Multimodal Transportation Site Impact

Applications Guide

March 2024

FDOT

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List of Acronyms

AADT	Annual Average Daily Traffic
ADA	Americans with Disabilities Act
AGR	Annual Growth Rate
BLTS	Bicycle Level of Traffic Stress
CPA	Comprehensive Plan Amendment
CPC	Community Planning Coordinator
DMO	Directional Median Opening
FDM	FDOT Design Manual
FDOT	Florida Department of Transportation
FLU	Future Land Use
FLUE	Future Land Use Element
FLUM	Future Land Use Map
FMO	Full Median Opening
FSUTMS	Florida Standard Urban Transportation Model Structure
FTO	Florida Traffic Online
ICE	Intersection Control Evaluation
ITE	Institute of Transportation Engineers
KSF	Thousand (K) Square Feet (of Gross Floor Area)
LAROW	Limited Access Right-of-Way
LOS	Level of Service
LTS	Level of Traffic Stress
LUC	Land Use Code
MPO	Metropolitan Planning Organization
MTIA	Multimodal Transportation Impact Analysis
MTSIH	Multimodal Transportation Site Impact Handbook
NCHRP	National Cooperative Highway Research Program
PD	Planned Development
PLTS	Pedestrian Level of Traffic Stress
PSCF	Peak Seasonal Category Factor
PSWADT	Peak Season Weekday Average Daily Traffic
Q/LOS	Quality Level of Service
RIRO	Right-In Right-Out
ROW	Right-of-Way
RRFB	Rectangular Rapid Flashing Beacons
SF	Seasonal Factor
SFDU	Single Family Dwelling Units
TAZ	Transportation Analysis Zone
TEM	Traffic Engineering Manual

1. Introduction

1.1. Purpose of the Guide

The Florida Department of Transportation (FDOT) *Multimodal Transportation Site Impact Applications Guide (MTSIH Applications Guide)* serves as a companion document to the FDOT ***Multimodal Transportation Site Impact Handbook (MTSIH)***. The ***MTSIH*** serves two primary purposes: 1) to provide guidelines to assist FDOT staff in their review of the transportation impacts of proposed developments, and 2) to communicate FDOT's guidance for reviewing various documents to local governments and other transportation partners. This updated version of the MTSIH Applications Guide has been revised with a series of new case studies to demonstrate the concepts of the ***MTSIH***. This *Applications Guide* is not a standalone document and should be reviewed in conjunction with the ***MTSIH*** which provides further discussion and details on the concepts and processes discussed within this *Application Guide*.

This *Applications Guide* demonstrates the multimodal transportation impact analysis (MTIA) concepts outlined in the ***MTSIH*** by providing examples from hypothetical developments. An MTIA is an analysis that estimates and quantifies the specific transportation-related impacts of a proposed comprehensive plan amendment (CPA) or a proposed development. MTIAs are conducted to evaluate how the transportation network would function once a proposed land use change or development takes place.

1.2. Document Organization

This *Applications Guide* provides example MTIAs for the following case studies:

- Case Study 1 – Comprehensive Plan Amendment
- Case Study 2 – Fast-Food Restaurant by an Interchange
- Case Study 3 – Downtown Mixed-Use
- Case Study 4 – Subdivision on Rural High-Speed Road

Several key issues are addressed by one or more of the case study examples in this *Applications Guide*. The key issues include:

Comprehensive Plan Amendment	Driveway/Connection Permit
Bicycle/Pedestrian Analysis	Safety Analysis
Off-Site Parking	Site Circulation/Drive-through
Pass-By Trips	Mitigation/Phased Mitigation
Cross Access/Non-Conforming Driveway	Turn Lanes
Intersection Control Evaluation (ICE)	Interchange Impacts
Study Area	Peak Hour of Generator

No two development projects are identical, and every traffic study must take into account the unique context of each proposed project. Local agency requirements, neighboring land uses, existing and forecasted traffic congestion, the extent and quality of the surrounding multimodal network, and community priorities for the site and the transportation network all influence the traffic study and shape the land use decision-making process. Given these interrelated factors, early coordination to establish a methodology, and thorough documentation of all assumptions and key decisions is critical to every traffic study.

2. Case Study 1 – Comprehensive Plan Amendment

2.1. Case Study Overview

This case study entails a CPA that proposes to change the existing land use from Agriculture (AG) to a Future Land Use (FLU) of Planned Development (PD). The subject property is 130 acres, and the preliminary site plan consists of 350 single-family dwelling units and 150,000 square feet of retail. There is an adjacent residential area to the east. The study area roadways have context classifications of C3C, C3R, and C2T (see ***FDOT Context Classification Guide*** for more information). The proposed development plans for buildout in 2027.

Review Type	Comprehensive Plan Amendment
Land Uses/Size	130 acres from Agriculture to Planned Development, 350 Single-Family dwelling units, 150,000 square feet of Retail
Surrounding Context Classification	C3C-Suburban Commercial, C3R-Suburban Residential, and C2T-Rural Town

2.2. CPA Application Package

The review process begins with the Community Planning Coordinators (CPCs) documenting the receipt of the proposed CPA application package. This starts the 30-day review timeline, where the District has 30 days to provide comments to the local government. The CPA considers the allowable land uses and maximum allowable densities and intensities set forth in the FLU. The proposed amendment may permit a density/intensity that is higher than what can realistically be constructed on the site. Coordination with the reviewing agencies is recommended to confirm the reasonable expectation for the development site. See the FDOT ***Community Planning Handbook*** for further information relating to the CPA and community planning process.

The application packet should contain the following information (the items in **bold** are necessary to review the CPA, other documents may be provided but are not required):

- **Cover Letter** from the applicant summarizing the amendment and requesting the review to be completed by the affected agencies;
- **Draft Ordinance** providing the legal description of the affected property(ies) and Future Land Use Map (FLUM) change;
- Meeting minutes showing approval of the CPA by the elected officials;
- Public Notice of the FLUM change, providing the opportunity for the public to comment upon the FLUM amendment; and
- **Staff Analysis Report/Developer Application** summarizing the location, size, current land use, surrounding land uses, proposed amendment, and compliance with the Comprehensive Plan. This report may or may not include a transportation impact analysis of the proposed change. A site plan may be submitted but is not required at this stage.
- Critical details on the proposed CPA including, but not limited to, the existing and proposed FLU, existing and proposed maximum densities/intensities, and the existing and proposed zoning (if applicable).

2.3. Trip Generation

2.3.1. Vehicular Trip Generation

In this scenario, the application is to change 130 acres of agriculturally designated land to Planned Development (PD). The current FLUM allows for 1 unit per 5 acres (0.2 DU/acre) for a maximum of 26 single-family dwelling units (SFDU). Since the proposed FLUM is PD, the owner/representative provided the intended land uses and densities. The proposed PD FLUM designation allows for 350 single-family dwelling units and 150,000 square feet of retail.

With this information, the daily, AM, and PM peak hour gross vehicle trip generation was estimated (**Table 2-1**). The CPC is to use the most recent copy of the Institute of Transportation Engineers (ITE) ***Trip Generation Handbook*** for the calculations.

For the purposes of this planning-level analysis, internal capture and pass-by trips were not included in this analysis. When a more detailed analysis is performed (for example, during the driveway/connection permit, or when proposing mitigation to a significant adverse impact), the trip generation estimate should account for these adjustments and be coordinated with reviewing agencies. It is important to note that the proposed FLUM program associated with a CPA may be too general and without enough detail to appropriately estimate the trips that may be captured internally or that may represent pass-by trips. Internal capture and pass-by rates can also vary significantly depending on the specific proposed development program. The CPA application package can include appropriate reductions for internal capture and pass-by trips based on the methodologies discussed in the ***MTSIH*** (Section 4.6.5); however, the specific assumptions should be discussed and be coordinated with reviewing agencies. If the CPA application package does not provide trip generation data, then the Department conducts a high-level trip generation analysis without trip reductions, as appropriate, or requests additional information/ analysis be provided. Per Florida Statute (F.S.) ***163.3184***, local governments are required to submit appropriate supporting data and analyses to reviewing agencies.

Another consideration for a CPA is the difference in trip generation between the existing FLU and the proposed FLU since a trip credit for the trip generation of the existing FLU can be considered. Similar to internal capture and pass-by credits, it is recommended that if a more detailed trip generation analysis with trip credits for the existing FLU is preferred, the trip generation data should be provided as a part of the CPA application package. As discussed above, the Department often does not have the information needed to perform a more detailed trip generation analysis, and appropriate supporting data and analysis are required to be submitted for the review of CPAs. If appropriate, pass-by and internal capture reductions can be accounted for both in the existing FLU trip generation and proposed FLU trip generation.

While net trips can be considered for CPAs, the Department ultimately needs to consider the total transportation impact of the proposed FLU program in order to plan for infrastructure and improvement needs. This is particularly true for undeveloped land that, while approved for a specific FLU, is not generating trips in the existing condition.

2.3.2. Pedestrian/Bicycle Trip Generation

The walk and bike trips for the existing land use designation, Land Use Code (LUC) 210 single-family detached housing was estimated. Since the ***ITE Trip Generation Manual, 11th Edition*** (*Manual*), provides trip generation estimates only for vehicles and trucks for this land use, the walk trips were estimated by following the ***ITE Trip Generation Handbook, 3rd Edition*** *(Handbook)*, methodology. In this process, baseline vehicle trips (the vehicle trip estimation for baseline sites) are converted to person trips by multiplying the baseline vehicle trips by the baseline vehicle occupancy, and then dividing by the baseline person trip mode share in vehicles. The estimations are shown in **Table 2-1**.

The *Handbook* does not provide baseline mode share or vehicle occupancy for LUC 210 single-family detached housing. Data is provided for LUC 220 apartments which shows a baseline vehicle occupancy rate of 1.09-1.21. For the purposes of this trip generation estimate, the baseline apartment data was used to estimate person trips for the single-family dwelling units.

The mode share data for LUC 220 apartments shows approximately 96-98% vehicle mode share. Per the *Handbook*, the baseline percentage mode share of person trips made by vehicles is assumed to be 95% or more. For the purposes of this trip generation estimate, the baseline mode share data for apartments was used.

The walk and bike trips were also estimated by using the baseline mode share data from LUC 220 apartments. Per the *Handbook*, the percentage of person trips that are walk trips ranges from 1.5-3.5%, and bike trips range from 0.2-0.7%.

The same methodology was used to estimate person, walk, and bike trips for the proposed single-family detached housing, as shown in **Table 2-1**.

For the proposed LUC 820 shopping center, the ***ITE Trip Generation Manual*** provides walk and walk+bike+transit trip generation rates/equations for the PM peak hour. The walk+bike+transit rate was used to estimate the walk+bike trips during the PM peak hour (transit trips volumes were assumed to be minor.) Only vehicle and truck rates/equations are provided for daily and AM peak. As such, the *Handbook's* methodology was used to estimate walk+bike trips for the AM peak hour. In addition, the *Handbook's* methodology was used to estimate person trips for both the AM and PM peak hours since person trip generation rates/equations is not available in the *Manual*.

The resulting walk plus bike trip estimate is shown in **Table 2-2**.

It should be noted that limited data was available in the *Manual* and the *Handbook* for the subject land uses. The latest available trip generation data, or other data as agreed to during the methodology development, should be utilized at the time of study. In some cases, it may be necessary to collect additional trip generation data for the analysis, use local data, or use an alternative source for mode split or vehicle occupancy data.

Table 2-1 | Person and Walk + Bike Trip Estimation using ITE *Trip Generation Handbook* Methodology

Single-Family (LUC 210)	Daily	AM			PM		
		Total	Enter	Exit	Total	Enter	Exit
Existing							
Baseline Vehicle Trips	292	22	6	16	28	18	10
Baseline Vehicle Occupancy (persons/vehicle)[1]	-	-	1.13	1.09	-	1.15	1.21
Baseline Vehicle Mode Share (percent Personal Passenger Vehicle + Truck)[1]	-	-	96.2	97.8	-	97.3	96.2
Person Trips[2]	**-**	**25**	**7**	**18**	**34**	**21**	**13**
Walk + Bike Mode Share (percent)[1]	-	-	3.5	2.2	-	2.5	3.8
Walk + Bike Trips[3]	**-**	**0**	**0**	**0**	**1**	**1**	**0**
Proposed							
Baseline Vehicle Trips	3,195	233	58	175	323	203	120
Baseline Vehicle Occupancy (persons/vehicle)[1]	-	-	1.13	1.09	-	1.15	1.21
Baseline Vehicle Mode Share (percent Personal Passenger Vehicle + Truck)[1]	-	-	96.2	97.8	-	97.3	96.2
Person Trips[2]	**-**	**263**	**68**	**195**	**391**	**240**	**151**
Walk + Bike Mode Share (percent)[1]	-	-	3.5	2.2	-	2.5	3.8
Walk + Bike Trips[3]	**-**	**6**	**2**	**4**	**12**	**6**	**6**
Shopping Center (LUC 820)	**Daily**	**AM**			**PM**		
		Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**
Baseline Vehicle Trips	9,780	222	138	84	756	363	393
Baseline Vehicle Occupancy (persons/vehicle)[4]	-	-	1.17	1.16	-	1.21	1.18
Baseline Vehicle Mode Share (percent Personal Passenger Vehicle + Truck)[4]	-	-	100	100	-	100	100
Person Trips[2]	**-**	**258**	**161**	**97**	**903**	**439**	**464**
Walk + Bike Mode Share (percent)[4]	-	-	0	0	-	-	-
Walk + Bike Trips	**-**	**0**	**0[3]**	**0[3]**	**6[5]**	**-**	**-**

[1] Baseline vehicle occupancy and mode share data was obtained from Appendix B of the ***ITE Trip Generation Handbook, 3rd Edition***, using the baseline Apartments land use.
[2] Estimated by multiplying the baseline vehicle trips by the baseline vehicle occupancy, and then dividing by the baseline percent person trip mode share in vehicles.
[3] Estimated by multiplying the person trips by the percent walk + bike mode share.
[4] Baseline vehicle occupancy and mode share data was obtained from Appendix B of the ***ITE Trip Generation Handbook, 3rd Edition***, using the baseline Shopping Center land use.
[5] The walk+bike+transit rate from the ***ITE Trip Generation Manual*** was used to estimate the walk+bike trips during the PM peak hour (unavailable for AM peak hour).
[6] "-"signifies information not available.

Table 2-2 | Existing vs. Proposed FLUM Gross Trip Generation

Land Use	ITE Land Use Code/ Setting	Intensity	Trip Type	Daily	AM Peak Hour	PM Peak Hour
					Total	Total
Existing						
Single-Family	210 / General Urban-Suburban	26 units	Vehicle trips	292	22	28
			Existing Total Vehicle Trips	**292**	**22**	**28**
Single-Family	210 / General Urban-Suburban	26 units	Person trips	-	25	34
			Existing Total Person Trips	**-**	**25**	**34**
Single-Family	210 / General Urban-Suburban	26 units	Walk +bike trips	-	0	1
			Existing Total Walk + Bike Trips	**-**	**0**	**1**
Proposed						
Single-Family	210 / General Urban-Suburban	350 units	Vehicle trips	3,195	233	323
Shopping Center	820 / General Urban-Suburban	150 KSF	Vehicle trips	9,780	222	756
			Proposed Total Vehicle Trips	**12,975**	**455**	**1,079**
Single-Family	210 / General Urban-Suburban	350 units	Person trips	-	263	391
Shopping Center	820 / General Urban-Suburban	150 KSF	Person trips	-	258	903
			Proposed Total Person Trips	**-**	**521**	**1,294**
Single-Family	210 / General Urban-Suburban	350 units	Walk +bike trips	-	6	12
Shopping Center	820 / General Urban-Suburban	150 KSF	Walk +bike trips	-	0	6
			Proposed Total Walk + Bike Trips	**-**	**6**	**18**
			Net Vehicular Trips (Proposed - Existing)	**12,683**	**433**	**1,051**

Note: Discussion of person trip and walk + bike trip estimation is provided in Section 2.3.2 and Table 2-1.

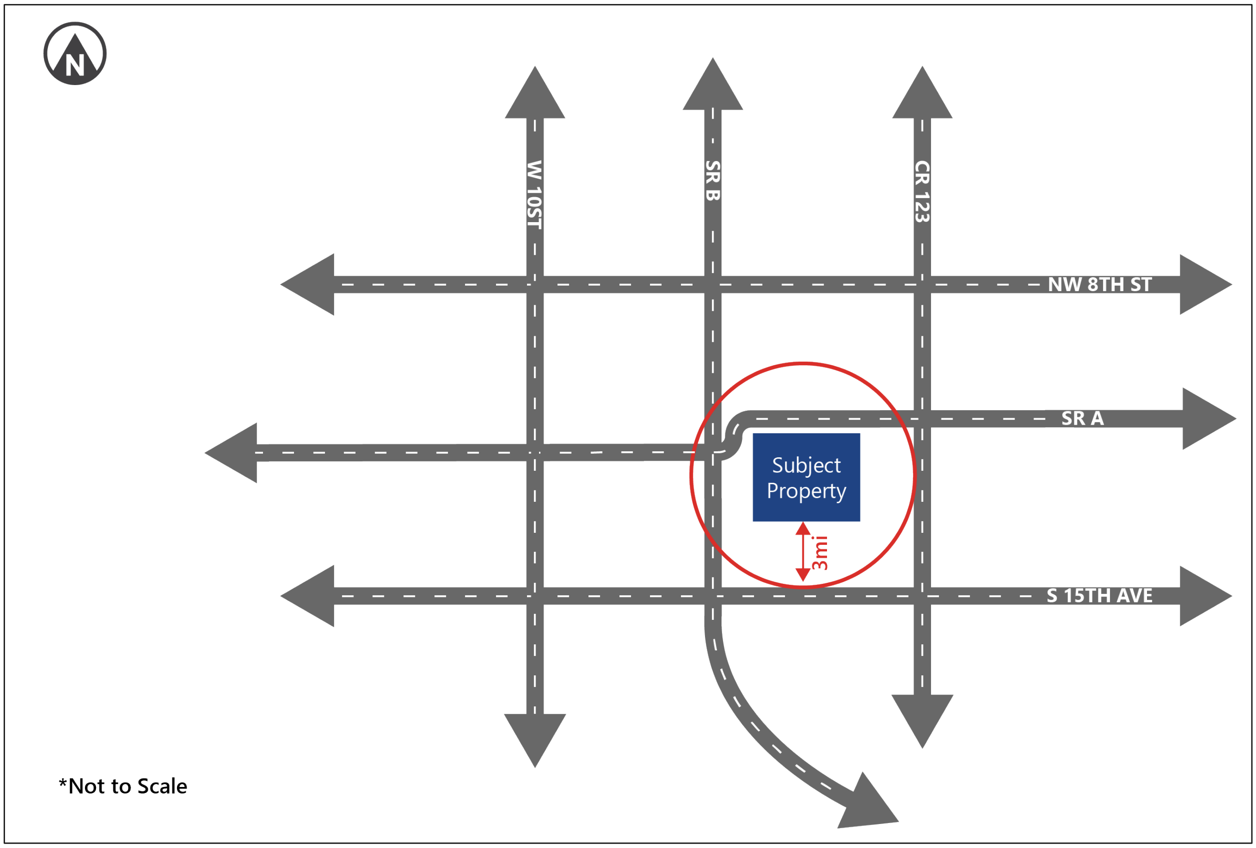
As shown, this proposed development is estimated to generate net new vehicle trips (proposed minus the existing vehicle trips) with 12,683 daily, 433 during the AM peak hour, and 1,051 during the PM peak hour. Additionally, the site is anticipated to generate approximately 6 walk and bike trips in the AM peak hour and 18 in the PM peak hour. This is an increase from 292 daily, 22 AM peak hour, and 28 PM peak hour vehicle trips with the existing land use. Only 1 walk/bike trip is anticipated with the existing land use.

2.4. Vehicular Impact Analysis

2.4.1. Study Area

According to the ***FDOT Community Planning Handbook***, the study area for a CPA is the Strategic Intermodal System (SIS), State Highway System (SHS), and/or National Highway System (NHS) facilities within a three-mile radius of the affected parcel(s). The study area for the proposed project is shown in **Figure 2-1**.

Figure 2-1 | Vehicular Study Area



2.4.2. Planning-Level Analysis

After the gross new trips are estimated, the trips are applied to the state facilities within three miles of the proposed project. For this case study, the analysis considers three scenarios, as follows:

- Existing Year ("Existing")
- Future Background Build Year without project, ("Future No Build")
- Future Build Year with project, ("Future Build")

For this case study, the PM peak hour was determined to have the highest volume of trips. **Figure 2-2** shows the future background, or no build (without the project), two-way projected level of service

(LOS). The ***MTSIH*** (Section 4.7.2) includes information on methods for projecting future background traffic. The project trip distribution was estimated using existing traffic patterns and knowledge of the area. Travel demand models can also be used to determine trip distribution (more information can be found in the ***MTSIH***). The gross PM peak hour trips are added to the projected future PM peak hour volumes for the buildout year of 2027 to estimate the build LOS for the study area with the project in place (**Figure 2-3**). The projected impacts to the SHS are shown in **Table 2-3,** based upon the trips from the proposed land use program. The land for this case study is outside the urbanized area boundaries, and based on FDOT's Policy on Level of Service Targets for the SHS, ***Topic No. 000-525-006***, the peak hour motorized vehicle LOS target is C. The maximum service volume thresholds shown correspond to LOS C, based on the most recent ***FDOT Multimodal Quality/Level of Service Handbook***. Performance measures of effectiveness and targets for auto analysis is discussed in Section 4.4.1 of the ***MTSIH***.

Figure 2-2 | Future 2027 No Build LOS

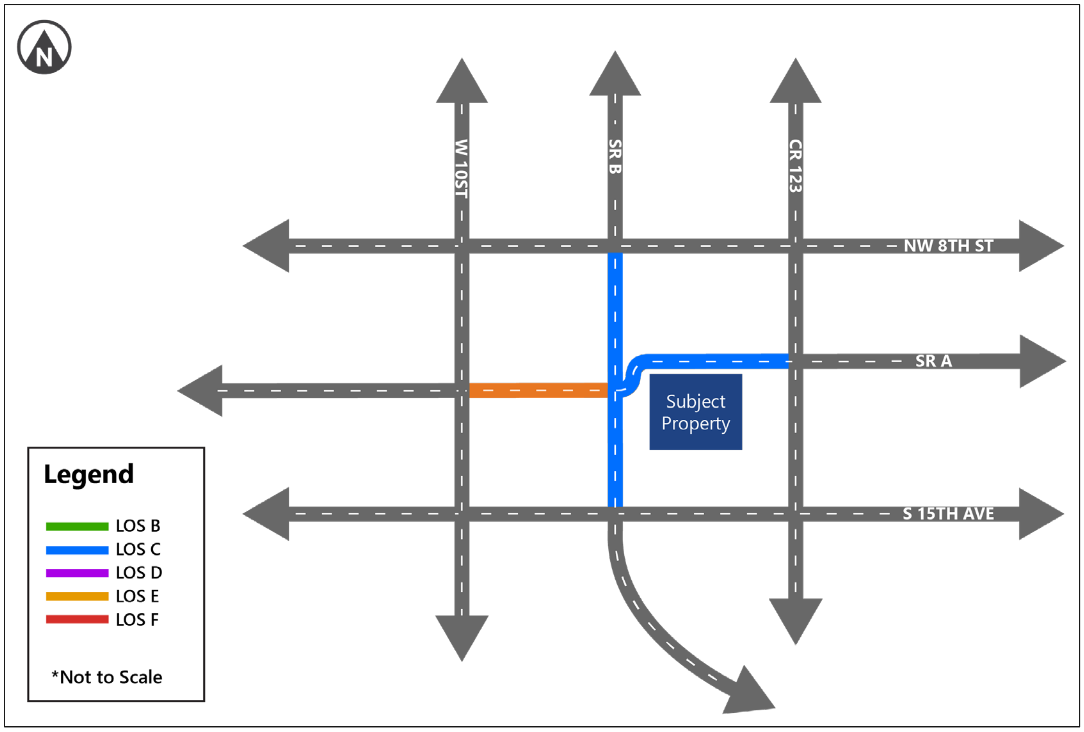


Figure 2-3 | Future 2027 Build LOS

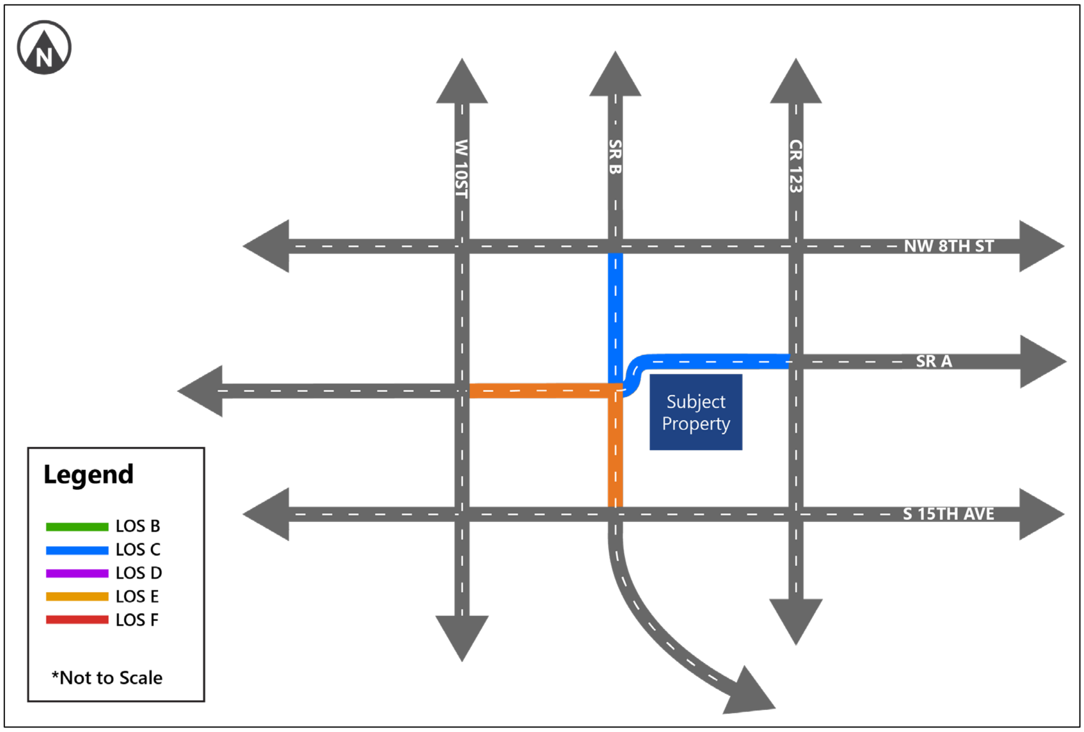


Table 2-3 | Projected Impact to State Highway System – PM Peak Hour Two-Way

Roadway	Segment	Lanes[2]	Context Class.	FDOT LOS Target	Max Ser. Vol.[2]	Existing 2021		Assumed Project Trip Distribution	Project Trips	Future 2027 No Build		Future 2027 Build	
						Volume	LOS			Volume	LOS	Volume	LOS
SR A	SR B to CR 123 South[1]	4	C3C	C	2,760	1,745	C	70%	755	1,965	C	2,720	C
SR A	W 10th St to SR B	4	C3C	C	2,760	3,308	**E**	10%	108	3,725	**E**	3,833	**E**
SR B	SR A to NW 8th St	2	C2T	C	1,310	985	C	10%	108	1,109	C	1,217	C
SR B	S 15th Ave to SR A	2	C3R	C	1,760	1,547	C	50%	540	1,742	C	2,282	**E**

[1] Segments adjacent to the affected parcel.
[2] No future improvements along study roadways which would impact the maximum service volume. Maximum service volumes taken from FDOT Multimodal Quality/Level of Service Handbook.

2.5. Bicycle/Pedestrian/Transit Impact Analysis

Due to the estimated number of bicycle/pedestrian trips generated by this project, a context-based assessment is recommended for this project. This includes review for compatibility with planning documents, internal site design pedestrian and bicycle accommodations, and pedestrian and bicycle connections to adjacent properties and/or transit stops.

2.5.1. Context-Based Assessment

2.5.1.1. Review for Compatibility with Planning Documents

State and local planning documents were reviewed to determine the proposed development's compatibility. The 'City 2045 Comprehensive Plan,' the Metropolitan Planning Organization (MPO) List of Project Priorities, and the FDOT 5-Year Work Program were reviewed as part of this effort. Based on the review, there were no noted planned pedestrian or bicycle improvements within a three-mile radius. However, the applicant should coordinate with the local agencies to determine what plans may be in place near the site.

2.5.1.2. Internal Site Design Pedestrian and Bicycle Accommodations

The site's design was reviewed for pedestrian and bicycle accommodations and circulation (note that the site design may not always be available at this stage). **Table 2-4** describes the on-site design considerations to accommodate non-motorized users. The basis for many of the recommendations in **Table 2-4** can be found within Appendix B of the ***MTSIH***.

2.5.1.3. Bicycle/Pedestrian Connections to Adjacent Properties and/or Transit Stops

To provide a connected street network to disperse vehicle trips and improve pedestrian and bicycle trips, connections to the neighboring residential area to the east should be considered during site planning. If vehicular connections are not feasible, pedestrian-only connections can be considered. If it is not possible to create the connections offsite, stub-outs can be considered for future connections. It is noted that particular consideration should be given to connect to pedestrian and bicycle generators such as schools, universities, public parks etc.

In addition, the site should be designed to provide a direct and convenient pedestrian path between the site and the bus stop along the site's frontage.

Table 2-4 | Internal Site Design to Accommodate Non-Motorized Users

Design Component	Review	Recommendation
Access Management	Although the proposed access locations are not typically available during CPAs, best practices for bicycle and pedestrian design can be coordinated with the applicant for incorporation in their site plan. These include reduced number of driveways, cross-access between properties, and connections to side streets.	Provide best practices for incorporation in site design
Driveway Design	Although the proposed driveway design is not typically reviewed during CPAs, best practices for bicycle and pedestrian design can be coordinated with the applicant for incorporation in their site plan. Considerations include curb radius, driveway width, sight distance, and meeting the requirements of the Americans with Disabilities Act (ADA).	Provide best practices for incorporation in site design
Site Frontage	Possible improvements needed to the frontage to enhance pedestrian and bicycle travel include lighting, landscaping, buffered sidewalk, and separated bike lanes. In addition, there is a transit stop located along the site's frontage.	Provide best practices for incorporation in site design
Site Circulation & Bicycle/ Pedestrian Access	Although the proposed site plan design is not typically reviewed during CPAs, best practices for bicycle and pedestrian access and circulation can be coordinated with the applicant for incorporation in their site plan, such as providing direct routes from external facilities to building entrances on-site.	Provide best practices for incorporation in site design
Amenities	Although the proposed site plan details are not typically reviewed during CPAs, best practices for bicycle and pedestrian amenities can be coordinated with the applicant for incorporation in their site plan.	Provide best practices for incorporation in site design
Network Review	While there are no plans for additional network improvements in or near the site, the applicant should coordinate with local agencies to determine what improvements are needed.	Coordinate with Local Agencies

2.6. Mitigation

Based on a high-level review, the CPA has potentially adverse vehicular impacts on state roads. As such, technical assistance comments are provided to encourage the applicant to perform a detailed MTIA. This MTIA will need to be performed by the applicant eventually as required by FDOT as part of the driveway/connection permit. Completing it now during the CPA could satisfy that future requirement. Furthermore, completing the full MTIA required for permitting during the CPA can provide many benefits to the applicant such as:

- Reduce overall effort with fewer required studies.
- Understand and plan for issues that will impact the site plan, such as driveway constraints, early on before more detailed site planning occurs and when changes to the site plan can be more difficult and costly to make.
- Propose and plan for mitigation strategies to address potentially adverse impacts.
- Avoid unknown surprises later during the development process at permitting that could have impacts to budgets and schedules.

Alternatively, the impacts can be further assessed later during a more detailed site plan review when the driveway/connection permit application is required.

