NOISE STUDY REPORT

State Road 40 (Granada Boulevard)
PD&E Study
From Breakaway Trail to Williamson Boulevard

Volusia County

Financial ID# 428947-1-22-01

Florida Department of Transportation
District Five

719 S. Woodland Boulevard,
DeLand, Florida 32720

February 27, 2013

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FINAL

EXECUTIVE SUMMARY

An assessment of noise impacts was conducted for this project according to *Title 23, Code of Federal Regulations (C.F.R.), Part 772: Procedures for Abatement of Highway Traffic Noise and Construction Noise* (July 13, 2010), Part II, Chapter 17 of the Florida Department of Transportation (FDOT) *Project Development and Environment Manual* (revised May 24, 2011) and *Chapter 335.17, Florida Statutes*. This assessment also adheres to current Federal Highway Administration (FHWA) traffic noise analysis guidelines contained in *Report FHWA-HEP-10-025, Highway Traffic Noise: Analysis and Abatement Guidance*, revised January 2011.

Consistent with FDOT and FHWA regulations, only the land uses falling under Activity Categories B, C and E (defined in Table 1) were analyzed for noise impacts. There are no land uses in the study corridor which warrant an Activity Category A analysis nor is an analysis of interior (Category D) noise levels required. A total of 84 Category B residences, six Category C sites and one Category E business were analyzed for project noise impacts. Project aerials provided as Appendix A illustrate these receptors.

EXISTING TRAFFIC NOISE CONDITION

For the majority of the existing study corridor, computer-predicted noise levels fall below the FHWA Noise Abatement Criteria with the exception of the soccer fields at Calvary Christian Academy. This site is also adjacent to the I-95 southbound off ramp which generates the majority of the traffic noise at this location. The current noise level approaches the FHWA 67.0 dBA Noise Abatement Criterion (NAC) with a predicted noise level of 66.1 dBA.

NO-BUILD ALTERNATIVE IMPACT SUMMARY

When Level of Service (LOS) "C" traffic volumes were applied to the existing road network to represent worst-case traffic noise conditions with the 2035 No-Build Alternative, predicted noise levels throughout most of the study area increased over existing conditions. However, in no circumstances is the predicted increase considered substantial, nor were there any new noise impacts. Instead, only the soccer fields at Calvary Christian Academy remained impacted by traffic noise; further indicating that I-95 traffic noise predominant.

BUILD ALTERNATIVE IMPACT SUMMARY

With the proposed SR 40 widening in place, predicted noise levels west of Tymber Creek Road (Project Segment 1) increase an average of 7.1 dBA. While noticeable, the increased noise levels do not constitute an impact to any of the adjacent subdivisions (Breakaway Trail, Il Villaggio, Indian Springs), nor to the Little Blessings Preschool or the Riverbend Church and Academy.

The average predicted noise levels east of Tymber Creek Road (Project Segment 2) increase 2.9 dBA over existing conditions. Despite this negligible increase, four locations are predicted to have noise levels that either approach or exceed the FHWA NAC. Each of these impacted receptors, representing four Category B residences, two Category C sites, and one Category E business was considered for abatement measures. That evaluation is summarized below in Table ES1.

Table ES-1: Project Noise Impacts

Segment 2 Receptor ID	NAC Activity Category	Represented Noise Sites	Existing Noise Level (dBA)	Project Noise Level (dBA)	Noise Level Change Over Existing (dBA)
Children's House Academy	C	Playground	63.5	68.8	5.3
Twin Rivers Receptor TR2	B	4 Single-family (sf) residences	63.8	68.0	4.2
Calvary Christian Academy	C	Portion of soccer field	66.1	66.7	0.6
Dunkin Donuts	E	Outdoor eating area	69.5	71.4	1.9

BARRIER ANALYSIS

Barriers were evaluated for each of the four impacted locations; a summary of which is provided below in Table ES-2. The Dunkin Donuts barrier and the Calvary Christian Academy barrier are not considered feasible due to their inability to meet the FHWA 5.0 dBA required minimum noise reduction. The remaining two barriers are not considered reasonable due to exceeding the FDOT $42,000 per benefited receptor cost reasonable requirement at the Twin Rivers neighborhood and the cost criteria assigned to special use locations such as the Children's House Academy.

Table ES-2: Feasible and Reasonable Barrier Summary

Feasible Noise Barrier	Number of Impacted Sites	Number of Benefited Noise Sites	Avg. Noise Reduction (dBA)	Wall Length	Optimum Wall Height	Estimated Barrier Cost	Cost Per Benefited Receptor	Barrier Reasonable ?
Children's House Academy	Playground	N/A – Special Use Site	7.2	547'	14'	$229,740	Exceeded Special Use Cost	No.
Twin Rivers Receptor TW2	4 sf residences	4	6.5	570'	14'	$239,400	$59,850	No
Dunkin Donuts	Outdoor eating area	N/A – Special Use Site	Not Feasible					No
Calvary Christian Academy	Portion of soccer field	N/A – Special Use Site	Not Feasible					No

STATEMENT OF LIKELIHOOD

Based on the noise analyses performed to-date, there appears to be no apparent solutions available to mitigate the noise impacts at the four impacted Activity Category B sites represented in this report by receptor TR2; two Category C sites (Children's House Academy playground and Calvary Christian Academy soccer fields); nor to the outdoor eating area affiliated with the Dunkin Donuts, a Category E land use.

The Florida Department of Transportation is committed to reevaluating project noise impacts during the subsequent final design phase, and will commit to constructing noise barriers contingent upon the following conditions:

- Further analysis conducted during the project's final design phase supports the need, feasibility and reasonableness of providing noise abatement;
- Viewpoints of the impacted property owners/renters are in favor of noise barrier construction, where applicable; and
- Safety and engineering aspects, as related to the roadway user and adjacent property owners, have been reviewed and any conflict or issues resolved.

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DEFINITIONS

The following are the definitions of terms used in this Noise Study Report. These terms are also contained in the guiding publication put forth by the Florida Department of Transportation (FDOT): *Project Development and Environment* (PD&E) Manual, Part 2, Chapter 17, revised May 24, 2011.

- **Approach Criteria.** Approaching the criteria means within one decibel (dB) of the appropriate Federal Highway Administration (FHWA) Noise Abatement Criteria (refer to definition below).

- **Benefited Receptor.** The recipient of an abatement measure that receives a noise reduction at or above the minimum 5.0 dBA FHWA requirement.

- **Common Noise Environment**. A group of receptors within the same FHWA Activity Category (Refer to Table 1) that are exposed to similar noise sources and levels; traffic volumes, traffic mix, and speed; and topographic features. Generally, common noise environments occur between two secondary noise sources, such as interchanges, intersections and/or cross-roads. A common noise environment involves a group of impacted receptors that would benefit from the same noise barrier or noise barrier system (i.e. overlapping/continuous noise barriers).

- **Date of Public Knowledge**. The approval date of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), the Record of Decision (ROD), State Environmental Impact Report (SEIR) or Non-major State Action (NMSA). Any noise sensitive receptor that is permitted between the completion of the Noise Study Report and the Date of Public Knowledge will be analyzed for traffic noise impacts and possible noise abatement considered during the design phase of the project.

- **Decibel.** A unit of sound level measurement. For traffic noise purposes, the A-weighted scale is used which closely approximates the frequency range of human hearing. The A-weighted decibel is abbreviated dBA.

- **Design Year.** The future year used to estimate the probable traffic volume for which a roadway is designed. For this project, Design Year is 2035.

- **Impacted Receptor.** A noise sensitive receptor that has a traffic noise impact.

- **Leq.** The equivalent steady-state sound level that, in a stated period of time, contains the same acoustic energy as the time-varying sound level during the same time period.

- **Noise Abatement Criteria (NAC).** The noise level, depending on Activity Category, at which noise abatement must be considered. Refer to Table 1.

- **Noise Barrier.** A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level. Noise barriers include stand-alone noise walls, noise berms (earth or other materials), and combination berm/wall systems.

- **Noise Reduction Design Goal.** The optimum desired noise reduction determined by calculating the difference between future build noise levels with abatement to future noise levels without abatement. The noise reduction design goal for the State of Florida is 7.0 dBA for at least one impacted receptor.

- **Permitted**. Vacant land is not noise-sensitive and is excluded from this traffic noise analysis. However, such property will be analyzed in this noise study if the local agency with jurisdiction has granted a building permit for a specific edifice associated with a noise sensitive land use prior to the project's Date of Public Knowledge.

- **Receptor.** A discrete or representative location of a noise sensitive area(s).

- **Residence.** A dwelling unit. Either a single family (sf) residence or each dwelling unit in a multifamily (mf) dwelling.

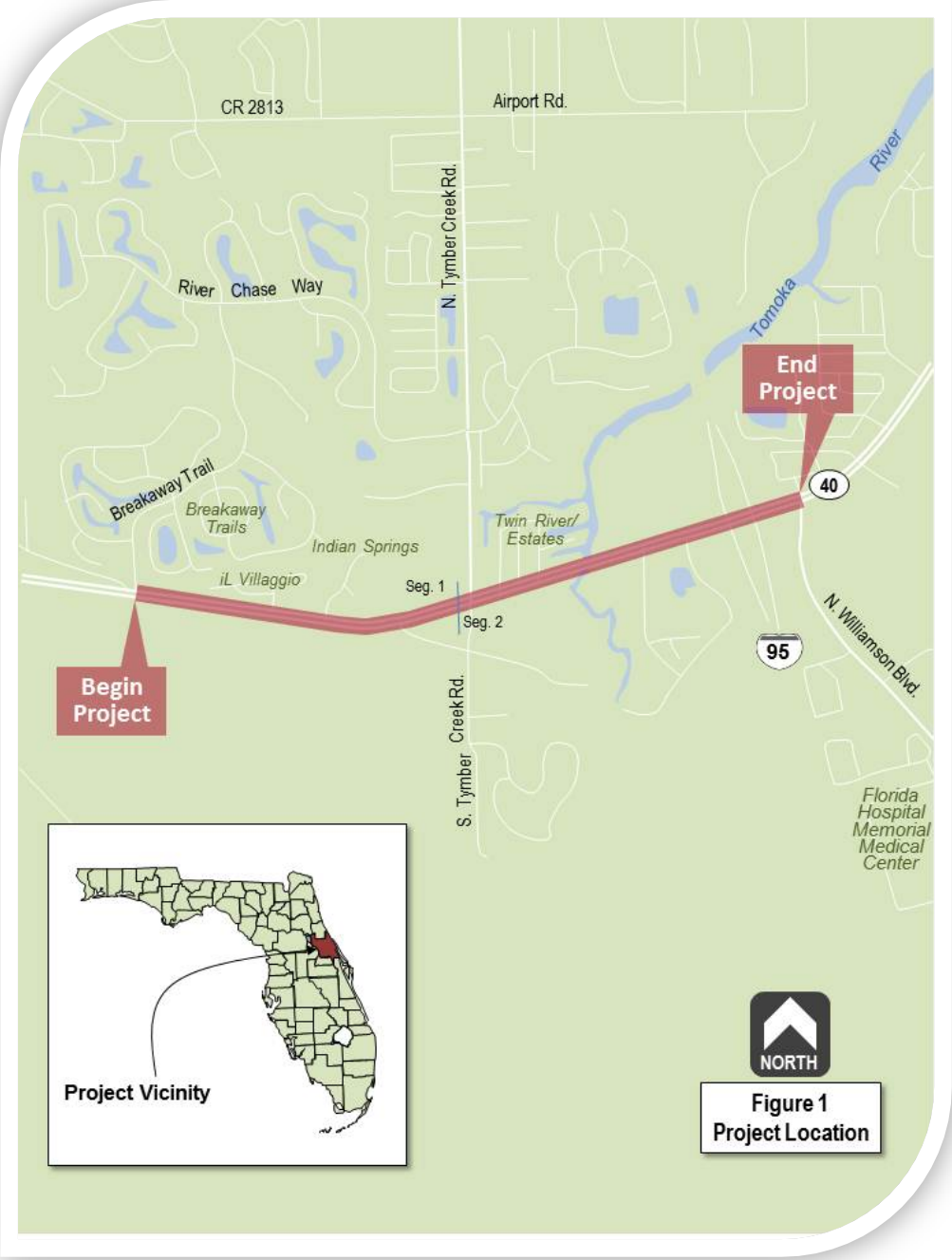
- **Statement of Likelihood.** A statement provided in the environmental clearance document based on the feasibility and reasonableness analysis completed at the time of the environmental document is being approved.

- **Substantial Noise Increase.** This is an increase of 15.0 or more decibels above the existing noise level as a direct result of the transportation improvement project.

- **Traffic Noise Impacts**. Design year build condition noise levels that approach or exceed the FHWA NAC; or design year build condition noise levels that create a substantial noise increase over existing noise levels.

INTRODUCTION

The Florida Department of Transportation (FDOT) District Five is conducting a Project Development and Environmental (PD&E) Study for widening State Road (SR) 40 (Granada Boulevard) from four to six lanes. The limits of the proposed project are from Breakaway Trail to Williamson Boulevard, a distance of approximately 2 miles in Volusia County, Florida. Figure 1 below illustrates the project corridor limits within the City of Ormond Beach and Volusia County.



PROJECT IMPROVEMENTS

The proposed improvement is a capacity project that involves widening the existing facility from a four lane roadway to a six lane roadway. Because the FDOT right of way is typically 200 feet along the study corridor, the focus of the project was to widen the roadway within the existing limits. The study area was broken into two segments for this noise analysis based on the proposed typical sections.

Segment 1 begins at Breakaway Trail and continues east to Tymber Creek Road. The proposed typical section for this segment is a rural design with a posted speed limit of 50 mph. Utilizing the existing 40-foot wide median, this typical section retains the current rural character through this segment with uncurbed, depressed median and flush outside shoulders. A 5-foot wide sidewalk is provided on the south side and a 12-foot wide shared use path provided on the north side. The 5-foot paved shoulders in each direction also serve as bicycle lanes as illustrated below in Figure 2a.

Figure 2a
Segment 1 Proposed
Typical Section

Segment 2 continues the widening effort east to Williamson Boulevard with an urban typical section and posted speed limit of 45 mph. Figure 2b illustrates the urban typical. Further engineering detail is provided in the *Project Development Summary Report* (PDSR).

