Assessment of Sidewalk/Bicycle-Lane Gaps with Safety and Developing Statewide Pedestrian Crash Rates

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CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft.	feet	0.305	meters	m
yd.	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
VOLUME				
fl oz.	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz.	ounces	28.35	grams	g
lb.	pounds	0.454	kilograms	kg
T	short tons (2000 lb.)	0.907	Mega grams (or "metric ton")	Mg (or "t")

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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16. Abstract

Pedestrian and bicycle safety have emerged to be of major concern to federal and selected states in the U.S. With the increased emphasis on the multimodal transportation, pedestrian and bicycle safety has become more common for governmental agencies to address and prioritize for strategic planning and construction. It was crucial to address the pedestrian-vehicular conflict within Florida as it was reported in the "Dangerous by Design" report as having the highest four (4) pedestrian incident locations in the country. This research has two objectives: (1) Developing a safety prioritization tool that would assist governmental agencies in the prioritization of sidewalk gaps and/or bicycle-lane gaps based on a balanced approach between safety needs, socioeconomic evaluation, operational constraints, and fiscal assessment. (2) The development of statewide averages for pedestrian crash rates that would give transportation planners and engineers a barometer indicating how the Districts compare against other areas. A wide array of Geographic Information Systems (GIS) layers associated with the sidewalk/bicycle lane gaps and the safety data was secured by FDOT. The results showed that absence of sidewalk along roadway segments is one of the main factors that have a significant impact on the expected number of pedestrian crashes at a specific location. The pilot studies conducted for the roadways and intersections revealed several critical safety locations within District Five when compared to the developed statewide average rates. These locations require further investigation to identify main causes and assess the mitigations that could potentially lead to improvements.

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EXECUTIVE SUMMARY

Pedestrian and bicycle safety have become more common for governmental agencies to address and prioritize for strategic planning and construction. Public safety is a focal point for our decision makers to emphasize during the planning, design, and construction phases of projects. The prioritization of these projects provides more challenges for the decision makers to identify. The Florida Department of Transportation (FDOT) – District Five has utilized Geographic Information Systems (GIS) to identify sidewalk gaps within its nine-county region. While the gaps have been identified, there is a need to understand the relationship between the sidewalk gaps or bicycle-lane gaps and the safety along the agency maintained facilities. In addition, identifying the relationship between safety and the gaps provides for the ability to statistically link the gaps to prioritizing for construction based on safety and available funding.

On the other hand, with the increased emphasis on the multimodal transportation, to date, there are no clear or uniform standards for a method to measure pedestrian incidents against a statewide average. However, the FDOT has developed vehicular crash rates that resulted in the hypothesis that geometrics and traffic characteristics influence vehicle incidents and corresponding crash rates. Therefore, research is needed to identify and evaluate crash rates for pedestrians that would result in the ability to identify locations with pedestrian crash rates higher than the statewide average. It is important to address the pedestrian-vehicular conflict as the State of Florida was reported in the "Dangerous by Design" report as having the highest four pedestrian incident locations in the country.

Therefore, this research has two objectives: (1) Developing a safety prioritization tool that would assist governmental agencies in the prioritization of sidewalk gaps and/or bicycle-lane gaps based on a balanced approach between safety needs, socioeconomic evaluation, operational constraints, and fiscal assessment. (2) The development of a statewide average for pedestrian crash rates that would give transportation planners and engineers a barometer indicating how the regions (or FDOT Districts) compare against other areas, thus evaluating locations that are operating above statewide averages and therefore emphasizing the need for mitigations to be implemented.

Pedestrian sidewalks and bicycle lanes in Florida are not continuous, and there is a concern among planners and engineers in the FDOT that these gaps constitute discontinuity of flow and are potentially posing threats to pedestrian and bicycle safety. Before these agencies attempt to develop a prioritization program to decide on which gaps need to be addressed, it was logical to carry out an analysis that investigates the correlation between safety and sidewalk/bicycle-lane gaps. The research team assembled a wide array of Geographic Information Systems (GIS) layers associated with the sidewalk/bicycle lane gaps; Roadway Characteristics Inventory (RCI), and the safety data from several agencies within District Five, including FDOT, MetroPlan Orlando, Orange, Seminole, Volusia, and Osceola Counties. It was found that every jurisdiction and agency uses their own independent GIS data that are not homogeneous and do not easily interact. This made it difficult to locate and analyze crash data along with roadway location and feature data using spatial analysis. As a result, the University of Central Florida (UCF) research team utilized the Florida Unified Basemap Repository (UBR). The UBR is a unified approach to GIS data management to develop a standard, comprehensive transportation network that could be used throughout the state, shared across jurisdictional boundaries through multi-agency involvement and coordination. Another source related to pedestrian and bicycle safety data was utilized: the Signal Four Analytics database.

A 0.25-mile buffer radius, which is within walking distance from the intersections, was selected in order to differentiate between intersection-related pedestrian crashes and roadway segment-related crashes, and a spatial join command between the crashes and the intersection's buffer was performed. Furthermore, intersections were separated based on the crash type (pedestrian or bicycle crash). The pedestrian dataset included minimum and maximum number of crashes within the buffer area at intersections as well as the overall average number of crashes per intersection. The sidewalk and bike lane gap layers were overlaid on the crash layer and a 50-foot buffer was created to identify the crashes along the roadway segments with no sidewalk or bike lane. Due to the fact that area population contributes to pedestrian activity within an area, it was imperative to include the population as a factor representing the intensity of pedestrian activity. The crash data was then overlaid on the population layer and a 0.5-mile radius was determined as a reasonable walking distance surrounding the crash location for the population parameters to be considered within.

Based on the analysis and modeling results, a negative binomial (NB) regression model was developed. It was found that the absence of sidewalk along roadway segments is one of the main factors that has a significant impact on the expected number of pedestrian crashes at a specific location. Other factors included average annual daily traffic (AADT) volumes, roadway category (ROADCAT), specifically along urban two-way divided arterials with four to six lanes, and the average population within a 0.5-mile radius surrounding the crash location. The analysis also showed that the expectation of a pedestrian crash along roadways with no sidewalk is three times greater than the expectation of a crash with the presence of a sidewalk.

The tool developed to prioritize gaps was crucial to the remaining research tasks. The developed tool takes into account the above-mentioned parameters as well as other pedestrian-related activity variables and proximity to generators using land use, income, and auto ownership data. The prioritization method was based on a multi-criterion ordinal ranking of the parameters of five main modules, using a scoring system that combines all criteria weights then aggregates them into a single indicator. The five main modules comprise roadway and traffic data, socioeconomic data, land use data, transit, and crash data. The need for roadway segment safety improvement was ranked according to its roadway pedestrian safety indicator (RPSI) threshold and categorized into five categories. The Sidewalk/Bike-Lane Gaps Safety Prioritization Tool (SBLPT) has the capability to generate sidewalk/bike-lane gaps map that can be viewed in

Google Earth ®. The generated map is color-coded based on five prioritization ranks, where red, purple, orange, yellow, and green colors indicate urgent, high, medium, low, and no safety concerns priorities, respectively.

On the other hand, the pedestrian crash rate methodology required the identification of an accurate yet practical exposure measure. Pedestrian exposure is one of the crucial factors needed in the analysis of pedestrian safety. Although there are numerous studies that attempted to identify pedestrian exposure factors, to date, there is no commonly accepted methodology to measure pedestrian exposure. In order to arrive at the correct exposure measure, specific data has to be available or collected, which is often a challenge, either due to its unavailability or the cost involved in collecting it. Researchers often use population density as a substitute for pedestrian exposure in pedestrian crash analyses because of its availability or the low cost to obtain it. However, it is not considered an accurate measure because it doesn't account for the probability of pedestrians appearing on the road.

The proposed approach focuses on the level of pedestrian activity and the potential conflict between pedestrians and motor vehicles expressed as the distance of walking while at risk of being involved in a motor vehicle accident. The majority of the pedestrian-vehicle crashes occur while crossing the street whereas an insignificant percentage of crashes occur while walking along the street. Therefore, it is believed that the pedestrian miles crossed (PMC) parameter is representative factor of the risks associated with pedestrian exposure. Furthermore, since the exposure measure should directly reflect the amount of walking in areas shared with vehicles, the vehicular traffic volume is another significant factor that should be included in the equation. Based on that, the three main significant parameters that were used in the exposure measure calculations were: pedestrian traffic, distance crossed and vehicular traffic. The proposed methodology is considered detailed and practical, and it provides a broad depiction of the main factors that directly contribute to pedestrian crashes.

The pedestrian crash rate methodology involved two types of analyses: roadways and intersections. Statewide RCI data was collected from the GIS layers and classified according to their functional classification, area type, and number of lanes, as well as their average annual daily traffic (AADT) and total lengths. Intersection data was classified according to several parameters, including their total entering traffic, total crossing distance, total daily pedestrians, and type of control. Furthermore, the total statewide number of crashes over the five-year period (June 2009 to May 2014) was identified from the Signal Four Analytics database for all the roadways and intersections. In addition to the intersection GIS data, sample intersection data was collected based on a pilot study within the nine counties of FDOT District Five. The purpose of the pilot study was to identify the critical pedestrian safety locations within the district and correlate this with safety locations based on statewide averages.

The main parameters used in calculating pedestrian the crash rates along the different roadway categories, which combine the functional classification, number of lanes, and area type were the

AADT and the total length of the roadway category. Conversely, the main parameters used for computing the pedestrian crash rates for the different intersection classifications were the daily pedestrian volumes, distance crossed, and the AADT in addition to the number of pedestrian crashes either along the studied roadways or at intersections. Although the socioeconomic conditions of the geographic area may provide higher accuracy for estimating pedestrian volume than the population, there was not a specific data collection source that could produce data at these intersection locations. It should be noted that the analysis also could not identify a correlation between the number of crashes and the average daily pedestrians at the intersections due to the high variability of the data.

The pilot studies conducted for the roadways and intersections revealed several critical safety locations within District Five when compared to the developed statewide average rates. This conclusion requires further investigation to identify main causes and emphasize the type of mitigations that can be implemented.

It is recommended that an annual statewide pedestrian count program be initiated for the intersections and roadways, which would increase the sample size and assist in validating the assumptions used in this study. The purpose and duration of data collection are essential pieces of information for determining the appropriate technology. Active or passive infrared sensors are common practice for counting pedestrians, and they may also be used to collect combined counts of bicyclists and pedestrians.

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I- INTRODUCTION

1.1 OVERVIEW

Pedestrian and bicycle safety have become a more prevalent issue for governmental agencies to address and prioritize for strategic constructing. With the transition to the mobility of people, to date, there are no clear or uniform standards for a method to measure pedestrian incidents against a statewide average. However, the Florida Department of Transportation (FDOT) has developed vehicular crash rates that resulted in hypothesis that geometrics and traffic characteristics influence vehicle incidents and corresponding crash rates. Therefore, research is needed to identify and evaluate crash rates for pedestrians. This process would result in the ability to identify locations within regions with higher than or above a statewide average pedestrian crash rate. It is important to address the pedestrian-vehicular conflict as the State of Florida currently was reported in the "Dangerous by Design" report to have the highest four pedestrian incident locations in the country.

Between 2006 and 2009, pedestrian fatalities in the United States declined from 4,795 to 4,109. However, the downward trend halted and there were 4,302 pedestrian deaths in 2010, increasing to 4,457 in 2011 and 4,743 in 2012, Williams (2013). The State of Florida has consistently ranked as one of the worst states in terms of pedestrian crashes, injuries, and fatalities according to National Highway Traffic Safety data, Chang (2011). Ernst (2011) also indicated that four metro areas in Florida (Orlando-Kissimmee, Tampa-St. Petersburg-Clearwater, Jacksonville, Miami-Fort Lauderdale-Pompano) were considered the most dangerous for pedestrians among all the United States. Therefore, pedestrian safety is of particular concern to Florida.

Several studies used differing methods and surrogate measures to estimate pedestrian crashes. In general, population, pedestrian volumes, time, and distance are examples of the most studied surrogate measures for pedestrian exposure. The methods used in estimating pedestrian hot spot crash locations included density methods, clustering methods, and other GIS-related methods. However, the main challenge in analyzing pedestrian crashes is to identify a practical and correct exposure measure, as in the case with vehicular crashes. In most cases, the exposure measure is unavailable or can only be obtained at a great cost.

On the other hand, several studies have investigated the development of strategies to determine candidate pedestrian hazard locations and assess pedestrian safety. The Federal Highway Administration (FHWA) published the first pedestrian and bicycle intersection safety user guide in April 2007. This user guide explains the methodology of ranking intersections based on calculated pedestrian safety indices. The University of Central Florida (UCF) research team conducted a statewide and national review to identify the current programs, procedures, and best practices for addressing the prioritization of pedestrian and bicycle-lane gaps. From this review, the UCF research team developed specific strategies and procedures for prioritizing the "level of need" for the pedestrian and bicycle-lane gaps. The technical strategies for prioritizing the sidewalk and bicycle-lane gaps involved the investigation of several correlation factors including roadway characteristics, land uses, socioeconomic, and safety data. The methodology designed to arrive at the strategies utilized GIS based methodology to identify high pedestrian crash locations and focused on the nine counties of FDOT District Five as a pilot study area that can be applied to other FDOT Districts.

In this study, statewide averages for pedestrian crash rates will be quantified to identify critical pedestrian crash locations, thus evaluating locations that are operating beyond statewide averages, identifying main causes, and developing a prioritization tool to emphasize where mitigations need to be implemented.

1.2 OBJECTIVES

Several factors should be considered in measuring the benefits of conducting this research. First, the State and local representatives will have a qualitative measure for determining and identifying critical pedestrian locations and how it relates to statewide averages. Second, a tool to prioritize sidewalk and bicycle-lane gaps for new construction will be developed which would potentially minimize FDOT staff hours on safety projects by identifying "hot spots" or critical areas of concern more readily versus lengthy reviews of pedestrian crash reports. The following summarizes the main objectives of this research:

1. Develop a methodology to measure pedestrian crash rates against statewide averages
2. Investigate the correlation between safety and sidewalk/bicycle-lane gaps
3. Develop an evaluation tool that will prioritize the needs for addressing gaps

1.3 SUMMARY OF PROJECT TASKS

Task 1: Research and Data Procurement
Task 2: Investigate Correlation between Safety and Sidewalk/Bicycle-Lane Gaps
Task 3: Pilot Project to Establish Statewide Pedestrian Crash Rates (District Five)
Task 4: Strategies for the Prioritization of Pedestrian/Bicycle-Lane Gap Projects
Task 5: Sidewalk and Bicycle Lane Gap Application
Task 6: Draft and Final Report

II- RESEARCH AND DATA PROCUREMENT

A number of methods for measuring pedestrian accidents have been developed in the United States and in different countries over recent years. By analyzing the pedestrian accident data, governmental agencies can determine the factors related to the pedestrian safety in order to provide useful information to guide countermeasure choices. The following sections explain in greater detail the methods used to quantify pedestrian safety.

2.1 NATIONAL REPORTS RELATED TO PEDESTRIAN SAFETY

There have been numerous reports that were devoted to investigate and evaluate the pedestrian safety at the national level. The United States Department of Transportation (USDOT) produced the National Pedestrian Crash Report in 2008 using the fatal pedestrian crash data from Fatality Analysis Reporting System (FARS) and other pedestrian crash data from the General Estimates System (GES) in the National Automotive Sampling System, Chang (2008). The purpose of the report was to analyze the latest trends in pedestrian fatalities to identify the probability of different contributing factors. The report mainly presented descriptive statistics and consisted of five parts: long-term trends, crash locations, crash time, pedestrian information, and involved driver information. Similar reports published by the USDOT also analyzed the pedestrian safety in 2011, NHTSA (2011).

The National Highway Traffic Safety Administration (NHTSA) developed the Pedestrian Crash Data Study (PCDS) in 1994 which was continued for two years. The data were collected through on-scene crash investigations (or within 24 hours) of pedestrian crashes using two techniques, video camera recording and contour gauge, to collect 521 pedestrian crashes at six sites which were selected from around the nation, Chidester and Isenberg (2001). The six sites selected for this study included Seattle, Washington; Chicago, Illinois; Buffalo, New York; Fort Lauderdale, Florida; Dallas, Texas; and San Antonio, Texas due to the significant number of pedestrian crashes in these six cities. The study provided trends analysis to summarize the scope and character of pedestrian accidents.

Governors Highway Safety Association (GHSA), also addressed pedestrian safety, Williams (2013). They used the pedestrian fatality data to identify reasons for the increase in pedestrian deaths in 2010 through 2012 and to compare the pedestrian fatalities in different states.

The Federal Highway Administration (FHWA) provided a distance-based methodology to estimate annual pedestrian and bicyclist exposure in an urban environment, Molino et al. (2012). Pedestrian volume data was collected through personnel who observed pedestrian movements while standing on the sidewalk and measuring travel distances with tape measures and remote distance-measuring equipment. By combining the two databases, a linear model was developed to estimate annual pedestrian exposure.

The “Dangerous by Design” national report conducted for the Transportation for America also examined the pedestrian fatalities for each state from 2000 to 2009 to identify the common thread on the roads. Using ten years of pedestrian fatality data, they used a Pedestrian Danger Index (PDI) to rank the country’s largest metropolitan areas according to their relative risk to walkers. The analysis concluded that Orlando tops the list of most dangerous places due to its high pedestrian fatality rate of 3 per 100,000 people, followed by Tampa, Jacksonville, and Miami. They suggested that more funding should be used for the safer roads and a complete street policy should be adopted for pedestrians and bicyclists, Ernst et al. (2011).

2.2 STATEWIDE AND LOCAL REPORTS FOR PEDESTRIAN SAFETY

The New York Bicycling Coalition (NYBC) studied bicycle and pedestrian accident data in 1999 and utilized two main databases to analyze pedestrian and bicyclist accident rates, Brustman (1999). One was “Hospitalizations Due To Bicyclist and Pedestrian Injuries” from the Department of Health (DOH), which was more reflective of the actual injury situation. Another one was the “Summary of Bicycle and Pedestrian Accidents on State Highways” from the Department of Transportation, which looked for clusters of accidents on state highway routes. Through these two databases, researchers analyzed contributory factors, roadway factors, age, gender factors, and pedestrian location factors in bicycle and pedestrian accidents. They employed a descriptive research method, which uses the ratio of each factor to analyze bicycle and pedestrian accident rates. The report also provided suggestions for improving the local and statewide data collection, such as redefining bicycle accident reporting criteria and offering financial assistance for the data collection system upgrades.

Thomas et al. used five years of state crash data from Traffic Engineering Accident Analysis System (TEAAS) and the perception data from 400 intercept survey respondents to identify the general trends in characteristics of people and the high risk locations in North Carolina, Thomas et al. (2009). They used kernel density analysis method through GIS to identify high risk locations and exploited Ripley’s K-function test to decide whether crashes were clustered randomly.

In Langley Park, Maryland, Ballesteros et al. examined how pedestrian injury is associated with vehicle type, while controlling for vehicle weight and speed, Ballesteros et al. (2004). They integrated two pedestrian accident databases to reclassify pedestrian accidents. They divided the severely injured pedestrian accident types into life threatening, potentially life threatening, and dead prior to arriving the hospital. The other type was considered as non-life threatening. They concluded that the increased danger due to sport utility vehicles and pick-up trucks to pedestrians is explained by larger vehicle masses and faster speeds. Through calculations of the severity of the pedestrian’s injury, they indicated that vehicle design may contribute to different injury patterns.

The Chicago Department of Transportation (CDOT) published a summary report for pedestrian crash analysis in 2011, T.Y. Lin Int'l (2011). The report did not look at exposure measures. However, they provided descriptive analysis about the crash types, locations and severity. Pedestrian crash fatality rates per 100,000 residents were also used to compare with other U.S. cities. This measure is often used when considering population density. Crash maps were provided to analyze where pedestrian crashes generally occurred in central business district and neighborhoods.

An overall technical guide for pedestrian safety assessments was introduced in California, Mitman et al. (2008). They divided California cities into several population groups according to the population size. Then, by using frequencies and rates of the different population groups, calculated per 10,000 populations, they identified cities with high pedestrian accidents.

Dumbaugh et al. mainly focused on the relationship between the infrastructure and pedestrian crash accidents in Texas, Dumbaugh (2012). Negative binomial regression models were fitted to the data and it was concluded that the environmental factors associated with a vehicle-pedestrian crash were combination of traffic conflicts and the vehicle speed.

Oregon Department of Transportation (ODOT) utilized network screening methods, which complement the crash frequency and severity screening by identifying risk factors, to identify locations for safety improvements where crashes have not been reported, Braughton and Griffin (2014). A segment scoring system was also developed to estimate each risk factor and GIS software summarized the pedestrian score of segments to identify the crash frequency and severity network for each Oregon region.

An FDOT Pedestrian Safety Report published by the University of Florida (UF) pointed out why pedestrian fatality rates in Florida was higher than other states, Dewey et al. (2003). A multivariate regression model was used to analyze specific factors that could relate to the pedestrian fatality, including environmental factors, and accidents locations. They found that Florida residents walk more often in places that are exposed to traffic compared to other U.S. residents because of warm winters, the natural timing of summer, and winter sunlight. Furthermore, there are millions of tourists visiting Florida every year, which lead to more pedestrian exposure to traffic. Moreover, elderly residents, the interstate shortfall, and poverty rate explained over 70% of Florida's pedestrian fatalities. They also found that Tampa-St. Petersburg, Fort Myers, Daytona Beach, and Ocala were the metro areas which exceed the national fatality rates taking into account the effects of exposure, daylight timing, and age.

In another FDOT pedestrian safety report produced by the Florida International University (FIU), Alluri et al. analyzed 6,434 pedestrian crashes on roads during 2008-2010 in Florida, Alluri et al. (2013). A mixed logit model was developed to identify factors contributing to pedestrian injury severity at signalized and non-signalized locations. Statewide crash patterns, causes, and contributing factors such as the age, time, and location were identified to have a better understanding of pedestrian injury severity. Several countermeasures at both non-signalized and signalized locations were suggested to reduce pedestrian crash frequency and severity.

2.3 RISK FACTORS RELATED TO PEDESTRIAN CRASHES

There have been numerous studies that attempted to identify significant factors related to pedestrian accidents. The main factors discussed in this report include environmental factors, roadway characteristics factors, human factors, vehicle characteristics factors and special locations.

2.3.1 Environmental Factors

The reports conducted by CDOT and NHTSA were two examples that analyzed time of day of pedestrian crashes, Chang et al. (2008), NHTSA (2011). Chang et al., found that 26% of pedestrian crashes occurred from 3 p.m. to 6 p.m. in Chicago, this was the period with most occurrences. However, NHTSA found that 24.7% percent of pedestrian deaths were between 6 p.m. and 9 p.m., the highest number of pedestrian deaths of the whole day. Weather and lighting condition factors were a common concern. Other studies showed that poor lighting conditions lead to increase the likelihood of pedestrian injuries, Clifton et al. (2009), Mohamed et al. (2013). However, weather was not a significant factor in several studies, Clifton et al. (2009), Dai (2012).

While analyzing whether different income areas would affect pedestrian safety, Noland and Quddus (2004), using negative binomial model, found that areas with lower income were more prone to pedestrian crashes in England. This finding concurred with the study by Kravetz and Noland, Kravetz and Noland (2012). They also found that areas with lower population density experienced more casualties compared to those areas with higher population densities. Ukkusuri et al. showed that a greater fraction of residential land use decreased pedestrian crashes compared to the industrial, commercial and open land use type in New York City, Ukkusuri, et al. (2012). Other similar studies concluded that low density residential areas were more dangerous than compact residential areas, Cho et al. (2009), Zajac and Ivan (2003).

On the other hand, Zhu et al. (2008), studied urban and rural areas as locations of interest. They gathered information from 35,732 pedestrians struck by vehicles and used an adjusted rate ratio (aRR) of pedestrian-vehicle crash and pedestrian injury according to resident years and miles walked in either urban or rural setting using Poisson distribution to estimate their 95% confidence interval (CI). Pedestrian hits were calculated per 100,000 person-years and per million miles walked according to the region size. The analysis confirmed that hot accident spots appear closer to urban areas, especially for small- to mid-size, whether based on resident years or miles walked. The high rate of pedestrian crashes based on person-years in large urban areas, may be explained by the fact that residents in such areas walk about as twice as much as residents in rural areas.

2.3.2 Roadway Characteristics Factors

Several studies also focused on investigating roadway factors affecting pedestrian crashes. Turner et al. investigated roadway factors in an urban area in New Zealand, Turner and Roozenburg (2006). They found that 56% of accidents occurred at mid-block locations, which were the highest among urban pedestrian accident locations. The second highest were at intersections which accounted for 38% of accidents. Brustman found that municipal streets had a higher probability of accidents involving a pedestrian compared to state roads, county roads, town roads and limited access highways, Brustman (1999).

Considine investigated the pedestrian safety based on the data from CDOT, T.Y. Lin Int'l (2011). They found that nearly 50% of pedestrian crashes occurred on arterial roadways and 23% of crashes occurred on local streets.

Tarko and Azam developed bivariate ordered probit model to identify pedestrian injury severity factors using the linked police-hospital data, Tarko and Azam (2011). They found an increased likelihood of a pedestrian injury severity on rural roads and high-speed urban roads.

Lee and Abdel-Aty used four years of vehicle-pedestrian crashes data from 1999 to 2002 in Florida to identify roadway characteristics that were correlated with high pedestrian crashes using a log-linear model, Lee and Abdel-Aty (2005). They found that undivided roads with a greater number of lanes were more dangerous than divided roads with fewer lanes.

Ukkusuri et al. developed pedestrian accident frequency models for New York City and found that more pedestrian crashes were associated with larger road width and road width was related to operating speeds, length of crosswalks and traffic volume Ukkusuri et al. (2012).

Hanson also studied roadway characteristics which included the presence of sidewalks, buffers between the road and the sidewalk, number of travel lanes and presence of medians, traffic control at intersections, and posted speed limits with a database of pedestrian casualties, Hanson et al. (2013). The Google Street View imagery was used to collect data. The results showed that the presence of sidewalks could reduce the severity of pedestrian crashes. Lack of buffers between the road and the sidewalk and higher speed limits were found to be associated with higher pedestrian severe causalities and fatality rates. However, the number of travel lanes and presence of medians were not statistically significant for the pedestrian crashes; crosswalks at traffic-controlled intersections were the only significant factor among the traffic control at intersections. Other related factors, like crosswalk at intersection, control only, control at intersection and control and crosswalk, appeared not to be significant.

2.3.3 Human Factors

There have been numerous studies that aimed at identifying significant human factors related to pedestrian crashes. Human factors included age, gender, race, and alcohol involvement.

According to different areas, crash distributions of different age groups were distinct. For example, an age-specific study of death rates due to pedestrian-vehicle accidents in the city of Montreal was conducted in which the inner city was compared to the outer parts of the cities in four contiguous areas. They found that the rates are highest in downtown and decrease progressively in the outlying areas, the absolute difference between areas is being largest where victims were commonly above the age of 65, Allard (1982). They concluded that older pedestrians have difficulty in crosswalk situations and that crossing times at signalized intersections should be extended especially in areas with large population of elders.

In Chicago, crash rates of the ages between 15 and 18 was highest among all age groups, T.Y. Lin Int'l (2011). However, Lee and Abdel-Aty found that middle-age male drivers and pedestrians were more involved in pedestrian accidents than other groups when analyzing age and gender factors in Florida, Lee and Abdel-Aty (2005). Similar findings were also observed by Eluru et al. (2008), Tarko and Azam (2011), LaScala et al. (2000), and Dai (2012).

A study by Zhu et al. in 2013 used walking exposure (kilometers walked per person-year), vehicle-pedestrian collision risk (number of collisions per kilometers walked) and vehicle-pedestrian collision case fatality rate (number of deaths per collision) to study the male-female discrepancy, Zhu et al. (2013). The study concluded that the pedestrian death rate per person-year for men was 2.3 times more than women and is attributed to a higher fatality per collision rate among male pedestrians.

Chang analyzed pedestrian fatalities using ethnic groups, Chang (2008). He found that nearly 60% of pedestrian fatalities were White, 15% were Black, and 18% were Hispanic, which concurred with the study by Ukkusuri, Ukkusuri et al. (2011).

Other studies claimed that pedestrian's alcohol involvement was an important human factor affecting pedestrian crashes. Noland and Quddus suggested that alcohol involvement increased the risk of a fatal crash, which was also observed by Mohamed et al. and Miles-Doan, Miles-Doan (1996), Mohamed et al. (2013), Noland and Quddus (2004). Zajac and Ivan stressed that both driver alcohol involvement and pedestrian alcohol involvement were found to significantly increase pedestrian injury severity, Zajac and Ivan (2003).

In addition to these human factors, researchers recently started looking into the effects of pedestrian distraction when talking or texting on their cell phones. Nasar and Troyer used the National Electronic Injury Surveillance System (NEISS) database in hospital emergency rooms from 2004 to 2010, Nasar and Troyer (2013). Pedestrian injuries were found to be higher in the case of distraction using cell phones compared to no distraction. Byington and Schwebel utilized virtual pedestrian streets to examine hazards for pedestrians while crossing a street and distracted by cell phone, Byington and Schwebel (2013). They concluded that pedestrian behavior was considered to be more dangerous while crossing the street and using cell phones than crossing the street without distractions.

2.3.4 Vehicle Characteristics Factors

Several studies had investigated vehicle types in pedestrian crashes. In the NHTSA Pedestrian Crash Data Study (PCDS), 68% of the involved vehicles were passenger cars and 32% were other light vehicles, including light trucks, vans, and utility vehicles, Chidester and Isenberg (2001). However, although the truck was not the highest volume in terms of vehicle types, the influence of truck flow at intersections with high pedestrian activity was found to be one of the crash factors associated with the most severe injuries, Mohamed et al. (2013). Satiennam used chi-square tests to study types of vehicles and ages of pedestrian fatalities in traffic accidents in Thailand, Satiennam and Tanaboriboon (2003). The results indicated that more than 60% of pedestrian fatalities were motorcycle crashes, which was the highest frequency of pedestrian accidents.

In recent years, many studies have focused on the vehicle speed for pedestrian crashes and pedestrian injury severities. Han et al. used two finite element pedestrian models and four finite element models for vehicles with different front-end shapes to evaluate pedestrian injury severities, Han et al. (2012). The authors found that vehicle speed was the significant factor in injury severity and the speed below 30 km/hr can reduce all injury parameters, which is similar to the findings of Pitt et al., Pitt et al. (1990).

During the last decades, vehicle designs and uses have changed over the years and increased in number which is believed to have caused changes to pedestrian injury profiles involving pedestrian crashes. Roudsari conducted a data study from 1994 to 1998 that developed a database involving the mechanism of pedestrian crashes, Roudsari (2004). Pedestrians struck by light truck vehicles (LTV) had a higher risk injuries at 29% compared to passenger vehicles at 18%. After adjustment for pedestrian age and impact speed, LTVs were associated with a risk of severe injuries that is three times higher. Mortality rates were also two times higher. He concluded that a close watch is needed in the areas where LTVs currently operate most often to identify higher risk areas.

2.3.5 Special Locations

Many researchers also have attempted to perceive the pedestrian safety in some special locations, such as parking lots, school zones, and highway-rail crossings. Charness et al. investigated pedestrian crash data for parking lots based on pedestrian age in west Central Florida, Charness et al. (2012). The data was from several locations between 2004 and 2008, and included Citrus, Hernando, Hillsborough, Pasco, and Pinellas Counties in west Central Florida. They observed that pedestrian crashes in small parking lots and residential parking lots had a greater effect on crash rates than in large parking lots and other types of parking lots, such as retail and gas station. Moreover, older pedestrian group (age 75 and older) were more involved in backward driving (cars in reverse) crashes while the younger pedestrian group (age 14 and younger) were more involved in forward-driving crashes. However, parking space angle and attention patterns such as head turns and eye fixation while walking in crosswalks were found as non-significant factors when related to pedestrian crash frequency.

Warsh et al. used five-year police-reported collision data and Geographic Information Systems (GIS) to assess child pedestrian crashes in school zones, Warsh et al. (2009). They found that school zones were the most dangerous locations for child pedestrians and those crashes decrease as distance from school increase. Also, 37.3% of collisions happened among 10-14 years olds.

Using the 2007-2010 highway-rail grade crossings (HRGC) crash data, Khattak employed the ordered probit model to investigate different variables that contributed to the severity level of pedestrian injuries, Khattak (2013). Model results showed that higher train speeds were associated with more severe injuries. Female pedestrians have higher injury severity when compared to others. Pedestrian crashes at highway-rail grade crossings in commercial areas were more severe compared to other land uses (e.g., open space, residential, etc.) and lower crash severity levels at highway-rail grade crossings with greater number of crossing highway lanes, with standard flashing light signals and in clear weather.

2.4 PEDESTRIAN EXPOSURE

Walking is the most basic form of human mobility and it is considered a healthy, environmentally friendly form of transportation. In addition, any trip made by other modes of travel begins and ends with walking. Walking is considered the most commonly used mode of transportation and should form the basis for calculating exposure measures for pedestrians.

Pedestrian exposure is one of the crucial factors needed in the analyses of pedestrian safety. The term exposure is mainly defined as the exposure to risk; the risk to be involved in a vehicular accident. Risk is used as a way to quantify the level of safety relative to the amount of exposure; the probability of an accident occurring, as opposed to the absolute number of accidents, Hakkert and Brainmaister (2002). To calculate pedestrian risk, the typical approach is to divide the number of pedestrian crashes by the estimated pedestrian exposure. Using the correct exposure measure, we can objectively estimate pedestrian safety at different locations. Although there are numerous studies that attempted to identify pedestrian exposure, to date, there is no clear or commonly accepted methodology that has been adopted as a measure of pedestrian exposure. This report attempts at reviewing all previous efforts in the literature to assess how pedestrian crash rates are currently being evaluated, compare the different methods used for measuring pedestrian exposure, then recommend a procedure to calculate pedestrian crash rates.

In order to arrive at the correct exposure measure, specific data has to be available or collected which is often a challenge either due to its unavailability or the cost involved in collecting it. In most of the reports, researchers often use population density as a substitute for pedestrian exposure in pedestrian crash analyses because of its availability or the low-cost to obtain it.

However, it is not considered an accurate measure because it doesn't account for the probability of pedestrians appearing on the road.

Pedestrian volume that passes through a fixed point during a specific time interval is a common measurement in calculating pedestrian exposure. For example, Zegeer et al. used pedestrian volume to determine the pedestrian exposure at marked and unmarked crosswalks for uncontrolled locations and found that the average daily pedestrian traffic at marked crossings was 312 pedestrians per site, Zegeer et al. (2001). Qin and Ivan conducted a study at 32 sites in rural Connecticut. They used several factors including sidewalks, number of lanes, campus factor, tourist area, and downtown area as the independent variables. They used the weekly pedestrian volume as the dependent variable to predict a practical pedestrian exposure instead of population density in rural areas, Qin and Ivan (2011). Similarly, Molino et al. applied a linear model using land use group, hour of day or time period, and day of the week as independent variables to calculate 15-minute counts for pedestrian exposure estimation in eight different pedestrian-vehicle and bicycle-vehicle facilities (Molino et al., 2009).

Other parameters which are used to estimate pedestrian exposure are number of pedestrian trips, distance traveled, and time spent walking, Greene-Roesel et al. (2007). Distance-traveled data needed to be collected by way of survey. Distance traveled is expressed as the total or average distance that an individual pedestrian travel in a fixed time period, Greene-Roesel et al. (2007). The survey for the U.S. was conducted in 2001 by National Household Travel Survey, Purcher and Renne (2003). The number of pedestrian trips is generally gathered by surveying a representative subset of a population for the purpose of commuting to work or school, for social visiting, and for utilitarian purpose. This method is useful to assess pedestrian exposure over large areas. The FDOT conducted telephone interviews with 963 Florida residents to reevaluate bicycle and pedestrian exposure, Turner (2002). The profiles of survey participants and collision reports were used to estimate the trip generation and characteristics for pedestrian and bicyclist exposure. As a result, it was found that bicycle and pedestrian exposure was higher than four years ago.

The time spent walking not only considers the distance traveled but also the walking speed. For example, Keall compared the crash data with survey data using the exposures measures "time spent walking" and "number of roads crossed" and estimated the risks of traffic collision for different sex and age groups, Keall (1995). Using the same exposure measure, Lassarre et al. developed an exposure model to evaluate risk exposure for pedestrians using pedestrian crossing behavior, Lassarre et al. (2007). First, they divided pedestrian crossing scenarios into two parts: one was mid-block locations and the other was traffic controlled junctions. Analyzing the two kinds of crossing behaviors, the exposure calculation was divided into two parts, and the pedestrian crossing behavior model was used to estimate crossing probabilities for each location along the pedestrian trip. Finally, a hierarchical exposure model was used to estimate pedestrian exposure.

Other researchers used parts of the measures to estimate pedestrian exposure. For example, Blaizot et al. estimated the injury incidence rates through the accident and exposure data, Blaizot et al. (2013). Accident data was estimated from police reports and hospital-based data, and an exposure measure was estimated from a regional household travel survey (RTS). RTS was employed to collect resident information about weekday travel for each type of resident along with the number of trips, distance traveled, and time spent traveling. Using the resulting databases, accident rates were calculated by dividing the number of injuries by the exposure measure.

2.5 MODELS RELATED TO PEDESTRIAN CRASHES

There are a significant number of studies which aim at calculating pedestrian crashes, crash rates, or reducing the risk of pedestrian injury. Statistical models are often used to evaluate pedestrian exposure, hot spots and other factors related to pedestrian safety. The following section summarizes some of these statistical models based on different parameters.

2.5.1 Models Related to Pedestrian Exposure

Qin and Ivan developed a general linear model to estimate pedestrian exposure using weekly pedestrian volume in rural area in Connecticut, Ivan et al. (2000), Qin and Ivan (2011). They investigated factors such as population density, presence of sidewalks, demographic characteristics, land use characteristics and road site features. Scatter plots showed that there might be a positive linear relationship between InV and lnP. Therefore, the linear model for weekly pedestrian volumes predictions was as follows:

$$V = P^{\alpha} e^{(\beta_0 + X_S\beta_S + X_D\beta_D + X_L\beta_L + X_R\beta_R + \epsilon)}$$

After the natural log transformation, a simple linear form was as follows:

$$\ln V = \alpha \ln P + \beta_0 + X_S\beta_S + X_D\beta_D + X_L\beta_L + X_R\beta_R + \epsilon$$

Where

V = weekly pedestrian volumes,

P = population density,

X_S = site characteristics,

X_D = demographic characteristics,

X_L = land use characteristics,

X_R = road characteristics,

β_0, β_S, β_D, β_L, and β_R = parameters to be estimated, and

ϵ = error term.

Using linear regression analysis, the number of lanes, area type, and sidewalk systems fit well with the model. However, some factors didn't conform, such as population density and traffic control facilities. Also, weekly pedestrian volume, as a substitution of pedestrian exposure, didn't account for the amount of time spent walking or the distance walked by pedestrian which shows that the model did not include all the expected factors.

Molino et al. also used linear regression model to calculate pedestrian exposure in urban areas of Washington, D.C., Molino et al. (2009). In this study, seven of the sampling variables were considered independent variables in the model, which are hour of day, time period, day of week, land use type, political district, zoning type, and week category, and 15-min pedestrian volume count acted as a dependent variable. The results showed an average of 0.82 hundred million miles of travel distance as the pedestrian exposure in the D.C. area in 2007.

Ernst developed a Pedestrian Danger Index (PDI), which was the rate of pedestrian deaths relative to the amount of walking in a specific area, Ernst (2011). The model was developed using the fatality rate of different study areas divided by the percent of commuters walking to work. The model mainly compares metropolitan areas based on danger to pedestrians going to work on foot. However, it doesn't explain or adjoin other types of pedestrian trips such as jogging, walking to school or to the store and therefore can be misleading when taking into account the total respective hours of commute.

2.5.2 Models Related to Hot Spots

LaScala et al. developed spatial autocorrelation corrected regression model to determine factors associated with pedestrian crash injury, LaScala et al. (2000). The authors investigated a number of demographic factors (gender, age, marital status, education, income, and unemployment) and several environmental features (high traffic flow, complex roadway systems, greater population densities, and alcohol availability). The dependent measure was the densities of pedestrian injuries within the geographic units of the city and a final logarithmic transformation of the dependent measures was as follows:

$$\ln[1 + (\text{pedestrian injuries})/(\text{roadway length})]$$

All geostatistical analyses were performed using Spatial Statistical System software. The spatial autocorrelation corrected regression model was:

$$Y = Xb + (I - \rho W)^{-1}\varepsilon$$

Where

Y is an $n \times 1$ vector of dependent variables observed across n units,

X is an $n \times k$ matrix of k exogenous measures,

b is the $n \times 1$ coefficients for each measure,

ρ is the coefficient of the spatial lag term

W is an $n \times n$ matrix indicating connections between adjacent spatial units with 0 and 1.

The results showed that traffic flow, population density, age composition of the local population, unemployment, gender, and education were significant factors associated with pedestrian injury rates.

Espino et al. applied a Poisson distribution model to identify pedestrian crash hot spots in Florida, Espino et al. (2003). The authors implemented the framework for identifying pedestrian hot spots on the state highway system as part of the Highway Safety Improvement Program. The Poisson function of a pedestrian crash frequency for every one mile segment was defined as follows:

$$P(y) = \frac{\lambda^y}{y!} e^{-\lambda}$$

Where

λ is the average number of pedestrian crashes per mile,

y is the number of pedestrian crashes.

Zhan et al. used another Poisson model for pedestrian crash counts in New York City, which was called a multivariate Poisson-Lognormal (MVPLN) model, Zhan et al. (2014). They developed this model using data collected from 2002 to 2006. This MVPLN model apparently overcomes the limitations of the ordinary univariate count models that analyze crashes of different severity level separately and ignores the correlations among different crashes severity levels. Furthermore, this model captures the general correlation structure in crashes frequency and also is aware of over-dispersion in the data to avoid discrepancy issues and acquires better aggregate results.

Wang and Kockleman also devised a Poisson model for pedestrian crash counts across neighborhoods, Wang and Kockleman (2013). They researched years of pedestrian crash occurrences in Austin, Texas with information on sidewalk density, lane-mile densities (including roadway class), and demographic information such as its population and areas of employment. With this information, they could generate a model for regions via Poisson-based multivariate conditional auto-regressive (CAR) framework and is estimated using Bayesian Markov chain Monte Carlo methods and least-squares regression estimates of walk-miles traveled per zone serve as the exposure measure. Their model fits better than previous models, such as spatial Poisson-lognormal multivariate model and a spatial model (without cross-severity correlation). Their results also suggest greater mixing of residences and commercial land uses is associated with higher pedestrian crash risk across different severity levels presumably since such access produces more potential conflicts between pedestrian and vehicle movements.

2.5.3 Density Models

Density models have also been tried to measure pedestrian crash rates. The degree of concentration is measured based on density, calculated as pedestrian crash frequency per unit area, for example, a square mile or a mile. As of today, there are two density methods: The simple method, which density values are calculated as the ratio of total number of crashes that fall within a search area. The other is the Kernel Density method, which uses a more sophisticated procedure, where a new search area is drawn for each cell and equations are individually applied, Alluri et al. (2013). The latter method is more appropriate since it can detect hot spots better as it treats areas individually. The equations are as follows:

$$K(u) = \frac{1}{\sqrt[2]{2\pi}} e^{\frac{-u^2}{2}}$$

And the Kernel Density Estimator

$$f_h(X) = \frac{1}{Nh} \sum_{i=1}^{N} K\left(\frac{X - X_i}{h}\right)$$

The larger the radius the flatter the kernel surface, derived from factor h which is one of the most influential parameters. Once the areas are established, the concentration areas are categorized in very low, low, medium, high, and very high risk locations, represented with 20th percentile increments.

The K-means clustering method also works as density model for pedestrian crash rates in which it relies on the distance between the dataset attributes and attempts to maximize the similarity between clusters. The K-means algorithm aims at minimizing an objective function or a squared error function. It was as follows:

$$f(j) = \sum_{j=1}^{K} \sum_{i=1}^{n} ||x_i - c_j||^2$$

Where

X_i = attribute of data point i

n = total number of data points

c_j = centroid or mean value of cluster j

K = total number of clusters

When the data is mixed with several probability distributions, the Latent Class type of Clustering method may be used instead. It is based on the maximum likelihood estimation and its sole advantage over the K-means method is that it doesn't depend on the distance between datasets or normalize the data before processing

$$f(z_i|\theta) = \sum_{k=1}^{K} \pi_k f_k(z_i|\theta_k)$$

Where

$fk(z_i|\theta)$ = probability density function

Z_i = vector of observed variables of the ith crash

K = total number of clusters

π_k = prior probability of being assigned to cluster k

Θ_k = vector of parameters of the kth latent class cluster model

2.5.4 Probit models

Probit models have also been investigated, but rather, their usefulness is not in the general sense of the crash rate but in specific scenarios for a certain crash to occur. An ordered probit model is used to estimate the effects of the personal and locational characteristics on the severity of the injury sustained in the crash according to Clifton (2009). It associates a certain element of the crash, such as injury types. The model at its simplest form:

$Y_i = \beta' X_I + \epsilon_i$

Y_i = predicted injury sustained by the pedestrian in a crash

β'= vector of unknown parameter to be estimated

X_i = vector of explanatory variables describing the pedestrian (i)

ϵ = random error

And when to specify the type of injury to which can occur, the probabilities are calculated as follows:

$$Prob(y = 0|x) = \Phi(-\beta_{\{0\},\{1,2\}}X)$$

$$Prob(y = 1|x) = \Phi(-\beta_{\{0\},\{1,2\}}X) - \Phi(-\beta_{\{0\},\{1,2\}}X)$$

$$Prob(y = 2|x) = 1 - \Phi(-\beta_{\{0\},\{1,2\}}X)$$

Where Probabilities of having are:

Y = 0 no injury

Y = 1 non-fatal injury

Y = 2 fatal injury

2.5.5 Negative Binomial Models

Lam et al. examined the pedestrian crash risk by formulating effective road safety measures, Lam et al. (2014). Three pedestrian exposure measures were considered to calculate pedestrian exposure measures, namely POP (Population based), STP (Space Time Path), and PPT (Potential Path Tree). After getting the pedestrian exposure, negative binomial (NB) regression models were used to establish the relationship between crash frequency and a combination of different independent variables, which included exposure variables, roadway variables, and environmental variables.

Assuming that pedestrian crashes are random, discrete, and non-negative events which often demonstrate an over-dispersed distribution. The NB model has the following specification:

$$\ln(\lambda_k) = \beta\chi_k + \varepsilon$$

Where

λ_k is the expected mean number of pedestrian crashes on segment k,

β is the vector representing the parameters to be estimated,

χ_k represents independent variables on segment k,

ε is the error term.

They found that the model using PPT method for the pedestrian exposure has the highest interpretation power among the three models, which means PPT method generates promising results with respect to modeling pedestrian crashes. Besides, some roadway variables (such as main road) and environmental variables (such as the presence of public transport stations) were found to be associated with higher pedestrian risk.

Ukkusuri et al. also used negative binomial regressive model for predicting pedestrian crash frequencies at the census tract level Ukkusuri et al. (2011). The independent variables used in the model are presented for three categories: demographic characteristics (including census tract population, proportion of African-American population, etc.), land use patterns (including industrial land use proportion of total land use, total park area, etc.), and traffic system attributes (including total number of all-way stop intersections, number of signalized intersections, etc.). Overall, some conclusions were summarized through the negative binomial regressive model. For instance, more pedestrian crashes occurred in the areas with a greater number of schools or commercial and industrial land use.

A study by Zhu et al. in 2013 used walking exposure (kilometers walked per person-year), vehicle-pedestrian collision risk (number of collisions per kilometers walked) and vehicle-pedestrian collision case fatality rate (number of deaths per collision) to study male-female discrepancy, Zhu et al. (2013). The decomposition method has been shown to calculate pedestrian death rate. The equation was as follows:

$$\text{Pedestrian death rate} = \text{walking exposure} \times$$

$$\text{collision risk} \times \text{collision case fatality rate}$$

Besides, the natural logarithmic transformation was used to identify the relative importance of individual components with regard to developing prevention strategies. The ratio of each component to the difference in pedestrian death rate with the following equation:

$$\mathrm{RC_i} = \frac{|\ln(\mathrm{ratio_i})|}{|\ln(\mathrm{ratio_b})| + |\ln(\mathrm{ratio_c})| + |\ln(\mathrm{ratio_d})|}$$

Where:

$\mathrm{ratio_b}$ = the ratio of the differences between male and female in walking exposure,

$\mathrm{ratio_c}$ = the ratio of the differences between male and female in collision risk,

$\mathrm{ratio_d}$ = the ratio of the differences between male and female in collision case fatality rate, and

I = b, c or d.

The study concluded that the pedestrian death rate per person-year for men was 2.3 times more than women. Through the ratio equation, the better understanding of the reason for the additional fatality risk in men was that the collision case fatality rate in men was higher than that in women. However, the researchers may not get this data easily.

Table 1 provides an evaluation matrix for all the previously studies models and methods for measuring pedestrian crashes including some advantages and disadvantages.

Table 1: Summary of Methods for Measuring Pedestrian Crashes

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
1	Pedestrian Traffic Fatalities by State	No model, but death statistics per year in age groups. **Deaths/year**	Death Rate	-Fatalities -Patterns in pedestrian deaths involve age, time of day and alcohol involvement	Can find areas most concerned, as well as their time of day and users at most risk	No actual Accident rate, but death rates which only represent the deadly accidents
2	NHTS Traffic Safety Facts 2011 Data	Pedestrian fatalities/total traffic fatalities-year; injury/population (thousands); **pedestrian fatalities/ time of day**	Death rate Injury rate	Weather conditions, location, land use, age, gender, time of day. population	Less crashes in non-normal weather conditions, more during the nighttime	No actual accident rates, study only on deaths and injured per gender per year
3	National Pedestrian Crash Report	Various. Pedestrian crash deaths/many different factors	Death + injury rates	Pedestrian crashes, exposure data, time of day, sex, age, weather, Speeding	Extensive study finding relationships with single factors at a time	Based on probability rather than census, most data based on deaths. Basing findings on single factors may not be realistic for real world scenarios
4	Final Report – The Pedestrian Crash data	No model, study of crashes	crashes	Human characteristics (age, gender, height, etc.), vehicle characteristics, speed, type of injuries	Involves the type of vehicle and injuries associated with them	Not a crash rate model. Only Pedestrian crash study.
5	Dangerous by Design	Pedestrian Danger Index (PDI): Rate of pedestrian death relative to the amount of	PDI= Pedestrian Danger Index	Fatality rate: Walking distance, time, deadly	Compares metropolitan areas based on danger to	Doesn't take into account pedestrian behavior prior to

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
		walking in that area. Yearly fatality rate divided by percentage of commuters walking to work $PDI = \frac{yearly\ fatality}{\frac{fatality\ rate}{\frac{x}{100}}}$		crashes, race, age, income X/100= % of commuters walking to work	pedestrians who go to work on foot	incidents, be it jogging, walking to school, to the store, etc.
6	An Analysis of Available Bicycle and Pedestrian Accident Data	Percentage of bicyclist/pedestrian accidents to overall traffic accidents	Pedestrian accidents	NY accident data form police reports: accidents number, injuries, fatalities	Separates Injuries and fatalities	Not a crash rate model.
7	Identifying Locations for Pedestrian and Bicyclist Safety Improvements in Chapel Hill and Carrboro, NC	Vast pedestrian and Bicycle lane usage, incidents location clusters, and recommendations to improve on. No prediction model	study	Clusters, hot spot locations	Recommendations	Needs crash rate model
8	Pedestrian Crash Analysis Summary Report	Vast database and history of pedestrian-car incidents in Chicago. No model to use.	-study	Databases of pedestrian crash accidents	-	No crash rate
9	A Technical Guide for Conducting Pedestrian Safety Assessments for California Cities	No model. Walk-on study and countermeasures	-	-	-	-
10	Examining the Design and Developmental Factors Associated with Crashes involving	No model. Study tries to understand what types of intersection and locations are more at risk due to behavior in certain areas	-	Type of intersections locations	-	-

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	Pedestrian, Cyclists, and Motorists in Urban Environments					
11	Transportation issues: pedestrian safety, Dewey (2003)	Talk of Regression analysis to understand high death rates in FL, but no equation is shown. Equations show are associated with the spending to reduce the fatalities and coping with them	Fatalities	Temperature, Daylight, Tourism, Age, Poverty, Area	-	No crash rate
12.1	Comprehensive Study to Reduce Pedestrian Crashes in Florida. 2.2.1 Statistical Regression Models	Exposure studies based on different factors independently. Pedestrian Probability distribution function for hot spots (Poisson): $P(y) = \frac{\lambda^y}{y!} e^{-\lambda}$	Probability Distribution of crashes	λ= average number of pedestrian crashes per mile y= number of pedestrian crashes	Presence of sidewalks is the most significant factor affecting pedestrian activities	
12.2	Linear regression model $V = P^{\alpha} e^{(\beta_0+\beta_S X_S+\beta_D X_D+\beta_A X_A+\beta_R X_R+\epsilon)}$		V = weekly pedestrian volume	P=Population density X_s = site char. X_D=Demographic characteristics X_A=Are type X_R=Roadway characteristics α=regression coefficient of Pop. Density β_0 = intercept coefficient	Authors found that are type, presence of sidewalks, and number of lanes were the only significant variables in predicting pedestrian exposure.	Amount of cars and their speed and other characteristics not taken into consideration

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
				$\beta_{S,D,A,R}$ = reg-coef ϵ= error term		
12.3	Kernel Density Estimation (KDE) (Gaussian)	$K(u) = \frac{1}{\sqrt[2]{2\pi}} e^{\frac{-u^2}{2}}$ $f_h(X) = \frac{1}{Nh} \sum_{i=1}^{N} K\left(\frac{X - X_i}{h}\right)$	K is Kernel function $f_h(X)$=Kernel density estimator	Gaussian Kernel h>0 is the smoothing parameter	The density value is highest at the crash location and diminishes as it leaves. Smoother density surface	It appears to only concentrate on hot spots after the crash fact
12.4	K-Cluster Method	$f(j) = \sum_{j=1}^{K} \sum_{i=1}^{n} \lvert\lvert x_i - c_j \rvert\rvert^2$	F(j) = k-cluster probability	X_i= attribute of data point i n = total number of data points c_j = centroid or mean value of cluster j K = total number of clusters .	rely on the distance between the dataset attributes and attempt to maximize the similarity within each cluster and the dissimilarity between clusters	The association can be limiting in overall scope. Depends on the distance between elements
12.5	Latent Class Clustering Method	$f(z_i \vert \theta) = \sum_{k=1}^{K} \pi_k f_k(z_i \vert \theta_k)$	$fk(z_i \vert \theta)$ = probability density function	Z_i = vector of observed variables of the ith crash K=total number of clusters π_k=prior probability of being assigned to cluster k Θ_k=vector of parameters of the kth latent class cluster model	Based on maximum likelihood estimation. Does not depend on the distance between elements and does not need to normalize data before processing	

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
13	Severity of injury resulting from pedestrian-vehicle crashes…	Ordered Probit Model $Y_i = \beta' X_i + \epsilon_i$	Y_i = predicted injury sustained by the pedestrian in a crash	β'=vector of unknown parameter to be estimated X_i=vector of explanatory variables describing the pedestrian(i) ϵ =r andom error	Used to estimate the effects of personal and location characteristic on the severity of injury sustained	
13.2		$Prob(y = 0\|x) = \Phi(-\beta_{\{0\},\{1,2\}}X)$ $Prob(y = 1\|x) = \Phi(-\beta_{\{0\},\{1,2\}}X) - \Phi(-\beta_{\{0\},\{1,2\}}X)$ $Prob(y = 2\|x) = 1 - \Phi(-\beta_{\{0\},\{1,2\}}X)$	Probabilities of having Y = 0 no injury Y = 1 non-fatal injury Y = 2 fatal injury	Based on previous factors above	Good way to separate probabilities for each type of injury at the time of a crash	Must combine all to get a total crash rate
14	A clustering regression Approach….New York, Canada	Clustering: $f(z_i\|\theta) = \sum_{k=1}^{k} \pi_k f_k(z_i\|\theta_k))$		Z_i = vector of observed variables from the ith crash outcome K= number of clusters π_k=prior probability of membership in latent class or cluster k θ_k = cluster model parameters $f_k(z_i\|\theta_k)$= mixture of probability density	Homogenous subsets help identify important contributing factors that would be hidden if whole dataset is used	

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
14.2	Injury severity model: $y_i^* = \sum_{k=1}^{k} \beta_k X_{ki} + \epsilon_i$		y_i^* = injury severity risk, with τ_1 and τ_2 as its threshold values for its severity levels	β = a vector of parameters to be estimated from the data ε_i = error (normally distributed)	Good way to separate probabilities for each type of injury at the time of a crash	Must combine all to get a total crash rate
14.3	Multinomial Logit Model: $P_k(i) = \frac{e^{\beta_k x_{ki}}}{\sum_{k=1} e^{\beta_k x_{ki}}}$		P_k = Probability of pedestrian k being injured with severity *i* Based on 14.2 equation	Based on above	Considers 3 or more severity outcomes	Would not be possible to test in singular types of severity/outcomes
15	Identifying the Clusters and Risk factors of injuries in pedestrian-vehicle crashes in a GIS Environment	No model. Study of clusters	-	-	-	-
16	A spatially disaggregate analysis of road casualties in England.	Probability Density function for the Negative Binomial distribution: $\Pr(n_i \mid \mu_i, k) = \frac{\Gamma\left(n_i + \frac{1}{k}\right)}{\Gamma\left(\frac{1}{k}\right)\Gamma(n_i+1)} (\frac{k\mu_i}{1+k\mu_i})^{n_i}($	Probability Density	K(≥0) = over dispersion parameter	If k=0, then it becomes a Poisson regression model. It can be used to evaluate the significant presence of overdispersion on the data.	A limitation could be the use of group level data, specially to model outcomes that are determined by the nature of individuals.
17	Spatial Analysis of Income Disparities in Pedestrian Safety in Northern New	NB > Poisson		Population charac., land uses, road networks	Poisson regression has a restrictive assumption of equi-dispersion	

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	Jersey.					
18	The role of built environment on pedestrian crash frequency.	Poisson regression: $Y_i \mid \theta \sim Poisson(\theta_i)$ $\theta_i = \mu_i \exp(\varepsilon_i)$ Function of environmental factors $\mu_i = f(x_i; \beta)$ Vector of regression parameters to be estimate from data: $\beta = (\beta_{0,} \dots, \beta_k)$	Y_i = number of accidents over given area i	exp (ε_i) = represents the multiplicative random effect of the model following a Gamma distribution with parameter 1/α x_i=vector of built environment factors	Ease of computation	Equal mean and variance assumptions. Unobserved heterogeneities and excess zeros
18.2	Zero-inflated negative binomial (ZINB) regression model: $Y_i \sim 0, with\ probability\ p_i$ $Y_i \mid \theta \sim Poisson(\theta_i) with\ probability\ (1 - p_i)$		Y_i = number of accidents over given area i	P_i = parameter that represents the proportion of zeros added to the NB distribution	Ability to account for over dispersion, between heterogeneity of crash variations, and its computational simplicity for model calibration	Must have a good understanding of the reasons of the high number of zero values
19	Factors influencing injury severity of motor vehicle–crossing pedestrian crashes in rural Connecticut.	Ordered probit model: $y^* = \beta' x + \varepsilon$	Y*= unobserved variable measuring risk of injury, has thresholds	x= vector of non-random explanatory variables β'=the row vector of unknown parameters ε=random error term	Good in getting estimates to each type of car-pedestrian hit regarding the type of injury, no injury, or death from it	Must combine all to get a worldly crash rate. Probit models may not converge if variables are not similar scales
20	The role of the built environment	No model. Study analysis of data	-	-	-	-

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	in explaining relationships between perceived and actual pedestrian and bicyclist safety.					
21	Predicting accident rates for cyclists and pedestrians, Turner et al. (2006)	2.3.1 (Eq. 2.1) Multiplicative model using Poisson regression $A = \exp(3.16 - 0.18X_1 - 0.27X_2 + 0.29X_3 + 0.27X_4$	A=number of mid-block accidents (per 10^8 veh·km)	X_1=1 for residential development, 0 otherwise X_2=1 for raised medians, 0 otherwise X_3=1 for 50 km/h areas, 0 otherwise X_4=number of intersections per km	Most appropriate for mid-block accidents, intersection accidents and total accidents	
21.2	2.3.1 (Eq.2.2) Refined model $A = \exp(3.02 - 0.10X_1 - 0.16X_2 - 0.26X_3 - 0.32X_4 - 0.028X_5)$		A=number of mid-block accidents (per 10^8veh-km)	X_1=1 for residential development, 0 otherwise X_2=1 for flush medians, 0 otherwise X_3=1 for raised medians, 0 otherwise X_4=1 for 50km/h areas, 0 otherwise X_5=number of intersections per km	Most appropriate for mid-block accidents, intersection accidents and total accidents. Flush medians have reduced the accident increasing effects of residential use	

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
21.3	Injury and property damage, Hauer Model (Eq. 2.3) $A = kO_a^{\alpha}Q_b^{\beta}$		A=accidents	O_a, O_b = flows K_1, α and β = parameters	Accounts for most common accident types and time periods	
21.4	Generalized regression techniques assumed to follow a Poisson Error distribution $A = 0.023QT^{1.28}(1+PT^{0.30})$ (Eq. 2.5)		A= Accidents	QT = Q1 +…Q12 (total vehicles inflow 12 hours) PT = P1 +…P8 (total pedestrian flows across the four legs)	Models were developed for approach widths, number of lanes, sight distance, displacement, etc.	
22	Pedestrian injury analysis with consideration of the selectivity bias in linked police-hospital data.	Heckman's linear regression $y_1 = \alpha x_1 + \varepsilon_1$ $y_2 = \beta x_2 + \varepsilon_2$	Y_i=number of accidents over given area I		Linked reports and data of police crash information	
23	Comprehensive analysis of vehicle-pedestrian crashes at intersections in Florida	Log-linear model and method of calculating odds multipliers (likelihood of crash occurrence relative to a reference) $\ln(F_{ij}) = \theta + \lambda_{x(i)} + \lambda_{y(j)} + \lambda_{xy(ij)}$	Likelihood of crash occurrence	F_{ij} is the expected number of pedestrian crashes when x = I and y = j Θ a constant $\lambda_{x(i)}$ the effect of the i^{th} level of factor x, y,	A way to evaluate the crash due to the driver's error, and pedestrian error on each side	Hard to control reason the driver or pedestrian cause the crash, such as alcohol use
24	The severity of pedestrian crashes: an analysis using Google Street View imagery	No model. Just a study drawn from the imagery	-	-	-	-
25	A mixed	MGORL model structure is an	Y_{qk} =	Z_{qk}= set of	Includes threshold	Can lead to

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	generalized ordered response model for examining pedestrian and bicyclist injury severity level in traffic crashes.	enhanced probit model $\psi_{q,k} = \psi_{q,k-1} + \exp\left(\alpha_{qk} + y'_{qk} Z_{qk}\right)$	corresponding crash-specific vector of coefficients	exogenous variables associated with k[th] α_{qk}=parameter associated with injury severity level k=1,2..K-1	values in the same equation, 4 levels of severity	inconsistent estimates of the effects of several variables in the empirical context
31	A study on pedestrian accidents and investigation of pedestrian's unsafe conditions in Khon Kaen Municipality, Thailand	Linear Prediction models Stepwise Y = 1.626 X_1+ 0.184 X_3 + 0.25 X_5 + 0.627 Forward Y = 1.626 X_1 + 0.184 X_3 + 0.25 X_5 + 0.627 Backward Y = 1.461 X_2 + 0.210 X_3+ 0.283 X_4 + 0.543	Y = Number of Pedestrian Casualties per intersection/ Section	X_1 = Number of Hospitals Located in the Radius of 100 m X_2 = Number of Hospitals Located in the Radius of 150 m X_3 = Number of Lanes X_4 = Number of Schools Located in the Radius of 100 m X_5 = Number of Schools Located in the Radius of 150 m	Includes lanes of road. Also includes particular points of interests for trips, such as hospitals and schools	Only includes areas near hospitals
31.1	Non Linear Models $Y = 1.068e^{(0.563X_2+0.086X_3)}$ $Y = 0.822e^{(0.396X_1+0.098X_3+0.209X_4)}$ $Y = 0.777e^{(0.342X_1+0.108X_3+0.223X_4)}$ $Y = 1.224X_1^2 + 0.197X_3 + 0.795$ $Y = 1.867X_1^2 + 0.299X_3 + 0.696$		Y = Number of Pedestrian Casualties per Intersection/ Section	X_1 = Number of Hospitals Located in the Radius of 100 m X_2 = Number of Hospitals Located in the Radius of	Includes lanes of road. Also includes particular points of interests for trips, such as hospitals and schools	Only includes areas near hospitals

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
				150 m X_3 = Number of Lanes X_4 = Number of Schools Located in the Radius of 150 m		
32	Effects of vehicle impact velocity, vehicle front-end shapes on pedestrian injury risk. *Traffic injury prevention*	Combined injury probability is not a complete crash model. $P_{sum} = P_{head} + P_{chest} - P_{head} \times P_{chest}$	P= injury probability		Takes account all injuries that may be received at a car-pedestrian accident ant their risk	Not a standard crash model
33	The severity of pedestrian injuries in children: an analysis of the pedestrian injury causation study.	No model. Types of pedestrian injuries	-	-	-	-
34	Final Report Aging Driver and Pedestrian Safety Parking Lot Hazard Study.	No model. Study of eye tracking head set used by pedestrians in a test.	-	-	-	-
35	Are school zones effective? An examination of motor vehicle versus child pedestrian crashes near schools.	Study based on walking distance from schools and crashes. No prediction model	-	-	-	-

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
36	Severity of Pedestrian Crashes at Highway-Rail Grade Crossings.	Analyzes crash dates	-	-	-	-
1	Pedestrian Deaths Fall After Three-Year Increase	Statistics by state. No prediction model	-	-	-	-
2	Pedestrian Traffic Fatalities by State: 2013 Preliminary Data.	Pedestrian death statistics and pattern across the US	-	-	-	-
3	These Are The 5 Most Lethal States For Pedestrians.	Pedestrian Death rates per city/state.	-	-	-	-
4	<<< Prime Number>>>	Fact in a magazine about the recent pedestrian accidents	-	-	-	-
5	Excess Mortality From Traffic Accidents Among Elderly Pedestrians Living In The Inner City.	Study which hot spots are found in the inner parts of the cities and most affected are the elderly.	-	-	-	-
6	From Targeted "Black Spots" To Area-Wide Pedestrian Safely	Central boroughs tend to be the more risky	-	-	-	-
7	Evaluation Of A Comprehensive Pedestrian Safety Initiative	Study and countermeasure to pedestrian deaths in Miami-Dade county	-	-	-	-
8	Urban And Rural	Using miles walked,	aRR (adjusted rate	Count of	Takes into account	Doesn’t develop a

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	Variation In Walking Patterns And Pedestrian Crashes	pedestrian walk patterns vs pedestrian struck, manages to gather a rating ratio to compare situations when accidents occurred. Rate/100,000person-years and per million miles walked	ratio)	accidents, location, miles walked	rural, suburban and urban areas	prediction model
9	Building National Estimates of Road Traffic Injuries In Developing Countries: Iran.	Simple study, total fatalities/population	Death rate	Fatality counts, locations	Simple way to look at the issue	Not a good way to measure unless the whole country is pedestrian. Doesn't have non-fatal statistics
40	Estimating Pedestrian Exposure Prediction Model in Rural Areas	Linear model $V = P^{\alpha} e^{(\beta_0+\beta_s X_s+\beta_D X_D+\beta_L X_L+\beta_R X_{.}}$ After natural log transformation lnV = αlnP+$\beta_0 + \beta_s X_s + \beta_D X_D + \beta_L X_L + \beta_R X_R + \epsilon$	V = Weekly Pedestrian Volume	P=Population Density X_S=Site char. X_D=Demo char. X_L=Land use X_R=Road char. B_0, B_S, B_D, B_L, B_R=parameters to be estimated ε=error term	Simple way to predict pedestrian exposure	Some factors not significant Does not account for amount of time spent walking or distance walked
38	Pedestrian and Bicyclist Exposure to Risk in an Urban Env.	Linear model	15-min pedestrian volume count	Hour of delay Time period Day of week Land use type Political district Zoning Type Week Category	Simple way to predict pedestrian exposure	Some factors not significant Does not account for amount of time spent walking or distance walked
2-16	Pedestrian exposure measures: A time-space	Negative Binomial Regression Model $\ln(\lambda_k) = \beta_{Xk} + \varepsilon$	λ = Number of pedestrian crashes on segment k	Exposure variable, roadway variable, environmental variable	Indicate heterogeneous influence on pedestrian crashes	Cannot evaluate pedestrian exposure

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	framework. *Travel Behaviour and Society*			β= vector representing the parameters to be estimated X_k = independent variables on segment k ε=error term		
27	A. Random Parameter Model Used to Explain Effects of Built-Env on Ped Crash Frequency	Negative Binomial Regression Model	Pedestrian crash frequencies	Demographic characteristics, land use patterns, traffic system attributes	Indicate heterogeneous influence on pedestrian crashes	Cannot evaluate pedestrian exposure
26	Demographic and environmental correlates of pedestrian injury collisions a spatial analysis. *Accident Analysis and Prevention,* LaScala (2000).	Spatial Autocorrelation Corrected Regression Model ln[1+(pedestrian injuries)/(roadway length)] Spatial autocorrelation corrected Regression $Y = Xb + (I - pW)^{-1}\varepsilon$	Densities of pedestrian injuries Y = n x 1 vector of dependent variables observed across units n	Demographic factors, environmental features X=n x k matrix of k exogenous measures b=n x 1 coefficients for each measure p=coefficient of spatial lag term W=n x n matrix indicating connections between adjacent spatial units with 0 and 1	Identify hot pot	Need Spatial Statistical System software
	Identifying	Poisson Model	Pedestrian crash	λ= average	Identify hot pot	Did not consider

Table 1: Summary of Methods for Measuring Pedestrian Crashes (Continued)

R#	Name of Study	Type of Model	Response Variable	Independent Variables	Advantages	Disadvantages
	Pedestrian High-Crash Locations as Part of FHSIP	$P(y) = \frac{\lambda^y}{y!} e^{-\lambda}$	frequency y= number of pedestrian crashes	number of pedestrian crashes per mile		the human factor
2-8/12	Why more male pedestrians die in vehicle-pedestrian collisions than female pedestrians	Decomposition Method Pedestrian death rate = walking exposure x collision risk x collision case fatality x rate	Pedestrian death rate	Walking exposure, collision risk, collision case fatality rate	Easy to calculate the rate when have exposure data	Difficult to get independent variable Cannot find the essential reason

III- CORRELATION BETWEEN SAFETY AND GAPS

The UCF research team assembled a wide array of Geographic Information Systems (GIS) information associated with the sidewalk/bicycle-lane gaps and the safety data secured by FDOT District Five. The data also included all the Roadway Characteristics Inventory (RCI) data within the district. The following sections explain in greater detail the sources and methods used in this investigation.

3.1 DATA SOURCES

In order to gather all the necessary GIS and RCI data needed in this investigation, several agencies within District Five were contacted, including FDOT, MetroPlan Orlando, Orange, Seminole, Volusia, and Osceola Counties. It was found that every jurisdiction and agency uses independent GIS data that are not homogeneous and do not easily interact. This makes it difficult to locate and analyze crash data along with roadway location and feature data using spatial analysis. Spatial data is key to understanding not only safety information such as crash mapping but also other related transportation phenomenon such as roadway characteristics and environmental impacts. As a result, the UCF research team utilized the Florida Unified Basemap Repository (UBR). The UBR is a unified approach to GIS data management to support transportation decision-making that was formed as the "GIS One Map" initiative in 2006 by the Florida Traffic Records Coordinating Committee (TRCC) as a response to the 2005 SAFETEA-LU (Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy for Users) legislation that placed an increased emphasis on the coordination and sharing of information to support safety analyses. The project goal was to develop a standard, comprehensive transportation network that could be used throughout the state, shared across jurisdictional boundaries, through multi-agency involvement and coordination, FDOT (2016d).

Other sources related to pedestrian and bicycle safety data were utilized such as Signal Four Analytics database (http://s4.geoplan.ufl.edu/). The University of Florida curated, *Signal Four Analytics*, is an interactive, Web-based system designed to support the crash mapping and analysis needs of traffic engineering, transportation planning agencies, and research institutions in the State of Florida. The system was developed by the GeoPlan Center at the University of Florida, and funded by the State of Florida through the Traffic Records Coordinating Committee (TRCC).

3.2 STATEWIDE PEDESTRIAN AND BICYCLE CRASHES

A preliminary analysis of statewide pedestrian and bicycle crashes was conducted utilizing the Signal Four Analytics database for the most recent 5-year period (May 2009 through May 2014). The data showed a total of 61,545 pedestrian- and bicycle-related crashes, an average of approximately 12,300 crashes per year. Further analysis for crashes per district was also conducted and separating pedestrian crashes from bicycle crashes as shown in Table 2.

Table 2: Number of Pedestrian- and Bicycle-related Crashes per District

District	Total Ped/Bike Crashes	Ped-Related Crashes	Bike-Related Crashes	Ped/Bike Split %
District 1	7,118	3,765	3,353	53/47 %
District 2	5,850	3,359	2,491	57/43 %
District 3	3,530	2,110	1,420	60/40 %
District 4	12,960	7,295	5,665	56/44 %
District 5	11,352	6,496	4,856	57/43 %
District 6	9,784	6,300	3,484	64/36 %
District 7	10,951	5,824	5,127	53/47 %
Statewide	**61,545**	**35,149**	**26,396**	**57/43 %**

As can be concluded from Table 2, District Four has the highest number of total crashes (21%) followed by District Five (18.4%), then District Seven (17.8%) and District Six (15.9%).

3.3 DISTRICT FIVE PEDESTRIAN AND BICYCLE CRASH ANALYSIS

Pedestrian and bicycle crashes were further analyzed within District Five using Arc GIS' Kernel Density function as well as Spatial analysis. Kernel Density calculates the density of point features around each output raster cell. A smoothly curved surface is fitted over each point as shown in Figures 1 and 2. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero at the search radius distance from the point. The density at each output raster cell is calculated by adding the values of all the kernel surfaces where they overlay the raster cell center. The kernel function is based on the quadratic kernel function described in Silverman (1986).

On the other hand, spatial analysis is an exploratory technique to better understand what patterns exist in a given data set, and to propose explanations for those patterns. Spatial Join analysis can be particularly useful when combined with mapping, because the clusters that emerge may form geographic patterns that lead to insights about connections between the attribute data and the spatial context formed. Based on that, all crashes within District Five were selected. A 0.25-mile buffer radius which is a walking distance from the intersections was selected and spatial join between the crashes and the intersection's buffer was performed. It should be noted that errors associated with this approach result from the close proximity of some intersections especially within the downtown area.

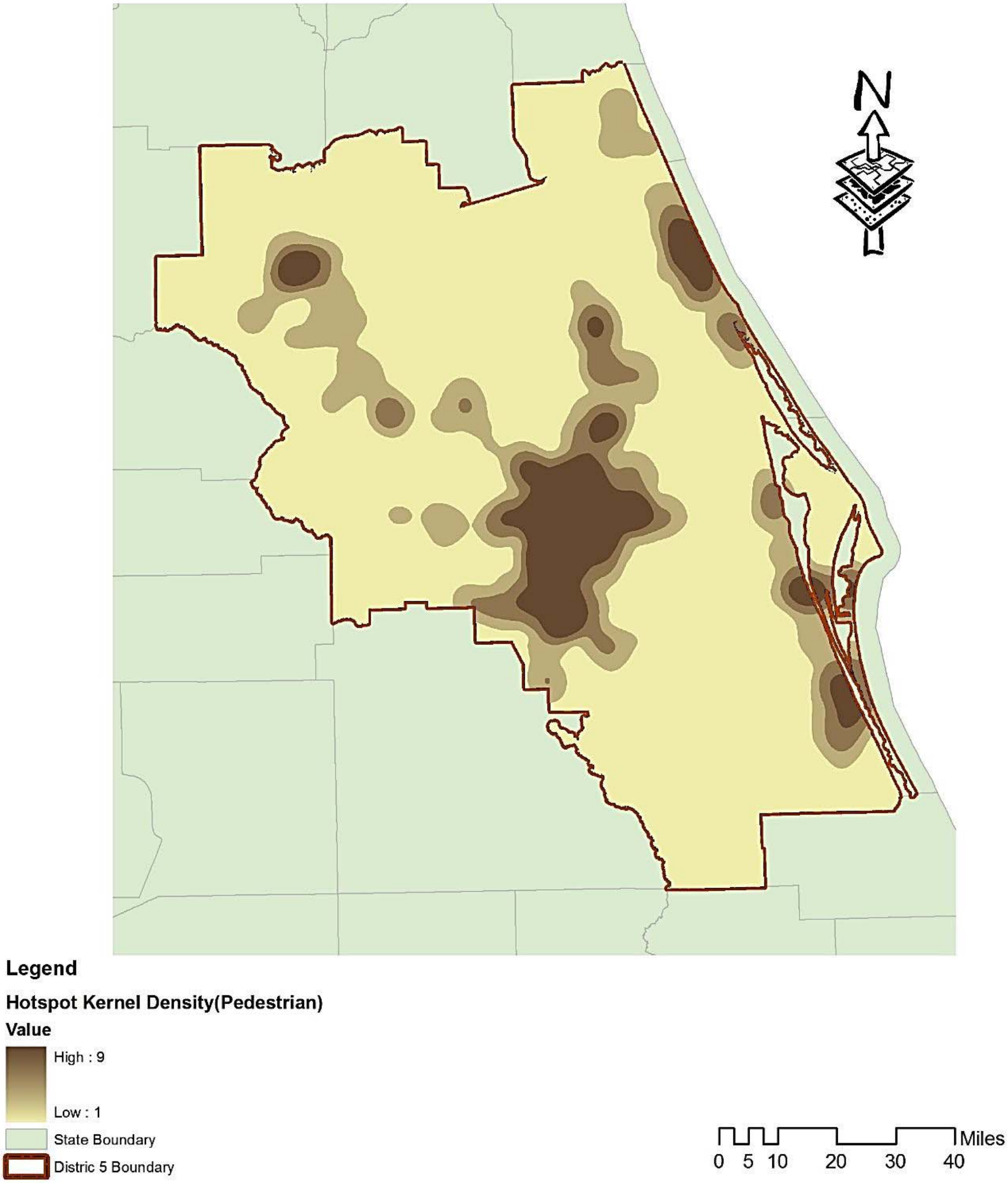


Figure 1: Hotspot Pedestrian Crashes within District Five – Kernel Density

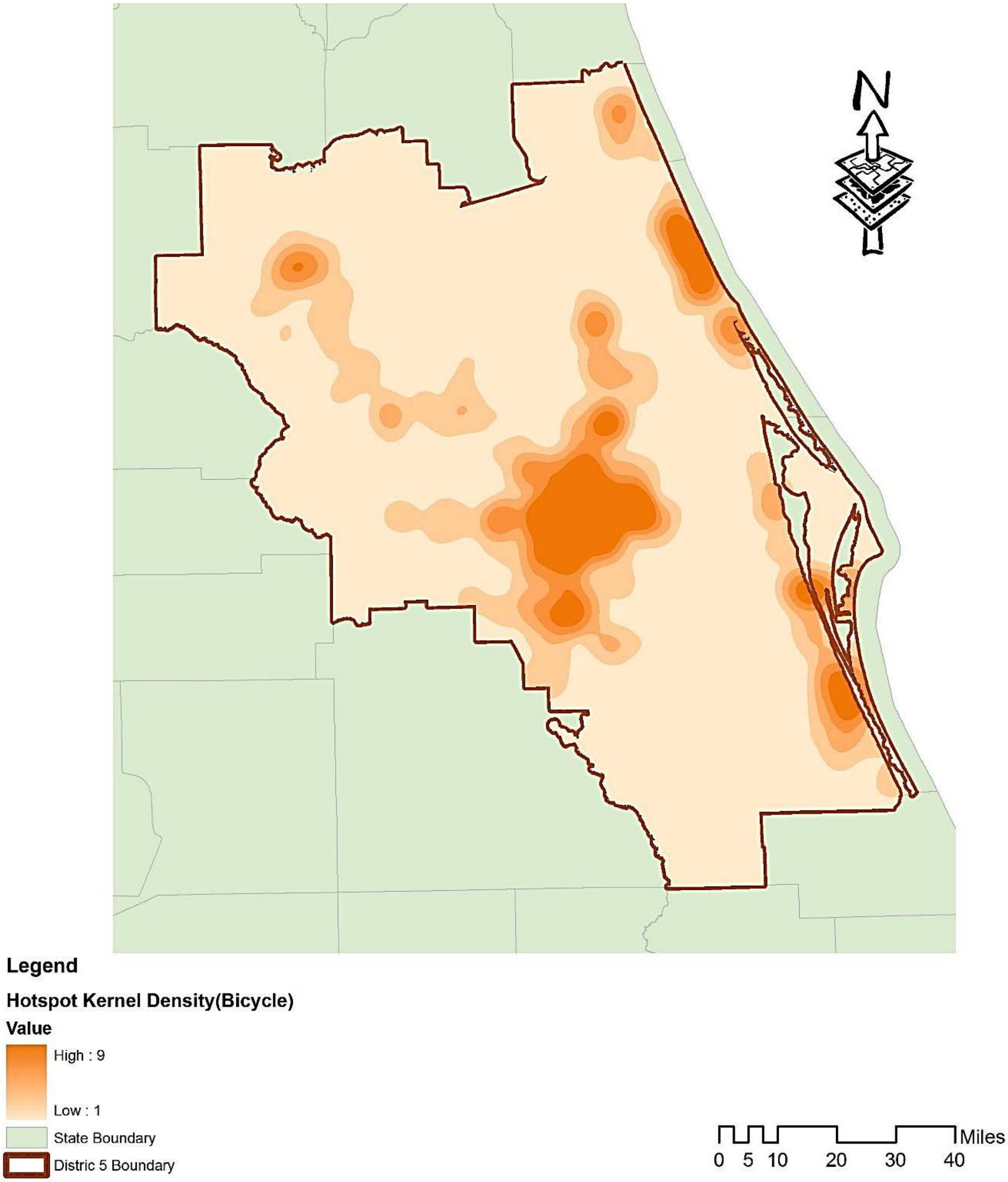


Figure 2: Hotspot Bicycle Crashes within District Five – Kernel Density

As can be seen from Figures 1 and 2, pedestrian and bicycle crashes have a similar pattern and are concentrated in certain zones within District Five, especially urbanized and downtown areas. However, some areas have high crash densities while others have low and medium densities according to kernel distribution. For example, Palm Coast and Eustis show low crash densities while Leesburg and New Smyrna beach areas show medium densities. On the other hand, Daytona Beach, Palm Bay, Cocoa, Ocala, Sanford, and the Orlando-Kissimmee areas show high crash concentrations.

Furthermore, intersections were separated based on the crash type (pedestrian and bicycle crash) and average statistics was calculated. The pedestrian dataset included minimum and maximum number of crashes surrounding the buffer area as well as an overall average number of crashes per intersection. A total of 36,363 intersections were in District Five. The average value for the whole data set for pedestrian crashes was 0.19 over the 5-year period as it can be observed in Table 3. Moreover, intersections that have pedestrian crashes greater than 0.19 were categorized into different group and another average was calculated for this group as shown in Table 4. Same approach was employed for bicycle crashes. Figures 3-8 show the results of the spatial analysis for the crash locations above the average values and their correlation with different RCI data such as area type, AADT, and functional classification. It can be concluded that most crashes were within the urban boundary and on the 4-5 lane roadways with AADT ranging from 30,000-70,000 entering vehicles per day. Same pattern was also observed for both pedestrian and bicycle crashes.