In addition to the vehicular impacts to state roads, the bicycle/pedestrian/transit impact analysis provided the following recommendations:

- Coordinate with FDOT and the local agencies to determine what plans may be in place near the site.
- Coordinate and review best practices for pedestrian and bicycle circulation and accommodation for incorporation in the site design.
- Incorporate connections to compatible neighboring land uses, as feasible, and provide direct pedestrian connections to nearby transit stops.

Section 2 in the Planning and Development Review Chapter of the ***FDOT Community Planning Handbook*** provides a Future Land Use Map Amendment Decision Tree to be followed when reviewing CPAs. This process should be followed in coordination with District leadership and Central Office.

2.7. Comment Letter

Based on the analysis results and review, a comment letter is prepared as shown in **Figure 2-4**. Guidance on how to write comment letters and the types of comments can be found in the ***FDOT Community Planning Handbook***.

Figure 2-4 | Sample Comment Letter

September 25, 2023

John Doe
Planning Director
Anytown Planning and Economic Development Department
12345 Main Street
Anytown, Florida 11111

SUBJECT: Anytown Proposed Comprehensive Plan Amendment (23-1ESR)

Dear Mr. Doe,

Pursuant to Section 163.3184(3), Florida Statues, (F.S.) in its role as a reviewing agency as identified in Section 163.3184(1)(c), F.S., the Florida Department of Transportation (FDOT) reviewed proposed amendment, City of Anytown 23-2ESR.

Amendment Summary
The Future Land Use Element (FLUE) amendment proposes to change the Future Land Use Classification from Agriculture to Planned Development to ±130 acres located on SR A, east of the SR A Road and SR B intersection. The developer wants to develop the site non-residential (max. 150,000 sf) along the SR A with the site's remainder as a single-family detached subdivision (max. 350 units).

As proposed, FDOT is providing the following comments:

Comments
The level of service standards as proposed by the City are insufficient to ensure the availability of public facilities and the adequacy of those facilities to meet established acceptable levels of service in accordance with s. 163.3177(3)(a)3 and s. 163.3177(3)(a)(4), F.S. Upon review of the Capital Improvements Element, it is not clear if the projects satisfy all deficiencies in the level of service standards. Based on a planning-level analysis, adverse impacts are anticipated on SR A from W 10th Street to SR B, and SR B from S 15th Avenue to SR A.

Resolution
Due to potential adverse impacts, FDOT recommends a Multimodal Transportation Impact Analysis be performed and either resubmitted for review as part of this Comprehensive Plan Amendment Review or as part of the subsequent driveway permit application. This analysis can further assess the potential impacts and identify necessary improvements to achieve level of service targets.

If these comments are not resolved prior to adoption, FDOT may request the State Land Planning Agency challenge the amendment pursuant to Section 163.3184(5), F.S.

Technical Assistance Comments
In addition to the comment above, FDOT is providing a technical assistance comments consistent with Section 163.3168(3), Florida Statutes. The technical assistance comments will not form the basis of a challenge. The technical assistance comments can strengthen the local government's comprehensive plan in order to foster a vibrant, healthy community or is/are technical in nature and designed to ensure consistency with the Community Planning Act in Chapter 163, Part II, F.S.:

- Coordinate with the local agencies to determine what plans may be in place near the site to ensure consistency.
- Coordinate and review best practices for pedestrian and bicycle circulation and accommodation for incorporation in the site design.
- Incorporate vehicle and pedestrian/bicycle connections to compatible neighboring land uses, as feasible, and provide direct pedestrian/bicycle connections to nearby transit stops.

We appreciate the opportunity to review the proposed comprehensive plan amendment and request that a copy of the adopted amendment, along with the supporting data and analysis be transmitted within ten working days after the second public hearing for FDOT review.

If you have any questions, please do not hesitate to contact me by email: jane.smith@dot.state.fl.us or call: (904) 555-5555.

Sincerely,

Jane Smith
Community Planning Coordinator
FDOT District Two

3. Case Study 2 – Fast-Food Restaurant by an Interchange

3.1. Case Study Overview

This case study involves a proposed fast-food restaurant applying for a driveway/connection permit. It is 5,000 square feet and has indoor seating and a drive-through. The site is located near an interchange and the proposed driveway is within the interchange influence area (within one-quarter of a mile). As described in the ***FDOT Access Management Guidebook***, access management on a crossroad at an interchange is critical for the efficient operation of an interchange. ***FDM 214*** – Driveways, requires provision of adequate connection spacing along the crossroad at an interchange for the following:

- To minimize spillback on the ramp and crossroad approaches to the ramp terminal
- Provide adequate distance for crossroad weaving
- Provide space for merging maneuvers
- Provide space for storage of turning vehicles at access connections on the crossroad

Rule Chapter: ***14-97 F.A.C.***, requires that driveways/connections and median openings on a controlled access facility located up to 1/4 mile from an interchange area or up to the first intersection with an arterial road, whichever distance is less, shall be more stringently regulated to protect safety and operational efficiency of the SHS, as set forth below:

1. The 1/4-mile distance shall be measured from the end of the taper of the ramp furthest from the interchange.
2. With the exception of Access Class 2 facilities with posted speed limits over 45 mph, the distance from the interchange ramp(s) to the first connection shall be at least 660 feet where the posted speed limit is greater than 45 mph, or at least 440 feet where the posted speed limit is 45 mph or less. This distance will be measured from the end of the taper for that particular quadrant of the interchange on the controlled access facility. For Access Class 2 facilities with posted speed limits over 45 mph, the distance to the first connection shall be at least 1,320 feet.
3. The standard distance to the first full median opening shall be at least 2,640 feet as measured from the end of the taper of the off ramp.
4. Greater distances between proposed connections and median openings will be required when the Department determines, based on generally accepted professional practice standards, that the engineering and traffic information provided in the Rule Chapter ***14-96, F.A.C.***, permit application shows that the safety or operation of the interchange or the limited access highway would be adversely affected.

It should be noted that the directional median opening spacing requirement near interchanges is not specified in the current adopted Rule Chapter: ***14-97 F.A.C.***, however it is suggested to apply at least 1,320 feet as measured from the end of the taper of the off ramp as the standard distance to the first directional median opening.

Furthermore, a driveway or median opening cannot break the Limited Access Right-of-Way (LAROW) . If there are any modifications within the LAROW, the FDOT District Interchange Coordinator will decide if an interchange access request is required.

The state roadway proposed for access to the site is a four-lane divided roadway with a context classification of suburban commercial (C3C), Access Class 5, and a posted speed limit of 45 mph. There are other nearby existing unsignalized full median opening (FMO) accesses to existing land uses that need to be revised to meet the spacing standards near the interchange.

Review Type	Driveway/Connection Permit – Category D
Land Uses/Size	5,000 square-foot Fast-Food Restaurant with Indoor Seating and a Drive-Through
Access Management Classification, Posted Speed Limit	Access Class 5, 45 mph
Surrounding Context Classification	C3C-Suburban Commercial
Other Characteristics	Nearby interchange (Eastside LAROW line is located 400 feet from the end of the taper of the interchange northbound off-ramp)

3.2. Pre-Application Meeting

For Category C, D, E, F, or G driveway permit applications, a pre-application meeting with the Department is required to review the site plan with respect to the proposed connection(s) location, establish the connection category, and establish required documentation and traffic study requirements. The pre-application meeting checklist provided in the *MTSIH* can be used as guidance in conducting the meeting. The local government can also be represented at the pre-application meeting. In the pre-application meetings, the proposed site plan and the potential driveway connections to the adjacent roadways are discussed.

A new driveway with an FMO is initially proposed for the fast-food restaurant located approximately 865 feet from the end of the taper of the interchange northbound off-ramp. As such, the proposed driveway does not meet FMO spacing standards near the interchange. The required spacing distance to the first FMO should be at least 2,640 feet as measured from the end of the taper of the off ramp. The interchange northbound off-ramp terminal (both left-turn and right-turn movements) operates under signal control. The right-turn lane taper ends at the signalized intersection without the lane extending along the arterial cross street. The operation of the interchange is very critical.

Given the driveway spacing and proximity to the interchange, a backage road connection to the development site and nearby properties was discussed in the pre-application meeting. Discussion of access issues and consideration of potential backage roads, frontage roads or shared access connections upfront in the pre-application meeting can save the applicant time and money without redeveloping the site plan after the potential denial of the driveway permit application. Inclusion of a backage road connection in the traffic impact analysis was proposed in the pre-application meeting for this case study.

The applicant and nearby properties benefit from the backage road connection in several ways. First, the backage road connection between the applicant's site and the nearby properties consolidates all of their trips to a single access point. In this case, the consolidated trips may potentially warrant a signal that would have not been warranted if each property had individual access. In addition, the backage road connection located further from the interchange meets access management spacing standards for a signal. This allows for signalized access to their properties, which is highly desirable for these properties and can increase business and property values. Furthermore, the nearby properties will be informed that their driveways are non-conforming; when they sell/redevelop in the future, their access will be modified and/or closed with a backage road access provided instead. As such, it is beneficial for the nearby properties to modify now, improve customer access to/from their site currently in operation, and increase their resale value for the future. Finally, the backage road connection improves operation and safety not only for the users of their properties, but also for the general traveling public on the roadway.

Furthermore, the proposed site access management improvements would convert Main Street and A Driveway intersection median opening (located approximately 1,355 feet from the end of the taper of the interchange northbound off-ramp) from a FMO into directional median opening (DMO), and additionally include the signalization of B Avenue intersection.

3.3. Trip Generation

3.3.1. Vehicular Trip Generation

The ***ITE Trip Generation Manual***, ***ITE Trip Generation Handbook***, and the ***MTSIH*** provide a more detailed breakdown of how to use the data contained within the *Trip Generation Manual*. For the proposed fast-food restaurant with drive-through window, the trip generation average rates for LUC 934 from the ***ITE Trip Generation Manual 11th Edition*** were used. Trip generation estimates for the daily, adjacent street AM peak hour, adjacent street PM peak hour, and PM peak hour of generator were obtained as illustrated in **Table 3-1**. With an unadjusted daily vehicle trip generation of 2,337 trips, this site is a Category D driveway permit application. The PM peak hour of generator trip generation values were estimated to evaluate the mid-day afternoon traffic operational analysis for the proposed fast-food restaurant development lunch time peak period in addition to the traditional adjacent street AM and PM peak hour analyses. Since local data is not available and the proposed development is a fast-food restaurant, it is reasonable to use the PM peak hour of generator trip generation values to represent mid-day afternoon traffic conditions. The analysis periods and trip generation methodology was discussed and determined during the pre-application meeting.

3.3.1.1. Pass-by Traffic

Many retail and convenience-oriented land uses such as fast-food restaurants, gas stations, and coffee shops tend to seek out heavily traveled corridors so that customers can simply "stop in" on the way to their primary destination. When estimating the potential amount of traffic added to the roadway network surrounding a proposed site that includes retail uses, it is important to take this effect into account. These "pass-by" trips are already on the roadway network and will not impact offsite intersection operations (other than shifting turning movement percentages if medians restrict direct site access). ITE's *Trip Generation Handbook* provides recommended pass-by percentages for a variety of land uses including shopping centers, supermarkets, gas stations, banks, and restaurants. Pass-by trip data for the proposed fast-food restaurant with drive-through window, as shown in the trip generation tables below, were obtained from the ITE's *Trip Generation Handbook, 3rd Edition*.

Pass-by data was not available for every land use or all time periods within ITE's *Trip Generation Handbook, 3rd Edition*, but can be developed based on the available data if there is reasonable justification for applying pass-by rates. As a general guideline, the number of pass-by trips assumed for a site should not exceed 10% of the adjacent street traffic. To check this, the calculated number of pass-by trips should be compared to two-way volume on the roadway(s) adjacent to the project site for each analysis hour.

As discussed in Section 4.6.6.6 of the ***MTSIH***, pass-by trips are typically limited to no more than 10% of the adjacent street traffic. For the proposed fast-food restaurant site, the 10% (provided in parenthesis) of the AM peak hour, PM peak hour, and mid-day peak hour two-way traffic volumes is estimated for the adjacent Main Street as shown below:

- AM Peak Hour Volume = 1,510 (151)
- PM Peak Hour Volume = 1,592 (159)
- Mid-Day Peak Hour Volume = 1,381 (138)

The estimated proposed fast-food restaurant pass-by trips are 110, 82, and 128 for the AM peak hour, PM peak hour, and mid-day peak hour time periods, respectively. As such, these estimates are less than the 10% of the adjacent street traffic volumes and no further adjustment is needed.

3.3.1.2. Net External Trips

The net external trips for this case study are the vehicular trips generated by the development which are not pass-by trips. Pass-by trips represent existing vehicular traffic on the adjacent roadways (with direct access to the development site) and were removed from the total vehicle trips to estimate the net external trips for the case study as presented in **Table 3-1**.

3.3.2. Pedestrian/Bicycle Trip Generation

The ITE *Manual* provides person trip generation rates/equations for the PM peak hour (69.64 person trips per 1,000 square feet of gross floor area, KSF), AM peak hour of generator (31.85 person trips per KSF), and PM peak hour of generator (66.25 person trips per KSF). Person trip generation data is not provided for daily trips in the ***ITE Manual***. While the PM peak hour person trip generation rate yields a reasonable estimate, the AM peak hour rate yields an estimated 159 total person trips which is not reasonable compared to the vehicle trip generation estimate of 223 total trips during the AM peak hour. As such, the AM peak hour person trip generation estimate was omitted for this case study.

The AM and PM peak hour bicycle and pedestrian trips were estimated for the site based on the latest ***ITE Trip Generation Manual, 11th Edition*** walk, bicycle, and transit trip generation data. The ***Trip Generation Manual*** provides an average rate for walk, bicycle, and transit trip generation for LUC 934 Fast-Food Restaurant with Drive-Through Window in general urban/suburban settings, for the weekday PM peak hour, AM peak hour of generator, and PM peak hour of generator as 2.92, 5.48, and 5.75 per KSF, respectively. The AM peak hour of generator rate was used to estimate the walk+bike+transit trips for the AM peak hour of adjacent street traffic. The walk+bike+transit trip generation estimate based on the trip rates provided in the ***ITE Trip Generation Manual, 11th Edition*** is shown in **Table 3-1**.

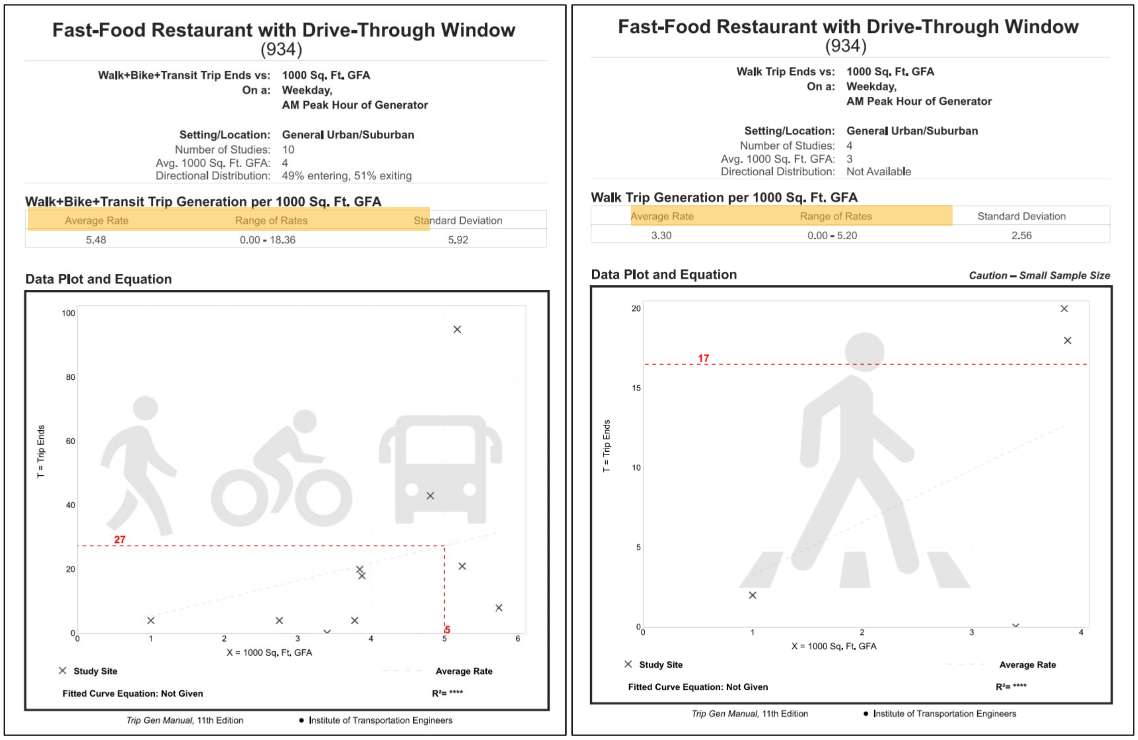
Table 3-1 | Trip Generation

Land Use	ITE Land Use Code / Setting	Intensity	Trip Type	Daily	AM Peak Hour			PM Peak Hour			PM Peak Hour of Generator		
					Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit
Fast-Food Restaurant with Drive-Through Window	934/ General Urban-Suburban	5 KSF	Total Vehicle Trips	2,337	223	114	109	165	86	79	255	130	125
			Pass-by Trip Reduction	-	110	55	55	82	41	41	128	64	64
			Net External Vehicle Trips	-	113	59	54	83	45	38	127	66	61
			Person Trips	-	-	-	-	348	160	188	331	166	165
			Walk+Bike+ Transit Trips	-	27 [2]	13 [2]	14 [2]	15 [1]	8 [1]	7 [1]	29 [1]	14 [1]	15 [1]
			Walk Trips	-	17 [3]	-	-	8 [3]	-	-	8	-	-

[1] The walk+bike+transit rate from the ***ITE Trip Generation Manual*** was used to estimate the walk+bike trips during the PM peak hour and PM peak hour of Generator (unavailable for AM peak hour).
[2] The AM peak hour of generator rate was used to estimate the walk+bike+transit trips for the AM Peak Hour.
[3] The AM peak hour of generator rate and the PM peak hour of generator rate were used to estimate the walk trips for the AM Peak Hour and the PM peak hour, respectively.

The ITE *Manual* also provides walk trip rates for the AM and PM peak hour of generator of 3.30 and 1.65 walk trips per KSF, respectively. The walk trips for the AM and PM peak hour of adjacent street traffic were estimated by using the AM and PM peak hour of generator walk rates, respectively. As an example, walk+bike+transit trips, and walk trips obtained from ***ITE Trip Generation Manual, 11th Edition*** for the AM peak hour of generator are provided in **Figure 3-1**.

Figure 3-1 | ITE Trip Generation Manual Non-Motorized Trips for AM Peak Hour of Generator



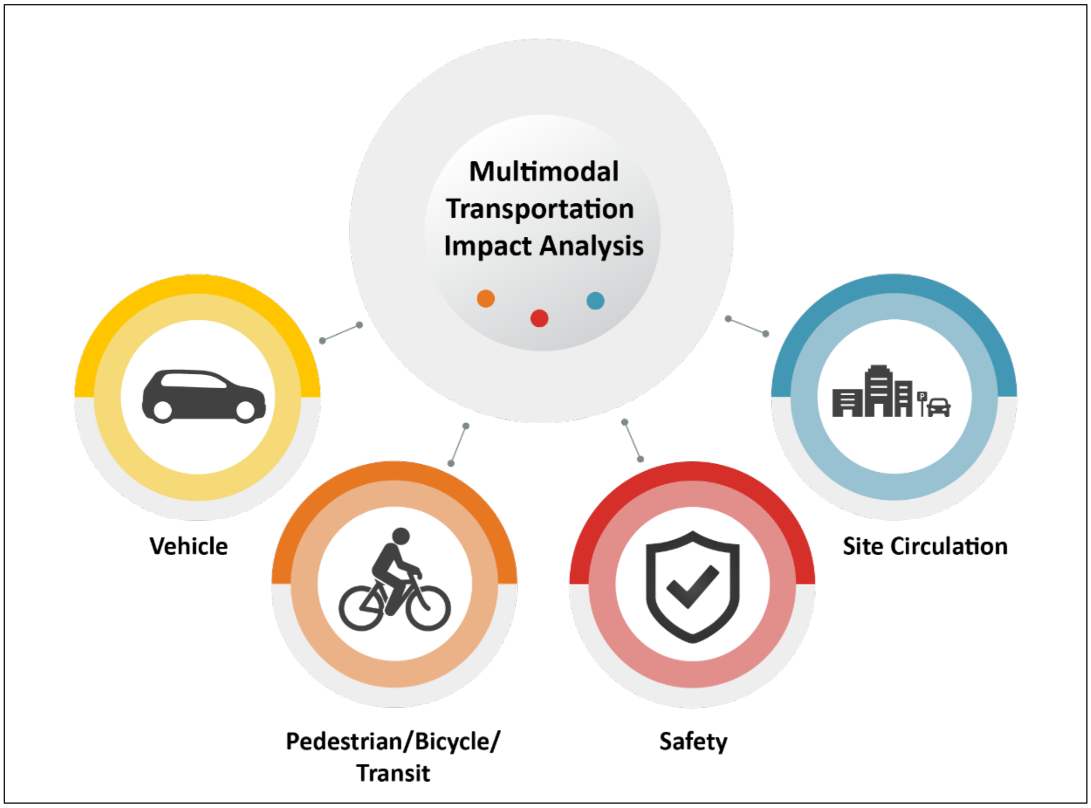
The ***ITE Manual*** does not provide transit or bike trips for this land use in general urban/suburban settings. The ***ITE Handbook*** only provides baseline mode share and vehicle occupancy data for restaurant land uses in the PM peak. This data shows a mode share of 98.7% vehicles, 1.3% walk, and 0% transit and bike. Given the limited data for this land use, the walk and bike trips are assumed to be similar to the ***ITE Manual's*** walk+bike+transit trips for the purposes of assessing the site's impact to pedestrians and bicyclists.

It should be noted that there are limited data and study sites in the ***ITE Trip Generation Manual, 11th Edition*** for the subject land use. This limited data results in a potential discrepancy when comparing the calculated total person trips by mode using the rates provided in the ***ITE Manual*** with the expected person trips in vehicles if using the vehicle trip generation and applying an average vehicle occupancy. Further information on estimating trips by mode and potential discrepancies based on using different trip generation data sources is provided in Section 4.6.5 of the ***MTSIH***. As with any MTIA, critical analysis elements like trip generation should be discussed and agreed upon during the pre-application/ methodology meeting. In some cases, it may be necessary to collect additional trip generation data for the analysis, such as if there is an insufficient number of studies in the ***ITE Manual*** or in cases where the trip generation characteristics may be unusual or unique to the locality.

3.4. Vehicular Impact Analysis

As discussed in the ***MTSIH***, a driveway/connection permit MTIA is recommended to include four primary components as shown in **Figure 3-2**: vehicle, pedestrian/bicycle/transit, safety, and site circulation. This section discusses the vehicular impact analysis, and the following sections cover the other analysis elements.

Figure 3-2 | Recommended Driveway/Connection Permit MTIA Components



3.4.1. Study Area

The guidelines regarding the selection of the study area for a driveway/connection permit application are discussed in Chapter 3 of the ***MTSIH***. The ***MTSIH*** guidelines and the application to this Case Study are summarized in **Table 3-2**. Note that further discussion of the guidelines and other study area considerations can be found in the ***MTSIH***.

Table 3-2 | Study Area Determination

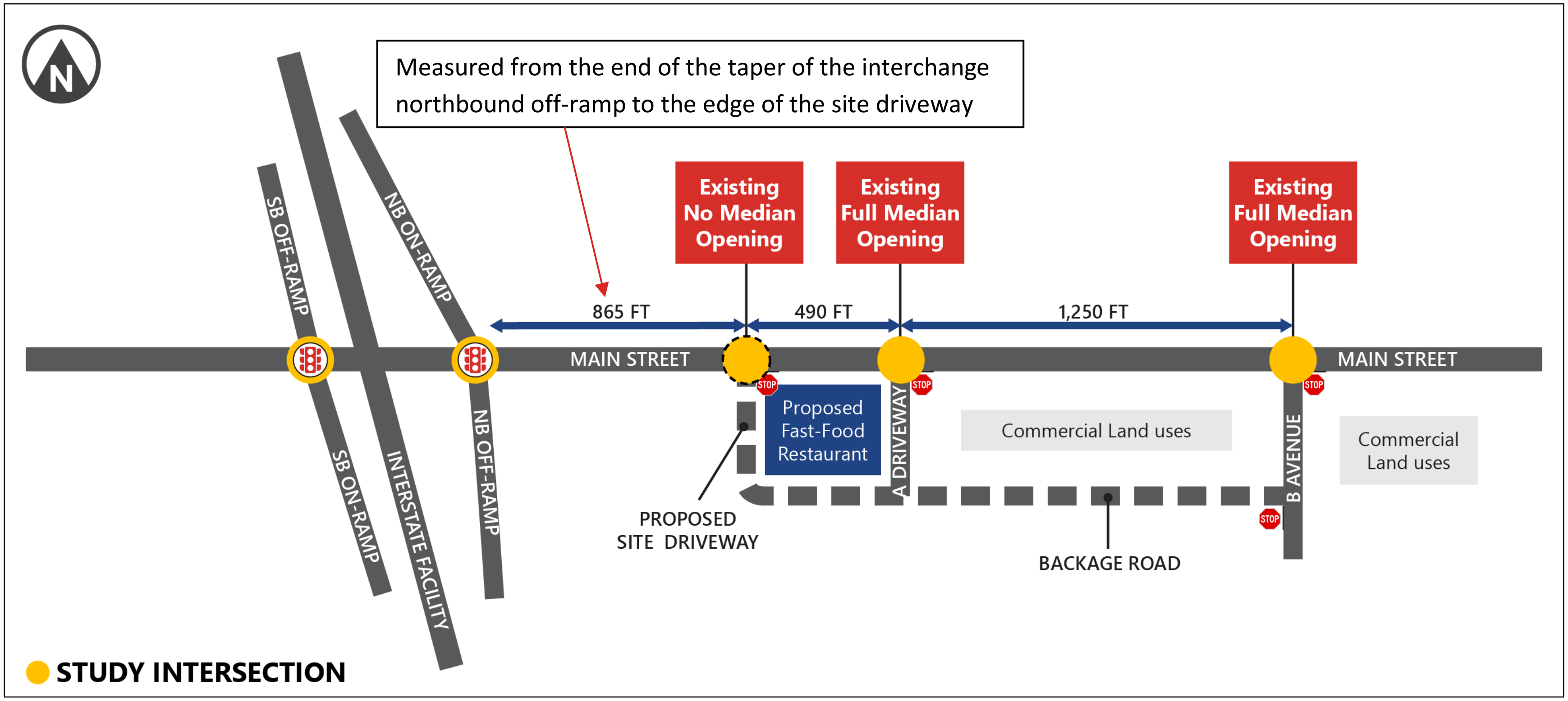
MTSIH Study Area Guidelines	Case Study 2 Application	Study Intersection(s)
Site access driveway(s)	Site trips will turn directly in/out of the site at the intersection of Main Street and Proposed Site Driveway	• Main Street and Proposed Site Driveway (unsignalized)
Indirect site access points	The proposed backage road will provide indirect access to the site via A Driveway and B Avenue	• Main Street and A Driveway (unsignalized) • Main Street and B Avenue (unsignalized)
First signalized intersection on the SHS in each direction from the site up to one-half (0.5) mile from each site access point	No signals (other than the ramp terminals discussed below) are located within 0.5 miles of the site access points	N/A
Interchange ramp terminals for developments located within one-half (0.5) mile of an interchange	The interchange ramp terminals are located within 0.5 mile from the site access	• Main Street and Southbound ramps (signalized) • Main Street and Northbound ramps (signalized)
Indirect impact area where traffic from the project site is anticipated to result in a 25 percent increase or greater for any single movement during the peak hour analysis period	No other indirect impact resulting in a ≥25% increase on an intersection movement is anticipated	N/A
Other Considerations	Per coordination during the Pre-Application Meeting, no other study area adjustments needed	N/A

For this case study, based on the *MTSIH* guidelines, the following intersections are included in the study area (**Figure 3-3).**

- Main Street and Southbound ramps (signalized)
- Main Street and Northbound ramps (signalized)
- Main Street and Proposed Site Driveway (unsignalized)
- Main Street and A Driveway (unsignalized)
- Main Street and B Avenue (unsignalized)

It should be noted that even when a local agency has a defined procedure in place to determine the size of the study area, it is always good practice to ensure participating agencies agree with the proposed scope and study area before proceeding with the analysis.

Figure 3-3 | Vehicular Study Area



3.4.2. Analysis Horizon Years and Periods

As indicated in the ***MTSIH***, a driveway/connection permit should include evaluation of future traffic operating conditions at buildout of the site for which access is being requested. At a minimum, the analysis horizon years and scenarios should include the existing year, future background buildout year (without project), and future buildout year (with project). For this case study the existing year is established as 2023 and the project buildout year is identified as 2025.

3.4.3. Existing Conditions Analysis

The data collection effort for this study consisted of eight-hour turning movement counts collected at the study area intersections, including three hours during the AM peak period, two hours during the Mid-Day period, and three hours during the PM peak period. The AM, PM, and Mid-Day peak hour volumes were developed from the field collected intersection traffic counts. Data collection was conducted in accordance with FDOT standards. Vehicles, trucks, pedestrians, and bicycles were included in the intersection counts. The 24-hour daily traffic count was also obtained for Main Street near the project driveway location.

FDOT develops Seasonal Factors (SF) for all Florida counties, which are available from the FDOT Florida Traffic Online (FTO) and are used to convert short-term traffic counts to Annual Average Daily Traffic (AADT). The SF of 0.98 corresponding to the data collection week was applied to the raw intersection traffic data to seasonally adjust the volumes. The seasonally adjusted existing traffic volumes are shown in **Figure 3-4**. It is noted that a common error is to use the Peak Season Category Factor (PSCF) instead of the SF, however PSCF converts daily counts to Peak Season Weekday Average Daily Traffic (PSWADT), which represents the average weekday traffic volume during the 13 consecutive weeks of the year with the highest traffic volume demand (peak season). Refer to the ***FDOT Project Traffic Forecasting Handbook*** Section 3.12 for more details on SF conversion.

3.4.4. Future Background Conditions Analysis

The fast-food restaurant development buildout year is specified as 2025. The buildout year 2025 background traffic volumes were estimated by applying a linear annual growth rate (AGR) of 1%. The AGR was calculated based on the most recent five-year historical traffic volumes for the adjacent Main Street roadway segment, obtained from the FDOT FTO. The future background traffic volumes for year 2025 is shown in **Figure 3-5**.