Figure 2b
Segment 2 Proposed
Typical Section

NO-BUILD ALTERNATIVE

Consistent with FHWA guidelines, this analysis also considers an alternative that assesses what would happen to the environment in the future if the proposed SR 40 widening project was not built. This alternative, called the No-Build Alternative, consists not only of the existing roadways within the study area, but also includes the routine maintenance improvements to these facilities. Also included in the No-Build roadway network is the planned widening of Tymber Creek Road.

The majority of the segment to be studied is classified as a principal arterial with the section west of I-95 identified as a Scenic Byway. Existing SR 40 consists of four travel lanes (two lanes in each direction). From Breakaway Trail to Booth Road, SR 40 has paved shoulders adjacent to the outside travel lanes and is separated by a swale median that varies between 40 and 46 feet in width. From Booth Road to Williamson Boulevard, a raised median of varying width is provided, and curb and gutter with adjacent sidewalks are provided from I-95 to Williamson Boulevard. Figure 3 on the following page illustrates the existing roadway typical section along most of the corridor.

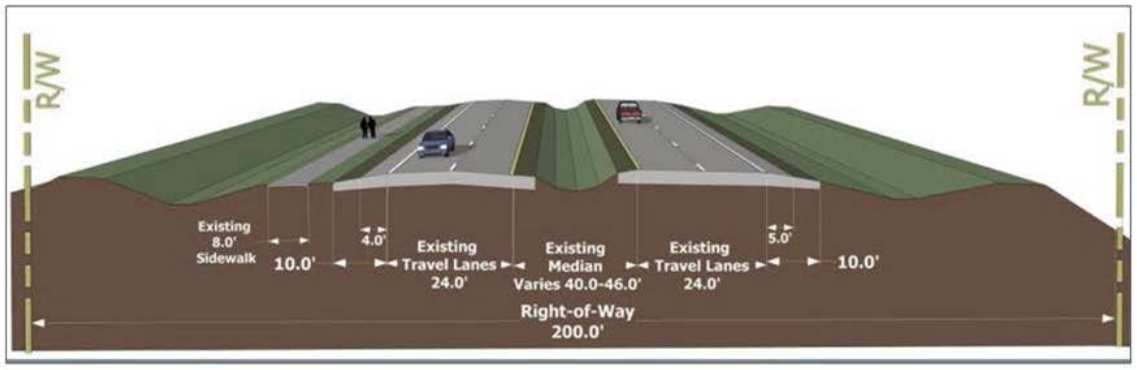


Figure 3:
Existing Typical Section

The existing posted speed limit is 50 mph from Breakaway Trail to just west of I-95. Through the I-95 interchange area to Williamson Boulevard, the posted speed limit is 45 mph. An 8-foot wide sidewalk runs on the north side of SR 40 between Breakaway Trail and Tymber Creek Road and a sidewalk is provided on both sides of SR 40 from I-95 through the eastern extents of the study area.

While the No-Build Alternative does not meet project needs, it provides a baseline condition to compare and measure the effects of the proposed corridor.

TRAFFIC NOISE IMPACT ANALYSIS

This section of the Noise Study Report summarizes the traffic noise impact analysis, conducted for this project according to *Title 23, Code of Federal Regulations (C.F.R.), Part 772: Procedures for Abatement of Highway Traffic Noise and Construction Noise* (July 13, 2010), Part II, Chapter 17 of the Florida Department of Transportation (FDOT) *Project Development and Environment Manual* (revised May 24, 2011) and *Chapter 335.17, Florida Statutes*. This assessment also adheres to current Federal Highway Administration (FHWA) traffic noise analysis guidelines contained in *Report FHWA-HEP-10-025, Highway Traffic Noise: Analysis and Abatement Guidance*, revised January 2011.

METHODOLOGY

Traffic noise is a combination of noises produced by the engine, exhaust, and tires and is never constant. The noise level is always changing with the number, type and speed of the vehicles that produce the noise. As such, the noise metric used to describe this combination of noise is referred to as "L_{eq}". This metric allows for the fluctuations of daily traffic noise to be analyzed in terms of steady noise levels with the same acoustic energy, and thus, is the level of constant sound. The constant sound is quantified by a meter that measures units called decibels (dB). For highway traffic noise, an adjustment or weighting of the high and low-pitched sounds is made to approximate the way an average person hears. These adjusted sounds are called "A-weighted decibels" and are expressed as "dBA".

Identification of Noise Sensitive Sites

Land use plays an important role in traffic noise analyses. To determine which land uses are "noise-sensitive", this noise impact analysis used the FHWA Noise Abatement Criteria (NAC). Shown on the following page in Table 1, these criteria are divided into individual land use activity categories. For each of these categories, the FHWA determined measures which indicate the point at which traffic noise becomes intrusive, thus requiring abatement consideration. Additionally, the FDOT requires noise abatement consideration for all noise levels that approach within one decibel of the FHWA abatement criteria. These "approach" levels are also identified on Table 1 and are considered as the project impact thresholds.

One additional threshold for determining project impacts occurs when project noise levels are *below* the NAC but the predicted project-related noise levels show a substantial increase (+15 dBA or more) over existing levels. For example, if existing noise levels are 41.0 dBA and project-related noise levels are 56.0 dBA, noise abatement consideration is required due to the 15.0 dBA increase.

Table 1: Hourly A-Weighted Noise Abatement Criteria (dBA)				
Activity Category	FHWA Abatement Criteria	FDOT Approach Criteria	Evaluation Location	Description of Activity Category
A	57.0	56.0	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need; and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67.0	66.0	Exterior	Residential.
C	67.0	66.0	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, golf courses, places of worship, playgrounds, public meeting rooms, public/non-profit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52.0	51.0	Interior	Auditoriums, daycare centers, hospitals libraries, medical facilities, places of worship, public meeting rooms, public/nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72.0	71.0	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	-	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing.
G	-	-	-	Undeveloped lands that are not permitted.

In Project Segment 1, Activity Category B land uses along the study corridor consist of the subdivisions and residential neighborhoods adjacent to SR 40. These include Breakaway Trails, Il Villaggio, and Indian Springs. The Il Villaggio neighborhood is currently under construction; all lots with active building permits as of September 6, 2012 were included in this noise impact analysis. In Segment 2, Category B land uses include the Twin Rivers/Twin Rivers Estates subdivision and three single-family residences south of SR 40 near the Tomoka River.

Several Activity Category C land uses are also within the project study corridor. Located in Segment 1 are the Coquina Presbyterian Church and its Little Blessings Preschool. The preschool's playground faces SR 40 and was selected as the noise sensitive area for this parcel. Across the highway from the preschool is the Riverbend Community Church and Academy. The Academy utilizes the open lawn areas as soccer fields and general sports fields. These fields were selected to represent the exterior noise sensitive areas associated with the Church/Academy.

At the beginning of Segment 2 are the Faith Lutheran Church and its Children's House Academy. The school's playground faces SR 40 and is considered the noise sensitive area for this analysis. Other Category C land uses within Segment 2 include the Halifax Medical Center with its outdoor eating area, the outdoor eating area associated with Dunkin Donuts, and the Calvary Christian Church and Academy. The Academy has a playground facing SR 40 and a soccer field adjacent to I-95, both considered noise sensitive. In addition to the Halifax Medical Center, there are other medical offices in Segment 2; however, none have areas of exterior use and are therefore, not considered noise sensitive.

The corridor's Activity Category E land uses are located predominantly in Project Segment 2. These land uses include non-medical office buildings, hotels, and restaurants. The NAC definitions specify that for Category E land uses, only areas of frequent exterior use will be considered noise sensitive. The only property with an exterior use is the Duncan Donuts which is co-located at the BP station near the I-95 southbound on-ramp. A small concrete table with benches is located in the parking lot.

The remainder of the corridor is either Category F uses such as retail, businesses, or Category G uses like vacant land. A records search for active building permits on Category F and G lands did not identify any active permits for buildings that would be considered noise sensitive.

Consistent with FDOT and FHWA regulations, only the land uses falling under Activity Categories B, C and E were analyzed for noise impacts. There are no land uses in the study corridor which warrant an Activity Category A analysis and analysis of interior (Category D) noise levels was not required for this project.

With so many noise sensitive sites adjacent to SR 40, the noise analysis considered both front row receptors and receptors farther removed from the roadway. As such, a total of 84 Category B receptors, 6 Category C sites, and 1 Category E commercial sites were analyzed for project noise impacts. An illustration of the analyzed receptors is provided in Appendix A.

FIELD MEASUREMENTS/MODEL VALIDATION PROCESS

The FHWA Traffic Noise Model (TNM) - version 2.5 was used to predict traffic noise levels for this project. This program estimates the traffic noise level from a series of roadway segments (the source) at a noise sensitive site (the receptor). The TNM program requires certain data to be entered. These data are noise influencing variables that include the volume and types of vehicles traveling the roadway, vehicular speed and roadway geometry, and the presence of existing barriers between the road and receptor such as berms, building rows and dense trees.

Before TNM can be used to predict traffic noise field measurements are required to validate the model. Following the FHWA guidelines, noise measurements were taken at three locations using an Extech Instruments Model 407780 Type 2 Integrating Sound Level Meter. The sound level meter, calibrated at 114.0 dBA with an Extech Instruments Model 407766 calibrator, was adjusted to the A-weighted

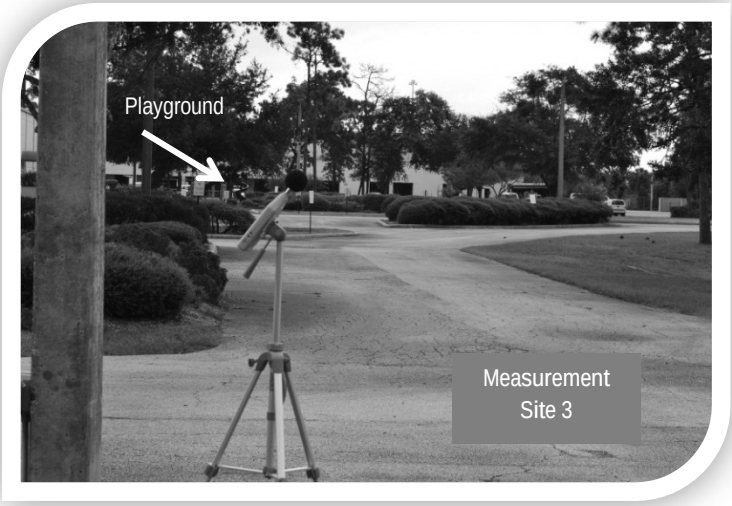
frequency scale which makes it respond more like a human ear. During each of the 10-minute monitoring sessions, traffic data was collected and included the number of cars, medium trucks (delivery-type trucks/two axles, six wheels), buses, motorcycles, and heavy trucks (tractor-trailers, concrete trucks/more than two axles) traversing the measurement site. The data collection effort also included recording the travel speed for each type of vehicle using a Bushnell Speedster hand-held radar gun.


Measurement Site 1

The weather during the September 10, 2012 monitoring session was 81°, and cloudy with a slight breeze. Rain was imminent. Field measurements were taken at three locations along the corridor. Measurement Site #1 is located in the Il Villaggio subdivision. The meter was placed in an adjacent lot fronting SR 40, 119 feet from the SR 40 westbound travel lane, a distance that is representative of the adjacent residence shown in the photo (left). In front of the sound level meter is a stand of fairly dense vegetation, although cars and trucks could be seen over the 6' subdivision wall. No unusual noise events occurred during the three 10-minute monitoring sessions.

The second measurement site is located at a commercial parcel across SR 40 from the Twin Rivers subdivision. Because the commercial building was closed, this site was selected to avoid interruptions during the monitoring sessions. The sound level meter was placed 68 feet from the SR 40 eastbound travel lane, a distance that is representative of the first row residences in Twin Rivers. As illustrated in the photo (right) there are no visual barriers blocking the meter from the roadway. No unusual noise events occurred during the three 10-minute monitoring sessions.


Measurement Site 2



The third field measurement site is located at the Calvary Christian Church 180 feet from the edge of the SR 40 westbound travel lane. As shown in the photo (left), the meter is on a line perpendicular to the school playground at a distance where playground sounds are no longer a factor of the background noise levels.

This location experiences traffic noise from the church driveway, the interior road system, SR 40 and the nearby I-95 interchange (photo right). Because of the nearby traffic signals, traffic speed along this portion of SR 40 fluctuates with each cycle. No unusual noise events occurred during the three 10-minute monitoring sessions.

Since all noise levels in this analysis are based on a one-hour period, each of the 10-minute field-recorded traffic volumes were adjusted upward by a factor of "6" to reflect hourly traffic flow. The Table 2 series on the following page presents the traffic data used to validate the model. Validation of TNM occurs when the model-predicted noise levels are within three decibels of the field-measured levels. As shown in Table 2, TNM predicted within the 3.0 decibel acceptance range noise levels for all field-measured sites. The model, therefore, is considered validated and acceptable for predicting existing and future noise levels for this project.

Table 2: Traffic Noise Prediction Model Validation												
Site 1: Il Villaggio – Single-Family Residence												
	Run 1: 10:30 – 10:40 a.m. Field Measurement – 55.0 dBA TNM Prediction – 56.4 dBA				**Run 2**: 10:40 – 10:50 a.m. Field Measurement – 56.9 dBA TNM Prediction – 57.4 dBA				**Run 3**: 10:52 – 11:02 a.m. Field Measurement – 53.3 dBA TNM Prediction – 55.6 dBA			
Mode	EB SR 40		WB SR 40		EB SR 40		WB SR 40		EB SR 40		WB SR 40	
	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed
Car	283	47	173	47	317	58	195	58	301	52	185	52
Medium Truck	25	47	15	47	27	49	17	49	26	47	16	47
Heavy Truck	15	44	14	44	22	49	9	49	19	45	11	45
Bus	0	0	0	0	0	0	0	0	0	0	0	0
Motorcycle	0	0	0	0	4	52	2	52	4	51	2	51
Unusual Occurrences	Nearby construction activity				None.				None.			
Site 2: Calvary Christian Church/Academy - Playground												
	Run 1: 11:14 – 11:24 a.m. Field Measurement – 60.7 dBA TNM Prediction – 62.9 dBA				**Run 2**: 11:24 – 11:34 a.m. Field Measurement – 61.8 dBA TNM Prediction – 62.5 dBA				**Run 3**: 12:30 – 12:40 p.m. Field Measurement – 60.5 dBA TNM Prediction – 61.2 dBA			
Mode	EB SR 40		WB SR 40		EB SR 40		WB SR 40		EB SR 40		WB SR 40	
	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed
Car	594	48	636	48	636	46	678	46	696	36	744	36
Medium Truck	30	33	18	33	30	34	18	34	36	34	24	34
Heavy Truck	18	42	6	42	24	41	6	41	24	34	12	34
Bus	0	0	0	0	0	0	0	0	0	0	0	0
Motorcycle	12	47	0	47	12	47	6	47	6	41	6	41
Unusual Occurrences	None.				None.				None.			

