Louisiana Pedestrian Crash Study

An Analysis of Pedestrian Crashes on State-Owned Highways in Louisiana from 2015-2019

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Prepared For

The Louisiana Department of Transportation and Development

Prepared By

Louisiana State University Center for Analytics & Research in Transportation Safety

179 South Quad Drive
Baton Rouge, LA 70803

225.578.0366
carts@lsu.edu

CARTS
Center for Analytics and Research in Transportation Safety

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Project Leader

- Jessica DeVille, Louisiana Department of Transportation and Development (DOTD) Highway Safety

Report Authors

- David Whitchurch, LSU Center for Analytics and Research in Transportation Safety
- Emily Pfetzer, LSU Center for Analytics and Research in Transportation Safety
- Michael Allen, LSU Center for Analytics and Research in Transportation Safety

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List of Abbreviations

The following table lists various abbreviations and acronyms used in this report. The page on which each on is first used is also given. See report glossary for definitions where applicable.

Abbreviation	Full Term	Page
AADT	Annual average daily traffic	21
ADT	Average daily traffic	6
CARTS	Center for Analytics and Research in Transportation Safety	11
CURE	Cumulative residual	18
DOT	Department of Transportation	7
DOTD	Louisiana Department of Transportation and Development	7
EEACF	Excess expected average crash frequency	22
FHWA	Federal Highway Administration	8
LOSS	Level of service of safety	21
LTRC	Louisiana Traffic Research Center	11
PCD	Percent of CURE deviance	19
SPF	Safety performance function	17

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Introduction

Pedestrian Crashes in Louisiana

Across the United States, trends in crash data indicate a rise in pedestrian fatalities, particularly in metropolitan areas where people are more likely to use active forms of transportation like walking and biking. In Louisiana, the number of pedestrian fatalities has been on an upward trend from 2015-2019 and the number of pedestrian injuries has not fallen (Figure 1). To address pedestrian safety and strategically reverse this trend, a better understanding of the types of highway and land use features and particular risk factors involved in pedestrian crashes is needed.

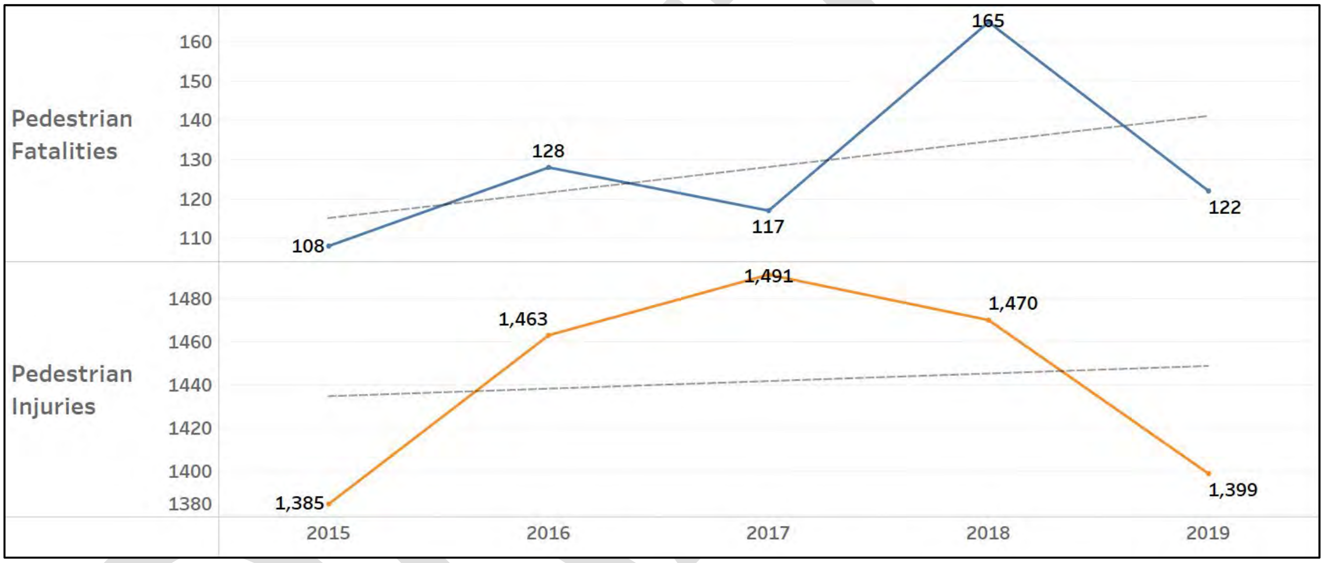

Figure 1: Pedestrian Crash Trends in Louisiana 2015 – 2019 [1]

Project Purpose

This report and its associated output provide information to help prioritize the implementation of engineering countermeasures and other projects related to reducing the number of pedestrian crashes on state-owned highways throughout Louisiana. This information is given in three forms:

1) A list of state-owned highways ranked in order of potential for safety improvement related to pedestrian crashes. Ranking was performed using results from statistical models combined with pedestrian crash history from 2015-2019 and is provided in a separate appendix.
2) An overrepresentation analysis of potential risk factors related to pedestrian crashes on state-owned highways (included in this report).
3) This project report.

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[1] Chart data was retrieved from the crash data warehouse at Louisiana State University Center for Analytics and Research in Transportation Safety (CARTS).

The remaining sections of this introduction contain an overview of the challenges, limitations, and considerations faced in the process of conducting a statewide pedestrian safety analysis in Louisiana with data that is currently available.

About the Analysis: Why Only State-Owned Highways?

Although it was hoped that this study would include an analysis of pedestrian crashes on all roads in Louisiana, this report only includes an analysis of State-Owned highways. To perform a useful systemic analysis, highway data must contain features associated with a linear referencing system.[2] Data for characteristics of interest including Average Daily Traffic (ADT) must be available for all highways within the network being analyzed. At the time of this study, ADT data were missing for a large portion of local roads in Louisiana. This issue made it impossible to conduct a systemic analysis of all highways in Louisiana. Data for State-Owned highways did not have this issue, so it was used instead.

Addressing Pedestrian Safety – Some Common Concerns

A major challenge in addressing pedestrian crashes is the low-density distribution of crashes. This is not unlike challenges to addressing crashes in rural areas, which are not typically identified as locations of concern in a traditional site-specific analysis process (Preston et al., 2013). The low-density nature of rural crashes is a challenge because, though the crashes tend to be severe where they do occur, the traditional approach is primarily used to identify locations with high percentage of severe crash history, i.e., hot spots, aka black spots (Preston et al., 2013). In addition to crash history issues, many crashes involving pedestrians and cyclists occur on local roads, which often lack robust data to identify specific locations of concern. There may be infrastructure-related commonalities associated with higher frequencies of specific *types* of pedestrian crashes, which if identified could be proactively addressed by deploying appropriate countermeasures across the system as well as determining local candidates for spot safety improvements.

Resources and Methodology

The framework for implementing a systemic approach is provided in *NCHRP Research Report 893: Systemic Pedestrian Safety Analysis,* a “practitioner-ready” guidebook to assist departments of transportation (DOTs) personnel, contractors, safety management

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[2] “A *linear referencing system* consists of a set of line features, on which events, elements, and characteristics can be located based on a reference to the line itself rather than through absolute x and y coordinates. Events are things that happen on or to the line feature, such as crash locations and highway projects. Elements are objects that exist on or near the line feature, such as signs or guardrails. Characteristics describe the line features, like speed limits or number of lanes.” (https://desktop.arcgis.com/en/arcmap/10.3/guide-books/extensions/production-mapping/what-is-a-linear-referencing-system.htm)

programs, and others beginning the process with existing data (Libby Thomas et al., 2018). The guidebook defines '*systemic approach*' as:

> "A data-driven, network wide (or system-level) approach to identifying and treating high risk highway features correlated with specific or severe crash types. Systemic approaches seek to not only address locations with prior crash occurrence but also those locations with similar highway or environmental crash risk characteristics. A systemic approach resides on a spectrum of ways that transportation agencies may address safety issues… and is considered a more proactive approach than those that focus only on treating specific locations with a crash history."

The guidebook describes the end-to-end process, associated methodologies, and selected case studies describing how to complete a systemic analysis using crash exposure and highway element data. The process outlined in the guidebook builds on the process established in the FHWA's Systemic Safety Project Selection Tool (Preston et al., 2013). There are a few additional key steps that must be taken due to the particular requirements for a systemic analysis focused on pedestrian safety regarding crash risks, countermeasures, and available data (Libby Thomas et al., 2018). This process involves the following steps:

Step 1: Define Study Scope
Step 2: Compile Data
Step 3: Determine Risk Factors
Step 4: Identify Potential Treatment Sites
Step 5: Select Potential Countermeasures
Step 6: Refine and Implement Treatment Plan
Step 7: Evaluate Program and Project Impacts

It is important to note that this process is data-driven and flexible, so these steps may proceed simultaneously, iteratively, or in a different order (Libby Thomas et al., 2018). In other words, it is not necessarily a linear process. Additionally, the guidebook provides four case studies illustrating "real world" examples of the process used by state and local DOTs in conducting their systemic pedestrian safety analyses.

The first four steps were adapted for use in our study. The basic framework laid out in the guidebook provided a template for structuring this report. There are several other key publications that were highly instrumental in informing our study. The predictive modeling methodology and underlying concepts applied in this study were adapted from (Hauer, 2015), *The Art of Regression Modeling in Road Safety*. This book provides the methodology used to calculate the number of predicted crashes and the expected value of crashes for highway segments and intersections. The Virginia Department of Transportation's *Pedestrian Safety Action Plan* provides details on one of the only statewide-level pedestrian crash studies available at the time of this writing (Cole & Read, 2018).[3] Several of the socioeconomic indicators and "place" type geography information used as pedestrian exposure surrogates for the VA study were statistically significant in this study as well (i.e., percent of no-vehicle households, population density, percentage of households below poverty line, and presence of school within ¼ mile of crash).

Additional sources used for data-related guidance at individual steps in the process are described at the pertinent step where they apply.

Data Constraints and Challenges

The quality and usefulness of results in a data-driven analysis ultimately rests on the availability, quality, and preparation of source data. The specific data needed for conducting any systemic analysis depends on the scope of the project and the questions asked of the data (Carter et al., 2017). The process is inherently flexible and can be adapted to meet agency-specific needs or crash reduction goals, consistent with data available (Preston et al., 2013). Some data elements are necessary to identify target/focus crash types and location characteristics (Preston et al., 2013). Specifically, these include:

- System type (e.g., state, local)
- Crash type (e.g., pedestrian, road departure, right angle, head-on, rear end, turning)
- Facility type (e.g., freeway, expressway, arterial, or collector)
- Crash location type (e.g., urban vs. rural, intersection vs. segment, tangent vs. curve)
- Location characteristics (e.g., topography, intersection elements, highway characteristics)

For a systemic analysis of pedestrian crashes, the following data elements are recommended (L Thomas et al., 2018):

- Highway segment identifier and/or intersection identifier
- Traffic volumes for segments (i.e., ADT)
- Pedestrian volumes for segments (i.e., average daily pedestrian counts)

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[3] "Statewide" in this case refers to all public highways maintained by State and/or local entities.

As discussed previously, linear referencing features which link adjacent highway subsections must be available for all highway subsections to be analyzed. Data for highway elements or characteristics of interest must be available and accurate as well. For example, if pedestrian crashes on 2-lane urban highways are of interest, the highway data must contain fields which indicate area type (i.e., urban) and number of lanes for each subsection in the data set. In addition to this, highway section length, vehicle traffic data (average daily traffic, or ADT), and pedestrian traffic data are required for creating models to predict the number of pedestrian crashes. Pedestrian traffic is ideally measured by average pedestrian counts along or across an intersection or segment. Since pedestrian traffic counts are not available for most State-owned highways in Louisiana, surrogates such as socioeconomic characteristics and the proximity of highway sections to schools or parks were used. Additional data needed for identifying risk factors within a systemic analysis include the highway features and intersection features relevant to the crash type(s) being studied.

Another challenge related to this study is the low number of pedestrian crashes relative to the number of highways in the state. Despite this limitation, the project team was able to construct a dataset and model that will improve understanding of pedestrian crashes on State-owned highways in Louisiana, help prioritize pedestrian safety projects for State-owned highways, and serve as a basis for future studies of this type on all public roads in the State once data becomes available.

Data Collection

Data for the project includes information related to all pedestrian crashes which occurred on State-owned highways in Louisiana from 2015-2019. This data was obtained from multiple data sources representing three categories of data – crash report data, highway and land use elements, and socioeconomic factors. Before analysis could begin, these sources were cleaned and aggregated to satisfy the methodology used in the study.

Crash Data

Crash reports for fatal, suspected serious injury, and suspected minor injury pedestrian crashes were reviewed by staff members and student workers at Louisiana State University's Center for Analytics and Research in Transportation Safety (CARTS) and the Louisiana Traffic Research Center (LTRC). The student workers and staff applied a set of rules to the data from each pedestrian crash report to screen out any crashes which were not actually pedestrian crashes. Data from pedestrian crashes which occurred on State-owned highways from 2015-2019 were retrieved from DOTD's "Crash 1" table. Table 1 contains the crash data elements which were used in the study.

Table 1: Crash Data Elements and Definitions

Element Name	Full Name	Definition
crash num	crash number	crash identifier
Route	route	State route identifier
Csect	control section	highway section identifier
Log Mile	log mile	Point on control section where crash occurred
tot acc (1)	total accidents	Crash indicator. This number is always = 1 in Crash 1 and is used to sum up the number of crashes on a highway section.
pdo acc (0 or 1)	property damage only accident	1 if crash did not involve any injuries or fatalities, 0 otherwise.
fat acc (0 or 1)	fatal accidents	1 if one or more persons died in crash, 0 otherwise.
inj acc (0 or 1)	injury accidents	1 if one or more persons were injured in crash, 0 otherwise.
num fat	number fatalities	Number of persons killed in crash.
num inj	number of injuries	Number of persons injured in crash.
crash date	crash date	Date of crash
crash type	crash type	Primary type of crash (e.g., Pedestrian, Pedalcycle, Motorcycle, etc.).

Highway Data

Data elements describing highway elements, highway characteristics, and potential pedestrian traffic generators were collected using two processes:

1) Data was gathered from the Louisiana DOTD Geographic Information System (GIS) database. Multiple database layers were joined for the project. Data for highway elements and characteristics which did not completely align with subsection endpoints defined by Control Section, Logmile From, and Logmile To was not used.
2) Place information from the U.S. Geological Survey was used to gather the specific location (i.e., latitude and longitude) of each school, day care center, and park in Louisiana. These place types were chosen due to their significant correlation to pedestrian crashes in the Virginia Pedestrian Safety Action Plan (Cole & Read, 2018). Although the inclusion of other place types may have been appropriate, none were included in the study due to project time constraints related to literature review and data collection.

Table 2 contains the highway data elements which were used in the study.

Table 2: Highway Data Elements and Definitions

Element Name	**Definition**
Control Section	Highway section identifier
Logmile From	“Beginning” point of highway subsection
Logmile To	“End” point of highway subsection
Route	State route identifier
Highway Class	Facility type (e.g., Rural 2-lane, Urban 4-lane, Urban 4-lane divided, etc.)
Close to School (Yes/No)	Indicates if any point on subsection is within ¼ mile of school or daycare center.
Close to Park (Yes/No)	Indicates if any point on subsection is within ¼ mile of park.
Shoulder type	Indicates shoulder type (e.g., Curb and Gutter, Shoulder<6ft, Shoulder>6ft, etc.)

Socioeconomic Data

Prior studies have used socioeconomic elements to reflect the amount of pedestrian exposure along highways where pedestrian traffic count data are unavailable (Cole & Read, 2018; Libby Thomas et al., 2018). Socioeconomic elements used in this study were retrieved from U.S. Census Bureau data (Table 3). Values for these elements were obtained at the Census Tract level to reflect characteristics of interest for most pedestrians who live and work in the vicinity of the highways studied.

Table 3: Socioeconomic Data Elements and Definitions[4]

Element Name	**Definition**
Percentage of No-Vehicle Households	Percentage of households with no vehicle
Unemployment Percentage	Percentage of persons 16 and older in the labor force who are jobless, looking for a job, and available for work
Population Density	Number of persons per square mile
Percentage of Households Below Poverty Line	Percentage of households below poverty line
Median Household Income	Median household income, in dollars

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[4] All socioeconomic data was retrieved from the U.S. Census American Community Survey 2012 – 2016.

Data Preparation

The scope of the study required an extensive amount of data preparation to be performed. The overall data preparation process included the following subprocesses:

1) Data quality checks, in which data sources were evaluated for completeness and accuracy.
2) Other data processing, which included the following:
    a. Data integration, in which source data sets were merged using common elements.
    b. Data aggregation, where individual observations were rolled up into higher levels, resulting in a final data set where a single row represented one contiguous highway segment with all associated data.
    c. Data cleaning, which included the following:
        i. Renaming data field names and converting coded information
        ii. Removing data associated with controlled-access highways (i.e., interstates and freeways).
        iii. Removing data associated with facility types which had less than 100 pedestrian crashes from 2015-2019.

Data Quality

Pedestrian crash data for 3,496 crashes were inspected for completeness and accuracy throughout the analysis with multiple quality control steps. The following changes were made to the data initially received from Crash 1:

- Reviewed 124 crashes which originally had a crash type other than "Pedestrian" but were listed as Pedestrian crashes in the data source. 26 of these crashes were recoded as pedestrian crashes based on details from the crash report narrative and the remaining 98 crashes were excluded from analysis. 33 other crashes were also removed based on a review of crash report narratives[5].
- Removed 25 crashes where crash location information was unavailable or indeterminate.

Once the analysis was completed and sections were ranked according to potential for safety improvement, the number of crashes for the highest-ranked sections listed in the final data set was cross-checked against source data and lists containing crash numbers for crashes which were recoded or excluded. After removing crashes as described, the data set contained information about 3,340 pedestrian crashes.

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[5] When reviewing crash report narratives, crashes were excluded only when it was obvious from comments in the narrative that crash was miscoded in the data. For example, a crash would be excluded if the narrative clearly indicated that a motor vehicle hit a bicycle and no other persons were involved in the crash, but the crash was listed as a pedestrian crash in the data.

Other Data Processing

Data were prepared to facilitate the construction of statistical models using the following elements:

- Observed number of pedestrian crashes for each section from 2015-2019
- Highway Class
- Average Daily Traffic (ADT)
- Population Density
- % of Households below Poverty Line
- % of Households with No Vehicle
- % Unemployed
- Median Income
- Close to School (within ¼ mile)
- Close to Park (within ¼ mile)
- Shoulder Type (Curb and Gutter, Shoulder<6ft, Shoulder>6ft, None, Unknown)

After the initial crash data quality checks, additional data processing included four main processes to clean and integrate data from the crash, highway, and socioeconomic data sets used in the study: data integration, data aggregation, data cleaning, and removal of data.

Data Integration

Data integration was necessary to join source data contained in multiple formats and tables. Joins between two or more tables were performed using key fields common to the tables, such as Crash Number, Control Section, and Logmile.

Data Aggregation

To structure the data set to create predictive models for the study, rows of data referring to crashes were collapsed to highway subsections so that one row in the data set represented one highway subsection and its associated crash data. Individual subsections were defined by the combination of values in “Control Section”, “Logmile from”, and “Logmile to” fields. Adjacent highway subsections having similar characteristics were then joined together to form highway sections that would be analyzed. Adjacent subsections with the following characteristics were joined:

- Similar ADT (+/- 2.5%)
- Matching Highway Class
- Similar Population Density (+/- 500)
- Similar % of Households Below Poverty Level (+/- 5%)
- Similar % of Households with No Vehicle (+/- 5%)
- Similar % Unemployed (+/- 5%)
- Similar Median Household Income (+/- $5000)
- Matching “Close to school” (1/4 mi)
- Matching “Close to Park” (1/4 mi)
- Matching Shoulder Type

Removal of Rows

Before analysis, rows referring to controlled-access highways were removed (i.e., interstates and freeways). There were 470 pedestrian crashes on these types of highways from 2015-2019. In addition, rows referring to subsections with the following characteristics were removed:

- Subsections of facility types with less than 100 pedestrian crashes[6]:
    - Rural 2-Lane w/Continuous Turn Lane (0 crashes)
    - Rural 4-Lane (8 crashes)
    - Rural 4-Lane w/Continuous Turn Lane (7 crashes)
    - Rural 6-Lane (0 crashes)
    - Urban 2-Lane w/Continuous Turn Lane (29 crashes)
- ADT=0 (6 crashes)

The final prepared data set contained 7,336 rows where each row contains information about one highway section of interest.

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[6] 100 crashes is the minimum sample size needed for systemic analysis. Analyzing facility types with less than 100 crashes can lead to inaccurate results.

Data Analysis Methodology

Data analysis methodology for the study used two methods: network screening and overrepresentation analysis. Details of each method follow.

Network Screening

Network screening is a method that objectively considers crash history, highway factors, and traffic characteristics that may contribute to future crashes and helps agencies identify and prioritize locations for potential safety investment. Network screening was performed using the following steps:

1. Safety Performance Functions were created for each highway class.
2. Results of the Safety Performance Functions were combined with pedestrian crash history to calculate two metrics, Level of Service of Safety and Excess Expected Average Crash Frequency.
3. These metrics were then used to rank highway sections in terms of the magnitude of potential for improvement for pedestrian crashes. The ranked list provides a means to identify high-priority highway sections which may benefit from further analysis and implementation of countermeasures to reduce the number of pedestrian crashes.

Safety Performance Functions

Description and Construction

Safety Performance Functions (SPFs) are used to predict the number of crashes on a highway section. They are statistical models which relate the number of crashes to different site characteristics. These models always include vehicle traffic volume (ADT) and section length (Srinivasan & Bauer, 2013) For pedestrian crashes, SPFs should reflect pedestrian traffic volume as well. Ideally, pedestrian traffic would be measured by taking daily counts of pedestrians who cross or walk along a highway section and calculating an average. Since pedestrian counts are not available for most highways, socioeconomic characteristics have been used as surrogates for pedestrian traffic in other studies (Cole, 2018; Libby Thomas et al., 2018). Examples include population density and percentage of households with no vehicles in areas surrounding a highway section. SPFs were created for the following facility types or characteristics:

- Urban 2-Lane Highways with ADT>0 & ADT<=10,000
- Urban 2-Lane Highways with ADT>10,000 & Length>=2 miles
- Urban 2-Lane Highways with ADT>10,000 & Length<2 miles
- Urban 4-Lane Highways
- Urban 4-Lane Divided Highways
- Urban 4-Lane Highways with Continuous Two-Way Left-Turn Lanes
- Urban 6-Lane Highways
- Rural 2-Lane Highways

The SPFs listed above are used to predict the number of pedestrian crashes on highway sections in the study. Different combinations of the following variables were used to create the SPFs:

- ADT (used in all SPFs)
- Section Length (used as an offset in all SPFs)[7]
- Population Density (used in all SPFs)
- % of Households Below Poverty Level
- % of Households with No Vehicle
- % Unemployed
- Median Household Income
- Close to School (section within ¼ mile)
- Close to Park (section within ¼ mile)
- Shoulder Type

Evaluation of Safety Performance Functions

SPFs were evaluated using cumulative residual (CURE) plots. A CURE plot provides a convenient way to assess the usefulness of a single continuous numeric predictor variable in a SPF (Hauer, 2015). An example CURE plot for a predictor variable, ADT, is provided in Figure 3. A CURE plot is constructed by first sorting the data by the values of a predictor of interest, from least to greatest. A line is then plotted which displays the cumulative residual value[8] for each highway in the data set. This line is shown in red in the example and is between the other two lines, which are the upper and lower bounds for the plot. These bounds are based on the following formula:

$$\boxed{\hat{\sigma}'_S(i) = \pm\hat{\sigma}_S(i)\sqrt{1-\frac{\hat{\sigma}^2_S(i)}{\hat{\sigma}^2_S(n)}}},$$

Figure 2: Formula for constructing CURE plot upper and lower boundaries

which is calculated at each level of the variable of interest, similarly to the cumulative residual line. In this formula $\hat{\sigma}^2{}_S(i)$ and $\hat{\sigma}^2{}_S(n)$ are the sum of squared residuals at the current level and the final level of the variable of interest, respectively. $\hat{\sigma}_S(i)$ is the standard deviation at the current level and can be estimated by taking the square root of

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[7] An offset is used when the number predicted is proportional to a variable. In this case, the number of crashes on a longer section is typically greater than the number of crashes on a shorter section, so *section length* is used as an offset.

[8] A *residual value* is the difference between the observed value and the value predicted by the SPF for a highway subsection. The *cumulative residual value* is the sum of the subsection's residual value and all residual values above it in the data table.

the sum of squared residuals at the current level. The result of this calculation is $\widehat{\sigma}'_S(i)$. The positive and negative of this are the values on which the upper and lower bounds are made.

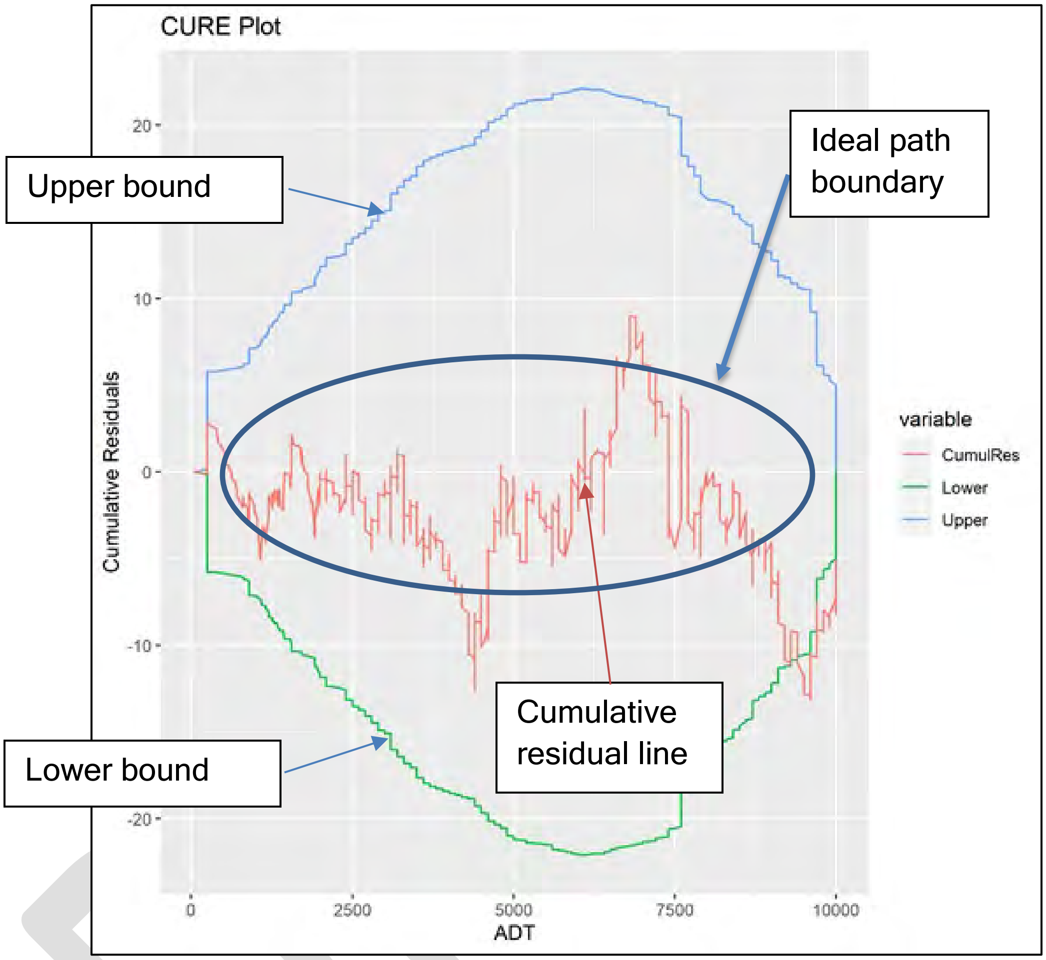


Figure 3: CURE Plot for Urban 2-Lane Highways with ADT <= 10,000

Two conditions, based on characteristics of CURE plots, can be used to assess a numeric predictor variable in an SPF:

1) **Percent of CURE Deviance (PCD)** – This is the percentage of points on the residual line which are above or below the upper or lower bounds. Hauer (2015) suggests using a cutoff of 5%. That is, no more than 5% of the points on the cumulative residual line should fall outside the upper or lower bounds. In this study, the cutoff was raised to 10%. The primary reason has to do with the relative frequency of pedestrian crashes. Pedestrian crashes are a much rarer event than motor-vehicle-only crashes, and this makes it difficult to achieve a strict 5% cutoff for all facility types. For this study, the cutoff for CURE plots for two of the facility types was around 7%.

2) **Cumulative residual line path –** In an ideal CURE plot, the cumulative residual line should hover just above or below "0" on the y axis. The dark blue oval overlay on Figure 3 provides a visual of this path. This would indicate that the SPF predictions are random and are slightly above or below actual values. The example in Figure 3 conforms to this ideal in general but does contain two sections with a downward-sloping line (3,000 - 4,000 and 7,000 – 9,000). This indicates that the SPF, using ADT, slightly over-predicts pedestrian crashes within these ranges. On the contrary, the upward-sloping section of the line (4,000 – 7,000) indicates slight under-prediction.

In this study, SPFs were deemed to be "adequate" if at least one predictor variable in the SPF met condition 1 above (PCD<10%) and deemed to be "good" if at least one predictor variable met both conditions 1 and 2 above. For example, the summary statistics in Table 4 below include PCD for all numeric predictors included in the SPF for Urban 2-Lane Highways with ADT<=10,000. All three of the numeric predictor variables in this SPF model are under 10%, so condition 1 is met.

Table 4: SPF Summary Statistics (Urban 2-Lane Highways with ADT<=10,000)

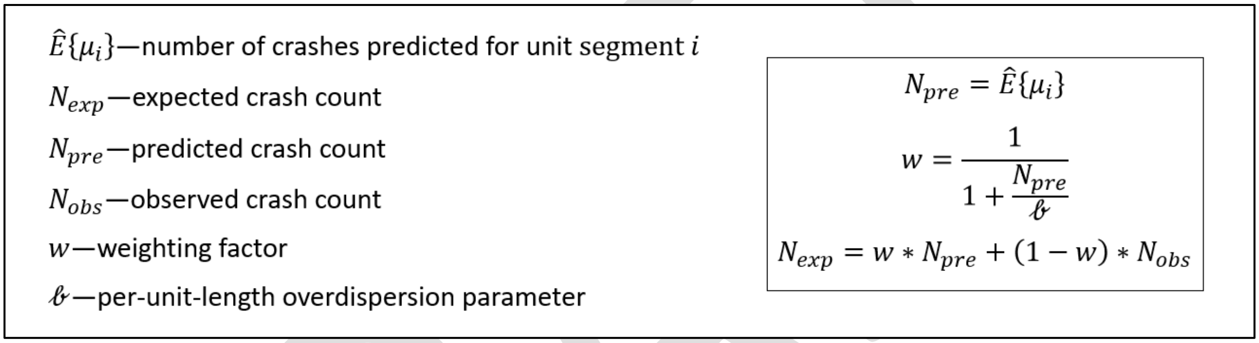
Sample Size (Number of Hwy Sections)	1425
Total Length (All Sections)	1524.81 mi
Observed Pedestrian Crash Count (All Sections)	394
PCD - ADT	**3.30%**
PCD – Population Density	**5.89%**
PCD - % of No-Vehicle Households	**9.05%**

Figure 3 is the CURE plot using ADT for this SPF. As previously discussed, the path of the cumulative residual line in this CURE plot generally conforms to the ideal path, so condition 2 is met for this SPF as well, so the SPF was deemed to be "good".

SPF model information, including lists of variables, summary statistics, and CURE plots, has been provided for each SPF in the analysis. CURE plots for all numeric predictor variables in each model have been provided as part of this output. It is important to note that only numeric predictors can be assessed using CURE plots. This type of analysis is not appropriate for non-numeric predictors. In the case of this study, overrepresentation analysis is used to evaluate non-numeric predictors as risk factors.

Expected Values

The predicted number of pedestrian crashes generated by SPFs are subject to two effects which must be accounted for. The first effect, regression to the mean, is a statistical phenomenon which states that roads with a high number of crashes in a particular period are likely to have fewer crashes during the following period. The second effect is caused by the low number of pedestrians crashes compared to the number of highway sections. SPFs utilize the number of pedestrian crashes on each highway section of a particular facility type to make predictions. Since most highway sections have 0 pedestrian crashes, this makes SPFs for pedestrian crashes tend to predict less crashes. To adjust for both effects, an expected number of pedestrian crashes for each highway section was calculated using the predicted number of pedestrian crashes generated by its corresponding SPF, the per-unit-length overdispersion parameter generated by the SPF, and the section's observed number of pedestrian crashes. This calculation is called Empirical Bayes adjustment and is specified in Figure 4. This methodology mitigates the effects of regression to the mean and the low number of pedestrian crashes relative to the number of highway sections. The expected values are then used to calculate the primary statistic of interest for this study – Level of Service of Safety (LOSS).



$\hat{E}\{\mu_i\}$—number of crashes predicted for unit segment i

N_{exp}—expected crash count

N_{pre}—predicted crash count

N_{obs}—observed crash count

w—weighting factor

$\mathscr{b}$—per-unit-length overdispersion parameter

$$N_{pre} = \hat{E}\{\mu_i\}$$

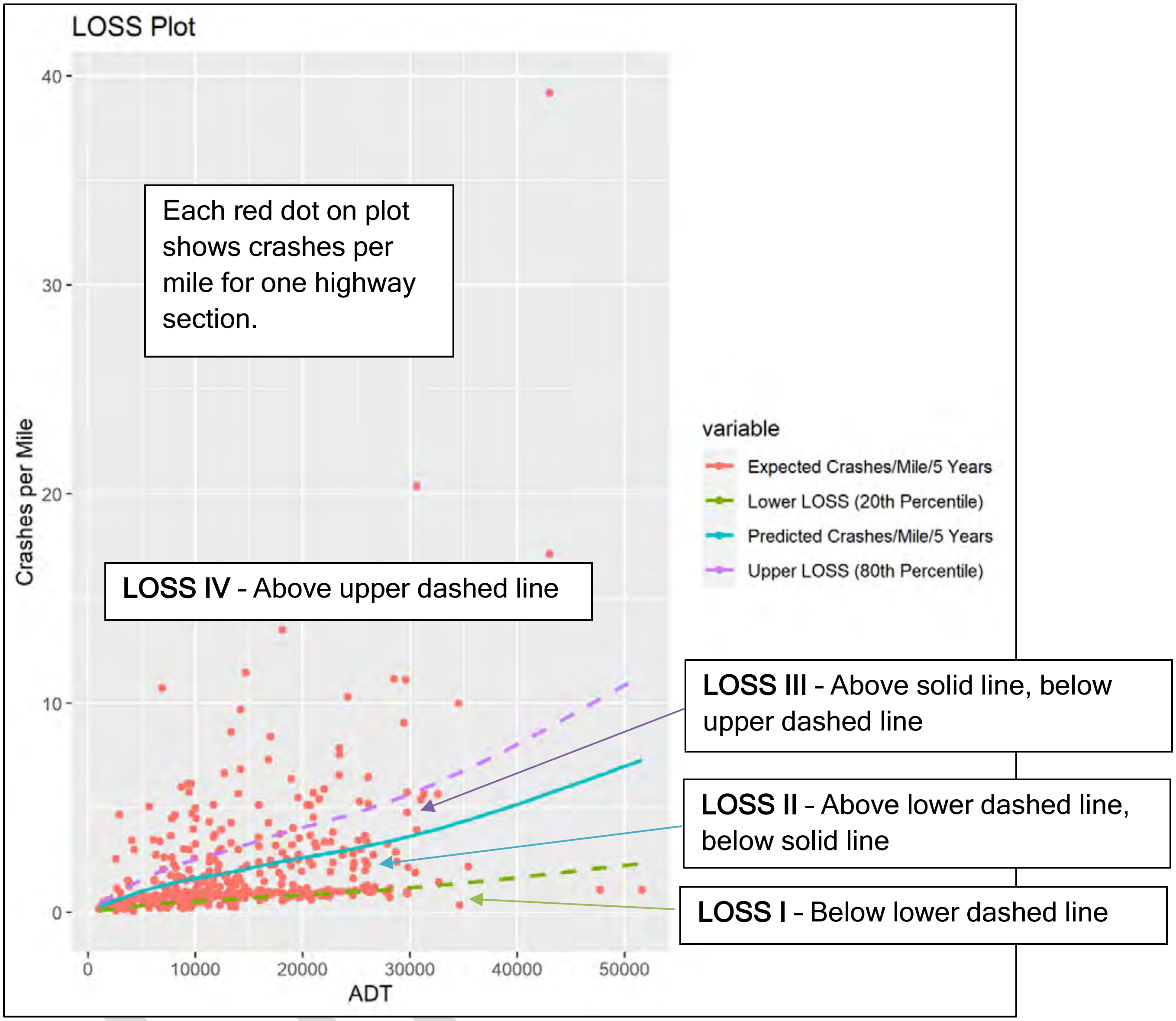
$$w = \frac{1}{1 + \frac{N_{pre}}{\mathscr{b}}}$$

$$N_{exp} = w * N_{pre} + (1 - w) * N_{obs}$$

Figure 4: Empirical Bayes Adjustment Calculation

Level of Service of Safety (LOSS)

Level of Service of Safety is a concept developed by design engineers at the Colorado Department of Transportation to quantify the magnitude of the safety problem (Kononov & Allery, 2003). The grouping provided by LOSS calculations is helpful when looking at potential safety problems from a high level and was used to create the maps contained in the appendix of this report. LOSS utilizes the number of predicted crashes per mile per year by ADT or AADT (annual average daily traffic) as a baseline and adds two other lines for comparison, calculated using the 20th and 80th percentile of the inverse gamma distribution. The LOSS level for a highway section is determined by its position relative to these lines. Figure 5 provides an example.



Each red dot on plot shows crashes per mile for one highway section.

LOSS IV - Above upper dashed line

LOSS III - Above solid line, below upper dashed line

LOSS II - Above lower dashed line, below solid line

LOSS I - Below lower dashed line

Figure 5: LOSS plot

Four LOSSs can be determined:

- **LOSS I indicates a low potential for safety improvement**. In Figure 5, these highway sections have points below 20th percentile.
- **LOSS II indicates better than expected safety performance**. In Figure 5, these highway sections have points between the 20th and 50th percentile.
- **LOSS III indicates less than expected safety performance**. In Figure 5, these highway sections have points between the 50th and 80th percentile.
- **LOSS IV indicates a high potential for safety improvement.** In Figure 5, these highway sections have points located above the 80th percentile.

Excess Expected Average Crash Frequency (EEACF)

Excess expected average crash frequency (EEACF) is a simple calculation performed on each highway section analyzed using SPF results:

EEACF = Expected number of pedestrian crashes per mile – Predicted number of pedestrian crashes per mile [9]

The result accounts for regression to the mean bias discussed previously in this section and is specific to an individual highway section.

Ranking of Highway Sections

In the study output, highway sections were ranked to help prioritize which sections can benefit most from engineering countermeasures or other safety projects related to the reduction of pedestrian crashes. Ranking was accomplished using study output loaded into a Microsoft Excel workbook. Sections were ranked by LOSS, with LOSS IV sections at the top of the list. Sections were then ranked within each LOSS group by EEACF. The LOSS ranking provides a high-level grouping of highway sections, while the EEACF ranking provides ranking at a more granular level. The Excel workbook is provided as a major part of study output so that users wishing to rank the output in other ways will have a convenient means of doing so.

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[9] For this study, a 5-year time period was used. Therefore, both the expected number of pedestrian crashes and predicted number of crashes used in the EEACF calculations are for the 5-year period, not "per year".

Overrepresentation Analysis

Overrepresentation analysis compares the percentage of pedestrian crashes to the percentage of highway miles for highway sections with similar characteristics, such as Average Daily Traffic (ADT). Determining overrepresentation helps determine characteristics which are risk factors for pedestrian crashes. For example, Figure 6 contains a chart showing the percentage of crashes and percentage of highway miles by ADT range for State-owned 2-Lane Urban highways in Louisiana. Each blue bar represents the percentage of pedestrian crashes for a specific ADT range. Each point on the black line represents the percentage of 2-Lane Urban highways for a specific ADT range. In this example, all points on the line for ADT values greater than or equal to 5000 are below the top of the blue bars in the same ADT range. This shows pedestrian crashes are overrepresented on State-owned urban 2-lane highways where ADT is 5000 and above.

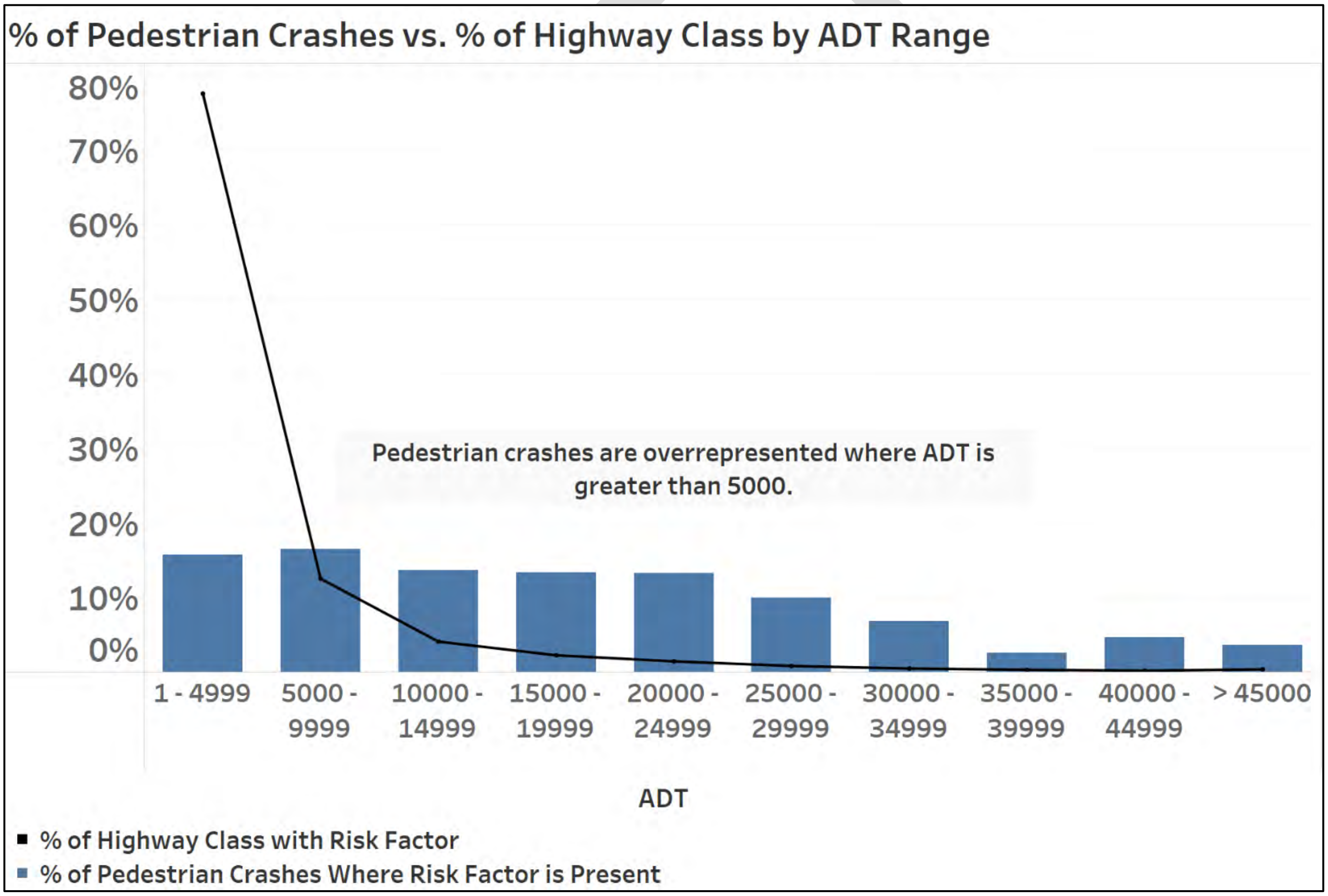


Figure 6: Overrepresentation Chart

Overrepresentation analysis was performed for all facility types included in the study on the following characteristics:

- ADT
- Population Density
- Shoulder Type
- Close to Park (within ¼ mile)
- Close to School (within ¼ mile)
- Median Income Range
- Percentage of Household below Poverty Line
- Unemployment Percentage
- Percentage of Households with No Vehicle

All charts are provided in the appendix. A discussion of overrepresentation results for all facility types in the study is provided in the study results section which follows.

Study Findings

Summary of Findings

Overrepresentation – All Highway Classes

For all highways in the study, the percentage of pedestrian crashes is greater than the percentage of highway miles over all but the lowest ranges of ADT and population density per square mile (Figure 7). Significant overrepresentation is indicated when the population density per square mile is 3,500 or greater. Pedestrian crashes are also overrepresented where highways are within one quarter mile of a school or park. Overrepresentation charts for all highway classes and potential risk factors in the study are provided in the report appendix.