Figure 3-4 | Existing Year (2023) Traffic Volumes

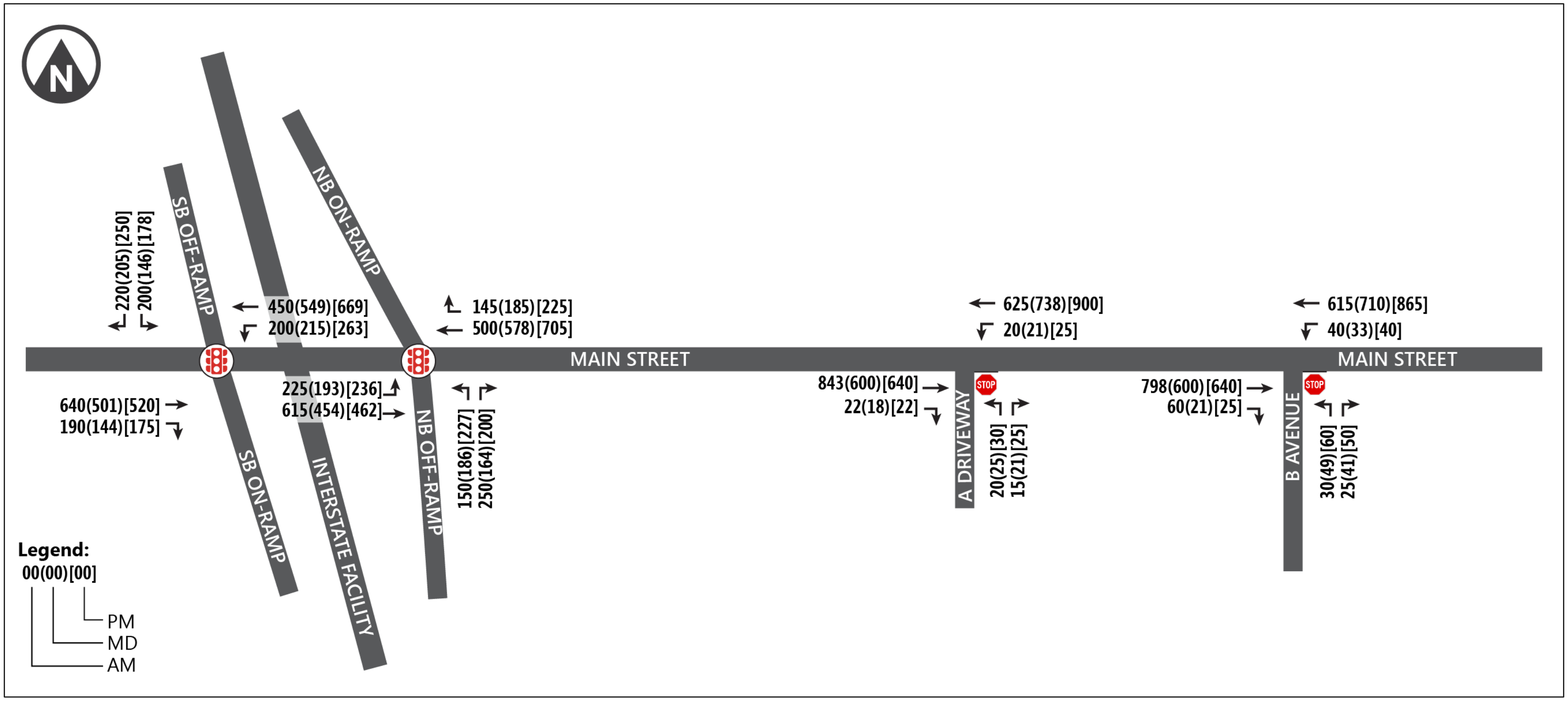
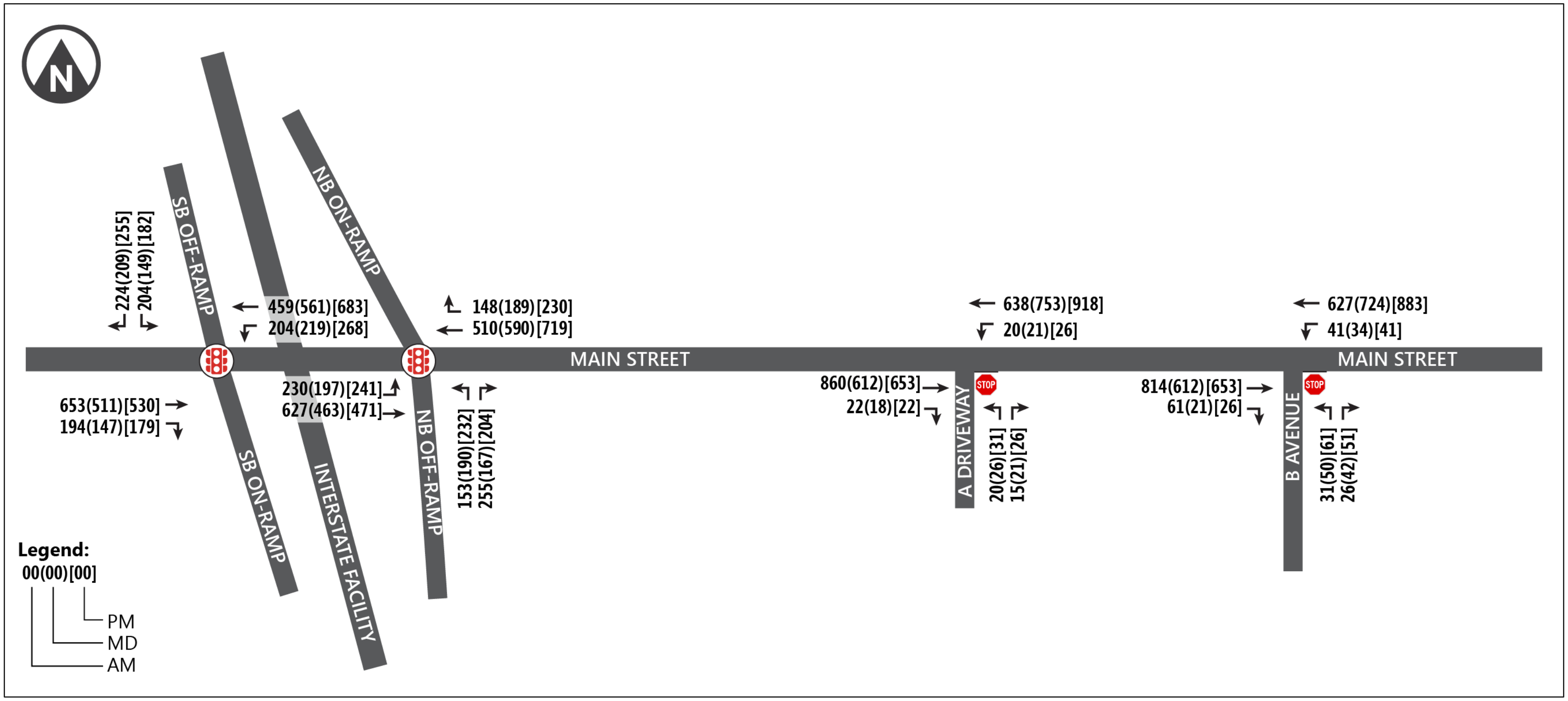


Figure 3-5 | Future Year (2025) Background Traffic Volumes (without project)



3.4.5. Vehicular Trip Distribution and Assignment

3.4.5.1. Vehicular Trip Distribution

Trip distribution refers to the anticipated origins and destinations of new trips to and from the proposed site. In some cases, an existing travel demand model can be used as a tool to estimate trip distribution. Using a travel demand model to serve as a guide for the manual distribution of trips through the network is typically an acceptable approach. When using a travel demand model to aid with trip distribution, it is important to confirm that any nearby future developments or roadway changes are accounted for in future models in order to account for changes in travel behavior. Some level of professional judgment is typically used with the travel demand model results.

The local area version of the Florida Standard Urban Transportation Model Structure (FSUTMS) can be used to obtain initial estimates for overall site trip distribution and roadway assignment percentages. To accomplish this, a transportation analysis zone (TAZ) representing the subject project needs to be added to the network, including employment numbers to approximately represent the development, and a select zone analysis should be performed to obtain the percentage of trips assigned to each of the surrounding links. Adjustments will be then made to the model to account for programmed and committed future changes to the roadway network. Additionally, minor adjustments to the model can be made to account for changes in driveway access and expected local assignment patterns.

For this case study, the areawide FSUTMS travel demand model was used to estimate the fast-food restaurant project site trip distribution and trip assignment percentages as shown on **Figure 3-6**.

3.4.5.2. Vehicular Traffic Assignment

While trip distribution identifies the general origin and destination of site trips, trip assignment refers to the process of determining the amount of traffic that will use each potential route. When the site includes a single full access driveway, the task of assigning traffic to the network may be a straightforward exercise. Multiple driveways, access control, one-way streets, and nearby regional facilities all add variability to driver decision-making, often requiring the development of multiple paths for each origin/destination pair.

The following influencing factors can be considered when assigning traffic to the local network:

- Driver tendencies and local behavior (such as the percentage of drivers who choose the first available driveway when multiple options exist, and whether the use will draw local, daily users or regional drivers who are not likely to be familiar with the network).
- Internal circulation design (outbound trips tend to be more evenly distributed among multiple exists compared to inbound trips, although the traffic control at access points, such as signalization, can impact this).
- Congestion and travel times by time of day (drivers familiar with the area may consider avoiding a congested left turn, for example).
- Planned network improvements that could modify assignment in one or more horizon years.
- One-way street or other factors that would lead to different inbound and outbound paths.

When assigning trips to a traffic network, it is advisable to create separate figures for net external trips and pass-by trip assignment. Net external trips are new trips generated by the site that impact roadways external to the project and represent the resulting project trips after applying two potential trip reductions. The first relates to internal capture, where the external project trips are determined after subtracting internal capture trips that do not leave the project site. For the second, pass-by trips are subtracted from the external project trips to determine the net external trips. In this case study with only a single use, there is no internal capture, so the net external trips are determined simply by subtracting the pass-by trips from the total project vehicle trips.

3.4.5.3. Net External Trips Assignment

For this case study, a figure showing the percentage distribution of net external site trips through the network was developed first, as shown in **Figure 3-6**. These percentages were then converted to hourly trips by multiplying each percentage by the total number of inbound and outbound net external trips, rounding to the nearest vehicle. Due to rounding, it is good practice to balance site trips through the network as well as confirm that the total number of inbound and outbound trips matches expectations. In this case study, it is assumed that the project trips from Main Street west will use the B Avenue signalized intersection and the Backage Road to access the development site. The final calculated trip assignment for the AM, PM, and Mid-Day peak hours are shown on **Figure 3-7**.

3.4.5.4. Pass-By Trips Assignment

Pass-by trips should be analyzed carefully. The assignment should consider the unique turn movement patterns of pass-by trips and should account for the subtraction of existing turn movements related to the pass-by trips that are no longer made. Note that unlike primary trips, the outbound segment of pass-by trips should continue in the original direction of travel.

Pass-by trips are assigned to the network by removing trips from the mainline through movement, adding them to a turning movement entering the site, then adding them to a turning movement exiting the site in the vehicle's original direction of travel. The assignment of pass-by trips differs from the assignment of new site trips in two significant ways:

- No new trips are added to the network; rather, existing trips are rerouted to and from the site resulting in no net change in trips on the roadway network.
- Whereas new site trips are returned in the direction of their origin when exiting the site, pass-by trips are routed in the direction of their original destination (i.e., returned to their original direction of travel).

Pass-by trip assignment should be performed based on the percent directional traffic volumes along the adjacent street for the individual peak hours. In both the existing (2023) and future (2025) conditions, the eastbound/westbound directional split of traffic on Main Street adjacent to the project based on the volumes shown in **Figure 3-4** and **Figure 3-5** is 57%/43% in the AM peak hour, 45%/55% in the mid-day peak hour, and 42%/58% in the PM peak hour, respectively. Therefore, multiplying the pass-by trips shown in **Table 3-1** by the directional split of traffic in the eastbound and westbound directions in each peak hour provides the following peak hour directional pass-by trips: 32 eastbound and 23 westbound in the AM peak hour, 29 eastbound and 35 westbound in the mid-day peak hour, and 17 eastbound and 24 westbound in the PM peak hour. Further discussion of the pass-by trip estimation and limiting the pass-by trips to 10% of adjacent street traffic is provided in **Section 3.3.1.1**. These directional pass-by volumes in each of the three peak hours are shown in **Figure 3-8**.

In this case, the proposed site driveway is assumed to be right-in right-out only since it does not meet the spacing standard for an FMO near an interchange. All pass-by trips that are headed east are assumed to use this driveway. With the connection of the proposed backage road to B Avenue, it is assumed for this analysis that the Main Street/B Avenue intersection is signalized. All pass-by trips that are headed west towards the interstate are assumed to route via B Avenue and the backage road for both inbound and outbound movements. An additional assumption with the provision of the backage road connection to B Avenue is that the existing FMO on Main Street at A Driveway is converted to a directional left-turn median opening for westbound left turns. As such, the previous northbound left-turn movement is assumed to be re-routed via the backage road to B Avenue where that traffic would turn left at the signal.

Figure 3-6 | Net Vehicle Trip Distribution

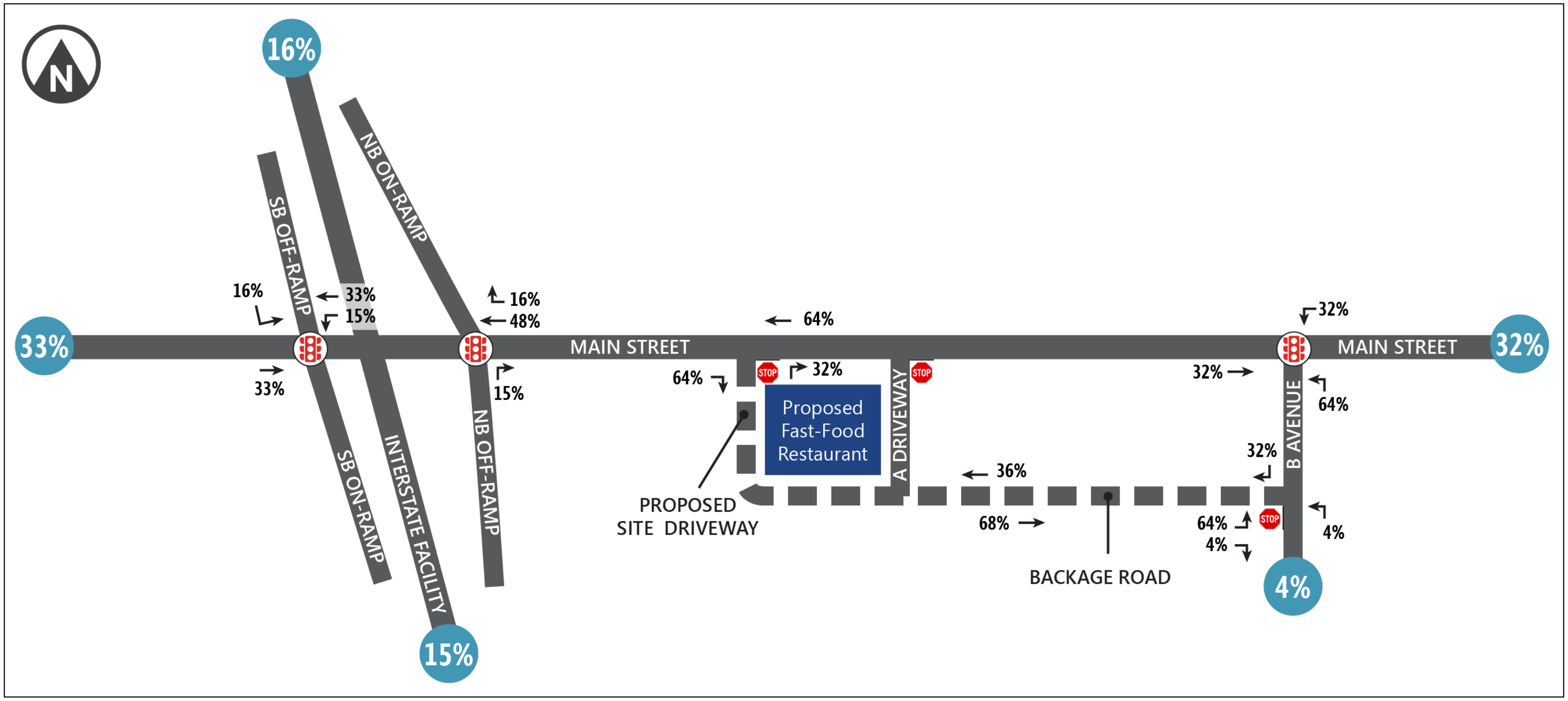


Figure 3-7 | Vehicle Trip (Net External) Assignment

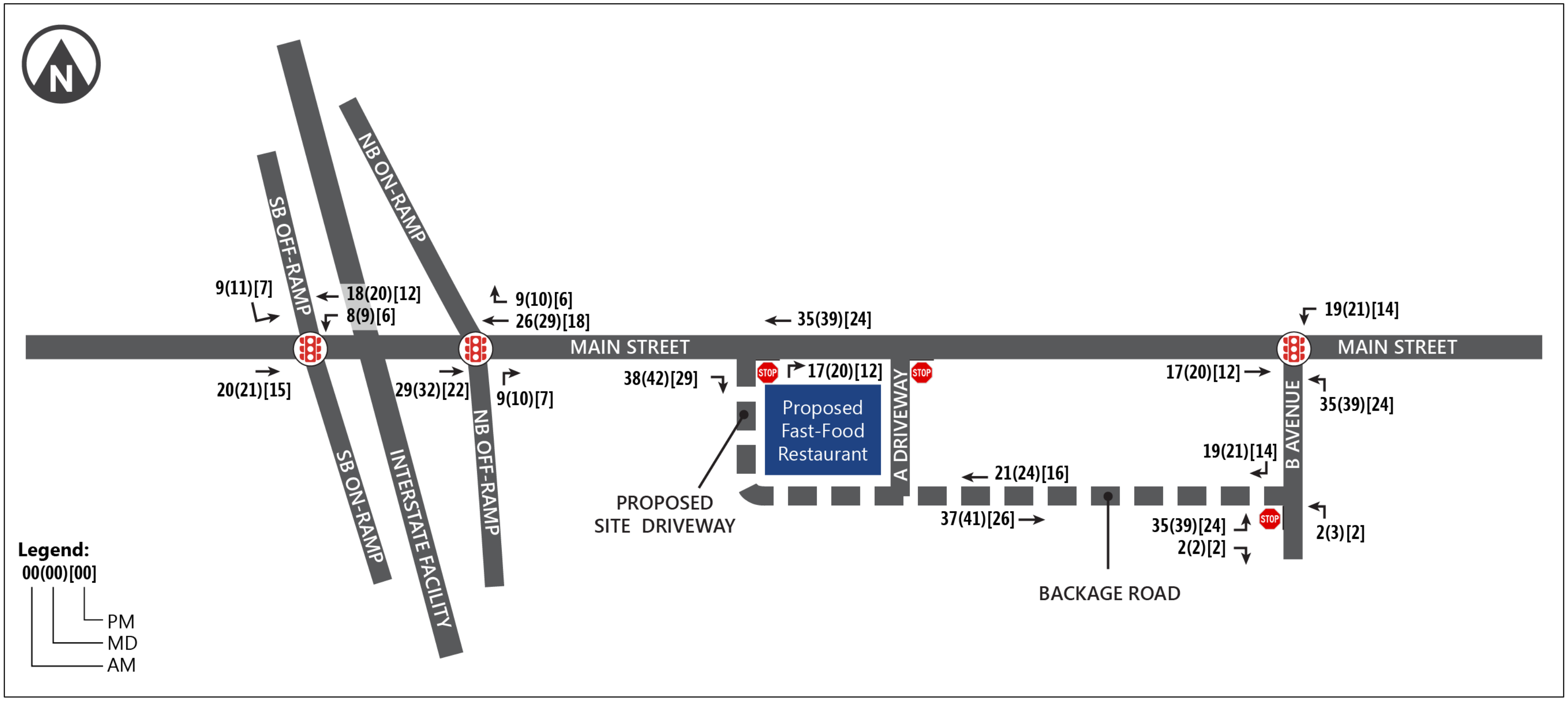
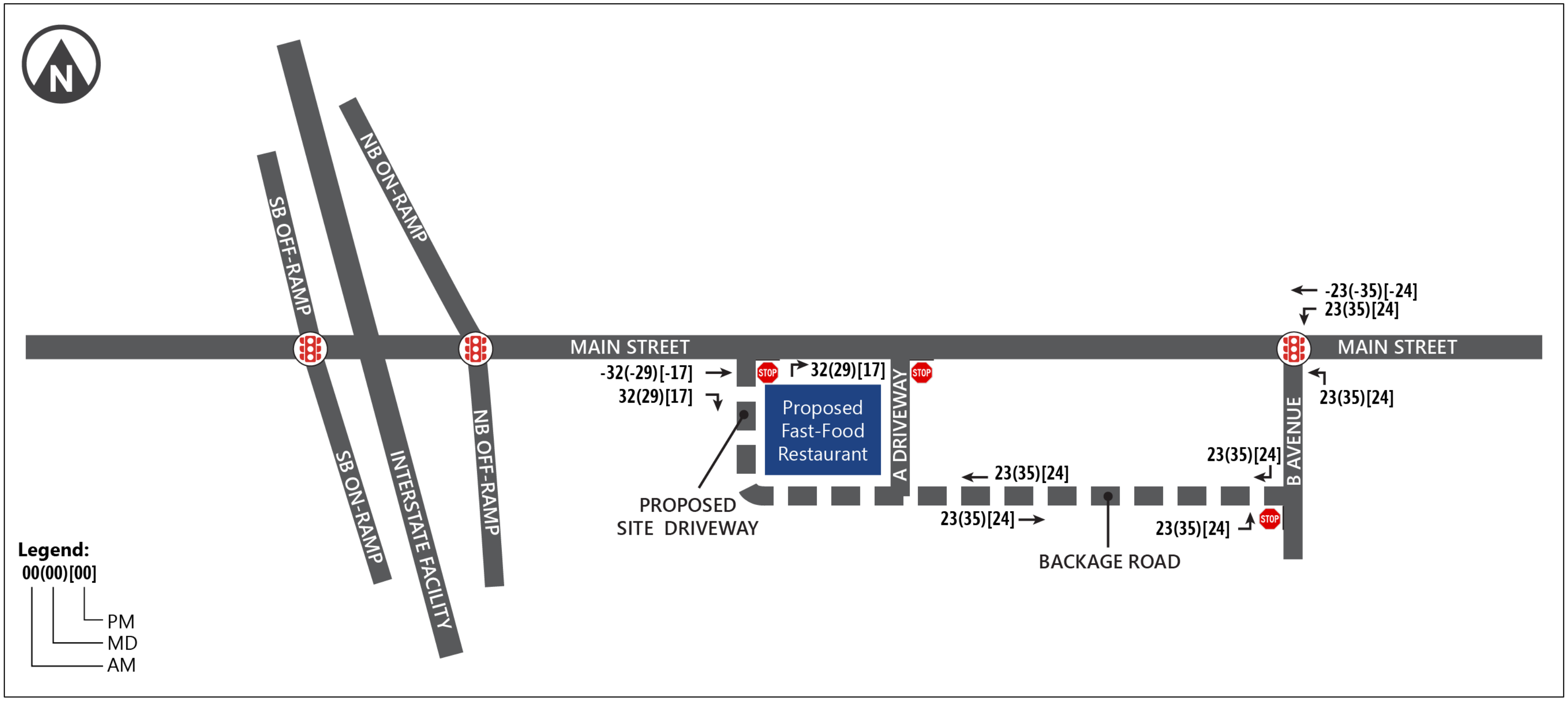


Figure 3-8 | Pass-By Trip Assignment



3.4.6. Future Build Conditions

Future traffic volumes were estimated by adding project trips (net external trips and pass-by trips) to the future background volumes and reassigned to the proposed roadway configuration with backage road and revised median openings along Main Street (See **Figure 3-9)**.

3.4.7. Capacity Analysis

3.4.7.1. Intersection Analysis

The level of detail that is required to be analyzed may vary between projects and reviewing agencies. Delay and LOS may be reported on an intersection-by-intersection basis, by approach, or by movement. A queueing analysis may be required by movement, especially in areas with tightly spaced intersections and driveways, or to verify the adequacy of existing turn lane storage lengths. The modeling software that will be used in an analysis and the measures of effectiveness that will be reported should always be agreed upon with the reviewing agency before beginning analysis.

In this case study, Synchro software was used to analyze existing year, background, and buildout conditions at each of the study area intersections. Each intersection was compared using the following measures:

- Average Intersection Delay and LOS.
- For the side-street stop-controlled intersections, the side street delay is reported.
- LOS E and LOS F are typically considered unacceptable and require mitigation; however, this may vary based on the reviewing agency. For roadways on the SHS, the peak hour motorized vehicle LOS target is D in urbanized areas, and LOS C for areas outside of urbanized areas, based on FDOT's Policy on Level of Service Targets, ***Topic No. 000-525-006***. Additional information on performance measures of effectiveness and targets for auto analysis is provided in Section 4.4.1 of the ***MTSIH***.

Delay and LOS results from the study signalized and unsignalized intersections are shown in **Table 3-3**.

Figure 3-9 | Future Year (2025) Build Traffic Volumes (with project)

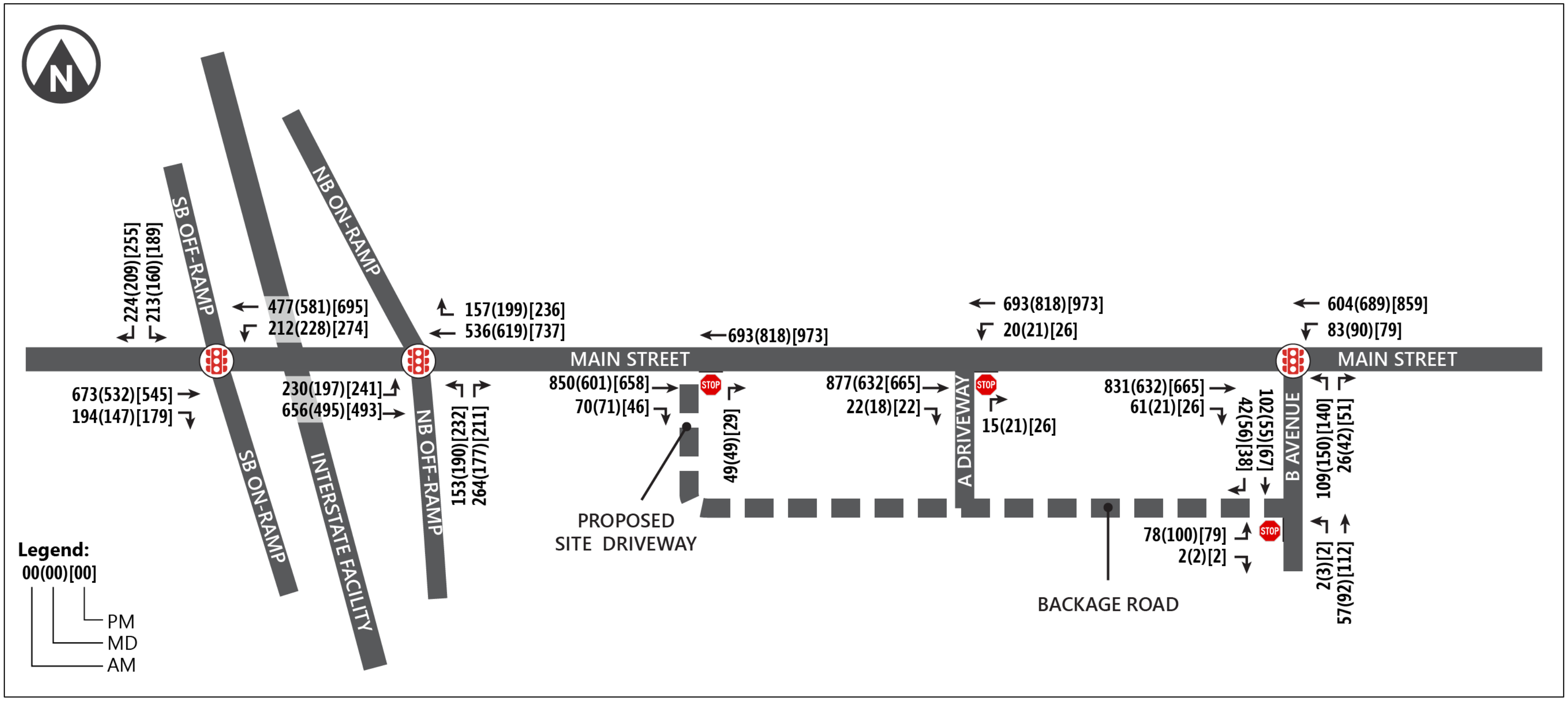


Table 3-3 | Intersection Capacity Analysis Results

Period / Intersection	LOS (Delay, sec/veh)		
AM Peak Hour	**2023 Existing**	**2025 Background**	**2025 Buildout**
Main Street and Southbound Ramps	C (20.4)	C (20.5)	C (20.6)
Main Street and Northbound Ramps	C (20.2)	C (20.3)	C (20.2)
Main Street and Proposed Site Driveway	NA		B (12.4) NB Approach
Main Street and A Driveway	D (26.4) NB Approach	D (27.5) NB Approach	B (12.1) NB Approach
Main Street and B Avenue	D (26.9) NB Approach	D (28.5) NB Approach	A (9.8)
B Avenue and Backage Road	NA		B (10.1) EB Approach
PM Peak Hour	**2023 Existing**	**2025 Background**	**2025 Buildout**
Main Street and Southbound Ramps	B (18.6)	B (18.6)	B (18.8)
Main Street and Northbound Ramps	C (32.0)	C (32.3)	C (32.4)
Main Street and Proposed Site Driveway	NA		B (11.0) NB Approach
Main Street and A Driveway	D (25.9) NB Approach	D (27.4) NB Approach	B (11.1) NB Approach
Main Street and B Avenue	D (30.4) NB Approach	D (32.3) NB Approach	B (10.7)
B Avenue and Backage Road	NA		B (10.3) EB Approach
Mid-Day Peak Hour	**2023 Existing**	**2025 Background**	**2025 Buildout**
Main Street and Southbound Ramps	B (18.6)	B (18.6)	B (18.8)
Main Street and Northbound Ramps	C (22.4)	C (22.5)	C (22.3)
Main Street and Proposed Site Driveway	NA		B (10.9) NB Approach
Main Street and A Driveway	D (25.9) NB Approach	D (27.4) NB Approach	B (10.9) NB Approach
Main Street and B Avenue	C (22.1) NB Approach	C (23.0) NB Approach	B (11.5)
B Avenue and Backage Road	NA		B (10.3) EB Approach

Note: For unsignalized intersections, the minor street approach with the highest delay is reported.

3.4.7.2. *Right-Turn Lane Analysis*

A right-turn lane warrant analysis was performed at the proposed fast-food restaurant driveway based on ***NCHRP Report 457***. The result of the analysis is shown in **Figure 3-10** (*NCHRP right-turn lane warrants for various scenarios are provided in the* ***FDOT Multimodal Access Management Guidebook***)**.** As shown, the driveway meets the warrant for an eastbound right-turn lane.

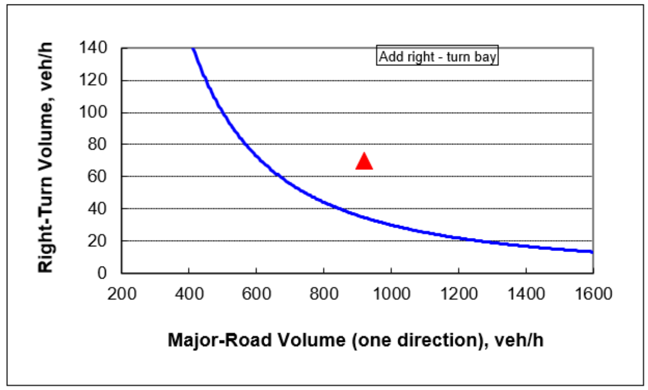
Figure 3-10 | Right-turn Lane Warrant (NCHRP 457)

INPUT

Roadway geometry:	4-lane roadway
Variable	**Value**
Major-road speed, mph:	45
Major-road volume (one direction), veh/h:	920
Right-turn volume, veh/h:	70

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	35
Guidance for determining the need for a major-road right-turn bay for a 4-lane roadway:	
Add right-turn bay.	



It is also important to consider potential pedestrian conflicts with the addition of a right-turn lane. A well-designed right-turn lane can help to reduce pedestrian conflicts by slowing turning vehicle speeds, increasing pedestrian visibility, and reducing pedestrian exposure with a pedestrian refuge area.

3.4.7.3. *Intersection Control Evaluation (ICE)*

According to the ***FDOT Design Manual (FDM)***, ICE is required when a new signalization is proposed along a state roadway. The Department's ICE policy and procedure is published in the FDOT ***Manual on Intersection Control Evaluation***. In this case study, the median opening modifications along Main Street and the backage road connection to B Avenue will increase cross-street traffic volumes at the intersection, thereby potentially warranting signalization of the Main Street/B Avenue intersection. Hence, ICE should be performed to identify the appropriate control strategy. Based on the ICE stage 1 evaluation findings as provided in **Figure 3-11**, the signalization alternative is selected as preferred alternative for the intersection.

