peak hour conditions and that is not necessarily indicative of an area that requires improvements.

Capacity analyses were completed under NCDOT Congestion Management Capacity Analysis Guidelines<sup>7</sup> and the Policy on Street and Driveway Access to North Carolina Highways<sup>8</sup>. Table 5 presents the criteria of each LOS indicated in the HCM.

**Table 5: Level of Service Criteria**

Level of Service (LOS)	Signalized Intersection Control Delay (seconds / vehicle)	Unsignalized Intersection Control Delay (seconds / vehicle)
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Peak hour factors for all analysis scenarios were set to 0.9. All heavy vehicle percentages for all analysis scenarios were set to 2%. Any calculated volume of zero (0), one (1), two (2), or three (3) vehicles per hour was increased to four (4) vehicles per hour per NCDOT Congestion Management Capacity Analysis Guidelines<sup>7</sup>.

All synchro files and detailed printouts can be found in the appendix. A summary of the results of the analyses is provided in the following sub-sections.












# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Capacity Analysis  
November 7, 2024

## 6.1 EXISTING CAPACITY ANALYSIS (2024)

In the base year of 2024, under the existing geometric conditions, all study intersections and approaches operate at LOS D or better in both the AM and PM peak hours. Additionally, no significant queues were observed in the model. The results from the 2024 existing analysis are shown in Table 6.

**Table 6: 2024 Existing Analysis Results**

Intersection	Approach	Lane Group	Delay (sec./veh.)		Level of Service (LOS)		95 <sup>th</sup> % Queue (feet)		Max. Obs. Queue (feet)	
			AM	PM	AM	PM	AM	PM	AM	PM
 Old Bunn Road at Parks Village Road	EB	L	7.5	7.5	A	A	0	2.5	26	20
	SB	L	9.6	10.2	A	B	0	0	24	24
		R	8.9	8.9	A	A	0	0	31	34
 Old Bunn Road at Barrington Run Boulevard	EB	L	7.5	7.5	A	A	0	0	26	26
	SB	L	9.8	10.3	A	B	2.5	2.5	55	32
		R	9.0	8.9	A	A	2.5	2.5	51	42
 US 264 EB Ramps at NC 97	WB	LT	7.8	8.8	A	A	0	0	40	44
	SB	LT	15.3	21.0	C	C	12.5	32.5	86	90
		R	11.9	11.2	B	B	17.5	17.5	0	0
 US 264 WB Ramps at NC 97	EB	L	8.4	8.0	A	A	5	7.5	59	44
	NB	LT	17.9	27.4	C	D	40	60	83	102
		R	9.0	10.5	A	B	0	0	0	0
 NC 97 at Old Bunn Road	EB	LTR	8.3	7.8	A	A	2.5	5	37	22
	WB	LTR	7.4	7.9	A	A	0	0	5	0
	NB	LTR	14.0	15.7	B	C	7.5	5	58	38
	SB	LTR	12.5	16.4	B	C	17.5	37.5	76	110
 NC 97 at NC 39	Overall		10.1	13.1	B	B				
	EB	LTR	9.2	15.1	A	C	10	80	68	124
	WB	LTR	10.3	10.5	B	B	30	17.5	72	72
	NB	LTR	10.5	12.2	B	B	40	42.5	84	96
	SB	LTR	9.7	12.5	A	B	25	50	96	108
 NC 39 at Old Bunn Road	EB	LR	9.9	9.9	A	A	2.5	2.5	49	39
	NB	LT	7.7	7.7	A	A	2.5	0	33	30



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## 6.2 NO-BUILD CAPACITY ANALYSIS (2028)








In 2028, under the geometric conditions discussed in section 2.3, all study intersections and approaches are expected to operate at LOS D or better in both the AM and PM peak hours; with four exceptions. The results from the 2028 no-build analysis are shown in Table 7. The following lane groups operate at LOS F in the PM peak hour:

- Southbound shared left / through movement at the intersection of US 264 EB Ramps at NC 97
- Northbound shared left / through movement at the intersection of US 264 WB Ramps at NC 97
- Southbound shared left / through / right movement at the intersection of NC 97 at Old Bunn Road