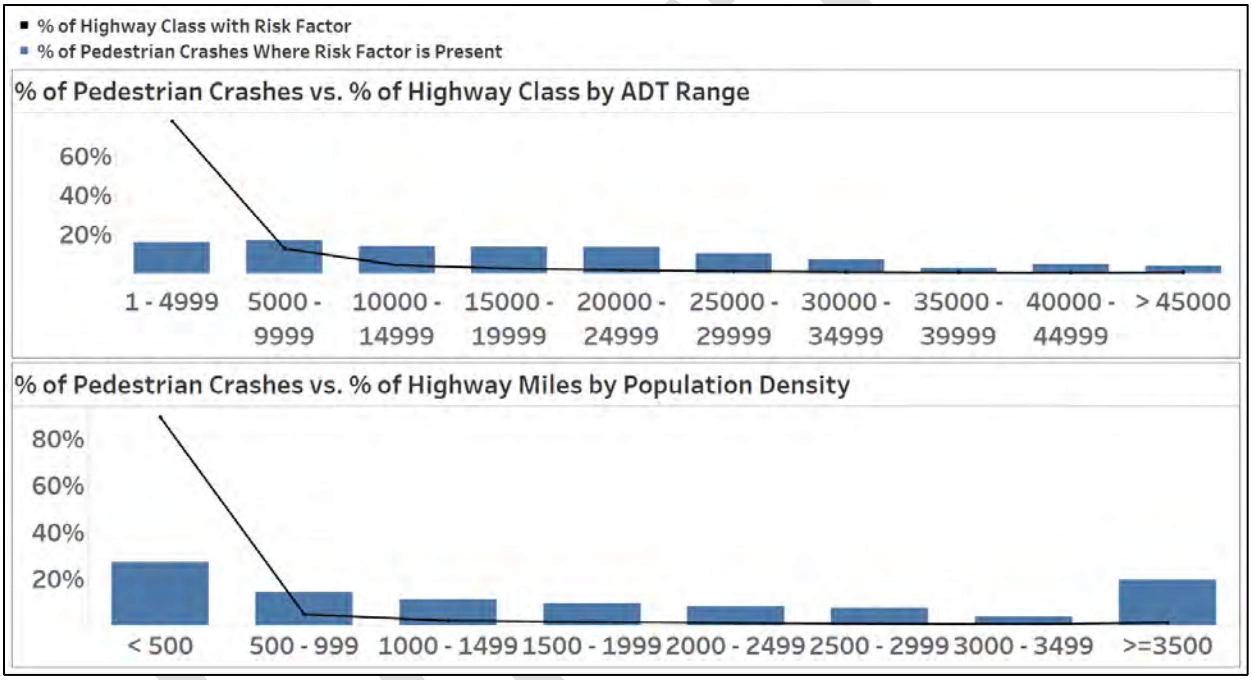
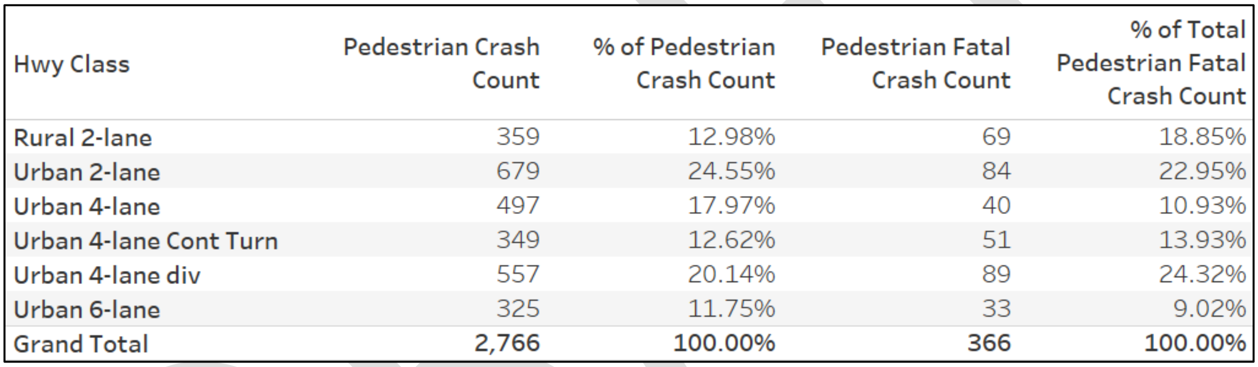


Figure 7: Overrepresentation of Pedestrian Crashes - ADT and Population Density

SPF Results – All Highway Classes

The distribution of pedestrian crashes for the highway types considered in the study is shown in Table 5. Almost 45% of pedestrian crashes and almost 47% of pedestrian fatalities occurred on urban 4-lane divided highways and urban 2-lane highways. Pedestrian fatalities were overrepresented compared to total percentage of pedestrian crashes on rural 2-lane highways, urban 4-lane highways with continuous left turn lanes, and urban 4-lane divided highways. Based on CURE plot analysis, ADT was determined to be the best overall predictor of pedestrian crashes for all but two SPFs (urban 2-lane highways with ADT>10,000 and length<2 miles, rural 2-lane highways). Population density per square mile was also determined to be a significant predictor of pedestrian crashes in 5 of the 8 SPFs created. Specific details for each SPF are listed below. The report appendix contains SPF output and CURE plots for each SPF. Sections determined to be LOSS 4 comprised 434 of the 7336 highway sections analyzed (5.9%).

Table 5: Pedestrian Crashes by Highway Class (2015-2019)



Hwy Class	Pedestrian Crash Count	% of Pedestrian Crash Count	Pedestrian Fatal Crash Count	% of Total Pedestrian Fatal Crash Count
Rural 2-lane	359	12.98%	69	18.85%
Urban 2-lane	679	24.55%	84	22.95%
Urban 4-lane	497	17.97%	40	10.93%
Urban 4-lane Cont Turn	349	12.62%	51	13.93%
Urban 4-lane div	557	20.14%	89	24.32%
Urban 6-lane	325	11.75%	33	9.02%
Grand Total	**2,766**	**100.00%**	**366**	**100.00%**

Findings by Highway Class

Urban 2-Lane Highways

Overrepresentation

Pedestrian crashes on urban 2-lane highways were overrepresented in the study under the following conditions:

- ADT >= 5,000
- Population density per square mile >= 500
- Close to school (within ¼ mile)
- Close to park (within ¼ mile)
- Percentage of families below poverty line >= 30%
- Income < $30,000
- Unemployment >= 5%
- Percentage of no-vehicle households >= 10%

Significant overrepresentation of pedestrian crashes on this highway class occurred when the percentage of no-vehicle households was greater than or equal to 16%.

SPF Results

Three SPFs were needed to represent crash patterns on urban 2-lane highways:

> **For Urban 2-Lane Highways with ADT>0 and ADT<=10,000**, we observed 1,425 sections with a combined length of 1,524.81 miles. On these sections, there were a total of 394 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, and % Unemployed were 3.30%, 5.89%, and 9.05%, respectively. There were an average of 0.28 crashes per segment and 0.35 crashes per mile. The mean and median ADT in this set were 4,715.6 and 4,500, respectively. The mean and median section length were 1.07 miles and 0.63 miles.
>
> Over 58% of pedestrian crashes on urban 2-lane highways are accounted for by this SPF. The SPF includes ADT, percentage of no-vehicle households, and population density as predictors. ADT and population density are the best predictors based on CURE plot analysis.[10]

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[10] It is important to note that for all SPFs, all other predictors listed for a specific SPF must also be included in the SPF for the "best" predictors to be significant.

For Urban 2-Lane Highways with ADT>10,000 and Length >= 2 miles, we observed 74 sections with a combined length of 227.12 miles. On these sections, there were a total of 64 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, % of Households Below Poverty Line, and % of Households with No Vehicle were all 1.35%. There were an average of 0.86 crashes per segment and <0.29 crashes per mile. The mean and median ADT in this set were 14,312 and 13,100, respectively. The mean and median section length were 3.07 miles and 2.8 miles.

9.4% of pedestrian crashes on urban 2-lane highways are accounted for by this SPF. The SPF includes ADT, percentage of no-vehicle households, population density, and percentage of households below the poverty line as predictors. ADT and the percentage of no-vehicle households are the best predictors based on CURE plot analysis.

For Urban 2-Lane Highways with ADT>10,000 and Length < 2 miles, we observed 419 sections with a combined length of 265.7 miles. On these sections, there were a total of 215 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, % of Households Below Poverty Line, and % of Households with No Vehicle were 9.79%, 22.43%, 3.82%, and 4.30% respectively. There were an average of 0.51 crashes per segment and 1.01 per mile. The mean and median ADT in this set were 16,451.8 and 14,600, respectively. The mean and median section length were 0.63 miles and 0.48.

About 32% of pedestrian crashes on urban 2-lane highways are accounted for by this SPF. The SPF includes ADT, percentage of no-vehicle households, population density, and percentage of households below the poverty line as predictors. Percentage of households below the poverty line and percentage of no-vehicle households are the best predictors based on CURE plot analysis.

For all urban 2-lane highways, sections determined to be LOSS 4 comprised 152 of the 1918 highway sections analyzed (7.9%).

Urban 4-Lane Highways

Overrepresentation

Pedestrian crashes on urban 4-lane highways were overrepresented in the study under the following conditions:

- ADT >= 15,000
- Population density per square mile >= 1,000
- Close to school (within ¼ mile)
- Close to park (within ¼ mile)
- Percentage of families below poverty line >= 30%
- Income < $30,000
- Unemployment >= 15%
- Percentage of no-vehicle households >= 10%

Significant overrepresentation of pedestrian crashes on this highway class occurred when the percentage of no-vehicle households was greater than or equal to 16%.

SPF Results

For Urban 4-Lane Highways, we observed 478 sections with a combined length of 250 miles. On these sections, there were a total of 497 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, and % Unemployed were 0.21%, 5.02%, and 17.57% respectively. There were an average of 1.04 crashes per segment and 1.96 crashes per mile. The mean and median ADT in this set were 13,867 and 12,300, respectively. The mean and median section length were 0.52 miles and 0.37 miles.

Almost 18% of pedestrian crashes for the highway classes in the study are accounted for by this SPF. The SPF includes ADT, unemployment percentage, and population density as predictors. ADT and population density are the best predictors based on CURE plot analysis. For all urban 4-lane highways, sections determined to be LOSS 4 comprised 75 of the 478 highway sections analyzed (15.7%).

Rural 2-Lane Highways

Overrepresentation

Pedestrian crashes on rural 2-lane highways were overrepresented in the study under the following conditions:

- ADT >= 5,000
- Population density per square mile >= 500
- Close to school (within ¼ mile)
- Close to park (within ¼ mile)
- Percentage of families below poverty line <= 20%
- Income between $45,000 - $74,999
- Unemployment > 15% (slight overrepresentation)
- Percentage of no-vehicle households >= 4% (slight overrepresentation)

Significant overrepresentation of pedestrian crashes on this highway class occurred when ADT was greater than or equal to 5,000. However, this range of ADT accounted for less than 30% of pedestrian crashes on rural 2-lane highways.

SPF Results

For Rural 2-Lane Highways, we observed 3,996 sections with a combined length of 11,814.42 miles. On these sections, there were a total of 359 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT and Population Density were 4.70% and 0.93% respectively. There were an average of 0.09 crashes per segment and 0.04 crashes per mile. The mean and median ADT in this set were 2,436 and 1,520, respectively. The mean and median section length were 2.96 miles and 2.16 miles.

Almost 13% of all pedestrian crashes and almost 19% of all pedestrian fatal crashes for the highway classes in the study are accounted for by this SPF. These crashes were widely distributed across the 11,814 miles of highways in this class, with an average of 0.04 pedestrian crashes per mile. The SPF includes ADT and population density as predictors. Both predictors are adequate based on CURE plot analysis. For all rural 2-lane highways, sections determined to be LOSS 4 comprised 57 of the 3,996 highway sections analyzed (1.4%).

Urban 4-Lane Divided Highways

Overrepresentation

Pedestrian crashes on urban 4-lane divided highways were overrepresented in the study under the following conditions:

- ADT >= 20,000
- Population density per square mile >= 1,000
- Close to school (within ¼ mile)
- Close to park (within ¼ mile)
- Percentage of families below poverty line >= 30%
- Income < $45,000
- Unemployment >= 10%
- Percentage of no-vehicle households >= 16%

Significant overrepresentation of pedestrian crashes on this highway class occurred for all the risk factors listed above except unemployment percentage.

SPF Results

For Urban 4-Lane Divided Highways, we observed 566 sections with a combined length of 535.83 miles. On these sections, there were a total of 557 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, % of No-Vehicle Households, and % of Households Below the Poverty Line were 7.07%, 17.49%, 43.29%, and 40.11% respectively. There were an average of 0.98 crashes per segment and 1.34 crashes per mile. The mean and median ADT in this set were 22,004 and 20,000, respectively. The mean and median section length were 0.95 miles and 0.53 miles.

Over 20% of all pedestrian crashes and over 24% of fatal pedestrian crashes for the highway classes in the study are accounted for by this SPF. The SPF includes ADT, percentage of no-vehicle households, percentage of households below the poverty line and population density as predictors. ADT is the best predictor based on CURE plot analysis. Population density is also an adequate predictor but is biased towards overprediction of crashes when its value is below 1,250. For all urban 4-lane divided highways, sections determined to be LOSS 4 comprised 89 of the 566 highway sections analyzed (15.7%).

Urban 4-Lane Highways with Continuous Left Turn Lane

Overrepresentation

Pedestrian crashes on urban 4-lane highways with continuous left turn lanes were overrepresented in the study under the following conditions:

- ADT between 15,000-29,999 or between 40,000-44999
- Population density per square mile <500, between 1,000-1,499, or greater than 3,499
- Close to school (within ¼ mile)
- Close to park (within ¼ mile)
- Percentage of families below poverty line >= 30%
- Income < $30,000
- Unemployment >= 10%
- Percentage of no-vehicle households >= 10%

Significant overrepresentation of pedestrian crashes on this highway class occurred where highways were close to schools or parks, where population density per square mile was greater than or equal to 2,000, and where the percentage of no-vehicle households was greater than or equal to 10%.

SPF Results

For Urban 4-Lane Highways with Continuous Left Turn Lane, we observed 251 sections with a combined length of 188.8 miles. On these sections, there were a total of 349 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, and % of Households Below the Poverty Line were 7.17%, 27.49%, and 31.08% respectively. There were an average of 1.39 crashes per segment and 2.07 crashes per mile. The mean and median ADT in this set were 19,222 and 18,500, respectively. The mean and median section length were 0.75 miles and 0.52 miles.

Over 12% of pedestrian crashes for the highway classes in the study are accounted for by this SPF. The SPF includes ADT, percentage of no-vehicle households, and population density as predictors. ADT is the best predictor based on CURE plot analysis. For all urban 4-lane highways with continuous left turn lanes, sections determined to be LOSS 4 comprised 40 of the 251 highway sections analyzed (15.9%).

Urban 6-Lane Highways

Overrepresentation

Pedestrian crashes on urban 6-lane highways were overrepresented in the study under the following conditions:

- ADT >= 20,000
- Population density per square mile >= 1,000
- Close to school (within ¼ mile)
- Close to park (within ¼ mile)
- Percentage of families below poverty line >= 30%
- Income <= $30,000
- Unemployment >= 10%
- Percentage of no-vehicle households >= 16%

Significant overrepresentation of pedestrian crashes on this highway class occurred in specific ranges of all risk factors but was most pronounced where population density was greater than or equal to 3,500. 50% of all crashes on this highway class occurred on highways in areas with this population density range.

SPF Results

For Urban 6-Lane Highways, we observed 127 sections with a combined length of 61.7 miles. On these sections, there were a total of 325 crashes involving pedestrians. The percent CURE deviations (PCD) for ADT, Population Density, % of No-Vehicle Households, and % of Households Below Poverty Line were 3.15%, 9.45%, 9.45%, and 12.60%, respectively. There were an average of 2.56 crashes per segment and 7.02 crashes per mile. The mean and median ADT in this set were 26,672 and 22,500, respectively. The mean and median section length were 0.49 miles and 0.33 miles.

Almost 18% of pedestrian crashes for the highway classes in the study are accounted for by this SPF. The SPF includes ADT, percentage of no-vehicle households, population density, and percentage of households below the poverty line as predictors. ADT is the best predictor based on CURE plot analysis. For all urban 6-lane highways, sections determined to be LOSS 4 comprised 23 of the 127 highway sections analyzed (18.1%).

Summary

Data

The data limitations and their implications in relation to the results of this study have been discussed throughout the report, but it is important to reiterate them here. Complete, clean, and accurate data is important to all research and studies, but it is particularly critical for systemic safety analysis. Current efforts to improve the completeness and quality of highway data in Louisiana must continue to enable meaningful systemic research and studies to be performed at the statewide level. Fortunately, data for socioeconomic features significant in this study are readily available and complete so they can be tested in future studies and research. School and park locations were also found to be significant in relation to highways where pedestrian crashes occurred.

Results concerning significant socioeconomic and place location characteristics are consistent with findings in previous studies (e.g., Cole & Read, 2018). These include percentage of no-vehicle households, percentage of total population employed, population density, percentage of households below poverty line, and proximity of parks and schools to a highway. Where data limitations related to the availability of pedestrian traffic counts exist, these factors appear to provide reliable surrogates for estimating pedestrian exposure along highways in future research or studies.

Results

Network Screening Rankings

In terms of potential for safety improvement, the top-ranked highway sections in the study were all urban highway classes. The highest ranked rural 2-lane highway section appears at position 221. The disparity in ranking between urban and rural sections is not surprising, since the observed number of pedestrian crashes per mile is much higher in urban areas than in rural areas. However, since almost 19% of pedestrian fatalities for the years analyzed in the study occurred on rural 2-lane highways, it may be appropriate to consider this highway class separately when reviewing the network rankings. It is important to note that the rankings provided by the study methodology are meant only as an initial guide and should be used in conjunction with the knowledge of stakeholders familiar with characteristics of the highways listed.

Overrepresentation – Risk Factors

Overrepresentation was used as an indicator of risk for the characteristics used in the study. If overrepresentation was present, a characteristic is classified as a risk factor. Considering the entire network analyzed in the study, pedestrian crashes were overrepresented on highways at all but the lowest ranges of ADT (1 - 4,999) and population density per square mile (0 – 500). Pedestrian crashes were also overrepresented on highways close to schools and parks, and in areas where 16% or more of households did not own vehicles. Several other socioeconomic characteristics also stood out as risk factors for specific highway classes. Unfortunately, data was not available or usable for many potential risk factors of interest identified in other research, such as speed limit, presence of median, presence of signal, and others (Kumfer et al., 2018). As this data becomes available or complete, it can be incorporated in future studies so the results will be even more useful to stakeholders.

Conclusion

The methodology used in this study was successful in identifying several socioeconomic and other risk factors involved in pedestrian crashes in Louisiana. The network screening process developed in the study provides a useful means of ranking highway sections based on safety potential in terms of pedestrian crashes. This information is actionable to stakeholders interested in reducing pedestrian crashes on State-owned highways throughout Louisiana. Finally, the methodology can be reused to include other characteristics and highway types (i.e., local roads) as relevant data becomes available or complete.

Glossary

Annual Average Daily Traffic (AADT): This is a measure which estimates, with as little bias as possible, the mean traffic volume across all days for a year for a given location along a roadway. AADT is different from ADT because it represents data for the entire year.

Average Daily Traffic (ADT): This measure, also referred to as mean daily traffic, is the average number of vehicles that travel through a specific point of a road over a short duration (often 7 days or less). It is estimated by dividing the total daily volumes during a specified time period by the number of days in the period.

Cumulative residual (CURE): In this report, a residual value is the difference between the observed number of pedestrian crashes and the predicted number of pedestrian crashes for a highway section. The *cumulative residual* is the running sum of all residual values after the values have been ordered by a third factor such as ADT. The example table below contains information about 10 highway sections. This information has been ordered by ADT. Residuals values are listed, and a Cumulative Residual column has been added (Table 6).

Table 6: ADT, Residuals, and Cumulative Residual by Highway Section

Hwy Section ID	ADT	Residual	Cumulative Residual
1	500	1	1
2	1000	2	3
3	1500	-1	2
4	2000	-1	1
5	2500	2	3
6	3000	-1	2
7	3500	-3	-1
8	4000	2	1
9	4500	-2	-1
10	5000	3	2

The chart on page 36 shows a plot of Residual values and Cumulative Residual values for the highway sections in the table above (Figure 8). The Cumulative Residual line is the basis for the CURE plot used to evaluate SPFs. More information about CURE plots can be found in the Data Analysis Methodology section of this report.

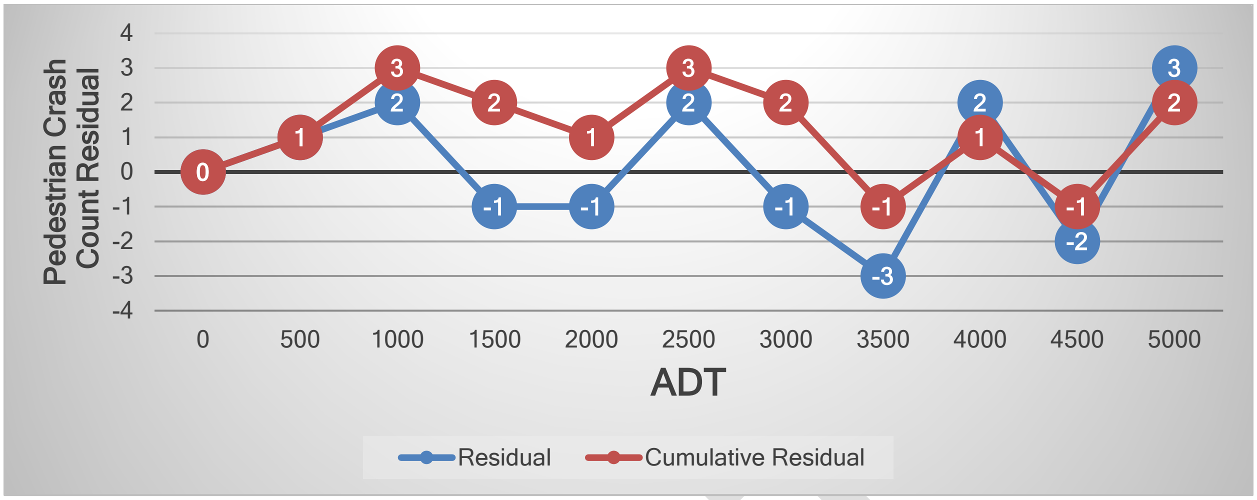

Figure 8: Residuals and Cumulative Residuals

Excess expected average crash frequency (EEACF): This method represents the difference between the observed crash frequency for the site and the predicted crash frequency based on the SPF with information specific to an individual highway section.

Level of Safety of Service (LOSS): This is a metric used to rank sites according to their observed and expected crash frequency for an entire population, where the degree of deviation is labeled into four classes of level of service:

- LOSS-I indicates a low potential for safety improvement.
- LOSS-II indicates better than expected safety performance.
- LOSS-III indicates less than expected safety performance.
- LOSS-IV indicates a high potential for safety improvement.

Linear referencing system: This system consists of a set of line features, on which events, elements, and characteristics can be located based on a reference to the line itself rather than through absolute x and y coordinates. Events are things that happen on or to the line feature, such as crash locations and highway projects. Elements are objects that exist on or near the line feature, such as signs or guardrails. Characteristics describe the line features, like speed limits or number of lanes.

Safety Performance Function (SPF): This is an equation used to estimate or predict the expected average crash frequency per year at a location as a function of traffic volume and in some cases roadway or intersection characteristics (e.g., number of lanes, traffic control, or type of median).

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Appendix

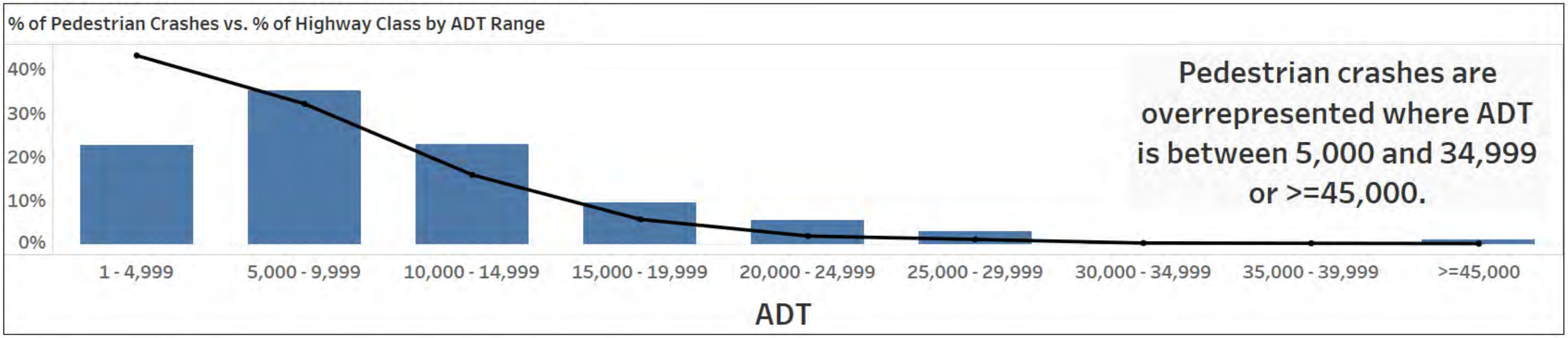
If viewing on a computer, click the links below to navigate directly to the content.

Overrepresentation Analysis of Pedestrian Crashes on State-owned Highways

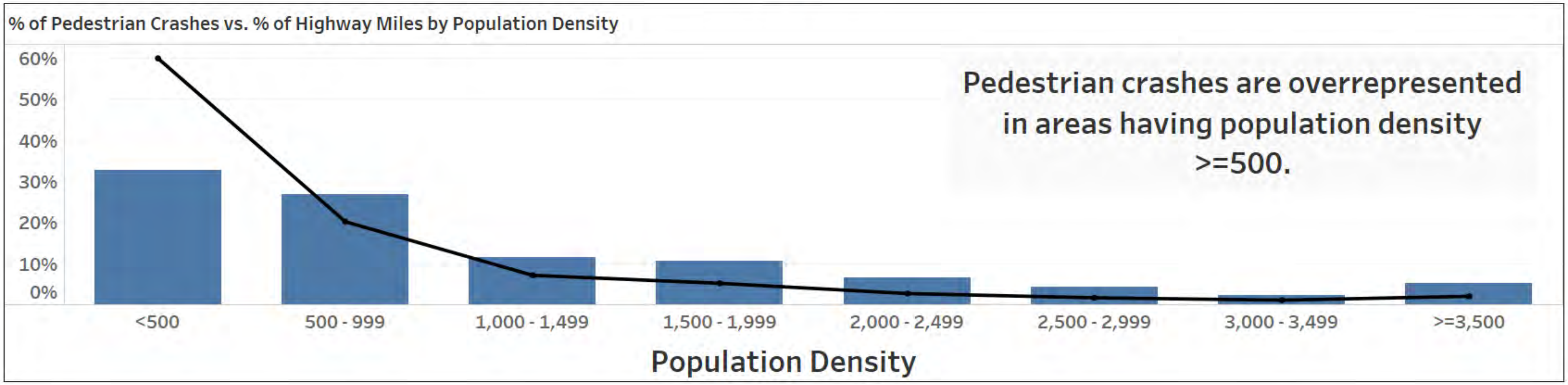
Urban 2-Lane Highways

Overrepresentation Analysis: State-Owned Urban 2-Lane Highways

- ■ % of Highway Class with Risk Factor
- ■ % of Pedestrian Crashes Where Risk Factor is Present



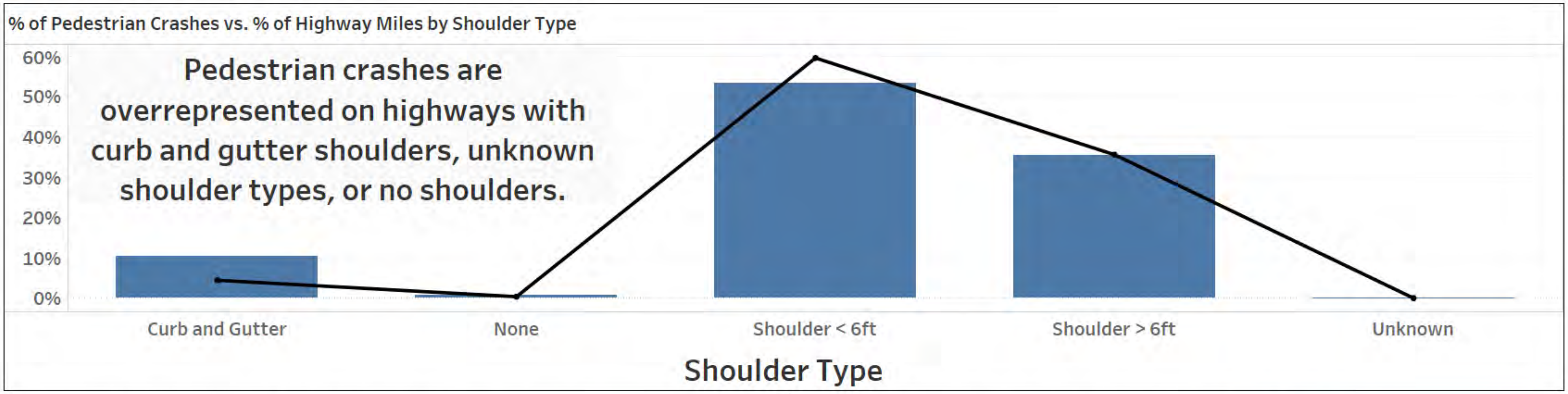
Pedestrian crashes are overrepresented where ADT is between 5,000 and 34,999 or >=45,000.



Pedestrian crashes are overrepresented in areas having population density >=500.

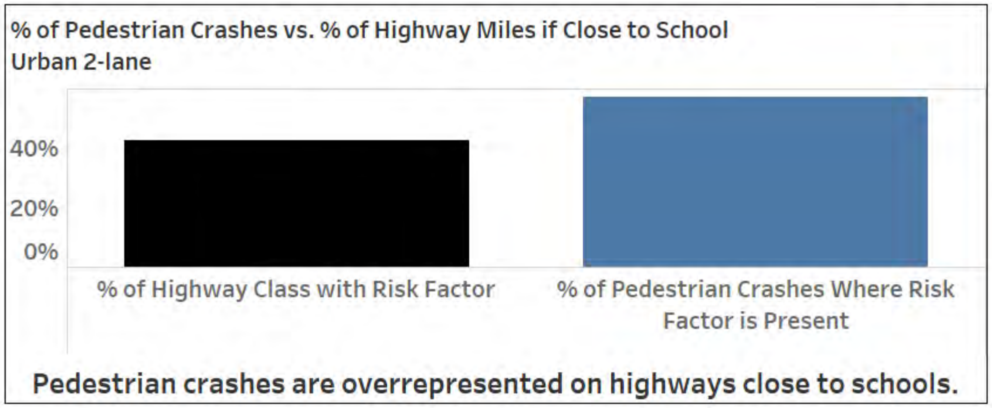
Overrepresentation Analysis: State-Owned Urban 2-Lane Highways

■ % of Highway Class with Risk Factor
🟦 % of Pedestrian Crashes Where Risk Factor is Present



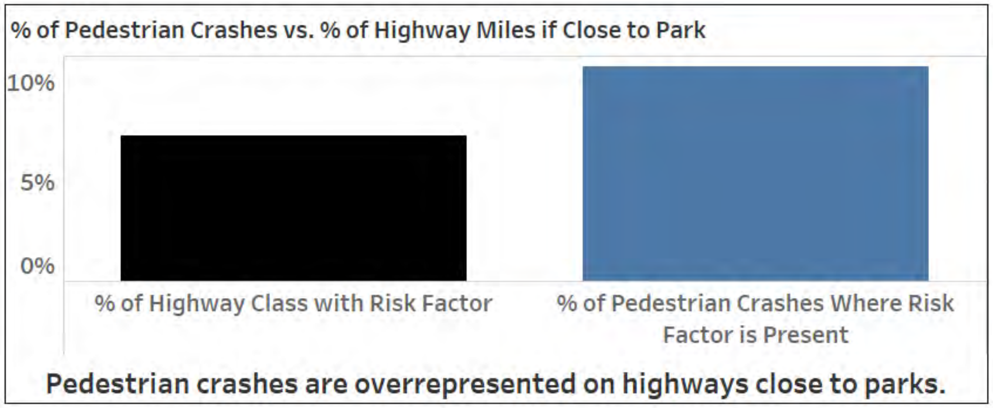
% of Pedestrian Crashes vs. % of Highway Miles by Shoulder Type

Pedestrian crashes are overrepresented on highways with curb and gutter shoulders, unknown shoulder types, or no shoulders.



% of Pedestrian Crashes vs. % of Highway Miles if Close to School
Urban 2-lane

Pedestrian crashes are overrepresented on highways close to schools.

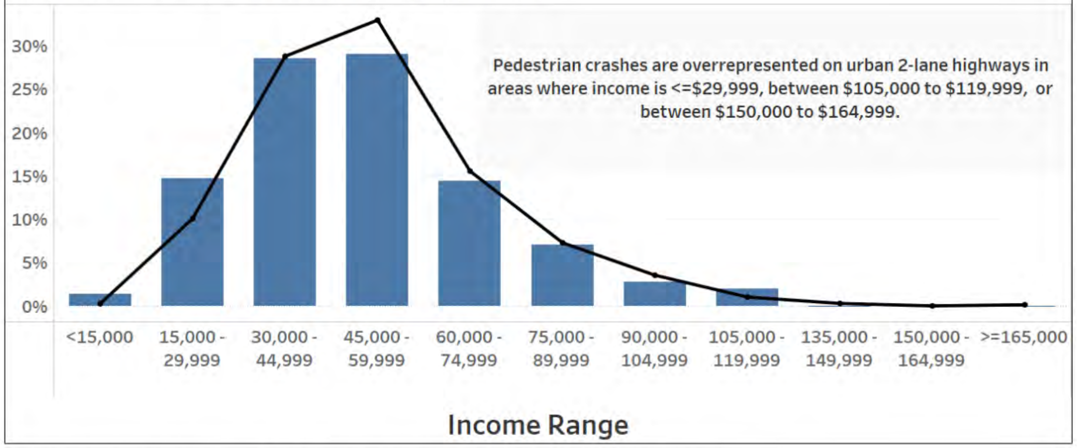


% of Pedestrian Crashes vs. % of Highway Miles if Close to Park

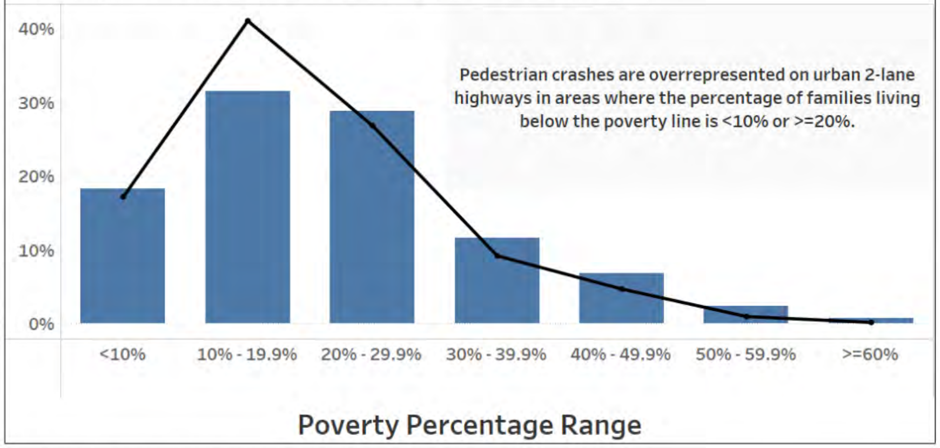
Pedestrian crashes are overrepresented on highways close to parks.

Overrepresentation Analysis: State-Owned Urban 2-Lane Highways

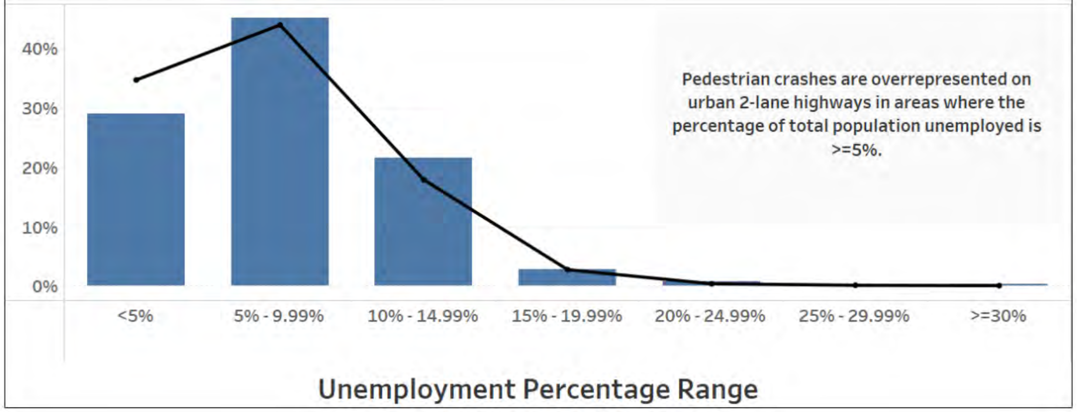
■ % of Highway Class with Risk Factor
■ % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by Income Range

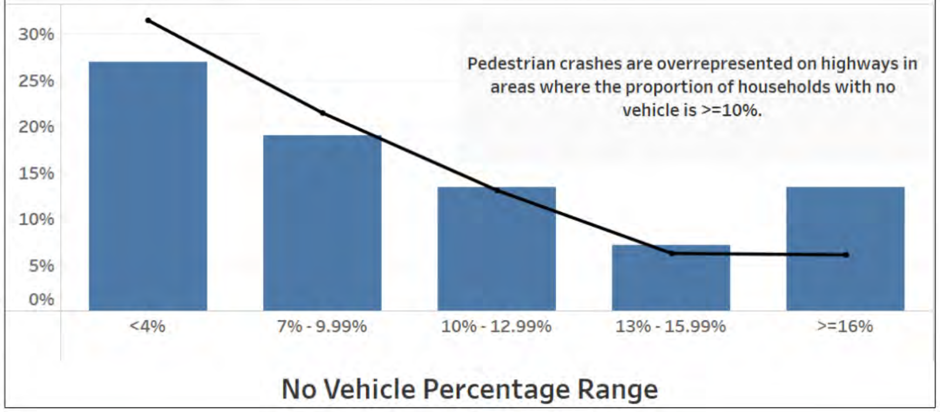
Pedestrian crashes are overrepresented on urban 2-lane highways in areas where income is <=$29,999, between $105,000 to $119,999, or between $150,000 to $164,999.


% of Pedestrian Crashes vs. % of Highway Miles by Poverty Percentage Range

Pedestrian crashes are overrepresented on urban 2-lane highways in areas where the percentage of families living below the poverty line is <10% or >=20%.

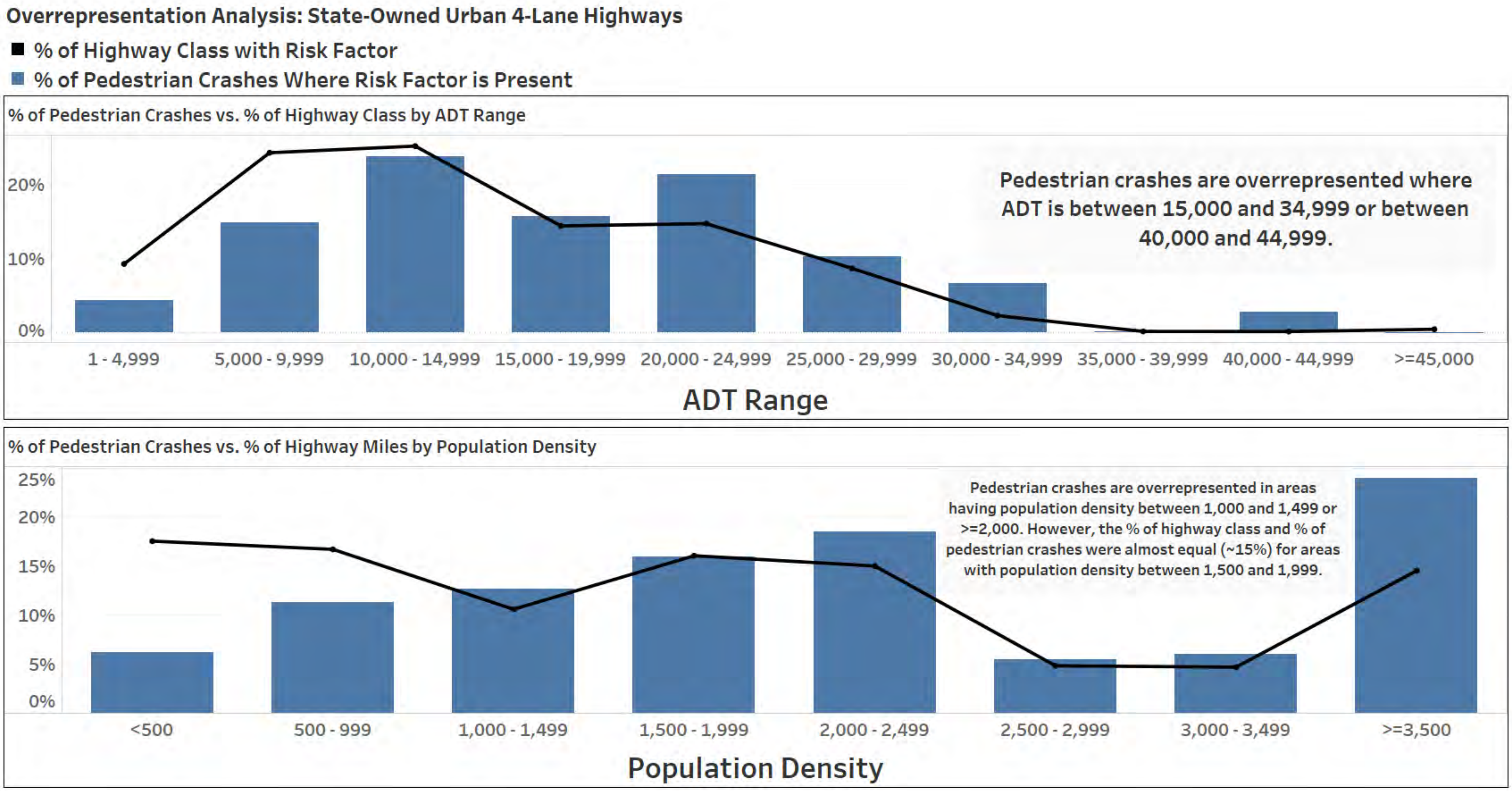

% of Pedestrian Crashes vs. % of Highway Miles by Unemployment Percentage Range

Pedestrian crashes are overrepresented on urban 2-lane highways in areas where the percentage of total population unemployed is >=5%.


% of Pedestrian Crashes vs. % of Highway Miles by No Vehicle Percentage Range

Pedestrian crashes are overrepresented on highways in areas where the proportion of households with no vehicle is >=10%.

Urban 4-Lane Highways

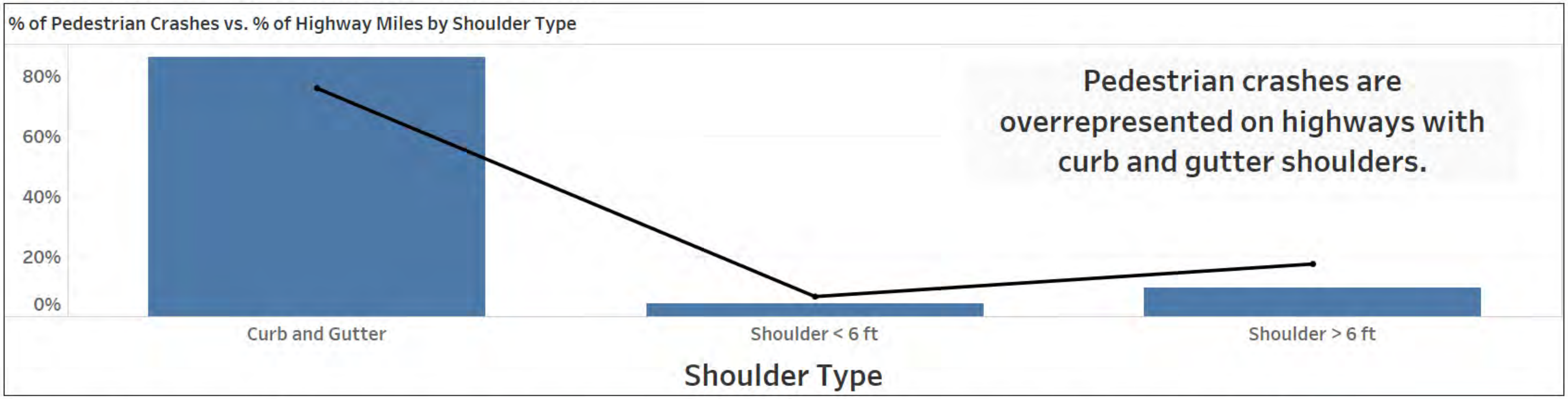


Pedestrian crashes are overrepresented where ADT is between 15,000 and 34,999 or between 40,000 and 44,999.

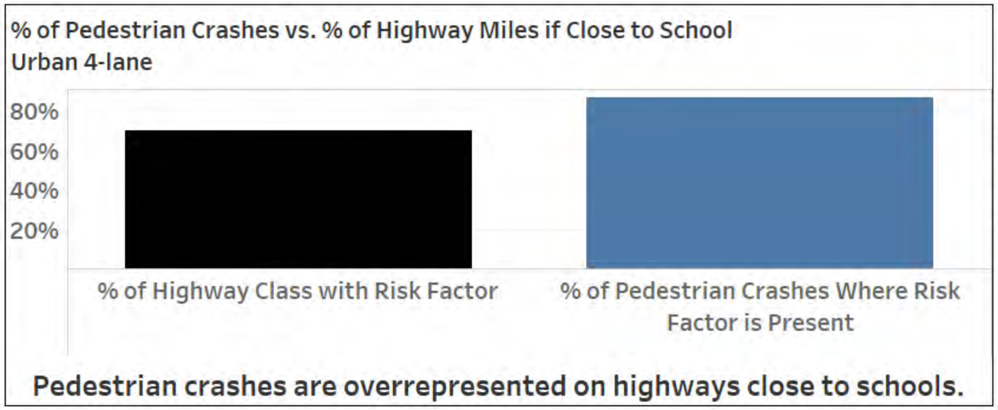
Pedestrian crashes are overrepresented in areas having population density between 1,000 and 1,499 or >=2,000. However, the % of highway class and % of pedestrian crashes were almost equal (~15%) for areas with population density between 1,500 and 1,999.

Risk Factor Analysis: State-Owned Urban 4-Lane Highways

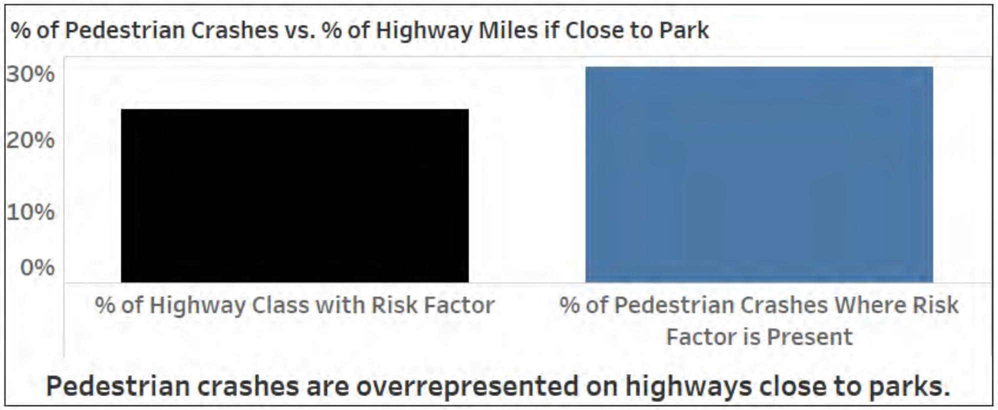
■ % of Highway Class with Risk Factor
■ % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by Shoulder Type

Pedestrian crashes are overrepresented on highways with curb and gutter shoulders.


% of Pedestrian Crashes vs. % of Highway Miles if Close to School Urban 4-lane

Pedestrian crashes are overrepresented on highways close to schools.