Table 2: Traffic Noise Prediction Model Validation (cont.) Site 3: Office Building (Twin Rivers)												
	Run 1: 10:05 – 10:15 a.m. Field Measurement –64.7 dBA TNM Prediction – 65.9 dBA				Run 2: 1:12 – 1:22 p.m. Field Measurement – 62.5 dBA TNM Prediction – 63.9 dBA				Run 3: 1:22 - 1:32 p.m. Field Measurement – 63.6 dBA TNM Prediction – 65.9 dBA			
Mode	EB SR 40		WB SR 40		EB SR 40		WB SR 40		EB SR 40		WB SR 40	
	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed	Count	Avg. Speed
Car	678	46	570	46	534	45	864	45	1104	46	1212	46
Medium Truck	42	45	66	45	30	43	30	43	36	44	30	44
Heavy Truck	6	43	18	43	6	43	18	43	12	44	15	44
Bus	0	0	0	0	0	0	0	0	0	0	0	0
Motorcycle	6	45	18	45	6	45	12	45	12	45	0	0
Unusual Occurrences	None.				None.				None.			

TRAFFIC INPUT DATA

Once validation has occurred, TNM is ready to predict existing and future noise conditions. Traffic volumes for the existing condition were obtained from actual FDOT traffic counts. Traffic for the 2035 design year represents the worst-case condition in terms of noise for both the No-Build and Build Alternatives. Noisiest conditions occur when the maximum amount of traffic is traveling at posted speed while maintaining a Level of Service (LOS) "C". These LOS C volumes were derived from the FDOT Level of Service Manual included in this report as Appendix B. Also included in Appendix B are the 2011 FDOT traffic counts that are representative of the existing condition. The traffic volumes as they were applied to TNM are also presented in the Appendix.

NOISE ANALYSIS RESULTS

An illustration of typical exterior and interior noises and their associated decibel reading are presented on the following page in Table 3. This graph provides the reader a better understanding of the noise levels discussed herein. Noise levels that reach or exceed 66.0 dBA at Category B and C land uses will require noise abatement consideration. Noise levels that reach or exceed 71.0 dBA for Category E land uses will also require abatement consideration.

With 84 Category B receptors, six Category C sites, and one Category E noise-sensitive commercial site adjacent to the study corridor, the reporting of project noise levels was simplified by using 37 representative receptors. A discussion of the project's noise impact on these representative receptors follows. An illustration of all 91 analyzed sites is provided as Appendix A.

Table 3: Comparative Noise Levels		
Outside Activity	**dBA**	**Inside Activity**
	110	Rock Band
Jet Flyover at 1,000 ft.		
	100	
Gas Lawn Mower at 3 ft.		
	90	
Diesel Truck at 50 mph (at 50 ft.)		Food Blender at 3 ft.
	80	Garbage Disposal at 3 ft.
Busy Urban Area Daytime		
	71	Activity Category "E" NAC Threshold
Gas Mower at 100 ft.	*70*	Vacuum Cleaner at 10 ft.
Activity Category "B/C" NAC Threshold	*66*	
		Busy Restaurant
Heavy Traffic at 300 ft.	*60*	Normal Speech at 3 ft.
		Large Business Office
Quiet Urban Daytime	*50*	
Quiet Urban Nighttime	*40*	Large Conference Room (background)
Quiet Suburban Nighttime		
	30	Library
Quiet Rural Nighttime		Bedroom at Night
	20	
	10	
Threshold of Human Hearing	*0*	Threshold of Human Hearing
Sources: California Dept. of Transportation Technical Noise Supplement, Oct. 1998, Aviation Noise Effects Report No. FAA-EE-85-2		

Existing Condition

For the majority of the existing study corridor, TNM-predicted noise levels fall below the FHWA Noise Abatement Criteria with the exception of the soccer fields at Calvary Christian Academy. This site is predicted to approach the FHWA 67.0 dBA noise abatement criterion with a predicted noise level of 66.1 dBA.

FHWA also considers a receptor to be impacted if future No-Build or Build noise levels increase 15 dBA or more over existing conditions. Consequently, the existing noise level at each of the 37 representative receptors was compared to the Year 2035 predictions for both the No-Build and Build Alternatives as summarized on the following page in Table 4.

Table 4: Noise Impact Summary									
Representative Noise Receptor			Analyzed Scenario/Alternative						Consider Abatement
			Year 2012 Existing Scenario		Year 2035 No-Build	Year 2035 Build			
Receptor ID	Sites Represented	NAC/ Impact Criterion (dBA)	Distance *	Projected Noise Level (dBA)	Projected Noise Level (dBA)	Distance *	Projected Noise Level (dBA)	Change From Existing (dBA)	
Segment 1: West of Tymber Creek Road									
Breakaway Trails									
BT1	1	B/66.0	515'	49.8	54.5	520	56.6	6.8	-
BT2	4	B/66.0	304'	53.0	57.7	304	60.0	7.0	-
BT3	2	B/66.0	220'	56.2	60.9	204	64.1	7.9	-
BT4	5	B/66.0	381'	52.3	57.0	370	59.9	7.6	-
BT5	1	B/66.0	429'	52.6	57.2	415	59.7	7.1	-
BT6	2	B/66.0	314'	55.1	59.7	285	62.3	7.2	-
BT7	6	B/66.0	189'	58.0	62.6	197	65.0	7.0	-
BT8	6	B/66.0	359'	54.0	58.6	366	61.4	7.4	-
BT9	6	B/66.0	364'	54.5	59.2	328	60.9	6.4	-
Il Villaggio									
IV1	2	B/66.0	182'	57.6	62.3	170	65.3	7.7	-
IV2	1	B/66.0	114'	58.9	63.6	100	65.8	6.9	-
IV3	2	B/66.0	392'	51.1	55.7	380	57.9	6.8	-
IV4	1	B/66.0	96'	57.1	61.8	83	64.2	7.1	-
IV5	2	B/66.0	336'	52.2	56.8	326	59.5	7.3	-
IV6	3	B/66.0	590'	49.1	53.5	578	56.1	7.0	-
IV7	2	B/66.0	366'	52.6	57.1	357	60.1	7.5	-
Indian Springs									
IS1	2	B/66.0	146'	58.8	63.5	139	65.7	6.9	-
IS2	1	B/66.0	462'	51.4	55.8	448	58.1	6.7	-
IS3	3	B/66.0	237'	56.3	60.8	226	63.7	7.4	-
IS4	1	B/66.0	492'	51.9	56.0	484	59.5	6.6	-
Little Blessings Preschool	Playground	C/66.0	429'	52.9	56.9	416	59.8	6.9	-
Riverbend Church & Academy	soccer fields	C/66.0	355'	54.0	58.5	342	61.3	7.3	-
Segment 2: East of Tymber Creek Road									
Faith Lutheran & Children's House Academy	Playground	C/66.0	127'	63.5	63.3	112	68.8	5.3	✔ Yes

Continued on following page.

Table 4: Noise Impact Summary (Cont.)									
Representative Noise Receptor			Analyzed Scenario/Alternative						Consider Abatement
			Year 2012 Existing Scenario		Year 2035 No-Build	Year 2035 Build			
Receptor ID	Sites Represented	NAC/ Impact Criterion (dBA)	Distance *	Projected Noise Level (dBA)	Projected Noise Level (dBA)	Distance *	Projected Noise Level (dBA)	Change From Existing (dBA)	
Segment 2: East of Tymber Creek Road (Cont.)									
Twin Rivers									
TR1	3	B/66.0	228'	59.8	60.1	213	64.6	4.8	-
TR2	4	B/66.0	115'	63.8	63.2	85	68.0	4.2	✓ Yes
TR3	4	B/66.0	273'	57.4	57.0	280	62.0	4.6	-
TR4	3	B/66.0	186'	56.3	59.7	191	64.7	8.4	-
TR5	6	B/66.0	284'	58.0	57.5	288	60.0	2.0	-
TR6	1	B/66.0	285'	58.6	58.0	274	60.9	2.3	-
TR7	6	B/66.0	444'	55.7	55.2	436	57.8	2.1	-
TR8	1	B/66.0	406'	56.7	56.1	406	59.6	2.9	-
Scattered Residences									
R1	2	B/66.0	273'	58.1	57.5	275	62.4	4.3	-
R2	1	B/66.0	256'	58.4	57.8	250	61.8	3.4	-
Halifax Medical	outdoor eating	C/66.0	396'	58.8	58.5	369	60.9	2.1	-
Calvary Christian Academy	Playground	C/66.0	353'	61.4	61.3	340	63.1	1.7	-
Calvary Christian Academy	Soccer	C/66.0	351'	66.1	66.3	168	66.7	0.6	✓ Yes
Dunkin Donuts	outdoor eating	E/71.0	115'	69.5	69.3	101'	71.4	1.9	✓ Yes
* = Distance measured from edge of nearest SR 40 travel lane or I-95 ramp.									

No-Build Alternative

When Level of Service (LOS) "C" traffic volumes were applied to the existing road network to represent worst-case traffic noise conditions with the 2035 No-Build Alternative, predicted noise levels throughout most of the study area increased over existing conditions. However, in no instance is the increase considered substantial, nor are there any new noise impacts. Instead, only the soccer fields at Calvary Christian Academy remain impacted.

Build Alternative

With the proposed SR 40 widening in place, predicted noise levels through Project Segment 1 increase an average of 7.1 dBA. While noticeable, the increased noise levels are not considered substantial nor do they constitute an impact to any of the subdivisions (Breakaway Trail, Il Villaggio, Indian Springs) or to the Little Blessings Preschool or the Riverbend Church and Academy.

While predicted noise levels throughout Segment 2 average an increase of 2.9 dBA over existing conditions, four locations are predicted to have noise levels that either approach or exceed the FHWA Noise Abatement Criteria. The first project noise impact occurs at the playground associated with the Children's House Academy. As previously summarized in Table 4, this FHWA Activity Category C site is predicted to have a project-related noise level of 68.8 dBA, with a noticeable 5.3 dBA increase over existing conditions.

The second noise impact occurs in the Twin Rivers neighborhood at representative receptor TR2. This receptor, representing four single-family residences (Category B sites), is predicted to have project-related noise levels of 68.0 dBA, an increase of 4.2 dBA over existing conditions.

The third impacted site is the outdoor seating area of the Dunkin Donuts. This Category E restaurant is co-located with the BP gas station adjacent to the I-95 southbound entrance ramp. Despite a negligible project-related noise level increase of 1.9 dBA over the existing condition, the predicted noise level of 71.4 dBA approaches the FHWA 72.0 dBA noise abatement criterion.

The fourth impacted site is the Calvary Christian Academy soccer field. Because of its location near the I-95 mainline, this site is impacted under all analyzed alternatives, including the existing condition. Despite predicted project noise level remaining virtually identical to the existing condition (0.6 dBA), the overall noise level of 66.7 dBA approaches the FHWA 67.0 dBA noise abatement criterion for Activity Category C land uses.

Consequently, abatement consideration is required for each of these four receptors, representing four single-family residences (TR2), two recreation areas (Children's House Academy playground and Calvary Christian Academy soccer field), and one restaurant (Dunkin Donuts).

NOISE ABATEMENT CONSIDERATION

The abatement measure analyzed for this project is the construction of noise barriers. Noise barriers reduce the sound that enters a community from a busy roadway by reflecting it back across the road and by forcing the noise to take a longer path over and around the barrier. The FDOT requires these barriers to be positioned 5-feet inside the FDOT rights of way to facilitate construction and future maintenance. They cannot obstruct safe access to adjacent properties and streets. They must also allow adequate driver visibility of SR-40 from an adjacent driveway or side street.

Feasibility Analysis

When analyzing noise barriers two main factors are considered; the first factor is feasibility. Feasibility focuses on the barrier's ability to reduce traffic noise at affected properties. In order to be effective, a barrier must block the impacted receptor's line of sight to the noise source. FHWA requires that noise barriers achieve a minimum noise reduction of 5.0 dBA *at two* impacted receptors. This is the point at which a lowered noise level is noticeable and is the threshold for determining whether a site benefits from a barrier.

Reasonableness Analysis

The total cost of an economically reasonable barrier cannot exceed $42,000 per benefited receptor, including costs associated with additional right of way and/or easements. For this project, estimated barrier costs were calculated using the current FDOT statewide average of $30 per square foot. In addition to cost, the barrier must also meet the FDOT abatement design goal of 7.0 dBA for *at least one* impacted site behind the analyzed barrier.

Children's House Academy Barrier Analysis

To determine feasibility of providing abatement for the playground, a 547-foot long noise wall was analyzed inside the FDOT south right of way of SR 40 (refer to Figure 4 on the following page). Summarized below in Table 5, various wall heights were assessed for maximum effectiveness; the goal being to first achieve he FHWA 5.0 dBA minimum noise reduction requirement and then to attain the FDOT noise reduction design goal of 7.0 dBA. At a height of 14 feet, the noise barrier achieves both of these requirements and is thereby considered feasible for further reasonableness evaluation.

Table 5: Children's House Academy Barrier Feasibility Analysis

Receptor ID	Existing Noise Level (dBA)	Predicted Noise Level Without Barrier (dBA)	Estimated Noise Reduction (dBA) Total Length – 547'			
			10'	12'	14'	16'
Playground	67.2	67.4	5.2	6.5	7.2	7.7
Conclusion: Analyzed noise barrier is feasible.						

Children's House Academy
Analyzed Noise Barrier

Figure 4

This Activity Category C receptor requires a separate cost calculation method using the FDOT's Special Use Matrix shown below as Table 6. By applying the following assumptions to the matrix calculations, the noise barrier for the Children's House Academy is not cost-reasonable.