One lane group was found to operate at LOS E in the PM peak hour:

- Northbound shared left / through / right movement at the intersection of NC 97 at Old Bunn Road

**Table 7: 2028 No-Build Analysis Results**

Intersection	Approach	Lane Group	Delay (sec./veh.)		Level of Service (LOS)		95 <sup>th</sup> % Queue (feet)		Max. Obs. Queue (feet)	
			AM	PM	AM	PM	AM	PM	AM	PM
 Old Bunn Road at Parks Village Road	EB	L	7.8	7.7	A	A	0	2.5	29	28
	SB	L	10.7	12.0	B	B	2.5	5	26	40
		R	9.4	9.3	A	A	0	2.5	35	37
 Old Bunn Road at Barrington Run Boulevard	EB	L	7.7	8.4	A	A	2.5	10	39	66
	SB	L	13.4	16.9	B	C	40	32.5	114	86
		R	9.6	9.3	A	A	12.5	7.5	96	66
 US 264 EB Ramps at NC 97	WB	LT	7.9	9.2	A	A	2.5	2.5	54	66
	SB	LT	20.4	66.2	C	F	27.5	172.5	108	142
		R	13.1	11.9	B	B	22.5	20	0	19
 US 264 WB Ramps at NC 97	EB	L	9.2	8.4	A	A	7.5	10	65	48
	NB	LT	27.4	64.4	D	F	67.5	127.5	110	115
		R	9.3	12.4	A	B	2.5	10	0	0
 NC 97 at Old Bunn Road	EB	LTR	8.5	8.4	A	A	7.5	20	59	98
	WB	LTR	7.4	7.9	A	A	0	0	0	1
	NB	LTR	18.3	40.4	C	E	12.5	30	65	72
	SB	LTR	20.4	105.1	C	F	100	287.5	194	402
 NC 97 at NC 39	Overall		10.6	14.3	B	B				
	EB	LTR	9.7	16.9	A	C	15	95	73	111
	WB	LTR	10.8	11.1	B	B	35	22.5	87	71
	NB	LTR	10.1	13.0	B	B	27.5	47.5	84	102
	SB	LTR	11.1	13.6	B	B	47.5	60	87	110
 NC 39 at Old Bunn Road	EB	LR	9.9	10.0	A	B	2.5	5	58	52
	NB	LT	7.7	7.7	A	A	5	2.5	25	38



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### 6.3 BUILD CAPACITY ANALYSIS (2028)

As part of the 2028 build analysis, two (2) access points to the proposed development were added to the network. These are detailed in Section 2.2. In 2028, with the proposed development in place, all study intersections and approaches are expected to operate at LOS D or better in both the AM and PM peak hours; with four exceptions. The results from the 2028 Build analysis are shown in Table 8. The following lane groups operate at LOS F in either the AM or PM peak hour:










- Southbound shared left / through movement at the intersection of US 264 EB Ramps at NC 97
- Northbound shared left / through movement at the intersection of US 264 WB Ramps at NC 97
- Northbound shared left / through / right movement at the intersection of NC 97 at Old Bunn Road
- Southbound shared left / through / right movement at the intersection of NC 97 at Old Bunn Road



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**Table 8: 2028 Build Analysis Results**

