

Traffic Impact Analysis Update

StoneRiver

Knightdale, NC



TRAFFIC IMPACT ANALYSIS UPDATE

FOR

STONERIVER

LOCATED

IN

KNIGHTDALE, NORTH CAROLINA

Prepared For:
Terramor Homes
7208 Falls of Neuse Road, Suite 201
Raleigh, NC 27615

Prepared By:
Ramey Kemp & Associates, Inc.
5808 Faringdon Place, Suite 100
Raleigh, NC 27609
License #C-0910



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RKA Project No. 16049

Prepared By: DL

Reviewed By: JM

TABLE OF CONTENTS

1. INTRODUCTION.....1

1.1. Site Location and Study Area..... 1

1.2. Proposed Land Use and Site Access 2

1.3. Adjacent Land Uses.....2

1.4. Existing Roadways 2

2. EXISTING (2016) TRAFFIC CONDITIONS.....6

2.1. Analysis of Existing (2016) Peak Hour Traffic Conditions6

3. BACKGROUND (2017/2021) TRAFFIC CONDITIONS9

3.1. Ambient Traffic Growth.....9

3.2. Approved Adjacent Development Traffic.....9

3.3. Future Roadway Improvements 10

3.4. Background (2017/2021) Peak Hour Traffic Volumes 10

3.5. Analysis of Background (2017/2021) Peak Hour Traffic Conditions..... 10

4. TRIP GENERATION.....18

5. SITE TRIP DISTRIBUTION AND ASSIGNMENT.....19

6. COMBINED (2017/2021) TRAFFIC CONDITIONS.....24

6.1. Analysis of Combined (2017/2021) Peak Hour Traffic Conditions..... 24

7. FUTURE (2031) TRAFFIC CONDITIONS.....28

7.1. Analysis of Future (2031) Peak Hour Traffic Conditions..... 28

8. TRAFFIC ANALYSIS PROCEDURE.....30

8.1. Adjustments to Analysis Guidelines 31

9. CAPACITY ANALYSIS32

9.1. Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road 32

9.2. Hodge Road and US 64 Bypass Eastbound Ramps 35

9.3. Hodge Road and Water Tower Road / Faison Ridge Lane 38

9.4. Hodge Road and Panther Rock Boulevard / Ellen Drive 41

9.5. Hodge Road and Business Park Site Drive 44

10. SIGNAL WARRANT ANALYSIS.....45

11. CONCLUSIONS47
12. RECOMMENDATIONS.....52

LIST OF TABLES

Table 1 Site Trip Generation (Phase 1) 18
Table 2 Site Trip Generation (Full Build-Out)..... 18
Table 3 Highway Capacity Manual - Levels-of-Service and Delay 30
Table 4 Analysis Summary of Hodge Road and US 64 Bypass Westbound Ramps / Old
Faison Road 32
Table 5 Analysis Summary of Hodge Road and US 64 Bypass Eastbound Ramps 35
Table 6 Analysis Summary of Hodge Road and Water Tower Road /
Faison Ridge Lane 38
Table 7 Analysis Summary of Hodge Road and Panther Rock Boulevard /
Ellen Drive 41
Table 8 Analysis Summary of Hodge Road and Business Park Site Drive..... 44
Table 9 Signal Warrants Analysis Results for Hodge Road and Panther Rock Boulevard /
Ellen Drive 44

LIST OF FIGURES

Figure 1 Site Location Map4

Figure 2 Preliminary Site Plan.....5

Figure 3 Existing Lane Configurations and Storage.....7

Figure 4 Existing (2016) Peak Hour Traffic8

Figure 5a Projected (2017) Peak Hour Traffic 11

Figure 5b Projected (2021) Peak Hour Traffic 12

Figure 6a Adjacent Development Trips - Without Hodge Road Business Park..... 13

Figure 6b Adjacent Development Trips - With Hodge Road Business Park..... 14

Figure 7a Background (2017) Peak Hour Traffic..... 15

Figure 7b Background (2021) Peak Hour Traffic without Hodge Road Business Park 16

Figure 7c Background (2021) Peak Hour Traffic with Hodge Road Business Park 17

Figure 8a Site Trip Distribution (2017) 20

Figure 8b Site Trip Distribution (2021) 21

Figure 9a Site Trip Assignment (2017) 22

Figure 9b Site Trip Assignment (2021) 23

Figure 10a Combined (2017) Peak Hour Traffic..... 25

Figure 10b Combined (2021) Peak Hour Traffic without Hodge Road Business Park 26

Figure 10c Combined (2021) Peak Hour Traffic with Hodge Road Business Park 27

Figure 11 Future (2031) Peak Hour Traffic..... 29

Figure 12a Recommended Lane Configurations (2017) 54

Figure 12b Recommended Lane Configurations (2021) 55

TECHNICAL APPENDIX

- Appendix A Memorandum of Understanding (MOU) & NCDOT Access Restriction Documentation for Water Tower Access Road
- Appendix B Traffic Count Data & Traffic Signal Information
- Appendix C Adjacent Development Information
- Appendix D Capacity Calculations – Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road
- Appendix E Capacity Calculations – Hodge Road and US 64 Bypass Eastbound Ramps
- Appendix F Capacity Calculations – Hodge Road and Water Tower Road / Faison Ridge Lane
- Appendix G Capacity Calculations – Hodge Road and Panther Rock Boulevard / Ellen Drive
- Appendix H Capacity Calculations – Hodge Road and Business Park Site Drive
- Appendix I Signal Warrants Analysis

TRAFFIC IMPACT ANALYSIS UPDATE

STONERIVER

KNIGHTDALE, NORTH CAROLINA

1. INTRODUCTION

This report summarizes the findings of the Traffic Impact Analysis (TIA) that was conducted for the proposed StoneRiver residential development to be located west of Hodge Road, south of the US 64 Bypass interchange in Knightdale, NC. This document is an updated TIA for the study previously submitted in September, 2015. The purpose of this study is to determine the potential impacts to the adjacent roadway network expected due to the traffic generated by the proposed development.

For the purpose of this study, the development was analyzed in two phases. Phase 1 consists of 70 single-family homes, to be completed in 2017. Full build-out consists of 286 single-family homes and 98 townhomes, to be completed in 2021.

This study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- Existing (2016) Traffic Conditions
- Background (2017) Traffic Conditions
- Combined (2017) Traffic Conditions (Phase 1)
- Background (2021) Traffic Conditions without Hodge Road Business Park
- Background (2021) Traffic Conditions with Hodge Road Business Park
- Combined (2021) Traffic Conditions (Full Build-Out) without Hodge Road Business Park
- Combined (2021) Traffic Conditions (Full Build-Out) with Hodge Road Business Park
- Future (2031) Traffic Conditions (Full Build-Out) with Hodge Road Business Park

1.1. Site Location and Study Area

The proposed StoneRiver residential development is located west of Hodge Road, south of the US 64 Bypass and Hodge Road interchange in Knightdale, NC. Refer to Figure 1 for the site location map.

The updated Memorandum of Understanding (MOU) was developed in coordination with the Town of Knightdale (Town) Planning staff and North Carolina Department of Transportation (NCDOT) District staff. A copy of the MOU is provided in Appendix A. Based on the coordination, the following existing intersections were identified to be included in the study:

- Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road
- Hodge Road and US 64 Bypass Eastbound Ramps
- Hodge Road and Water Tower Road / Faison Ridge Lane
- Hodge Road and Panther Rock Boulevard / Ellen Drive

1.2. Proposed Land Use and Site Access

For the purpose of this study, the development was analyzed in two phases. Phase 1 consists of 70 single-family homes, to be completed in 2017. Full build-out consists of 286 single-family homes, to be completed in 2021.

Access to the development is proposed via two site driveways connecting to Hodge Road. Panther Rock Boulevard, located approximately 750 feet south of the US 64 Bypass eastbound ramps, will serve as the main site driveway. The existing water tower access road located approximately 300 feet south of the US 64 Bypass eastbound ramps on Hodge Road will be used for emergency access only during Phase I and will provide regular site access as a right-in/right-out for full build out. Refer to Figure 2 for the site plan.

1.3. Adjacent Land Uses

The land uses in the area of the proposed site consist of a mix of residential and agriculture uses. The site will connect to the Cheswick residential development to the south. There were 96 existing single family homes occupied off Panther Rock Boulevard at the time of data collection. Cheswick Phases 2B and 3 are considered as adjacent developments in this study and details are presented in Section 3.2.

1.4. Existing Roadways

Hodge Road is a two lane, undivided road that runs north-south through the study area. Hodge Road has a center two-way left-turn lane through much of the study area. The posted speed limit in the study area is 45 miles per hour (mph). According to the most recent NCDOT data,

Hodge Road had an average annual daily traffic (AADT) volume of approximately 11,000 vehicles per day (vpd) in 2013.

US 64 Bypass is a six lane, divided highway that runs along the southern side of Knightdale. According to the most recent NCDOT data, US 64 Bypass had an AADT volume of approximately 72,000 vpd in the study area in 2013.

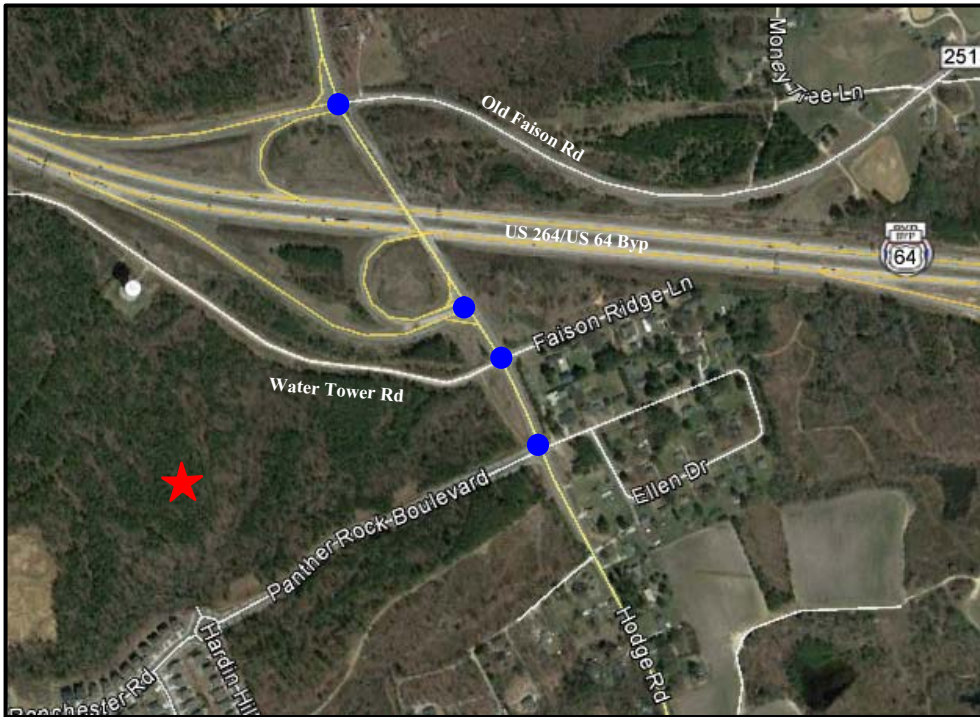
Old Faison Road is a two lane, undivided road connecting Bethlehem Road to the US 64 Bypass westbound ramp. The posted speed limit on Old Faison Road is 45 mph in the study area. Based on the assumption that the PM peak hour traffic is 10% of AADT, the 2016 AADT on Old Faison Road is approximately 6,200 vpd.

Faison Ridge Lane is a two lane, undivided road that provides the only access to Hodge Road for a small number of residences. There is no posted speed limit on Faison Ridge Lane; therefore it is assumed to be 25 mph. Based on observations made during data collection, there were very few trips traveling on Faison Ridge Lane. It is assumed the AADT on Faison Ridge Lane is fewer than 50 vpd.

The water tower access road is an unpaved, unmarked road that provides service access to the Town of Knightdale water tower. Under existing conditions, the access road aligns with Faison Ridge Lane at Hodge Road, creating an unsignalized full movement intersection.

Panther Rock Boulevard is a two lane, undivided road that serves as the main access for the Cheswick residential development off Hodge Road. Bike lanes and sidewalk are provided on both sides of the road. The posted speed limit on Panther Rock Boulevard is 25 mph. Based on the assumption that the PM peak hour traffic is 10% of AADT, the 2016 AADT on Panther Rock Boulevard is approximately 900 vpd.

Ellen Drive is a two lane, undivided road that aligns with Panther Rock Boulevard on Hodge Road and serves a small number of residences. The posted speed limit on Ellen Drive is 25 mph. Based on the assumption that the PM peak hour traffic is 10% of AADT, the 2016 AADT on Ellen Drive is approximately 200 vpd.



LEGEND

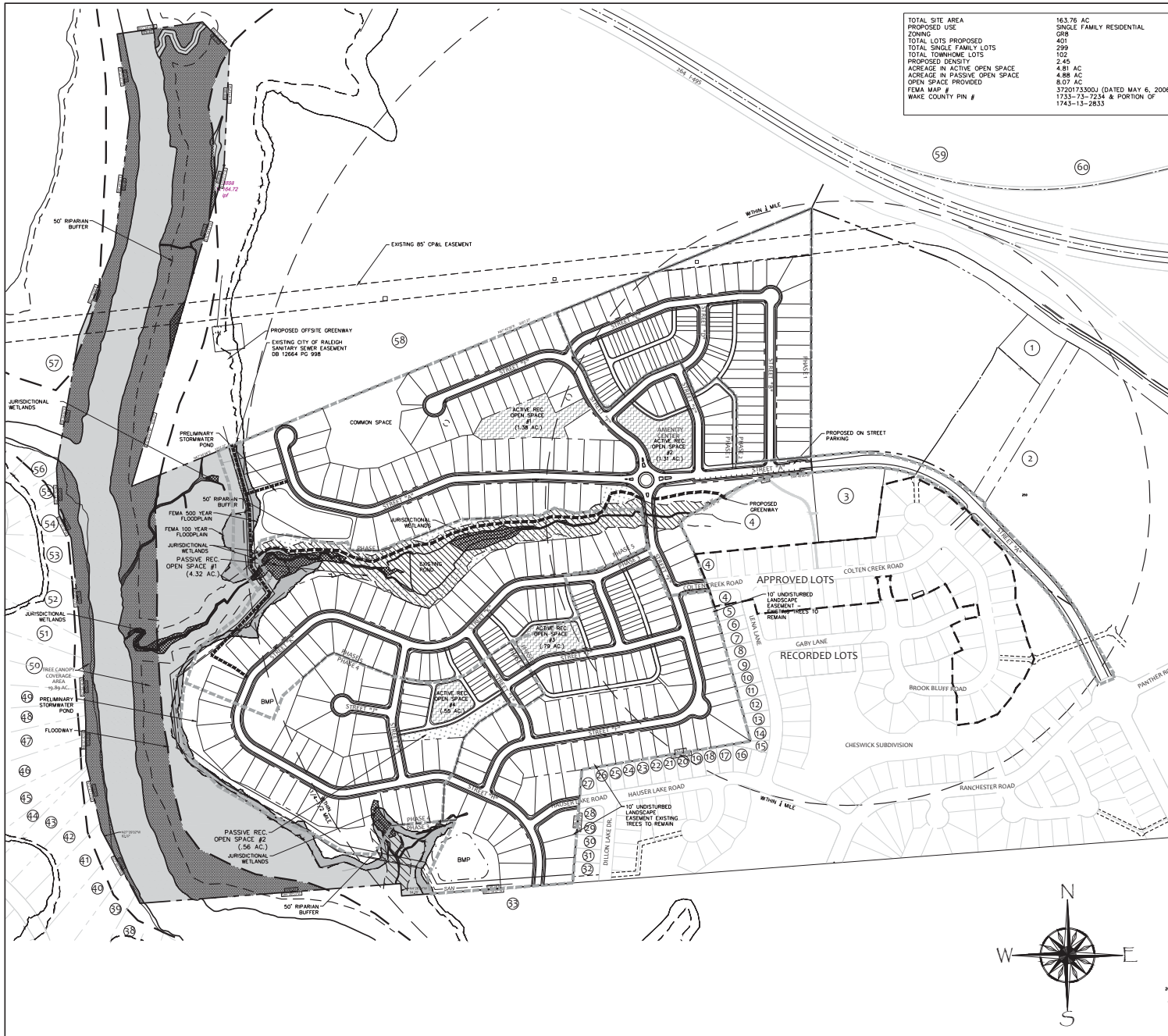
- ★ Site Location
- Existing Study Intersection



StoneRiver
Knightdale, North Carolina

Site Location Map

Figure 1



TOTAL SITE AREA	163.76 AC
PROPOSED USE	SINGLE FAMILY RESIDENTIAL
ZONING	GR
TOTAL LOTS PROPOSED	401
TOTAL SINGLE FAMILY LOTS	299
TOTAL TOWNHOME LOTS	102
PROPOSED DENSITY	2.45
ACREAGE IN ACTIVE OPEN SPACE	4.81 AC
ACREAGE IN PASSIVE OPEN SPACE	4.88 AC
OPEN SPACE PROVIDED	8.07 AC
FEMA MAP #	3720173300J (DATED MAY 6, 2006)
WAKE COUNTY PIN #	1723-15-7234 & PORTION OF 1743-13-2833

- LEGEND:**
- NEUSE RIPARIAN BUFFER
 - 100 YEAR FLOOD ZONE
 - 500 YEAR FLOOD ZONE
 - WETLANDS
 - TREE CANOPY COVERAGE
 - ACTIVE RECREATION OPEN SPACE
 - PASSIVE RECREATION OPEN SPACE
 - PHASE LINE
 - OPEN SPACE PROXIMITY ZONES

1. Boundary information and topographic information provided by Timmons Group.
2. Existing Neuse Riparian Buffer and wetland delineation by S&C Dated September 24, 2014.
3. 100 year flood exists on this property per FEMA Flood Mapping 3720173300J dated 05/06/06.
4. Adjacent property ownership information taken from Wake County GIS.
5. All streets shall be public and turn over to the Town of Knightdale for maintenance upon completion.
6. All alleys shall be private and maintained by a duly established homeowners association.
7. See street section designs on detail sheets.
8. The street layout is conceptual and subject to change. Approval by Town Staff is required.
9. Greenway trails shall be provided in the locations depicted and are subject to relocation. Trails shall be private and maintained by the HOA and open to the public.
10. Any signage located on the site shall be approved by the Town of Knightdale and shall be located outside of any sight triangles.
11. Driveway access for corner lots may access secondary street and shall not be required to access alley.
12. No driveway access on collector streets.
13. Planometrics for property and adjacent properties provided by Wake County GIS.
14. Phasing is preliminary and subject to change.
15. All materials and methods of construction shall conform to Town of Knightdale Standards and Specifications.
16. All necessary permits shall be obtained from NCDENR, DWQ, The Army Corp of Engineers or other authorized agencies prior to construction drawing approval in the affected phase.