Figure 3-11 | Intersection Control Evaluation Form Excerpts

Project Name	Main Street and B Avenue		FDOT Project #		
Submitted By	FDOT District #	Agency/Company		Date	9/5/2023
Email		FDOT District		County	
Project Locality (*City/Town/Village*)					
Intersection Type	At-Grade Intersection	FDOT Context Classification	C3C - Suburban Commercial		
Project Funding Source	Non-federal	Project Type	Land Development Project		
Project Purpose (*What is the catalyst for this project and why is it being undertaken?*)	Fast Food restaurant development is proposed on the south side of Main Street, with a shared acess road connecting to B Avenue, south of Main Street intersection. Signalization of Main Street and B Avenue intersection is warranted with the additional traffic at the south leg of the intersection because of the shared access roadway. The ICE process is used to determine the appropriate intersection control type that will provide acceptable traffic operations and safety conditions at the Main Street and B Avenue intersection.				
Project Setting Description (*Describe the area surrounding the intersection*)	The Main Street and B Avenue intersection is located in ABC County. There are commercial properties in the north side of the intersection, and commercial properties in the south side.				
Multimodal Context (*Describe the pedestrian, bicycle, and transit activity in the area and the potential for activity based on surrounding land uses and development patterns*)	There are sidewalks along eastbound and westbound Main Street, and northbound and southbound B Avenue. Crosswalk is present on the south leg of the Main Street and B Avenue intersection. There are bicycle lanes present along eastbound and westbound Main Street. Bus routes exist within the intersection area.				

Resolution	
To be filled out by FDOT District Traffic Operations Engineer and District Design Engineer	
Project Determination	Identified Control Strategy Approved
Comments	Signal alternative is recommended for the intersection.

3.5. Pedestrian/Bicycle/Transit Impact Analysis

As shown in **Table 3-1**, the walk+bike+transit trips were estimated as 27, 15, and 29 for the weekday AM peak hour, PM peak hour, and PM peak hour of generator (used for the mid-day peak hour) time periods, respectively. Both a context-based assessment and a quantitative analysis were performed for this site and are discussed below.

3.5.1. Context-Based Assessment

3.5.1.1. Review Compatibility with Planning Documents

State and local planning documents were reviewed to determine if the proposed development is consistent with local, area, and District plans. The ''City Uptown Master Plan," and FDOT 5-Year Work Program were reviewed as a part of this effort. The following planned improvements were noted near the site. Based on the findings of this review, it is recommended that the developer coordinate with the local government/s to determine what design requirements may be required to support these plans.

- The site is located in the Uptown Master Plan area. Per the 'City Uptown Master Plan,' a new roadway is planned behind the site to serve as a tertiary street: tertiary streets are internal connectors primarily to service and access sites, as well as provide bicycle/pedestrian connectivity. Furthermore, the plan calls for specific site design criteria and requirements for developments. This needs to be coordinated with the proposed backage road plan associated with the proposed site development.
- Per the 'City's Comprehensive Plan,' buffered bicycle lanes are planned on Main Street in both directions.
- There are no planned and programmed projects included in the FDOT 5-Year Work Program.
- There are no Project Development and Environment Studies (PD&E) for the arterial roadway or for the adjacent interstate/interchange.
- There are no future interchange modification plans that would have impact on this development site and its proposed access.
- There is no right-of-way (ROW) need for any FDOT projects that would affect the development site and its proposed access.
- The local government does not have a ROW preservation ordinance.

3.5.1.2. Internal Site Design Pedestrian and Bicycle Accommodations

In order to provide safe and convenient access to and circulation within the development for all users, the site's design is recommended to incorporate pedestrian and bicycle facilities, where appropriate. **Table 3-4** describes the on-site design specification to accommodate non-motorized users. The basis for many of the recommendations in **Table 3-4** can be found within Appendix B of the ***MTSIH***.

Table 3-4 | Internal Site Design to Accommodate Non-Motorized Users

Design Component	Review	Recommendation
Access Management	The proposed median opening modifications will reduce the number of vehicular conflict points with the non-motorized users.	None
Driveway Design	An eastbound right-turn lane is provided into the site with a large turning radius which could increase turning vehicle speeds.	Reduce turning radius; incorporate truck apron at corner if needed
Site Frontage	There are sidewalks along eastbound and westbound Main Street with a six-foot grass landscape strip behind the curbs. There are bicycle lanes present along eastbound and westbound Main Street. No marked crosswalk is provided across driveway on Main Street.	Provide marked crosswalk at the driveway
Site Circulation & Bicycle/ Pedestrian Access	A designated path is provided from the external sidewalk along Main Street to the front door with awnings and crosswalks through the parking lot. This path also serves the parking area.	None
Amenities	Unknown if bike racks provided.	Provide bike racks on site
Network Review	The City's Uptown Master Plan shows a new roadway in the back of the site. The backage road is proposed to connect behind the development to A Driveway and B Avenue. This new roadway would not only improve connectivity for vehicles, but also pedestrians and bicyclists.	Developer should continue to coordinate with the city on completion of this road and potential extension further west.

3.5.1.3. Pedestrian and Bicycle Connections to Adjacent Properties and/or Transit Stops

Connections between the site and neighboring properties and nearby bus stops were reviewed.

Adjacent Properties

There are no direct pedestrian connections between the proposed fast-food restaurant and the commercial properties east of A Street (see red line on **Figure 3-12**). Coordination with the adjoining properties is recommended to provide safe and direct pedestrian paths. It is also recommended to provide crosswalks and pedestrian signal phasing at the proposed signal at B Avenue and Main Street.

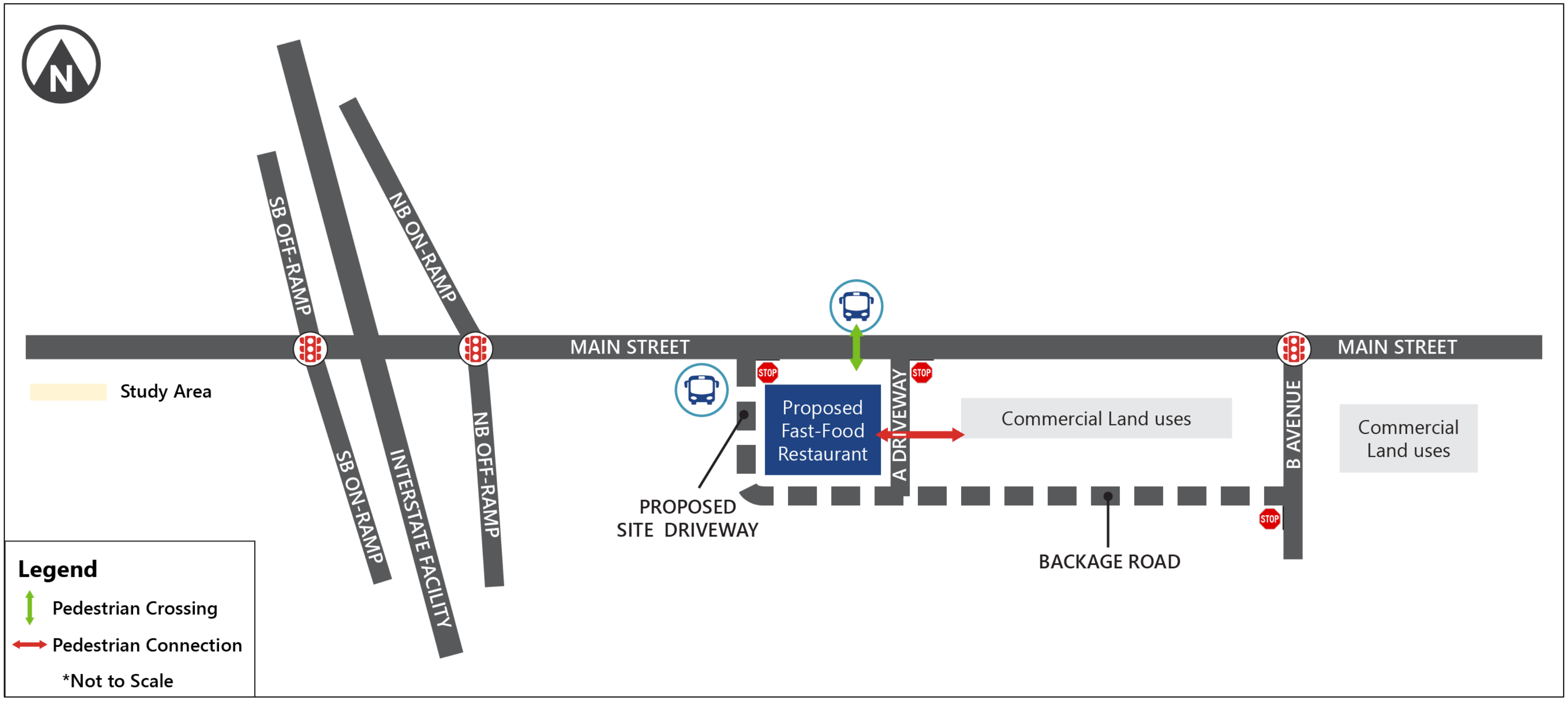
Consideration should be given to nearby pedestrian and bicycle generators such as schools, universities, public parks etc. However, there are no such pedestrian and bicycle generators in the vicinity of the proposed development.

Nearby Bus Stops

There are sidewalks along Main Street in both directions. However, there is no crosswalk to the westbound bus stop on the north side of Main Street from the proposed fast-food restaurant (see green line on **Figure 3-12**). The bus stop is not located within the LAROW. There is no bus pull out. It is recommended to consider a direct path with marked pedestrian midblock crossing and appropriate traffic control (if warranted based on the criteria for midblock crosswalks in the ***Traffic Engineering Manual*** (TEM)).

Due to the proximity of the interchange, a midblock signal crossing here may not be appropriate and needs to be evaluated. Based on ***F.A.C. 14.97.003 (3)(i)***, traffic signals, which are proposed at intervals closer than the access management standard for the designated access class, will be approved only where the need for such signal(s) is clearly demonstrated for the safety and operation of the roadway and approved through the signal warrant process. However, pedestrian midblock crossing opportunities may be provided as needed and will not affect or be affected by the access management class or interchange influence area guidelines.

Figure 3-12 | Connections to Adjacent Properties and Bus Stops



3.5.2. Quantitative Analysis

3.5.2.1. Pedestrian and Bicycle Trip Generation

As shown in **Table 3-1**, the walk+bike+transit trips were estimated as 27, 15, and 29 for the weekday AM peak hour, PM peak hour, and PM peak hour of generator (used for mid-day peak hour) time periods, respectively. Based on the recommended pedestrian and bicycle quantitative analysis study level guidelines as shown in **Figure 3-13** and **Table 3-5**, a Level 2 (Medium) analysis was performed. **Table 3-6** shows the steps for the quantitative analysis. Note that Step 1 is required as part of the MTIA for access connection permit applications for driveway classifications C, D, E, F, and G.

Figure 3-13 | Pedestrian and Bicycle Quantitative Analysis

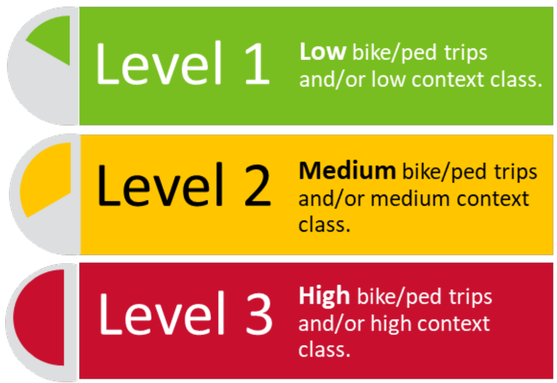


Table 3-5 | Level of Pedestrian and Bicycle Study based on Context Classification and Peak Hour Volume

Peak Hour Volume of Non-Motorized Trips	C1	C2	C2T	C3	C4	C5	C6
Low (< 20)	1	1	2	1	1	2	2
Medium (20 – 49)	2	2	2	2	2	3	3
High (≥ 50)	3	3	3	3	3	3	3

Table 3-6 | Pedestrian and Bicycle Study Requirements – Quantitative Analysis

Analysis Type	Study Requirements	Level of Pedestrian and Bicycle Study		
		Level 1 (Low)	Level 2 (Medium)	Level 3 (High)
Quantitative Analysis	**1. Bicycle/Pedestrian Trip Generation**	Required when total vehicle trips per day exceeds 600 (driveway connection permit categories C-G). Optional for other study types.		
	2. Study Area	N/A	500-foot radius or nearest signalized intersection beyond 500 feet [1]	1,500-foot radius or nearest signalized intersection beyond 1,500 feet [1]
	3. Network Connectivity Analysis	N/A	Optional	Optional
	4. Multimodal Q/LOS Analysis	N/A	Optional	Optional

[1] Access connection permit applications for Driveway Categories C, D, E, F, and G should meet the above study area guidance as a minimum or utilize the same study area being evaluated for vehicle trips.

3.5.2.2. Study Area

For the Level 2 analysis, the recommended study area is a 500-foot radius measured from the driveway, or the nearest signalized intersection beyond 500 feet from each driveway per **Table 3-6**. For this case study, the pedestrian/bicycle study area is extended to the nearest signalized intersections on both sides of the proposed fast-food restaurant site driveway, as shown in **Figure 3-14**.

3.5.2.3. Network Connectivity Analysis

The first step of the route directness analysis is to define the origin and destination point/s. For Case Study 2, one origin and three destinations were selected within the study area. In this study area the commercial parcels located on the north side of Main Street are not yet substantially developed. The origin corresponds to the primary land use on the proposed site, which is the proposed fast-food restaurant, and the destinations selected within the study area are the bus stop and the adjacent commercial land uses.

After the origins/destinations are determined, the route directness analysis is performed with each origin-destination pair for Case Study 2. As discussed in ***MTSIH*** Section 4.8.3, the route directness ratio equals the distance along the actual route a bicyclist or pedestrian will travel between an origin and destination (actual shortest path route distance) divided by the straight-line distance. The target route directness ratio is 1.5 or less. For each origin-destination pair, the quality and completeness of the actual routes are reviewed. In order to promote safe and efficient bicycle and pedestrian trips, improvements are identified to improve walking/biking routes and to reduce the route directness ratio (provide a more direct path).

The route directness analysis, the quality and completeness of the routes, and the recommended improvements for Case Study 2 are summarized in **Table 3-7.**

Figure 3-14 | Pedestrian/Bicycle Analysis Study Area

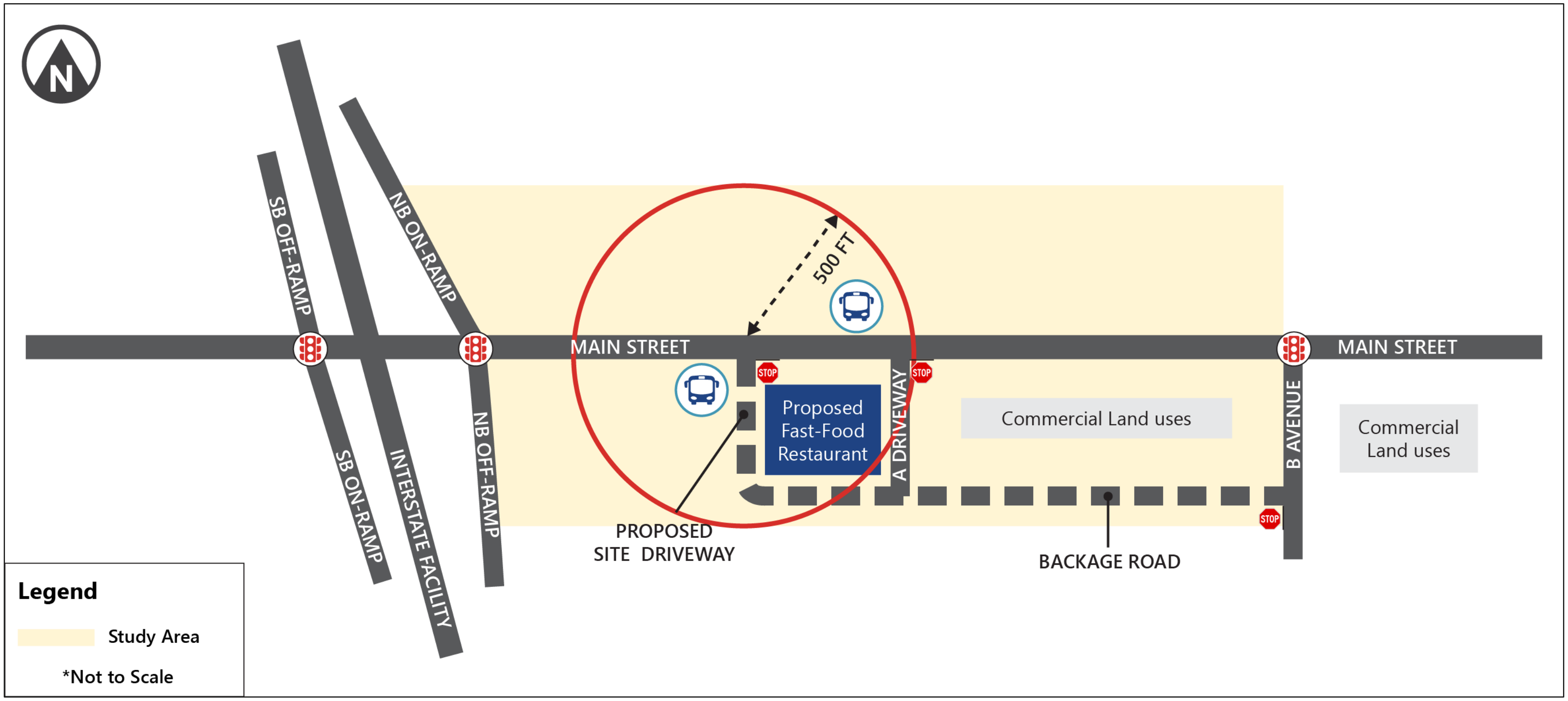


Table 3-7 | Network Connectivity for Bus Stop

Location	Route Distance (ft)	Straight-Line Distance (ft)	Route Directness Ratio	Route Completeness and Quality	Improvements
1. Westbound Bus Stop	2,000	1,000	2.0	Adequate sidewalks are present.	Provide direct path with a marked pedestrian midblock crossing and appropriate traffic control (if warranted by the ***TEM*** and feasible). Possible improvements needed at bus stop.
2. Commercial Land uses A (East of A Driveway)	1,050	800	1.31	Adequate sidewalks are present.	Provide direct pedestrian path between the adjacent properties across A Driveway.
3. Commercial Land uses B (East of B Avenue)	2,100	1,800	1.17	Adequate sidewalks are present.	Provide crosswalk across A Driveway connecting the sidewalks both sides of the driveway. Provide crosswalks and pedestrian signal phasing at the proposed signal at B Avenue and Main Street intersection.

3.5.2.4. Multimodal Q/LOS Analysis

The Pedestrian Level of Traffic Stress (PLTS) and the Bicycle Level of Traffic Stress (BLTS) were performed for the study. The estimation of PLTS was based on the flow chart provided in the FDOT ***Quality/Level of Service Handbook***. With a six-foot grass landscape strip between the back of curb and sidewalks (no trees or other vertical element), pedestrians are expected to experience PLTS 3 on Main Street in the study area. PLTS could be improved to PLTS 2 if trees were added to the landscape strip.

The BLTS estimation for the study area was based on the BLTS criteria developed by Peter G. Furth and the BLTS flow charts provided in the FDOT ***Quality/Level of Service Handbook***. Bicyclists are expected to experience BLTS 4 on Main Street within the study area. Main Street provides bike lanes in both eastbound and westbound directions, but the high speed and volume of the roadway yields the high stress level for bicyclists. Buffered bicycle lanes are planned as part of the 'City's Comprehensive Plan'; however, this change would still yield BLTS 4 due to the high speeds on Main Street. Separated bike lanes or a shared-use path could be considered along Main Street to improve the BLTS, if feasible. No bicycle facilities are currently provided on B Avenue.

This specific analysis provides an opportunity for the Department to engage with the applicant and local agency on potential mitigation measures to provide more inviting, less stressful multimodal facilities along the SHS. The developer could provide improvements along their frontage, such as trees within the landscape strip between the sidewalk and roadway, or ROW for future bicycle facility improvements. Consideration could be given to reevaluating the specific future bicycle facility along the SHS in this case, and if a facility providing more separation to motor vehicle traffic was feasible, the developer could configure their frontage appropriately. The developer could also contribute funding towards multimodal improvements that might span more than their specific street frontage based on coordination with the local agency.

3.6. Safety Analysis

Based on the guidelines in the ***MTSIH***, the safety analysis should be conducted to assess the existing crash patterns and impacts the proposed development will have on existing crash patterns. If crash patterns are identified, the next step is using engineering judgment to determine if the development site will exacerbate those existing crash patterns. In collaboration with FDOT District staff, appropriate countermeasures will be identified that will lessen the impact that the development will have on existing crash patterns. The study area and site development will be reviewed and assessed to see if additional changes can be made to improve safety for all users and to reduce the potential for crashes and severity.

3.6.1. Review of Crash Data

Crash analyses were conducted for the Main Street intersections and segment between the interstate northbound ramp signalized intersection and B Avenue using the most recent five-year crash data obtained from Signal Four Analytics. The Main Street roadway intersections and segment crashes with the highest severity of incident, by year, are shown in **Table 3-8**. The crash types are summarized in **Table 3-9**. The crashes by the lighting conditions are presented in **Table 3-10**. As shown in the tables, from January 1, 2018, through December 31, 2022, there were 60 reported crashes in the five-year period. No fatal crashes were reported during these five-years, but 14 injury crashes were reported during this timeframe. Most of the crashes occurred within the project study area were rear-end and angle crashes. There were 21 (35%) rear-end crashes and 18 (30%) angle crashes reported. There were no pedestrian or bicyclist involved crashes reported during the five-year period. More than 83% of the crashes (50) occurred during daylight conditions, with only five each (8%) occurring during dusk and dark conditions suggesting existing street lighting is sufficient. Further, no more than one crash each occurred during dusk and dark conditions at each of three intersections evaluated.

A significant number of study area crashes 24 (40%) occurred near the interstate northbound ramps signalized intersection. There were 12 crashes at the B Avenue intersection and ten crashes at the A Driveway intersection that occurred during the last five years. Seven of the crashes that occurred at the B Avenue unsignalized intersection were angle crashes, and three crashes were rear-end crashes. Five of the crashes at the A Driveway were angle crashes.

The proposed access improvements that would convert Main Street and A Driveway intersection median opening from an FMO into DMO, and the signalization of B Avenue intersection with the construction of the backage road would potentially improve safety for all modes of transportation by reducing conflicts. As such, the proposed site, and the modification to these median openings is likely to decrease the crash experience at A Driveway and B Avenue.

Table 3-8 | Crashes by Severity

Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Total Crashes
Intersection: Main Street at NB Ramps Intersection				
2018	0	2	5	7
2019	0	1	4	5
2020	0	2	3	5
2021	0	1	3	4
2022	0	0	3	3
Total	**0**	**6**	**18**	**24**
Intersection: Main Street at A Driveway				
2018	0	1	1	2
2019	0	0	2	2
2020	0	1	2	3
2021	0	0	1	1
2022	0	1	1	2
Total	**0**	**3**	**7**	**10**
Intersection: Main Street at B Avenue				
2018	0	1	3	4
2019	0	1	2	3
2020	0	0	1	1
2021	0	0	2	2
2022	0	0	2	2
Total	**0**	**2**	**10**	**12**
Segment: Main Street between NB Ramps and A Driveway				
2018	0	0	2	2
2019	0	0	1	1
2020	0	1	1	2
2021	0	0	2	2
2022	0	0	1	1
Total	**0**	**1**	**7**	**8**
Segment: Main Street between A Driveway and B Avenue				
2018	0	0	1	1
2019	0	1	0	1
2020	0	0	0	0
2021	0	1	1	2
2022	0	0	2	2
Total	**0**	**2**	**4**	**6**
Study Area Total	**0**	**14**	**46**	**60**

Note: As per the FHWA ***Highway Safety Manual (HSM)***, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

Table 3-9 | Crashes by Type of Collision

Year	Rear End	Head-On	Angle	Sideswipe	Other	Total Crashes
Intersection: Main Street at NB Ramps Intersection						
2018	4	0	1	1	1	7
2019	2	1	1	0	1	5
2020	2	0	1	1	1	5
2021	1	0	2	1	0	4
2022	1	0	1	1	0	3
Total	**10**	**1**	**6**	**4**	**3**	**24**
Intersection: Main Street at A Driveway						
2018	0	0	1	0	1	2
2019	0	0	1	1	0	2
2020	1	0	2	0	0	3
2021	0	0	0	1	0	1
2022	0	0	1	1	0	2
Total	**1**	**0**	**5**	**3**	**1**	**10**
Intersection: Main Street at B Avenue						
2018	1	0	2	0	1	4
2019	1	1	1	0	0	3
2020	0	0	1	0	0	1
2021	1	0	1	0	0	2
2022	0	0	2	0	0	2
Total	**3**	**1**	**7**	**0**	**1**	**12**
Segment: Main Street between NB Ramps and A Driveway						
2018	1	0	0	1	0	2
2019	0	0	0	0	1	1
2020	1	0	0	0	1	2
2021	1	0	0	1	0	2
2022	1	0	0	0	0	1
Total	**4**	**0**	**0**	**2**	**2**	**8**
Segment: Main Street between A Driveway and B Avenue						
2018	0	0	0	1	0	1
2019	1	0	0	0	0	1
2020	0	0	0	0	0	0
2021	1	0	0	1	0	2
2022	1	0	0	0	1	2
Total	**3**	**0**	**0**	**2**	**1**	**6**
Study Area Total	**21**	**2**	**18**	**11**	**8**	**60**

Note: As per the *HSM*, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

Table 3-10 | Crashes by Lighting Condition

Year	Daylight	Dusk	Dark	Total Crashes
Intersection: Main Street at NB Ramps Intersection				
2018	5	1	1	7
2019	5	0	0	5
2020	5	0	0	5
2021	4	0	0	4
2022	3	0	0	3
Total	**22**	**1**	**1**	**24**
Intersection: Main Street at A Driveway				
2018	2	0	0	2
2019	1	1	0	2
2020	2	0	1	3
2021	1	0	0	1
2022	2	0	0	2
Total	**8**	**1**	**1**	**10**
Intersection: Main Street at B Avenue				
2018	3	0	1	4
2019	3	0	0	3
2020	1	0	0	1
2021	1	1	0	2
2022	2	0	0	2
Total	**10**	**1**	**1**	**12**
Segment: Main Street between NB Ramps and A Driveway				
2018	2	0	0	2
2019	1	0	0	1
2020	1	0	1	2
2021	1	1	0	2
2022	1	0	0	1
Total	**6**	**1**	**1**	**8**
Segment: Main Street between A Driveway and B Avenue				
2018	1	0	0	1
2019	1	0	0	1
2020	0	0	0	0
2021	1	0	1	2
2022	1	1	0	2
Total	**4**	**1**	**1**	**6**
Study Area Total	**50**	**5**	**5**	**60**

Note: As per the *HSM*, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

3.6.2. Site and Study Area Assessment

As previously discussed, the proposed site will convert A Driveway to a DMO and signalize the intersection with B Avenue at Main Street. These modifications will reduce conflict points and enhance safety at these locations. The proposed right-in right-out driveway instead of an FMO at the proposed fast-food restaurant site would also be critical for traffic safety at the proposed driveway and along the Main Street roadway.

At the proposed development site driveway Right in Right Out (RIRO), an exclusive right-turn lane is provided which would further enhance safety. It is recommended to reduce the eastbound right-turn lane turning radius at the project site driveway to decrease the turning vehicle speeds.

It is also recommended to provide crosswalk across the project driveway connecting the sidewalks located both sides of the driveway.

3.7. Site Circulation Review

3.7.1. Access Management

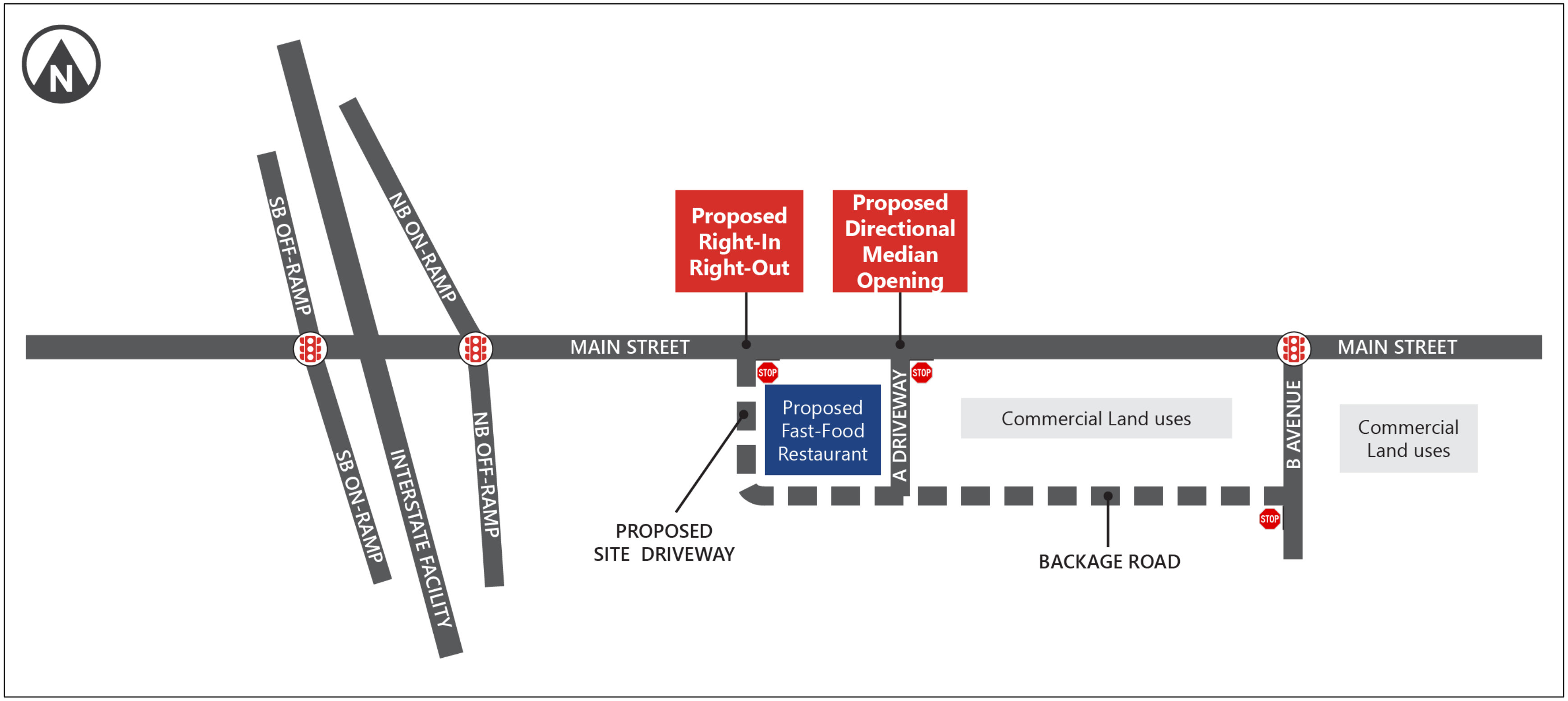
The proposed site access management with the shared use access driveway configuration is depicted in **Figure 3-15**. As shown in the figure, a RIRO driveway at the proposed fast-food restaurant site, DMO at A Driveway, and FMO (potential signalization) at B Avenue are proposed to meet the driveway and median opening spacing standards. The intersection of Main Street at B Avenue is an unsignalized T-intersection, but it has a high propensity to become a four-leg intersection when the land on the north side is developed. Sidewalks exist along both sides of Main Street and B Avenue, and bicycle lanes are present along Main Street in both eastbound and westbound directions. The proposal complies with the spacing standards set out in Chapter 2 of the ***Multimodal Access Management Guidebook*** and are discussed in ***Section 3.2*** of this *Applications Guide* and shown on **Figure 3-3**.