Table 3: Crashes Statistics – 5-Year Period

	Pedestrian Crashes	Bicycle Crashes
Total number of intersections:	36,363	36,363
Minimum number of crashes within buffer:	1	1
Maximum number of crashes within buffer:	50	24
Sum:	6,778	5,256
Mean:	0.1864	0.1445
Standard Deviation:	2.679	1.796

Table 4: Intersections with Above Average Crashes – 5-Year Period

	Pedestrian Crashes	Bicycle Crashes
Total number of intersections:	9,334	8,828
Minimum number of crashes within buffer:	1	2
Maximum number of crashes within buffer:	50	24
Sum:	4,297	3,432
Mean:	0.4603	0.3887
Standard Deviation:	4.281	2.641

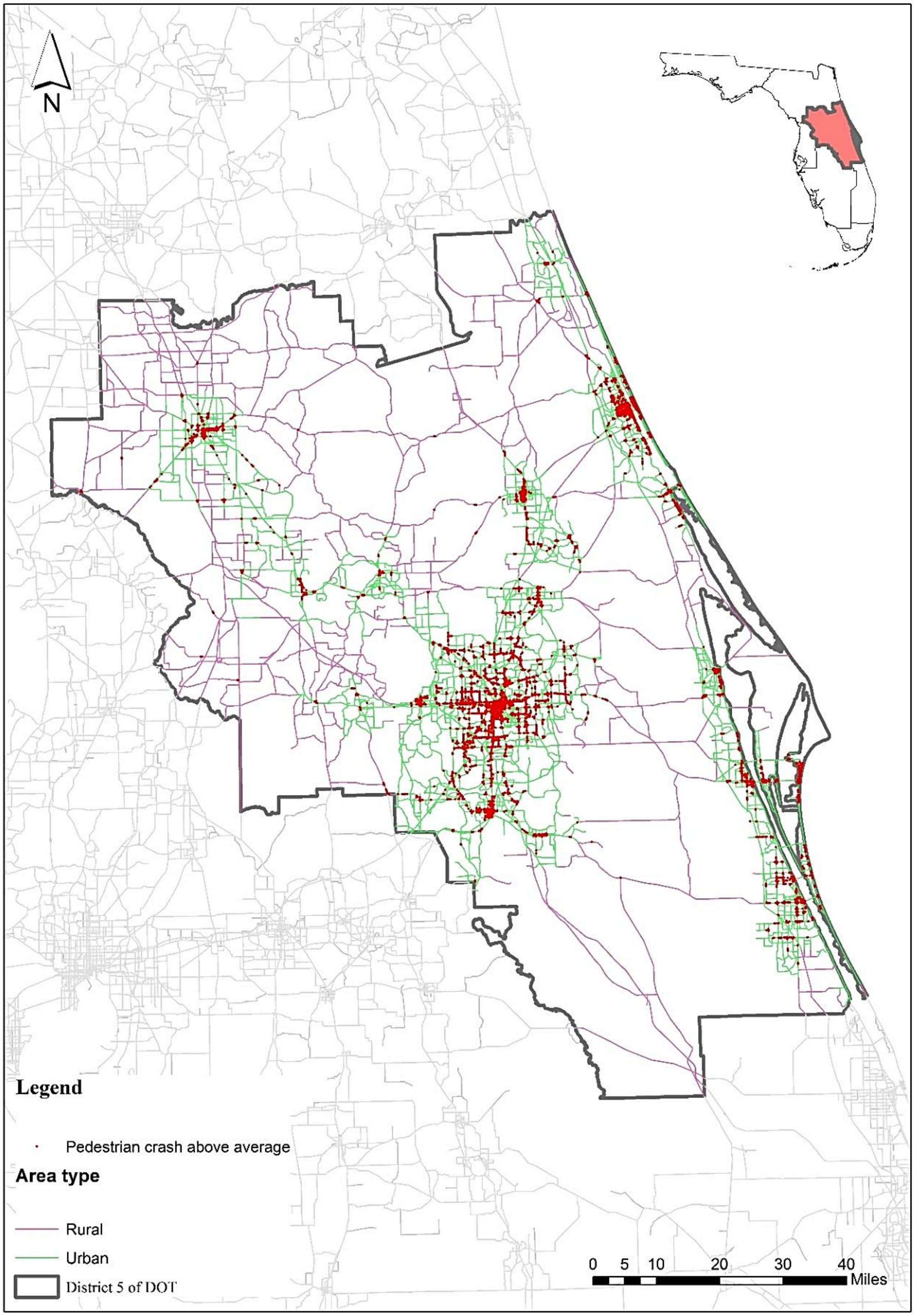


Figure 3: Area Type and Pedestrian Crashes above Average

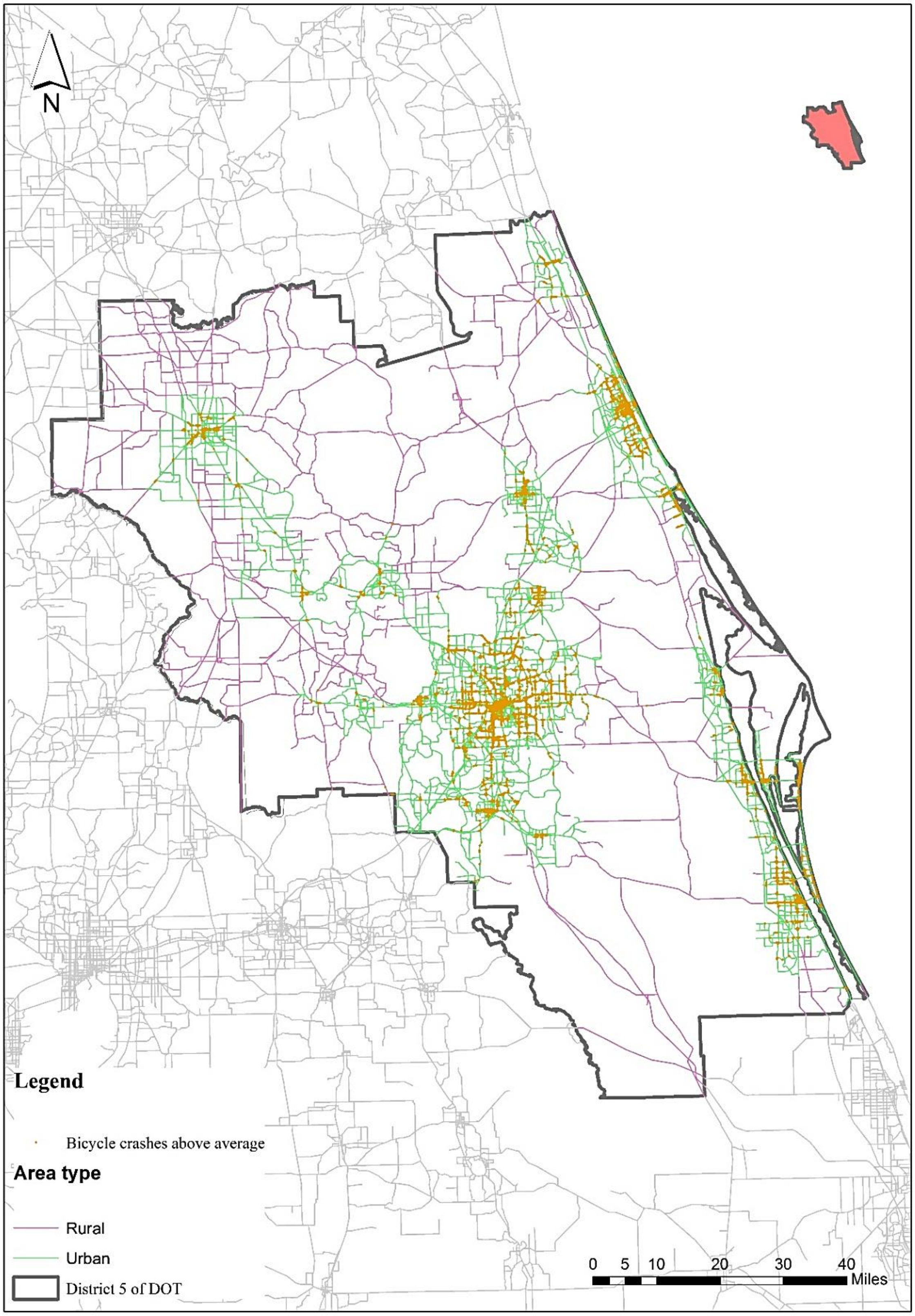


Figure 4: Area Type and Bicycle Crashes above Average

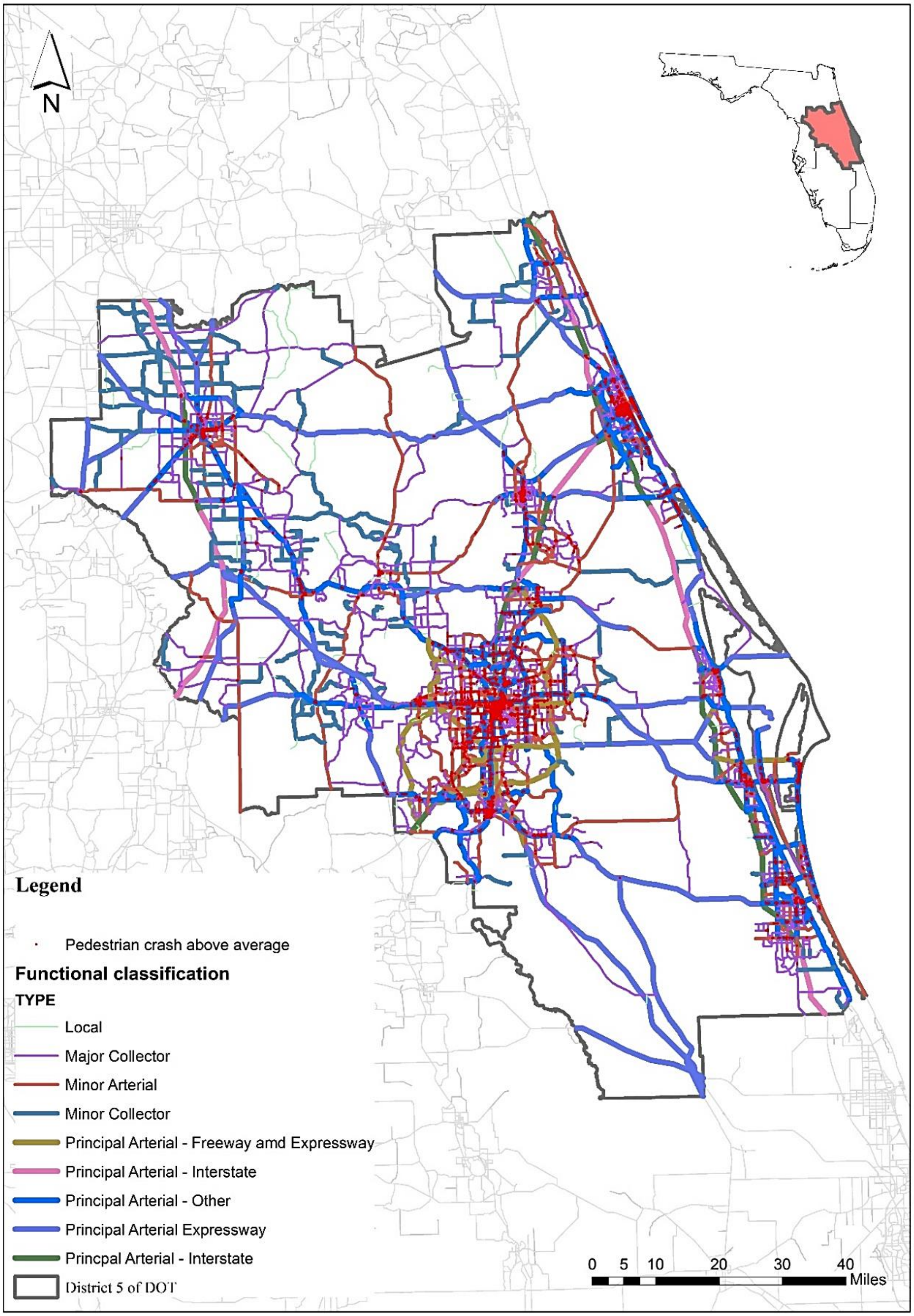


Figure 5: Functional Classification and Pedestrian Crashes above Average

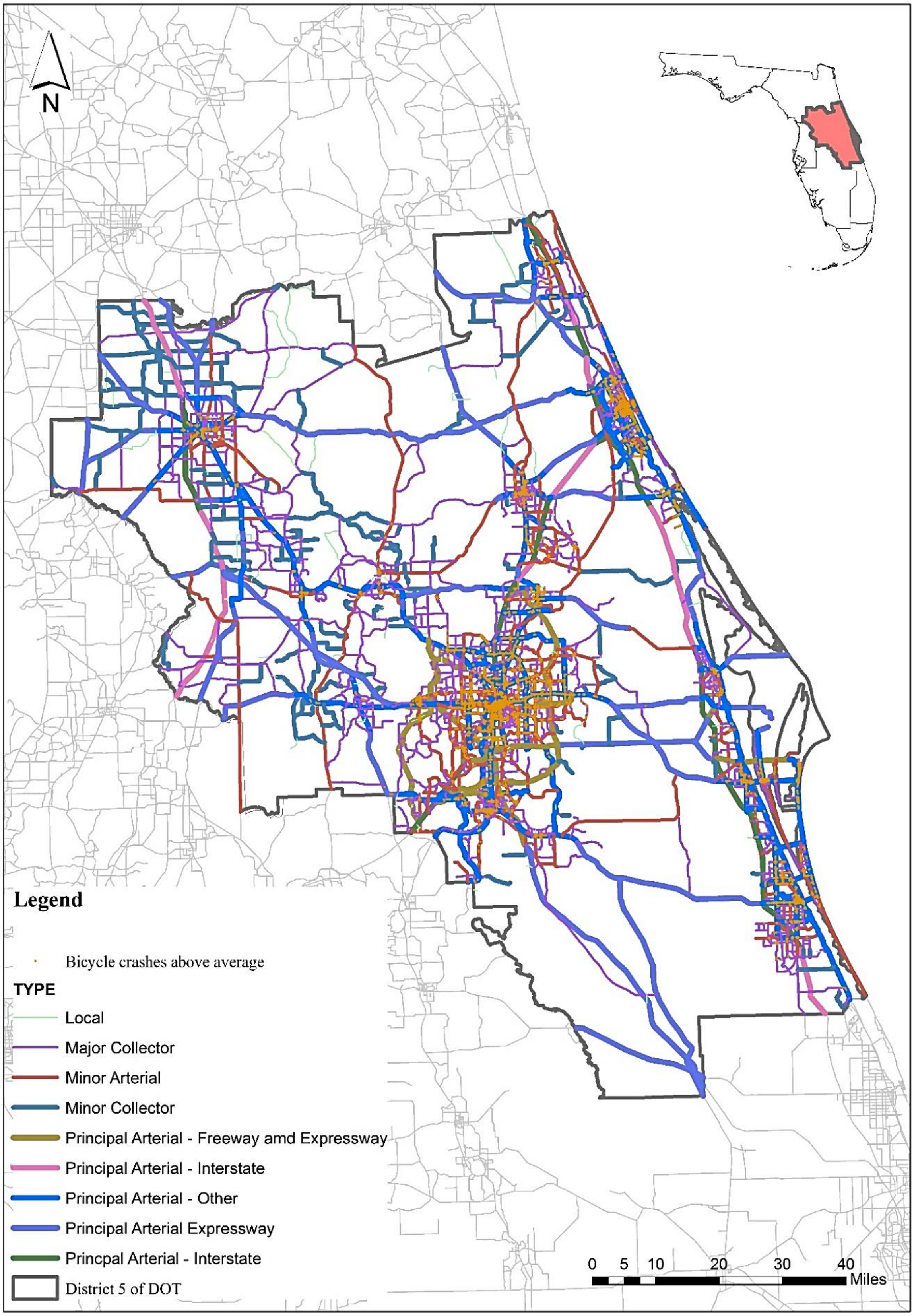


Figure 6: Functional Classification and Bicycle Crashes above Average

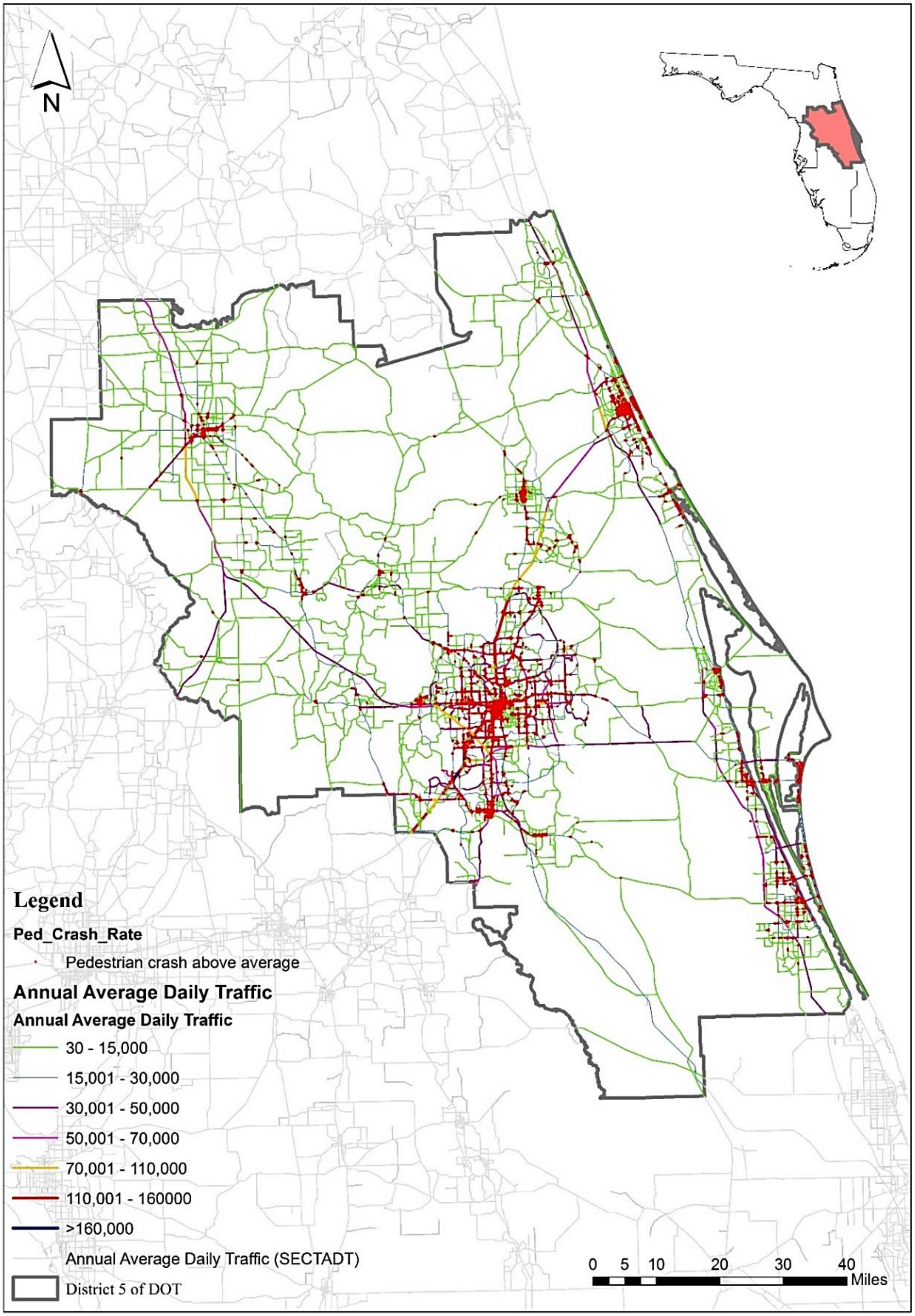


Figure 7: AADT and Pedestrian Crashes above Average

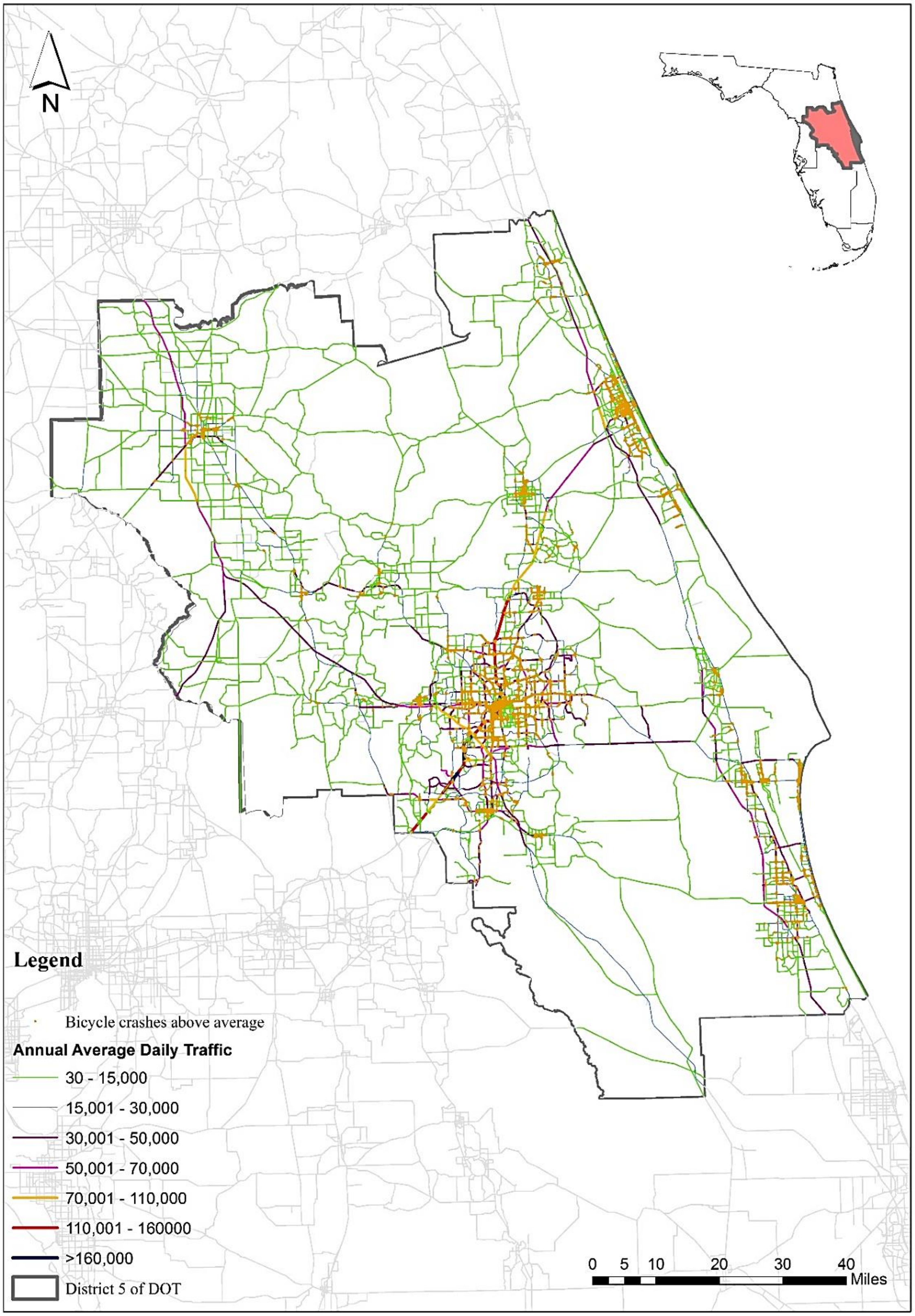


Figure 8: AADT and Bicycle Crashes above Average

3.4 ANALYSIS OF PEDESTRIAN CRASHES AND SIDEWALK GAPS

As mentioned earlier, due to the discrepancies and non-homogeneousness of the different jurisdictions' RCI and GIS data, which makes it difficult to locate and analyze crash data along with roadway location and feature data using spatial analysis. The Florida Unified Basemap Repository (UBR) GIS was utilized, which included all the needed information such as RCI and Crash data for District Five. Furthermore, FDOT Sidewalks shape file was obtained from the 2013 Florida Traffic Information DVD, and the sidewalk gaps shape file was obtained from FDOT District Five Urban Office.

It should be noted that the following analysis was conducted for the sidewalk gaps and pedestrian crashes only for two main reasons. First, there are more pedestrian crashes than bicycle crashes. Second, it was concluded that both pedestrian and bicycle crashes have the same patterns in terms of location and frequency. Also, based on the conclusions derived from this analysis, bicycle crashes can be further investigated with bike lane gap, based on the Research Project Coordination Team (RPCT) feedback.

3.4.1 On- and Off-System Pedestrian Crashes

The process started by identifying the total pedestrian crashes on and off the State Highway System (SHS) within District Five based on the latest available information of the UBR database which included the 5-year period between 2008 and 2012. A total of 4,887 pedestrian crashes were identified as total crashes which was lower than the 6,172 Signal Four Analytics crashes for the same period. This could be attributed to the fact that Signal Four Analytics includes erroneous pedestrian and bike crash data which requires further refining.

The total crashes were then divided into on-system and off-system pedestrian crashes. A total of 2,533 crashes were identified as on-System pedestrian crashes located within District Five boundary and on or involving the State Highway System (SHS) during the 5-year period between 2008 and 2012. Figure 9 shows the on-System pedestrian crash locations within District Five.

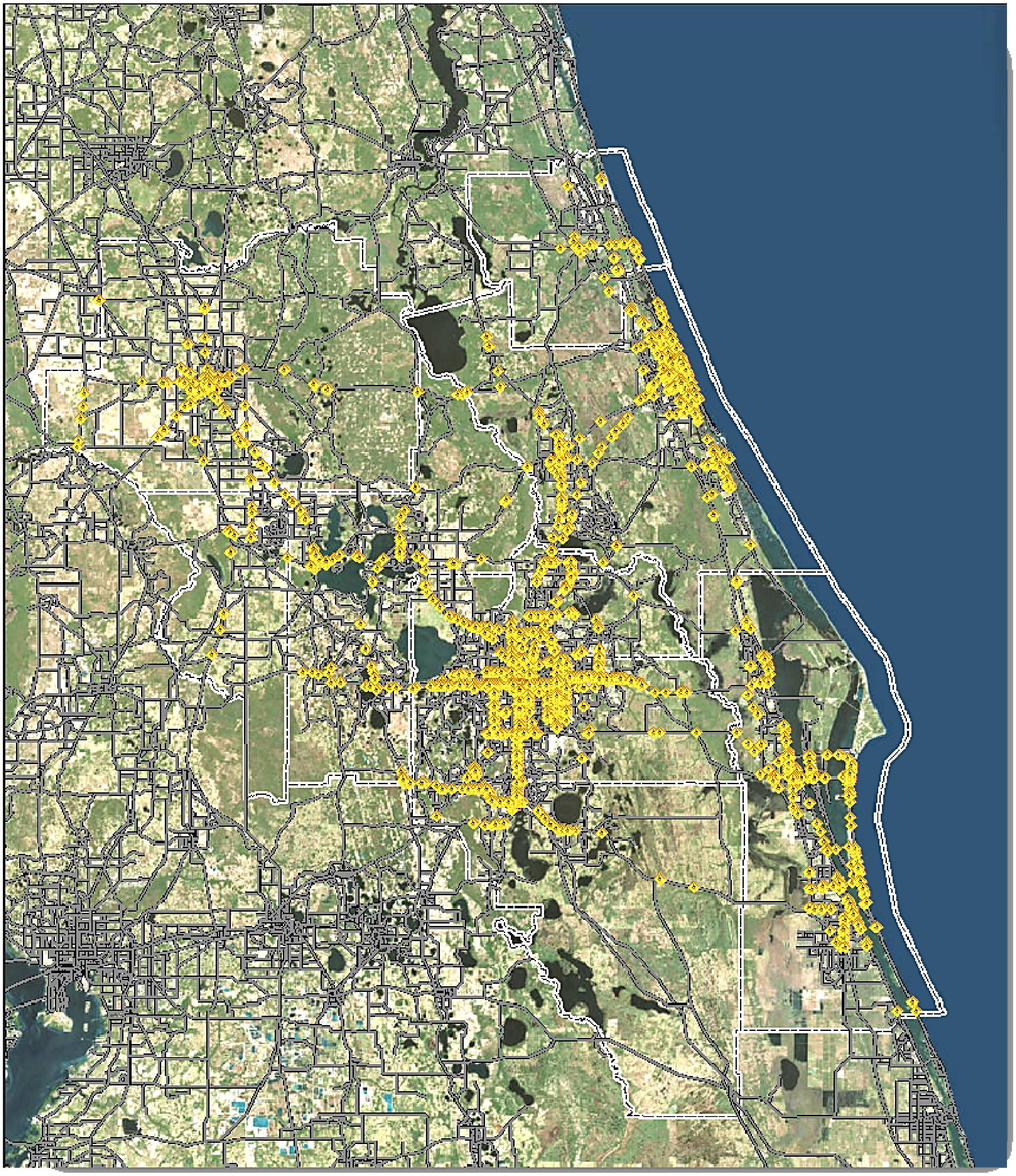


Figure 9: District Five On-System Pedestrian Crashes

The 2,533 On-System pedestrian crashes were then divided into the following two categories based on the crash locations:

- Pedestrian crashes at signalized intersections
- Pedestrian crashes at roadway segments

3.4.2 On-System Pedestrian Crashes at Signalized Intersections

Pedestrian crashes at signalized intersection were identified by selecting all crashes that were located within 125 feet from the center of the intersection. A total of 1,154 pedestrian crashes were located within the signalized intersections area of influence. Figure 10 illustrates the on-system pedestrian crashes located at signalized intersections.

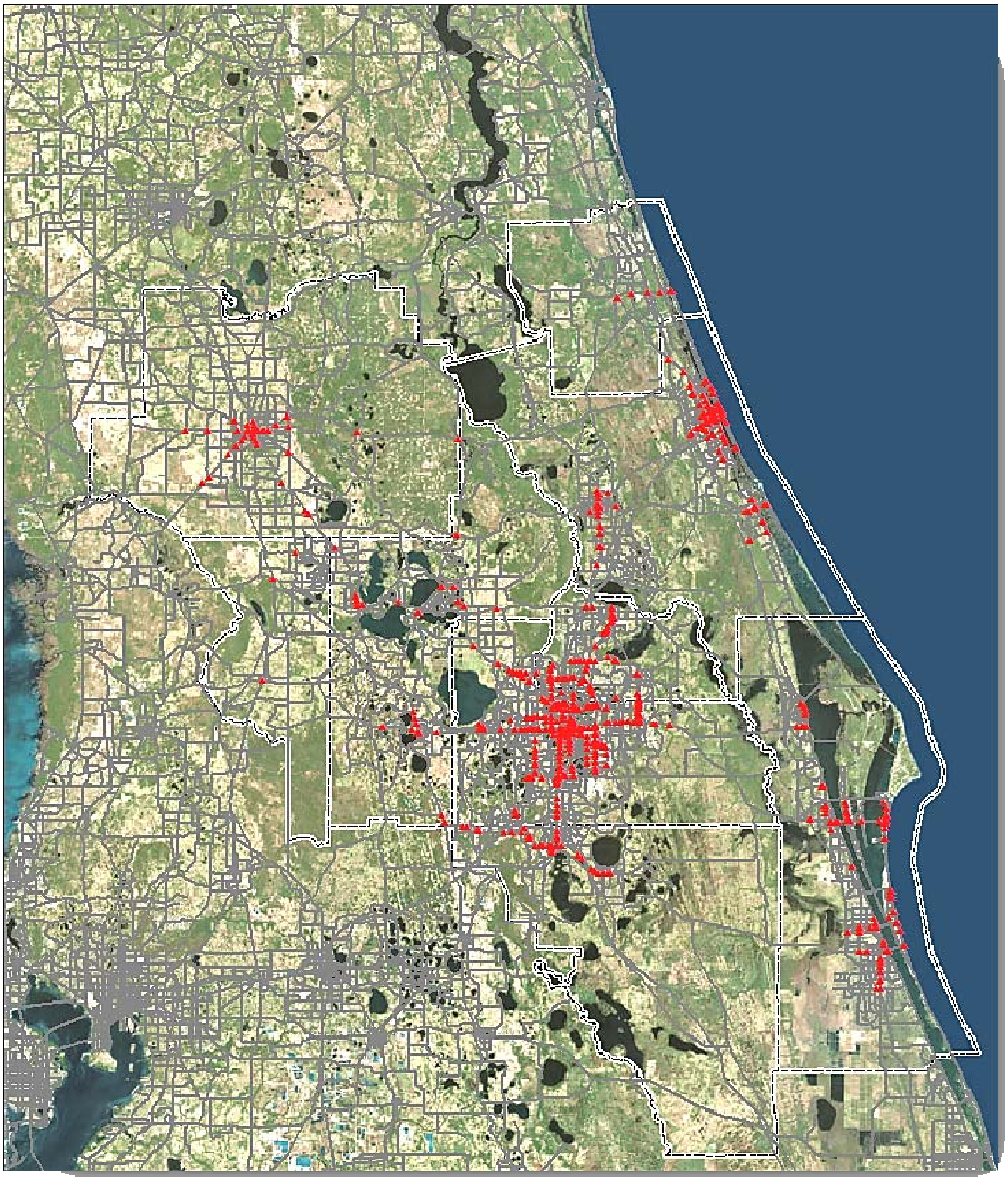


Figure 10: On-System Pedestrian Crashes at Signalized Intersections

3.4.3 On-System Pedestrian Crashes at Roadway Segments

A total of 1,379 crashes were identified as on-system pedestrian crashes that were located outside of signalized intersection area of influence of 125 feet. Figure 11 shows the on-system roadway pedestrian crashes within FDOT District Five between 2008 and 2012.

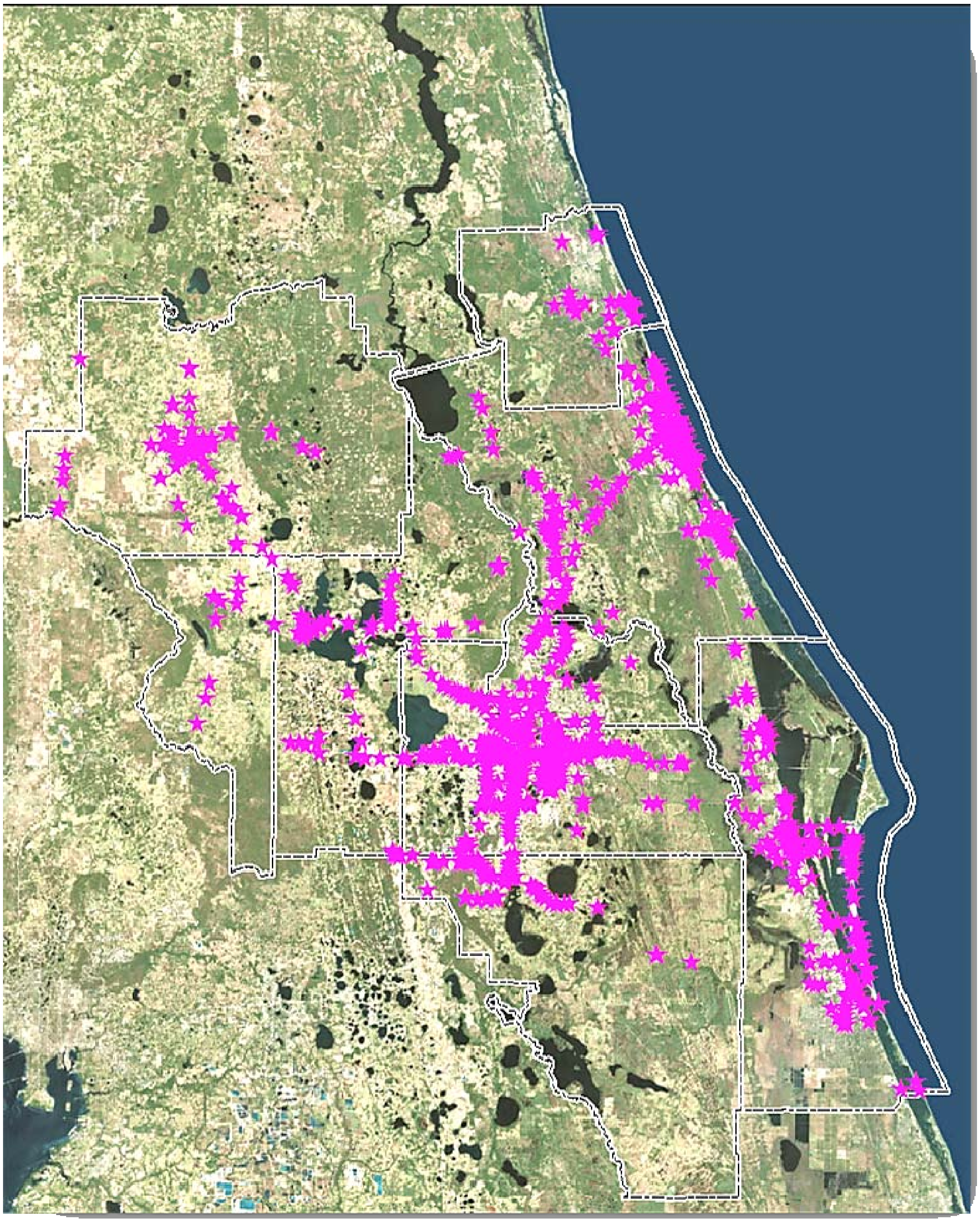


Figure 11: On-System Pedestrian Crashes at Roadway Segments

3.4.4 Identifying Sidewalk Locations and Gaps within On-System Roadway Segments

The available 2013 FDOT GIS layer "Sidewalk_Width_Sep", obtained from the Florida Office of Transportation Statistics, was used to map sidewalk locations. After reviewing the existing sidewalks within the District in order to spatially illustrate the locations of pedestrian crashes within the study area, it was observed that this layer covers about 90-95% of all FDOT roadways segments. Figure 12 illustrates the available sidewalk layer in District Five.

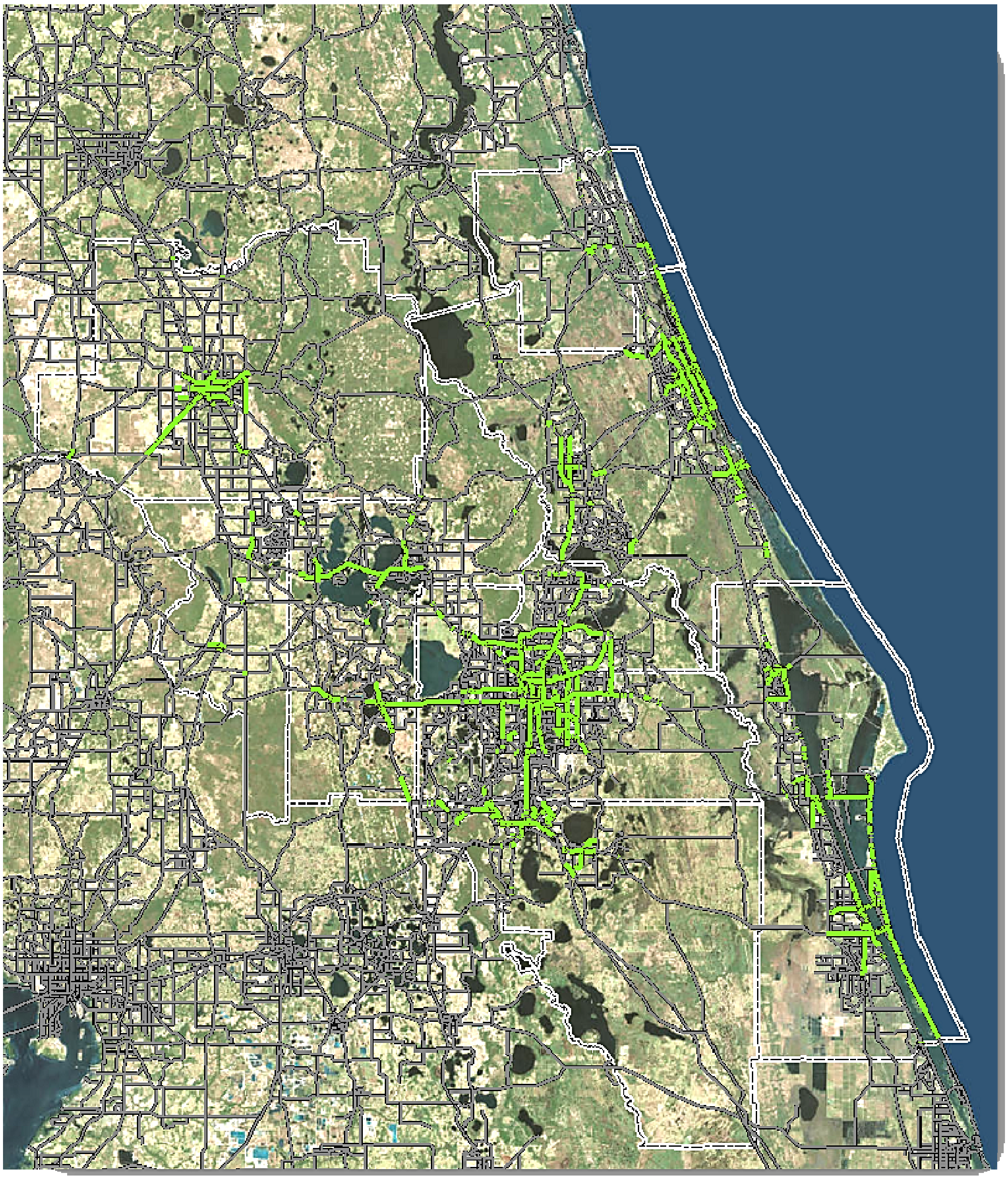


Figure 12: Sidewalk Locations within District Five

Pedestrian crashes located within 50 feet from any available sidewalk were identified. A total of 1,120 crashes were identified as pedestrian crashes located within roadways that feature sidewalks as shown in Figure 13. A summary of crash data along sidewalks is provided in Appendix A.

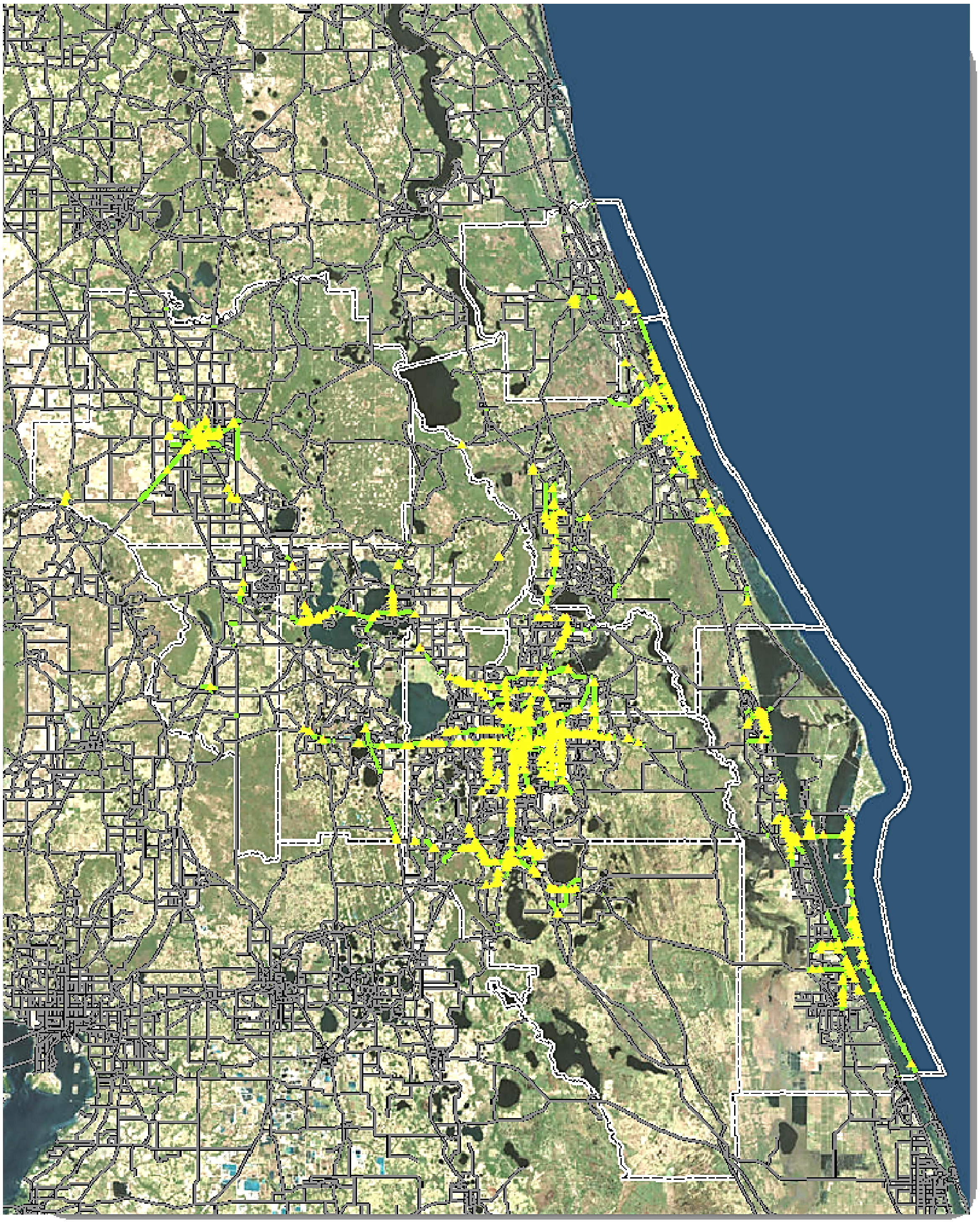


Figure 13: Pedestrian Crashes within 50 Feet of Available Sidewalks

The layer named "Gaps" provided by FDOT shows the on-system gaps for sidewalks and bike lanes. A new layer was created by selecting only sidewalk gaps from the "Gaps" layer to identify sidewalk gap locations as shown in Figure 14.

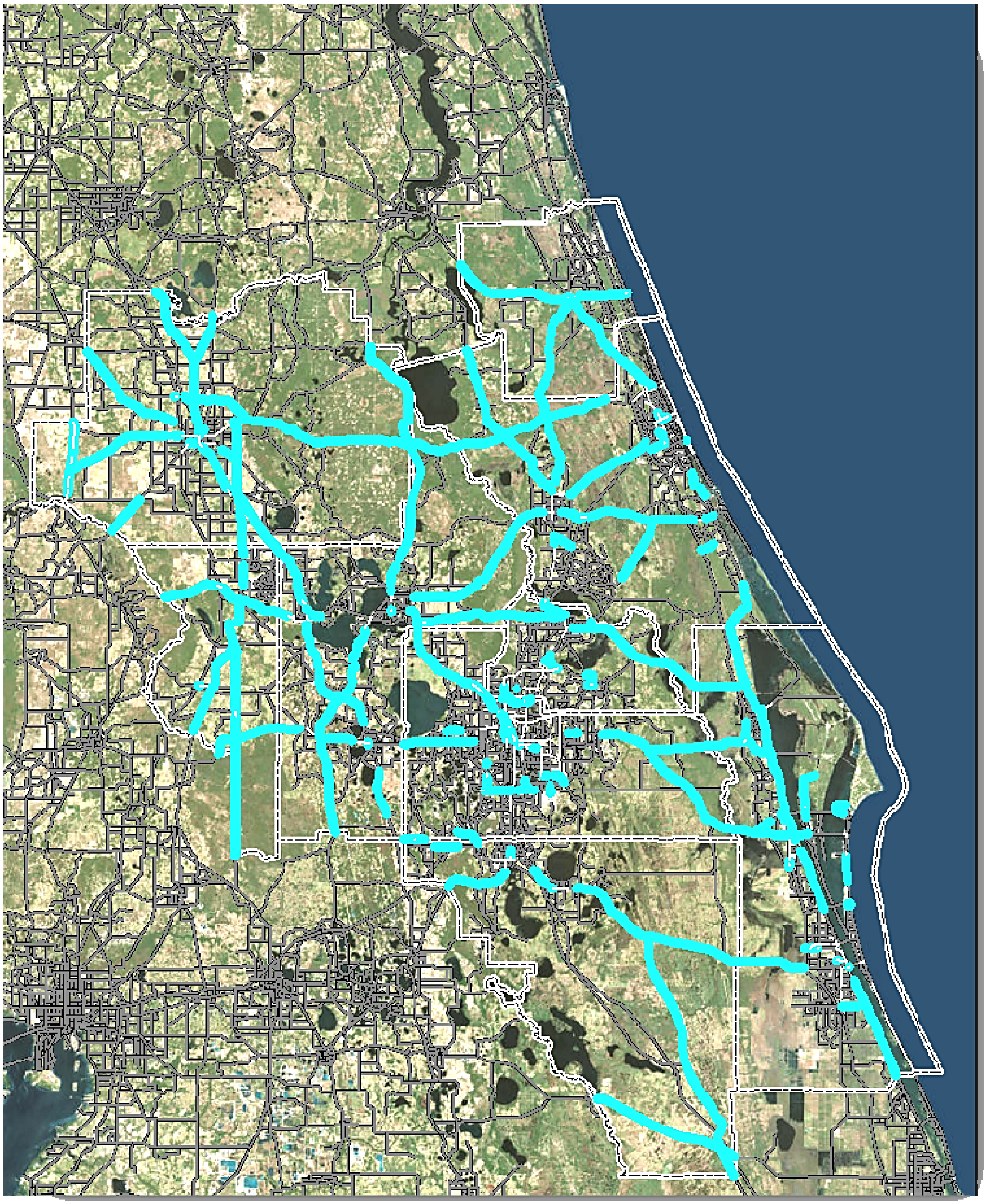


Figure 14: Sidewalk Gaps within District Five

Similar to sidewalk crashes, pedestrian crashes located within 50 feet from any sidewalk gap were identified. A total of 318 pedestrian crashes were identified and shown in Figure 15. A summary of the crash data along sidewalk gaps is provided in Appendix B.

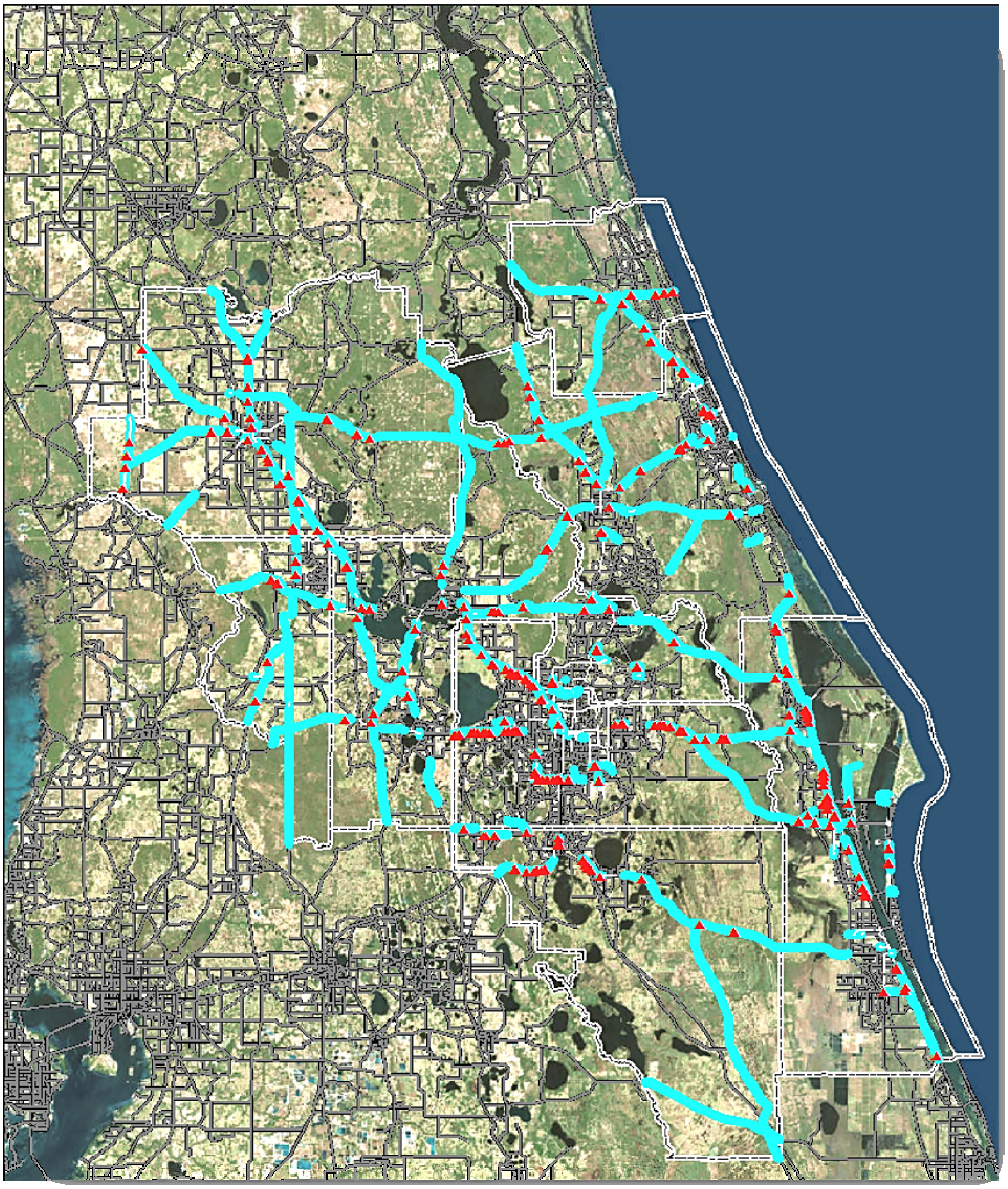


Figure 15: Pedestrian Crashes within 50 Feet of Sidewalk Gaps

However, it was observed that the sidewalk gaps layer was overlapped with the Sidewalk_Width_Sep layer in some locations and as result, a total of 124 crashes out of the 318 sidewalk gaps crashes were overlapped between the Sidewalk_Width_Sep and the sidewalk gaps Layers.

The 124 overlapped crashes were checked using the available aerials and they were identified to be within roadway segments that have sidewalks. Therefore they were eliminated from sidewalk gap crashes. After elimination of the 124 overlapped crashes, the remaining 194 crashes as shown in Figure 16 were identified as the final count of pedestrian crashes located within roadway segments that have sidewalk gaps. Finally, the remaining 65 crashes were found to be located at areas that do not have sidewalks or gaps and were totally eliminated from the database.

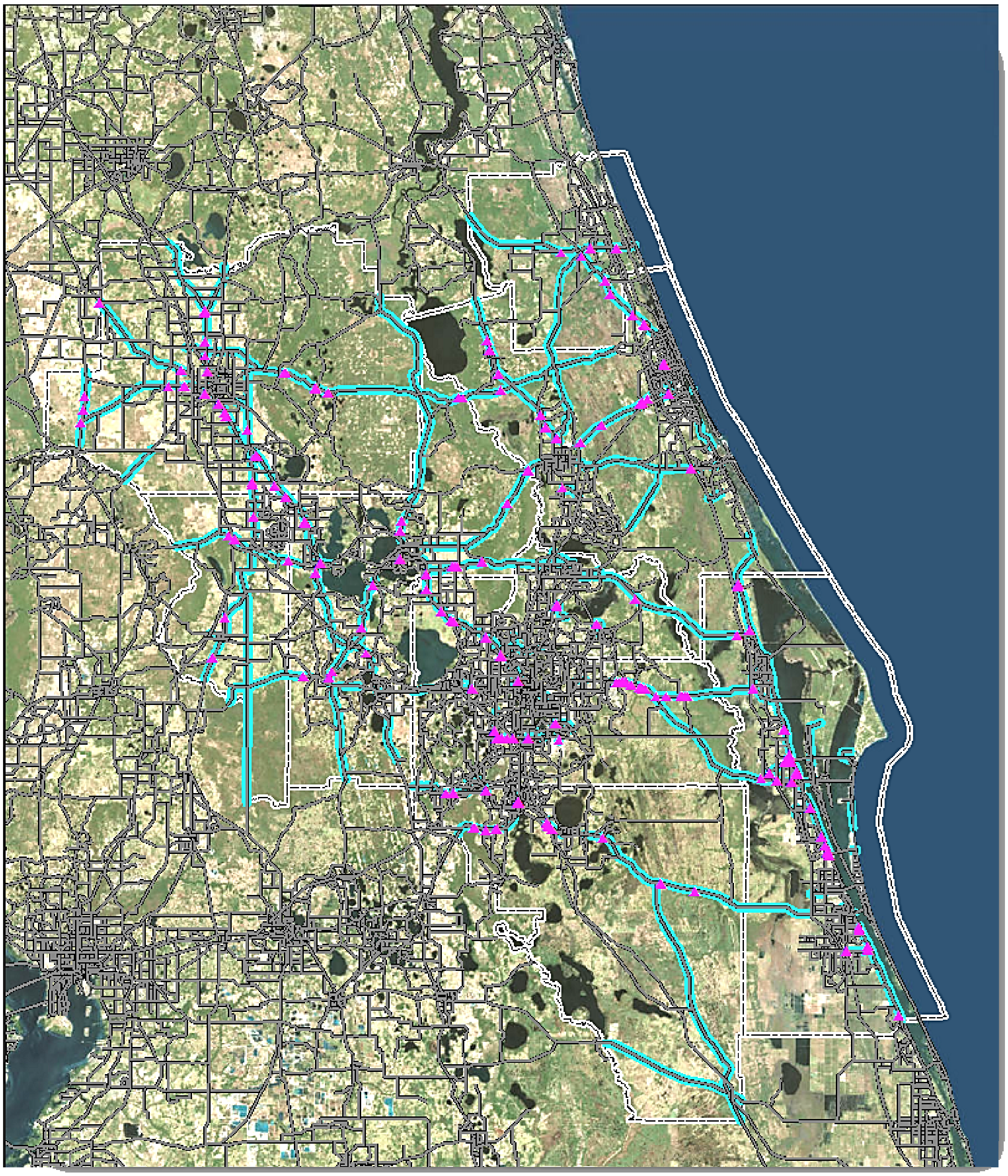


Figure 16: Final Count of Pedestrian Crashes at Sidewalk Gaps

3.4.5 Census Data

Due to the fact that area population contributes to pedestrian activity within the area, it was imperative to include the population as a factor representing the intensity of pedestrian activity. Population GIS layer was obtained from the 2010 census data at the tract level for the State of Florida. The crash data was then overlaid on top of the population layer and a 0.5-mile radius was determined as a reasonable walking distance surrounding the crash location. Figure 17 illustrates the 2010 population data and the 0.5-mile radius around the crash locations.

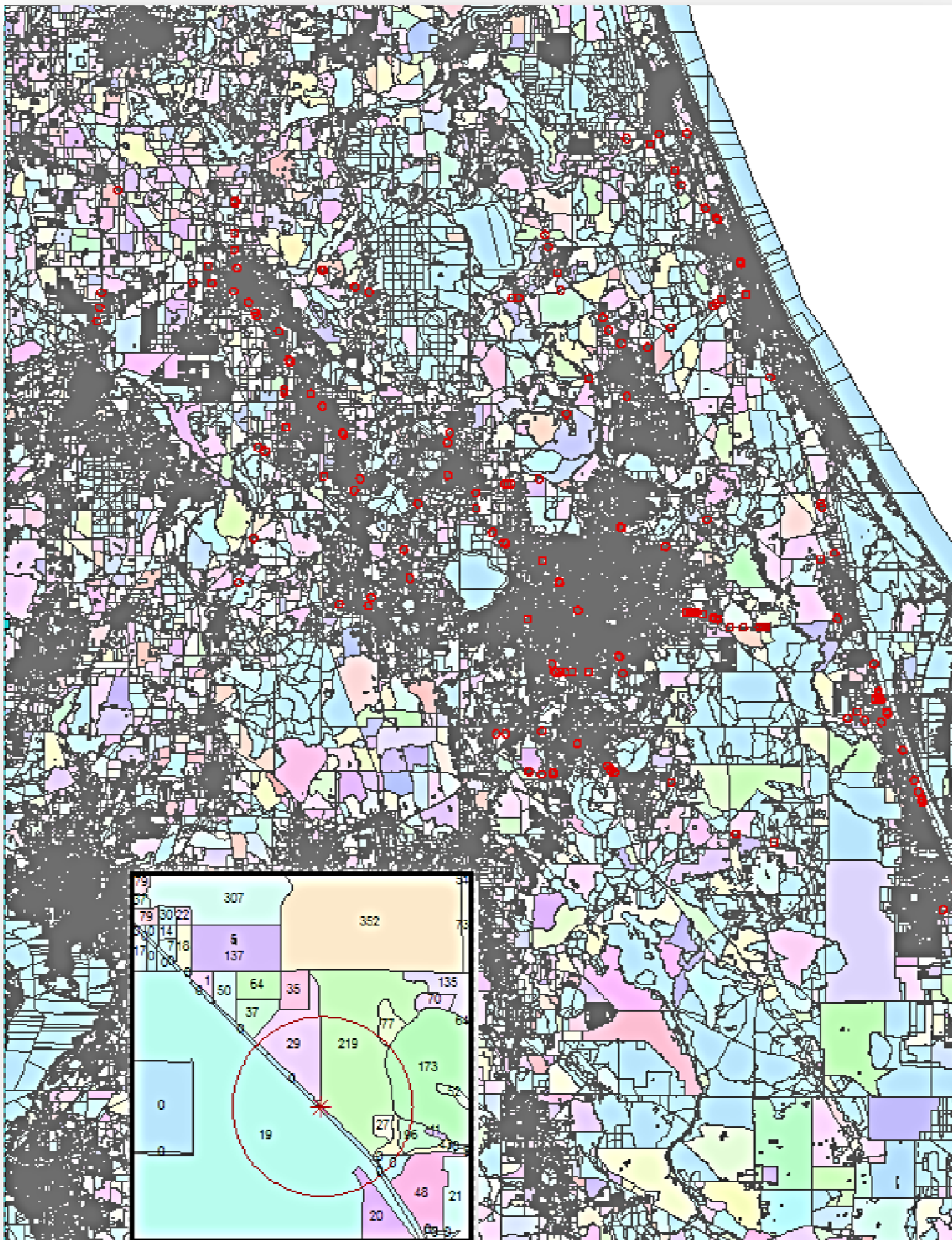


Figure 17: Year 2010 Population Data within 0.5-mile radius of Pedestrian Crashes

3.5 PEDESTRIAN CRASH MODELING

The dataset was normalized and sorted based on one of the independent variables (Roadway Category) and then aggregated using a variable bin size for AADT to ensure that the second independent variable remains constant across the various bins. Data transformations were then applied to ensure normality and homoscedasticity (equal variance). Once the parameters of the first independent variable were computed, the data was sorted again based on the second independent variable. The dataset was then aggregated in order to ensure normality and homoscedasticity. The following parameters were selected for the modeling process:

- **Number of pedestrian crashes (crash)**
- **Average Annual Daily Traffic (AADT) (vehicle per day)**
- **Posted Speed (mph)**
- **Year 2010 average population within half mile radius (person)**
- **Sidewalk**
  - 0 – No existing sidewalk (Gap in sidewalk)
  - 1 – There is an existing sidewalk
- **Roadway Category**
  - 1 – Urban interstate
  - 2 – Rural interstate
  - 8 – Rural ramp
  - 12 – Urban 2-3 lanes two-way undivided
  - 13 – Suburban 2-3 lanes two-way divided raised median
  - 14 – Suburban 2-3 lanes two-way divided painted median
  - 15 – Suburban 2-3 lanes two-way undivided
  - 16 – Rural 2-3 lanes two-way divided raised median
  - 17 – Rural 2-3 lanes two-way divided painted median
  - 18 – Rural 4-5 lanes two-way undivided
  - 20 – Urban 4-5 lanes two-way divided raised median
  - 21 – Urban 4-5 lanes two-way divided painted median
  - 22 – Urban 4-5 lanes two-way undivided
  - 23 – Suburban 4-5 lanes two-way divided raised median
  - 24 – Suburban 4-5 lanes two-way divided painted median
  - 25 – Suburban 4-5 lanes two-way undivided
  - 26 – Rural 4-5 lanes two-way divided raised median
  - 30 – Urban 6 or more lanes two-way divided raised median
  - 31 – Urban 6 or more lanes two-way divided painted median
  - 33 – Suburban 6 or more lanes two-way divided raised median
  - 34 – Suburban 6 or more lanes two-way divided painted median
  - 40 – Urban one-way
  - 41 – Suburban one-way

"R" statistical package was utilized to develop a model that can predict the expected number of pedestrian crashes (as the response variable) from posted speed, average population within half mile radius, existence of sidewalk, and roadway category (as the independent variable). Due to the fact that observed number of crashes in the data represented 5-year period and AADT is daily volume, AADT was multiplied by 5 and by 365 and divided by 10^6 to obtain the total 5-year million vehicles of travel and used as an independent variable representing the vehicles interaction in the model. Number of the residential housing units was not used as an independent variable in the model due to its correlation with the average population variable. Since the response variable observation is count data, a Poisson regression model was developed and tested for statistical accuracy. Table 5 shows the results of the Poisson regression model.

Table 5: Poisson Regression Model Results

COEFFICIENT	ESTIMATE	STD. ERROR	Z VALUE	PR(>|Z|)	SIGNIFICANCE
INTERCEPT	-5.205e-01	6.722e-01	-0.774	0.438700	
5-YEAR VOLUME	-1.012e-02	1.614e-03	-6.267	3.68e-10	***
SIDEWALK	6.568e-01	1.009e-01	6.510	7.52e-11	***
POSTED SPEED	1.003e-02	1.020e-02	0.983	0.325649	
ROADCATGRYRCAT2	1.936e-02	1.154e+00	0.017	0.986613	
ROADCATGRYRCAT8	-1.271e+00	1.131e+00	-1.124	0.261170	
ROADCATGRYRCAT12	6.822e-01	6.734e-01	1.013	0.311053	
ROADCATGRYRCAT13	-1.044e-01	7.161e-01	-0.146	0.884055	
ROADCATGRYRCAT14	5.204e-01	5.416e-01	0.961	0.336561	
ROADCATGRYRCAT15	1.272e+00	5.336e-01	2.383	0.017161	*
ROADCATGRYRCAT16	1.361e-02	1.128e+00	0.012	0.990371	
ROADCATGRYRCAT17	3.682e-01	5.937e-01	0.620	0.535208	
ROADCATGRYRCAT18	1.329e+00	5.561e-01	2.389	0.016897	*
ROADCATGRYRCAT20	2.265e+00	5.056e-01	4.481	7.43e-06	***
ROADCATGRYRCAT21	2.190e+00	5.062e-01	4.326	1.52e-05	***
ROADCATGRYRCAT22	3.922e-01	6.111e-01	0.642	0.520974	
ROADCATGRYRCAT23	1.870e+00	5.115e-01	3.656	0.000256	***
ROADCATGRYRCAT24	1.337e+00	5.159e-01	2.592	0.009534	**
ROADCATGRYRCAT25	-4.667e-01	7.680e-01	-0.608	0.543381	
ROADCATGRYRCAT26	1.572e+00	5.854e-01	2.685	0.007244	**
ROADCATGRYRCAT30	2.315e+00	5.088e-01	4.550	5.37e-06	***
ROADCATGRYRCAT31	1.486e+00	5.164e-01	2.878	0.004008	**
ROADCATGRYRCAT33	6.231e-01	5.289e-01	1.178	0.238696	
ROADCATGRYRCAT34	-7.080e-01	7.684e-01	-0.921	0.356895	
ROADCATGRYRCAT40	5.183e-01	5.605e-01	0.925	0.355173	
ROADCATGRYRCAT41	-3.961e-01	7.657e-01	-0.517	0.604957	
AVGPOP	2.298e-04	2.946e-05	7.801	6.12e-15	***

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
z = 4.0945, p-value = 2.115e-05
Alternative hypothesis: true dispersion is greater than 1
Sample estimates - dispersion: 4.86354

Unfortunately, the Poisson regression model suffered from over-dispersion as indicated by the value of the deviance divided by the degrees of freedom which measures the amount of variation in the data, was significantly greater than 1.0 (was 4.86) indicating that a negative binomial model would be appropriate for the data. Consequently, a Negative Binomial (NB) regression model was developed and showed the value of the deviance divided by the degrees of freedom was close to 1.0 (1.09) and thus demonstrating the adequacy of the negative binomial error structure. Table 6 presents the Negative Binomial regression model coefficients and their significance. Final model data is included in Appendix C and the statistical output is included in Appendix D.

Table 6: Negative Binomial Regression Model Results

COEFFICIENT	ESTIMATE	STD. ERROR	Z VALUE	PR(>|Z|)	SIGNIFICANCE
INTERCEPT	8.217e-01	1.193e+00	0.689	0.49113	
5-YEAR VOLUME	-1.114e-02	3.620e-03	-3.077	0.00209	**
SIDEWALK	5.129e-01	2.025e-01	2.532	0.01134	*
POSTED SPEED	-1.992e-02	2.224e-02	-0.896	0.37026	
ROADCATGRYRCAT12	4.124e-01	1.064e+00	0.388	0.69836	
ROADCATGRYRCAT13	1.488e-01	9.553e-01	0.156	0.87624	
ROADCATGRYRCAT14	6.086e-01	7.656e-01	0.795	0.42665	
ROADCATGRYRCAT15	1.153e+00	7.729e-01	1.492	0.13579	
ROADCATGRYRCAT16	3.104e-01	1.419e+00	0.219	0.82685	
ROADCATGRYRCAT17	7.438e-01	8.412e-01	0.884	0.37659	
ROADCATGRYRCAT18	1.668e+00	8.185e-01	2.038	0.04157	*
ROADCATGRYRCAT2	9.920e-01	1.527e+00	0.650	0.51582	
ROADCATGRYRCAT20	2.032e+00	7.182e-01	2.830	0.00466	**
ROADCATGRYRCAT21	1.986e+00	7.168e-01	2.770	0.00561	**
ROADCATGRYRCAT22	-7.635e-02	9.290e-01	-0.082	0.93450	
ROADCATGRYRCAT23	2.178e+00	7.278e-01	2.992	0.00277	**
ROADCATGRYRCAT24	1.299e+00	7.351e-01	1.767	0.07729	.
ROADCATGRYRCAT25	-7.356e-01	1.035e+00	-0.711	0.47733	
ROADCATGRYRCAT26	2.025e+00	9.007e-01	2.249	0.02453	*
ROADCATGRYRCAT30	2.412e+00	7.344e-01	3.285	0.00102	**
ROADCATGRYRCAT31	1.429e+00	7.383e-01	1.935	0.05297	.
ROADCATGRYRCAT33	6.722e-01	7.609e-01	0.883	0.37702	
ROADCATGRYRCAT34	-4.781e-01	9.928e-01	-0.482	0.63012	
ROADCATGRYRCAT40	3.684e-01	8.047e-01	0.458	0.64711	
ROADCATGRYRCAT41	-6.359e-01	1.019e+00	-0.624	0.53262	
ROADCATGRYRCAT8	-9.575e-01	1.431e+00	-0.669	0.50341	
AVGPOP	2.782e-04	6.247e-05	4.452	8.49e-06	***

3.6 MODEL RESULTS AND CONCLUSIONS

Based on the analysis and modeling results, it was found that presence of sidewalk along roadway segments is one of the main factors that have significant impact on the expected number of pedestrian crashes at a specific location. Other factors included average annual daily traffic volumes (AADT), roadway category (ROADCAT), specifically along urban two-way divided arterials with 4-6 lanes as well as the average population within half mile radius surrounding the crash location. The final form of the model is represented by the following equation:

Ln (Expected Number of Crashes) = 8.217e-01 + -1.114e-02 (AADT x 5 x 365/1000,000) + 5.129e-01 ("x1" if sidewalk present or "x0" for gap) + Coefficient of one of the significant Roadway Categories (18, 20, 21, 23, 24, 26, 30, 31) + 2.782e-04 (Average Population within 0.5 miles).

While utilizing the spatial join analysis to identify sidewalk and sidewalk gap locations along the roadway segments and the associated number of crashes in each case, two main parameters were considered; frequency of crashes and the corresponding length of sidewalk, and sidewalk gap along the roadway segment. It was concluded that there exist 1,120 crashes along a total of 28,000 miles of sidewalk length within District Five. However, these 28,000 miles included both directions in approximately 80% of the locations. Therefore it was converted to miles of roadway, and amounted to 16,800 roadway miles, which equates to an average of 0.067 crashes per mile of roadway length over the 5-year period. This means that on average, there is an expected crash every 15 roadway miles of sidewalk. On the other hand, there were 194 crashes along a total of 923 miles of sidewalk gaps which equates to 0.2 crashes per mile of sidewalk gap. It should be noted that the gap lengths represented roadway length. This means that on average, there is an expected crash every five miles of sidewalk gap over the 5-year period. The analysis showed that the expectancy of a pedestrian crash along roadways with no sidewalk is three times greater than the expectancy of a crash with the presence of a sidewalk.

As mentioned earlier, the main objective of this task was to investigate whether there is correlation between pedestrian crashes and sidewalk/bicycle lane gaps. The analysis showed that there is a strong statistical correlation. The conclusions of this task are crucial to the rest of the research tasks which requires developing an evaluation tool to prioritize the need for addressing these gaps. Using the aforementioned factors and their degree of significance along with a ranking order methodology, a prioritization process can be identified. The following section discusses some of the methodologies and best practices used for addressing the prioritization of pedestrian and bicycle-lane gaps.

IV- DEVELOPMENT OF STATEWIDE PEDESTRIAN CRASH RATES

4.1 PROPOSED METHODOLOGY

Based on the literature review and previous studies, it can be seen that majority of the exposure measures used are either in an aggregate form and not accurate enough to represent a clear picture of the safety situation or not practical enough to collect the data needed. Some exposure measures do not accurately indicate the overall level of the transportation activity. Very few studies in previous research incorporated the product of P × V (pedestrian and vehicular traffic) as a measure of exposure. Others included the pedestrian miles traveled. The proposed approach focuses on the level of pedestrian activity and the potential conflict between pedestrians and motor vehicles expressed in the amount of walking while at risk of being involved in a motor vehicle accident. The majority of the pedestrian-vehicle crashes occur while crossing the street, whereas an insignificant percentage of crashes occur while walking along the street. Therefore, it is believed that the pedestrian miles crossed (PMC) parameter is more representative of the risks associated with pedestrian exposure. Furthermore, since the exposure measure should directly reflect the amount of walking in areas shared with vehicles, the vehicular traffic volume is another significant factor that should be included in the equation. Based on that, the three main significant parameters that will be used in the exposure measure calculations are:

1- Pedestrian traffic
2- Distance crossed
3- Vehicular traffic

The proposed methodology in this section is considered detailed, practical and provides a broad depiction of the main factors that directly contribute to pedestrian crashes as shown in Figure 18.

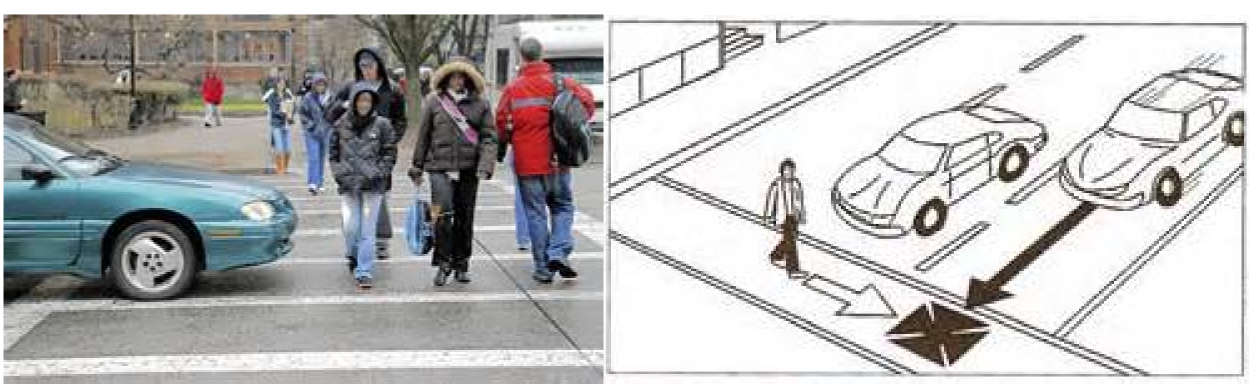


Figure 18: Condition Showing Potential Pedestrian-Vehicle Conflict

4.1.1 Determining Pedestrian Volumes

Pedestrian activity at intersections and midblock crossings along the roadway segments is needed to calculate the average daily pedestrian (ADP) traffic. Data collection can be conducted in a number of ways. Video cameras are mounted at the intersection for the collecting period and the number of pedestrians are counted for 24 hours or 72 hours to get the average of the 3-day period, or using manual counts where observations can take place during the highest 8 or 12 hours of the day (6 a.m. to 6 p.m.) to create a temporal distribution curve that represent the variation of pedestrian counts over a 24-hour period. It is recommended to separate the counts by approach as will be explained later.

4.1.2 Determining Distance Crossed

The distance crossed by pedestrians at crosswalks is calculated either using direct measurement from the field or through Google Earth maps or using the number of lanes crossed multiplied by the lane width. It is also recommended to separate the distances by entering and departing approaches. It should be noted that pavement distance only is included in the calculations which excludes any raised median distances especially at midblock crossings.

4.1.3 Determining Vehicular Volume

Total entering vehicular volume for each approach at intersections is required in the exposure calculations. The majority of the pedestrian-vehicle conflicts occur at turning maneuvers. Therefore, turning movement counts (TMCs) for each of the entering and departing approaches are needed as shown in Figure 19. TMCs are collected typically during peak periods. However, 24-hour TMCs are needed for consistency with other units. If TMCs are collected for each approach for 24 hours, the resulting count would be the average daily traffic (ADT) for this specific approach. Therefore, the ADT for each of the entering and departing approaches will be the targeted data at intersections as well as roadway segments as shown in Figure 20. ADT data can be obtained using tube counts in the field or the State Highway Performance Monitoring System (HPMS) database.

4.1.4 Calculating Pedestrian Crash Rates

The next step in the proposed methodology is to calculate the actual pedestrian crash rate at intersections and midblock crossings. This rate is calculated using the number of pedestrian crashes linked to the studied intersection or along the studied roadway segment divided by the exposure. It is recommended to collect a minimum of 5-year crash data for each location since pedestrian accidents are rare events and requires a long period of time to obtain a reasonable number.

It seemed more logical to use the sum of the product of the pedestrian miles crossed (PMC) and entering volume (ADT) for each entering and departing approach separately instead of using the cross product of the aggregate sum of each parameter along all approaches.

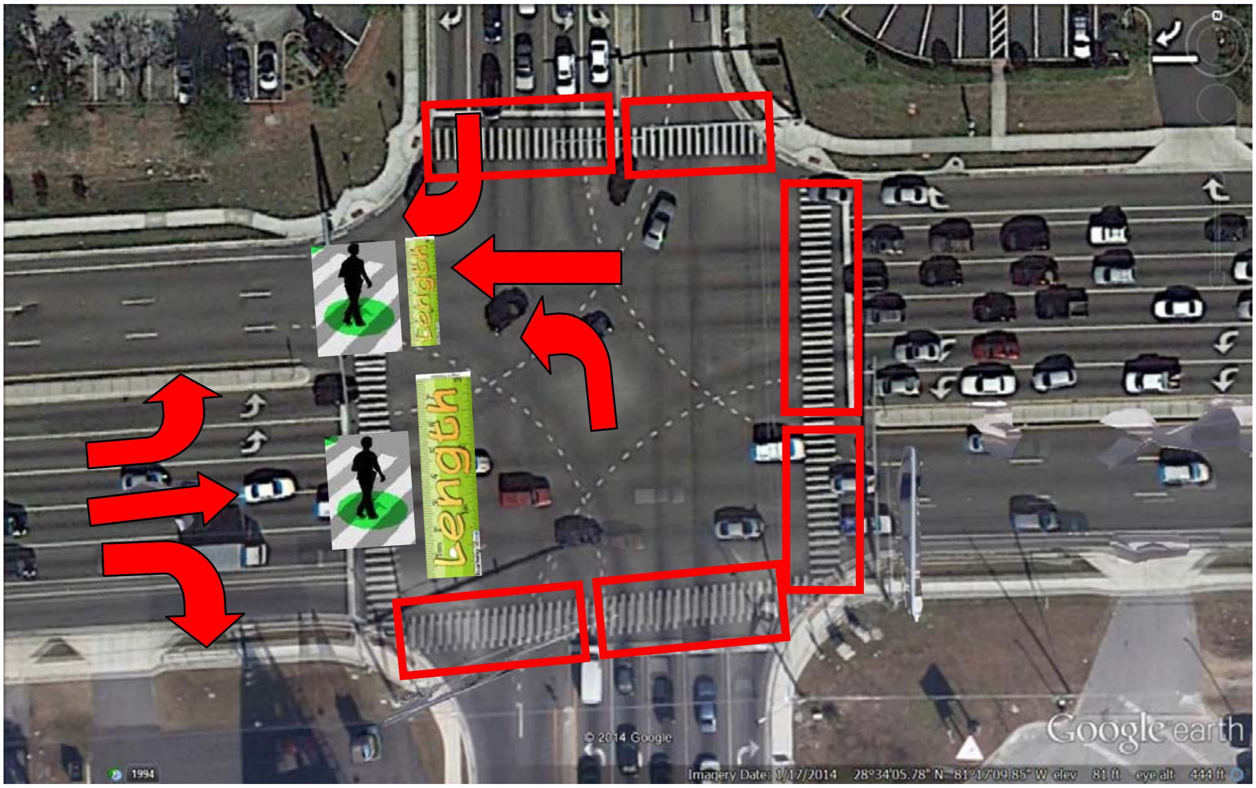


Figure 19: Pedestrian Exposure at Eight (8) Intersection Crossings

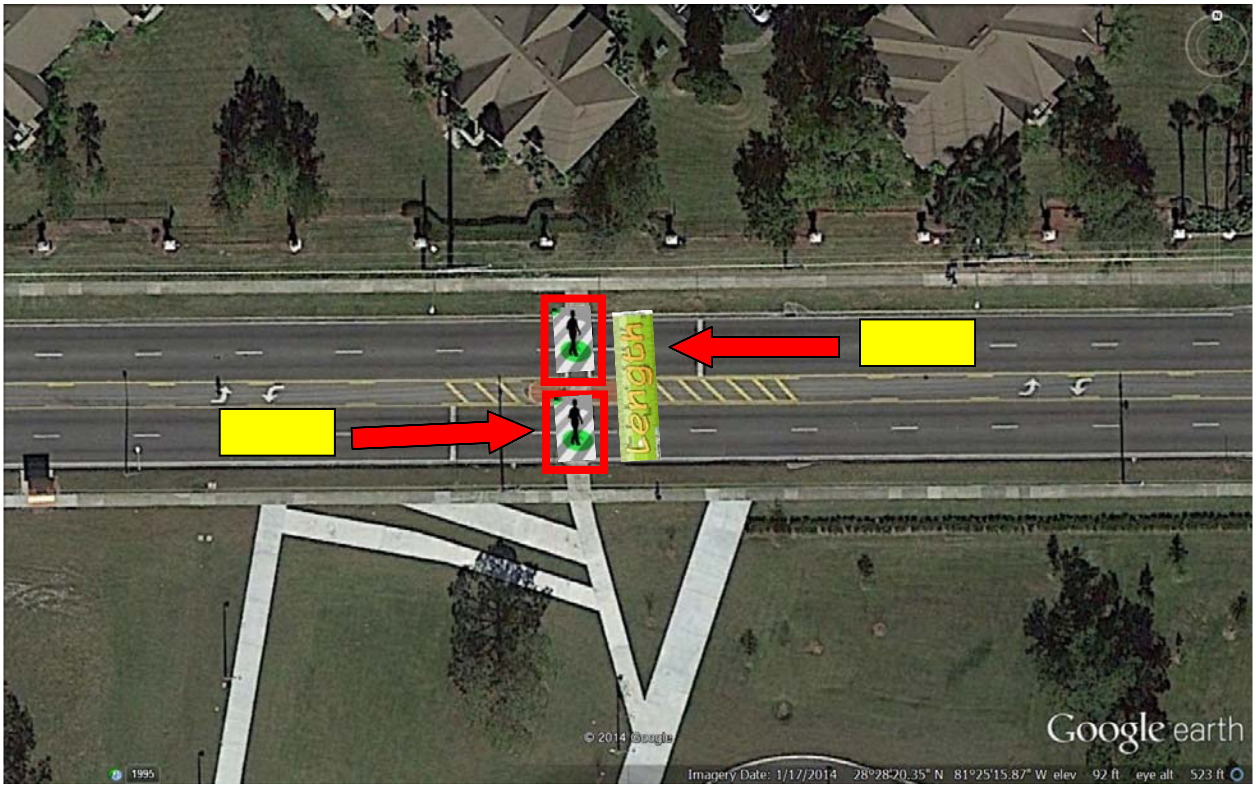


Figure 20: Pedestrian Exposure at Two (2) Midblock Crossings

The following formula is used to calculate the actual pedestrian crash rate at intersections as well as roadway segments:

$$\text{APCR} = \frac{\#PC_5 \text{x } 5280 \text{ x } 10^6}{5 \text{ x } 365 \text{ x } \sum_{i=1}^{n} ADP_i \text{ x } DC_i \text{ x } ADT_i}$$

Where:

APCR = Actual Pedestrian Crash Rate

$\#PC_5$ = Number of Pedestrian Crashes over 5-year period

$\sum_{i=1}^{n} ADP_i * DC_i * ADT_i$ = Sum of cross product of the average daily pedestrians x distance crossed in feet x average daily traffic for each directional approach 1-8.

The same formula would be used for the roadway segments except that the number of directional approaches is two (2) instead of eight (8) for 4-legged intersections and six (6) for 3-legged intersections. It should be noted that the approaches with crosswalks only would be included in the calculations or where pedestrian traffic is observed crossing.

4.1.5 Practical Example

First, assume that we have a four-leg intersection with four crosswalks and the total number of pedestrian crashes over 5-year period was seven crashes and the data collected are as follows:

West Approach:

a) No of daily crossing pedestrians (ADP) = 12 peds
b) Distance Crossed:

EB no of lanes = 3 (12 ft.) lanes - 1 exclusive left turn and 2 thrus = 12 x 3 = 36 ft.
WB no of lanes = 2 thrus (12 ft.) = 24 ft.

c) Average Daily Traffic (ADT)

EB ADT = 13,000 veh./day
WB ADT = 15,000 veh./day

East Approach:

a) No of daily crossing pedestrians (ADP) = 8 peds
b) Distance Crossed:

WB no of lanes = 3 (12 ft.) lanes - 1 exclusive left turn and 2 thrus = 12 x 3 = 36 ft.
EB no of lanes = 2 thrus (12 ft.) = 24 ft.

c) Average Daily Traffic (ADT)

WB ADT = 12,000 veh./day
EB ADT = 14,000 veh./day

South Approach:

a) No of daily crossing pedestrians (ADP) = 10 peds
b) Distance Crossed:

NB no of lanes = 4 (12 ft.) lanes - 1 exclusive left turn and 2 thrus and 1 right turn = 12 x 4 = 48 ft.
SB no of lanes = 2 thrus (12 ft.) = 24 ft.

c) Average Daily Traffic (ADT)

NB ADT = 17,000 veh./day
SB ADT = 16,000 veh./day

North Approach:

a) No of daily crossing pedestrians (ADP) = 6 peds
b) Distance Crossed:

SB no of lanes = 4 (12 ft.) lanes - 1 exclusive left turn and 2 thrus and 1 right turn = 12 x 4 = 48 ft.
NB no of lanes = 2 thrus (12 ft.) = 24 ft.

c) Average Daily Traffic (ADT)

SB ADT = 18,000 veh./day
NB ADT = 19,000 veh./day

Second, calculate exposure for each of the 8 directional approaches as follows:

1- 12 x 36 x 13,000 = 5,616,000
2- 12 x 24 x 15,000 = 4,320,000
3- 8 x 36 x 12,000 = 3,456,000
4- 8 x 24 x 14,000 = 2,688,000
5- 10 x 48 x 17,000 = 8,160,000
6- 10 x 24 x 16,000 = 3,840,000
7- 6 x 48 x 18,000 = 5,184,000
8- 6 x 24 x 19,000 = 2,736,000

The sum of all 8 approaches = 36,000,000 PFC-EV (pedestrian feet crossed-Entering Vehicle)

Third, calculate the actual pedestrian crash rate for this intersection =

$$\text{APCR} = \frac{7\ x\ 5280\ x\ 10^6}{5\ x\ 365\ x\ 36{,}000{,}000} = 0.5626\ Crashes/million\ PMC/EV$$

The proposed methodology is considered valid for other locations that have the same pedestrian-vehicle conflict such as school crossings and parking lots.

4.1.6 Methodology Summary

The methodology involved two types of analyses; roadways and intersections. Statewide RCI data was collected from the GIS layers and classified according to their functional classification, area type and number of lanes as well as their average annual daily traffic (AADT) and total lengths. Intersection data was classified according to several parameters including their total entering traffic, total crossing distance, total daily pedestrians and type of control. Furthermore, the total statewide number of crashes over the 5-year period (June 2009 through May 2014) was identified from Signal Four Analytics database for all the roadways and intersections. In addition to the intersection GIS data, sample intersection data was collected based on a pilot study within the nine counties of FDOT District Five. The purpose of the pilot study is to identify the critical pedestrian safety locations within the District and correlate this against safety locations based on statewide averages. An appropriate statistical sample size was needed to represent variations within statewide roadway and intersection types and to determine actual pedestrian crash rates using the proposed methodology. The methodology is summarized into the following steps:

Roadways:

1- Identify statewide roadway categories and characteristics
2- Assemble statewide pedestrian crashes along roadways
3- Develop statewide average pedestrian crash rates along roadways

4- Determine critical segment locations within District Five

Intersections:

1- Identify statewide intersections and characteristics
2- Identify pedestrian crashes at signalized intersections
3- Pilot study for District Five intersections
4- Estimation of intersection pedestrian volume
5- Intersection classification
6- Establish statewide average pedestrian crash rates at intersections
7- Determine critical hotspot locations within District Five

4.2 ROADWAYS

4.2.1 Identify Statewide Roadway Categories and Characteristics

FDOT roadway GIS layers were spatially joined to categorize the roadways according to their functional classification, area type, AADT, number of lanes, and total lengths. Functional classification layer included seven different roadway classes:

1- Principal Arterial-Interstate
2- Principal Arterial-Expressway
3- Principal Arterial-Other
4- Minor Arterial
5- Major Collector
6- Minor Collector
7- Local

Area type included two types (urban and rural). The number of lanes layer included 12 categories and was further split based on the feature class “road_side” value of C, L, R, where C (centerline) represents the number of lanes for undivided roadways, while L (left side) and R (right side) represent the number of lanes for divided roadways. L & R were spatially joined to get the total number of lanes for divided roadways. A total of 135 different categories resulted from these combinations (83 for divided and 52 for undivided). The last 5-year AADT data (2009-2013) were then overlaid on top of the roadway categories and the average AADT values were calculated for each roadway type. The total length for each roadway category was also calculated. The total length of the undivided roadways was about 29,400 miles while the divided roadways length was about 15,400. Sample raw data extracted from the GIS layers for the divided and undivided roadways are included in Appendix A.

4.2.2 Assemble Statewide Pedestrian Crashes along Roadways

The GIS layer from Signal Four Analytics database for the most recent 5-year period (June 2009 through May 2014) was utilized to identify statewide pedestrian crashes along the roadways. The statewide data showed a total of 35,287 pedestrian related crashes. The crash layer was spatially joined with the roadways layer and a 15 foot buffer was used to identify the crashes that occurred specifically on the roadway segments. A total of 14,451 pedestrian related crashes were located along roadways involving the state highway system. There were 9,552 pedestrian crashes on the divided roadways while there were 4,899 crashes on the undivided roadways.

4.2.3 Develop Statewide Average Pedestrian Crash Rates along Roadways

The exposure measure used to calculate pedestrian crash rates along the roadways included the total length in miles, total number of crashes and the AADT for each roadway category over the 5-year study period. The average number of daily pedestrians for each roadway category is not applicable in this case due to the fact that pedestrians are less confined to paths of travel than motor vehicles and that they often travel in closely spaced groups in specific areas. There will be numerous locations along the roadway with no pedestrians or no designated crossings except at intersections or mid-blocks which are addressed in the intersections' section. Therefore, it is difficult to define an average number of pedestrians that are always using a 2-lane urban major arterial or 4-lane rural minor collector and generalize it statewide for the entire roadway type. Reliable data is necessary for measuring trends in facility use and for putting crash data into context. Accordingly, the equation used to calculate average pedestrian crash rates along roadways is:

$$\text{APCR} = \frac{\#PC_5 * 10^8}{5 * 365 * L_i * ADT_i}$$

Where:

APCR = Average Pedestrian Crash Rate per 100 million vehicle miles.

$\#PC_5$ = Number of Pedestrian Crashes over 5-year period

L_i= total length of the roadway category

ADT_i= Average daily traffic for the roadway category

Using the above formula, statewide averages for pedestrian crash rates along roadways were established based on the available GIS layers' data. Tables 7 and 8 summarize all the divided and undivided roadway data respectively, exposure measure and average crash rate for each category. It should be noted that few roadway categories had total lengths of less than one mile and others exhibited zero pedestrian crashes. Therefore, these categories were eliminated from the database. The analysis resulted in a total of 70 different roadway categories with 70 different statewide average rates. The divided roadways had 45 categories while the undivided roadways had 25 categories.