TOTAL SITE PERIMETER	= 15,596 L.F.
TOTAL SITE AREA	= 163.8 AC
REQUIRED TREE CANOPY AREA	15,596 L.F. X 20 = 311920 S.F. OR 7.16 AC
TREE CANOPY PERCENTAGE	7.16 AC / 164 AC = 4.37% < 10% MAX.
TREE CANOPY REQUIRED	4.37 AC
STREAM BUFFER	19.89 AC
TOTAL TREE CANOPY PROVIDED	19.89 AC

DENSITY	= 9999 UNITS/ACRE	
BEDROOM ESTIMATE		
187 UNITS X 3.5 BEDROOMS/UNIT	= 655 TOTAL BEDROOMS	1/4 mile
200 UNITS X 3.5 BEDROOMS/UNIT	= 700 TOTAL BEDROOMS	1/2 mile
14 UNITS X 3.5 BEDROOMS/UNIT	= 49 TOTAL BEDROOMS	1 mile
655 BEDROOMS X 260 S.F.	= 170,170 S.F.	
700 BEDROOMS X 350 S.F.	= 245,000 S.F.	
49 BEDROOMS X 520 S.F.	= 25,480 S.F.	
TOTAL RECREATIONAL SPACE REQUIRED	= 468,650 S.F. 10.76 AC	
25% REDUCTION DUE TO AMENITY CENTER	= 8.07 AC	

ACTIVE RECREATIONAL OPEN SPACE	
OPEN SPACE AREA #1	= 1.36 AC
OPEN SPACE AREA #2	= 1.31 AC
OPEN SPACE AREA #3	= 0.78 AC
OPEN SPACE AREA #4	= 0.65 AC
OPEN SPACE AREA #5	= 0.76 AC
TOTAL PROVIDED	= 4.81 AC
TOTAL REQUIRED	= 4.03 AC
PASSIVE RECREATIONAL OPEN SPACE	
OPEN SPACE AREA #1	= 4.32 AC
OPEN SPACE AREA #2	= 0.56 AC
TOTAL O.S. PROVIDED	= 4.88 AC
TOTAL O.S. REQUIRED	= 4.03 AC

CONNECTIVITY INDEX CALCULATIONS	
CONNECTIVITY INDEX REQUIRED FOR GR 8 + 140	
TOTAL NODES: 35	
TOTAL LENGTH: 38	
CONNECTIVITY RATIO PROVIDED: 1.44	

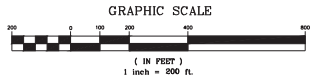
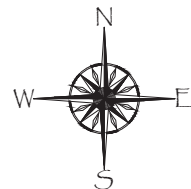


TIMMONS GROUP
5410 Trinity Road
Raleigh, NC 27607

REVISIONS:

Preliminary Master Plan
StoneRiver
KINGSDALE, NC
ARCADIERLAND, LLC, RALEIGH NC

SCALE:
1" = 200'
DRAWN BY:
T.M.T.
PROJECT #
14073
DATE:
4/13/2015
SHEET
MP-2
OF 12



TONY M. TATE LANDSCAPE ARCHITECTURE PA
8011 SOUTH PARK DRIVE, STE. 200 - DURHAM, NC 27713
p: (919) 484-8880 f: (919) 484-8881 e: tony@tmlla.com

2. EXISTING (2016) TRAFFIC CONDITIONS

Existing lane configurations (number of traffic lanes on the intersection approach), lane widths, storage capacities, and other intersection and roadway information was collected through field reconnaissance by Ramey Kemp & Associates, Inc. (RKA). Refer to Figure 3 for the existing lane configurations.

Turning movement traffic counts were conducted by RKA on a typical weekday during the AM peak period (7:00 – 9:00 AM) and PM peak period (4:00 – 6:30 PM) at the following existing intersections in February 2016:

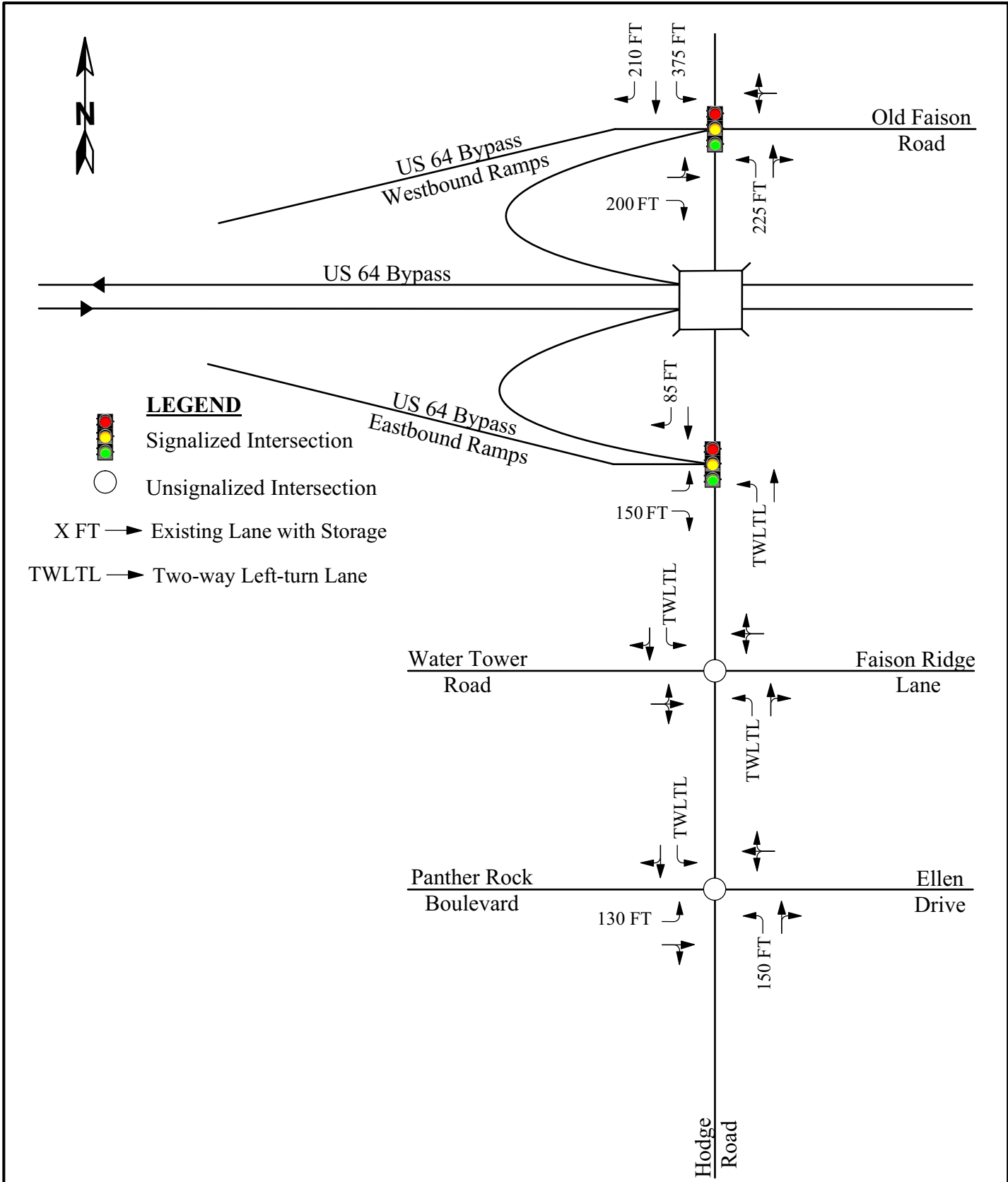
- Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road
- Hodge Road and US 64 Bypass Eastbound Ramps
- Hodge Road and Panther Rock Boulevard / Ellen Drive

Based on discussions with the Town and NCDOT, there are high volumes of traffic using Hodge Road to access US 64 Bypass during the peak commute times due to existing congestion at the US 64 Bypass interchange with Smithfield Road – the next interchange to the east of Hodge Road. Just to the south of the study area, count data shows a substantial amount of traffic turning north onto Hodge Road during the AM peak hour from Poole Road as well as high southbound left-turn volumes from Hodge Road onto Poole Road during the PM peak hour. Poole Road connects to Smithfield Road.

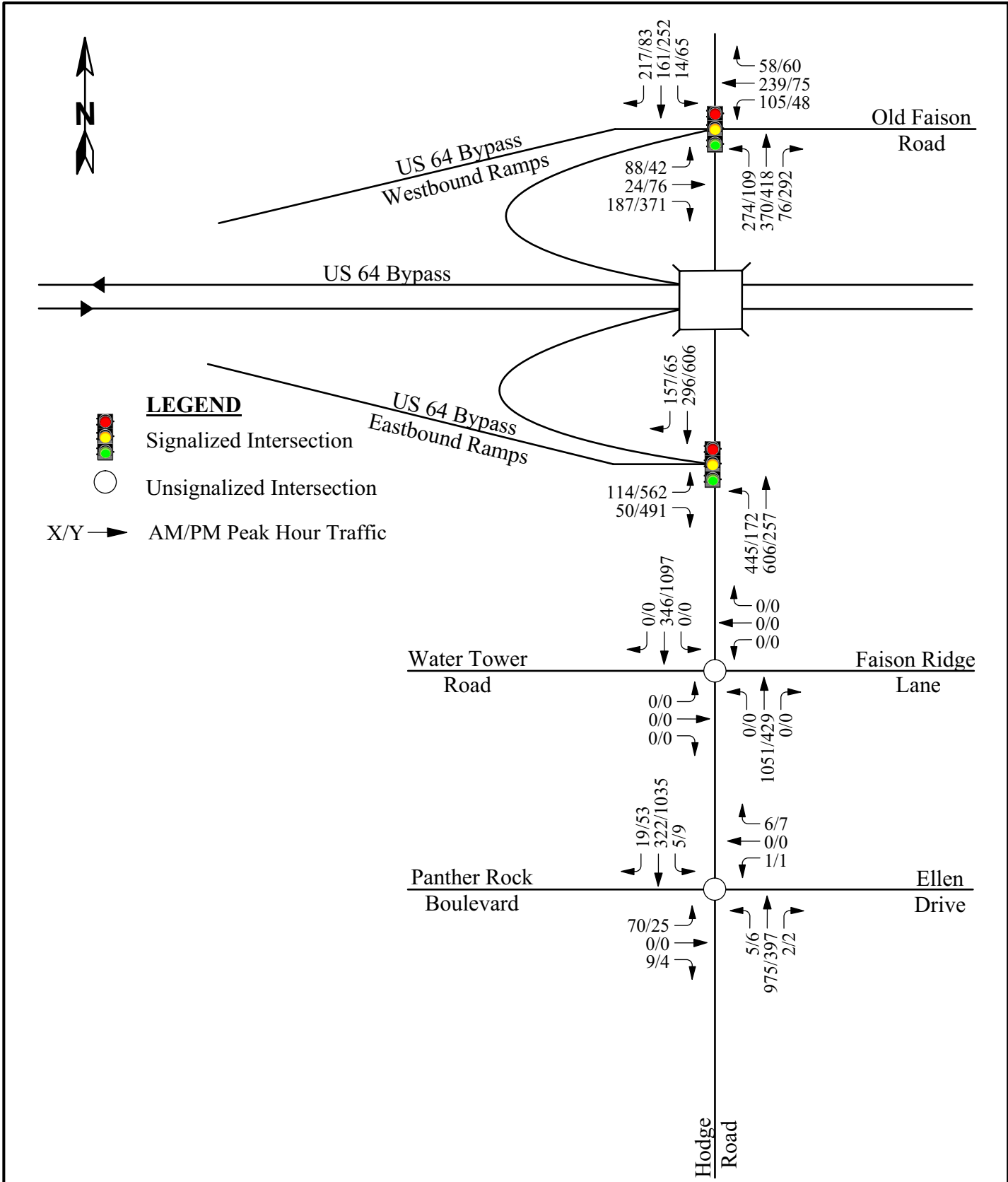
Refer to Figure 4 for the existing (2016) weekday AM and PM peak hour traffic volumes at the existing study intersection. A summary of the traffic count data and signal information is provided in Appendix B of this report.

2.1. Analysis of Existing (2016) Peak Hour Traffic Conditions

The existing (2016) AM and PM peak hour traffic volumes at the study intersections were analyzed to determine the current levels-of-service under existing roadway conditions. The results of the analysis are presented in Section 9 of this report.



	StoneRiver Knightdale, North Carolina		Existing Lane Configurations and Storage	
			Scale: Not to Scale	Figure 3



	<p align="center">StoneRiver Knightdale, North Carolina</p>	Existing (2016) Peak Hour Traffic	
		Scale: Not to Scale	Figure 4

3. BACKGROUND (2017/2021) TRAFFIC CONDITIONS

In order to account for the growth of traffic and subsequent traffic conditions at a future year, background traffic projections are needed. Background traffic includes traffic due to the growth of the community and surrounding area that is anticipated to occur regardless of whether the site is developed. Background traffic growth includes two components – ambient traffic growth and new trips from approved, but not yet built, adjacent developments.

3.1. Ambient Traffic Growth

Based on coordination with the Town and NCDOT, an annual growth rate of 3% per year was used to project existing traffic volumes at the study intersections to the analysis years of 2017 and 2021. A 1% annual growth rate was used to project traffic volumes to 2031. The ambient traffic growth rate was applied to all intersections within the study area. Projected (2017) peak hour traffic volumes are shown in Figure 5a. Projected (2021) peak hour traffic volumes are shown in Figure 5b.

3.2. Approved Adjacent Development Traffic

Based on coordination with the Town and NCDOT, Cheswick Phases 2B and 3 and the Hodge Road Business Park were considered as adjacent developments for this study. Refer to Figure 6a for the adjacent development trips without the Hodge Road Business Park and Figure 6b for the adjacent development trips with the Hodge Road Business park and Appendix C for adjacent development information.

Cheswick Phases 2B and 3 are expected to consist of a total of 100 single-family homes, located in the southwest quadrant of the intersection of Hodge Road and US 64 in Knightdale, North Carolina. Currently, the development is partially built-out with 36 single-family homes occupied. The adjacent development trip generation was based on the remaining 64 single-family homes and trips were distributed using the same regional trip distribution as the StoneRiver development.

Hodge Road Business Park is expected to consist of 1,000,000 sq. ft. of warehouse space located in the northeast quadrant of Hodge Road and Kemp Drive in Knightdale, North

Carolina. The business park is expected to be built-out in 2020. For the purpose of this study, the Hodge Road Business Park is only being considered for full build-out of the proposed StoneRiver development.