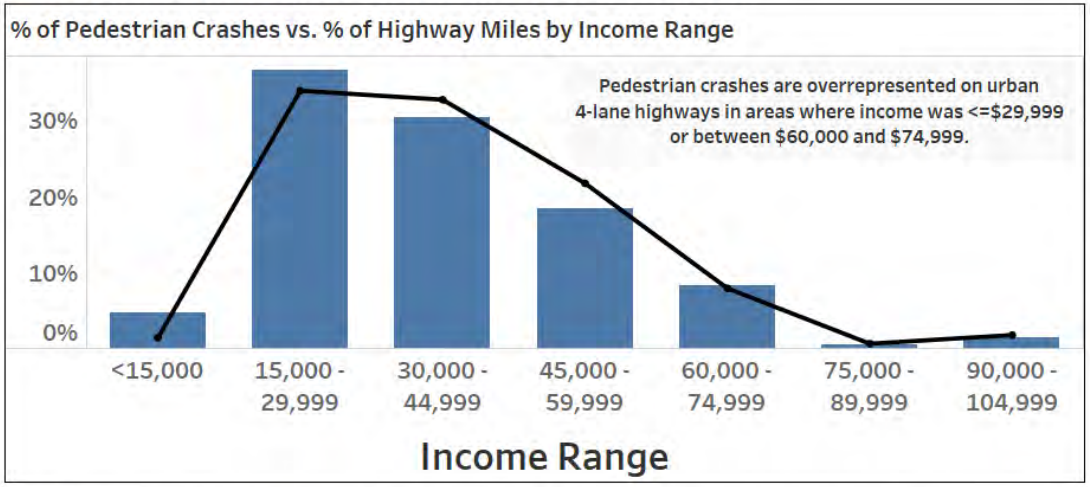

% of Pedestrian Crashes vs. % of Highway Miles if Close to Park

Pedestrian crashes are overrepresented on highways close to parks.

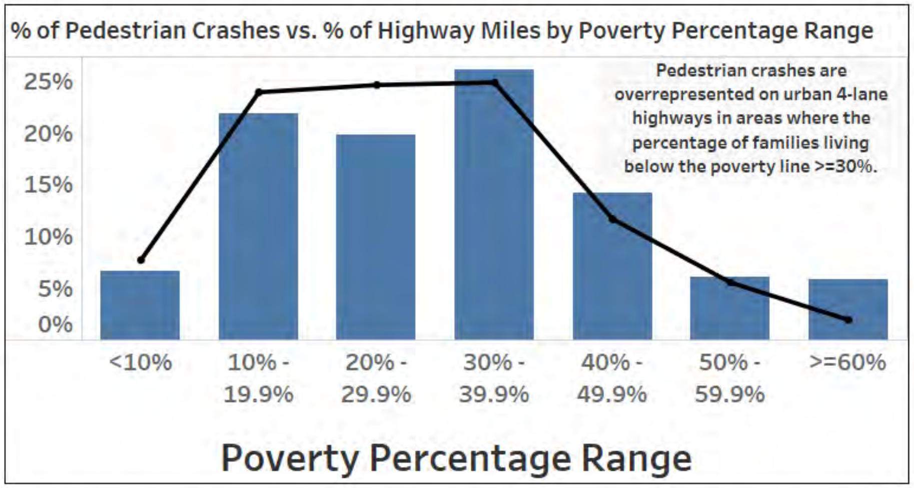
Risk Factor Analysis: State-Owned Urban 4-Lane Highways

■ % of Highway Class with Risk Factor

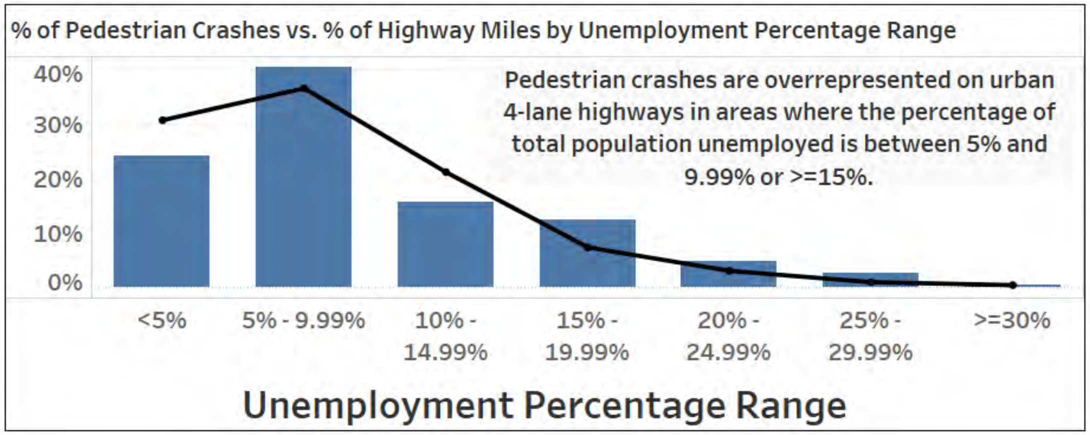
🟦 % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by Income Range

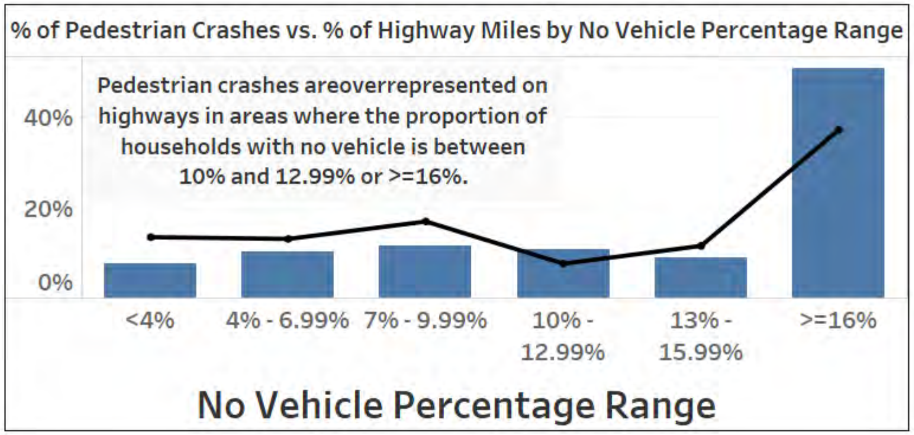
Pedestrian crashes are overrepresented on urban 4-lane highways in areas where income was <=$29,999 or between $60,000 and $74,999.


% of Pedestrian Crashes vs. % of Highway Miles by Poverty Percentage Range

Pedestrian crashes are overrepresented on urban 4-lane highways in areas where the percentage of families living below the poverty line >=30%.


% of Pedestrian Crashes vs. % of Highway Miles by Unemployment Percentage Range

Pedestrian crashes are overrepresented on urban 4-lane highways in areas where the percentage of total population unemployed is between 5% and 9.99% or >=15%.


% of Pedestrian Crashes vs. % of Highway Miles by No Vehicle Percentage Range

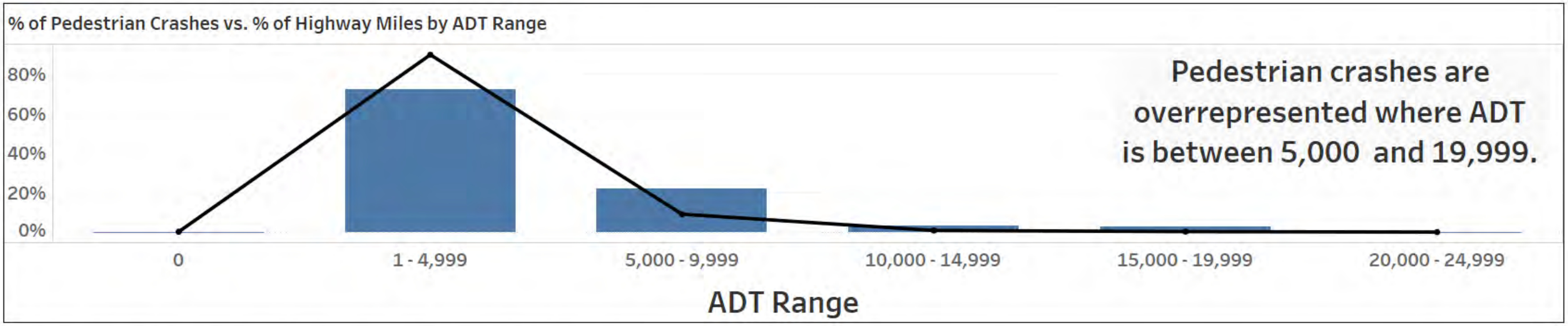
Pedestrian crashes areoverrepresented on highways in areas where the proportion of households with no vehicle is between 10% and 12.99% or >=16%.

Rural 2-Lane Highways

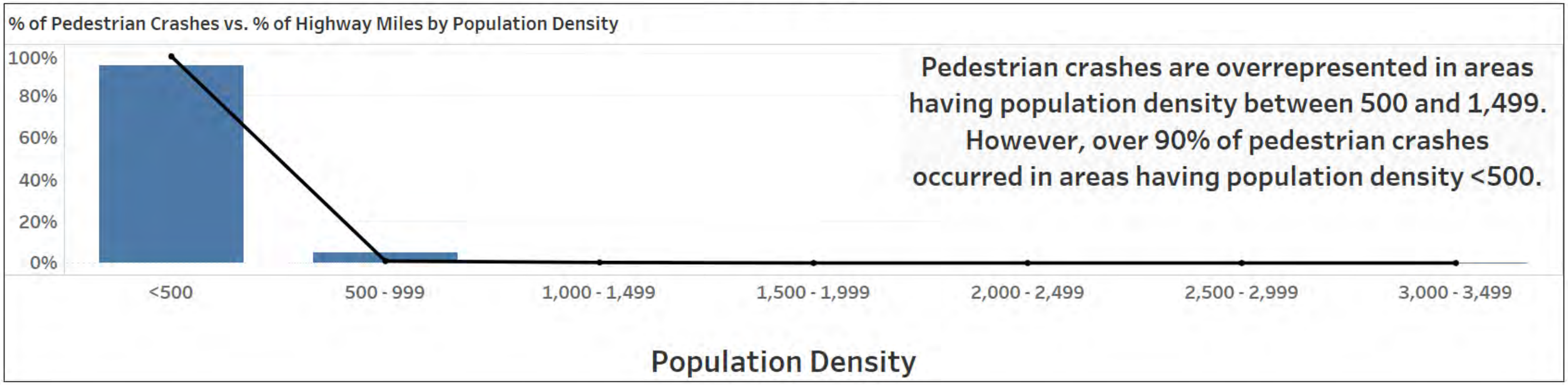
Overrepresentation Analysis: State-Owned Rural 2-Lane Highways

■ % of Highway Class with Risk Factor

🟦 % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by ADT Range

Pedestrian crashes are overrepresented where ADT is between 5,000 and 19,999.


% of Pedestrian Crashes vs. % of Highway Miles by Population Density

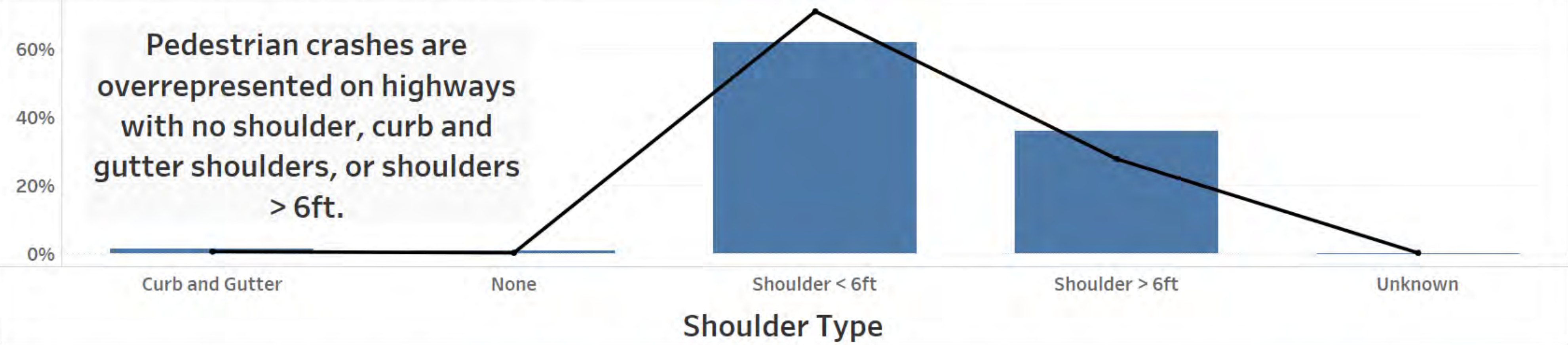
Pedestrian crashes are overrepresented in areas having population density between 500 and 1,499. However, over 90% of pedestrian crashes occurred in areas having population density <500.

Overrepresentation Analysis: State-Owned Rural 2-Lane Highways

■ % of Highway Class with Risk Factor

🟦 % of Pedestrian Crashes Where Risk Factor is Present

% of Pedestrian Crashes vs. % of Highway Miles by Shoulder Type

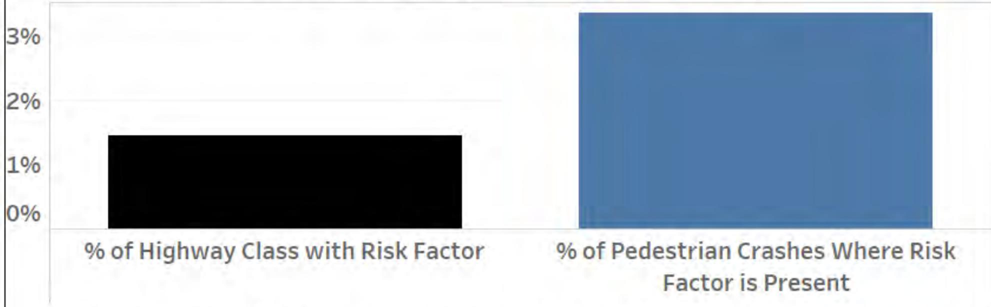


Pedestrian crashes are overrepresented on highways with no shoulder, curb and gutter shoulders, or shoulders > 6ft.

% of Pedestrian Crashes vs. % of Highway Miles Where Close to School

Pedestrian crashes are overrepresented on highways close to schools.

% of Pedestrian Crashes vs. % of Highway Miles Where Close to Park

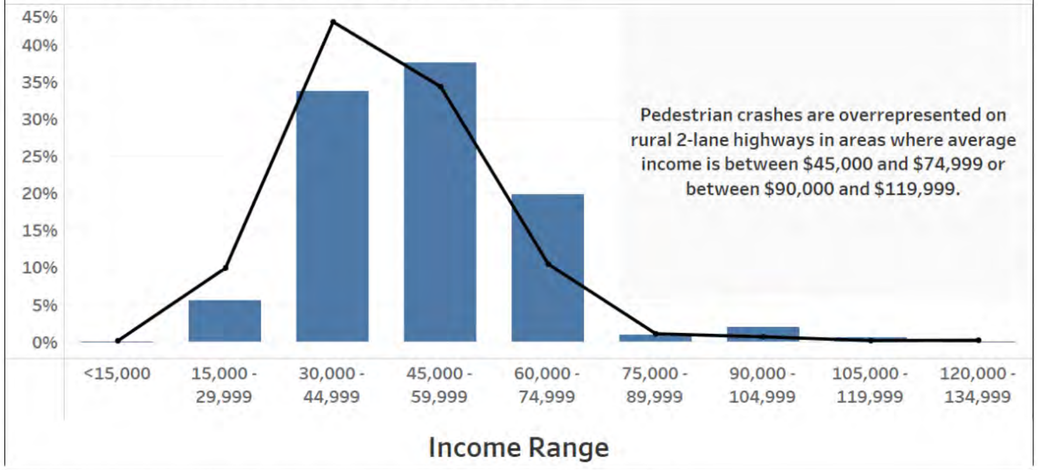


Pedestrian crashes are overrepresented on highways close to parks.

Overrepresentation Analysis: State-Owned Rural 2-Lane Highways

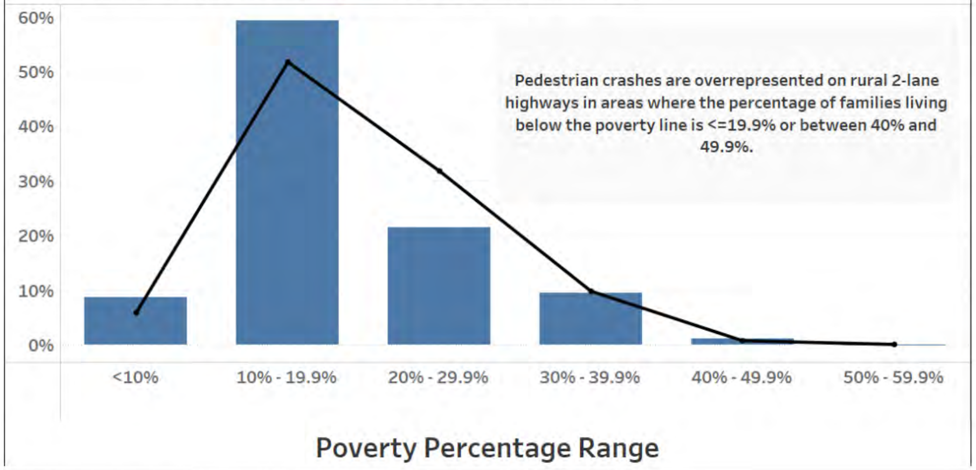
■ % of Highway Class with Risk Factor
🟦 % of Pedestrian Crashes Where Risk Factor is Present

% of Pedestrian Crashes vs. % of Highway Miles by Income Range



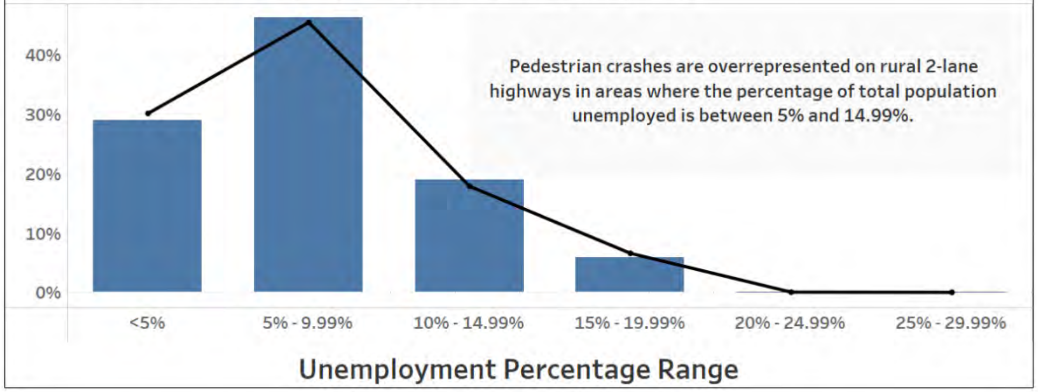
Pedestrian crashes are overrepresented on rural 2-lane highways in areas where average income is between $45,000 and $74,999 or between $90,000 and $119,999.

% of Pedestrian Crashes vs. % of Highway Miles by Poverty Percentage Range



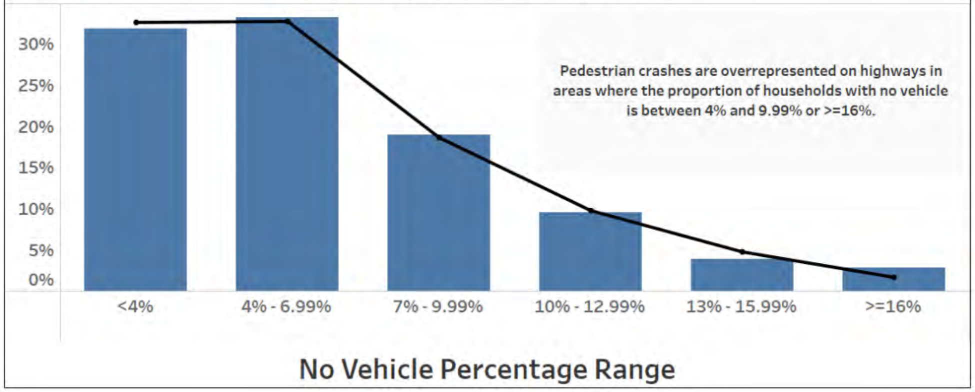
Pedestrian crashes are overrepresented on rural 2-lane highways in areas where the percentage of families living below the poverty line is <=19.9% or between 40% and 49.9%.

% of Pedestrian Crashes vs. % of Highway Miles by Unemployment Percentage Range



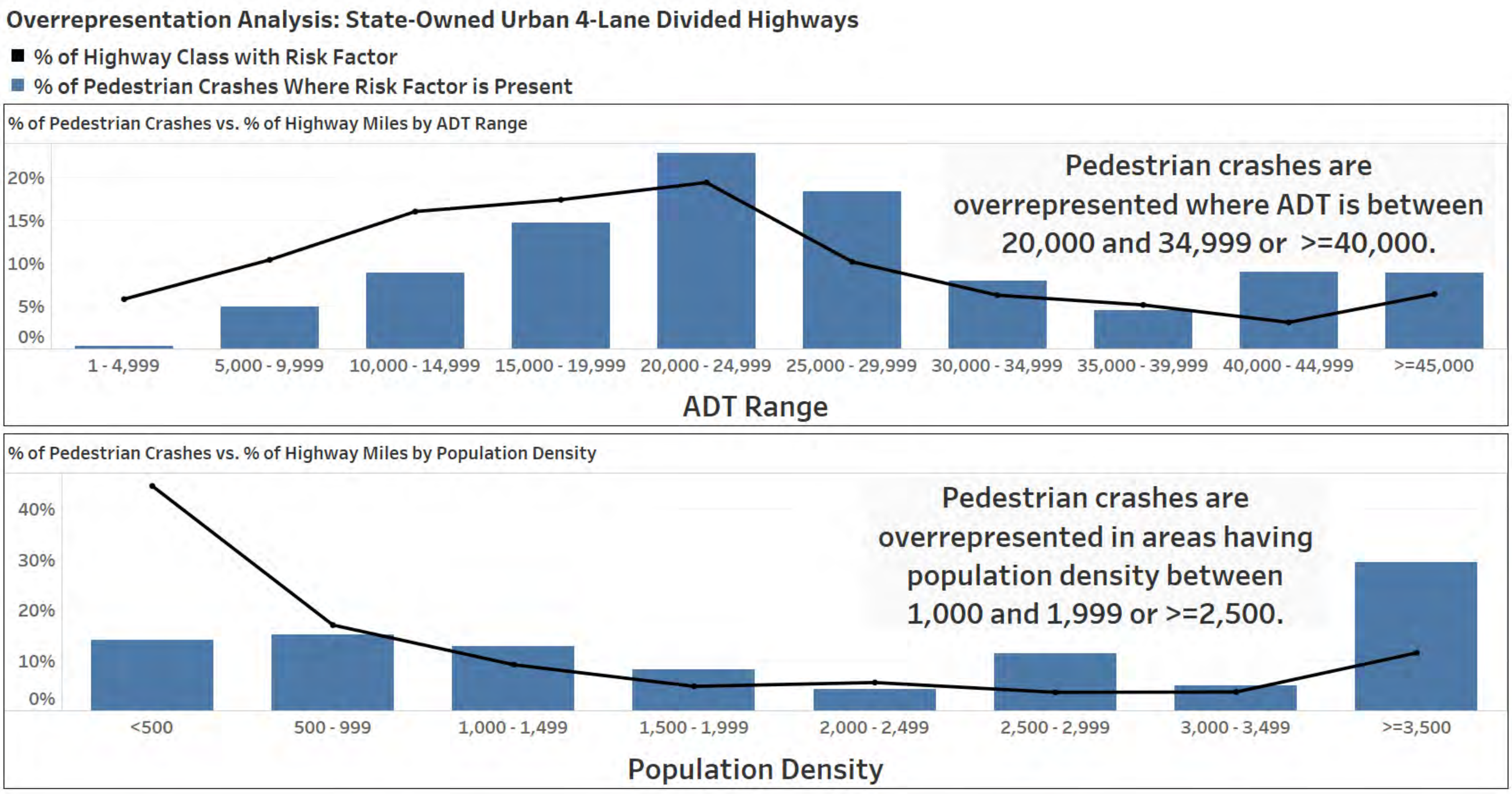
Pedestrian crashes are overrepresented on rural 2-lane highways in areas where the percentage of total population unemployed is between 5% and 14.99%.

% of Pedestrian Crashes vs. % of Highway Miles by No Vehicle Percentage Range



Pedestrian crashes are overrepresented on highways in areas where the proportion of households with no vehicle is between 4% and 9.99% or >=16%.

Urban 4-Lane Divided Highways


Overrepresentation Analysis: State-Owned Urban 4-Lane Divided Highways

■ % of Highway Class with Risk Factor
■ % of Pedestrian Crashes Where Risk Factor is Present

% of Pedestrian Crashes vs. % of Highway Miles by ADT Range

Pedestrian crashes are overrepresented where ADT is between 20,000 and 34,999 or >=40,000.

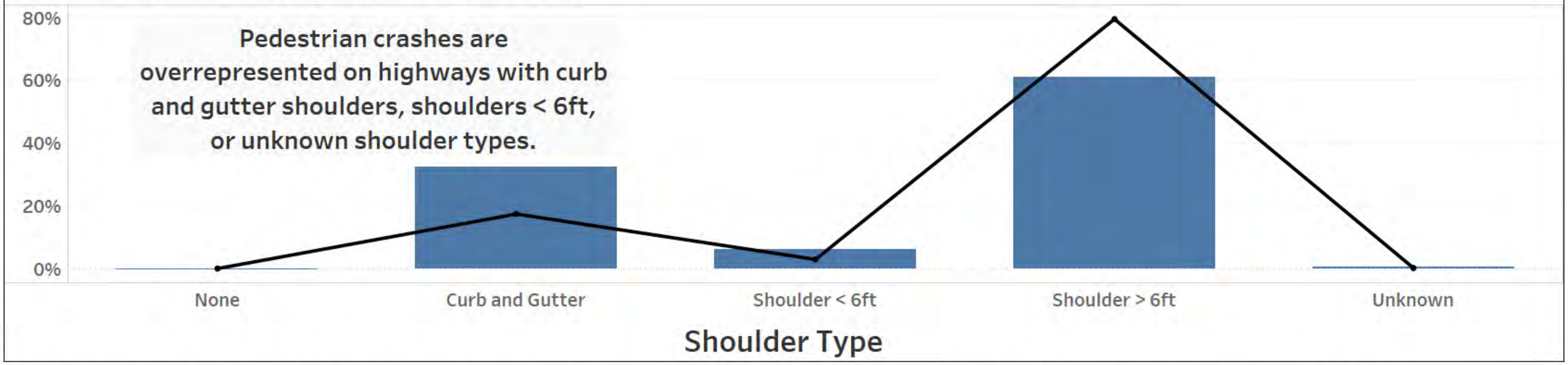
% of Pedestrian Crashes vs. % of Highway Miles by Population Density

Pedestrian crashes are overrepresented in areas having population density between 1,000 and 1,999 or >=2,500.

Overrepresentation Analysis: State-Owned Urban 4-Lane Divided Highways

■ % of Highway Class with Risk Factor
■ % of Pedestrian Crashes Where Risk Factor is Present

% of Pedestrian Crashes vs. % of Highway Miles by Shoulder Type

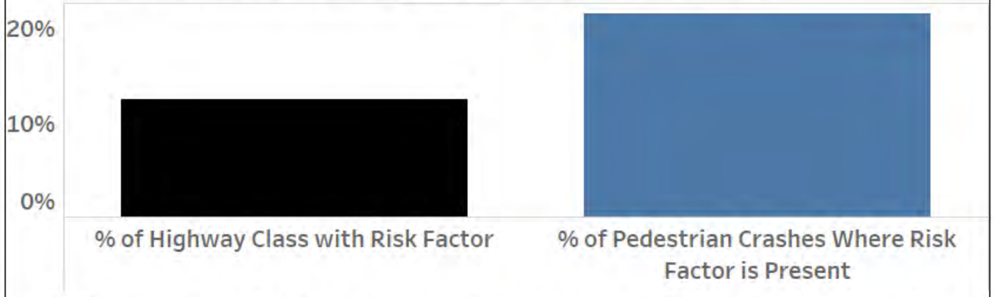


Pedestrian crashes are overrepresented on highways with curb and gutter shoulders, shoulders < 6ft, or unknown shoulder types.

% of Pedestrian Crashes vs. % of Highway Miles Where Close to School

Pedestrian crashes are overrepresented on highways close to schools.

% of Pedestrian Crashes vs. % of Highway Miles Where Close to Park

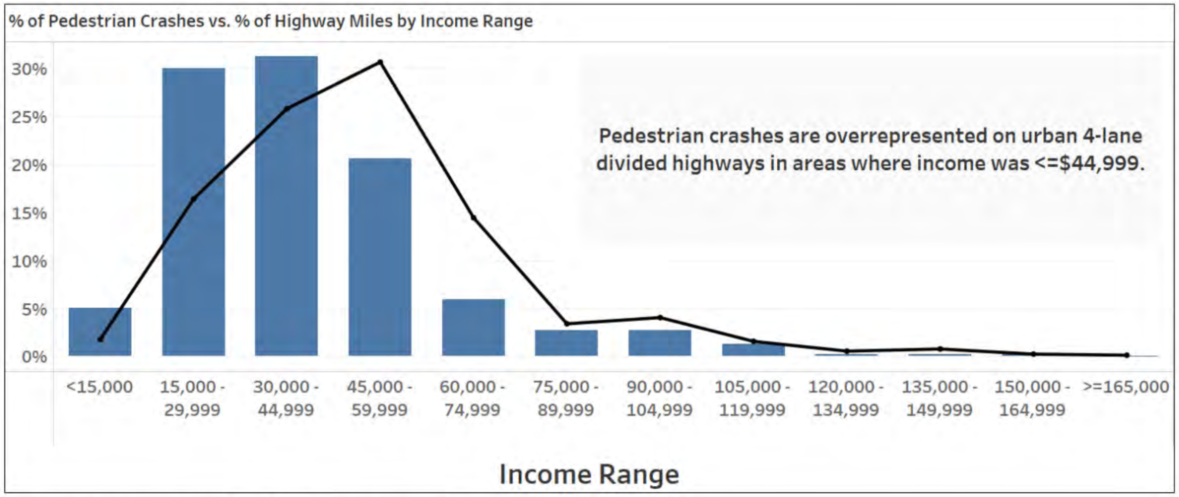


Pedestrian crashes are overrepresented on highways close to parks.

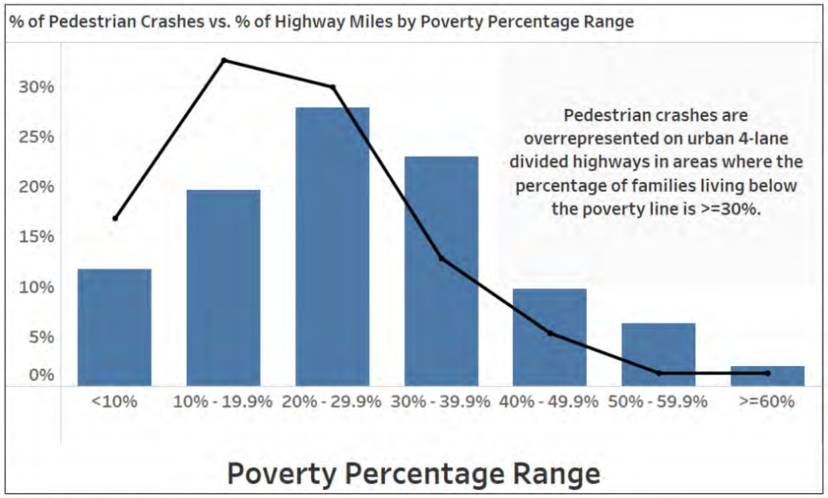
Overrepresentation Analysis: State-Owned Urban 4-Lane Divided Highways

■ % of Highway Class with Risk Factor

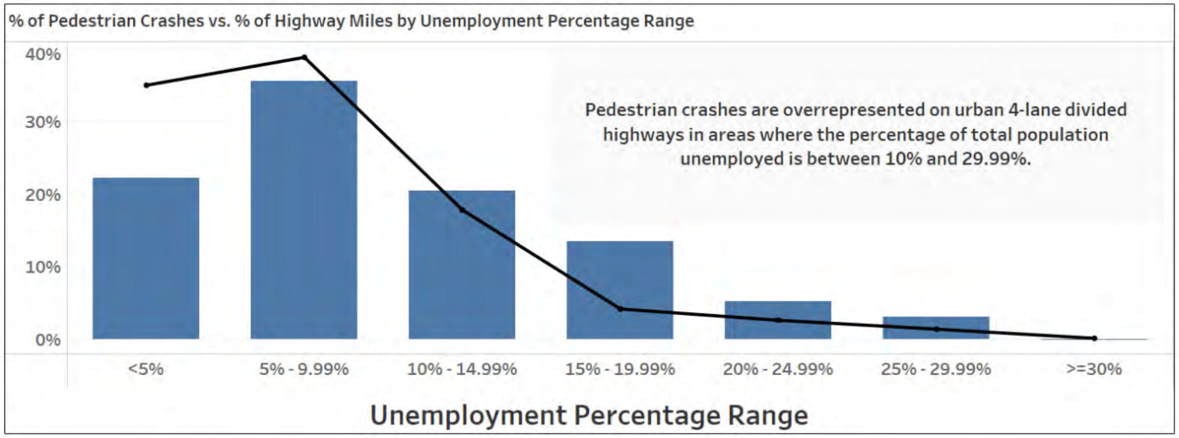
■ % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by Income Range

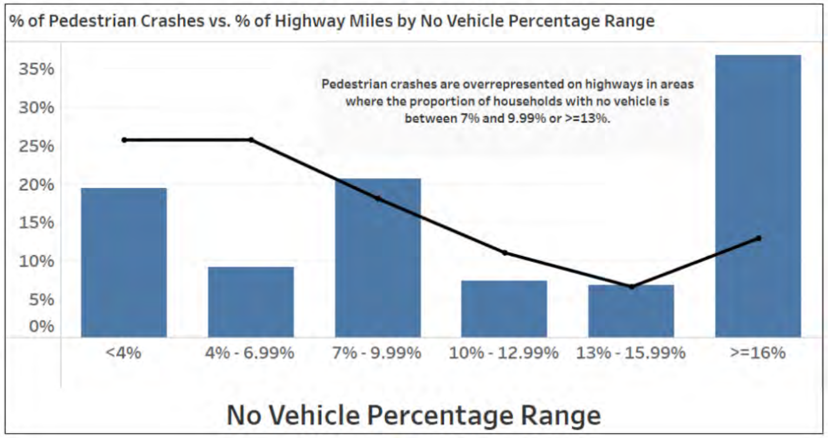
Pedestrian crashes are overrepresented on urban 4-lane divided highways in areas where income was <=$44,999.


% of Pedestrian Crashes vs. % of Highway Miles by Poverty Percentage Range

Pedestrian crashes are overrepresented on urban 4-lane divided highways in areas where the percentage of families living below the poverty line is >=30%.

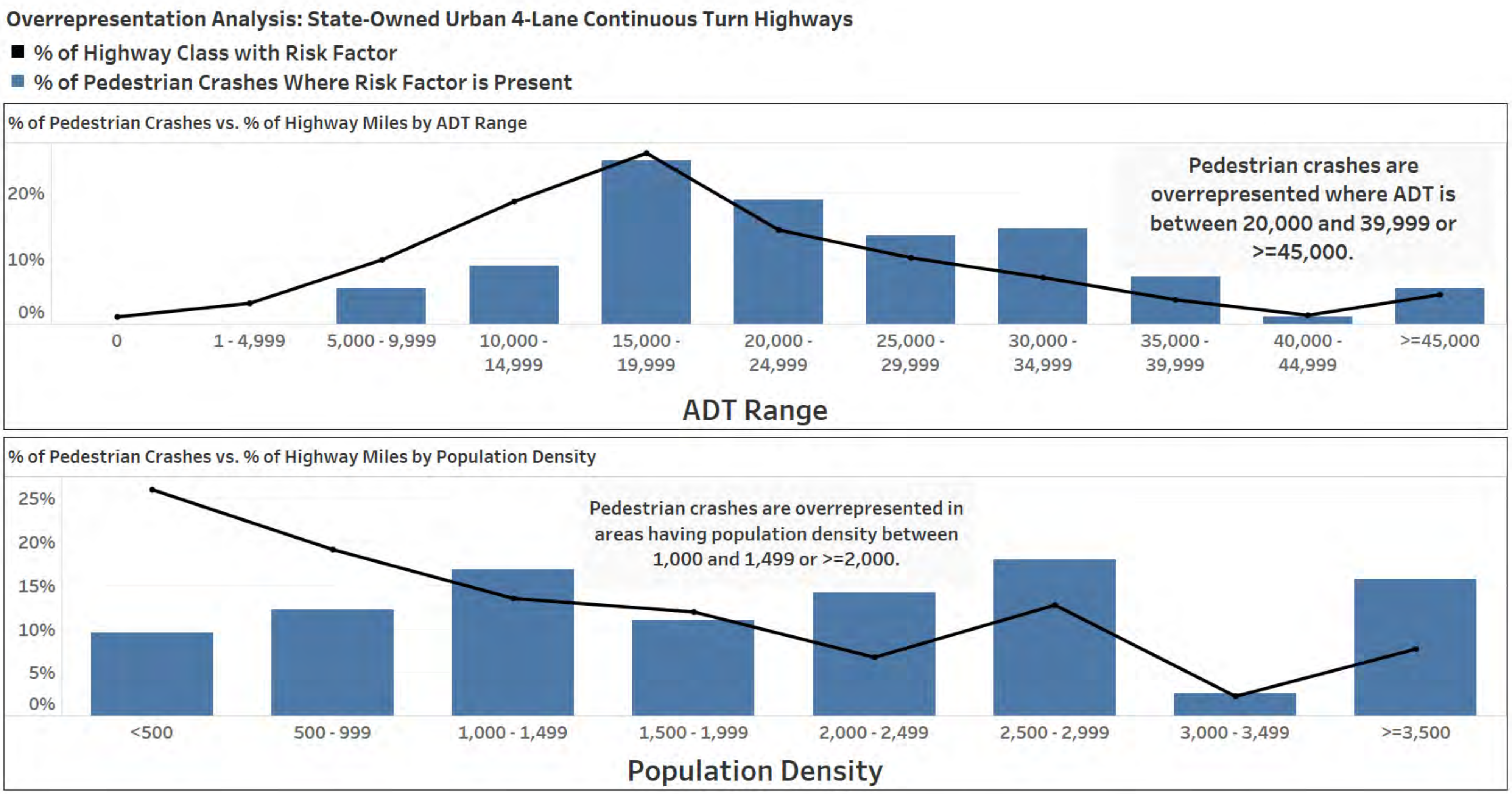

% of Pedestrian Crashes vs. % of Highway Miles by Unemployment Percentage Range

Pedestrian crashes are overrepresented on urban 4-lane divided highways in areas where the percentage of total population unemployed is between 10% and 29.99%.


% of Pedestrian Crashes vs. % of Highway Miles by No Vehicle Percentage Range

Pedestrian crashes are overrepresented on highways in areas where the proportion of households with no vehicle is between 7% and 9.99% or >=13%.

Urban 4-Lane Highways with Continuous Left Turn Lane



Overrepresentation Analysis: State-Owned Urban 4-Lane Continuous Turn Highways

% of Pedestrian Crashes vs. % of Highway Miles by ADT Range

Pedestrian crashes are overrepresented where ADT is between 20,000 and 39,999 or >=45,000.

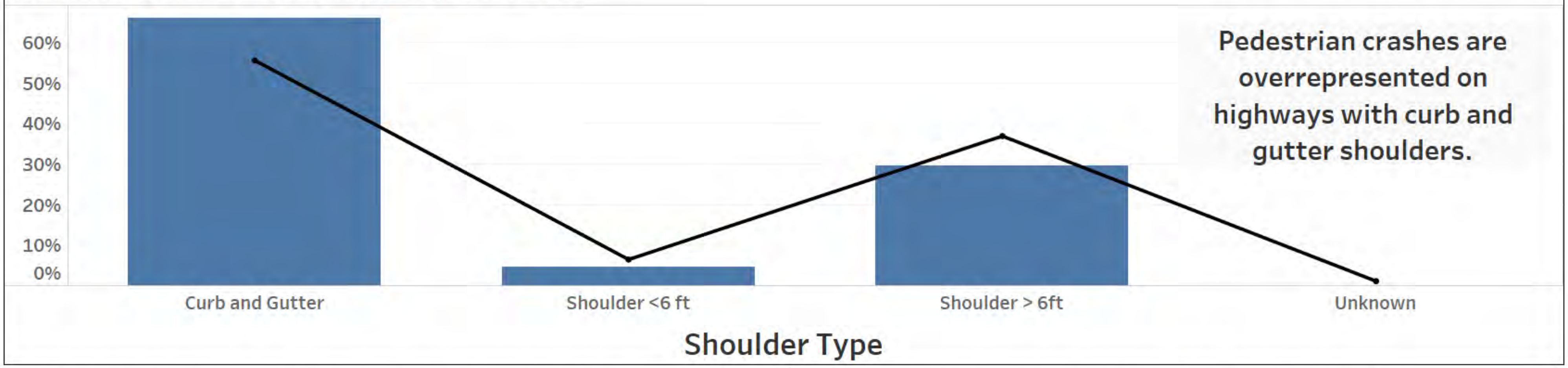
% of Pedestrian Crashes vs. % of Highway Miles by Population Density

Pedestrian crashes are overrepresented in areas having population density between 1,000 and 1,499 or >=2,000.

Overrepresentation Analysis: State-Owned Urban 4-Lane Continuous Turn Highways

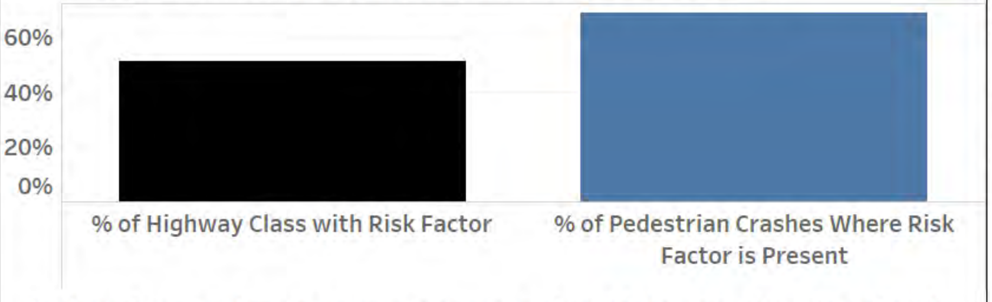
■ % of Highway Class with Risk Factor
🟦 % of Pedestrian Crashes Where Risk Factor is Present

% of Pedestrian Crashes vs. % of Highway Miles by Shoulder Type



Pedestrian crashes are overrepresented on highways with curb and gutter shoulders.

% of Pedestrian Crashes vs. % of Highway Miles Where Close to School



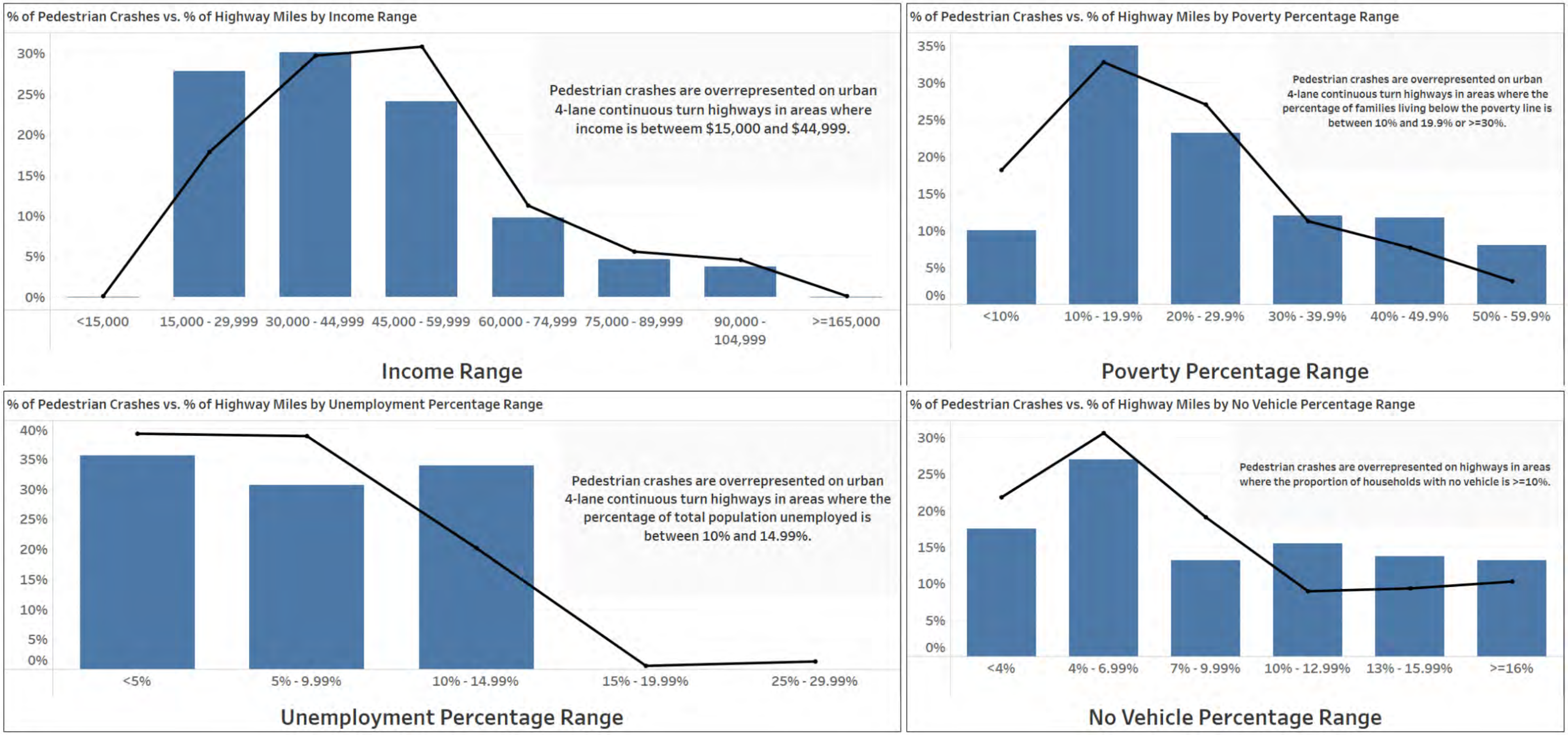
Pedestrian crashes are overrepresented on highways close to schools.

% of Pedestrian Crashes vs. % of Highway Miles Where Close to Park

Pedestrian crashes are overrepresented on highways close to parks.

Overrepresentation Analysis: State-Owned Urban 4-Lane Continuous Turn Highways

■ % of Highway Class with Risk Factor
🟦 % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by Income Range

Pedestrian crashes are overrepresented on urban 4-lane continuous turn highways in areas where income is betweem $15,000 and $44,999.