Table 7: Statewide Average Pedestrian Crash Rates for Divided Roadways

Divided Roadway Category	5-YR Number of Ped Crashes	5-YR AADT	Total Length (mile)	Statewide Crash Rate per 100 MVM
2-Lane - Divided Local - URBAN	89	7443	108.04	6.064
2-Lane - Divided Major Collector - RURAL	5	4380	78.50	19.922
2-Lane - Divided Major Collector - URBAN	967	9647	1153.97	4.760
2-Lane - Divided Minor Arterial - RURAL	15	4051	114.29	44.382
2-Lane - Divided Minor Arterial - URBAN	511	13124	575.79	3.705
2-Lane - Divided Minor Collector (Fed Aid) - URBAN	152	8289	239.61	4.193
2-Lane - Divided Principal Arterial-Other - RURAL	31	9118	152.42	30.558
2-Lane - Divided Principal Arterial-Other - URBAN	199	14652	228.05	3.263
3-Lane - Divided Local - URBAN	3	7367	10.14	3.667
3-Lane - Divided Major Collector - URBAN	108	11173	101.66	5.210
3-Lane - Divided Minor Arterial - URBAN	68	16686	73.03	3.058
3-Lane - Divided Minor Collector (Fed Aid) - URBAN	17	11320	14.05	5.857
3-Lane - Divided Principal Arterial-Other - RURAL	2	8071	102.99	8.240
3-Lane - Divided Principal Arterial-Other - URBAN	21	16482	35.89	1.945
4-Lane - Divided Local - RURAL	1	3850	12.03	29.580
4-Lane - Divided Local - URBAN	49	20295	73.45	1.801
4-Lane - Divided Major Collector - RURAL	2	10025	116.64	5.858
4-Lane - Divided Major Collector - URBAN	748	15434	1089.63	2.437
4-Lane - Divided Minor Arterial - RURAL	4	7451	101.66	9.042
4-Lane - Divided Minor Arterial - URBAN	2043	23835	1858.32	2.527
4-Lane - Divided Minor Collector (Fed Aid) - URBAN	92	13185	187.98	2.034
4-Lane - Divided Principal Arterial-Expressway - RURAL	4	29706	350.22	0.658
4-Lane - Divided Principal Arterial-Frwy and Expwy - URBAN	77	49155	519.58	0.165
4-Lane - Divided Principal Arterial-Interstate - RURAL	8	37999	762.82	0.378
4-Lane - Divided Principal Arterial-Interstate - URBAN	10	51122	508.62	0.527
4-Lane - Divided Principal Arterial-Other - RURAL	30	10755	1264.34	3.022
4-Lane - Divided Principal Arterial-Other - URBAN	1382	28393	2308.33	1.155
5-Lane - Divided Major Collector - URBAN	15	19333	10.14	4.192
5-Lane - Divided Minor Arterial - URBAN	81	30298	66.05	2.218
5-Lane - Divided Principal Arterial-Frwy and Expwy - URBAN	1	28250	21.27	0.456
5-Lane - Divided Principal Arterial-Interstate - URBAN	5	92502	18.03	0.164
5-Lane - Divided Principal Arterial-Other - URBAN	81	41642	65.92	1.617
6-Lane - Divided Local - URBAN	10	38853	1.91	7.372
6-Lane - Divided Major Collector - URBAN	60	30640	35.10	3.057
6-Lane - Divided Minor Arterial - URBAN	371	34409	308.23	1.917
6-Lane - Divided Minor Collector (Fed Aid) - URBAN	10	19248	2.14	13.309
6-Lane - Divided Principal Arterial-Frwy and Expwy - URBAN	42	96328	136.53	0.175
6-Lane - Divided Principal Arterial-Interstate - RURAL	7	48554	520.98	0.379

Table 7: Statewide Average Pedestrian Crash Rates for Divided Roadways (Continued)

Divided Roadway Category	5-YR Number of Ped Crashes	5-YR AADT	Length (mile)	Statewide Crash Rate per 100 MVM
6-Lane - Divided Principal Arterial-Other - URBAN	1154	45934	910.85	1.511
7-Lane - Divided Principal Arterial-Frwy and Expwy - URBAN	6	80900	22.37	0.182
7-Lane - Divided Principal Arterial-Interstate - URBAN	7	183571	28.20	1.852
7-Lane - Divided Principal Arterial-Other - URBAN	37	51604	23.40	1.679
8-Lane - Divided Principal Arterial-Frwy and Expwy - URBAN	6	138421	39.42	1.506
8-Lane - Divided Principal Arterial-Other - URBAN	57	49186	46.29	1.372
9-Lane - Divided Principal Arterial-Interstate - URBAN	2	110250	7.21	0.344

It should be noted that Signal Four Analytics crash data was cross verified with the crash reports for selected intersections only. However, cross verification for the entire database is outside the scope of the research.

Table 8: Statewide Average Pedestrian Crash Rates for Undivided Roadways

Undivided Roadway Category	5-YR Number of Ped Crashes	5-YR AADT	Length (mile)	Statewide Crash Rate per 100 MVM
1-Lane - Undivided Major Collector - URBAN	5	5500	16.92	2.944
1-Lane - Undivided Minor Collector (Fed Aid) - URBAN	5	6240	5.65	7.776
1-Lane - Undivided Principal Arterial-Other - URBAN	1	33000	5.31	1.565
2-Lane - Undivided Local - RURAL	39	7017	4203.49	1.811
2-Lane - Undivided Local - URBAN	260	5207	1443.28	1.896
2-Lane - Undivided Major Collector - RURAL	79	3131	5231.34	6.608
2-Lane - Undivided Major Collector - URBAN	1464	6664	5273.38	2.283
2-Lane - Undivided Minor Arterial - RURAL	69	5342	2578.46	6.862
2-Lane - Undivided Minor Arterial - URBAN	470	10758	1688.91	1.417
2-Lane - Undivided Minor Collector - RURAL	55	2439	4087.43	7.559
2-Lane - Undivided Minor Collector (Fed Aid) - URBAN	349	5009	1813.10	2.106
2-Lane - Undivided Principal Arterial-Frwy and Expwy - URBAN	1	5925	22.00	2.102
2-Lane - Undivided Principal Arterial-Other - RURAL	77	7153	1740.54	8.473
2-Lane - Undivided Principal Arterial-Other - URBAN	160	12705	730.20	0.945
3-Lane - Undivided Local - URBAN	3	7300	2.73	13.727
3-Lane - Undivided Major Collector - URBAN	75	9620	49.77	8.583
3-Lane - Undivided Minor Arterial - URBAN	102	11590	54.61	8.830
3-Lane - Undivided Minor Collector (Fed Aid) - URBAN	5	3867	5.08	13.945
3-Lane - Undivided Principal Arterial-Other - URBAN	164	19348	63.40	7.325
4-Lane - Undivided Local - RURAL	1	14400	2.35	40.480
4-Lane - Undivided Local - URBAN	5	5981	4.90	9.354
4-Lane - Undivided Major Collector - RURAL	1	10267	3.49	38.230
4-Lane - Undivided Major Collector - URBAN	132	9782	111.80	6.614
4-Lane - Undivided Minor Arterial - URBAN	337	16457	115.43	9.721
4-Lane - Undivided Minor Collector (Fed Aid) - URBAN	18	11285	13.10	6.673
4-Lane - Undivided Principal Arterial-Other - URBAN	160	20184	46.89	9.265

4.2.4 Area Type Adjustment Factor (ATAF)

From the analysis, it was found that the statewide average rates for rural roads exhibited very low values especially when compared with the urban rates. This could be attributed to the effect of averaging over the entire state and also due to the fact that rural roadway categories were less than the urban categories but have longer lengths since they connect between urban areas and usually have less AADT volumes than urban roads and with extremely low number of pedestrian crashes. In order to account for the pedestrians at risk on rural roads, an Area Type Adjustment Factor (ATAF) needs to be considered in the exposure measure for the rural areas. The analysis showed that out of the 21,434 miles of rural roads only 431 pedestrian crashes were recorded over the 5-year period. On the other hand, there were 12,233 pedestrian crashes recorded on the 23,145 miles of urban roads. Therefore, an ATAF of 0.04 is needed to adjust for the pedestrians at risk in rural areas when compared to urban areas. Accordingly, the statewide average rates were revised to include the ATAF for rural roads as shown on Tables 1 and 2. An additional criterion was also required to disqualify segments with extremely low number of pedestrian crashes over the 5-year period. Therefore, the analysis was revised to include a minimum threshold of five crashes over the 5-year period to be considered in the analysis and compared to the statewide averages. Hence, the revised equation used to calculate average pedestrian crash rates along the roadways is:

$$\text{APCR} = \frac{\#PC_5 * 10^8}{5 * 365 * L_i * ADT_i * ATAF}$$

Where ATAF is (1) for urban roads and 0.04 for rural roads.

4.2.5 Determine Critical Segment Locations within District Five

A random sample of ten segments located within FDOT District Five's jurisdiction were selected to identify critical safety concerns along these facilities and whether they are considered high crash locations. This should be determined by comparing the actual pedestrian crash rates to the developed statewide averages. As shown in Table 3, the sample included different roadway types and categories from Orange, Osceola, Seminole, and Lake Counties. Roadway segment data included the length measured from aerial maps as well as the average daily traffic over the 5-year period between 2009 and 2013 based on the latest FDOT traffic information online. The 5-year pedestrian crash data was obtained from Signal Four Analytics database from June 2009 until May 2014. There were many of discrepancies between the FDOT GIS layers and the local agencies in terms of the functional classification for each roadway segment. However, the roadway category data was obtained from the FDOT GIS functional classification and area type layers to be consistent with the same categories used in the statewide averages. Also, crash data from Signal Four Analytics was cross verified with FDOT crash layer as well as the crash reports for selected intersections only.

The results showed that majority of the urban roadway segments within the District Five sample have the actual pedestrian crash rates greater than their corresponding statewide averages which qualify them to be considered hazardous segments. It should be noted that although the number of crashes on some roadway segments seemed low, they exceeded the statewide average rate based on their exposure measure which takes into consideration traffic volume and length of the roadway segment. Since the length of the roadway segment plays a major role in the exposure measure, it is recommended to consider the maximum length of the studied segment that corresponds to the number of crashes. For example, if the studied roadway segment is two miles and has four crashes, then the analyst should consider the maximum length of this roadway segment that contains those four crashes by extending the segment from both sides just before the next crash, excluding the crashes at the intersections within a 250-foot radius.

Table 9: Actual Crash Rates versus Statewide Averages for Roadway Pilot Study

No	Roadway Name	Segment	Roadway Category	AADT (5-YR Avg)	Length (miles)	No of Ped Crashes (5-YR)	Exposure	Actual Ped Crash Rate per 100 MVM	Statewide Avg Rate per 100 MVM	Hazardous Segment
1	US 17/92 (OBT)	Oak Ridge Rd to Holden Ave	6 Ln Div Principal Arterial-Other-Urban	58,500	1.50	14	160,143,750	8.74	1.51	YES
2	SR 434 (Alafaya Tl)	SR 50 to McCulloch Rd	6 Ln Div Principal Arterial-Other-Urban	59,400	3.12	22	338,223,600	6.50	1.51	YES
3	SR 436 (Semoran Blvd)	SR 528 to SR 408	6 Ln Div Principal Arterial-Other-Urban	45,992	5.54	59	464,998,072	12.69	1.51	YES
4	SR 551 (Goldenrod Road)	Lake Underhill to SR 50	4 Ln Div Minor Arterial-Urban	33,300	2.00	5	121,545,000	4.11	2.53	YES
5	SR 50 (Colonial Dr)	Dean Rd to Alafaya Tl	4 Ln Div Principal Arterial-Other-Urban	47,800	2.27	14	198,023,450	7.07	1.16	YES
6	SR 15 (Hoffner Ave)	Conway Rd to Goldenrod Rd	2 Ln Undiv Minor Arterial -Rural	21,060	2.61	4	100,314,045	3.99	6.86	NO
7	US 27	CR 474 to Lake Louisa Rd	4 Ln Div Principal Arterial-Other-Rural	20,920	8.52	2	325,285,080	0.61	3.02	NO
8	US 192	Holopaw Rd to Deer Park Rd	4 Ln Div Principal Arterial-Other-Rural	5,800	11.38	3	120,457,300	2.49	3.02	NO
9	SR 415	Celery Ave to Reed Ellis Rd	2 Ln Undiv Minor Arterial-Rural	16,920	2.48	2	76,579,920	2.61	6.86	NO
10	CR 419 (Chuluota Rd)	SR 50 to Lake Pickett Rd	2 Ln Div Minor Arterial-Urban	12,000	1.93	1	42,267,000	2.37	3.59	NO

Notes:

* AADT data was obtained from the latest 2013 FDOT Traffic Information Online and based on the average of the 5-yr period (2009-2013)

* No of crashes were obtained from Signal 4 Analytics Database for the 5-yr period (June 2009-May 2014)

* 2 out of the 3 crashes on US 192 segment were fatalities

* 2 out of the 2 crashes on SR 415 segment were fatalities

4.3 INTERSECTIONS

4.3.1 Identify Statewide Intersections and Characteristics

Several FDOT intersection GIS layers were utilized for this task in order to gather all the relevant information associated with each intersection. The intersection layer included all types of intersections such as signalized and unsignalized. Furthermore, the GIS Traffic Signal Locations feature class layer provided spatial information on locations of traffic signals in the RCI database. The signal locations layers included five types of signalized intersections as follows:

1- Flashing Beacon
2- Standard Traffic Signal
3- Mid-block Pedestrian Control
4- Emergency Signal
5- School Signal

The FDOT GIS PTMS shapefile provided feature class information on Florida Portable Traffic Monitoring Sites (PTMS), as well as attribute information compatible with the Roadway Characteristics Inventory (RCI) database. The PTMS shapefile along with the AADT layer were overlaid on top of the intersection layer and a ten foot buffer surrounding the intersection was used in order to determine the AADT associated with each approach. It should be noted also that the number of lanes layer for the roadways was utilized to determine the number of lanes at each approach for each intersection to detect the total approach width. This process facilitated the calculation of several parameters needed for this task. For example, total traffic, total crossing distance and type of intersection control within the state. Sample raw data extracted from the GIS layers for the intersections are included in Appendix B.

4.3.2 Identify Pedestrian Crashes at Signalized Intersections

To identify statewide pedestrian crashes that are related to signalized intersections, a 250-foot buffer radius was created around each of the signalized intersections. The GIS layer for pedestrian crashes was spatially intersected with the 250-foot buffer to isolate pedestrian crashes located at signalized intersections from those located along the roadway segments. Data associated with the resulting pedestrian crashes at signalized intersection was then extracted and exported to a spreadsheet.

Due to the overlapped traffic signal buffers at adjacent signalized intersections that are spaced less than 500 feet apart, some crashes associated with more than one signalized intersection were duplicated. Therefore, those duplicated crashes were eliminated from the analysis.

A total of 6,684 statewide pedestrian crashes were located within the signalized intersections area of influence. Out of the 10,500 signalized intersections in the State of Florida, 3,492 signalized intersections experienced one or more pedestrian crash during the 5-year study period. Crashes ranged from 1 to 20 crashes per intersection.

4.3.3 Pilot Study for District Five Intersections

A pilot study was necessary to collect intersection specific data. FDOT District Five was selected for this purpose. A sample of 52 intersections located within FDOT District Five's jurisdiction were selected to represent sufficient parameter variations to be utilized in the statewide analysis. The process for selecting these intersections is explained in the following section.

Selection criteria

The FDOT GIS intersections layer within District Five and the pedestrian crash layer were spatially joined. Based on the dataset, a total of 2,166 crashes were located within a 250-foot diameter surrounding the intersections for the 5-year period between June 1, 2009 and May 31, 2014. The intersections were further divided into two categories: urban intersections and rural intersections. There were 1,760 crashes within the vicinity of urban intersections and 406 crashes within the vicinity of rural intersections. Preliminary selection criteria based on the number of pedestrian crashes and area type was utilized. The intersections that have more than one pedestrian crash were first selected and sorted. It was found that more than 85% of the rural intersections have only one crash. Furthermore, the urban intersection crashes were divided into four groups based on the frequency of the number of crashes at the intersections as shown in Table 10. It was found that urban intersections with crashes ranging from one to five have rate of occurrence of more than 90%.

Table 10: Frequency of Crashes at Urban Intersections in District Five

No of Crashes (Group)	N
1-5	1628
6-10	87
11-20	40
Over 20	5

Sample Size

A reasonable statistical sample size should include more than 30 intersections; therefore 52 intersections were randomly selected using the random number generator. About third of the intersections were selected to be in rural areas (15 intersections). The remaining intersections were in urban areas (37 intersections).

Sample Refinement

Since the sample size was randomly selected, therefore visual inspection of the selected intersections was necessary to ensure proper locations and correct number of crashes within the vicinity of the intersection. The visual inspection utilized the Signal Four Analytics crash database. The selected sample was further refined to include major intersections at appropriate locations with reasonable number of crashes that would trigger a reasonable amount of pedestrian activity. The refinement process also considered other parameters at the intersections such as number of lanes, speed limits and AADTs. The intersections were then plotted on District Fiver map to ensure an appropriate distribution. The selected intersections were distributed over seven counties out of the nine counties within District Five as shown on Figure 21. Excerpts from the final list of the candidate intersections are shown on Table 11.

It should be noted that Signal Four Analytics crash data was cross verified with the FDOT crash layer as well as the crash reports for selected intersections only. However, cross verification for the entire database is not within the scope of the research.

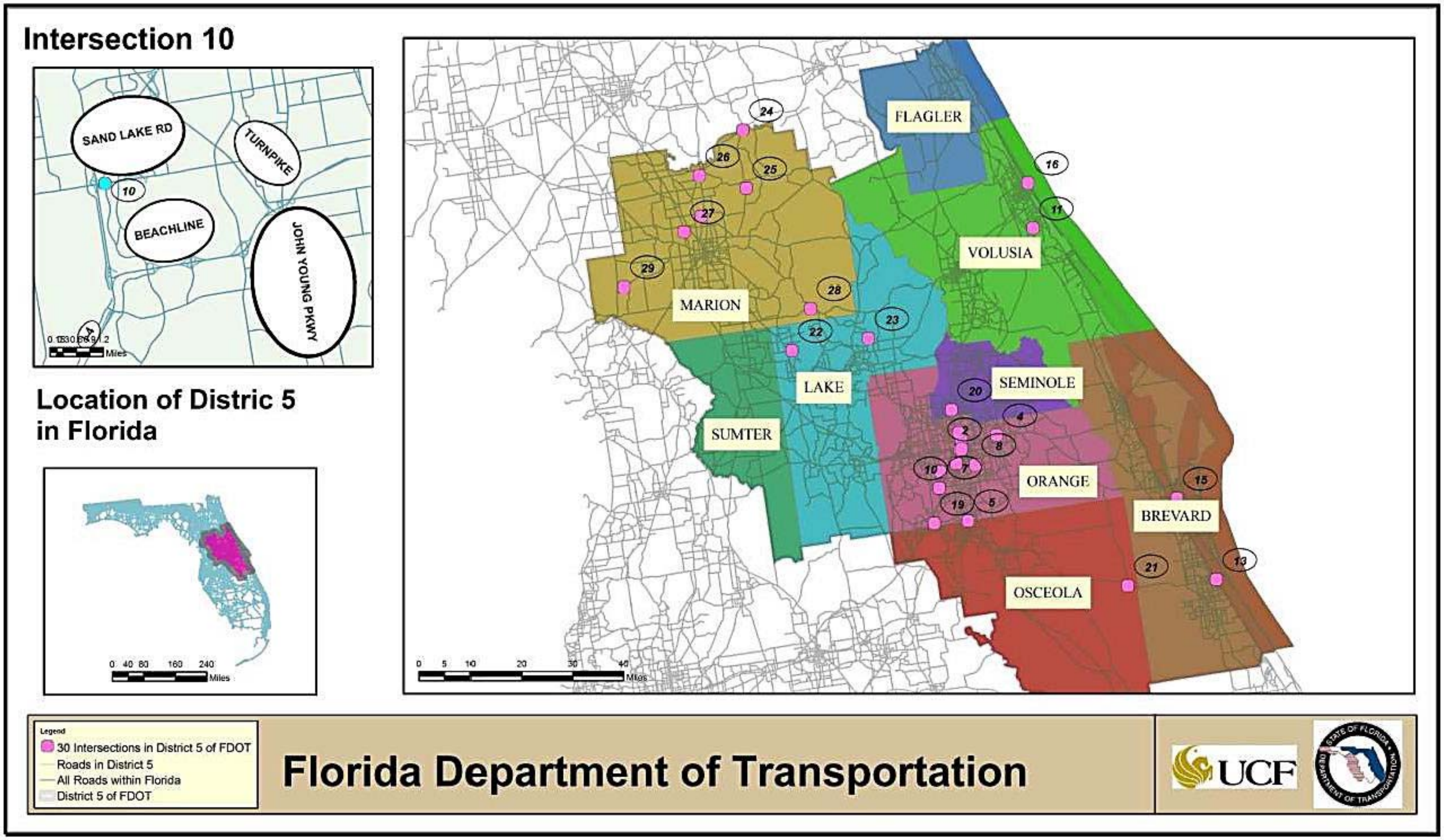


Figure 21: Candidate Intersection Locations within District Five

Table 11: List of Candidate Intersections for Pilot Study

No	Intersection Name		5-year Ped Crashes (June 2009-May 2014)	Area Type	Location	County	Notes
1	Orange Ave	Central Blvd	8	Urban	Orlando	Orange County	Downtown area
2	Primrose Dr	Colonial Dr	9	Urban	Orlando	Orange County	Downtown area
3	Lee Rd	I-4 Ramps	7	Urban	Winter Park	Orange County	NB Off Ramp
4	Dean Road	Colonial Dr	9	Urban	Orlando	Orange County	Between Econ & Dean (4 fatalities)
5	Ridgewood Ave	OBT	10	Urban	Kissimmee	Osceola County	Kissimmee near FL Hospital (4 fatalities)
6	JYP	SR 50	13	Urban	Orlando	Orange County	1 fatality
7	Silver Star Rd (SR 438)	Hiawassee Rd	20	Urban	Pine Hills	Orange County	1 fatality
8	Pershing Ave	Semoran Blvd	8	Urban	Orlando	Orange County	1 fatality
9	41st Street	OBT	8	Urban	Orlando	Orange County	4 fatalities (more crashes between 39th & 43rd)
10	Sand Lake Rd	I-Drive	6	Urban	Orlando	Orange County	Tourist area
11	Dunlawton Ave	Clyde Morris Blvd	12	Urban	Port Orange	Volusia County	Beach area
12	Kirkman Rd	Conroy-Windermere Rd	16	Urban	Orlando	Orange County	2 fatalities
13	Palm Bay Rd NE	Babcock St NE	5	Urban	Melbourne	Brevard County	2 more fatalities east of the intersection
14	SR 426 (Aloma)	SR 436 (Semoran)	11	Urban	Orlando	Orange County	1 fatality (Aloma High School)
15	Courtenay Pkwy	Lucas Rd	8	Urban	Meritt Island	Brevard County	Beach area
16	Martin Luther King	US 92 (ISB)	7	Urban	Daytona Beach	Volusia County	Campus area
17	Michigan Street	SR 527	12	Urban	Orlando	Orange County	Downtown area
18	Orlando Central Pkwy	US 17-92 (OBT)	14	Urban	Orlando	Orange County	Chancery High School
19	Winter Garden Vineland Rd	Apopka-Vineland Rd (SR 535	8	Urban	Lake Buena Vista	Orange County	Tourist area
20	Lake Mary Blvd	US 17-92	6	Urban	Sanford	Seminole County	Lake Mary Area
21	Science Drive	Alafaya Trail	5	Urban	Orlando	Orange County	1 fatality (UCF Area)
22	Holopaw Rd	US 192	2	Rural	St. Cloud	Osceola County	Saint Cloud area
23	Picciola Rd	US 27	4	Rural	Leesburg	Lake County	1 fatality
24	Dixie Ave (SR 44)	US 441	2	Rural	Leesburg	Lake County	Mount Dora area
25	US 441/US 301	CR 329	2	Rural	Ocala	Marion County	1 fatality
26	NE 52nd CT	E Siver Springs Blvd	6	Rural	Ocala	Marion County	1 fatality
27	NE Jacksonville Rd (CR200A	US 301	2	Rural	Ocala	Marion County	1 fatality (dangerous by design)
28	Howland Blvd (CR 4145)	SR 415	3	Rural	Deltona	Volusia County	Isolated Commercial landuse
29	Howland Blvd (CR 4145)	Courtland Blvd	2	Rural	Deltona	Volusia County	additional fatality to the north (drunk ped)
30	Airport Blvd	Sanford Ave	2	Rural	Sanford	Seminole County	West of the Airport
31	SR 50	Belvedere Rd	3	Rural	Orlando	Orange County	1 fatality
32	SR 50	Chuluota Rd	3	Rural	Orlando	Orange County	school area (Corner Lake Middle School)

Data Collection

The 52 intersections were videotaped for one day. Then the following data was extracted from viewing and analyzing the recorded tapes in increments of 15 minutes:

a. Number of daily vehicles at each directional approach (ADT)
b. Number of daily pedestrians crossing each directional approach (ADP)

In addition, distances crossed (DC) at each directional approach was measured from the aerial maps. As mentioned earlier, the number of crashes at each of those intersections was obtained from Signal Four Analytics. Moreover, documentation of sidewalk/bicycle-lanes and identification of the ADA compliance for each approach at the studied intersections were extracted and summarized in Table 12.

Table 12: Sidewalks, Bicycle Lanes and ADA Compliance Data at Sample Intersections

Intersection ID	Intersection Name	ADA compliance												Sidewalk				Bicycle-lane			
		West Approach			East Approach			South Apporach			North Apporach										
		Curb	Tactile	Audible	Curb	Tactile	Audible	Curb	Tactile	Audible	Curb	Tactile	Audible	West	East	South	North	West	East	South	North
1	Orange Ave @ Central Blvd	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	No
2	Primrose Dr @ Colonial Dr	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	No
3A	Lee Rd @ I-4 WB Off Ramp	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No
3B	Lee Rd @ I-4 EB Off Ramp	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No
4	Dean Rd @ Colonial Dr	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes
5	Ridgewodd Ave @ OBT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	Yes	Yes	No	No	No	No
6	JYP @SR 50	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Silver Star @ Hiawassee Rd	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
8	Pershing Ave @ Semoran	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9	41 st St @ OBT	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes	Yes	No	No	No	No	No
10	Sand Lake Rd @ I-Drive	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
11	Dunlawton Ave @ Clyde Morris Blvd	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
12	Kirkman Rd @ Conroy-Windemere Rd	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
13	Palm Bay Rd @ Babcock St	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	SR 426 @SR 436	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
15	Courtenay Pkwy @ Lucas Rd	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
16	Martin Luther King @ US 92	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes
17	Michigan St @ SR 527	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	No
18	Orlando Central Pkwy @ US 17-92	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
19	Vineland Rd @ Apopka- Vineland Rd	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
20	Lake Mary Bv @ US 17-92	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
21	Science Dr @ Alafaya Dr	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
22	Holopaw Rd @ US 192	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No	No	No	No
23	Picciola Rd @ US 27	N/A	N/A	N/A	Yes	Yes	No	N/A	N/A	N/A	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	No
24	Dixie Ave @ US 441	Yes	Yes	No	N/A	N/A	N/A	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes
25	US 441/US 301 @ CR 329	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No	No	No	No
26	NE 52nd CT @ E Silver Springs Bv	Yes	No	No	Yes	No	No	N/A	N/A	N/A	No	No	No	Yes	Yes	N/A	No	No	No	N/A	No
27	NE Jacksonville Rd (CR 200A) @ US 301	N/A	N/A	N/A	No	No	No	No	No	No	No	No	No	N/A	No	No	No	N/A	No	No	No
28	Howland Blvd @ SR 415	No	No	No	N/A	N/A	N/A	Yes	No	No	Yes	No	No	N/A	Yes	Yes	Yes	N/A	No	No	No
29	Howland Blvd @Courtland Bv	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
30	Airport Av @ Sanford Ave	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
31	SR 50 @ Belvedere Rd	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
32	SR 50 @ Chuluota Rd	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
33	US 441 at Osceola Pkwy	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
34A	Lake Nona Blvd @ SR 417 SB Ramp	No	No	No	No	No	No	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No
34B	Lake Nona Blvd @ SR 417 NB Ramp	No	No	No	No	No	No	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No

Table 12: Sidewalks, Bicycle Lanes and ADA Compliance Data at Sample Intersections (Continued)

35	US 27 @ Hartwood Marsh	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
36	University Blvd @ Dean Rd	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
37	SR436 at Old Cheney Hwy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
38	SR 436 & Curry Ford Rd	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
39	SR 50 & Alafaya Trail	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
40	SR 438 at CR 431	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
41	US 92 (Int. Speedway Blvd) & SR 5A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
42	US 1 (N. Ridgewood Ave) & Madison Ave	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
43	US 1 & US 192	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
44	US 192 (Vine Street) & US 17/92	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
45	SR 424 at SR 423	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
46	SR 435 at Conroy Rd	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
47	SR 436 at Hoffner Ave	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
48	SR 436 at Oxford Rd	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
49	US 17-92 at 1st St	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
50	US 192 at Budinger Ave	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No

Pedestrian Crash Rates

Based on the proposed methodology to calculate actual pedestrian crash rates at intersections, three main significant parameters were required to calculate the exposure measure:

1- Average Daily Pedestrian traffic (ADP)
2- Distance Crossed (DC)
3- Average Daily Vehicular traffic (ADT)

The following formula is used to calculate the actual pedestrian crash rate at intersections:

$$\text{APCR} = \frac{\#PC_5 * 5280 * 10^6}{5 * 365 * \sum_{i=1}^{n} ADP_i * DC_i * ADT_i}$$

Where:

APCR = Actual Pedestrian Crash Rate

$\#PC_5$ = Number of Pedestrian Crashes over 5-year period

$\sum_{i=1}^{n} ADP_i * DC_i * ADT_i$ = Sum of cross product of the average daily pedestrians x distance crossed in feet x average daily traffic for each directional approach (1 to 8).

The above parameters were extracted from the sample intersections and pedestrian crash rates per million pedestrian miles crossed per entering vehicle (PMC/EV) was calculated for each intersection as shown in Table 13.

Table 13: Pedestrian Crash Rates at Sample Intersections

Int ID	Intersection Name	West Approach				East Approach				South Approach				North Approach				West Approach	East Approach	South Apporach	North Apporach	Exposure Measure (PFC-EV)	Number of Crashes (250 ft Radius)	APCR per MPMC per EV
		EB ADT	WB ADT	EB Dist	WB Dist	WB ADT	EB ADT	WB Dist	EB Dist	NB ADT	SB ADT	NB Dist	SB Dist	SB ADT	NB ADT	SB Dist	NB Dist	ADP	ADP	ADP	ADP			
1	Orange Ave @ Central Blvd	1,600	1,600	12	24	1,600	1,600	24	12	0	16,041	0	36	16,041	0	36	0	3,321	4,217	2,117	1,514	2,531,004,156	7	0.008
2	Primrose Dr @ Colonial Dr	23,500	25,500	48	36	25,500	23,500	48	36	4,540	2,756	24	24	1,553	1,056	24	24	192	52	122	227	536,048,520	9	0.049
3A	Lee Rd @ I-4 WB Off Ramp	21,500	21,000	48	36	17,500	18,000	48	36	0	13,000	0	50	12,000	0	84	0	0	0	114	51	125,508,000	3	0.069
3B	Lee Rd @ I-4 EB Off Ramp	21,500	21,000	36	48	17,500	18,000	60	24	11,500	0	65	0	0	12,500	0	20	0	0	57	57	56,857,500	3	0.153
4	Dean Rd @ Colonial Dr	28,000	28,500	77	36	24,500	23,000	65	55	11,000	10,500	60	24	10,500	11,000	60	24	114	43	67	40	582,484,500	3	0.015
5	Ridgewood Ave @ OBT	862	877	12	12	43	41	12	12	15,000	15,500	36	24	15,500	15,000	36	24	45	14	2	3	5,531,172	5	2.615
6	JYP @SR 50	20,000	19,000	72	55	16,000	16,000	72	36	24,000	21,000	72	36	21,500	22,000	77	36	59	59	153	110	897,844,000	7	0.023
7	Silver Star @ Hiawassee Rd	14,500	16,500	65	36	18,500	20,000	60	36	16,500	16,000	48	24	16,500	17,500	48	24	261	226	203	310	1,429,054,500	13	0.026
8	Pershing Ave @ Semoran	4,500	4,500	48	12	11,000	10,000	48	24	28,000	25,500	65	50	25,500	28,000	50	77	115	98	139	100	879,619,000	4	0.013
9	41 st St @ OBT	164	680	12	12	0	0	0	0	29,453	29,453	48	36	29,453	29,453	36	36	260	2	40	37	180,058,152	7	0.112
10	Sand Lake Rd @ I-Drive	24,500	26,500	60	36	22,500	22,000	53	24	11,627	11,627	48	24	8,375	8,375	48	24	945	1,608	741	572	6,022,483,704	4	0.002
11	Dunlawton Ave @ Clyde Morris Blvd	21,000	24,500	60	36	15,000	13,500	60	36	4,500	4,500	48	24	4,500	4,500	48	24	12	38	35	19	95,868,000	8	0.241
12	Kirkman Rd @ Conroy-Windemere Rd	16,500	18,500	48	36	18,000	17,500	73	40	28,237	28,237	77	55	29,708	29,708	75	60	208	197	157	317	2,556,559,448	8	0.009
13	Palm Bay Rd @ Babcock St	12,500	13,500	70	55	13,500	12,500	70	55	18,500	15,000	77	45	13,938	14,162	70	40	25	20	37	36	206,286,040	5	0.070
14	SR 426 @SR 436	22,000	22,000	72	36	18,500	18,500	72	36	26,500	24,000	60	36	27,000	24,500	72	36	58	115	142	66	902,562,000	6	0.019
15	Courtenay Pkwy @ Lucas Rd	1,200	1,300	12	12	1,300	1,200	24	12	17,500	17,500	48	24	17,500	17,500	48	36	55	42	41	174	311,005,200	8	0.074
16	Martin Luther King @ US 92	13,000	13,000	36	24	11,000	11,000	36	24	1,450	1,450	24	15	1,450	1,450	24	15	149	192	108	136	256,738,200	4	0.045
17	Michigan St @ SR 527	16,000	13,000	48	24	13,000	16,000	48	24	18,404	17,712	60	24	14,500	16,500	48	24	116	125	157	107	608,228,496	5	0.024
18	Orlando Central Pkwy @ US 17-92	2,400	1,400	24	24	1,400	2,400	12	12	25,855	25,855	48	48	27,642	27,642	60	36	166	210	117	85	540,677,280	12	0.064
19	Vineland Rd @ Apopka- Vineland Rd	24,000	24,500	48	36	7,200	7,300	48	24	10,000	10,000	60	36	10,000	10,000	48	24	158	3	9	126	422,294,400	5	0.034
20	Lake Mary Bv @ US 17-92	6,700	5,000	60	24	5,700	6,300	60	24	18,000	18,500	60	36	18,902	18,875	60	24	13	148	18	5	119,143,200	5	0.121
21	Science Dr @ Alafaya Dr	4,440	4,440	24	12	4,072	4,179	24	12	27,500	26,000	48	36	26,000	27,500	48	36	165	44	115	128	578,784,144	4	0.020
22	Holopaw Rd @ US 192	4,358	4,302	48	24	3,000	3,100	36	24	1,100	1,100	24	12	17	23	24	12	0	0	6	0	237,600	1	12.177
23	Picciola Rd @ US 27	0	0	0	0	3,000	3,000	56	60	12,000	11,500	48	36	15,000	14,500	48	36	0	16	1	33	47,544,000	3	0.183
24	Dixie Ave @ US 441	13,000	14,000	24	24	14,000	13,000	36	24	2,900	2,900	12	12	0	0	0	0	4	0	5	3	2,940,000	2	1.968
25	US 441/US 301 @ CR 329	850	900	24	12	900	900	24	12	11,500	11,000	48	36	11,000	11,500	48	36	1	7	4	0	4,050,000	2	1.429
26	NE 52nd CT @ E Silver Springs Bv	10,381	9,613	18	18	9,613	10,381	18	18	0	0	0	0	634	620	12	12	81	4	0	22	30,921,876	1	0.094
27	NE Jacksonville Rd (CR 200A) @ US 301	0	0	0	0	3,800	3,700	36	24	13,500	14,000	36	24	14,000	13,500	36	24	0	2	0	0	451,200	1	6.412

Table 13: Pedestrian Crash Rates at Sample Intersections (Continued)

28	Howland Blvd @ SR 415	5,100	5,100	24	12	0	0	0	0	7,500	7,700	24	12	3,400	3,100	12	12	2	0	4	9	2,158,800	2	2.680
29	Howland Blvd @Courtland Bv	9,900	10,500	36	24	10,500	9,900	36	12	2,700	2,700	24	12	2,700	2,700	24	12	23	29	26	38	34,621,200	2	0.167
30	Airport Av @ Sanford Ave	2,100	2,000	60	24	2,000	2,100	48	24	6,800	8,200	48	24	8,200	6,800	48	24	20	8	25	8	22,185,600	2	0.261
31	SR 50 @ Belvedere Rd	12,874	12,402	36	36	12,402	12,874	36	24	375	400	12	12	623	1,326	12	12	4	27	3	4	24,158,292	3	0.359
32	SR 50 @ Chuluota Rd	19,500	17,500	48	36	12,402	12,874	48	24	3,548	2,973	36	24	6,000	6,000	36	24	168	1	19	3	268,854,792	3	0.032
33	US 441 at Osceola Pkwy	17,000	17,000	60	36	21,000	21,000	60	36	12,500	19,500	72	36	17,000	15,000	72	36	6	18	27	37	154,602,000	1	0.019
34A	Lake Nona Blvd @ SR 417 SB Ramp	0	3,635	0	65	2,016	0	60	0	4,894	3,064	36	24	2,700	2,700	24	24	19	5	1	1	5,473,345	0	0.000
34B	Lake Nona Blvd @ SR 417 NB Ramp	1,785	0	24	0	0	1,236	0	24	2,683	5,111	36	24	1,861	1,861	36	36	2	6	0	2	531,648	0	0.000
35	US 27 @ Hartwood Marsh	797	418	24	24	6,100	4,200	36	12	12,000	12,500	70	36	14,500	15,000	77	45	25	0	6	2	12,052,000	0	0.000
36	University Blvd @ Dean Rd	23,500	23,000	72	36	30,000	32,000	60	36	8,300	8,400	48	24	8,400	8,300	60	24	5	60	31	10	215,352,000	1	0.013
37	SR436 at Old Cheney Hwy	1,050	1,050	30	10	1,050	1,050	20	10	20,000	21,000	48	36	21,000	20,000	60	36	61	155	91	117	394,688,500	10	0.073
38	SR 436 & Curry Ford Rd	16,500	16,000	60	24	16,000	16,500	48	24	28,000	25,500	60	36	26,500	30,500	60	36	30	141	123	46	648,934,000	5	0.022
39	SR 50 & Alafaya Trail	25,000	24,500	60	24	24,500	25,000	60	24	26,500	26,500	72	36	26,500	26,500	72	36	92	117	73	68	836,401,500	1	0.003
40	SR 438 (Silver Star Rd) & CR 431 (N. Pine Hills Rd)	17,000	19,500	60	36	20,500	19,500	60	36	16,000	16,500	60	36	18,500	19,500	60	36	150	69	129	184	924,904,500	11	0.034
41	US 92 (Int. Speedway Blvd) & SR 5A (Nova Rd)	18,000	18,000	60	24	13,000	13,000	36	24	17,000	16,000	60	36	16,000	15,000	60	36	53	44	61	111	378,312,000	2	0.015
42	US 1 (N. Ridgewood Ave) & Madison Ave	200	200	60	24	200	200	36	24	13,500	14,000	60	36	12,000	12,000	60	36	272	148	108	69	227,691,600	5	0.064
43	US 1 (S. Harbor City Blvd) & US 192 (E Strawbridge Ave)	8,300	7,700	36	24	12,500	10,500	36	24	14,500	15,500	48	36	15,500	14,500	48	36	26	17	24	47	113,940,400	4	0.102
44	US 192 (Vine Street) & US 17/92	21,500	21,000	48	36	24,000	23,000	48	36	18,000	18,000	60	24	19,000	20,500	60	36	86	132	135	180	957,918,000	3	0.009
45	SR 424 at SR 423	17,500	16,500	40	36	17,500	17,000	48	38	11,000	11,500	50	35	15,500	16,000	33	45	36	21	27	6	110,896,500	4	0.104
46	SR 435 at Conroy Rd	16,500	18,500	64	52	18,000	17,500	75	47	29,000	27,500	87	66	27,500	29,000	90	60	72	0	30	72	578,916,000	8	0.040
47	SR 436 at Hoffner Ave	11,500	11,000	48	24	9,700	9,900	48	30	24,177	25,668	72	40	25,668	24,177	80	40	54	57	30	18	224,925,480	1	0.013
48	SR 436 at Oxford Rd	19,500	25,000	48	36	36,000	34,000	60	36	4,700	4,200	36	12	4,200	4,700	36	30	153	57	24	21	485,202,600	4	0.024
49	US 17-92 at 1st St	8,800	8,600	36	24	8,600	8,800	36	12	11,500	11,500	36	24	5,400	5,500	36	22	24	0	51	60	66,670,800	1	0.043
50	US 192 at Budinger Ave	19,500	20,500	50	44	20,000	18,500	50	42	2,300	2,300	45	20	700	700	24	22	12	9	9	15	40,345,500	0	0.000

4.3.4 Estimation of Intersection Pedestrian Volume

In order to arrive at the statewide averages for the intersections, the three main parameters mentioned above are required. Since statewide pedestrian counts at each intersection are not available and not feasible to collect, it needs to be estimated from existing data. Estimating the intersection pedestrian volume using the collected sample data was one of the most challenging tasks of this methodology. The 52 sample intersections, where pedestrian count data were collected, were utilized for this analysis. Several attempts were performed to find correlations between pedestrian volumes and intersection data, i.e., distance crossed in feet and daily traffic volume. It was also essential to include population size around each intersection due to its known correlation to the magnitude of pedestrian volume. Population size around each of the statewide intersection within a quarter mile (0.25) distance were obtained using the census population block GIS layer and included in the statistical analysis. **Although socioeconomic conditions of the geographic area may provide higher accuracy for estimating pedestrian volume than population, there was no evidence to support this claim throughout the research. Also, socioeconomic data includes several factors such as income, household and auto ownership associated with each land use which requires data collection and is not an available source. It should be noted also that the analysis couldn't identify a correlation between the number of crashes and the average daily pedestrians at the intersections due to the high variability in the data.**

Statistical Analysis

JMP statistical model (version 11), a module from SAS software, was used in this investigation. The three independent variables used in the statistical analysis included daily traffic volumes (ADT), distance crossed (DIST), and population (POP). The response variable was the pedestrian volume (ADP). Preliminary analysis was conducted for the 52 intersections of sample data using JMP's forward stepwise regression approach with all main effects and interactions as candidate effects according to the effect hierarchy principle. Stepwise regression is a very basic way of handling variable inclusion issues. This step-by-step iterative construction of the regression model that involves automatic selection of independent variables can be achieved either by trying out one independent variable at a time and including it in the regression model if it is statistically significant, or by including all potential independent variables in the model and eliminating those that are not statistically significant, or by a combination of both methods. An initial model was developed but the fit was poor due to the presence of five data points that were considered outliers. Therefore, they were eliminated from the dataset. Different data transformations were applied to the parameters and the highest correlation was found between the Distance (DIST), square root of the daily traffic volume (SQRTADT), natural logarithm of Population (LNPOP) and the natural logarithm of pedestrian volume (LNADP).

This improved form of the model included the three significant main effect parameters along with other two, two-way factor interaction terms with an adjusted coefficient of determination (R^2) of 72.08% which means that 72% of the data were explained by the model:

$Ln(ADP) = a_1 + a_2\ Ln(POP) + a_3\ sqrt(ADT) – a_4\ Ln(POP)\ x\ sqrt(ADT) – a_5\ DIST + a_6\ DIST\ x\ sqrt(ADT)$

Prediction profiles for the significant factors selected by the model are displayed on Figure 22 showing the actual values of the response variable (Ln ADP). The prediction profilers are dynamic and interactive. The statistical analysis and the model results are shown in Figure 22. The developed model was applied to the statewide data where pedestrian volumes were estimated using the AADT at each approach, total distance crossed as well as the population size surrounding each intersection within 0.25-mile radius.

Response LNADP

Actual by Predicted Plot

Summary of Fit

RSquare	0.76332
RSquare Adj	0.720838
Root Mean Square Error	0.710611
Mean of Response	4.941958
Observations (or Sum Wgts)	47

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	7	63.514437	9.07349	17.9685
Error	39	19.693748	0.50497	**Prob > F**
C. Total	46	83.208185		<.0001*

Parameter Estimates

Effect Tests

Sorted Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
LNPOP	0.7119133	0.181992	3.91	0.0004*
SQRTADT	0.0075499	0.002171	3.48	0.0013*
(LNPOP-7.70822)*(SQRTADT-309.002)	-0.005767	0.001964	-2.94	0.0055*
DIST	-0.005261	0.001921	-2.74	0.0092*
(DIST-299.787)*(SQRTADT-309.002)	6.512e-5	2.573e-5	2.53	0.0155*
(DIST-299.787)*(LNPOP-7.70822)	-0.002932	0.001938	-1.51	0.1383
(DIST-299.787)*(LNPOP-7.70822)*(SQRTADT-309.002)	5.4344e-6	1.461e-5	0.37	0.7120

Effect Details

Prediction Profiler

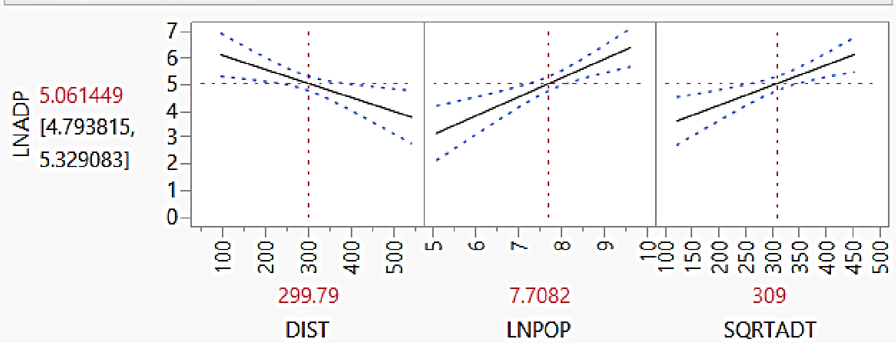


Figure 22: Statistical Results and Pedestrian Volume Model

4.3.5 Intersection Classification

The three main parameters required to calculate the exposure measure at intersections are now available especially after applying the above model for estimating pedestrian volume. The next step in the process demanded the classification of the intersections based on these three parameters and at the same time capture other intersection characteristics such as functional classification of the intersecting roadways, number of approaches, their number of lanes and AADT. The sample intersection data was used to examine distributions of total crossed distances as well as the total daily number of pedestrians at each intersection. Based on the total distance crossed for all the approaches, Intersections were classified as:

a. Intersections with total crossing distance less than 200 ft. (11)
b. Intersections with total crossing distance between 200 ft. and 300 ft. (17)
c. Intersections with total crossing distance between 300 ft. and 400 ft. (17)
d. Intersections with total crossing distance greater than 400 ft. (7)

This classification provided similar number of intersections at each crossed distance category as shown in parenthesis from the pilot intersection data.

Similarly, intersections were classified based on the total daily number of pedestrians crossing the intersection approaches. The following classification provided similar number of intersections at each pedestrian category as shown in parenthesis from the pilot intersection data:

a. Intersections with total daily pedestrians less than 100 pedestrians per day (16)
b. Intersections with total daily pedestrians between 100 and 300 pedestrians per day (17)
c. Intersections with total daily pedestrians more than 300 pedestrians per day (19)

On the other hand, statewide total daily number of vehicles at every intersection in the State of Florida was obtained from the data associated with the traffic monitoring sites along with the AADT GIS layer as explained earlier. The distribution of the total number of vehicles for all approaches was examined for the 3,492 intersection that experienced crashes. The following classification based on the total daily number of vehicles provided similar number of intersections at each AADT category as shown in parenthesis from the statewide intersection data:

a. Intersections with total AADT less than 20,000 vehicles per day (836)
b. Intersections with total AADT between 20,000 and 30,000 veh per day (827)
c. Intersections with total AADT between 30,000 and 40,000 veh per day (772)
d. Intersections with total AADT between 40,000 and 50,000 veh per day (537)
e. Intersections with total AADT more than 50,000 vehicles per day (518)

Based on the above classifications, there existed 5 x 4 x 3 = 60 different combinations for average values for crash rates at the intersections. The average rates for the different combinations are explained in the following section.

4.3.6 Establish Statewide Average Pedestrian Crash Rates at Intersections

The same methodology for calculating the exposure measure for the sample intersections was used to calculate the exposure measure at all the statewide intersections using the three main parameters; AADT at each approach, distance crossed and the estimated daily pedestrians. It should be noted that there were some missing data from the GIS layers such as the AADT values for one or two approaches as well as the number of turn lanes at the approaches to determine the total distance crossed which were assumed. The missing AADT data assumptions included using the average AADT based on the functional class of the intersecting roads for the missing approaches. For the missing turn lanes, the assumption included adding an additional 100 to 200 feet to the total distance crossed which was based on the comparison between the sample data and the GIS data for the 52 intersections. Based on the intersection classifications and combinations of the different ranges, the statewide averages for pedestrian crash rates at intersections were established. It was found that 47 different averages out of the 60 were generated. The remaining averages for the 13 combinations were not found in the database. Table 14 summarizes the developed statewide averages for the intersection crash rates.

Table 14: Statewide Averages for Pedestrian Crash Rates at Intersections

No	Intersection Classification & Ranges	Statewide Average Rate per MPMC/EV
1	< 20,000 vpd & < 100 ped & < 200 ft. Average	6.822
2	< 20,000 vpd & < 100 ped & 200 - 300 ft. Average	3.371
3	< 20,000 vpd & < 100 ped & 300 - 400 ft. Average	1.808
4	< 20,000 vpd & < 100 ped & > 400 ft. Average	
5	< 20,000 vpd & 100 - 300 ped & < 200 ft. Average	2.682
6	< 20,000 vpd & 100 - 300 ped & 200 - 300 ft. Average	0.726
7	< 20,000 vpd & 100 - 300 ped & 300 - 400 ft. Average	
8	< 20,000 vpd & 100 - 300 ped & > 400 ft. Average	
9	< 20,000 vpd & > 300 ped & < 200 ft. Average	0.196
10	< 20,000 vpd & > 300 ped & 200 - 300 ft. Average	0.174
11	< 20,000 vpd & > 300 ped & 300 - 400 ft. Average	
12	< 20,000 vpd & > 300 ped & > 400 ft. Average	
1	20,000 - 30,000 vpd & < 100 ped & < 200 ft. Average	5.578
2	20,000 - 30,000 vpd & < 100 ped & 200 - 300 ft. Average	1.693
3	20,000 - 30,000 vpd & < 100 ped & 300 - 400 ft. Average	2.104
4	20,000 - 30,000 vpd & < 100 ped & > 400 ft. Average	
5	20,000 - 30,000 vpd & 100 - 300 ped & < 200 ft. Average	0.948
6	20,000 - 30,000 vpd & 100 - 300 ped & 200 - 300 ft. Average	0.673
7	20,000 - 30,000 vpd & 100 - 300 ped & 300 - 400 ft. Average	0.653
8	20,000 - 30,000 vpd & 100 - 300 ped & > 400 ft. Average	
9	20,000 - 30,000 vpd & > 300 ped & < 200 ft. Average	0.159
10	20,000 - 30,000 vpd & > 300 ped & 200 - 300 ft. Average	0.129
11	20,000 - 30,000 vpd & > 300 ped & 300 - 400 ft. Average	0.139
12	20,000 - 30,000 vpd & > 300 ped & > 400 ft. Average	
1	30,000 - 40,000 vpd & < 100 ped & < 200 ft. Average	1.880
2	30,000 - 40,000 vpd & < 100 ped & 200 - 300 ft. Average	1.469
3	30,000 - 40,000 vpd & < 100 ped & 300 - 400 ft. Average	1.212
4	30,000 - 40,000 vpd & < 100 ped & > 400 ft. Average	1.165
5	30,000 - 40,000 vpd & 100 - 300 ped & < 200 ft. Average	0.433
6	30,000 - 40,000 vpd & 100 - 300 ped & 200 - 300 ft. Average	0.457
7	30,000 - 40,000 vpd & 100 - 300 ped & 300 - 400 ft. Average	0.424
8	30,000 - 40,000 vpd & 100 - 300 ped & > 400 ft. Average	
9	30,000 - 40,000 vpd & > 300 ped & < 200 ft. Average	0.106
10	30,000 - 40,000 vpd & > 300 ped & 200 - 300 ft. Average	0.118
11	30,000 - 40,000 vpd & > 300 ped & 300 - 400 ft. Average	
12	30,000 - 40,000 vpd & > 300 ped & > 400 ft. Average	

Table 14: Statewide Averages for Pedestrian Crash Rates at Intersections (Continued)

1	**40,000 - 50,000 vpd & < 100 ped & < 200 ft. Average**	**7.740**
2	**40,000 - 50,000 vpd & < 100 ped & 200 - 300 ft. Average**	**0.960**
3	**40,000 - 50,000 vpd & < 100 ped & 300 - 400 ft. Average**	**1.106**
4	**40,000 - 50,000 vpd & < 100 ped & > 400 ft. Average**	**0.599**
5	**40,000 - 50,000 vpd & 100 - 300 ped & < 200 ft. Average**	**0.394**
6	**40,000 - 50,000 vpd & 100 - 300 ped & 200 - 300 ft. Average**	**0.352**
7	**40,000 - 50,000 vpd & 100 - 300 ped & 300 - 400 ft. Average**	**0.163**
8	40,000 - 50,000 vpd & 100 - 300 ped & > 400 ft. Average	
9	**40,000 - 50,000 vpd & > 300 ped & < 200 ft. Average**	**0.072**
10	**40,000 - 50,000 vpd & > 300 ped & 200 - 300 ft. Average**	**0.099**
11	**40,000 - 50,000 vpd & > 300 ped & 300 - 400 ft. Average**	**0.096**
12	40,000 - 50,000 vpd & > 300 ped & > 400 ft. Average	

1	**> 50,000 vpd & < 100 ped & < 200 ft. Average**	**2.322**
2	**> 50,000 vpd & < 100 ped & 200 - 300 ft. Average**	**0.620**
3	**> 50,000 vpd & < 100 ped & 300 - 400 ft. Average**	**0.582**
4	**> 50,000 vpd & < 100 ped & > 400 ft. Average**	**0.387**
5	**> 50,000 vpd & 100 - 300 ped & < 200 ft. Average**	**0.213**
6	**> 50,000 vpd & 100 - 300 ped & 200 - 300 ft. Average**	**0.154**
7	**> 50,000 vpd & 100 - 300 ped & 300 - 400 ft. Average**	**0.195**
8	**> 50,000 vpd & 100 - 300 ped & > 400 ft. Average**	**0.167**
9	**> 50,000 vpd & > 300 ped & < 200 ft. Average**	**0.055**
10	**> 50,000 vpd & > 300 ped & 200 - 300 ft. Average**	**0.051**
11	**> 50,000 vpd & > 300 ped & 300 - 400 ft. Average**	**0.050**
12	**> 50,000 vpd & > 300 ped & > 400 ft. Average**	**0.053**

Notes:

vpd = total entering vehicles per day at the intersection (AADT for all approaches/2)
ped = total pedestrian counts for all intersection approaches
ft. = total crossing distance for all intersection approaches

4.3.7 Determine Critical Hotspot Locations within District Five

The final step in the process included the application of the developed statewide average rates to the sample data for the purpose of identifying critical hotspot locations within District Five. As can be seen in Table 15, the 52 sample intersection actual crash rates based on the data collected from the field were compared against the statewide average rates. The data showed several intersections with extremely low number of pedestrian crashes over the 5-year period. In order to disqualify intersections with extremely low crash occurrences over the 5-year period, another criterion was required. At minimum, five crashes over the 5-year period are required to qualify for the analysis. Therefore, the analysis was revised to include the minimum threshold of five crashes over the 5-year period which was compared to the statewide averages. The results showed that few of the intersections within the urban boundary of District Five triggered safety concerns as critical locations which require further investigation to identify main causes and emphasize mitigation improvements.

Table 15: Actual Crash Rates versus Statewide Averages for Intersection Pilot Study

Int ID	Intersection Name	Number of Crashes (250 ft Radius)	APCR per MPMC per EV	Total ADT	Total Dist Crossed	Total ADP	Intersection Category	Statewide Average Crash Rate	Hazardous Intersection
1	Orange Ave @ Central Blvd	7	0.008	38,482	144	11,169	30,000 - 40,000 vpd & > 300 ped & < 200 ft	0.106	NO
2	Primrose Dr @ Colonial Dr	9	0.049	107,905	264	593	> 50,000 vpd & > 300 ped & 200 - 300 ft	0.051	NO
3A	Lee Rd @ I-4 WB Off Ramp	3	0.069	103,000	302	165	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	NO
3B	Lee Rd @ I-4 EB Off Ramp	3	0.153	102,000	253	114	> 50,000 vpd & 100 - 300 ped & 200 - 300 ft	0.154	NO
4	Dean Rd @ Colonial Dr	3	0.015	147,000	401	264	> 50,000 vpd & 100 - 300 ped & > 400 ft	0.167	NO
5	Ridgewood Ave @ OBT	5	2.615	62,823	168	64	> 50,000 vpd & < 100 ped & < 200 ft	2.322	YES
6	JYP @SR 50	7	0.023	159,500	456	381	> 50,000 vpd & > 300 ped & > 400 ft	0.053	NO
7	Silver Star @ Hiawassee Rd	13	0.026	136,000	341	1,000	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
8	Pershing Ave @ Semoran	4	0.013	137,000	374	452	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
9	41 st St @ OBT	7	0.112	118,656	180	339	> 50,000 vpd & > 300 ped & < 200 ft	0.055	YES
10	Sand Lake Rd @ I-Drive	4	0.002	135,504	317	3,866	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
11	Dunlawton Ave @ Clyde Morris Blvd	8	0.241	92,000	336	104	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	YES
12	Kirkman Rd @ Conroy-Windemere Rd	8	0.009	186,390	464	879	> 50,000 vpd & > 300 ped & > 400 ft	0.053	NO
13	Palm Bay Rd @ Babcock St	5	0.070	113,600	482	118	> 50,000 vpd & 100 - 300 ped & > 400 ft	0.167	NO
14	SR 426 @SR 436	6	0.019	183,000	420	381	> 50,000 vpd & > 300 ped & > 400 ft	0.053	NO
15	Courtenay Pkwy @ Lucas Rd	8	0.074	75,000	216	312	> 50,000 vpd & > 300 ped & 200 - 300 ft	0.051	YES
16	Martin Luther King @ US 92	4	0.045	53,800	198	585	> 50,000 vpd & > 300 ped & < 200 ft	0.055	NO
17	Michigan St @ SR 527	5	0.024	125,116	300	505	> 50,000 vpd & > 300 ped & 200 - 300 ft	0.051	NO
18	Orlando Central Pkwy @ US 17-92	12	0.064	114,594	264	578	> 50,000 vpd & > 300 ped & 200 - 300 ft	0.051	YES
19	Vineland Rd @ Apopka- Vineland Rd	5	0.034	103,000	324	296	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	NO
20	Lake Mary Bv @ US 17-92	5	0.121	97,977	348	184	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	NO
21	Science Dr @ Alafaya Dr	4	0.020	124,131	240	452	> 50,000 vpd & > 300 ped & 200 - 300 ft	0.051	NO
22	Holopaw Rd @ US 192	1	12.177	17,000	204	6	< 20,000 vpd & < 100 ped & 200 - 300 ft	3.371	NO
23	Picciola Rd @ US 27	3	0.183	59,000	284	50	> 50,000 vpd & < 100 ped & 200 - 300 ft	0.620	NO
24	Dixie Ave @ US 441	2	1.968	59,800	132	12	> 50,000 vpd & < 100 ped & < 200 ft	2.322	NO
25	US 441/US 301 @ CR 329	2	1.429	48,550	240	12	40,000 - 50,000 vpd & < 100 ped & 200 - 300 ft	0.960	NO
26	NE 52nd CT @ E Silver Springs Bv	1	0.094	41,242	96	107	40,000 - 50,000 vpd & 100 - 300 ped & < 200 ft	0.394	NO
27	NE Jacksonville Rd (CR 200A) @ US 301	1	6.412	62,500	180	2	> 50,000 vpd & < 100 ped & < 200 ft	2.322	NO
28	Howland Blvd @ SR 415	2	2.680	31,900	96	15	30,000 - 40,000 vpd & < 100 ped & < 200 ft	1.880	NO
29	Howland Blvd @Courtland Bv	2	0.167	51,600	180	116	> 50,000 vpd & 100 - 300 ped & < 200 ft	0.213	NO
30	Airport Av @ Sanford Ave	2	0.261	38,200	300	61	30,000 - 40,000 vpd & < 100 ped & 200 - 300 ft	1.469	NO
31	SR 50 @ Belvedere Rd	3	0.359	53,276	180	38	> 50,000 vpd & < 100 ped & < 200 ft	2.322	NO
32	SR 50 @ Chuluota Rd	3	0.032	80,797	276	191	> 50,000 vpd & 100 - 300 ped & 200 - 300 ft	0.154	NO
33	US 441 at Osceola Pkwy	1	0.019	140,000	408	88	> 50,000 vpd & < 100 ped & > 400 ft	0.387	NO
34A	Lake Nona Blvd @ SR 417 SB Ramp	0	0.000	19,009	233	26	< 20,000 vpd & < 100 ped & 200 - 300 ft	3.371	NO
34B	Lake Nona Blvd @ SR 417 NB Ramp	0	0.000	14,537	180	10	< 20,000 vpd & < 100 ped & < 200 ft	6.822	NO

Table 15: Actual Crash Rates versus Statewide Averages for Intersection Pilot Study (Continued)

35	US 27 @ Hartwood Marsh	0	0.000	65,515	324	33	> 50,000 vpd & < 100 ped & 300 - 400 ft	0.582	NO
36	University Blvd @ Dean Rd	1	0.013	141,900	360	106	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	NO
37	SR436 at Old Cheney Hwy	10	0.073	86,200	250	424	> 50,000 vpd & > 300 ped & 200 - 300 ft	0.051	YES
38	SR 436 & Curry Ford Rd	5	0.022	175,500	348	340	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
39	SR 50 & Alafaya Trail	1	0.003	205,000	384	350	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
40	SR 438 (Silver Star Rd) & CR 431 (N. Pine Hills Rd)	11	0.034	147,000	384	532	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
41	US 92 (Int. Speedway Blvd) & SR 5A (Nova Rd)	2	0.015	126,000	336	269	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	NO
42	US 1 (N. Ridgewood Ave) & Madison Ave	5	0.064	52,300	336	597	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	YES
43	US 1 (S. Harbor City Blvd) & US 192 (E Strawbridge Ave)	4	0.102	99,000	288	114	> 50,000 vpd & 100 - 300 ped & 200 - 300 ft	0.154	NO
44	US 192 (Vine Street) & US 17/92	3	0.009	165,000	348	533	> 50,000 vpd & > 300 ped & 300 - 400 ft	0.050	NO
45	SR 424 at SR 423	4	0.104	122,500	325	90	> 50,000 vpd & < 100 ped & 300 - 400 ft	0.582	NO
46	SR 435 at Conroy Rd	8	0.040	183,500	541	174	> 50,000 vpd & 100 - 300 ped & > 400 ft	0.167	NO
47	SR 436 at Hoffner Ave	1	0.013	141,790	382	159	> 50,000 vpd & 100 - 300 ped & 300 - 400 ft	0.195	NO
48	SR 436 at Oxford Rd	4	0.024	132,300	294	255	> 50,000 vpd & 100 - 300 ped & 200 - 300 ft	0.154	NO
49	US 17-92 at 1st St	1	0.043	68,700	226	135	> 50,000 vpd & 100 - 300 ped & 200 - 300 ft	0.154	NO
50	US 192 at Budinger Ave	0	0.000	84,500	297	45	> 50,000 vpd & < 100 ped & 200 - 300 ft	0.620	NO

4.4 CONCLUSIONS AND RECOMMENDATIONS

To date there are no clear or uniform standards for a method to measure pedestrian incidents against a statewide average. In this study, statewide averages for pedestrian crash rates along the roadways as well as the intersections were quantified. The main objective is to identify critical pedestrian crash locations, thus evaluating locations that are operating above statewide averages, identifying main causes, and developing a prioritization tool to emphasize the need for mitigation implementation. It was crucial to address the pedestrian-vehicular conflict as the State of Florida currently tops the list in the "Dangerous by Design" report as having the highest four pedestrian incident locations in the country. The main challenge in analyzing pedestrian crashes is to identify a practical and correct exposure measure. In most cases, the exposure measure is either unavailable or can only be obtained at a higher cost. The methods and procedures explained in this study are considered detailed, practical, and provide a broad depiction of the main factors that directly contribute to pedestrian crashes.

The main parameters used in calculating pedestrian crash rates along the different roadway categories which combine the functional classification, number of lanes and area type together were the AADT and the total length of the roadway category. Conversely, the main parameters used for computing pedestrian crash rates for the different intersection classifications were the daily pedestrian volumes, distance crossed, and the AADT in addition to the number of pedestrian crashes either along the studied roadways or intersections. Although socioeconomic conditions of the geographic area may provide higher accuracy for estimating pedestrian volume than population, there was no evidence to support this claim throughout the research. Also, socioeconomic data includes several factors such as income, household, and auto ownership associated with each land use which requires data collection and is not an available source. It should be noted also that the analysis couldn't identify a correlation between the number of crashes and the average daily pedestrians at the intersections due to the high variability in the data.

The pilot studies conducted for the roadways and intersections revealed several critical safety locations within District Five when compared to the developed statewide average rates which require further investigation to identify main causes and emphasize mitigation improvements.

It is recommended that an annual statewide pedestrian count program be initiated for the intersections as well as roadways which would increase the sample size and help in validating the assumptions provided in this study. The purpose and duration of data collection are essential pieces of information for determining the appropriate technology. Active or passive infrared sensors are common practice for counting pedestrians and they may also be used to collect combined counts of bicyclists and pedestrians.

V- SIDEWALK/BICYCLE-LANE GAP APPLICATION TOOL

5.1 PEDESTRIAN SAFETY PRIORITIZATION TOOL (PSPT)

The pedestrian safety prioritization tool (PSPT) was developed primarily to prioritize the sidewalk gap locations within FDOT District Five which directly affects the safety of pedestrians along roadways. Prioritization means identifying the potential projects and ranking them most to least desirable so that the agency can develop an implementation plan and budget proposal according to the right order. Based on the analysis conducted earlier in this project, absence of sidewalks along roadways was one of the main factors that have significant impact on the expected number of pedestrian crashes at a specific location. Other factors included daily traffic volumes (AADT), roadway category (ROADCAT), specifically along urban two-way divided arterials with 4-6 lanes as well as the average population within half mile radius surrounding the crash location. The developed tool takes into account the above mentioned parameters as well as other pedestrian-related activity variables and proximity to generators using land use, income and auto ownership data. The prioritization method is based on a multi-criteria ordinal ranking of the parameters of five main modules using a scoring system that combines all criteria weights then aggregates it into a single indicator. The five main modules comprise roadway and traffic data, socioeconomic data, land use data, transit and crash data. The following sections explain in greater detail the input data sources and preparation as well as a hands-on procedure.

5.1.1 Data Collection and Preparation

5.1.1.1 Input Data Sources

The data required for the Sidewalk Gaps Pedestrian Safety Prioritization Tool (PSPT) utilizes several statewide shape files of Geographic Information Systems (GIS) layers including roadway characteristics data, land use data, socioeconomic data, transit and safety data that were obtained from various sources. Table 16 presents the list of input layers and their sources.

Table 16: Input Layers and Data Sources

GIS Input Data	GIS Data Source
Roadway and Traffic Data	
Roadway Functional Classification	FDOT, Transportation Statistics Office.
2014 AADT	FDOT, Transportation Statistics Office.
Intersections	FDOT, Transportation Statistics Office.
Sidewalks	FDOT, Transportation Statistics Office.
Gaps	FDOT D5
D5 LOS_All_2014	FDOT D5
Socioeconomic Data	
Population and Housing	2010 Census Block with Housing and Population Data for Florida
Auto Ownership	American Fact Finder
Income	American Fact Finder
Land Use Data	
D5 Land Use	Florida Geographic Data Library (FGDL)
Transit Data	
D5 Transit Stations	FDOT / MetroPlan Orlando
Pedestrian Crash Data	
D5 Pedestrian Crashes	FDOT / Signal Four Analytics

5.1.1.2 Input Data Preparation Process

The original GIS data requires special preparation in order to be used as inputs for the Sidewalk Gaps Pedestrian Safety Prioritization Tool. Several ArcMap GIS toolbox processes were utilized to manipulate the original data format to extract data associated with FDOT D5 roadway network and pedestrian criteria. Figure 23 illustrates the overall pedestrian data preparation flow chart. This chart demonstrates the original GIS layer data file (shown in green color), the GIS process that was applied such as intersect, join, select, and/or buffer (shown in yellow color) and the output layer that was used as input data for the prioritization tool (shown in Orange color). The blue color represents an intermediate output layer. The dashed grey boundaries represent the data input module. The following sections explain in greater detail the steps needed to manipulate the original data to specific format to be used as inputs to the Sidewalk Gaps Pedestrian Safety Prioritization Tool.

PEDESTRIAN DATA PREPARATION FLOW CHART

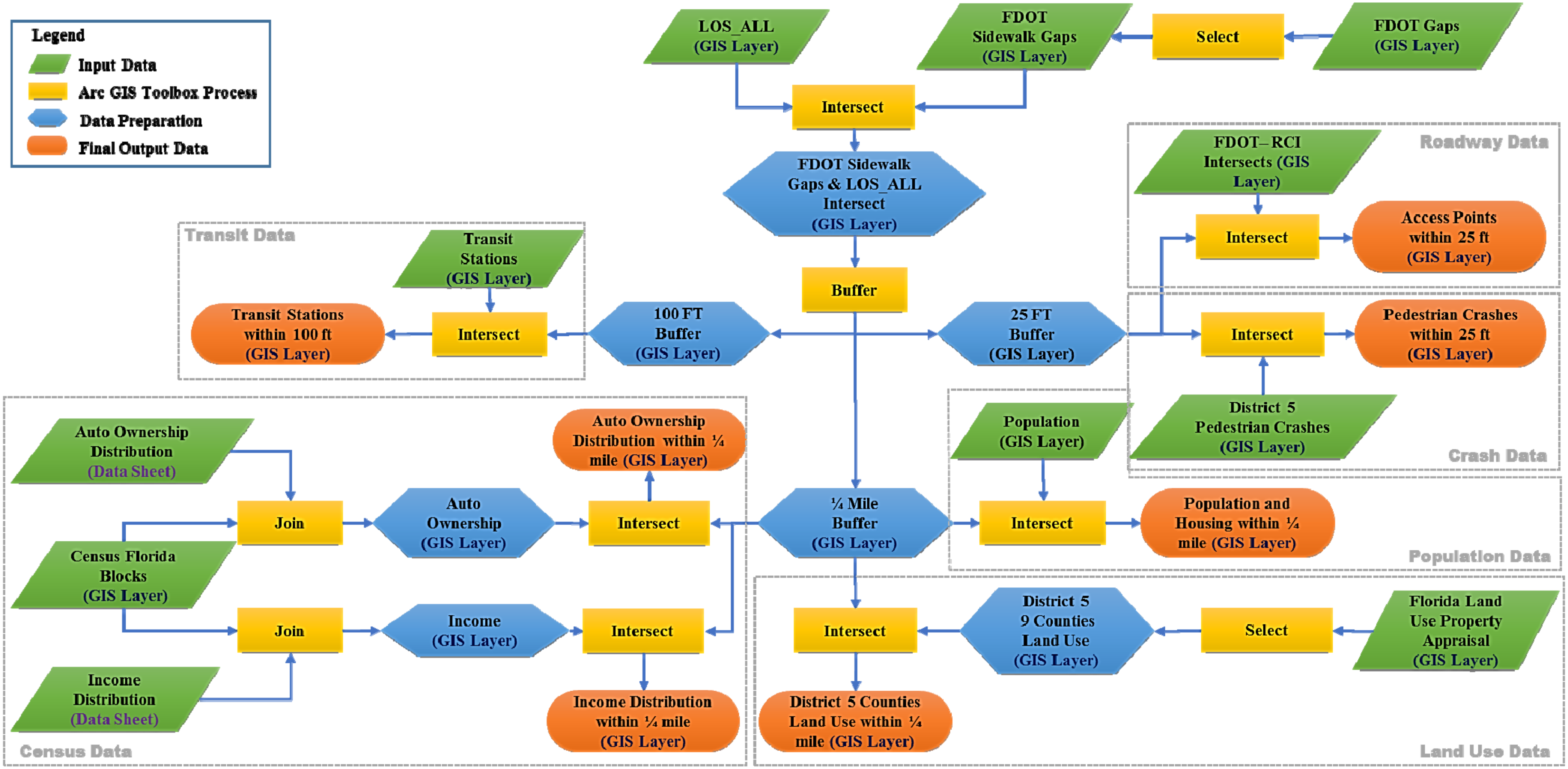


Figure 23: Pedestrian Data Preparation Flow Chart

Step 1: The Gaps shape file was provided by FDOT D5 staff. This shape file includes list of both sidewalks and bike lane gaps located within D5 roadway network. Using Arc GIS “select” tool as shown in Figure 24, only sidewalk gaps were identified from the original D5 Gap layer. The output shape file includes only sidewalks gaps within the FDOT D5 network.

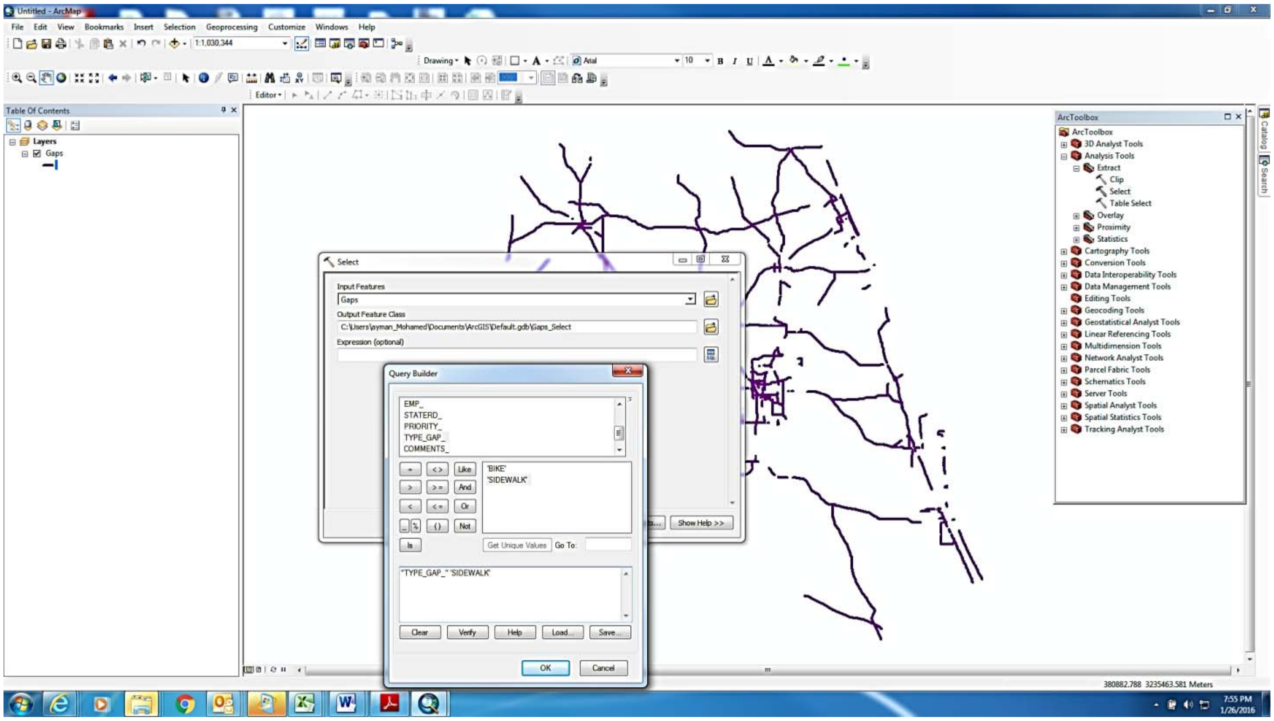


Figure 24: Sidewalk Gaps Shapefile (Step 1)

Step 2: The FDOT D5 roadway network shape file was included in the 2014 FDOT D5 LOS_ALL tool that was provided by the Department. This shape file includes the roadway corridors and segments and their logical termini located within the nine counties in FDOT D5. The 2014 FDOT D5 LOS_ALL shape file and the sidewalk gaps shape file resulted from the previous step were then intersected using Arc GIS “intersect” as shown in Figure 25. The output intersection layer includes the logical termini of the sidewalk gaps, roadway name, area type, number of lanes, number of directions, posted speed, traffic count station, existence of right and left turn bays associated with each individual sidewalk gap.

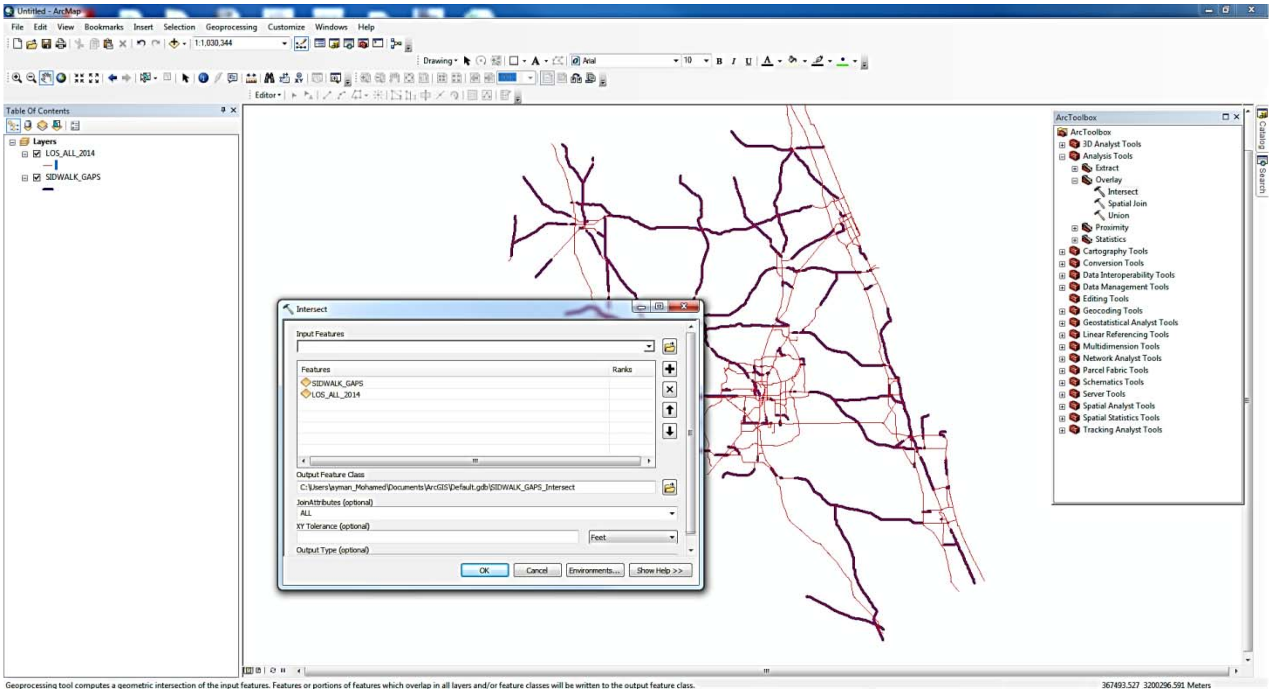


Figure 25: Sidewalk Gaps with FDOT LOS_ALL Shapefile (Step 2)

Step 3: A 25-foot buffer was then generated around each individual sidewalk gap that resulted from the previous step using GIS "buffer" process as shown in Figure 26.

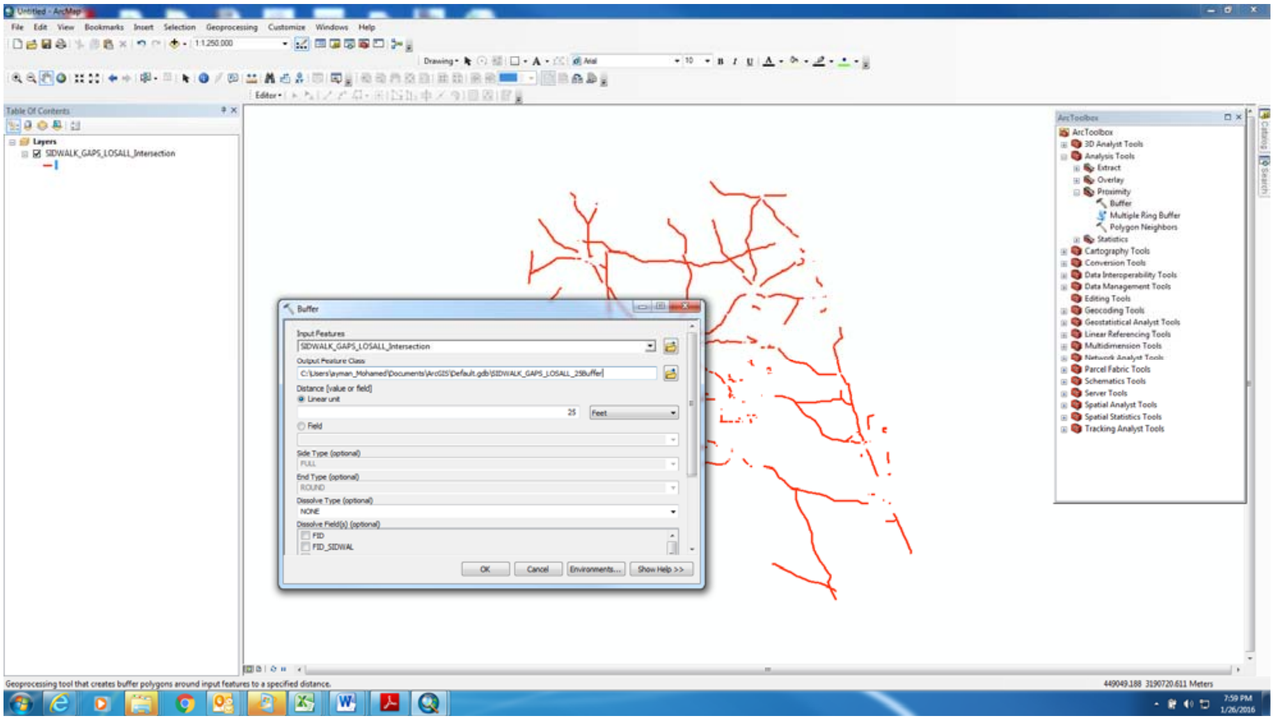


Figure 26: Sidewalk Gap Shapefile with 25-Foot Buffer (Step 3)

<u>Step 4:</u> The Intersections RCI shape file was downloaded from the FDOT, Transportation Statistics Office (TRANSTAT) website. The 25-foot buffer sidewalk gaps shape file from previous step was then intersected with the Intersections RCI shape file as shown in Figure 27. The output shape file identifies access points that are located within 25 feet from each of the sidewalk gaps.

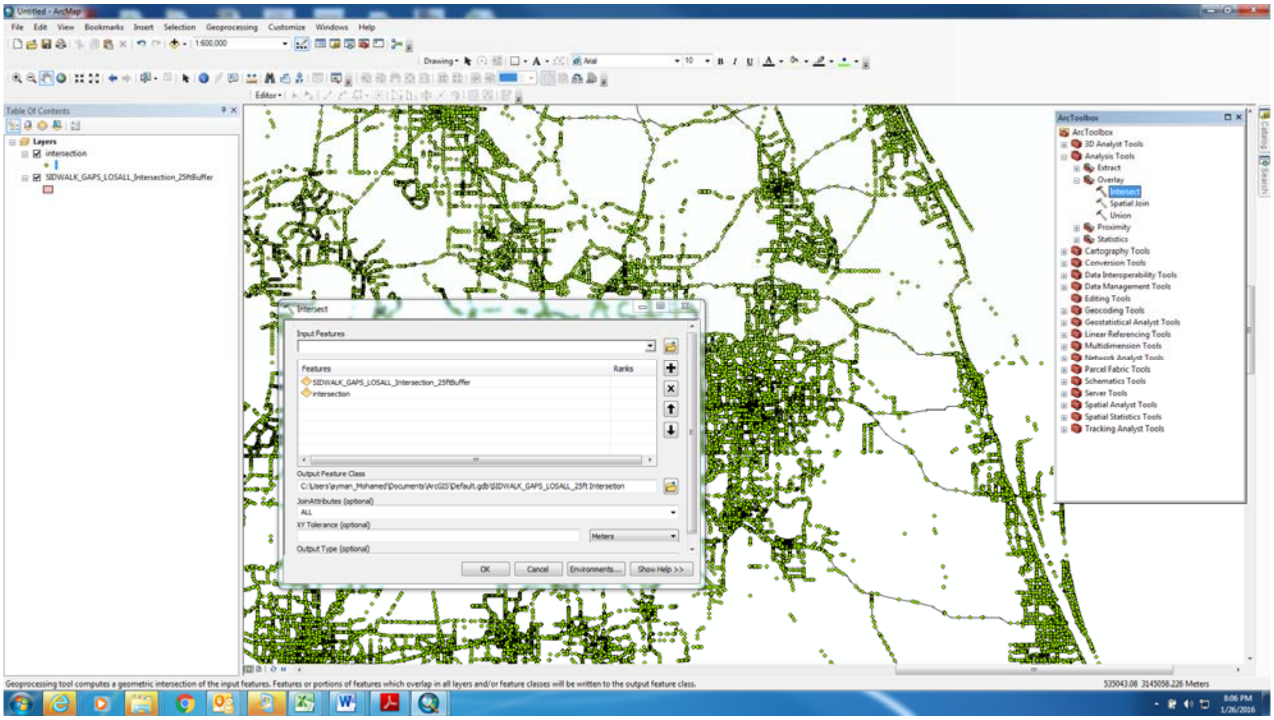


Figure 27: Access Points with 25-Foot Buffer along Sidewalk Gaps (Step 4)

<u>Step 5:</u> The latest 2014 Average Annual Daily Traffic (AADT), Functional Classification, and Sidewalk Width & Separation RCI GIS shape file were also downloaded from the FDOT, Transportation Statistics Office (TRANSTAT) to be used by the Sidewalk Gaps Pedestrian Safety Prioritization Tool later.

<u>Step 6:</u> Using GIS "buffer" tool as shown in Figure 28, another buffer of quarter mile was generated around each individual sidewalk gap shape file from Step 2 for housing and population purposes.

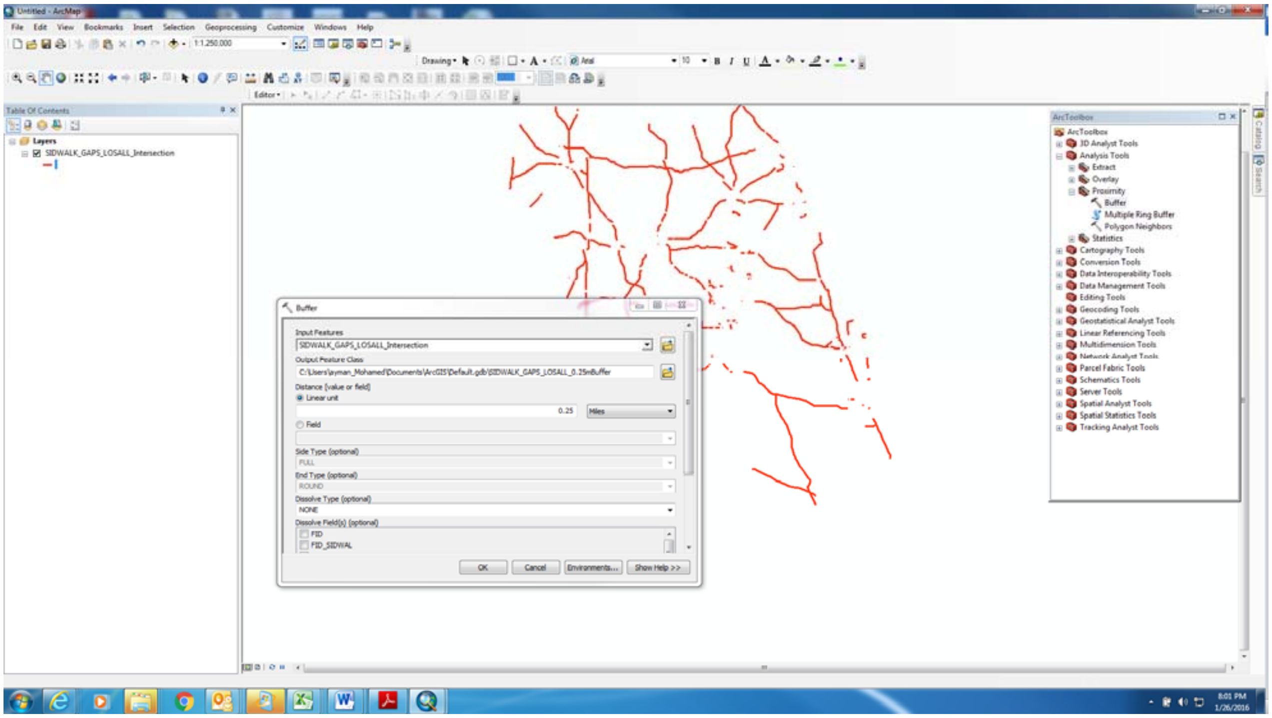


Figure 28: Quarter Mile Buffer from Sidewalk Gaps (Step 6)

Step 7: The 2010 Census Block with Housing and Population Data for Florida tiger/line shape file was downloaded from http://catalog.data.gov/dataset/tiger-line-shapefile-2010-2010-state-florida-2010-census-block-state-based-shapefile-with-housi. The typical walking distance of a quarter-mile was used as a buffer to quantify the population density and number of housing along each roadway segment. Population density and number of housing provide key indication of pedestrian activities along the roadway where heavily populated residential areas encounter higher pedestrian activities.

The quarter-mile buffer surrounding the sidewalk gaps from Step 6 was then intersected with the downloaded 2010 population and housing for Florida GIS shape file as shown in Figure 29. The output shape file identifies the estimated population and housing within a quarter-mile from each of the sidewalk gaps.