3.3. Future Roadway Improvements

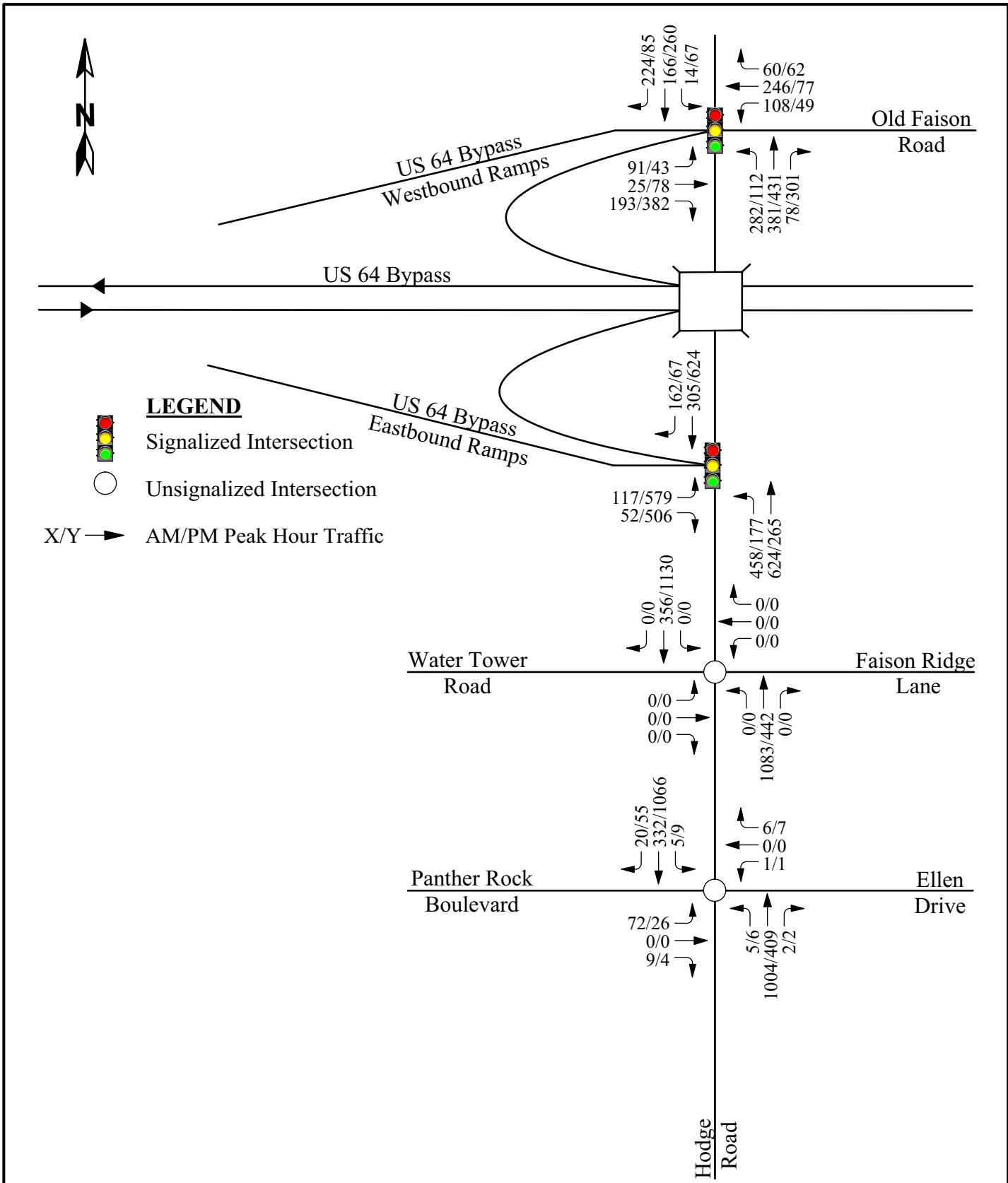
Based on coordination with the NCDOT, there are no future roadway improvements identified to be considered in this study.

3.4. Background (2017/2021) Peak Hour Traffic Volumes

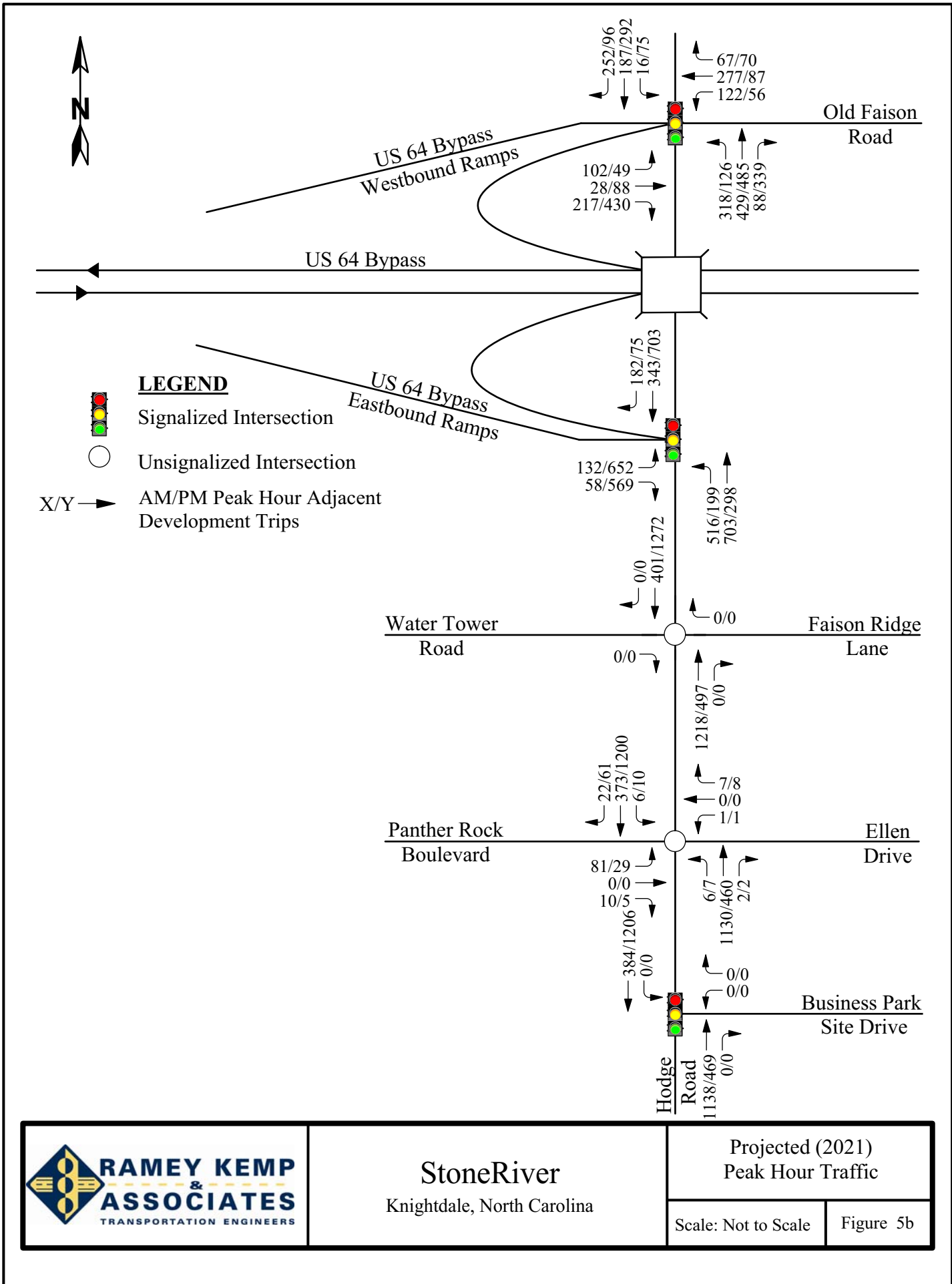
The background peak hour traffic volumes are the combination of trips anticipated from adjacent development plus the projected traffic volumes. Refer to Figure 7a for the background (2017) weekday AM and PM peak hour traffic volumes. Refer to Figure 7b for the background (2021) weekday AM and PM peak hour traffic volumes without the Hodge Road Business Park. Refer to Figure 7c for the background (2021) weekday AM and PM peak hour traffic volumes with the Hodge Road Business Park.

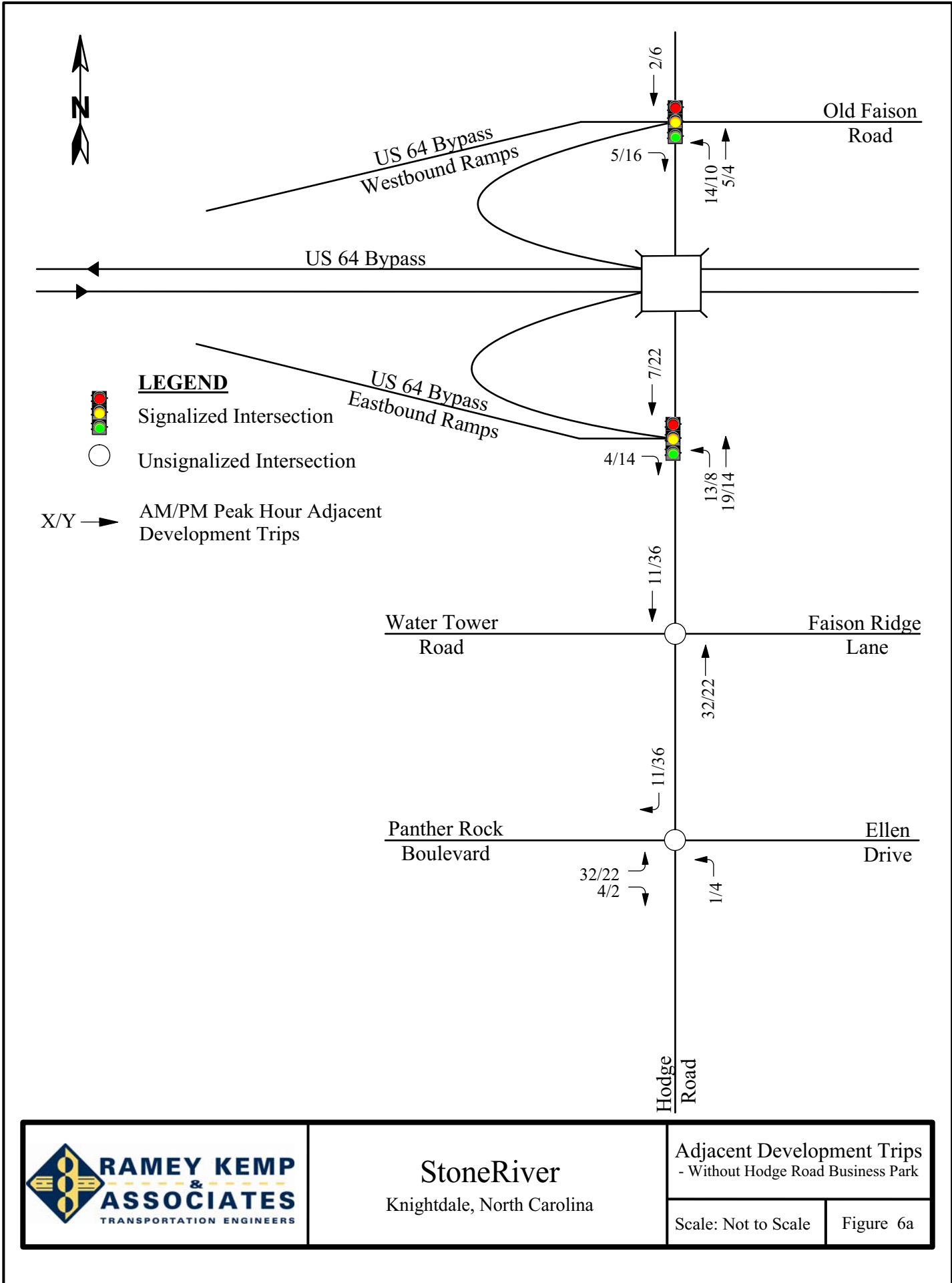
3.5. Analysis of Background (2017/2021) Peak Hour Traffic Conditions

Background traffic conditions were analyzed with the existing roadway network. The results of the background conditions analyses are presented in Section 9 of this report.



	<h3>StoneRiver</h3> <p>Knightdale, North Carolina</p>	Projected (2017) Peak Hour Traffic	
		Scale: Not to Scale	Figure 5a