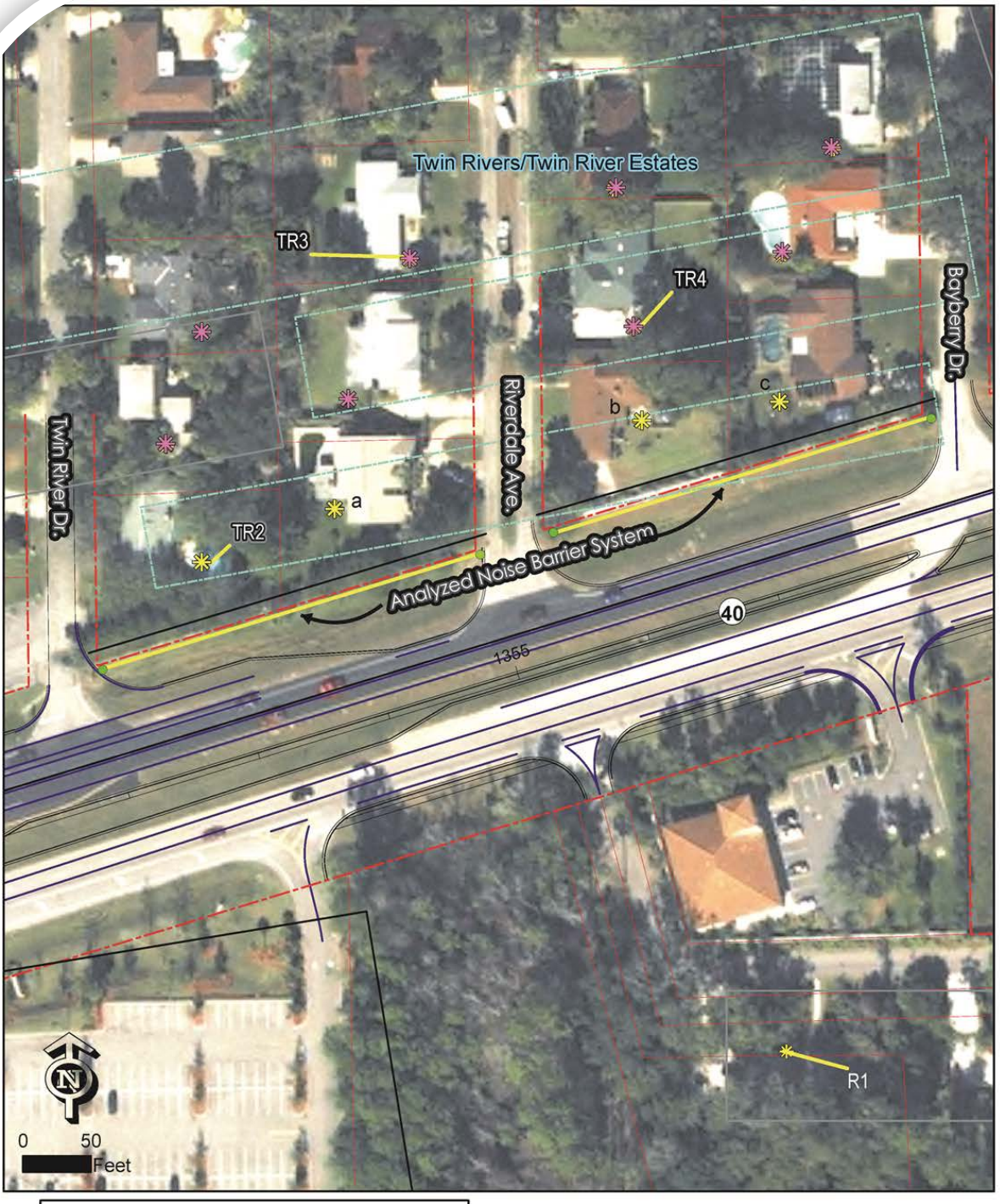
Assumptions:

- Estimated average amount of time that a person uses the playground 1 hour per visit.
- Average number of people that use the playground:
  - Avg. enrollment – 45 students (obtained from the Academy's website)
  - Estimated staff – 3 administrators and 7 teachers = 10 staff

Table 6: Children's House Academy Special Use Cost Reasonable Analysis		
Line	Criteria	Input
1	Length of analyzed barrier	547 ft.
2	Min. height of analyzed barrier	14 ft.
3	Multiply Line 1 by Line 2	7,658 ft^2
4	Enter the average amount of time that a person stays at the site per visit	1 hours
5	Enter the average number of people that use this site per day that will receive at least 5 dBA benefit from abatement at this site.	55
6	Multiply Line 4 by Line 5	55 person-hr.
7	Divide Line 3 by Line 6	139 ft^2/person-hr.
8	Multiply $42,000 by Line 7	$5,847,927 per person-hr per ft^2
9	Does Line 8 exceed the "abatement cost factor" of $995,935 person-hr/$ft^2$?	Yes
10	If Item 9 is no, abatement is reasonable.	*1
11	If Item 9 is yes, abatement is not reasonable.	Not Reasonable
*1 = To be cost-reasonable, 323 people would need to use the playground each day.		

Twin Rivers Barrier Analysis

Traffic noise impacts are predicted at four residences closest to SR 40 as represented by receptor TR2. Side street access to SR 40 presents a challenge to designing a continuous barrier for these four residences, as illustrated on the following page in Figure 5. Considered a Common Noise Environment, the analyzed noise barrier for these residences consists of a two-wall system. The west wall is situated between Twin Rivers Drive and Riverside Avenue. The east wall is positioned between Riverside Avenue and Bayberry Drive. Combined length of the system is approximately 570 feet.



LEGEND
- Impacted/Benefited Residence
- Not Impacted/Not Benefited Residence
- FDOT Right of Way

Twin Rivers
Analyzed Noise Barrier System

Figure 5

Summarized below in Table 7, the Twin Rivers barrier system was assessed at varying heights to determine at what height the FHWA 5.0 dBA minimum noise abatement criterion would be met; at what height the FDOT 7.0 dBA noise reduction design goal would be met; and to determine the most cost-reasonable dimension. At heights above 14 feet, the barrier is able to achieve both the FHWA and FDOT noise abatement requirements at all four impacted residences; but not within the $42,000 cost per benefited receptor criterion. Thus, abatement at this location is not cost reasonable.

Table 7: Twin Rivers Barrier Analysis

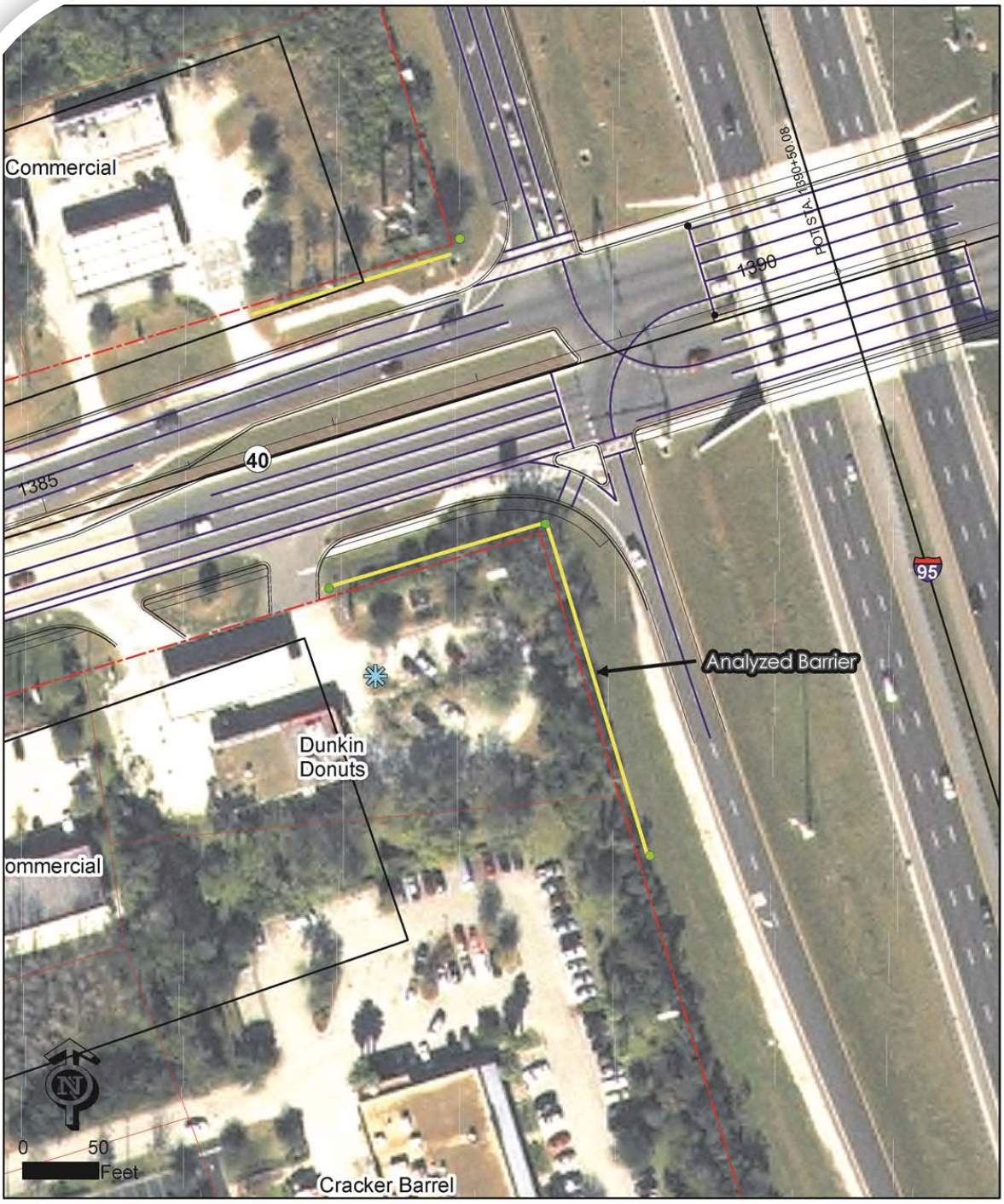
Receptor ID	Noise Sensitive Sites	Existing Noise Level (dBA)	Predicted Noise Level Without Barrier (dBA)	Estimated Noise Reduction (dBA) Total Length – 570'			
				10'	12'	14'	16'
TR1	3	59.8	64.6	<5.0	<5.0	<5.0	<5.0
TR2	1	63.8	68.0	5.1	5.7	6.1	6.3
TR2a	1	-	67.3	5.3	5.9	6.3	6.7
TR2b	1	-	67.0	5.4	6.0	6.4	6.7
TR2c	1	-	67.5	5.8	6.5	7.0	7.3
TR3	4	57.4	62.0	<5.0	<5.0	<5.0	<5.0
TR4	3	56.3	64.7	<5.0	<5.0	<5.0	<5.0
Number of Benefited and Impacted Noise Sensitive Receptors				4	4	4	4
Number of Benefited/Not Impacted Receptors				0	0	0	0
Average Noise Reduction For All Benefited Receptors				5.4 dBA	6.0 dBA	6.5 dBA	6.8 dBA
Total Cost of Noise Barrier				$171,000	$205,200	$239,400	$273,600
Cost per Benefited Receptor				$42,750	$51,300	$59,850	$68,400
Conclusion: Not cost reasonable.							

Dunkin Donuts Barrier Analysis

The only impacted Activity Category E site is the outdoor eating area of the Dunkin Donuts. Located on the corner of SR 40 and the I-95 southbound entrance ramp, this area receives traffic noise impacts from both roadways. To provide optimum coverage, the analyzed noise barrier begins 5 feet inside the FDOT south right of way on SR 40 and continues south along the limited access right of way for the I-95 ramp. The total length of the barrier is 372 feet. Providing an adequate sound shadow for the impacted site is constrained by the eastern-most driveway at the BP Station/Dunkin Donuts, as illustrated on the following page in Figure 6. The FHWA required 5.0 dBA minimum noise reduction requirement cannot be met at this location (refer to Table 8).

Table 8: Dunkin Donuts Barrier Feasibility Analysis

Receptor ID	Existing Noise Level (dBA)	Predicted Noise Level Without Barrier (dBA)	Estimated Noise Reduction (dBA) Total Length – 372'			
			14'	18'	20'	22'
Dunkin Donuts	69.5	71.4	2.3	3.6	3.9	4.1
Conclusion: Not Feasible.						



Dunkin Donuts
Analyzed Noise Barrier

Figure 6

Calvary Christian Academy Barrier Analysis

To determine the extent of traffic noise impacts, additional "receptor" points were laid in a grid pattern that represents the entire field, as illustrated on the following page in Figure 7. By including the additional points in TNM, the area of impact was confined to the hatched area containing receptors a, b, and d. The remainder of the soccer fields is not impacted by the traffic noise.

Providing an adequate sound shadow for the impacted area is constrained by the commercial driveways accessing SR 40. This constraint, combined with the distance of the field to the analyzed barrier, does not allow the barrier to achieve FHWA's 5.0 dBA minimum noise reduction requirement (refer to Table 9). Consequently, a barrier at this location is not feasible.

Table 9: Calvary Christian Academy Soccer Field Barrier Analysis

Receptor ID	Noise Sensitive Sites	Existing Noise Level (dBA)	Predicted Noise Level Without Barrier (dBA)	Estimated Noise Reduction (dBA) Total Length – 358'			
				16'	18'	20'	22'
a	1	66.1	66.8	<5.0	<5.0	<5.0	<5.0
b	1	-	66.3	<5.0	<5.0	<5.0	<5.0
d	1	-	66.1	<5.0	<5.0	<5.0	<5.0
Average Noise Reduction for Benefited Areas				<5.0	<5.0	<5.0	<5.0
Conclusion: Cannot achieve FHWA 5.0 dBA minimum noise reduction requirement. Not Feasible.							

STATEMENT OF LIKELIHOOD

Based on the noise analysis performed to date, there appears to be no apparent solutions available to mitigate the noise impacts at the four impacted Activity Category B residences represented in this report by receptor TR2; two Category C sites (Children's House Academy playground and Calvary Christian Academy soccer fields); nor to the outdoor eating area affiliated with the Dunkin Donuts, a Category E land use.