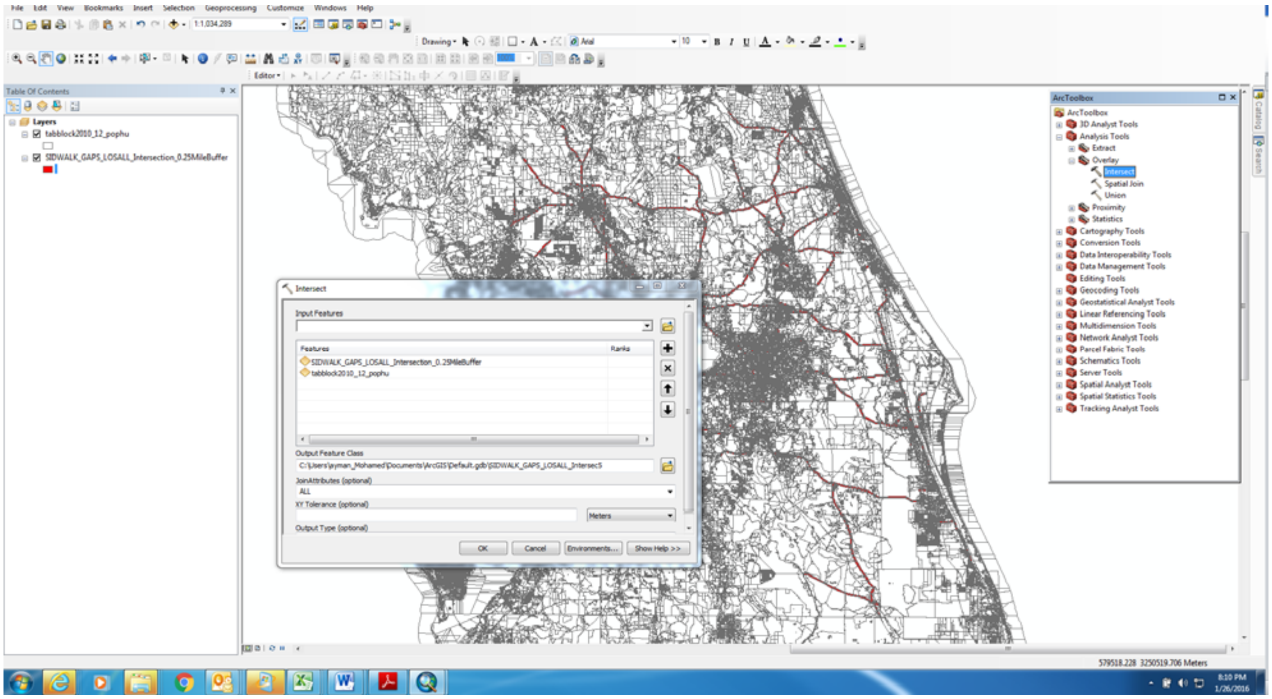


Figure 29: Estimated Population & Housing within Quarter Mile (Step 7)

<u>Step 8:</u> Other socioeconomic key factors that affect pedestrian activities are household income and auto-ownership. Several studies indicated that lower income and less number of owned vehicles results in higher pedestrian activities. Therefore, the average household income and auto-ownership distributions were downloaded from the American Fact Finder website download center at http://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml. The household income and auto-ownership census tract data were spatially joined with the census tract shape file then intersected with the quarter mile sidewalk gaps buffer from Step 6 as shown in Figures 30 and 31. The two output shape files identify the Income and the Auto-Ownership information within a quarter-mile for each individual sidewalk gap.

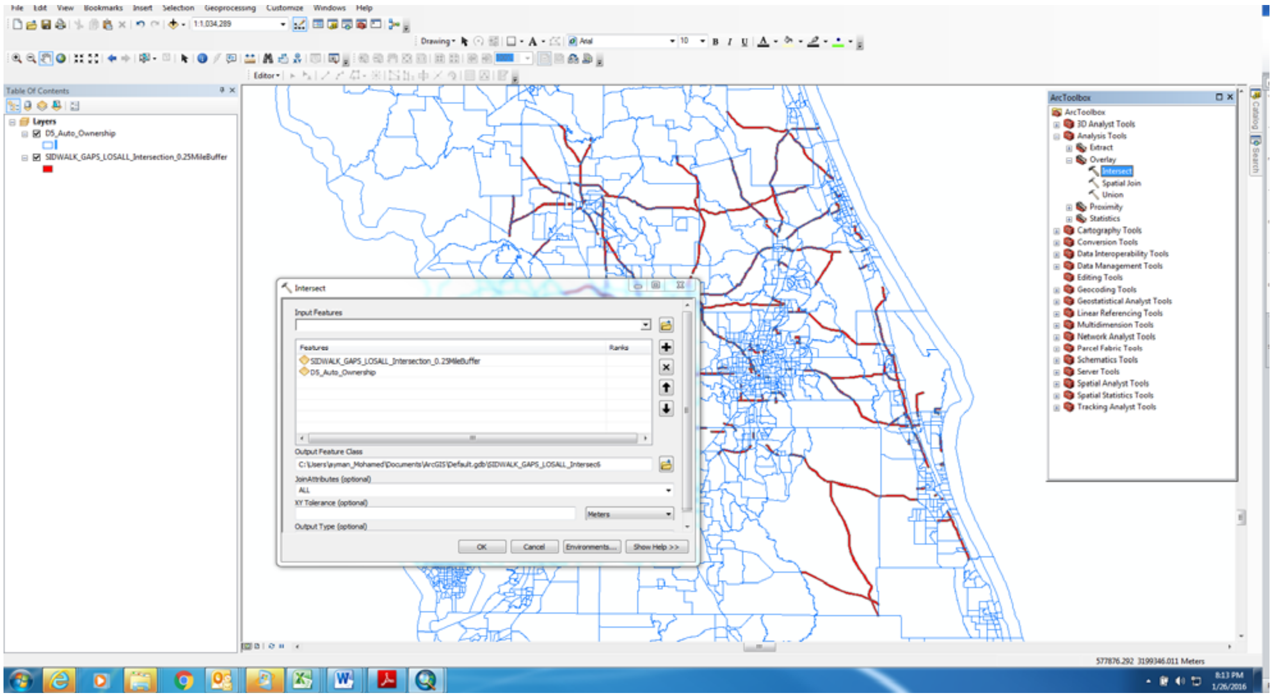


Figure 30: Auto Ownership within Quarter Mile (Step 8)

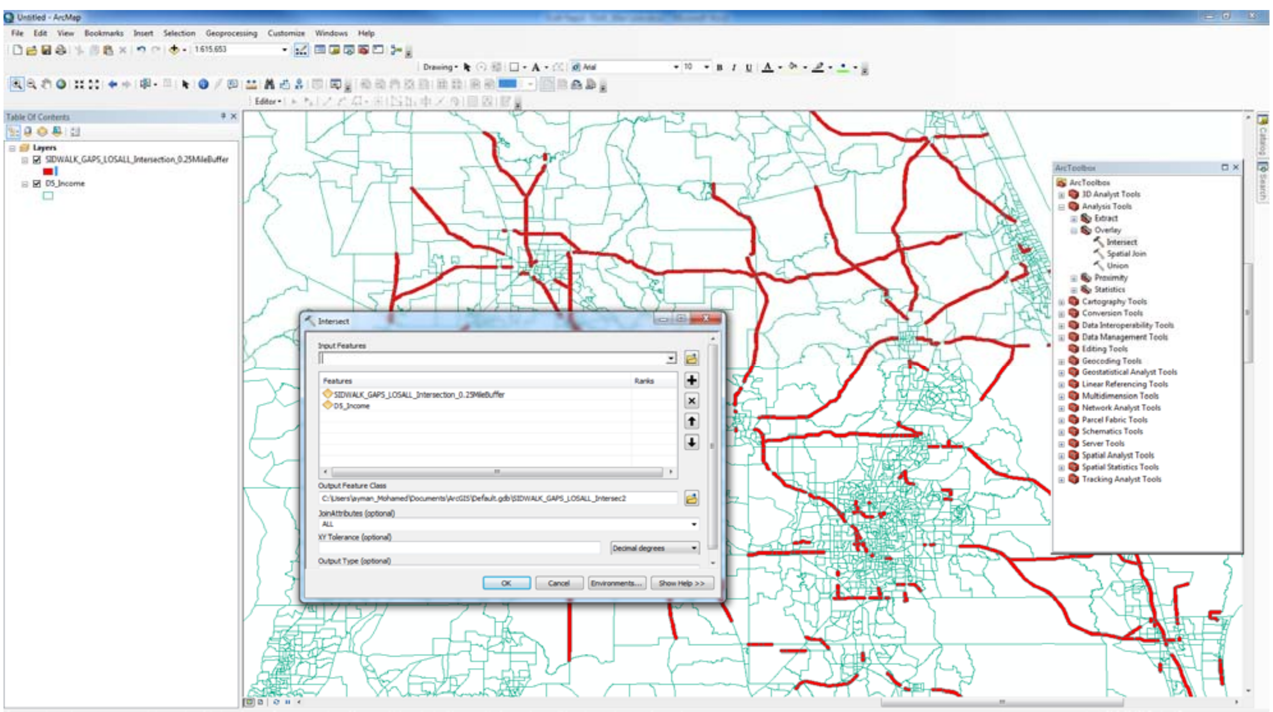


Figure 31: Income within Quarter Mile (Step 8)

<u>Step 9:</u> Area type (e.g., urban and rural) and the characteristics of the surrounding land uses play a major role in the mobility and movement of people. As such, land uses and their sizes along each roadway segment provide the magnitude of pedestrian activities along the roadway segments. More commercial, offices, social, recreational, educational, and residential land uses along the corridor usually result in more pedestrian activities and higher risk of pedestrian crashes. The 2014 Florida parcel data statewide shape file created by the Florida Department of Revenue was downloaded from the Florida Geographic Data Library (FGDL) website at http://www.fgdl.org/metadataexplorer/explorer.jsp. Using GIS "select" tool, all nine counties within D5 were selected individually generating nine land use shape files, one for each county.

Step 10: Each county land use shape file was then intersected; using the GIS "intersect" tool as shown in Figure 32 for Brevard County as an example; with the quarter mile sidewalk gaps buffer shape file from Step 6. The nine output shape files identify land uses within a quarter-mile of each individual sidewalk gap.

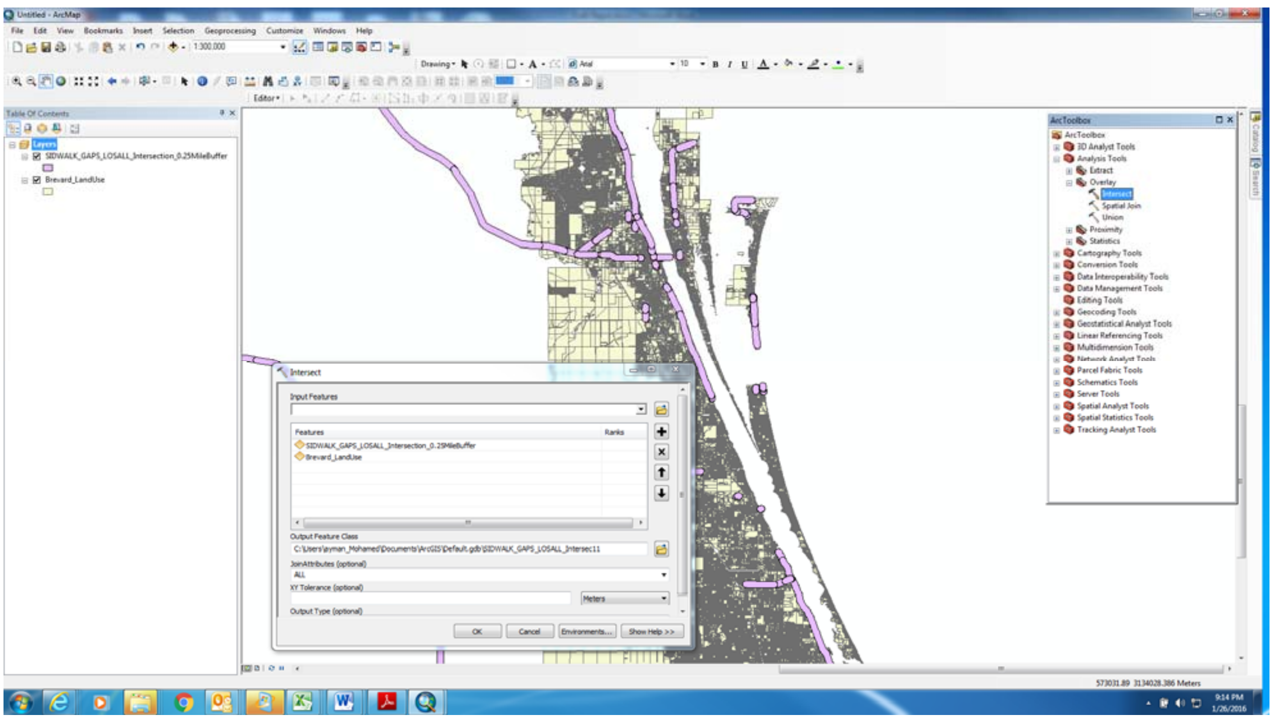


Figure 32: Land Uses within Quarter mile for Nine Counties (Step 10)

Step 11: Using GIS "buffer" tool as shown in Figure 33, another buffer of 100 feet was generated around each individual sidewalk gap shape file resulting from Step 2 for transit purposes.

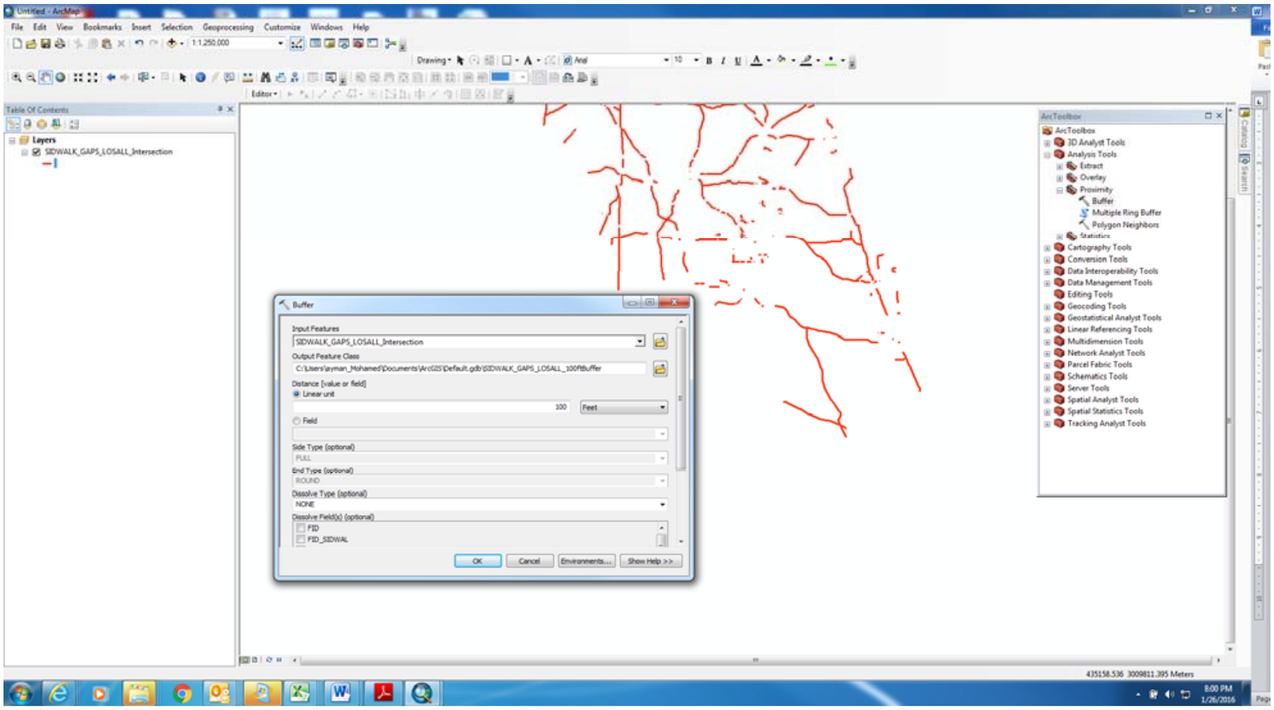


Figure 33: 100-Foot Buffer from Sidewalk Gaps (Step 11)

Step 12: The transit station shape file was provided by FDOT and MetroPlan Orlando staff. This GIS layer includes all transit stations and bus stops within the nine counties in D5 area. The transit station GIS layer was intersected with the 100 feet sidewalk gaps buffer shape file resulted from Step 11 using the "intersect" tool as shown in Figure 34. The output shape file identifies all transit stations within 100 feet of each of the sidewalk gaps.

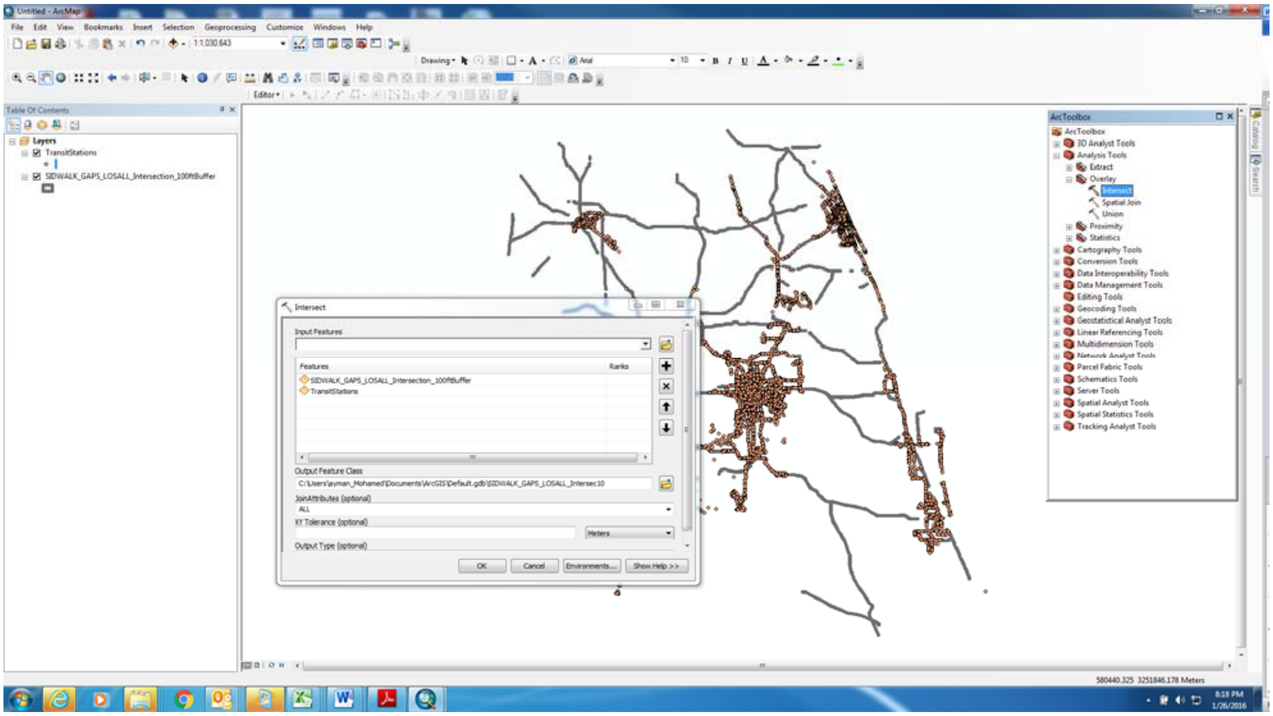


Figure 34: Transit Stations within 100-Foot Buffer of Sidewalk Gaps (Step 12)

<u>Step 13:</u> The GIS layer from Signal Four Analytics database for the most recent 5-year period (June 2009 - June 2014) was utilized to identify pedestrian crashes along the FDOT District Five roadway segments. The crash layer was intersected with the 25-foot sidewalk gaps buffer developed in Step 3 using the "intersect" tool as shown in Figure 35. The output shape file includes all recent 5-year pedestrian crashes that were located around each of the sidewalk gaps.

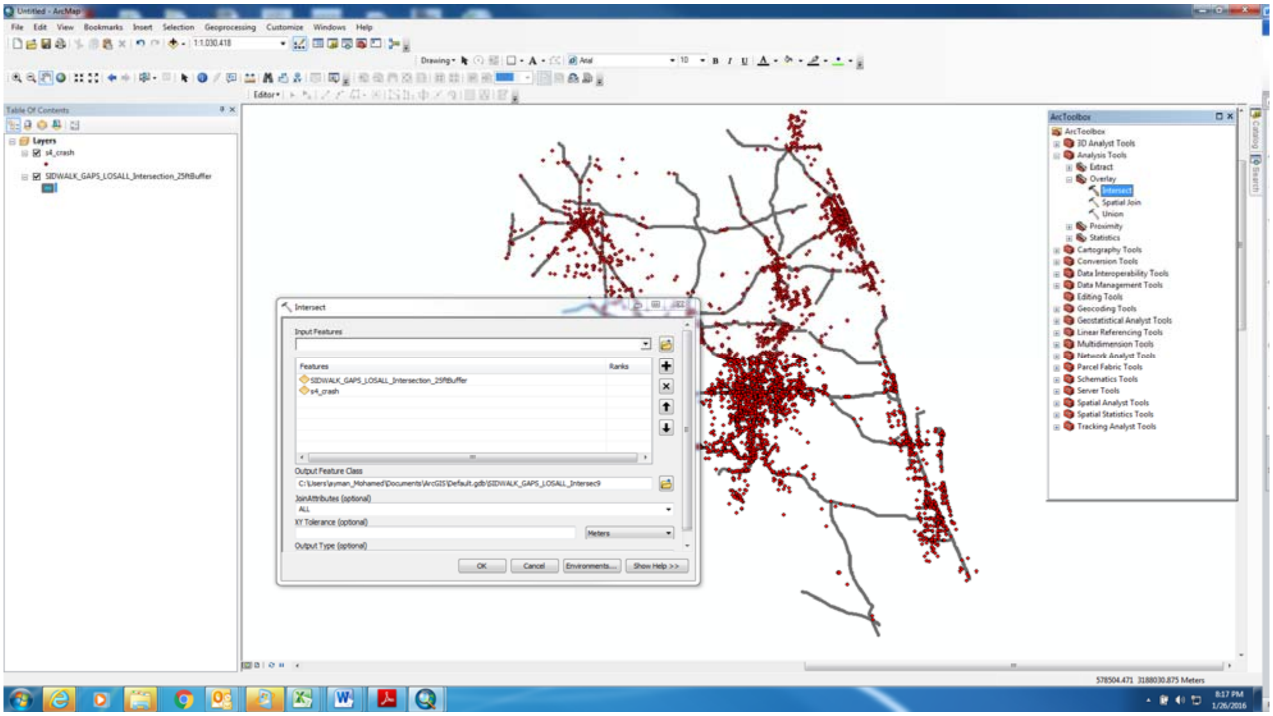


Figure 35: Five-Year Pedestrian Crashes along Sidewalk Gaps (Step 13)

Step 14: The developed layer from Step 2 which includes the logical termini of the sidewalk gaps is then converted to a google earth file using the ArcMap GIS conversion to KML tool, as shown in Figure 36.

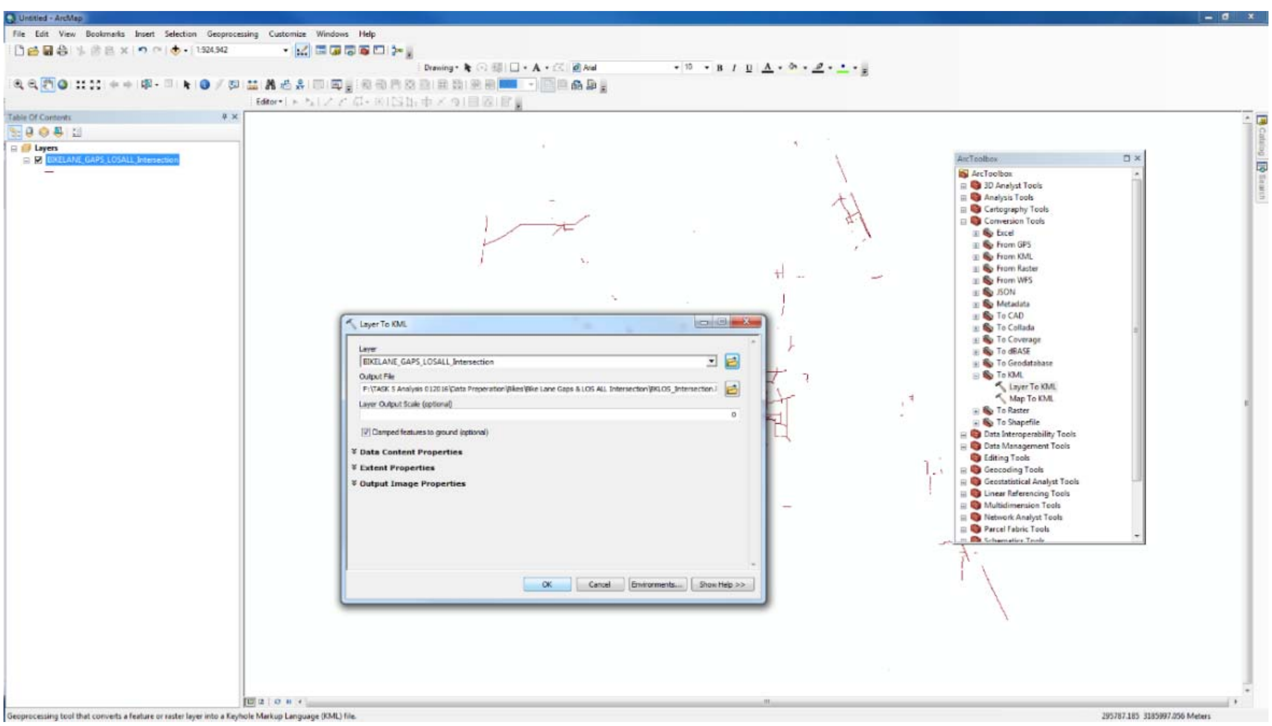


Figure 36: Conversion to Google Earth File (Step 14)

Step 15: The converted file generated in Step 14 is a google earth file that has an extension ".kmz". Using the "7Zip" software, the kmz file is extracted to "*doc.kml*" as shown in Figure 37. The doc.kml file is renamed to be used later in mapping the data section.

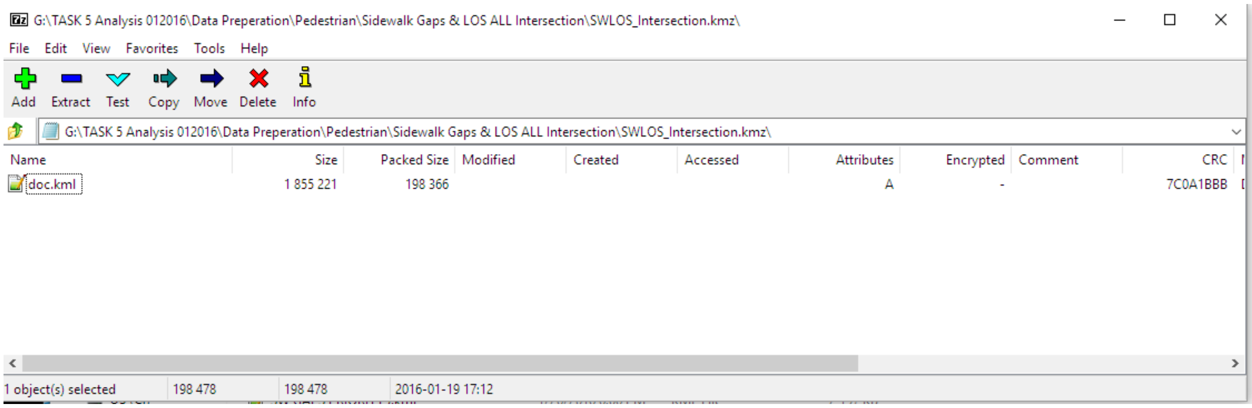


Figure 37: kmz to doc.kml File for Mapping Data (Step 15)

5.1.2 Input Data Coding and Modules

The Sidewalk Gaps Pedestrian Safety Prioritization Tool was coded using Visual Basic for Application (VBA) and utilizes Microsoft Excel® as the working environment. Microsoft Excel® is a package included in Microsoft Office® developed by Microsoft Corporation. The Sidewalk Gaps Pedestrian Safety Prioritization Tool was coded in module basis by separating the graphical user interface (GUI) modules and subroutines from the specific data processing and calculations. This helps in debugging, maintaining and expanding the features of the tool.

As mentioned earlier, the prioritization method is based on five main modules of input data which included roadway and traffic data, socioeconomic data, land use data, transit and crash data. Each of the output shape files generated from the data preparation process described above includes detailed information in database format ".dbf" associated with each module of the input data. The Sidewalk Gaps Pedestrian Safety Prioritization Tool connects to each of the individual database files to allocate specific data and calculates total scores for each module then aggregates it into a single indicator to rank their prioritization. The following sections describe the different parameters and variables in each module and the corresponding scoring system.

1- **Roadway and Traffic Data Module**

Roadway and traffic module included the following data:

- ***Sidewalk Gaps:*** This layer is the base layer for all five modules. It includes all listed sidewalk gaps located in D5 roadway network. The developed tool associates all parameters of the five modules with each of the listed sidewalk gaps. Sidewalk gaps data includes County, Roadway Section number, sidewalk gap beginning and ending mile posts, State Road name, priority, gap type, Roadway ID, traffic count station number, and beginning and ending mile posts for the LOS roadway segment. This data is obtained from the intersection layer between the sidewalk gaps layer and the 2014 LOS_All layer.

- ***Functional Class:*** Roadway functional classification associated with each sidewalk gap is obtained from the functional classification RCI GIS database file downloaded in Step 5.
- ***AADT:*** Average Annual Daily Traffic (AADT) for each traffic count station associated with each sidewalk gap is obtained from the Average Annual Daily Traffic RCI GIS database file downloaded in Step 5.
- ***1-Way or 2-Way:*** This data describes the roadway traffic directions at the sidewalk gap if one-way or two-way direction. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Divided:*** This data describes if the roadway is divided or undivided at the sidewalk gap. The letter "Y" indicates it is divided roadway and the Letter "N" indicates it is undivided. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***No. of Through Lanes:*** This data lists the number of through lanes at each of the sidewalk gaps. This data is also obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Posted Speed:*** This data lists the posted speed at the each of the sidewalk gaps. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Left-Turn Bays and Right-Turn Bays:*** This data includes the existence of left turn or right turn bays along the roadway at the sidewalk gaps. The Letter "Y" indicates there are turn bays, the letter "N" indicates there are no turn bays. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***No of Access Points:*** This data includes number of roadway access points at the sidewalk gap locations. This data is obtained from the output layer identifying access points within 25 feet from each of the sidewalk gaps developed in Step 4.
- ***Left and Right Sidewalks Percentages:*** This data represents the percentage of sidewalk coverage within the sidewalk gap area. This percentage is calculated for each sidewalk gap by dividing the length of existing sidewalks by the length of the sidewalk gap length. The length of the sidewalk is obtained from the Sidewalk Width & Separation RCI GIS database file downloaded in Step 5.

2. <u>Socioeconomic Data Module</u>

Socioeconomic module includes the following data:

- ***Area Type:*** This data represents the area type around each individual sidewalk gap. The letter "U" indicates urban area, letter "R" indicates rural area, letter "T" indicates transitioning area from rural to urban, and letters "RD" indicates a rural area under development. The area type data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Population:*** Population data shows the 2010 populations within a quarter mile from the sidewalk gap. The population data identifies the estimated population and housing within a quarter-mile developed in step 7.
- ***Housing:*** Similar to population data, housing data shows number of housing in 2010 within a quarter mile from the sidewalk gap. The housing data also identifies the

estimated population and housing within a quarter a mile developed in step 7.

- ***Low Income Percentage:*** The low income percentage represents the percentage of households with yearly income less than $40,000 within a quarter mile of the sidewalk gap location. This data is calculated from the database file that includes income distribution within a quarter mile developed in Step 8.
- ***Medium Income Percentage:*** The medium income percentage represents the percentage of households with yearly income ranging from $40,000 to $75,000 within a quarter mile of the sidewalk gap location. This data is calculated from the database file that includes income distribution within a quarter mile developed in Step 8.
- ***High Income percentage:*** The high income percentage represents the percentage of households with income more than $75,000 within a quarter mile of the sidewalk gap location. This data is calculated from the database file that includes income distribution within a quarter mile developed in Step 8.
- ***No Vehicle Auto-Ownership Percentage:*** This data shows the percentage of households within a quarter mile of the sidewalk gaps that have no vehicles. This data is calculated from the database file that includes auto-ownership distribution within a quarter mile generated in Step 8.
- ***One Vehicle Auto-Ownership Percentage:*** This data shows the percentage of households within a quarter mile of the sidewalk gaps that have only one vehicle. This data is calculated from the database file that includes auto-ownership distribution within a quarter mile generated in Step 8.
- ***Two Vehicles Auto-Ownership Percentage:*** This data shows the percentage of households within a quarter mile of the sidewalk gaps that have two vehicles. This data is calculated from the database file that includes auto-ownership distribution within a quarter mile generated in Step 8.
- ***Three Vehicles Auto-Ownership Percentage:*** This data shows the percentage of households within a quarter mile of the sidewalk gaps that have three vehicles. This data is calculated from the database file that includes auto-ownership distribution within a quarter mile generated in Step 8.
- ***Four+ Vehicles Auto-Ownership Percentage:*** This data shows the percentage of households within a quarter mile of the sidewalk gaps that have four or more vehicles. This data is calculated from the database file that includes auto-ownership distribution within a quarter mile generated in Step 8.

3. **Land Use Data Module**

Land used data includes the distribution of land uses within a quarter mile from the sidewalk gap location. This data is calculated for each individual sidewalk gap using the nine database files for each county within D5 that resulted from Step 10.

4. **Transit Data Module**

Number of transit stops within 100 feet at each individual sidewalk gap is calculated using the output database file for transit stations generated in Step 12.

5. **Pedestrian Crash Data Module**

Pedestrian crash module includes the following data:

- ***Pedestrian Crashes 5-year Total:*** Pedestrian crash data is calculated at each sidewalk gap location using the output database file that includes all recent 5-year pedestrian crashes between June 2009 - June 2014 that were located within 25 feet from each of the sidewalk gaps generated in Step 13.
- ***Pedestrian Crashes 5-year Fatalities:*** Similar to pedestrian crash data, pedestrian fatalities data is calculated at each sidewalk gap location using the resulted database file that includes all recent 5-year pedestrian crashes between June 2009 - June 2014 that were located within 25 feet from each of the sidewalk gaps generated in Step 13.
- ***Pedestrian Crashes 5-year Injuries:*** Similar to pedestrian crash data and pedestrian fatalities data, pedestrian injuries data is calculated at each sidewalk gap location using the resulted database file that includes all recent 5-year pedestrian crashes between June 2009 - June 2014 that were located within 25 feet from each of the sidewalk gaps generated in Step 13.

5.1.3 Exposure Weight Scores and Indicators

1. **Roadway Indicator**

The objective of this indicator is to provide a surrogate measure for roadway and traffic characteristics along the roadway segment that is expected to have impacts on pedestrian safety. This indicator includes several correlation factors that represent the magnitude of pedestrian activities within the corridor.

Roadway indicator includes the following parameters:

- ***Functional Classification***
- ***Traffic Direction***
- ***Median Type***
- ***Number of Lanes***
- ***Posted Speed***
- ***RT Bay***
- ***LT Bay***
- ***Accessibility***
- ***Traffic Direction***
- ***Sidewalk %***
- ***SW Gaps***

Weight score was assumed for each factor value with respect to the other values based on pedestrian safety concerns as follows:

Table 17: Roadway Functional Classification Scores

Function Class	Weight Score
Principal Arterial - Interstate - RURAL	1
Principal Arterial - Expressway - RURAL	1
Local - RURAL	5
Minor Arterial - RURAL	5
Minor Collector - RURAL	5
Principal Arterial - Other - RURAL	5
Major Collector - RURAL	5
Minor Arterial - URBAN	8
Principal Arterial - Interstate - URBAN	5
Principal Arterial - Freeway And Expressway - URBAN	5
Local - URBAN	8
Minor Collector (Fed Aid) - URBAN	8
Principal Arterial - Other - URBAN	8
Major Collector - URBAN	8

Table 18: Number of Lanes Scores

Number of Lanes	Weight Score
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

Table 19: Posted Speed Scores

Posted Speed	Weight Score
< 20 mph	1
25 mph – 40 mph	2
45 mph – 60 mph	3
> 60 mph	4

Table 20: Percent of Sidewalk Coverage Scores

Percentage Value	Weight Score
0- 10%	30
>10% - 25%	25
>25% - 50%	20
>50% - 75%	15
>75% - 90%	10
> 90%	5

Table 21: Sidewalk Gaps Scores

Existing Gap	Weight Score
Yes	50
No	0

Table 22: Number of Traffic Direction Scores

Number of Directions	Weight Score
One Way	1
Two Way	4

Table 23: Median Type Scores

Type	Weight Score
Divided Roadway	1
Undivided Roadway	4

Table 24: Average Annual Daily Traffic (AADT) Scores

Range	Weight Score
< 10,000	1
> 10,000 - 20,000	2
> 20,000 - 30,000	3
> 30,000 - 40,000	4
> 40,000 - 50,000	5
> 50,000 - 60,000	6
> 60,000 - 70,000	7
> 70,000 - 80,000	8
> 80,000 - 90,000	9
> 90,000	10

Accessibility

Accessibility weight score = Number of access points/mile

Table 25: Left Turn/Right Turn Bays Scores

Left Turn/Right Turn Bays	Weight Score
Yes	2
No	1
NA	0

Calculate Roadway Indicator:

The roadway and traffic characteristics exposure weight indicator is then calculated by adding all weight scores together resulting in a single value representing an indication of pedestrians at risk with different roadway and traffic characteristics.

2. Pedestrian Indicator

The objective of this indicator is to provide a surrogate measure for pedestrian exposure along the roadway segments. This indicator includes several correlation factors that represent the magnitude of pedestrian activities within the corridor. For example, pedestrian activities are significantly higher in urban areas than rural areas. Higher population around roadway segments with more residential housing will increase pedestrian activities. Pedestrian activities are often concentrated in specific areas that are in the vicinity of specific land uses that attract pedestrians (i.e., malls, offices, restaurants, parks... etc.).

Pedestrian indicator includes the following parameters:

- ***Area Type***
- ***Population***
- ***Housing***
- ***Land Use***
- ***Income***
- ***Auto-ownership***
- ***Transit***

Table 26: Area Type Scores

Area Type	Weight Score
Urban (U)	8
Transitioning (T)	4
Rural Developed (RD)	2
Rural (R)	1

Population (1/4 mile buffer)

Population weight score = Population/1000

Number of Housing (1/4 mile buffer)

Housing weight score = Number of Houses/1000

Table 27: Land Use Distribution Scores

Land Use	Weight Score
Tourist	25 X Land use Percentage
Hospitals	20 X Land use Percentage
SF	20 X Land use Percentage
MF	20 X Land use Percentage
Schools and Colleges	20 X Land use Percentage
Churches	15 X Land use Percentage
High Commercial	15 X Land use Percentage
Hotels	15 X Land use Percentage
High Offices	15 X Land use Percentage
Parks	15 X Land use Percentage
Multi-use	10 X Land use Percentage
Light Offices	10 X Land use Percentage
Restaurants	10 X Land use Percentage
Service	10 X Land use Percentage
Light Social/Recreational	10 X Land use Percentage
High Social/Recreational	10 X Land use Percentage
Transportation	10 X Land use Percentage
Medium Commercial	9 X Land use Percentage
Light Commercial	8 X Land use Percentage
Government	5 X Land use Percentage
Light Industrial	3 X Land use Percentage
Medium Industrial	2 X Land use Percentage
Heavy Industrial	2 X Land use Percentage
Agriculture	1 X Land use Percentage
Other	0
Utilities	0
Vacant	0

Table 28: Household Income Scores

Income Level	Weight Score
High	1 X Percentage of Households
Medium	10 X Percentage of Households
Low	20 X Percentage of Households

Table 29: Household Auto Ownership Scores

Household Auto-ownership	Weight Score
Zero Vehicle	20 X Percentage of Households
One Vehicle	5 X Percentage of Households
Two Vehicles	3 X Percentage of Households
Three Vehicles	1 X Percentage of Households
Four or more Vehicles	1 X Percentage of Households

Transit Activity

Transit activity weight score = Number of Transit Stops X 1

Calculate Pedestrian Indicator:

The roadway pedestrian activity exposure weight indicator is then calculated by adding all weight scores together resulting in a single value representing an indication of activity at the roadway segment.

3. Safety Indicator

This indicator is the most important indicator for the pedestrian safety improvement decision making process. It includes both the crash frequency and severity.

Safety indicator includes the following parameters:

- ***Crash Frequency***
- ***Crash Severity***

Crash Frequency

Crash Frequency weight score = Number of crashes X 10

Crash Severity

Crash severity scores are shown in Table 30.

Table 30: Crash Severity Scores

Crash Severity	Weight Score
Fatality	50 X Number of Fatalities
Injuries	15 X Number of Injuries

Calculate Safety Indicator:

The crash frequency and severity weight indicator is then calculated by adding crash frequency and severity weight scores together resulting in a single value representing an indication of pedestrian safety along the roadway segment.

5.1.4 Roadway Pedestrian Safety Indicator (RPSI)

Roadway Pedestrian Safety Indicator (RPSI) is based on the three weight indicator groups which include roadway characteristics, pedestrian activity, crash frequency and severity. The RPSI is calculated for each roadway segment by assigning different weights to each group of the three indicator groups based on its level of influence on pedestrian safety as follows:

- Roadway and traffic characteristics exposure weight indicator 15% of RPSI
- Pedestrian activity exposure weight indicator 20% of RPSI
- Crash frequency and severity weight indicator 65% of RPSI

The following equation was used to calculate the Roadway Pedestrian Safety Indicator (RPSI):

RPSI = Roadway Indicator x 15% + Pedestrian Indicator x 20% + Safety Indicator x 65%

5.1.5 Prioritization Rank

The need for roadway segment safety improvement was ranked according to its RPSI threshold and categorized into five categories; urgent, high, medium, low and no safety concern as shown in Table 16. The need for urgent pedestrian safety improvements was assigned to segments that exceed RPSI threshold value of 100. Roadways that have RPSI value more than 75 but less than 100 can be categorized as highly hazardous roadways and will need early attention for pedestrian safety improvements. For those roadways that have RPSI values between 50 and 75, they are considered medium and might need the improvement in the near future. Roadways with RPSI between 25 and 50, they shall be monitored for future pedestrian safety improvements. Roadway segments with RPSI less than 25 have no safety concerns.

Table 31: Prioritization Ranking Thresholds

Prioritization Rank	RPSI
Urgent	>100
High	75-100
Medium	50-75
Low	25-50
No Safety Concern	<25

5.1.6 Data Mapping

One of the useful features of the Sidewalk Gaps Pedestrian Safety Prioritization Tool is the capability to generate sidewalk gaps map that can be viewed in Google Earth ®. The generated map is color-coded based on the prioritization ranks where red, purple, orange, yellow, and green colors indicate urgent, high, medium, low, and no safety concerns priorities, respectively as shown in Figure 38.

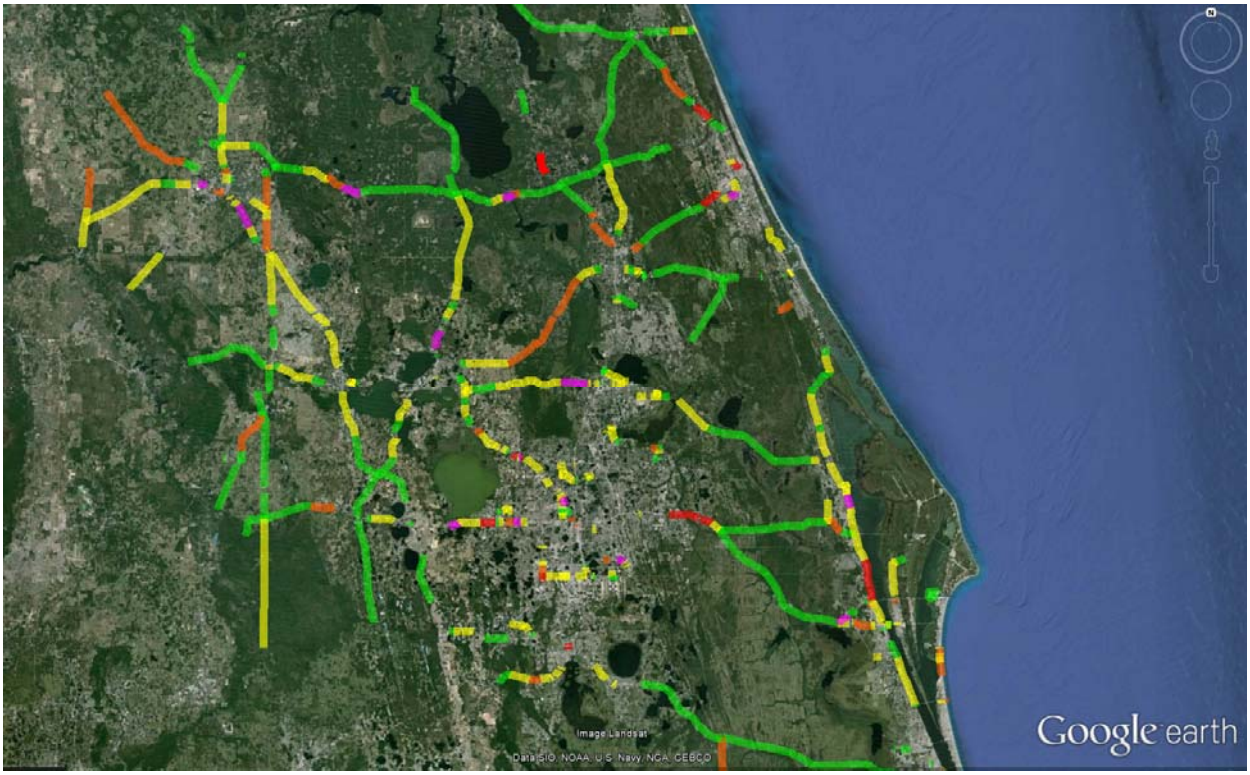


Figure 38: Color-Coded Sidewalk Gap Prioritization Map

The tool reads the sidewalk gaps coordinates from the .kml file that was generated in Step 15 and then assign for each sidewalk gap in the "SW Gaps" worksheet its associated coordinates. Finally the tool generates a kml file that can be saved and viewed as a layer in Google earth.

The tool also has the capability of viewing specific data associated with each individual sidewalk as shown in Figure 39. The user can specify the data to be viewed by changing the column header from "YES" as to be viewed in the map to "NO" as to be hidden. Similarly, if the user needs to map only specific sidewalk gaps represented by a row in the "SW GAPS" worksheet; he/her can select "YES" in the first cell for mapping the sidewalk gap or "NO" for not including the gap in the map.

Mapped Columns >	NO	NO	YES	NO	NO	NO	NO	NO	YES
Mapped Rows V	Coordinates	COUNTY	SECTION	GAP BMP	GAP EMP	STATE RD	PRIORITY	GAP TYPE	COMMENTS
YES	13755,0 -80.82495	BREVARD	70001000.000000	0.000000	4.410000	SR 405	1.000000	SIDEWALK	Schools in area
YES	0108056494,28.52	BREVARD	70001000.000000	0.000000	4.410000	SR 405	1.000000	SIDEWALK	Schools in area
YES	6958827,28.52767	BREVARD	70001000.000000	0.000000	4.410000	SR 405	1.000000	SIDEWALK	Schools in area
YES	01264905,28.21268	BREVARD	70008000.000000	4.960000	5.250000	SR 513	1.000000	SIDEWALK	Schools in area
YES	014633,0 -80.4926	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	554,0 -80.5573651	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	55,0 -80.56788166	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	77,0 -80.5768063	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	2757109,28.39023	BREVARD	70011000.000000	2.240000	2.620000	SR 501	1.000000	SIDEWALK	On County Priority List. Instances of pedestrians and baby strollers in road traveling to Wal-Mart; some property
YES	47413631,0 -80.755	BREVARD	70011000.000000	2.240000	2.620000	SR 501	1.000000	SIDEWALK	On County Priority List. Instances of pedestrians and baby strollers in road traveling to Wal-Mart; some property
YES	74427273,0 -80.74	BREVARD	70014000.000000	0.000000	0.570000	SR 519	1.000000	SIDEWALK	On County Priority List, history of ped incidents per D5 data
YES	098589,0 -80.7428	BREVARD	70014000.000000	0.000000	0.570000	SR 519	1.000000	SIDEWALK	On County Priority List, history of ped incidents per D5 data

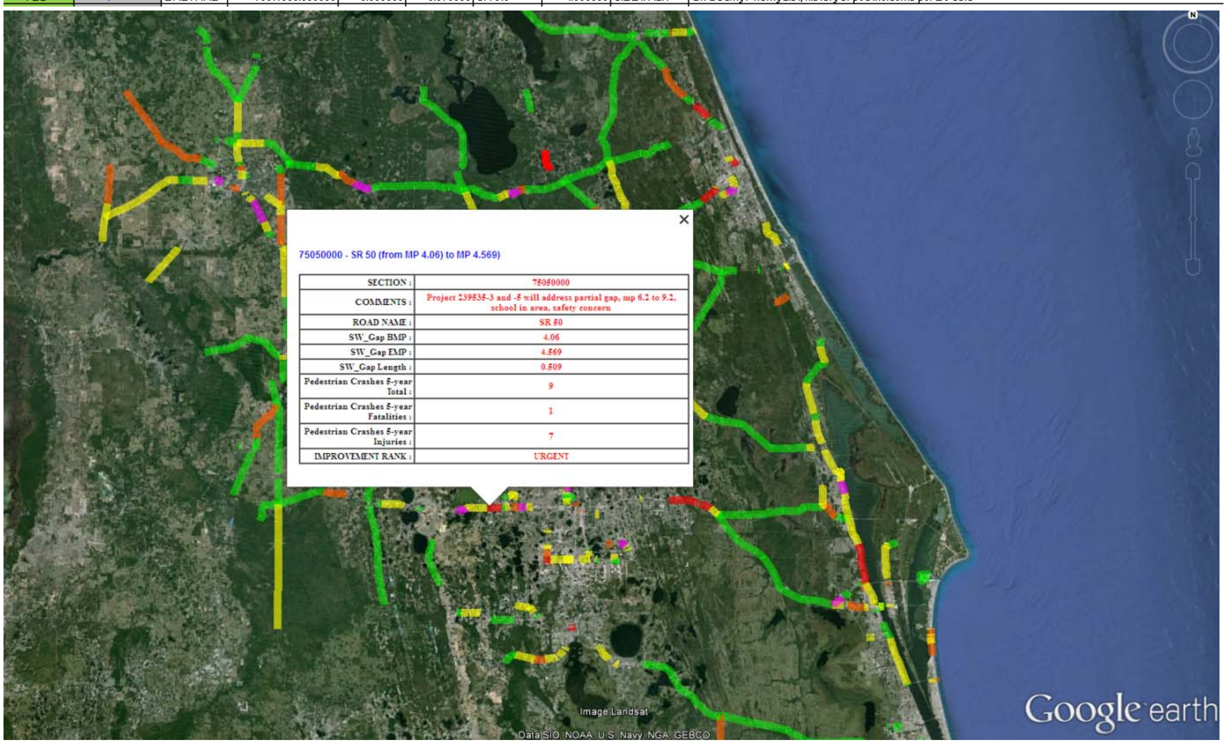


Figure 39: Data Associated with Each Prioritized Sidewalk Gap

5.2 SIDEWALK GAPS SPT HANDS-ON INSTRUCTIONS

1. Open FDOT D5 SWGAPS.xlsm
2. Make sure to enable macros
3. Welcome screen will pop up as shown below
4. Click anywhere to hide welcome screen

Figure 40: Sidewalk Gaps Safety Prioritization Tool Welcome Screen

5. Click on Add-Ins Menu Bar

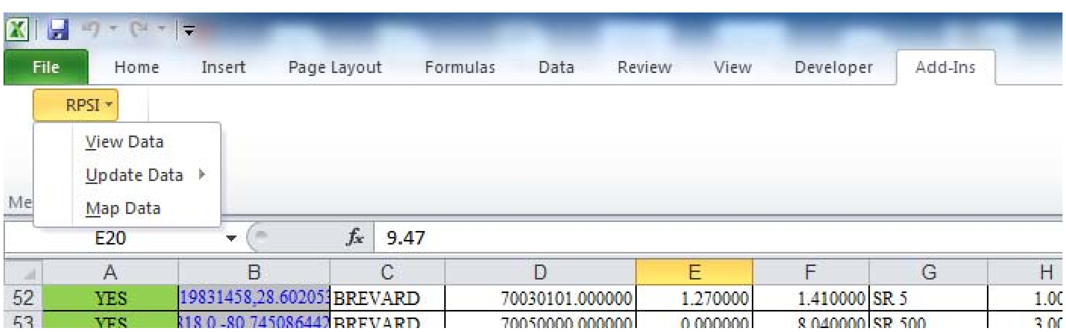


Figure 41: Add-Ins Menu Bar

6. Click on RPSI Menu

5.2.1 Viewing Data

- Select View Data and Sidewalk Gap Safety Prioritization Data Screen will pop up.

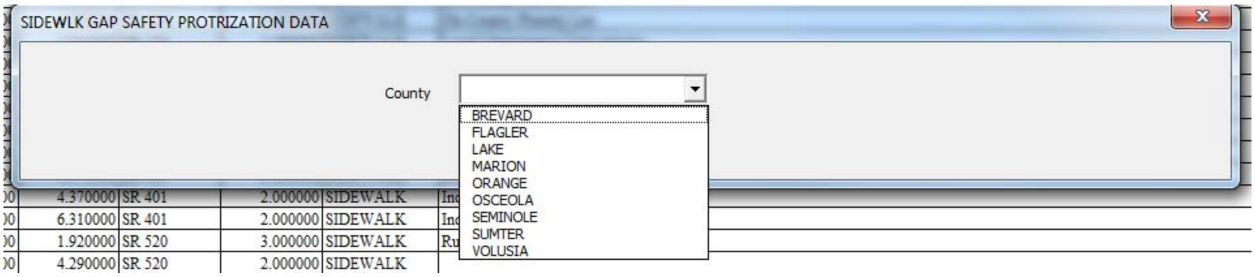


Figure 42: County Name Pull Down Menu

- Select county name from the pull down menu. After selection the county name a new roadway section pull down menu will appear.

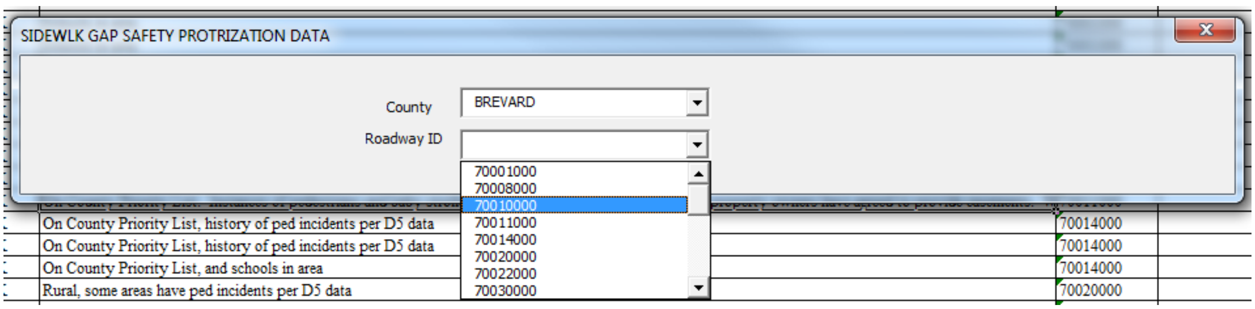


Figure 43: Roadway ID Pull Down Menu

- Select the roadway section that you need to list its information

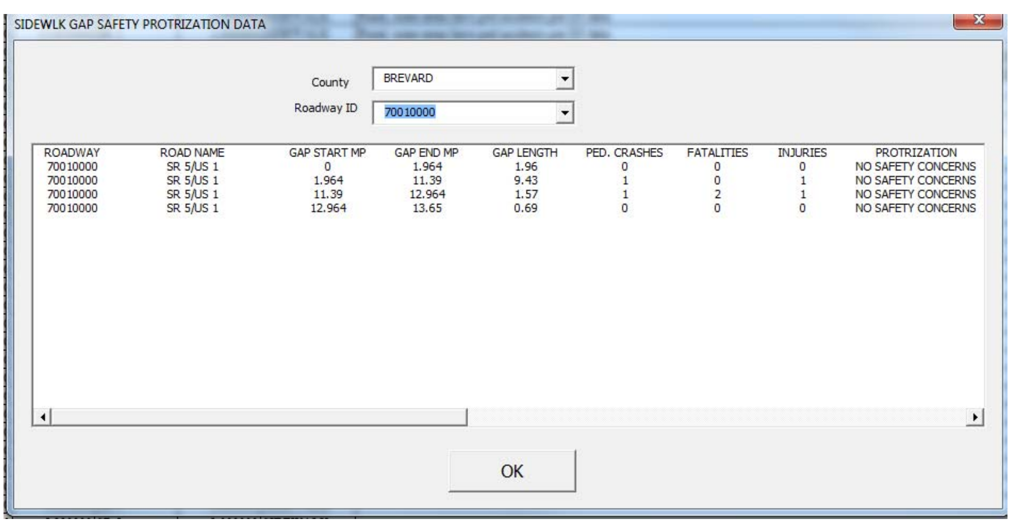


Figure 44: Roadway Segment Menu

- You can view the information for each segment of the roadway section. The information include Roadway ID, Road name, Starting and ending mile posts of sidewalk gaps, gap length, number of crashes, number of fatalities, number of injuries, prioritization, and comments provided in the FDOT D5 Gap layer.

- You can select a new county from the pull down menu or selecting a new roadway segment from the roadway pull down menu. If you are done viewing the data press OK and view data screen will disappear.

5.2.2 Updating Data

- Select Update Data under RPSI menu. You will have two options to select either "Update input Data Files" or "Update Scoring"

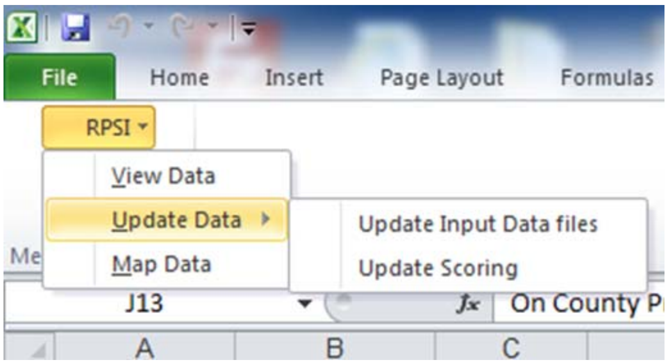


Figure 45: Update Data Menu

- By selecting "Update input Data Files the "Update Input Data Files" Screen will pop up

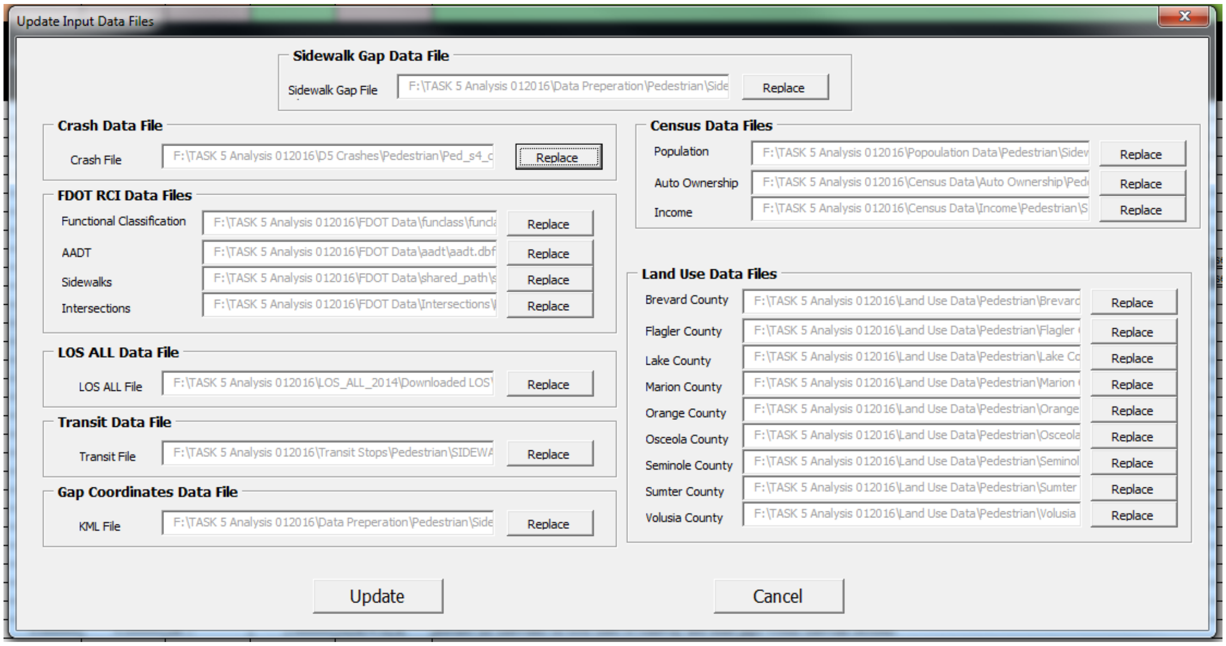


Figure 46: Data Input Window

- This screen includes all default links to the input files that are used in the FDOT District Five Sidewalk Gaps Safety Prioritization Tool. If you need to update any of these data with a new file, select replace and an open file dialog will open to select the new file.

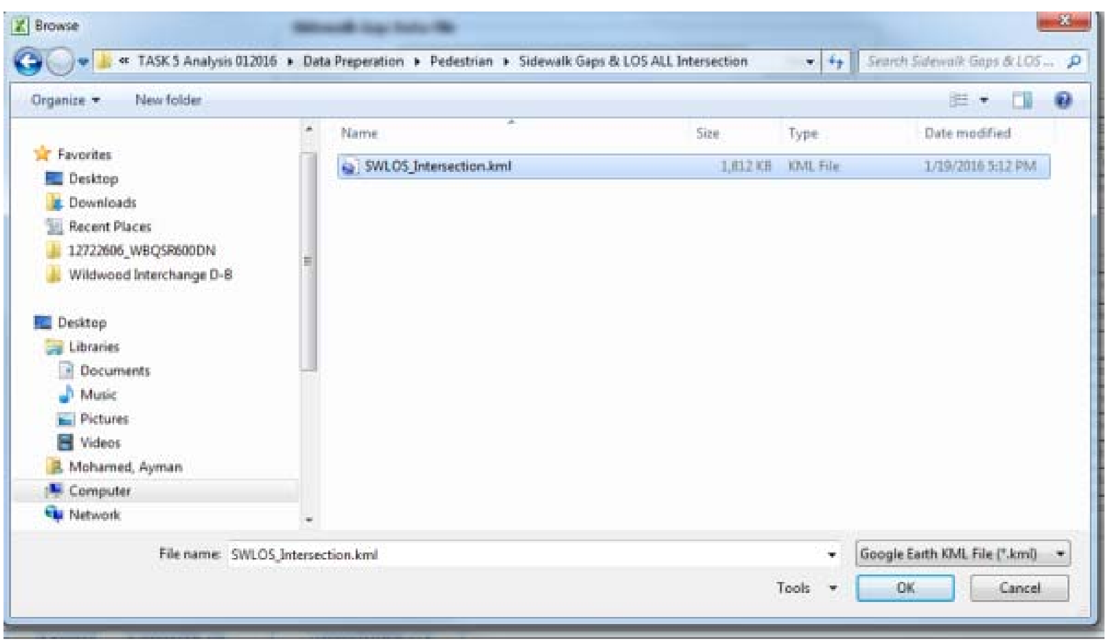


Figure 47: Open Data File Window

- Click on "Update" button and all data associated with the new files will be updated.

NOTE: IF YOU UPDATE THE SIDEWALK GAPS FILE, YOU WILL NEED TO UPDATE ALL INPUT DATA FILES TO NEW FILES.

- By selecting "Update Scoring" from "Update Data" menu bar, the Scoring window will popup.
- The Scoring window includes four tabs. Each tab includes the default weight scoring value for each data category as shown in the following four figures. To edit these values select edit button at each tab.

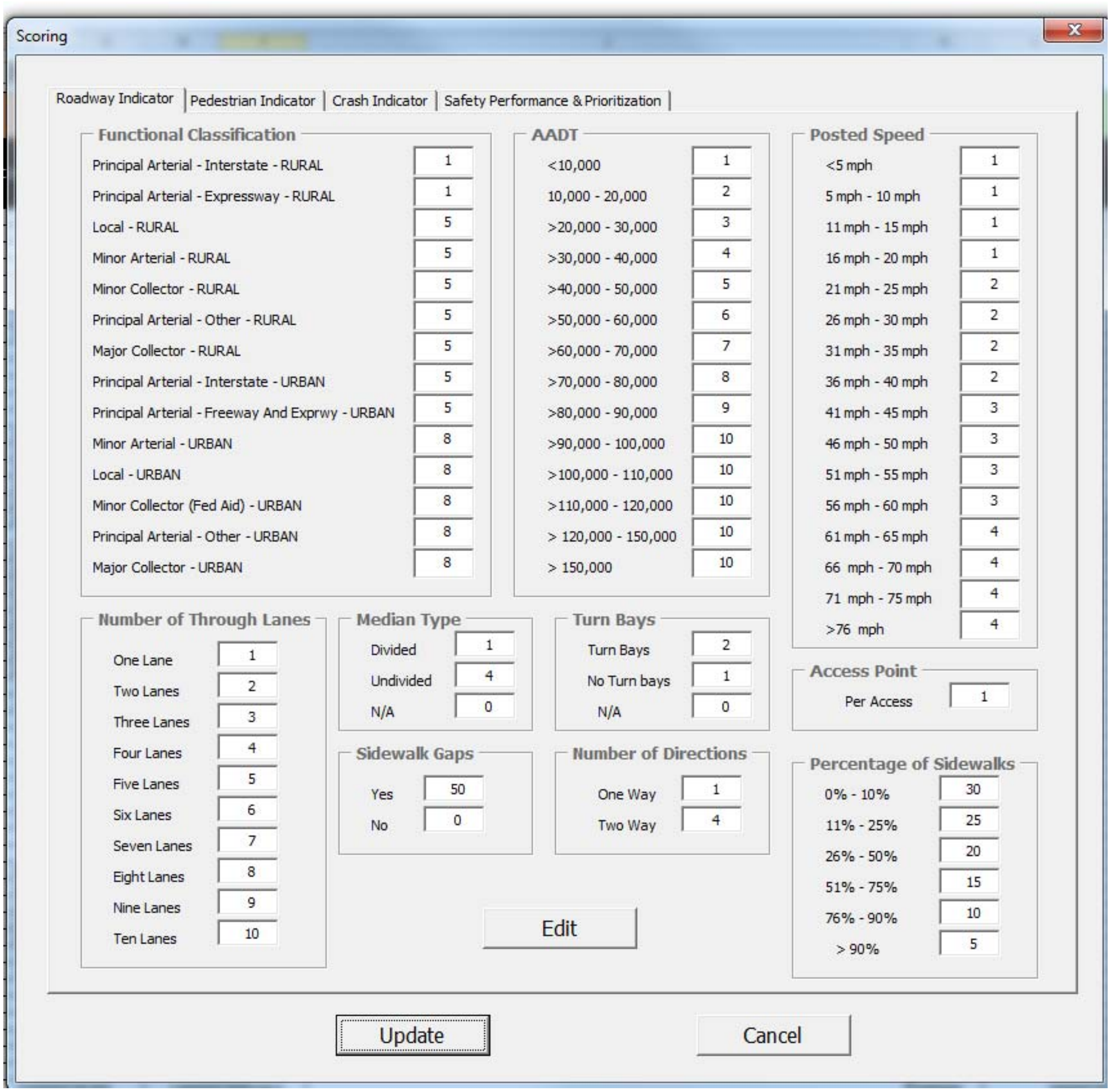


Figure 48: Scoring Window – Roadway Indicator Tab

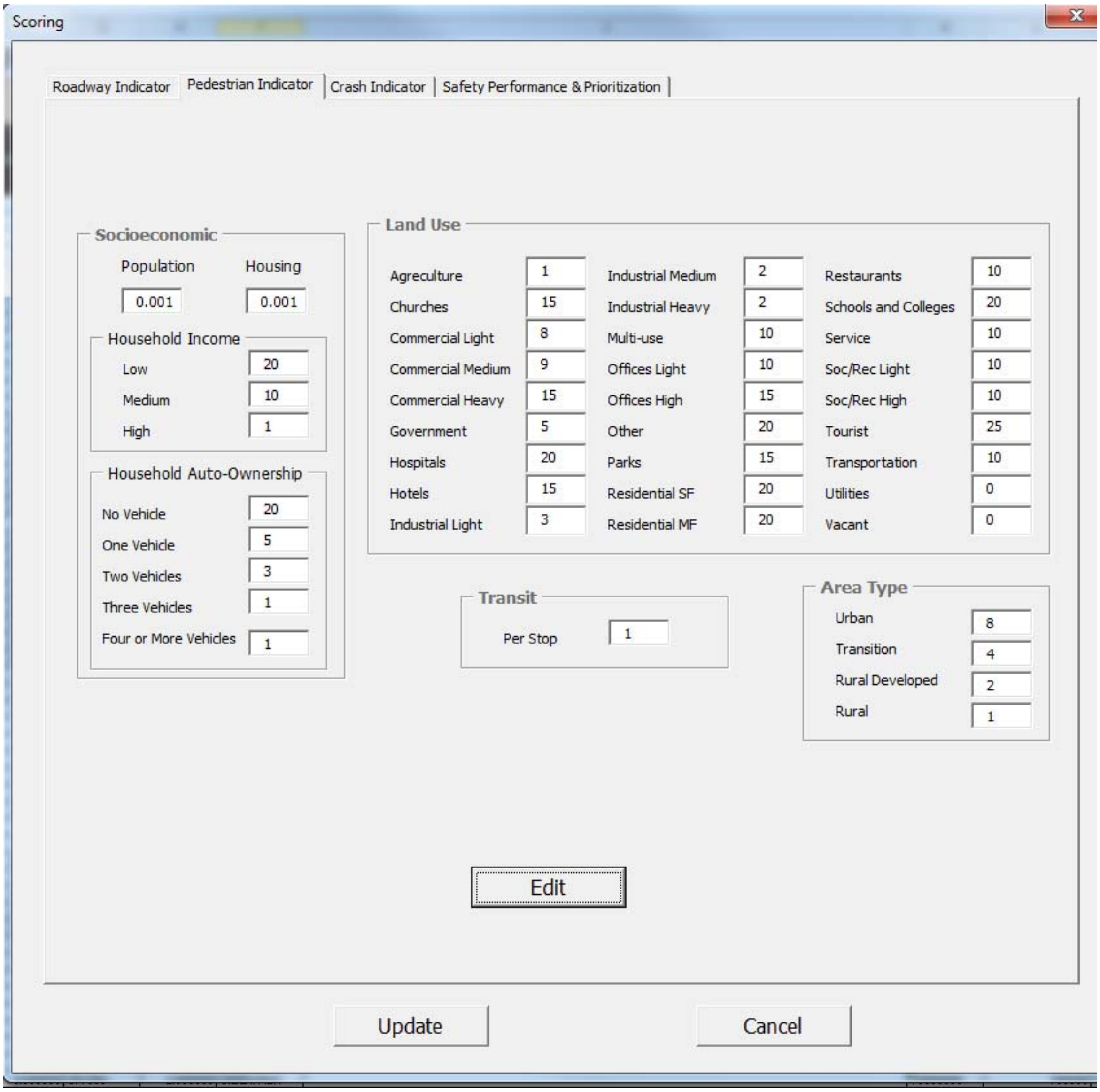


Figure 49: Scoring Window – Pedestrian Indicator Tab

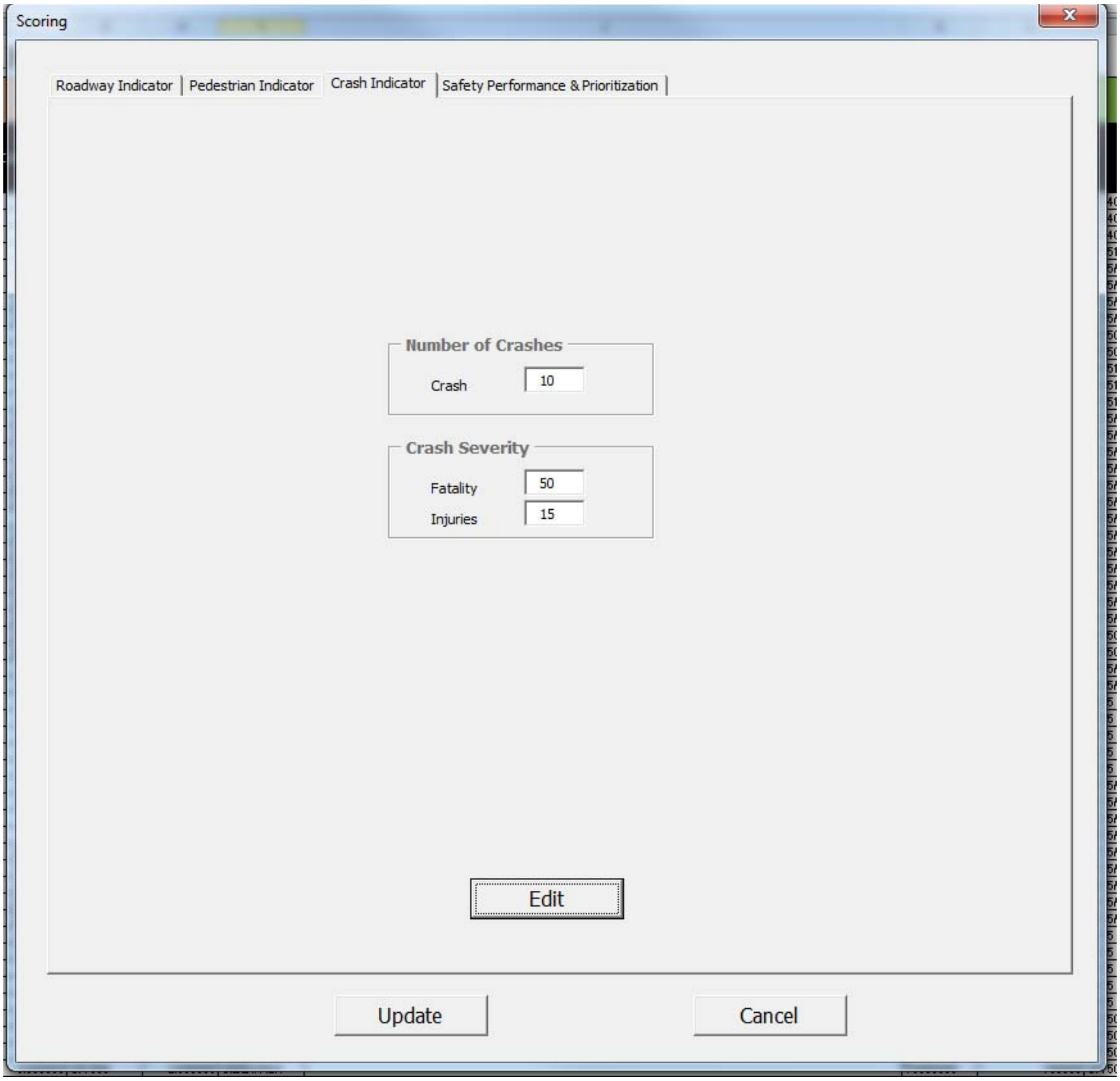


Figure 50: Scoring Window – Crash Indicator Tab

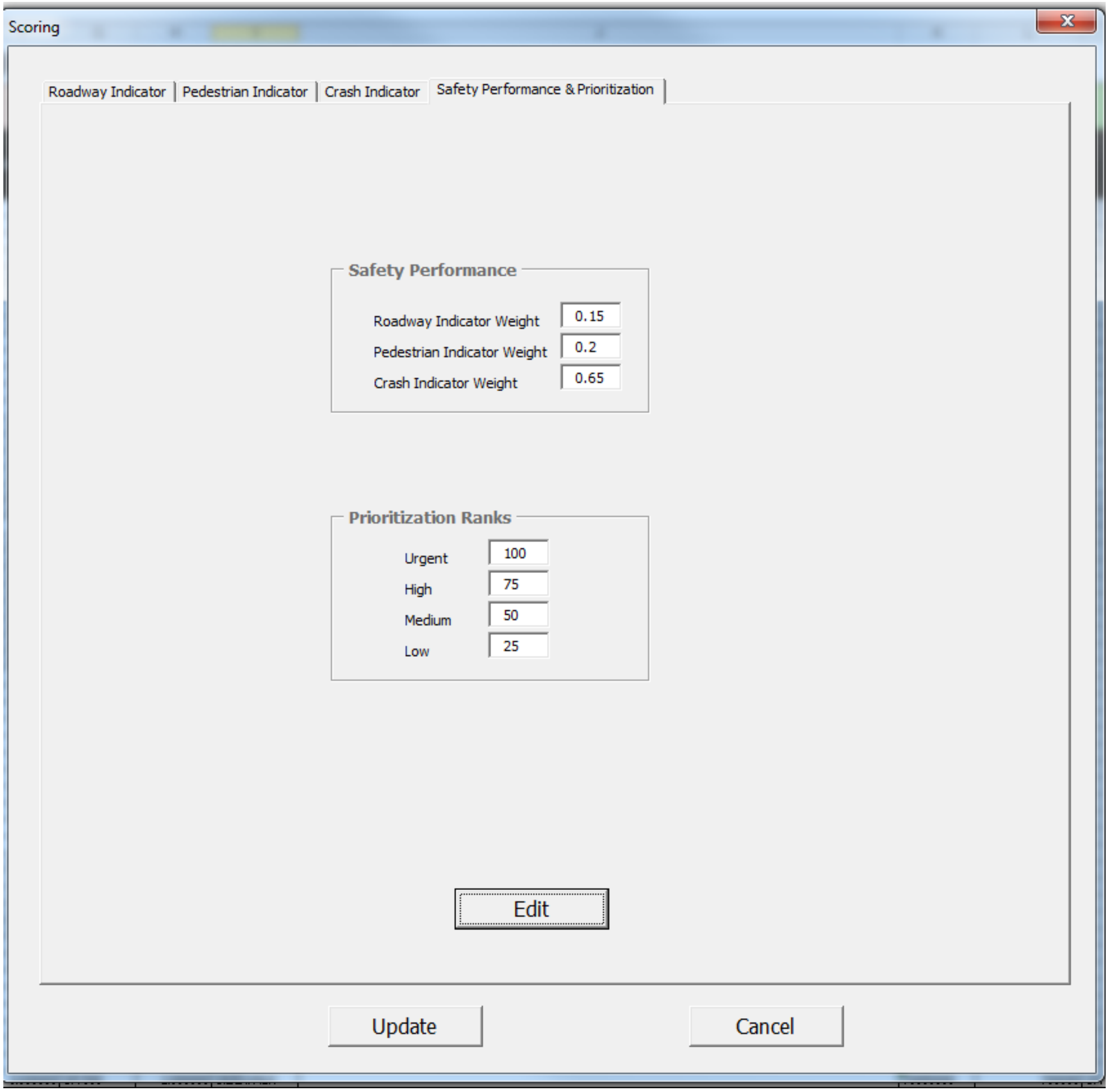


Figure 51: Scoring Window – Safety Performance & Prioritization Indicator Tab

5.2.3 Map Data

- Select “Map Data” under “RPSI” pull down menu. This selection will open a save dialog box to save a google earth .kml file to be viewed under google earth.
- Open Google Earth then open the saved file
- The sidewalk gaps layer will be shown with different color representing prioritization level as follows:

Table 32: Prioritization Ranking Levels

Color	Prioritization Level
Red	URGENT
Purple	HIGH
Orange	MEDIUM
Yellow	LOW
Green	NO SAFETY CONCERNS

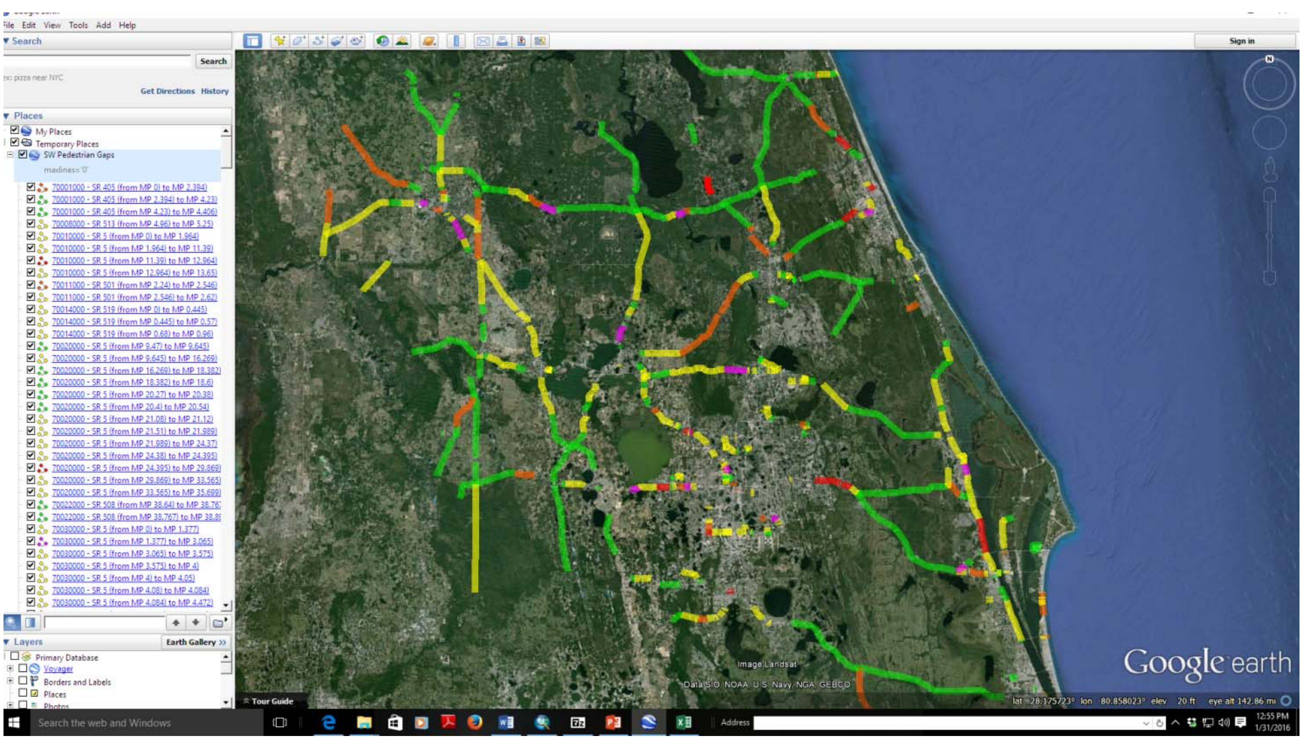


Figure 52: Map View of Prioritization Levels

- Click on any of the links and link information window will popup.

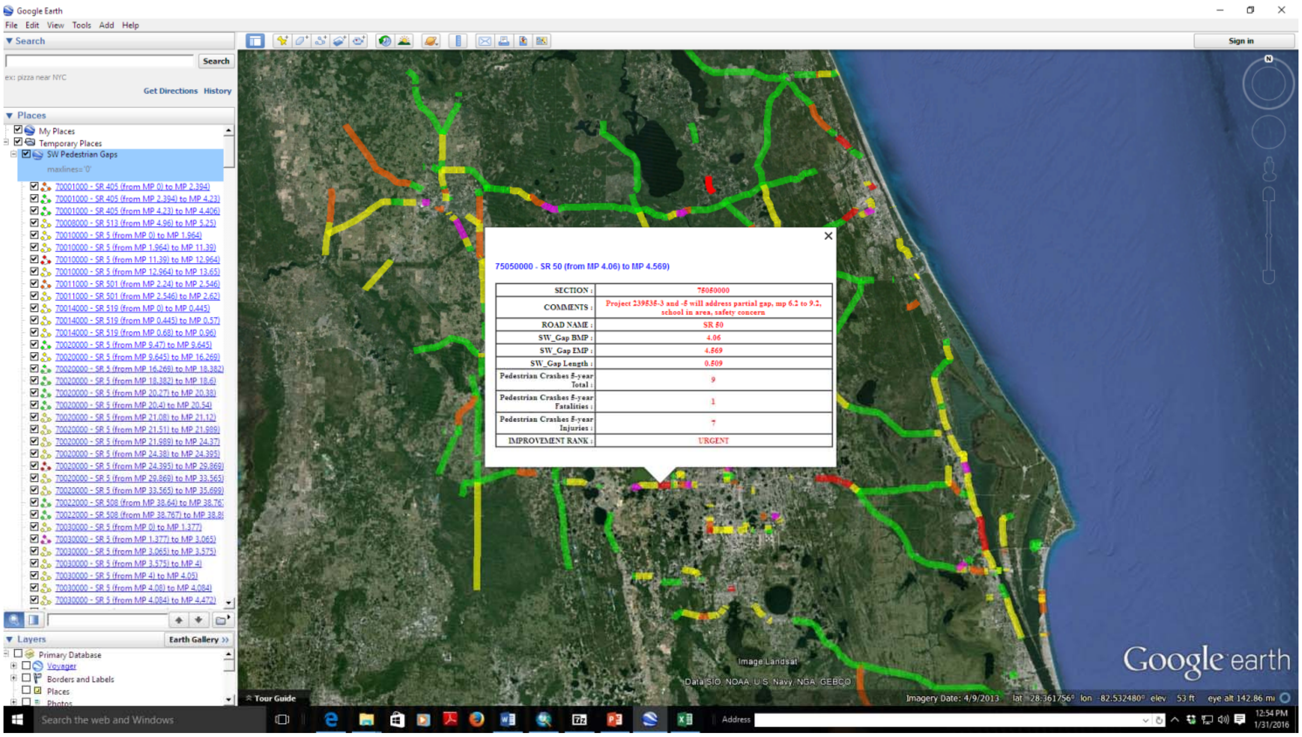


Figure 53: Map View of Prioritization Levels with Selection Window

5.2.4 SW GAPS Worksheet

SW GAPS Worksheet includes all sidewalk gaps and associated data. The following table shows the worksheet data headers and sources associated with each column. All scoring data are calculated based on the methodology described earlier.

<u>CAUTION:</u> DO NOT CHANGE COLUMN HEADERS AND/OR WORKSHEET NAMES.

Data Group	Column Header	Source
Roadway Configuration and Traffic Data	COUNTY	FDOT GAPS GIS Layer
	SECTION	
	GAP BMP	
	GAP EMP	
	STATE RD	
	PRIORITY	
	GAP TYPE	
	COMMENTS	
	ROADWAY	FDOT D5 LOS_ALL tool
	STATION	
	ROAD NAME	
	BMP	
	EMP	
	SW_Gap BMP	Calculated
	SW_Gap EMP	
	SW_Gap Length	
	Segment Length	
	Functional Class	FDOT Functional Class GIS Layer
	1-Way or 2-Way	FDOT D5 LOS_ALL tool
	Divided	
	No. of Through Lanes	
	Posted Speed	
	AADT	FDOT AADT GIS Layer
	Left-Turn Bays	FDOT D5 LOS_ALL tool
	Right-Turn Bays	
	No. of Access Points	FDOT Intersection GIS Layer
	Left Sidewalk (%)	FDOT Sidewalk Width & Separation GIS Layer
	Right Sidewalk (%)	
	Area Type	FDOT D5 LOS_ALL tool
Transit Data	No. of Transit Stops	Transit Layer
Socioeconomic Data	Population	TIGER/Line Shapefile, 2010, 2010 Census Block with Housing and
	Housing	
	Household Size	Calculated
	Low Income (%)	American Community Survey (ACS)
	Medium Income (%)	
	High Income (%)	
	No Vehicle	
	One Vehicle	
	Two Vehicles	
	Three Vehicles	
	Four+ Vehicles	
Land Use Data	Agreculture	FLORIDA PARCEL DATA STATEWIDE - 2014 By Florida Department of Revenue
	Churches	
	Comm. Light	
	Comm. Medium	
	Comm. Heavy	
	Government	
	Hospitals	
	Hotels	
	Ind. Light	
	Ind. Medium	
	Ind. Heavy	
	Multi-use	
	Offices Light	
	Offices High	
	Other	
	Parks	
	SF	
	MF	
	Resturants	
	Schools and Colleges	
	Service	
	Soc/REC Light	
	Soc/REC High	
	Tourist	
	Transportation	
	Utilities	
	Vacant	
Roadway Crash Data	Pedestrian Crashes 5-year Total	Signal Four Analytics GIS Layer
	Pedestrian Crashes 5-year Fatalities	
	Pedestrian Crashes 5-year Injuries	

Figure 54: Input Data and Sources

- Selecting specific roadway segment(s) and specific information to be mapped.
  You can select "YES" in the second row above the heading to show this data associated with each link in the google earth map, you can select "NO" to hide this data. Similarly you can also select "YES" in the first column to show this link or "NO" to hide it.