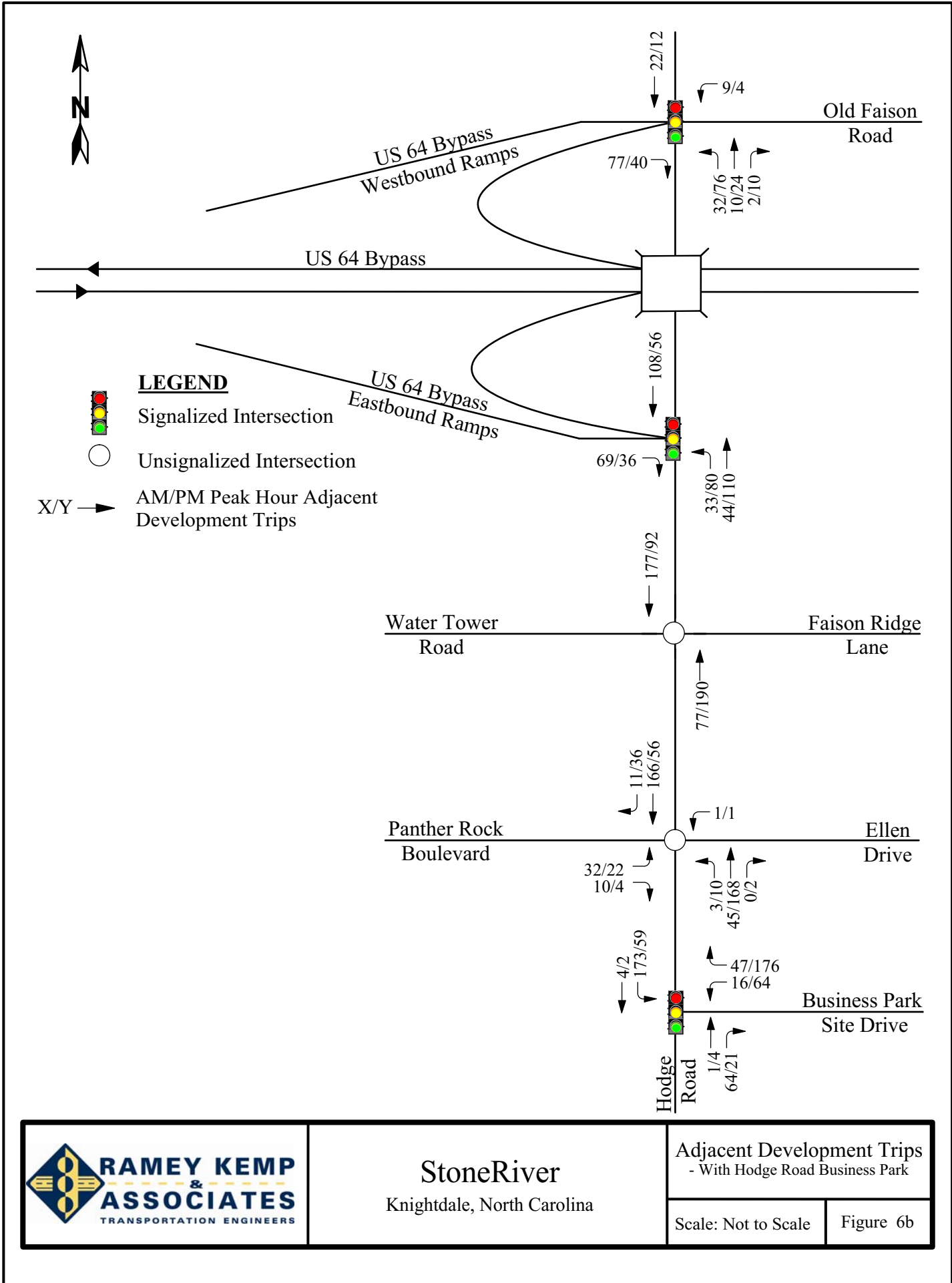


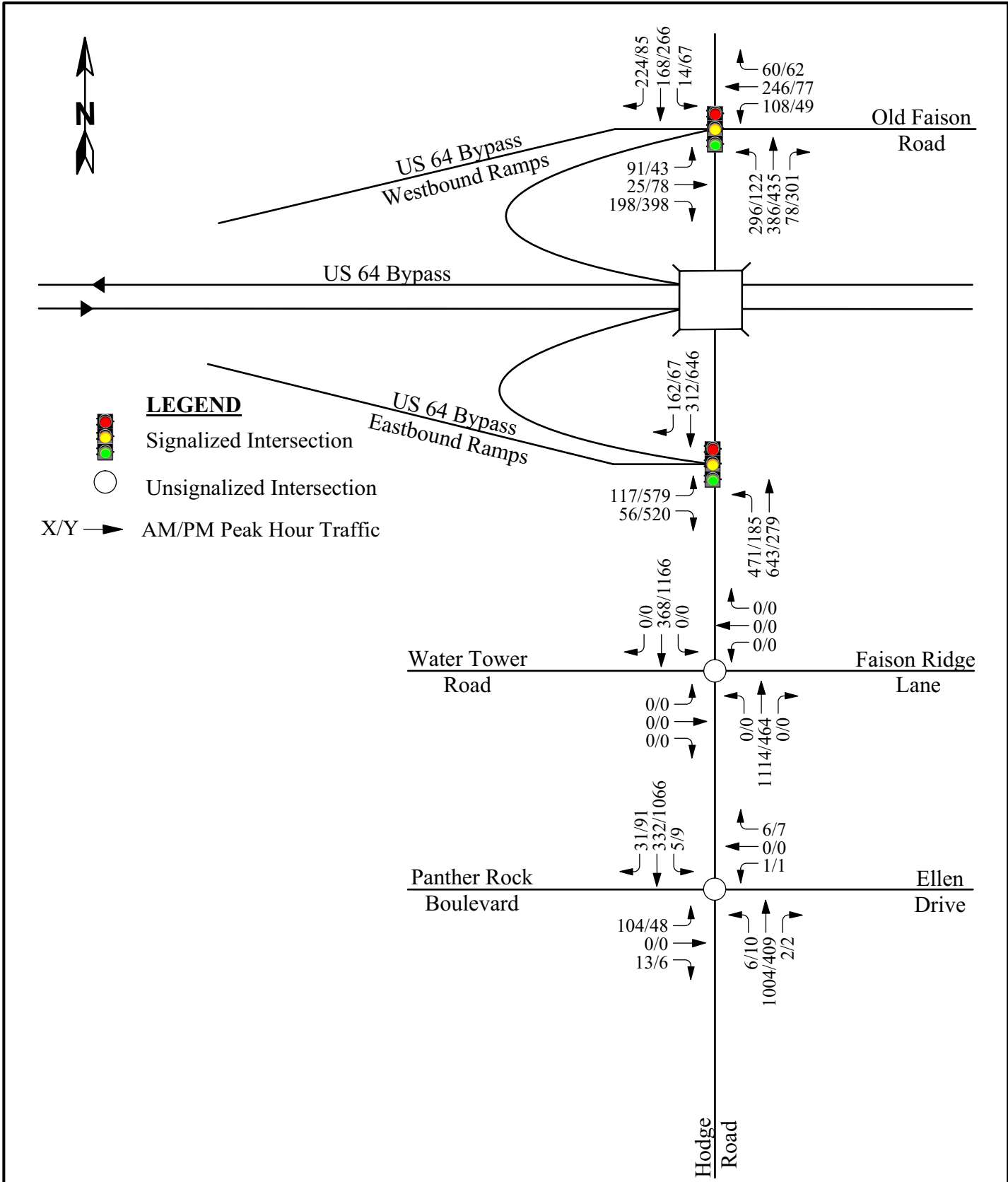
StoneRiver
Knightdale, North Carolina

Adjacent Development Trips
- Without Hodge Road Business Park

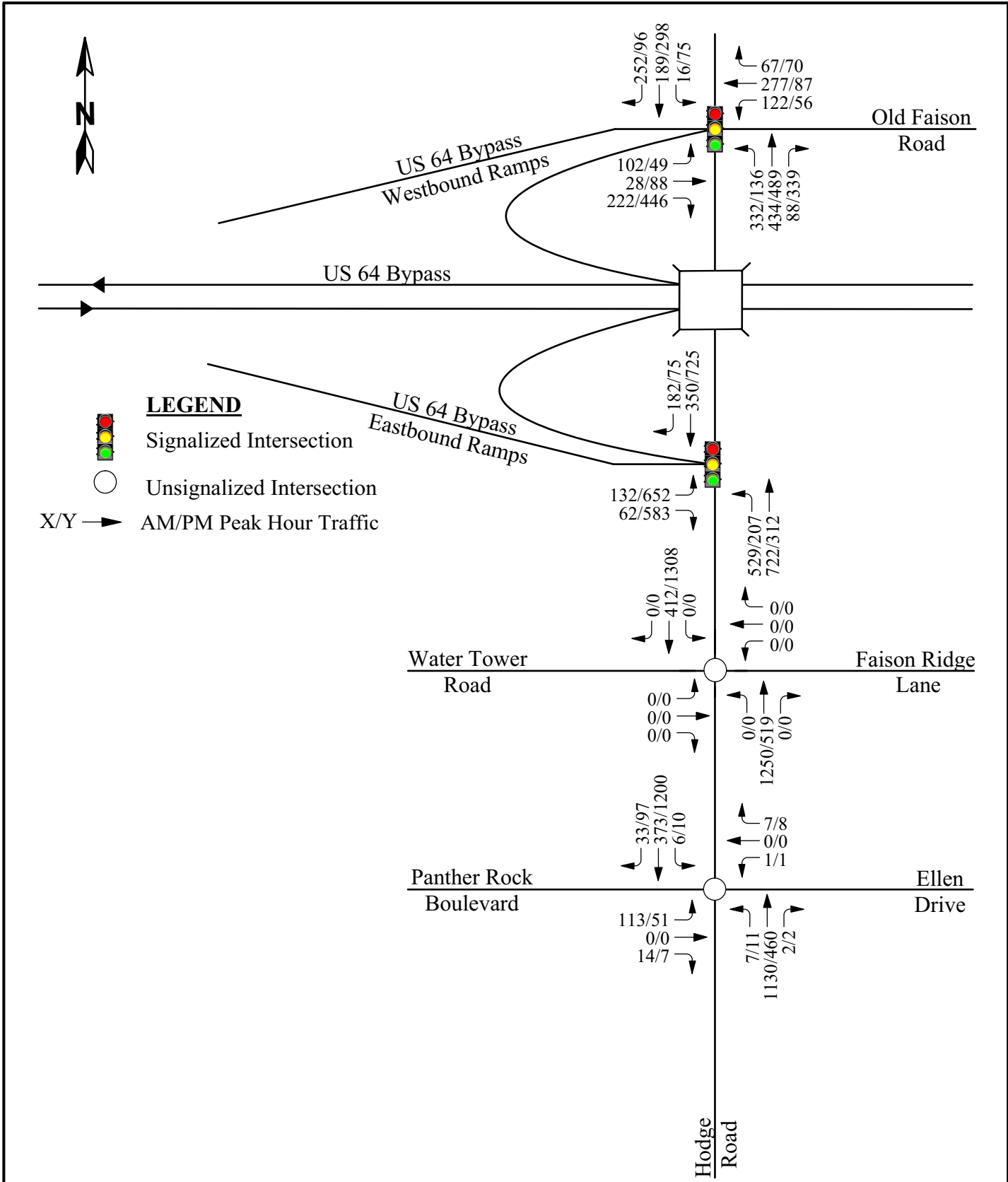
Scale: Not to Scale

Figure 6a

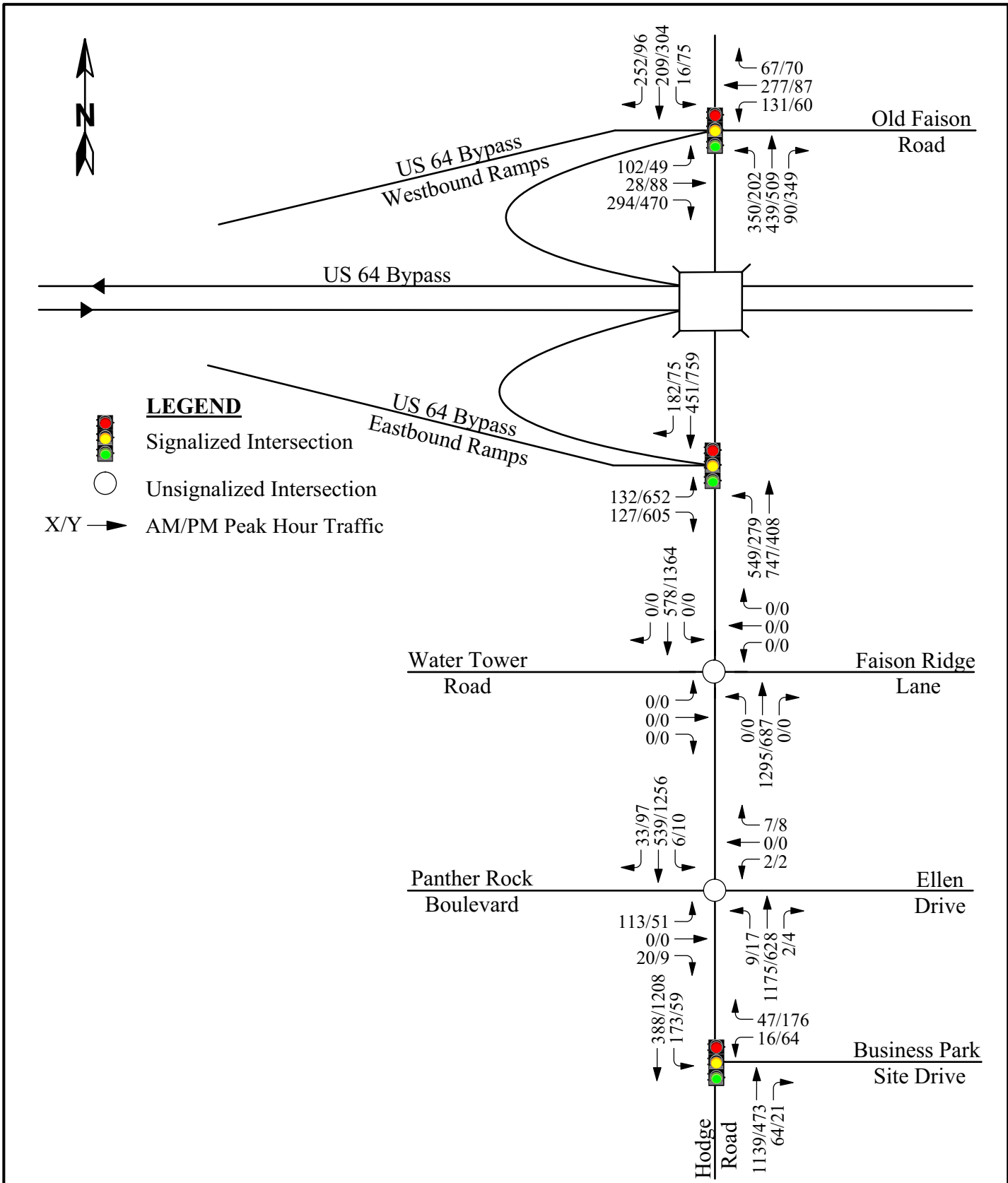




	<p style="text-align: center;">StoneRiver Knightdale, North Carolina</p>	<p style="text-align: center;">Background (2017) Peak Hour Traffic</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 7a</p>



	<p align="center">StoneRiver Knightdale, North Carolina</p>	<p align="center">Background (2021) Peak Hour Traffic without Hodge Road Business Park</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 7b</p>



	<p align="center">StoneRiver Knightdale, North Carolina</p>	<p align="center">Background (2021) Peak Hour Traffic with Hodge Road Business Park</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 7c</p>

4. TRIP GENERATION

The proposed development will consist of a mix of townhomes and single-family homes. Average weekday daily, AM peak hour, and PM peak hour trips for the proposed development were estimated using methodology contained within the *ITE Trip Generation Manual*, 9th Edition. Table 1 and Table 2 provide a summary of the trip generation potential for Phase 1 and full build-out of the site.

**Table 1
Site Trip Generation (Phase 1)**

Land Use (ITE Code)	Size	Unit	Weekday 24 Hour Volumes	Weekday AM Peak Hour Trips		Weekday PM Peak Hour Trips	
				Enter	Exit	Enter	Exit
Single-Family Homes (210)	70	Dwelling Units	670	13	40	44	26

It is estimated that Phase 1 will generate 670 total trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 53 trips (13 entering and 40 exiting) will occur during the weekday AM peak hour and 70 trips (44 entering and 26 exiting) will occur during the weekday PM peak hour.

**Table 2
Site Trip Generation (Full Build-Out)**

Land Use (ITE Code)	Size	Unit	Weekday 24 Hour Volumes	Weekday AM Peak Hour Trips		Weekday PM Peak Hour Trips	
				Enter	Exit	Enter	Exit
Single-Family Homes (210)	286	Dwelling Units	2,750	54	161	180	106
Townhomes (230)	98	Dwelling Units	570	7	36	34	17
Total Site Trips			3,320	61	197	214	123

It is estimated that full build out will generate 3,320 total trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 258 trips (61 entering and 197 exiting) will occur during the weekday AM peak hour and 337 trips (214 entering and 123 exiting) will occur during the weekday PM peak hour.

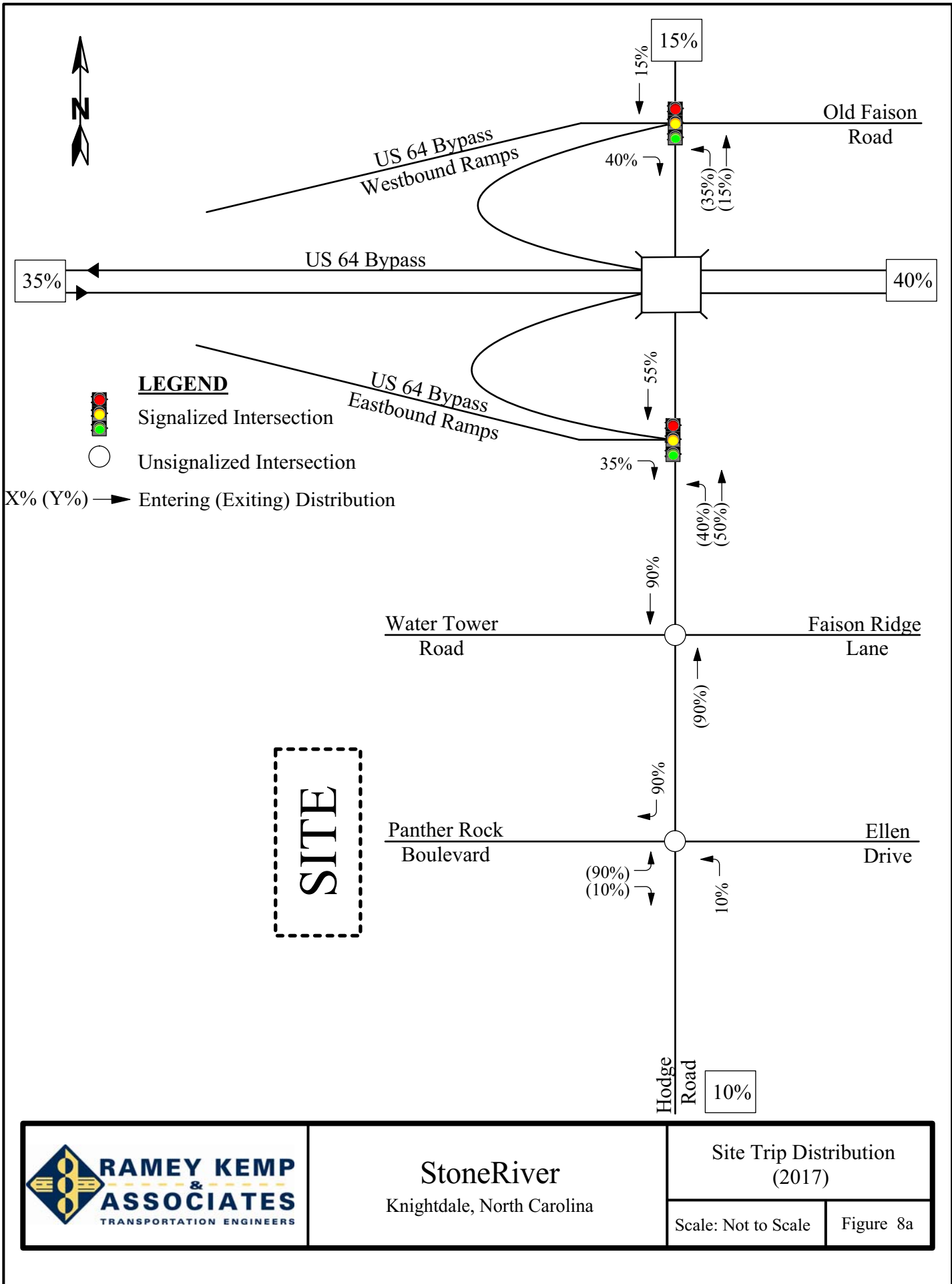
5. SITE TRIP DISTRIBUTION AND ASSIGNMENT

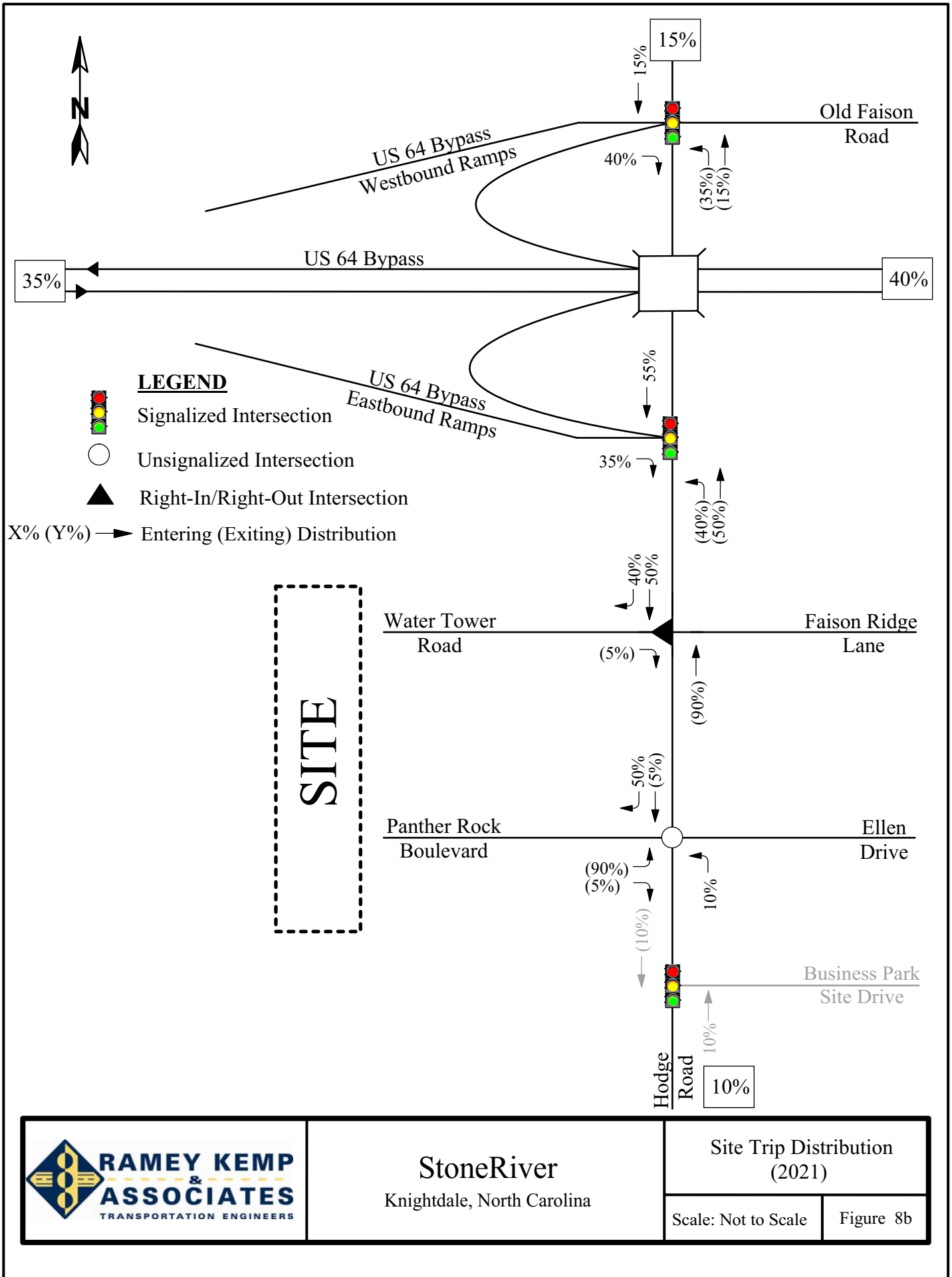
Trip distribution percentages for the proposed development were determined based on a combination of existing traffic patterns, locations of office and commercial population centers, and engineering judgment through coordination with NCDOT and the Town. The trip distribution was approved via the MOU.