The Florida Department of Transportation is committed to reevaluating project noise impacts during the subsequent final design phase and will commit to constructing noise barriers contingent upon the following conditions:

- Further analysis conducted during the project's final design phase supports the need, feasibility and reasonableness of providing noise abatement;
- Viewpoints of the impacted property owners/renters are in favor of noise barrier construction, where applicable; and
- Safety and engineering aspects, as related to the roadway user and adjacent property owners, have been reviewed and any conflict or issues resolved.

Calvary Christian Academy
Analyzed Noise Barrier

Figure 7

PUBLIC COORDINATION

NOISE IMPACT CONTOURS

The Florida Department of Transportation is committed to working with local governments, developers, and residents by providing them access to this Noise Study Report. To aid local government officials in promoting compatibility between land development and the proposed project, potential noise impact contours were developed for this project and are included on the following page in Figure 8. These contours represent the approximate distance at which the FHWA noise abatement criteria will be approached with implementation of the proposed project. Please note these are unshielded contours that do not consider the noise reduction effects of buildings, elevation changes, or adjacent vegetation.

For purposes of this noise analysis, only exterior land uses falling under Activity Categories B, C and E were analyzed for noise impacts. There are no land uses in the study corridor which warrant an Activity Category A analysis. Additionally, analysis of Activity Categories F and G land uses are not required pursuant to FHWA and FDOT guidelines.

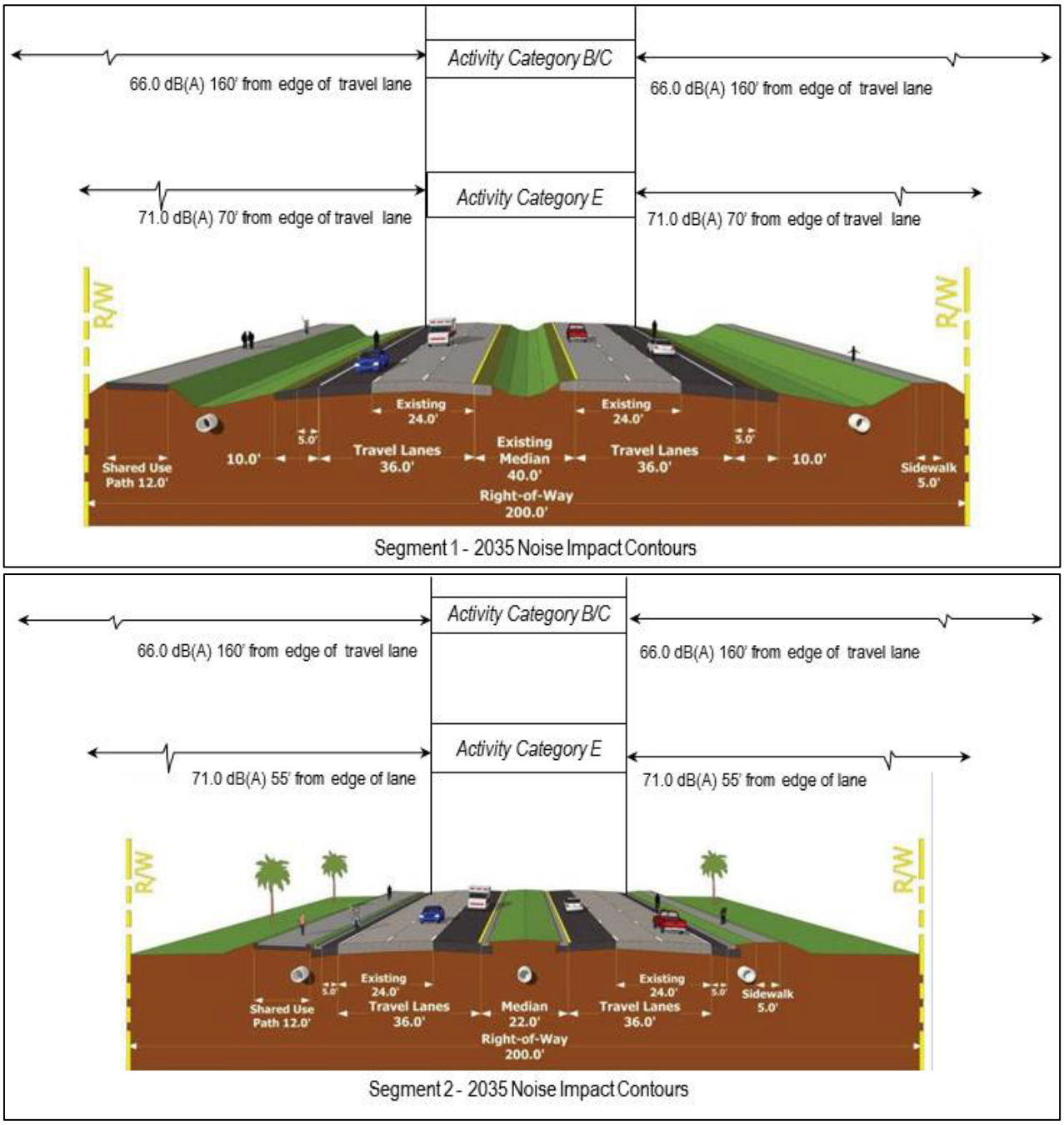


Figure 8: Project Noise Impact Contours

CONSTRUCTION NOISE AND VIBRATION IMPACTS

Trucks, earth moving and pile driving equipment, pumps, and generators are construction noise and vibration sources. Peak noise levels from these types of equipment are in short duration and may vary from 70.0 dBA to 100.0 dBA. Construction of the proposed project will have a temporary noise and vibration impact on all noise sensitive sites previously identified in Table 4 of this Noise Study Report. There are no additional land uses within and/or near the project study area, that are construction and/or noise sensitive.

The contractor will adhere to the most current FDOT Standard Specifications for Road and Bridge Construction, and any special provisions in the construction contract which are related to the control of noise and vibration impacts. The FDOT Standard Specifications contain the following requirements for construction noise and vibration control:

- The contractor shall operate only factory recommended exhaust mufflers on internal combustion engines;
- Pile driving operations will be restricted to the hours between 7:00 am and 10:00 pm to avoid interfering with any adjacent noise and/or vibration sensitive land uses or a different foundation design will be considered (i.e., a drilled shaft);
- Preformed pile holes will be required where they are in proximity to vibration-sensitive land uses to maximize vibration transfer;
- Back up alarm noise from heavy equipment and trucks will be minimized by requiring the contractor to operate in forward passes or in a figure eight pattern when dumping, spreading, or compacting material;
- Adequate equipment maintenance procedures will be used to insure that the elimination of unnecessary noise caused by loose body parts on all construction equipment;
- Excessive tailgate banging by haul trucks will be prohibited;
- All stationary equipment shall be screened from noise sensitive receptors if the equipment is to operate beyond normal working hours. If feasible, the equipment shall be screened during normal working hours to reduce noise impacts; and
- When feasible, the contractor shall establish haul routes to direct vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

Specific noise impact problems that may arise during construction of the project will be addressed by the Construction Engineer in cooperation with the appropriate FDOT Environmental Specialist.

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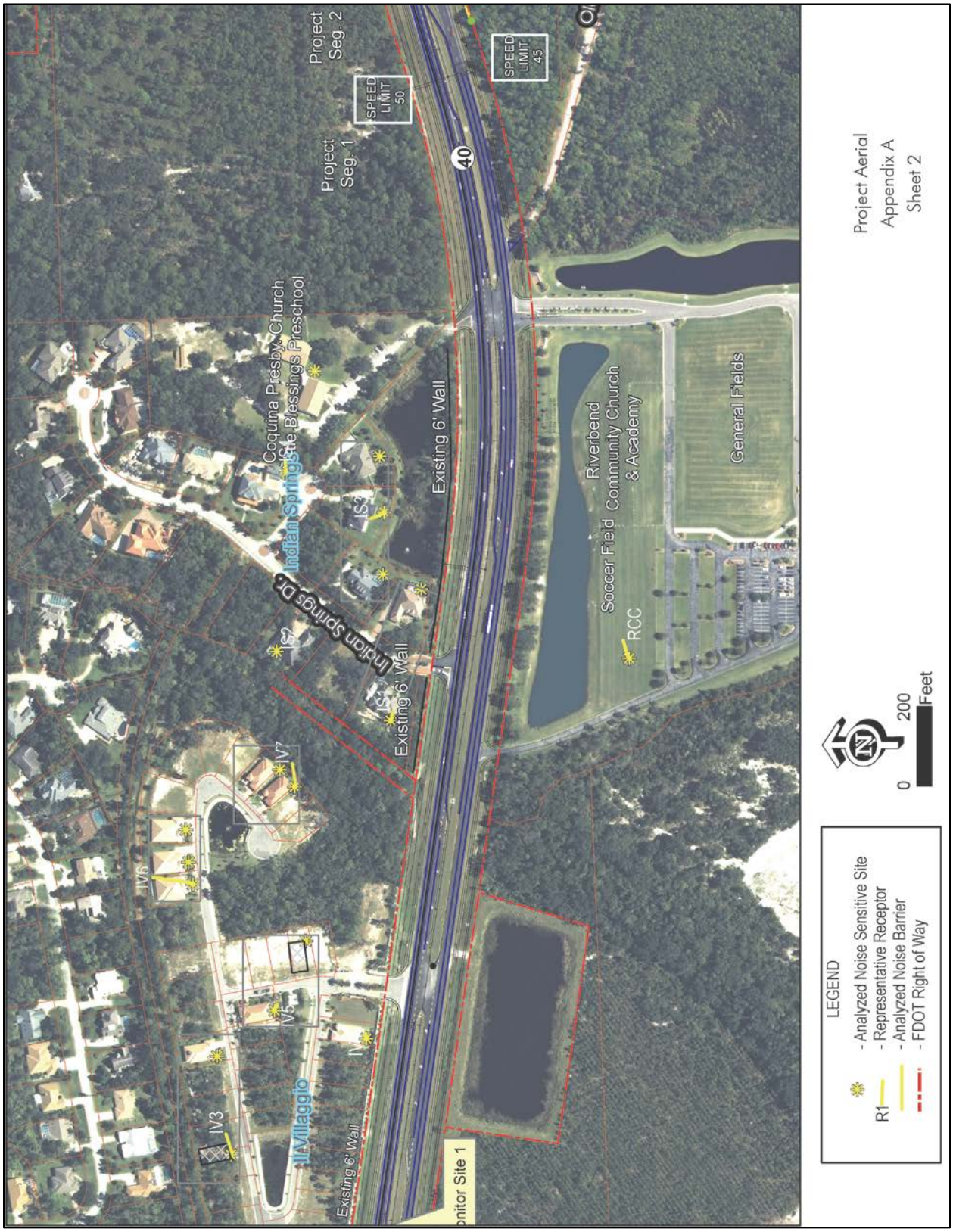
Monitor Site 1
Existing 6' Wall
V1
BT9
BT8
BT7
BT6
BT5
BT4
BT3
BT2
BT1
Breakaway Trails
Breakaway Trail
40
Begin Project
Project Aerial
Appendix A
Sheet 1
LEGEND
- Analyzed Noise Sensitive Site
R1 - Representative Receptor
- Analyzed Noise Barrier
- FDOT Right of Way
0
200
Feet


Project Seg. 2
Project Seg. 1
SPEED LIMIT 50
SPEED LIMIT 45
40
Coquina Presby. Church
Indian Springs Preschool
Indian Springs Dr
Existing 6' Wall
Existing 6' Wall
Existing 6' Wall
IS3
IS4
IV7
IV6
IV5
IV3
IV
Villaggio
Riverbend Community Church & Academy
Soccer Field
RCC
General Fields
LEGEND
- Analyzed Noise Sensitive Site
- Representative Receptor
- Analyzed Noise Barrier
- FDOT Right of Way
R1
0
200
Feet
Project Aerial
Appendix A
Sheet 2


TR8
TR6
TR7
TR5
R2
Twin Rivers/Twin Pines Estates
Bayberry Dr.
40
R1
TR4
Riverdale Ave.
TR3
TR2
Twin River Dr.
TR1
Commercial/Storage
Tymber Creek Rd.
Tymber Creek Rd.
Walgreens
Child's House
Playground
Faith Lutheran Academy
Church
Old Tomoka Rd W.
Project Seg. 2
SPEED LIMIT 50
SPEED LIMIT 45
Project Seg. 1
LEGEND
- Analyzed Noise Sensitive Site
- Representative Receptor
- Analyzed Noise Barrier
- FDOT Right of Way
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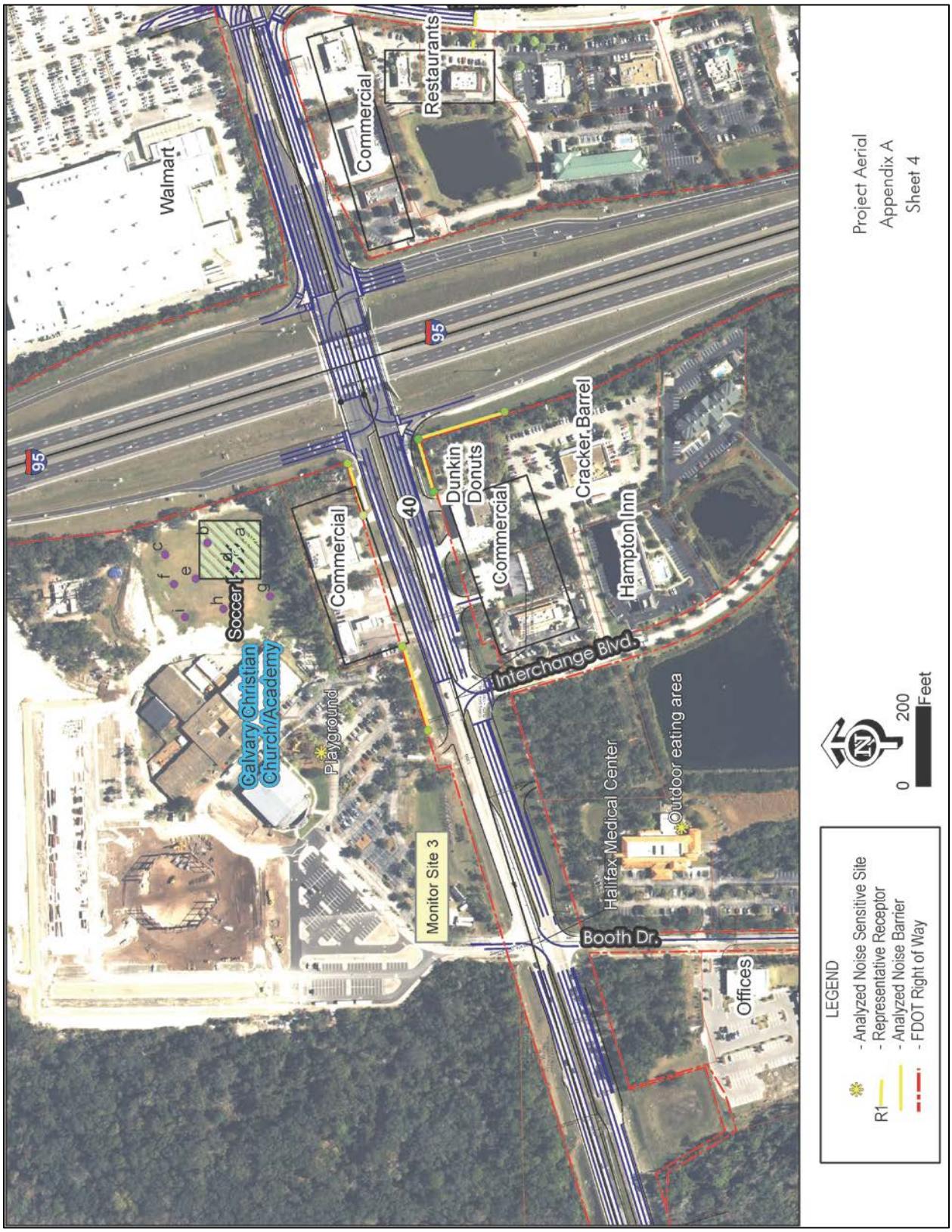
200
Feet
Project Aerial
Appendix A
Sheet 3