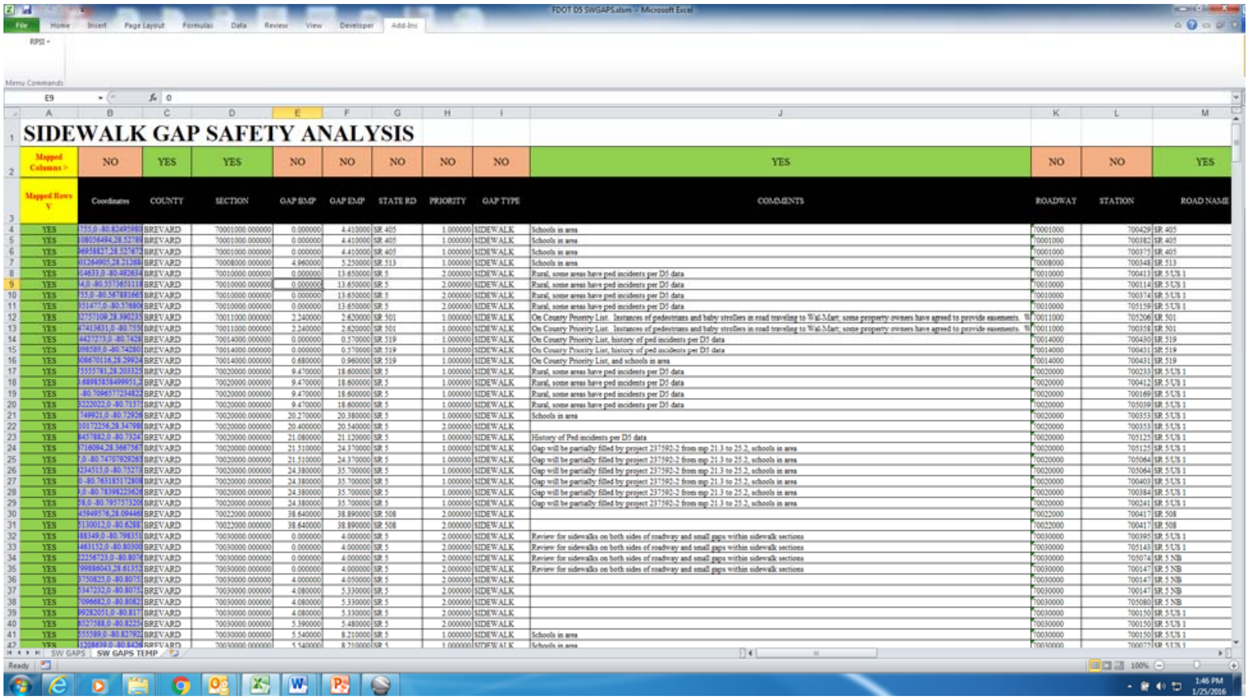


Figure 55: Excel Table View of Bike Lane Gap Safety Performance Tool

- Filter data based on Prioritization level

COUNTY	GAP TYPE	COMMENTS	ROADWAY	ROAD NAME	SW_Gap BMP	SW_Gap EMP	SW_Gap Length	IMPROVEMENT RANK
BREVARD	SIDEWALK	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2, schools in area	70020000	SR 5/US 1	24.380	24.395	0.02	URGENT
BREVARD	SIDEWALK		70030000	SR 5 NB	4.080	4.084	0.00	URGENT
BREVARD	SIDEWALK	Local Maintenance Unit priority	70060001	SR A1A SB	0.950	0.980	0.03	URGENT
MARION	SIDEWALK		36030000	SR 25/US 441	0.680	0.696	0.02	URGENT
MARION	SIDEWALK	Sidewalk on only one side of road, safety concern according to LMU	36100000	SR 200	17.064	17.100	0.04	URGENT
ORANGE	SIDEWALK	Safety concern, on County Priority List, school in area	75002000	SR 482	4.618	4.650	0.03	URGENT
ORANGE	SIDEWALK	School in area	75020000	SR 500/US 441	10.840	11.063	0.22	URGENT
ORANGE	SIDEWALK	Under constrcution, check for sidewalks at later date	75080000	SR 15	9.020	9.040	0.02	URGENT
ORANGE	SIDEWALK		75080000	SR 15	9.974	9.980	0.01	URGENT
OSCEOLA	SIDEWALK	On County Priority List	92010000	SR 600/US 17/92	12.910	13.050	0.14	URGENT
OSCEOLA	SIDEWALK	On County Priority List	92010000	SR 600/US 17/92	13.160	13.180	0.02	URGENT
OSCEOLA	SIDEWALK	On County Priority List	92010000	SR 600/US 17/92	13.250	13.280	0.03	URGENT
SEMINOLE	SIDEWALK		77070000	SR 419/SR 434	8.260	8.290	0.03	URGENT
VOLUSIA	SIDEWALK	On County Priority List C	79050000	SR 15/US 17	17.194	17.200	0.01	URGENT

Figure 56: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 1

COUNTY	GAP TYPE	COMMENTS	ROADWAY	ROAD NAME	SW_Gap BMP	SW_Gap EMP	SW_Gap Length	IMPROVEMENT RANK
BREVARD	SIDEWALK		70030000	SR 5 NB	4.000	4.050	0.05	HIGH
BREVARD	SIDEWALK	Local Maintenance Unit priority	70060001	SR A1A SB	1.150	1.200	0.05	HIGH
LAKE	SIDEWALK		11080000	SR 19	4.580	4.620	0.04	HIGH
ORANGE	SIDEWALK	Project 239535-3 and -5 will address partial gap, mp 6.2 to 9.2, school in area, safety conc	75050000	SR 50	4.060	4.569	0.51	HIGH
ORANGE	SIDEWALK		75080000	SR 15	10.780	10.960	0.18	HIGH

Figure 57: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 2

COUNTY	GAP TYPE	COMMENTS	ROADWAY	ROAD NAME	SW_Gap BMP	SW_Gap EMP	SW_Gap Length	IMPROVEMENT RANK
BREVARD	SIDEWALK	On County Priority List. Instances of pedestrians and baby strollers in road traveling to V	70011000	SR 501	2.240	2.546	0.31	MEDIUM
BREVARD	SIDEWALK	On County Priority List. Instances of pedestrians and baby strollers in road traveling to V	70011000	SR 501	2.546	2.620	0.07	MEDIUM
BREVARD	SIDEWALK		70060000	SR A1A	25.794	25.912	0.12	MEDIUM
BREVARD	SIDEWALK		70060000	SR A1A	25.987	26.099	0.11	MEDIUM
BREVARD	SIDEWALK	Local Maintenance Unit priority	70060001	SR A1A SB	1.570	1.630	0.06	MEDIUM
BREVARD	SIDEWALK	On County Priority List, and schools in area	70140000	SR 3	2.520	2.600	0.08	MEDIUM
BREVARD	SIDEWALK	On County Priority List, and schools in area	70140000	SR 3	3.110	3.180	0.07	MEDIUM
ORANGE	SIDEWALK	School in area	75030101	SR 526	0.000	0.059	0.06	MEDIUM
ORANGE	SIDEWALK	School in area	75030101	SR 526 WB	0.059	0.180	0.12	MEDIUM
ORANGE	SIDEWALK		75060000	SR 50	17.070	18.604	1.53	MEDIUM
ORANGE	SIDEWALK	School in area	75080000	SR 15	11.980	12.050	0.07	MEDIUM
OSCEOLA	SIDEWALK	On County Priority List, school in area	92010000	SR 600/US 17/92	12.290	12.680	0.39	MEDIUM
SEMINOLE	SIDEWALK	Addressed by project 240196-1 from mp 5.7 to 9.3, on County Priority List	77010000	SR 15/US 17/92	6.540	6.590	0.05	MEDIUM
SEMINOLE	SIDEWALK	Addressed by project 240196-1 from mp 5.7 to 9.3, on County Priority List	77010000	SR 15/US 17/92	7.088	7.150	0.06	MEDIUM
VOLUSIA	SIDEWALK	Identified as a priority by LMU	79040000	SR 600/SR 15	9.500	9.567	0.07	MEDIUM

Figure 58: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 3

COUNTY	GAP TYPE	COMMENTS	ROADWAY	ROAD NAME	SW_Gap BMP	SW_Gap EMP	SW_Gap Length	IMPROVEMENT RANK
BREVARD	SIDEWALK	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2, schools in area	70020000	SR 5/US 1	24.395	29.869	5.47	LOW
BREVARD	SIDEWALK	Schools in area	70030000	SR 5/US 1	13.339	13.470	0.13	LOW
BREVARD	SIDEWALK		70060000	SR A1A	26.099	26.272	0.17	LOW
BREVARD	SIDEWALK	Local Maintenance Unit priority	70060001	SR A1A SB	1.020	1.120	0.10	LOW
BREVARD	SIDEWALK		70140000	SR 3	0.000	0.300	0.30	LOW
BREVARD	SIDEWALK	Schools in area, history of ped incidents per D5 data	70140000	SR 3	3.240	3.354	0.11	LOW
MARION	SIDEWALK	Sidewalk on only one side of road, safety concern according to LMU	36100000	SR 200	16.800	17.064	0.26	LOW
ORANGE	SIDEWALK	On County Priority List, recommended by LMU	75020000	SR 500/US 441	4.320	4.460	0.14	LOW
ORANGE	SIDEWALK		75020000	SR 500/US 441	5.660	5.768	0.11	LOW
ORANGE	SIDEWALK	School in area	75020000	SR 500/US 441	11.063	11.391	0.33	LOW
ORANGE	SIDEWALK	School in area	75020000	SR 500/US 441	11.391	11.522	0.13	LOW
ORANGE	SIDEWALK	School in area	75020000	SR 500/US 441	11.522	12.260	0.74	LOW
ORANGE	SIDEWALK	Project 239535-3 and -5 will address partial gap, mp 6.2 to 9.2, school in area, safety conc	75050000	SR 50	4.569	6.068	1.50	LOW
ORANGE	SIDEWALK	Project 239535-3 and -5 will address partial gap, mp 6.2 to 9.2, school in area, safety conc	75050000	SR 50	8.399	9.338	0.94	LOW
ORANGE	SIDEWALK	Project 239203-4 will address partial gap, mp 9.4 to 14.6, history of ped incidents per D5	75060000	SR 50	12.990	16.880	3.89	LOW
ORANGE	SIDEWALK		75080000	SR 15	9.820	9.974	0.15	LOW
ORANGE	SIDEWALK		75080000	SR 15	10.030	10.720	0.69	LOW
ORANGE	SIDEWALK	School in area	75080000	SR 15	11.720	11.940	0.22	LOW
ORANGE	SIDEWALK	School in area	75080000	SR 15	12.070	12.190	0.12	LOW
OSCEOLA	SIDEWALK	Project 239682-1 will address sidewalks	92030000	SR 500/US 441	3.860	4.090	0.23	LOW
OSCEOLA	SIDEWALK	Project 239682-1 will address sidewalks, history of ped incidents per D5 data	92030000	SR 500/US 441	4.160	4.360	0.20	LOW
SEMINOLE	SIDEWALK	Addressed by project 240196-1 from mp 5.7 to 9.3, on County Priority List	77010000	SR 15/US 17/92	5.890	5.990	0.10	LOW
VOLUSIA	SIDEWALK		79190007	SR 5A	0.000	0.140	0.14	LOW
VOLUSIA	SIDEWALK	Sidewalks needed on North side of road	79220000	SR 430	1.000	1.900	0.90	LOW
VOLUSIA	SIDEWALK	Sidewalk will be addressed by project 408178-1 from mp 0 to 2.2, on County Priority Lis	79270000	SR 483	1.000	1.150	0.15	LOW
VOLUSIA	SIDEWALK	Sidewalk will be addressed by project 408178-1 from mp 0 to 2.2, on County Priority Lis	79270000	SR 483	1.780	1.880	0.10	LOW

Figure 59: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 4

5.3 BICYCLIST SAFETY PRIORITIZATION TOOL (BSPT)

The bicyclist safety prioritization tool (BSPT) was developed primarily to prioritize the bike lane gap locations within FDOT District Five which directly affects the safety of bicyclists along roadways. Absence of bike lanes along roadways was one of the main factors that have significant impact on the expected number of bike crashes at a specific location. Other factors included daily traffic volumes (AADT), roadway category (ROADCAT), and average population within one mile radius surrounding the crash location. The developed tool takes into account the above mentioned parameters as well as other activity variables and proximity to generators using land use, income and data. The prioritization method is based on a multi-criteria ordinal ranking of the parameters of five main modules using a scoring system that combines all criteria weights then aggregates it into a single indicator. The five main modules comprise roadway and traffic data, socioeconomic data, land use data, transit and bike crash data. The following sections explain in greater detail the input data sources and preparation as well as a hands-on procedure.

5.3.1 Data Collection and Preparation

5.3.1.1 Input Data Sources

Similar to the Sidewalk Gaps Pedestrian Safety Prioritization Tool (PSPT), the data required for the Bike Safety Prioritization Tool (BSPT) utilizes several statewide shape files of Geographic Information Systems (GIS) layers including roadway characteristics data, land use data, socioeconomic data, transit and safety data that were obtained from various sources. Table 32 presents the list of input layers and their sources.

Table 33: Input Layers and Data Sources

GIS Input Data	GIS Data Source
Roadway and Traffic Data	
Roadway Functional Classification	FDOT, Transportation Statistics Office.
2014 AADT	FDOT, Transportation Statistics Office.
Intersections	FDOT, Transportation Statistics Office.
Bike Lanes	FDOT, Transportation Statistics Office.
Gaps	FDOT D5
D5 LOS_All_2014	FDOT D5
Socioeconomic Data	
Population and Housing	2010 Census Block with Housing and Population Data for Florida
Auto Ownership	American Fact Finder
Income	American Fact Finder
Land Use Data	
D5 Land Use	Florida Geographic Data Library (FGDL)
Transit Data	
D5 Transit Stations	FDOT / MetroPlan Orlando
Bike Crash Data	
D5 Bike Crashes	FDOT / Signal Four Analytics

5.3.1.2 Input Data Preparation Process

The original GIS data requires special preparation in order to be used as inputs for the Bike Lane Gaps Safety Prioritization Tool. Several ArcMap GIS toolbox processes were utilized to manipulate the original data format to extract data associated with FDOT D5 roadway network and bicyclist criteria. Figure 60 illustrates the overall Bicycle data preparation flow chart. This chart demonstrates the original GIS layer data file (shown in green color), the GIS process that was applied such as intersect, join, select, and/or buffer (shown in yellow color) and the output layer that was used as input data for the prioritization tool (shown in Orange color). The blue color represents an intermediate output layer. The dashed grey boundaries represent the data input module. The following sections explain in greater detail the steps needed to manipulate the original data to specific format to be used as inputs to the Bike Lane Gaps Safety Prioritization Tool.

Bicycle Data Preparation Flow Chart

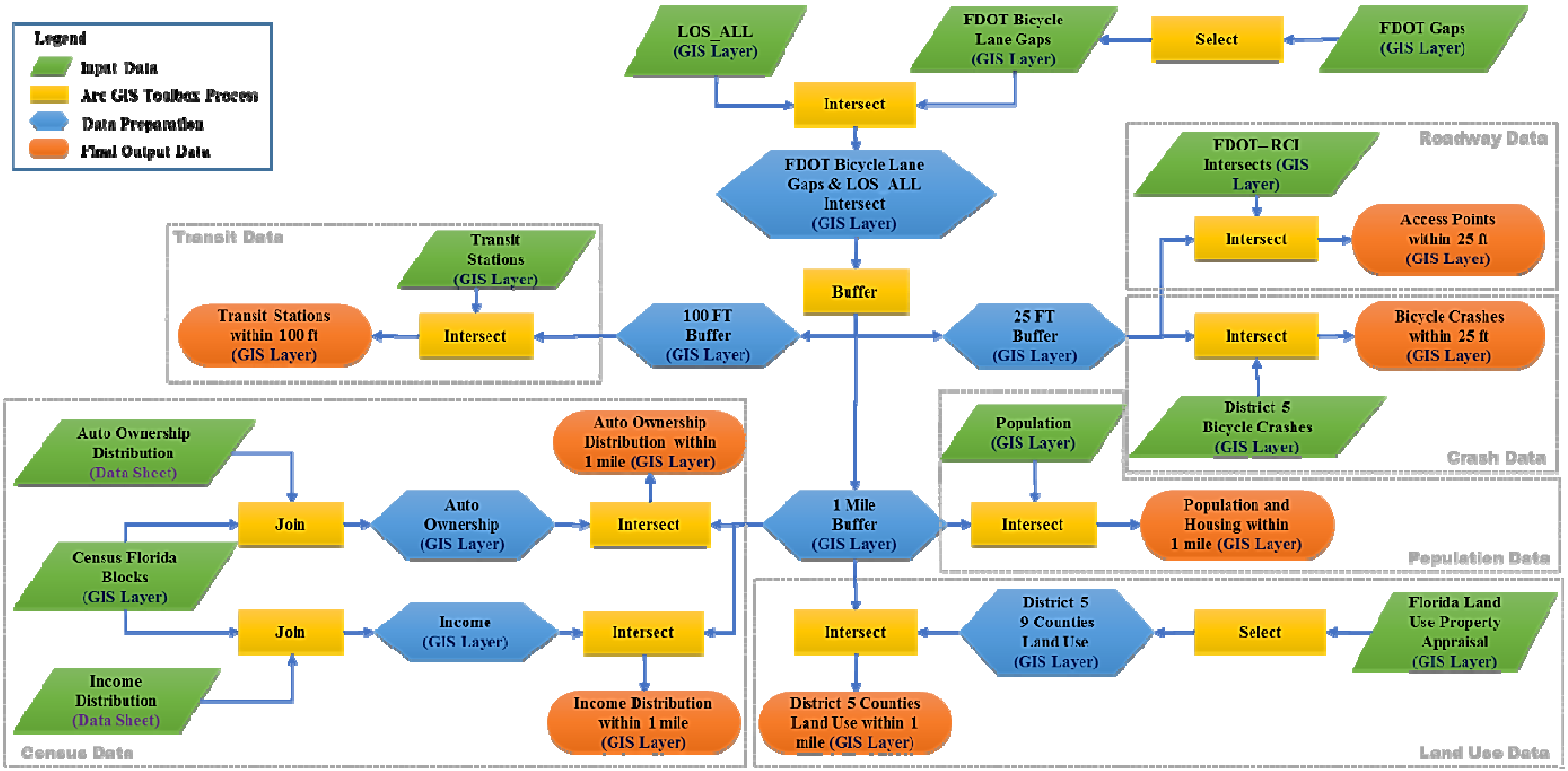


Figure 60: Bicycle Data Preparation Flow Chart

<u>Step 1:</u> The Gaps shape file was provided by FDOT D5 staff. This shape file includes list of both Bike Lanes and bike lane gaps located within D5 roadway network. Using Arc GIS "select" tool as shown in Figure 61, only bike lane gaps were identified from the original D5 Gap layer. The resulted shape file includes only bike lanes gaps within the FDOT D5 network.

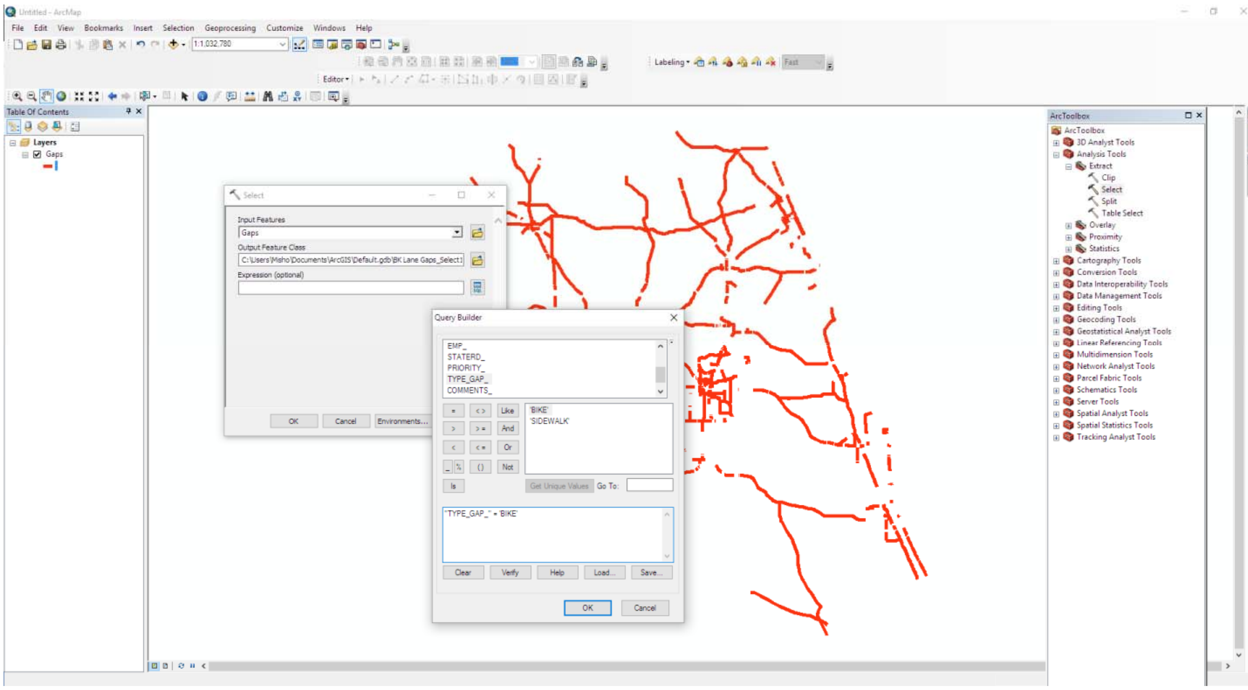


Figure 61: Bike Lane Gaps Shapefile (Step 1)

<u>Step 2:</u> The FDOT D5 roadway network shape file was included in the 2014 FDOT D5 LOS_ALL tool that was provided by the Department. This shape file includes the roadway corridors and segments and their logical termini located within the nine counties in FDOT D5. The 2014 FDOT D5 LOS_ALL shape file and the bike lane gaps shape file resulted from the previous step were then intersected using Arc GIS "intersect" as shown in Figure 62. The output intersection layer includes the logical termini of the bike lane gaps, roadway name, area type, number of lanes, number of directions, posted speed, traffic count station, existence of right and left turn bays associated with each individual bike lane gap.

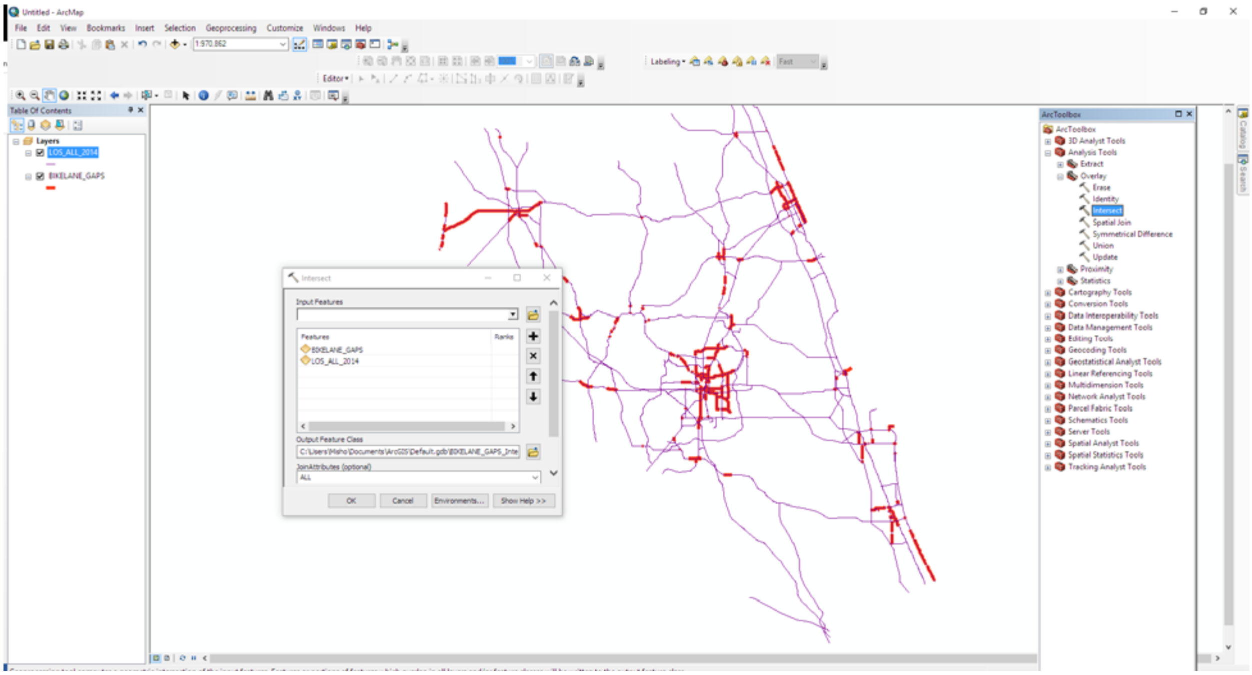


Figure 62: Bike Lane Gaps with FDOT LOS_ALL Shapefile (Step 2)

<u>Step 3:</u> Using GIS "buffer" process as shown in Figure 63, a buffer of 25 feet was generated around each individual bike lane gap resulted from the previous step.

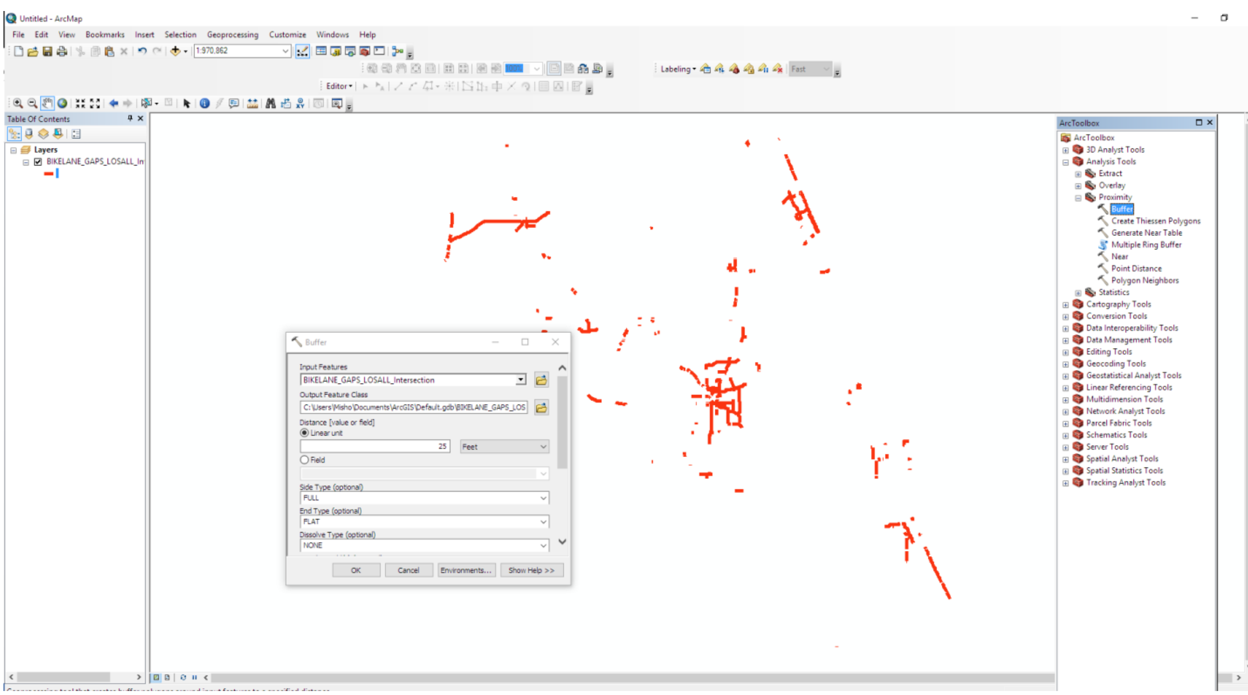


Figure 63: Bike Lane Gap Shapefile with 25-Foot Buffer (Step 3)

Step 4: The Intersections RCI shape file was downloaded from the FDOT, Transportation Statistics Office (TRANSTAT) website. The 25-foot buffer bike lane gaps shape file from previous step was then intersected with the Intersections RCI shape file as shown in Figure 64. The output shape file identifies access points that are located within 25 feet from each of the bike lane gaps.

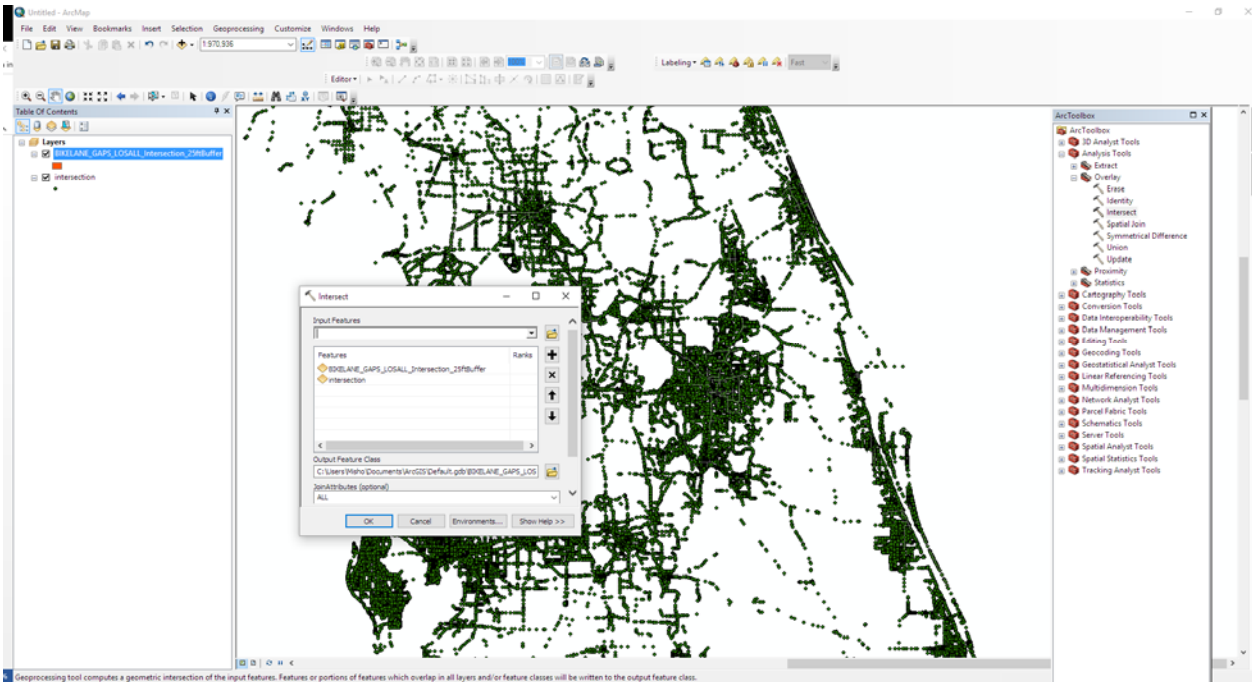


Figure 64: Access Points with 25-Foot Buffer along Bike lane Gaps (Step 4)

Step 5: The latest 2014 Average Annual Daily Traffic (AADT), Functional Classification, and Bike Lane RCI GIS shape file were also downloaded from the FDOT, Transportation Statistics Office (TRANSTAT) to be used by the Bike lane Gaps Pedestrian Safety Prioritization Tool later.

Step 6: Using GIS "buffer" tool as shown in Figure 65, a buffer of one mile was generated around each individual bike lane gap shape file from Step 2 above.

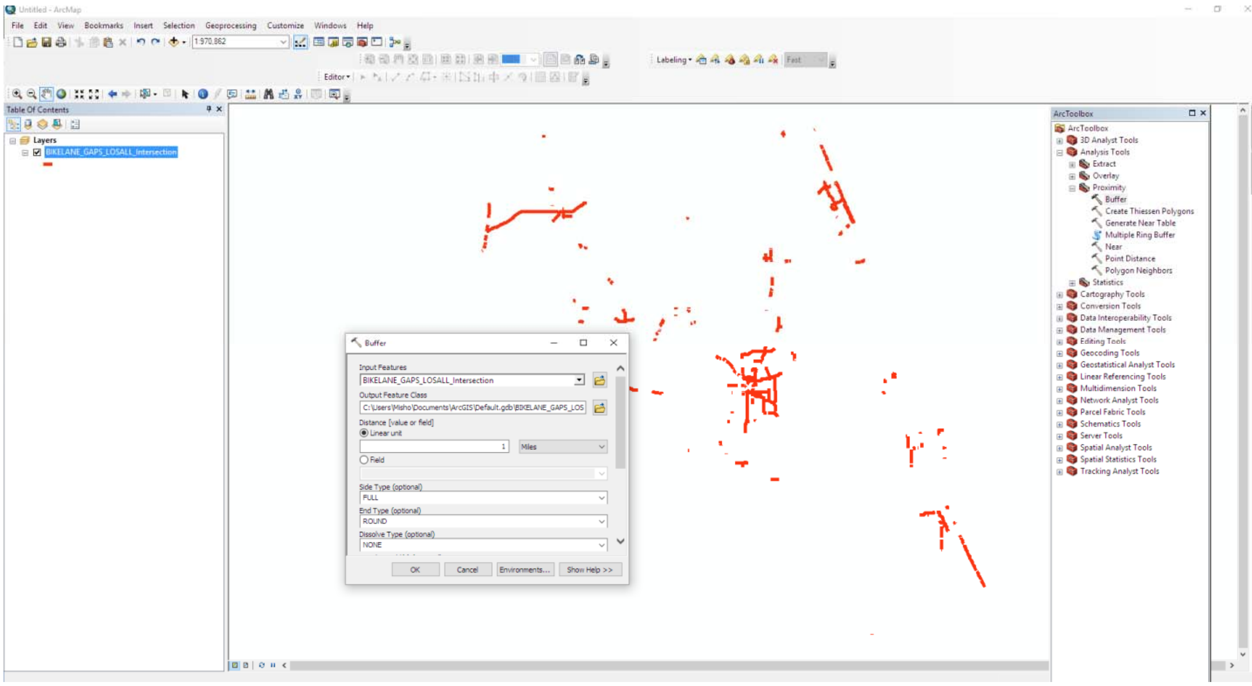


Figure 65: One-Mile Buffer from Bike Lane Gaps (Step 6)

Step 7: The 2010 Census Block with Housing and Population Data for Florida tiger/line shape file was downloaded from http://catalog.data.gov/dataset/tiger-line-shapefile-2010-2010-state-florida-2010-census-block-state-based-shapefile-with-housi. A typical distance of one-mile was used as a buffer to quantify the population density and number of housing along each roadway segment. Population density and number of housing provide key indication of bicyclist activities along the roadway where heavily populated residential areas encounter high bicyclist activities.

The one-mile buffer surrounding the bike lane gaps from Step 6 was then intersected with the downloaded 2010 population and housing for Florida GIS shape file as shown in Figure 66. The output shape file identifies the estimated population and housing within a quarter-mile from each of the bike lane gaps.

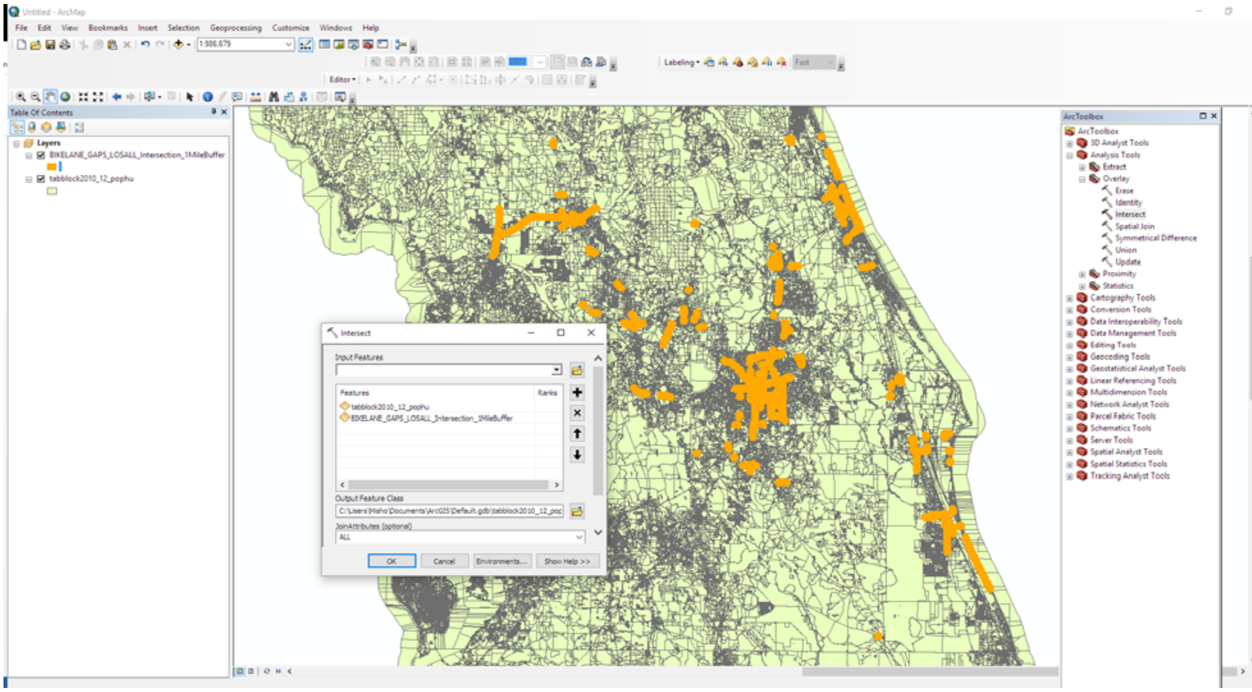


Figure 66: Estimated Population & Housing within One Mile (Step 7)

<u>Step 8:</u> Other socioeconomic key factors that affect bicyclist activities are household income and auto-ownership. The average household income and auto-ownership distributions were downloaded from the American Fact Finder website download center at http://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml. The household income and auto-ownership census tract data were spatially joined with the census tract shape file then intersected with the one mile bike lane gaps buffer from Step 6 as shown in Figures 67 and 68. The two output shape files identify the Income and the Auto-Ownership information within a quarter-mile for each individual bike lane gap.

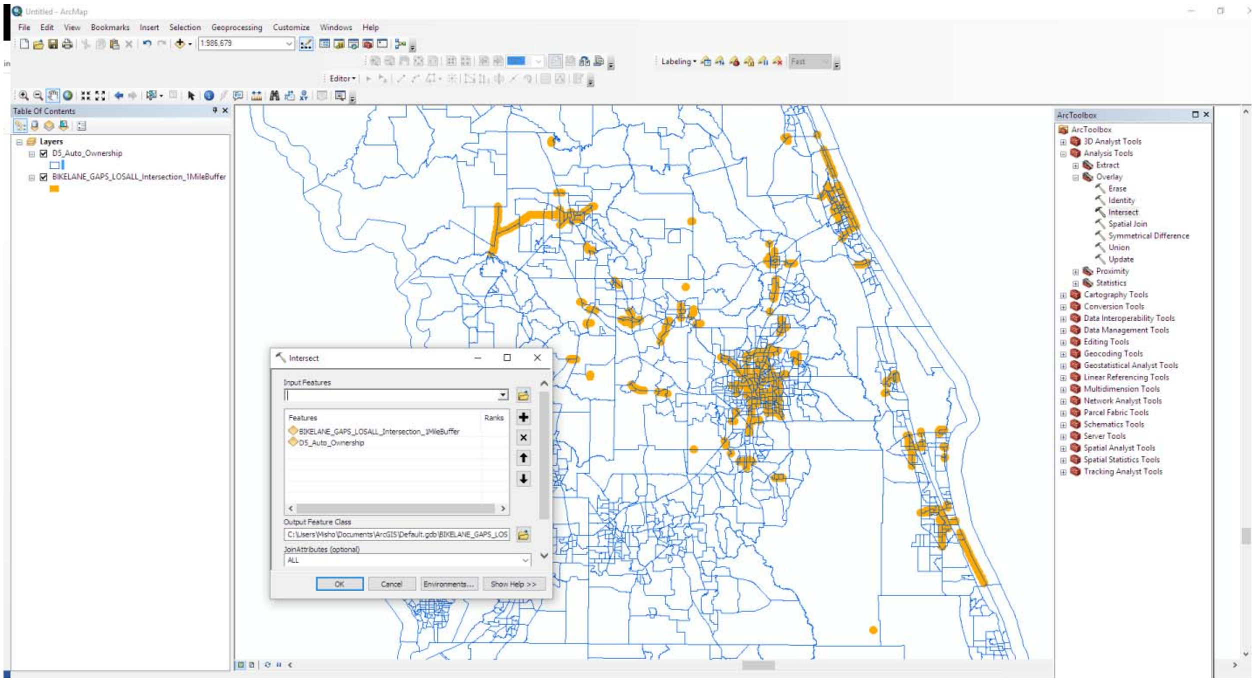


Figure 67: Auto Ownership within Quarter Mile (Step 8)

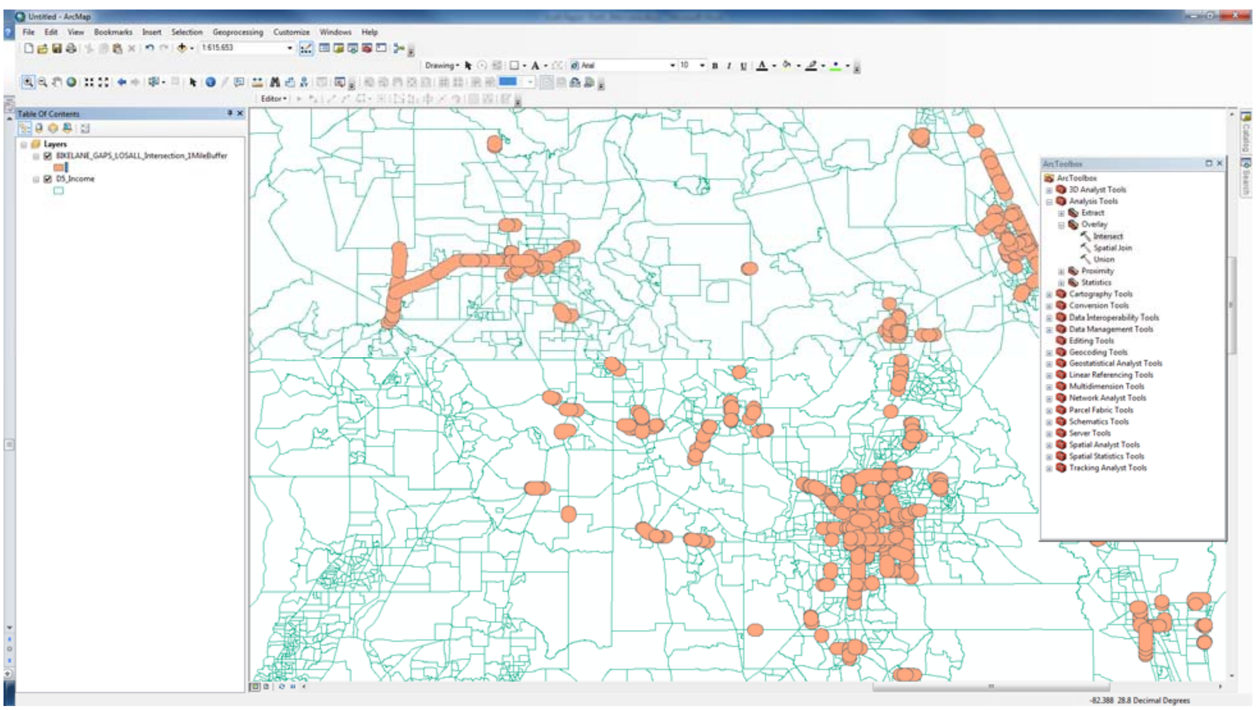


Figure 68: Income within Quarter Mile (Step 8)

Step 9: The 2014 Florida parcel data statewide shape file created by the Florida Department of Revenue was downloaded from the Florida Geographic Data Library (FGDL) website at http://www.fgdl.org/metadataexplorer/explorer.jsp. Using GIS "select" tool, all nine counties within D5 were selected individually generating nine land use shape files, one for each county.

Step 10: Each county land use shape file was then intersected; using the GIS "intersect" tool as shown in Figure 69 for Brevard County as an example; with the one mile bike lane gaps buffer shape file from Step 6. The nine output shape files identify land uses within a one-mile of each individual bike lane gap.

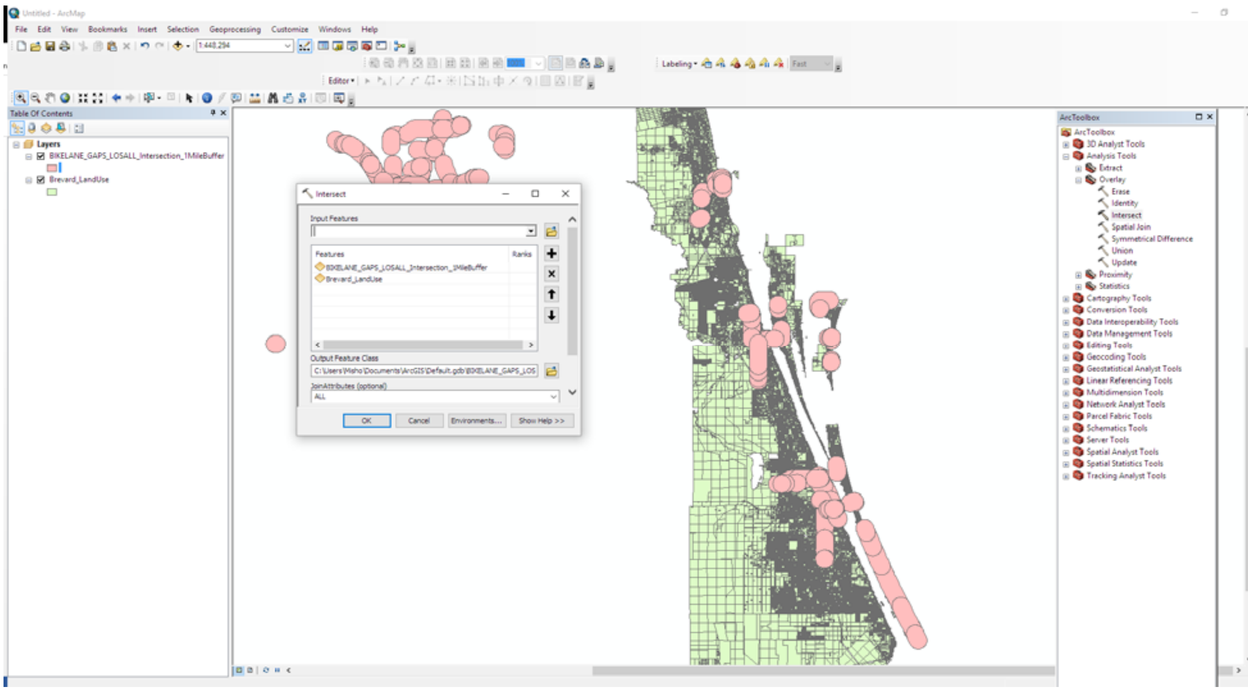


Figure 69: Land Uses within One mile for Nine Counties (Step 10)

Step 11: Using GIS "buffer" tool as shown in Figure 70, a buffer of 100 feet was generated around each individual bike lane gap shape file resulting from Step 2.

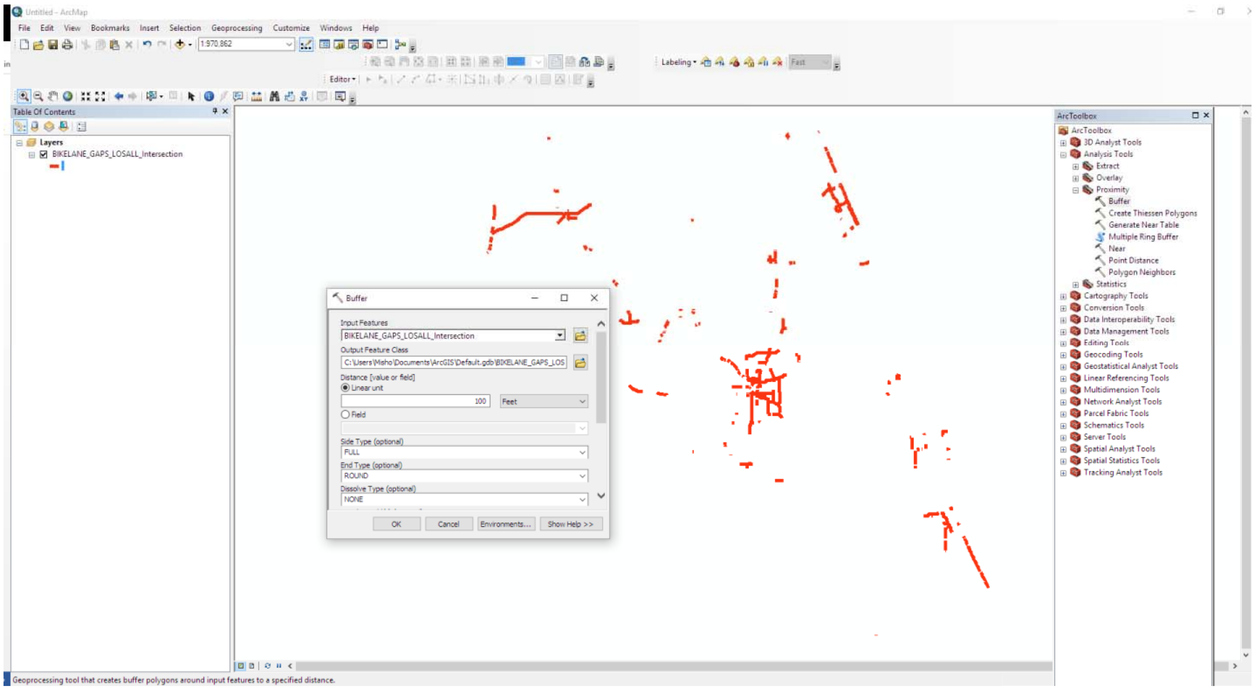


Figure 70: 100-Foot Buffer from Bike lane Gaps (Step 11)

Step 12: The transit station shape file was provided by FDOT and MetroPlan Orlando staff. This GIS layer includes all transit stations and bus stops within the nine counties in D5 area. The transit station GIS layer was intersected with the 100 feet bike lane gaps buffer shape file resulted from Step 11 using the "intersect" tool as shown in Figure 71. The output shape file identifies all transit stations within 100 feet of each of the bike lane gaps.

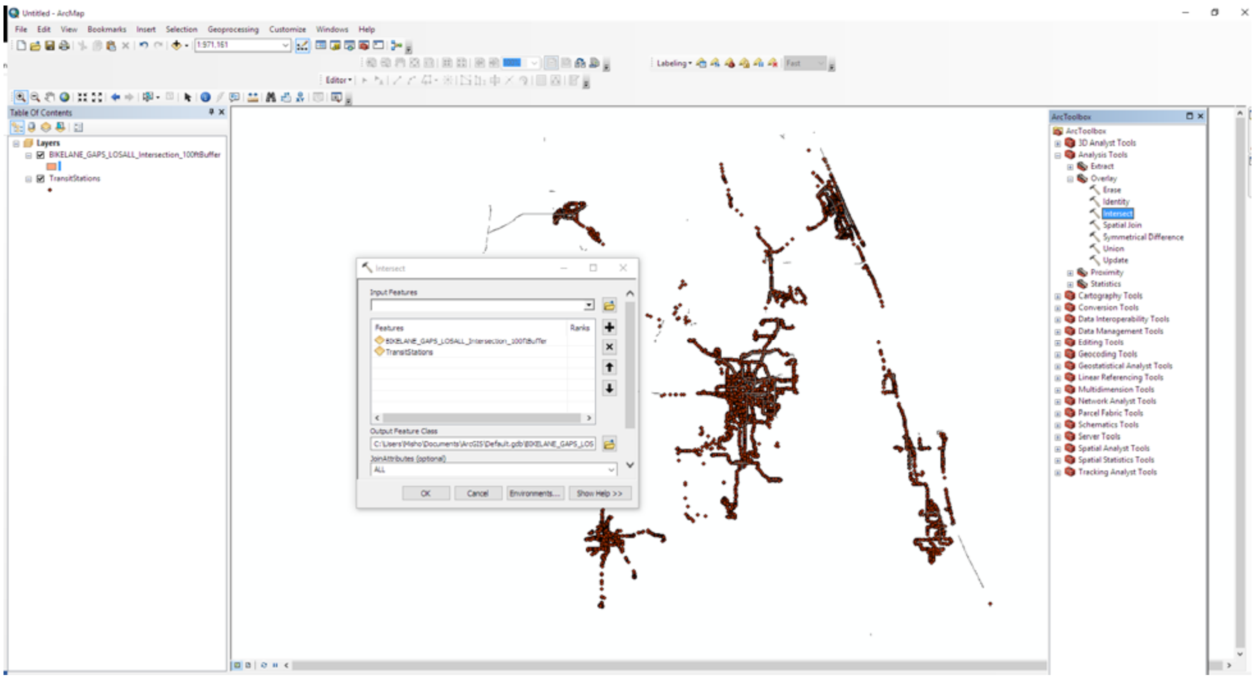


Figure 71: Transit Stations within 100-Foot Buffer of Bike lane Gaps (Step 12)

Step 13: The GIS layer from Signal Four Analytics database for the most recent 5-year period (June 2009 - June 2014) was utilized to identify bike crashes along the FDOT District Five roadway segments. The crash layer was intersected with the 25-foot bike lane gaps buffer developed in Step 3 using the "intersect" tool as shown in Figure 72. The output shape file includes all recent 5-year bike crashes that were located around each of the bike lane gaps.

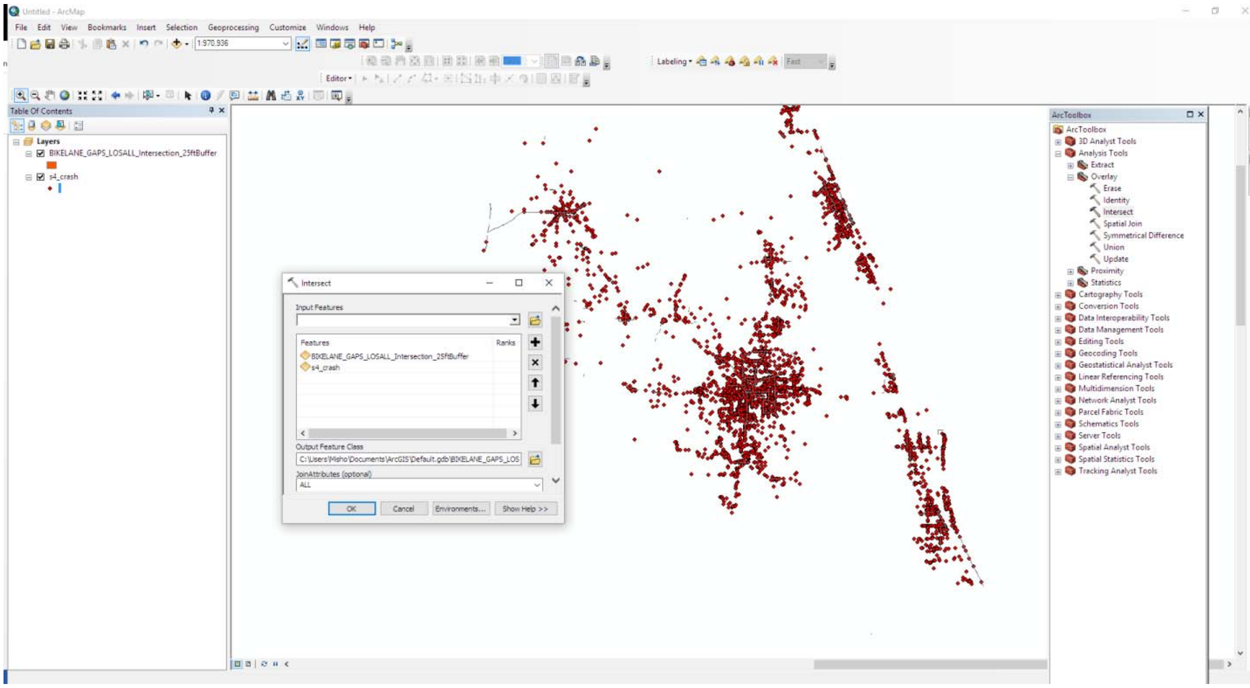


Figure 72: Five-Year Pedestrian Crashes along Bike Lane Gaps (Step 13)

<u>**Step 14:**</u> The developed layer from Step 2 which includes the logical termini of the bike lane gaps is then converted to a google earth file using the ArcMap GIS conversion to KML tool, as shown in Figure 73.

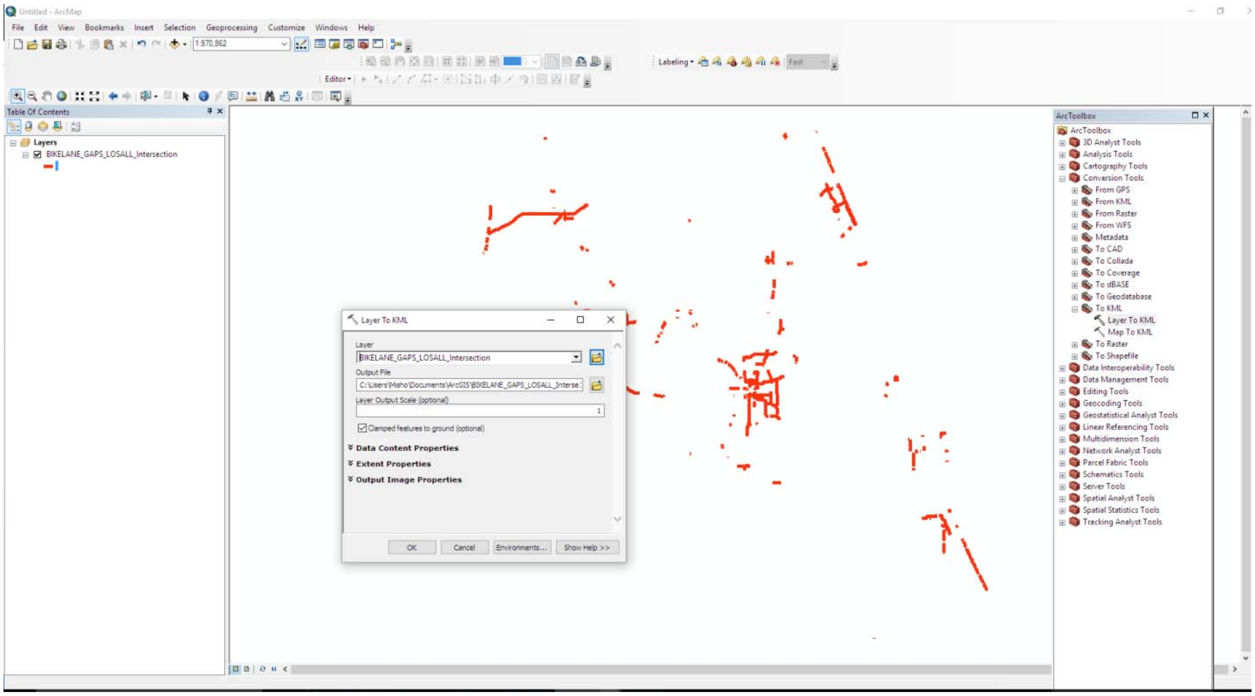


Figure 73: Conversion to Google Earth File (Step 14)

<u>Step 15:</u> The converted .kmz file generated in Step 14 is a google earth file that has an extension ".kmz". Using the "7Zip" software, the kmz file is extracted to "*doc.kml*" as shown in Figure 74. The doc.kml file is renamed to be used later in mapping the data section.

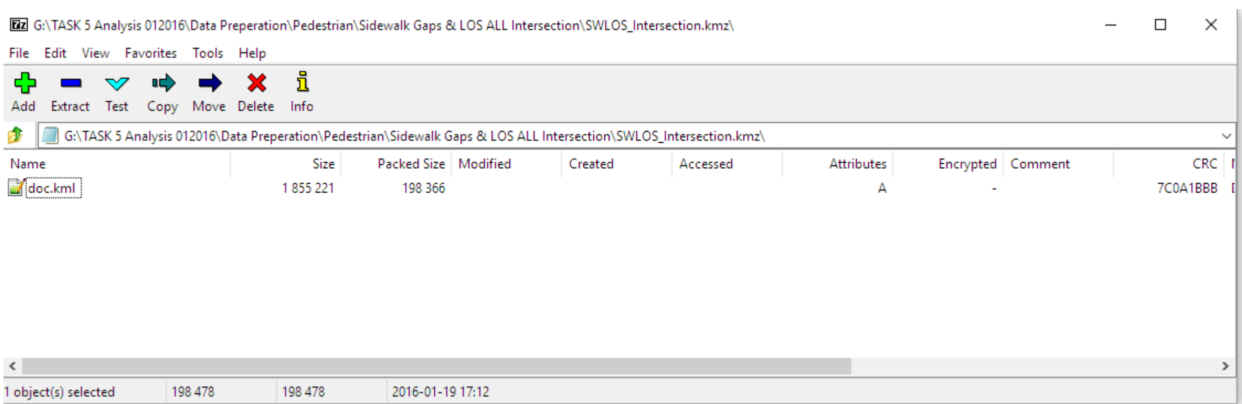


Figure 74: kmz to doc.kml File for Mapping Data (Step 15)

5.3.2 Input Data Coding and Modules

Similar to the Sidewalk Gaps Pedestrian Safety Prioritization Tool (PSPT), the Bike Lane Gaps Safety Prioritization Tool (BSPT) was coded using Visual Basic for Application (VBA) and utilizes Microsoft Excel® as the working environment. Microsoft Excel® is a package included in Microsoft Office® developed by Microsoft Corporation. The Bike Lane Gaps Safety Prioritization Tool was coded in module basis by separating the graphical user interface (GUI) modules and subroutines from the specific data processing and calculations. This helps in debugging, maintaining and expanding the features of the tool.

As mentioned earlier, the prioritization method is based on five main modules of input data which included roadway and traffic data, socioeconomic data, land use data, transit and crash data. Each of the output shape files generated from the data preparation process described above includes detailed information in database format ".dbf" associated with each module of the input data. The Bike Lane Gaps Pedestrian Safety Prioritization Tool connects to each of the individual database files to allocate specific data and calculates total scores for each module then aggregates it into a single indicator to rank their prioritization. The following sections describe the different parameters and variables in each module and the corresponding scoring system.

1- Roadway and Traffic Data Module

Roadway and traffic module included the following data:

- ***Bike lane Gaps:*** This layer is the base layer for all five modules. It includes all listed bike lane gaps located in D5 roadway network. The tool associates any parameter of the five modules with each of the listed bike lane gaps. Bike lane gaps data includes County, Roadway Section number, bike lane gap beginning and ending mile posts, State Road name, priority, gap type, Roadway ID, traffic count station number, and beginning and ending mile posts for the LOS roadway segment. This data is obtained from the intersection layer between the bike lane gaps layer and the 2014 LOS_All layer.
- ***Functional Class:*** Roadway functional classification associated with each bike lane gap is obtained from the functional classification RCI GIS database file downloaded in tep 5.
- ***AADT:*** Average Annual Daily Traffic (AADT) for each traffic count station associated with each bike lane gap is obtained from the Average Annual Daily Traffic RCI GIS database file downloaded in Step 5.
- ***1-Way or 2-Way:*** This data describes the roadway traffic directions at the bike lane gap if one-way or two-way direction. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Divided:*** This data describes if the roadway is divided or undivided at the bike lane gap. The letter "Y" indicates it is divided roadway and the Letter "N" indicates it is undivided. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***No. of Through Lanes:*** This data lists the number of through lanes at each of the bike lane gaps. This data is also obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Posted Speed:*** This data lists the posted speed at the each of the bike lane gaps. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.

- ***Left-Turn Bays and Right-Turn Bays:*** This data includes the existence of left turn or right turn bays along the roadway at the bike lane gaps. The Letter “Y” indicates there are turn bays, the letter “N” indicates there are no turn bays. This data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***No of Access Points:*** This data includes number of roadway access points at the bike lane gap locations. This data is obtained from the output layer identifying access points within 25 feet from each of the bike lane gaps developed in Step 4.
- ***Left and Right Bike lanes Percentages:*** This data presents the percentage of bike lane coverage within the bike lane gap area. This percentage is calculated for each bike lane gap by dividing the length of existing bike lanes by the length of the bike lane gap length. The length of the bike lane is obtained from the Bike lane Width & Separation RCI GIS database file downloaded in Step 5.

2- <u>Socioeconomic Data Module</u>

Socioeconomic module includes the following data:

- ***Area Type:*** This data represents the area type around each individual bike lane gap. The letter “U” indicates urban area, letter “R” indicates rural area, letter “T” indicates transitioning area from rural to urban, and letters “RD” indicates a rural area under development. The area type data is obtained from the 2014 FDOT D5 LOS_ALL database file.
- ***Population:*** Population data shows the 2010 populations within a one mile from the bike lane gap. The population data identifies the estimated population and housing within a one-mile developed in step 7.
- ***Housing:*** Similar to population data, housing data shows number of housing in 2010 within a one mile from the bike lane gap. The housing data also identifies the estimated population and housing within a one a mile developed in step 7.
- ***Low Income Percentage:*** The low income percentage represents the percentage of households with yearly income less than $40,000 within one mile of the bike lane gap location. This data is calculated from the database file that includes income distribution within a one mile developed in Step 8.
- ***Medium Income Percentage:*** The medium income percentage represents the percentage of households with yearly income ranging from $40,000 to $75,000 within a one mile of the bike lane gap location. This data is calculated from the database file that includes income distribution within a one mile developed in Step 8.
- ***High Income percentage:*** The high income percentage represents the percentage of households with yearly income more than $75,000 within one mile of the bike lane gap location. This data is calculated from the database file that includes income distribution within a one mile developed in Step 8.
- ***No Vehicle Auto-Ownership Percentage:*** This data shows the percentage of households within one mile of the bike lane gaps that have no vehicles. This data is calculated from the database file that includes auto-ownership distribution within a one mile generated in Step 8.
- ***One Vehicle Auto-Ownership Percentage:*** This data shows the percentage of households within one mile of the bike lane gaps that have only one vehicle. This data is calculated from the database file that includes auto-ownership distribution

within a one mile generated in Step 8.

- ***Two Vehicles Auto-Ownership Percentage:*** This data shows the percentage of households within one mile of the bike lane gaps that have two vehicles. This data is calculated from the database file that includes auto-ownership distribution within a one mile generated in Step 8.
- ***Three Vehicles Auto-Ownership Percentage:*** This data shows the percentage of households within one mile of the bike lane gaps that have three vehicles. This data is calculated from the database file that includes auto-ownership distribution within a one mile generated in Step 8.
- ***Four+ Vehicles Auto-Ownership Percentage:*** This data shows the percentage of households within one mile of the bike lane gaps that have four or more vehicles. This data is calculated from the database file that includes auto-ownership distribution within a one mile generated in Step 8.

3- <u>Land Use Data Module</u>

Land used data includes the distribution of land uses within a one mile from the bike lane gap location. This data is calculated for each individual bike lane gap using the nine database files for each county within D5 that resulted from Step 10.

4- <u>Transit Data Module</u>

Number of transit stops within 100 feet at each individual bike lane gap is calculated using the resulted database file for transit stations generated in Step 12.

5- <u>Bike Crash Data Module</u>

Bike crash module includes the following data:

- ***Bike Crashes 5-year Total:*** Bike crash data is calculated at each bike lane gap location using the output database file that includes all recent 5-year bike crashes between June 2009 - June 2014 that were located within 25 feet from each of the bike lane gaps generated in Step 13.
- ***Bike Crashes 5-year Fatalities:*** Similar to bike crash data, bike fatalities data is calculated at each bike lane gap location using the resulted database file that includes all recent 5-year bike crashes between June 2009 - June 2014 that were located within 25 feet from each of the bike lane gaps generated in Step 13.
- ***Bike Crashes 5-year Injuries:*** Similar to bike crash data and pedestrian fatalities data, bike injuries data is calculated at each bike lane gap location using the resulted database file that includes all recent 5-year bike crashes between June 2009 - June 2014 that were located within 25 feet from each of the bike lane gaps generated in Step 13.

5.3.3 Exposure Weight Scores and Indicators

1. **Roadway Indicator**

The objective of this indicator is to provide a surrogate measure for roadway and traffic characteristics along the roadway segment that is expected to have impacts on bicyclist safety. This indicator includes several correlation factors that represent the magnitude of bicyclist activities within the corridor.

Roadway indicator includes the following parameters:

- ***Functional Classification***
- ***Traffic Direction***
- ***Median Type***
- ***Number of Lanes***
- ***Posted Speed***
- ***RT Bay***
- ***LT Bay***
- ***Accessibility***
- ***Traffic Direction***
- ***Bike lane %***
- ***SW Gaps***

Weight score was assumed for each factor value with respect to the other values based on pedestrian safety concerns as follows:

Table 34: Roadway Functional Classification Scores

Type	Weight Score
Principal Arterial - Interstate - RURAL	1
Principal Arterial - Expressway - RURAL	1
Local - RURAL	5
Minor Arterial - RURAL	5
Minor Collector - RURAL	5
Principal Arterial - Other - RURAL	5
Major Collector - RURAL	5
Minor Arterial - URBAN	8
Principal Arterial - Interstate - URBAN	5
Principal Arterial - Freeway And Expressway - URBAN	5
Local - URBAN	8
Minor Collector (Fed Aid) - URBAN	8
Principal Arterial - Other - URBAN	8
Major Collector - URBAN	8

Table 35: Number of Lanes Scores

Number of Lanes	Weight Score
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

Table 36: Posted Speed Scores

Posted Speed	Weight Score
< 20 mph	1
25 mph – 40 mph	2
45 mph – 60 mph	3
> 60 mph	4

Table 37: Percent of Bike lane Coverage Scores

Percentage Value	Weight Score
0- 10%	30
>10% - 25%	25
>25% - 50%	20
>50% - 75%	15
>75% - 90%	10
> 90%	5

Table 38: Bike Lane Gaps Scores

Existing Gap	Weight Score
Yes	50
No	0

Table 39: Number of Traffic Direction Scores

Number of Directions	Weight Score
One Way	1
Two Way	4

Table 40: Median Type Scores

Type	Weight Score
Divided Roadway	1
Undivided Roadway	4

Table 41: Average Annual Daily Traffic (AADT) Scores

Range	Weight Score
< 10,000	1
> 10,000 - 20,000	2
> 20,000 - 30,000	3
> 30,000 - 40,000	4
> 40,000 - 50,000	5
> 50,000 - 60,000	6
> 60,000 - 70,000	7
> 70,000 - 80,000	8
> 80,000 - 90,000	9
> 90,000	10

Accessibility

Accessibility weight score = Number of access points/mile

Table 42: Left Turn/Right Turn Bays Scores

Left Turn/Right Turn Bays	Weight Score
Yes	2
No	1
NA	0

Calculate Roadway Indicator:

The roadway and traffic characteristics exposure weight indicator is then calculated by adding all weight scores together resulting in a single value representing an indication of bicyclist at risk with different roadway and traffic characteristics.

2. Bicyclist Indicator

The objective of this indicator is to provide a surrogate measure for bicyclist exposure along the roadway segments. This indicator includes several correlation factors that represent the magnitude of bicyclist activities within the corridor. For example, bicyclist activities are significantly higher in urban areas than rural areas. Higher population around roadway segments with more residential housing will increase bicyclist activities. Bicyclist activities are often concentrated in specific areas that are in the vicinity of specific land uses that attract bicyclist (i.e., malls, shopping centers, parks... etc.).

Pedestrian indicator includes the following parameters:

- ***Area Type***
- ***Population***
- ***Housing***
- ***Land Use***
- ***Income***
- ***Auto-ownership***
- ***Transit***

Table 43: Area Type Scores

Area Type	Weight Score
Urban (U)	8
Transitioning (T)	4
Rural Developed (RD)	2
Rural (R)	1

Population (1 mile buffer)

Population weight score = Population/1000

Number of Housing (1mile buffer)

Housing weight score = Number of Houses/1000

Table 44: Land Use Distribution Scores

Land Use	Weight Score
Tourist	25 X Land use Percentage
Hospitals	20 X Land use Percentage
SF	20 X Land use Percentage
MF	20 X Land use Percentage
Schools and Colleges	20 X Land use Percentage
Churches	15 X Land use Percentage
High Commercial	15 X Land use Percentage
Hotels	15 X Land use Percentage
High Offices	15 X Land use Percentage
Parks	15 X Land use Percentage
Multi-use	10 X Land use Percentage
Light Offices	10 X Land use Percentage
Restaurants	10 X Land use Percentage
Service	10 X Land use Percentage
Light Social/Recreational	10 X Land use Percentage
High Social/Recreational	10 X Land use Percentage
Transportation	10 X Land use Percentage
Medium Commercial	9 X Land use Percentage
Light Commercial	8 X Land use Percentage
Government	5 X Land use Percentage
Light Industrial	3 X Land use Percentage
Medium Industrial	2 X Land use Percentage
Heavy Industrial	2 X Land use Percentage
Agriculture	1 X Land use Percentage
Other	0
Utilities	0
Vacant	0

Table 45: Household Income Scores

Income Level	Weight Score
High	1 X Percentage of Households
Medium	10 X Percentage of Households
Low	20 X Percentage of Households

Table 46: Household Auto Ownership Scores

Household Auto-ownership	Weight Score
Zero Vehicle	20 X Percentage of Households
One Vehicle	5 X Percentage of Households
Two Vehicles	3 X Percentage of Households
Three Vehicles	1 X Percentage of Households
Four or more Vehicles	1 X Percentage of Households

Transit Activity

Transit activity weight score = Number of Transit Stops X 1

Calculate Bicyclist Indicator:

The roadway bicyclist activity exposure weight indicator is then calculated by adding all weight scores together resulting in a single value representing an indication of activity at the roadway segment.

3. Safety Indicator

This indicator is the most important indicator for the bicyclist safety improvement decision making process. It includes both the crash frequency and severity.

Safety indicator includes the following parameters:

- ***Crash Frequency***
- ***Crash Severity***

Crash Frequency

Crash Frequency weight score = Number of crashes X 10

Crash Severity

Crash severity scores are shown in Table 47.

Table 47: Crash Severity Scores

Crash Severity	Weight Score
Fatality	50 X Number of Fatalities
Injuries	15 X Number of Injuries

Calculate Safety Indicator:

The crash frequency and severity weight indicator is then calculated by adding crash frequency and severity weight scores together resulting in a single value representing an indication of bicyclist safety along the roadway segment.

5.3.4 Roadway Bicyclist Safety Indicator (RBSI)

Roadway Bicyclist Safety Indicator (RBSI) is based on the three weight indicator groups which include roadway characteristics, bicyclist activity, crash frequency and severity. The RBSI is calculated for each roadway segment by assigning different weights to each group of the three indicator groups based on its level of influence on bicyclist safety as follows:

- Roadway and traffic characteristics exposure weight indicator 15% of RPSI
- Bicyclist activity exposure weight indicator 20% of RPSI
- Crash frequency and severity weight indicator 65% of RPSI

The following equation was used to calculate the Roadway Bicyclist Safety Indicator (RPSI):

RBSI = Roadway Indicator x 15% + Bicyclist Indicator x 20% + Safety Indicator x 65%

5.3.5 Prioritization Rank

The need for roadway segment safety improvement was ranked according to its RBSI threshold and categorized into five categories; urgent, high, medium, low and no safety concern as shown in Table 48. The need for urgent bike safety improvements was assigned to segments that exceed RBSI threshold value of 180. Roadways that have RBSI value more than 130 but less than 180 can be categorized as highly hazardous roadways and will need early attention for bike safety improvements. For those roadways that have RBSI values between 80 and 130, they are considered medium and might need the improvement in the near future. Roadways with RBSI between 30 and 80, they shall be monitored for future bike safety improvements. Roadway segments with RPSI less than 30 have no safety concerns.

Table 48: Prioritization Ranking Thresholds

Prioritization Rank	RPSI
Urgent	>180
High	130-180
Medium	80-130
Low	30-80
No Safety Concern	<30

5.3.6 Data Mapping

One of the useful features of the Bike Safety Prioritization Tool is the capability to generate bike lane gaps map that can be viewed in Google Earth ®. The generated map is color-coded based on the prioritization ranks where red, purple, orange, yellow, and green colors indicate urgent, high, medium, low, and no safety concerns priorities, respectively as shown in Figure 75.

The tool reads the bike lane gaps coordinates from the .kml file that was generated in Step 15 and then assign for each bike lane gap in the "BKL Gaps" worksheet its associated coordinates. Finally the tool generates a kml file that can be saved and viewed as a layer in Google earth.

The tool also has the capability of viewing specific data associated with each individual bike lane as shown in Figure 76. The user can specify the data to be viewed by changing the column header from "YES" as to be viewed in the map to "NO" as to be hidden. Similarly, if the user needs to map only specific bike lane gaps represented by a row in the "BKL GAPS" worksheet; he/her can select "YES" in the first cell for mapping the bike lane gap or "NO" for not including the gap in the map.

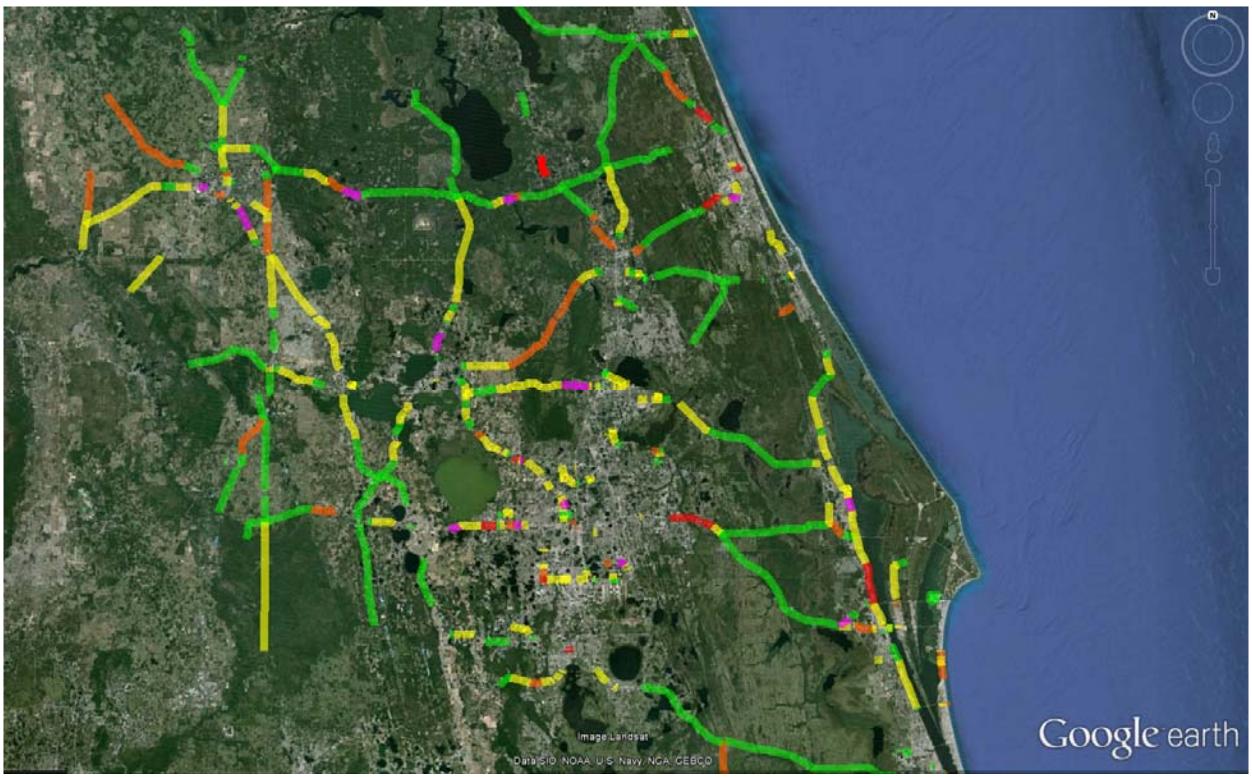


Figure 75: Color-Coded Bike Lane Gap Prioritization Map

Mapped Columns >	NO	NO	YES	NO	NO	NO	NO	NO	YES
Mapped Rows V	**Coordinates**	**COUNTY**	**SECTION**	**GAP BMP**	**GAP EMP**	**STATE RD**	**PRIORITY**	**GAP TYPE**	**COMMENTS**
YES	13755,0 -80.82495	BREVARD	70001000.000000	0.000000	4.410000	SR 405	1.000000	SIDEWALK	Schools in area
YES	0108056494,28.52	BREVARD	70001000.000000	0.000000	4.410000	SR 405	1.000000	SIDEWALK	Schools in area
YES	6958827,28.52767	BREVARD	70001000.000000	0.000000	4.410000	SR 405	1.000000	SIDEWALK	Schools in area
YES	01264905,28.21268	BREVARD	70008000.000000	4.960000	5.250000	SR 513	1.000000	SIDEWALK	Schools in area
YES	014633,0 -80.4926	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	554,0 -80.5573651	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	55,0 -80.56788166	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	77,0 -80.5768063	BREVARD	70010000.000000	0.000000	13.650000	SR 5	2.000000	SIDEWALK	Rural, some areas have ped incidents per D5 data
YES	2757109,28.39023	BREVARD	70011000.000000	2.240000	2.620000	SR 501	1.000000	SIDEWALK	On County Priority List. Instances of pedestrians and baby strollers in road traveling to Wal-Mart; some property
YES	47413631,0 -80.755	BREVARD	70011000.000000	2.240000	2.620000	SR 501	1.000000	SIDEWALK	On County Priority List. Instances of pedestrians and baby strollers in road traveling to Wal-Mart; some property
YES	74427273,0 -80.74	BREVARD	70014000.000000	0.000000	0.570000	SR 519	1.000000	SIDEWALK	On County Priority List, history of ped incidents per D5 data
YES	098589,0 -80.7428	BREVARD	70014000.000000	0.000000	0.570000	SR 519	1.000000	SIDEWALK	On County Priority List, history of ped incidents per D5 data

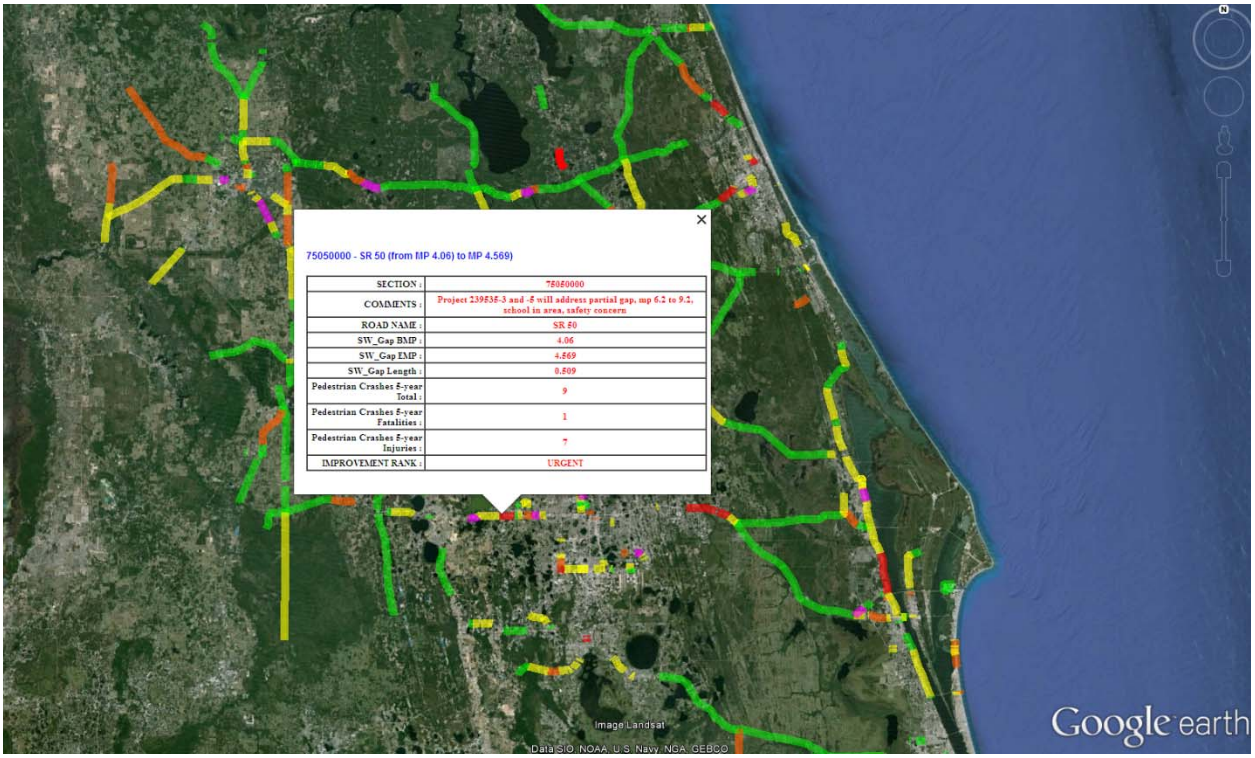


Figure 76: Data Associated with Each Prioritized Bike Lane Gap

5.4 BIKE LANE GAPS SPT HANDS-ON INSTRUCTIONS

- Open FDOT D5 BKLGAPS.xlsm
- Make sure to enable macros
- Welcome screen will pop up as shown below
- Click anywhere to hide welcome screen

Figure 77: Bike Lane Gaps Safety Prioritization Tool Welcome Screen

- Click on Add-Ins Menu Bar

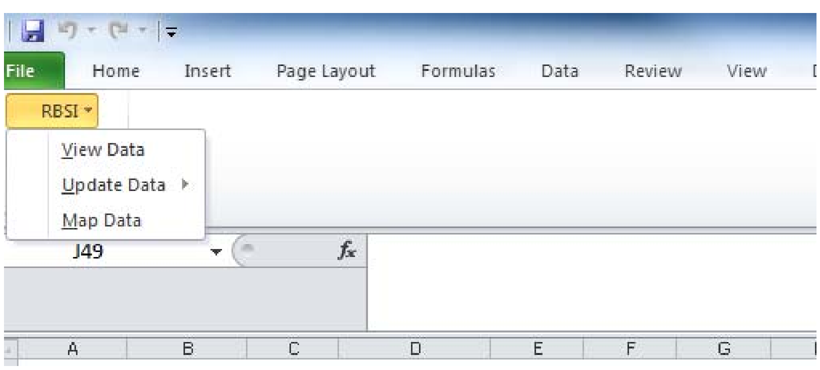


Figure 78: Add-Ins Menu Bar

- Click on RBSI Menu

5.4.1 Viewing Data

- Select View Data and Bike lane Gap Safety Prioritization Data Screen will pop up.

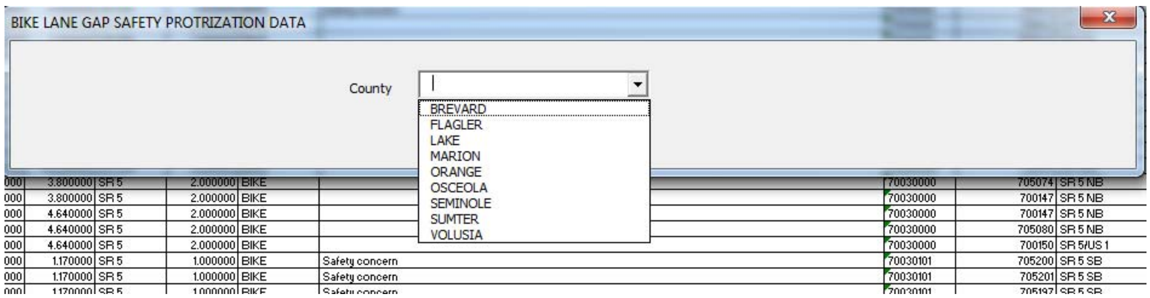


Figure 79: County Name Pull Down Menu

- Select county name from the pull down menu. After selection the county name a new roadway section pull down menu will appear.

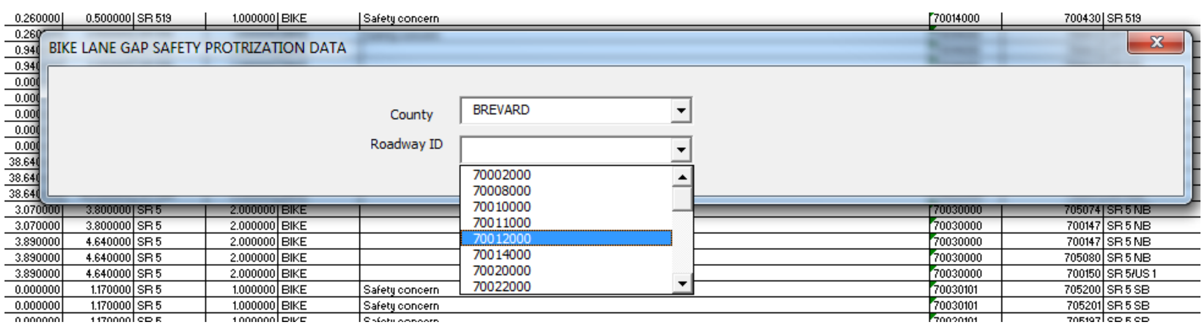
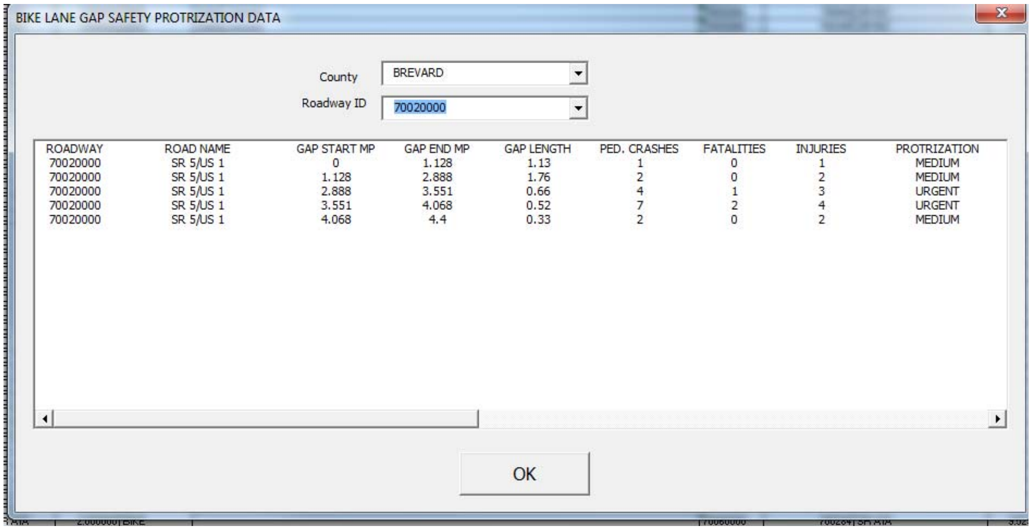


Figure 80: Roadway ID Pull Down Menu

- Select the roadway section that you need to list its information



ROADWAY	ROAD NAME	GAP START MP	GAP END MP	GAP LENGTH	PED. CRASHES	FATALITIES	INJURIES	PROTRIZATION
70020000	SR 5/US 1	0	1.128	1.13	1	0	1	MEDIUM
70020000	SR 5/US 1	1.128	2.888	1.76	2	0	2	MEDIUM
70020000	SR 5/US 1	2.888	3.551	0.66	4	1	3	URGENT
70020000	SR 5/US 1	3.551	4.068	0.52	7	2	4	URGENT
70020000	SR 5/US 1	4.068	4.4	0.33	2	0	2	MEDIUM

Figure 81: Roadway Segment Menu

- You can view the information for each segment of the roadway section. The information include Roadway ID, Road name, Starting and ending mile posts of bike lane gaps, gap length, number of crashes, number of fatalities, number of injuries, prioritization, and comments provided in the FDOT D5 Gap layer.