Intersection	Approach	Lane Group	Delay (sec./veh.)		Level of Service (LOS)		95 <sup>th</sup> % Queue (feet)		Max. Obs. Queue (feet)	
			AM	PM	AM	PM	AM	PM	AM	PM
 Old Bunn Road at Parks Village Road	EB	L	7.9	7.8	A	A	0	2.5	36	28
	SB	L	11.0	12.5	B	B	2.5	5	25	45
		R	9.6	9.4	A	A	0	2.5	40	38
 Old Bunn Road at Barrington Run Boulevard	EB	L	7.8	8.5	A	A	2.5	10	50	199
	SB	L	14.1	18.3	B	C	42.5	35	124	144
		R	9.8	9.5	A	A	12.5	7.5	116	496
 US 264 EB Ramps at NC 97	WB	LT	8.1	9.7	A	A	7.5	5	78	63
	SB	LT	40.8	#	E	F	77.5	645	158	489
		R	14	12.3	B	B	25	22.5	52	175
 US 264 WB Ramps at NC 97	EB	L	10.3	8.9	B	A	7.5	10	74	48
	NB	LT	53.8	211.4	F	F	117.5	230	122	173
		R	9.8	16.9	A	C	5	22.5	0	90
 NC 97 at Old Bunn Road	EB	LTR	8.9	9.7	A	A	15	53	90	222
	WB	LTR	7.4	7.9	A	A	0	0	3	7
	NB	LTR	35.3	#	E	F	30	*	87	228
	SB	LTR	123.6	#	F	F	552.5	*	516	517
 NC 97 at NC 39	Overall		10.3	15.2	B	C				
	EB	LTR	9.9	18.3	A	C	17.5	107.5	67	118
	WB	LTR	11.0	11.5	B	B	35	25	82	77
	NB	LTR	10.3	13.5	B	B	27.5	52.5	100	104
	SB	LTR	11.3	14.5	B	B	47.5	67.5	107	120
 NC 39 at Old Bunn Road	EB	LR	10.0	10.0	B	B	5	5	58	43
	NB	LT	7.8	7.8	A	A	2.5	2.5	41	41
 Old Bunn Road at Site Access A	EB	LT	7.8	9.0	A	A	0	2.5	446	554
	SB	LR	19.0	26.7	C	D	42.5	42.5	619	1057
 Old Bunn Road at Site Access B	EB	LT	7.7	8.5	A	A	0	0	111	2171
	SB	LR	15.4	19.2	C	C	32.5	30	160	992

# delay exceeding 400 seconds per vehicle was noted on the lane group  
\* excessive queueing noted



## 6.4 BUILD WITH IMPROVEMENTS CAPACITY ANALYSIS (2028)

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. The recommendations are illustrated in Figure 11. The results of the analysis containing the recommended improvements are shown in Table 9.

### US 264 EB Ramps at NC 97

- Monitor the intersection for the installation of a traffic signal. If a signal is found to be warranted before full build-out of the proposed development, it is recommended that the cost of the signal be pro-rata across all known development projects impacting the intersection.

### US 264 WB Ramps at NC 97

- Monitor the intersection for the installation of a traffic signal. If a signal is found to be warranted before full build-out of the proposed development, it is recommended that the cost of the signal be pro-rata across all known development projects impacting the intersection.

### NC 97 at Old Bunn Road

- Construct an exclusive southbound right-turn lane with 350 feet of full-width storage and appropriate taper
- Construct an exclusive eastbound left-turn lane with 450 feet of full-width storage and appropriate taper
- Install a traffic signal at the intersection

### NC 97 at NC 39

- No improvements are recommended at this intersection

### NC 39 at Old Bunn Road

- No improvements are recommended at this intersection

### Old Bunn Road at Site Access A

- Construct Access A as a full-movement access point with one ingress lane and one egress lane
- Provide Access A with a minimum of 100 feet of internal stem length
- Construct an exclusive westbound right-turn lane with 50' of full-width storage and appropriate taper

### Old Bunn Road at Site Access B

- Construct Access B as a full-movement access point with one ingress lane and one egress lane
- Provide Access B with a minimum of 100 feet of internal stem length
- Construct an exclusive westbound right-turn lane with 50' of full-width storage and appropriate taper

#### 6.4.1 Build with Improvements Analysis Results






The results of the capacity analysis with the recommended improvements in-place are shown in Table 9. For simplicity, the table only shows study intersections where improvements have been recommended.