Walmart
Commercial
Restaurants
95
40
Dunkin Donuts
Cracker Barrel
Commercial
Hampton Inn
Commercial
Soccer
Calvary Christian Church/Academy
Playground
Interchange Blvd.
Outdoor eating area
Halifax Medical Center
Monitor Site 3
Booth Dr.
Offices
LEGEND
- Analyzed Noise Sensitive Site
- Representative Receptor
- Analyzed Noise Barrier
- FDOT Right of Way
R1
0
200
Feet
Project Aerial
Appendix A
Sheet 4

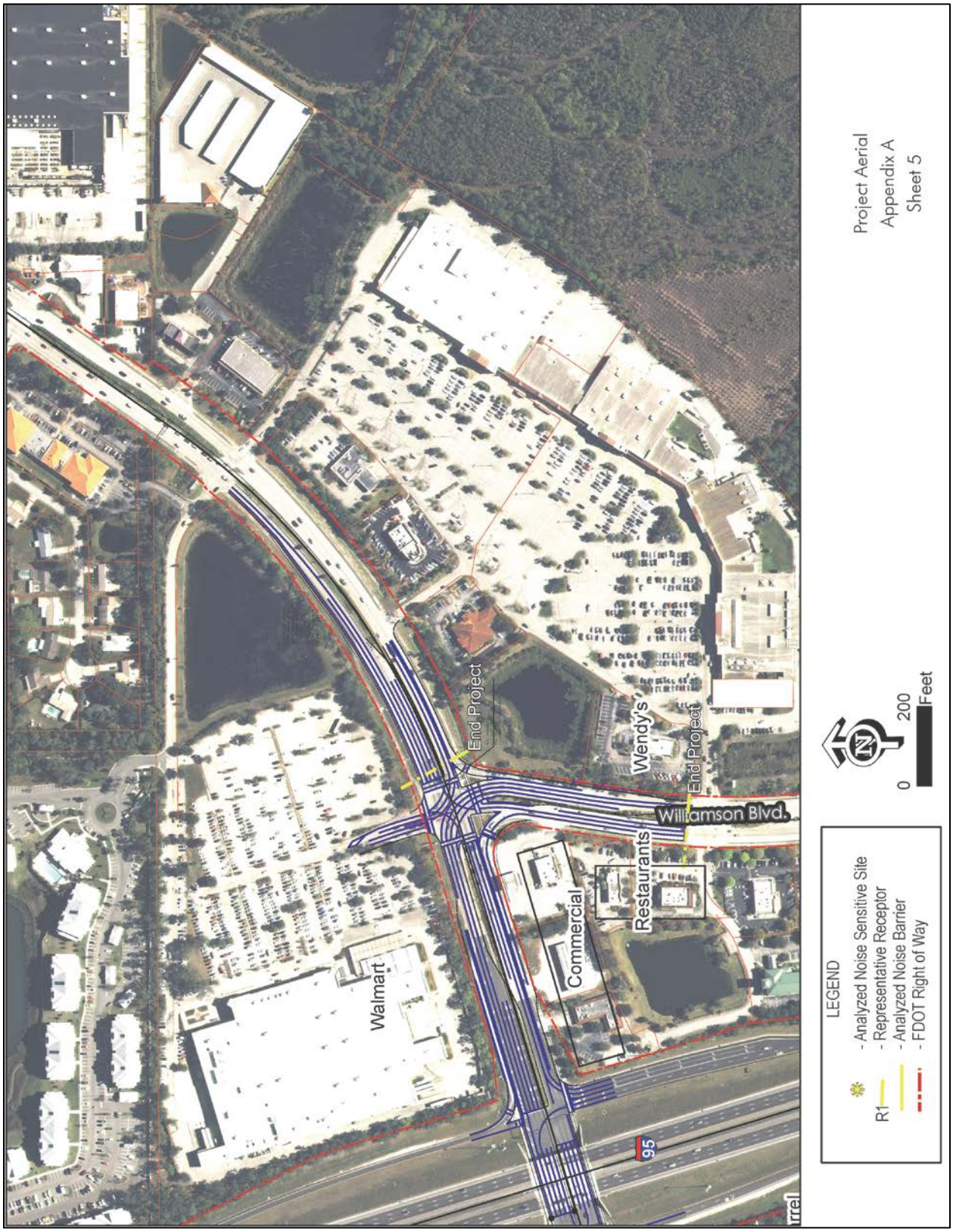

Project Aerial
Appendix A
Sheet 5
LEGEND
- Analyzed Noise Sensitive Site
- Representative Receptor
- Analyzed Noise Barrier
- FDOT Right of Way
R1
0
200
Feet
End Project
Wendy's
End Project
Williamson Blvd.
Restaurants
Commercial
Walmart
95

TABLE 1

Generalized **Annual Average Daily** Volumes for Florida's **Urbanized Areas**[1]

10/4/10

W. Tymber Creek

E. Tymber Creek

I-95

STATE SIGNALIZED ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	9,600	15,400	16,500	***
4	Divided	29,300	35,500	36,700	***
6	Divided	45,000	53,700	55,300	***
8	Divided	60,800	71,800	73,800	***

Class II (2.00 to 4.50 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	**	10,500	15,200	16,200
4	Divided	**	25,000	33,200	35,100
6	Divided	**	39,000	50,300	53,100
8	Divided	**	53,100	67,300	70,900

Class III/IV (more than 4.5 signalized intersections per mile)

Lanes	Median	B	C	D	E
2	Undivided	**	5,100	11,900	14,900
4	Divided	**	12,600	28,200	31,900
6	Divided	**	19,700	43,700	48,200
8	Divided	**	27,000	59,500	64,700

FREEWAYS

Lanes	B	C	D	E
4	43,500	59,800	73,600	79,400
6	65,300	90,500	110,300	122,700
8	87,000	120,100	146,500	166,000
10	108,700	151,700	184,000	209,200
12	149,300	202,100	238,600	252,500

Freeway Adjustments

Auxiliary Lanes	Ramp Metering
+ 20,000	+ 5%

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Median	B	C	D	E
2	Undivided	7,800	15,600	22,200	27,900
4	Divided	34,300	49,600	64,300	72,800
6	Divided	51,500	74,400	96,400	109,400

Uninterrupted Flow Highway Adjustments

Lanes	Median	Exclusive left lanes	Adjustment factors
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Major City/County Roadways	- 10%
Other Signalized Roadways	- 35%

State & Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Divided/Undivided & Turn Lane Adjustments

Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
–	–	–	Yes	+ 5%

One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6.

BICYCLE MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/ Bicycle Lane

Coverage	B	C	D	E
0-49%	**	3,200	12,100	>12,100
50-84%	2,400	3,700	>3,700	***
85-100%	6,300	>6,300	***	***

PEDESTRIAN MODE[2]

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	B	C	D	E
0-49%	**	**	5,000	14,400
50-84%	**	**	11,300	18,800
85-100%	**	11,400	18,800	>18,800

BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

Sidewalk Coverage	B	C	D	E
0-84%	>5	≥4	≥3	≥2
85-100%	>4	≥3	≥2	≥1

[1] Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. Although presented as daily volumes, they actually represent peak hour direction conditions with applicable K and D factors applied. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the Highway Capacity Manual, Bicycle LOS Model, Pedestrian LOS Model and Transit Capacity and Quality of Service Manual, respectively for the automobile/truck, bicycle, pedestrian and bus modes.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of motorized vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

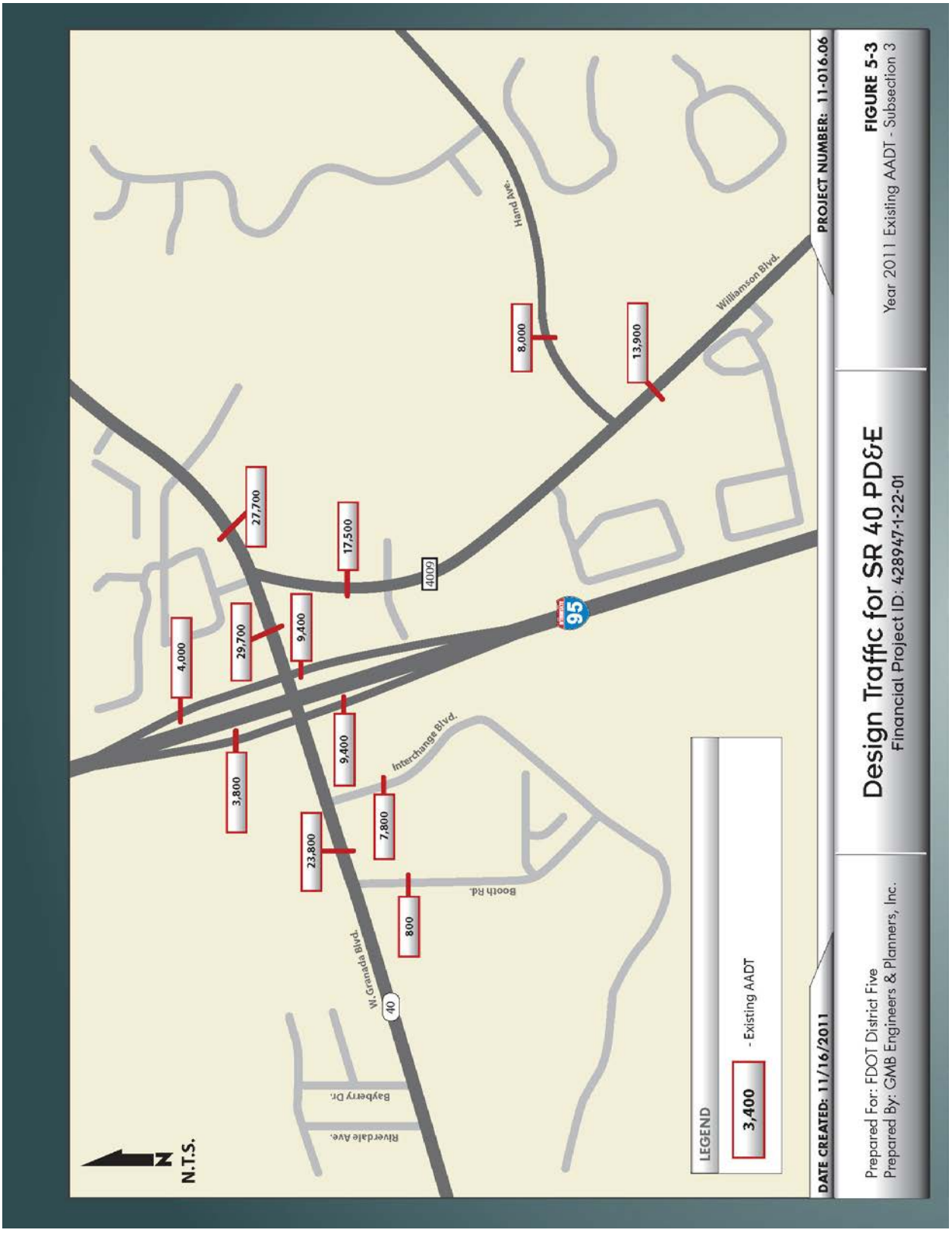
** Cannot be achieved using table input value defaults.