3.7.2. On-Site Queueing

Driveway operations were also evaluated based on a queuing analysis for the drive-through restaurant. The restaurant drive-through window is located at the back of the building. There are two drive-through lanes provided within the proposed fast-food restaurant site. The length of each drive-through lane is approximately 550 feet from the driveway entrance. Assuming, a vehicle length of 25 feet, the dual drive-through lanes can store 44 vehicles. The maximum number of vehicles entering the site (during the mid-day peak hour) is estimated as 130 vehicles per hour.

From observations at a similar fast-food restaurant, it was determined that 60% of the trips would use the drive-through window with an average service time of 2.5 minutes. Based on these assumptions, the peak hour arrival rate is 39 vehicles per lane per hour, and the service rate is 24 vehicles per lane per hour at the drive-through window. Therefore, the available 22 vehicles per lane storage at the drive-through lanes is expected to be sufficient to accommodate the drive-through traffic without impacting Main Street traffic operations.

Figure 3-15 | Site Access Management



3.7.3. Multimodal Access and Circulation

The ***MTSIH*** states that to provide safe and convenient pedestrian and bicycle access to development sites, and circulation within developments for all users, the site's design should incorporate appropriate on-site pedestrian and bicycle facilities. The internal site design bicycle/pedestrian accommodations and the bicycle/pedestrian network connections recommended for this fast-food restaurant development site (refer to Bicycle/Pedestrian/Transit Impact Analysis section) will facilitate multimodal access and circulation. Furthermore, various strategies for site design presented in the *Pedestrian/Bicycle Site Design Toolbox* and the *Site Design Development and Review Checklist* (provided in the ***MTSIH***), will be used to enhance the multimodal access and circulation for the proposed development site.

3.8. Mitigation

Mitigation is required at locations that are found to operate unacceptably. Agencies set their own criteria for unacceptable operations, and these may vary by agency type and context classification. Movements or intersections that exceed the threshold set by the reviewing agency require mitigation strategies to improve their operations to within the acceptable range.

The locally adopted LOS standards should be reviewed to determine when an intersection is considered to operate unacceptably and require mitigation. This is often, but not always, LOS E or LOS F. For roadways on the SHS, the peak hour motorized vehicle LOS target is D in urbanized areas, and LOS C for areas outside of urbanized areas, based on FDOT's Policy on Level of Service Targets, ***Topic No. 000-525-006***. Additional information on performance measures of effectiveness and targets for auto analysis is provided in Section 4.4.1 of the ***MTSIH***. When analyzing queueing, movements that are expected to produce queues that spill back into the upstream intersection, queues that block turn lanes, or queues that create vehicle spillback out of a turn lane typically require mitigation. Mitigation strategies for locations that are determined to operate unacceptably should be discussed with the reviewing agency.

In this case study, all the signalized and unsignalized intersections are projected to operate at LOS C or better with the proposed Main Street access management plan and the backage roadway. The estimated intersection queue lengths are also found to be acceptable, and the turning movement traffic can be accommodated by the proposed turn lanes at the intersections and driveways. It is recommended to reduce the eastbound right-turn lane turning radius at the project site driveway to decrease the turning vehicle speeds.

The proposed right-in right-out at the site development access driveway, and the conversion of the Main Street and A Driveway intersection from an FMO into a DMO will bring the Main Street driveways and median openings into compliance with the required spacing standards for an interchange area.

The proposed backage road would improve traffic operation and safety along Main Street and at the driveway intersections. It will also improve accessibility to the proposed fast-food restaurant site and to the adjacent commercial land uses. The signalization of Main Street and B Avenue intersection further improves accessibility and safety for vehicular traffic as well as for pedestrians and bicyclists.

It is recommended to provide a direct pedestrian path between the proposed development site and the adjacent commercial properties across A Driveway. It is also recommended to provide direct access to the bus stop located on the north side of Main Street from the development site and other commercial land uses on the south side of Main Street with a marked pedestrian midblock crossing with appropriate traffic control (when warranted).

The addition of crosswalks is recommended across the project site driveway and at the existing A Driveway to connect the sidewalks located on both sides of the driveways. Crosswalks and pedestrian signal phasing are recommended at the proposed signal at B Avenue and Main Street intersection.

4. Case Study 3 – Downtown Mixed-Use

4.1. Case Study Overview

This case study is a mixed-use site in a downtown setting applying for a driveway/connection permit. The property proposes two construction phases. Parking for the site will be provided in a garage attached to the mixed-use residential building in Phase 1. Phase 2, consisting of a hotel, will be located across the street and will utilize the Phase 1 parking garage. The property's frontage and proposed driveway are located on a two-lane roadway, Main Street, with on-street parking. Main Street is a state-maintained roadway with a C5-Urban Center context classification and Access Class 7.

Review Type	Driveway/Connection Permit – Category D
Land Uses/Size	*Phase 1.* 140 Multi-family dwelling units with ground-floor commercial (15,000 square-foot Retail, 2,500 square-foot Coffee Shop, 5,000 square-foot Restaurant), Parking Garage
	Phase 2. 200-room hotel
Access Management Classification, Posted Speed Limit	Class 7, 30 mph
Surrounding Context Classification	C5-Urban Center
Other Characteristics	Downtown environment, on-street parking

4.2. Trip Generation

4.2.1. Phase 1

Based on review of the available land uses in the ***ITE Trip Generation Manual, 11th Edition***, LUC 231 Mid-Rise Residential with Ground Floor Commercial 1,000-25,000 square feet was selected for Phase 1. Per ITE, this land use represents a mixed-use multi-family housing building with between four and 10 floors of residential living space and commercial space open to the public on the ground level. With a total of 22,500 square feet of total retail space, this land use description matches the proposed uses in Phase 1. It also has three settings/locations available to choose from: general urban/suburban, dense multi-use urban, and center city core. The center city core setting was selected because the proposed site is located in a downtown area. Additionally, several trip types are available with this land use and setting: vehicle (**Figure 4-1**), person, walk+bike+transit, walk, transit, and bicycle. All of these trip type estimates are useful in assessing the site's transportation impacts to all modes.

However, daily trip generation rates/equations were not available for this land use in the center city core setting. For the purposes of estimating daily vehicle trip generation, the weekday trip generation rate for ITE LUC 221 Multifamily Housing (Mid-Rise) in the dense multi-use urban setting was used. It was assumed that the vehicle trips generated from the coffee shop and restaurant would be relatively minor in the urban center setting since the site will be mostly reliant on walk trips, and because the parking garage will be gated. Trip generation data sources, assumptions, estimates, and site-specific operations such as the parking garage, curbside management needs, etc., should be discussed and agreed upon during the pre-application/methodology meeting. The State Highway System Connection Permit Pre-Application Meeting Checklist and Scoping Form in the ***MTSIH*** can be used to guide discussion on these topics.

Figure 4-1 | ITE Trip Generation Manual Vehicle Trips for the AM Peak Hour of Adjacent Street Traffic

Mid-Rise Residential with Ground-Floor Commercial

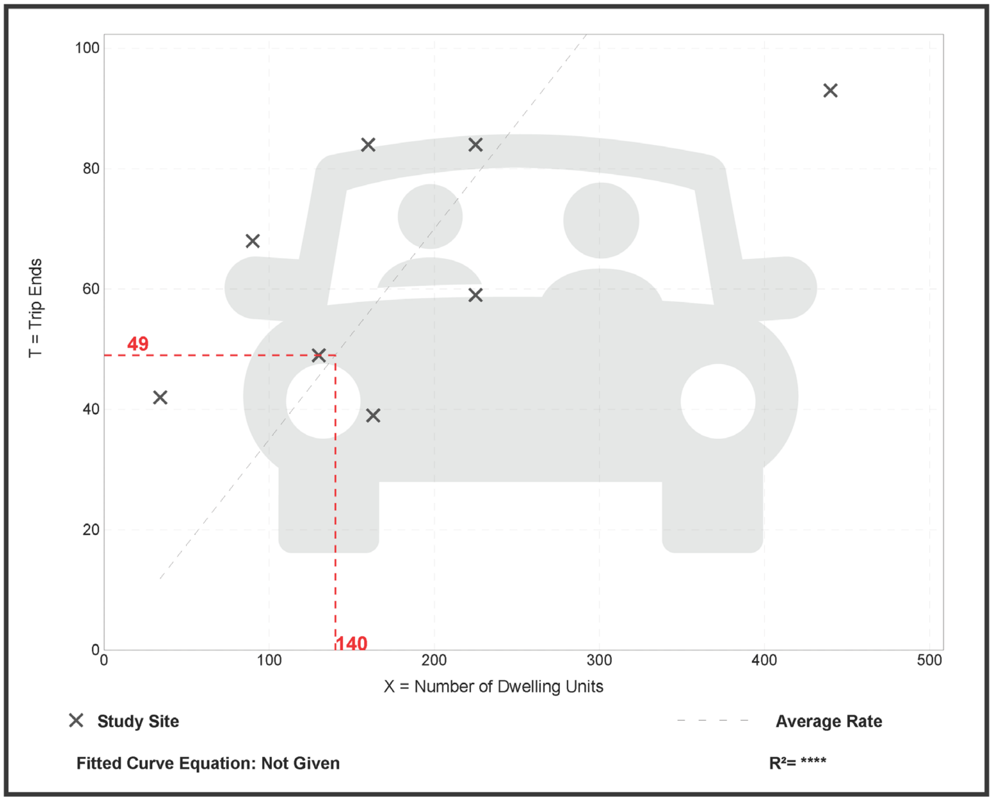
GFA (1-25k) (231)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Setting/Location:	**Center City Core**
Number of Studies:	8
Avg. Num. of Dwelling Units:	183
Directional Distribution:	41% entering, 59% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.35	0.21 - 1.24	0.21

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

Many land uses in ***ITE's Trip Generation Handbook*** include two options for estimating peak hour or daily trips: 1) average trip generation rates, and 2) trip generation equations. ***ITE's Trip Generation Handbook*** (Section 4.2.4) provides detailed guidance on when the average rate or the fitted equation should be used. In general, the fitted curve equation should be used when one of the following conditions are satisfied:

- There are at least 20 data points distributed over the range of values typically found for the independent value **AND** the line corresponding to the fitted curve equation is within the cluster of data points near the size of the study site.
- The R^2 for the fitted curve equation is ≥ 0.75, the line corresponding to the fitted curve equation is within the cluster of data points near the size of the study area, and the weighted standard deviation is more than 55% of the weighted average rate.

Each of the AM and PM peak hour trip calculations used the average trip rate with the exception of the vehicle trips and the bike trips in the PM peak hour. In those two cases per the ***ITE Trip Generation Handbook***, the fitted curved equation was used because one is provided, the curve has an R^2 of at least 0.75, the fitted curve falls within data cluster, and the weighted standard deviation is more than 55 percent of the weighted average rate. Professional judgment should be used when selecting to use the average rate or fitted curve equation and should be discussed and agreed upon during the pre-application/methodology meeting.

No directional distribution percentages are provided for the total person trips; however it was assumed that they would match the directional distribution percentages of the vehicle trips (41% enter, 59% exit in AM peak hour as shown in **Figure 4-1**; 52% enter, 48% exit in PM peak hour). Similarly, there is no directional distribution provided for the walk trips, transit trips, and bike trips. However, in those cases, the directional distribution percentages were assumed to match the directional distribution percentages of the walk+bike+transit trips (44% enter, 56% exit in AM peak hour; 57% enter, 43% exit in PM peak hour).

Trip adjustments such as internal capture and pass-by were also considered. Per ITE, the land use code 231 trip generation rates and equations represent external trips and do not include trips internal to the site. As such, internal capture is already accounted for in the vehicular trip generation estimate for this land use. While pass-by vehicle trips may be possible with the ground floor retail and coffee shop, the limited amount of parking on-site limits the potential for pass-by trip reductions. Furthermore, due to the relatively low peak hour vehicular trip generation in the center city core setting, pass-by trips are conservatively assumed to be negligible.

The trip generation estimate for Phase 1 is shown in **Table 4-1**. Further information on estimating trips by mode and potential discrepancies based on using different trip generation data sources is provided in Section 4.6.5 of the ***MTSIH***. As with any MTIA, critical analysis elements like trip generation should be discussed and agreed upon during the pre-application/methodology meeting.

Table 4-1 | Phase 1 Trip Generation

Land Use	ITE Land Use Code / Setting	Intensity	Trip Type	Daily	AM Peak Hour			PM Peak Hour		
					Total	Enter	Exit	Total	Enter	Exit
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 Dwelling Units	Vehicle trips	410[1]	49	20	29	46	24	22
			Person trips	-	213	87	126	262	136	126
			Walk+Bike+ Transit trips[2]	-	150	66	84	192	109	83
			Walk trips	-	113	50	63	171	97	74
			Transit trips	-	32	14	18	15	9	6
			Bike trips	-	6	3	3	5	3	2

[1] Estimated based on ITE LUC 221 Multifamily Housing (Mid-Rise) in Dense Multi-Use Urban setting.
[2] Separate ITE trip generation rates/equations were utilized for Walk+Bike+Transit, Walk, Transit, and Bike trip generation estimates. As such, the sum of the separate Walk, Transit, Bike trip estimates may not match the Walk+Bike+Transit trip estimate.

4.2.2. Phase 2

In Phase 2, a hotel is proposed across the street from Phase 1. ITE LUC 310 was selected. Similar to Phase 1, internal capture and pass-by trips were considered for the site. Although it is possible there may be some internal capture between the hotel and commercial uses of Phase 1, the impact to the vehicular trip generation is likely to be minimal given the low volume of vehicle trips. Pass-by trips for the retail uses were assumed to be negligible, consistent with Phase 1. Daily vehicle trip generation for the hotel was estimated using ITE LUC 310 in the center city core setting. Based on a total daily vehicle trip generation of 1,508 trips for both phases, this site requires a Category D driveway connection permit application.

To estimate the trip generation for other modes, the ITE LUC 310 hotel has person, walk+bike+transit, and walk trip rates and equations, but only for the AM and PM peak hour of the generator; therefore, these rates were used for the AM and PM peak hour of adjacent street traffic. It does not have separate transit or bike trip rates or equations. Based on information provided by the applicant, it was assumed that there are no bike trips and transit trips were estimated by subtracting the walk trips from the walk+bike+transit trips. In all cases, a directional distribution was not provided for the person trip data, so the directional distribution was assumed to match that of the vehicle trips. The trip generation estimate for Phase 2 (buildout) is shown in **Table 4-2**.

Table 4-2 | Phase 2 (Buildout) Trip Generation

Land Use	ITE Land Use Code / Setting	Intensity	Trip Type	Daily	AM Peak Hour			PM Peak Hour		
					Total	Enter	Exit	Total	Enter	Exit
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 units	Vehicle trips	410[1]	49	20	29	46	24	22
Hotel	310 / Center City Core	200 rooms	Vehicle trips	1,098	42	21	21	36	17	19
			Total Vehicle Trips	**1,508**	**91**	**41**	**50**	**82**	**41**	**41**
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 units	Person trips	-	213	87	126	262	136	126
Hotel	310 / Center City Core	200 rooms	Person trips	-	338	166	172	400	188	212
			Total Person Trips	**-**	**551**	**253**	**298**	**662**	**324**	**338**
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 units	Walk+ Bike+ Transit trips	-	150	66	84	192	109	83
Hotel	310 / Center City Core	200 rooms	Walk+ Bike+ Transit trips	-	166	81	85	242	114	128
			Total Walk+Bike+Transit Trips	**-**	**316**	**147**	**169**	**434**	**223**	**211**
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 units	Walk trips	-	113	50	63	171	97	74
Hotel	310 / Center City Core	200 rooms	Walk trips	-	148	73	75	210	99	111
			Total Walk Trips	**-**	**261**	**123**	**138**	**381**	**196**	**185**
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 units	Transit trips	--	32	14	18	15	9	6
Hotel	310 / Center City Core	200 rooms	Transit trips	-	18	10	8	32	15	17
			Total Transit Trips	**-**	**50**	**24**	**26**	**47**	**24**	**23**
Mid-Rise Residential with Ground-Floor Commercial GFA (1-25k)	231 / Center City Core	140 units	Bike trips	-	6	3	3	5	3	2
Hotel	310 / Center City Core	200 rooms	Bike trips	-	0	0	0	0	0	0
			Total Bike Trips	**-**	**6**	**3**	**3**	**5**	**3**	**2**

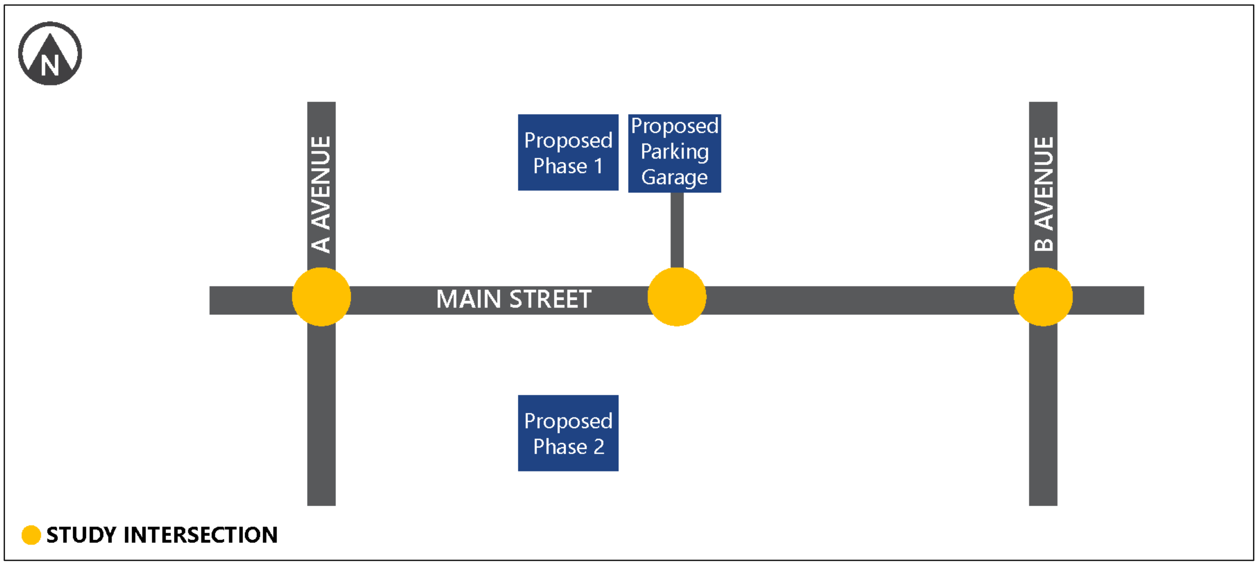
[1]Estimated based on ITE LUC 221 Multifamily Housing (Mid-Rise) in Dense Multi-Use Urban setting.

4.3. Vehicular Impact Analysis

4.3.1. Study Area

This site is located in a downtown environment with a grid network and block system. The site is anticipated to be primarily served by modes like walking, biking, and transit, and less dependent on vehicular trips. The site is located on Main Street with a signalized intersection at A Avenue to the west and B Avenue to the east. Given the relatively low vehicular trip generation anticipated for the site, these two adjacent signalized intersections, along with the driveway entrance into the site's parking garage were selected for the study area, as shown in **Figure 4-2**.

Figure 4-2 | Vehicular Study Area



4.3.2. Analysis Horizon Years and Periods

The analysis years include the AM and PM peak hours. In coordination with the developer, it is understood that Phase 1 is anticipated to be built in 2026, and Phase 2 in 2028. The following scenarios are included in the analysis:

- 2022 Existing
- 2026 No Build
- 2026 Phase 1 Build
- 2028 No Build
- 2028 Phase 2 Build (Buildout)

In cases where the buildout volumes result in unacceptable operations, it is recommended to provide an additional analysis scenario for failing facilities. The additional scenario will be the 'buildout with mitigation' scenario, used to demonstrate recommended improvements to achieve acceptable operations.

4.3.3. Existing Conditions Analysis

Existing AM and PM peak hour turning movement counts were collected for the study area. Data collection was conducted in accordance with FDOT standards. The SF corresponding to the data collection week was applied to the raw intersection traffic data to seasonally adjust the volumes. FDOT develops SF for all Florida counties, which are available from the FDOT FTO. The seasonally adjusted existing traffic volumes are shown in **Figure 4-3**.

Figure 4-3 | Existing Year (2022) Traffic Volumes

4.3.4. Future Background Conditions Analysis

Phase 1 is anticipated to be complete in 2026, and Phase 2 is anticipated to be complete in 2028. Based on review of historical traffic volumes from FTO, a 1.5% linear AGR was selected for this study area. The future background traffic volumes for years 2026 and 2028 are shown in **Figure 4-4** and **Figure 4-5**, respectively.

The method selected to project future traffic and growth rate, if used, should be discussed during the pre-application/methodology meeting.

Figure 4-4 | Future Year (2026) Background Traffic Volumes (without project)

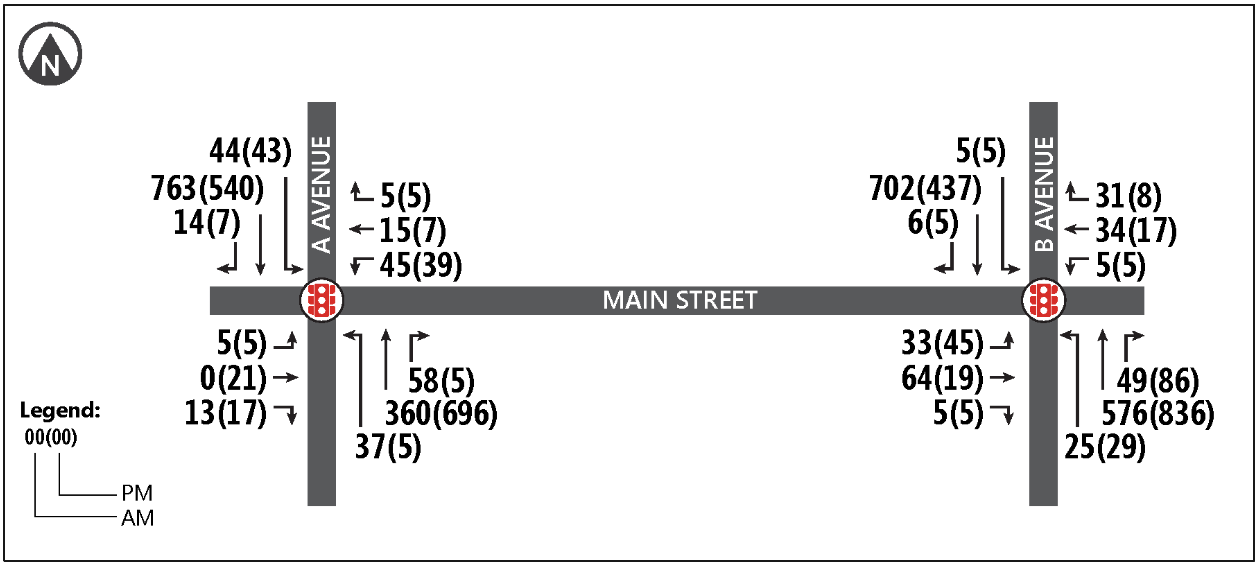
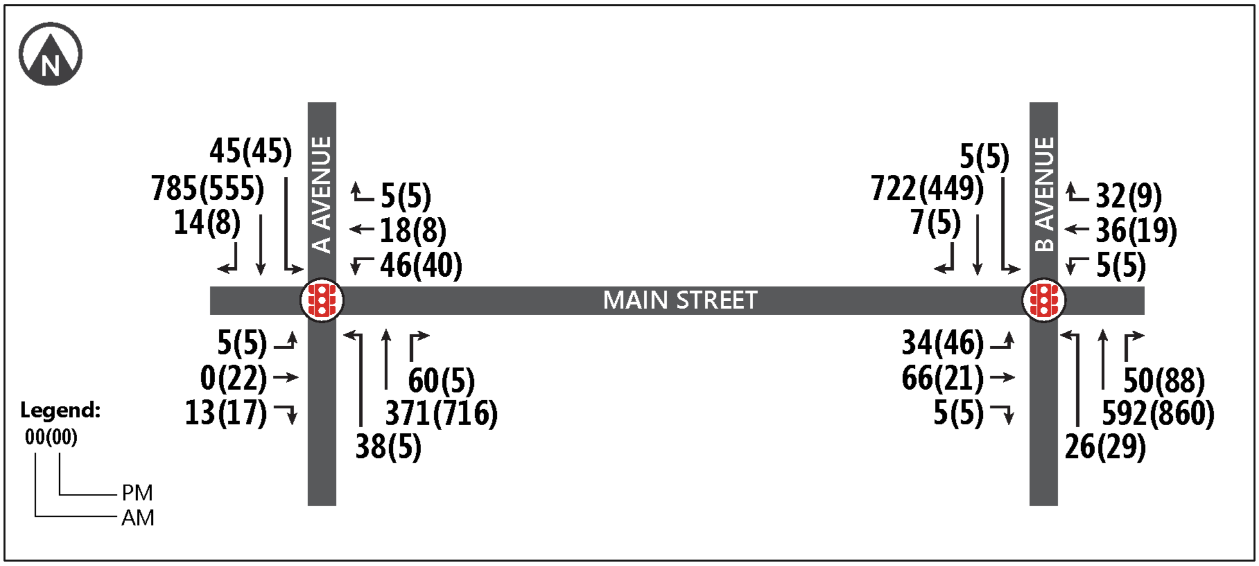


Figure 4-5 | Future Year (2028) Background Traffic Volumes (without project)



4.3.5. Vehicular Trip Distribution and Assignment

Vehicle trip distribution and assignment was estimated based on existing traffic patterns and knowledge of the area. Travel demand models can also be used to determine trip distribution (more discussion provided in the Section 4.7.2.1 of the ***MTSIH***). The distribution is provided in **Figure 4-6**, and vehicle trip assignment is provided in **Figure 4-7** and **Figure 4-8** for Phases 1 and 2, respectively.

Figure 4-6 | Vehicle Trip Distribution

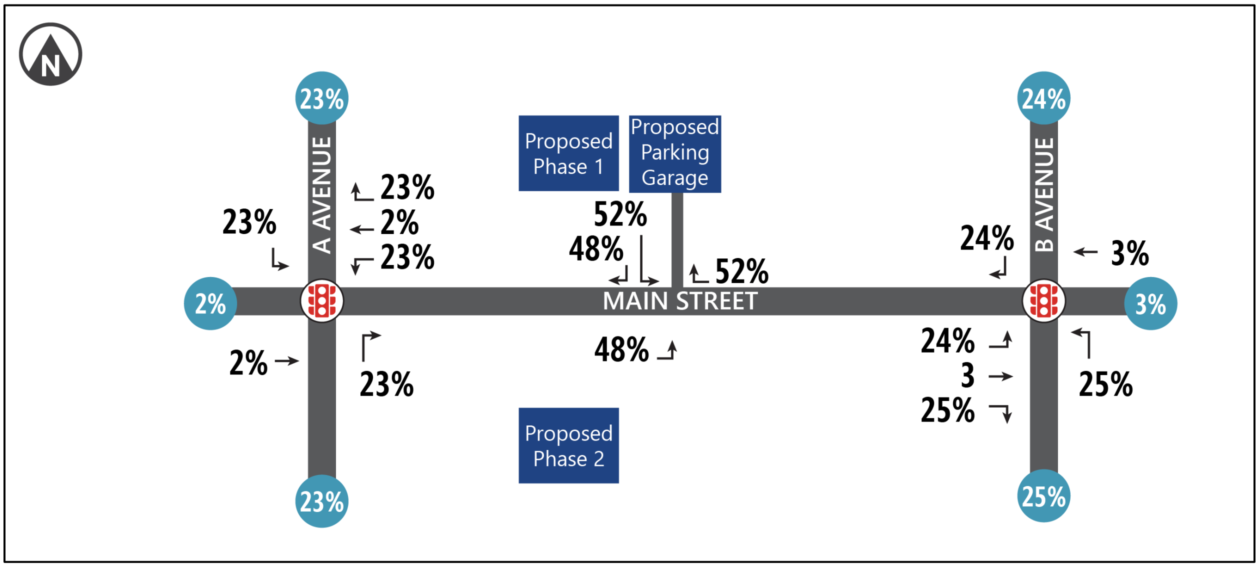


Figure 4-7 | Phase 1 Vehicle Trip Assignment

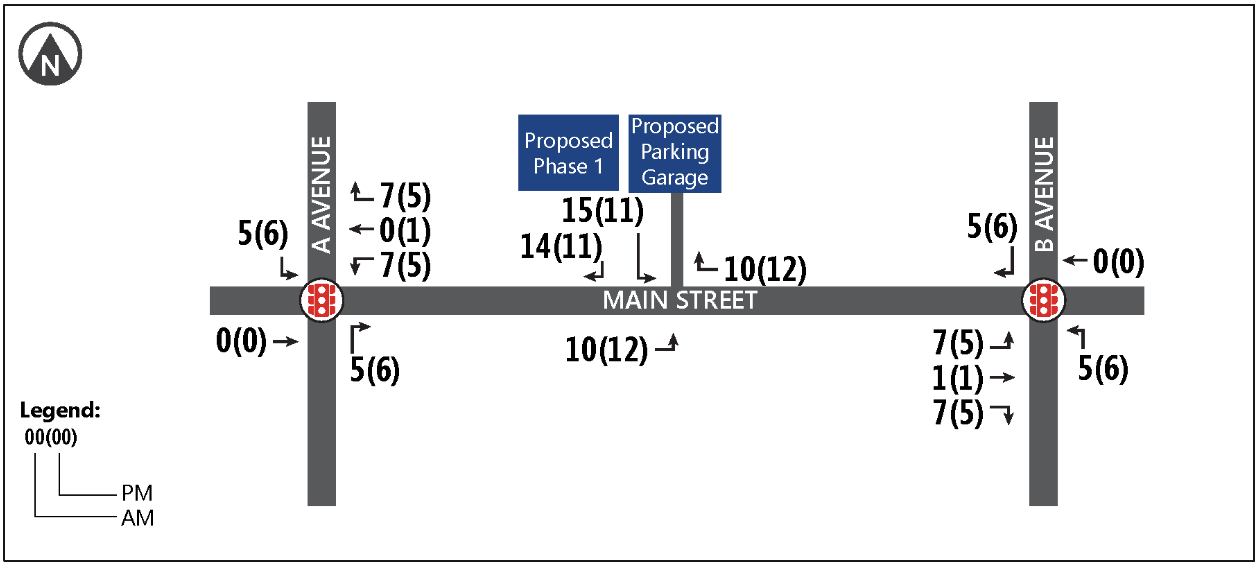
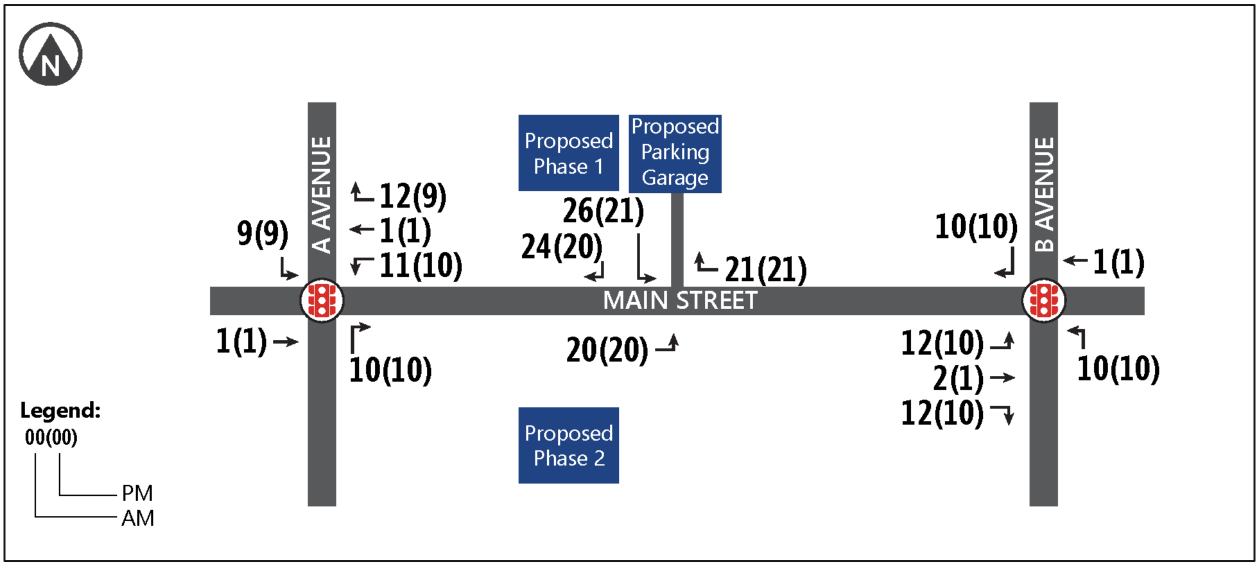


Figure 4-8 | Phase 2 Build (Buildout) Vehicle Trip Assignment



4.3.6. Future Build Conditions

Future traffic volumes were estimated by adding project trips to the future no build volumes and are shown in **Figure 4-9** and **Figure 4-10** for Phase 1 and Phase 2 build, respectively.