- You can select a new county from the pull down menu or selecting a new roadway segment from the roadway pull down menu. If you are done viewing the data press OK and view data screen will disappear.

5.4.2 Updating Data

- Select Update Data under RPSI menu. You will have two options to select either "Update input Data Files" or "Update Scoring"

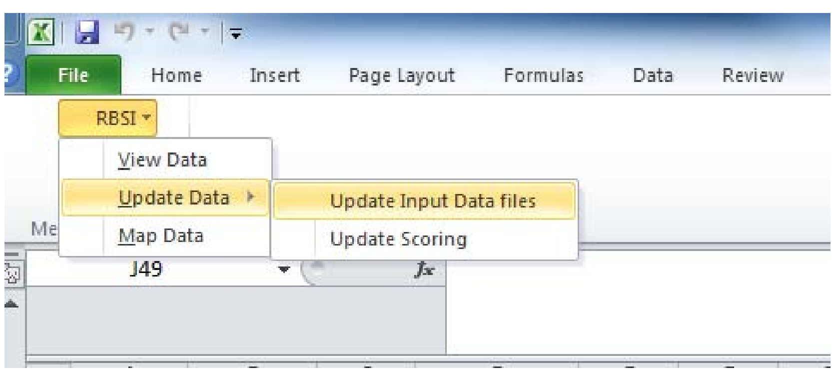


Figure 82: Update Data Menu

- By selecting "Update input Data Files the "Update Input Data Files" Screen will pop up

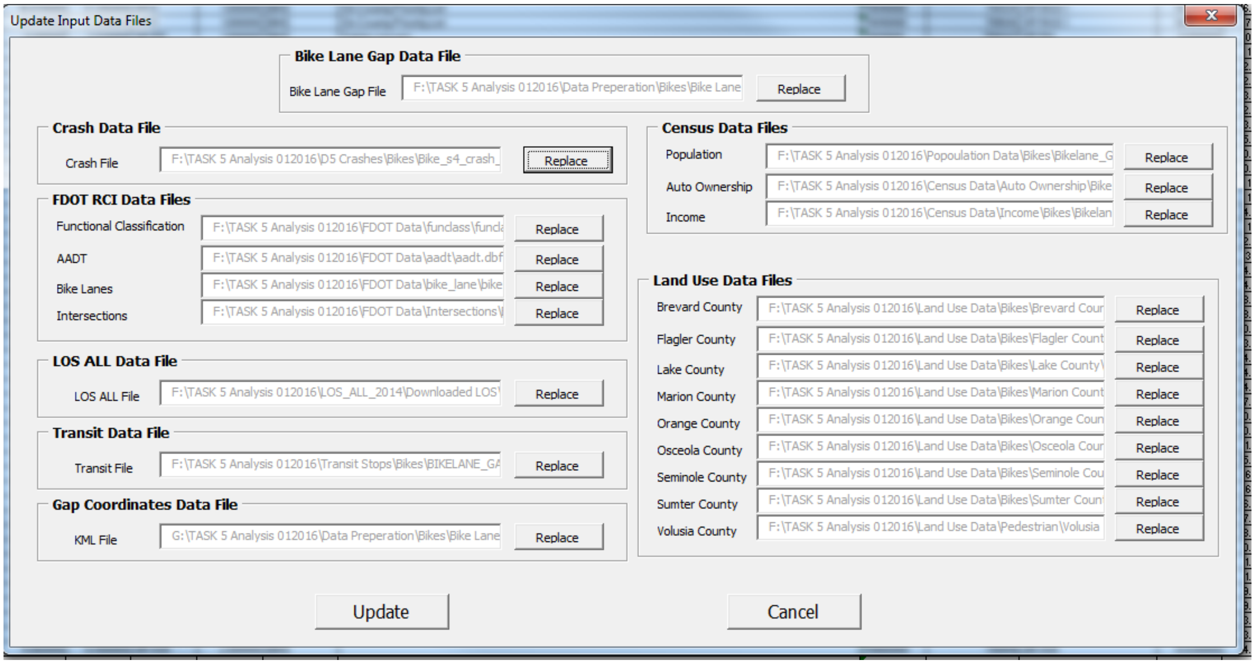


Figure 83: Input Data Window

- This screen includes all default links to the input files that are used in the FDOT District Five Bike lane Gaps Safety Prioritization Tool. If you need to update any of these data with a new file, select replace and an open file dialog will open to select the new file.

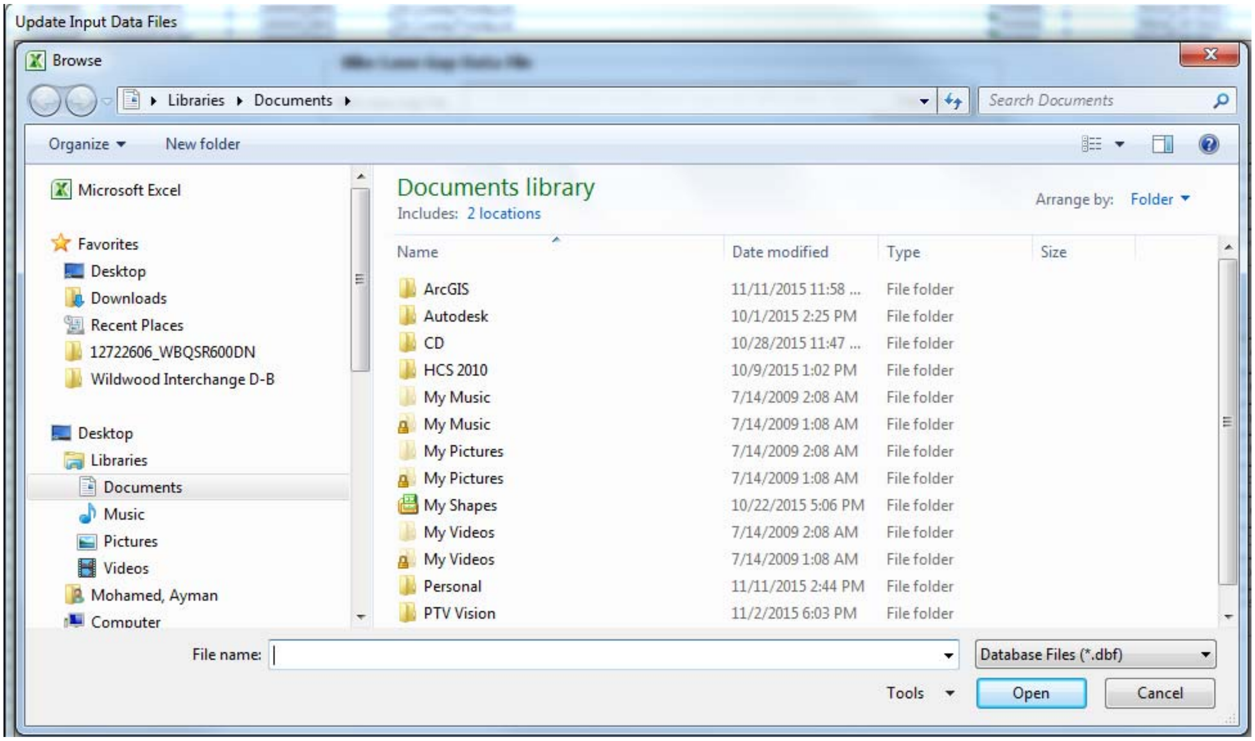


Figure 84: Open Data File Window

- Click on "Update" button and all data associated with the new files will be updated.

<u>**NOTE:**</u> **IF YOU UPDATE THE BIKE LANE GAPS FILE, YOU WILL NEED TO UPDATE ALL INPUT DATA FILES TO NEW FILES.**

- By selecting "Update Scoring" from "Update Data" menu bar, the Scoring window will popup.
- The Scoring window includes four tabs. Each tab includes the default weight scoring value for each data category as shown in the following four figures. To edit these values select edit button at each tab.

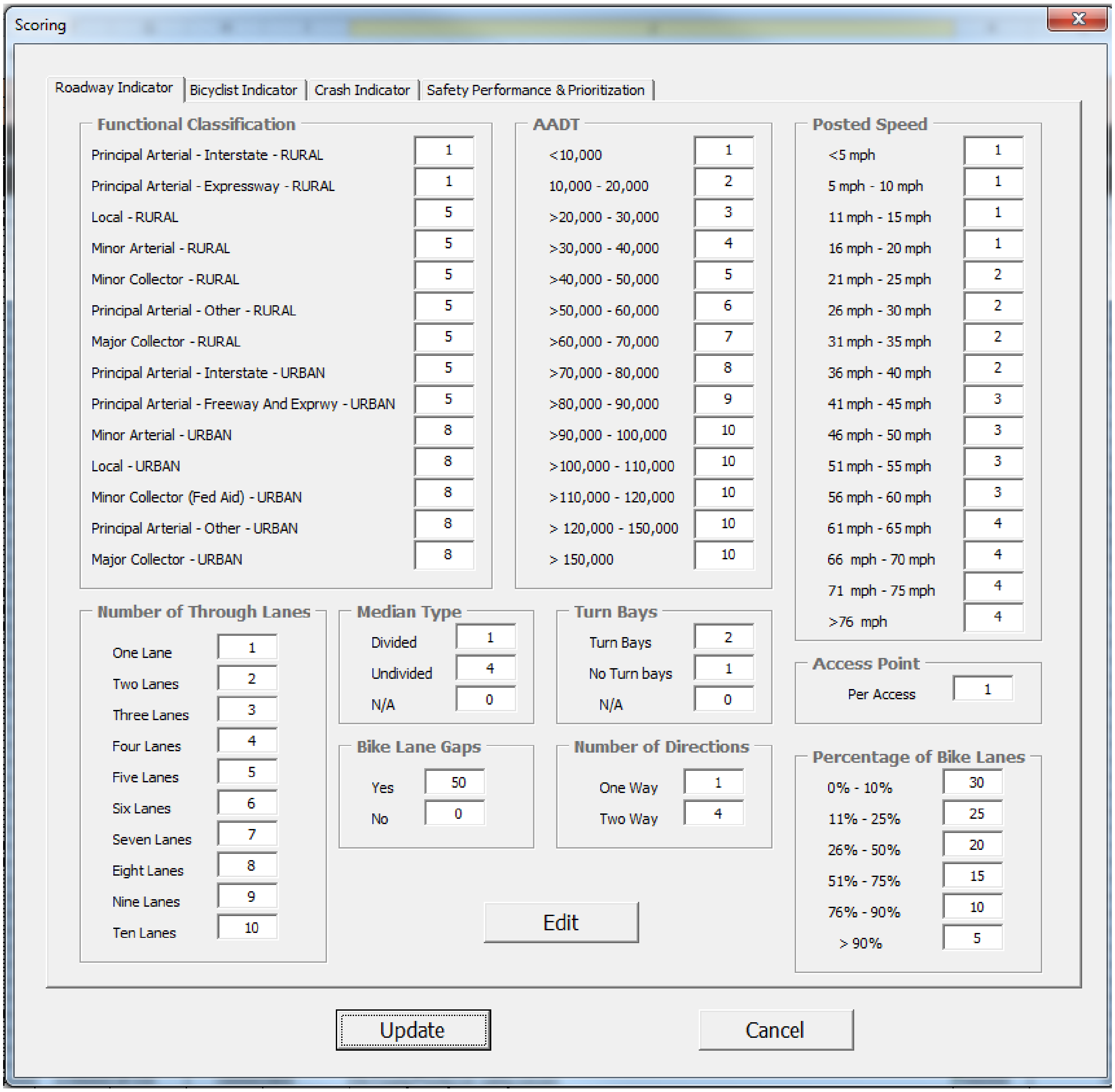


Figure 85: Scoring Window – Roadway Indicator Tab

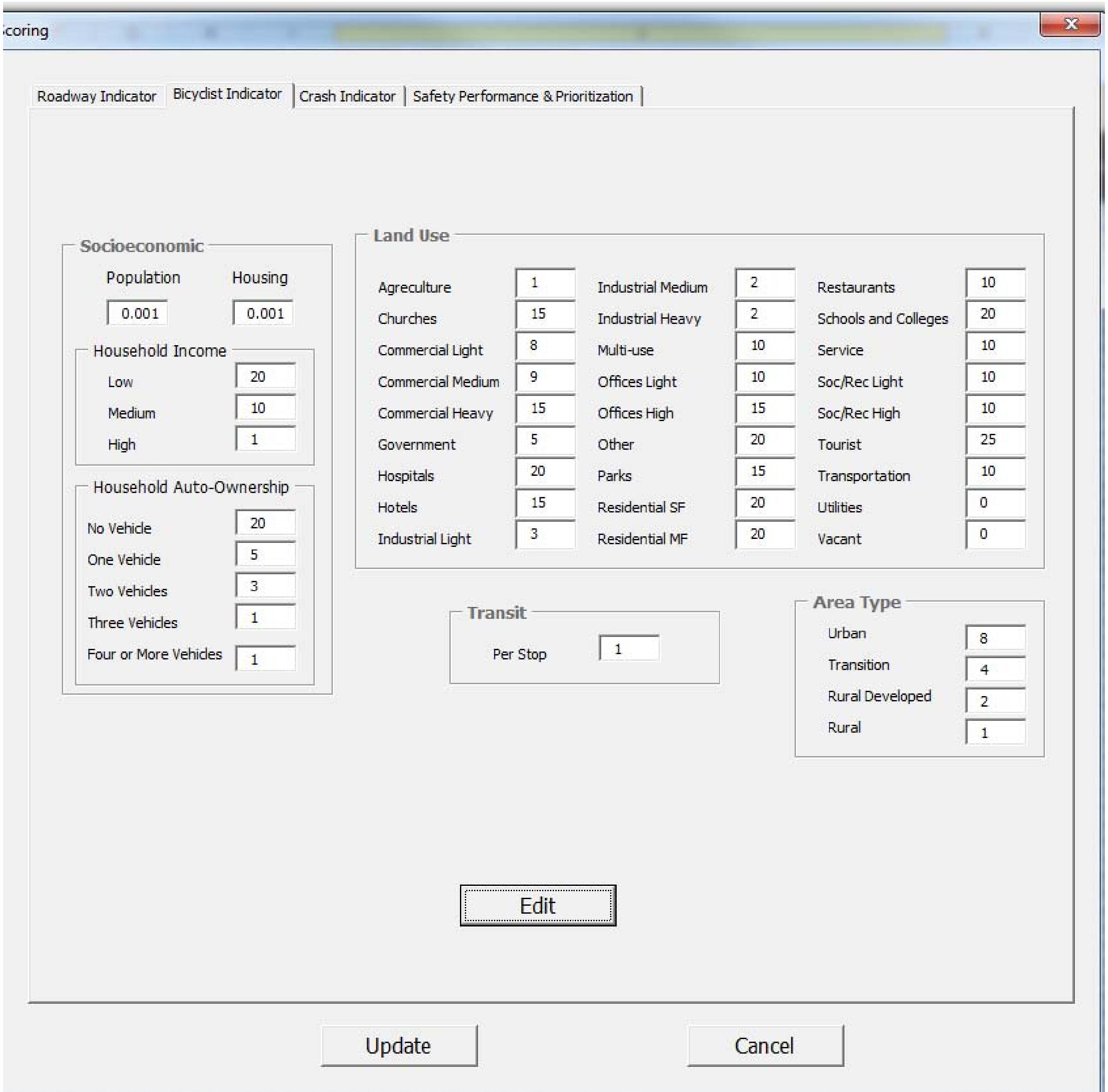


Figure 86: Scoring Window – Bicyclist Indicator Tab

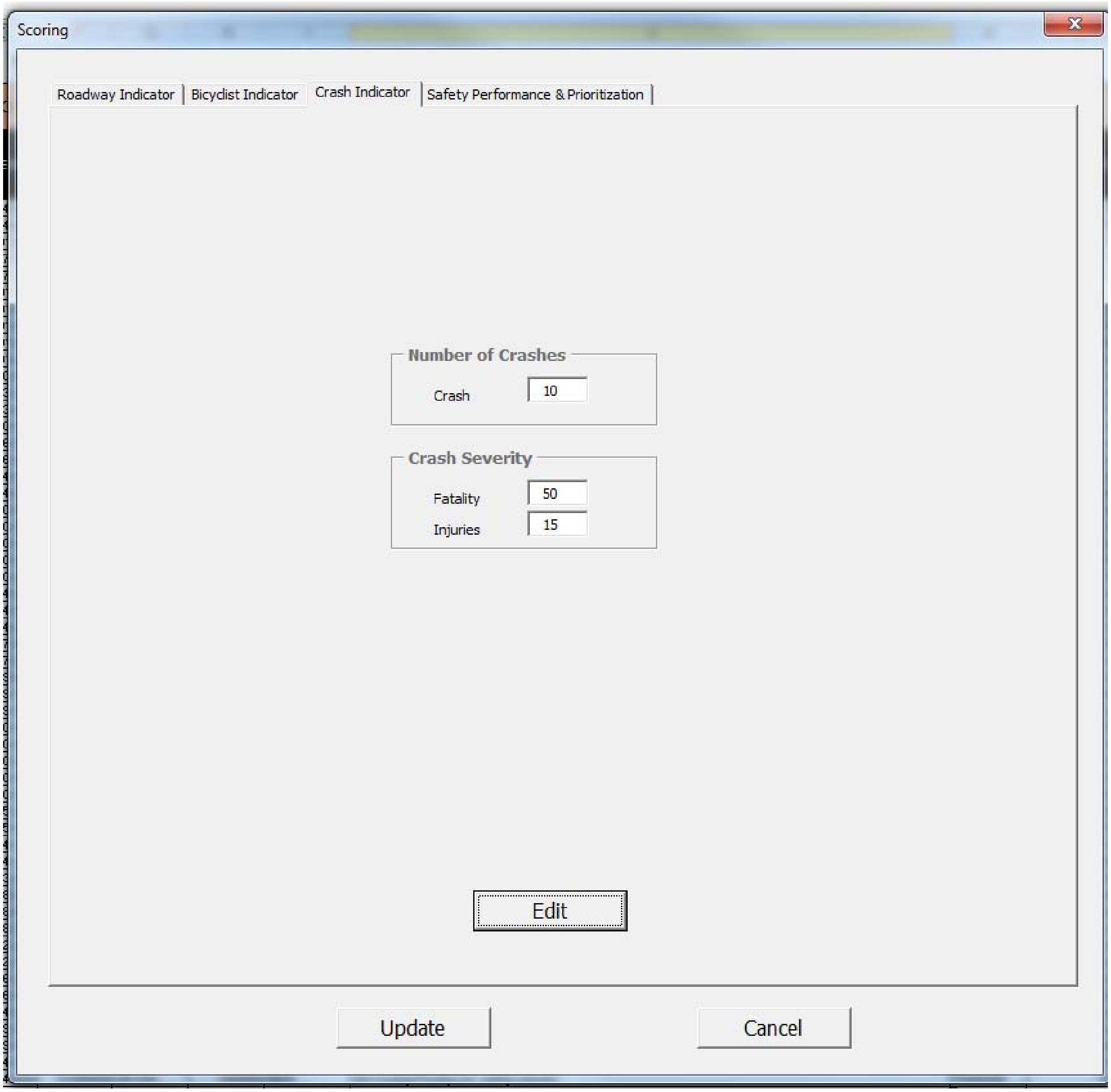


Figure 87: Scoring Window – Crash Indicator Tab

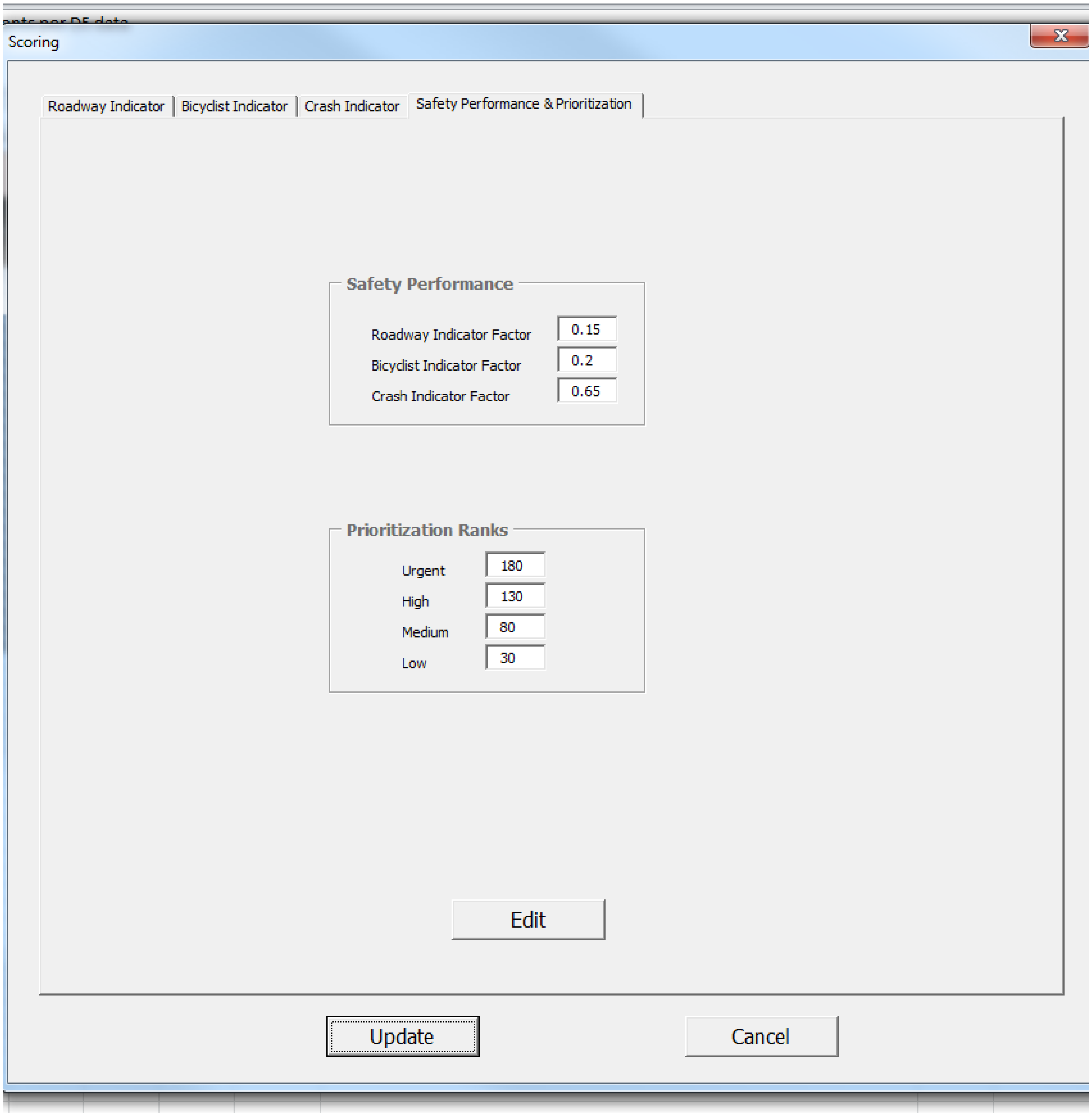


Figure 88: Scoring Window – Safety Performance & Prioritization Tab

5.4.3 Map Data

- Select "Map Data" under "RBSI" pull down menu. This selection will open a save dialog box to save a google earth .kml file to be viewed in google earth.
- Open Google Earth then open the saved file.
- The bike lane gaps layer will be shown with different color representing prioritization level as follows:

Table 49: Prioritization Ranking Levels

Color	Prioritization Level
Red	URGENT
Purple	HIGH
Orange	MEDIUM
Yellow	LOW
Green	NO SAFETY CONCERNS

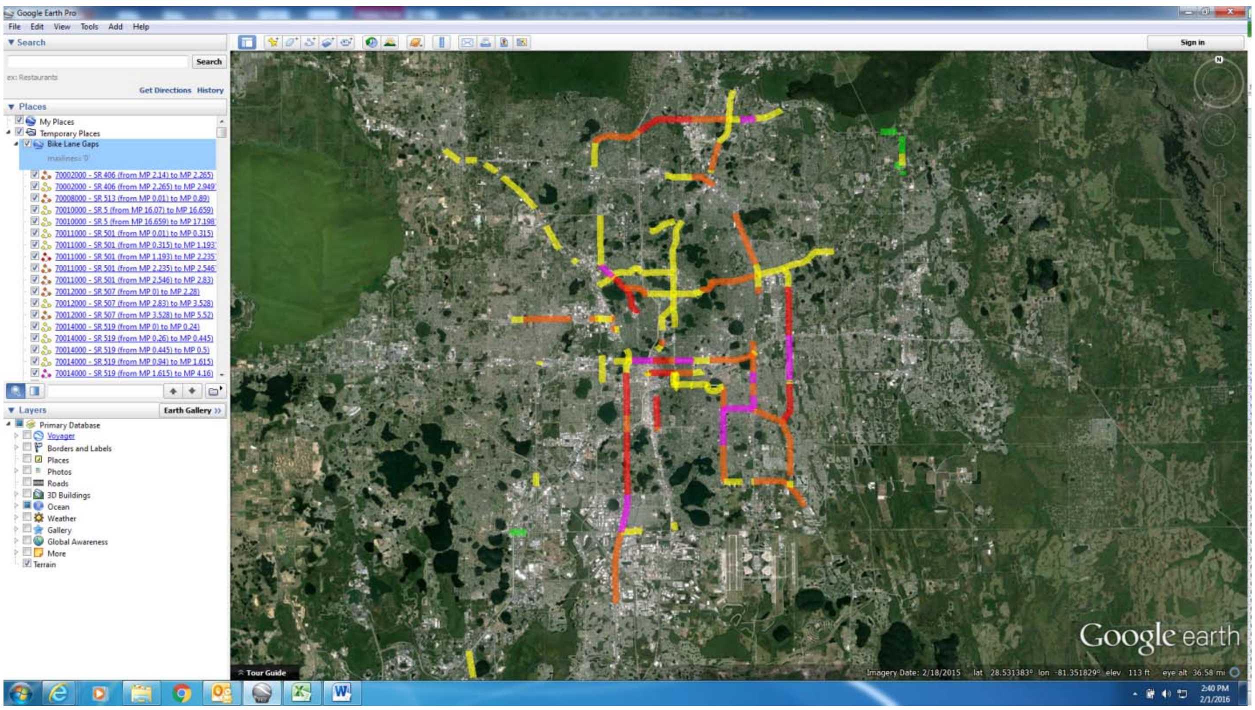


Figure 89: Map View of Prioritization Levels

- Click on any of the links and link information window will popup.

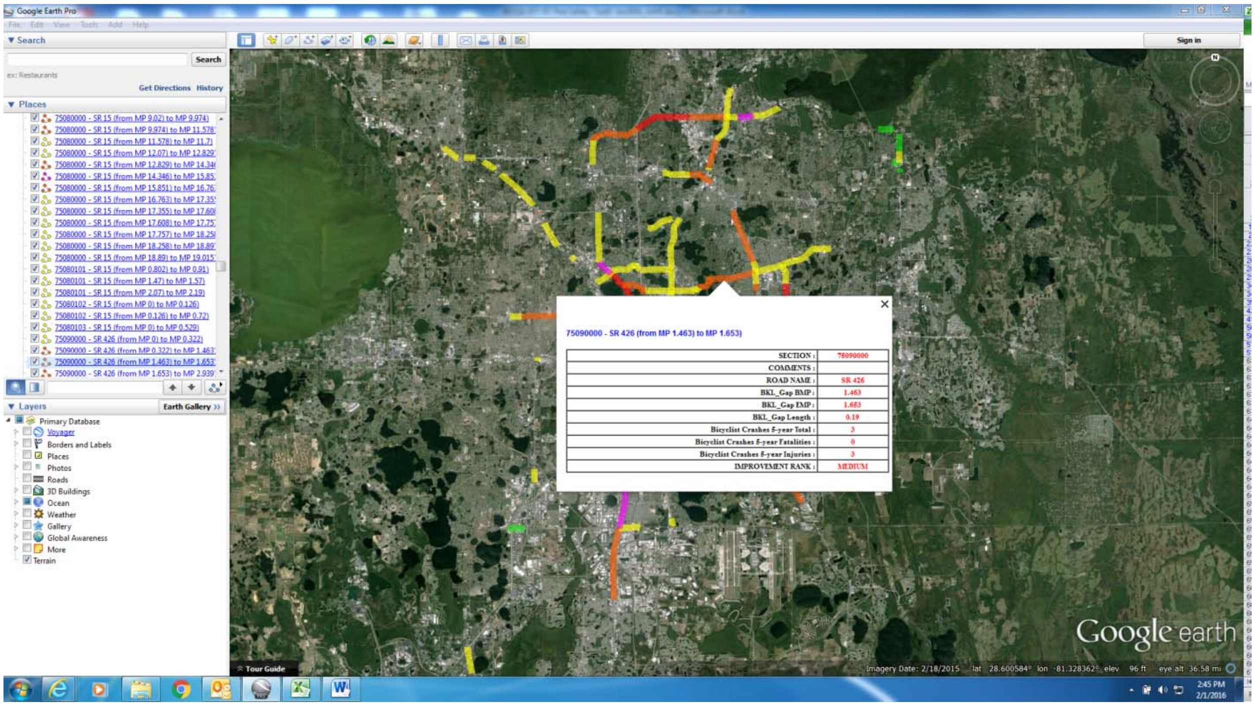


Figure 90: Map View of Prioritization Levels with Selection Window

5.4.4 BKL GAPS Worksheet

BKL GAPS Worksheet includes all bike lane gaps and associated data. The following table shows the worksheet data headers and sources associated with each column. All scoring data are calculated based on the methodology described earlier.

CAUTION: DO NOT CHANGE COLUMN HEADERS AND/OR WORKSHEET NAMES.

Data Group	Column Header	Source
Roadway Configuration and Traffic Data	COUNTY	FDOT GAPS GIS Layer
	SECTION	
	GAP BMP	
	GAP EMP	
	STATE RD	
	PRIORITY	
	GAP TYPE	
	COMMENTS	
	ROADWAY	FDOT D5 LOS_ALL tool
	STATION	
	ROAD NAME	
	BMP	
	EMP	
	BKL_Gap BMP	Calculated
	BKL_Gap EMP	
	BKL_Gap Length	
	Segment Length	
	Functional Class	FDOT Functional Class GIS Layer
	1-Way or 2-Way	FDOT D5 LOS_ALL tool
	Divided	
	No. of Through Lanes	
	Posted Speed	
	AADT	FDOT AADT GIS Layer
	Left-Turn Bays	FDOT D5 LOS_ALL tool
	Right-Turn Bays	
	No. of Access Points	FDOT Intersection GIS Layer
	Left Bike Lane (%)	FDOT Bike_Lane GIS Layer
	Right Bike Lane (%)	
	Area Type	FDOT D5 LOS_ALL tool
Transit Data	No. of Transit Stops	Transit Layer
Socioeconomic Data	Population	TIGER/Line Shapefile, 2010, 2010 Census Block with Housing and
	Housing	
	Household Size	Calculated
	Low Income (%)	American Community Survey (ACS)
	Medium Income (%)	
	High Income (%)	
	No Vehicle	
	One Vehicle	
	Two Vehicles	
	Three Vehicles	
	Four+ Vehicles	
Land Use Data	Agreculture	FLORIDA PARCEL DATA STATEWIDE - 2014 By Florida Department of Revenue
	Churches	
	Comm. Light	
	Comm. Medium	
	Comm. Heavy	
	Government	
	Hospitals	
	Hotels	
	Ind. Light	
	Ind. Medium	
	Ind. Heavy	
	Multi-use	
	Offices Light	
	Offices High	
	Other	
	Parks	
	SF	
	MF	
	Resturants	
	Schools and Colleges	
	Service	
	Soc/REC Light	
	Soc/REC High	
	Tourist	
	Transportation	
	Utilities	
	Vacant	
Roadway Crash Data	Bicyclist Crashes 5-year Total	Signal Four Analytics GIS Layer
	Bicyclist Crashes 5-year Fatalities	
	Bicyclist Crashes 5-year Injuries	

Figure 91: Input Data and Sources

- Selecting specific roadway segment(s) and specific information to be mapped. You can select "YES" in the second row above the heading to show this data associated with each link in the google earth map, you can select "NO" to hide this data. Similarly you can also select "YES" in the first column to show this link or "NO" to hide it.

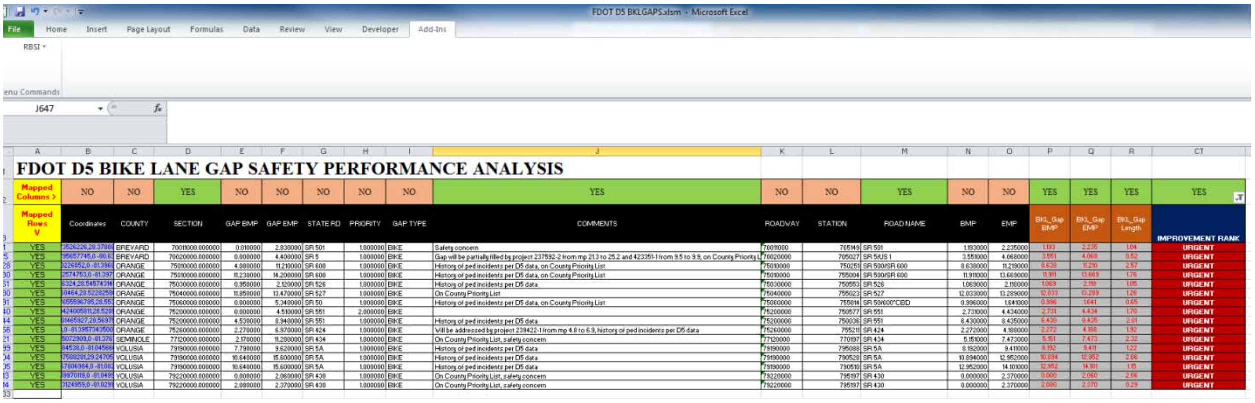
FDOT D5 BIKE LANE GAP SAFETY PERFORMANCE ANALYSIS

Mapped Columns >	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	Y
Mapped Rows V	Coordinates	COUNTY	SECTION	GAP BMP	GAP EMP	STATE RD	PRIORITY	GAP TYPE	COMMENTS	ROADWAY	STATION	ROAD
YES	9620873,0 -80.8199	BREVARD	70002000.000000	2.140000	2.950000	SR 406	2.000000	BIKE		70002000	705146	SR 406
YES	5594872,0 -80.8099	BREVARD	70002000.000000	2.140000	2.950000	SR 406	2.000000	BIKE		70002000	705098	SR 406
YES	67220156,28.14853	BREVARD	70008000.000000	0.010000	0.890000	SR 513	2.000000	BIKE		70008000	705178	SR 513
YES	569624,0 -80.59831	BREVARD	70010000.000000	16.070000	17.250000	SR 5	1.000000	BIKE	On County Priority List	70010000	700124	SR 5/US 1
YES	028472647,28.0771	BREVARD	70010000.000000	16.070000	17.250000	SR 5	1.000000	BIKE	On County Priority List	70010000	705018	SR 5/US 1
YES	1683518,28.35765	BREVARD	70011000.000000	0.010000	2.830000	SR 501	1.000000	BIKE	Safety concern	70011000	700327	SR 501
YES	38616986,28.3614	BREVARD	70011000.000000	0.010000	2.830000	SR 501	1.000000	BIKE	Safety concern	70011000	700378	SR 501
YES	3526226,28.37888	BREVARD	70011000.000000	0.010000	2.830000	SR 501	1.000000	BIKE	Safety concern	70011000	705149	SR 501
YES	2757109,28.39023	BREVARD	70011000.000000	0.010000	2.830000	SR 501	1.000000	BIKE	Safety concern	70011000	705206	SR 501
YES	4407316,0 -80.755	BREVARD	70011000.000000	0.010000	2.830000	SR 501	1.000000	BIKE	Safety concern	70011000	700358	SR 501
YES	2217004772347,28	BREVARD	70012000.000000	0.000000	2.280000	SR 507	1.000000	BIKE	Safety concern	70012000	700410	SR 507
YES	78626713,28.04215	BREVARD	70012000.000000	2.830000	5.520000	SR 507	1.000000	BIKE	Safety concern	70012000	700345	SR 507
YES	401694271,0 -80.62	BREVARD	70012000.000000	2.830000	5.520000	SR 507	1.000000	BIKE	Safety concern	70012000	705131	SR 507
YES	054053,0 -80.74281	BREVARD	70014000.000000	0.000000	0.240000	SR 519	1.000000	BIKE	Safety concern	70014000	700430	SR 519
YES	56303022,0 -80.742	BREVARD	70014000.000000	0.260000	0.500000	SR 519	1.000000	BIKE	Safety concern	70014000	700430	SR 519
YES	98051704,28.29600	BREVARD	70014000.000000	0.260000	0.500000	SR 519	1.000000	BIKE	Safety concern	70014000	700431	SR 519
YES	5843038,0 -80.742	BREVARD	70014000.000000	0.940000	4.160000	SR 519	2.000000	BIKE		70014000	700431	SR 519
YES	841702844,28.3301	BREVARD	70014000.000000	0.940000	4.160000	SR 519	2.000000	BIKE		70014000	700432	SR 519
YES	5518,28.084000403	BREVARD	70020000.000000	0.000000	4.400000	SR 5	1.000000	BIKE	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2 and 423351-1 from 9.5 to 9.9, on County Priority L	70020000	700249	SR 5/US 1
YES	5891309,28.1140513	BREVARD	70020000.000000	0.000000	4.400000	SR 5	1.000000	BIKE	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2 and 423351-1 from 9.5 to 9.9, on County Priority L	70020000	700321	SR 5/US 1
YES	3131336,28.1192222	BREVARD	70020000.000000	0.000000	4.400000	SR 5	1.000000	BIKE	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2 and 423351-1 from 9.5 to 9.9, on County Priority L	70020000	705026	SR 5/US 1
YES	95657745,0 -80.63	BREVARD	70020000.000000	0.000000	4.400000	SR 5	1.000000	BIKE	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2 and 423351-1 from 9.5 to 9.9, on County Priority L	70020000	705027	SR 5/US 1
YES	5360698,0 -80.630	BREVARD	70020000.000000	0.000000	4.400000	SR 5	1.000000	BIKE	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2 and 423351-1 from 9.5 to 9.9, on County Priority L	70020000	705126	SR 5/US 1
YES	45949576,28.0944	BREVARD	70022000.000000	38.640000	40.000000	SR 508	2.000000	BIKE		70022000	700417	SR 508
YES	30871,0 -80.62774	BREVARD	70022000.000000	38.640000	40.000000	SR 508	2.000000	BIKE		70022000	700417	SR 508
YES	2178,0 -80.6160085	BREVARD	70022000.000000	38.640000	40.000000	SR 508	2.000000	BIKE		70022000	700417	SR 508
YES	2256723,0 -80.8076	BREVARD	70030000.000000	3.070000	3.800000	SR 5	2.000000	BIKE		70030000	705074	SR 5 NB
YES	72883,0 -80.80760	BREVARD	70030000.000000	3.070000	3.800000	SR 5	2.000000	BIKE		70030000	700147	SR 5 NB
YES	57465712,28.61538	BREVARD	70030000.000000	3.890000	4.640000	SR 5	2.000000	BIKE		70030000	700147	SR 5 NB
YES	96682,0 -80.80821	BREVARD	70030000.000000	3.890000	4.640000	SR 5	2.000000	BIKE		70030000	705080	SR 5 NB
YES	85118949,28.619453	BREVARD	70030000.000000	3.890000	4.640000	SR 5	2.000000	BIKE		70030000	700150	SR 5/US 1
YES	787914,0 -80.80786	BREVARD	70030101.000000	0.000000	1.170000	SR 5	1.000000	BIKE	Safety concern	70030101	705200	SR 5 SB
YES	79769168,28.61355	BREVARD	70030101.000000	0.000000	1.170000	SR 5	1.000000	BIKE	Safety concern	70030101	705201	SR 5 SB
YES	395457,28.606312	BREVARD	70030101.000000	0.000000	1.170000	SR 5	1.000000	BIKE	Safety concern	70030101	705197	SR 5 SB
YES	2064163,28.079445	BREVARD	70050000.000000	15.300000	15.620000	SR 500	2.000000	BIKE		70050000	705104	SR 500/US 19
YES	0077127,0 -80.6129	BREVARD	70050000.000000	15.300000	15.620000	SR 500	2.000000	BIKE		70050000	705205	SR 500/US 19
YES	815275361,28.0793	BREVARD	70050000.000000	15.950000	16.210000	SR 500	1.000000	BIKE	On County Priority List	70050000	705205	SR 500/US 19
YES	293436,0 -80.6020	BREVARD	70050000.000000	15.950000	16.210000	SR 500	1.000000	BIKE	On County Priority List	70050000	705195	SR 500/US 19
YES	298274856,28.089	BREVARD	70050000.000000	17.940000	18.480000	SR 500	2.000000	BIKE		70050000	701004	SR 500/US 19
YES	918941371,28.09144	BREVARD	70050000.000000	17.940000	18.480000	SR 500	2.000000	BIKE		70050000	705099	SR 500/US 19
YES	998633,0 -80.6005	BREVARD	70050001.000000	0.130000	0.220000	SR 500	2.000000	BIKE		70050001	705014	SR 500/US 19
YES	487949387,27.874	BREVARD	70060000.000000	0.280000	4.570000	SR A1A	2.000000	BIKE		70060000	880291	SR A1A
YES	71281319,0 -80.4590	BREVARD	70060000.000000	0.280000	4.570000	SR A1A	2.000000	BIKE		70060000	880291	SR A1A
YES	8661243,0 -80.476	BREVARD	70060000.000000	0.280000	4.570000	SR A1A	2.000000	BIKE		70060000	700325	SR A1A
YES	-80.508807460354	BREVARD	70060000.000000	4.720000	11.590000	SR A1A	2.000000	BIKE		70060000	700325	SR A1A
YES	23109838,0 -80.52	BREVARD	70060000.000000	4.720000	11.590000	SR A1A	2.000000	BIKE		70060000	700284	SR A1A
YES	395896,0 -80.5372	BREVARD	70060000.000000	11.860000	13.500000	SR A1A	2.000000	BIKE		70060000	700284	SR A1A
YES	3079008,0 -80.543	BREVARD	70060000.000000	11.860000	13.500000	SR A1A	2.000000	BIKE		70060000	700414	SR A1A
YES	4716633,28.041303	BREVARD	70060000.000000	13.640000	14.160000	SR A1A	2.000000	BIKE		70060000	700414	SR A1A
YES	19389818,28.09152	BREVARD	70060000.000000	17.390000	17.540000	SR A1A	1.000000	BIKE	Safety concern	70060000	700228	SR A1A
YES	2217091,0 -80.5667	BREVARD	70060000.000000	17.390000	17.540000	SR A1A	1.000000	BIKE	Safety concern	70060000	700022	SR A1A
YES	9068255,0 -80.6089	BREVARD	70060000.000000	33.340000	33.590000	SR A1A	1.000000	BIKE	On County Priority List, safety concern	70060000	700218	SR A1A NB
YES	806269,0 -80.6089	BREVARD	70060000.000000	33.340000	33.590000	SR A1A	1.000000	BIKE	On County Priority List, safety concern	70060000	705118	SR A1A NB
YES	32862539,28.3565	BREVARD	70060000.000000	35.840000	36.150000	SR A1A	1.000000	BIKE	On County Priority List, safety concern	70060000	705154	SR A1A

BKL GAPS

Figure 92: Excel Table View of Bike Lane Gap Safety Performance Tool

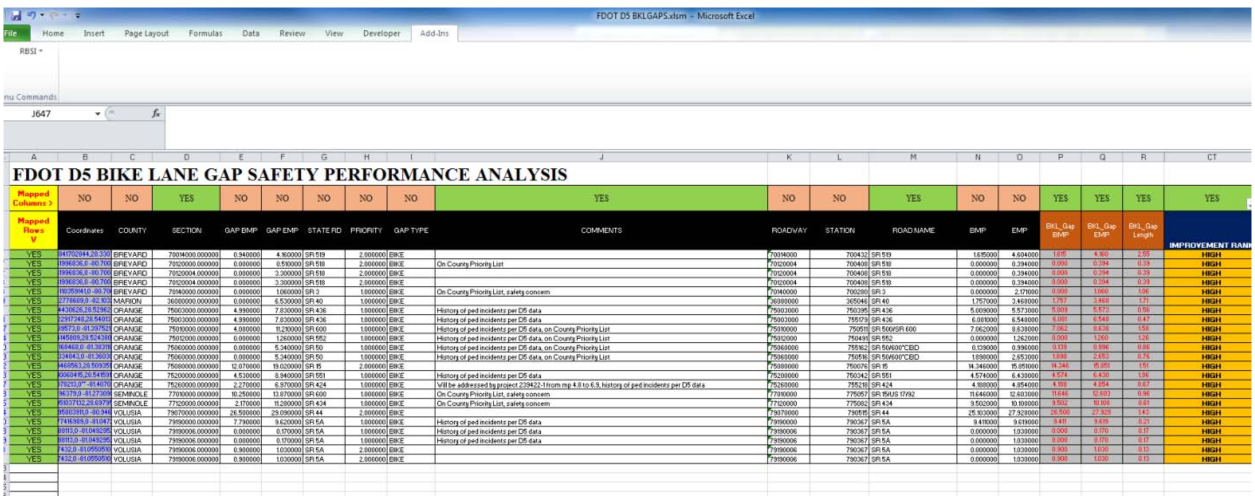
- Filter data based on Prioritization level



FDOT D5 BIKE LANE GAP SAFETY PERFORMANCE ANALYSIS

Mapped Columns >	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	YES	YES	YES	YES
Mapped Rows V	**Coordinates**	**COUNTY**	**SECTION**	**GAP BMP**	**GAP EMP**	**STATE RD**	**PRIORITY**	**GAP TYPE**	**COMMENTS**	**ROADWAY**	**STATION**	**ROAD NAME**	**BMP**	**EMP**	**BKL_Gap BMP**	**BKL_Gap EMP**	**BKL_Gap Length**	**IMPROVEMENT RANK**
YES	75262226,28.37989	BREVARD	70011000.000000	0.010000	2.830000	SR 501	1.000000	BIKE	Safety concern	70011000	705149	SR 501	1.193000	2.235000	1.193	2.235	1.04	URGENT
YES	95657745,0-80.6	BREVARD	70020000.000000	0.000000	4.400000	SR 5	1.000000	BIKE	Gap will be partially filled by project 237592-2 from mp 21.3 to 25.2 and 423351-1 from 9.5 to 9.9, on County Priority L	70020000	705027	SR 5/US 1	3.551000	4.068000	3.551	4.068	0.52	URGENT
YES	3226852,0-81.398	ORANGE	75010000.000000	4.000000	11.210000	SR 600	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75010000	750251	SR 500/SR 600	8.638000	11.219000	8.638	11.210	2.57	URGENT
YES	2574753,0-81.397	ORANGE	75010000.000000	11.230000	14.200000	SR 600	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75010000	755004	SR 500/SR 600	11.911000	13.669000	11.911	13.669	1.76	URGENT
YES	6324,28.54574391	ORANGE	75030000.000000	0.950000	2.120000	SR 526	1.000000	BIKE	History of ped incidents per D5 data	75030000	750553	SR 526	1.069000	2.118000	1.069	2.118	1.05	URGENT
YES	30464,28.5228258	ORANGE	75040000.000000	11.850000	13.470000	SR 527	1.000000	BIKE	On County Priority List	75040000	755023	SR 527	12.033000	13.289000	12.033	13.289	1.26	URGENT
YES	55596795,28.55	ORANGE	75060000.000000	0.000000	5.340000	SR 50	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75060000	755014	SR 50/600"CBD	0.996000	1.641000	0.996	1.641	0.65	URGENT
YES	42400581,28.528	ORANGE	75200000.000000	0.000000	4.510000	SR 551	2.000000	BIKE		75200000	750577	SR 551	2.731000	4.434000	2.731	4.434	1.70	URGENT
YES	30465627,28.5897	ORANGE	75200000.000000	4.530000	8.940000	SR 551	1.000000	BIKE	History of ped incidents per D5 data	75200000	750036	SR 551	6.430000	8.435000	6.430	8.435	2.01	URGENT
YES	1,0-81.3957343500	ORANGE	75260000.000000	2.270000	6.970000	SR 424	1.000000	BIKE	Will be addressed by project 239422-1 from mp 4.8 to 6.9, history of ped incidents per D5 data	75260000	755211	SR 424	2.272000	4.188000	2.272	4.188	1.92	URGENT
YES	5072909,0-81.376	SEMINOLE	77120000.000000	2.170000	11.280000	SR 434	1.000000	BIKE	On County Priority List, safety concern	77120000	770197	SR 434	5.151000	7.473000	5.151	7.473	2.32	URGENT
YES	84536,0-81.04569	VOLUSIA	79190000.000000	7.790000	9.620000	SR 5A	1.000000	BIKE	History of ped incidents per D5 data	79190000	795088	SR 5A	8.192000	9.411000	8.192	9.411	1.22	URGENT
YES	75880201,29.24705	VOLUSIA	79190000.000000	10.640000	15.600000	SR 5A	1.000000	BIKE	History of ped incidents per D5 data	79190000	790528	SR 5A	10.894000	12.952000	10.894	12.952	2.06	URGENT
YES	17006964,0-81.08	VOLUSIA	79190000.000000	10.640000	15.600000	SR 5A	1.000000	BIKE	History of ped incidents per D5 data	79190000	790510	SR 5A	12.952000	14.101000	12.952	14.101	1.15	URGENT
YES	3997069,0-81.049	VOLUSIA	79220000.000000	0.000000	2.060000	SR 430	1.000000	BIKE	On County Priority List, safety concern	79220000	795197	SR 430	0.000000	2.370000	0.000	2.060	2.06	URGENT
YES	3249559,0-81.0291	VOLUSIA	79220000.000000	2.000000	2.370000	SR 430	1.000000	BIKE	On County Priority List, safety concern	79220000	795197	SR 430	0.000000	2.370000	2.080	2.370	0.29	URGENT

Figure 93: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 1



FDOT D5 BIKE LANE GAP SAFETY PERFORMANCE ANALYSIS

Mapped Columns >	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	YES	YES	YES	YES
Mapped Rows V	**Coordinates**	**COUNTY**	**SECTION**	**GAP BMP**	**GAP EMP**	**STATE RD**	**PRIORITY**	**GAP TYPE**	**COMMENTS**	**ROADWAY**	**STATION**	**ROAD NAME**	**BMP**	**EMP**	**BKL_Gap BMP**	**BKL_Gap EMP**	**BKL_Gap Length**	**IMPROVEMENT RANK**
YES	841702844,28.330	BREVARD	70014000.000000	0.940000	4.160000	SR 519	2.000000	BIKE		70014000	700432	SR 519	1.615000	4.604000	1.615	4.160	2.55	HIGH
YES	1996836,0-80.700	BREVARD	70120000.000000	0.000000	0.510000	SR 518	2.000000	BIKE	On County Priority List	70120004	700408	SR 518	0.000000	0.394000	0.000	0.394	0.39	HIGH
YES	1996836,0-80.700	BREVARD	70120004.000000	0.000000	3.300000	SR 518	2.000000	BIKE		70120004	700408	SR 518	0.000000	0.394000	0.000	0.394	0.39	HIGH
YES	1996836,0-80.700	BREVARD	70120004.000000	0.000000	3.300000	SR 518	2.000000	BIKE		70120004	700408	SR 518	0.000000	0.394000	0.000	0.394	0.39	HIGH
YES	11035914,0-80.70	BREVARD	70140000.000000	0.000000	1.060000	SR 3	1.000000	BIKE	On County Priority List, safety concern	70140000	700280	SR 3	0.000000	2.171000	0.000	1.060	1.06	HIGH
YES	2778609,0-82.103	MARION	36080000.000000	0.000000	6.530000	SR 40	1.000000	BIKE		36080000	365046	SR 40	1.757000	3.468000	1.757	3.468	1.71	HIGH
YES	4430626,28.52962	ORANGE	75003000.000000	4.990000	7.830000	SR 436	1.000000	BIKE	History of ped incidents per D5 data	75003000	750395	SR 436	5.009000	5.573000	5.009	5.573	0.56	HIGH
YES	2917348,28.5401	ORANGE	75003000.000000	4.990000	7.830000	SR 436	1.000000	BIKE	History of ped incidents per D5 data	75003000	755179	SR 436	6.081000	6.548000	6.081	6.548	0.47	HIGH
YES	39573,0-81.397521	ORANGE	75010000.000000	4.000000	11.210000	SR 600	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75010000	750511	SR 500/SR 600	7.062000	8.638000	7.062	8.638	1.58	HIGH
YES	145809,28.524380	ORANGE	75012000.000000	0.000000	1.260000	SR 552	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75012000	750491	SR 552	0.000000	1.262000	0.000	1.260	1.26	HIGH
YES	168468,0-81.3831	ORANGE	75060000.000000	0.000000	5.340000	SR 50	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75060000	755162	SR 50/600"CBD	0.139000	0.996000	0.139	0.996	0.86	HIGH
YES	334843,0-81.3603	ORANGE	75060000.000000	0.000000	5.340000	SR 50	1.000000	BIKE	History of ped incidents per D5 data, on County Priority List	75060000	750516	SR 50/600"CBD	1.898000	2.653000	1.898	2.653	0.76	HIGH
YES	468563,28.509351	ORANGE	75080000.000000	12.070000	19.020000	SR 15	2.000000	BIKE		75080000	750076	SR 15	14.346000	15.851000	14.346	15.851	1.51	HIGH
YES	0060415,28.54159	ORANGE	75200000.000000	4.530000	8.940000	SR 551	1.000000	BIKE	History of ped incidents per D5 data	75200000	750342	SR 551	4.574000	6.430000	4.574	6.430	1.86	HIGH
YES	78213,0"-81.4070	ORANGE	75260000.000000	2.270000	6.970000	SR 424	1.000000	BIKE	Will be addressed by project 239422-1 from mp 4.8 to 6.9, history of ped incidents per D5 data	75260000	755218	SR 424	4.188000	4.854000	4.188	4.854	0.67	HIGH
YES	96379,0-81.27309	SEMINOLE	77010000.000000	10.250000	13.870000	SR 600	1.000000	BIKE	On County Priority List, safety concern	77010000	775057	SR 15/US 17/92	11.646000	12.603000	11.646	12.603	0.96	HIGH
YES	51037132,28.6979	SEMINOLE	77120000.000000	2.170000	11.280000	SR 434	1.000000	BIKE	On County Priority List, safety concern	77120000	775082	SR 434	9.502000	10.108000	9.502	10.108	0.61	HIGH
YES	95803911,0-80.946	VOLUSIA	79070000.000000	26.500000	29.090000	SR 44	2.000000	BIKE		79070000	790515	SR 44	25.103000	27.928000	26.500	27.928	1.43	HIGH
YES	7416989,0-81.047	VOLUSIA	79190000.000000	7.790000	9.620000	SR 5A	1.000000	BIKE	History of ped incidents per D5 data	79190000	790367	SR 5A	9.411000	9.619000	9.411	9.619	0.21	HIGH
YES	88113,0-81.049295	VOLUSIA	79190006.000000	0.000000	0.170000	SR 5A	1.000000	BIKE	History of ped incidents per D5 data	79190006	790367	SR 5A	0.000000	1.030000	0.000	0.170	0.17	HIGH
YES	88113,0-81.049295	VOLUSIA	79190006.000000	0.000000	0.170000	SR 5A	1.000000	BIKE	History of ped incidents per D5 data	79190006	790367	SR 5A	0.000000	1.030000	0.000	0.170	0.17	HIGH
YES	7432,0-81.0550510	VOLUSIA	79190006.000000	0.900000	1.030000	SR 5A	2.000000	BIKE		79190006	790367	SR 5A	0.000000	1.030000	0.900	1.030	0.13	HIGH
YES	7432,0-81.0550510	VOLUSIA	79190006.000000	0.900000	1.030000	SR 5A	2.000000	BIKE		79190006	790367	SR 5A	0.000000	1.030000	0.900	1.030	0.13	HIGH

Figure 94: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 2

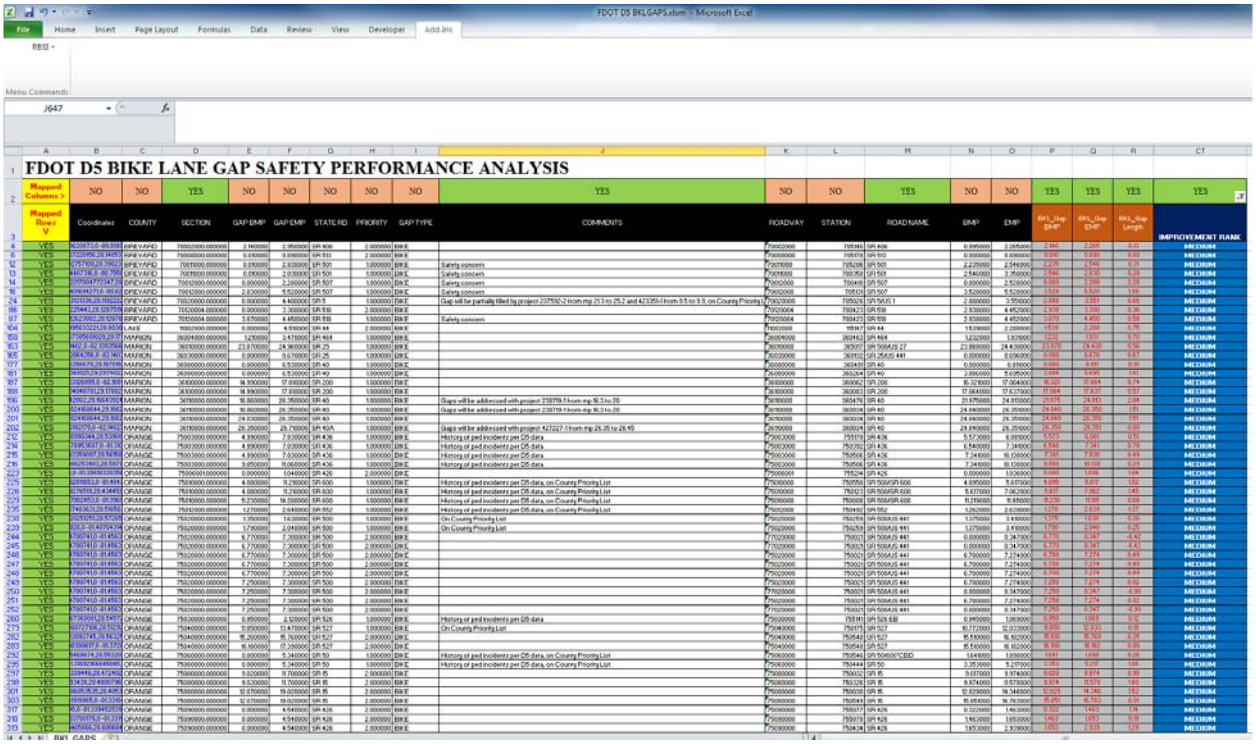


Figure 95: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 3

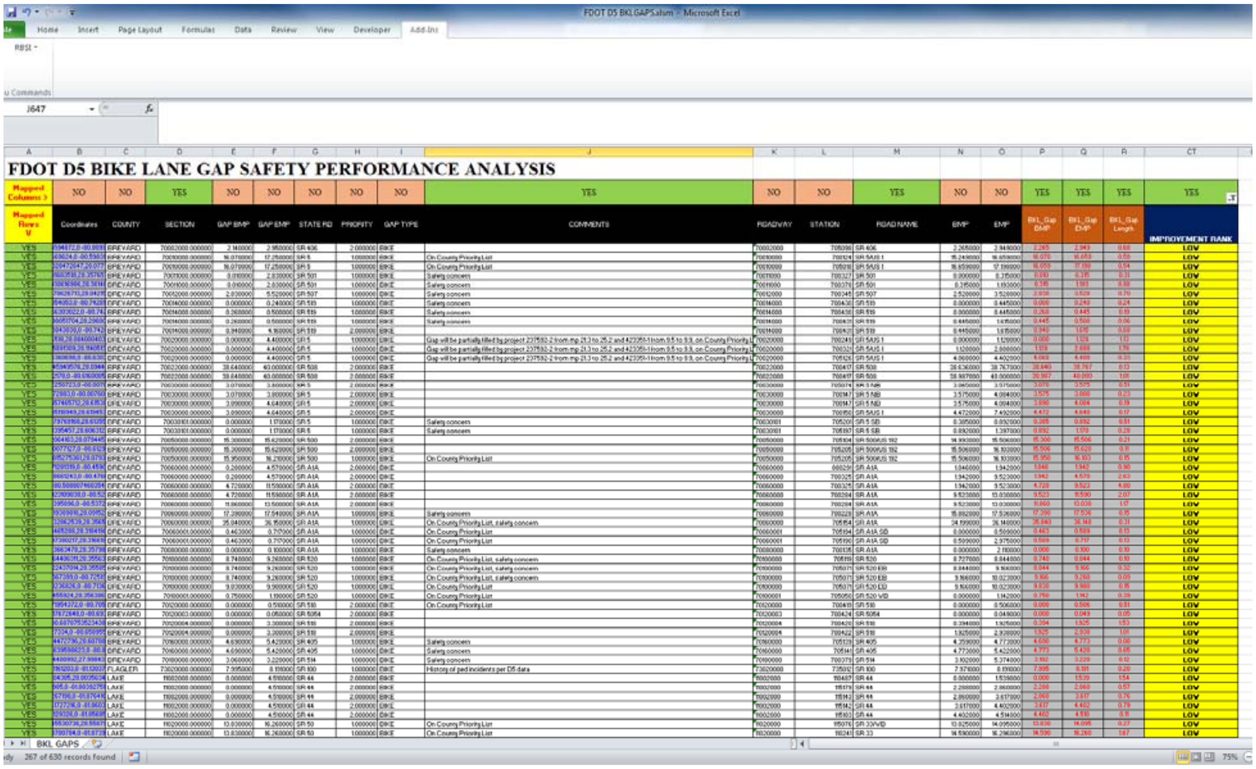


Figure 96: Excel Table View of Bike Lane Gap Safety Performance Tool – Filtered Table Example 4

VI- CONCLUSIONS AND RECOMMENDATIONS

To date there are no clear or uniform standards for a method to measure pedestrian incidents against a statewide average. In this study, statewide averages for pedestrian crash rates along the roadways as well as the intersections were quantified. The main objective was to identify critical pedestrian crash locations, thus evaluating locations that are operating beyond or above statewide averages, identifying main causes and developing a prioritization tool to emphasize the need for mitigation implementation. It was crucial to address the pedestrian-vehicular conflict as the State of Florida currently tops the list in the "Dangerous by Design" report as having the highest four pedestrian incident locations in the country. The main challenge in analyzing pedestrian crashes is to identify a practical and correct exposure measure. In most cases, the exposure measure is either unavailable or can only be obtained at a high cost. The methods and procedures explained in this study are considered detailed, practical and provide a broad depiction of the main factors that directly contribute to pedestrian crashes.

The main parameters used in calculating pedestrian crash rates along the different roadway categories which combine the functional classification, number of lanes, and area type together were the AADT and the total length of the roadway category. Conversely, the main parameters used for computing pedestrian crash rates for the different intersection classifications were the daily pedestrian volumes, distance crossed and the AADT in addition to the number of pedestrian crashes either along the studied roadways or intersections. Although socioeconomic conditions of the geographic area may provide higher accuracy for estimating pedestrian volume than population, there was no evidence to support this claim throughout the research. Also, socioeconomic data included several factors such as income, household, and auto ownership associated with each land use which requires data collection and was not an available source. It should be noted also that the analysis could not identify a correlation between the number of crashes and the average daily pedestrians at the intersections due to the high variability in the data.

The pilot studies conducted for the roadways and intersections revealed several critical safety locations within District Five when compared to the developed statewide average rates which require further investigation to identify main causes and emphasize mitigation improvements.

Based on the sidewalk/bike-lane gaps analysis and modeling results, it was found that presence of sidewalk along roadway segments is one of the main factors that have significant impact on the expected number of pedestrian crashes at a specific location. Other factors included average annual daily traffic volumes (AADT), roadway category (ROADCAT), specifically along urban two-way divided arterials with 4-6 lanes as well as the average population within half-mile radius surrounding the crash location.

While utilizing the spatial join analysis to identify sidewalk and sidewalk gap locations along the roadway segments and the associated number of crashes in each case, two main parameters were considered; frequency of crashes and the corresponding length of sidewalk/sidewalk-gaps along the roadway segment. The analysis showed that the likelihood of a pedestrian crash along roadways with no sidewalk is three times greater than the likelihood of a crash with the presence of a sidewalk.

The aforementioned analysis showed that there is a strong statistical correlation between sidewalk/bike-lane gaps and safety. The conclusions of this task were crucial to the rest of the research tasks, which required developing an evaluation tool to prioritize the need for addressing these gaps. Using the aforementioned factors and their degree of significance along with a ranking order methodology, a prioritization process was identified.

The pedestrian/bicyclist safety prioritization tool (SPT) was developed primarily to prioritize the sidewalk/bike-lane gap locations within FDOT District Five, which directly affects the safety of pedestrians/bicyclists along roadways. Prioritization means identifying the potential projects and ranking them most to least desirable so that the agency can develop an implementation plan and budget proposal according to the right order. The developed tool takes into account the above mentioned parameters as well as other ped/bike-related activity variables and proximity to generators using land use, income and auto ownership data. The prioritization method is based on a multi-criteria ordinal ranking of the parameters of five main modules using a scoring system that combines all criteria weights then aggregates it into a single indicator. The five main modules comprise roadway and traffic data, socioeconomic data, land use data, transit and crash data. The software tool provided a greater detail on the input data sources and preparation as well as a hands-on procedure.

It is recommended that an annual statewide pedestrian/bicycle count program be initiated for the intersections as well as roadways which would increase the sample size and help in validating the assumptions provided in this study. The purpose and duration of data collection are essential pieces of information for determining the appropriate technology. Active or passive infrared sensors are common practice for counting pedestrians and they may also be used to collect combined counts of bicyclists and pedestrians.

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APPENDICES

Appendix A: Summary of Crash Data along Sidewalks

No of Crashes	ROADWAY	DESC_FRM	DESC_TO	BEGIN_POS	END_POST	Distance of Sidewalks
0	79001000	PELICAN BAY DR	CR 483/CLYDE MORRIS	0.958	2.194	6526.08
0	73020000	SR 5 / SR 100	SMITH COUNTY RD	0	1.249	6594.72
0	73020000	SMITH COUNTY RD	BELLE TERRE PKWY	1.249	2.447	6325.44
0	73020000	SMITH COUNTY RD	BELLE TERRE PKWY	1.249	2.447	6325.44
0	73050000	N/A	KNIGHT ST	14.338	15.183	4461.6
0	73050000	N/A	KNIGHT ST	14.338	15.183	4461.6
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73010000	PALM COAST PKWY	ST JOHNS CO LINE	16.646	23.673	37102.56
0	73030000	N/A	N/A	4.007	4.888	4651.68
0	73030000	N/A	N/A	4.007	4.888	4651.68
1	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	73030000	VOLUSIA COUNTY LINE	N/A	0	3.629	19161.12
0	75000065	SR 50	PLANT ST	0	1.117	5897.76
0	16130000	CR 630	E END BR/OSCEOLA C/L	18.34	25.623	38454.24
0	79521000	DIXIE FWY\SR. 5	N RIVERSIDE DR	0	0.352	1858.56
0	79002000	SR 40	N/A	35.307	36.899	8405.76
1	79010000	W PUTNAM GROVE RD	WEST HALIFAX AVE	4.71	6.164	7677.12
0	79010000	W PUTNAM GROVE RD	WEST HALIFAX AVE	4.71	6.164	7677.12
0	79010000	W PUTNAM GROVE RD	WEST HALIFAX AVE	4.71	6.164	7677.12
0	79010000	W PUTNAM GROVE RD	WEST HALIFAX AVE	4.71	6.164	7677.12
0	79010000	W PUTNAM GROVE RD	WEST HALIFAX AVE	4.71	6.164	7677.12
0	79220001	HALIFAX AV	PENNISULA DR	0.62	0.703	438.24
0	79220001	N BEACH ST	HALIFAX AV	0	0.62	3273.6
0	79220001	N BEACH ST	HALIFAX AV	0	0.62	3273.6
0	79220001	N BEACH ST	HALIFAX AV	0	0.62	3273.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
2	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
1	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
1	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6
0	79220000	SR 483/CLYDE MORRIS	N BEACH ST	0	2.37	12513.6

0	79210000	N/A	N/A	0.192	2.285	11051.04
0	79190007	8TH ST	SR 5A/79190006	0	0.14	739.2
1	79190006	BRENTWOOD DR / 79190	10TH ST / 79190000	0	1.03	5438.4
0	79190005	SR 5A/79190006	SR 5A/79190000	0	0.022	116.16
0	79190000	TOMOKA OAKS BLVD	US 1 / SR 5	15.235	15.606	1958.88
0	79190000	TOMOKA OAKS BLVD	US 1 / SR 5	15.235	15.606	1958.88
0	79100000	N/A	SHADOW CROSSINGS BL	21.33	23.269	10237.92
0	18070000	N/A	SR 35/ US 301	11.721	11.963	1277.76
0	73030000	N/A	N/A	3.629	4.007	1995.84
0	73030000	N/A	N/A	3.629	4.007	1995.84
0	73040000	CR 205	US 1 / SR 5	12.16	17.684	29166.72
0	73000011	ZINNIA TR	SR 100/MOODY BLVD	2.345	3.751	7423.68
0	73020000	FLAGLER AVE	SR A1A/OCEAN SHORE B	7.985	8.191	1087.68
0	73020000	FLAGLER AVE	SR A1A/OCEAN SHORE B	7.985	8.191	1087.68
0	73030000	N/A	ST JOHNS COUNTY LINE	17.51	18.595	5728.8
0	73030000	N/A	ST JOHNS COUNTY LINE	17.51	18.595	5728.8
0	73030000	N/A	ST JOHNS COUNTY LINE	17.51	18.595	5728.8
0	73030000	N/A	ST JOHNS COUNTY LINE	17.51	18.595	5728.8
0	73030000	N/A	ST JOHNS COUNTY LINE	17.51	18.595	5728.8
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	N/A	FLAGLER AVE	5.59	7.985	12645.6
0	73020000	CR 2001/OLD KINGS RD	N/A	5	5.59	3115.2
0	73020000	CR 2001/OLD KINGS RD	N/A	5	5.59	3115.2
0	73010000	SR 20/100	N/A	10.779	11.279	2640
0	73020000	SEMINOLE WOODS PKWY	N/A	4.118	4.679	2962.08
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73020000	BELLE TERRE PKWY	SEMINOLE WOODS PKWY	2.447	4.118	8822.88
0	73010000	N/A	S RAILROAD ST	9.232	9.908	3569.28
0	73010000	N/A	S RAILROAD ST	9.232	9.908	3569.28
0	73050000	KNIGHT ST	US 1 / SR 5	15.183	15.477	1552.32
0	73050000	KNIGHT ST	US 1 / SR 5	15.183	15.477	1552.32
0	73050000	KNIGHT ST	US 1 / SR 5	15.183	15.477	1552.32
0	73050000	KNIGHT ST	US 1 / SR 5	15.183	15.477	1552.32
0	73050000	KNIGHT ST	US 1 / SR 5	15.183	15.477	1552.32
0	73050000	KNIGHT ST	US 1 / SR 5	15.183	15.477	1552.32
0	75020000	N/A	N/A	10.514	10.702	992.64
0	75020000	N/A	N/A	10.514	10.702	992.64
0	75030000	GARLAND AVE	ROBINSON ST	0.945	1.069	654.72
0	75030000	GARLAND AVE	ROBINSON ST	0.945	1.069	654.72
0	75000043	N ORANGE BLOSSOM TR.	HUGHEY AV	0	0.879	4641.12
0	75000043	N ORANGE BLOSSOM TR.	HUGHEY AV	0	0.879	4641.12

0	75024501	KENNEDY AVE	DIXIE BELLE	1.502	1.754	1330.56
0	75024501	KENNEDY AVE	DIXIE BELLE	1.502	1.754	1330.56
0	75024501	KENNEDY AVE	DIXIE BELLE	1.502	1.754	1330.56
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
1	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
1	75020000	PIEDMONT WEKIVA RD	N/A	8.57	10.514	10264.32
0	75020000	COUNTRY CLUB VILLA	SR438/PRINCETON ST	0.993	1.375	2016.96
0	75000017	ORANGE BLOSSOM TRL	ORANGE AVE/SR 527	0	2.027	10702.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75020000	JUNCTION RD	JONES AV	17.285	18.687	7402.56
0	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
0	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
0	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
1	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
0	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
0	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
0	75010000	N/A	SR 482(SAND LAKE RD)	5.603	7.062	7703.52
0	75011001	END OF BRIDGE 770053	MAITLAND SUMMIT BLVD	38.442	39.255	4292.64
0	75010000	OSCEOLA CO LINE	FALCON TRACE BLVD	0	0.965	5095.2
0	75020000	T L SMITH	JUNCTION RD	14.763	17.285	13316.16
0	75020000	T L SMITH	JUNCTION RD	14.763	17.285	13316.16
0	75020000	T L SMITH	JUNCTION RD	14.763	17.285	13316.16
0	75020000	T L SMITH	JUNCTION RD	14.763	17.285	13316.16
0	75020000	OVERLAND RD	N/A	5.768	7.298	8078.4
0	75020000	OVERLAND RD	N/A	5.768	7.298	8078.4
0	75020000	OVERLAND RD	N/A	5.768	7.298	8078.4
0	75020000	OVERLAND RD	N/A	5.768	7.298	8078.4
0	75020000	OVERLAND RD	N/A	5.768	7.298	8078.4
0	75020000	OVERLAND RD	N/A	5.768	7.298	8078.4
0	75010000	CENTRAL FLA PKWY	N/A	4.095	5.603	7962.24
1	75008140	SR 50/W.G.B.MC GEE	SR 408/E-W EXPWY	0	0.848	4477.44
0	75000019	MICHIGAN AVENUE	SR 526/WASHINGTON ST	0	2.08	10982.4
0	75024501	CONWAY GARDENS RD.	KENNEDY AVE	0.245	1.502	6636.96
0	75024501	CONWAY GARDENS RD.	KENNEDY AVE	0.245	1.502	6636.96
0	75024501	CONWAY GARDENS RD.	KENNEDY AVE	0.245	1.502	6636.96
0	75000120	US 441/N OBT	VOTAW RD	0	2.072	10940.16
0	75000120	US 441/N OBT	VOTAW RD	0	2.072	10940.16
0	75000120	US 441/N OBT	VOTAW RD	0	2.072	10940.16
0	75000103	TURKEY LAKE RD.	SR 435/KIRKMAN RD	0	0.985	5200.8
0	75000084	CLARCONA-OCOEE RD	MAITLAND BLVD	0	1.8	9504
0	75000084	CLARCONA-OCOEE RD	MAITLAND BLVD	0	1.8	9504
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64

0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75020000	ERROL PKWY	T L SMITH	13.275	14.763	7856.64
0	75008180	SR 408/EAST WEST EXP	SR50/BILL MC GEE HWY	0	0.69	3643.2
0	75008160	SS#178(RAMP)	END OF MAINTENANCE	5.835	6.26	2244
0	75000118	OCOEE APOPKA RD	US 441	0	0.975	5148
0	75030000	PARAMORE AVE	HUGHEY AVE	0.5	0.881	2011.68
0	75030000	PARAMORE AVE	HUGHEY AVE	0.5	0.881	2011.68
0	75030000	PARAMORE AVE	HUGHEY AVE	0.5	0.881	2011.68
0	75011000	MAITLAND AVE	SR 15 / 600	1.742	2.485	3923.04
0	75011000	MAITLAND AVE	SR 15 / 600	1.742	2.485	3923.04
0	75011000	MAITLAND AVE	SR 15 / 600	1.742	2.485	3923.04
0	75011000	MAITLAND AVE	SR 15 / 600	1.742	2.485	3923.04
0	75011000	MAITLAND AVE	SR 15 / 600	1.742	2.485	3923.04
0	75008000	BRIDGE @ SR 435	JOHN YOUNG PKWY	0.44	3.21	14625.6
0	75008000	BRIDGE @ SR 435	JOHN YOUNG PKWY	0.44	3.21	14625.6
0	75008000	BRIDGE @ SR 435	JOHN YOUNG PKWY	0.44	3.21	14625.6
0	75008000	JOHN YOUNG PKWY	I-4 CONNECTOR	3.21	4.955	9213.6
0	75008000	JOHN YOUNG PKWY	I-4 CONNECTOR	3.21	4.955	9213.6
0	75003000	SR 528 / BR 750317	T G LEE BLVD	0	0.652	3442.56
0	75003000	SR 528 / BR 750317	T G LEE BLVD	0	0.652	3442.56
0	75003000	SR 528 / BR 750317	T G LEE BLVD	0	0.652	3442.56
0	75020001	A	A	0	0.207	1092.96
0	75020001	A	A	0	0.207	1092.96
0	75020000	CR 448 (SADLER RD)	CR 500A	20.241	22.23	10501.92
0	75020000	CR 448 (SADLER RD)	CR 500A	20.241	22.23	10501.92
0	75020000	CR 448 (SADLER RD)	CR 500A	20.241	22.23	10501.92
0	75020000	CR 448 (SADLER RD)	CR 500A	20.241	22.23	10501.92
0	75020000	SR 429 WESTERN BELT	ERROL PKWY	12.727	13.275	2893.44
0	75020000	SR 429 WESTERN BELT	ERROL PKWY	12.727	13.275	2893.44
0	75020000	SR 429 WESTERN BELT	ERROL PKWY	12.727	13.275	2893.44
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75002000	JOHN YOUNG PKWY	SR 500 / O B T	2.981	4.618	8643.36
0	75020000	N/A	EDGEWOOD DR	10.702	11.063	1906.08
0	75020000	N/A	EDGEWOOD DR	10.702	11.063	1906.08
0	75020000	N/A	EDGEWOOD DR	10.702	11.063	1906.08
0	75011002	SR 500/US 441	SEMINOLE COUNTY LINE	35.959	36.781	4340.16
0	75011002	SR 500/US 441	SEMINOLE COUNTY LINE	35.959	36.781	4340.16
0	75011002	SR 500/US 441	SEMINOLE COUNTY LINE	35.959	36.781	4340.16
0	75011002	SR 500/US 441	SEMINOLE COUNTY LINE	35.959	36.781	4340.16
0	75011002	SR 500/US 441	SEMINOLE COUNTY LINE	35.959	36.781	4340.16
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
1	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	12450.24

0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	**12450.24**
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	**12450.24**
0	75020000	SR 423 (LEE RD)	OVERLAND RD	3.41	5.768	**12450.24**
0	75020000	SR 50 / COLONIAL DR	COUNTRY CLUB DR	0	0.503	**2655.84**
0	75000182	DIVISION AVENUE	SR 527/ORANGE AVE.	0	0.51	**2692.8**
0	75008000	LK UNDERHILL DR/SR15	GOLDENROD RD	7.788	11.205	**18041.76**
0	75008000	LK UNDERHILL DR/SR15	GOLDENROD RD	7.788	11.205	**18041.76**
0	75008000	LK UNDERHILL DR/SR15	GOLDENROD RD	7.788	11.205	**18041.76**
0	75008000	LK UNDERHILL DR/SR15	GOLDENROD RD	7.788	11.205	**18041.76**
0	75013000	RAMP FROM I-4 WB	BUMBY AV.	0.625	3.071	**12914.88**
0	75013000	RAMP FROM I-4 WB	BUMBY AV.	0.625	3.071	**12914.88**
0	75020000	JONES AV	CR 448 (SADLER RD)	18.687	20.241	**8205.12**
0	75020000	JONES AV	CR 448 (SADLER RD)	18.687	20.241	**8205.12**
0	75020000	JONES AV	CR 448 (SADLER RD)	18.687	20.241	**8205.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75011000	I-4/SR-400	MAITLAND AVE	0.338	1.742	**7413.12**
0	75006001	SR 424/EDGEWATER DR	RAMP 75280096	0	1.036	**5470.08**
0	75006001	SR 424/EDGEWATER DR	RAMP 75280096	0	1.036	**5470.08**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	CR 527 / ORANGE AVE	TRADEPORT DR	6.874	8.749	**9900**
0	75002000	SANDLAKE WEST	JOHN YOUNG PKWY	1.541	2.981	**7603.2**
0	75030000	PRINCETON ST	SR 527/ORANGE AVE	3.805	4.881	**5681.28**
0	75030000	PRINCETON ST	SR 527/ORANGE AVE	3.805	4.881	**5681.28**
0	75030000	PRINCETON ST	SR 527/ORANGE AVE	3.805	4.881	**5681.28**
0	75030000	PRINCETON ST	SR 527/ORANGE AVE	3.805	4.881	**5681.28**
0	75008000	I-4 CONNECTOR	LK UNDERHILL DR/SR15	4.955	7.788	**14958.24**
0	75008000	I-4 CONNECTOR	LK UNDERHILL DR/SR15	4.955	7.788	**14958.24**
0	75008000	I-4 CONNECTOR	LK UNDERHILL DR/SR15	4.955	7.788	**14958.24**
0	75000164	BEGGS RD	ORANGE BLOSSOM TRAIL	0	2.056	**10855.68**
0	75000164	BEGGS RD	ORANGE BLOSSOM TRAIL	0	2.056	**10855.68**
0	75000315	JOHN YOUNG PKY	GREYHOUND BUS STATIO	0	0.164	**865.92**
0	75012000	SR 436 SEMORAN BLVD	SR 551	1.262	2.639	**7270.56**
0	75003000	T G LEE BLVD	SR 15 / HOFFNER RD	0.652	2.048	**7370.88**
0	75002000	SR 436	INT CORP PARK BLVD	10.272	19.291	**47620.32**
0	75002000	SR 436	INT CORP PARK BLVD	10.272	19.291	**47620.32**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**
0	75002000	SR 500 / O B T	CR 527 / ORANGE AVE	4.618	6.874	**11911.68**

Appendix B: Summary of Crash Data along Sidewalk Gaps

No of Crashes at Sidewalk Gaps

NO OF CRASHES	TARGET_FID	MAP_ID_	COUNTY_	SECTION_	BMP_	EMP_	GAP DISTANCE
3	0	8	LAKE	11040000	5.8	10.86	26716.8
0	1	18	OSCEOLA	92010000	9.37	9.44	369.6
0	2	43	BREVARD	70030000	4	4.05	264
0	3	19	SEMINOLE	77080000	4.42	4.48	316.8
0	4	29	BREVARD	70080000	3.25	4.11	4540.8
0	5	48	ORANGE	75003002	0	0.55	2904
1	6	51	VOLUSIA	79100000	0	22.3	117744
0	7	35	ORANGE	75190000	3.47	4.97	7920
0	8	18	VOLUSIA	79270000	1.78	1.88	528
0	9	7	MARION	36100000	16.8	17.1	1584
0	10	8	OSCEOLA	92010000	8.02	8.81	4171.2
0	11	33	BREVARD	70120000	0.92	2.05	5966.4
0	12	9	SEMINOLE	77030000	6.5	6.56	316.8
1	13	56	BREVARD	70150000	3.97	6	10718.4
1	14	16	SUMTER	18070000	14.33	17.957	19150.56
0	15	38	ORANGE	75220000	0	1.45	7656
0	16	41	VOLUSIA	79210000	1.12	2.26	6019.2
0	17	62	ORANGE	75080000	10.78	10.96	950.4
3	18	30	MARION	36060000	1.56	11.93	54753.6
0	19	25	ORANGE	75060000	9.38	9.4	105.6
0	20	61	BREVARD	70110000	0	4.1	21648
0	21	43	ORANGE	75251000	1.12	1.84	3801.6
3	22	46	VOLUSIA	79050000	7.85	22.41	76876.8
7	23	67	ORANGE	75060000	19.7	29.01	49156.8
0	24	30	ORANGE	75080000	12.25	12.57	1689.6
0	25	13	VOLUSIA	79270000	0.18	0.69	2692.8
3	26	2	MARION	36010000	16.69	22.98	33211.2
2	27	28	BREVARD	70070002	0	0.38	2006.4
0	28	3	OSCEOLA	92010000	13.16	13.18	105.6
0	29	4	SEMINOLE	77010000	6.54	6.59	264
2	30	27	BREVARD	70070000	0	2.91	15364.8
0	31	51	BREVARD	70100000	1.93	4.29	12460.8
1	32	34	LAKE	11200000	17.86	21.61	19800
1	33	11	SUMTER	18010000	6.93	13.761	36067.68
0	34	36	VOLUSIA	79070006	0.4	0.94	2851.2
5	35	57	ORANGE	75060000	17.07	19.69	13833.6
0	36	25	MARION	36002000	0	4.77	25185.6
0	37	45	LAKE	11190000	0.57	9.73	48364.8
0	38	20	ORANGE	75050000	0	7.07	37329.6
2	39	16	LAKE	11100000	1.05	3.82	14625.6
0	40	26	OSCEOLA	92070000	0.11	21.89	114998.4
0	41	3	VOLUSIA	79030000	6	7.97	10401.6
0	42	27	SEMINOLE	77040000	2.89	5.09	11616
0	43	26	BREVARD	70060001	2.14	2.98	4435.2
0	44	32	SEMINOLE	77170000	3.95	4.02	369.6
0	45	8	VOLUSIA	79070000	6.38	8.66	12038.4

No of Crashes at Sidewalk Gaps

1	46	4	FLAGLER	73040000	0	17.884	**94427.52**
0	47	25	BREVARD	70060001	1.68	2.02	**1795.2**
0	48	11	ORANGE	75020000	4.32	4.46	**739.2**
0	49	29	LAKE	11080000	4.58	4.62	**211.2**
0	50	6	SUMTER	18060000	8.085	8.356	**1430.88**
0	51	31	VOLUSIA	79070000	28.8	29.15	**1848**
1	52	52	ORANGE	75020000	20.35	22.87	**13305.6**
0	53	20	MARION	36110000	26.54	26.58	**211.2**
0	54	40	LAKE	11110000	4.9	18.11	**69748.8**
0	55	15	ORANGE	75020000	12.98	13.95	**5121.6**
1	56	11	LAKE	11050000	13.85	14.06	**1108.8**
0	57	21	OSCEOLA	92030000	7.28	7.53	**1320**
0	58	46	BREVARD	70030101	0	0.39	**2059.2**
0	59	22	SEMINOLE	77010000	13.66	16.93	**17265.6**
0	60	24	BREVARD	70060001	1.57	1.63	**316.8**
0	61	54	VOLUSIA	79181000	0.38	3.07	**14203.2**
4	62	1	ORANGE	75002000	0.56	3.05	**13147.2**
0	63	19	LAKE	11200000	14.616	15.059	**2339.04**
0	64	6	ORANGE	75011000	1.75	2.17	**2217.6**
0	65	24	LAKE	11050101	1.51	1.56	**264**
1	66	1	SUMTER	18120000	0	1.016	**5364.48**
3	67	26	VOLUSIA	79060000	11.91	16.12	**22228.8**
0	68	15	MARION	36030000	0.68	1.22	**2851.2**
0	69	6	LAKE	11020000	12.15	13.51	**7180.8**
0	70	16	OSCEOLA	92010000	0	0.54	**2851.2**
0	71	41	BREVARD	70022000	38.64	38.89	**1320**
0	72	17	SEMINOLE	77070000	2.35	2.53	**950.4**
0	73	23	BREVARD	70060001	1.15	1.2	**264**
0	74	46	ORANGE	75003000	0	0.65	**3432**
0	75	49	VOLUSIA	79070000	10.72	21.46	**56707.2**
0	76	33	ORANGE	75080000	18.09	18.26	**897.6**
0	77	16	VOLUSIA	79270000	1.16	1.46	**1584**
3	78	5	MARION	36050000	0	6.76	**35692.8**
0	79	6	OSCEOLA	92010000	7.22	7.65	**2270.4**
0	80	31	BREVARD	70100000	9.25	9.89	**3379.2**
0	81	21	VOLUSIA	79030000	11.46	12.8	**7075.2**
2	82	10	MARION	36001000	0	4.52	**23865.6**
0	83	1	LAKE	11010000	6.04	6.29	**1320**
1	84	11	OSCEOLA	92030000	11.31	17.31	**31680**
0	85	36	BREVARD	70140000	3.24	3.4	**844.8**
0	86	12	SEMINOLE	77030000	8.1	8.17	**369.6**
0	87	17	BREVARD	70030101	1.27	1.41	**739.2**
0	88	59	BREVARD	70050000	0	8.04	**42451.2**
0	89	41	ORANGE	75250000	0.46	1.84	**7286.4**
0	90	44	VOLUSIA	79010000	0	7.2	**38016**
0	91	65	ORANGE	75190000	5.97	6.33	**1900.8**
0	92	33	MARION	36090000	0	16.69	**88123.2**