% of Pedestrian Crashes vs. % of Highway Miles by Poverty Percentage Range

Pedestrian crashes are overrepresented on urban 4-lane continuous turn highways in areas where the percentage of families living below the poverty line is between 10% and 19.9% or >=30%.

% of Pedestrian Crashes vs. % of Highway Miles by Unemployment Percentage Range

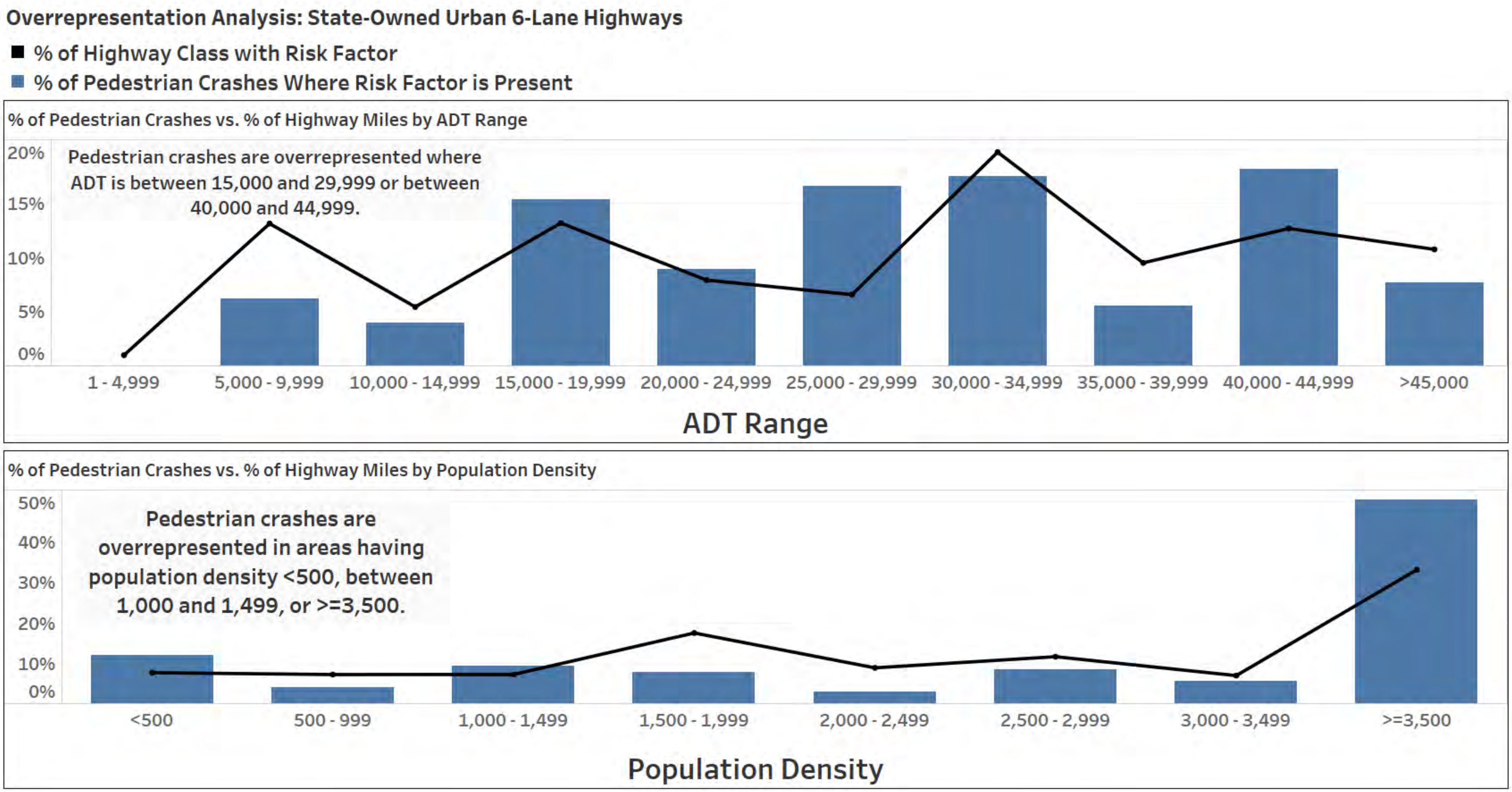
Pedestrian crashes are overrepresented on urban 4-lane continuous turn highways in areas where the percentage of total population unemployed is between 10% and 14.99%.

% of Pedestrian Crashes vs. % of Highway Miles by No Vehicle Percentage Range

Pedestrian crashes are overrepresented on highways in areas where the proportion of households with no vehicle is >=10%.

This document and the information contained herein were prepared solely for the purpose of identifying, evaluating, and planning safety improvements on public roads which may be implemented utilizing federal aid highway funds; and are therefore exempt from discovery or admission into evidence pursuant to 23 U.S.C. 409.

Urban 6-Lane Highways



Overrepresentation Analysis: State-Owned Urban 6-Lane Highways

■ % of Highway Class with Risk Factor

■ % of Pedestrian Crashes Where Risk Factor is Present

% of Pedestrian Crashes vs. % of Highway Miles by ADT Range

Pedestrian crashes are overrepresented where ADT is between 15,000 and 29,999 or between 40,000 and 44,999.

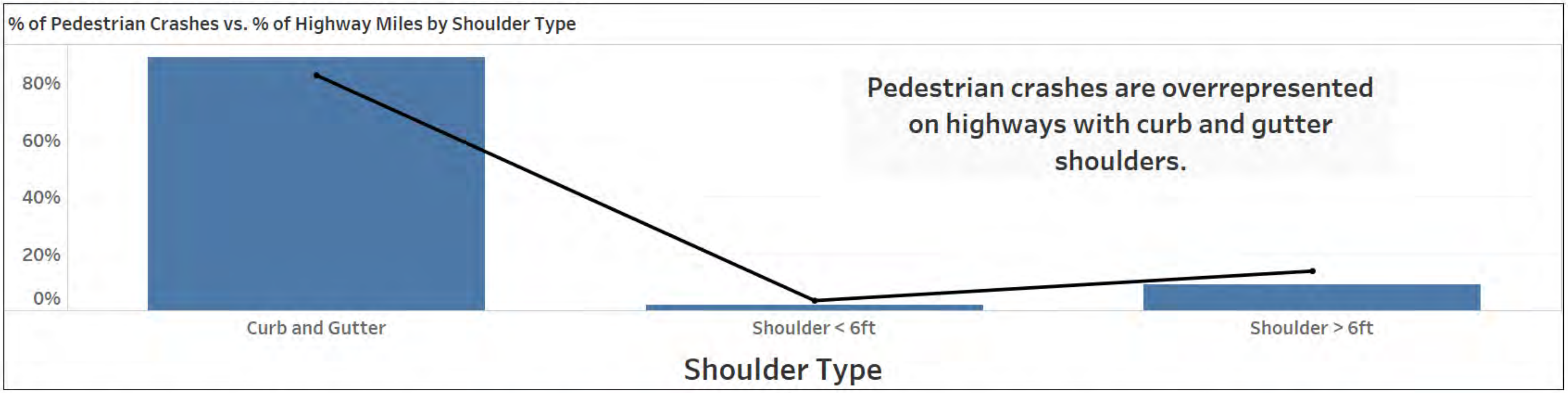
% of Pedestrian Crashes vs. % of Highway Miles by Population Density

Pedestrian crashes are overrepresented in areas having population density <500, between 1,000 and 1,499, or >=3,500.

Overrepresentation Analysis: State-Owned Urban 6-Lane Highways

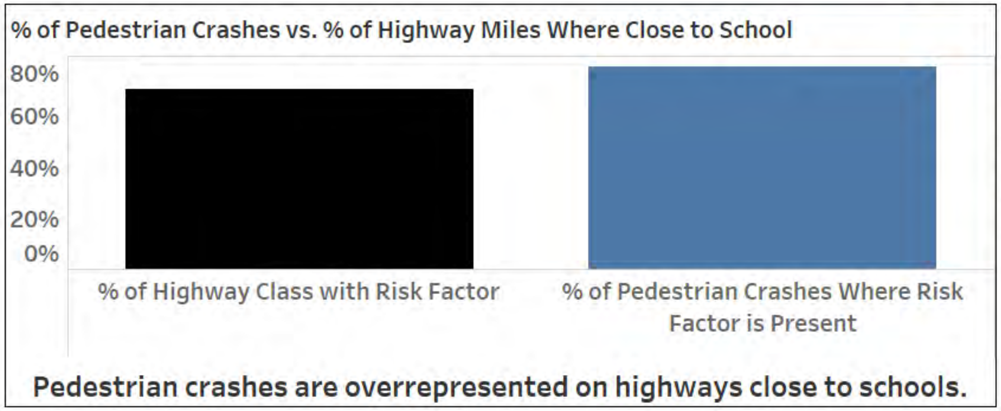
■ % of Highway Class with Risk Factor

▨ % of Pedestrian Crashes Where Risk Factor is Present



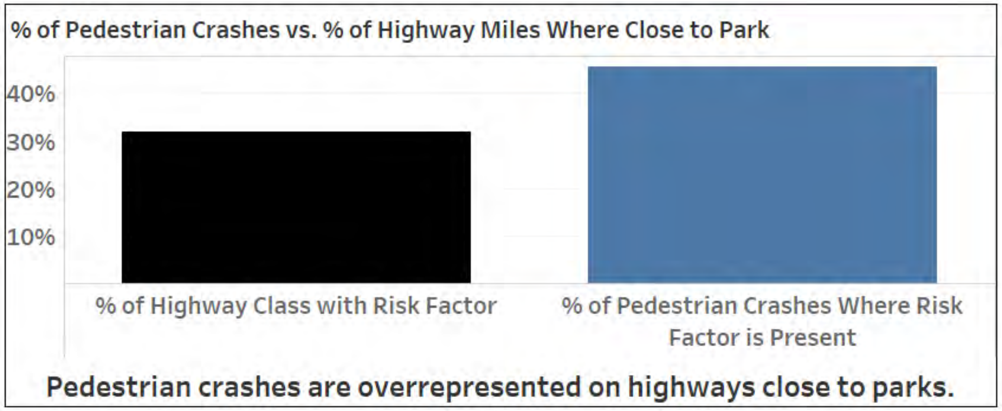
% of Pedestrian Crashes vs. % of Highway Miles by Shoulder Type

Pedestrian crashes are overrepresented on highways with curb and gutter shoulders.



% of Pedestrian Crashes vs. % of Highway Miles Where Close to School

Pedestrian crashes are overrepresented on highways close to schools.



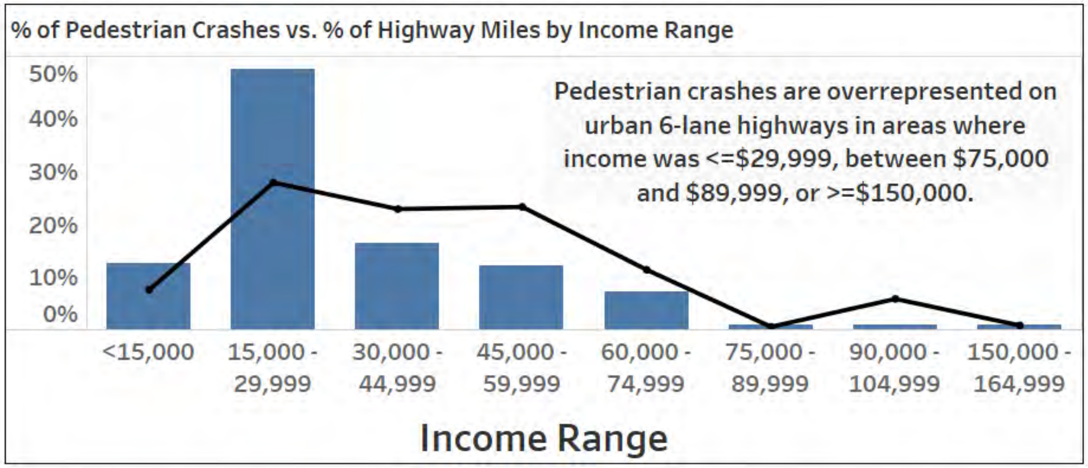
% of Pedestrian Crashes vs. % of Highway Miles Where Close to Park

Pedestrian crashes are overrepresented on highways close to parks.

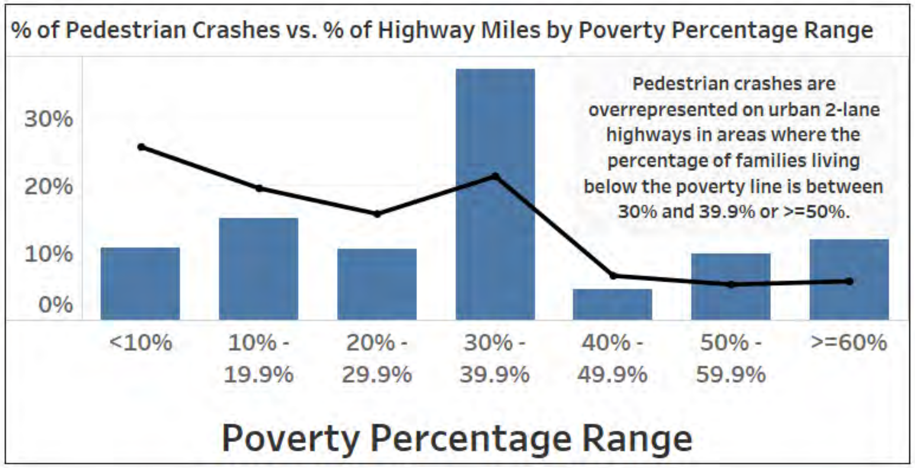
Overrepresentation Analysis: State-Owned Urban 6-Lane Highways

■ % of Highway Class with Risk Factor

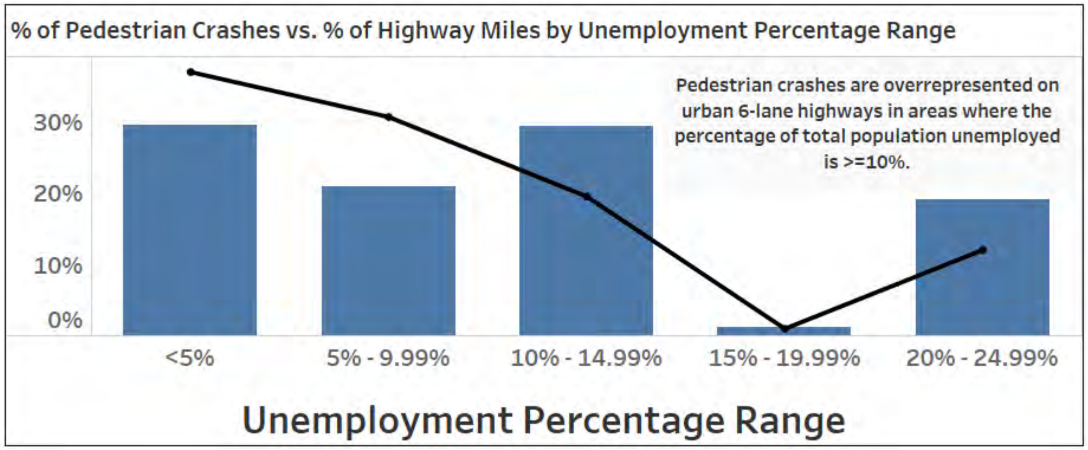
■ % of Pedestrian Crashes Where Risk Factor is Present


% of Pedestrian Crashes vs. % of Highway Miles by Income Range

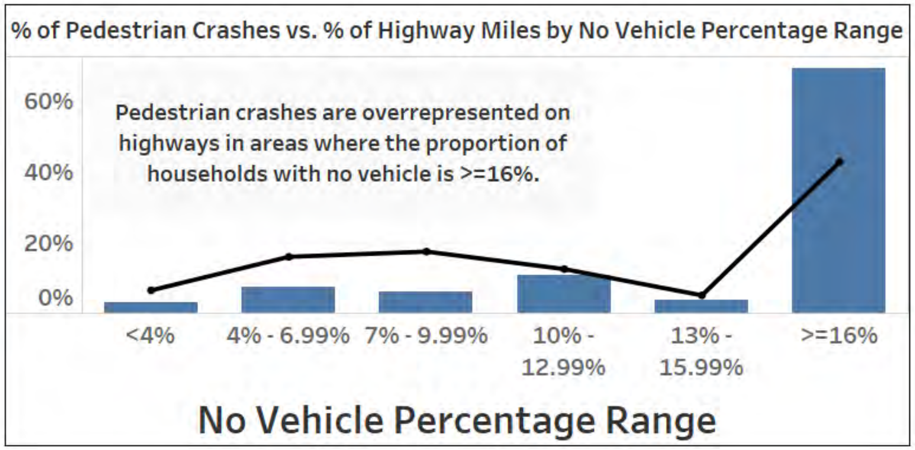
Pedestrian crashes are overrepresented on urban 6-lane highways in areas where income was <=$29,999, between $75,000 and $89,999, or >=$150,000.


% of Pedestrian Crashes vs. % of Highway Miles by Poverty Percentage Range

Pedestrian crashes are overrepresented on urban 2-lane highways in areas where the percentage of families living below the poverty line is between 30% and 39.9% or >=50%.


% of Pedestrian Crashes vs. % of Highway Miles by Unemployment Percentage Range

Pedestrian crashes are overrepresented on urban 6-lane highways in areas where the percentage of total population unemployed is >=10%.


% of Pedestrian Crashes vs. % of Highway Miles by No Vehicle Percentage Range

Pedestrian crashes are overrepresented on highways in areas where the proportion of households with no vehicle is >=16%.

If viewing on a computer, click the links below to navigate directly to the content.

SPFs

Urban 2-Lane Highways with ADT>0 & ADT<=10,000
Urban 2-Lane Highways with ADT>10,000 & Length>=2 miles
Urban 2-Lane Highways with ADT>10,000 & Length<2 miles
Urban 4-Lane Highways
Rural 2-Lane Highways
Urban 4-Lane Divided Highways
Urban 4-Lane Highways with Continuous Left Turn Lane
Urban 6-Lane Highways

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

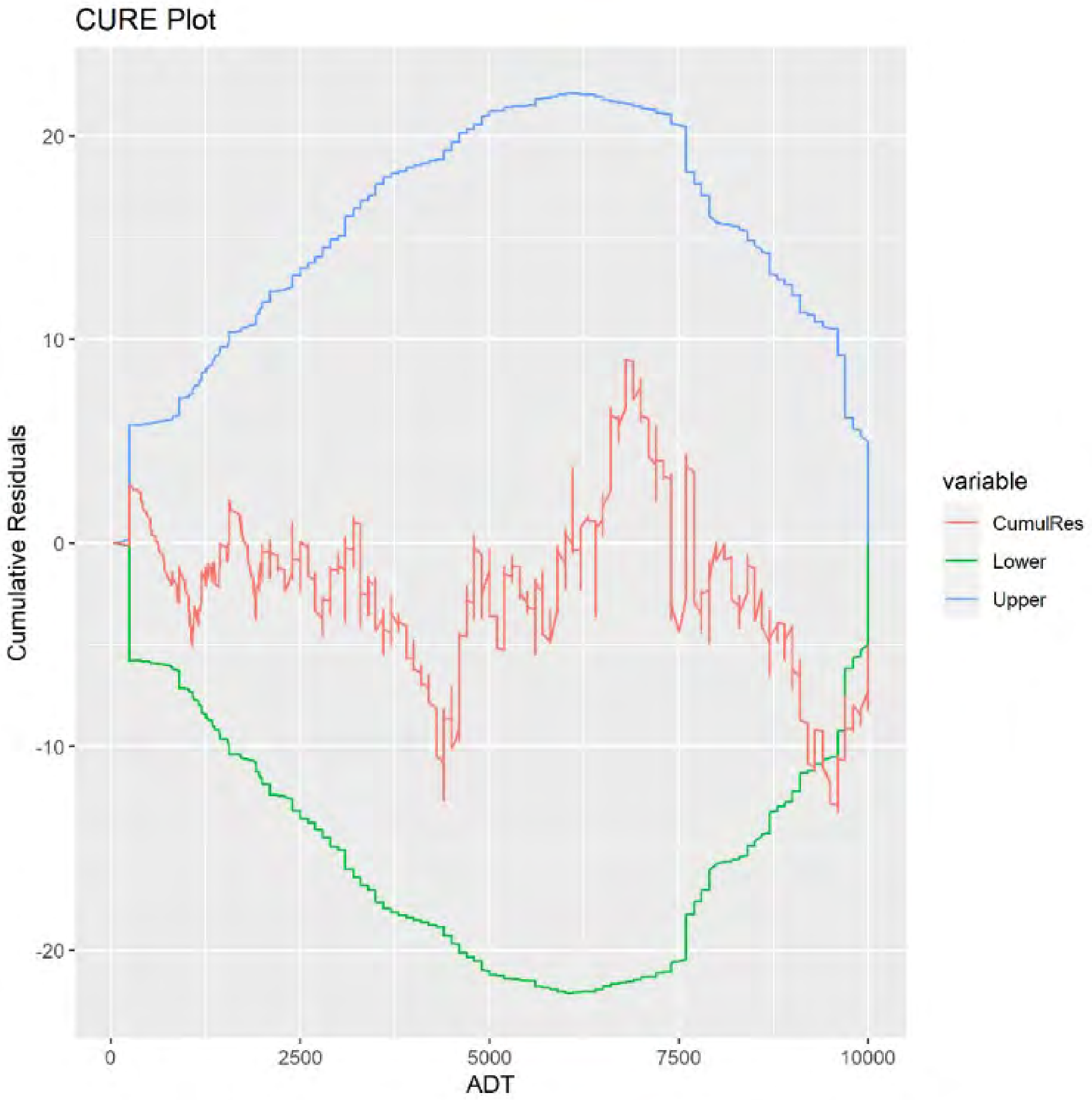
Urban 2-Lane Highways with ADT>0 & ADT<=10,000

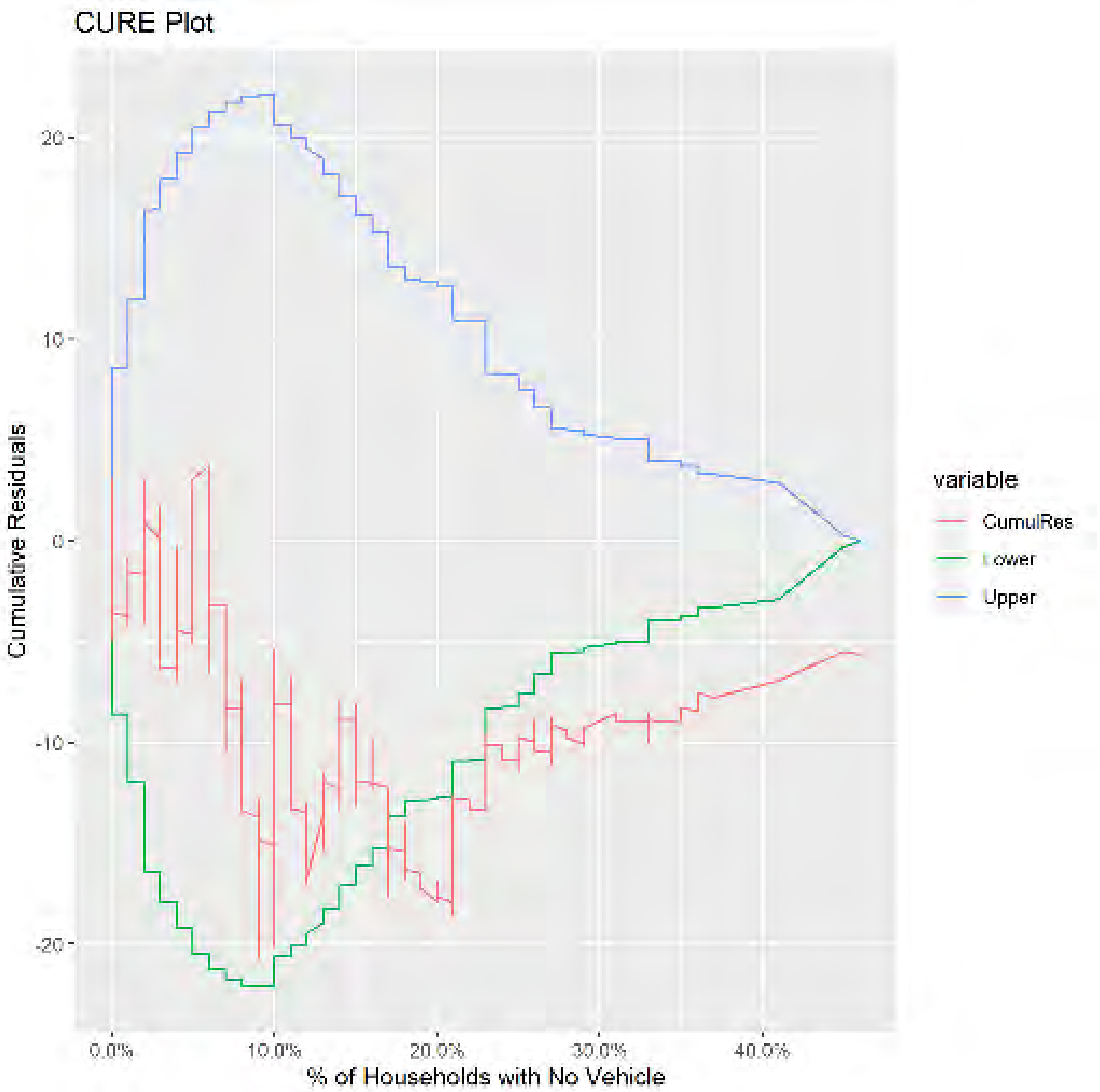
Sample Size (Number of Hwy Sections)	1425
Total Length (All Sections)	1524.81 mi
Observed Pedestrian Crash Count (All Sections)	394
PCD - ADT	3.30%
PCD – Population Density	5.89%
PCD - % of No-Vehicle Households	9.05%

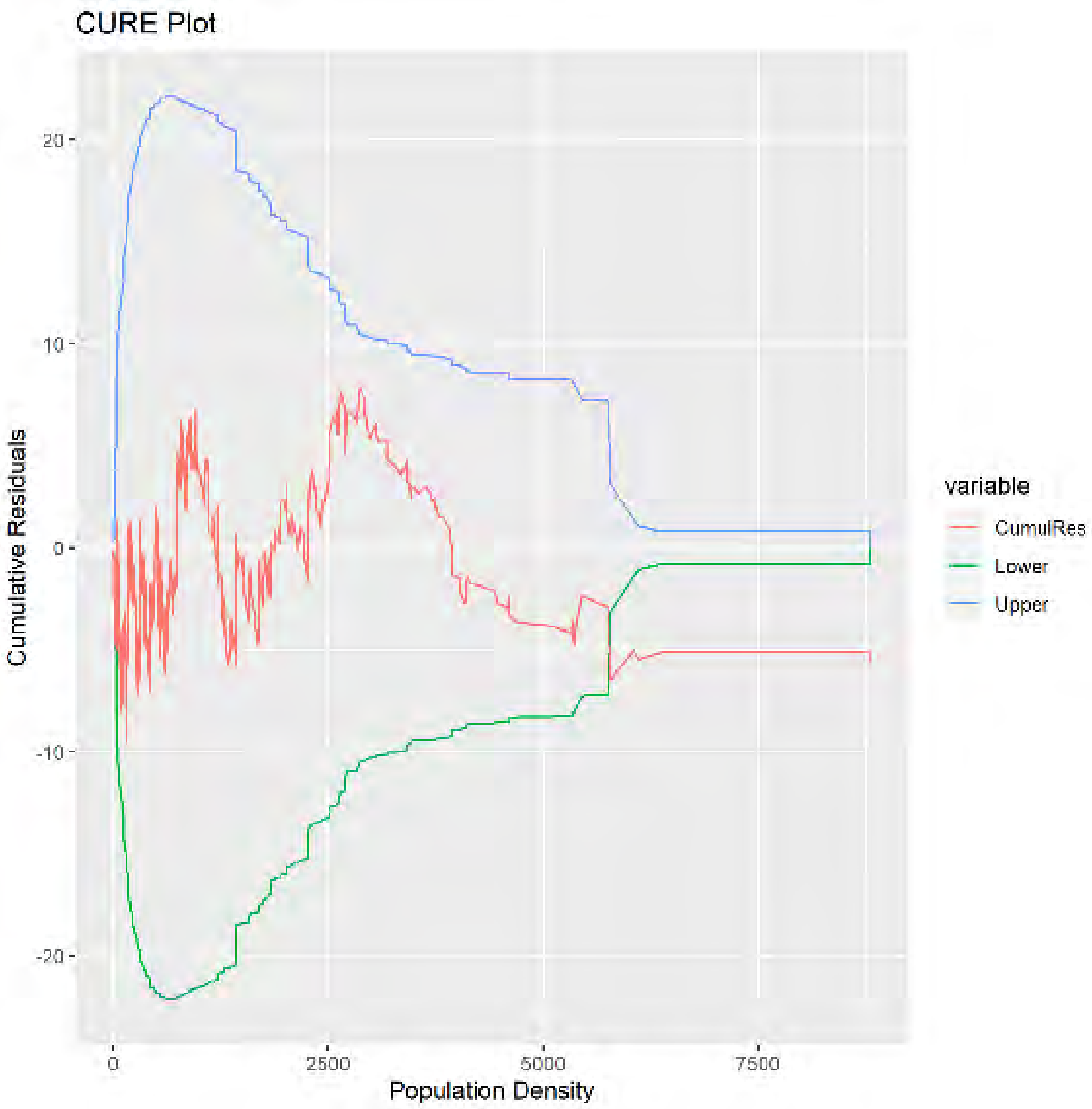
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	0.28	0.35	4715.59	1.07
Std Dev	0.68	1.30	2659.03	1.28
Min	0	0	30	0.01
Q1	0	0	2600	0.28
Median	0	0	4500	0.63
Q3	0	0	6900	1.37
Max	7	25	10000	12.48

CURE PLOTS

Urban 2-Lane Highways with ADT>0 & ADT<=10,000




CURE Plot
20
10
0
-10
-20
Cumulative Residuals
0.0%
10.0%
20.0%
30.0%
40.0%
% of Households with No Vehicle
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
20
10
0
-10
-20
0
2500
5000
7500
Population Density
variable
CumulRes
Lower
Upper

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

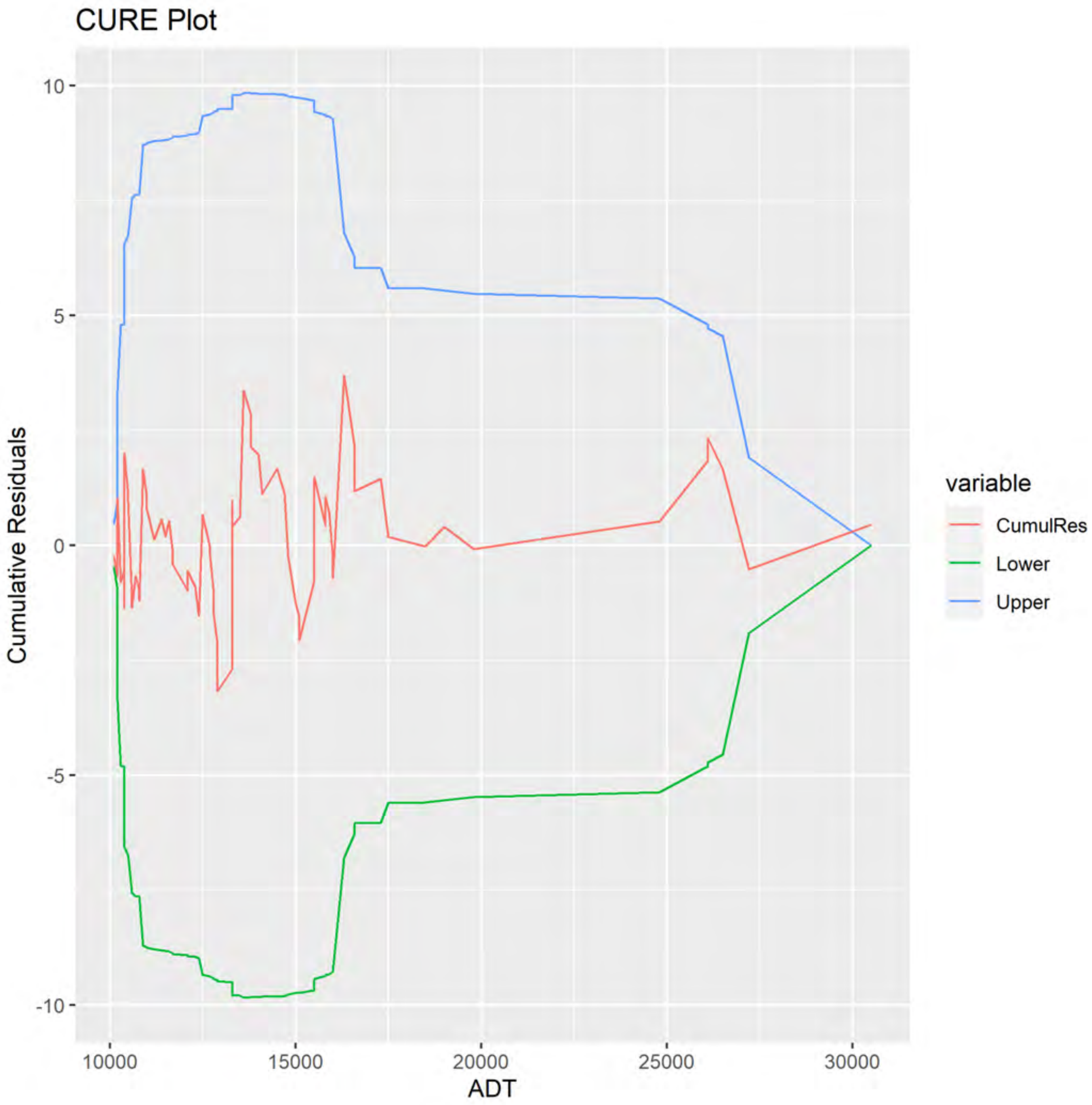
Urban 2-Lane Highways with ADT>10,000 & Length>=2 miles

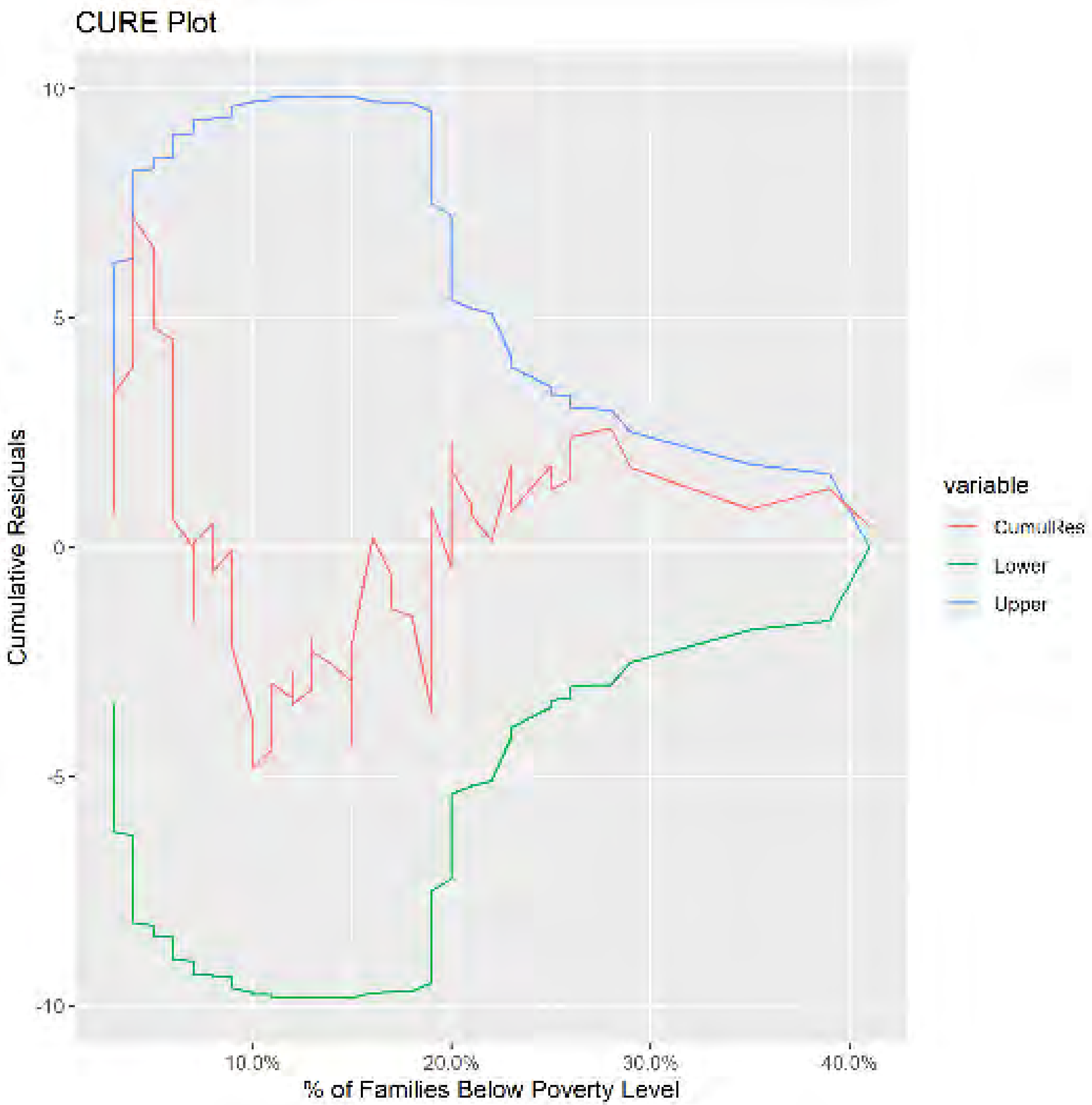
Sample Size (Number of Hwy Sections)	74
Total Length (All Sections)	227.12 mi
Observed Pedestrian Crash Count (All Sections)	64
PCD - ADT	1.35%
PCD – Population Density	1.35%
PCD - % of Households Below Poverty Line	1.35%
PCD - % of Households with No Vehicle	1.35%

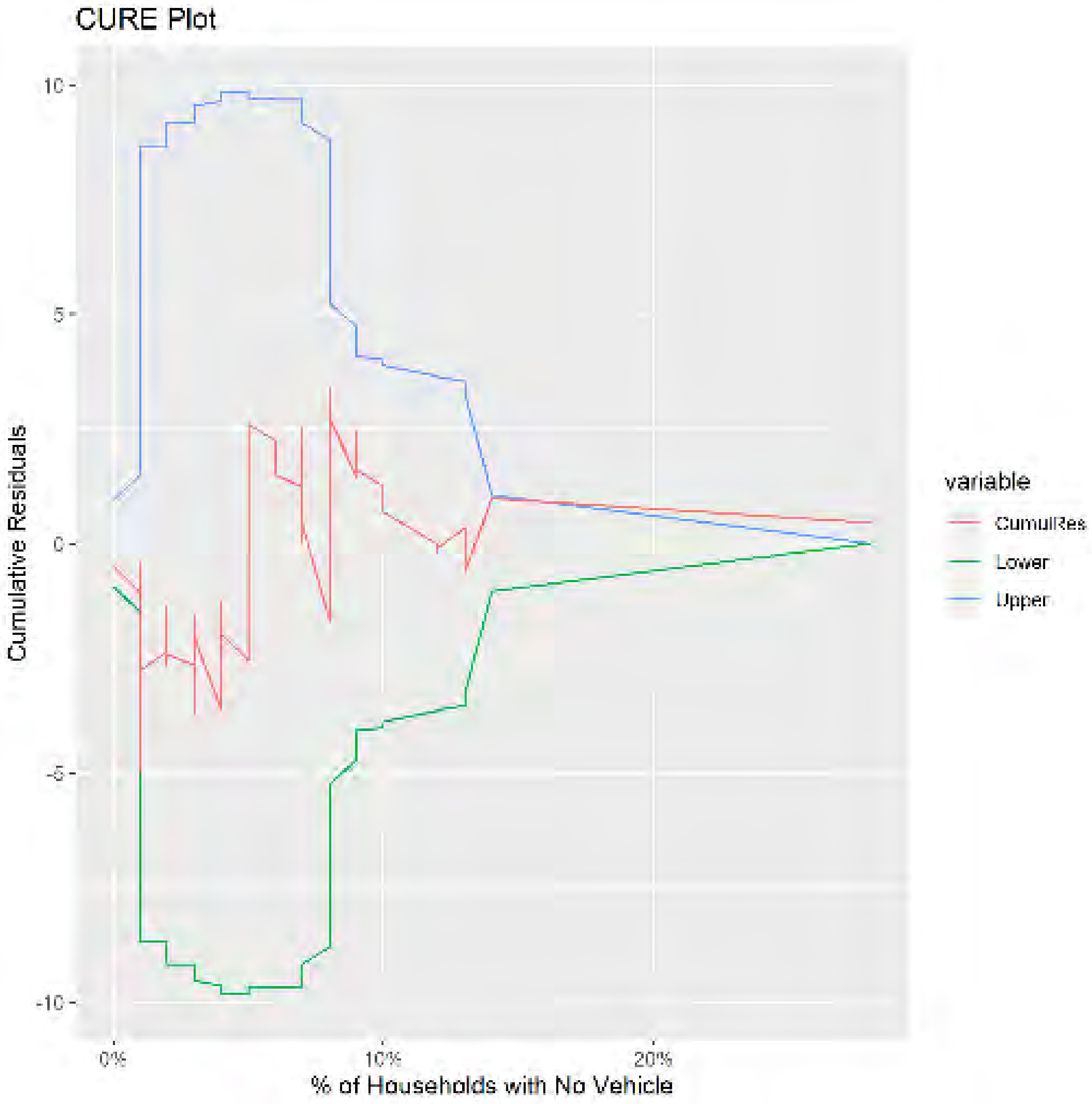
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	0.86	0.29	14312.16	3.07
Std Dev	1.30	0.45	4449.81	0.99
Min	0	0	10100	2
Q1	0	0	11050	2.43
Median	0	0	13100	2.8
Q3	1	0.43	15725	3.44
Max	6	2.14	30500	7.22

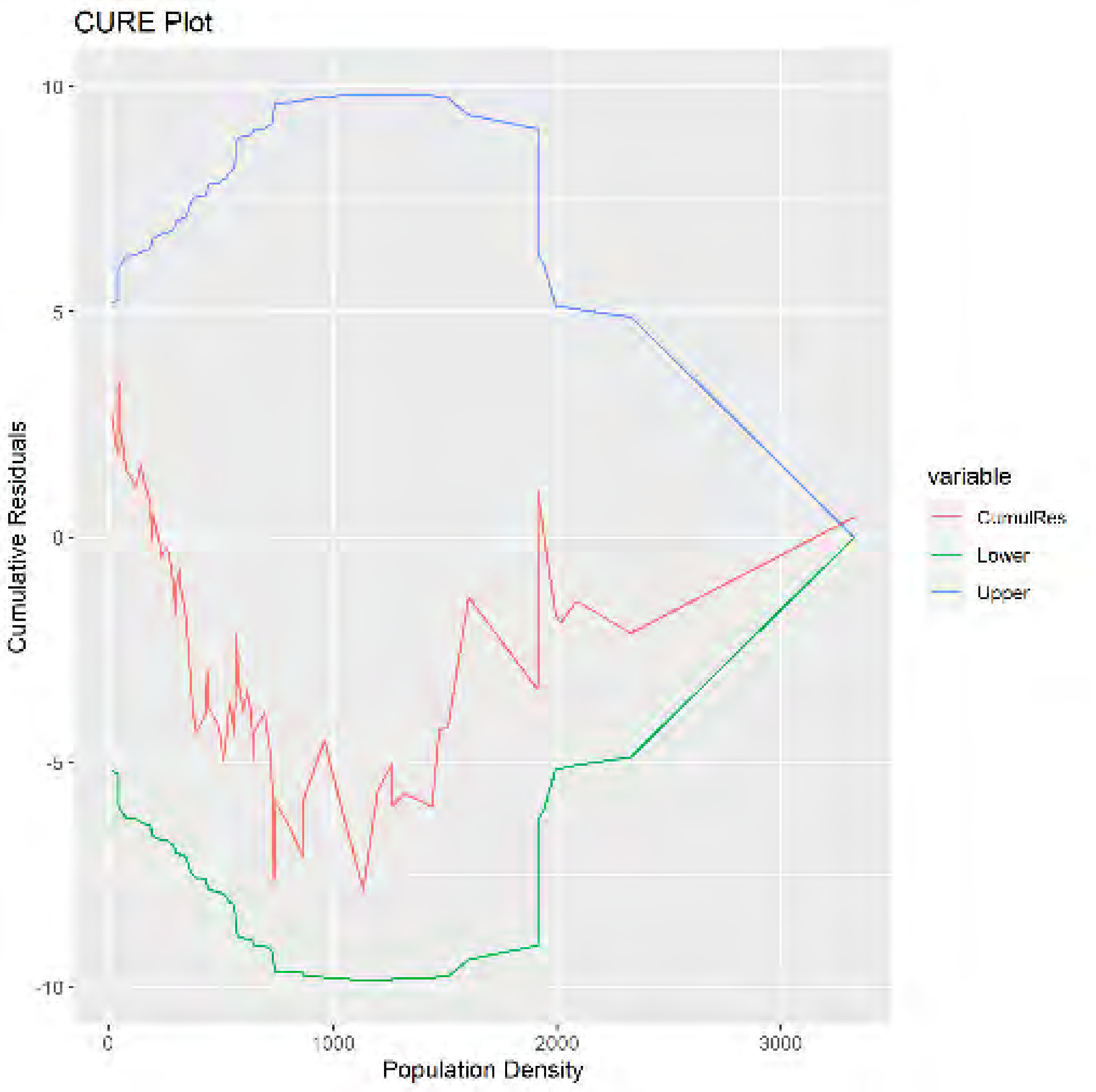
CURE PLOTS

Urban 2-Lane Highways with ADT>10,000 & Length>=2 miles




CURE Plot
Cumulative Residuals
10
5
0
-5
-10
10.0%
20.0%
30.0%
40.0%
% of Families Below Poverty Level
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
10
5
0
-5
-10
0%
10%
20%
% of Households with No Vehicle
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
10
5
0
-5
-10
0
1000
2000
3000
Population Density
variable
CumulRes
Lower
Upper