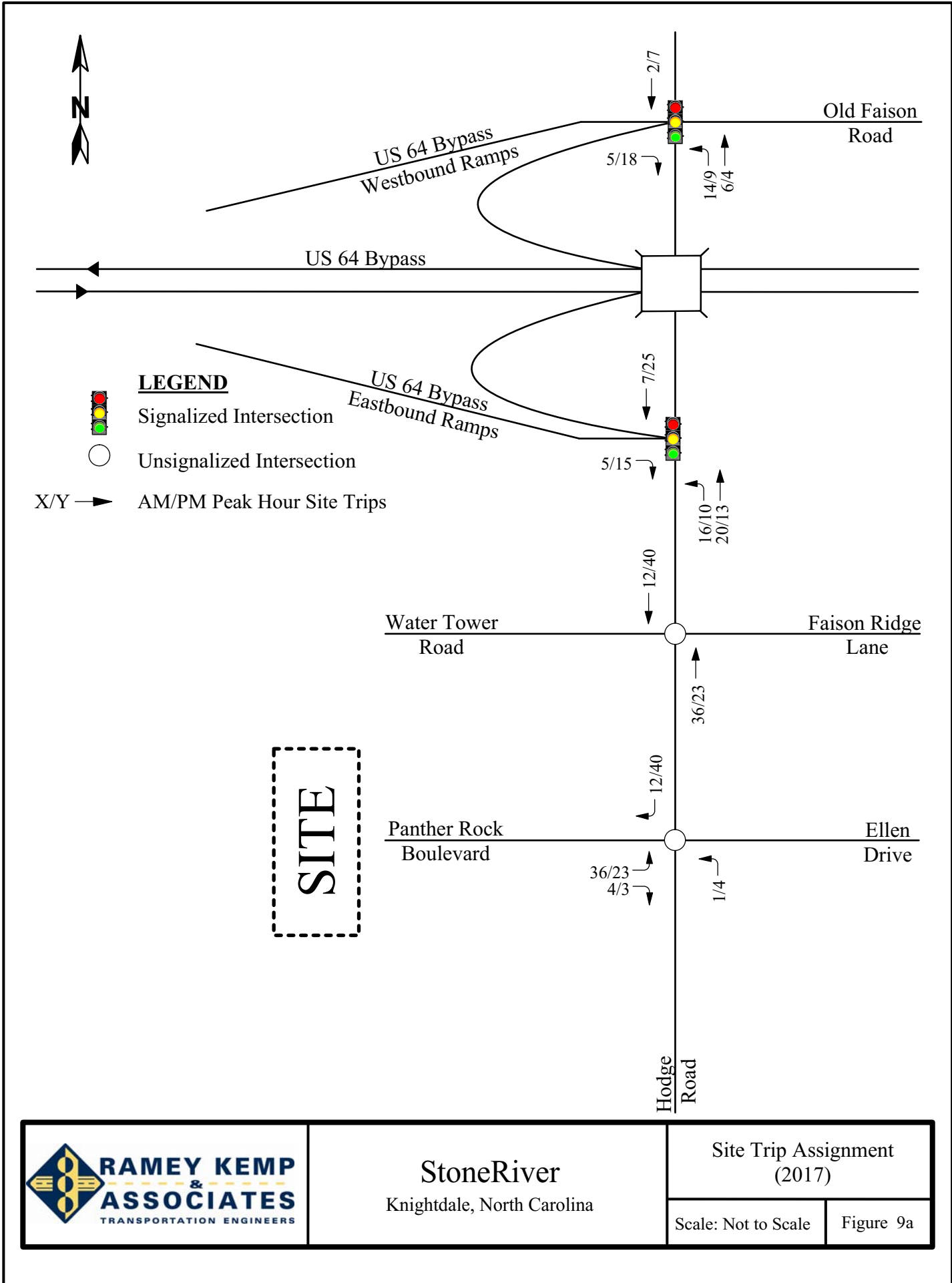
The site trips were distributed based on the following distribution:

- 35% to/from the west via US 64
- 40% to/from the east via US 64
- 15% to/from the north via Hodge Road
- 10% to/from the south via Hodge Road

The site trip distribution for the 2017 analysis year is shown in Figure 8a. Figure 8b shows the site trip distribution for the 2021 analysis year. Refer to Figure 9a for the peak hour site trips for the 2017 analysis year. Figure 9b shows the peak hour site trips for the 2021 analysis year.

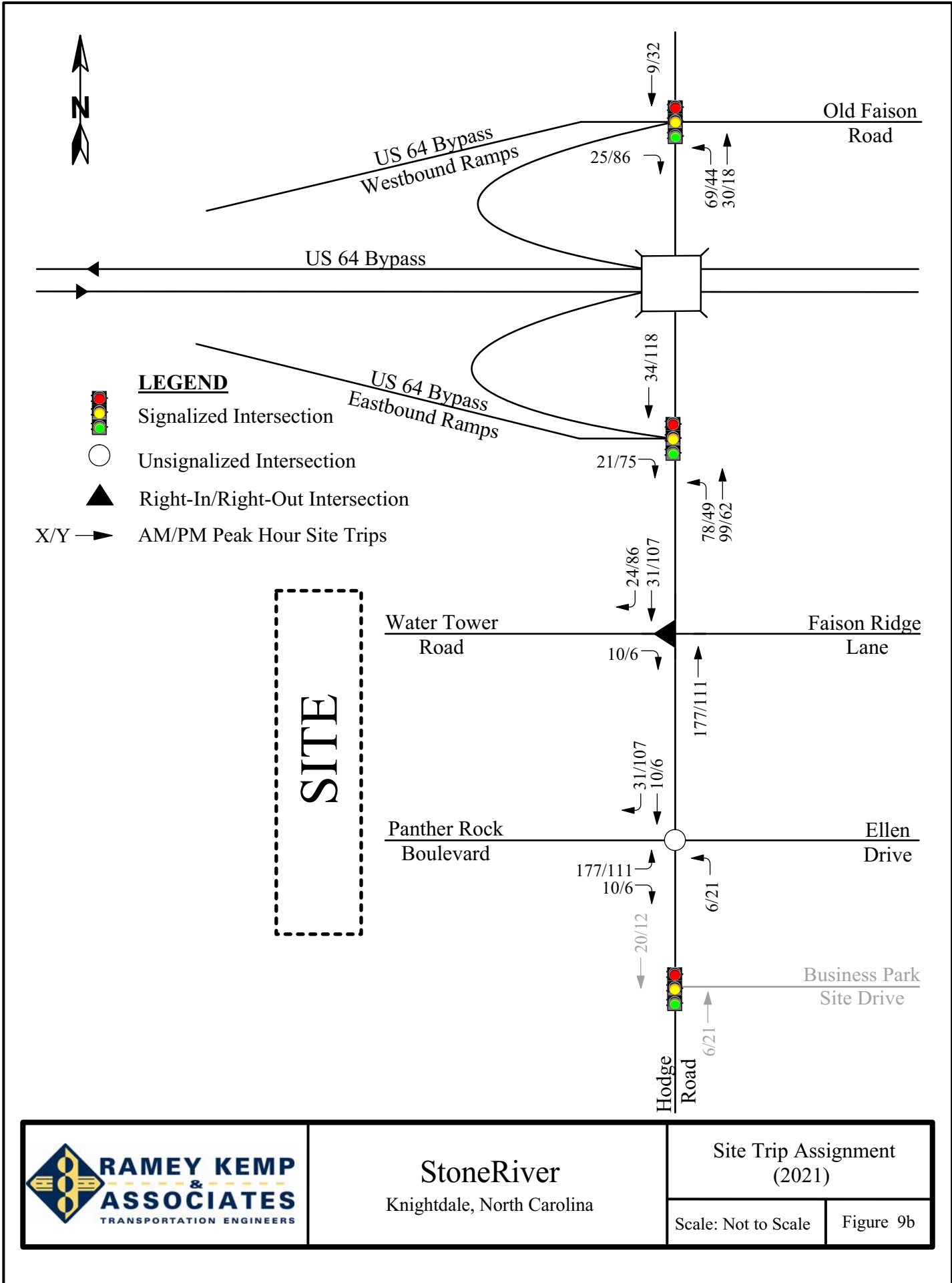






StoneRiver
Knightdale, North Carolina

Site Trip Assignment (2017)	
Scale: Not to Scale	Figure 9a



StoneRiver
Knightdale, North Carolina

Site Trip Assignment (2021)

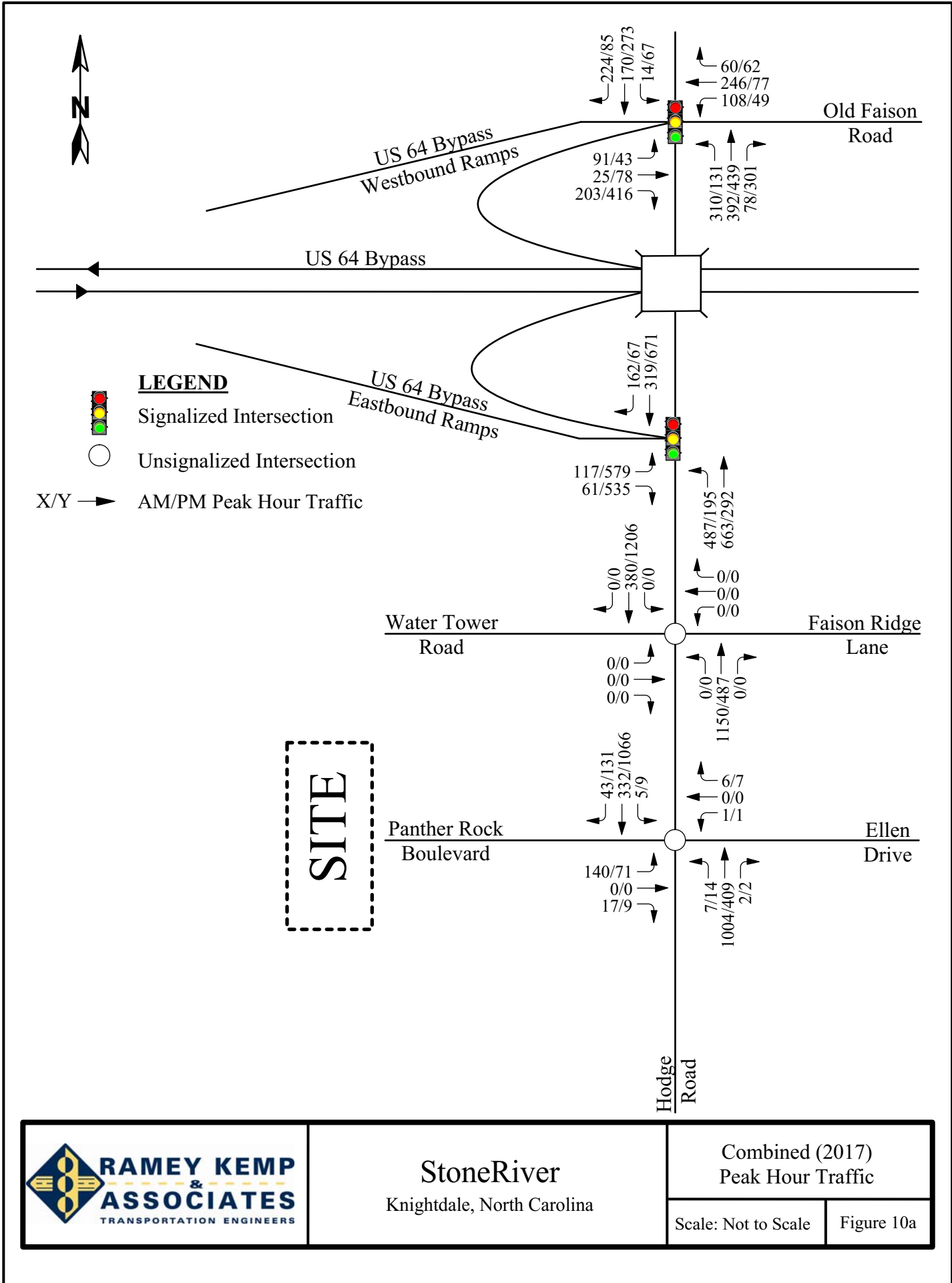
Scale: Not to Scale	Figure 9b
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6. COMBINED (2017/2021) TRAFFIC CONDITIONS

The site trips were added to the background traffic volumes to determine the combined peak hour traffic volumes that can be expected upon build out of the proposed development. Refer to Figure 10a for the combined (2017) weekday AM and PM peak hour traffic volumes. Refer to Figure 10b for the combined (2021), without the Hodge Road Business Park, weekday AM and PM peak hour traffic volumes. Refer to Figure 10c for the combined (2021), with the Hodge Road Business Park, weekday AM and PM peak hour traffic volumes.

6.1. Analysis of Combined (2017/2021) Peak Hour Traffic Conditions

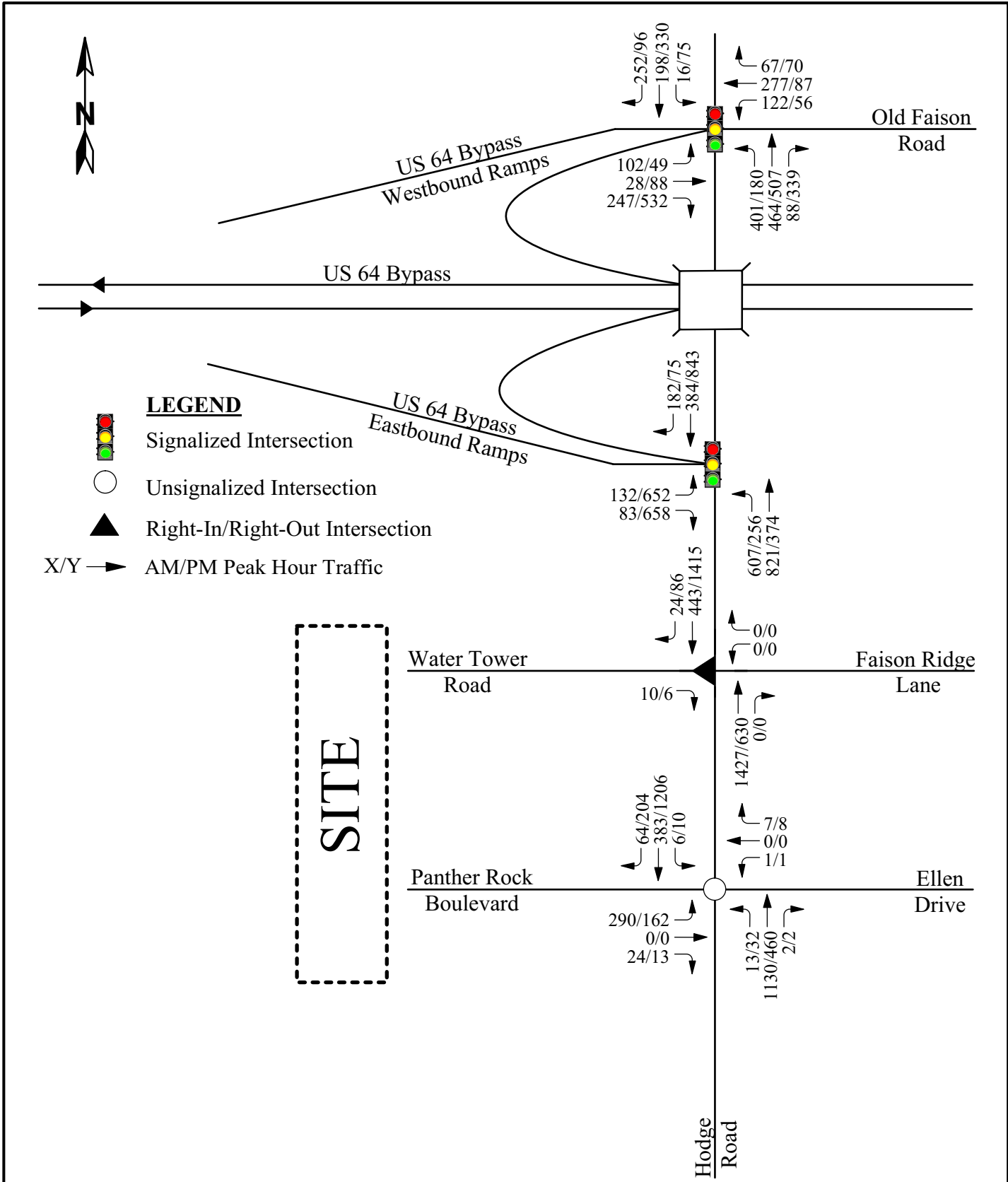
The combined (2017/2021) peak hour conditions were analyzed according to the same methodology as described for background and existing conditions. The results of the capacity analysis for each intersection are presented in Section 9 of this report.