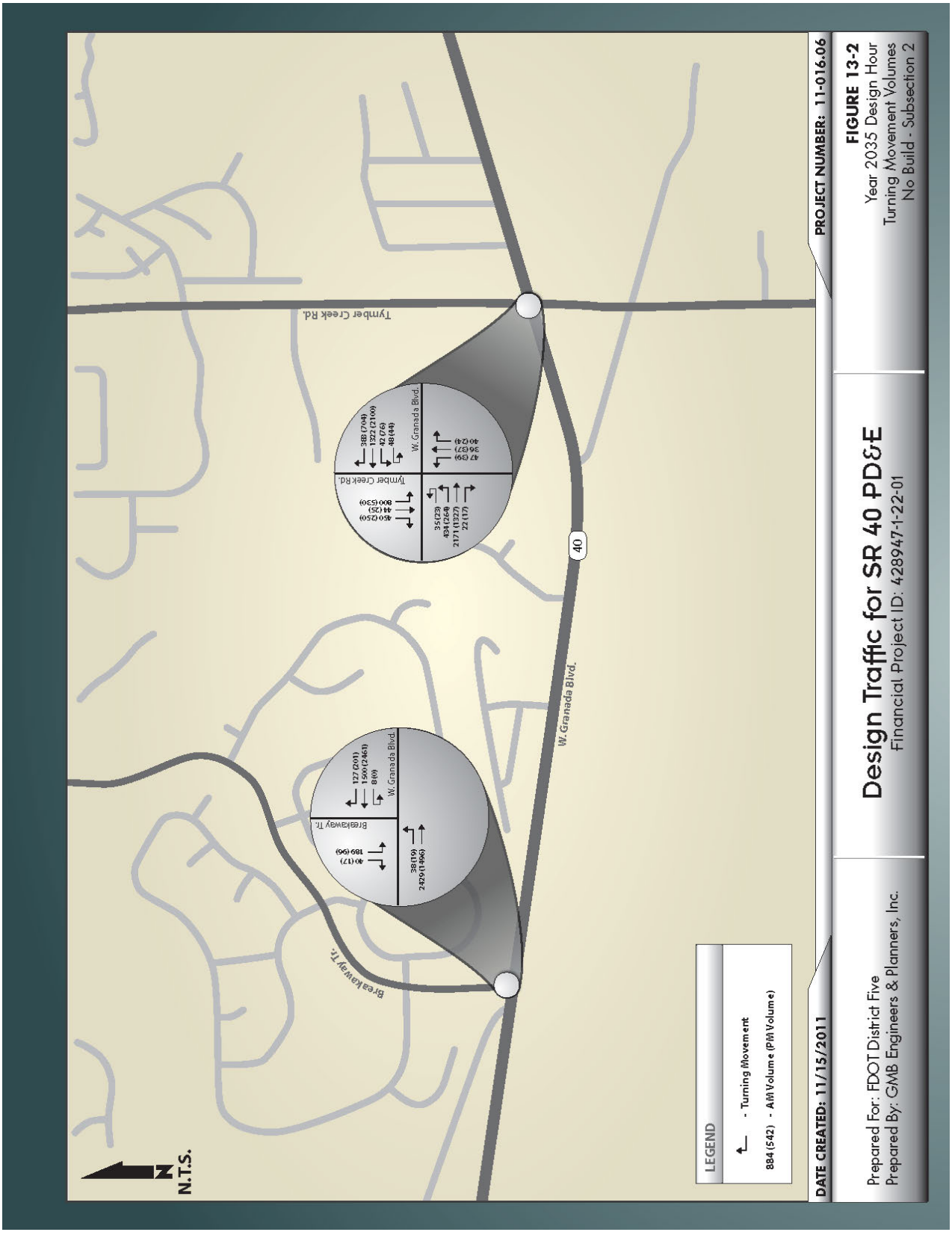
*** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

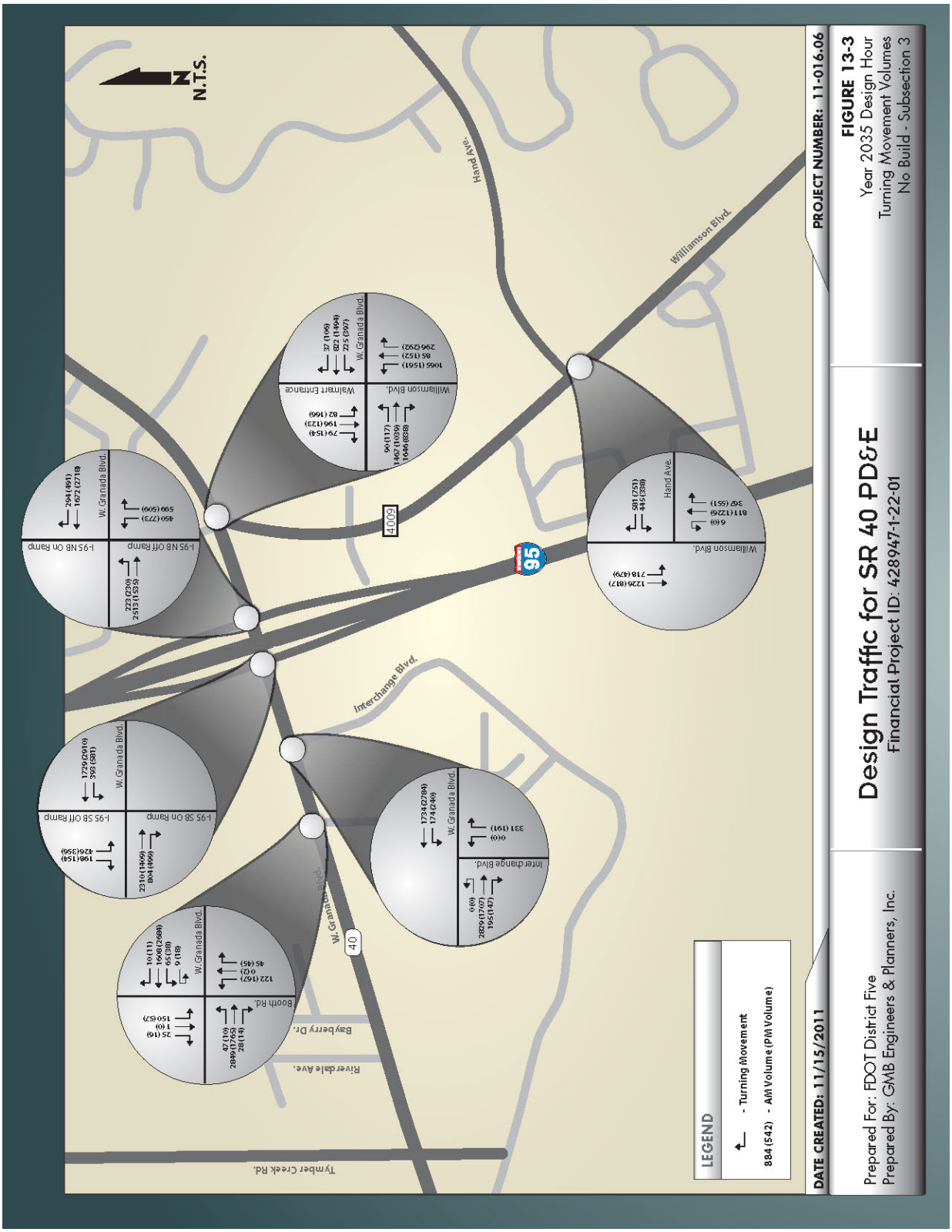
Source:
Florida Department of Transportation
Systems Planning Office
605 Suwannee Street, MS 19
Tallahassee, FL 32399-0450

www.dot.state.fl.us/planning/systems/sm/los/default.shtm

2009 FDOT QUALITY/LEVEL OF SERVICE HANDBOOK


Design Traffic for SR 40 PD&E
Financial Project ID: 428947-1-22-01
FIGURE 5-3
Year 2011 Existing AADT - Subsection 3
PROJECT NUMBER: 11-016.06
DATE CREATED: 11/16/2011
Prepared For: FDOT District Five
Prepared By: GMB Engineers & Planners, Inc.
LEGEND
3,400 - Existing AADT
N.T.S.
N
Williamson Blvd.
Hand Ave.
Interchange Blvd.
Booth Rd.
W. Granada Blvd.
Riverdale Ave.
Bayberry Dr.
95
40
4000
4,000
29,700
27,700
9,400
17,500
3,800
9,400
23,800
7,800
800
8,000
13,900


N
N.T.S.
Tymber Creek Rd.
W. Granada Blvd.
40
Breakaway Tr.
W. Granada Blvd.
Breakaway Tr.
Tymber Creek Rd.
W. Granada Blvd.
LEGEND
- Turning Movement
884 (542) - AM Volume (PM Volume)
DATE CREATED: 11/15/2011
PROJECT NUMBER: 11-016.06
Prepared For: FDOT District Five
Prepared By: GMB Engineers & Planners, Inc.
Design Traffic for SR 40 PD&E
Financial Project ID: 428947-1-22-01
FIGURE 13-2
Year 2035 Design Hour
Turning Movement Volumes
No Build - Subsection 2


N
N.T.S.
Design Traffic for SR 40 PD&E
Financial Project ID: 428947-1-22-01
FIGURE 13-3
Year 2035 Design Hour
Turning Movement Volumes
No Build - Subsection 3
PROJECT NUMBER: 11-016.06
DATE CREATED: 11/15/2011
Prepared For: FDOT District Five
Prepared By: GMB Engineers & Planners, Inc.
LEGEND
- Turning Movement
884 (542) - AM Volume (PM Volume)
Tymber Creek Rd.
Riverdale Ave.
Baryberry Dr.
Booth Rd.
W. Granada Blvd.
Interchange Blvd.
Williamson Blvd.
Hand Ave.
Walmart Entrance
I-95 NB Off Ramp
I-95 NB On Ramp
I-95 SB Off Ramp
I-95 SB On Ramp
40
4009
95