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

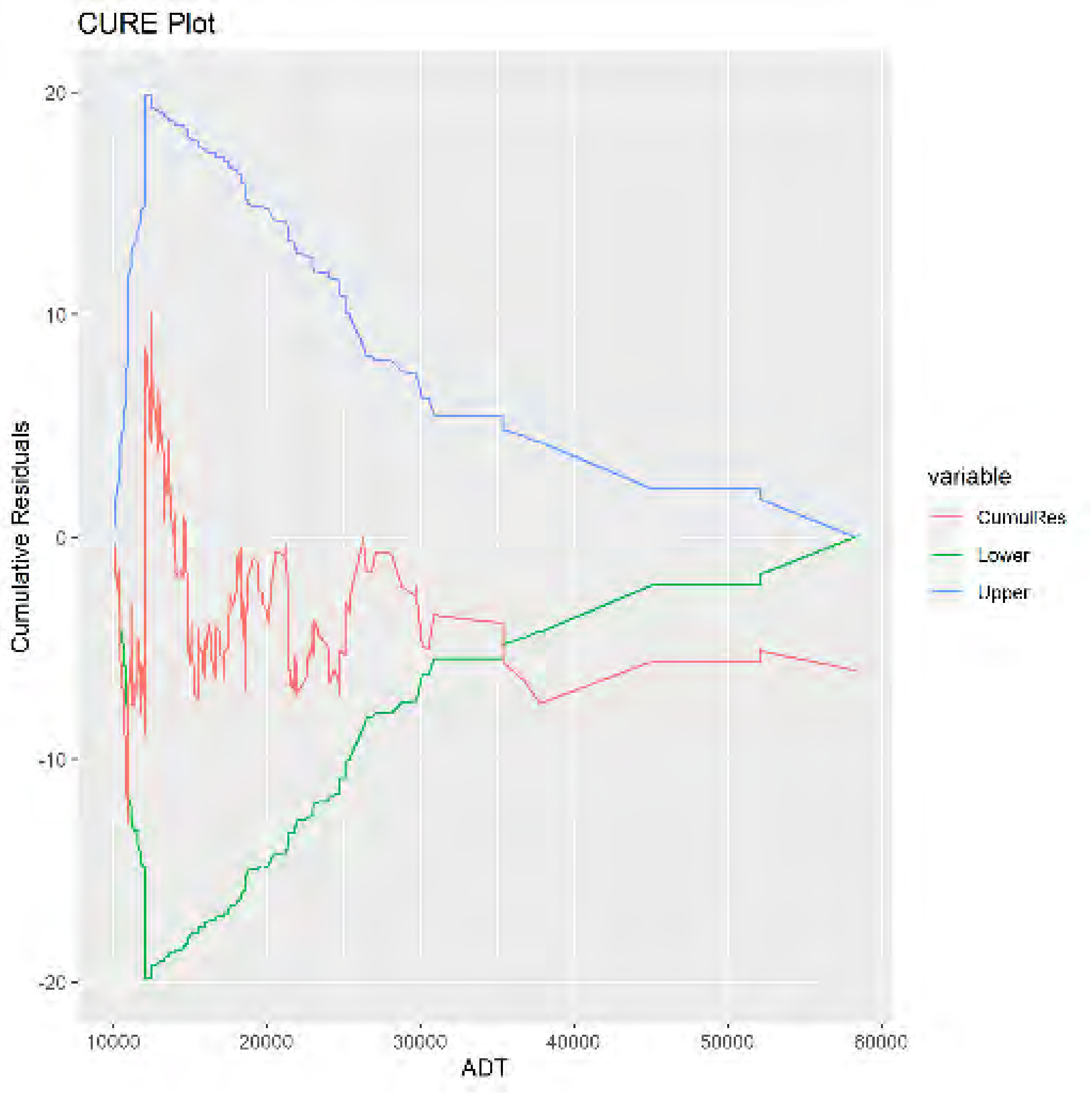
Urban 2-Lane Highways with ADT>10,000 & Length<2 miles

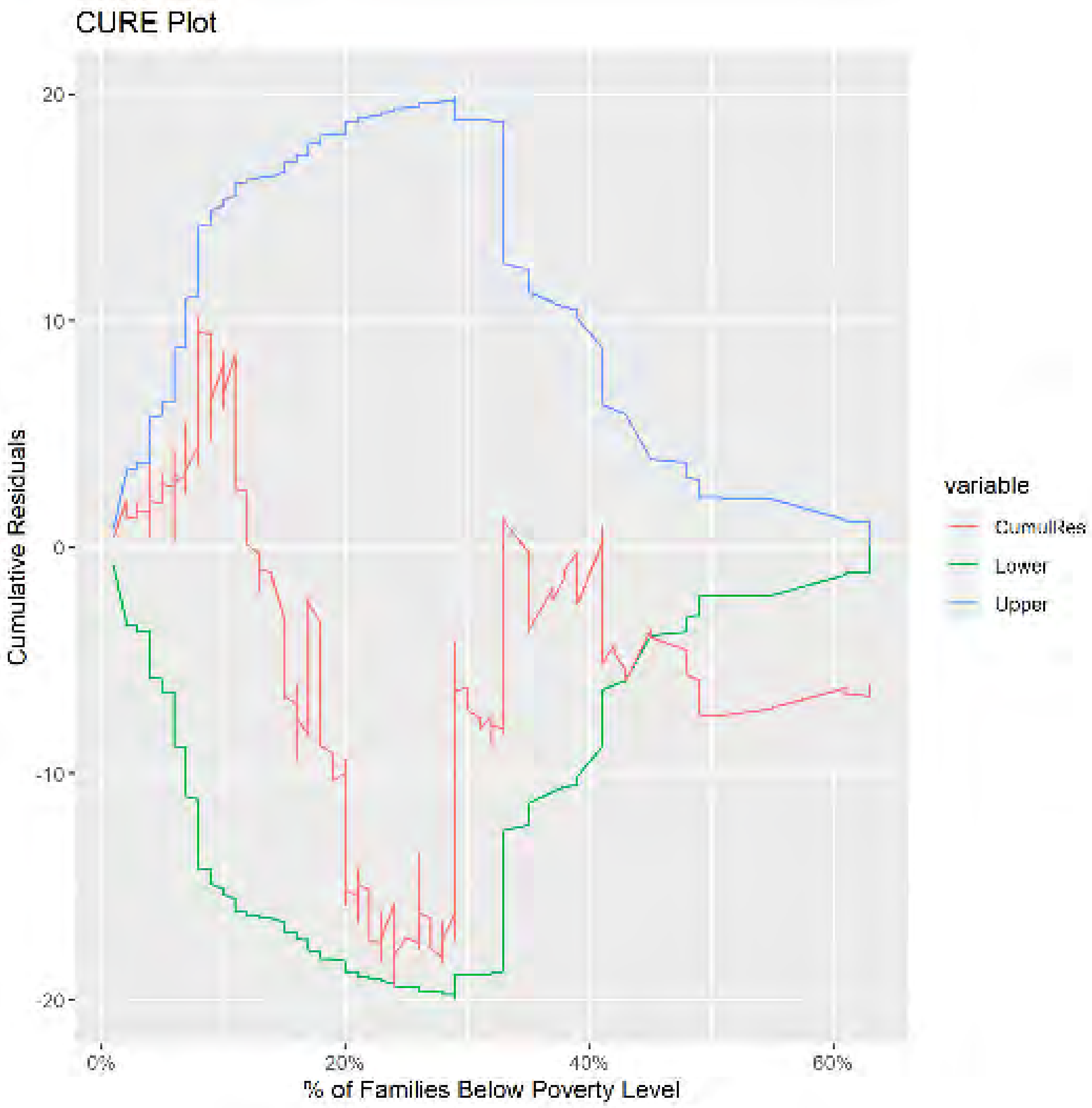
Sample Size (Number of Hwy Sections)	419
Total Length (All Sections)	265.7 mi
Observed Pedestrian Crash Count (All Sections)	215
PCD - ADT	9.79%
PCD – Population Density	22.43%
PCD - % of Households Below Poverty Line	3.82%
PCD - % of Households with No Vehicle	4.30%

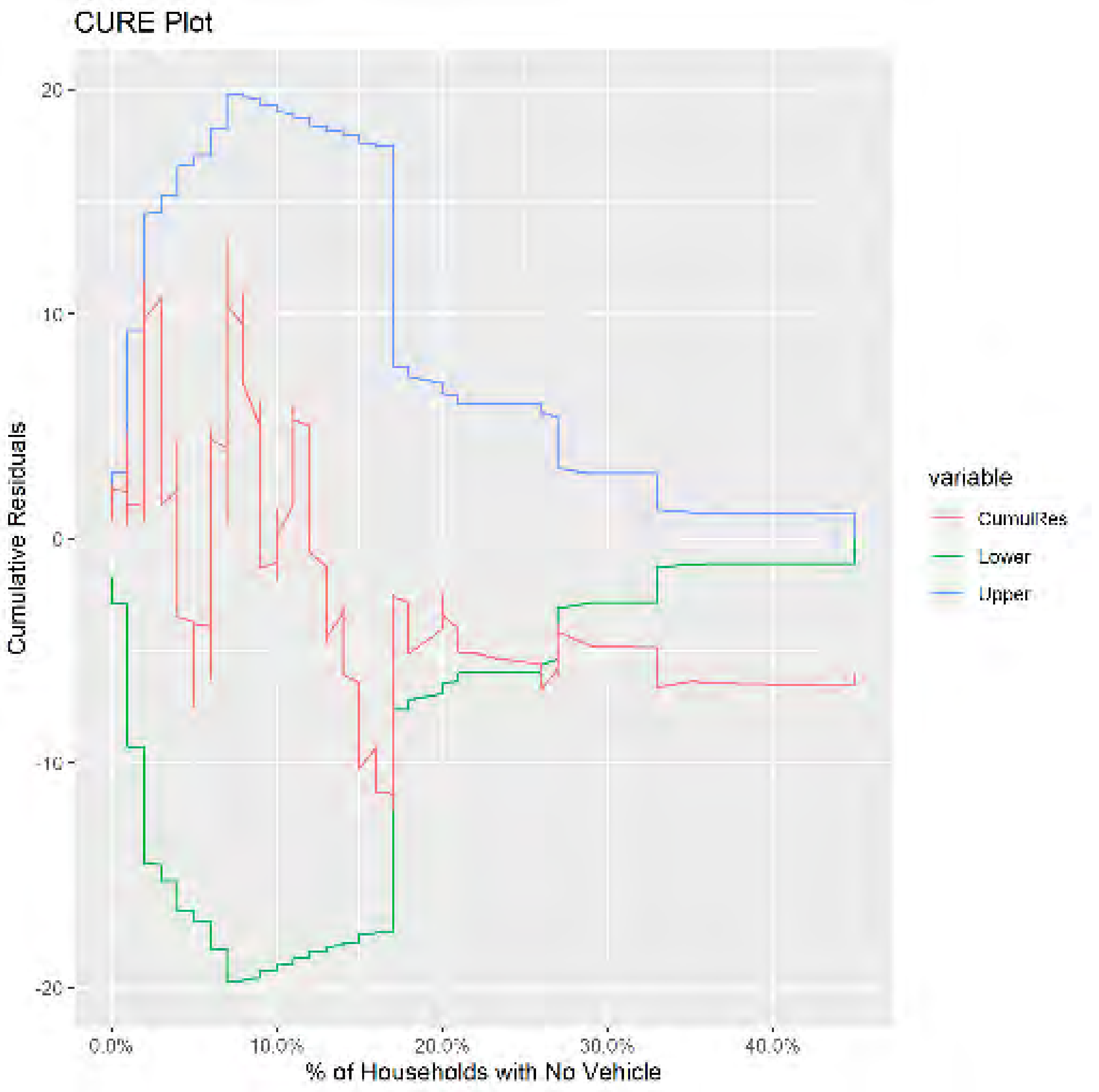
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	0.51	1.01	16451.79	0.63
Std Dev	1.12	2.76	6672.72	0.54
Min	0	0	10100	0.01
Q1	0	0	11800	0.18
Median	0	0	14600	0.48
Q3	1	0.85	18600	1
Max	10	25	58300	1.96

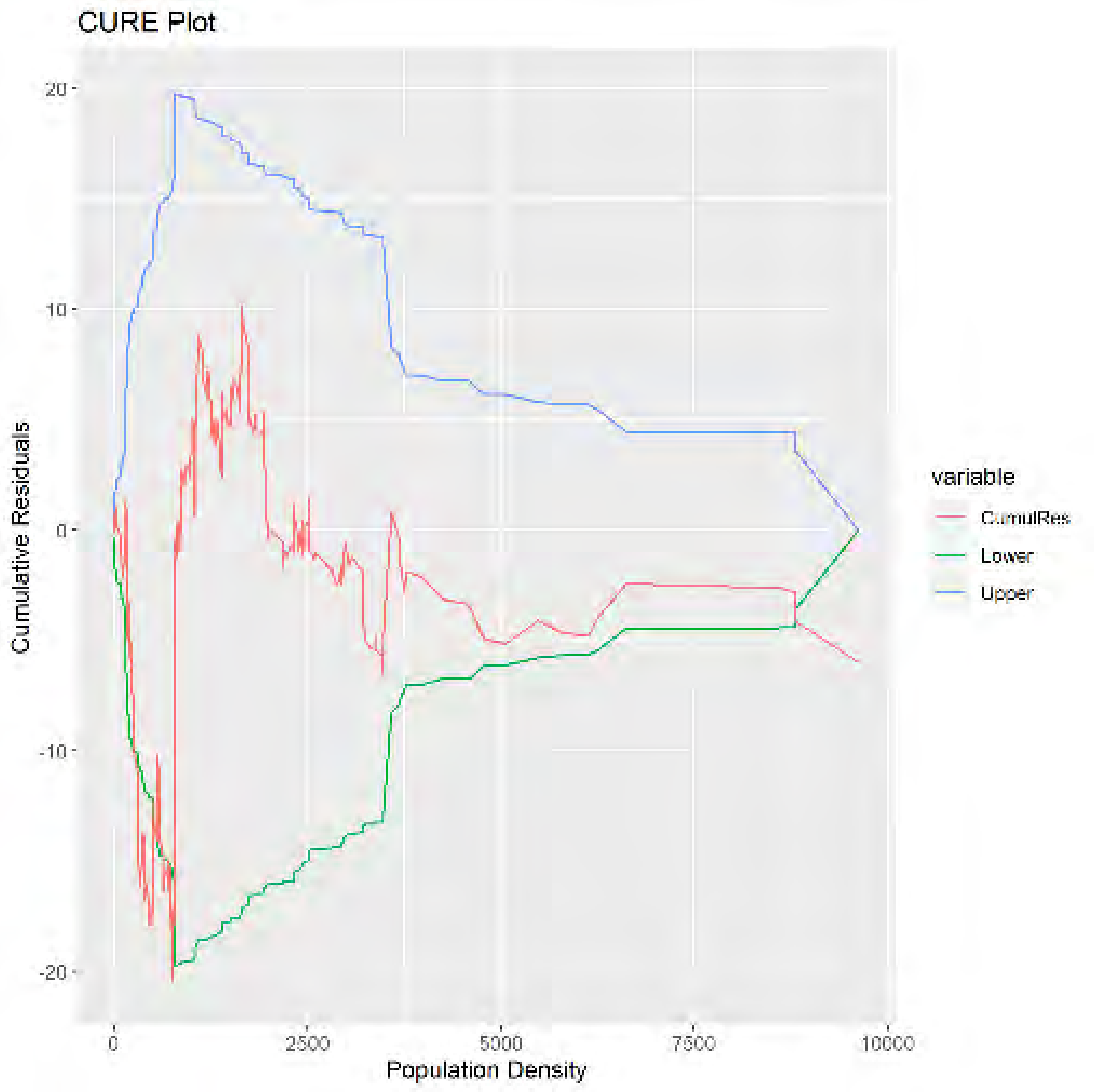
CURE PLOTS

Urban 2-Lane Highways with ADT>10,000 & Length<2 miles




CURE Plot
20
10
0
-10
-20
Cumulative Residuals
0%
20%
40%
60%
% of Families Below Poverty Level
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
20
10
0
-10
-20
0.0%
10.0%
20.0%
30.0%
40.0%
% of Households with No Vehicle
variable
CumulRes
Lower
Upper



This document and the information contained herein were prepared solely for the purpose of identifying, evaluating, and planning safety improvements on public roads which may be implemented utilizing federal aid highway funds; and are therefore exempt from discovery or admission into evidence pursuant to 23 U.S.C. 409.

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

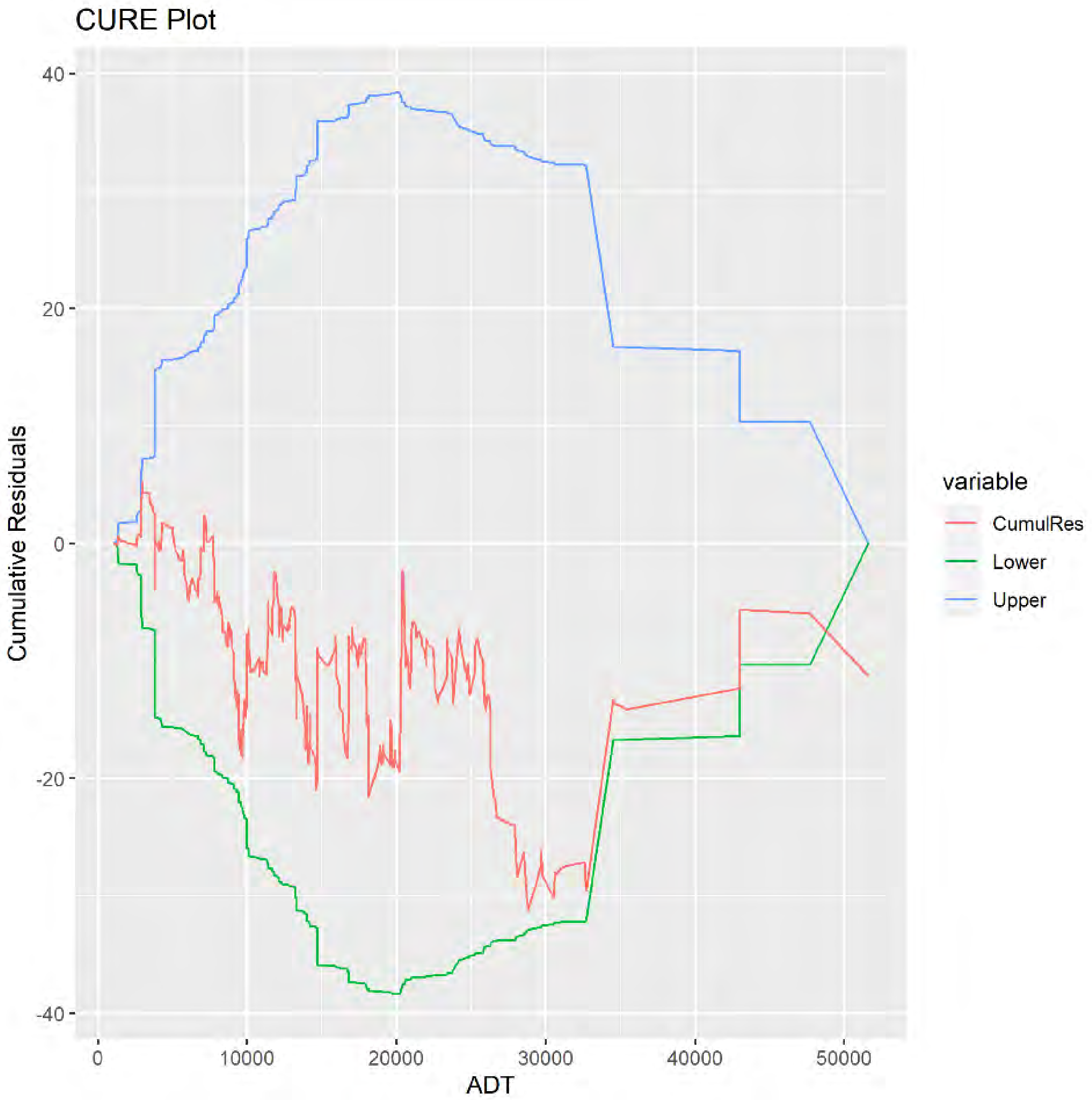
Urban 4-Lane Highways

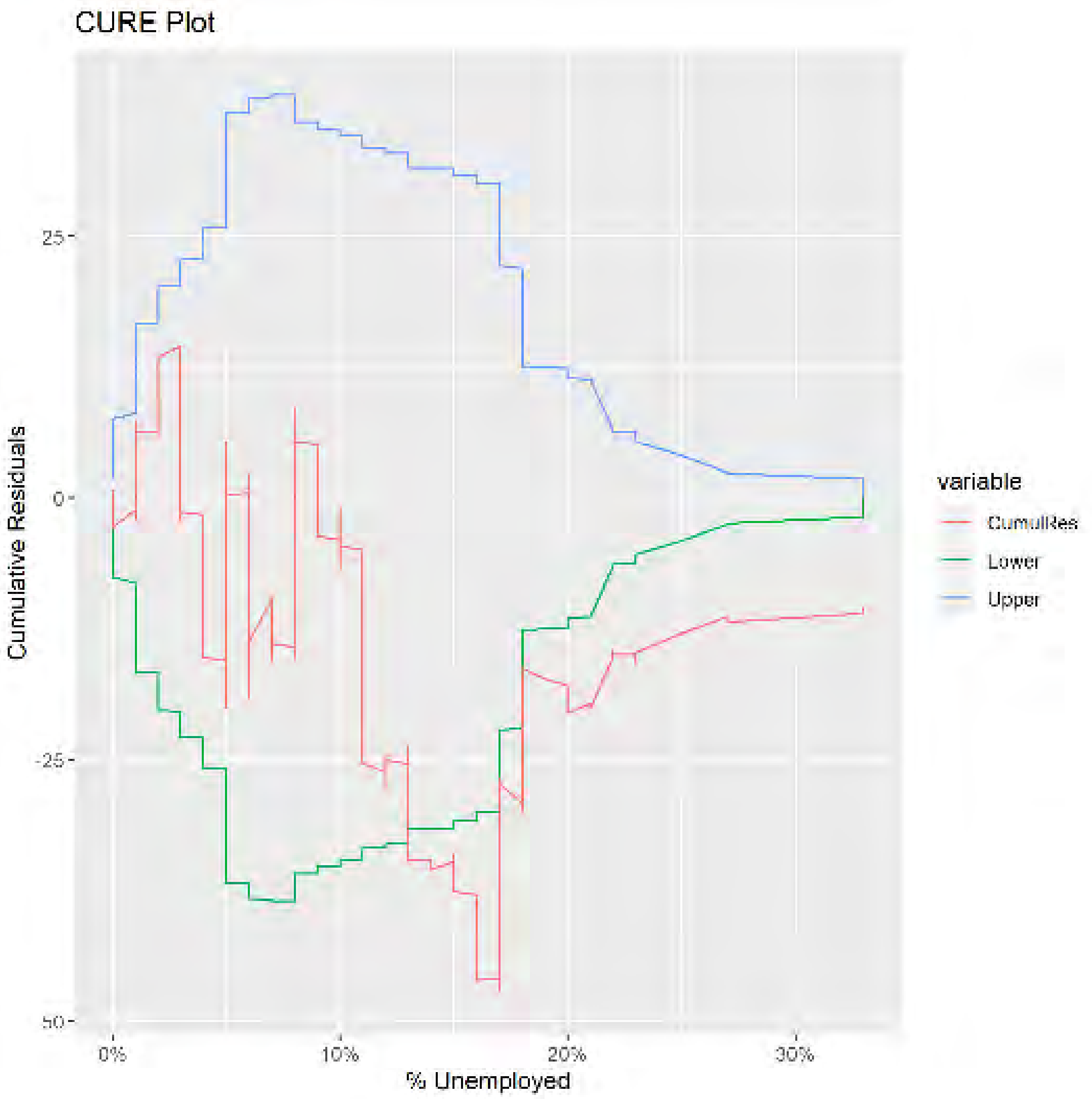
Sample Size (Number of Hwy Sections)	478
Total Length (All Sections)	249.97 mi
Observed Pedestrian Crash Count (All Sections)	497
PCD - ADT	0.21%
PCD – Population Density	5.02%
PCD - % Unemployed	17.57%

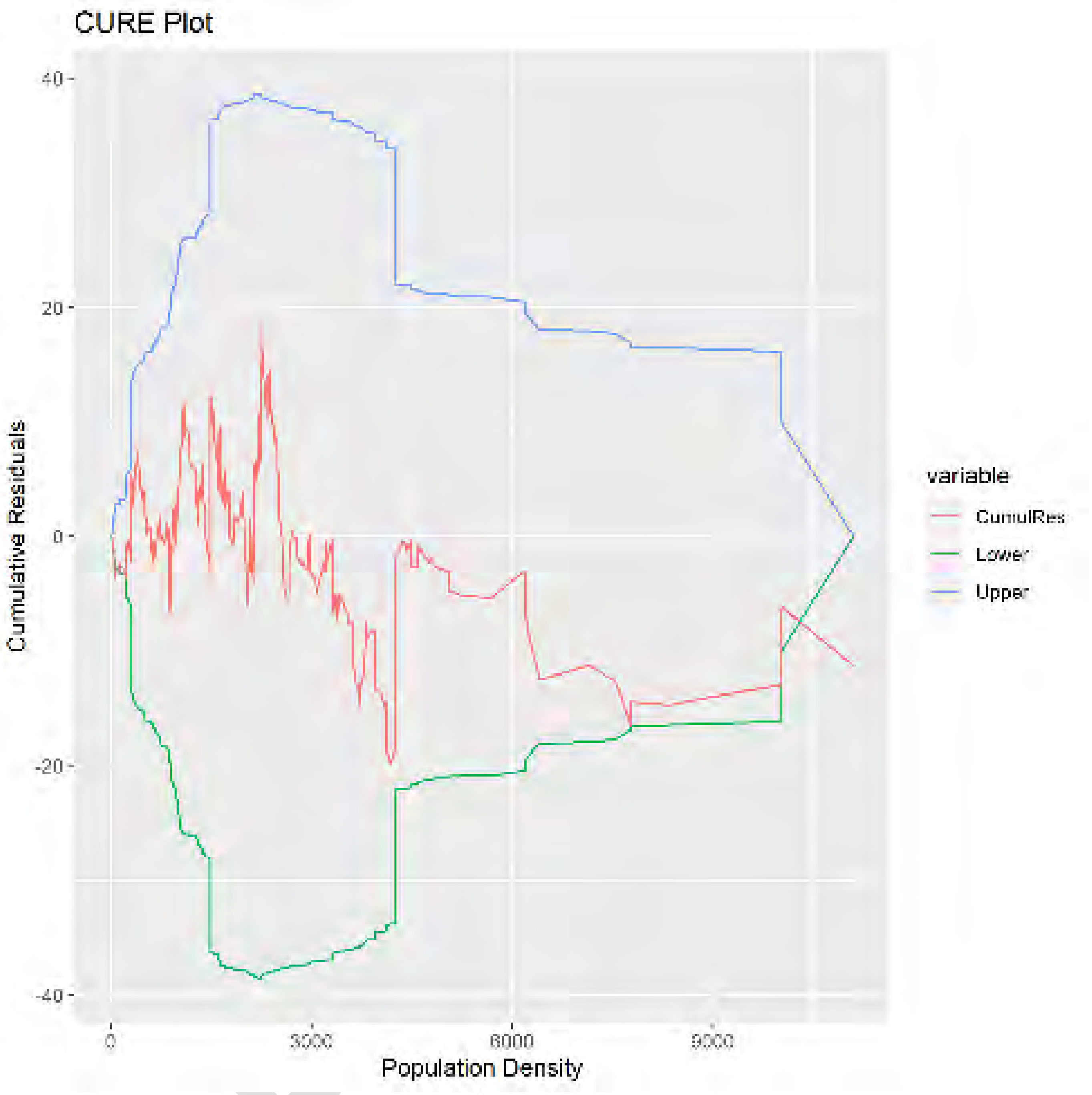
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	1.04	1.96	13867.03	0.52
Std Dev	2.15	4.05	8127.83	0.55
Min	0	0	1020	0.02
Q1	0	0	8000	0.16
Median	0	0	12300	0.37
Q3	1	2.55	19100	0.66
Max	22	42.86	51600	5.66

CURE PLOTS

Urban 4-Lane Highways




CURE Plot
Cumulative Residuals
25
0
-25
-50
0%
10%
20%
30%
% Unemployed
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
40
20
0
-20
-40
0
3000
6000
9000
Population Density
variable
CumulRes
Lower
Upper

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

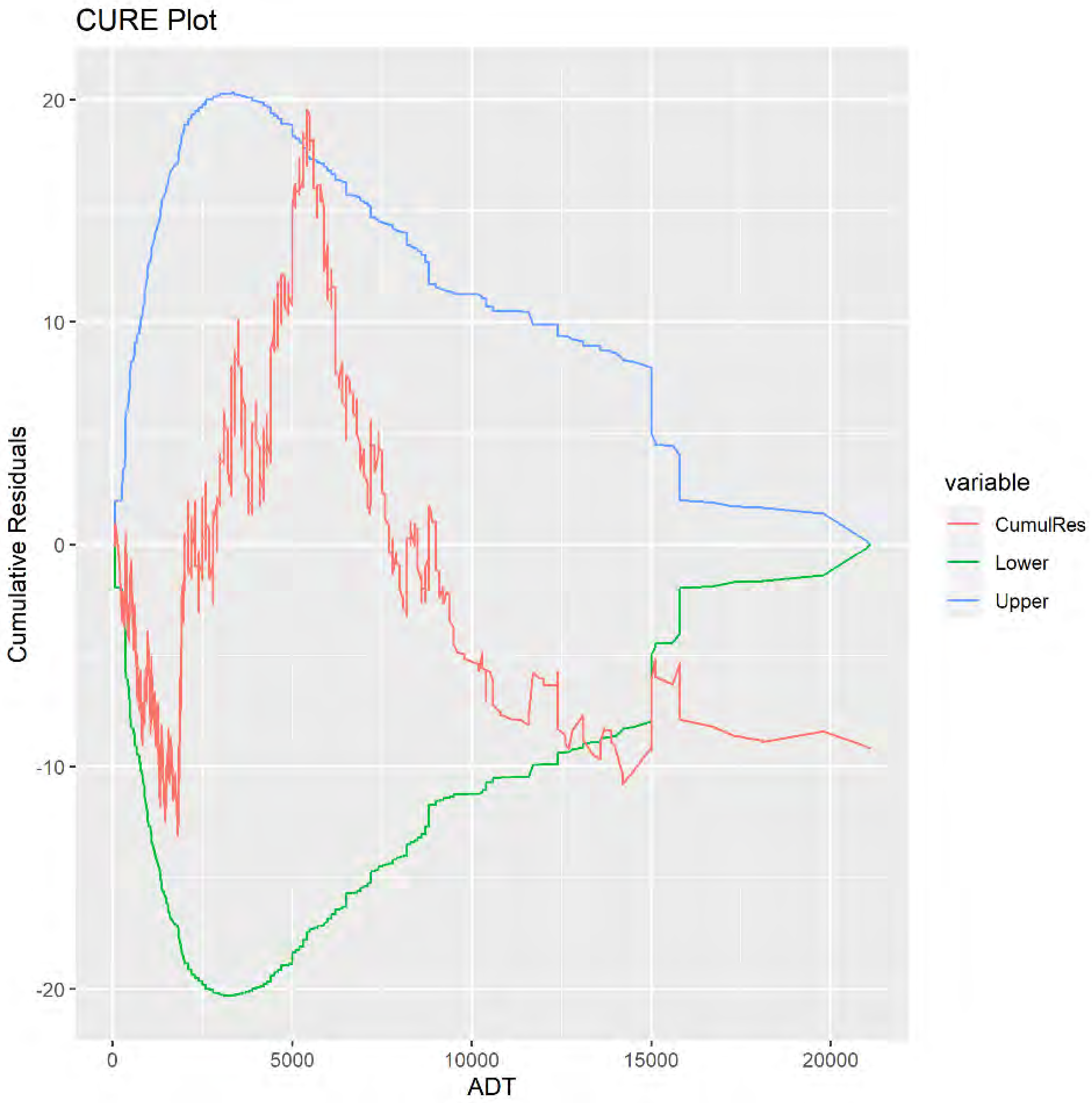
Rural 2-Lane Highways

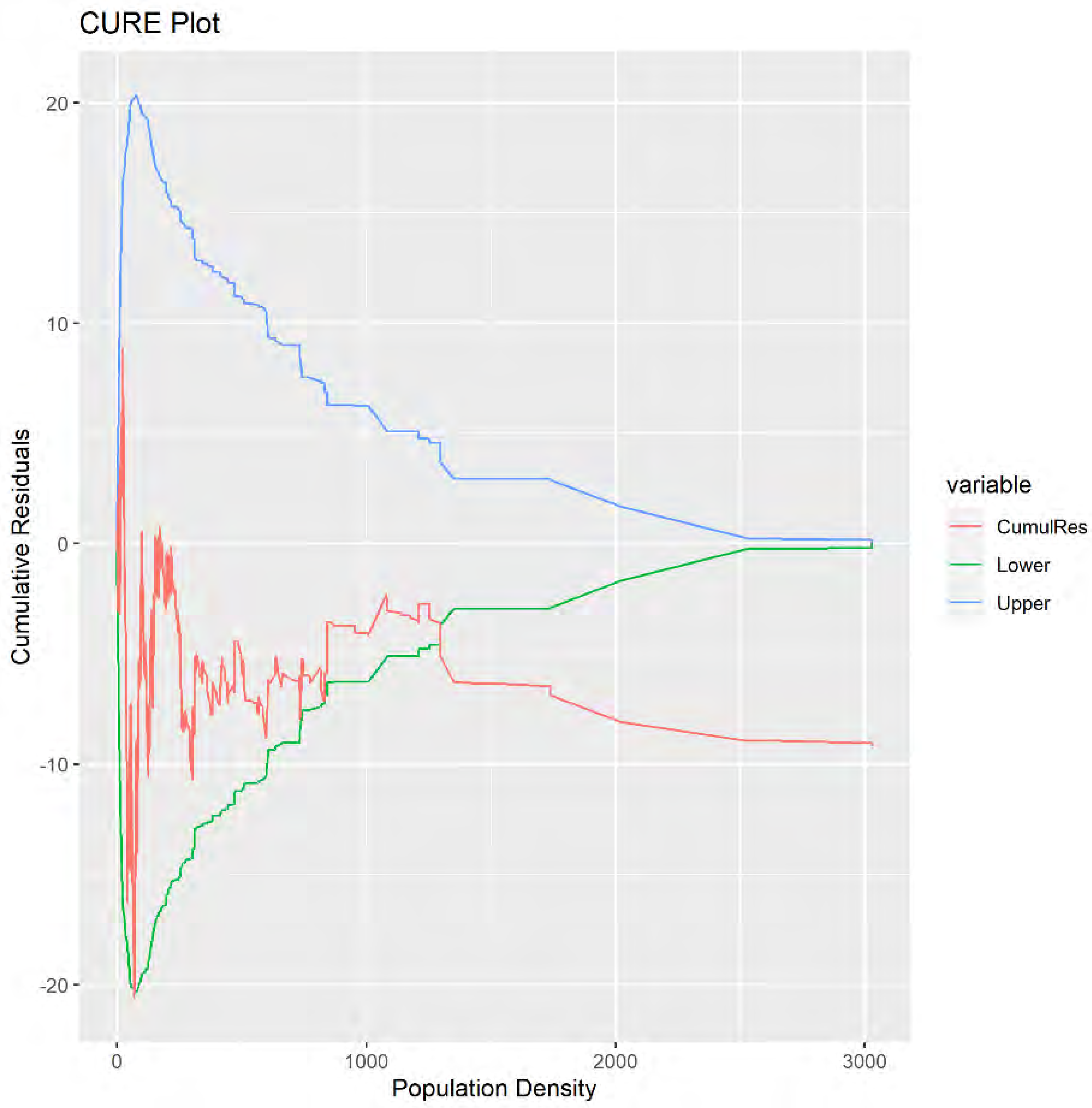
Sample Size (Number of Hwy Sections)	3996
Total Length (All Sections)	11814.42 mi
Observed Pedestrian Crash Count (All Sections)	359
PCD - ADT	4.70%
PCD – Population Density	0.93%

	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	0.09	0.04	2436.32	2.96
Std Dev	0.34	0.26	2627.06	2.78
Min	0	0	30	0.01
Q1	0	0	670	0.67
Median	0	0	1520	2.16
Q3	0	0	3200	4.54
Max	4	6.67	21100	18.38

CURE PLOTS

Rural 2-Lane Highways




CURE Plot
Cumulative Residuals
20
10
0
-10
-20
0
1000
2000
3000
Population Density
variable
CumulRes
Lower
Upper

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

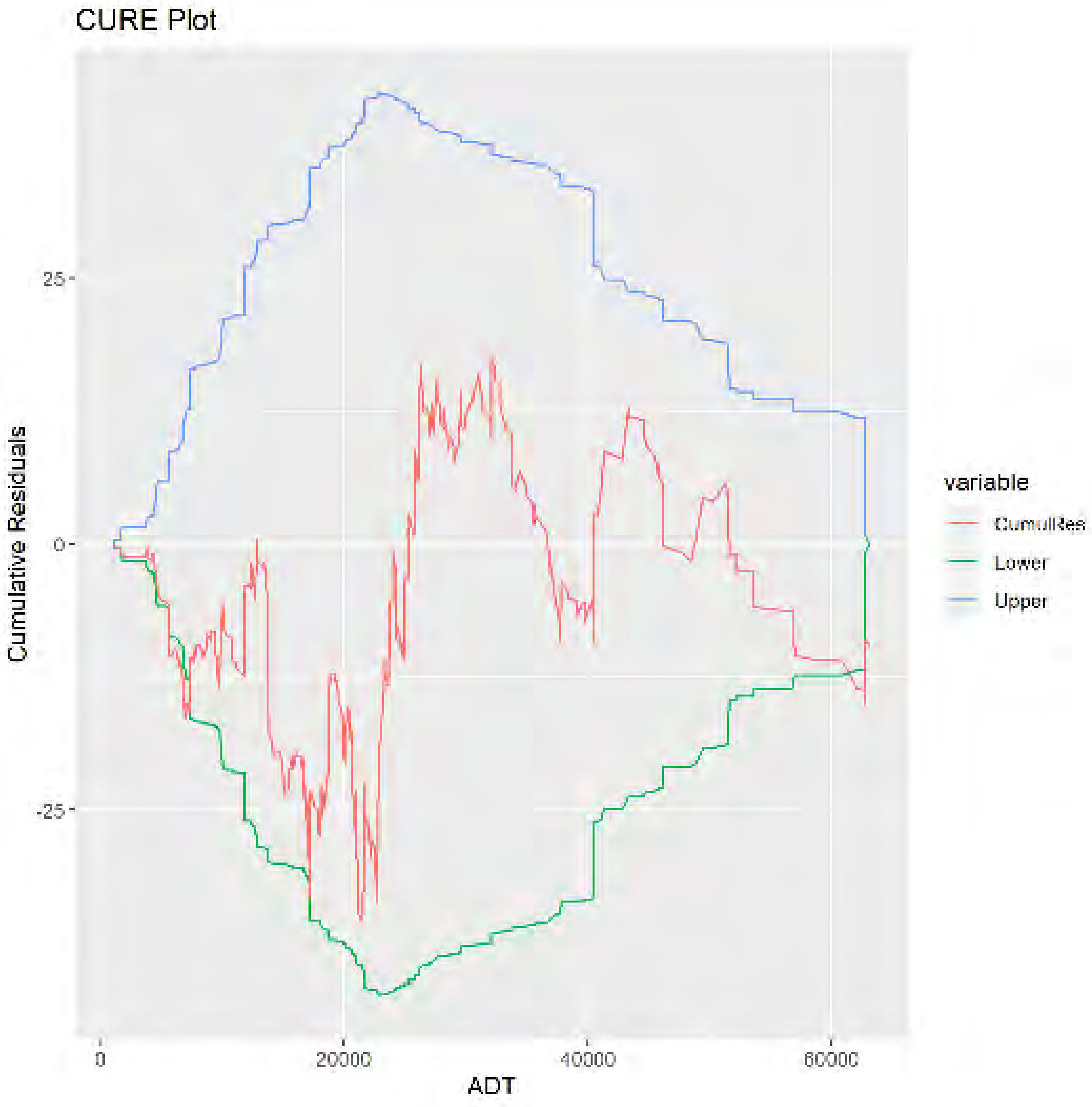
Urban 4-Lane Divided Highways

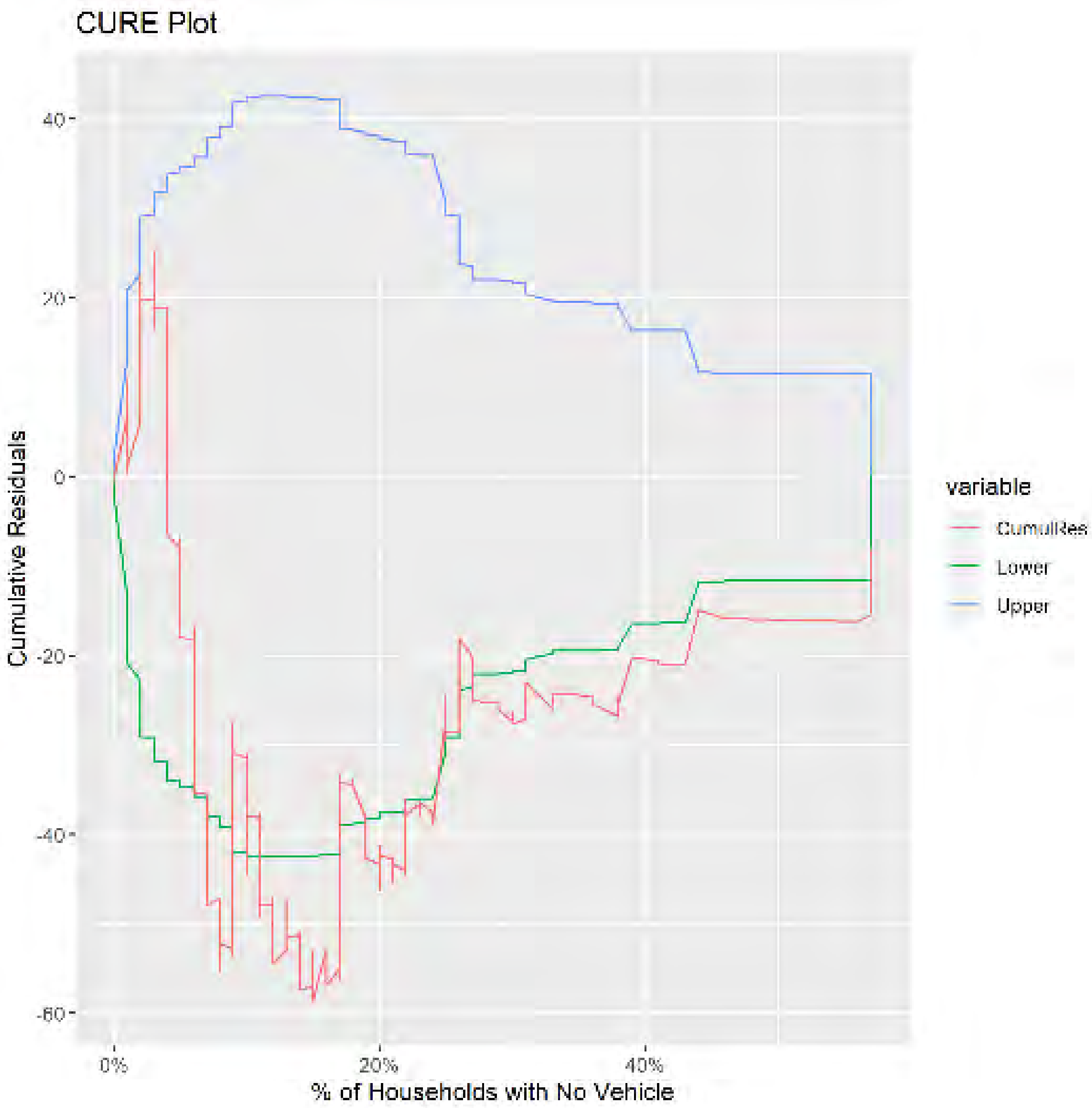
Sample Size (Number of Hwy Sections)	566
Total Length (All Sections)	535.83 mi
Observed Pedestrian Crash Count (All Sections)	557
PCD - ADT	7.07%
PCD – Population Density	17.49%
PCD - % of No-Vehicle Households	43.29%
PCD - % of Households Below Poverty Line	40.11%

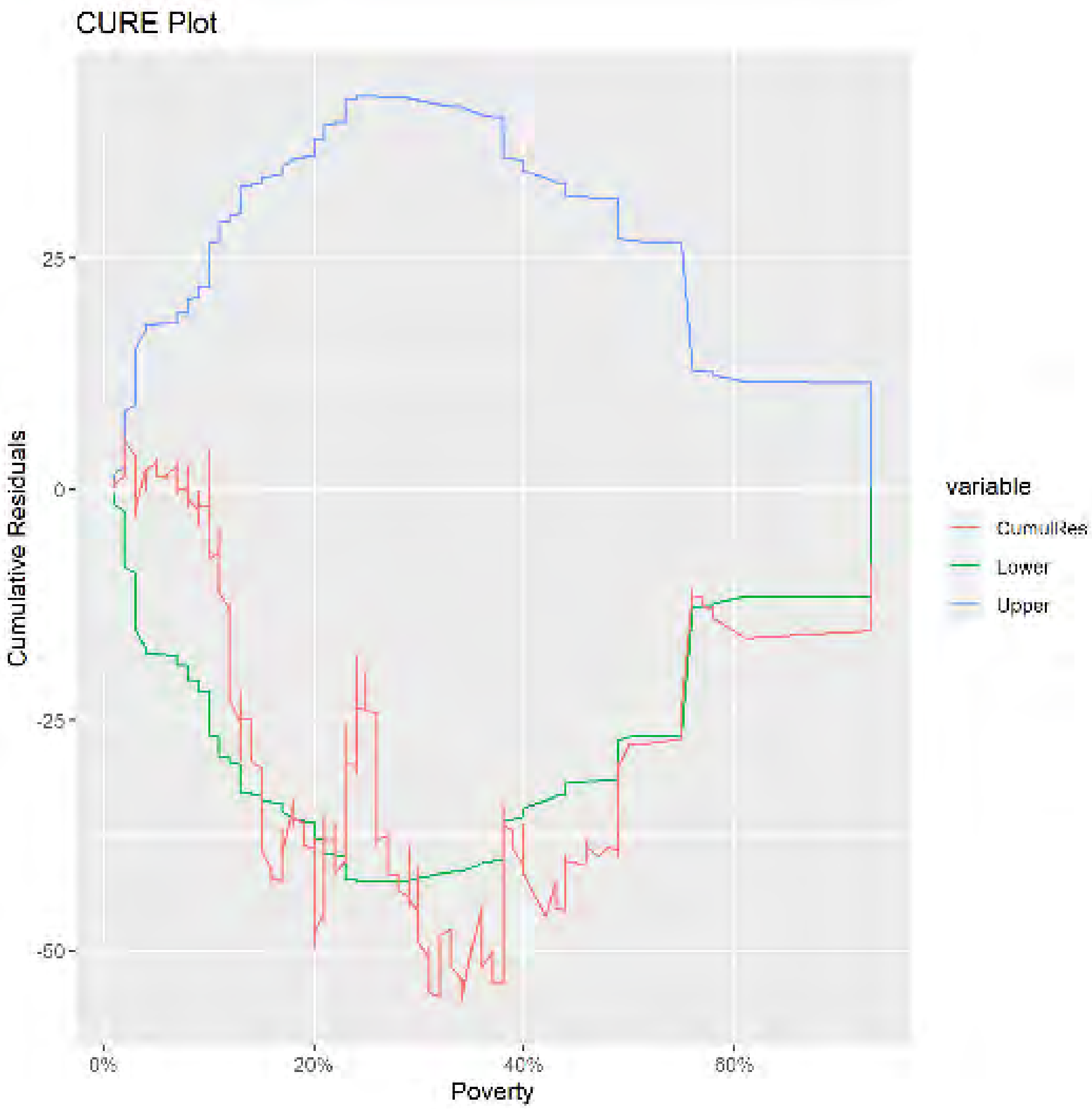
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	0.98	1.34	22003.87	0.95
Std Dev	2.27	2.78	13003.24	1.09
Min	0	0	1060	0.02
Q1	0	0	12335.50	0.25
Median	0	0	20000	0.53
Q3	1	1.38	28650	1.24
Max	22	24	63100	7.54