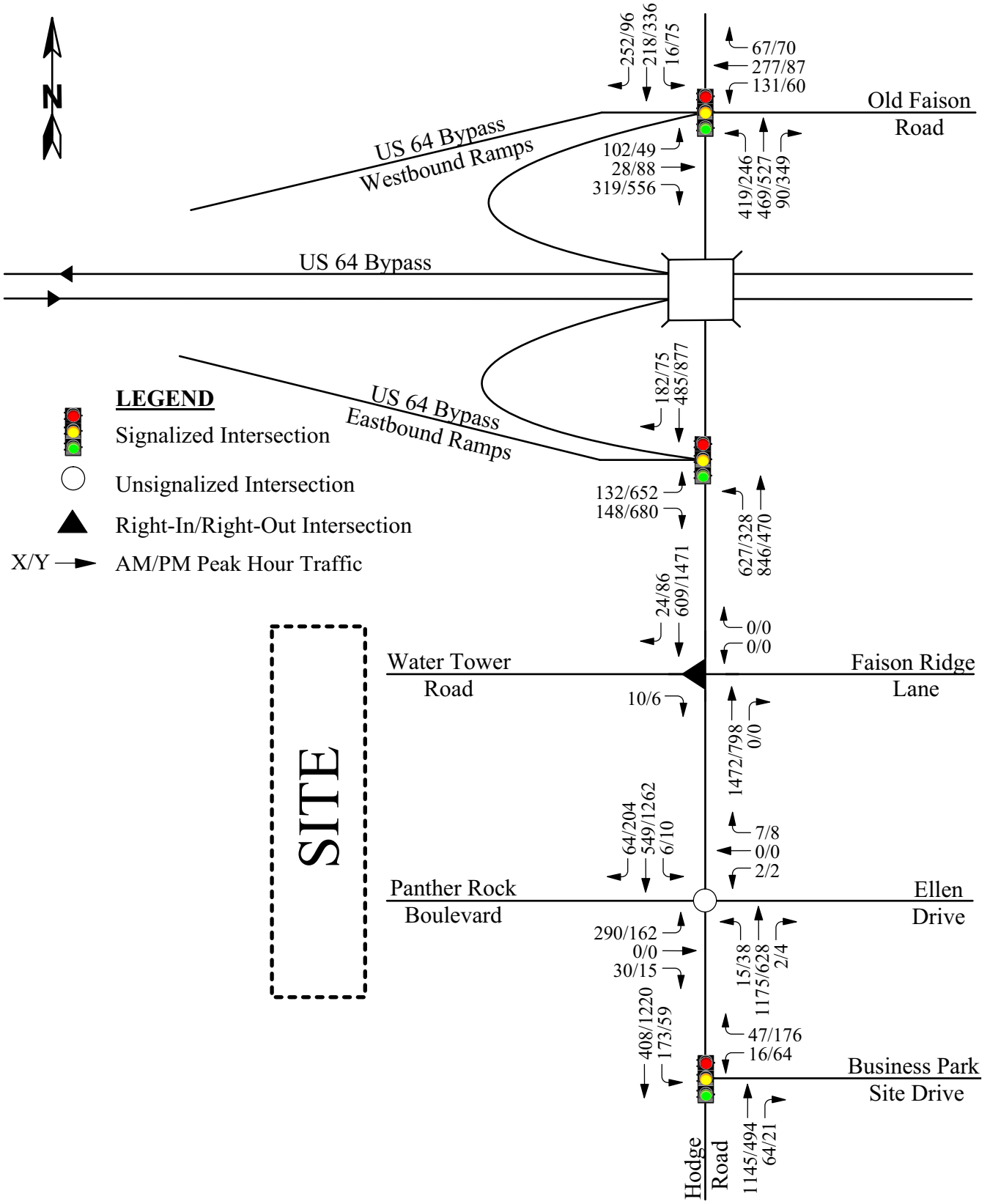
StoneRiver
Knightdale, North Carolina

Combined (2017)
Peak Hour Traffic

Scale: Not to Scale Figure 10a



	<p align="center">StoneRiver Knightdale, North Carolina</p>	<p align="center">Combined (2021) Peak Hour Traffic without Hodge Road Business Park</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 10b</p>



- LEGEND**
- Signalized Intersection
 - Unsignalized Intersection
 - Right-In/Right-Out Intersection
 - X/Y → AM/PM Peak Hour Traffic

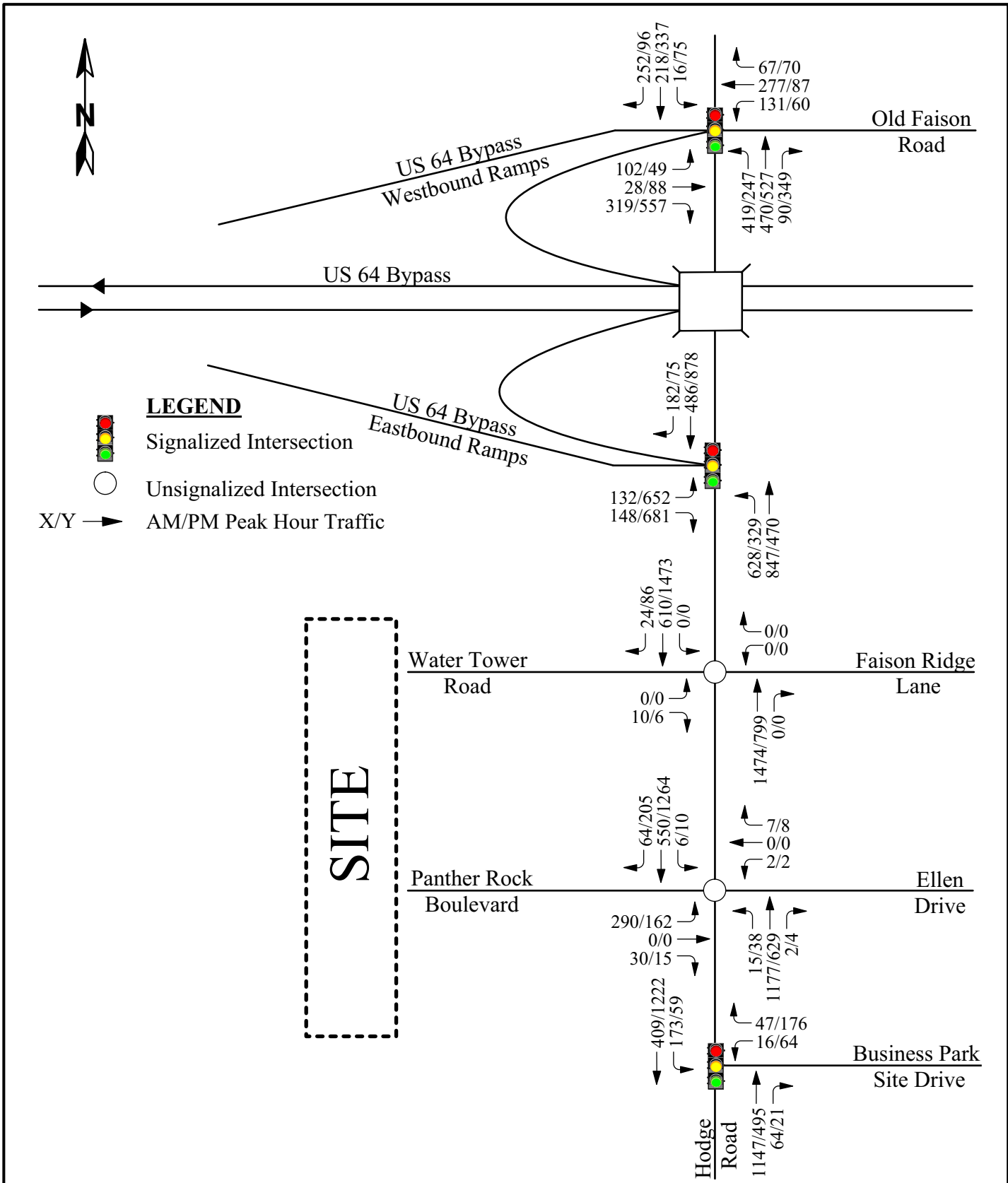
	<h2 style="margin: 0;">StoneRiver</h2> <p style="margin: 0;">Knightdale, North Carolina</p>		<p>Combined (2021) Peak Hour Traffic with Hodge Road Business Park</p>	
	<p>Scale: Not to Scale</p>		<p>Figure 10c</p>	

7. FUTURE (2031) TRAFFIC CONDITIONS

Per the Town’s Unified Development Ordinance (UDO), future traffic conditions were analyzed for 2031, or 10 years beyond the full build-out of the site. The existing traffic volumes were grown to the year 2031 using a 1% growth rate and combined with the adjacent development trips and site trips to determine the future (2031) peak hour traffic volumes. Refer to Figure 11 for the future (2031) weekday AM and weekday PM peak hour traffic volumes.

7.1. Analysis of Future (2031) Peak Hour Traffic Conditions

The analysis of future (2031) peak hour conditions considers improvements necessary to achieve LOS D. The results of the capacity analysis for each intersection are presented in Section 9 of this report.



	<p align="center">StoneRiver Knightdale, North Carolina</p>	<p align="center">Future (2031) Peak Hour Traffic</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 11</p>

8. TRAFFIC ANALYSIS PROCEDURE

Study intersections were analyzed using the methodology outlined in the 2010 Highway Capacity Manual (HCM) published by the Transportation Research Board. Capacity and level of service are the design criteria for this traffic study. A computer software package, Synchro (Version 9.1), was used to complete the analyses for most of the study area intersections. Please note that the unsignalized capacity analysis does not provide an overall level of service for an intersection; only delay for an approach with a conflicting movement.

The HCM defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” Level of service (LOS) is a term used to represent different driving conditions, and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.” Level of service varies from Level “A” representing free flow, to Level “F” where breakdown conditions are evident. Refer to Table 3 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes “initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay”. An average control delay of 50 seconds at a signalized intersection results in LOS “D” operation at the intersection.

**Table 3
Highway Capacity Manual – Levels-of-Service and Delay**

UNSIGNALIZED INTERSECTION		SIGNALIZED INTERSECTION	
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
A	0-10	A	0-10
B	10-15	B	10-20
C	15-25	C	20-35
D	25-35	D	35-55
E	35-50	E	55-80
F	>50	F	>80

8.1 Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the NCDOT Congestion Management Guidelines with the exception of the following:

- Zero-volumes were not adjusted due to the nature of the roadway network. All movements that had no volumes analyzed are expected to have little-to-no traffic volumes or are not typical movements (such as a vehicle traveling from one residential development into another).

9. CAPACITY ANALYSIS

9.1 Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road

The existing signalized intersection of Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road was analyzed under existing (2016), background (2017/2021), combined (2017/2021), and future (2031) conditions using the lane configurations and traffic control shown in Table 4. Refer to Table 4 for a summary of the capacity analysis results. Copies of the Synchro analysis reports are provided in Appendix D.

**Table 4
Analysis Summary of Hodge Road and
US 64 Bypass Westbound Ramps / Old Faison Road**

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (Delay)	Approach	Overall (Delay)
Existing (2016) Conditions	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	B D B B	C (21)	C C B B	C (21)
Background (2017) Conditions	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	B D B B	C (22)	C C C B	C (23)
Combined (2017) Conditions	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	B D B B	C (22)	C C C B	C (23)
Combined (2017) Conditions with Signal Timing Modifications	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	--	--	D D B B	C (25)
Background (2021) Conditions without Hodge Road Business Park	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	B C D B	C (27)	C C F B	D (47)
Combined (2021) Conditions without Hodge Road Business Park	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	B C D C	C (28)	C C F B	D (50)

Combined (2021) Conditions without Hodge Road Business Park with Improvements	EB	1 LT-TH, 1 RT	C	C (26)	D	C (30)
	WB	1 LT, 1 TH-RT	D			
	NB	1 LT, 1 TH-RT	C			
	SB	1 LT, 1 TH, 1 RT	B			
Background (2021) Conditions with Hodge Road Business Park	EB	1 LT-TH, 1 RT	A	C (29)	C	E (58)
	WB	1 LT-TH-RT	C			
	NB	1 LT, 1 TH-RT	D			
	SB	1 LT, 1 TH, 1 RT	C			
Combined (2021) Conditions with Hodge Road Business Park	EB	1 LT-TH, 1 RT	A	C (31)	C	E (62)
	WB	1 LT-TH-RT	C			
	NB	1 LT, 1 TH-RT	D			
	SB	1 LT, 1 TH, 1 RT	C			
Combined (2021) Conditions with Hodge Road Business Park with Improvements	EB	1 LT-TH, 1 RT	C	C (28)	D	C (26)
	WB	1 LT, 1 TH-RT	D			
	NB	1 LT, 1 TH-RT	C			
	SB	1 LT, 1 TH, 1 RT	C			
Future (2031) Conditions	EB	1 LT-TH, 1 RT	C	C (28)	D	C (27)
	WB	1 LT, 1 TH-RT	D			
	NB	1 LT, 1 TH-RT	C			
	SB	1 LT, 1 TH, 1 RT	C			
Future (2031) Conditions with Improvements	EB	1 LT-TH, 1 RT	C	C (32)	D	C (27)
	WB	1 LT, 1 TH-RT	C			
	NB	2 LT, 1 TH, 1 RT	D			
	SB	1 LT, 1 TH, 1 RT	B			

Improvements by developer are shown in bold.

Future improvements needed to achieve LOS D are shown in bold and italics.

Capacity analysis of existing (2016), background (2017), and combined (2017) traffic conditions indicates that the intersection of Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road operates at an overall LOS C during the weekday AM and PM peak hours. In order to improve the level of service for the US 64 Bypass Eastbound Ramp, the weekday PM peak hour signal timings were modified for both ramps. With this improvement, the intersection is expected to continue to operate at an overall LOS C during the weekday PM peak hour.

Under background (2021) and combined (2021) traffic conditions without the Hodge Road Business Park developed, the intersection is expected to operate at an overall LOS C during the weekday AM peak hour and LOS D during the weekday PM peak hour. To lessen queuing, an exclusive westbound left-turn lane was analyzed under combined traffic conditions. Also, the signal timings were modified to include the recommended signal at the intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive in the coordinated system. With these

improvements, the intersection is expected to operate at an overall LOS C during both weekday peak hours.

Under background (2021) and combined (2021) traffic conditions with the Hodge Road Business Park developed, the intersection is expected to operate at an overall LOS C during the weekday AM peak hour and LOS E during the weekday PM peak hour. To lessen queuing, an exclusive westbound left-turn lane was analyzed under combined traffic conditions. Also, the signal timings were modified to include the recommended signal at the intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive in the coordinated system. With these improvements, the intersection is expected to operate at an overall LOS C during both weekday peak hours.

Under Future (2031) traffic conditions, the intersection is expected to operate at an overall LOS C during the weekday AM and PM peak hours. Additional lanes needed along the study corridor to improve levels-of-service at other intersections resulted in dual left-turn lanes for the northbound approach as well as an exclusive northbound right-turn lane at this intersection. Also, the signal timings were modified to account for the growth in traffic. With these improvements, the intersection is expected to continue to operate at an overall LOS C during both weekday peak hours.

9.2. Hodge Road and US 64 Bypass Eastbound Ramps

The existing signalized intersection of Hodge Road and US 64 Bypass Eastbound Ramps was analyzed under existing (2016), background (2017/2021), combined (2017/2021), and future (2031) conditions using the lane configurations and traffic control shown in Table 5. Refer to Table 5 for a summary of the capacity analysis results. Copies of the Synchro analysis reports are provided in Appendix E.

**Table 5
Analysis Summary of Hodge Road and US 64 Bypass Eastbound Ramps**

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (Delay)	Approach	Overall (Delay)
Existing (2016) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D A A	B (10)	D B E	D (46)
Background (2017) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D A B	B (11)	D B F	E (56)
Combined (2017) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D A B	B (11)	D C F	E (61)
Combined (2017) Conditions with Signal Timing Modifications	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	--	--	D D D	D (49)
Background (2021) Conditions without Hodge Road Business Park	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D A B	B (14)	E C F	F (84)
Combined (2021) Conditions without Hodge Road Business Park	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	D B C	B (18)	E D F	F (115)
Combined (2021) Conditions without Hodge Road Business Park with Improvements	EB NB SB	1 LT, 2 RT 1 LT, 1 TH 1 TH, 1 RT	D A B	B (13)	F E F	F (85)

Background (2021) Conditions with Hodge Road Business Park	EB NB SB	<u>2 LT</u> , 1 RT 1 LT, 1 TH 1 TH, 1 RT	C B A	B (13)	E B E	D (52)
Combined (2021) Conditions with Hodge Road Business Park	EB NB SB	2 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	C B B	B (19)	F C F	E (79)
Combined (2021) Conditions with Hodge Road Business Park with Improvements and Signal Modifications	EB NB SB	2 LT, 2 RT 1 LT, 1 TH 1 TH, 1 RT	D B B	B (17)	D D F	E (57)
Future (2031) Conditions	EB NB SB	2 LT, 2 RT 1 LT, 1 TH 1 TH, 1 RT	D B B	B (17)	E D F	E (67)
Future (2031) Conditions with Improvements	EB NB SB	2 LT, 2 RT 1 LT, 2 TH 2 TH , 1 RT	D A B	B (13)	D B C	C (30)

Improvements by Hodge Road Business Park are shown in bold and underlined.
Improvements by developer are shown in bold.
Future improvements needed to achieve LOS D are shown in bold and italics.