Figure 4-9 | Future Year (2026) Phase 1 Build Traffic Volumes (with project)

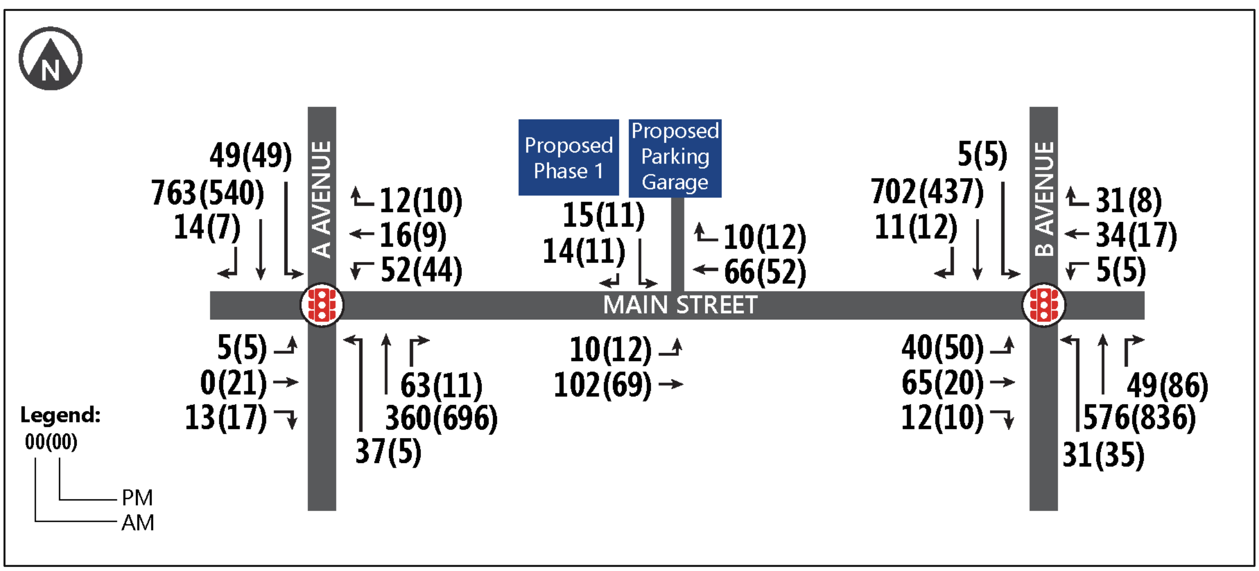
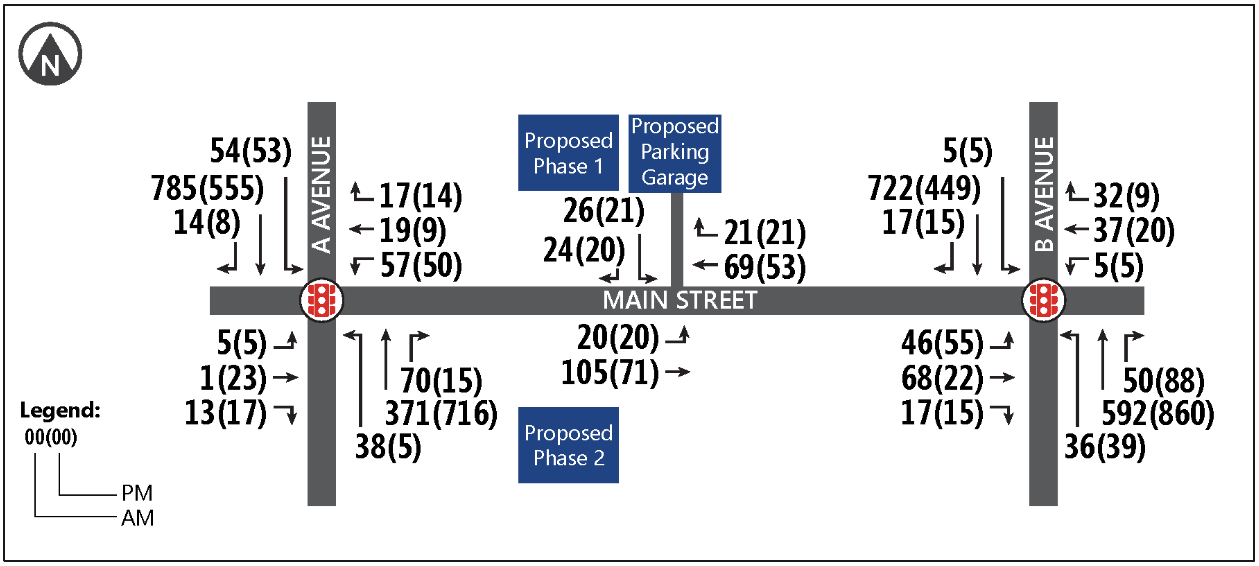


Figure 4-10 | Future Year (2028) Phase 2 Build (Buildout) Volumes (with project)



4.3.7. *Capacity Analysis*

For this site, it was determined at the pre-application/methodology meeting that LOS and delay based on ***Highway Capacity Manual*** methods would be adequate to assess the site's impact on the nearby intersections. The capacity analysis results are shown in **Table 4-3.** For roadways on the SHS, the peak hour motorized vehicle LOS target is D in urbanized areas, and LOS C for areas outside of urbanized areas, based on FDOT's Policy on Level of Service Targets, ***Topic No. 000-525-006***. Additional information on performance measures of effectiveness and targets for auto analysis is provided in Section 4.4.1 of the ***MTSIH***.

Table 4-3 | Intersection Capacity Analysis Results

Period / Intersection	LOS (Delay, sec/veh)				
AM Peak	2022 Existing	2026 Background	2028 Background	2026 Buildout	2028 Buildout
Main Street and A Avenue	A (6.2)	A (6.5)	A (6.8)	A (7.2)	A (7.9)
Main Street and B Avenue	A (9.9)	B (10.2)	B (10.4)	B (10.9)	B (11.6)
Main Street and Proposed Site Driveway	N/A			A (9.3) SB Approach	A (9.6) SB Approach
PM Peak	2022 Existing	2026 Background	2028 Background	2026 Buildout	2028 Buildout
Main Street and A Avenue	A (6.0)	A (6.2)	A (6.3)	A (7.1)	A (7.6)
Main Street and B Avenue	A (7.4)	A (7.9)	A (8.4)	A (9.0)	B (10.0)
Main Street and Proposed Site Driveway	N/A			A (9.1) SB Approach	A (9.4) SB Approach

Note: For unsignalized intersections, the minor street approach with the highest delay is reported.

4.4. Pedestrian/Bicycle/Transit Impact Analysis

As shown in **Table 4-2**, there are 267 and 386 walk and bike trips estimated during the AM and PM peak hours in Phase 2 (buildout), respectively. Given the site's high reliance on non-vehicular trips, and its location in the downtown area, both a context-based assessment and a quantitative analysis were performed for this site. The analysis and results are discussed below.

4.4.1. Context-Based Assessment

4.4.1.1. Review Compatibility with Planning Documents.

State and local planning documents were reviewed to determine the proposed development's compatibility with the plan. The '2035 Downtown Master Plan,' 'Bicycle Master Plan,' 'Downtown Transportation Master Plan,' '2045 Bicycle/Pedestrian Plan,' and FDOT 5-Year Work Program, were all reviewed as part of this process. The following planned improvements were noted near the site.

- Per the 'Bicycle Master Plan,' downtown is a Priority District for bicycle parking provisions. U-rack bicycle parking locations are indicated in the Plan near the site at the intersection of Main Street and B Avenue and Main Street and A Avenue.
- The 'Bicycle Master Plan' recommends a two-way separated bicycle lane on Main Street, including along the site's frontage.
- Per the '2045 Bicycle/Pedestrian Plan' and '2035 Downtown Master Plan,' improvements are planned for Main Street to implement a Pedestrian Promenade concept located a block from the site (i.e., an exclusive pedestrian street/corridor closed to vehicular traffic).
- There are no planned and programmed projects included in the FDOT 5-Year Work Program.
- The 'Downtown Transportation Master Plan' calls for improvements to streets for pedestrian amenities, including Main Street, A Avenue, and B Avenue. Improvements include wider sidewalks, connectivity, street furniture, ADA compliance, landscaping, paving, crosswalks, curb extensions, lighting, signal timing, median refuges, pedestrian detectors, and recessed stop lines.

Given the volume of non-motorized project trips anticipated and the proximity of these planned improvements to the site, the developer should coordinate with the local governments to provide consistency with the planned improvements and promote pedestrian/bicycle safety and mobility.

4.4.1.2. Internal Site Design Pedestrian and Bicycle Accommodations.

The site's design was reviewed for pedestrian and bicycle accommodations and circulation. **Table 4-4** describes the on-site design specification to accommodate non-motorized users. The basis for many of the recommendations in **Table 4-4** can be found within Appendix B of the ***MTSIH***.

Table 4-4 | Internal Site Design to Accommodate Non-Motorized Users

Design Component	Review	Recommendation
Access Management	There is one vehicular access to the parking garage – this site is less reliant on vehicles given its location within the central business district.	None
Driveway Design	Flared driveway design is proposed with low-speed and low-volume design.	None
Site Frontage	The frontage has a wide sidewalk with landscaping and lighting. However, bicycle facilities and markings are not present.	The 'Bicycle Master Plan' calls for a two-way separated bicycle lane on Main Street. The developer should coordinate with the review agencies and design the site with an appropriate setback to accommodate the future bicycle facility.
Site Circulation & Bicycle/ Pedestrian Access	There is direct bike and pedestrian access from the fronting sidewalk to the site's main entrances. There is a parking garage onsite that is connected to the Phase 1 building. Phase 2 is located across the street and pedestrian travel between the buildings is anticipated, particularly as parking for the hotel in Phase 2 is accommodated in the parking garage across the street.	Review the need for a crosswalk on Main Street for pedestrian travel between Phase 1 and 2, and appropriate crosswalk treatment. This review is provided in the Network Connectivity Analysis and the Pedestrian and Bicycle Trip Distribution and Assignment section.
Amenities	Bike storage, etc. provided for residents, and bike racks are proposed onsite for the commercial uses.	Coordinate with review agencies to determine other needed amenities along the site's frontage consistent with local plans.
Network Review	The 'Bicycle Master Plan' recommends a two-way separated bicycle lane on Main Street.	The developer should coordinate with the review agencies and design the site with an adequate setback to accommodate the future two-way separated bicycle lane planned along the site's frontage.

4.4.1.3. Pedestrian and Bicycle Connections to Adjacent Properties and/or Transit Stops.

Connections between the site and neighboring properties and nearby bus stops were reviewed.

Adjacent Properties

The site is located in the central business district and well-connected with surrounding non-vehicular infrastructure. No improvements are recommended.

Nearby Bus Stops

There are two bus stops located on Main Street near the site. Pedestrians/bicyclists have direct routes to these bus stops with sidewalks and a crosswalk to the bus stop located to the west. These routes are further reviewed in the **Network Connectivity Analysis**.

4.4.2. Quantitative Analysis

4.4.2.1. Pedestrian and Bicycle Trip Generation

The pedestrian and bicycle trip generation was estimated and shown in **Table 4-2**. As shown, there are 267 and 386 walk and bike trips estimated during the AM and PM peak hours in Phase 2 (buildout), respectively. Based on the recommended pedestrian and bicycle quantitative analysis study level guidelines as shown in **Figure 4-11** and **Table 4-5**, a Level 3 (High) analysis was performed. **Table 4-6** shows the steps for the quantitative analysis. Note that Step 1 is required as part of the MTIA for access connection permit applications for driveway classifications C, D, E, F, and G.

Figure 4-11 | Pedestrian and Bicycle Quantitative Analysis

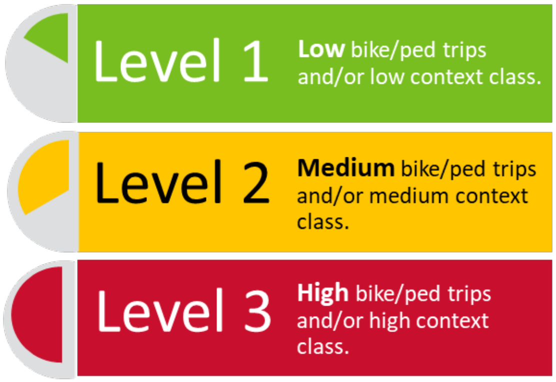


Table 4-5 | Level of Pedestrian and Bicycle Study based on Context Classification and Peak Hour Volume

Peak Hour Volume of Non-Motorized Trips	C1	C2	C2T	C3	C4	C5	C6
Low (< 20)	1	1	2	1	1	2	2
Medium (20 – 49)	2	2	2	2	2	3	3
High (≥ 50)	3	3	3	3	3	3	3

Table 4-6 | Pedestrian and Bicycle Study Requirements – Quantitative Analysis

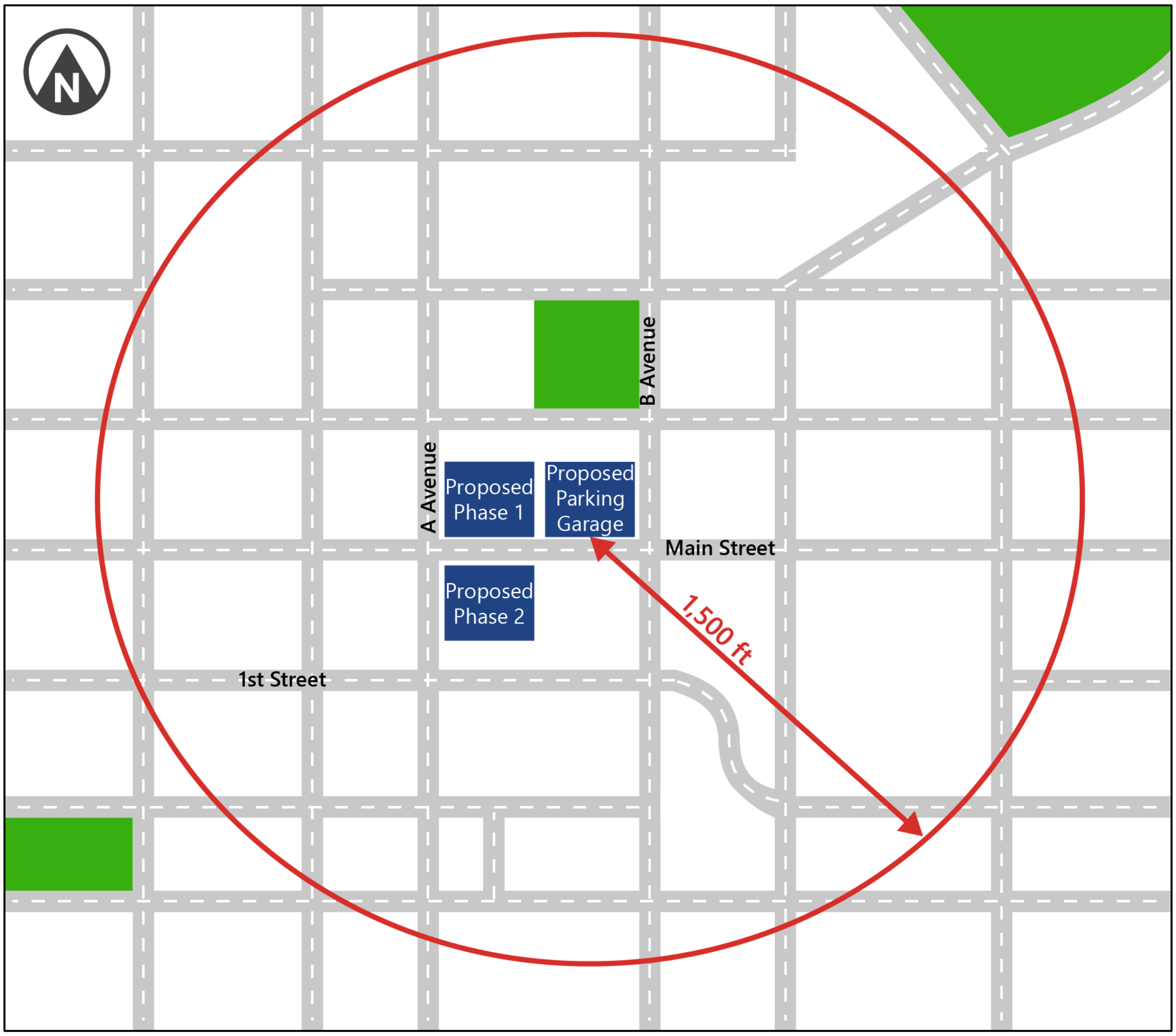
Analysis Type	Study Requirements	Level of Pedestrian and Bicycle Study		
		Level 1 (Low)	Level 2 (Medium)	Level 3 (High)
Quantitative Analysis	**1. Bicycle/Pedestrian Trip Generation**	Required when total vehicle trips per day exceeds 600 (driveway connection permit categories C-G). Optional for other study types.		
	2. Study Area	N/A	500-foot radius or nearest signalized intersection beyond 500 feet [1]	1,500-foot radius or nearest signalized intersection beyond 1,500 feet [1]
	3. Network Connectivity Analysis	N/A	Optional	Optional
	4. Multimodal Q/LOS Analysis	N/A	Optional	Optional

[1] Access connection permit applications for Driveway Categories C, D, E, F, and G should meet the above study area guidance as a minimum or utilize the same study area being evaluated for vehicle trips.

4.4.2.2. Study Area

For a Level 3 analysis, the study area is a 1,500-foot radius measured from each driveway or the nearest signalized intersection beyond 1,500 feet from each driveway per **Table 4-6**. The driveway to the parking garage serves as the center of the 1,500-foot radius study area as shown in **Figure 4-12.**

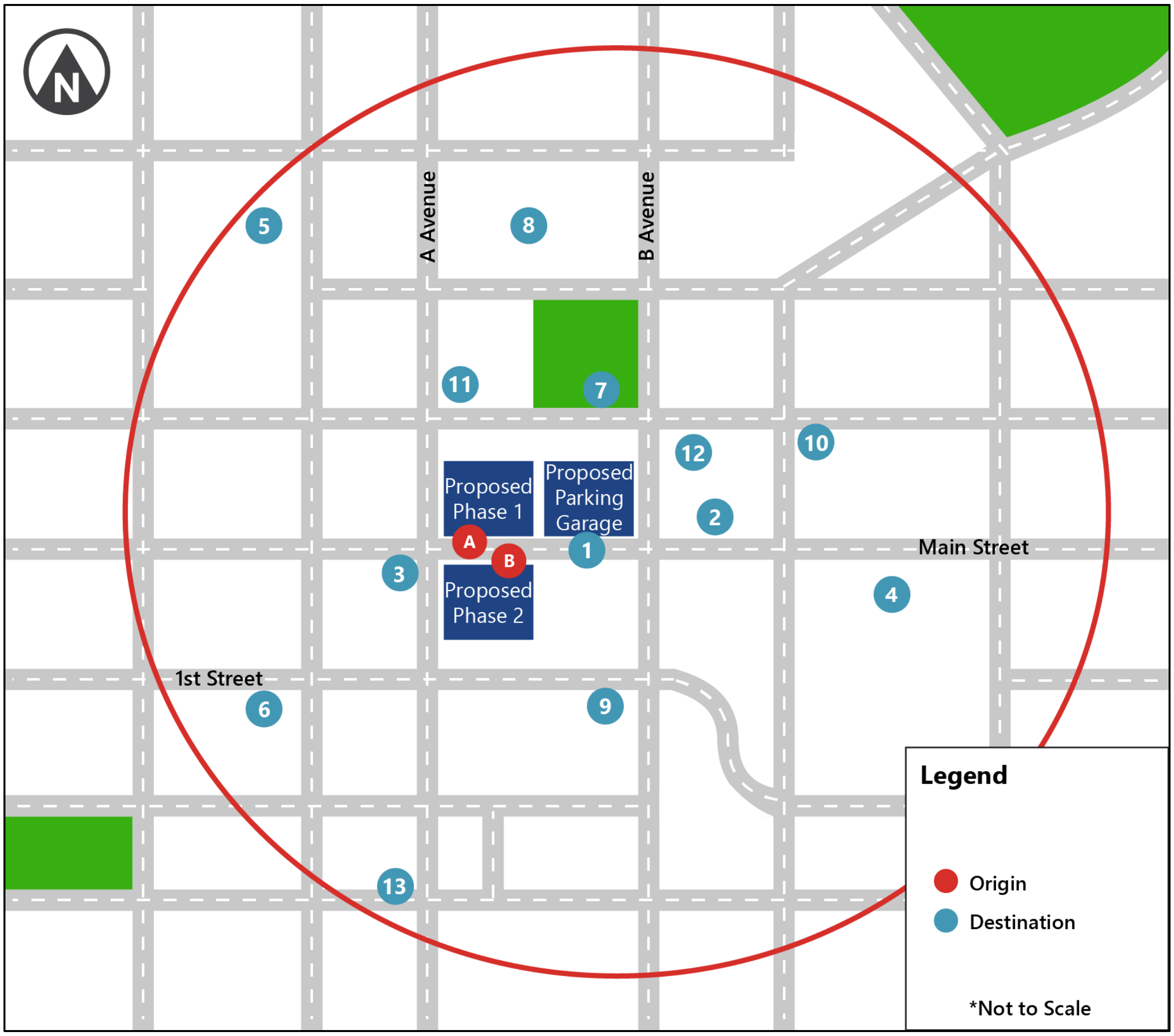
Figure 4-12 | Pedestrian/Bicycle Study Area



4.4.2.3. Network Connectivity Analysis

The first step of the route directness analysis is to define the origin and destination point/s. For Case Study 3, 2 origins and 13 destinations were identified within the 1,500-foot radius. **Figure 4-13** illustrates the location of origin and the destination points for Case Study 3.

Figure 4-13 | Origins and Destinations



After the origins/destinations are determined, the route directness analysis is performed with each origin-destination pair for Case Study 3. As discussed in ***MTSIH*** Section 4.8.3, the route directness ratio equals the distance along the actual route a bicyclist or pedestrian will travel between an origin and destination (actual shortest path route distance) divided by the straight-line distance. The target route directness ratio is 1.5 or less. For each origin-destination pair, the quality and completeness of the actual routes are reviewed. In order to promote safe and efficient bicycle and pedestrian trips, improvements are identified to improve walking/biking routes and to reduce the route directness ratio (provide a more direct path).

The route directness analysis, the quality and completeness of the routes, and the recommended improvements for Case Study 3 are summarized in **Figure 4-14**, **Figure 4-15**, **Table 4-7**, and **Table 4-8**. Note that recommended improvements to facilities not maintained by FDOT should be coordinated, reviewed, and approved by the appropriate maintaining agency.

Figure 4-14 | Network Connectivity Routes

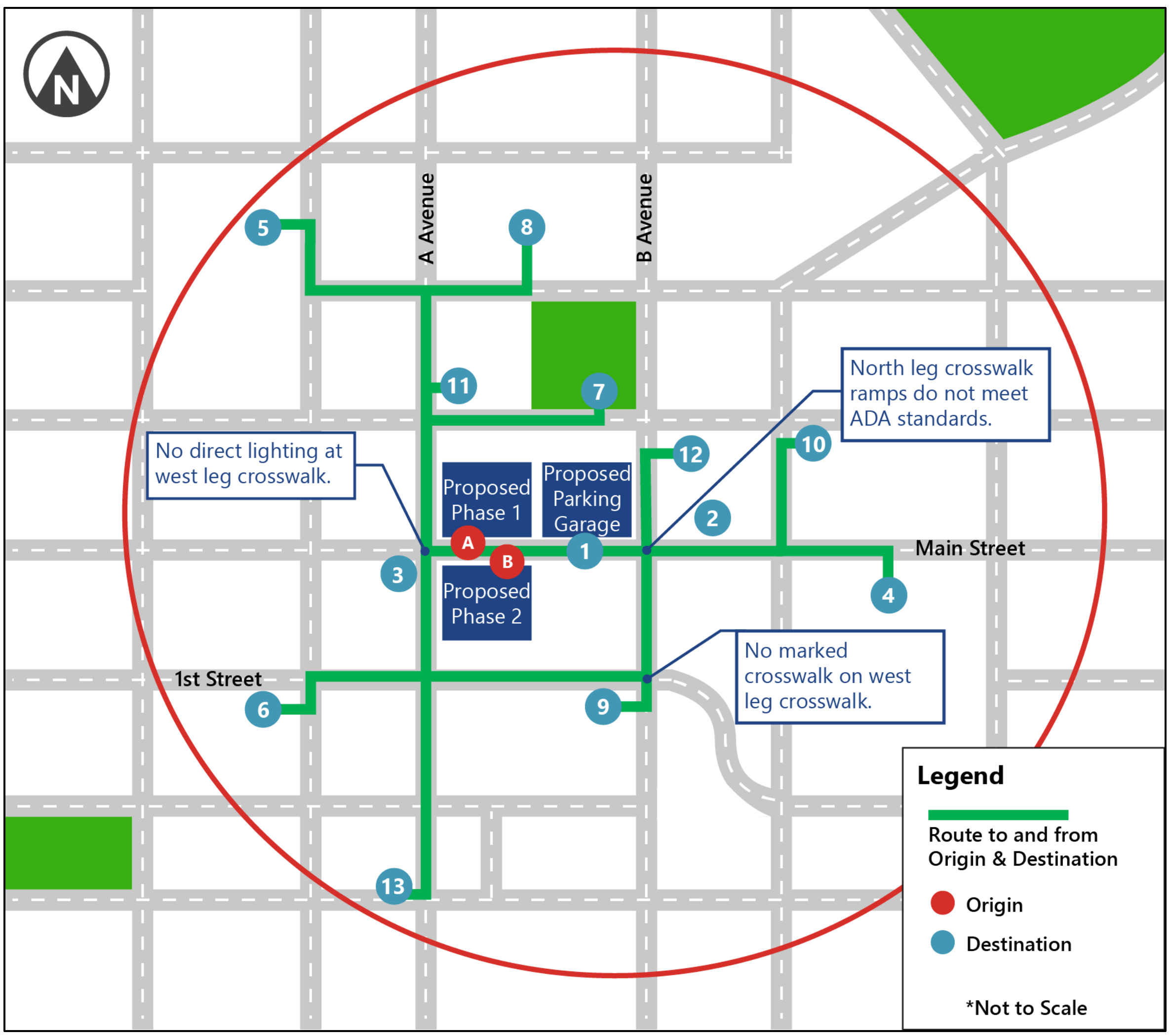


Figure 4-15 | Network Connectivity Straight-Line Distances

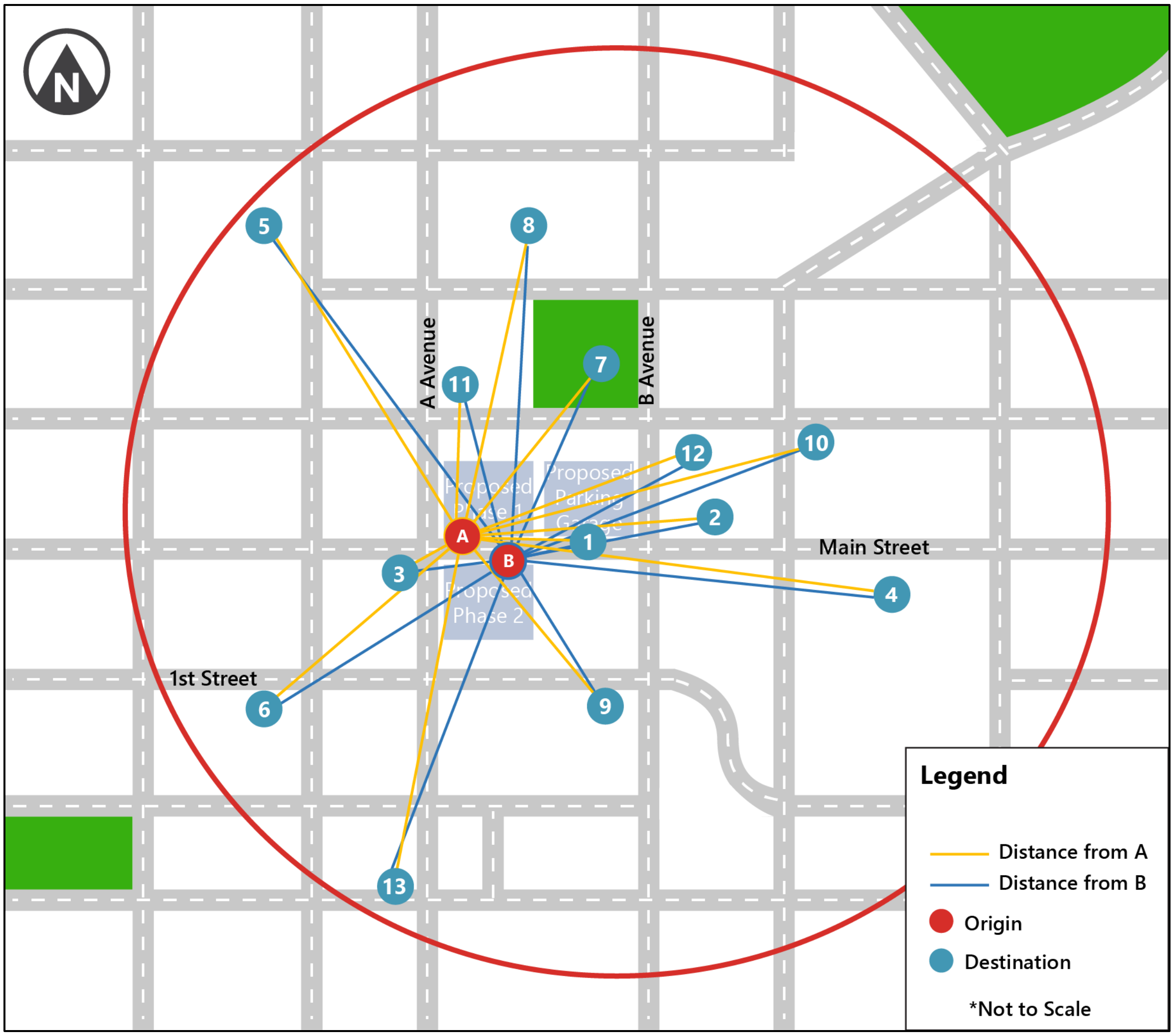


Table 4-7 | To/From Origin A (Phase 1 Main Entrance)

Location	Route Distance (ft)	Straight-Line Distance (ft)	Route Directness Ratio	Route Completeness and Quality	Improvements
1. Site's parking garage	123	123	1.0	Adequate sidewalks and pedestrian access is proposed in the site plan	None recommended
2. Bus stop	354	354	1.0	Crosswalk ramps do not meet ADA standards	Replace crosswalk ramps per FDOT standards
3. Bus stop	397	282	1.41	No direct lighting at crosswalk	Coordinate with review agencies to provide lighting
4. Drug Store	1,274	1,138	1.12	Adequate sidewalks are present	None recommended
5. Office	1,652	1,125	1.47	Adequate sidewalks are present	None recommended
6. Supermarket	1,170	809	1.45	Adequate sidewalks are present	None recommended
7. Park	962	530	1.82	Adequate sidewalks are present	None recommended
8. Office	1,466	831	1.76	Adequate sidewalks are present	None recommended.
9. Office	998	607	1.64	No marked crosswalk	Install high visibility crosswalk
10. Office	1,196	893	1.34	Adequate sidewalks are present	None recommended
11. Restaurant	686	401	1.71	Adequate sidewalks are present	None recommended
12. Restaurant	546	427	1.28	Adequate sidewalks are present	None recommended
13. School	1,411	1,129	1.25	Adequate sidewalks are present	None recommended

Note: Recommended improvements on facilities not maintained by FDOT should be coordinated, reviewed, and approved by the appropriate maintaining agency.