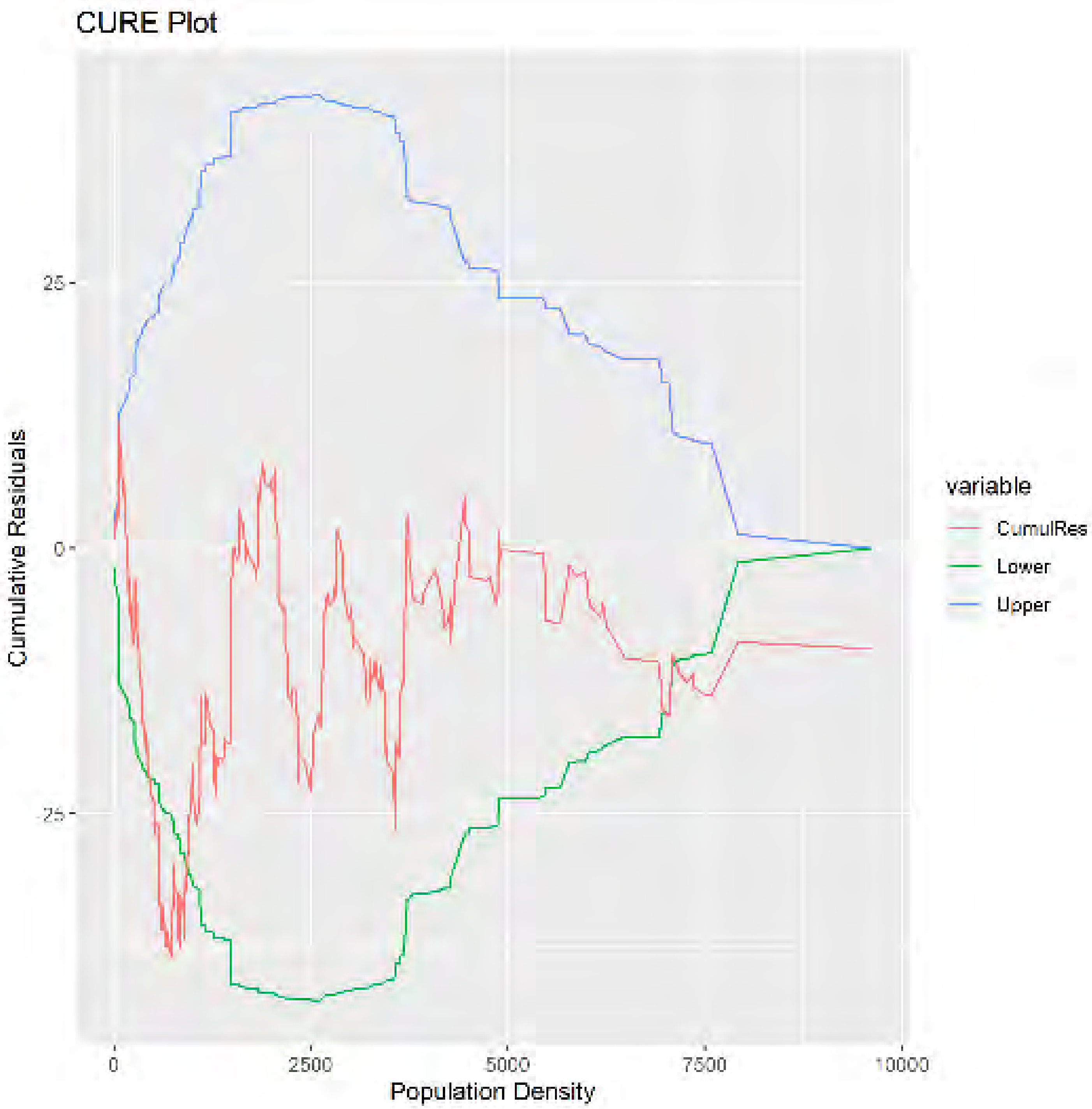
CURE PLOTS

Urban 4-Lane Divided Highways




CURE Plot
40
20
0
-20
-40
-60
Cumulative Residuals
0%
20%
40%
% of Households with No Vehicle
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
25
0
-25
-50
0%
20%
40%
60%
Poverty
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
25
0
-25
0
2500
5000
7500
10000
Population Density
variable
CumulRes
Lower
Upper

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

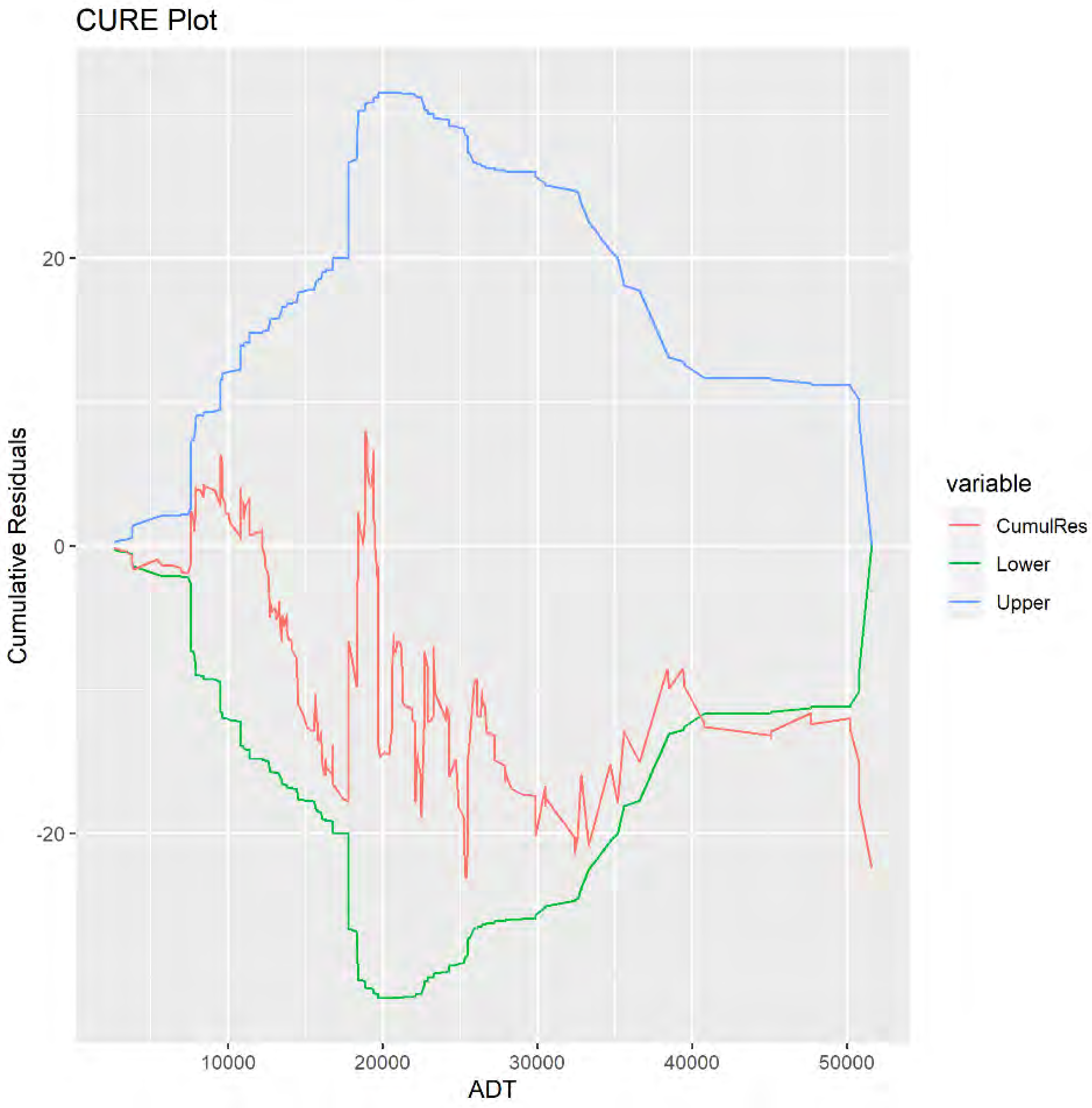
Urban 4-Lane Highways with Continuous Left Turn Lane

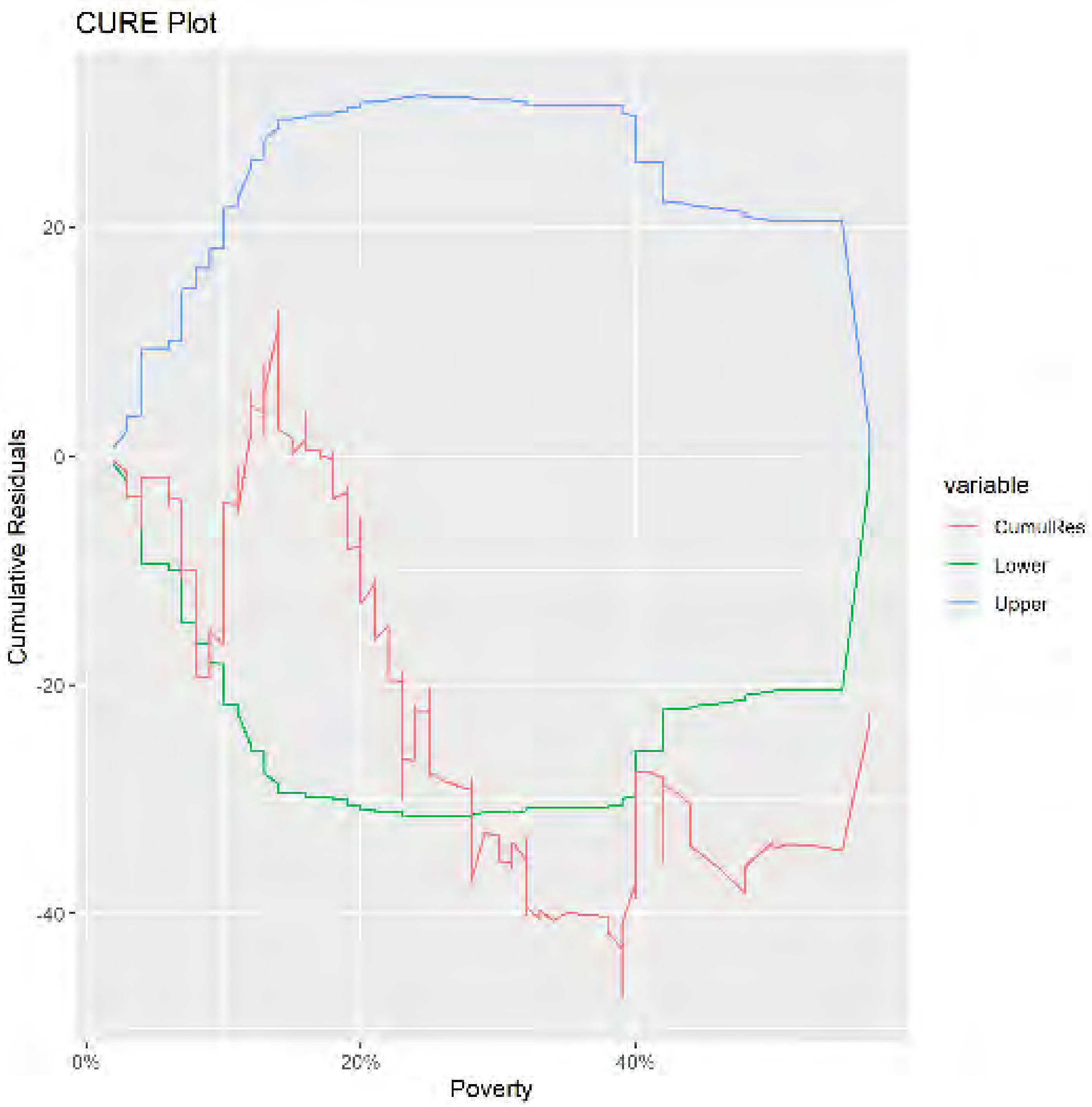
Sample Size (Number of Hwy Sections)	251
Total Length (All Sections)	188.78 mi
Observed Pedestrian Crash Count (All Sections)	349
PCD - ADT	7.17%
PCD – Population Density	27.49%
PCD - % of Households Below Poverty Line	31.08%

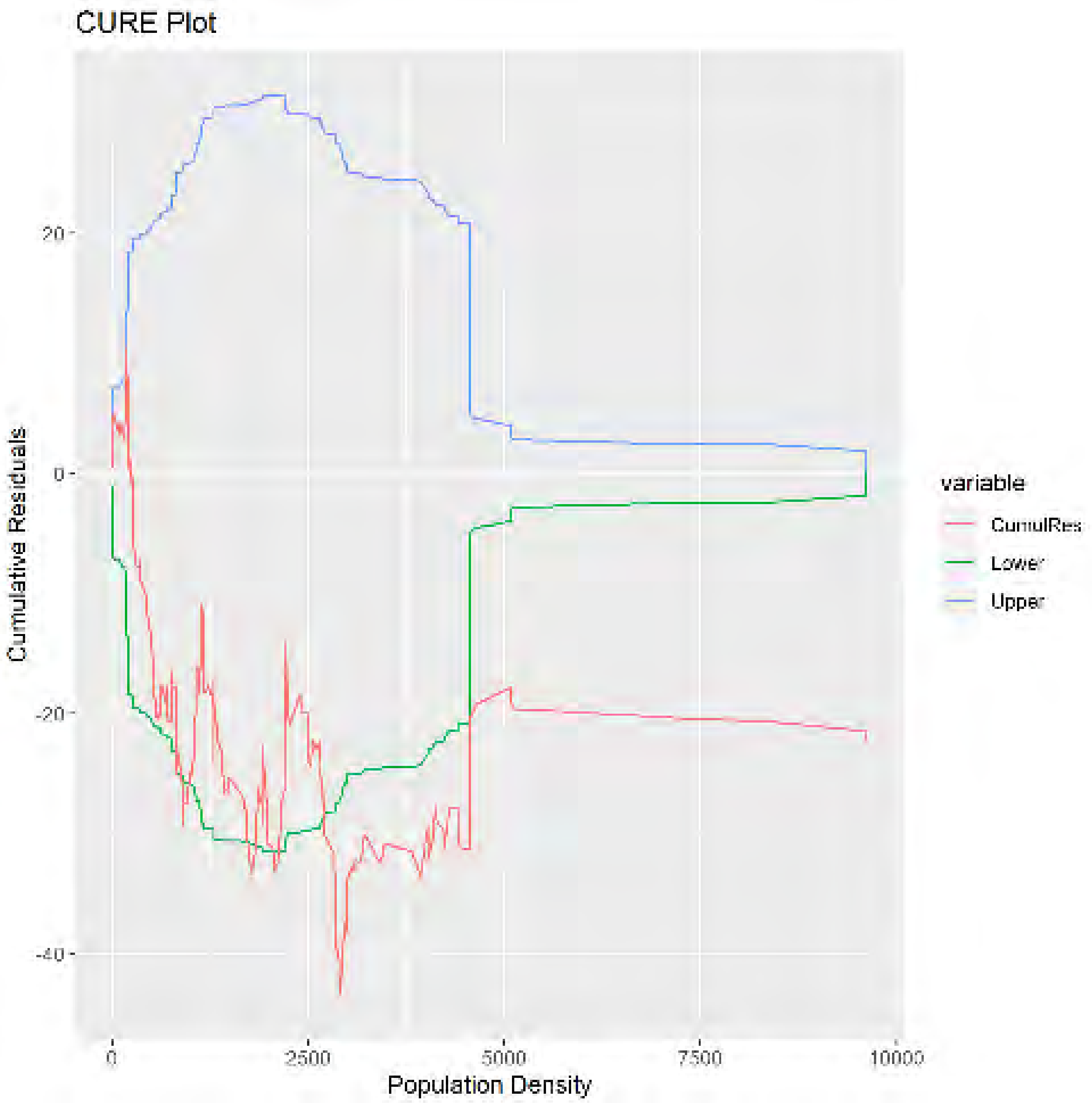
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	1.39	2.07	19222.43	0.75
Std Dev	2.46	3.57	10090.73	0.73
Min	0	0	2600	0.02
Q1	0	0	12300	0.27
Median	0	0	18500	0.52
Q3	2	2.41	23300	1.06
Max	15	20	51600	5.31

CURE PLOTS

Urban 4-Lane Highways with Continuous Left Turn Lane




CURE Plot
Cumulative Residuals
20
0
-20
-40
0%
20%
40%
Poverty
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
20
0
-20
-40
0
2500
5000
7500
10000
Population Density
variable
CumulRes
Lower
Upper

SAFETY PERFORMANCE FUNCTION SUMMARY STATISTICS

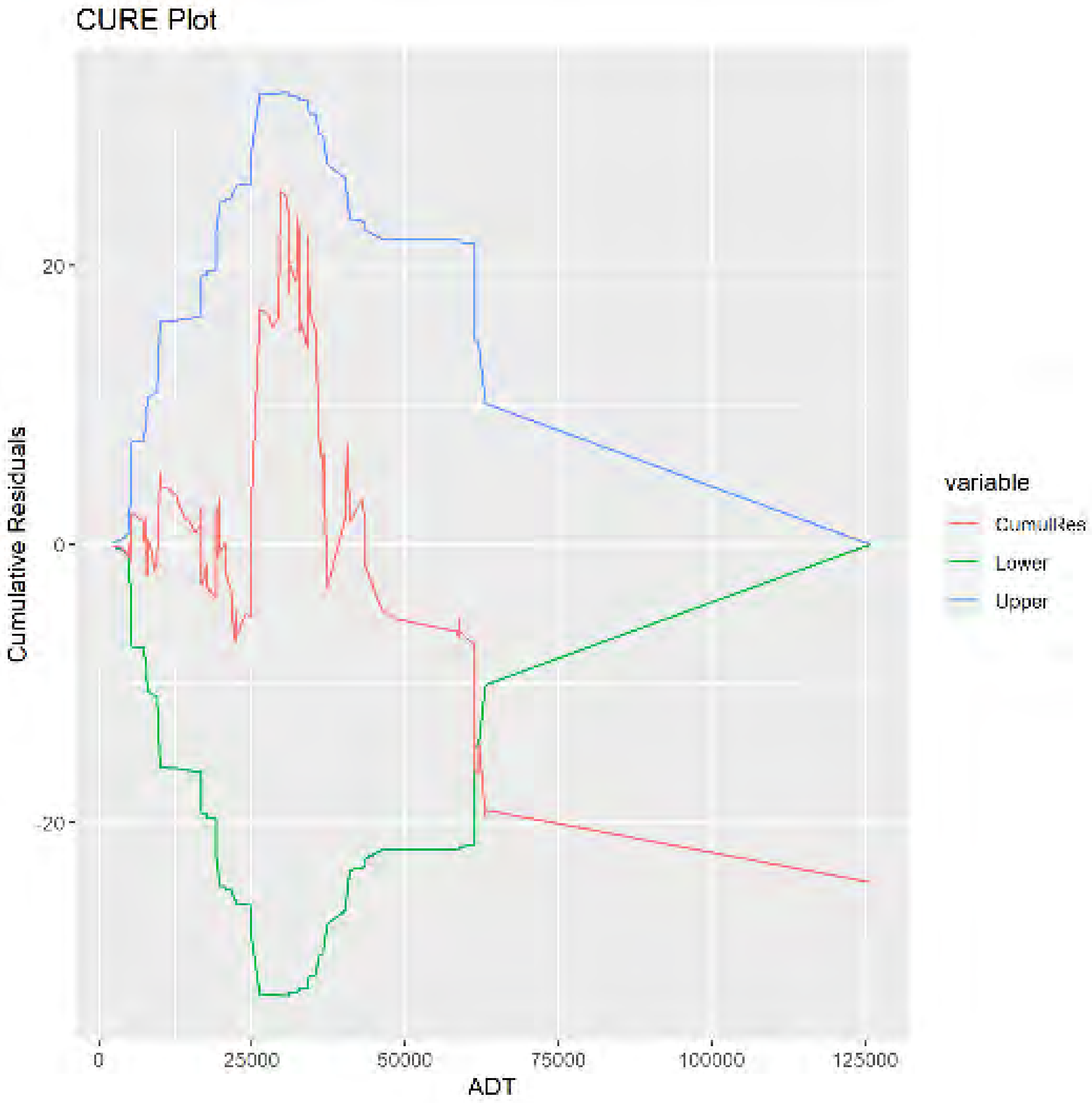
Urban 6-Lane Highways

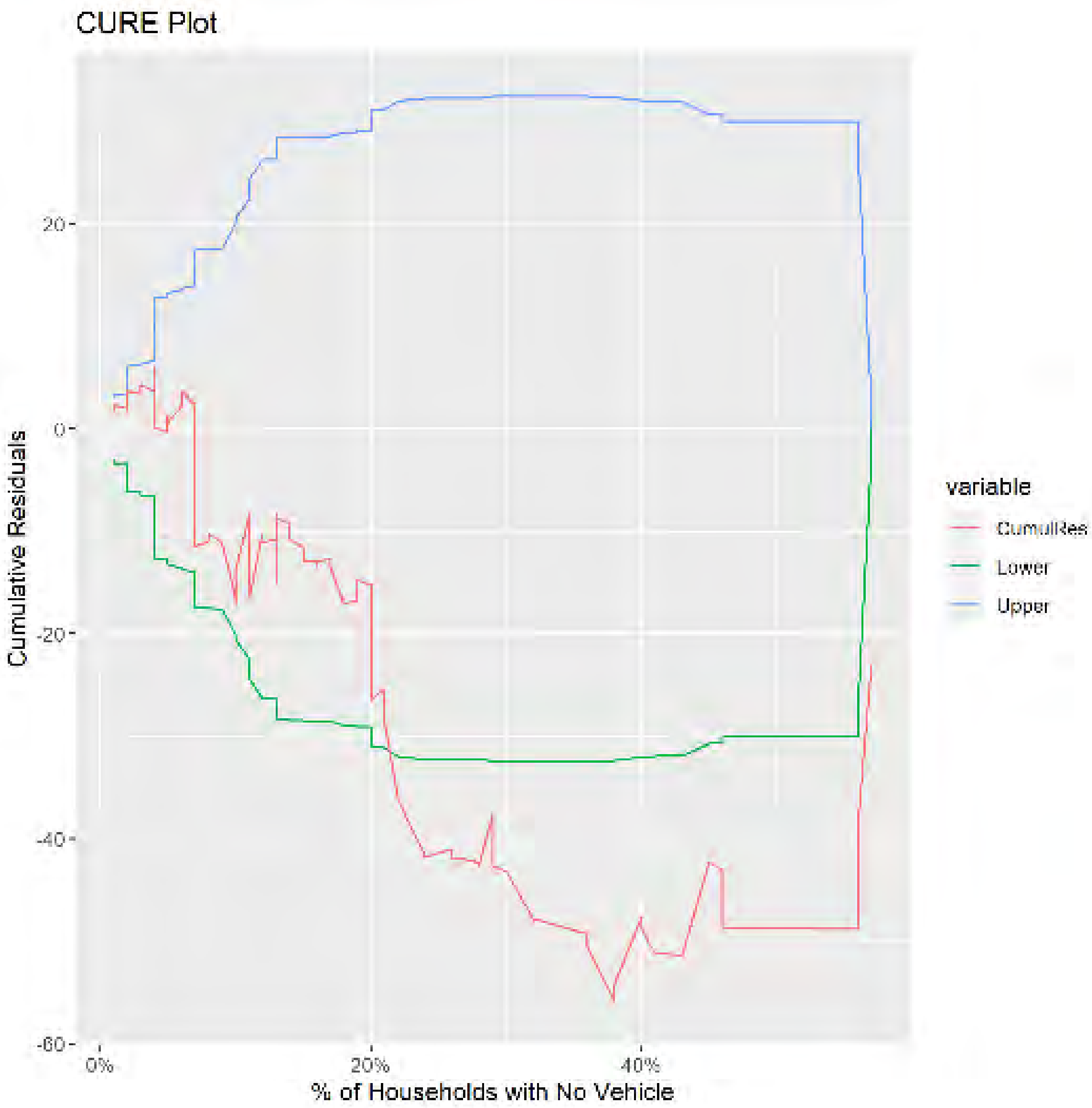
Sample Size (Number of Hwy Sections)	127
Total Length (All Sections)	61.69 mi
Observed Pedestrian Crash Count (All Sections)	325
PCD - ADT	5.51%
PCD – Population Density	20.47%
PCD - % of No-Vehicle Households	27.56%
PCD - % of Households Below Poverty Line	25.20%

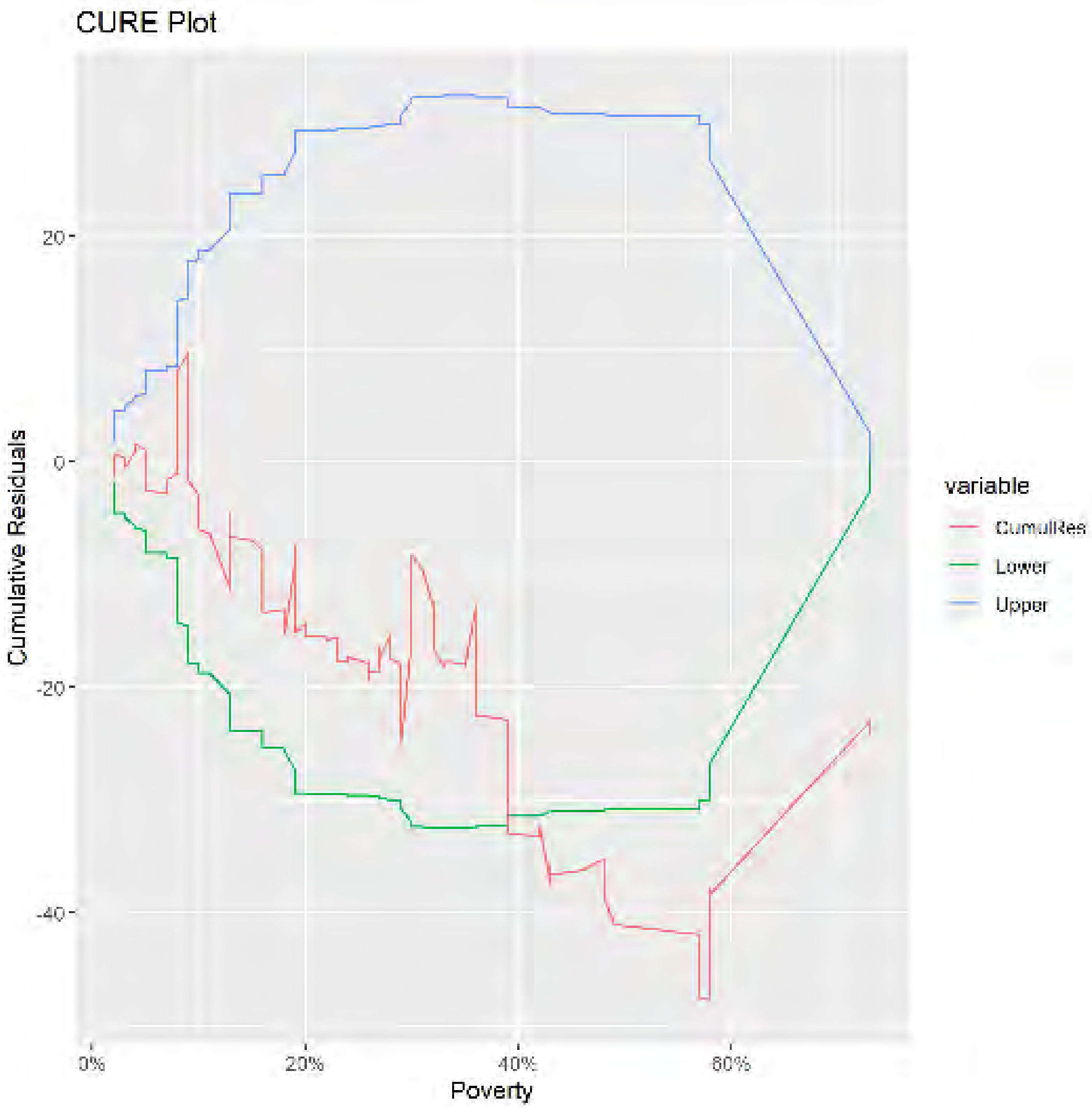
	Pedestrian Crashes	**Pedestrian Crashes Per Mile**	**ADT**	**Section Length (mi)**
Mean	2.56	7.02	26671.92	0.49
Std Dev	5.01	23.38	18242.55	0.46
Min	0	0	2400	0.01
Q1	0	0	11950	0.17
Median	1	1.85	22500	0.33
Q3	3	6.52	34100	0.62
Max	36	250	125900	2.55

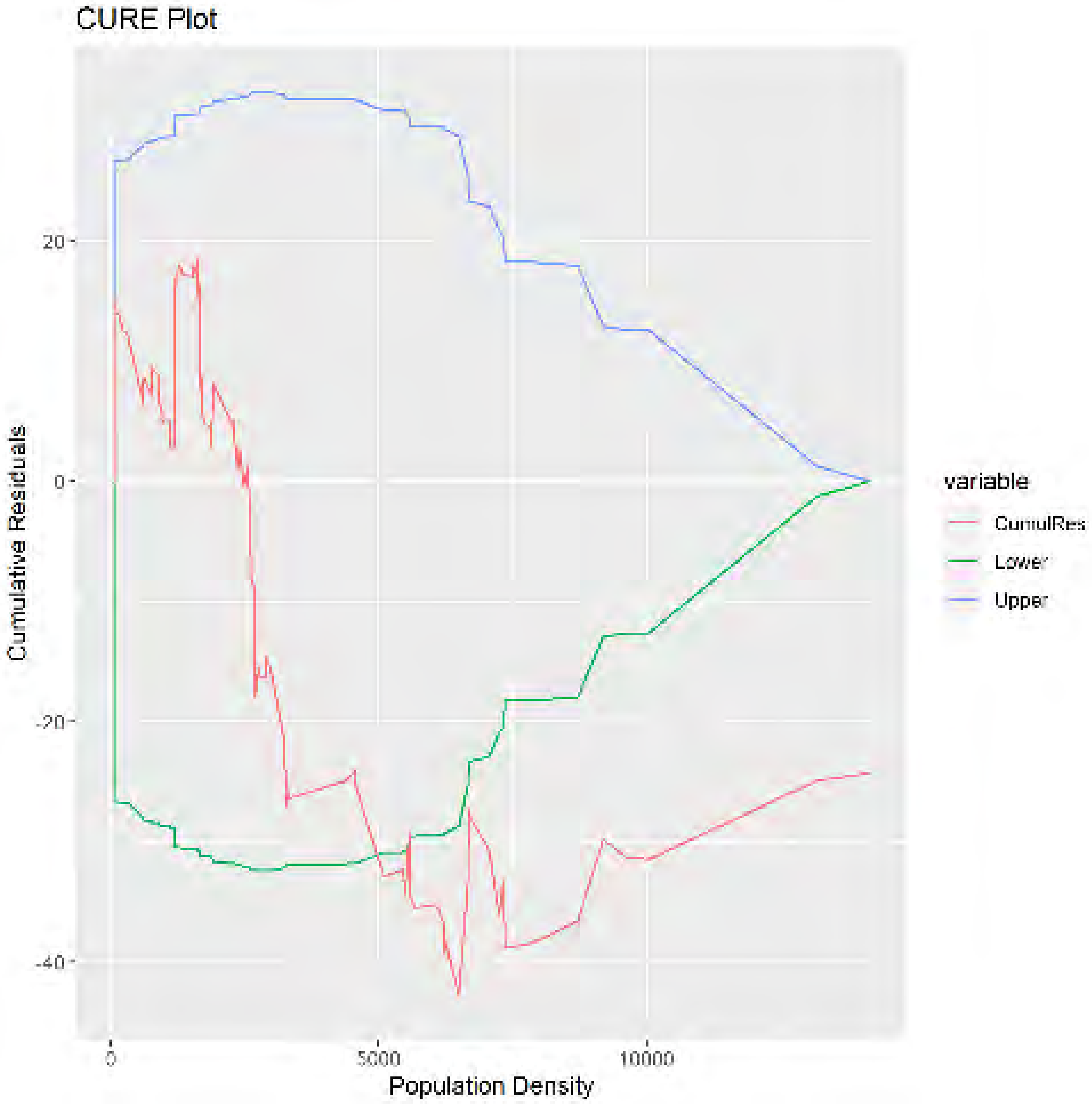
CURE PLOTS

Urban 6-Lane Highways




CURE Plot
Cumulative Residuals
20
0
-20
-40
-60
0%
20%
40%
% of Households with No Vehicle
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
20
0
-20
-40
0%
20%
40%
60%
Poverty
variable
CumulRes
Lower
Upper


CURE Plot
Cumulative Residuals
20
0
-20
-40
0
5000
10000
Population Density
variable
CumulRes
Lower
Upper

Maps – LOSS IV Sections[11]

District 02

- Jefferson
- Lafourche
- Orleans
- St. Bernard
- St. Charles
- Terrebonne

District 03

- Acadia
- Evangeline
- Iberia
- Lafayette
- St. Landry
- St. Martin
- St. Mary
- Vermillion

District 04

- Bienville
- Bossier
- Caddo
- DeSoto
- Red River
- Webster

District 05

- Lincoln
- Morehouse
- Ouachita
- Union
- West Carroll

District 07

- Beauregard
- Calcasieu
- Jefferson Davis

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[11] There were 16 Parishes in Louisiana which did not have any LOSS IV sections, so maps of these Parishes are not included.

District 08

- Avoyelles
- Natchitoches
- Rapides
- Sabine
- Vernon
- Winn

District 58

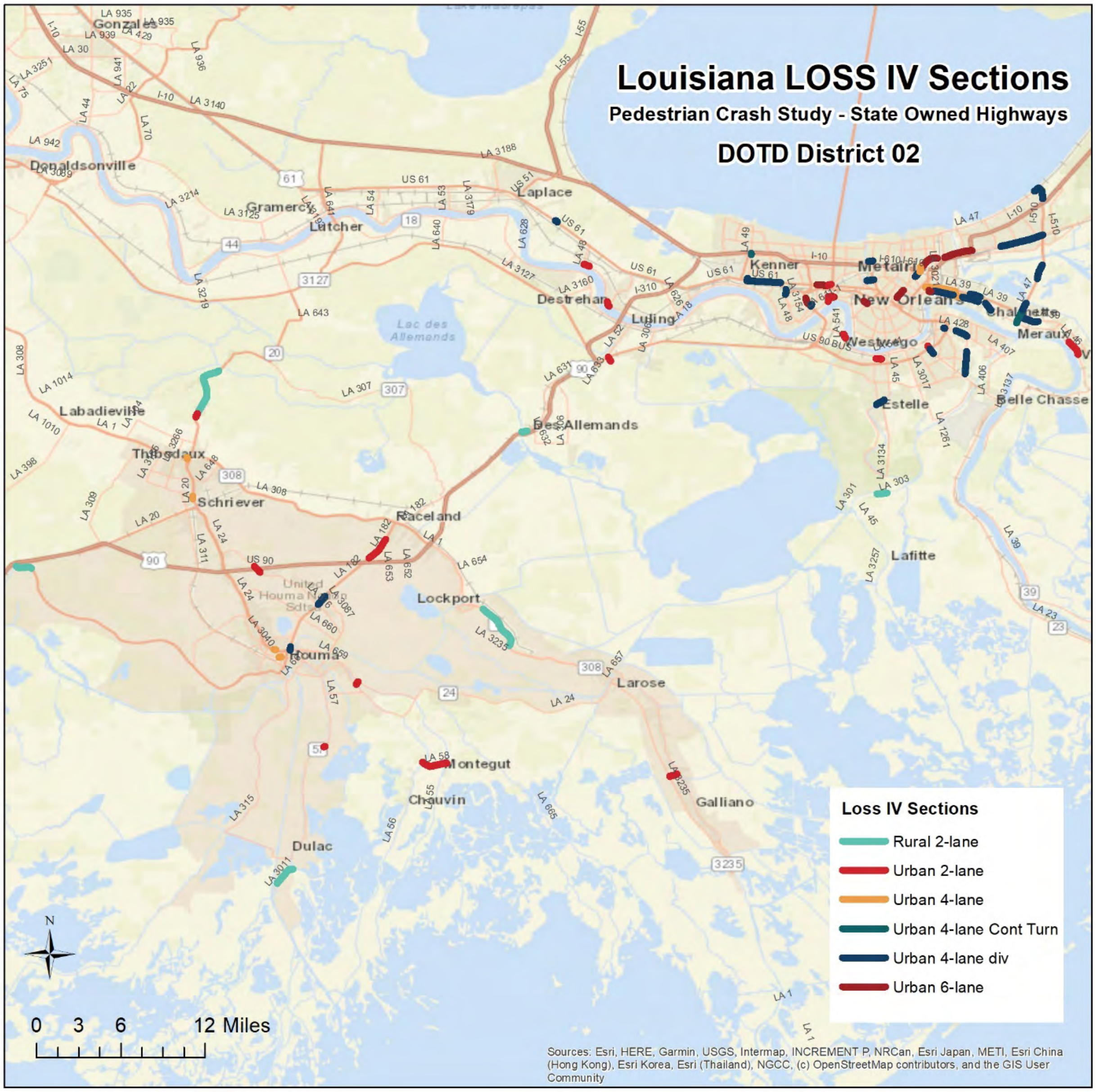
- Concordia
- Franklin
- Tensas

District 61

- Ascension
- Assumption
- East Baton Rouge
- Iberville
- St. James
- West Baton Rouge

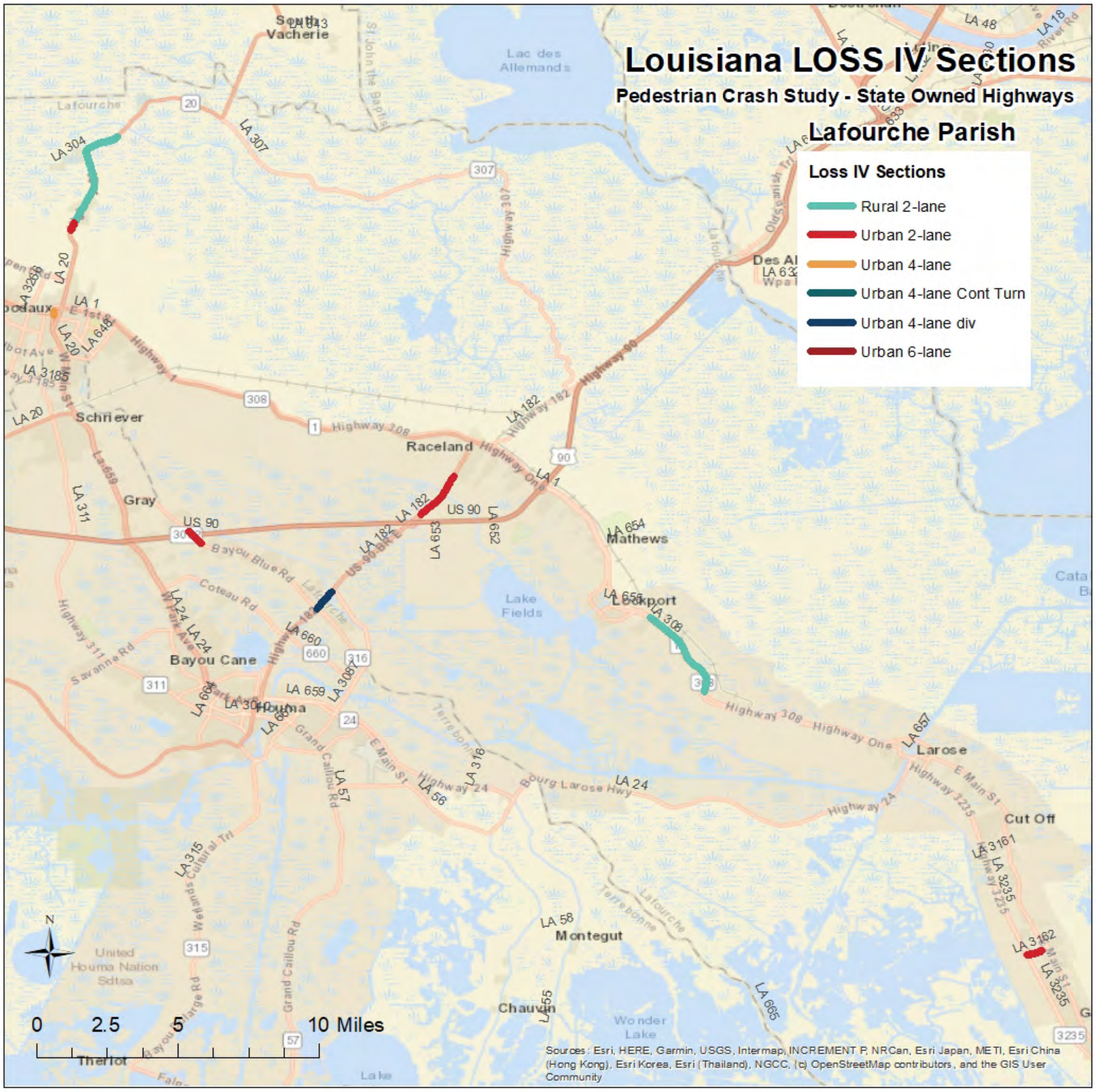
District 62

- Livingston
- St. John the Baptist
- St. Tammany
- Tangipahoa
- Washington

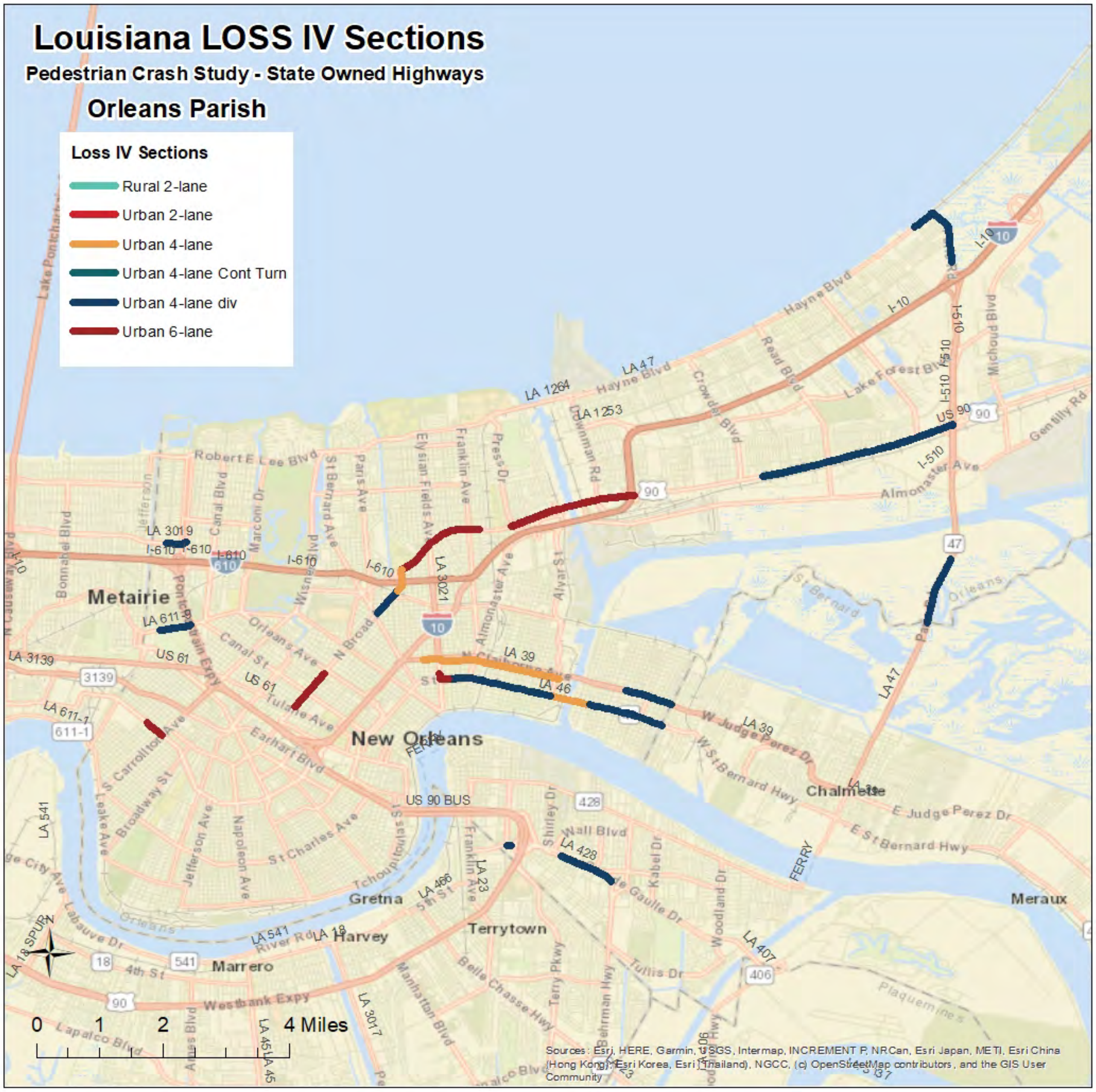


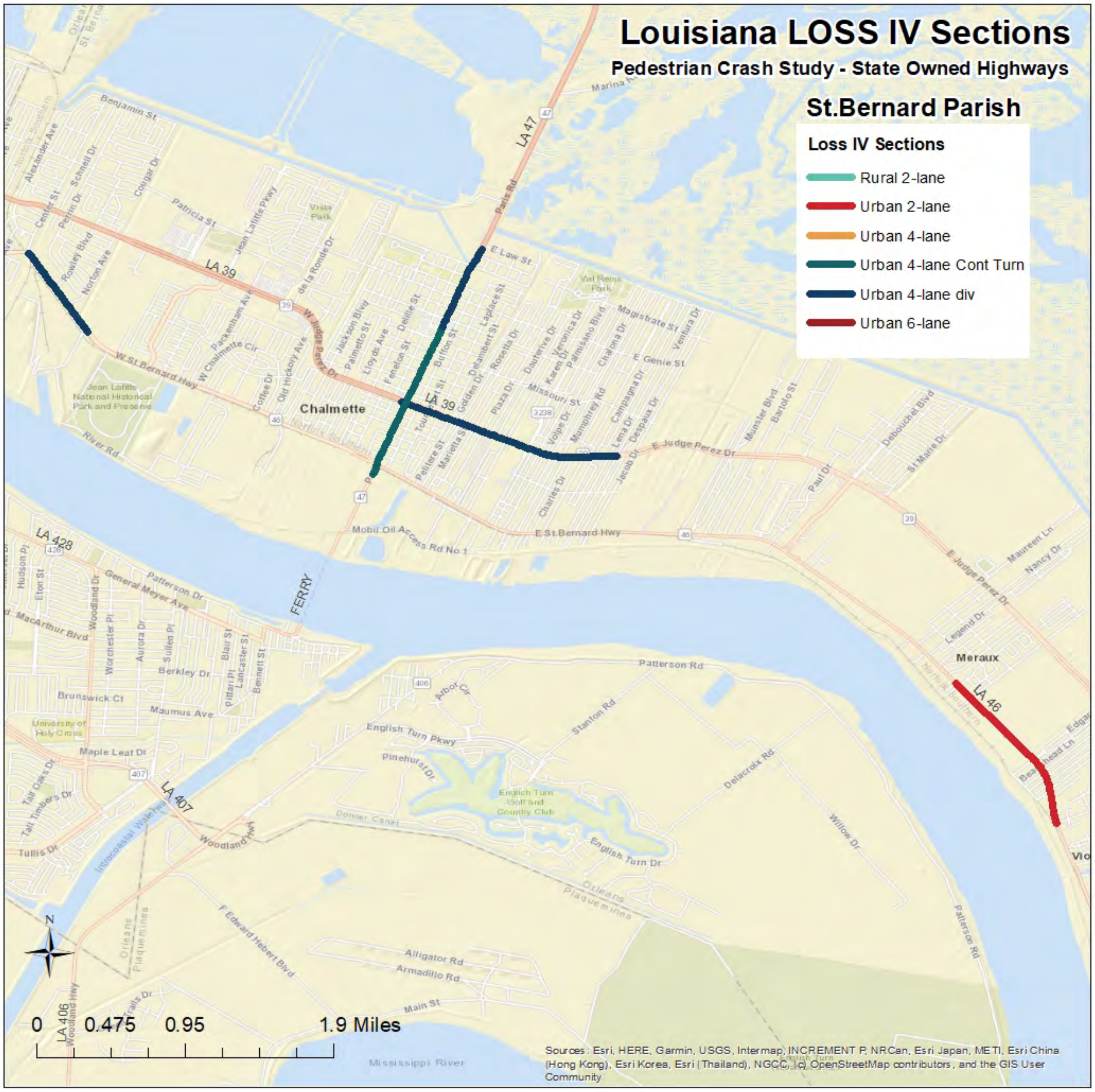
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Jefferson Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Kenner
Metairie
River Ridge
Elmwood
Harahan
Waggaman
Avondale
Gretna
Harvey
Terrytown
Marrero
Woodmere
Estelle
Lake Catouatchie
Couba Island
Jean Lafitte National Historical Park and Preserve
Nas Joint Reserve Base New Orleans
I-10
LA 49
US 61
LA 48
LA 3155
LA 3139
LA 3154
LA 3152
LA 611-1
LA 541
LA 18
US 90 BUS
LA 3018
LA 23
LA 428
LA 45
LA 3134
LA 3017
LA 1261
LA 39
LA 301
LA 303
N
0
1.25
2.5
5 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