Capacity analysis of existing (2016) traffic conditions indicates that the intersection of Hodge Road and US 64 Bypass Eastbound Ramps operates at an overall LOS B during the weekday AM peak hour and LOS D during the weekday PM peak hour. Under background (2017) and combined (2017) traffic conditions the intersection is expected to operate at an overall LOS B during the weekday AM peak hour and LOS E during the weekday PM peak hour. To improve the signal system operations for both US 64 Ramps, the weekday PM peak hour signal timings were modified. With this improvement, the intersection is expected to operate at an overall LOS D during the weekday PM peak hour under combined (2017) conditions.

Under background (2021) and combined (2021) traffic conditions without the Hodge Road Business Park developed, the intersection is expected to operate at an overall LOS B during the weekday AM peak hour and LOS F during the weekday PM peak hour. To improve intersection operations, dual eastbound right-turn lanes on the 64 Bypass Eastbound Ramp were analyzed under combined traffic conditions. With the additional lane, both right-turn lanes were brought back under signal control. Also, the signal timings were modified to include the recommended signal at the intersection of Hodge Road and Panther Rock

Boulevard / Ellen Drive in the coordinated system. With these improvements, the intersection is expected to continue to operate at similar levels-of-service, with decreased overall delays.

If the Hodge Road Business park is to be developed before the StoneRiver development, the business park will be required to provide dual eastbound left-turn lanes on the US 64 Bypass Eastbound Ramp. Under background (2021) traffic conditions with the Hodge Road Business Park developed, the intersection is expected to operate at an overall LOS B during the weekday AM peak hour and LOS D during the weekday PM peak hour. Under combined (2021) traffic conditions, the intersection is expected to operate at an overall LOS B during the weekday AM peak hour and LOS E during the weekday PM peak hour. To improve intersection operations, dual eastbound right-turn lanes on the 64 Bypass Eastbound Ramps were analyzed under combined traffic conditions. With the additional lane, both right-turn lanes were brought back under signal control. Also, the signal timings were modified to include the recommended signal at the intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive in the coordinated system. With these improvements, the intersection is expected to operate at similar levels-of-service with decreased vehicle delays.

Under Future (2031) traffic conditions, the intersection is expected to operate at an overall LOS B during the weekday AM peak hour and LOS E during the weekday PM peak hour. To improve intersection operations, the northbound and southbound approaches on Hodge Road were analyzed with two through lanes. Also, the signal timings were modified to account for the growth in traffic. With these improvements, the intersection is expected to operate at an overall LOS B during the weekday AM peak hour and LOS C during the weekday PM peak hour. It should be noted that additional through lanes on Hodge Road would require significant infrastructure modifications, including the bridge over US 64 Bypass.

9.3 Hodge Road and Water Tower Road / Faison Ridge Lane

The existing unsignalized intersection of Hodge Road and Water Tower Road / Faison Ridge Lane was analyzed under existing (2016), background (2017/2021), combined (2017/2021), and future (2031) conditions using the lane configurations and traffic control shown in Table 6. Refer to Table 6 for a summary of the analysis results. Refer to Appendix F for copies of the Synchro capacity analysis reports.

**Table 6
Analysis Summary of Hodge Road and Water Tower Road / Faison Ridge Lane**

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (Delay)	Approach	Overall (Delay)
Existing (2016) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A ¹ A ¹ A ² A ²	N/A	A ¹ A ¹ A ² A ²	N/A
Background (2017) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A ¹ A ¹ A ² A ²	N/A	A ¹ A ¹ A ² A ²	N/A
Combined (2017) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A ¹ A ¹ A ² A ²	N/A	A ¹ A ¹ A ² A ²	N/A
Background (2021) Conditions without Hodge Road Business Park	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A ¹ A ¹ A ² A ²	N/A	A ¹ A ¹ A ² A ²	N/A
Combined (2021) Conditions without Hodge Road Business Park	EB WB NB SB	1 RT 1 LT-RT 1 TH-RT 1 LT, 1 TH-RT	B ¹ A ¹ -- A ²	N/A	D ¹ A ¹ -- A ²	N/A
Combined (2021) Conditions without Hodge Road Business Park with Improvements	EB WB NB SB	1 RT 1 LT-RT 1 TH-RT 1 LT, 1 TH, 1 TH-RT	A ¹ A ¹ -- A ²	N/A	C ¹ A ¹ -- A ²	N/A
Background (2021) Conditions with Hodge Road Business Park	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	A ¹ A ¹ A ² A ²	N/A	A ¹ A ¹ A ² A ²	N/A

Combined (2021) Conditions with Hodge Road Business Park	EB	1 RT	B ¹	N/A	E ¹	N/A
	WB	1 LT-RT	A ¹		A ¹	
	NB	1 TH-RT	--		--	
	SB	1 LT, 1 TH-RT	A ²		A ²	
Combined (2021) Conditions with Hodge Road Business Park with Improvements	EB	1 RT	B ¹	N/A	C ¹	N/A
	WB	1 LT-RT	A ¹		A ¹	
	NB	1 TH-RT	--		--	
	SB	1 LT, 1 TH, 1 TH-RT	A ²		A ²	
Future (2031) Conditions	EB	1 RT	B ¹	N/A	C ¹	N/A
	WB	1 LT-RT	A ¹		A ¹	
	NB	1 TH-RT	--		--	
	SB	1 LT, 1 TH, 1 TH-RT	A ²		A ²	
Future (2031) Conditions with Improvements	EB	1 RT	B ¹	N/A	C ¹	N/A
	WB	1 LT-RT	A ¹		A ¹	
	NB	<i>1 TH</i> , 1 TH-RT	--		--	
	SB	1 LT, 1 TH, 1 TH-RT	A ²		A ²	

1. LOS for the minor street approach.
2. LOS for the left-turn movement of the major street.

Improvements by developer are shown in bold.

Future improvements needed to achieve LOS D are shown in bold and italics.

Capacity analysis of existing (2016), background (2017), and combined (2017) traffic conditions indicates that all approaches and left-turn movements from major approaches at the intersection of Hodge Road and Water Tower Road / Faison Ridge Lane operate at LOS A during both weekday AM and PM peak hours.

Under background (2021) traffic conditions without the Hodge Road Business Park developed, all approaches of the intersection are expected to operate at LOS A during both weekday AM and PM peak hours. With the full-build-out of the site, the eastbound approach of Water Tower Road becomes a right-in / right-out access, providing access to the proposed development. Under combined (2021) traffic conditions, the eastbound approach is anticipated to operate at LOS B during the weekday AM peak hour and LOS E during the weekday PM peak hour. As part of the improvements at the US 64 Bypass Eastbound Ramp, a shared southbound through / right-turn lane at this intersection was analyzed under combined traffic conditions. With these improvements, the eastbound approach is expected to operate at LOS A during the weekday AM peak hour and LOS C during the weekday PM peak hour.

Under background (2021) traffic conditions with the Hodge Road Business Park developed, all approaches of the intersection are expected to operate at LOS A during both weekday AM and

PM peak hours. With full build-out of the site, the eastbound approach of Water Tower Road becomes a right-in / right-out access, providing access to the proposed development. Under combined (2021) traffic conditions, the eastbound approach is expected to operate at LOS B during the weekday AM peak hour and LOS E during the weekday PM peak hour. With the southbound shared through / right-turn lane considered, the eastbound approach is expected to operate at LOS B during the weekday AM peak hour and LOS C during the weekday PM peak hour.

Under Future (2031) traffic conditions, the eastbound approach is expected to operate at LOS B during the weekday AM peak hour and LOS C during the weekday PM peak hour. A northbound through lane is added on Hodge Road as part of the improvements necessary to meet UDO requirements; this additional lane does not impact levels-of-service at this intersection.

9.4 Hodge Road and Panther Rock Boulevard / Ellen Drive

The existing unsignalized intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive was analyzed under existing (2016), background (2017/2021), combined (2017/2021), and future (2031) conditions using the lane configurations and traffic control shown in Table 7. Refer to Table 7 for a summary of the analysis results. Refer to Appendix G for copies of the Synchro capacity analysis reports.

**Table 7
Analysis Summary of Hodge Road and Panther Rock Boulevard / Ellen Drive**

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (Delay)	Approach	Overall (Delay)
Existing (2016) Conditions	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ C ¹ A ² B ²	N/A	F ¹ C ¹ B ² A ²	N/A
Background (2017) Conditions	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ C ¹ A ² B ²	N/A	F ¹ C ¹ B ² A ²	N/A
Combined (2017) Conditions	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ C ¹ A ² B ²	N/A	F ¹ C ¹ B ² A ²	N/A
Background (2021) Conditions without Hodge Road Business Park	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ D ¹ A ² B ²	N/A	F ¹ C ¹ B ² A ²	N/A
Combined (2021) Conditions without Hodge Road Business Park	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ D ¹ A ² B ²	N/A	F ¹ C ¹ B ² A ²	N/A
Combined (2021) Conditions without Hodge Road Business Park with Improvements and Signalization	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	F D C B	D (47)	E E B E	D (47)

Combined (2021) Conditions without Hodge Road Business Park with Permitted+Protected Signal Phasing	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	E D D B	D (39)	E E A D	D (42)
Background (2021) Conditions with Hodge Road Business Park	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ E ¹ A ² B ²	N/A	F ¹ E ¹ B ² A ²	N/A
Combined (2021) Conditions with Hodge Road Business Park	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH-RT	F ¹ E ¹ A ² B ²	N/A	F ¹ F ¹ C ² A ²	N/A
Combined (2021) Conditions with Hodge Road Business Park with Improvements and Signalization	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	E E D B	D (40)	F D B E	D (50)
Combined (2021) Conditions with Hodge Road Business Park with Permitted+Protected Signal Phasing	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	E E C A	C (33)	F D A D	D (41)
Future (2031) Conditions	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, 1 TH-RT 1 LT, 1 TH, 1 RT	F E C A	C (33)	F D A E	D (51)
Future (2031) Conditions with Improvements	EB WB NB SB	1 LT, 1 TH-RT 1 LT-TH-RT 1 LT, <i>1 TH</i> , 1 TH-RT 1 LT, 1 TH, <i>1 TH-RT</i>	D D A A	B (16)	E D A B	B (13)

1. LOS for the minor street approach.
 2. LOS for the left-turn movement of the major street.
- Improvements by developer are shown in bold.**
Future improvements needed to achieve LOS D are shown in bold and italics.

Capacity analysis of existing (2016), background (2017), and combined (2017) traffic conditions indicates that the eastbound approach of the intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive operates at LOS F during both weekday AM and PM peak hours.

Under background (2021) and combined (2021) traffic conditions without the Hodge Road Business Park developed, the eastbound approach is expected to operate at LOS F during both weekday AM and PM peak hours. The intersection should be monitored for signal warrants and a traffic signal should be installed when warranted. Under signalization with protected-

only left-turn phasing per NCDOT Congestion Management Guidelines, the intersection is anticipated to operate at an overall LOS D during both AM and PM peak hours. The signal was also analyzed with permitted+protected left-turn phasing. With these improvements, the intersection is expected to operate at an overall LOS D during the weekday AM and PM peak hours.

Under background (2021) and combined (2021) traffic conditions with the Hodge Road Business Park developed, the eastbound approach is expected to operate at LOS F during both weekday AM and PM peak hours. Under signalization with protected-only left-turn phasing per NCDOT Congestion Management Guidelines, the intersection is anticipated to operate at an overall LOS D during both AM and PM peak hours. The signal was also analyzed with permitted+protected left-turn phasing. With these improvements, the intersection is expected to operate at an overall LOS C during the weekday AM peak hour and an overall LOS D during the PM peak hour.

Under Future (2031) traffic conditions, the intersection is anticipated to operate at an overall LOS E during both weekday AM and PM peak hours. In order to improve intersection operations, the northbound and southbound approaches on Hodge Road were analyzed with two through lanes. With these improvements, the intersection is expected to operate at an overall LOS B during both weekday AM and PM peak hours.

9.5 Hodge Road and Business Park Site Drive

The future signalized intersection of Hodge Road and Business Park Site Drive was analyzed under background (2021), combined (2021), and future (2031) conditions using the lane configurations and traffic control shown in Table 8. It should be noted that this intersection is a background improvement committed by the Hodge Road Business Park. Refer to Table 8 for a summary of the analysis results. Refer to Appendix H for copies of the Synchro capacity analysis reports.

**Table 8
Analysis Summary of Hodge Road and Business Park Site Drive**

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (Delay)	Approach	Overall (Delay)
Background (2021) Conditions with Hodge Road Business Park	WB NB SB	<u>1 LT, 1 RT</u> <u>1 TH, 1 RT</u> <u>1 LT, 1 TH</u>	E C D	D (36)	E A B	B (20)
Combined (2021) Conditions with Hodge Road Business Park	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	E C C	C (33)	E A B	B (19)
Future (2031) Conditions	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	D C C	C (33)	D A B	B (19)
Future (2031) Conditions with Improvements	WB NB SB	1 LT, 1 RT <u>2 TH, 1 RT</u> 1 LT, <u>2 TH</u>	D A A	A (8)	D B A	B (11)

Improvements by Hodge Road Business Park are shown in bold and underlined. Future improvements needed to achieve LOS D are shown in bold and italics.

Under background (2021) and combined (2021) traffic conditions, with the Hodge Road Business Park developed, the intersection of Hodge Road and Hodge Road Business Park Site Drive is expected to operate at acceptable levels-of-service.

Under Future (2031) and Future (2031) improved traffic conditions, the intersection is expected to operate at acceptable levels-of-service.

10. SIGNAL WARRANT ANALYSIS

A signal warrant analysis was conducted at the intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive under combined (2021) conditions, without Hodge Road Business Park developed, as part of the recommended improvements to mitigate the site impacts. The purpose of the signal warrant analysis is to evaluate the intersection to determine whether a traffic signal is warranted based on combined (2021) conditions. The analysis of the traffic volumes utilizes the criteria contained in the *Manual on Uniform Traffic Control Devices* (MUTCD).

Hodge Road is a two lane roadway with a posted speed limit of 45 mph within the vicinity of the site. There currently exists a signalized intersection approximately 750 feet north at the intersection of Hodge Road and US 64 Eastbound Ramps and approximately 4,200 feet south at the intersection of Hodge Road and Poole Road.

A twelve (12) hour traffic count was conducted at the intersection of Hodge Road and Panther Rock Boulevard / Ellen Drive by RKA on February 18, 2016. The existing traffic volumes were combined with the site trips that were distributed throughout the day and were then compared to signal warrants. The results of the signal warrants are summarized in Table 9.

TABLE 9
Signal Warrants Analysis Results for Hodge Road and Panther Rock Boulevard / Ellen Drive
Combined (2021) Conditions, without Hodge Road Business Park

TIME	VEHICLE COUNT		WARRANTS (2009)			
	MAJOR	MINOR	#1A	#1B	#2	#3
7:00 am to 8:00 am	1,526	282	Y	Y	Y	Y
8:00 am to 9:00 am	1,215	207	Y	Y	Y	Y
9:00 am to 10:00 am	709	103	N	N	N	N
10:00 am to 11:00 am	631	104	N	N	N	N
11:00 am to 12:00 pm	582	95	N	N	N	N
12:00 pm to 1:00 pm	755	175	Y	Y	Y	N
1:00 pm to 2:00 pm	712	92	N	N	N	N
2:00 pm to 3:00 pm	799	172	Y	Y	Y	N
3:00 pm to 4:00 pm	1,074	135	N	Y	Y	N
4:00 pm to 5:00 pm	1,372	113	N	Y	Y	Y
5:00 pm to 6:00 pm	1,684	195	Y	Y	Y	Y
6:00 pm to 7:00 pm	1,421	167	Y	Y	Y	Y
WARRANTS MET			6	8	8	5

Signal warrants indicate that Warrant 1A (8-hour warrant) was met for 6 hours, Warrant 1B (8-hour warrant) was met for 8 hours, Warrant 2 (4-hour warrant) was met for 8 hours, and Warrant 3 (peak hour warrant) was met for 5 hours. It is recommended that the intersection be monitored for signalization. When and if warranted, it is recommended that a signal be installed. Refer to Appendix I for signal warrant analysis printouts.

11. CONCLUSIONS

This report summarizes the findings of the updated Traffic Impact Analysis (TIA) that was conducted for the proposed StoneRiver (formerly Cheswick North) residential development to be located west of Hodge Road, south of the US 64 Bypass interchange in Knightdale, NC. The proposed development is anticipated to be built out by 2021 and is expected to include 286 single-family homes and 98 townhomes. Phase 1 of the development, consisting of 70 single-family homes, is anticipated to be built out in 2017.

Access to the development is proposed via two site driveways connecting to Hodge Road. Panther Rock Boulevard, located approximately 750 feet south of the US 64 Bypass Eastbound ramps, will serve as the main site driveway. The existing water tower access road, located approximately 300 feet south of the US 64 Bypass Eastbound ramps on Hodge Road, will be used for emergency access only during Phase 1 and will provide regular access to the site at full build-out as a right-in / right-out access.