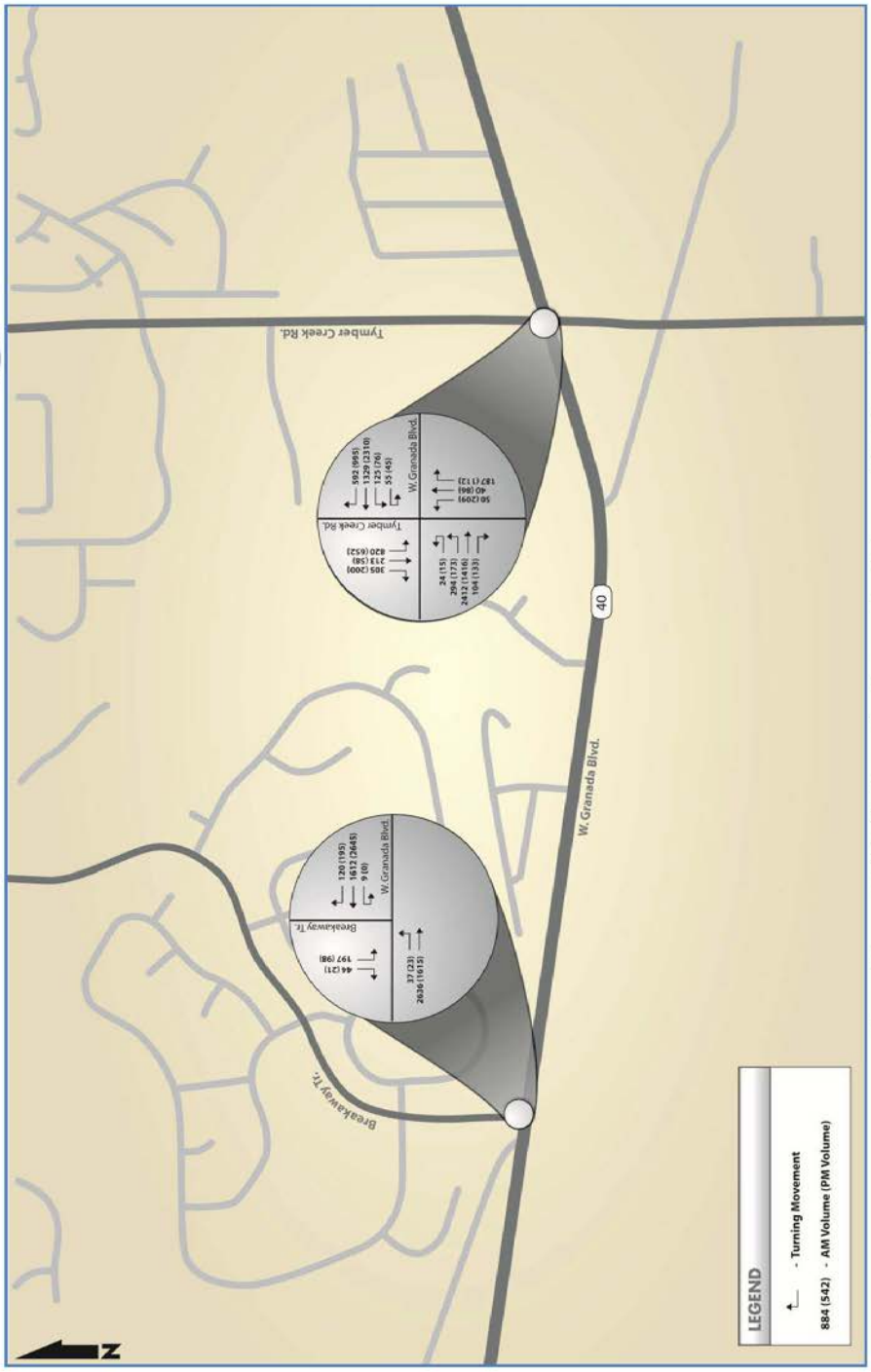


Figure 3-3 2035 Build Alternative 5 Intersection Volumes – West Segment

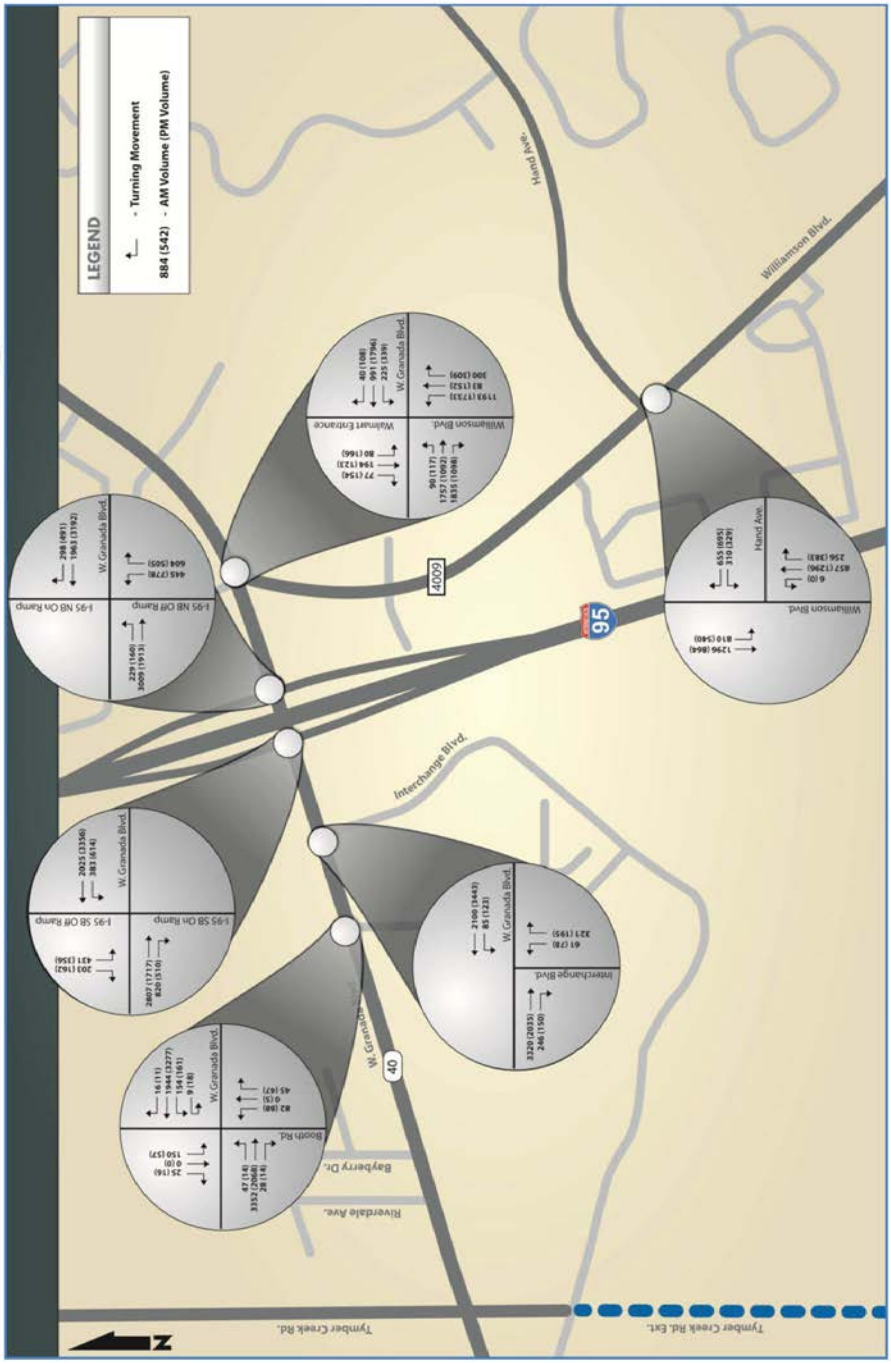


Figure 3-4 2035 Build Alternative 5 Intersection Volumes – East Segment

4.4 Recommended Design Traffic Characteristics

Based on the afore-mentioned discussions, the following **Table 12** provides a summary of the recommended design traffic characteristics for this study.

Table 12: Recommended Design Traffic Characteristics

Roadway / Segment	Recommended Design Characteristics			
	"K_{30}" Factor	"D_{30}" Factor	"Tdaily" Factor	"Tpeak" Factor
Mainline Characteristics				
SR 40	9.0%	62.0%	10.5%	5.3%
Williamson Boulevard	9.0%	60.0%	7.6%	3.8%
LPGA Boulevard	9.0%	54.5%	7.1%	3.6%
Side Street Characteristics				
Cone Road	9.0%	62.0%	2.0%	1.0%
Shadow Crossing Boulevard	9.0%	62.0%	2.0%	1.0%
Tymber Creek Road	9.0%	59.5%	14.8%	6.4%
Booth Road	9.0%	50.5%	2.0%	1.0%
Breakaway Trail	9.0%	67.1%	2.0%	1.0%
Interchange Boulevard	9.0%	55.7%	2.0%	1.0%
SR 40 & I-95 Ramps	9.0%	55.0%	10.5%	5.3%
Hand Avenue	9.0%	51.5%	3.0%	1.5%
Tomoka Farms Road	9.0%	55.2%	2.0%	1.0%

SR 40 TNM Traffic Input Data

Existing	2012								
Segment 1	*Roadway*	Count	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	*SPEED*
West of Tymber Creek			9.00%	62.00%		3.0%	2.3%	94.7%	
	SR 40 4-lanes	11800	1062	658	EB Lane 1	10	7	312	50
					EB Lane 2	10	7	312	
				404	WB Lane 1	6	5	191	
					WB Lane 2	6	5	191	
	WB/NB Breakaway	Count	131	1 lane		4	3	124	50
	EB/NB Tymber	Count	294	1 lane		9	7	278	50
	EB/SB Tymber	Count	104	1 lane		3	2	98	50
	WB/NB at Tymber	Count	995	498	Lane 1	15	11	471	50
					Lane 2	15	11	471	
	Tymber Creek	Count	9.00%	59.50%		3.7%	2.7%	93.6%	40
			NB	736	Lane 1	27	20	689	
						-	-	-	
			SB	19	Lane 1	1	1	18	
						-	-	-	
			EB	526	Lane 1	19	14	492	
						-	-	-	
			WB	40	Lane 1	1	1	37	
						-	-	-	
	I-95 Ramps					*MT*	*HT*	*CARS*	*SPEED*
						3.0%	*2.3%*	*94.7%*	
	SB/EB off	Count	218	1 lane		7	5	206	35
	SB/WB off	Count	108	1 lane		3	2	102	35
	EB/SB On	Count	409	1 lane		12	9	387	35
	WB/SB On	Count	432	216	Lane 1	7	5	205	35
					Lane 2	7	5	205	

Segment 2	*Roadway*	*Count*	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	*SPEED*
East of Tymber Creek			9.00%	62.00%		3.0%	2.3%	94.7%	
	SR 40 4-lane	29700	2673	1,657	WB Lane 1	25	19	785	45
					WB Lane 2	25	19	785	
				1,016	EB Lane 1	15	12	481	
					EB Lane 2	15	12	481	
	EB/SB Turn on	DDHV		371	Lane 1	11	8	351	45
						-	-	-	
	Williamson Blvd.	DDHV	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	40
			9.00%	60.00%		2.2%	1.6%	96.2%	
		NB/WB	670	168	Lane 1	4	3	161	
				168	Lane 2	4	3	161	
				168	Lane 3	4	3	161	
				168	Lane 4	4	3	161	
		NB/EB		167	Lane 1	4	3	161	
		SB	317	159	Lane 1	3	3	152	
				159	Lane 2	3	3	152	
	I-95	LOS C	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	70
			9.00%	55.00%		3.0%	2.3%	94.7%	
		90500	8145	4,480	NB 1	45	34	1,414	
					NB2	45	34	1,414	
					NB3	45	34	1,414	
				3,665	SB 1	37	28	1,157	
					SB2	37	28	1,157	
					SB3	37	28	1,157	
	WB/NB on	Count	491	1 lane		15	11	465	35
	NB/WB off ramp	Count	492	246	Lane 1	7	6	233	35
				246	Lane 2	7	6	233	
	NB/EB off ramp	Count	371	186	Lane 1	6	4	176	35
				186	Lane 2	6	4	176	

Source: Table 2: Generalized Annual Average Daily Volumes, 2009 FDOT Quality/Level of Service Handbook
Figures 5-2 and 5-3; Figures 7-2 and 7-3: SR-40 Design Traffic Technical Memorandum, Nov. 2011
Table 12 Recommended Design Traffic Characteristics: SR-40 Design Traffic Tech. Memo, Nov. 2011

SR 40 TNM Traffic Input Data

No-Build	2035								
Segment 1	*Roadway*	LOSC	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	*SPEED*
West of Tymber Creek			9.00%	62.00%		3.0%	2.3%	94.7%	
	SR 40 4-lanes	35500	3195	1,981	EB Lane 1	30	22	938	50
					EB Lane 2	30	22	938	
				1,214	WB Lane 1	18	14	575	
					WB Lane 2	18	14	575	
	WB/NB Breakaway	DDHV	201	1 lane		6	5	190	50
	EB/NB Tymber	DDHV	264	1 lane		8	6	250	50
	EB/SB Tymber	DDHV	22	1 lane		1	0	21	50
	WB/NB at Tymber	DDHV	704	352	Lane 1	11	8	333	50
					Lane 2	11	8	333	
	Tymber Creek	DDHV	9.00%	59.50%		3.7%	2.7%	93.6%	40
			NB	1005	Lane 1	18	14	470	
					Lane 2	18	14	470	
			SB Thru/Right	275	Lane 1	5	4	129	
			EB	530	Lane 1	6	5	165	
					Lane 2	6	5	165	
					Lane 3	6	5	165	
	I-95 Ramps					*MT*	*HT*	*CARS*	*SPEED*
						3.0%	*2.3%*	94.7%	
	SB/EB off	DDHV	356	1 lane		11	8	337	35
	SB/WB off	DDHV	154	1 lane		5	3	146	35
	EB/SB On	DDHV	499	1 lane		15	11	473	35
	WB/SB On	DDHV	581	291	Lane 1	9	7	275	35
					Lane 2	9	7	275	

No-Build	2035								
Segment 2	*Roadway*	*LOS C*	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	*SPEED*
East of Tymber Creek			9.00%	62.00%		3.0%	2.3%	94.7%	
	SR 40 4-lane	25000	2250	1,395	WB Lane 1	21	16	661	45
					WB Lane 2	21	16	661	
				855	EB Lane 1	13	10	405	
					EB Lane 2	13	10	405	
	EB/SB Turn on	DDHV	838	419	Lane 1	13	10	397	45
				419	Lane 2	13	10	397	
	Williamson Blvd.	DDHV	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	40
			9.00%	60.00%		2.2%	1.6%	96.2%	
		NB/WB	1561	390	Lane 1	8	6	375	
				390	Lane 2	8	6	375	
				390	Lane 3	8	6	375	
				390	Lane 4	8	6	375	
		NB/EB		292	Lane 1	6	5	281	
		SB	520	260	Lane 1	6	4	250	
				260	Lane 2	6	4	250	
	I-95	90500	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	70
			9.00%	55.00%		3.0%	2.3%	94.7%	
			8145	4,480	NB 1	45	34	1,414	
					NB2	45	34	1,414	
					NB3	45	34	1,414	
				3,665	SB 1	37	28	1,157	
					SB2	37	28	1,157	
					SB3	37	28	1,157	
	WB/NB on	DDHV	491	1 lane		15	11	465	35
	NB/WB off ramp	DDHV	773	387	Lane 1	12	9	366	35
				387	Lane 2	12	9	366	
	NB/EB off ramp	DDHV	509	255	Lane 1	8	6	241	35
				255	Lane 2	8	6	241	

Source: Table 2: Generalized Annual Average Daily Volumes, 2009 FDOT Quality/Level of Service Handbook
Figures 13-2 and 13-3: SR-40 Design Traffic Technical Memorandum, November 2011
Table 12 Recommended Design Traffic Characteristics: SR-40 Design Traffic Tech. Memo, Nov. 2011

SR 40 TNM Traffic Input Data									
Build	**2035**								
Segment 1	*Roadway*	LOSC	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	*SPEED*
West of Tymber Creek			9.00%	62.00%		3.0%	2.3%	94.7%	
	SR 40 6-lanes	53700	4833	2,996	EB Lane 1	30	23	946	50
					EB Lane 2	30	23	946	
					EB Lane 3	30	23	946	
				1,837	WB Lane 1	19	14	580	
					WB Lane 2	19	14	580	
					WB Lane 3	19	14	580	
	WB/NB Breakaway	DDHV	195	1 lane		6	4	185	50
	EB/NB Tymber	DDHV	294	1 lane		9	7	278	50
	EB/SB Tymber	DDHV	104	1 lane		3	2	98	50
	WB/NB at Tymber	DDHV	995	498	Lane 1	15	11	471	50
					Lane 2	15	11	471	
			9.00%	59.50%		3.7%	2.7%	93.6%	
	Tymber Creek	DDHV	NB	1254	Lane 1	23	17	587	40
					Lane 2	23	17	587	
			SB	58		2	2	54	
			EB	652	Lane 1	8	6	203	
					Lane 2	8	6	203	
					Lane 3	8	6	203	
			WB	200		7	5	187	
	I-95 Ramps					*MT*	*HT*	*CARS*	*SPEED*
						3.0%	*2.3%*	94.7%	
	SB/EB off	DDHV	356	1 lane		11	8	337	35
	SB/WB off	DDHV	162	1 lane		5	4	153	35
	EB/SB On	DDHV	1717	1 lane		52	39	1,626	35
	WB/SB On	DDHV	614	307	Lane 1	9	7	291	35
					Lane 2	9	7	291	

Build	**2035**								
Segment 2	*Roadway*	*LOS C*	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	*SPEED*
East of Tymber Creek			9.00%	62.00%		3.0%	2.3%	94.7%	
	SR 40 6-lane	39000	3510	2,176	WB Lane 1	33	25	1,030	45
					WB Lane 2	33	25	1,030	
				1,334	EB Lane 1	20	15	632	
					EB Lane 2	20	15	632	
	EB/SB Turn on Williamson	DDHV	1098	549	Lane 1	17	12	520	45
				549	Lane 2	17	12	520	
		DDHV	*K*	*D*	*Direction*	*MT*	*HT*	*CARS*	
			9.00%	60.00%		2.2%	1.6%	96.2%	
	Williamson Blvd.	NB/WB	1885	471	Lane 1	10	8	453	40
				471	Lane 2	10	8	453	
				471	Lane 3	10	8	453	
				471	Lane 4	10	8	453	
		NB/EB		309	Lane 1	7	5	297	
		SB	462	231	Lane 1	5	4	222	
				231	Lane 2	5	4	222	
			K	*D*	*Direction*	*MT*	*HT*	*CARS*	
			9.00%	55.00%		3.0%	2.3%	94.7%	
	I-95	90500	8145	4,480	NB 1	45	34	1,414	70
					NB2	45	34	1,414	
					NB3	45	34	1,414	
				3,665	SB 1	37	28	1,157	
					SB2	37	28	1,157	
					SB3	37	28	1,157	
	WB/NB on	DDHV	491	1 lane		15	11	465	35
	NB/WB off ramp	DDHV	778	389	Lane 1	12	9	368	35
				389	Lane 2	12	9	368	
	NB/EB off ramp	DDHV	505	253	Lane 1	8	6	239	35
				253	Lane 2	8	6	239	

Source: Table 2: Generalized Annual Average Daily Volumes, 2009 FDOT Quality/Level of Service Handbook
Figures 19-2 and 19-3: SR-40 Design Traffic Technical Memorandum, November 2011
Table 12 Recommended Design Traffic Characteristics: SR-40 Design Traffic Tech. Memo, Nov. 2011