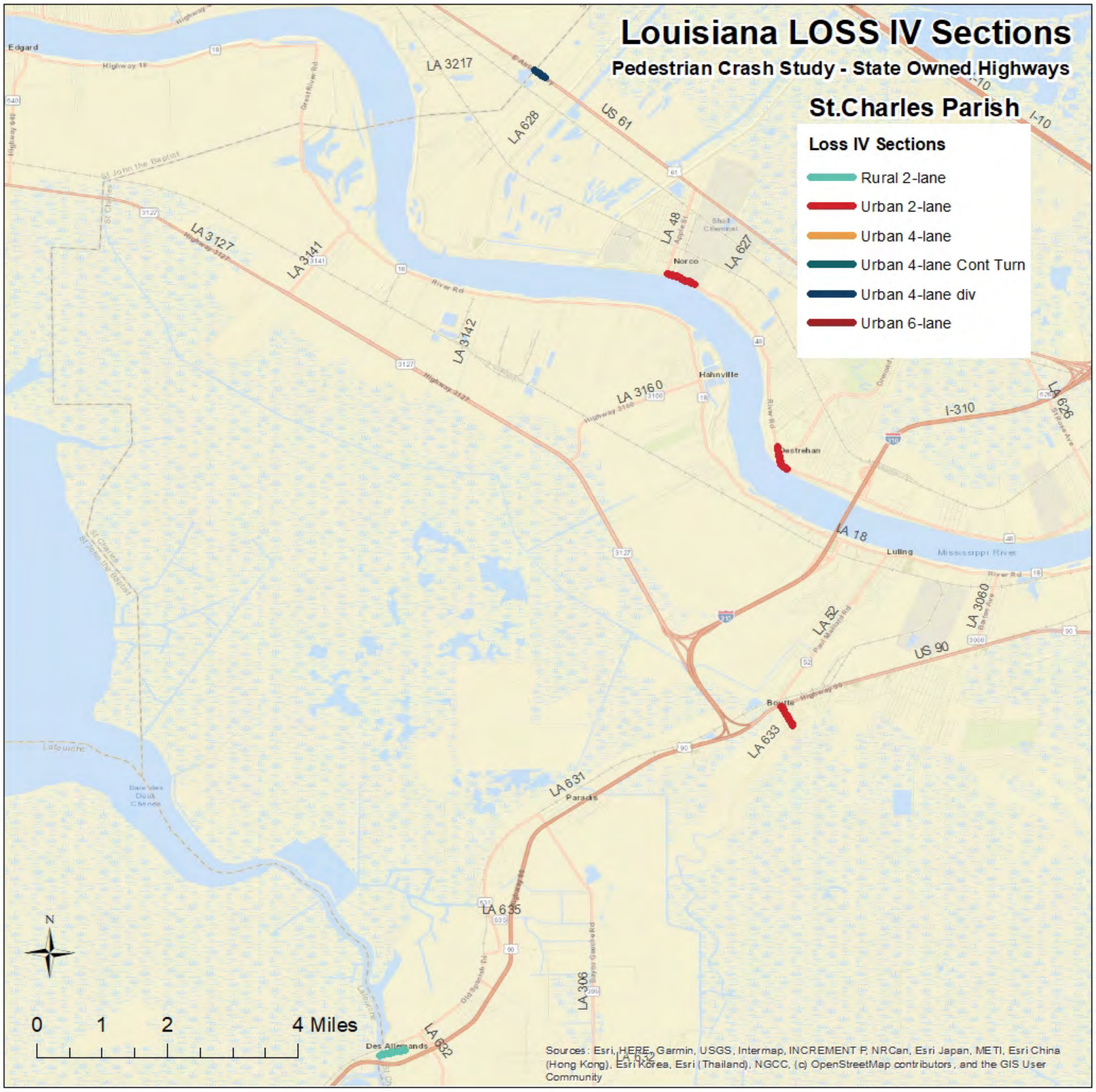


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Orleans Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Metairie
New Orleans
Chalmette
Gretna
Terrytown
Harvey
Marrero
Meraux
0 1 2 4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Louisiana LOSS IV Sections

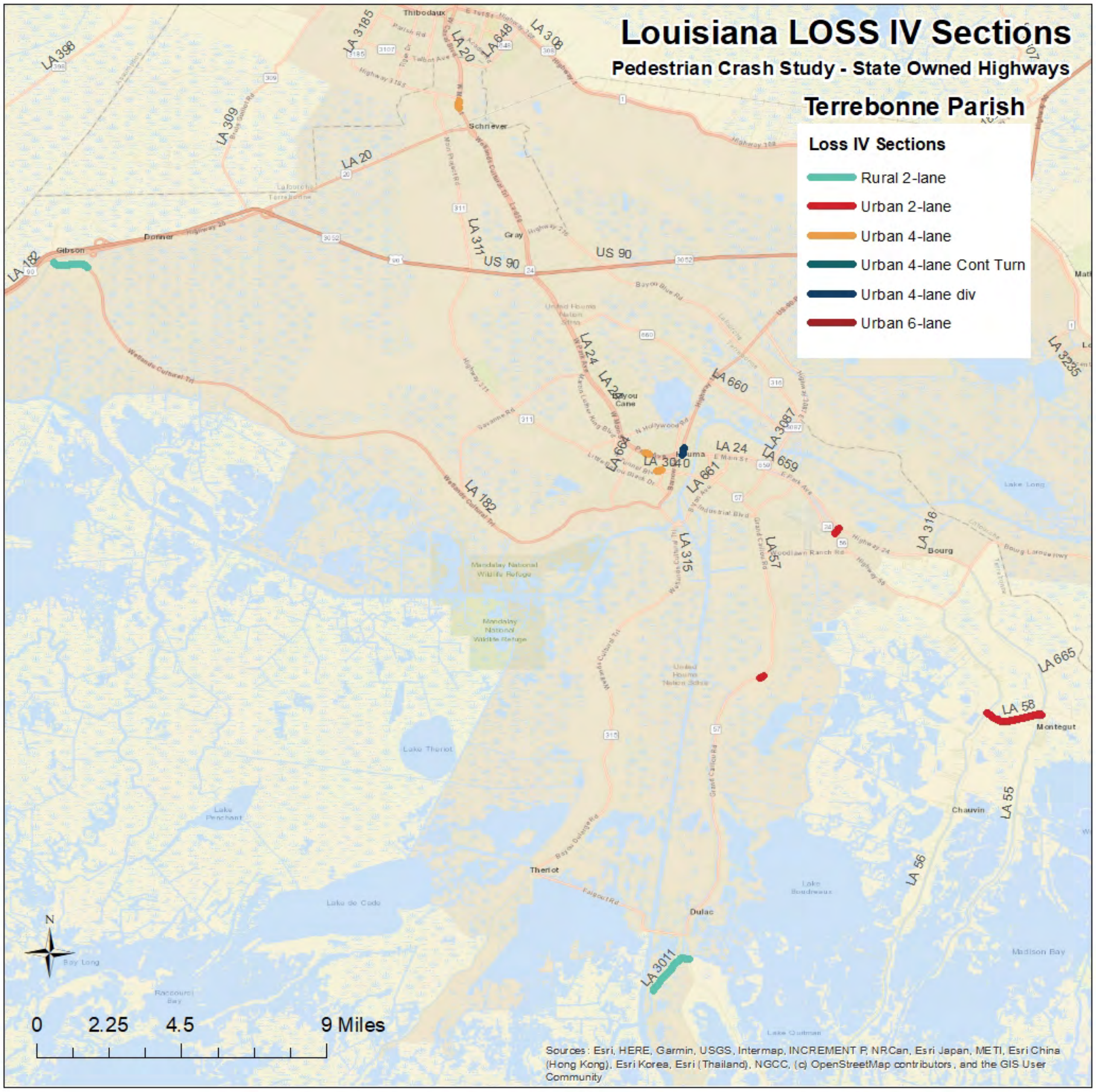
Pedestrian Crash Study - State Owned Highways

St.Charles Parish

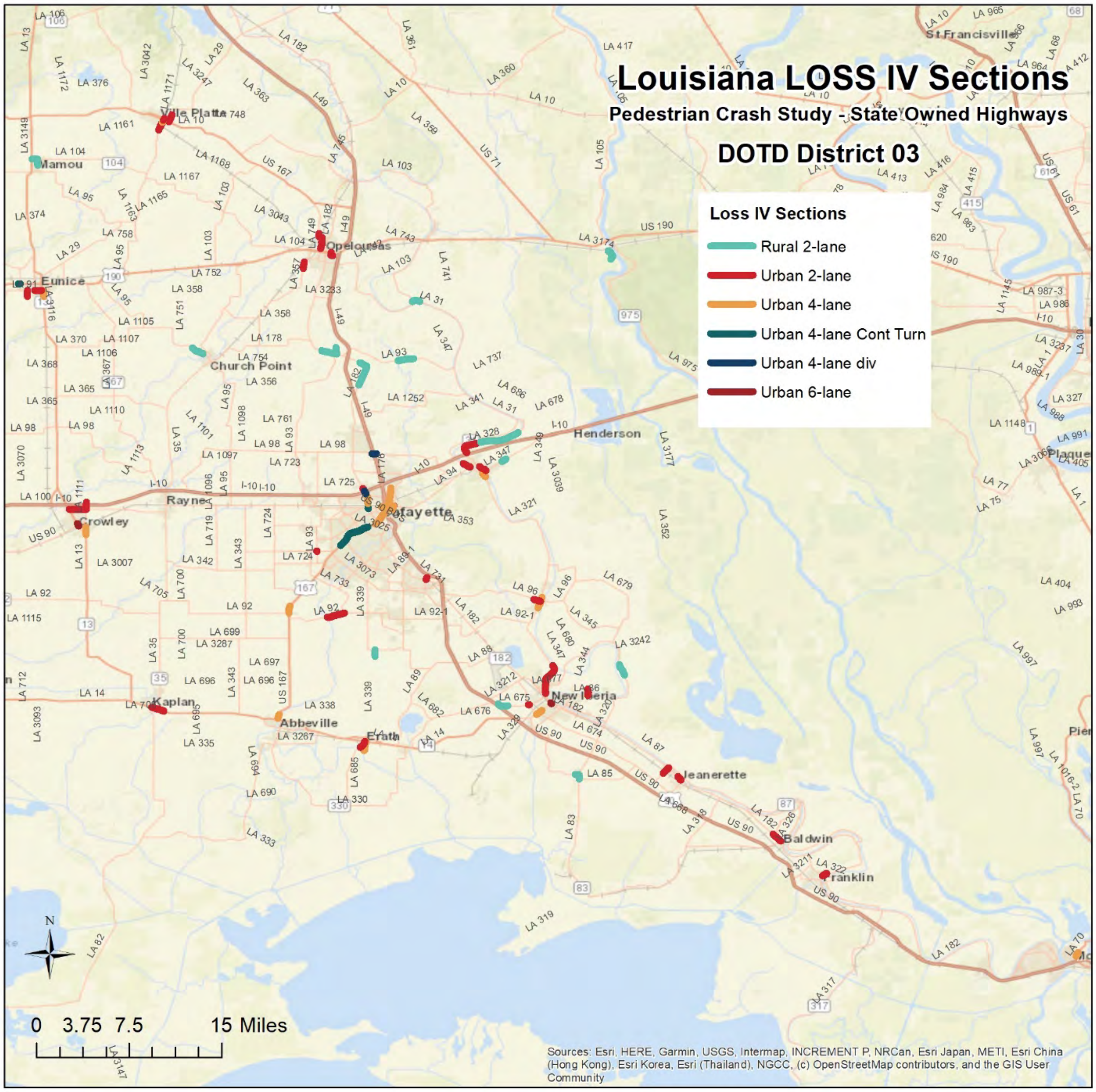
Loss IV Sections

- 🟩 Rural 2-lane
- 🟥 Urban 2-lane
- 🟧 Urban 4-lane
- 🟦 Urban 4-lane Cont Turn
- 🟦 Urban 4-lane div
- 🟥 Urban 6-lane

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

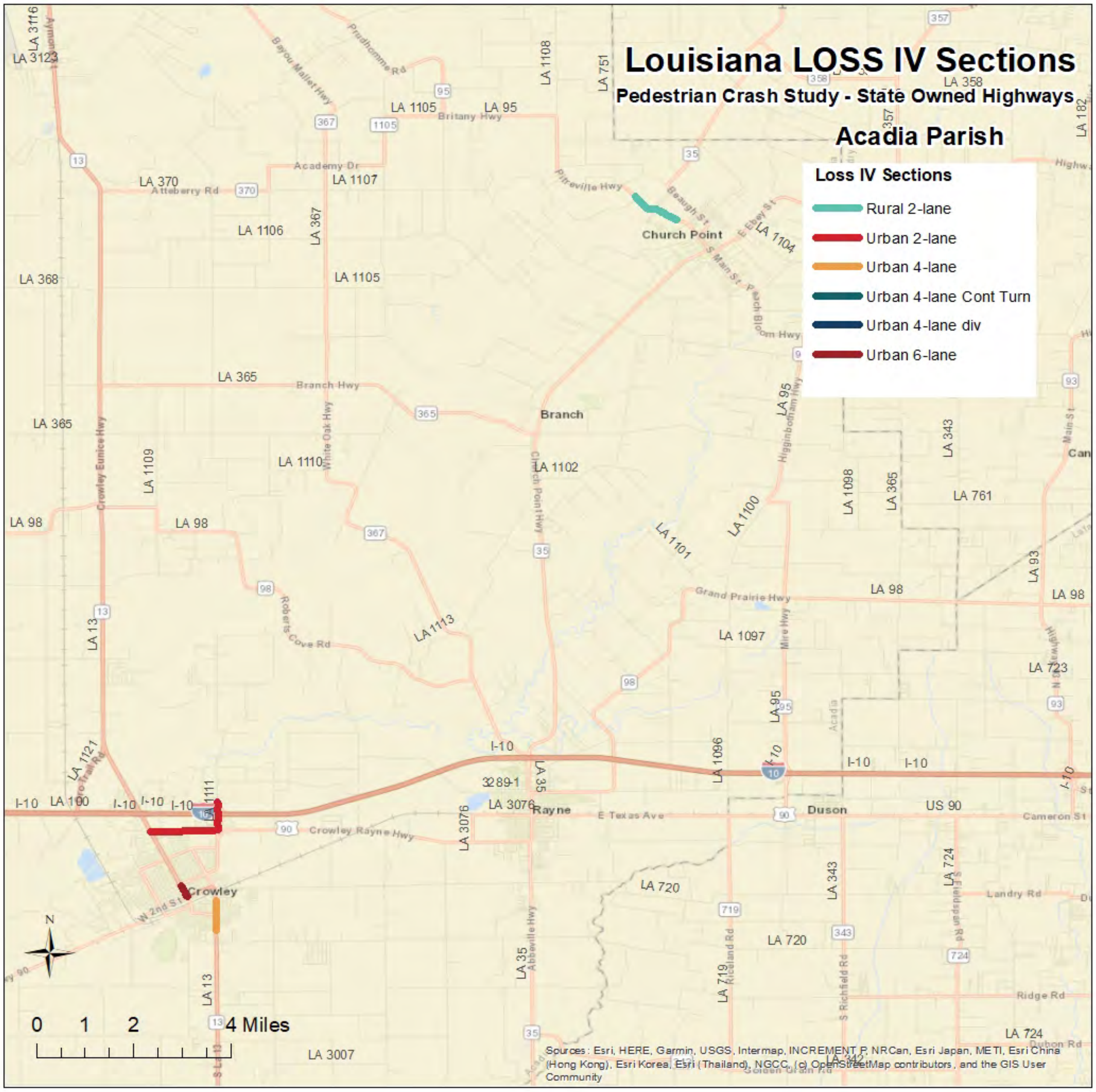


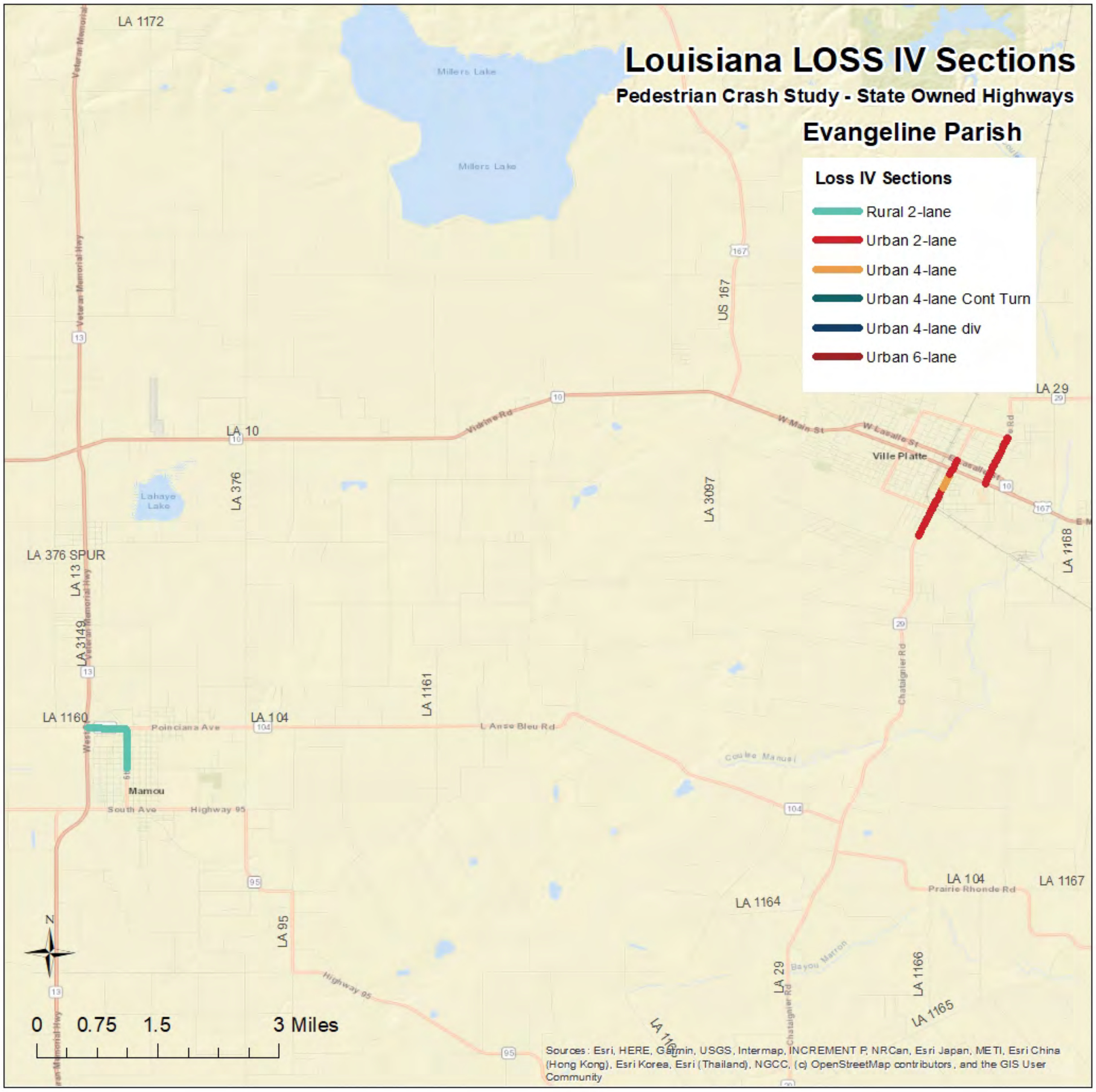
Louisiana LOSS IV Sections

Pedestrian Crash Study - State Owned Highways

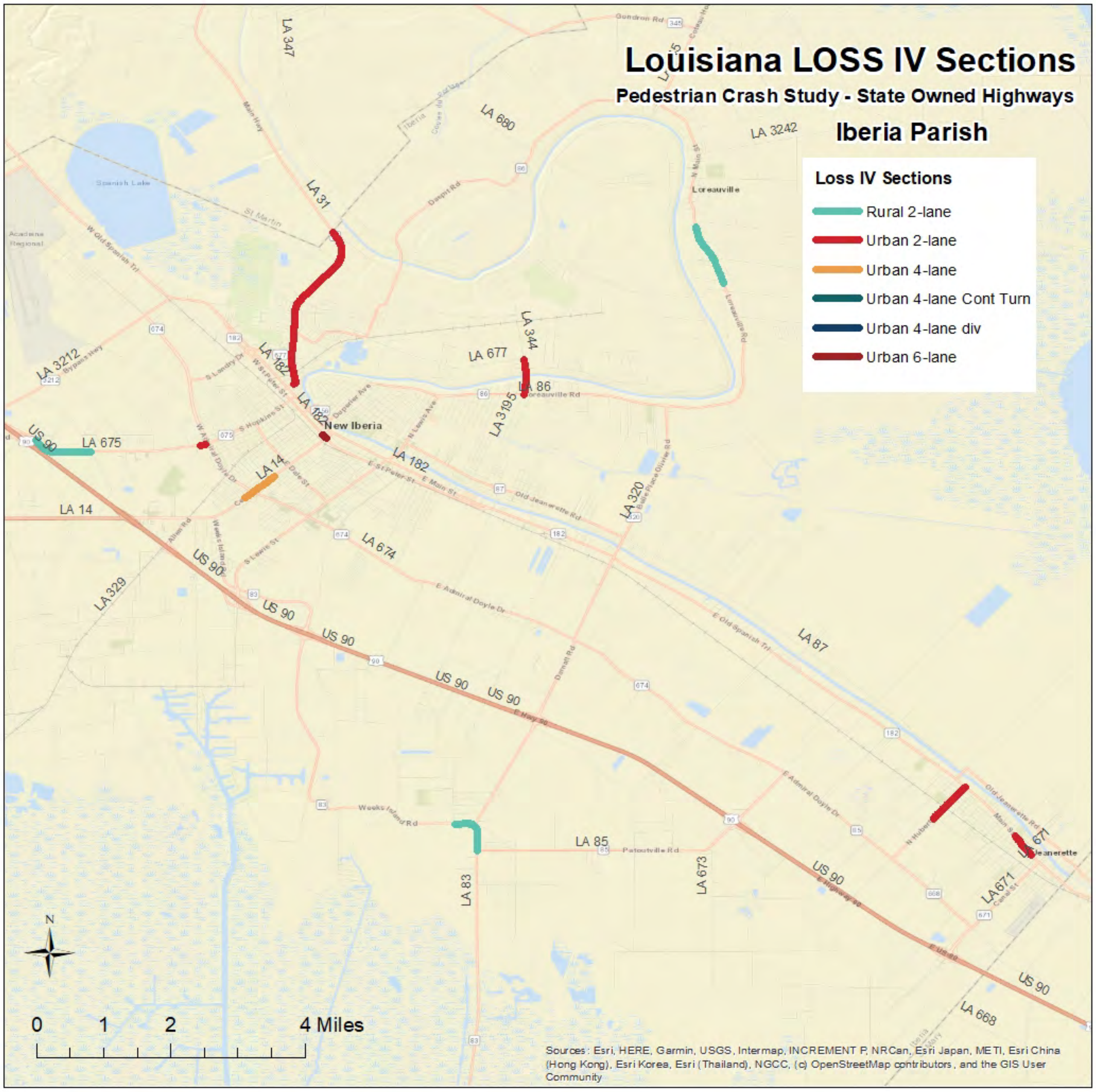
DOTD District 03

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

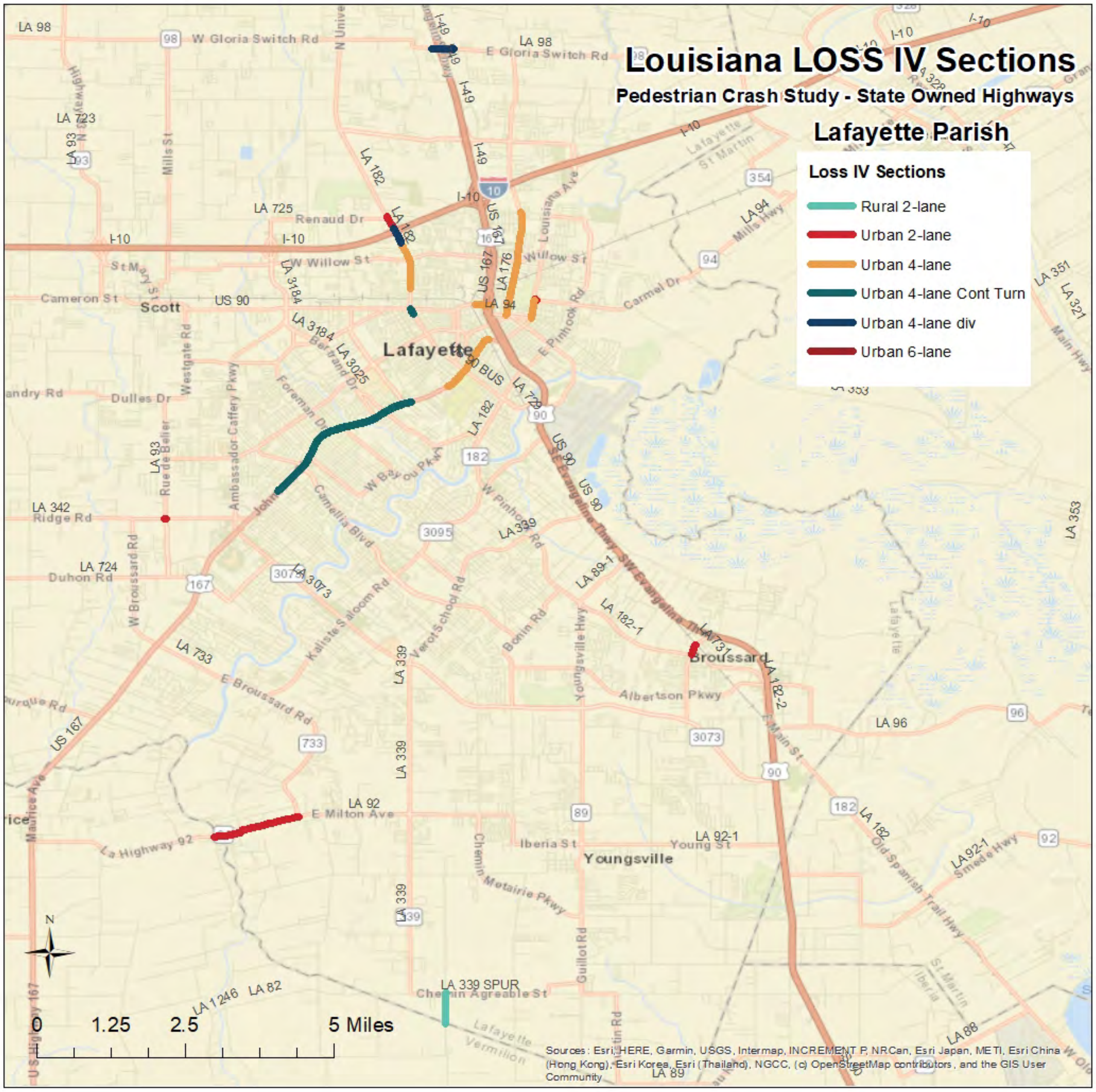

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Acadia Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Church Point
Branch
Rayne
Duson
Crowley
I-10
US 90
LA 13
LA 35
LA 95
LA 98
LA 365
LA 367
N
0 1 2 4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

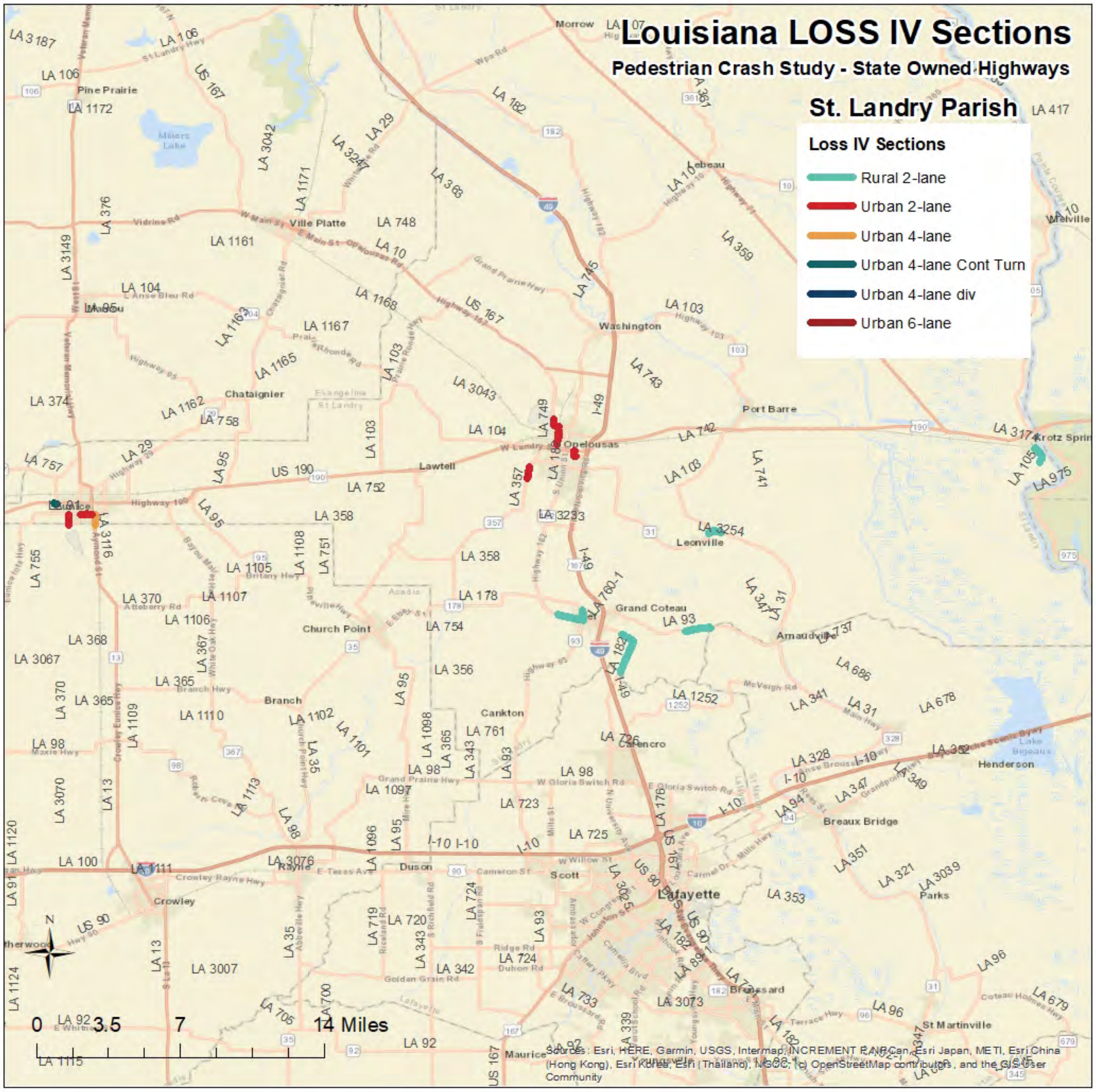


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

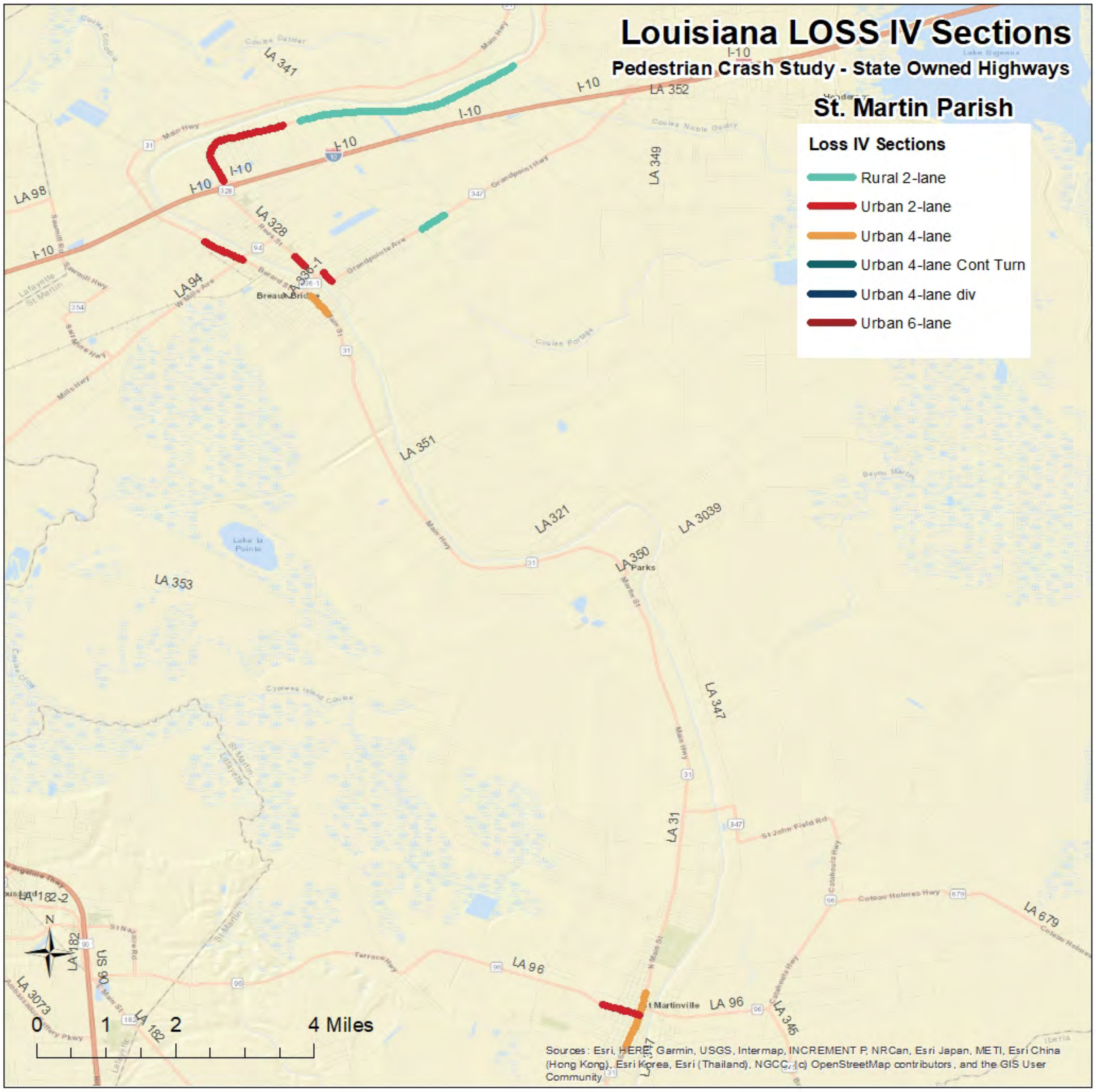


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

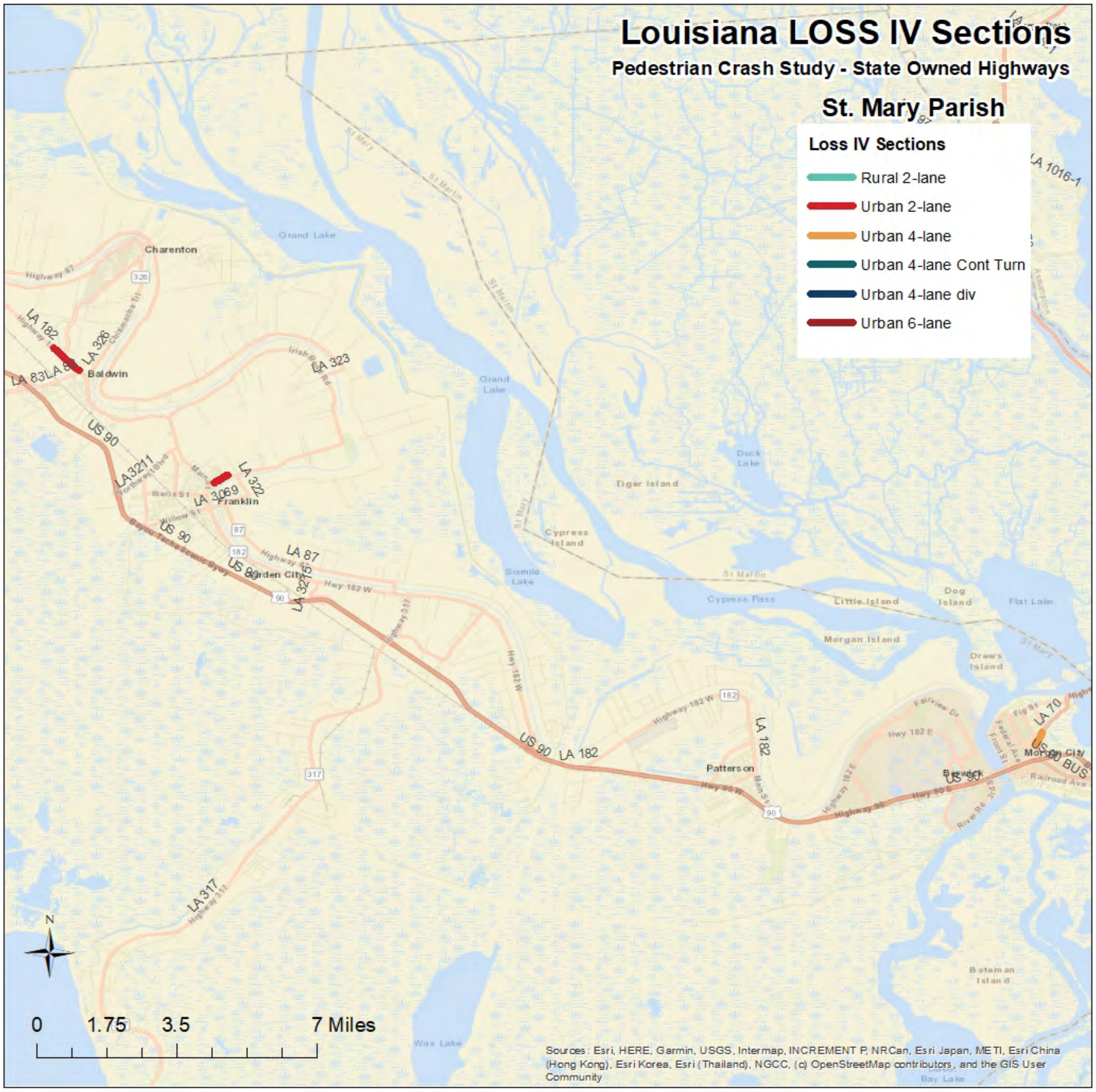

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Lafayette Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Lafayette
Scott
Broussard
Youngsville
I-10
I-49
US 90
US 167
LA 182
LA 94
LA 92
LA 339
LA 339 SPUR
LA 342
LA 93
LA 98
LA 733
LA 89
LA 96
N
0 1.25 2.5 5 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