This study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- Existing (2016) Traffic Conditions
- Background (2017) Traffic Conditions
- Combined (2017) Traffic Conditions (Phase 1)
- Background (2021) Traffic Conditions without Hodge Road Business Park
- Background (2021) Traffic Conditions with Hodge Road Business Park
- Combined (2021) Traffic Conditions (Full Build-Out) without Hodge Road Business Park
- Combined (2021) Traffic Conditions (Full Build-Out) with Hodge Road Business Park
- Future (2031) Traffic Conditions (Full Build-Out) with Hodge Road Business Park

Trip Generation

It is estimated that full build out will generate 3,320 total trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 258 trips (61 entering and 197 exiting) will occur during the weekday AM peak hour and 337 trips (214 entering and 123 exiting) will occur during the weekday PM peak hour.

Existing Conditions Impacting the Study Area Intersections

It should be noted that it is likely the study area intersections may operate better than what is shown in the analysis results if improvements are made at the US 64 Bypass and Smithfield Road interchange, just to the east of the study area, as this may reduce the amount of background traffic using Hodge Road to access US 64 Bypass. Additionally, future traffic volumes used for the analysis are likely conservative as congestion along Hodge Road due to development may encourage drivers to access US 64 Bypass using Smithfield Road instead of avoiding that interchange by using Hodge Road.

Hodge Road and US 64 Westbound Ramps / Old Faison Road

This intersection was analyzed as a signalized intersection with signal timings coordinated with the US 64 Bypass Eastbound ramps intersection. The intersection currently operates at acceptable levels-of-service and is anticipated to continue to under background conditions. With signal timing modifications and an exclusive eastbound left-turn lane, the intersection is anticipated to operate at acceptable levels-of-service after the development is built. Additional storage will be necessary for the queueing anticipated for the northbound left turn movement. The existing storage for the northbound left turn lane is 225 feet and will need to be extended to approximately 400 feet. The bridge over US 64 Bypass is three lanes with a center hatched area. The additional storage for the northbound left turn lane can be provided by restriping a portion of the hatched area.

To improve the anticipated intersection operation under Future (2031) conditions, additional lanes will need to be added to the northbound approach and southbound receiving lanes. This would require the Hodge Road bridge over US 64 Bypass to be widened. It may be beneficial to consider redesigning the US 64 Bypass and Hodge Road interchange at such time additional lanes are needed on the bridge.

Hodge Road and US 64 Eastbound Ramps

This intersection was analyzed as a signalized intersection with signal timings coordinated with the US 64 Bypass Westbound ramps intersection. The intersection currently operates at acceptable levels-of-service. During the AM peak hour, the intersection is anticipated to

continue to operate at an acceptable level-of-service after the development is built. The intersection is anticipated to experience poor operations under background (2017) and combined (2017) conditions in the PM peak hour. With signal timing modifications, the intersection is anticipated to operate with a level-of-service and delay better than background conditions.

Under background (2021) and combined (2021) conditions, without the Hodge Road Business Park development, the intersection is anticipated to experience poor levels-of-service during the PM peak hour. With the addition of a second eastbound right-turn lane, the level-of-service and delay are anticipated to be similar to background (2021) conditions. With this additional right-turn lane, the right-turn movement will need to be brought back under signal control and an additional receiving lane on southbound Hodge Road will need to be constructed.

The Hodge Road Business Park is committed to constructing an additional eastbound left-turn lane with 300 feet of storage at this intersection. When this improvement is combined with the dual eastbound right-turn lanes as part of the StoneRiver development, the intersection operates similar to background (2021) conditions.

To improve the anticipated intersection operation under Future (2031) conditions, additional lanes will need to be added to the northbound and southbound approaches. This would require the Hodge Road bridge over US 64 Bypass to be widened. It may be beneficial to consider redesigning the US 64 Bypass and Hodge Road interchange at such time additional lanes are needed on the bridge.

Hodge Road and Faison Ridge Lane / Water Tower Access Road

The water tower access road will provide access to the development for emergency personnel only during Phase 1. Under combined (2021) conditions the water tower access road will provide regular access to the development and will be converted to a right-in / right-out driveway with a porkchop island.

Hodge Road and Panther Rock Boulevard / Ellen Drive

This intersection was analyzed as an unsignalized, two-way stop controlled intersection for existing and background conditions. With the development of Phase 1, the eastbound approach is anticipated to experience a proportional increase in delay and queueing – a rough equivalent of four vehicles during the AM peak hour. Panther Rock Boulevard has been constructed as a two lane road, with an exclusive left turn lane with approximately 130 feet of storage and a shared through-right turn lane at Hodge Road. Bike lanes are provided on both sides of the road. Curb and gutter, landscaping, and sidewalks have also been installed the length of the road on both sides. Adding storage to the left turn lane would require the removal and reinstallation of these components for an extended distance on Panther Rock Boulevard. It is anticipated the left turn traffic would use the through-right turn lane as storage once the left turn lane storage is filled. The number of through and right turns on Panther Rock Boulevard is anticipated to be much fewer than the left turns.

The anticipated addition of site trips to the southbound right-turn movement at this intersection is on the threshold of warranting a short, exclusive right-turn lane at an unsignalized intersection. Significant construction efforts are likely necessary to build this right-turn lane due to the grade change on the west side of Hodge Road in this area. As such, it is recommended that the right-turn lane be built as part of the improvements for full build-out when it is anticipated the right-turn lane will extend from Panther Rock Boulevard to the US 64 Bypass Eastbound off-ramp.

It is recommended that the intersection be monitored for signal warrants during the full build-out phase. Under combined (2021) conditions, the eastbound approach (site access) is anticipated to experience significant delays and queueing due to the heavy mainline volumes and the high number of left turns exiting the site. Signalization of the intersection when warranted will reduce delay and queueing for the minor approaches while managing the heavy mainline volumes. It is recommended that permitted + protected left-turn phasing be implemented due to the relatively low volume of northbound and southbound left-turn movements. Under combined (2021) conditions, it is also recommended that the southbound right-turn lane on Hodge Road be built and extend to the US 64 Bypass Eastbound ramp to

serve as a second receiving lane for the dual eastbound right-turn lanes on the off-ramp.

To improve the anticipated intersection operation under Future (2031) conditions, additional lanes will need to be added to the northbound and southbound approaches.

Hodge Road and Business Park Site Drive

Traffic generated by the StoneRiver development is not anticipated to significantly impact operations at the Hodge Road Business Park driveway.

Future 2031 Conditions

Analysis of 2031 conditions suggests that additional through lanes would be needed on Hodge Road, which would require significant modifications to the bridge over US 64 Bypass. It would be recommended to consider a redesign of the interchange if and when the bridge modifications are necessary to evaluate the economic impacts of the options. It should be noted that 2031 traffic volumes in this study are likely high due to the sustained growth rate over the long period of time.

12. RECOMMENDATIONS

Based on the findings of this study, specific improvements were identified and are recommended in order to accommodate future traffic conditions. Refer to Figure 12a for the recommended lane configuration for the 2017 analysis year. Refer to Figure 12b for the recommended lane configurations for the 2021 analysis year.

Phase 1 (2017)

Improvements by the Developer

Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road

- Modify signal timings as necessary in coordination with the signal at Hodge Road and US 64 Bypass Eastbound ramps to accommodate traffic volumes.

Hodge Road and US 64 Bypass Eastbound Ramps

- Modify signal timings as necessary in coordination with the signal at Hodge Road and US 64 Bypass Westbound ramps to accommodate traffic volumes.

Phase 2 (2021)

Improvements by Hodge Road Business Park

Hodge Road and US 64 Bypass Westbound Ramps / Old Faison Road

- Restripe the northbound left-turn lane to provide continuous storage south to the US 64 Bypass Eastbound Ramps

Hodge Road and US 64 Bypass Eastbound Ramps

- Construct a second eastbound left-turn lane with 300 feet of storage.

Hodge Road and Business Park Site Drive

- Construct a southbound left-turn lane with 250 feet of storage.
- Construct a northbound right-turn lane with 100 feet of storage.
- Install a traffic signal at the intersection.

Improvements by the DeveloperHodge Road and US 64 Bypass Westbound Ramps / Old Faison Road

- Restripe the northbound left-turn lane to provide 400 feet of storage and appropriate taper. [If Hodge Road Business Park is not built.]
- Construct an exclusive westbound left-turn lane with 125 feet of storage and appropriate taper.
- Modify the signal and timings as necessary in coordination with the signal at Hodge Road and US 64 Bypass Eastbound ramps to accommodate traffic volumes.

Hodge Road and US 64 Bypass Eastbound Ramps

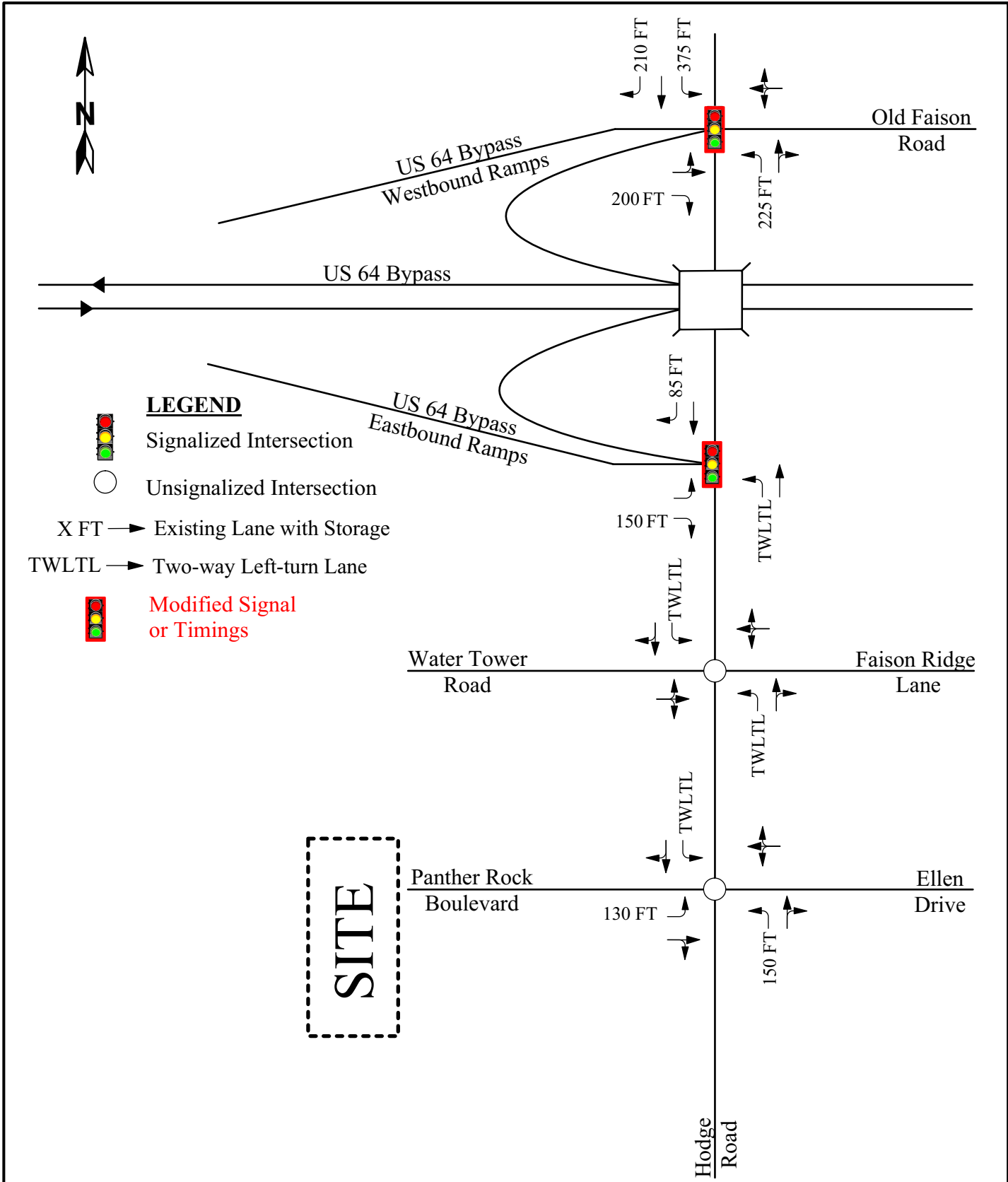
- Construct a second eastbound right-turn lane with 150 feet of storage and appropriate taper. Bring the eastbound right-turn movement under signal control.
- Modify the signal and timings as necessary in coordination with the signal at Hodge Road and US 64 Bypass Westbound ramps to accommodate traffic volumes.
- Construct a southbound lane on Hodge Road from the US 64 Bypass Eastbound off-ramp to Panther Rock Boulevard.

Hodge Road and Water Tower Access Road

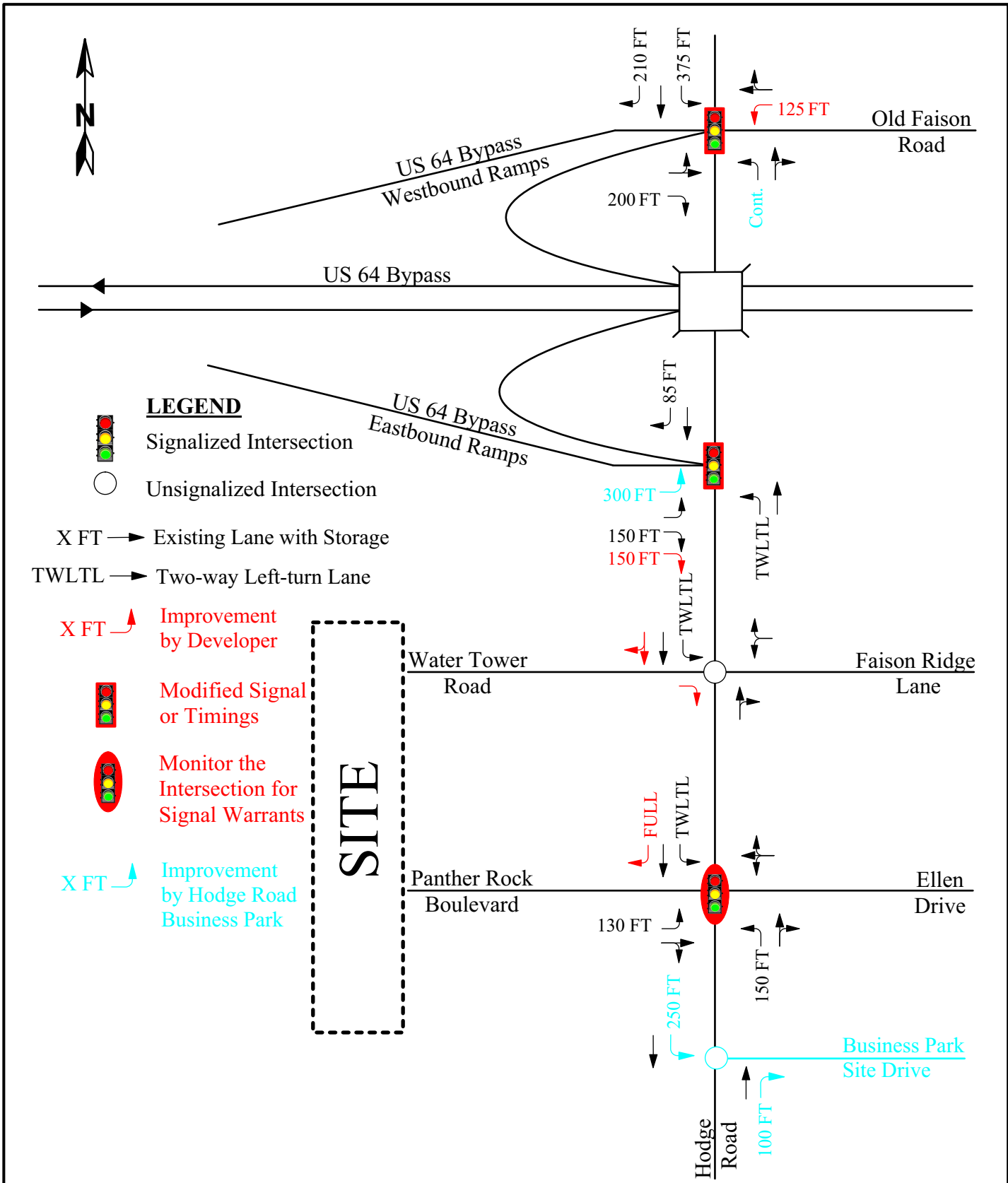
- Convert the water tower access road to a right-in / right-out only access with a porkchop island.

Hodge Road and Panther Rock Boulevard / Ellen Drive

- Construct a southbound right turn lane on Hodge Road that extends to the US 64 Bypass Eastbound off-ramp.
- When and if warranted, install a traffic signal with permitted + protected left-turn phasing. Coordinate signal timings with the US 64 Bypass ramps.



	<p style="text-align: center;">StoneRiver Knightdale, North Carolina</p>	<p style="text-align: center;">Recommended Lane Configurations (2017)</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 12a</p>



<p>RAMEY KEMP & ASSOCIATES TRANSPORTATION ENGINEERS</p>	<p>StoneRiver Knightdale, North Carolina</p>	<p>Recommended Lane Configuration (2021)</p>	
		<p>Scale: Not to Scale</p>	<p>Figure 12b</p>