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**Table 9: 2028 Build with Improvements Analysis Results**

Intersection	Approach	Lane Group	Delay (sec./veh.)		Level of Service (LOS)		95 <sup>th</sup> % Queue (feet)		Max. Obs. Queue (feet)		
			AM	PM	AM	PM	AM	PM	AM	PM	
	US 264 EB Ramps at NC 97	Overall		10.3	14.5	B	B				
		EB	T	5.8	12.5	A	B	63	220	110	183
			R	5.6	9.4	A	A	27	88	74	135
		WB	LT	7.0	10.4	A	B	146	129	249	281
		SB	LT	23.7	25.4	C	C	74	178	155	215
			R	23.5	17.8	C	B	77	79	82	153
	US 264 WB Ramps at NC 97	Overall		8.9	9.3	A	A				
		EB	L	5.2	4.8	A	A	32	33	104	102
			T	4.9	8.0	A	A	79	250	92	232
		WB	T	7.4	6.2	A	A	162	98	154	118
			R	7.0	6.2	A	A	114	65	137	104
		NB	LT	23.3	23.3	C	C	89	85	124	156
			R	18.4	21.1	B	C	29	59	19	30
	NC 97 at Old Bunn Road	Overall		21.2	23.8	C	C				
		EB	L	26.3	35.8	C	D	143	466	173	323
			TR	4.5	5.6	A	A	34	101	82	151
		WB	LTR	26.0	34.3	C	C	242	206	195	197
		NB	LTR	28.0	30.0	C	C	54	59	85	82
		SB	LT	31.1	36.4	C	D	94	120	107	128
			R	17.3	8.3	B	A	310	129	286	156
	Old Bunn Road at Site Access A	EB	L	7.8	9.0	A	A	0	2.5	16	92
		SB	LR	18.4	23.6	C	C	40	37.5	94	78
	Old Bunn Road at Site Access B	EB	L	7.7	8.5	A	A	0	0	13	55
		SB	LR	14.9	17.4	B	C	30	25	82	66

With the recommended improvements in place, all study intersections are expected to operate at LOS D or better. Furthermore, the installation of a signal and turn lanes at the intersections of NC 97 at Old Bunn Road significantly reduces the queuing observed when compared to the build without improvements scenario.

Additionally, the installation of a traffic signal at the US 264 eastbound and westbound ramps at NC 97 are also shown to reduce approach delays and have the intersection operate at an acceptable level of service. These signals are not anticipated to be needed for acceptable operations during the initial phases of development as the intersections operate at LOS F in the PM peak hour but LOS C and D in the AM peak hour under 2028 no-build traffic conditions. During peak hours, it is not uncommon for unsignalized side street approaches to operate with high delays. The traffic on the main line of NC 97 operates without delay resulting in minimal delay overall at the intersection. In-order to merit the installation of a traffic signal, the Manual on Uniform Traffic Control Devices (MUTCD) establishes nine warrants for the installation of a traffic signal. Three of these nine warrants involve traffic



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volumes at the intersection that occur over eight, four, and one hour periods. Accordingly, it is recommended that the intersection be monitored to determine the necessity and appropriate time to install a traffic signal as approved by NCDOT.



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### 7.0 RECOMMENDATIONS

Based on the analysis and information presented herein, all study intersections are expected to operate with acceptable levels of service with the proposed development and recommended improvements in-place. The recommended improvements are described below and shown in Figure 11.

#### Old Bunn Road at Parks Village Road

- No improvements are recommended at this intersection

#### Old Bunn Road at Barrington Run Boulevard

- No improvements are recommended at this intersection

#### US 264 EB Ramps at NC 97

- Monitor the intersection for the installation of a traffic signal. If a signal is found to be warranted before full build-out of the proposed development, it is recommended that the cost of the signal be pro-rata across all known development projects impacting the intersection.

The installation of a traffic signal at the US 264 eastbound ramps at NC 97 are also shown to reduce approach delays and have the intersection operate at an acceptable level of service. These signals are not anticipated to be needed for acceptable operations during the initial phases of development as the intersections operate at LOS F in the PM peak hour but lower delays in the AM peak hour under 2028 no-build traffic conditions. During peak hours, it is not uncommon for unsignalized side street approaches to operate with high delays. The traffic on the main line of NC 97 operates without delay resulting in minimal delay overall at the intersection. In-order to merit the installation of a traffic signal, the Manual on Uniform Traffic Control Devices (MUTCD) establishes nine warrants for the installation of a traffic signal. Three of these nine warrants involve traffic volumes at the intersection that occur over eight, four, and one hour periods. Accordingly, it is recommended that the intersection be monitored to determine the necessity and appropriate time to install a traffic signal as approved by NCDOT.