Table 4-8 | To/From Origin B (Phase 2 Main Entrance)

Location	Route Distance (ft)	Straight-Line Distance (ft)	Route Directness Ratio	Route Completeness and Quality	Improvements
1. Site's parking garage	766	141	5.43	A high volume of pedestrians is anticipated to travel between Phases 1 and 2 and this route has a high Route Directness Ratio (indirect route).	An indirect route with a high Route Directness Ratio may lead to jaywalking across Main Street. In order to provide a more direct and safer route for pedestrians, a midblock crosswalk should be constructed. Discussion of the midblock crosswalk treatment section is provided in the Pedestrian and Bicycle Trip Distribution and Assignment Section.
2. Bus stop	555	342	1.62	Adequate sidewalks are present	None recommended
3. Bus stop	378	289	1.31	Adequate sidewalks are present	None recommended
4. Drug store	1,307	1,122	1.16	Adequate sidewalks are present	None recommended
5. Office	1,642	1,166	1.41	Adequate sidewalks are present	None recommended
6. Supermarket	1,165	784	1.49	Adequate sidewalks are present	None recommended
7. Park	982	575	1.71	Adequate sidewalks are present	None recommended
8. Office	1,454	874	1.66	Adequate sidewalks are present	None recommended
9. Office	981	562	1.75	No marked crosswalk	Install high visibility crosswalk
10. Office	1,205	911	1.32	Adequate sidewalks are present	None recommended
11. Restaurant	667	452	1.48	Adequate sidewalks are present	None recommended
12. Restaurant	544	439	1.24	Adequate sidewalks are present	None recommended
13. School	1,408	1,083	1.30	Adequate sidewalks are present	None recommended

Note: Recommended improvements on facilities not maintained by FDOT should be coordinated, reviewed, and approved by the appropriate maintaining agency.

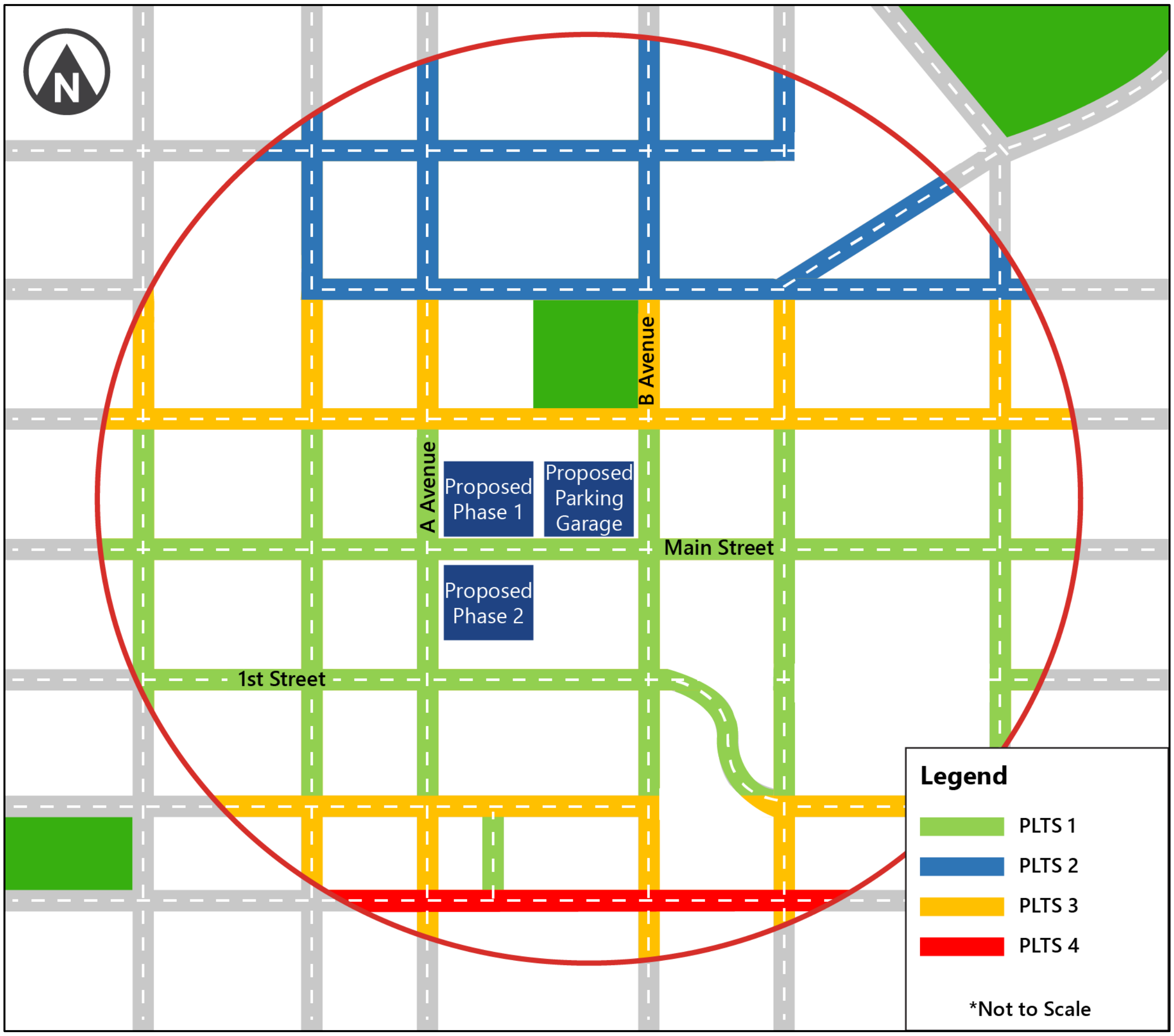
4.4.2.4. Multimodal Q/LOS Analysis

The Pedestrian and Bicycle Level of Traffic Stress (PLTS and BLTS) are summarized below for Case Study 3.

Pedestrian LTS

PLTS was estimated using the latest FDOT ***Quality/Level of Service (Q/LOS) Handbook***. **Figure 4-16** presents the PLTS analysis for Case Study 3. As shown, a PLTS of 1 is estimated for pedestrians traveling along most roadway near the site.

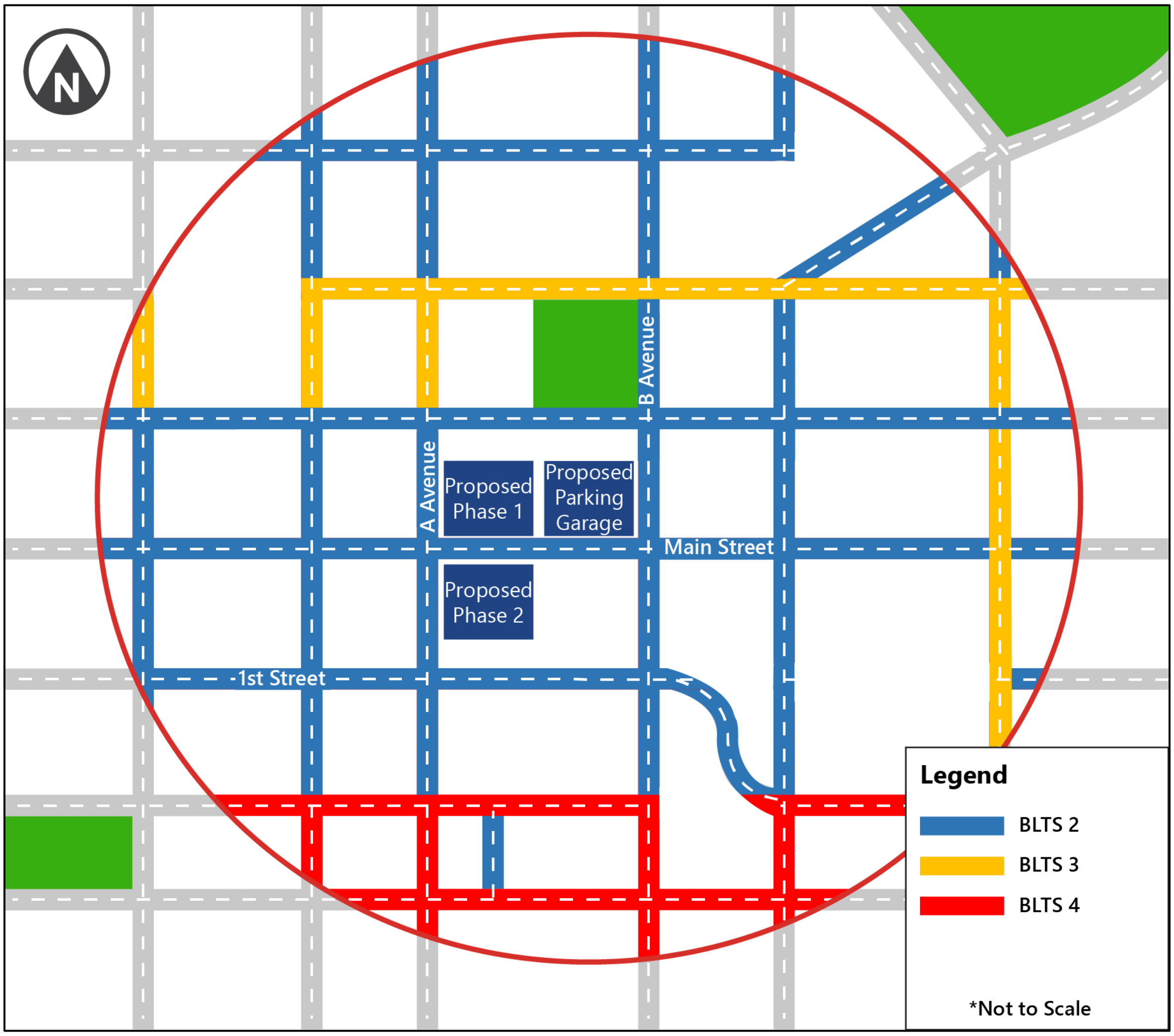
Figure 4-16 | Pedestrian LTS



Bicycle LTS

The BLTS estimation for the study area is presented in **Figure 4-17**. Bicyclists are expected to experience BLTS 2 on most roadways near the site. The two-way separated bicycle lane planned along on Main Street per 'Bicycle Master Plan' would improve the BLTS on Main Street to BLTS 1.

Figure 4-17 | Bicycle LTS



4.4.3. Pedestrian and Bicycle Trip Distribution and Assignment

Pedestrian/bicycle trip distribution can be necessary in some cases to determine the volume of pedestrian and bicycle trips for specific facilities after the proposed site is in place. This can be necessary for high pedestrian volume areas and/or Level 2 or 3 sites or at midblock crossing locations.

As previously identified in the **Internal Site Design Pedestrian and Bicycle Accommodations** and the **Network Connectivity Analysis** sections, a midblock crosswalk is needed for Case Study 3 to serve the high volume of pedestrians anticipated to travel between Phases 1 and 2. It is anticipated that patrons and employees from the hotel will utilize the parking garage, and may also visit the retail, restaurant, and coffee shop across the street in Phase 1, generating pedestrians crossing Main Street.

FDOT guidance for midblock crossing locations in the ***TEM*** was followed as a guide. The location for the potential midblock crosswalk can be justified based on ***TEM*** criteria (AADT, distance to alternate crossing location, outside adjacent intersection influence area). Per the ***TEM***, a minimum pedestrian volume demand to justify a midblock crosswalk is not necessary for Context Classification C5 with a posted speed limit at or below 35 mph. Although the crossing pedestrian volume is not needed to justify a midblock crossing at this location, it is needed to determine an appropriate treatment for the crosswalk.

To estimate the crossing pedestrian volume, the pedestrian trips traveling to/from the hotel in Phase 2 were split into two categories: 1. Pedestrians walking to/from their vehicles parked in the parking garage; and 2. Pedestrians traveling to/from the commercial uses in Phase 1.

For the first category, the site's trip generation can be used to estimate the volume of pedestrians using the crosswalk. As shown in **Table 4-2** 42/36 vehicle trips were estimated for the hotel during the AM/PM peak hour. Assuming a vehicle occupancy of 1.3 (estimated using the baseline motel vehicle occupancy in the ***ITE Trip Generation Handbook*** *Tables B.1 and B.2*), approximately 55/47 person trips are associated with the vehicle trips during the AM/PM peak hour and can be assumed to utilize the crosswalk.

For the second category of pedestrian trips from the hotel traveling to/from the commercial uses in Phase 1, the pedestrian volume can be estimated by determining what percentage of hotel pedestrian trips will travel to/from Phase 1. As previously discussed, the hotel has an estimated 148/210 walk trips in the AM/PM. There were 13 destinations identified within the study area of the site per the network connectivity analysis. If including Phase 1 as a destination for the hotel in Phase 2, each of the 14 destinations would be assigned approximately 7% of the site's walk/bike trips when divided evenly. Given the proximity, convenience, and attraction of Phase 1 across the street, a higher weight can be assumed for this destination compared to others further from the site and potentially less attractive. For the purpose of this analysis, 15% of the hotel's walk/bike trips were assumed to travel to/from Phase 1 across the street. This yields about 22/32 crossing pedestrians in the AM/PM peak hour.

Combining the estimated crossing pedestrians from the two categories discussed above (55/47 pedestrians walking to/from their vehicles parked in the parking garage + 22/32 pedestrians traveling to/from the commercial uses in Phase 1), there are 77/79 crossing pedestrians estimated during the AM/PM peak hour. It is also likely that additional pedestrians not associated with the site may utilize the midblock crosswalk. As such, this estimated volume of pedestrians can be assumed to be a low-end estimate.

Based on the roadway's AADT, the estimated crossing pedestrians per hour, speed limit, the cross section with two travel lanes and on-street parking, and other site characteristics, an appropriate treatment option can be selected for the midblock crosswalk location per FDOT ***TEM***, ***FDM***, and other best practices. Per the ***TEM***, rectangular rapid flashing beacons (RRFB) are recommended to enhance pedestrian visibility at this location. The following features are recommended for the midblock crosswalk:

- High visibility markings
- RRFB
- Direct lighting
- Advance stop here for pedestrians signs and stop lines in both directions of travel before the crosswalk
- Curb extensions

4.4.4. Transit Impact Analysis

The nearest bus stops are not along the site's frontage; one is located west of A Avenue and one is located east of B Avenue. The pedestrian/bicycle routes to/from the site to these bus stops were reviewed as part of the Network Connectivity Analysis. Per that analysis, improvements to the routes were identified. These include providing direct lighting for the crosswalk on the western leg at the intersection of Main Street and A Avenue, and replacing the crosswalk ramps at the northern leg at the intersection of Main Street and B Avenue. It is recommended that the applicant also coordinate with the local transit agency to review the needs of the proposed site, the existing and planned transit service in the area, and existing infrastructure. The focus of this analysis is to determine if there is sufficient infrastructure to support the transit riders generated by this site.

4.5. Safety Analysis

4.5.1. Review of Crash Data

A review of the crash history for the study area was completed using the most recent five-year crash data obtained from Signal Four Analytics. The analysis includes review of both intersections on Main Street with A Avenue and B Avenue, as well as the segment of Main Street from A Avenue to B Avenue. Crash severity, by year, is shown in **Table 4-9**. The crashes by type of collision and lighting condition are summarized in **Table 4-10** and **Table 4-11**, respectively.

Table 4-9 | Crashes by Severity

Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Total Crashes
Intersection: Main Street at A Avenue				
2018	0	0	1	1
2019	0	1	1	2
2020	0	1	2	3
2021	0	1	1	2
2022	0	2	1	3
Total	**0**	**5**	**6**	**11**
Intersection: Main Street at B Avenue				
2018	0	1	1	2
2019	0	0	0	0
2020	0	1	2	3
2021	0	1	0	1
2022	0	0	0	0
Total	**0**	**3**	**3**	**6**
Segment: Main Street between A Avenue and B Avenue				
2018	0	1	1	2
2019	0	0	1	1
2020	0	0	1	1
2021	0	1	1	2
2022	0	0	0	0
Total	**0**	**2**	**4**	**6**
Study Area Total	**0**	**10**	**13**	**23**

Note: As per the *HSM*, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

Table 4-10 | Crashes by Type of Collision

Year	Rear End	Left-Turn	Angle	Bicycle	Other	Total Crashes
Intersection: Main Street at A Avenue						
2018	0	0	1	0	0	1
2019	0	0	1	0	1	2
2020	2	0	1	0	0	3
2021	0	0	2	0	0	2
2022	0	0	3	0	0	3
Total	**2**	**0**	**8**	**0**	**1**	**11**
Intersection: Main Street at B Avenue						
2018	0	0	2	0	0	2
2019	0	0	0	0	0	0
2020	1	1	1	0	0	3
2021	0	0	0	0	1	1
2022	0	0	0	0	0	0
Total	**1**	**1**	**3**	**0**	**1**	**6**
Segment: Main Street between A Avenue and B Avenue						
2018	1	0	0	0	1	2
2019	1	0	0	0	0	1
2020	1	0	0	0	0	1
2021	1	0	0	1	0	2
2022	0	0	0	0	0	0
Total	**4**	**0**	**0**	**1**	**1**	**6**
Study Area Total	**7**	**1**	**11**	**1**	**3**	**23**

Note: As per the ***HSM***, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

Table 4-11 | Crashes by Lighting Condition

Year	Daylight	Dusk	Dark	Total Crashes
Intersection: Main Street at A Avenue				
2018	1	0	0	1
2019	1	1	0	2
2020	2	0	1	3
2021	1	0	1	2
2022	3	0	0	3
Total	**8**	**1**	**2**	**11**
Intersection: Main Street at B Avenue				
2018	1	0	1	2
2019	0	0	0	0
2020	2	0	1	3
2021	1	0	0	1
2022	0	0	0	0
Total	**4**	**0**	**2**	**6**
Segment: Main Street between A Avenue and B Avenue				
2018	1	0	1	2
2019	1	0	0	1
2020	1	0	0	1
2021	1	0	1	2
2022	0	0	0	0
Total	**4**	**0**	**2**	**6**
Study Area Total	**16**	**1**	**6**	**23**

Note: As per the ***HSM***, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

As shown, the majority of the crashes at the intersections were angle collisions and the majority of the crashes along the segment were rear end collisions. No fatal crashes were reported in the study area during this timeframe. There was one bicycle crash reported on the segment in 2021, and no pedestrian crashes reported.

Given that this site is projected to generate a relatively minor volume of vehicles, it is anticipated that the site will not exacerbate the existing crash patterns. The site is expected to have a high volume of walk and bike trips; however, and there was one bicycle crash reported along the study segment. The planned two-way separated bicycle lane could enhance bicycle safety along the segment. As previously discussed, it is recommended that the applicant coordinate with reviewing agencies to design the site with sufficient setbacks to allow for the future construction of this bicycle facility.

4.5.2. Site and Study Area Assessment

The proposed site and study area were reviewed for improvements to enhance safety. As previously discussed, there are recommendations associated with the site to accommodate the high volume of bicycle and pedestrian trips. These include designing the site with proper setbacks to accommodate the future two-way separated bicycle lane planned along the site's frontage. In addition, it is recommended to install a midblock crosswalk with RRFB as a part of Phase 2 to accommodate pedestrians traveling between the two development phases.

Within the study area, the Network Connectivity Analysis identified improvements for pedestrian/ bicycle routes to/from the site. These include replacing the crosswalk ramps at Main Street and B Avenue, coordinating with review agencies to provide lighting at Main Street and A Avenue, and installing a high visibility crosswalk at B Avenue and 1st Street.

4.6. Site Circulation Review

4.6.1. Access Management

The proposed site will be served by a single vehicular access to the parking garage. The proposed driveway design is appropriate for the volume of site traffic and the context of the roadway, consistent with the ***FDOT Multimodal Access Management Guidebook*** and ***FDM***.

4.6.2. On-Site Queueing

Since the site's parking garage is planned to be gated, the site plan was reviewed for vehicle queuing and available on-site storage. The site plan shows approximately 50 feet available for vehicle storage between the gate and the sidewalk. As such, a queue of up to two vehicles can be stored on-site. Based on the vehicle trip generation estimate, 41 entering vehicles are estimated during the AM and PM peak hour, which is an arrival rate of 0.7 vehicles per minute on average. Based on information received from the applicant, the gate will have card access for residents, hotel guests, and employees. Other visitors will be able to pull a ticket and complete payment upon exit. Assuming it takes less than one minute for a vehicle to access the gate, it is anticipated that sufficient storage is provided on-site for queueing.

4.6.3. Multimodal Access and Circulation

As previously discussed in the **Pedestrian/Bicycle/Transit Impact Analysis** section, there is direct bike and pedestrian access to site. For pedestrian/bicycle circulation, a midblock crosswalk is recommended on Main Street to serve pedestrians crossing between Phases 1 and 2. This crosswalk is recommended to have RRFB to enhance pedestrian visibility (see discussion in **Section 4.4.3**). Furthermore, it recommended that the applicant coordinate with review agencies to determine the pedestrian and bicycle amenities needed for consistency with local plans. It is also recommended that the site design be able to accommodate the future planned construction of the two-way separated bicycle lane on Main Street.

4.7. Mitigation

As shown in the **Table 4-3**, it is anticipated that the study intersections will operate acceptably with the addition of site traffic from both phases (buildout). As such, no improvements are recommended for vehicles.

The **Pedestrian/Bicycle/Transit Impact Analysis** results show the need for the following improvements:

- Coordinate with state and local governments to provide consistency with the planned improvements and promote pedestrian/bicycle safety and mobility in the study area.
- Coordinate with the review agencies and design the site with an appropriate setbacks to accommodate the future two-way separated bicycle facility planned on Main Street.
- Coordinate with review agencies to determine other needed amenities along the site's frontage consistent with local plans.
- Replace the crosswalk ramps on the northern leg of the intersection of Main Street and B Avenue per latest FDOT standards.
- Coordinate with review agencies to provide direct crosswalk lighting at the western leg of the intersection of Main Street and A Avenue.
- Install a high visibility crosswalk on the western leg of B Avenue and 1st Street.
- Install a midblock crosswalk on Main Street between Phases 1 and 2 to serve pedestrians/ bicyclists. The midblock crosswalk should include:
    - High visibility markings
    - RRFB
    - Direct lighting
    - Advance stop here for pedestrians signs and stop lines in both directions of travel before the crosswalk
    - Curb extensions
- Coordinate with the local transit agency to review the needs of the proposed site, the existing and planned transit service in the area, and existing infrastructure.

Note that recommended improvements on facilities not maintained by FDOT should be coordinated, reviewed, and approved by the appropriate maintaining agency.

5. Case Study 4 – Subdivision on Rural High-Speed Road

5.1. Case Study Overview

This case study involves a residential subdivision applying for a driveway/connection permit. The state roadway (SR 100) being applied for a driveway connection is undivided with two lanes, has a C2 (rural) context classification, an access management classification four, and a posted speed limit of 55 mph. The subdivision will have 200 single-family dwelling units.

Review Type	Driveway/Connection Permit – Category D
Land Uses/Size	200 Detached Single-Family Dwelling Units
Access Management Classification, Posted Speed Limit	Access Class 4, 55 mph
Surrounding Context Classification	C2-Rural
Other Characteristics	None

5.2. Trip Generation

5.2.1. Vehicular Trip Generation

As discussed in **Section 4.2.1**, ITE's *Trip Generation Handbook* provides detailed guidance on when the average rate or the fitted equation should be used. For the proposed single-family detached residential development, the trip generation fitted equations for the LUC 210 in the ***ITE Trip Generation Manual 11th Edition*** were used. The estimated development site daily, AM and PM peak hour trip generation values for the buildout conditions are presented in **Table 5-1**. There will not be any pass-by trips for residential land uses. Based on an estimated 1,909 daily vehicle trips, this site requires a Category D driveway connection permit application.

Table 5-1 | Trip Generation

Land Use	ITE Land Use Code / Setting	Intensity	Trip Type	Daily	AM Peak Hour			PM Peak Hour		
					Total	Enter	Exit	Total	Enter	Exit
Single-Family Detached Housing	210 / General Urban-Suburban	200 units	Vehicle trips	1,909	140	35	105	191	120	71

5.2.2. Pedestrian/Bicycle Trip Generation

The ***ITE Trip Generation Manual, 11th Edition*** does not provide walk, bicycle, and transit trip generation data for single-family detached housing (LUC 210). The study area is located in a rural area and significant pedestrian and bicycle trips are not expected. There are no sidewalks present on the surrounding roadways and the pedestrian and bicycle trips to and from the site were assumed to be zero.

5.3. Vehicular Impact Analysis

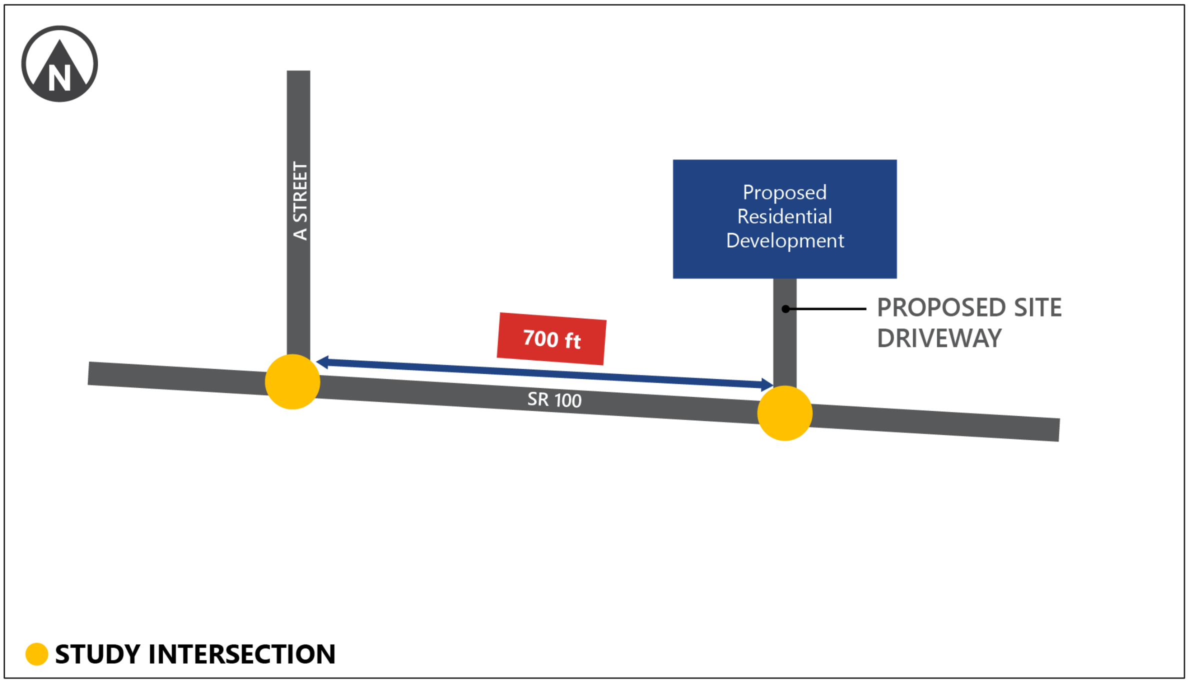
5.3.1. Study Area

For this case study, the proposed residential subdivision on SR 100 is located in a rural area. A Street is the only cross street located near the proposed site driveway. The study area for the proposed development is determined to include the proposed site access driveway and the adjacent A Street unsignalized intersection, as shown in **Figure 5-1**.

5.3.2. Analysis Horizon Years and Periods

The proposed 200 single-family dwelling units are planned to be built by the year 2025 in a single phase. Hence, the existing year is established as 2023 and the project buildout year is determined as 2025. For larger developments with multiple phases, multiple build analysis years can be decided based on the phased construction plan.

Figure 5-1 | Vehicular Study Area



5.3.3. Existing Condition Analysis

For this study, 6-hour turning movement counts were collected at the SR 100 and A Street unsignalized intersection located near the proposed site development. The AM and PM peak hour volumes were developed from the field collected intersection traffic counts. Data collection was conducted in accordance with FDOT standards. Vehicles, trucks, pedestrians, and bicycles were included in the intersection counts. A 24-hour daily traffic count was also obtained for SR 100 near the project driveway location.

FDOT develops SF for all Florida counties, which are available from the FDOT FTO. The SF of 0.98 corresponding to the data collection week was applied to the raw intersection traffic data to seasonally adjust the volumes. The seasonally adjusted existing traffic volumes are shown in **Figure 5-2**.

5.3.4. Future Background Conditions Analysis

The residential development buildout year is determined as 2025. The buildout year 2025 background traffic volumes were estimated by applying a linear AGR of 2% to the existing traffic volumes and adding the vested (committed) trips from an adjacent residential development located along SR 100 east of the proposed development. The AGR was calculated based on the most recent five-year historical traffic volumes for the adjacent SR 100 roadway segment, obtained from the FTO. Due to the rural nature of this study area, the vested trips were added on top of other anticipated through trips on SR 100 represented by the 2% AGR, however the decision as to how to calculate future background traffic should generally be guided by Section 4.7.2.1 of the ***MTSIH*** and discussed and decided upon at the methodology meeting. The future background traffic volumes for year 2025 is shown in **Figure 5-3**.