No of Crashes at Sidewalk Gaps

0	93	28	ORANGE	75080000	11.98	12.05	369.6
1	94	35	SEMINOLE	77040000	5.81	16.1	54331.2
3	95	11	VOLUSIA	79190000	9.79	10.39	3168
0	96	18	BREVARD	70060000	25.794	25.912	623.04
6	97	1	OSCEOLA	92010000	12.29	12.68	2059.2
0	98	2	SEMINOLE	77010000	5.89	5.99	528
0	99	49	BREVARD	70080000	4.11	4.37	1372.8
0	100	32	LAKE	11110000	3.17	4.89	9081.6
1	101	9	SUMTER	18010000	0	6.2	32736
0	102	7	SEMINOLE	77030000	5.48	5.64	844.8
0	103	19	BREVARD	70060000	25.987	26.272	1504.8
0	104	54	BREVARD	70140000	0	0.3	1584
0	105	14	SUMTER	18030000	8.4	17.962	50487.36
0	106	36	ORANGE	75190000	5	5.15	792
0	107	39	VOLUSIA	79090000	1.63	3.42	9451.2
0	108	60	ORANGE	75080000	9.82	9.98	844.8
0	109	28	MARION	36040000	14.16	14.96	4224
0	110	23	ORANGE	75060000	8.97	9.15	950.4
0	111	6	VOLUSIA	79040101	0	0.11	580.8
3	112	2	FLAGLER	73010000	0	9.571	50534.88
0	113	30	SEMINOLE	77070000	8.26	8.29	158.4
0	114	20	BREVARD	70060000	29.34	32.95	19060.8
0	115	9	ORANGE	75020000	2.3	3.4	5808
1	116	27	LAKE	11080000	3.3	3.94	3379.2
1	117	4	SUMTER	18010000	24.476	27.33	15069.12
0	118	29	VOLUSIA	79070000	8.77	8.83	316.8
0	119	50	ORANGE	75011002	35.96	36.21	1320
0	120	18	MARION	36100000	4.66	6.02	7180.8
0	121	38	LAKE	11070000	0	1.77	9345.6
1	122	13	ORANGE	75020000	7.9	10.45	13464
0	123	9	LAKE	11040000	11.48	11.56	422.4
0	124	19	OSCEOLA	92010100	0	1.35	7128
0	125	44	BREVARD	70030000	4.08	5.33	6600
0	126	34	VOLUSIA	79070005	0	1.26	6652.8
0	127	55	ORANGE	75040000	8.084	8.72	3358.08
0	128	23	MARION	36518000	0	8.46	44668.8
2	129	43	LAKE	11140000	0	7.8	41184
0	130	18	ORANGE	75030000	8.02	8.09	369.6
1	131	14	LAKE	11070000	1.78	3.05	6705.6
3	132	24	OSCEOLA	92030000	17.32	38.15	109982.4
0	133	1	VOLUSIA	79010000	21	24.77	19905.6
0	134	25	SEMINOLE	77030000	4.14	4.16	105.6
0	135	21	BREVARD	70060001	0.95	0.98	158.4
0	136	4	ORANGE	75002000	7.54	7.94	2112
0	137	22	LAKE	11010000	0	1.5	7920
1	138	24	VOLUSIA	79050000	14.5	17.2	14256
1	139	13	MARION	36009000	0	10.83	57182.4

1	140	4	LAKE	11010047	0.879	1.988	5855.52
0	141	14	OSCEOLA	92090000	0	1.33	7022.4
2	142	39	BREVARD	70010000	0	13.65	72072
0	143	15	SEMINOLE	77060000	6.58	6.74	844.8
0	144	22	BREVARD	70060001	1.02	1.12	528
0	145	62	BREVARD	70150000	0	3.96	20908.8
1	146	44	ORANGE	75270000	0	1.99	10507.2
0	147	47	VOLUSIA	79050000	22.79	25.87	16262.4
0	148	68	ORANGE	75140000	0	18.21	96148.8
0	149	20	SEMINOLE	77120001	0.32	1.79	7761.6
0	150	52	VOLUSIA	79120000	8.15	17.59	49843.2
1	151	19	VOLUSIA	79001000	0	2.17	11457.6
2	152	8	MARION	36110000	22.81	24.04	6494.4
0	153	9	OSCEOLA	92030000	4.16	4.36	1056
0	154	34	BREVARD	70140000	2.52	2.6	422.4
0	155	10	SEMINOLE	77030000	6.67	7.17	2640
0	156	57	BREVARD	70150000	7.27	7.31	211.2
0	157	17	SUMTER	18110000	0	16.727	88318.56
0	158	39	ORANGE	75220000	1.56	1.73	897.6
0	159	42	VOLUSIA	79220000	1	1.9	4752
0	160	63	ORANGE	75190000	5.49	5.67	950.4
1	161	31	MARION	36070000	13.44	16.66	17001.6
9	162	26	ORANGE	75060000	12.99	16.88	20539.2
0	163	33	SEMINOLE	77030000	0.07	4.02	20856
0	164	9	VOLUSIA	79070000	9.65	10.17	2745.6
0	165	5	FLAGLER	73050000	0	15.161	80050.08
0	166	31	ORANGE	75080000	17.58	17.61	158.4
0	167	14	VOLUSIA	79270000	0.69	0.97	1478.4
0	168	3	MARION	36010000	23.45	23.77	1689.6
0	169	4	OSCEOLA	92010000	13.25	13.28	158.4
1	170	5	SEMINOLE	77010000	6.74	7.15	2164.8
0	171	52	BREVARD	70110000	4.11	5.52	7444.8
0	172	35	LAKE	11200000	29.02	33.71	24763.2
0	173	12	SUMTER	18020000	0	6.421	33902.88
0	174	37	VOLUSIA	79070006	0.97	1.05	422.4
0	175	58	ORANGE	75080000	9.02	9.04	105.6
0	176	26	MARION	36030000	16.4	19.62	17001.6
0	177	46	LAKE	11200000	3.92	9.12	27456
1	178	21	ORANGE	75050000	7.31	10.19	15206.4
1	179	17	LAKE	11130000	0.6	4.8	22176
0	180	4	VOLUSIA	79040000	8.82	9.28	2428.8
0	181	28	SEMINOLE	77060000	6.245	6.49	1293.6
1	182	1	BREVARD	70001000	0	4.41	23284.8
0	183	7	ORANGE	75011000	2.18	2.48	1584
0	184	2	BREVARD	70008000	4.96	5.25	1531.2
0	185	30	LAKE	11100000	4.97	5.16	1003.2
0	186	7	SUMTER	18070000	9.85	11.46	8500.8

0	187	32	VOLUSIA	79070000	8.66	9.65	5227.2
0	188	53	ORANGE	75035001	0	0.97	5121.6
0	189	21	MARION	36180000	12.56	12.74	950.4
1	190	41	LAKE	11110000	18.52	24.06	29251.2
3	191	16	ORANGE	75020000	14.24	18.28	21331.2
0	192	12	LAKE	11050000	14.08	14.22	739.2
0	193	22	OSCEOLA	92030000	7.59	7.77	950.4
0	194	47	BREVARD	70050000	8.05	9.69	8659.2
0	195	23	SEMINOLE	77010101	0	0.52	2745.6
3	196	3	BREVARD	70010000	14.213	15.23	5369.76
0	197	55	VOLUSIA	79210000	0.19	1.11	4857.6
1	198	2	ORANGE	75002000	3.23	4.65	7497.6
0	199	20	LAKE	11200000	21.62	29.01	39019.2
3	200	22	VOLUSIA	79050000	1.17	5.17	21120
1	201	11	MARION	36004000	0.31	0.74	2270.4
1	202	2	LAKE	11010000	20.07	23.29	17001.6
0	203	25	LAKE	11070000	7.82	11.3	18374.4
0	204	2	SUMTER	18010000	13.762	17.517	19826.4
2	205	27	VOLUSIA	79070000	0	1.19	6283.2
1	206	16	MARION	36070000	0	13.43	70910.4
0	207	7	LAKE	11020000	13.62	13.81	1003.2
0	208	17	OSCEOLA	92010000	9.09	9.33	1267.2
0	209	42	BREVARD	70030000	0	4	21120
0	210	18	SEMINOLE	77070001	0	0.36	1900.8
0	211	4	BREVARD	70011000	2.24	2.62	2006.4
1	212	47	ORANGE	75003001	0	0.49	2587.2
0	213	50	VOLUSIA	79090000	3.43	14.32	57499.2
0	214	34	ORANGE	75180000	0	0.11	580.8
0	215	17	VOLUSIA	79270000	1.49	1.78	1531.2
0	216	6	MARION	36090000	16.7	17.45	3960
0	217	7	OSCEOLA	92010000	7.9	7.96	316.8
0	218	32	BREVARD	70100001	0	0.85	4488
0	219	8	SEMINOLE	77030000	6.15	6.17	105.6
0	220	5	BREVARD	70014000	0	0.57	3009.6
1	221	12	OSCEOLA	92040000	0.31	0.43	633.6
0	222	37	BREVARD	70160000	0	2.64	13939.2
0	223	13	SEMINOLE	77030000	8.23	8.35	633.6
0	224	6	BREVARD	70014000	0.68	0.96	1478.4
0	225	60	BREVARD	70100000	0.05	1.92	9873.6
0	226	42	ORANGE	75250001	0	0.23	1214.4
0	227	66	ORANGE	75250002	0.95	1.02	369.6
0	228	34	MARION	36100000	0	4.65	24552
0	229	29	ORANGE	75080000	12.07	12.19	633.6
0	230	12	VOLUSIA	79190000	15.59	15.61	105.6
0	231	1	MARION	36004000	4.81	7.21	12672
6	232	7	BREVARD	70020000	9.47	18.6	48206.4
0	233	2	OSCEOLA	92010000	12.91	13.05	739.2

No of Crashes at Sidewalk Gaps

0	234	3	SEMINOLE	77010000	6.06	6.31	**1320**
0	235	8	BREVARD	70020000	20.27	20.38	**580.8**
0	236	50	BREVARD	70080000	4.37	6.31	**10243.2**
0	237	33	LAKE	11200000	9.13	10.426	**6842.88**
0	238	10	SUMTER	18010000	6.86	6.93	**369.6**
0	239	35	VOLUSIA	79070006	0	0.13	**686.4**
0	240	56	ORANGE	75040101	0.94	1.08	**739.2**
2	241	24	MARION	36001000	4.53	14.22	**51163.2**
2	242	44	LAKE	11170000	1.74	12.07	**54542.4**
0	243	19	ORANGE	75030101	0	0.18	**950.4**
0	244	15	LAKE	11080000	3.99	4.25	**1372.8**
0	245	25	OSCEOLA	92060000	0	38.03	**200798.4**
0	246	55	BREVARD	70140000	3.87	9.76	**31099.2**
2	247	15	SUMTER	18070000	0	9.84	**51955.2**
0	248	37	ORANGE	75190000	5.29	5.39	**528**
2	249	40	VOLUSIA	79190007	0	0.14	**739.2**
0	250	61	ORANGE	75080000	10.03	10.72	**3643.2**
0	251	29	MARION	36040000	16	16.65	**3432**
0	252	24	ORANGE	75060000	9.29	9.3	**52.8**
0	253	7	VOLUSIA	79070000	2.45	3.36	**4804.8**
2	254	3	FLAGLER	73020000	1.242	8.191	**36690.72**
0	255	31	SEMINOLE	77070000	8.4	8.78	**2006.4**
0	256	9	BREVARD	70020000	21.08	21.12	**211.2**
0	257	10	ORANGE	75020000	3.41	4.03	**3273.6**
0	258	28	LAKE	11080000	4.3	4.52	**1161.6**
0	259	5	SUMTER	18010000	28.765	30.287	**8036.16**
1	260	30	VOLUSIA	79070000	21.47	26.17	**24816**
2	261	51	ORANGE	75020000	5.66	7.3	**8659.2**
1	262	19	MARION	36110000	18.59	21.95	**17740.8**
0	263	39	LAKE	11100000	7.99	12.77	**25238.4**
0	264	14	ORANGE	75020000	10.84	12.26	**7497.6**
0	265	10	LAKE	11050000	11.18	11.28	**528**
0	266	20	OSCEOLA	92030000	3.86	4.09	**1214.4**
0	267	45	BREVARD	70030000	5.39	5.48	**475.2**
0	268	21	SEMINOLE	77161000	0	0.9	**4752**
4	269	10	BREVARD	70020000	21.51	24.37	**15100.8**
0	270	2	VOLUSIA	79010000	24.97	25.08	**580.8**
0	271	26	SEMINOLE	77030000	4.45	4.79	**1795.2**
9	272	11	BREVARD	70020000	24.38	35.7	**59769.6**
0	273	5	ORANGE	75011000	0	0.64	**3379.2**
1	274	23	LAKE	11040000	0	2.31	**12196.8**
1	275	25	VOLUSIA	79060000	2.63	5.3	**14097.6**
0	276	14	MARION	36010000	14.35	14.41	**316.8**
0	277	5	LAKE	11010047	1.231	2.205	**5142.72**
2	278	15	OSCEOLA	92090000	3.1	6.53	**18110.4**
0	279	40	BREVARD	70020000	20.4	20.54	**739.2**
1	280	16	SEMINOLE	77070000	0	2.21	**11668.8**

No of Crashes at Sidewalk Gaps

0	281	12	BREVARD	70030000	5.54	8.21	**14097.6**
0	282	45	ORANGE	75270000	3.64	4	**1900.8**
1	283	48	VOLUSIA	79060000	5.31	11.9	**34795.2**
0	284	32	ORANGE	75080000	17.75	18.08	**1742.4**
0	285	15	VOLUSIA	79270000	1	1.15	**792**
0	286	53	VOLUSIA	79140000	0	5.44	**28723.2**
3	287	20	VOLUSIA	79030000	8.17	11	**14942.4**
3	288	9	MARION	36220000	0	8.41	**44404.8**
4	289	10	OSCEOLA	92030000	4.43	6.34	**10084.8**
0	290	35	BREVARD	70140000	3.11	3.18	**369.6**
0	291	11	SEMINOLE	77030000	7.25	7.92	**3537.6**
2	292	58	BREVARD	70030000	13.48	17.53	**21384**
0	293	40	ORANGE	75230000	6.85	7.15	**1584**
0	294	43	VOLUSIA	79260000	2.01	2.08	**369.6**
0	295	64	ORANGE	75190000	5.7	5.77	**369.6**
5	296	32	MARION	36080000	8.22	32.21	**126667.2**
2	297	27	ORANGE	75080000	11.72	11.94	**1161.6**
0	298	34	SEMINOLE	77040000	5.1	5.71	**3220.8**
0	299	10	VOLUSIA	79070000	28.76	29.15	**2059.2**
1	300	13	BREVARD	70030000	9.14	10.02	**4646.4**
0	301	1	SEMINOLE	77002000	37.9	38.44	**2851.2**
1	302	4	MARION	36030000	1.24	2.61	**7233.6**
5	303	5	OSCEOLA	92010000	1.92	7.18	**27772.8**
0	304	6	SEMINOLE	77030000	4.85	5.11	**1372.8**
0	305	14	BREVARD	70030000	10.05	13.47	**18057.6**
0	306	53	BREVARD	70120000	0	0.29	**1531.2**
0	307	36	LAKE	11683000	2.105	2.11	**26.4**
0	308	13	SUMTER	18030000	0	7.55	**39864**
0	309	38	VOLUSIA	79070006	0	0.06	**316.8**
0	310	59	ORANGE	75080000	9.28	9.51	**1214.4**
0	311	27	MARION	36030000	20.08	22.76	**14150.4**
0	312	22	ORANGE	75060000	8.13	8.17	**211.2**
1	313	18	LAKE	11170000	0.01	1.73	**9081.6**
1	314	5	VOLUSIA	79040000	9.5	9.87	**1953.6**
0	315	1	FLAGLER	73050000	15.426	15.43	**21.12**
1	316	29	SEMINOLE	77070000	7.03	7.89	**4540.8**
0	317	15	BREVARD	70030101	0.91	1.07	**844.8**
1	318	8	ORANGE	75020000	0	1.33	**7022.4**
0	319	26	LAKE	11080000	0	3.21	**16948.8**
0	320	3	SUMTER	18010000	18.713	22.35	**19203.36**
0	321	28	VOLUSIA	79070000	3.58	3.61	**158.4**
0	322	49	ORANGE	75011001	38.45	40	**8184**
0	323	17	MARION	36080000	6.52	8.21	**8923.2**
0	324	37	LAKE	11020000	0	12.14	**64099.2**
0	325	35	MARION	36110000	6.6	18.58	**63254.4**
0	326	12	ORANGE	75020000	7.62	7.73	**580.8**
0	327	31	LAKE	11100000	5.3	7.63	**12302.4**

No of Crashes at Sidewalk Gaps

0	328	8	SUMTER	18070000	12.55	14.32	**9345.6**
0	329	33	VOLUSIA	79070002	0	0.12	**633.6**
0	330	54	ORANGE	75039000	0	2.03	**10718.4**
0	331	22	MARION	36180001	0	1.67	**8817.6**
3	332	42	LAKE	11130000	4.81	13.78	**47361.6**
0	333	17	ORANGE	75020000	19.25	20.21	**5068.8**
0	334	13	LAKE	11060000	14.15	14.44	**1531.2**
0	335	23	OSCEOLA	92030000	11.02	11.18	**844.8**
0	336	48	BREVARD	70050000	16.22	16.3	**422.4**
0	337	24	SEMINOLE	77020000	0	0.35	**1848**
2	338	30	BREVARD	70100000	4.72	7.81	**16315.2**
1	339	3	ORANGE	75002000	5.44	6.88	**7603.2**
0	340	21	LAKE	11230000	0	2.76	**14572.8**
1	341	23	VOLUSIA	79050000	5.9	7.84	**10243.2**
0	342	12	MARION	36008000	0.43	0.8	**1953.6**
0	343	3	LAKE	11010047	0	0.105	**554.4**
0	344	13	OSCEOLA	92040000	0.45	0.7	**1320**
2	345	38	BREVARD	70180000	3.22	6.7	**18374.4**
0	346	14	SEMINOLE	77040000	1.02	2.2	**6230.4**
0	347	16	BREVARD	70030101	1.1	1.17	**369.6**
194							**4875103.2**

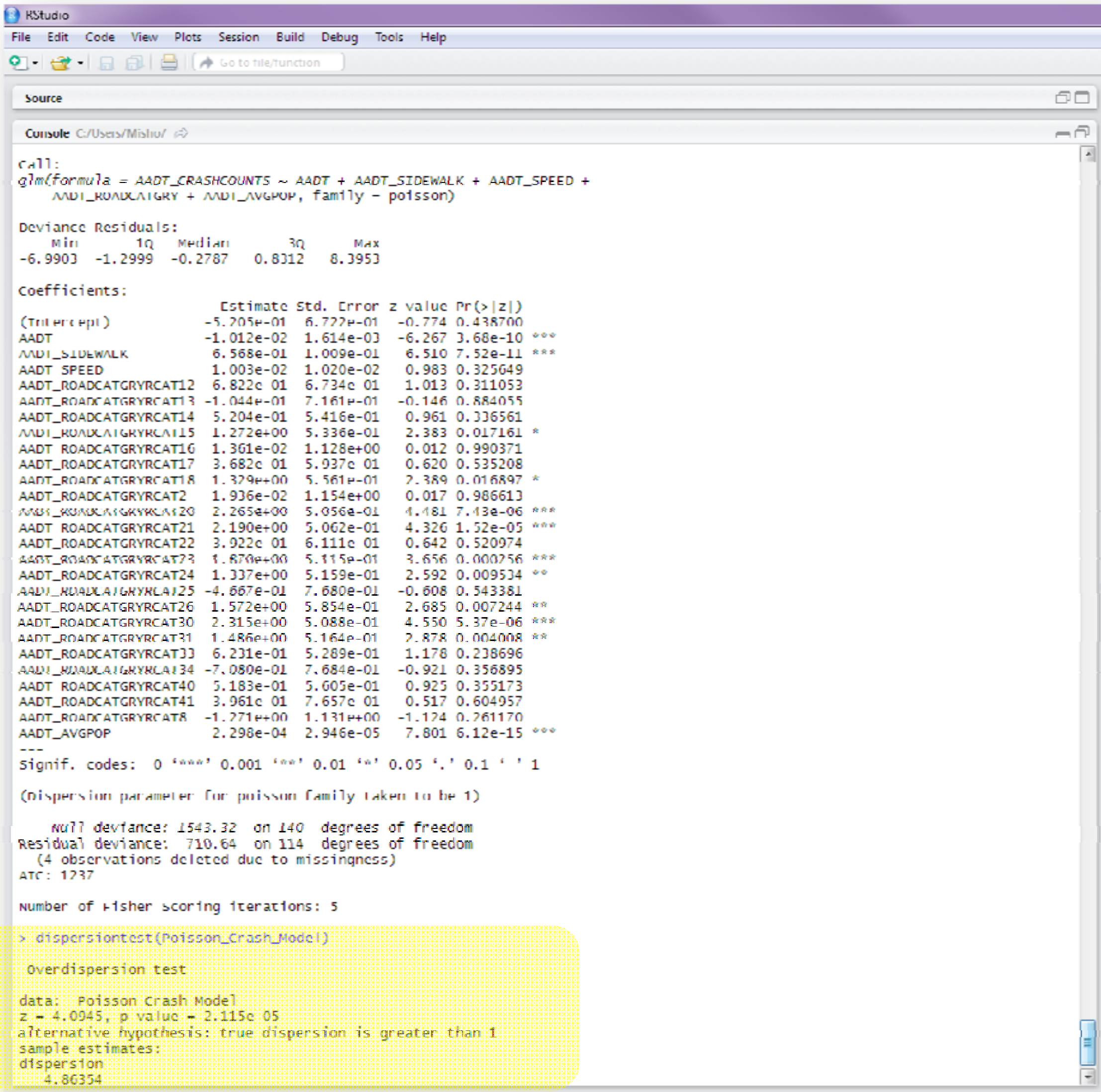
Appendix C: Model Data

AADT_CRASH COUNTS	AADT_ROAD CATGRY	AADT_ AADT	AADT_ SPEED	AADT_SIDEWALK	AADT_ AVGPOP
	RCAT13	9900.0	45.0	0.0	1779.0
2	RCAT13	12950.0	55.0	0.0	1541.5
1	RCAT14	5600.0	55.0	0.0	2850.0
1	RCAT14	10400.0	55.0	0.0	378.0
4	RCAT14	16925.0	48.8	0.0	1323.8
3	RCAT14	20766.7	45.0	0.0	2953.3
4	RCAT15	1650.0	40.0	0.0	3047.5
2	RCAT15	11950.0	42.5	0.0	1153.5
1	RCAT15	18000.0	55.0	0.0	1457.0
2	RCAT15	22500.0	50.0	0.0	1461.0
1	RCAT16	8700.0	55.0	0.0	505.0
1	RCAT17	4600.0	60.0	0.0	1153.0
5	RCAT17	7020.0	49.0	0.0	956.2
3	RCAT17	11233.3	51.7	0.0	980.0
1	RCAT17	18300.0	55.0	0.0	578.0
3	RCAT18	4366.7	60.0	0.0	405.7
11	RCAT18	7581.8	54.5	0.0	734.5
4	RCAT18	11750.0	48.8	0.0	982.3
2	RCAT18	16800.0	50.0	0.0	777.0
2	RCAT20	27750.0	42.5	0.0	3226.5
1	RCAT20	31000.0	35.0	0.0	1601.0
1	RCAT20	48500.0	55.0	0.0	1257.0
2	RCAT21	8100.0	40.0	0.0	140.0
1	RCAT21	24500.0	50.0	0.0	695.0
1	RCAT21	25500.0	50.0	0.0	844.0
5	RCAT23	12800.0	51.0	0.0	1746.4
16	RCAT23	18032.7	50.3	0.0	1374.3
12	RCAT23	21491.7	52.1	0.0	1655.7
20	RCAT23	27021.4	50.5	0.0	2300.2
15	RCAT23	31733.3	52.3	0.0	1754.7
16	RCAT23	37718.8	51.9	0.0	3868.5
8	RCAT23	41812.5	53.1	0.0	1302.5
2	RCAT23	50000.0	50.0	0.0	730.0
1	RCAT24	23000.0	45.0	0.0	1220.0
3	RCAT24	28666.7	45.0	0.0	4848.0
3	RCAT24	30166.7	45.0	0.0	4431.0
1	RCAT25	27500.0	45.0	0.0	4814.0
4	RCAT26	6300.0	57.5	0.0	408.8
9	RCAT26	11800.1	60.6	0.0	472.8
4	RCAT26	16891.5	61.3	0.0	660.5
1	RCAT26	26513.0	65.0	0.0	523.0
1	RCAT30	22000.0	50.0	0.0	695.0
2	RCAT33	37500.0	50.0	0.0	4476.0

1	RCAT33	46500.0	45.0	0.0	10.0
1	RCAT33	56000.0	55.0	0.0	179.0
1	RCAT33	73000.0	50.0	0.0	4.0
1	RCAT2	52500.0	70.0	1.0	486.0
1	RCAT8	6200.0	55.0	1.0	3037.0
2	RCAT8	12000.0	-	1.0	3118.5
2	RCAT10	18000.0	-	1.0	1043.0
2	RCAT11	10800.0	-	1.0	1793.0
3	RCAT11	18233.3	41.7	1.0	1549.7
1	RCAT11	22500.0	40.0	1.0	2949.0
2	RCAT12	8400.0	-	1.0	956.0
5	RCAT12	13420.0	35.0	1.0	2993.0
1	RCAT13	26500.0	55.0	1.0	2392.0
5	RCAT14	8960.0	42.0	1.0	1743.0
4	RCAT14	12675.0	46.3	1.0	2262.5
6	RCAT14	15683.3	42.5	1.0	3641.5
2	RCAT14	21250.0	45.0	1.0	3705.0
10	RCAT15	6320.0	43.5	1.0	1354.4
13	RCAT15	16015.4	41.5	1.0	2300.5
1	RCAT17	7200.0	55.0	1.0	1298.0
1	RCAT17	15100.0	55.0	1.0	630.0
3	RCAT18	5427.0	51.7	1.0	814.3
4	RCAT20	12650.0	42.5	1.0	1797.0
25	RCAT20	17992.0	40.6	1.0	2649.5
36	RCAT20	22688.9	42.4	1.0	3012.2
70	RCAT20	27460.3	41.6	1.0	3191.3
43	RCAT20	31930.6	40.8	1.0	4562.7
22	RCAT20	36453.0	40.0	1.0	4438.6
21	RCAT20	42238.1	43.6	1.0	4502.3
2	RCAT20	46750.0	40.0	1.0	4534.0
1	RCAT20	54000.0	40.0	1.0	3883.0
1	RCAT20	56000.0	40.0	1.0	3883.0

Appendix D: Statistical Output

Poisson Model and Dispersion Test Outputs from R Statistical Package




```
Call:
glm(formula = AADT_CRASHCOUNTS ~ AADT + AADT_SIDEWALK + AADT_SPEED +
    AADT_ROADCATGRY + AADT_AVGPOP, family = poisson)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-6.9903  -1.2999  -0.2787   0.8312   8.3953

Coefficients:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept)            -5.205e-01  6.722e-01  -0.774 0.438700
AADT                   -1.012e-02  1.614e-03  -6.267 3.68e-10 ***
AADT_SIDEWALK           6.568e-01  1.009e-01   6.510 7.52e-11 ***
AADT_SPEED              1.003e-02  1.020e-02   0.983 0.325649
AADT_ROADCATGRYRCAT12   6.822e-01  6.734e-01   1.013 0.311053
AADT_ROADCATGRYRCAT13  -1.044e-01  7.161e-01  -0.146 0.884055
AADT_ROADCATGRYRCAT14   5.204e-01  5.416e-01   0.961 0.336561
AADT_ROADCATGRYRCAT15   1.272e+00  5.336e-01   2.383 0.017161 *
AADT_ROADCATGRYRCAT16   1.361e-02  1.128e+00   0.012 0.990371
AADT_ROADCATGRYRCAT17   3.682e-01  5.937e-01   0.620 0.535208
AADT_ROADCATGRYRCAT18   1.329e+00  5.561e-01   2.389 0.016897 *
AADT_ROADCATGRYRCAT2    1.936e-02  1.154e+00   0.017 0.986613
AADT_ROADCATGRYRCAT20   2.265e+00  5.056e-01   4.481 7.43e-06 ***
AADT_ROADCATGRYRCAT21   2.190e+00  5.062e-01   4.326 1.52e-05 ***
AADT_ROADCATGRYRCAT22   3.922e-01  6.111e-01   0.642 0.520974
AADT_ROADCATGRYRCAT23   1.870e+00  5.115e-01   3.656 0.000256 ***
AADT_ROADCATGRYRCAT24   1.337e+00  5.159e-01   2.592 0.009534 **
AADT_ROADCATGRYRCAT25  -4.667e-01  7.680e-01  -0.608 0.543381
AADT_ROADCATGRYRCAT26   1.572e+00  5.854e-01   2.685 0.007244 **
AADT_ROADCATGRYRCAT30   2.315e+00  5.088e-01   4.550 5.37e-06 ***
AADT_ROADCATGRYRCAT31   1.486e+00  5.164e-01   2.878 0.004008 **
AADT_ROADCATGRYRCAT33   6.231e-01  5.289e-01   1.178 0.238696
AADT_ROADCATGRYRCAT34  -7.080e-01  7.684e-01  -0.921 0.356895
AADT_ROADCATGRYRCAT40   5.183e-01  5.605e-01   0.925 0.355173
AADT_ROADCATGRYRCAT41   3.961e-01  7.657e-01   0.517 0.604957
AADT_ROADCATGRYRCAT8   -1.271e+00  1.131e+00  -1.124 0.261170
AADT_AVGPOP             2.298e-04  2.946e-05   7.801 6.12e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 1543.32  on 140  degrees of freedom
Residual deviance:  710.64  on 114  degrees of freedom
  (4 observations deleted due to missingness)
AIC: 1237

Number of Fisher Scoring iterations: 5

> dispersiontest(Poisson_Crash_Model)

 Overdispersion test

data:  Poisson Crash Model
z = 4.0945, p-value = 2.115e-05
alternative hypothesis: true dispersion is greater than 1
sample estimates:
dispersion
   4.86354
```