#### US 264 WB Ramps at NC 97

- Monitor the intersection for the installation of a traffic signal. If a signal is found to be warranted before full build-out of the proposed development, it is recommended that the cost of the signal be pro-rata across all known development projects impacting the intersection.

The installation of a traffic signal at the US 264 westbound ramps at NC 97 are also shown to reduce approach delays and have the intersection operate at an acceptable level of service. These signals are not anticipated to be needed for acceptable operations during the initial phases of development as the intersections operate at LOS F in the PM peak hour but lower delays in the AM peak hour under 2028 no-build traffic conditions. During peak hours, it is not uncommon for unsignalized side street approaches to operate with high delays. The traffic on the main line of NC 97 operates without delay resulting in minimal delay overall at the intersection. In-order to merit the installation of a traffic signal, the Manual on Uniform Traffic Control Devices (MUTCD) establishes nine warrants for the installation





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of a traffic signal. Three of these nine warrants involve traffic volumes at the intersection that occur over eight, four, and one hour periods. Accordingly, it is recommended that the intersection be monitored to determine the necessity and appropriate time to install a traffic signal as approved by NCDOT.

### NC 97 at Old Bunn Road

- Construct an exclusive southbound right-turn lane with 350 feet of full-width storage and appropriate taper
- Construct an exclusive eastbound left-turn lane with 450 feet of full-width storage and appropriate taper
- Install a traffic signal at the intersection

### NC 97 at NC 39

- No improvements are recommended at this intersection

### NC 39 at Old Bunn Road

- No improvements are recommended at this intersection

### Old Bunn Road at Site Access A

- Construct Access A as a full-movement access point with one ingress lane and one egress lane
- Provide Access A with a minimum of 100 feet of internal stem length
- Construct an exclusive westbound right-turn lane with 50' of full-width storage and appropriate taper