Figure 5-2 | Existing Year (2023) Traffic Volumes

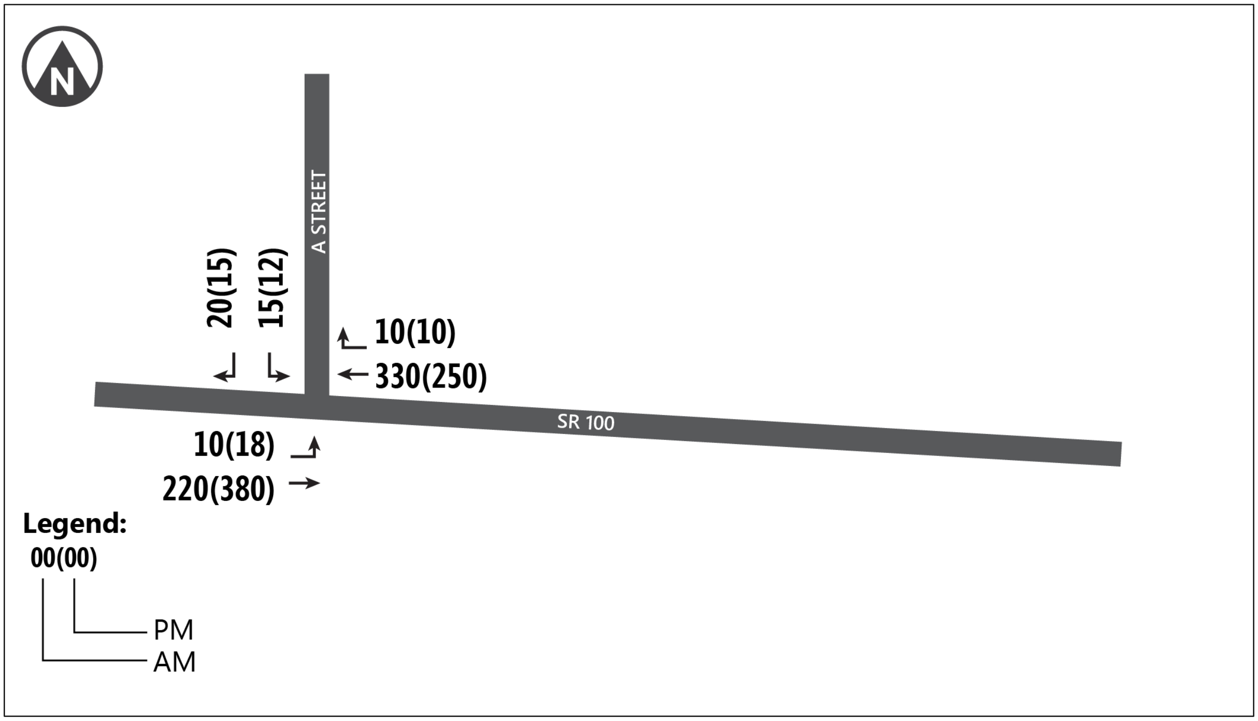
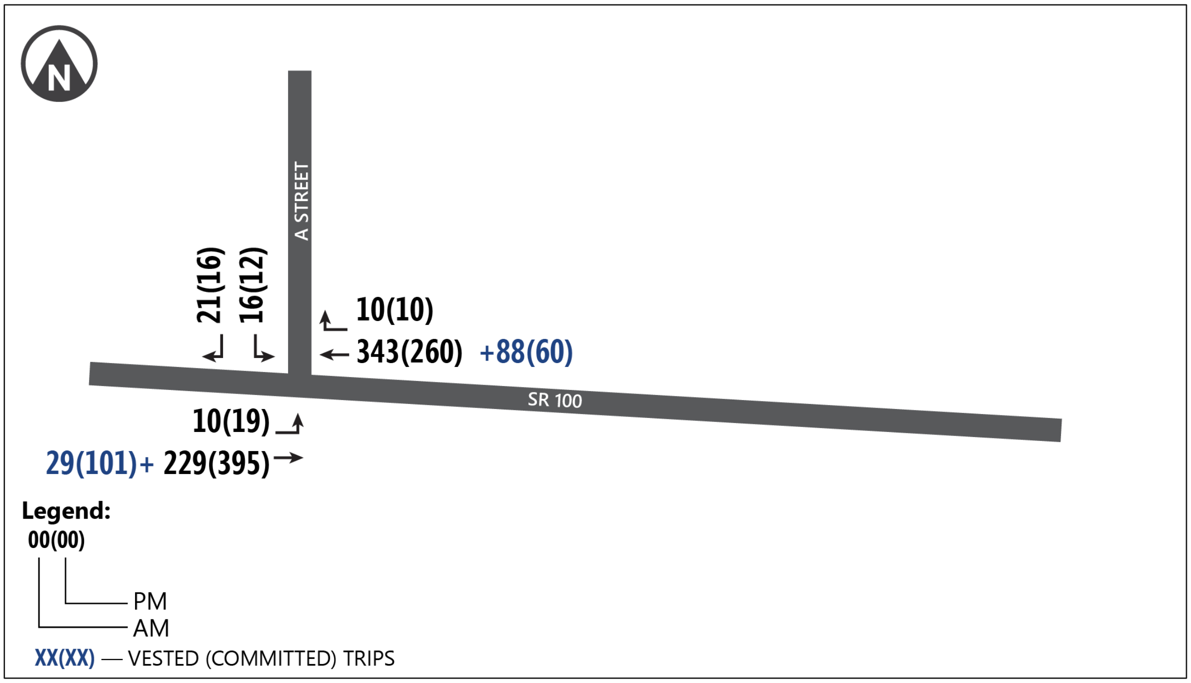


Figure 5-3 | Future Year (2025) Background Traffic Volumes (without project)



5.3.5. Vehicular Trip Distribution and Assignment

5.3.5.1. Vehicular Trip Distribution

A regional travel demand model is not available for this development site rural area. For small sites or areas where application of a travel demand model is infeasible, a variety of manual distribution methods may be applied. Some commonly applied approaches include:

- Existing local travel patterns – Existing traffic count and turning movement data will often provide a good indication of reasonable site distribution when the proposed site fits in with the surrounding land uses.
- Nearby existing and proposed land uses (including type and density) that will serve as likely origins and destinations for site trips – This method is more applicable for retail uses that are intended to serve neighborhoods within a few miles of the site; new residential and employment centers will tend to be more closely tied to regional commuter patterns than surrounding land uses.
- Regional corridor traffic volumes – Many residential and employment centers will have distribution patterns that heavily favor trips to and from roadways that provide the best access to the major regional corridors.
- Driveway counts from a nearby similar site – Similar sites located in the same area will often exhibit similar trip distribution characteristics.
- Data collection or surveys – License plate origin-destination studies, driver response surveys, or home zip code studies.

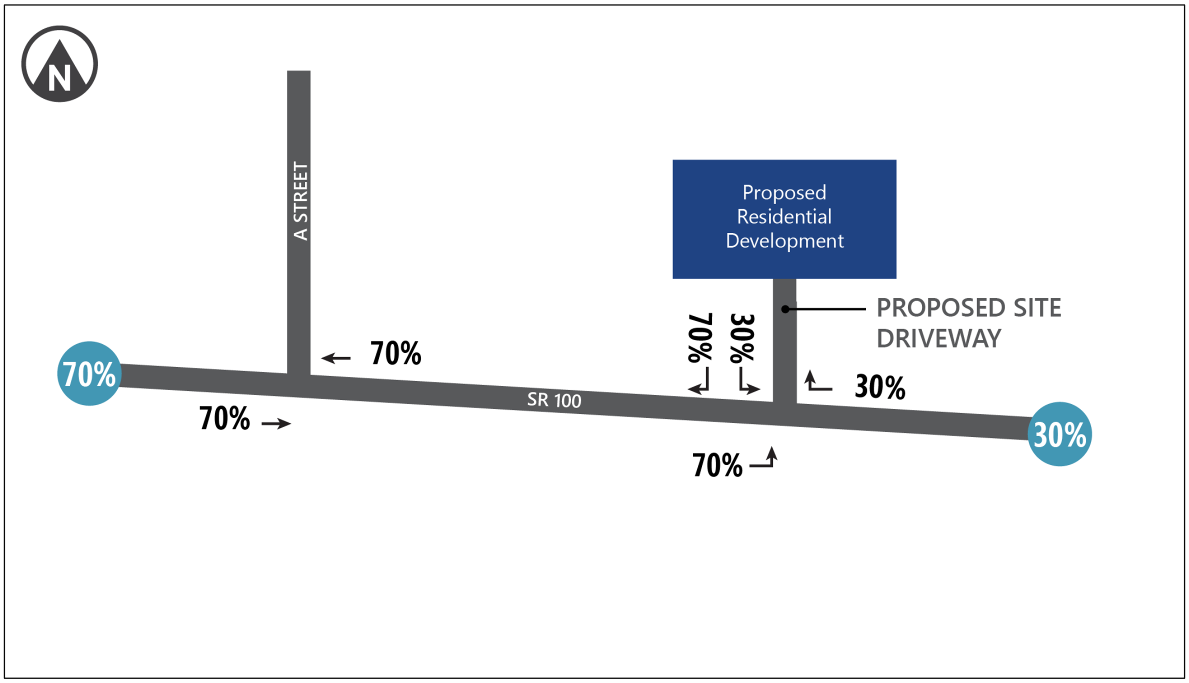
As a key study assumption, it is good practice to ensure reviewing agencies approve of the trip distribution methodology and assumptions used, in the connection permit pre-application meeting.

For the proposed residential subdivision, distribution of trips to and from the site was determined manually, based on knowledge of the local area network, current traffic volumes, and discussion with FDOT/county staff. The following general assumptions were made:

- 70% to and from the west
- 30% to and from the east

The trip distribution percentages for the site are provided in **Figure 5-4**. The distribution of project trips by movement is also depicted in **Figure 5-4**.

Figure 5-4 | Vehicle Trip Distribution



5.3.5.2. *Vehicular Traffic Assignment*

Based on the project distribution assumptions discussed in the above section, the project trip assignment for the AM, and PM peak hours are developed shown on **Figure 5-5**.

5.3.6. *Future Build Conditions*

Future traffic volumes (see **Figure 5-6**) were determined by adding project trips (**Figure 5-5**) to the future background volumes, including vested trips (**Figure 5-3**).

Figure 5-5 | Vehicle Trip Assignment

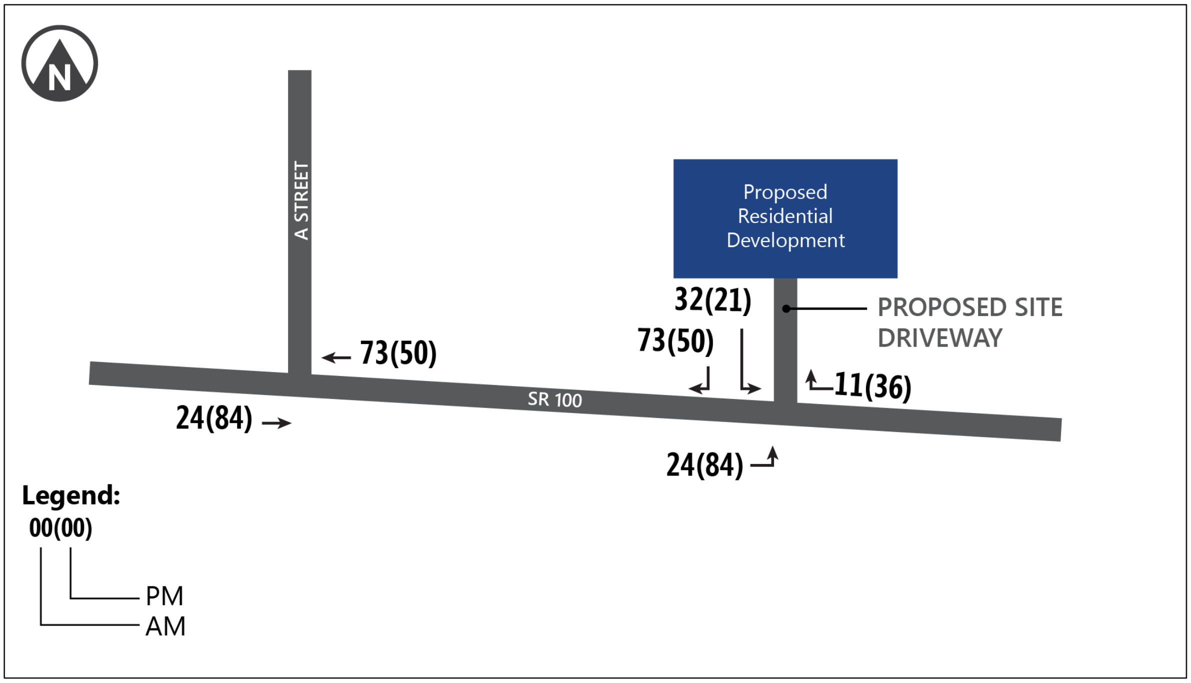
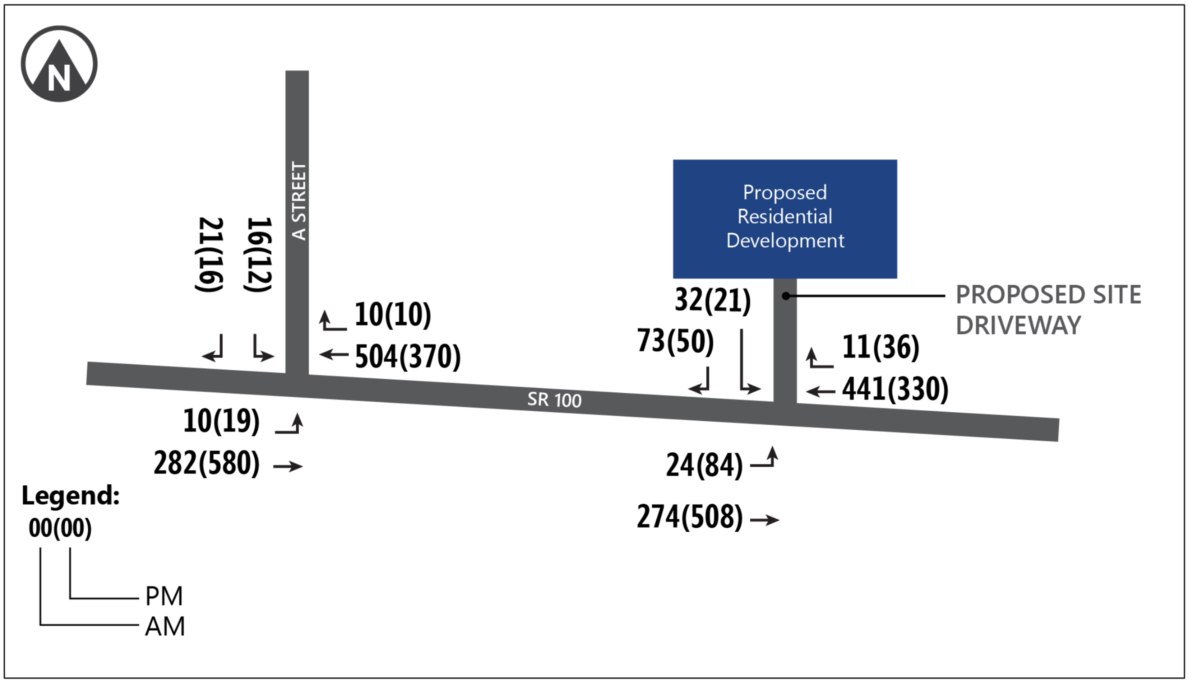


Figure 5-6 | Future Year (2025) Build Traffic Volumes (with project)



5.3.7. *Capacity Analysis*

5.3.7.1. *Intersection Analysis*

In this case study, Synchro software was used to analyze existing year, background, and buildout conditions at each of the study area intersections. Each intersection was compared using the following measures:

- Average Intersection Delay and LOS.
- For the side-street stop-controlled intersections, the side street delay is reported.
- LOS E and LOS F are typically considered unacceptable and require mitigation; however, this may vary based on the reviewing agency. For roadways on the SHS, the peak hour motorized vehicle LOS target is D in urbanized areas, and LOS C for areas outside of urbanized areas, based on FDOT's Policy on Level of Service Targets, ***Topic No. 000-525-006***. Additional information on performance measures of effectiveness and targets for auto analysis is provided in Section 4.4.1 of the ***MTSIH***.

Delay and LOS results from the study unsignalized intersections are shown in **Table 5-2.**

Table 5-2 | Intersection Capacity Analysis Results

Period / Intersection	LOS (Delay, sec/veh)		
AM Peak Hour	2023 Existing	2025 Background	2025 Buildout
SR 100 and A Street	B (12.2) SB Approach	B (13.9) SB Approach	C (15.2) SB Approach
SR 100 and Proposed Site Driveway	NA	NA	B (13.6) SB Approach
PM Peak Hour	2023 Existing	2025 Background	2025 Buildout
SR 100 and A Street	B (12.5) SB Approach	B (14.4) SB Approach	C (16.2) SB Approach
SR 100 and Proposed Site Driveway	NA	NA	B (14.4) SB Approach

Note: For unsignalized intersections, the minor street approach with the highest delay is reported.

5.3.7.2. *Left-Turn Lane Analysis*

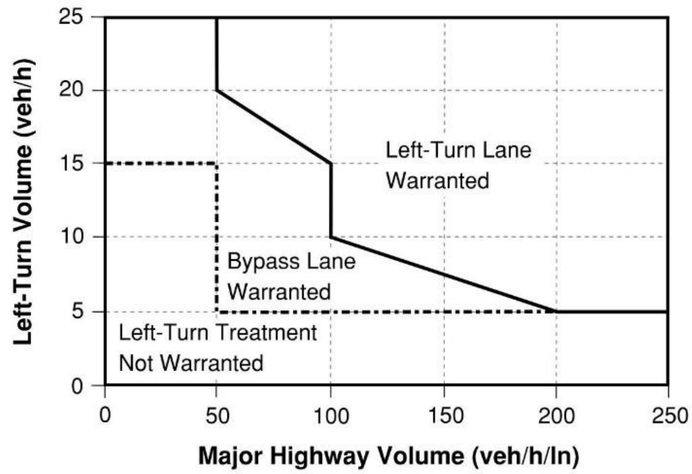
Based on the ***NCHRP Report 745*** guideline, an exclusive eastbound left-turn lane is recommended at the SR 100 and proposed residential development site driveway intersection. The ***NCHRP Report 745*** recommends an exclusive left-turn for left-turn movements with more than five vehicles per hour, and major highway volume of more than 200 vehicles per hour at three-leg intersections along rural two-lane roadways, as shown in **Figure 5-7** *(*NCHRP left-turn lane warrants for various scenarios are provided in the FDOT ***Multimodal Access Management Guidebook*)**.

SR 100 and Proposed Site Driveway
Unsignalized intersection:

<u>PM Peak Hour</u>
SR 100 Eastbound Volume = 592 vph
Eastbound Left-turn Volume = 84 vph

Alternatively, the ***NCHRP 457*** methodology was also reviewed to confirm the left-turn lane warrant at the proposed development site driveway, as provided in **Figure 5-8**. Both NCHRP warrants show that an eastbound left-turn lane is warranted at the project driveway.

Figure 5-7 | Left-Turn Lane Warrant (NCHRP 745)



(a) Three-Leg Intersections

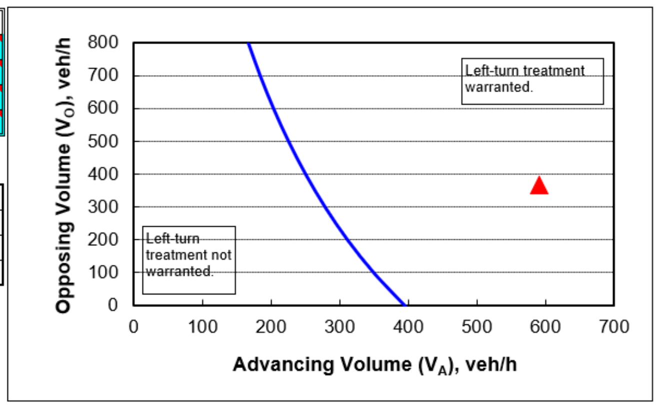
Figure 5-8 | Left-Turn Lane Warrant (NCHRP 457) – Alternative Method

INPUT

Variable	Value
85th percentile speed, mph:	55
Percent of left-turns in advancing volume (V_A), %:	14%
Advancing volume (V_A), veh/h:	592
Opposing volume (V_O), veh/h:	366

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	261
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

5.3.7.3. Right-Turn lane Analysis

A westbound right-turn lane warrant analysis was performed at the proposed residential development site driveway based on ***NCHRP Report 457***. The result of the analysis is shown in **Figure 5-9** (*NCHRP right-turn lane warrants for various scenarios are provided in the **FDOT Multimodal Access Management Guidebook***). Based on this analysis, a westbound right-turn lane is warranted at the project driveway.

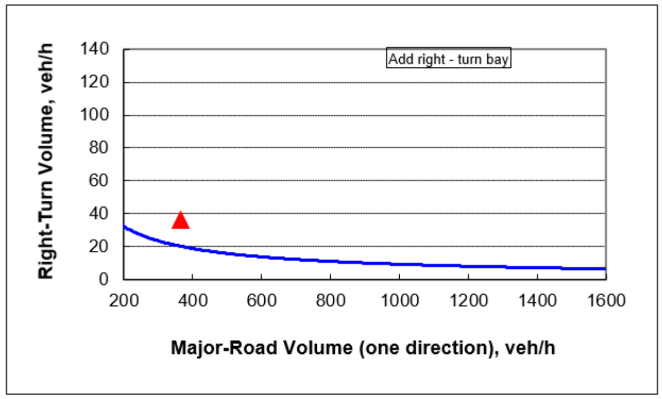
Figure 5-9 | Right-Turn Lane Warrant (NCHRP 457)

INPUT

Roadway geometry:	2-lane roadway
Variable	**Value**
Major-road speed, mph:	55
Major-road volume (one direction), veh/h:	366
Right-turn volume, veh/h:	36

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	20
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Add right-turn bay.	



5.4. Pedestrian/Bicycle/Transit Impact Analysis

As discussed in the **Trip Generation** section, based on the pedestrian and bicycle counts from other similar sites, it was determined that the proposed 200 single-family dwelling units' residential development will generate less than 20 pedestrian and bicycle trips during peak hours (estimated to be 0).

5.4.1. *Context-Based Assessment*

5.4.1.1. *Review Compatibility with Planning Documents*

State and local planning documents were reviewed to determine the proposed development's compatibility with the plan. The FDOT and county List of Project Priorities was reviewed as part of this effort. Based on the review, there are no planned improvements projects noted near the site. However, the applicant should coordinate with the agencies to confirm this.

- There are no planned pedestrian or bicycle improvements noted near the site.
- There are no planned and programmed projects included in the FDOT 5-Year Work Program.
- There are no Project Development and Environment Studies (PD&E) for the arterial roadway.
- There is no ROW need for any FDOT projects that would affect the development site and its proposed access.
- The local government does not have a ROW preservation ordinance.

5.4.1.2. *Internal Site Design Pedestrian and Bicycle Accommodations*

The site's design was reviewed for pedestrian and bicycle accommodations and circulation. **Table 5-3** describes the on-site design specification to accommodate non-motorized users. The basis for many of the recommendations in **Table 5-3** can be found within Appendix B of the ***MTSIH***.

Table 5-3 | Internal Site Design to Accommodate Non-Motorized Users

Design Component	Review	Recommendation
Access Management	Although the proposed site is in a rural area, bicycle and pedestrian facilities design can be incorporated in the site plan. These include reduced number of driveways, pedestrian/bicyclists cross-access between properties, and pedestrian/bicycle connections to side streets.	Provide best practices for incorporation in site design.
Driveway Design	Although the proposed site is in a rural area, best practices for bicycle and pedestrian design can be coordinated with the applicant for incorporation in their site plan. Considerations include curb radius, driveway width, sight distance, and meeting the requirements of the Americans with Disabilities Act (ADA).	Provide best practices for incorporation in site design.
Site Frontage	Possible improvements needed to the frontage to enhance pedestrian and bicycle travel and provide for future connectivity include lighting, landscaping, buffered sidewalk, and separated bike lanes.	Provide best practices for incorporation in site design.
Site Circulation & Bicycle/ Pedestrian Access	Although the proposed site is in a rural area, best practices for bicycle and pedestrian access and circulation can be coordinated with the applicant for incorporation in their site plan.	Provide best practices for incorporation in site design.
Amenities	Although the proposed site is in a rural area, best practices for bicycle- and pedestrian amenities can be coordinated with the applicant for incorporation in their site plan.	Provide best practices for incorporation in site design.
Network Review	While there are no plans for additional network in or near the site, the applicant should coordinate with local agencies to determine what improvements are needed.	Coordinate with Local Agencies

5.4.1.3. Pedestrian and Bicycle Connections to Adjacent Properties and/or Transit Stops

In order to provide a connected street network to improve pedestrian and bicycle travel, connections to the neighboring areas should be considered during site planning and design. If street connections are not feasible, pedestrian only connections can be considered. If it is not possible to create the connections offsite, stub-outs can be considered for future connections.

Adjacent Properties

There are no direct pedestrian connections between the proposed residential development and the adjacent properties. It is also noted that consideration should be given to nearby pedestrian and bicycle generators such as schools, universities, public parks etc. However, there is no such pedestrian and bicycle generators at the vicinity of the proposed development.

Nearby Bus Stops

There are no bus routes or bus stops located in the vicinity of the proposed residential development.

5.4.2. Quantitative Analysis

5.4.2.1. Pedestrian and Bicycle Trip Generation

As discussed in the **Trip Generation** section, based on the pedestrian and bicycle counts from other similar sites, it was determined that the proposed 200 single-family dwelling unit residential development will generate less than 20 pedestrian and bicycle trips during peak hours. Based on the recommended pedestrian and bicycle quantitative analysis study level guidelines as shown in **Figure 5-10** and **Table 5-4**, a Level 1 (Low) analysis was performed. **Table 5-5** outlines the recommended study requirements for Level 1 analyses. Hence, network connectivity analysis or multimodal Q/LOS analysis were not performed for this case study.

Figure 5-10 | Pedestrian and Bicycle Quantitative Analysis Study Levels

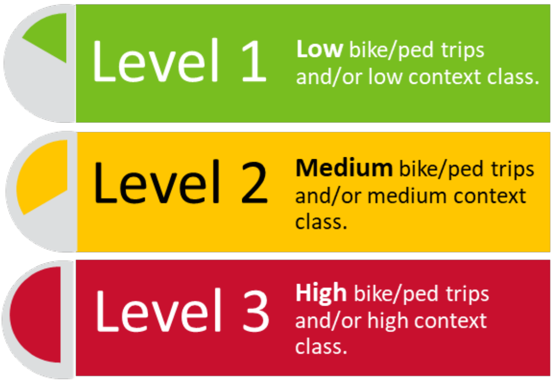


Table 5-4 | Level of Pedestrian and Bicycle Study based on Context Classification and Peak Hour Volume

Peak Hour Volume of Non-Motorized Trips	C1	C2	C2T	C3	C4	C5	C6
Low (< 20)	1	1	2	1	1	2	2
Medium (20 – 49)	2	2	2	2	2	3	3
High (≥ 50)	3	3	3	3	3	3	3

Table 5-5 | Pedestrian and Bicycle Study Requirements – Quantitative Analysis

Analysis Type	Study Requirements	Level of Pedestrian and Bicycle Study		
		Level 1 (Low)	Level 2 (Medium)	Level 3 (High)
Quantitative Analysis	**1. Bicycle/Pedestrian Trip Generation**	Required when total vehicle trips per day exceeds 600 (driveway connection permit categories C-G). Optional for other study types.		
	2. Study Area	N/A	500-foot radius or nearest signalized intersection beyond 500 feet [1]	1,500-foot radius or nearest signalized intersection beyond 1,500 feet [1]
	3. Network Connectivity Analysis	N/A	Optional	Optional
	4. Multimodal Q/LOS Analysis	N/A	Optional	Optional

[1] Access connection permit applications for Driveway Categories C, D, E, F, and G should meet the above study area guidance as a minimum or utilize the same study area being evaluated for vehicle trips.

5.5. Safety Analysis

5.5.1. Review of Crash Data

Crash analyses were conducted for the SR 100 study area between 200 feet west of A Street and 500 feet east of the proposed driveway location using the most recent five-year crash data obtained from Signal Four Analytics for the time frame of January 2018 to December 2022. The SR 100 roadway intersection and segment crash severity, by year, is shown in **Table 5-6**. The crash types are summarized in **Table 5-7**. The crashes by the lighting conditions are presented in **Table 5-8**. As shown in the tables, from January 1, 2018, through December 31, 2022, there were 14 reported crashes in the five-year period. No fatal crashes were reported during these five-years, but six injury crashes were reported during this timeframe. Most of the crashes occurred within the project study area were rear-end and off-road crashes. Nearly two-thirds of the study area crashes 9 (64%) occurred near the A Street intersection.

5.5.2. Site and Study Area Assessment

With provision of the exclusive left-turn and right-turn lanes at the proposed residential development site driveway, the turning vehicles can be safely accommodated. However, it is recommended to monitor the safety conditions, and to consider appropriate improvements to reduce the traffic operating speed, and other safety measures on SR 100 near the residential development.

Table 5-6 | Crashes by Severity

Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Total Crashes
Intersection: SR 100 at A Street Intersection				
2018	0	1	1	2
2019	0	0	1	1
2020	0	1	0	1
2021	0	1	1	2
2022	0	1	2	3
Total	**0**	**4**	**5**	**9**
Segment: SR 100 between A Street and 500 feet east of the Proposed Driveway				
2018	0	0	0	0
2019	0	0	1	1
2020	0	0	1	1
2021	0	1	0	1
2022	0	1	1	2
Total	**0**	**2**	**3**	**5**
Study Area Total	**0**	**6**	**8**	**14**

Note: As per the ***HSM***, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

Table 5-7 | Crashes by Type of Collision

Year	Rear End Crashes	Angle Crashes	Sideswipe Crashes	Animal Crashes	Off-Road Crashes	Total Crashes
Intersection: SR 100 at A Street Intersection						
2018	1	0	0	1	0	2
2019	0	1	0	0	0	1
2020	0	0	0	0	1	1
2021	1	1	0	0	0	2
2022	1	1	0	0	1	3
Total	**3**	**3**	**0**	**1**	**2**	**9**
Segment: SR 100 between A Street and 500 feet east of the Proposed Driveway						
2018	0	0	0	0	0	0
2019	0	0	0	0	1	1
2020	1	0	0	0	0	1
2021	0	0	0	1	0	1
2022	0	0	1	0	1	2
Total	**1**	**0**	**1**	**1**	**2**	**5**
Study Area Total	**4**	**3**	**1**	**2**	**4**	**14**

Note: As per the ***HSM***, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

Table 5-8 | Crashes by Lighting Condition

Year	Daylight	Dusk	Dark	Total Crashes
Intersection: SR 100 at A Street Intersection				
2018	1	0	1	2
2019	1	0	0	1
2020	0	0	1	1
2021	2	0	0	2
2022	2	1	0	3
Total	**6**	**1**	**2**	**9**
Segment: SR 100 between A Street and 500 feet east of the Proposed Driveway				
2018	0	0	0	0
2019	0	0	1	1
2020	1	0	0	1
2021	0	0	1	1
2022	1	1	0	2
Total	**2**	**1**	**2**	**5**
Study Area Total	**8**	**2**	**4**	**14**

Note: As per the *HSM*, intersection crashes include all crashes that occur at an intersection or on intersection legs and are intersection related. All other crashes not classified as an intersection or intersection-related crash are considered to be roadway segment crashes.

5.6. Site Circulation Review

5.6.1. Access Management

The nearby A Street unsignalized intersection is located approximately 700 feet west of the proposed site access driveway. Based on the ***F.A.C. 14-97*** access management spacing standards, the required distance between driveways/cross street on an Access Class 4 facility with greater than 45 mph speed limit is 660 feet.

5.6.2. On-Site Queueing

The proposed residential subdivision is not a gated community. The incoming and outgoing vehicles are not expected to stop at the entrance/exit driveway of the site, except at the driveway and the SR 100 unsignalized intersection. The queue length at the intersection is estimated as one vehicle based on the traffic operational analysis of the SR 100 and proposed site driveway unsignalized intersection.

5.6.3. Multimodal Access and Circulation

There are no sidewalks or bicycle lanes along SR 100 adjacent to the proposed residential development. The context classification of SR 100 is rural (C2) and significant pedestrian and bicyclist activity is not expected. There are no transit routes near the proposed site. However, the internal site design bicycle/pedestrian accommodations and the bicycle/pedestrian network connections recommended for this residential development site (refer to **Pedestrian/Bicycle/Transit Impact Analysis** section) can be considered to provide multimodal access and circulation. Furthermore, various strategies for site design presented in the *Pedestrian/Bicycle Site Design Toolbox* and the *Site Design Development and Review Checklist* (provided in the ***MTSIH***), can be used to enhance the multimodal access and circulation for the proposed development site.

5.7. Mitigation

In this case study, both SR 100 unsignalized intersections at the proposed residential site development driveway and at A Street intersection are projected to operate at LOS B or better for the buildout year 2025 traffic conditions. At the proposed development site driveway intersection an exclusive eastbound left-turn lane, and an exclusive westbound right-turn lane are also warranted and provided in the site plan. With four of 14 crashes occurred at night (29%), it is recommended to provide adequate lighting between A Street intersection and the proposed development site driveway intersection.

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