Negative Binomial Model Outputs from R Statistical Package

```
> NB_Crash_Model=glm.nb(formula=AADT_CRASHCOUNTS ~ AADT+AADT_SIDEWALK+AADT_SPEED+AADT_ROADCATGRY+AADT_AVGPOP)
> summary (NB_Crash_Model)

Call:
glm.nb(formula = AADT_CRASHCOUNTS ~ AADT + AADT_SIDEWALK + AADT_SPEED +
    AADT_ROADCATGRY + AADT_AVGPOP, init.theta = 2.224705647,
    link = log)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.8198  -0.7506  -0.1922   0.5460   2.5564

Coefficients:
                        Estimate Std. Error z value Pr(>|z|)
(Intercept)            8.217e-01  1.193e+00   0.689  0.49113
AADT                  -1.114e-02  3.620e-03  -3.077  0.00209 **
AADT_SIDEWALK          5.129e-01  2.025e-01   2.532  0.01134 *
AADT_SPEED            -1.992e-02  2.224e-02  -0.896  0.37026
AADT_ROADCATGRYRCAT12  4.124e-01  1.064e+00   0.388  0.69836
AADT_ROADCATGRYRCAT13  1.488e-01  9.553e-01   0.156  0.87624
AADT_ROADCATGRYRCAT14  6.086e-01  7.656e-01   0.795  0.42665
AADT_ROADCATGRYRCAT15  1.153e+00  7.729e-01   1.492  0.13579
AADT_ROADCATGRYRCAT16  3.104e-01  1.419e+00   0.219  0.82685
AADT_ROADCATGRYRCAT17  7.438e-01  8.412e-01   0.884  0.37659
AADT_ROADCATGRYRCAT18  1.668e+00  8.185e-01   2.038  0.04157 *
AADT_ROADCATGRYRCAT2   9.920e-01  1.527e+00   0.650  0.51582
AADT_ROADCATGRYRCAT20  2.032e+00  7.182e-01   2.830  0.00466 **
AADT_ROADCATGRYRCAT21  1.986e+00  7.168e-01   2.770  0.00561 **
AADT_ROADCATGRYRCAT22 -7.635e-02  9.290e-01  -0.082  0.93450
AADT_ROADCATGRYRCAT23  2.178e+00  7.278e-01   2.992  0.00277 **
AADT_ROADCATGRYRCAT24  1.299e+00  7.351e-01   1.767  0.07729 .
AADT_ROADCATGRYRCAT25 -7.356e-01  1.035e+00  -0.711  0.47733
AADT_ROADCATGRYRCAT26  2.025e+00  9.007e-01   2.249  0.02453 *
AADT_ROADCATGRYRCAT30  2.412e+00  7.344e-01   3.285  0.00102 **
AADT_ROADCATGRYRCAT31  1.429e+00  7.383e-01   1.935  0.05297 .
AADT_ROADCATGRYRCAT33  6.722e-01  7.609e-01   0.883  0.37702
AADT_ROADCATGRYRCAT34 -4.781e-01  9.928e-01  -0.482  0.63012
AADT_ROADCATGRYRCAT40  3.684e-01  8.047e-01   0.458  0.64711
AADT_ROADCATGRYRCAT41 -6.359e-01  1.019e+00  -0.624  0.53262
AADT_ROADCATGRYRCAT8  -9.575e-01  1.431e+00  -0.669  0.50341
AADT_AVGPOP            2.782e-04  6.247e-05   4.452 8.49e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for Negative Binomial(2.2247) family taken to be 1)

    Null deviance: 317.64  on 140  degrees of freedom
Residual deviance: 130.42  on 114  degrees of freedom
  (4 observations deleted due to missingness)
AIC: 835.87

Number of Fisher Scoring iterations: 1


              Theta:  2.225
          Std. Err.:  0.340

 2 x log-likelihood:  -779.869
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Appendix E: Excerpts of Raw Data for Divided and Undivided Roadways

HSMV_Repor	TYPE	FunClass	Number of lanes	2013 AADT	2011 AADT	2010 AADT	2009 AADT	Average AADT	Roadway Category
4025384	Divided	16	6	26000	29500	30500	30000	29000	6-Lane - Divided Minor Arterial - URBAN
4267339	Divided	14	6						6-Lane - Divided Principal Arterial-Other - URBAN
5696288	Divided	16	4	32500	32500	36500	34500	34000	4-Lane - Divided Minor Arterial - URBAN
6204323	Divided	16	4	18500	18500			18500	4-Lane - Divided Minor Arterial - URBAN
6300735	Undivided	16	2	18500	17200	17000	17600	17575	2-Lane - Undivided Minor Arterial - URBAN
6301141	Undivided	16	2	27000				27000	2-Lane - Undivided Minor Arterial - URBAN
6347370	Undivided	17	2	5600				5600	2-Lane - Undivided Major Collector - URBAN
6426788	Divided	14	4	18300	17500	19200	18300	18325	4-Lane - Divided Principal Arterial-Other - URBAN
6511459	Divided	16	4	57000	49500	55500		54000	4-Lane - Divided Minor Arterial - URBAN
6680694	Undivided	17	2	9700				9700	2-Lane - Undivided Major Collector - URBAN
6686479	Divided	17	4	13200	13800	13400	13300	13425	4-Lane - Divided Major Collector - URBAN
6686608	Divided	17	2	9200	9900	9300	9600	9500	2-Lane - Divided Major Collector - URBAN
6742819	Divided	14	6	23000	23000	27500	23000	24125	6-Lane - Divided Principal Arterial-Other - URBAN
7257605	Divided	14	6						6-Lane - Divided Principal Arterial-Other - URBAN
8094518	Divided	14	6	62000	16100	57000	58000	48275	6-Lane - Divided Principal Arterial-Other - URBAN
8096807	Undivided	19	2						2-Lane - Undivided Local - URBAN
8167514	Divided		6	35500	38500	39500	40500	38500	NA
8322852	Undivided	6	2	4800				4800	2-Lane - Undivided Minor Arterial - RURAL
8325915	Divided	14	6	45000	44000	47000	43000	44750	6-Lane - Divided Principal Arterial-Other - URBAN
8331780	Divided	14	6	35000				35000	6-Lane - Divided Principal Arterial-Other - URBAN
8651307	Divided	14	6						6-Lane - Divided Principal Arterial-Other - URBAN
8666646	#N/A	14	#N/A				54000	54000	NA
8720103	Divided	16	4	10100	11800	11200	11400	11125	4-Lane - Divided Minor Arterial - URBAN
8722343	Divided	16	4	18700	22000	22500	24000	21800	4-Lane - Divided Minor Arterial - URBAN
8730814	Undivided	18	2	3000	3400			3200	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
8853817	Divided	4	2	4700	4500	4500	4600	4575	2-Lane - Divided Principal Arterial-Other - RURAL
8927470	Divided		4	22500	24000	24000	23500	23500	NA
8964623	Divided	14	4	30500				30500	4-Lane - Divided Principal Arterial-Other - URBAN
9133627	Undivided	16	2	6600				6600	2-Lane - Undivided Minor Arterial - URBAN
9134363	Undivided	17	4	15500				15500	4-Lane - Undivided Major Collector - URBAN
9182330	Divided	14	4	36000				36000	4-Lane - Divided Principal Arterial-Other - URBAN
9267391	Undivided	17	2	9500	1200	10100	9800	7650	2-Lane - Undivided Major Collector - URBAN
9291689	Divided	14	6	60500	60500	59000	57000	59250	6-Lane - Divided Principal Arterial-Other - URBAN
9291932	Undivided	18	2	3700				3700	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
9291956	Divided	14	6	60000	63500	55000	57000	58875	6-Lane - Divided Principal Arterial-Other - URBAN
9291983	Divided	14	8	54000	61500	60000	44500	55000	8-Lane - Divided Principal Arterial-Other - URBAN
9292034	Divided	17	2	6600				6600	2-Lane - Divided Major Collector - URBAN
9292044	Divided	17	3	11000				11000	3-Lane - Divided Major Collector - URBAN
9337199	Undivided	17	2	5300	5800	6300	6200	5900	2-Lane - Undivided Major Collector - URBAN
9405120	#N/A	14	#N/A						NA
9568266	Undivided	14	3	4800	4800			4800	3-Lane - Undivided Principal Arterial-Other - URBAN
9631520	Divided	16	2	9600	9600	9500		9567	2-Lane - Divided Minor Arterial - URBAN
9647984	Divided	14	4	45500	42500	43500	51500	45750	4-Lane - Divided Principal Arterial-Other - URBAN
9683199	Undivided	18	2	4400	4200	4500	4500	4400	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
9793937	Divided	14	4	38500	34000	34000	34500	35250	4-Lane - Divided Principal Arterial-Other - URBAN
9914518	Divided		6	48000	48500	48500	46500	47875	NA
9919208	Divided		4	28000	30000	29500	32500	30000	NA
9952446	Undivided	16	2	20500	600	19700	20500	15325	2-Lane - Undivided Minor Arterial - URBAN
9960890	Undivided	18	2	5200	5500			5350	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
9986384	Undivided	19	2						2-Lane - Undivided Local - URBAN
9992493	Divided		6	40000	40500	41000	44000	41375	NA
10009250	Divided	14	4						4-Lane - Divided Principal Arterial-Other - URBAN
10009292	Divided	16	2	11700	11800	12800	13000	12325	2-Lane - Divided Minor Arterial - URBAN
10010132	Undivided	16	2	9100	9000			9050	2-Lane - Undivided Minor Arterial - URBAN

10010232	Divided	17	2	950	6700	6200	4400	4563	2-Lane - Divided Major Collector - URBAN
10010831	Divided	14	4	15200	14800	16200	17800	16000	4-Lane - Divided Principal Arterial-Other - URBAN
10118913	Divided	18	2	3300	5000		3200	3833	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
10122519	Divided	16	4						4-Lane - Divided Minor Arterial - URBAN
10152378	Undivided	19	2	1500	1400	1100		1333	2-Lane - Undivided Local - URBAN
10160826	Divided	14	4	23500	22500	24000	24500	23625	4-Lane - Divided Principal Arterial-Other - URBAN
10181048	Divided		6	72500	70000	75000	70500	72000	NA
10181448	Divided		6	41500	34500	42500	45000	40875	NA
10182102	Divided		6	52000	46000	53000	53500	51125	NA
10182464	Divided		6	55500	56000	56000	55500	55750	NA
10183057	Divided		6	50000	48500	52000	55000	51375	NA
10210564	Divided		4	35500	32000	32500	34000	33500	NA
10271452	Divided	16	4	19100	16000	16100	16200	16850	4-Lane - Divided Minor Arterial - URBAN
10284196	Divided	17	4	8200	4600	8100		6967	4-Lane - Divided Major Collector - URBAN
10434303	Divided	14	4						4-Lane - Divided Principal Arterial-Other - URBAN
10443425	Undivided	17	2	6900	6900			6900	2-Lane - Undivided Major Collector - URBAN
10448435	Undivided	14	2	3400	3400			3400	2-Lane - Undivided Principal Arterial-Other - URBAN
10471061	Divided	18	2	8800	9100	11100		9667	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
10477122	Divided	14	4	29000	29000	30000	29500	29375	4-Lane - Divided Principal Arterial-Other - URBAN
10482797	Divided		6	55500	56000	56000	55500	55750	NA
10483600	Divided		6	52000	53000	55500	52000	53125	NA
10517898	Divided	16	2	12000	12500	12000	12500	12250	2-Lane - Divided Minor Arterial - URBAN
10520550	Divided	14	2	1900	10600	11400	10800	8675	2-Lane - Divided Principal Arterial-Other - URBAN
10520752	Undivided	17	2	1500	1200			1350	2-Lane - Undivided Major Collector - URBAN
10557411	Divided		4	18000	18900	19100	19300	18825	NA
10559327	Divided	17	6	52500	20800	20900	23500	29425	6-Lane - Divided Major Collector - URBAN
10559331	Undivided	17	2	7900	7900	7900		7900	2-Lane - Undivided Major Collector - URBAN
10563735	Divided		6	70000	74500	72500	68000	71250	NA
10564709	Divided		4	26000	30500	31000	32000	29875	NA
10565928	Divided	17	6	60000	8600	8600	61000	34550	6-Lane - Divided Major Collector - URBAN
10567256	Undivided	17	2	9000	9100			9050	2-Lane - Undivided Major Collector - URBAN
10568094	Undivided	16	2	14200	15100	15100	15300	14925	2-Lane - Undivided Minor Arterial - URBAN
10575916	Divided	16	4	36500	34500	35000	32000	34500	4-Lane - Divided Minor Arterial - URBAN
10579713	#N/A	14	#N/A						NA
10590152	Undivided	17	2	7600	7500			7550	2-Lane - Undivided Major Collector - URBAN
10598399	Divided		6	32000	26500	26500	31500	29125	NA
10602738	Undivided	19	2	2500	2500	5500	5700	4050	2-Lane - Undivided Local - URBAN
10623484	Undivided	16	4	12200	11700	11600	12000	11875	4-Lane - Undivided Minor Arterial - URBAN
10624738	Undivided	18	2	9300	9400	9300		9333	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
10649817	#N/A	14	#N/A						NA
10676560	Divided	14	4	11300	12300			11800	4-Lane - Divided Principal Arterial-Other - URBAN
10683085	Divided	16	4	21000				21000	4-Lane - Divided Minor Arterial - URBAN
10696466	Undivided	17	2	8600	9300	8300	6200	8100	2-Lane - Undivided Major Collector - URBAN
10727574	Divided	14	6	50500	46000	52500	48000	49250	6-Lane - Divided Principal Arterial-Other - URBAN
10787955	Undivided	14	2	19300	16300	14600	11400	15400	2-Lane - Undivided Principal Arterial-Other - URBAN
10814311	Divided	14	4	37500	40000	40500	41500	39875	4-Lane - Divided Principal Arterial-Other - URBAN
10820943	Undivided	17	2	3100	3100	4000	4000	3550	2-Lane - Undivided Major Collector - URBAN
10826486	Divided	16	2	21500	7300	20500		16433	2-Lane - Divided Minor Arterial - URBAN
10826522	Divided	16	4	24000	24500	24500		24333	4-Lane - Divided Minor Arterial - URBAN
10832798	Divided		6	46000	48500	50500	52000	49250	NA
10848732	Divided	16	4	10700	11000			10850	4-Lane - Divided Minor Arterial - URBAN
10849324	Undivided	18	2	5200	6300		10000	7167	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
10849448	Divided	14	4						4-Lane - Divided Principal Arterial-Other - URBAN
10849758	Divided	16	4	10700	12500	10300	10500	11000	4-Lane - Divided Minor Arterial - URBAN
10852051	Divided	17	2	9000	9300			9150	2-Lane - Divided Major Collector - URBAN

10852755	Undivided	16	4	14200	12300	10500	12800	12450	4-Lane - Undivided Minor Arterial - URBAN
10870155	Divided	17	4	22000				22000	4-Lane - Divided Major Collector - URBAN
10870668	Divided	17	4	22000				22000	4-Lane - Divided Major Collector - URBAN
10877731	Divided	19	2	6700	9500	9000	8800	8500	2-Lane - Divided Local - URBAN
10878232	Divided	17	2	3800	3300	3400	3600	3525	2-Lane - Divided Major Collector - URBAN
10897920	Divided	16	4	24500				24500	4-Lane - Divided Minor Arterial - URBAN
10899970	Divided	16	4	30000	23500	27500	28500	27375	4-Lane - Divided Minor Arterial - URBAN
10928847	Undivided	16	2	14000	12000	11500	16000	13375	2-Lane - Undivided Minor Arterial - URBAN
10933163	Divided	16	3	22500	21000	21500	16800	20450	3-Lane - Divided Minor Arterial - URBAN
10933526	#N/A	14	#N/A						NA
10933785	Undivided	19	2						2-Lane - Undivided Local - URBAN
10968107	Divided	16	4	27000	25500	25500	29000	26750	4-Lane - Divided Minor Arterial - URBAN
11002344	Divided		6	60000	61000	55500	70500	61750	NA
11003009	Divided	17	4	16500	16600	16600		16567	4-Lane - Divided Major Collector - URBAN
11005471	Divided	17	6	60000	8600	8600	61000	34550	6-Lane - Divided Major Collector - URBAN
11005476	Divided	16	4	18300	17500	17500	16500	17450	4-Lane - Divided Minor Arterial - URBAN
11022712	Divided	16	2	10900	11000	11600	12400	11475	2-Lane - Divided Minor Arterial - URBAN
11032630	Divided	14	4	16300	21500	20300	20400	19625	4-Lane - Divided Principal Arterial-Other - URBAN
11043453	Divided		4	49500	51500	45000	40500	46625	NA
11043498	Divided		4	54500	53500	45000	47000	50000	NA
11051084	Undivided	17	2	7400	8500	7000	8700	7900	2-Lane - Undivided Major Collector - URBAN
11067334	Divided	14	6	60500	63500	65000	52000	60250	6-Lane - Divided Principal Arterial-Other - URBAN
11069915	Divided	17	4	3400	3400			3400	4-Lane - Divided Major Collector - URBAN
11070279	#N/A	14	#N/A						NA
11074233	Undivided	18	2	7000	7100			7050	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
11074382	Divided	16	2	10500	10500			10500	2-Lane - Divided Minor Arterial - URBAN
11082580	#N/A	14	#N/A						NA
11086712	Undivided	19	2						2-Lane - Undivided Local - URBAN
11091007	Undivided	19	2						2-Lane - Undivided Local - URBAN
11119720	Divided		6	49500	41500	41500	42500	43750	NA
11127789	Divided	17	2	2600	2600			2600	2-Lane - Divided Major Collector - URBAN
11128492	Undivided	14	4	14900	13700	14200	14700	14375	4-Lane - Undivided Principal Arterial-Other - URBAN
11145700	Divided		4	21400	23000	23000	24000	22850	NA
11190874	Undivided	17	2	5300	5300			5300	2-Lane - Undivided Major Collector - URBAN
11200863	Undivided	16	2	5300	5400	5400	6300	5600	2-Lane - Undivided Minor Arterial - URBAN
11201911	Divided	16	4	8100	7800	7900		7933	4-Lane - Divided Minor Arterial - URBAN
11219283	Divided	14	6						6-Lane - Divided Principal Arterial-Other - URBAN
11255657	Divided	17	4	20100	17700	17900		18567	4-Lane - Divided Major Collector - URBAN
11259590	Undivided	17	2	7600				7600	2-Lane - Undivided Major Collector - URBAN
11278573	Undivided	17	2	1500	1500			1500	2-Lane - Undivided Major Collector - URBAN
11286667	Divided	14	6						6-Lane - Divided Principal Arterial-Other - URBAN
11292780	Divided		6	47000	42500	41500	41500	43125	NA
11296339	Divided	14	4	11800	11600	11600	14200	12300	4-Lane - Divided Principal Arterial-Other - URBAN
11296571	Undivided	18	2	2700	2600			2650	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
11357592	Undivided	17	2	5900	6700	6200	4400	5800	2-Lane - Undivided Major Collector - URBAN
11381048	Divided	14	6	50500	53000	53500	52000	52250	6-Lane - Divided Principal Arterial-Other - URBAN
11421514	Divided	19	2	5100	5100	5400	4800	5100	2-Lane - Divided Local - URBAN
11426087	Divided		4	32500	32500	35000	31000	32750	NA
11432252	Undivided	17	2	1500	1500			1500	2-Lane - Undivided Major Collector - URBAN
11444223	Divided	16	4	23500	23000	22500	25500	23625	4-Lane - Divided Minor Arterial - URBAN
11455664	Divided	14	4	27500	28500	29000	28000	28250	4-Lane - Divided Principal Arterial-Other - URBAN
11482707	Divided		2	14200	11000	10800	11900	11975	NA
11482841	Undivided	17	2	6200	6300	5100		5867	2-Lane - Undivided Major Collector - URBAN
11534695	Undivided	19	2						2-Lane - Undivided Local - URBAN
11584951	Divided		4	3600	3600	3800	4200	3800	NA

11687118	Undivided	17	2	10800	9400			10100	2-Lane - Undivided Major Collector - URBAN
11688035	Divided	14	4	43000	45000	46000	49500	45875	4-Lane - Divided Principal Arterial-Other - URBAN
11689196	Divided	14	4	33500	35000	36000	40000	36125	4-Lane - Divided Principal Arterial-Other - URBAN
11689262	Divided	14	4	39500	43500	39500	43500	41500	4-Lane - Divided Principal Arterial-Other - URBAN
11746880	Divided	14	2	13300	13600	13600	13600	13525	2-Lane - Divided Principal Arterial-Other - URBAN
11747022	Divided	14	4	27500	26000	24000	24000	25375	4-Lane - Divided Principal Arterial-Other - URBAN
11753268	Divided	14	4	25000	27000	26500	24500	25750	4-Lane - Divided Principal Arterial-Other - URBAN
11803723	Undivided	16	2	8600	7500			8050	2-Lane - Undivided Minor Arterial - URBAN
11831657	Undivided	19	2	1400	1300	1100	1200	1250	2-Lane - Undivided Local - URBAN
11840031	Undivided	19	2						2-Lane - Undivided Local - URBAN
11841232	Divided	14	6	25000	35000	33500	34500	32000	6-Lane - Divided Principal Arterial-Other - URBAN
11900535	Divided		4	30929	32728	32975	32649	32320	NA
11939132	Undivided	16	4	10800				10800	4-Lane - Undivided Minor Arterial - URBAN
11957707	#N/A	16	#N/A				21000	21000	NA
12064514	Divided	17	2	13000	16500	13500	13500	14125	2-Lane - Divided Major Collector - URBAN
12095956	Undivided	18	2	10500	10500	10500		10500	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
12109564	Undivided	16	2	14500	14000	15500	18000	15500	2-Lane - Undivided Minor Arterial - URBAN
12161451	Divided	16	2	16300	16400	16700	16300	16425	2-Lane - Divided Minor Arterial - URBAN
12161457	Undivided	18	2	1650	2200	1450	1550	1713	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
12161636	Divided	14	2	8700	9200	15300	9700	10725	2-Lane - Divided Principal Arterial-Other - URBAN
12161817	Divided	16	2	16300	16400	16700	16300	16425	2-Lane - Divided Minor Arterial - URBAN
12240527	Divided	14	4	33500	34000	35000	36500	34750	4-Lane - Divided Principal Arterial-Other - URBAN
12245058	Divided	14	4	43000	45000	46000	49500	45875	4-Lane - Divided Principal Arterial-Other - URBAN
12245080	Divided	14	4	33500	35000	36000	40000	36125	4-Lane - Divided Principal Arterial-Other - URBAN
12245082	Divided	14	4	33500	35000	36000	40000	36125	4-Lane - Divided Principal Arterial-Other - URBAN
12245192	Undivided	18	2	6900	6900			6900	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
12245274	Divided	16	4	25500	22000	24500	24500	24125	4-Lane - Divided Minor Arterial - URBAN
12310942	Divided	17	4	32500		34500		33500	4-Lane - Divided Major Collector - URBAN
12311093	Undivided	14	3	9100	9100	9000	9000	9050	3-Lane - Undivided Principal Arterial-Other - URBAN
12379228	Undivided	16	2	14500	14000	15500	18000	15500	2-Lane - Undivided Minor Arterial - URBAN
12386727	Divided		6	19400	20800	20900	23500	21150	NA
12392330	Divided	16	4	20500	20400	20400		20433	4-Lane - Divided Minor Arterial - URBAN
12403342	Undivided	14	2	8000	8500	9100	8600	8550	2-Lane - Undivided Principal Arterial-Other - URBAN
12463787	Undivided	16	2	14000	12000	11500	16000	13375	2-Lane - Undivided Minor Arterial - URBAN
12468611	Divided	14	4	24000	22500	25500	24000	24000	4-Lane - Divided Principal Arterial-Other - URBAN
12524344	Divided	18	2	24500	24000	24000	25500	24500	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
12623260	Divided	14	4	28000	25000	28500	29000	27625	4-Lane - Divided Principal Arterial-Other - URBAN
12746261	Undivided	17	2	5200	4900	3900	4900	4725	2-Lane - Undivided Major Collector - URBAN
12746860	Undivided	19	2						2-Lane - Undivided Local - URBAN
12747482	Undivided	17	3	7300	7100	6400	5100	6475	3-Lane - Undivided Major Collector - URBAN
12754626	Divided	16	4	14976	15884	16877	17065	16201	4-Lane - Divided Minor Arterial - URBAN
12754937	Undivided	17	2	1200	1000	1400	1200	1200	2-Lane - Undivided Major Collector - URBAN
12758331	#N/A	14	#N/A						NA
12870871	#N/A	14	#N/A						NA
12921794	Undivided	14	2	13900	18200	19400	14500	16500	2-Lane - Undivided Principal Arterial-Other - URBAN
51775829	Divided		4	40500	41500	37000	37500	39125	NA
51948878	Undivided	17	4	15300	14100	14100		14500	4-Lane - Undivided Major Collector - URBAN
51948890	Divided		6	47000	49500	51500	51500	49875	NA
51948896	Undivided	17	4	15000	15000			15000	4-Lane - Undivided Major Collector - URBAN
51948905	Undivided	16	3	19500	16000	15500	18000	17250	3-Lane - Undivided Minor Arterial - URBAN
51948916	Undivided	16	4	26500				26500	4-Lane - Undivided Minor Arterial - URBAN
51948959	Divided	14	6	52000	53500	52500	50500	52125	6-Lane - Divided Principal Arterial-Other - URBAN
51948972	Undivided	14	4	19000	20200	19700	19400	19575	4-Lane - Undivided Principal Arterial-Other - URBAN
51948974	Divided	14	4	36000	34000	33000	28500	32875	4-Lane - Divided Principal Arterial-Other - URBAN
51948986	Undivided	16	2	9500	9500			9500	2-Lane - Undivided Minor Arterial - URBAN

51949020	Undivided	17	4	17400	17400			17400	4-Lane - Undivided Major Collector - URBAN
51949025	Divided		6	36000	42500	43500	36000	39500	NA
51949044	Divided	14	4	36000	34000	33000	28500	32875	4-Lane - Divided Principal Arterial-Other - URBAN
51949063	Divided		6	44000	43500	47000	45000	44875	NA
51949169	Divided	17	2	1900	1900			1900	2-Lane - Divided Major Collector - URBAN
51949222	Undivided		1	11500	9800	9800		10367	NA
51949224	Divided	16	4	26000	30000	28500	29500	28500	4-Lane - Divided Minor Arterial - URBAN
51949232	Divided	17	3	2400	9700	11200	13100	9100	3-Lane - Divided Major Collector - URBAN
51949301	Divided	19	4	25500	26000	25500	26000	25750	4-Lane - Divided Local - URBAN
51949350	Undivided	16	3	19500	16000	15500	18000	17250	3-Lane - Undivided Minor Arterial - URBAN
51949423	Undivided	16	4	26500				26500	4-Lane - Undivided Minor Arterial - URBAN
51949450	Divided	17	4	17400	17400			17400	4-Lane - Divided Major Collector - URBAN
51949451	Divided	16	4	9500	9500	30500	28500	19500	4-Lane - Divided Minor Arterial - URBAN
51949466	Divided	14	6	44500	43000	45500	44000	44250	6-Lane - Divided Principal Arterial-Other - URBAN
51949501	Undivided	17	2	1900	1900			1900	2-Lane - Undivided Major Collector - URBAN
51949511	#N/A	18	#N/A						NA
51949537	Divided		6	44000	43500	47000	45000	44875	NA
51949562	Undivided	16	2	17500	17500			17500	2-Lane - Undivided Minor Arterial - URBAN
51949649	Divided		6	47500	49500	49500	48000	48625	NA
51949688	Divided	17	2	9900	8400			9150	2-Lane - Divided Major Collector - URBAN
51949761	Undivided	17	2	15900	15900			15900	2-Lane - Undivided Major Collector - URBAN
51949797	Undivided		3	8000	7700	7700		7800	NA
51949855	Undivided	16	3	16000	17000	17000	14000	16000	3-Lane - Undivided Minor Arterial - URBAN
51949900	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51949960	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51949996	Divided	14	4	38500	37000	35500	35500	36625	4-Lane - Divided Principal Arterial-Other - URBAN
51950032	Divided	17	4	9900	8400			9150	4-Lane - Divided Major Collector - URBAN
51950038	Undivided	17	2	17400	17400			17400	2-Lane - Undivided Major Collector - URBAN
51950076	Divided	16	5	24000	43500	25000	45000	34375	5-Lane - Divided Minor Arterial - URBAN
51950164	Divided	19	4	32000	34500	35000	36500	34500	4-Lane - Divided Local - URBAN
51950194	Undivided	14	4	35500	31000	32000	33000	32875	4-Lane - Undivided Principal Arterial-Other - URBAN
51950269	Undivided	16	2	9500	9500			9500	2-Lane - Undivided Minor Arterial - URBAN
51950306	#N/A	18	#N/A						NA
51950323	Undivided	18	4	5600	6000			5800	4-Lane - Undivided Minor Collector (Fed Aid) - URBAN
51950326	Divided	17	2	5800	5800			5800	2-Lane - Divided Major Collector - URBAN
51950379	Divided	19	6	47000	49500	51500	51500	49875	6-Lane - Divided Local - URBAN
51950396	Undivided	16	3	11500	13500	13500	13000	12875	3-Lane - Undivided Minor Arterial - URBAN
51950470	Divided	16	5	26000	29500			27750	5-Lane - Divided Minor Arterial - URBAN
51950532	Divided	14	4	44000	37000	35500	35500	38000	4-Lane - Divided Principal Arterial-Other - URBAN
51950552	Divided	14	4	42000	42000	25500	26000	33875	4-Lane - Divided Principal Arterial-Other - URBAN
51950589	#N/A	16	#N/A						NA
51950626	Divided	14	6	65000	66500	71500	66000	67250	6-Lane - Divided Principal Arterial-Other - URBAN
51950644	Divided		6	24000	24500	25000	25500	24750	NA
51950666	Divided	14	4	45500	47000	44000	45000	45375	4-Lane - Divided Principal Arterial-Other - URBAN
51950680	Divided	17	2	2100	900			1500	2-Lane - Divided Major Collector - URBAN
51950694	Divided	16	2	11000	10500	11000	11500	11000	2-Lane - Divided Minor Arterial - URBAN
51950705	Divided	14	6	65000	66500	71500	66000	67250	6-Lane - Divided Principal Arterial-Other - URBAN
51950727	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51950728	Undivided	14	3	11500	11000	11000	10500	11000	3-Lane - Undivided Principal Arterial-Other - URBAN
51950858	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51950870	Divided		6	47500	49500	49500	48000	48625	NA
51950880	Divided	14	4	41500	43000	42000	40500	41750	4-Lane - Divided Principal Arterial-Other - URBAN
51950886	Divided	14	4	45500	47000	44000	45000	45375	4-Lane - Divided Principal Arterial-Other - URBAN
51950927	Divided	14	4	36000	34000	29000	28500	31875	4-Lane - Divided Principal Arterial-Other - URBAN
51950936	Divided	14	6	71500	73500	76000	62500	70875	6-Lane - Divided Principal Arterial-Other - URBAN

51950943	Divided	14	4	44000	37000	35500	35500	38000	4-Lane - Divided Principal Arterial-Other - URBAN
51950946	Undivided		2	6500	6700	6700		6633	NA
51950952	Divided	14	4	36000	38500	34500	9000	29500	4-Lane - Divided Principal Arterial-Other - URBAN
51950974	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51950987	Undivided	16	4	21000	21500	21000	21500	21250	4-Lane - Undivided Minor Arterial - URBAN
51951008	Undivided	16	3	16500	14000	17000	19500	16750	3-Lane - Undivided Minor Arterial - URBAN
51951050	Undivided	16	2	17500	20500			19000	2-Lane - Undivided Minor Arterial - URBAN
51951078	Divided	16	6	64000	41000	63000	39000	51750	6-Lane - Divided Minor Arterial - URBAN
51951098	Divided	14	6	44500	43000	37000	36000	40125	6-Lane - Divided Principal Arterial-Other - URBAN
51951147	Divided	14	6	56500	53500	56500	56000	55625	6-Lane - Divided Principal Arterial-Other - URBAN
51951201	Undivided	16	3						3-Lane - Undivided Minor Arterial - URBAN
51951207	Divided	14	6	61500	64500	59000	60500	61375	6-Lane - Divided Principal Arterial-Other - URBAN
51951285	Undivided	16	3	10000	11500	11500	11500	11125	3-Lane - Undivided Minor Arterial - URBAN
51951295	Divided	16	4	26000	33000	32000	31500	30625	4-Lane - Divided Minor Arterial - URBAN
51951422	Divided	14	6	71500	73500	76000	62500	70875	6-Lane - Divided Principal Arterial-Other - URBAN
51951442	Divided	14	4	45500	47000	44000	45000	45375	4-Lane - Divided Principal Arterial-Other - URBAN
51951607	Divided	14	6	65000	66500	71500	66000	67250	6-Lane - Divided Principal Arterial-Other - URBAN
51951634	Undivided	17	2	3900	1550			2725	2-Lane - Undivided Major Collector - URBAN
51951646	Divided	14	6	65000	66500	71500	66000	67250	6-Lane - Divided Principal Arterial-Other - URBAN
51951650	Divided	14	4	34500	35500	34000	32500	34125	4-Lane - Divided Principal Arterial-Other - URBAN
51951660	Divided	16	4	29000	29000	40500	39000	34375	4-Lane - Divided Minor Arterial - URBAN
51951696	Divided	16	5	47500	49500	47000	50000	48500	5-Lane - Divided Minor Arterial - URBAN
51951708	Divided	14	6	19500	22500	20200	52500	28675	6-Lane - Divided Principal Arterial-Other - URBAN
51951724	Undivided	16	2	4200	4200			4200	2-Lane - Undivided Minor Arterial - URBAN
51951812	Divided	17	4	1900	2000			1950	4-Lane - Divided Major Collector - URBAN
51951888	Divided	14	4	35500	31000	32000	33000	32875	4-Lane - Divided Principal Arterial-Other - URBAN
51951894	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51951968	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51952017	Divided	18	2	3200	30500	31500	32000	24300	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
51952024	Divided	14	4	42000	42000	25500	26000	33875	4-Lane - Divided Principal Arterial-Other - URBAN
51952088	Divided	16	5	26000	29500	30500	30000	29000	5-Lane - Divided Minor Arterial - URBAN
51952209	Divided	17	2	4100	4000			4050	2-Lane - Divided Major Collector - URBAN
51952243	Divided	17	4	17400	17400			17400	4-Lane - Divided Major Collector - URBAN
51952319	Divided	16	2	11200	12700	26000	9300	14800	2-Lane - Divided Minor Arterial - URBAN
51952452	Divided	16	2	15700	15000	14200	13300	14550	2-Lane - Divided Minor Arterial - URBAN
51952485	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51952527	Divided	16	2	9300	9300			9300	2-Lane - Divided Minor Arterial - URBAN
51952582	Divided	16	4	26000	33000	32000	31500	30625	4-Lane - Divided Minor Arterial - URBAN
51952656	Divided	14	6	64000	60500	63000	69000	64125	6-Lane - Divided Principal Arterial-Other - URBAN
51952724	Divided	18	2	32000	34500	35000	36500	34500	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
51952731	Undivided	16	2	9500	9500			9500	2-Lane - Undivided Minor Arterial - URBAN
51952759	Undivided	17	2	2800	2800			2800	2-Lane - Undivided Major Collector - URBAN
51952835	Divided	17	2	4100	4000			4050	2-Lane - Divided Major Collector - URBAN
51952847	Divided	14	6	64000	60500	63000	69000	64125	6-Lane - Divided Principal Arterial-Other - URBAN
51952904	Undivided	16	2	10500	10000	10500	11000	10500	2-Lane - Undivided Minor Arterial - URBAN
51952980	Undivided	17	2	2900	2900			2900	2-Lane - Undivided Major Collector - URBAN
51952998	Undivided	17	2	3500	3500			3500	2-Lane - Undivided Major Collector - URBAN
51953021	Divided	14	4	19500	22500	20200	20700	20725	4-Lane - Divided Principal Arterial-Other - URBAN
51953043	Divided		6	47000	49500	51500	51500	49875	NA
51953047	Undivided	18	2	2400	2400			2400	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
51953057	Divided	14	8	47854	51940	51872	52500	51042	8-Lane - Divided Principal Arterial-Other - URBAN
51953059	Divided	14	4	22000	22500	24500	24500	23375	4-Lane - Divided Principal Arterial-Other - URBAN
51953073	Divided	17	2	5800	5800			5800	2-Lane - Divided Major Collector - URBAN
51953145	Divided	16	4	21000	21500	21000	21500	21250	4-Lane - Divided Minor Arterial - URBAN
51953214	Divided	14	2	33500	34000	35000	32500	33750	2-Lane - Divided Principal Arterial-Other - URBAN

51953326	Undivided	17	4	20000	18500	19500	19800	19450	4-Lane - Undivided Major Collector - URBAN
51953339	Divided	16	2	9300	9900	9100	9300	9400	2-Lane - Divided Minor Arterial - URBAN
51953468	Divided	17	3	2100	900	7600		3533	3-Lane - Divided Major Collector - URBAN
51953504	Divided	17	2	47500	49500	49500	48000	48625	2-Lane - Divided Major Collector - URBAN
51953576	Divided	16	4	26500				26500	4-Lane - Divided Minor Arterial - URBAN
51953684	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51953690	Undivided	16	3	9800	9900	10000	9900	9900	3-Lane - Undivided Minor Arterial - URBAN
51953703	Undivided	17	4	15000	15000			15000	4-Lane - Undivided Major Collector - URBAN
51953881	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51953894	Undivided	16	2	4000	4000			4000	2-Lane - Undivided Minor Arterial - URBAN
51954153	Divided	18	2	3200	3200			3200	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
51954167	Divided	14	5	47000	49500	48000	26000	42625	5-Lane - Divided Principal Arterial-Other - URBAN
51954247	Divided	16	4	25500	26000	25500	26000	25750	4-Lane - Divided Minor Arterial - URBAN
51954312	Divided	17	2	47500	49500	49500	48000	48625	2-Lane - Divided Major Collector - URBAN
51954318	Divided	17	2	3900	1550			2725	2-Lane - Divided Major Collector - URBAN
51954354	Divided	16	4	26000	30000	28500	29500	28500	4-Lane - Divided Minor Arterial - URBAN
51954418	Divided	14	6	19500	22500	20200	52500	28675	6-Lane - Divided Principal Arterial-Other - URBAN
51954446	Undivided	16	3	9800	9900	10000	9900	9900	3-Lane - Undivided Minor Arterial - URBAN
51954454	Divided		6	47500	49500	49500	48000	48625	NA
51954483	Undivided	19	2	2200	2200			2200	2-Lane - Undivided Local - URBAN
51954485	Divided	18	2	3100	3100			3100	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
51954503	Divided	14	6	44500	43000	45500	44000	44250	6-Lane - Divided Principal Arterial-Other - URBAN
51954546	Divided	17	2	2900	21000			11950	2-Lane - Divided Major Collector - URBAN
51954548	Divided	17	2	1900	1900			1900	2-Lane - Divided Major Collector - URBAN
51954633	Undivided	16	3	6500	5500	5700	6100	5950	3-Lane - Undivided Minor Arterial - URBAN
51954697	Divided	16	2	13500	13500			13500	2-Lane - Divided Minor Arterial - URBAN
51954705	Divided	14	4	17500	17500	35000	36500	26625	4-Lane - Divided Principal Arterial-Other - URBAN
51954717	Divided	18	2	3200	3200			3200	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
51954724	Divided	14	4	35500	31000	32000	33000	32875	4-Lane - Divided Principal Arterial-Other - URBAN
51954732	Undivided	14	4	35500	31000	32000	33000	32875	4-Lane - Undivided Principal Arterial-Other - URBAN
51954772	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51954805	Divided	16	2	4200	4200			4200	2-Lane - Divided Minor Arterial - URBAN
51954816	Divided	16	2	9400	9400			9400	2-Lane - Divided Minor Arterial - URBAN
51954891	Undivided	17	2	500	500			500	2-Lane - Undivided Major Collector - URBAN
51954961	Undivided	16	4	19400	19400			19400	4-Lane - Undivided Minor Arterial - URBAN
51954962	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51954983	Undivided	16	4	26500				26500	4-Lane - Undivided Minor Arterial - URBAN
51955015	Divided	17	2	500	1550			1025	2-Lane - Divided Major Collector - URBAN
51955017	Undivided	16	3	9800	9900	10000	9900	9900	3-Lane - Undivided Minor Arterial - URBAN
51955132	#N/A	16	#N/A						NA
51955141	Divided	19	6	2200	2200	51500	51500	26850	6-Lane - Divided Local - URBAN
51955171	Undivided	16	3	10000	9400	9700	9700	9700	3-Lane - Undivided Minor Arterial - URBAN
51955196	Divided	18	6	3100	3100	45500	44000	23925	6-Lane - Divided Minor Collector (Fed Aid) - URBAN
51955237	Divided	14	4	34500	30500	31500	32000	32125	4-Lane - Divided Principal Arterial-Other - URBAN
51955460	Divided	14	6	45000	48000	42500	42000	44375	6-Lane - Divided Principal Arterial-Other - URBAN
51955521	Undivided	18	4	22000	25000	24000	22500	23375	4-Lane - Undivided Minor Collector (Fed Aid) - URBAN
51955561	Divided	17	4	9900	8400			9150	4-Lane - Divided Major Collector - URBAN
51955564	Divided	17	2	4100	4000			4050	2-Lane - Divided Major Collector - URBAN
51955618	Divided	16	6	35000	35000	45000	44000	39750	6-Lane - Divided Minor Arterial - URBAN
51955635	Divided	14	5	47500	49500	47000	50000	48500	5-Lane - Divided Principal Arterial-Other - URBAN
51955640	Divided	14	6	48500	54000	54000	52500	52250	6-Lane - Divided Principal Arterial-Other - URBAN
51955650	Undivided	16	3	10000	9400	9700	9700	9700	3-Lane - Undivided Minor Arterial - URBAN
51955655	Divided		6	47500	49500	49500	48000	48625	NA
51955672	Divided		6	47500	49500	49500	48000	48625	NA
51955737	Divided	14	4	19000	20200	19700	19400	19575	4-Lane - Divided Principal Arterial-Other - URBAN

51955763	Undivided	16	3	11500	19500	13500	13000	14375	3-Lane - Undivided Minor Arterial - URBAN
51955834	Divided	14	4	34500	30500	31500	32000	32125	4-Lane - Divided Principal Arterial-Other - URBAN
51955845	Undivided	18	3						3-Lane - Undivided Minor Collector (Fed Aid) - URBAN
51955849	Undivided	16	3	16500	14000	13500	13500	14375	3-Lane - Undivided Minor Arterial - URBAN
51955912	Divided	18	2	3200	3200			3200	2-Lane - Divided Minor Collector (Fed Aid) - URBAN
51955950	Divided	14	6	46500	49500	45500	44000	46375	6-Lane - Divided Principal Arterial-Other - URBAN
51956000	Divided		6	47000	49500	51500	51500	49875	NA
51956006	Undivided	16	4	19400	19400			19400	4-Lane - Undivided Minor Arterial - URBAN
51956116	Divided		6	47500	49500	49500	48000	48625	NA
51956154	Undivided	18	2	6800				6800	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
51956174	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51956211	Undivided	17	2	5200	5200			5200	2-Lane - Undivided Major Collector - URBAN
51956357	Divided	14	4	31000	30500	32000	30000	30875	4-Lane - Divided Principal Arterial-Other - URBAN
51956463	Divided	14	4	39500	40500	39000	37500	39125	4-Lane - Divided Principal Arterial-Other - URBAN
51956484	Divided	16	2	13500	13500			13500	2-Lane - Divided Minor Arterial - URBAN
51956596	Divided	14	4	45500	47000	44000	45000	45375	4-Lane - Divided Principal Arterial-Other - URBAN
51956676	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51956696	Divided	14	7	47854	51940	51872	52500	51042	7-Lane - Divided Principal Arterial-Other - URBAN
51956702	#N/A	17	#N/A	2800	2800			2800	NA
51956733	Undivided	17	2	5200	5200			5200	2-Lane - Undivided Major Collector - URBAN
51956897	Undivided	16	3	19500	19500	20500	21000	20125	3-Lane - Undivided Minor Arterial - URBAN
51956968	Undivided	14	3	16500	14000	9000	9000	12125	3-Lane - Undivided Principal Arterial-Other - URBAN
51956998	Undivided	14	2	16500	19000	17000	19500	18000	2-Lane - Undivided Principal Arterial-Other - URBAN
51957057	Undivided	17	3	20500	20500			20500	3-Lane - Undivided Major Collector - URBAN
51957078	Undivided	17	2	7300	3200			5250	2-Lane - Undivided Major Collector - URBAN
51957089	Divided	16	5	28000	33000	32000	31500	31125	5-Lane - Divided Minor Arterial - URBAN
51957107	Divided	19	2	2400	2400			2400	2-Lane - Divided Local - URBAN
51957182	Divided	17	4	17400	17400			17400	4-Lane - Divided Major Collector - URBAN
51957235	Undivided	17	2	9300	9300			9300	2-Lane - Undivided Major Collector - URBAN
51957253	Divided	14	4	19000	20200	19700	19400	19575	4-Lane - Divided Principal Arterial-Other - URBAN
51957254	Undivided	16	4	19400	19400			19400	4-Lane - Undivided Minor Arterial - URBAN
51957267	Divided	14	6	39500	39000	37000	36000	37875	6-Lane - Divided Principal Arterial-Other - URBAN
51957288	Undivided	14	4	3700	5200	5200	19000	8275	4-Lane - Undivided Principal Arterial-Other - URBAN
51957325	Divided	14	7	64000	60500	63000	69000	64125	7-Lane - Divided Principal Arterial-Other - URBAN
51957404	Divided	17	2	25500	16500			21000	2-Lane - Divided Major Collector - URBAN
51958303	Divided		6	67000	61000	60000	57000	61250	NA
51958312	Divided		4	40500	35000	34000	35000	36125	NA
51958394	Divided	14	6	38500	39000	39000	40000	39125	6-Lane - Divided Principal Arterial-Other - URBAN
51958399	Divided	16	4	20000	19800	19800	22000	20400	4-Lane - Divided Minor Arterial - URBAN
51958991	Divided		4	23500	23500	26000	27000	25000	NA
51959096	Divided	17	4	8300	46500	46500	36000	34325	4-Lane - Divided Major Collector - URBAN
51959180	Divided	17	2	8000	8000			8000	2-Lane - Divided Major Collector - URBAN
51959734	Divided	17	2	14800	19700	19700	17000	17800	2-Lane - Divided Major Collector - URBAN
51959884	Divided	14	6	30000	29500	29500	29000	29500	6-Lane - Divided Principal Arterial-Other - URBAN
54145302	Undivided	16	2	10000	14400	14500		12967	2-Lane - Undivided Minor Arterial - URBAN
60638551	Divided		4	49500	51500	45000	40500	46625	NA
70047571	Undivided	19	2	6600	6400	8900	7300	7300	2-Lane - Undivided Local - URBAN
70059857	Divided	14	6	56500	59000	58500	58500	58125	6-Lane - Divided Principal Arterial-Other - URBAN
70081359	Divided	16	4	30000	26000	29000	30000	28750	4-Lane - Divided Minor Arterial - URBAN
70083926	Divided	14	4	34000	33000	31500	31500	32500	4-Lane - Divided Principal Arterial-Other - URBAN
70095352	Divided		6	44000	43500	47000	45000	44875	NA
70097562	Divided	14	7	43000	51940	51872	52500	49828	7-Lane - Divided Principal Arterial-Other - URBAN
70097567	Undivided	17	2	9400	9400			9400	2-Lane - Undivided Major Collector - URBAN
70257222	Undivided	17	2	6000	3900	3900	3900	4425	2-Lane - Undivided Major Collector - URBAN
70258395	Divided		6	41500	36500	36500	36500	37750	NA

70303970	Undivided	19	2	4800	4700			4750	2-Lane - Undivided Local - URBAN
70322137	Divided	17	4	18900				18900	4-Lane - Divided Major Collector - URBAN
70343886	Divided	16	4	38000	8300	25000	27000	24575	4-Lane - Divided Minor Arterial - URBAN
70386496	Divided		4	21500	20000	20500	3400	16350	NA
70411538	Undivided	17	4	9500				9500	4-Lane - Undivided Major Collector - URBAN
70411769	Undivided	19	2						2-Lane - Undivided Local - URBAN
70443113	#N/A	16	#N/A						NA
70451899	Undivided	6	2	2300	2500	2500	3000	2575	2-Lane - Undivided Minor Arterial - RURAL
70472182	Undivided	18	2	9700	9700	9700	9900	9750	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
70487959	Undivided	18	2	8300	10800	10400	9400	9725	2-Lane - Undivided Minor Collector (Fed Aid) - URBAN
70489227	Divided	17	2	8300	40000	8200		18833	2-Lane - Divided Major Collector - URBAN
70517347	Undivided	14	3	25500	23500	24000	23000	24000	3-Lane - Undivided Principal Arterial-Other - URBAN
70541022	Undivided	14	3	25000	22000	22500	22500	23000	3-Lane - Undivided Principal Arterial-Other - URBAN
70547698	Undivided	14	4	26400	23000	22500	19500	22850	4-Lane - Undivided Principal Arterial-Other - URBAN
70549919	Undivided	14	2	15500	17500	14000	14500	15375	2-Lane - Undivided Principal Arterial-Other - URBAN
70663742	Undivided	14	4	16000	17300	17500	14500	16325	4-Lane - Undivided Principal Arterial-Other - URBAN
70715712	Undivided	17	2	13900	14800			14350	2-Lane - Undivided Major Collector - URBAN
70727437	Divided	14	6	30000	33500	25500	32500	30375	6-Lane - Divided Principal Arterial-Other - URBAN
70727559	Divided	14	4		30500	34000		32250	4-Lane - Divided Principal Arterial-Other - URBAN
70785627	Divided	14	6	39000	42000	39000	43500	40875	6-Lane - Divided Principal Arterial-Other - URBAN
70793995	Divided	16	2	10500	10500			10500	2-Lane - Divided Minor Arterial - URBAN
70822967	Divided	16	4	5300	5400	14100	10900	8925	4-Lane - Divided Minor Arterial - URBAN
70823227	Divided	14	2	11500	18000	5300	12400	11800	2-Lane - Divided Principal Arterial-Other - URBAN
70823802	Divided	16	4	10500	10500			10500	4-Lane - Divided Minor Arterial - URBAN
70824286	Divided		4	24000	26000	26000	26000	25500	NA
70876028	Divided	16	6	35000	35500	38500	39000	37000	6-Lane - Divided Minor Arterial - URBAN
70876031	Divided	16	6	44500	47000	47500	51500	47625	6-Lane - Divided Minor Arterial - URBAN
70877373	Divided	16	4	12500	12700	11600	12200	12250	4-Lane - Divided Minor Arterial - URBAN
70888234	Divided	17	2	10000	7500	8100		8533	2-Lane - Divided Major Collector - URBAN
70900375	Divided	17	4	17000	15600	16700	16400	16425	4-Lane - Divided Major Collector - URBAN
70900507	Divided	16	4	14500	14500			14500	4-Lane - Divided Minor Arterial - URBAN
70918467	Divided	14	4	30500	32500	31000	33000	31750	4-Lane - Divided Principal Arterial-Other - URBAN
70937085	Divided		4	12900	12100	11500	14000	12625	NA
70937101	Undivided	16	2	5200	5000	5000	6000	5300	2-Lane - Undivided Minor Arterial - URBAN
70937134	Divided	16	2	6500	6200	6000	6400	6275	2-Lane - Divided Minor Arterial - URBAN
70998173	Divided	17	2	4600	3600			4100	2-Lane - Divided Major Collector - URBAN
71031282	Divided	17	2	8600	7500	7500	9200	8200	2-Lane - Divided Major Collector - URBAN
71031283	Undivided	17	2	9100	8700	8700	9600	9025	2-Lane - Undivided Major Collector - URBAN
71042090	Undivided	4	2	8600	8100	8100	8100	8225	2-Lane - Undivided Principal Arterial-Other - RURAL
71042174	Divided	4	4				9700	9700	4-Lane - Divided Principal Arterial-Other - RURAL
71055817	Undivided	17	2	5000	5100			5050	2-Lane - Undivided Major Collector - URBAN
71057211	Undivided	17	2	900				900	2-Lane - Undivided Major Collector - URBAN
71117237	Divided	7	4	9500	6100	5600	18900	10025	4-Lane - Divided Major Collector - RURAL
71118837	Divided	4	4				18900	18900	4-Lane - Divided Principal Arterial-Other - RURAL
71221127	Divided	17	2	15200	14800	6700	6100	10700	2-Lane - Divided Major Collector - URBAN
71221811	Divided	17	4	7300				7300	4-Lane - Divided Major Collector - URBAN
71222238	Divided	17	4	7300				7300	4-Lane - Divided Major Collector - URBAN
71256081	Divided		4	18000	18900	19100	19300	18825	NA
71259956	Undivided	17	2	7700	9500	9500	9600	9075	2-Lane - Undivided Major Collector - URBAN
71267551	Divided	16	2	19200	26000	22500	23000	22675	2-Lane - Divided Minor Arterial - URBAN
71281019	Divided		6	29500	29000	29000	29000	29125	NA
71323533	Undivided	17	4	29000	4400	13600	13800	15200	4-Lane - Undivided Major Collector - URBAN
71353783	Undivided	17	2	3200				3200	2-Lane - Undivided Major Collector - URBAN
71378173	Divided	19	2						2-Lane - Divided Local - URBAN
71415185	Divided	17	2	11300	9300			10300	2-Lane - Divided Major Collector - URBAN

71450715	**Undivided**	**19**	**2**						**2-Lane - Undivided Local - URBAN**
71450762	**Divided**	**14**	**4**	26500	24500	26000	26500	**25875**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71466289	**Divided**	**16**	**5**						**5-Lane - Divided Minor Arterial - URBAN**
71467973	**Divided**	**14**	**6**	52500	56000	59500	55500	**55875**	**6-Lane - Divided Principal Arterial-Other - URBAN**
71486226	**Undivided**	**17**	**2**	7200	7200	6900		**7100**	**2-Lane - Undivided Major Collector - URBAN**
71493174	**Divided**	**16**	**2**	6800	6800			**6800**	**2-Lane - Divided Minor Arterial - URBAN**
71493268	**Divided**	**17**	**2**	6700	6700			**6700**	**2-Lane - Divided Major Collector - URBAN**
71493477	**Divided**	**14**	**6**	36000	36500	37000	39000	**37125**	**6-Lane - Divided Principal Arterial-Other - URBAN**
71591348	**Divided**	**16**	**2**	26000	5600	6000	27000	**16150**	**2-Lane - Divided Minor Arterial - URBAN**
71591352	**Divided**	**14**	**4**	12500	13700	15500	15800	**14375**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591378	**Divided**	**14**	**4**	12500	13700	15500	15800	**14375**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591390	**Divided**	**14**	**4**	12500	13700	15500	15800	**14375**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591400	**Divided**	**14**	**4**	12800	13800	16100	11800	**13625**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591419	**Divided**	**14**	**4**	12800	13800	16100	11800	**13625**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591422	**Divided**	**14**	**4**	12500	13700	15500	15800	**14375**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591443	**Divided**	**14**	**4**	400	400	16100	11800	**7175**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591458	**Divided**	**14**	**4**	12800	13800	16100	11800	**13625**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71591461	**Divided**	**14**	**4**	12500	13700	15500	15800	**14375**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71632873	**Divided**	**16**	**4**						**4-Lane - Divided Minor Arterial - URBAN**
71632883	**Undivided**	**18**	**2**						**2-Lane - Undivided Minor Collector (Fed Aid) - URBAN**
71632906	**Undivided**	**18**	**2**						**2-Lane - Undivided Minor Collector (Fed Aid) - URBAN**
71632931	**Divided**	**18**	**4**	7800	4500	4500	7100	**5975**	**4-Lane - Divided Minor Collector (Fed Aid) - URBAN**
71632996	**Undivided**	**18**	**2**	400				**400**	**2-Lane - Undivided Minor Collector (Fed Aid) - URBAN**
71633060	**Undivided**	**17**	**2**	5500	5500	5500		**5500**	**2-Lane - Undivided Major Collector - URBAN**
71633130	**Divided**	**14**	**4**						**4-Lane - Divided Principal Arterial-Other - URBAN**
71670773	**Divided**	**16**	**4**	37000	19600	56000		**37533**	**4-Lane - Divided Minor Arterial - URBAN**
71670778	**Divided**	**17**	**4**	3400	3400			**3400**	**4-Lane - Divided Major Collector - URBAN**
71670780	**#N/A**	**14**	**#N/A**						**NA**
71670819	**Undivided**	**17**	**2**	1700	1700			**1700**	**2-Lane - Undivided Major Collector - URBAN**
71670845	**Divided**	**14**	**4**	30500	28500	30000	30000	**29750**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71670889	**Divided**	**16**	**3**	14000	14000			**14000**	**3-Lane - Divided Minor Arterial - URBAN**
71670913	**Undivided**	**17**	**2**	1200	1200			**1200**	**2-Lane - Undivided Major Collector - URBAN**
71670924	**#N/A**	**14**	**#N/A**						**NA**
71670954	**Divided**	**19**	**2**	11100	9800	9800		**10233**	**2-Lane - Divided Local - URBAN**
71670963	**#N/A**	**14**	**#N/A**						**NA**
71670964	**#N/A**	**14**	**#N/A**						**NA**
71670998	**Undivided**	**17**	**2**	3300	3300			**3300**	**2-Lane - Undivided Major Collector - URBAN**
71671054	**Divided**		**7**	56500	49500	55000	54500	**53875**	**NA**
71671065	**#N/A**	**14**	**#N/A**						**NA**
71671154	**Divided**	**17**	**4**	8600	8900	10500		**9333**	**4-Lane - Divided Major Collector - URBAN**
71671159	**Undivided**	**17**	**2**	2600	2700			**2650**	**2-Lane - Undivided Major Collector - URBAN**
71671203	**Undivided**	**17**	**4**	3400	3400			**3400**	**4-Lane - Undivided Major Collector - URBAN**
71671265	**Divided**	**14**	**4**	30500	28500	30000	30000	**29750**	**4-Lane - Divided Principal Arterial-Other - URBAN**
71671344	**Divided**	**17**	**2**	6100	6200			**6150**	**2-Lane - Divided Major Collector - URBAN**
71671345	**Divided**	**19**	**2**						**2-Lane - Divided Local - URBAN**
71671364	**Divided**	**17**	**2**	8600	8900	8900	8900	**8825**	**2-Lane - Divided Major Collector - URBAN**
71671516	**#N/A**	**14**	**#N/A**						**NA**
71671781	**Undivided**	**17**	**2**	4900	12400	15100		**10800**	**2-Lane - Undivided Major Collector - URBAN**
71671796	**Divided**	**17**	**2**	14500	6200	15100	15100	**12725**	**2-Lane - Divided Major Collector - URBAN**
71671826	**#N/A**	**14**	**#N/A**						**NA**
71671849	**Divided**	**17**	**2**	14500	12400	15100		**14000**	**2-Lane - Divided Major Collector - URBAN**
71671906	**#N/A**	**14**	**#N/A**						**NA**
71672109	**Divided**	**16**	**4**	17200	18000	56000		**30400**	**4-Lane - Divided Minor Arterial - URBAN**
71672111	**Divided**		**6**	59966	58590	58426	57673	**58664**	**NA**
71672198	**Divided**		**6**	42500	42500	45000	45000	**43750**	**NA**

Appendix F: Excerpts of Raw Data for Signalized Intersections

FID_Signal	RDWYID	VALUE_	BEGPT	COSITE	AADT	DFCTR		FID_Signal	Population	Count of Approaches	AADT 1	AADT 2	AADT 3	AADT 4	AADT 5	2013 Total Entering Vehicles	SAMPLE ENTERING VEHICLES	Entering Vehicles Category	2009 -2014 No of Crashes
0	87002000	2	6.933	871190	54500	52.4		0	4841	1	54500					218000		> 50,000 vpd	1
1	87008000	2	7.187	870140	12000	99.9		5	10139	1	11500					46000		40,000 - 50,000 vpd	1
2	72230000	2	2.115	720577	27000	54.9		9	1882	1	16100					64400		> 50,000 vpd	1
3	86005000	2	0.97	860359	25500	54.6		12	1990	1	60000					240000		> 50,000 vpd	3
4	79060000	2	15.582	790532	25000	61		18	3012	2	5900	16400				22300		20,000 - 30,000 vpd	1
4	79060000	2	15.582	798165	5900	61		19	5070	1	28500					114000		> 50,000 vpd	1
5	93010101	2	0.964	935249	11500	99.9		23	2153	1	26500					106000		> 50,000 vpd	1
6	87080900	2	35.443	870538	28500	52.4		24	5077	1	23500					94000		> 50,000 vpd	1
6	87080900	2	35.443	870537	23500	52.4		28	2162	1	17800					71200		> 50,000 vpd	1
7	87080900	5	38.792	870104	26400	52.4		29	1645	3	25500	23000	8300			56800		> 50,000 vpd	1
8	87281000	5	10.234	870030	15700	52.4	DATA COLLECTED	30	3459	4	34000	31000	38500	32500		136000	136000	> 50,000 vpd	13
9	72150000	2	1.428	720021	16100	57.1		32	13900	2	16400	34000				50400		> 50,000 vpd	1
10	87030001	2	0.165	875046	21500	99.9		34	3170	2	57000	61500				118500		> 50,000 vpd	2
11	79080000	2	7.339	795125	14000	61		39	3221	1	66083					264332		> 50,000 vpd	1
12	86080000	2	18.177	860417	60000	53.6		51	5782	1	28000					112000		> 50,000 vpd	1
13	37510000	N/A	0	375021	7300	55.6		57	3957	1	51000					204000		> 50,000 vpd	1
13	37510000	N/A	0	379002	3800	55.6		58	6282	1	42000					168000		> 50,000 vpd	2
13	37510000	N/A	0	379134	1400	55.6		59	63424	1	25500					102000		> 50,000 vpd	3
14	86210000	2	3.019	860442	33000	53.6		62	6587	1	46000					184000		> 50,000 vpd	3
14	86210000	2	3.019	867378	28500	53.6		64	6124	4	7400	27593	34000	24000		92993		> 50,000 vpd	3
15	86220000	2	10.668	867129	52500	56.2		68	4518	1	55500					222000		> 50,000 vpd	1
16	87250000	2	0.186	875341	12400	52.4		69	10603	1	26300					105200		> 50,000 vpd	3
17	87250000	N/A	0	870200	55000	52.4		70	2688	2	37000	31500				68500		> 50,000 vpd	3
17	87250000	N/A	0	875341	12400	52.4		74	2156	1	27000					108000		> 50,000 vpd	2
17	87250000	N/A	0	878667	12300	58.9		76	6682	1	26500					106000		> 50,000 vpd	1
18	70022000	2	39.679	707059	5900	54.2		77	26051	1	58500					234000		> 50,000 vpd	1
18	70022000	2	39.679	700417	16400	54.2		80	2437	2	21500	28500				50000		40,000 - 50,000 vpd	2
19	79230000	2	1.472	791014	28500	61		83	38933	1	25500					102000		> 50,000 vpd	1
20	86020000	2	4.549	860139	49500	54.6		87	2130	1	8700					34800		30,000 - 40,000 vpd	1
21	93280000	2	9.916	930699	18500	58.5		91	3715	1	32000					128000		> 50,000 vpd	2
21	93280000	2	9.916	938506	6800	58.5		92	1354	2	8500	12500				21000		20,000 - 30,000 vpd	1
22	26005000	1	14.169	260491	6900	52.7		95	16152	2	17900	24500				42400		40,000 - 50,000 vpd	1
23	26010000	2	14.835	265015	26500	52.7		99	5054	1	44500					178000		> 50,000 vpd	1
24	87002000	2	0.889	870324	23500	52.4		105	895	3	13200	15100	5000			33300		30,000 - 40,000 vpd	1
25	29050000	1	0.966	290221	4900	55.3		106	7290	1	40500					162000		> 50,000 vpd	1
25	29050000	1	0.966	260248	8400	57.8		110	1150	2	48500	43000				91500		> 50,000 vpd	2
26	46010000	2	8.347	460166	12482	53.6	DATA COLLECTED	111	1320	1	31000					124000	126000	> 50,000 vpd	2
27	86130000	2	7.309	860435	24500	54.6		112	10817	2	11500	12200				23700		20,000 - 30,000 vpd	2
28	86170000	2	11.619	860047	17800	53.6	DATA COLLECTED	114	4739	1	53500					214000	137000	> 50,000 vpd	4
29	36010000	2	23.868	365017	25500	56.7		117	3683	1	37000					148000		> 50,000 vpd	2
29	36010000	2	23.868	360378	23000	56.7		118	14141	1	26400					105600		> 50,000 vpd	5
29	36010000	2	23.868	360038	8300	56.7		119	19289	1	26500					106000		> 50,000 vpd	2
30	75250000	2	4.812	758107	34000	53.3		121	7858	1	48000					192000		> 50,000 vpd	1
30	75250000	2	4.812	750059	31000	53.3		127	4760	2	12000	13200				25200		20,000 - 30,000 vpd	4
30	75250000	2	4.812	750058	38500	53.3		128	10652	2	68500	58000				126500		> 50,000 vpd	6
30	75250000	2	4.812	757037	32500	53.3		130	1413	1	21500					86000		> 50,000 vpd	2
31	14580001	2	0.224	149096	11800	60		131	23090	1	18500					74000		> 50,000 vpd	1
32	87060000	2	3.67	875159	16400	52.4		133	5714	1	26500					106000		> 50,000 vpd	2
32	87060000	2	3.67	872528	34000	54.1		135	10723	2	52000	38000				90000		> 50,000 vpd	7
33	15010000	2	17.869	159176	20000	55.2		136	2773	1	22000					88000		> 50,000 vpd	1

34	15030000	2	1.548	155127	57000	55.2		142	1456	1	16400			65600		> 50,000 vpd	2
34	15030000	2	1.548	150015	61500	55.2		143	2277	2	50000	48500		98500		> 50,000 vpd	5
35	27010000	1	23.537	273009	3900	58.6		144	513	2	5300	5300		10600		< 20,000 vpd	1
36	29002000	2	2.754	295033	8500	55.3		147	18378	1	16400			65600		> 50,000 vpd	2
37	88010000	2	8.375	880100	20300	53.4		154	2024	1	26500			106000		> 50,000 vpd	1
38	88060000	2	22.565	885195	9900	58		158	96561	2	13500	15600		29100		20,000 - 30,000 vpd	5
39	86200000	5	3.502	860150	66083	52		159	2556	1	50500			202000		> 50,000 vpd	1
40	1010101	2	1.528	10033	24000	99.9		160	2986	1	50000			200000		> 50,000 vpd	2
41	87027000	2	2.795	871204	33500	52.4		161	2261	1	34000			136000		> 50,000 vpd	1
41	87027000	2	2.795	871203	30500	52.4	DATA COLLECTED	163	1247	1	37000			148000	165000	> 50,000 vpd	3
42	75250000	2	8.07	750057	14300	53.3		164	2729	1	32000			128000		> 50,000 vpd	1
43	70030000	2	1.998	705143	23000	54.2		166	374	1	50000			200000		> 50,000 vpd	1
44	79220001	2	0.703	795195	4100	99.9		170	3445	1	47000			188000		> 50,000 vpd	4
44	79220001	2	0.703	795194	5600	99.9		172	5478	1	39500			158000		> 50,000 vpd	3
45	87250000	2	1.957	870541	19200	52.4		174	9457	1	30000			120000		> 50,000 vpd	2
46	71070000	2	10.956	710122	51500	55.1		175	7572	1	18600			74400		> 50,000 vpd	2
47	48004000	2	7.103	485275	39000	56.3		181	11090	1	30500			122000		> 50,000 vpd	1
48	48010000	2	14.196	484042	13900	56.3		183	1160	1	7100			28400		20,000 - 30,000 vpd	1
49	53110000	1	9.458	535077	11500	55.3		186	3464	1	16400			65600		> 50,000 vpd	1
49	53110000	1	9.458	535079	7000	55.3		190	6589	1	36000			144000		> 50,000 vpd	2
49	53110000	1	9.458	535069	2600	55.3		191	2764	1	50500			202000		> 50,000 vpd	3
49	53110000	1	9.458	531507	1200	55.3		196	3046	2	35500	38500		74000		> 50,000 vpd	2
50	46020000	2	1.049	465901	1450	55.3		201	3631	1	55000			220000		> 50,000 vpd	1
50	46020000	2	1.049	465221	60500	57.9		202	3095	1	37500			150000		> 50,000 vpd	1
50	46020000	2	1.049	461609	55000	53.6		203	13068	1	72500			290000		> 50,000 vpd	1
51	93010000	3	13.323	935033	28000	58.5		204	2000	1	3000			12000		< 20,000 vpd	1
52	79040000	2	7.833	795166	26500	61		206	4736	1	38000			152000		> 50,000 vpd	2
52	79040000	2	7.833	797105	8500	61		209	1877	1	36000			144000		> 50,000 vpd	1
53	72070000	2	11.084	720594	37000	57.1		215	5963	2	24500	33000		57500		> 50,000 vpd	3
54	87030000	3	5.124	870521	85000	58.9		217	2576	1	31500			126000		> 50,000 vpd	3
55	88080000	N/A	0	889220	3700	58		218	2365	1	21500			86000		> 50,000 vpd	1
56	71130000	N/A	2.781	715006	30500	55.1		219	3286	1	16200			64800		> 50,000 vpd	1
56	71130000	N/A	2.781	719102	2900	55.1		223	1705	2	24435	25000		49435		40,000 - 50,000 vpd	1
57	86012000	2	2.01	863015	51000	53.6		225	2309	1	23500			94000		> 50,000 vpd	6
58	86014000	2	9.776	865296	42000	53.6		229	1726	1	48500			194000		> 50,000 vpd	3
59	87060001	2	2.132	870520	25500	99.9		230	384	1	5100			20400		20,000 - 30,000 vpd	1
60	10002012	2	0.077	102842	2600	99.9		231	7131	1	36500			146000		> 50,000 vpd	1
61	10190112	2	0.255	102793	4700	99.9		232	5209	2	33500	49000		82500		> 50,000 vpd	5
62	86100000	2	14.36	860478	46000	53.6		233	5131	2	43500	40500		84000		> 50,000 vpd	2
63	46001000	2	0	465203	25000	55.3		236	1416	1	13700			54800		> 50,000 vpd	1
63	46001000	2	0	465202	7100	55.3		237	837	2	19700	31500		51200		> 50,000 vpd	1
63	46001000	2	0	461614	16600	55.3		242	23803	2	12000	19800		31800		30,000 - 40,000 vpd	1
63	46001000	2	0	465087	34000	55.3		244	2682	1	43500			174000		> 50,000 vpd	1
64	86018000	N/A	6.547	867819	7400	54.6		245	1821	2	16600	4200		20800		20,000 - 30,000 vpd	1
64	86018000	N/A	6.547	860176	27593	53.4		250	11582	1	37500			150000		> 50,000 vpd	2
64	86018000	N/A	6.547	865028	34000	54.6		251	20582	1	23004			92016		> 50,000 vpd	2
64	86018000	N/A	6.547	865093	24000	53.6		255	14465	1	78000			312000		> 50,000 vpd	1
65	87066000	2	1.014	871024	36000	52.4		256	15938	2	50500	36500		87000		> 50,000 vpd	11
66	26005000	2	9.716	260428	13300	52.7		257	7796	3	7900	19500	23500	50900		> 50,000 vpd	2
66	26005000	2	9.716	265067	14300	52.7		260	5992	1	56000			224000		> 50,000 vpd	7
67	75011000	2	0.904	750578	57000	53.3		261	2936	1	45500			182000		> 50,000 vpd	1
68	93120000	2	19.928	930141	55500	60.6		262	20352	3	38000	54000	65000	157000		> 50,000 vpd	4
69	87080900	2	37.987	870547	26300	52.4		263	30911	1	34000			136000		> 50,000 vpd	2
70	29010000	2	8.532	290102	37000	55.3		265	3215	2	54000	30500		84500		> 50,000 vpd	1
70	29010000	2	8.532	290285	31500	55.3		268	2959	2	19300	38000		57300		> 50,000 vpd	5

71	26060000	2	11.42	260227	10400	53.5		**270**	**2208**	1	21500				**86000**	**> 50,000 vpd**	**1**
72	26070000	1	18.305	265071	21500	52.7		**274**	**3215**	2	35500	25500			**61000**	**> 50,000 vpd**	**6**
73	14040000	2	0	140062	31000	60		**275**	**24296**	2	12000	9700			**21700**	**20,000 - 30,000 vpd**	**1**
73	14040000	2	0	105608	37000	58.2		**278**	**8186**	1	22597				**90388**	**> 50,000 vpd**	**1**
74	92010000	2	7.611	921002	27000	53		**279**	**17390**	1	39500				**158000**	**> 50,000 vpd**	**1**
75	93090000	2	8.174	930082	24000	60.6		**281**	**1554**	1	30000				**120000**	**> 50,000 vpd**	**3**
76	15007000	2	2.792	155179	26500	55.2		**282**	**7544**	1	32000				**128000**	**> 50,000 vpd**	**1**
77	87030000	2	23.145	870183	58500	52.4		**283**	**4446**	1	40000				**160000**	**> 50,000 vpd**	**1**
78	86200000	5	3.133	860150	66083	52		**285**	**6335**	1	18200				**72800**	**> 50,000 vpd**	**3**
79	16003000	2	0.685	165176	7600	55.9		**289**	**1809**	3	10700	18000	10000		**38700**	**30,000 - 40,000 vpd**	**1**
80	13010000	2	6.079	135078	21500	54.8		**293**	**1118**	1	17800				**71200**	**> 50,000 vpd**	**1**
80	13010000	2	6.079	130003	28500	54.8		**294**	**6119**	2	1500	58000			**59500**	**> 50,000 vpd**	**2**
81	86090000	2	2.689	865302	57500	56.2		**295**	**28118**	1	58500				**234000**	**> 50,000 vpd**	**1**
82	70020000	2	4.511	700405	40000	54.2		**296**	**276**	1	1250				**5000**	**< 20,000 vpd**	**1**
82	70020000	2	4.511	705127	37500	54.2		**299**	**1628**	1	51500				**206000**	**> 50,000 vpd**	**1**
82	70020000	2	4.511	708149	10800	54.2		**304**	**1118**	1	23500				**94000**	**> 50,000 vpd**	**1**
83	87060001	3	0.235	870520	25500	99.9		**305**	**2987**	1	52000				**208000**	**> 50,000 vpd**	**1**
84	72040345	2	0.126	723817	29500	57.1		**306**	**1625**	2	600	59966			**60566**	**> 50,000 vpd**	**4**
85	86100000	2	16.802	860426	47500	53.6		**311**	**1132**	4	23500	15100	28000	2600	**69200**	**> 50,000 vpd**	**3**
86	86100000	2	24.478	860118	54000	53.6		**312**	**4499**	1	36000				**144000**	**> 50,000 vpd**	**1**
87	79070000	N/A	5.107	795015	8700	61		**314**	**21284**	1	58500				**234000**	**> 50,000 vpd**	**6**
88	79080000	2	1.645	795115	17300	61		**317**	**3686**	1	51500				**206000**	**> 50,000 vpd**	**4**
89	55003000	2	2.218	555151	26500	65.9		**320**	**3408**	1	15200				**60800**	**> 50,000 vpd**	**3**
89	55003000	2	2.218	553030	16200	65.9		**322**	**7950**	1	58000				**232000**	**> 50,000 vpd**	**1**
89	55003000	2	2.218	553035	3100	70.4		**323**	**1565**	2	4500	20500			**25000**	**20,000 - 30,000 vpd**	**1**
90	87030000	2	18.298	870524	44000	52.4		**324**	**8012**	3	27500	49000	10100		**86600**	**> 50,000 vpd**	**3**
90	87030000	2	18.298	878444	1750	58.9		**328**	**11051**	2	14000	17900			**31900**	**30,000 - 40,000 vpd**	**2**
91	79100000	2	27.869	790489	32000	61		**329**	**2977**	2	12000	47000			**59000**	**> 50,000 vpd**	**2**
92	79180000	2	5.882	798159	8500	61		**331**	**2223**	1	52500				**210000**	**> 50,000 vpd**	**2**
92	79180000	2	5.882	790436	12500	61		**333**	**4046**	1	53500				**214000**	**> 50,000 vpd**	**2**
93	89010000	2	13.978	890159	33000	59.3		**334**	**3039**	2	22500	35766			**58266**	**> 50,000 vpd**	**1**
94	79010000	2	18.186	795155	22000	61		**335**	**23571**	2	15100	15600			**30700**	**30,000 - 40,000 vpd**	**7**
94	79010000	2	18.186	795154	18600	61		**337**	**2735**	1	51271				**205084**	**> 50,000 vpd**	**2**
95	86130000	2	7.87	860360	17900	54.6		**341**	**5107**	1	23000				**92000**	**> 50,000 vpd**	**4**
95	86130000	2	7.87	860435	24500	54.6		**345**	**2094**	2	32500	42000			**74500**	**> 50,000 vpd**	**4**
96	86170000	2	4.454	860501	19300	53.6		**347**	**3666**	1	42500				**170000**	**> 50,000 vpd**	**1**
97	93050000	2	5.328	935110	16600	58.5		**348**	**609**	2	58000	64000			**122000**	**> 50,000 vpd**	**1**
98	93060000	2	27.914	935138	11900	58.5		**350**	**2261**	1	31000				**124000**	**> 50,000 vpd**	**1**
99	72220000	2	7.393	720928	44500	57.1		**351**	**2306**	1	31500				**126000**	**> 50,000 vpd**	**5**
100	87030000	2	2.667	870164	79000	58.9		**352**	**1378**	2	12600	16100			**28700**	**20,000 - 30,000 vpd**	**2**
101	72500001	2	0.232	720855	12000	57.1		**354**	**2201**	1	30500				**122000**	**> 50,000 vpd**	**2**
102	78060000	2	6.303	780235	12500	58		**355**	**7628**	1	37500				**150000**	**> 50,000 vpd**	**1**
102	78060000	2	6.303	780262	7700	58		**360**	**10119**	2	54000	52000			**106000**	**> 50,000 vpd**	**1**
102	78060000	2	6.303	789111	3300	58		**361**	**5884**	1	25000				**100000**	**> 50,000 vpd**	**2**
103	70030101	2	0.892	705197	12500	99.9		**364**	**2617**	1	21500				**86000**	**> 50,000 vpd**	**3**
103	70030101	2	0.892	705141	6300	54.2		**367**	**4310**	2	25000	27500			**52500**	**> 50,000 vpd**	**1**
103	70030101	2	0.892	705201	11500	99.9		**372**	**6344**	2	6700	36500			**43200**	**40,000 - 50,000 vpd**	**2**
104	90060001	N/A	0	905042	14500	99.9		**374**	**18074**	3	31000	36500	38500		**106000**	**> 50,000 vpd**	**6**
104	90060001	N/A	0	908126	1000	54.8		**375**	**3921**	1	43500				**174000**	**> 50,000 vpd**	**1**
105	55002000	2	12.21	553044	13200	65.9		**377**	**209**	2	27500	30500			**58000**	**> 50,000 vpd**	**3**
105	55002000	2	12.21	553066	15100	65.9		**379**	**6638**	1	28000				**112000**	**> 50,000 vpd**	**1**
105	55002000	2	12.21	553074	5000	65.9		**380**	**5703**	1	39500				**158000**	**> 50,000 vpd**	**2**
106	93180000	2	4.398	937232	40500	60.6		**381**	**3272**	1	33500				**134000**	**> 50,000 vpd**	**3**
107	55080000	2	4.208	553056	27000	65.9		**386**	**6809**	3	9700	18000	7200		**34900**	**30,000 - 40,000 vpd**	**2**
108	10190120	2	0.281	102796	3500	99.9		**387**	**1426**	1	21000				**84000**	**> 50,000 vpd**	**1**

109	12010000	2	7.929	120089	35000	59.7		**388**	**4113**	1	51500			**206000**	**> 50,000 vpd**	**1**
109	12010000	2	7.929	120065	47500	59.7		**389**	**2097**	3	12600	23000	26000	**61600**	**> 50,000 vpd**	**1**
110	1010000	2	18.177	10030	48500	52.6		**390**	**7822**	1	43000			**172000**	**> 50,000 vpd**	**1**
110	1010000	2	18.177	15018	43000	52.6		**393**	**3165**	1	42000			**168000**	**> 50,000 vpd**	**2**
111	79190000	N/A	8.197	795088	31000	61		**395**	**3380**	1	40500			**162000**	**> 50,000 vpd**	**2**
112	93030000	2	8.647	935022	11500	60.6		**396**	**1389**	2	14200	5300		**19500**	**< 20,000 vpd**	**2**
112	93030000	2	8.647	935023	12200	58.5		**399**	**6505**	1	21500			**86000**	**> 50,000 vpd**	**1**
113	87008000	2	6.108	870140	12000	99.9		**400**	**19954**	1	57500			**230000**	**> 50,000 vpd**	**2**
114	75003000	2	3.312	750516	53500	53.3		**401**	**7225**	1	31000			**124000**	**> 50,000 vpd**	**4**
115	93130000	1	14.265	930374	4700	57.8		**402**	**6742**	1	49463			**197852**	**> 50,000 vpd**	**2**
115	93130000	1	14.265	930002	3600	57.8		**403**	**8172**	2	31500	42500		**74000**	**> 50,000 vpd**	**6**
116	93010000	2	18.749	930668	12500	58.5		**406**	**2053**	1	25000			**100000**	**> 50,000 vpd**	**1**
116	93010000	2	18.749	930221	8900	58.5		**413**	**7401**	1	58000			**232000**	**> 50,000 vpd**	**2**
116	93010000	2	18.749	935053	19600	58.5		**417**	**817**	3	27000	17300	13300	**57600**	**> 50,000 vpd**	**1**
117	93016000	2	6.139	930063	37000	60.6		**422**	**4725**	1	50500			**202000**	**> 50,000 vpd**	**2**
118	87080900	2	39.512	870104	26400	52.4		**424**	**1685**	1	12500			**50000**	**40,000 - 50,000 vpd**	**1**
119	72080000	2	0.093	725063	26500	99.9		**427**	**4715**	1	36500			**146000**	**> 50,000 vpd**	**2**
120	72130000	2	0.814	720983	2300	57.1		**429**	**3605**	1	36000			**144000**	**> 50,000 vpd**	**3**
120	72130000	2	0.814	720984	4400	57.1		**433**	**824**	1	39500			**158000**	**> 50,000 vpd**	**3**
121	72160000	2	4.684	720580	48000	57.1		**435**	**2942**	1	29500			**118000**	**> 50,000 vpd**	**1**
122	87080001	5	2.683	870106	8800	99.9		**436**	**5111**	2	6200	8500		**14700**	**< 20,000 vpd**	**1**
123	86080000	2	17.178	860199	45500	53.6		**438**	**7163**	1	50000			**200000**	**> 50,000 vpd**	**1**
124	70012000	2	0.409	700410	33500	54.2		**441**	**3234**	2	29000	33500		**62500**	**> 50,000 vpd**	**3**
125	86220000	2	8.876	860471	69500	56.2		**445**	**939**	2	21500	24000		**45500**	**40,000 - 50,000 vpd**	**1**
126	18010000	2	27.989	180100	15400	56.4		**446**	**1410**	1	35000			**140000**	**> 50,000 vpd**	**1**
126	18010000	2	27.989	180210	18800	56.4		**450**	**1540**	3	8200	10000	12200	**30400**	**30,000 - 40,000 vpd**	**1**
127	87250000	2	5.259	878269	12000	52.4		**456**	**5197**	2	38500	4800		**43300**	**40,000 - 50,000 vpd**	**1**
127	87250000	2	5.259	875355	13200	52.4		**457**	**869**	1	30000			**120000**	**> 50,000 vpd**	**1**
128	71070000	2	12.624	710121	68500	55.1		**461**	**9108**	1	21300			**85200**	**> 50,000 vpd**	**1**
128	71070000	2	12.624	710130	58000	55.1		**463**	**11075**	1	36500			**146000**	**> 50,000 vpd**	**1**
129	79220000	2	0	795182	18900	61		**466**	**221**	2	50508	47000		**97508**	**> 50,000 vpd**	**2**
129	79220000	2	0	797046	11200	61		**477**	**4965**	1	61500			**246000**	**> 50,000 vpd**	**3**
129	79220000	2	0	795197	18200	61		**479**	**3821**	1	11900			**47600**	**40,000 - 50,000 vpd**	**1**
129	79220000	2	0	797101	12400	61		**484**	**4261**	1	48500			**194000**	**> 50,000 vpd**	**4**
130	93050000	2	3.951	935082	21500	58.5		**486**	**1795**	1	56500			**226000**	**> 50,000 vpd**	**1**
131	93280000	2	9.403	930699	18500	58.5		**487**	**297**	1	6417			**25668**	**20,000 - 30,000 vpd**	**1**
132	93310000	2	17.066	930689	11100	57.8		**491**	**5065**	1	16900			**67600**	**> 50,000 vpd**	**1**
133	26010000	2	14.583	265015	26500	52.7		**492**	**14185**	2	30500	18900		**49400**	**40,000 - 50,000 vpd**	**4**
134	26020000	2	19.202	265106	19800	57.8		**493**	**5737**	2	16500	19800		**36300**	**30,000 - 40,000 vpd**	**1**
135	87072000	2	6.663	871218	52000	58.9		**496**	**88326**	1	2100			**8400**	**< 20,000 vpd**	**1**
135	87072000	2	6.663	872580	38000	58.9		**498**	**3236**	3	17300	8200	12700	**38200**	**30,000 - 40,000 vpd**	**1**
136	46001000	2	2.782	465197	22000	55.3		**501**	**304**	1	29500			**118000**	**> 50,000 vpd**	**1**
137	46010002	2	2.653	460280	18500	53.6		**503**	**6023**	1	53500			**214000**	**> 50,000 vpd**	**2**
137	46010002	2	2.653	460300	1700	53.6		**504**	**33899**	1	38500			**154000**	**> 50,000 vpd**	**4**
138	86170000	2	6.58	865334	11000	99.9		**505**	**25659**	2	6700	7300		**14000**	**< 20,000 vpd**	**1**
138	86170000	2	6.58	869425	6300	53.6		**506**	**3721**	1	28000			**112000**	**> 50,000 vpd**	**3**
139	8002000	2	1.523	80039	13800	57.9		**509**	**13939**	1	14000			**56000**	**> 50,000 vpd**	**2**
140	92030000	2	11.277	920255	19500	53		**510**	**10640**	1	22000			**88000**	**> 50,000 vpd**	**5**
140	92030000	2	11.277	920155	26000	53		**514**	**2682**	2	30500	34000		**64500**	**> 50,000 vpd**	**1**
141	87220000	2	0.713	871172	64000	52.4		**520**	**66**	1	91500			**366000**	**> 50,000 vpd**	**1**
142	15020000	2	9.331	155400	16400	55.2		**523**	**691**	2	48000	30000		**78000**	**> 50,000 vpd**	**1**
143	15040000	2	3.441	150075	50000	55.2		**524**	**1480**	2	14300	15800		**30100**	**30,000 - 40,000 vpd**	**1**
143	15040000	2	3.441	155307	48500	55.2		**526**	**1433**	2	25000	26000		**51000**	**> 50,000 vpd**	**1**
144	37040000	N/A	0	370051	5300	55.6		**528**	**3908**	2	15100	2500		**17600**	**< 20,000 vpd**	**1**
144	37040000	N/A	0	330104	5300	57.5		**532**	**19637**	1	36500			**146000**	**> 50,000 vpd**	**5**

145	86014000	2	8.061	860134	57500	53.6	**533**	**7904**	1	67500				**270000**	**> 50,000 vpd**	**2**
146	93210000	2	23.635	930037	56500	60.6	**535**	**496**	1	39500				**158000**	**> 50,000 vpd**	**1**
147	87060000	2	3.836	875159	16400	52.4	**536**	**4058**	1	34000				**136000**	**> 50,000 vpd**	**1**
148	87240101	N/A	0.098	870560	35000	52.4	**537**	**10867**	1	36500				**146000**	**> 50,000 vpd**	**2**
148	87240101	N/A	0.098	870051	7700	99.9	**544**	**2293**	1	39000				**156000**	**> 50,000 vpd**	**1**
148	87240101	N/A	0.098	870561	43000	52.4	**545**	**1409**	2	26500	18800			**45300**	**40,000 - 50,000 vpd**	**2**
149	10190110	2	0.185	102788	4700	99.9	**546**	**1625**	1	21500				**86000**	**> 50,000 vpd**	**1**
150	58010000	2	16.202	580019	11900	56.8	**549**	**1704**	2	17000	30000			**47000**	**40,000 - 50,000 vpd**	**1**
151	70020000	2	19.465	705039	31500	54.2	**552**	**3907**	1	51500				**206000**	**> 50,000 vpd**	**1**
152	86020000	2	3.243	865123	52000	53.6	**553**	**2847**	1	18300				**73200**	**> 50,000 vpd**	**2**
153	8010000	2	0	82020	9900	56.8	**554**	**3207**	1	31000				**124000**	**> 50,000 vpd**	**3**
153	8010000	2	0	80031	11700	56.8	**555**	**3931**	1	146500				**586000**	**> 50,000 vpd**	**3**
153	8010000	2	0	145301	10100	60	**556**	**11963**	1	55000				**220000**	**> 50,000 vpd**	**2**
154	10070000	2	3.025	106009	26500	58.2	**557**	**4928**	1	20500				**82000**	**> 50,000 vpd**	**1**
155	87001000	2	10.219	870683	44500	58.9	**559**	**8876**	1	22500				**90000**	**> 50,000 vpd**	**4**
156	93120000	2	14.159	930749	64000	60.6	**562**	**2062**	1	35000				**140000**	**> 50,000 vpd**	**1**
157	86130000	2	6.941	867423	31500	53.6	**563**	**2124**	1	25000				**100000**	**> 50,000 vpd**	**1**
158	87085000	2	1.464	870098	13500	99.9	**565**	**1618**	1	39000				**156000**	**> 50,000 vpd**	**2**
158	87085000	2	1.464	875011	15600	58.9	**567**	**1314**	1	51000				**204000**	**> 50,000 vpd**	**1**
159	86018000	2	4.001	860078	50500	53.6	**568**	**1372**	1	37500				**150000**	**> 50,000 vpd**	**1**
160	26070000	2	15.351	260478	50000	52.7	**571**	**3291**	2	60500	70000			**130500**	**> 50,000 vpd**	**3**
161	48020000	2	10.494	485062	34000	56.3	**574**	**24494**	2	27500	38500			**66000**	**> 50,000 vpd**	**3**
162	14120000	2	29.078	140092	13500	60	**578**	**2935**	2	48500	43500			**92000**	**> 50,000 vpd**	**7**
163	92010000	2	11.726	927086	37000	53	**579**	**89964**	1	15900				**63600**	**> 50,000 vpd**	**5**
164	15007000	2	0.25	150048	32000	55.2	**581**	**4397**	1	36500				**146000**	**> 50,000 vpd**	**2**
165	15010000	2	12.524	155131	32000	55.2	**585**	**19218**	2	38500	74500			**113000**	**> 50,000 vpd**	**1**
166	87030000	2	21.203	872523	50000	52.4	**586**	**3319**	1	38000				**152000**	**> 50,000 vpd**	**1**
167	27010000	1	11.719	270024	5200	58.6	**587**	**300**	1	14900				**59600**	**> 50,000 vpd**	**1**
168	86190000	1	10.514	860127	32500	56.2	**588**	**121201**	1	36500				**146000**	**> 50,000 vpd**	**2**
169	88060000	2	30.868	885104	7700	99.9	**600**	**4868**	1	47500				**190000**	**> 50,000 vpd**	**1**
170	13010000	2	3.387	135037	47000	54.8	**601**	**4669**	1	31500				**126000**	**> 50,000 vpd**	**1**
171	16010000	2	4.131	160038	15200	55.9	**607**	**2074**	1	37281				**149124**	**> 50,000 vpd**	**3**
171	16010000	2	4.131	160086	13400	55.9	**608**	**1308**	1	18100				**72400**	**> 50,000 vpd**	**1**
172	86100000	2	9.142	860056	39500	53.6	**609**	**1337**	3	13700	25500	14600		**53800**	**> 50,000 vpd**	**1**
173	70030000	2	1.867	705143	23000	54.2	**611**	**1569**	1	33000				**132000**	**> 50,000 vpd**	**2**
174	87060000	2	16.38	870314	30000	52.4	**612**	**1235**	1	31000				**124000**	**> 50,000 vpd**	**3**
175	87250000	2	0.691	875265	18600	52.4	**616**	**5250**	1	26500				**106000**	**> 50,000 vpd**	**1**
176	71030000	2	3.05	710001	16300	56.1	**620**	**281**	1	49500				**198000**	**> 50,000 vpd**	**1**
176	71030000	2	3.05	723547	17100	56.1	**622**	**1440**	2	38000	7300			**45300**	**40,000 - 50,000 vpd**	**1**
177	53090000	2	7.639	530368	5600	55.9	**623**	**6956**	2	45500	54500			**100000**	**> 50,000 vpd**	**1**
177	53090000	2	7.639	530153	6400	55.9	**624**	**5403**	2	20500	14400			**34900**	**30,000 - 40,000 vpd**	**1**
178	86100000	2	23.497	860005	56500	53.6	**625**	**4698**	1	56500				**226000**	**> 50,000 vpd**	**1**
179	93010000	2	1.428	935003	25500	58.5	**634**	**31392**	1	22100				**88400**	**> 50,000 vpd**	**1**
180	79080000	2	1.316	795109	8200	61	**635**	**40034**	1	38500				**154000**	**> 50,000 vpd**	**1**
181	71130000	2	0.15	710132	30500	55.1	**637**	**9206**	2	11500	19500			**31000**	**30,000 - 40,000 vpd**	**2**
182	79160000	2	3.248	790463	23000	61	**638**	**4583**	1	48000				**192000**	**> 50,000 vpd**	**1**
183	61010000	N/A	18.09	615011	7100	55.8	**641**	**33503**	1	22000				**88000**	**> 50,000 vpd**	**2**
184	88070000	4	9.974	887001	9000	53.4	**642**	**6115**	1	30000				**120000**	**> 50,000 vpd**	**1**
184	88070000	4	9.974	887000	10300	53.4	**644**	**4535**	3	15500	47500	43500		**106500**	**> 50,000 vpd**	**8**
185	86012000	2	1.823	863015	51000	53.6	**646**	**3085**	1	30500				**122000**	**> 50,000 vpd**	**4**
186	86170000	2	1.83	860212	16400	53.6	**653**	**5471**	1	7800				**31200**	**30,000 - 40,000 vpd**	**1**
187	10002006	2	0.182	102836	2400	99.9	**654**	**128856**	1	13500				**54000**	**> 50,000 vpd**	**1**
188	93060000	2	13.07	930673	7500	58.5	**655**	**1795**	1	9100				**36400**	**30,000 - 40,000 vpd**	**1**
189	86100000	2	19.532	865294	49500	53.6	**659**	**4871**	1	41500				**166000**	**> 50,000 vpd**	**1**
190	87066000	2	0.125	872535	36000	52.4	**660**	**5714**	4	38500	41500	40500	31500	**152000**	**> 50,000 vpd**	**1**

191	87030000	2	24.935	870268	50500	52.4		**661**	**60724**	2	6500	15000			**21500**		**20,000 - 30,000 vpd**	**1**
192	87080900	2	37.483	878260	12800	52.4		**665**	**5617**	2	35500	11000			**46500**		**40,000 - 50,000 vpd**	**1**
192	87080900	2	37.483	877049	15600	52.4		**668**	**11408**	1	81500				**326000**		**> 50,000 vpd**	**3**
192	87080900	2	37.483	870539	32500	52.4		**672**	**3348**	1	56000				**224000**		**> 50,000 vpd**	**5**
193	87008000	5	4.319	871224	19900	52.4		**673**	**630**	1	36000				**144000**		**> 50,000 vpd**	**2**
194	72300001	2	0.094	720978	5700	99.9		**677**	**2019**	1	39000				**156000**		**> 50,000 vpd**	**1**
195	14030000	2	7.158	145022	54000	60		**678**	**25421**	1	30500				**122000**		**> 50,000 vpd**	**2**
196	90010000	2	2.739	900105	35500	54.8		**679**	**696**	1	22500				**90000**		**> 50,000 vpd**	**2**
196	90010000	2	2.739	905034	38500	54.8		**683**	**1341**	1	34000				**136000**		**> 50,000 vpd**	**1**
197	93080000	2	5.349	935290	13000	58.5		**685**	**5391**	1	24500				**98000**		**> 50,000 vpd**	**3**
198	93180000	2	9.284	935071	9900	99.9		**689**	**3990**	2	33000	46000			**79000**		**> 50,000 vpd**	**1**
199	10190119	2	0.329	102798	4900	99.9		**690**	**1941**	3	9600	10500	13700		**33800**		**30,000 - 40,000 vpd**	**1**
200	16003000	2	0.466	165176	7600	55.9		**692**	**22186**	1	21600				**86400**		**> 50,000 vpd**	**1**
200	16003000	2	0.466	165173	23500	55.9		**693**	**918**	1	32500				**130000**		**> 50,000 vpd**	**1**
201	12010000	2	21.536	120093	55000	59.7		**694**	**11408**	1	16400				**65600**		**> 50,000 vpd**	**2**
202	93030000	2	5.966	937200	37500	60.6		**695**	**13911**	1	22500				**90000**		**> 50,000 vpd**	**3**
203	86090000	2	2.114	865309	72500	56.2		**698**	**5587**	1	30500				**122000**		**> 50,000 vpd**	**1**
204	93130000	2	10.79	930129	3000	57.8		**702**	**5965**	1	33000				**132000**		**> 50,000 vpd**	**1**
205	86100000	5	13.91	860478	46000	53.6		**704**	**6451**	1	42500				**170000**		**> 50,000 vpd**	**1**
206	93016000	2	5.127	937184	38000	60.6		**706**	**2225**	1	22000				**88000**		**> 50,000 vpd**	**1**
207	70001000	2	2.709	700382	12800	54.2		**708**	**6185**	1	31000				**124000**		**> 50,000 vpd**	**1**
208	72070000	2	15.217	720592	24500	57.1		**711**	**2157**	1	21500				**86000**		**> 50,000 vpd**	**1**
209	55003000	2	5.861	553057	36000	65.9		**713**	**17429**	1	32500				**130000**		**> 50,000 vpd**	**2**
210	72160000	2	0.908	723584	45000	57.1		**714**	**36142**	1	15100				**60400**		**> 50,000 vpd**	**1**
211	87030000	2	16.216	875068	60000	52.4		**718**	**14740**	2	20500	36500			**57000**		**> 50,000 vpd**	**3**
212	70010000	2	16.073	700124	29500	54.2		**720**	**18941**	1	38500				**154000**		**> 50,000 vpd**	**3**
213	79100000	2	26.027	790499	27000	61		**721**	**42**	4	14300	19000	19000	30000	**82300**		**> 50,000 vpd**	**1**
214	18010000	2	17.732	180041	6000	56.4		**723**	**4241**	4	15300	8100	25500	10400	**59300**		**> 50,000 vpd**	**2**
215	79001000	2	2.852	790502	24500	61		**724**	**6463**	1	28500				**114000**		**> 50,000 vpd**	**7**
215	79001000	2	2.852	790511	33000	61		**729**	**3143**	1	32500				**130000**		**> 50,000 vpd**	**1**
216	71070000	2	9.99	710050	37500	55.1		**730**	**6044**	1	34000				**136000**		**> 50,000 vpd**	**1**
217	86130000	2	6.526	867423	31500	53.6		**737**	**14767**	2	30500	5200			**35700**		**30,000 - 40,000 vpd**	**4**
218	93050000	2	3.801	935082	21500	58.5		**738**	**10006**	1	55000				**220000**		**> 50,000 vpd**	**8**
219	93050000	2	1.218	935061	16200	58.5		**739**	**1120**	2	36000	4700			**40700**		**40,000 - 50,000 vpd**	**1**
220	93060000	2	27.408	935138	11900	58.5		**740**	**33615**	1	8900				**35600**		**30,000 - 40,000 vpd**	**1**
221	93290000	2	4.309	930777	3800	57.8		**742**	**7432**	1	30500				**122000**		**> 50,000 vpd**	**1**
222	26020000	2	2.492	265501	13600	52.7		**743**	**2023**	1	21500				**86000**		**> 50,000 vpd**	**3**
223	26050000	2	4.529	260185	24435	52.4		**744**	**4441**	1	46000				**184000**		**> 50,000 vpd**	**3**
223	26050000	2	4.529	265063	25000	52.7	DATA COLLECTED	**749**	**11379**	1	56500				**226000**	**186000**	**> 50,000 vpd**	**8**
224	46010001	2	0.44	460181	3100	53.6		**753**	**1447**	1	31000				**124000**		**> 50,000 vpd**	**5**
224	46010001	2	0.44	460284	20400	57.9		**756**	**2619**	1	32000				**128000**		**> 50,000 vpd**	**2**
225	72220000	2	9.661	720931	23500	57.1		**757**	**62596**	1	11600				**46400**		**40,000 - 50,000 vpd**	**1**
226	87060000	2	12.984	870540	47500	52.4		**761**	**3775**	3	18500	30000	14900		**63400**		**> 50,000 vpd**	**7**
227	78051000	2	15.522	780271	20500	58		**769**	**10902**	3	16000	14200	22000		**52200**		**> 50,000 vpd**	**1**
228	86100000	2	11.494	860103	52000	53.6		**770**	**2123**	2	17100	56500			**73600**		**> 50,000 vpd**	**1**
229	15040000	2	2.179	155307	48500	55.2		**772**	**844**	2	29000	28000			**57000**		**> 50,000 vpd**	**1**
230	54030000	1	9.85	541504	5100	57.7		**773**	**2726**	2	37000	25500			**62500**		**> 50,000 vpd**	**1**
231	72170000	2	0.9	720012	36500	57.1		**780**	**3275**	1	42000				**168000**		**> 50,000 vpd**	**2**
232	86006000	2	6.773	867368	33500	53.6		**785**	**46**	2	5030	3800			**8830**		**< 20,000 vpd**	**1**
232	86006000	2	6.773	867367	49000	53.6		**787**	**5995**	1	48000				**192000**		**> 50,000 vpd**	**2**
233	93180000	2	3.614	937233	43500	60.6		**790**	**1675**	1	33000				**132000**		**> 50,000 vpd**	**1**
233	93180000	2	3.614	937232	40500	60.6		**791**	**9301**	1	74500				**298000**		**> 50,000 vpd**	**2**
234	88060000	2	30.179	885102	11500	99.9		**793**	**1333**	2	7000	8300			**15300**		**< 20,000 vpd**	**1**
234	88060000	2	30.179	885100	11500	99.9		**794**	**4480**	1	19400				**77600**		**> 50,000 vpd**	**1**
235	87030000	2	8.599	875037	23500	58.9		**796**	**1887**	4	8500	11300	42000	34500	**96300**		**> 50,000 vpd**	**1**

236	55070000	2	18.305	553037	13700	65.9	**798**	**1435**	1	18800				**75200**	**> 50,000 vpd**	**1**
237	75260000	2	4.854	750593	19700	53.3	**801**	**9623**	2	20500	8700			**29200**	**20,000 - 30,000 vpd**	**2**
237	75260000	2	4.854	755218	31500	53.3	**802**	**1952**	1	15100				**60400**	**> 50,000 vpd**	**3**
238	77030000	2	7.421	770004	17900	53.9	**803**	**5482**	3	25500	35500	37000		**98000**	**> 50,000 vpd**	**3**
238	77030000	2	7.421	770103	25000	53.9	**810**	**412**	1	25500				**102000**	**> 50,000 vpd**	**1**
238	77030000	2	7.421	778080	15900	53.9	**811**	**5671**	1	34000				**136000**	**> 50,000 vpd**	**1**
239	46050000	N/A	7.747	460192	1742	54.8	**812**	**1686**	1	29500				**118000**	**> 50,000 vpd**	**2**
240	79270000	2	0.697	795193	26000	61	**818**	**11489**	1	22500				**90000**	**> 50,000 vpd**	**4**
241	48013000	2	4.61	485205	12400	56.3	**819**	**26201**	1	22000				**88000**	**> 50,000 vpd**	**1**
242	87008000	N/A	5.102	870140	12000	99.9	**820**	**1696**	3	18100	17300	12500		**47900**	**40,000 - 50,000 vpd**	**3**
242	87008000	N/A	5.102	871223	19800	52.4	**821**	**4938**	1	29500				**118000**	**> 50,000 vpd**	**1**
243	72220000	2	7.774	720929	35000	57.1	**822**	**786**	1	40500				**162000**	**> 50,000 vpd**	**1**
244	75002000	2	7.616	750403	43500	53.3	**825**	**171537**	2	25500	16800			**42300**	**40,000 - 50,000 vpd**	**1**
245	79040000	2	12.346	795173	16600	61	**827**	**2353**	3	7000	11200	69000		**87200**	**> 50,000 vpd**	**3**
245	79040000	2	12.346	798027	4200	61	**831**	**1175**	2	37500	24500			**62000**	**> 50,000 vpd**	**2**
246	93010000	2	17.681	935051	14300	58.5	**838**	**2822**	2	52000	35557			**87557**	**> 50,000 vpd**	**1**
247	87080900	2	38.19	870547	26300	52.4	**842**	**18791**	1	35500				**142000**	**> 50,000 vpd**	**1**
248	87281000	2	1.353	870024	34000	58.9	**844**	**2465**	1	22500				**90000**	**> 50,000 vpd**	**1**
249	72130000	2	0.366	720060	7500	57.1	**845**	**7135**	1	40000				**160000**	**> 50,000 vpd**	**2**
249	72130000	2	0.366	720984	4400	57.1	**846**	**14639**	1	60000				**240000**	**> 50,000 vpd**	**3**
250	87030000	2	12.859	875058	37500	52.4	**847**	**2541**	3	56500	18000	11600		**86100**	**> 50,000 vpd**	**1**
251	87034000	3	3.07	870258	23004	53.2	**848**	**6222**	1	29500				**118000**	**> 50,000 vpd**	**2**
252	93020001	3	1.659	935423	16300	58.5	**849**	**12206**	1	26400				**105600**	**> 50,000 vpd**	**3**
253	79260000	N/A	5.409	798049	4800	61	**856**	**1748**	3	34000	30000	9200		**73200**	**> 50,000 vpd**	**1**
253	79260000	N/A	5.409	795109	8200	61	**858**	**3468**	3	13100	21100	15100		**49300**	**40,000 - 50,000 vpd**	**4**
253	79260000	N/A	5.409	795187	9300	61	**862**	**2335**	1	18100				**72400**	**> 50,000 vpd**	**1**
254	93200000	2	4.799	930153	43000	60.6	**863**	**36805**	1	18100				**72400**	**> 50,000 vpd**	**1**
255	86220000	2	8.404	860045	78000	56.2	**868**	**2192**	2	32000	24500			**56500**	**> 50,000 vpd**	**3**
256	87240000	2	2.231	875128	50500	58.9	**872**	**2072**	3	36500	40500	22500		**99500**	**> 50,000 vpd**	**1**
256	87240000	2	2.231	875126	36500	58.9	**874**	**3058**	2	7300	27500			**34800**	**30,000 - 40,000 vpd**	**3**
257	87250000	2	2.967	878341	7900	52.4	**876**	**4854**	1	47000				**188000**	**> 50,000 vpd**	**2**
257	87250000	2	2.967	875348	19500	52.4	**881**	**2128**	1	52000				**208000**	**> 50,000 vpd**	**1**
257	87250000	2	2.967	878342	23500	52.4	**882**	**7452**	1	11300				**45200**	**40,000 - 50,000 vpd**	**1**
258	70020000	2	18.638	705039	31500	54.2	**886**	**2844**	2	15200	37500			**52700**	**> 50,000 vpd**	**2**
259	70030000	2	5.555	700150	19600	54.2	**887**	**11615**	1	32500				**130000**	**> 50,000 vpd**	**1**
260	86020000	2	1.501	860445	56000	54.6	**890**	**6646**	4	38500	56000	23000	28000	**145500**	**> 50,000 vpd**	**1**
261	93280000	2	7.346	935277	45500	60.6	**891**	**3988**	1	18500				**74000**	**> 50,000 vpd**	**1**
262	87072000	N/A	6.17	872580	38000	58.9	**893**	**2304**	1	37000				**148000**	**> 50,000 vpd**	**1**
262	87072000	N/A	6.17	871090	54000	58.9	**894**	**1214**	1	43500				**174000**	**> 50,000 vpd**	**2**
262	87072000	N/A	6.17	870589	65000	58.9	**899**	**2092**	2	22000	12000			**34000**	**30,000 - 40,000 vpd**	**1**
263	26010000	2	13.623	265053	34000	52.7	**900**	**32675**	2	23004	15100			**38104**	**30,000 - 40,000 vpd**	**3**
264	87001000	2	8.199	870188	49665	58.8	**902**	**2238**	1	39500				**158000**	**> 50,000 vpd**	**4**
265	87072000	2	5.161	871090	54000	58.9	**903**	**7862**	2	55500	54500			**110000**	**> 50,000 vpd**	**2**
265	87072000	2	5.161	871091	30500	58.9	**904**	**17799**	1	16500				**66000**	**> 50,000 vpd**	**7**
266	46001000	2	1.777	461616	31000	55.3	**908**	**31210**	1	20500				**82000**	**> 50,000 vpd**	**3**
267	93150000	2	7.297	930027	25000	60.6	**911**	**5427**	1	21500				**86000**	**> 50,000 vpd**	**5**
268	86170000	2	4.959	860501	19300	53.6	**915**	**6142**	1	48000				**192000**	**> 50,000 vpd**	**3**
268	86170000	2	4.959	860301	38000	53.6	**916**	**16750**	1	36000				**144000**	**> 50,000 vpd**	**3**
269	86018000	2	3.268	860117	40500	53.6	**918**	**3193**	1	38500				**154000**	**> 50,000 vpd**	**1**
270	26070000	2	18.724	265071	21500	52.7	**919**	**393**	2	33500	36000			**69500**	**> 50,000 vpd**	**1**
271	36060000	4	3.739	360452	17900	56.7	**924**	**3183**	1	26000				**104000**	**> 50,000 vpd**	**1**
272	92010000	2	11.107	925003	23500	53	**929**	**2730**	1	13900				**55600**	**> 50,000 vpd**	**1**
273	92030000	2	7.211	928063	5200	53	**931**	**3325**	1	35000				**140000**	**> 50,000 vpd**	**1**
273	92030000	2	7.211	920105	40000	53	**933**	**3807**	1	26500				**106000**	**> 50,000 vpd**	**1**
273	92030000	2	7.211	920032	38000	53	**934**	**4178**	1	48500				**194000**	**> 50,000 vpd**	**1**

274	15010000	2	2.502	155085	35500	55.2	**935**	**2864**	1	18500			**74000**	**> 50,000 vpd**	**1**
274	15010000	2	2.502	155106	25500	55.2	**940**	**2129**	1	31000			**124000**	**> 50,000 vpd**	**1**
275	15010101	2	1.216	155189	12000	99.9	**942**	**8767**	1	23500			**94000**	**> 50,000 vpd**	**4**
275	15010101	2	1.216	155193	9700	99.9	**946**	**6521**	2	35000	34000		**69000**	**> 50,000 vpd**	**6**
276	10150000	2	2.776	105501	50000	58.2	**949**	**5396**	2	52000	54500		**106500**	**> 50,000 vpd**	**1**
277	28010000	2	8.338	285002	26500	54.4	**950**	**194**	1	27500			**110000**	**> 50,000 vpd**	**1**
277	28010000	2	8.338	285001	25000	54.4	**951**	**1453**	1	31000			**124000**	**> 50,000 vpd**	**1**
278	88010000	2	5.788	880314	22597	50.8	**952**	**4640**	3	40000	15000	41500	**96500**	**> 50,000 vpd**	**1**
279	86200000	3	4.629	865029	39500	54.6	**954**	**4398**	1	46000			**184000**	**> 50,000 vpd**	**2**
280	86190000	2	3.003	865295	50500	56.2	**955**	**10625**	1	56500			**226000**	**> 50,000 vpd**	**1**
281	1050000	2	3.992	10042	30000	51.9	**957**	**17406**	1	26400			**105600**	**> 50,000 vpd**	**1**
282	13020000	2	0.69	130035	32000	54.8	**961**	**793**	2	12100	14000		**26100**	**20,000 - 30,000 vpd**	**1**
283	75250000	2	6.526	750606	40000	53.3	**972**	**4193**	1	52500			**210000**	**> 50,000 vpd**	**1**
284	70030000	2	1.326	700395	25000	54.2	**973**	**5670**	2	37000	55000		**92000**	**> 50,000 vpd**	**2**
285	79220000	2	0.748	795197	18200	61	**974**	**7219**	1	20500			**82000**	**> 50,000 vpd**	**1**
286	87240000	2	10.893	870022	58500	52.4	**975**	**29408**	1	34000			**136000**	**> 50,000 vpd**	**3**
287	71070000	2	2.43	710025	38000	55.1	**976**	**9832**	1	22500			**90000**	**> 50,000 vpd**	**1**
288	48008000	2	0.582	485304	17700	56.3	**977**	**5259**	1	58500			**234000**	**> 50,000 vpd**	**3**
288	48008000	2	0.582	485310	18100	56.3	**980**	**7712**	1	34500			**138000**	**> 50,000 vpd**	**5**
288	48008000	2	0.582	480543	25000	56.3	**981**	**1466**	2	34500	3600		**38100**	**30,000 - 40,000 vpd**	**5**
289	72060000	2	2.252	720561	10700	57.1	**983**	**145294**	1	16800			**67200**	**> 50,000 vpd**	**4**
289	72060000	2	2.252	720024	18000	57.1	**984**	**1806**	1	58500			**234000**	**> 50,000 vpd**	**1**
289	72060000	2	2.252	729169	10000	57.1	**985**	**7270**	3	38500	85000	10500	**134000**	**> 50,000 vpd**	**3**
290	46010002	1	0.708	460298	1400	53.6	**987**	**3324**	2	51500	60500		**112000**	**> 50,000 vpd**	**2**
290	46010002	1	0.708	460285	14000	53.6	**992**	**4202**	1	16400			**65600**	**> 50,000 vpd**	**1**
290	46010002	1	0.708	460281	7400	53.6	**993**	**1264**	1	22000			**88000**	**> 50,000 vpd**	**1**
291	93006000	2	5.462	937171	31500	60.6	**994**	**9793**	1	47000			**188000**	**> 50,000 vpd**	**1**
291	93006000	2	5.462	937170	25000	60.6	**995**	**3223**	1	43500			**174000**	**> 50,000 vpd**	**1**
292	77160000	N/A	10.49	770268	123500	53.6	**997**	**1908**	1	24114			**96456**	**> 50,000 vpd**	**1**
293	79080000	2	4.946	795121	17800	61	**1001**	**7007**	1	28500			**114000**	**> 50,000 vpd**	**3**
294	71070000	2	13.705	719104	1500	55.1	**1004**	**28494**	1	15600			**62400**	**> 50,000 vpd**	**1**
294	71070000	2	13.705	710130	58000	55.1	**1010**	**3045**	1	19200			**76800**	**> 50,000 vpd**	**1**
295	87030000	2	23.358	870183	58500	52.4	**1011**	**5136**	2	37000	33500		**70500**	**> 50,000 vpd**	**1**
296	34070000	N/A	32.904	340224	1250	55.4	**1012**	**3321**	1	19500			**78000**	**> 50,000 vpd**	**1**
297	36110000	N/A	26.705	360132	34000	56.7	**1013**	**1622**	1	24500			**98000**	**> 50,000 vpd**	**2**
297	36110000	N/A	26.705	360042	600	56.7	**1017**	**1767**	3	25000	22500	24000	**71500**	**> 50,000 vpd**	**2**
298	89010000	2	19.469	895011	17900	59.3	**1026**	**6111**	2	4600	29500		**34100**	**30,000 - 40,000 vpd**	**2**
299	86014000	2	3.99	860016	51500	53.6	**1030**	**1082**	3	10300	11400	9600	**31300**	**30,000 - 40,000 vpd**	**2**
300	55002000	2	3.524	553052	13500	65.9	**1033**	**8073**	2	24000	31000		**55000**	**> 50,000 vpd**	**1**
300	55002000	2	3.524	553054	13000	65.9	**1040**	**4078**	1	9300			**37200**	**30,000 - 40,000 vpd**	**1**
301	88010000	2	6.794	887013	17900	53.4	**1042**	**9755**	1	32000			**128000**	**> 50,000 vpd**	**2**
302	10002036	2	0.165	102866	3300	99.9	**1045**	**22193**	1	36500			**146000**	**> 50,000 vpd**	**1**
303	86100000	2	14.488	860478	46000	53.6	**1046**	**2593**	2	25500	26000		**51500**	**> 50,000 vpd**	**3**
304	92010000	2	10.9	925003	23500	53	**1049**	**4120**	3	1300	18500	5100	**24900**	**20,000 - 30,000 vpd**	**2**
305	92090000	2	10.732	920313	52000	53	**1051**	**2434**	2	22500	31500		**54000**	**> 50,000 vpd**	**1**
306	92090000	2	13.37	928003	600	53	**1052**	**1410**	2	45000	1500		**46500**	**40,000 - 50,000 vpd**	**2**
306	92090000	2	13.37	920265	59966	51.9	**1053**	**1343**	1	9700			**38800**	**30,000 - 40,000 vpd**	**2**
307	87080000	N/A	4.175	870525	25000	99.9	**1054**	**2037**	2	24500	28000		**52500**	**> 50,000 vpd**	**3**
307	87080000	N/A	4.175	875189	11600	52.4	**1061**	**3161**	1	52000			**208000**	**> 50,000 vpd**	**2**
308	93190000	2	13.329	937235	52500	60.6	**1062**	**1444**	1	32500			**130000**	**> 50,000 vpd**	**1**
309	86200000	2	3.632	860590	42500	53.6	**1063**	**848**	1	20000			**80000**	**> 50,000 vpd**	**1**
309	86200000	2	3.632	860150	66083	52	**1064**	**936**	2	36000	29000		**65000**	**> 50,000 vpd**	**3**
310	16003001	2	7.562	165191	32000	55.9	**1069**	**2527**	2	7200	18600		**25800**	**20,000 - 30,000 vpd**	**1**
311	13010000	2	9.498	135004	23500	54.8	**1072**	**295**	1	3800			**15200**	**< 20,000 vpd**	**1**
311	13010000	2	9.498	135006	15100	54.8	**1074**	**1059**	1	24000			**96000**	**> 50,000 vpd**	**1**

311	13010000	2	9.498	135003	28000	54.8		1075	6885	2	9100	26000			35100		30,000 - 40,000 vpd	1
311	13010000	2	9.498	134188	2600	55.1		1076	6094	2	49620	15200			64820		> 50,000 vpd	1
312	86090000	2	8.517	860424	36000	53.6		1078	6228	2	18700	19900			38600		30,000 - 40,000 vpd	7
313	70022000	2	39.532	708076	1150	54.2		1081	5203	1	35000				140000		> 50,000 vpd	6
313	70022000	2	39.532	700417	16400	54.2		1084	3310	1	51000				204000		> 50,000 vpd	2
314	87060000	2	15.142	870269	58500	52.4		1091	1711	1	35500				142000		> 50,000 vpd	3
315	87060001	N/A	3.231	870520	25500	99.9		1092	3127	1	26500				106000		> 50,000 vpd	2
316	72050000	2	12.146	725500	14700	57.1		1093	1378	1	18400				73600		> 50,000 vpd	2
317	86100000	2	18.849	860169	51500	53.6		1095	5860	3	6500	2050	15600		24150		20,000 - 30,000 vpd	1
318	93006000	2	3.825	930695	32500	60.6		1097	14049	3	48500	43000	56000		147500		> 50,000 vpd	3
319	79070000	2	6.36	795019	14100	61		1098	4238	1	22000				88000		> 50,000 vpd	1
320	79080000	2	2.421	795117	15200	61		1101	3371	3	3200	4600	25500		33300		30,000 - 40,000 vpd	1
321	55010000	2	3.835	553043	20000	65.9		1102	2165	1	48000				192000		> 50,000 vpd	2
322	71070000	4	13.504	710130	58000	55.1		1103	5983	2	28500	44500			73000		> 50,000 vpd	1
323	79160000	N/A	0	798154	4500	61		1106	2876	1	74000				296000		> 50,000 vpd	1
323	79160000	N/A	0	791005	20500	61		1113	29417	1	22000				88000		> 50,000 vpd	1
324	10770000	N/A	0	109184	27500	58.2		1116	873	2	35000	28000			63000		> 50,000 vpd	2
324	10770000	N/A	0	105739	49000	58.2		1118	3317	2	1500	45000			46500		40,000 - 50,000 vpd	1
324	10770000	N/A	0	105745	10100	58.2		1119	7099	1	35000				140000		> 50,000 vpd	4
325	88060009	N/A	0.114	885004	16400	53.4		1124	1473	4	16100	20300	26000	19100	81500		> 50,000 vpd	2
325	88060009	N/A	0.114	880017	4500	50.8		1125	654	1	35000				140000		> 50,000 vpd	1
326	89010000	2	16.841	890022	43500	59.3		1126	2119	2	41000	45000			86000		> 50,000 vpd	6
327	79030000	2	6.223	791019	16600	61		1129	28583	1	12000				48000		40,000 - 50,000 vpd	2
328	86170000	2	0.366	869059	14000	53.6	DATA COLLECTED	1131	1824	2	29500	38500			68000	59000	> 50,000 vpd	3
328	86170000	2	0.366	860002	17900	53.6		1133	7809	1	37500				150000		> 50,000 vpd	1
329	86180000	N/A	0	867583	12000	53.6		1135	2449	1	30000				120000		> 50,000 vpd	1
329	86180000	N/A	0	865235	47000	54.6		1140	6720	1	28000				112000		> 50,000 vpd	1
330	93060000	4	1.28	930121	10400	58.5		1142	758	1	29500				118000		> 50,000 vpd	1
331	86100000	2	5.568	860111	52500	53.6		1144	2574	4	27000	22500	28500	35000	113000		> 50,000 vpd	2
332	87062000	2	3.567	870037	19700	58.9		1147	2627	1	52000				208000		> 50,000 vpd	1
333	75003000	2	2.354	750516	53500	53.3		1148	10354	2	34000	37500			71500		> 50,000 vpd	2
334	72170000	2	6.165	720564	22500	57.1		1149	1760	1	24500				98000		> 50,000 vpd	1
334	72170000	2	6.165	720172	35766	64.7		1159	0	1	51000				204000		> 50,000 vpd	1
335	87034000	N/A	2.343	872539	15100	52.4		1162	12826	1	4800				19200		< 20,000 vpd	1
335	87034000	N/A	2.343	871010	15600	52.4		1164	10469	1	24500				98000		> 50,000 vpd	3
336	93060000	2	14.376	930720	5900	58.5		1166	284	1	10200				40800		40,000 - 50,000 vpd	1
337	14030000	2	4.182	140199	51271	56.3		1171	460	1	46500				186000		> 50,000 vpd	1
338	71020000	2	13.658	715007	60000	55.1		1173	4721	2	29500	35500			65000		> 50,000 vpd	1
339	70050000	2	14.794	700024	30000	54.2		1177	432	1	13500				54000		> 50,000 vpd	1
340	93070000	2	24.16	930478	38500	60.6		1178	2438	2	12600	15700			28300		20,000 - 30,000 vpd	1
341	93180000	N/A	7.193	930025	23000	60.6		1179	2848	1	23500				94000		> 50,000 vpd	1
342	87281000	2	4.968	870028	98500	52.4		1183	5935	1	26000				104000		> 50,000 vpd	2
343	3175001	N/A	0.323	37011	2100	99.9		1190	4541	3	47000	31000	22371		100371		> 50,000 vpd	8
344	12010000	2	17.303	125041	65000	59.7		1191	6834	1	55000				220000		> 50,000 vpd	1
345	93030000	2	5.165	938536	32500	57.8		1192	8150	1	31000				124000		> 50,000 vpd	1
345	93030000	2	5.165	930423	42000	60.6		1199	19482	1	41000				164000		> 50,000 vpd	1
346	86090000	2	1.333	867354	8500	56.2		1203	2775	2	31500	25000			56500		> 50,000 vpd	3
346	86090000	2	1.333	860112	55500	53.6		1209	5472	2	43500	40000			83500		> 50,000 vpd	5
347	87008000	2	7.874	871025	42500	52.4		1211	578	2	22500	29000			51500		> 50,000 vpd	1
348	93120000	N/A	17.849	930384	58000	60.6		1214	4849	2	25500	17400			42900		40,000 - 50,000 vpd	1
348	93120000	N/A	17.849	935418	64000	60.6		1218	1206	1	19600				78400		> 50,000 vpd	1
349	93150000	2	6.923	930726	30000	60.6		1222	851	2	17700	24000			41700		40,000 - 50,000 vpd	1
350	93012000	2	2.651	937176	31000	60.6		1225	6364	1	56000				224000		> 50,000 vpd	1
351	87140000	2	7.673	875014	31500	52.4		1227	972	1	38000				152000		> 50,000 vpd	2
352	29010000	2	10.055	295001	12600	55.3		1231	1577	2	6700	40000			46700		40,000 - 50,000 vpd	1

352	29010000	2	10.055	295014	16100	55.3	**1233**	**2842**	1	38000					**152000**	**> 50,000 vpd**	**1**
353	72080000	2	0.688	725064	23500	99.9	**1237**	**3285**	1	30000					**120000**	**> 50,000 vpd**	**1**
354	72150000	2	2.367	720884	30500	57.1	**1238**	**16976**	1	24500					**98000**	**> 50,000 vpd**	**2**
355	87030000	2	14.292	875060	37500	52.4	**1242**	**13972**	2	25000	27000				**52000**	**> 50,000 vpd**	**6**
356	86090000	2	0.741	860112	55500	53.6	**1249**	**7703**	1	49000					**196000**	**> 50,000 vpd**	**2**
356	86090000	2	0.741	860018	38500	56.2	**1262**	**591**	1	9100					**36400**	**30,000 - 40,000 vpd**	**1**
357	70014000	2	0.025	700430	23500	54.2	**1268**	**2445**	2	25000	5000				**30000**	**20,000 - 30,000 vpd**	**1**
358	86220000	2	11.372	860049	55500	56.2	**1271**	**1181**	2	41500	48000				**89500**	**> 50,000 vpd**	**1**
359	18030000	N/A	4.21	180020	4100	56.4	**1272**	**1801**	2	34500	39232				**73732**	**> 50,000 vpd**	**1**
359	18030000	N/A	4.21	180021	5600	56.4	**1274**	**40497**	1	11500					**46000**	**40,000 - 50,000 vpd**	**1**
360	87260000	N/A	24.708	870021	54000	52.4	**1276**	**594**	1	33000					**132000**	**> 50,000 vpd**	**1**
360	87260000	N/A	24.708	872113	52000	58.3	**1277**	**2337**	1	22000					**88000**	**> 50,000 vpd**	**1**
361	93150000	2	7.927	930027	25000	60.6	**1279**	**6986**	1	13500					**54000**	**> 50,000 vpd**	**7**
362	93050000	N/A	0	930668	12500	58.5	**1281**	**2522**	2	33500	30000				**63500**	**> 50,000 vpd**	**13**
362	93050000	N/A	0	930221	8900	58.5	**1285**	**1493**	2	49500	34000				**83500**	**> 50,000 vpd**	**1**
362	93050000	N/A	0	935053	19600	58.5	**1286**	**3344**	1	68500					**274000**	**> 50,000 vpd**	**1**
363	79270000	2	2.804	798087	6200	61	**1287**	**2872**	1	68500					**274000**	**> 50,000 vpd**	**5**
363	79270000	2	2.804	795182	18900	61	**1290**	**5617**	2	34500	33000				**67500**	**> 50,000 vpd**	**3**
364	93050000	2	4.416	935082	21500	58.5	**1291**	**3222**	1	16200					**64800**	**> 50,000 vpd**	**6**
365	93280000	2	0.689	930754	49500	60.6	**1292**	**1348**	1	19500					**78000**	**> 50,000 vpd**	**1**
366	75020000	2	22.559	750642	25000	53.3	**1297**	**3250**	3	12100	35500	46000			**93600**	**> 50,000 vpd**	**4**
367	26010000	2	16.07	265057	25000	52.7	**1298**	**1001**	1	39500					**158000**	**> 50,000 vpd**	**2**
367	26010000	2	16.07	265056	27500	52.7	**1299**	**2553**	1	48500					**194000**	**> 50,000 vpd**	**2**
368	26050000	2	3.25	265047	18600	52.7	**1300**	**1258**	2	38000	8800				**46800**	**40,000 - 50,000 vpd**	**3**
369	46010000	2	10.214	460166	12482	53.6	**1308**	**5004**	1	57000					**228000**	**> 50,000 vpd**	**4**
370	46020000	2	6.225	461606	10200	55.3	**1309**	**10713**	2	47000	41000				**88000**	**> 50,000 vpd**	**5**
370	46020000	2	6.225	465153	4800	55.3	**1310**	**4703**	1	45500					**182000**	**> 50,000 vpd**	**7**
371	86170000	2	0.123	860002	17900	53.6	**1314**	**8**	1	34000					**136000**	**> 50,000 vpd**	**2**
372	75250000	2	5.788	758067	6700	53.3	**1315**	**4046**	2	6100	43500				**49600**	**40,000 - 50,000 vpd**	**2**
372	75250000	2	5.788	750607	36500	53.3	**1317**	**7909**	1	25500					**102000**	**> 50,000 vpd**	**3**
373	87060000	2	7.079	870011	35500	52.4	**1319**	**1522**	1	50000					**200000**	**> 50,000 vpd**	**4**
374	87240000	N/A	1.739	875104	31000	58.9	**1322**	**731**	3	13700	3005	12000			**28705**	**20,000 - 30,000 vpd**	**2**
374	87240000	N/A	1.739	875126	36500	58.9	**1323**	**1**	2	53500	54000				**107500**	**> 50,000 vpd**	**1**
374	87240000	N/A	1.739	875125	38500	58.9	**1327**	**18049**	2	27500	27593				**55093**	**> 50,000 vpd**	**6**
375	15030000	2	3.571	150007	43500	55.2	**1328**	**6638**	2	20500	6600				**27100**	**20,000 - 30,000 vpd**	**2**
376	15040000	2	5.703	150074	49000	55.2	**1329**	**6721**	1	4800					**19200**	**< 20,000 vpd**	**2**
377	29010000	2	7.504	290101	27500	55.3	**1330**	**744**	1	24000					**96000**	**> 50,000 vpd**	**1**
377	29010000	2	7.504	295048	30500	55.3	**1332**	**2528**	1	35500					**142000**	**> 50,000 vpd**	**1**
378	88050000	N/A	5.879	887035	11900	50.8	**1333**	**4490**	2	55000	57000				**112000**	**> 50,000 vpd**	**2**
378	88050000	N/A	5.879	880108	11900	53.4	**1336**	**2715**	5	61500	16500	17000	38000	18400	**151400**	**> 50,000 vpd**	**1**
379	86010000	5	4.998	865036	28000	54.6	**1338**	**2708**	1	32500					**130000**	**> 50,000 vpd**	**1**
380	86200000	2	4.256	865029	39500	54.6	**1341**	**5686**	1	37500					**150000**	**> 50,000 vpd**	**2**
381	87027000	N/A	3.247	871204	33500	52.4	**1343**	**5458**	1	34000					**136000**	**> 50,000 vpd**	**4**
382	55050000	2	0.076	555008	39500	65.9	**1346**	**847**	3	28500	29000	5800			**63300**	**> 50,000 vpd**	**7**
383	75260000	2	1.99	755154	13900	53.3	**1350**	**1956**	1	48000					**192000**	**> 50,000 vpd**	**1**
384	77010000	2	11.646	775057	26000	53.9	**1352**	**8579**	1	54500					**218000**	**> 50,000 vpd**	**2**
384	77010000	2	11.646	775051	22000	53.9	**1354**	**4007**	3	39500	33000	23500			**96000**	**> 50,000 vpd**	**2**
385	92550002	N/A	0	925003	23500	53	**1358**	**35283**	1	25000					**100000**	**> 50,000 vpd**	**1**
385	92550002	N/A	0	920319	36000	53	**1359**	**1660**	1	30000					**120000**	**> 50,000 vpd**	**1**
386	79220002	2	0.367	798048	9700	61	**1363**	**6209**	1	18000					**72000**	**> 50,000 vpd**	**1**
386	79220002	2	0.367	795196	18000	61	**1365**	**247**	2	3500	6000				**9500**	**< 20,000 vpd**	**1**
386	79220002	2	0.367	795186	7200	99.9	**1367**	**13483**	2	58000	44144				**102144**	**> 50,000 vpd**	**4**
387	93040000	2	8.698	930006	21000	58.5	**1368**	**2653**	3	2500	4100	6500			**13100**	**< 20,000 vpd**	**1**
388	71070000	2	11.491	710122	51500	55.1	**1369**	**19453**	1	41500					**166000**	**> 50,000 vpd**	**2**
389	48012000	2	6.268	484009	12600	56.3	**1370**	**326**	1	22000					**88000**	**> 50,000 vpd**	**1**

389	48012000	2	6.268	485008	23000	56.3		**1373**	**2441**	2	650	59966		**60616**		**> 50,000 vpd**	**4**
389	48012000	2	6.268	485186	26000	56.3		**1374**	**4157**	1	34500			**138000**		**> 50,000 vpd**	**2**
390	87002000	2	8.746	872515	43000	52.4		**1376**	**4358**	2	38500	8600		**47100**		**40,000 - 50,000 vpd**	**1**
391	72190000	2	13.568	720006	38000	54.9		**1377**	**1949**	1	12500			**50000**		**40,000 - 50,000 vpd**	**1**
391	72190000	2	13.568	720062	39301	55.6		**1378**	**555**	1	35000			**140000**		**> 50,000 vpd**	**1**
392	14090000	2	1.778	145101	55500	60		**1382**	**1541**	1	62000			**248000**		**> 50,000 vpd**	**11**
393	93070000	2	21.672	937209	42000	60.6	DATA COLLECTED	**1383**	**5684**	2	57000	53500		**110500**	175000	**> 50,000 vpd**	**5**
394	93110000	2	1.803	930445	14800	57.8		**1384**	**10145**	2	34000	51000		**85000**		**> 50,000 vpd**	**4**
394	93110000	2	1.803	930142	14700	57.8		**1385**	**10753**	1	43500			**174000**		**> 50,000 vpd**	**1**
395	93180000	2	4.944	937232	40500	60.6		**1388**	**671**	3	22000	15100	24500	**61600**		**> 50,000 vpd**	**2**
396	3080000	2	37.309	30029	14200	58.4		**1389**	**7775**	1	42500			**170000**		**> 50,000 vpd**	**2**
396	3080000	2	37.309	30002	5300	58.4		**1391**	**1654**	2	22500	8000		**30500**		**30,000 - 40,000 vpd**	**1**
397	16003001	2	8.077	165194	31500	55.9		**1392**	**4620**	1	43500			**174000**		**> 50,000 vpd**	**1**
397	16003001	2	8.077	165191	32000	55.9		**1395**	**3925**	3	17000	12000	28500	**57500**		**> 50,000 vpd**	**1**
398	1010000	2	20.221	15042	55000	52.6		**1396**	**4435**	2	67500	75000		**142500**		**> 50,000 vpd**	**2**
399	93040000	2	0.838	930103	21500	58.5		**1399**	**12062**	1	31000			**124000**		**> 50,000 vpd**	**1**
400	86090000	2	2.757	865302	57500	56.2		**1403**	**537**	2	26000	23000		**49000**		**40,000 - 50,000 vpd**	**1**
401	93150000	2	4.361	930495	31000	60.6		**1405**	**545**	1	17500			**70000**		**> 50,000 vpd**	**1**
402	86100000	2	18.583	860298	49463	52.7		**1410**	**1445**	2	18900	17500		**36400**		**30,000 - 40,000 vpd**	**1**
403	87140000	2	7.171	875014	31500	52.4		**1411**	**2342**	3	23500	24000	5900	**53400**		**> 50,000 vpd**	**1**
403	87140000	2	7.171	870235	42500	52.4		**1413**	**13645**	2	16500	5900		**22400**		**20,000 - 30,000 vpd**	**1**
404	79070000	2	5.36	795015	8700	61		**1414**	**4235**	2	36000	32059		**68059**		**> 50,000 vpd**	**1**
405	72080000	2	0.168	725063	26500	99.9		**1416**	**2761**	1	18500			**74000**		**> 50,000 vpd**	**1**
406	55010000	2	9.4	555009	25000	65.9		**1418**	**2189**	2	60000	48000		**108000**		**> 50,000 vpd**	**1**
407	87030000	2	11.717	875049	42500	58.9		**1421**	**3940**	3	25500	9500	11000	**46000**		**40,000 - 50,000 vpd**	**1**
408	70014000	3	1.453	700431	24000	54.2		**1422**	**2007**	1	31500			**126000**		**> 50,000 vpd**	**1**
409	79110000	2	3.534	799906	96379	55.2		**1431**	**29158**	1	34500			**138000**		**> 50,000 vpd**	**1**
410	88060001	N/A	0.263	880314	22597	50.8		**1438**	**1223**	1	32000			**128000**		**> 50,000 vpd**	**4**
410	88060001	N/A	0.263	885105	9300	99.9	DATA COLLECTED	**1442**	**2861**	1	26000			**104000**	53800	**> 50,000 vpd**	**4**
411	18010000	2	24.964	180002	16200	56.4		**1444**	**3092**	1	53000			**212000**		**> 50,000 vpd**	**5**
412	79010000	2	24.972	790152	13900	61		**1445**	**9312**	1	54000			**216000**		**> 50,000 vpd**	**1**
413	71070000	2	12.749	710130	58000	55.1		**1447**	**2827**	2	34000	27000		**61000**		**> 50,000 vpd**	**2**
414	86170000	5	0.085	860002	17900	53.6		**1449**	**1491**	2	11000	42000		**53000**		**> 50,000 vpd**	**1**
415	93060000	2	1.127	930121	10400	58.5		**1450**	**1426**	1	16100			**64400**		**> 50,000 vpd**	**1**
416	93050000	2	5.743	935110	16600	58.5		**1451**	**10473**	1	3600			**14400**		**< 20,000 vpd**	**2**
417	75020000	2	1.457	750259	27000	53.3		**1454**	**2062**	2	6800	16000		**22800**		**20,000 - 30,000 vpd**	**3**
417	75020000	2	1.457	750601	17300	53.3		**1456**	**3470**	1	11800			**47200**		**40,000 - 50,000 vpd**	**1**
417	75020000	2	1.457	755216	13300	53.3		**1458**	**19266**	1	12000			**48000**		**40,000 - 50,000 vpd**	**2**
418	26050000	2	2.118	265058	19600	52.7		**1459**	**1211**	2	22000	15200		**37200**		**30,000 - 40,000 vpd**	**1**
419	46020000	2	6.362	465073	13500	55.3		**1462**	**858**	1	13800			**55200**		**> 50,000 vpd**	**1**
419	46020000	2	6.362	461606	10200	55.3		**1463**	**2130**	1	23500			**94000**		**> 50,000 vpd**	**4**
419	46020000	2	6.362	465032	7700	55.3		**1464**	**1864**	3	15300	12600	45000	**72900**		**> 50,000 vpd**	**1**
420	72250000	2	5.914	720145	11100	57.1		**1466**	**4111**	1	49000			**196000**		**> 50,000 vpd**	**4**
421	93060000	2	27.694	935138	11900	58.5		**1469**	**4050**	1	22500			**90000**		**> 50,000 vpd**	**1**
422	87220000	N/A	3.705	870102	50500	52.4		**1470**	**9152**	1	7700			**30800**		**30,000 - 40,000 vpd**	**2**
423	71020000	2	12.759	715007	60000	55.1		**1480**	**13394**	1	58500			**234000**		**> 50,000 vpd**	**5**
424	70030101	2	1.397	705197	12500	99.9		**1481**	**4024**	2	30000	35500		**65500**		**> 50,000 vpd**	**1**
425	15040000	2	4.426	150075	50000	55.2		**1483**	**970**	1	44863			**179452**		**> 50,000 vpd**	**1**
426	55002000	2	1.33	553054	13000	65.9		**1484**	**1589**	3	31000	38000	9600	**78600**		**> 50,000 vpd**	**1**
427	72170000	2	1.639	720012	36500	57.1		**1491**	**764**	2	8400	3500		**11900**		**< 20,000 vpd**	**1**
428	86010000	3	2.947	860165	27500	54.6		**1494**	**7622**	1	39000			**156000**		**> 50,000 vpd**	**2**
429	93180000	4	6.748	937234	36000	60.6		**1496**	**3582**	1	10000			**40000**		**30,000 - 40,000 vpd**	**1**
430	55050000	2	5.05	553067	51500	65.9	DATA COLLECTED	**1500**	**10464**	2	37000	44000		**81000**	183000	**> 50,000 vpd**	**6**
431	87281000	2	4.118	871178	43500	52.4		**1506**	**1058**	1	60500			**242000**		**> 50,000 vpd**	**2**

432	77010000	2	1.748	770152	50500	53.9		**1509**	**9040**	1	48000				**192000**		**> 50,000 vpd**	**3**
432	77010000	2	1.748	770019	42000	53.9		**1510**	**20376**	1	20400				**81600**		**> 50,000 vpd**	**1**
433	12010000	2	10.571	120034	39500	59.7		**1511**	**127**	4	2400	34000	28000	26500	**90900**		**> 50,000 vpd**	**1**
434	92090000	N/A	15.386	927086	37000	53		**1513**	**62**	1	14400				**57600**		**> 50,000 vpd**	**1**
434	92090000	N/A	15.386	920147	46000	53		**1515**	**2629**	1	49500				**198000**		**> 50,000 vpd**	**2**
434	92090000	N/A	15.386	925017	44500	53		**1519**	**2046**	1	33346				**133384**		**> 50,000 vpd**	**1**
435	93030000	2	2.548	937199	29500	60.6		**1520**	**420**	2	9100	11584			**20684**		**20,000 - 30,000 vpd**	**1**
436	90010000	2	0.591	908112	6200	54.8		**1521**	**6215**	1	29500				**118000**		**> 50,000 vpd**	**1**
436	90010000	2	0.591	905011	8500	54.8		**1525**	**3178**	2	32500	28000			**60500**		**> 50,000 vpd**	**1**
437	87160000	2	8.089	870084	21000	58.9		**1527**	**1646**	2	19600	23000			**42600**		**40,000 - 50,000 vpd**	**1**
438	87170000	2	3.192	875225	50000	52.4		**1531**	**1632**	1	28000				**112000**		**> 50,000 vpd**	**4**
439	10110000	2	16.479	100012	28500	58.2		**1533**	**2462**	0					**0**		**< 20,000 vpd**	**1**
440	36010000	2	14.711	360467	11700	56.7		**1536**	**3723**	2	25000	52500			**77500**		**> 50,000 vpd**	**1**
440	36010000	2	14.711	365058	28000	56.7		**1539**	**2427**	2	12600	21900			**34500**		**30,000 - 40,000 vpd**	**1**
441	75006000	2	1.095	755071	29000	53.3		**1540**	**5367**	2	28500	26000			**54500**		**> 50,000 vpd**	**3**
441	75006000	2	1.095	750435	33500	53.3		**1543**	**1973**	1	40500				**162000**		**> 50,000 vpd**	**1**
442	16160000	N/A	0	165005	2500	55.9		**1551**	**5254**	2	12387	15000			**27387**		**20,000 - 30,000 vpd**	**1**
442	16160000	N/A	0	165003	8400	55.9		**1555**	**3152**	2	56500	54000			**110500**		**> 50,000 vpd**	**3**
443	72028000	2	2.861	720970	47500	57.1		**1558**	**13723**	1	41000				**164000**		**> 50,000 vpd**	**1**
444	87053001	5	1.557	870098	13500	99.9		**1562**	**399**	1	30500				**122000**		**> 50,000 vpd**	**1**
445	14050000	2	14.976	140111	21500	60		**1565**	**3932**	2	41500	7800			**49300**		**40,000 - 50,000 vpd**	**1**
445	14050000	2	14.976	140040	24000	60	DATA COLLECTED	**1566**	**350**	3	7300	22500	1750		**31550**	**48500**	**30,000 - 40,000 vpd**	**2**
446	14570000	2	1.341	145108	35000	60		**1570**	**2544**	2	54500	61500			**116000**		**> 50,000 vpd**	**5**
447	14571000	2	4.427	145601	39500	60		**1572**	**13231**	1	27500				**110000**		**> 50,000 vpd**	**2**
447	14571000	2	4.427	145602	41500	60		**1574**	**2090**	2	27000	29000			**56000**		**> 50,000 vpd**	**1**
448	55020000	2	2.02	553006	25000	65.9		**1576**	**1467**	1	13900				**55600**		**> 50,000 vpd**	**1**
449	79190000	2	4.576	790363	26500	61		**1577**	**4015**	2	21000	22500			**43500**		**40,000 - 50,000 vpd**	**2**
450	93030000	2	9.18	935013	8200	58.5		**1580**	**22653**	1	46000				**184000**		**> 50,000 vpd**	**1**
450	93030000	2	9.18	935009	10000	58.5		**1582**	**4467**	1	56500				**226000**		**> 50,000 vpd**	**4**
450	93030000	2	9.18	930681	12200	58.5		**1583**	**21109**	1	57500				**230000**		**> 50,000 vpd**	**4**
451	87120000	2	4.703	870088	46500	58.9		**1584**	**127040**	1	19000				**76000**		**> 50,000 vpd**	**2**
452	76020000	2	22.964	760254	6500	60.3		**1585**	**3604**	1	30000				**120000**		**> 50,000 vpd**	**1**
453	87140001	N/A	0.965	875022	20500	99.9		**1586**	**3367**	1	35000				**140000**		**> 50,000 vpd**	**1**
454	72050000	2	10.081	725009	12000	57.1		**1587**	**1667**	1	16400				**65600**		**> 50,000 vpd**	**1**
454	72050000	2	10.081	725010	12100	57.1		**1588**	**2282**	1	26000				**104000**		**> 50,000 vpd**	**2**
455	53020000	2	0.341	535036	3600	55.3		**1591**	**0**	1	35500				**142000**		**> 50,000 vpd**	**2**
455	53020000	2	0.341	535042	22000	55.3		**1596**	**801**	1	14900				**59600**		**> 50,000 vpd**	**3**
456	87281000	2	6.165	871179	38500	52.4		**1602**	**26142**	1	22000				**88000**		**> 50,000 vpd**	**2**
456	87281000	2	6.165	878153	4800	52.4		**1603**	**12206**	4	38500	27500	53500	72500	**192000**		**> 50,000 vpd**	**5**
457	72150000	2	3.386	720187	30000	57.1		**1604**	**8390**	1	48500				**194000**		**> 50,000 vpd**	**2**
458	72100000	2	6.001	723162	30000	57.1		**1608**	**5859**	1	35000				**140000**		**> 50,000 vpd**	**1**
459	72120000	2	16.726	720911	19800	57.1		**1612**	**2193**	1	31000				**124000**		**> 50,000 vpd**	**5**
460	72170000	2	2.556	723509	31000	57.1		**1617**	**809**	2	12100	19994			**32094**		**30,000 - 40,000 vpd**	**3**
460	72170000	2	2.556	720012	36500	57.1		**1619**	**2564**	1	57000				**228000**		**> 50,000 vpd**	**2**
461	72190000	2	0.54	723028	21300	57.1		**1622**	**1305**	1	24500				**98000**		**> 50,000 vpd**	**1**
462	87047000	2	9.134	871211	56000	58.9		**1624**	**3596**	2	5000	12000			**17000**		**< 20,000 vpd**	**2**
463	87053000	3	4.655	871138	36500	58.9		**1625**	**2426**	2	13500	43500			**57000**		**> 50,000 vpd**	**1**
464	72090003	2	0	722004	2800	99.9		**1628**	**1803**	1	62000				**248000**		**> 50,000 vpd**	**1**
465	14030000	2	19.688	85300	33500	57.9		**1629**	**23650**	1	52000				**208000**		**> 50,000 vpd**	**9**
465	14030000	2	19.688	140061	38000	60		**1633**	**411**	1	34500				**138000**		**> 50,000 vpd**	**1**
466	57030000	2	12.241	570293	50508	52.3		**1634**	**3296**	3	9400	25500	10800		**45700**		**40,000 - 50,000 vpd**	**3**
466	57030000	2	12.241	575104	47000	57.9		**1635**	**1789**	1	39000				**156000**		**> 50,000 vpd**	**2**
467	57040000	2	2.456	575108	40500	52.1		**1639**	**21384**	1	27593				**110372**		**> 50,000 vpd**	**1**
468	29020000	2	4.312	290082	3500	55.3		**1640**	**1088**	1	58000				**232000**		**> 50,000 vpd**	**1**
468	29020000	2	4.312	290140	4100	55.3		**1641**	**68**	3	31000	14300	8700		**54000**		**> 50,000 vpd**	**2**