### Old Bunn Road at Site Access B

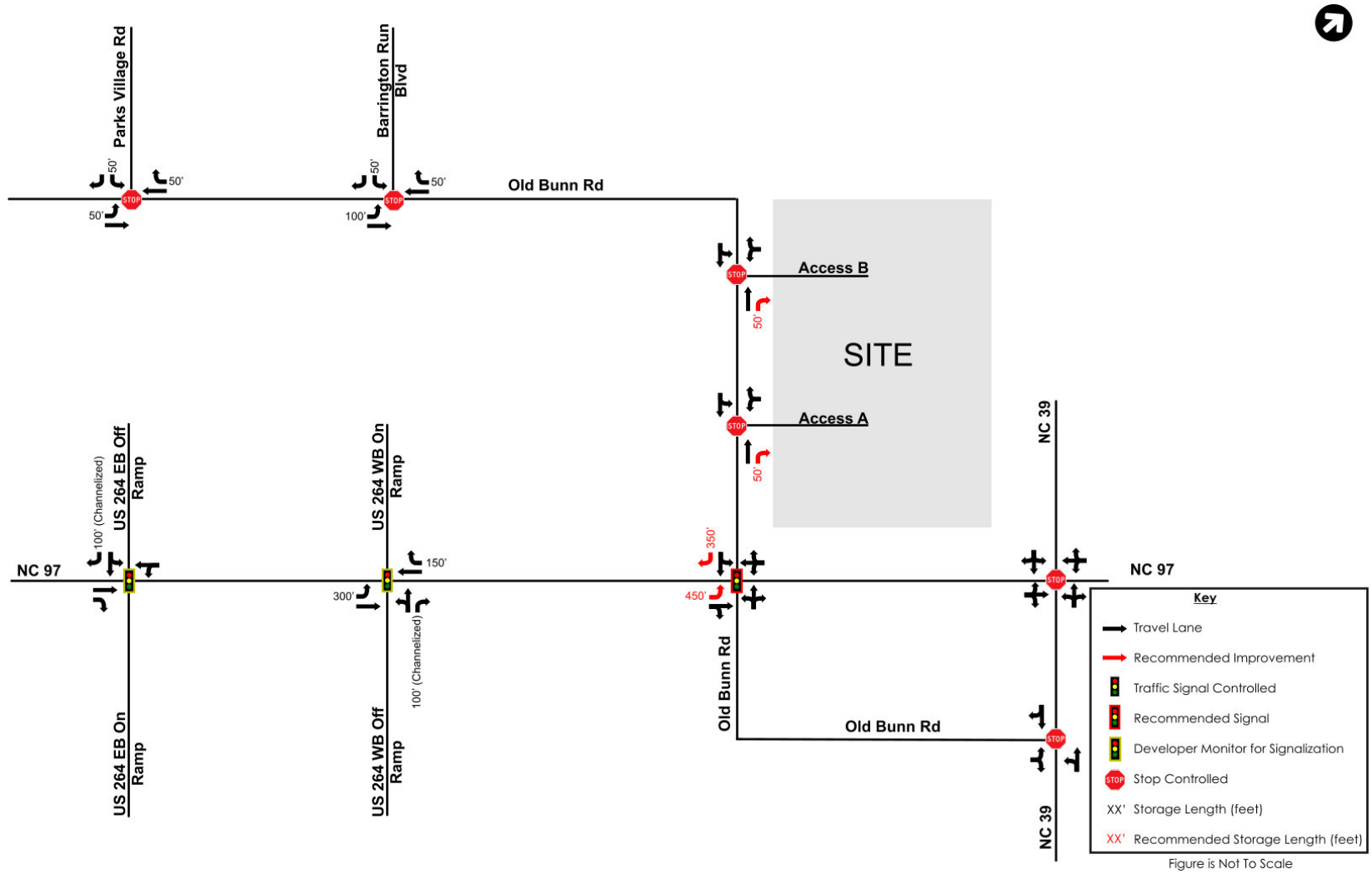
- Construct Access B as a full-movement access point with one ingress lane and one egress lane
- Provide Access B with a minimum of 100 feet of internal stem length
- Construct an exclusive westbound right-turn lane with 50' of full-width storage and appropriate taper



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**Figure 11: Recommended Improvements**



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References

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### 8.0 REFERENCES

<sup>1</sup> NCDOT Functional Class, *NCDOT*, October 2019

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<sup>2</sup> NCDOT AADT Web Map, *NCDOT*, February 2020

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<sup>3</sup> NCDOT State Maintained Network Map, *NCDOT*, October 2019

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<sup>4</sup> Trip Generation Manual, 11<sup>th</sup> Edition, *Institute of Transportation Engineers*, September 2021

<sup>5</sup> NCDOT Congestion Management Rate vs. Equation Spreadsheet, *NCDOT*, July 2022

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<sup>6</sup> Highway Capacity Manual 6<sup>th</sup> Edition: A Guide for Multimodal Mobility Analysis, *Transportation Research Board*, 2016

<sup>7</sup> NCDOT Congestion Management Capacity Analysis Guidelines, *NCDOT*, July 2015

<https://connect.ncdot.gov/resources/safety/Congestion%20Mngmt%20and%20Signing/Congestion%20Management/Capacity%20Analysis%20Guidelines.pdf>

<sup>8</sup> Policy on Street and Driveway Access to North Carolina Highways, *NCDOT*, July 2003



# OLD BUNN ROAD SUBDIVISION TRAFFIC IMPACT ANALYSIS

Appendix

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## 9.0 APPENDIX

A link containing all relevant files is electronically sent with this report:

- NCDOT Scoping Checklist
- Site Plan
- Raw Traffic Count Data
- Approved Development Information
- Traffic Volume Calculations
- Synchro Files
- Synchro / SimTraffic Reports