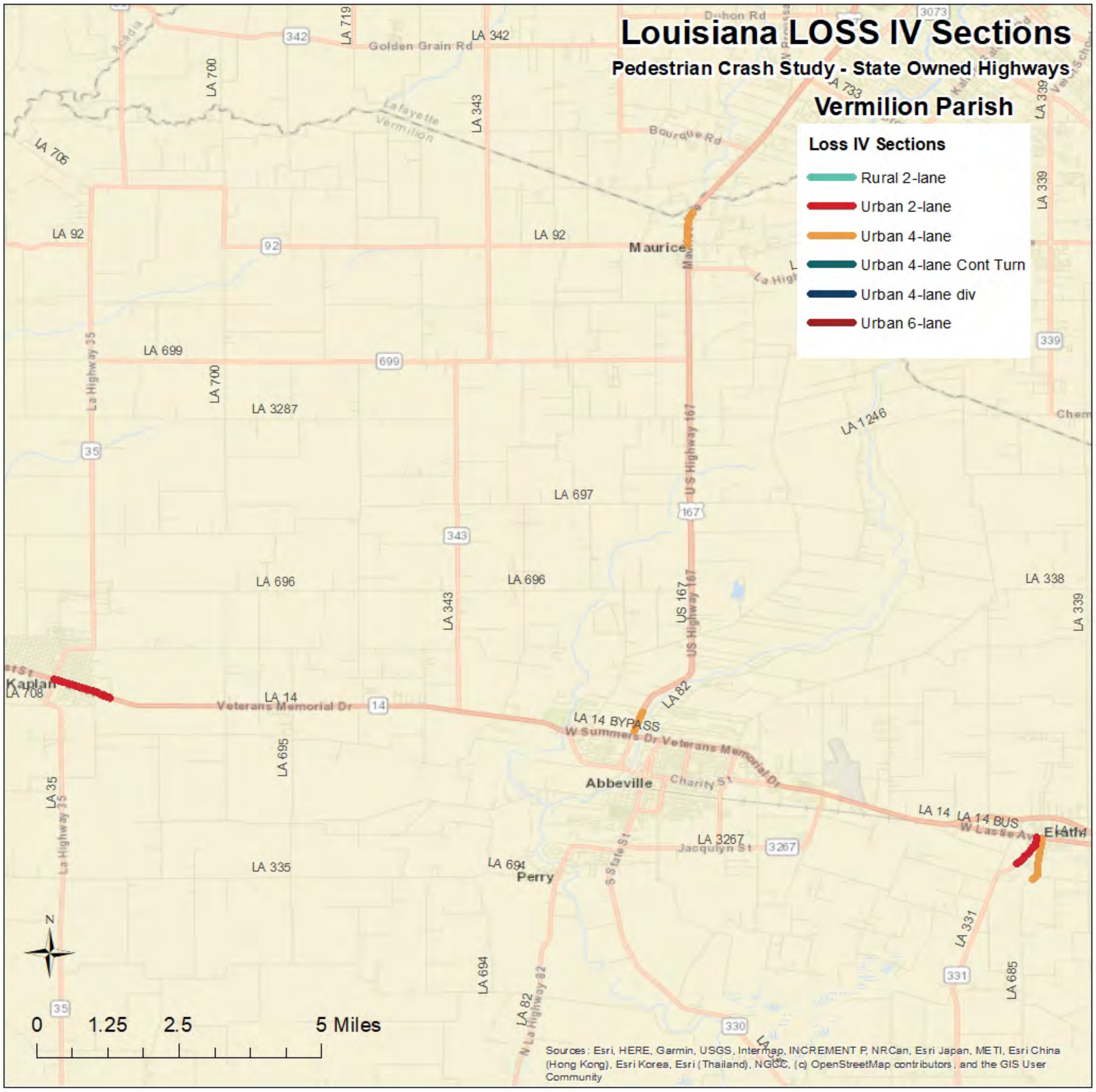


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

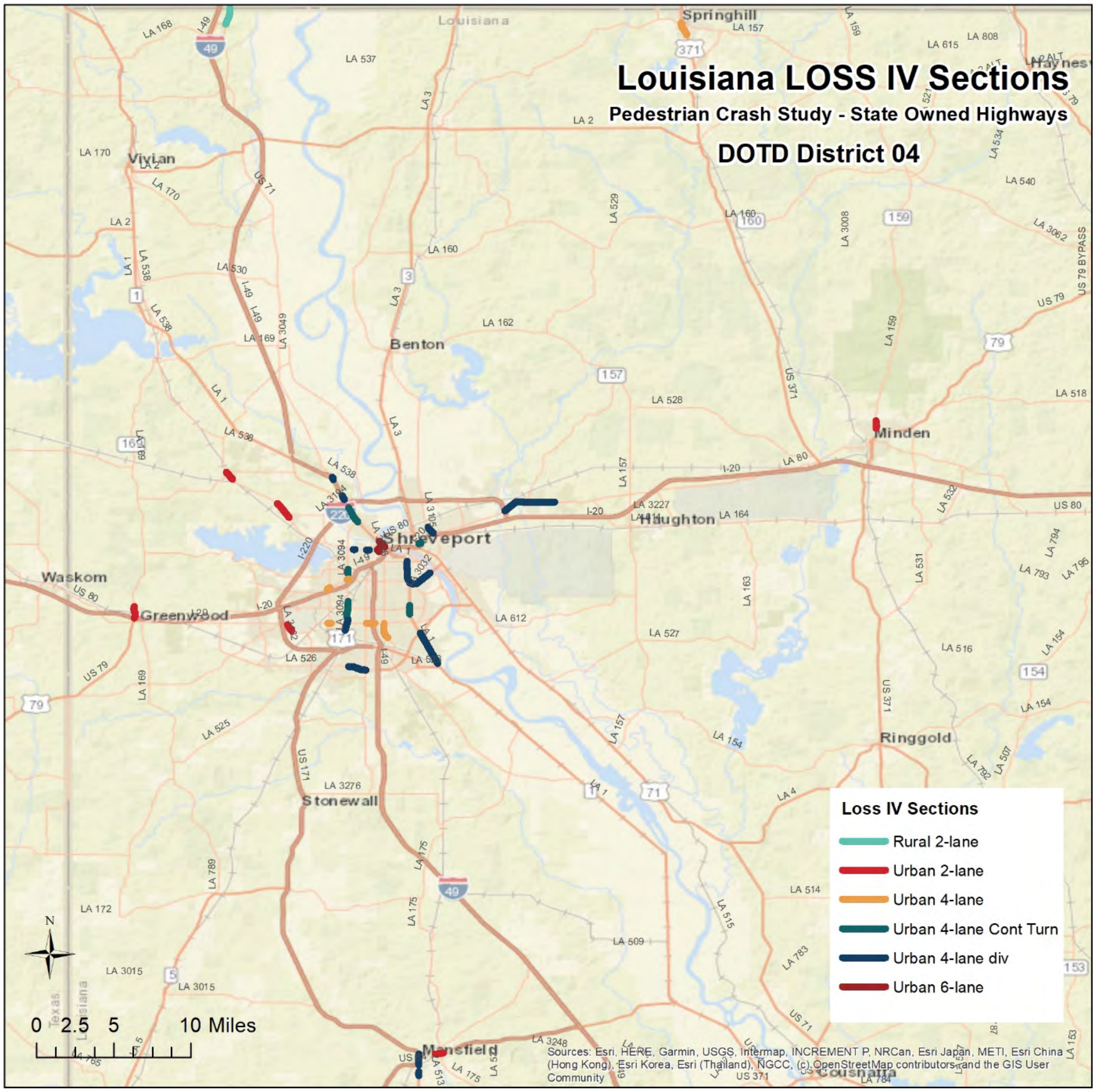


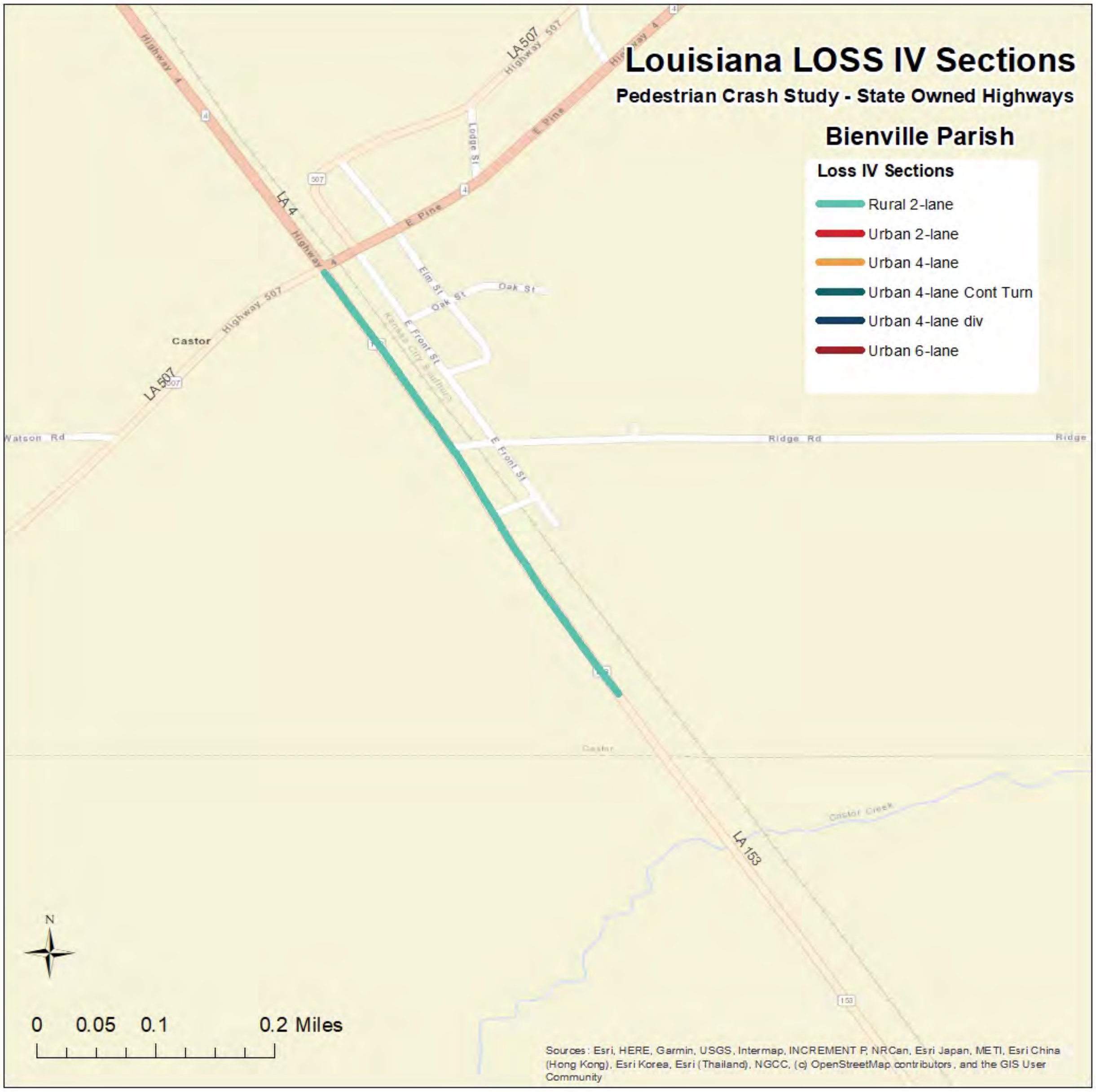
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
St. Mary Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Charenton
Grand Lake
LA 182
LA 326
LA 83
Baldwin
LA 323
US 90
LA 3211
LA 3069
LA 322
Franklin
LA 87
Garden City
LA 3215
Tiger Island
Duck Lake
Cypress Island
Sixmile Lake
Cypress Pass
Little Island
Dog Island
Flat Lake
Morgan Island
Drews Island
LA 182
Patterson
Berwick
Morgan City
LA 70
US 90 BUS
LA 1016-1
LA 317
Bateman Island
Wax Lake
Bay Lake
N
0 1.75 3.5 7 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
DOTD District 04
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
N
0 2.5 5 10 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Springhill
Vivian
Benton
Minden
Shreveport
Haughton
Waskom
Greenwood
Ringgold
Stonewall
Mansfield
Coushatta
Texas
Louisiana
I-20
I-220
I-49
US 71
US 79
US 80
US 171
US 371

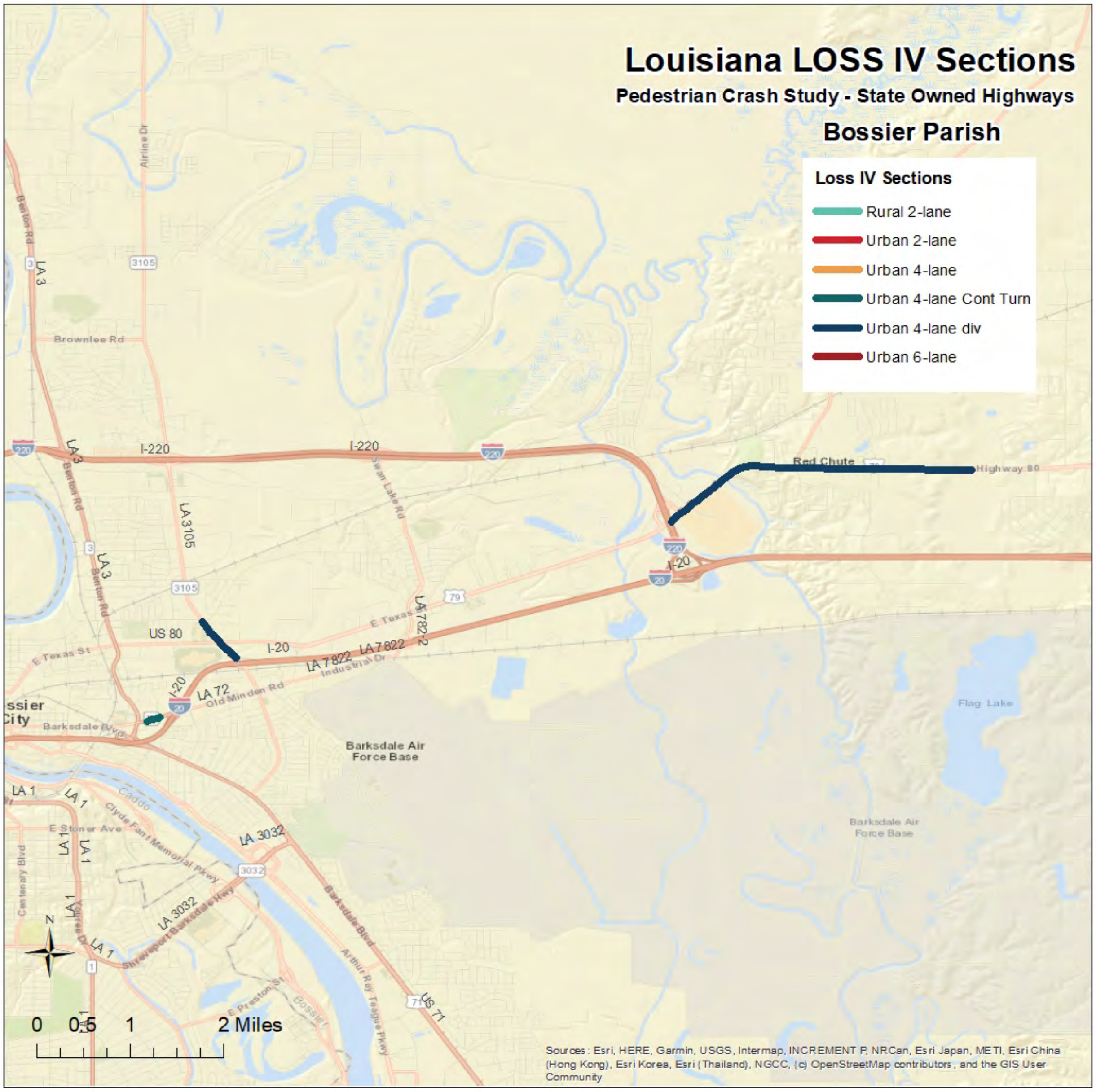


Louisiana LOSS IV Sections

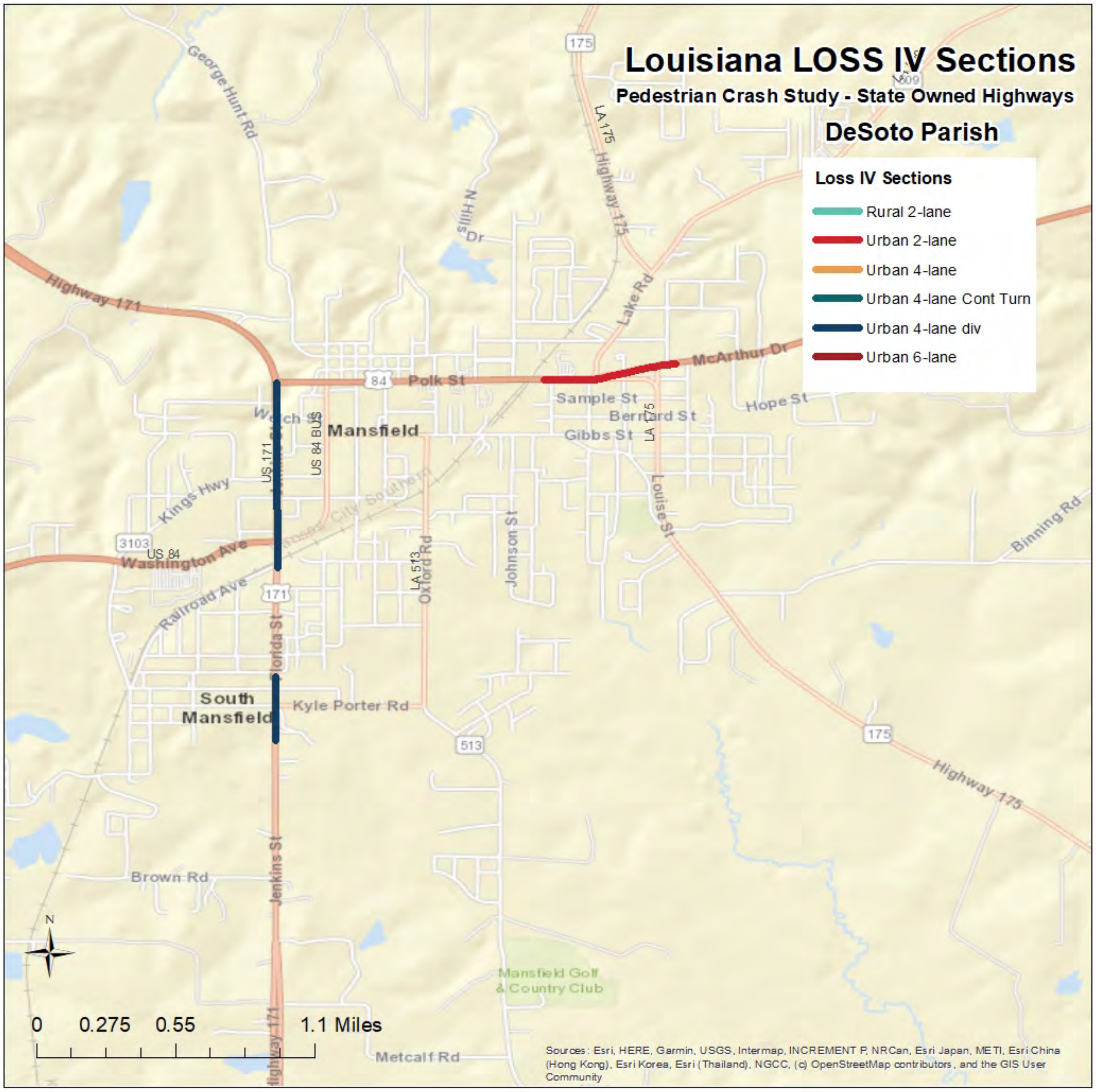
Pedestrian Crash Study - State Owned Highways

Bienville Parish

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Bossier Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
I-220
I-220
LA 3105
US 80
I-20
I-20
I-20
LA 72
LA 7822
LA 7822
LA 3
LA 3
Benton Rd
Brownlee Rd
Airline Dr
Swan Lake Rd
E Texas St
Industrial Dr
Old Minden Rd
Barksdale Blvd
Red Chute
Highway 80
Barksdale Air Force Base
Flag Lake
LA 1
LA 3032
LA 3032
Clyde Fant Memorial Pkwy
Shreveport Barksdale Hwy
E Stoner Ave
Centenary Blvd
Arthur Ray Teague Pkwy
US 71
Bossier City
N
0 0.5 1 2 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

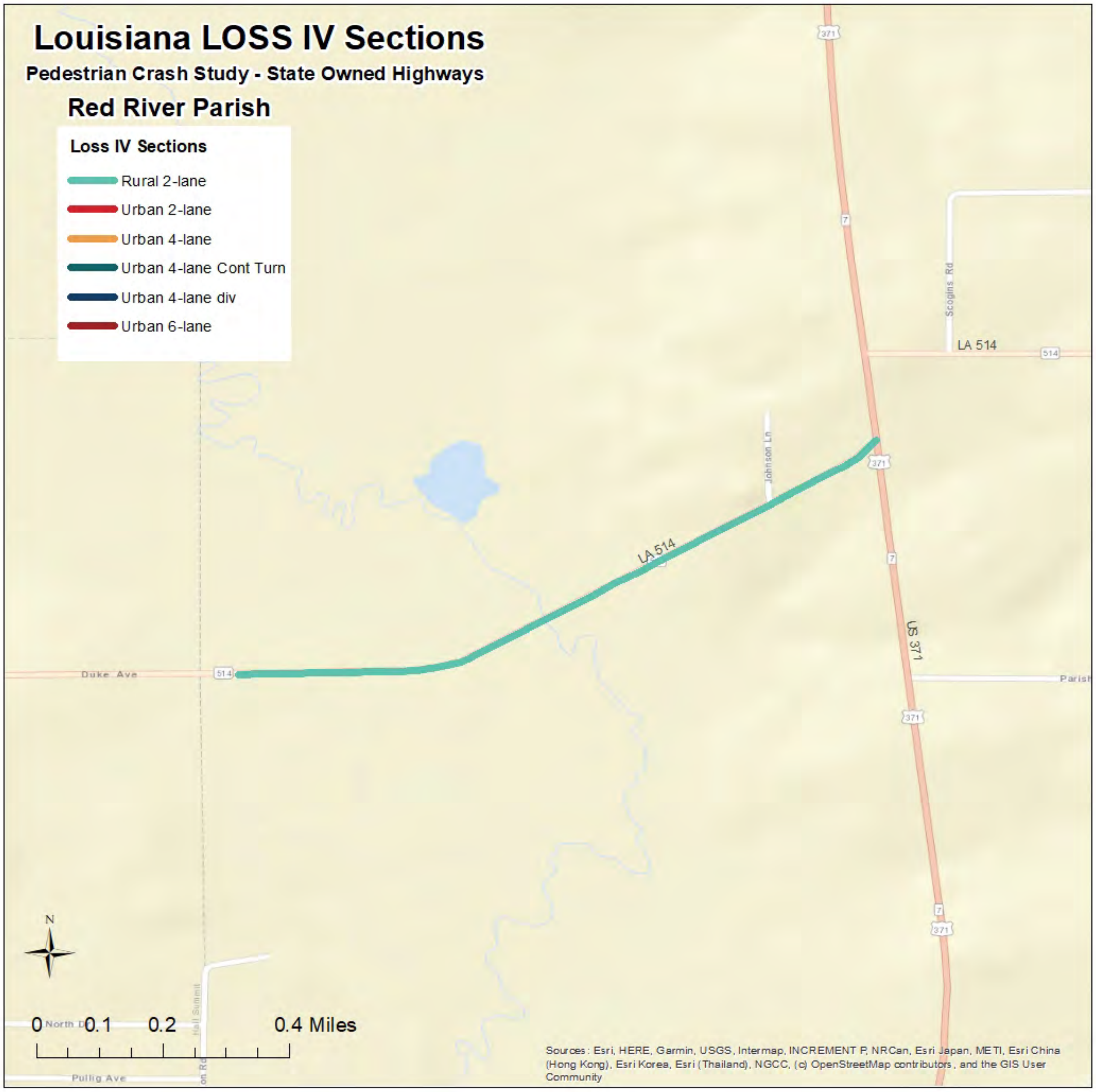


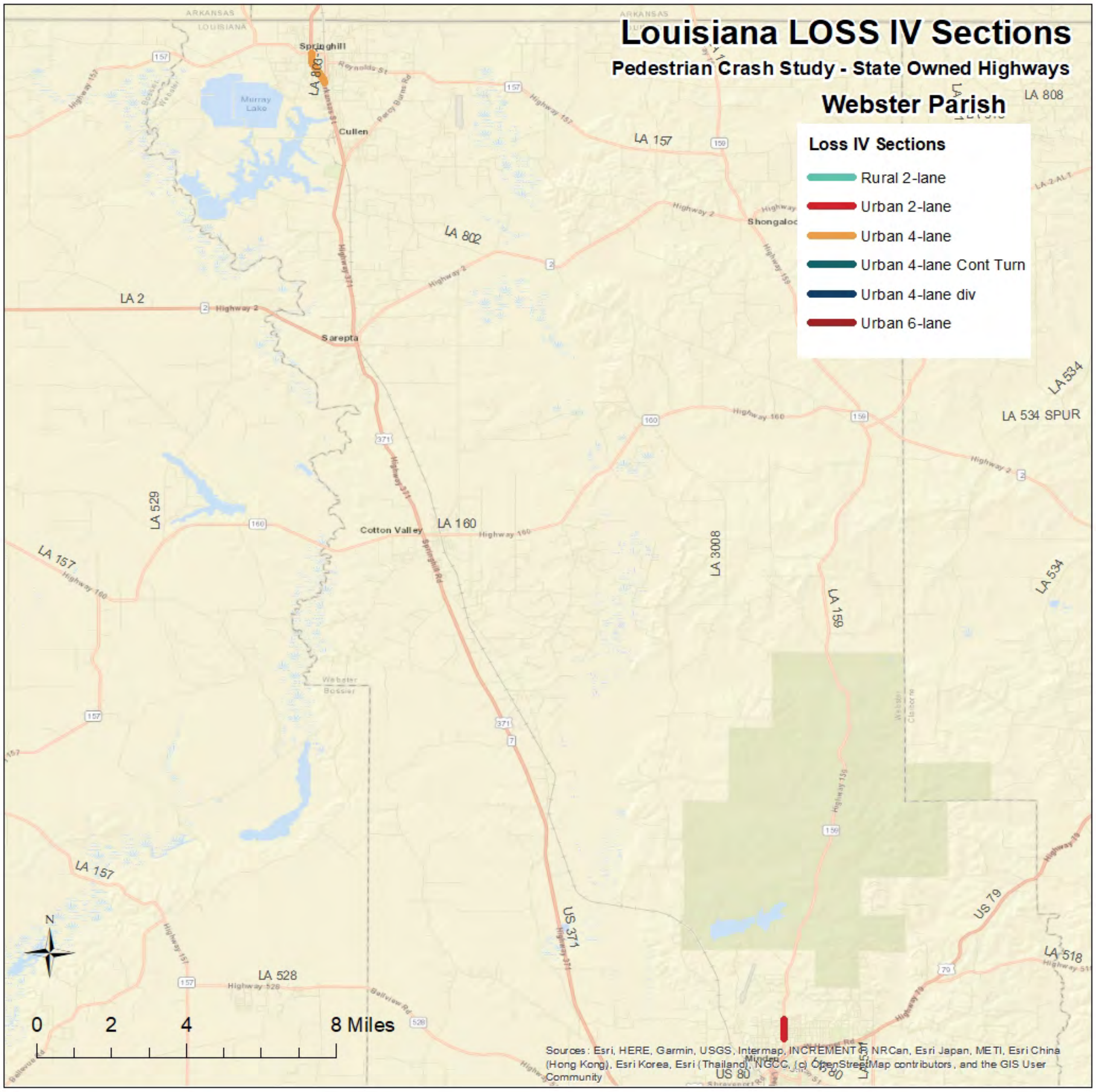
Louisiana LOSS IV Sections

Pedestrian Crash Study - State Owned Highways

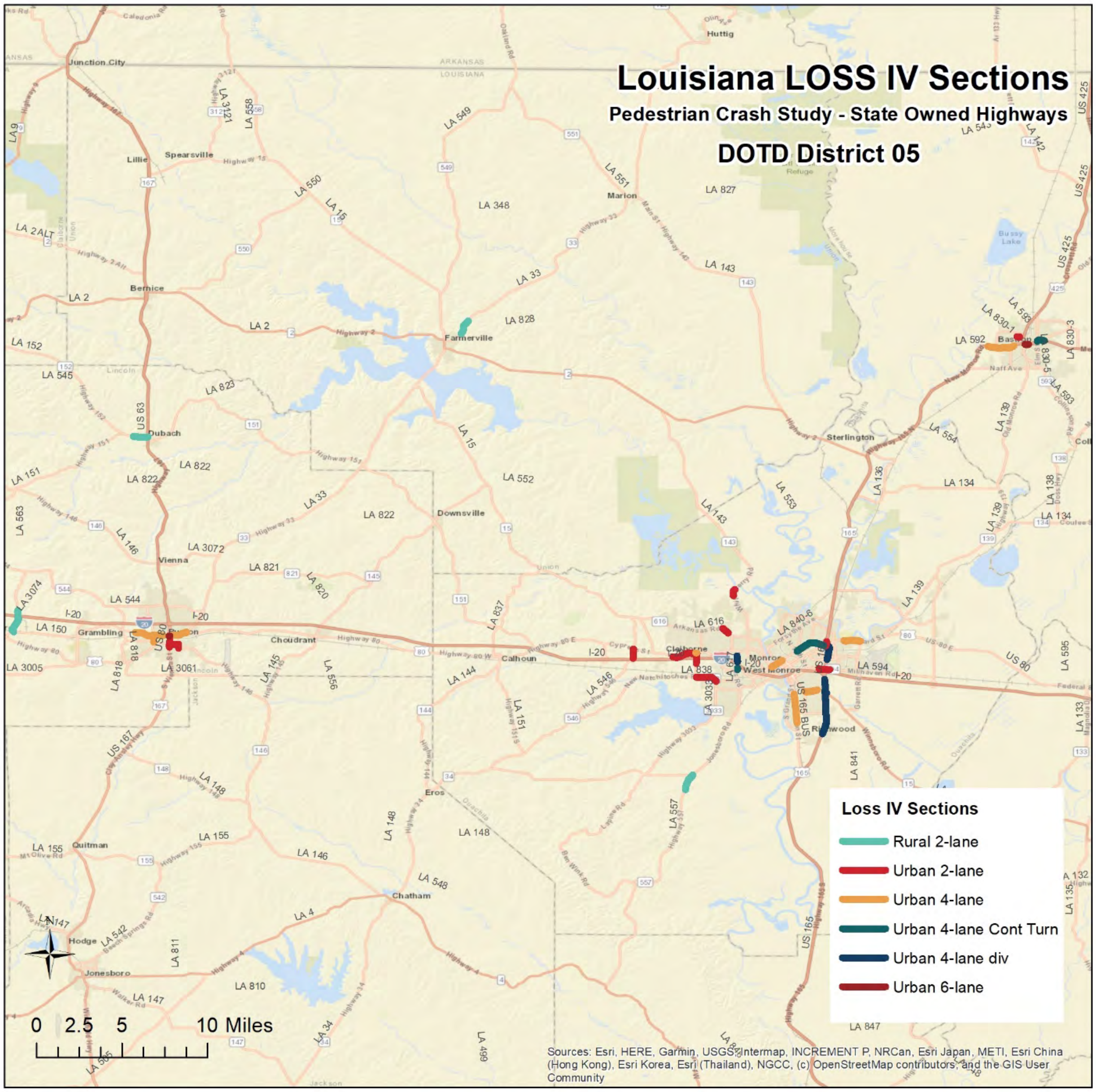
DeSoto Parish

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Red River Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
LA 514
US 371
Scogins Rd
Johnson Ln
Duke Ave
Pullig Ave
Parish
N
0 0.1 0.2 0.4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

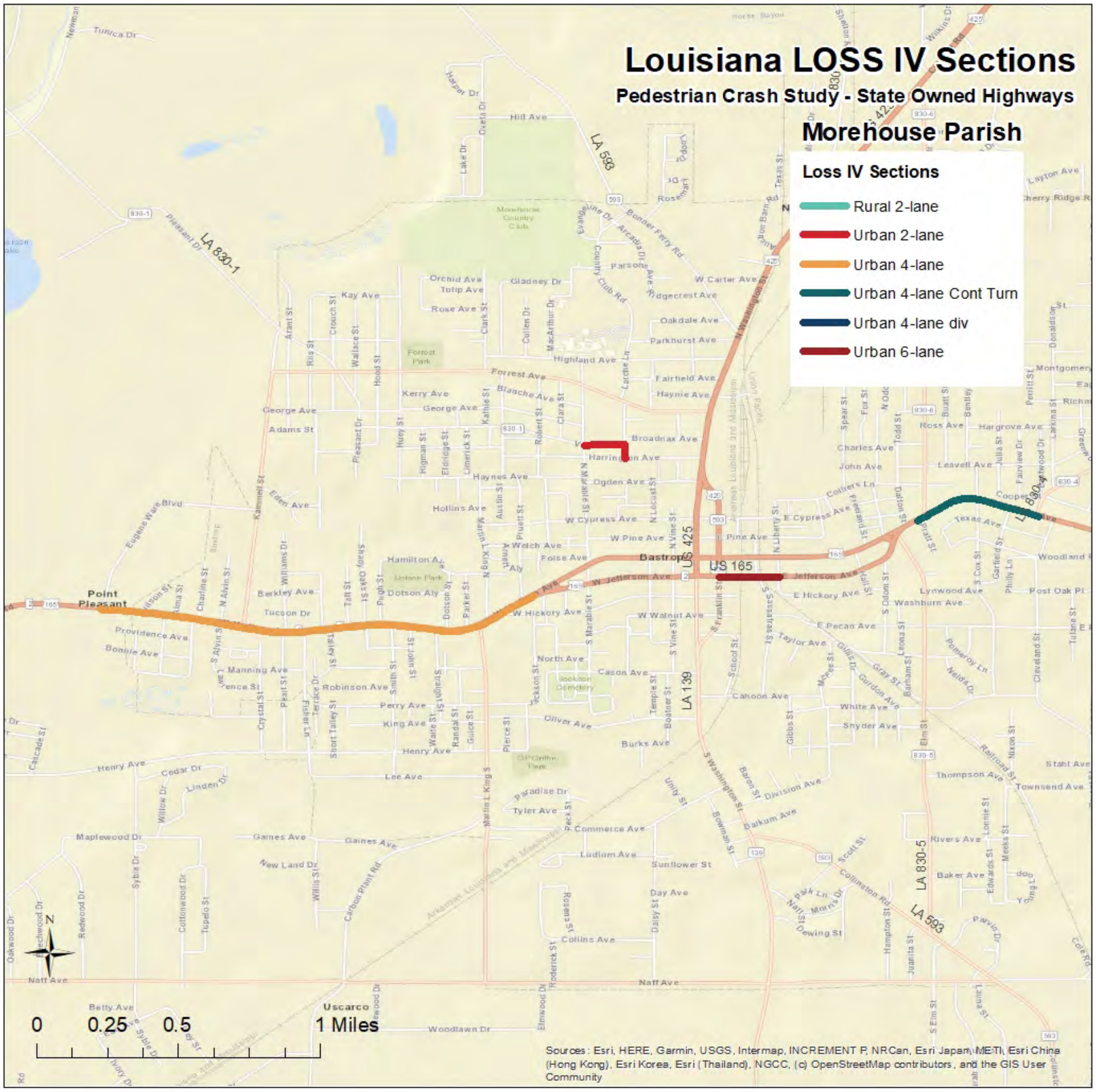


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

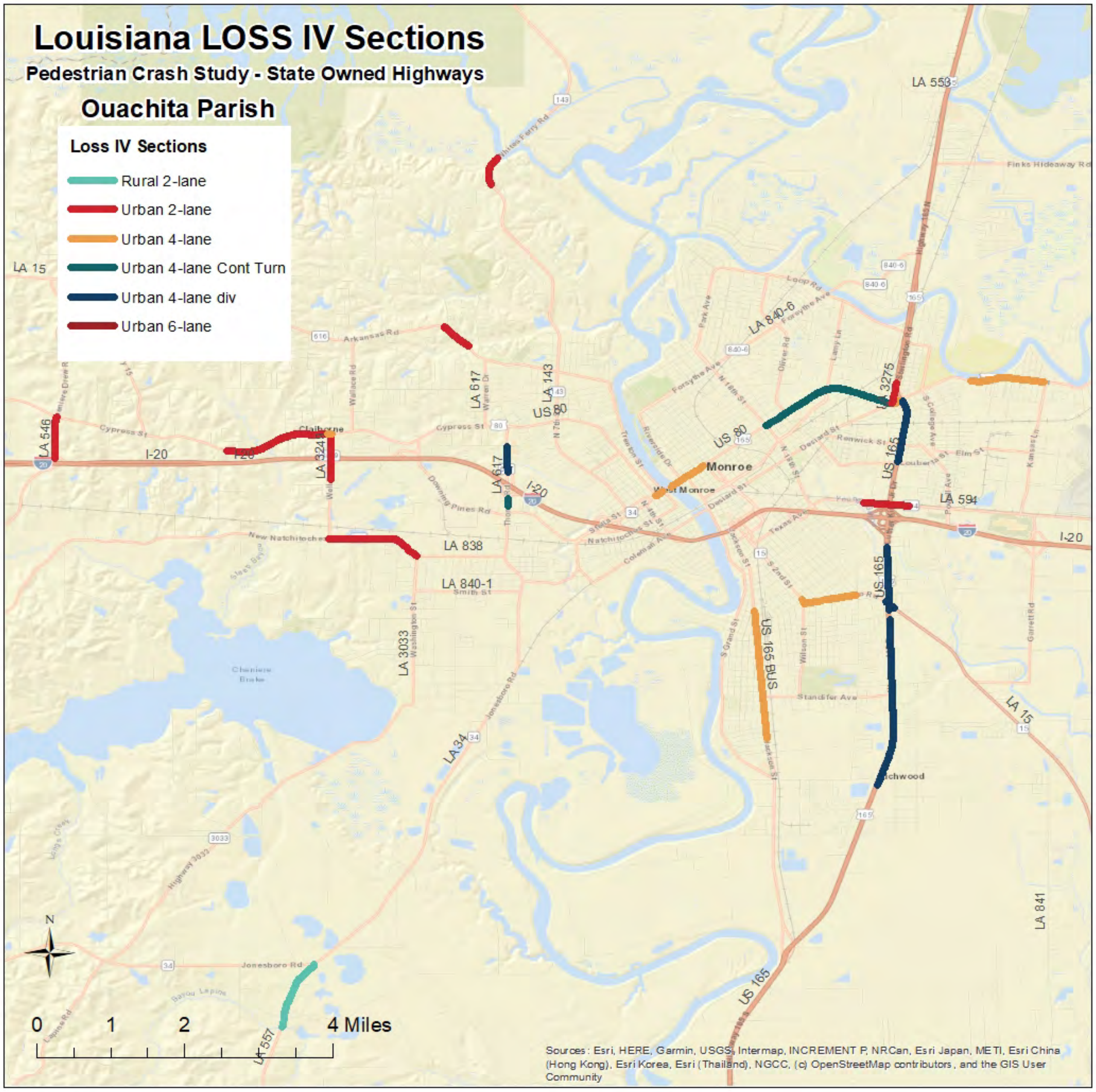


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

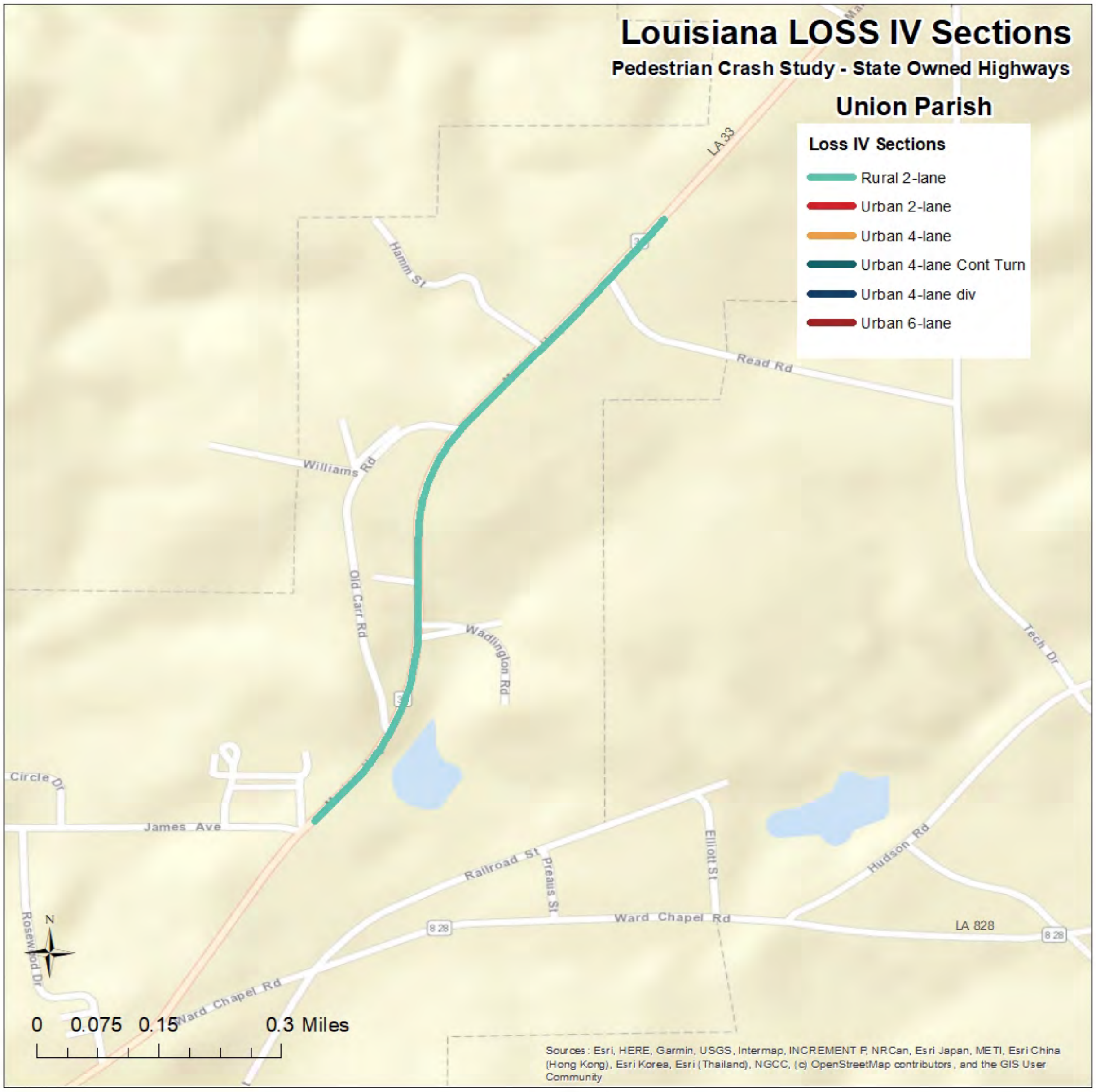

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Lincoln Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Dubach
Vienna
Grambling
Ruston
I-20
US 80
US 63
US 167
LA 146
LA 150
LA 151
LA 152
LA 544
LA 563
LA 822
N
0 1 2 4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



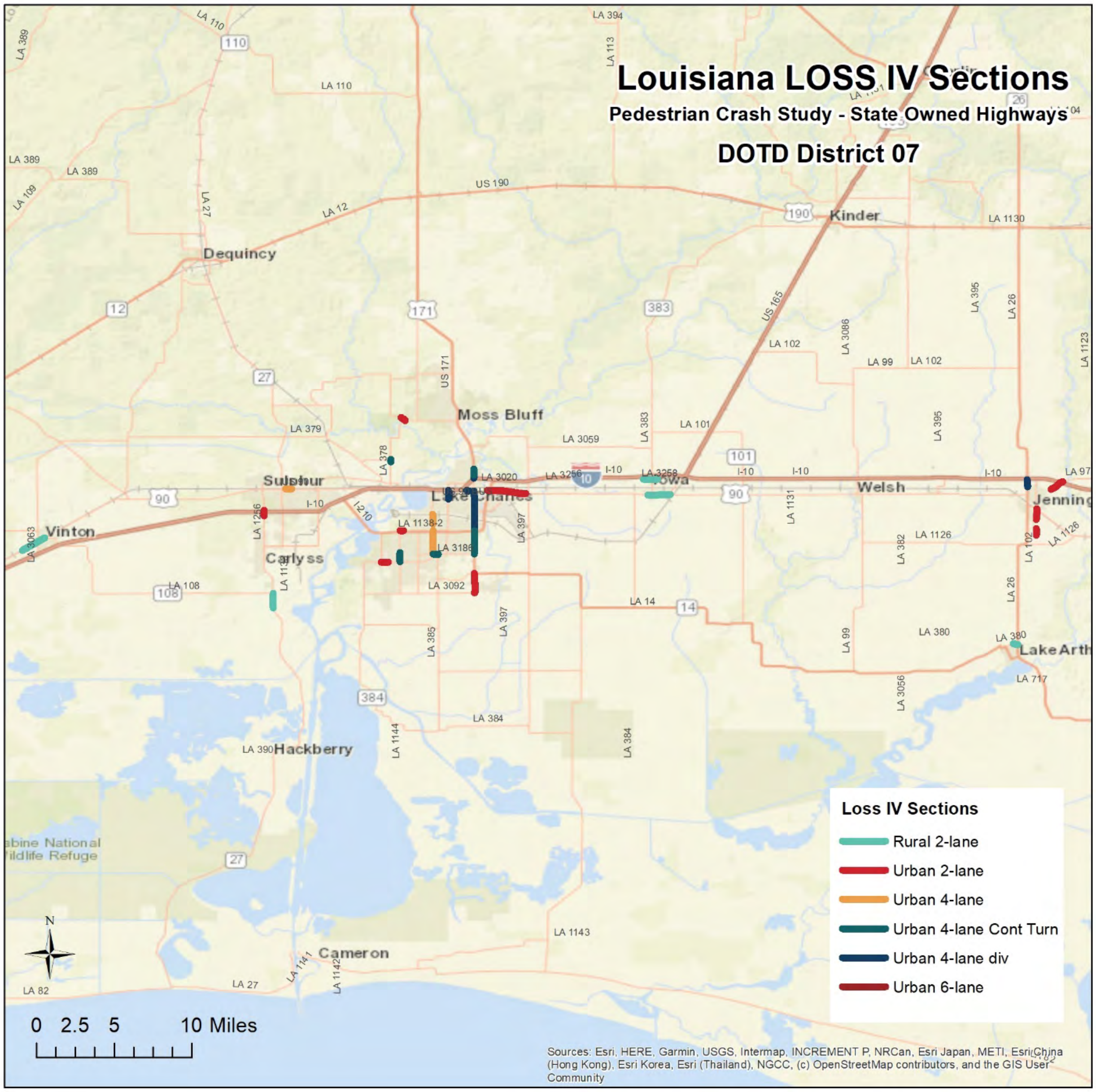
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

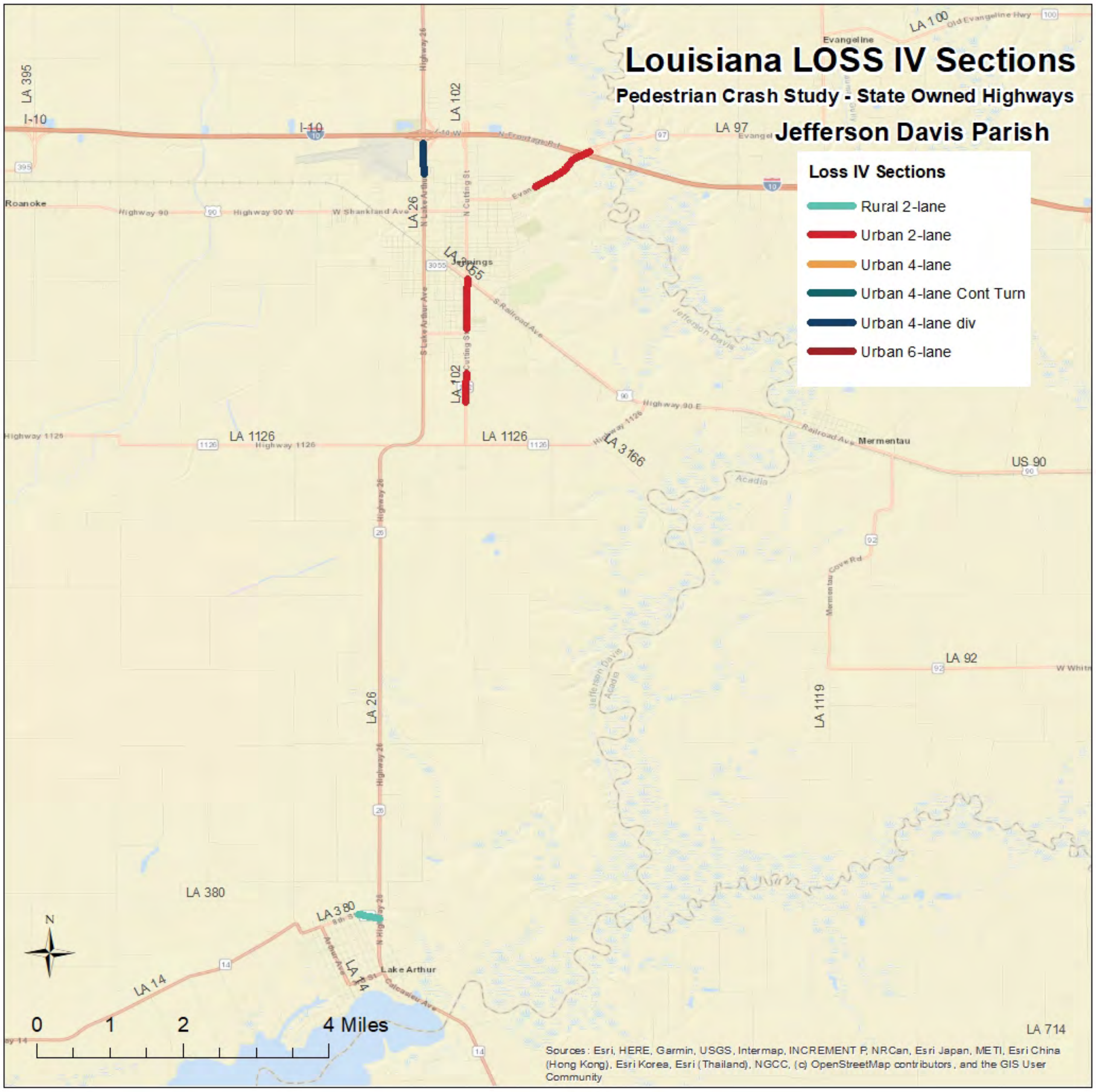

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Union Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
LA 33
Hamm St
Read Rd
Williams Rd
Old Carr Rd
Wadlington Rd
Tech Dr
Circle Dr
James Ave
Railroad St
Preaus St
Elliott St
Hudson Rd
Ward Chapel Rd
LA 828
Rosewood Dr
N
0 0.075 0.15 0.3 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

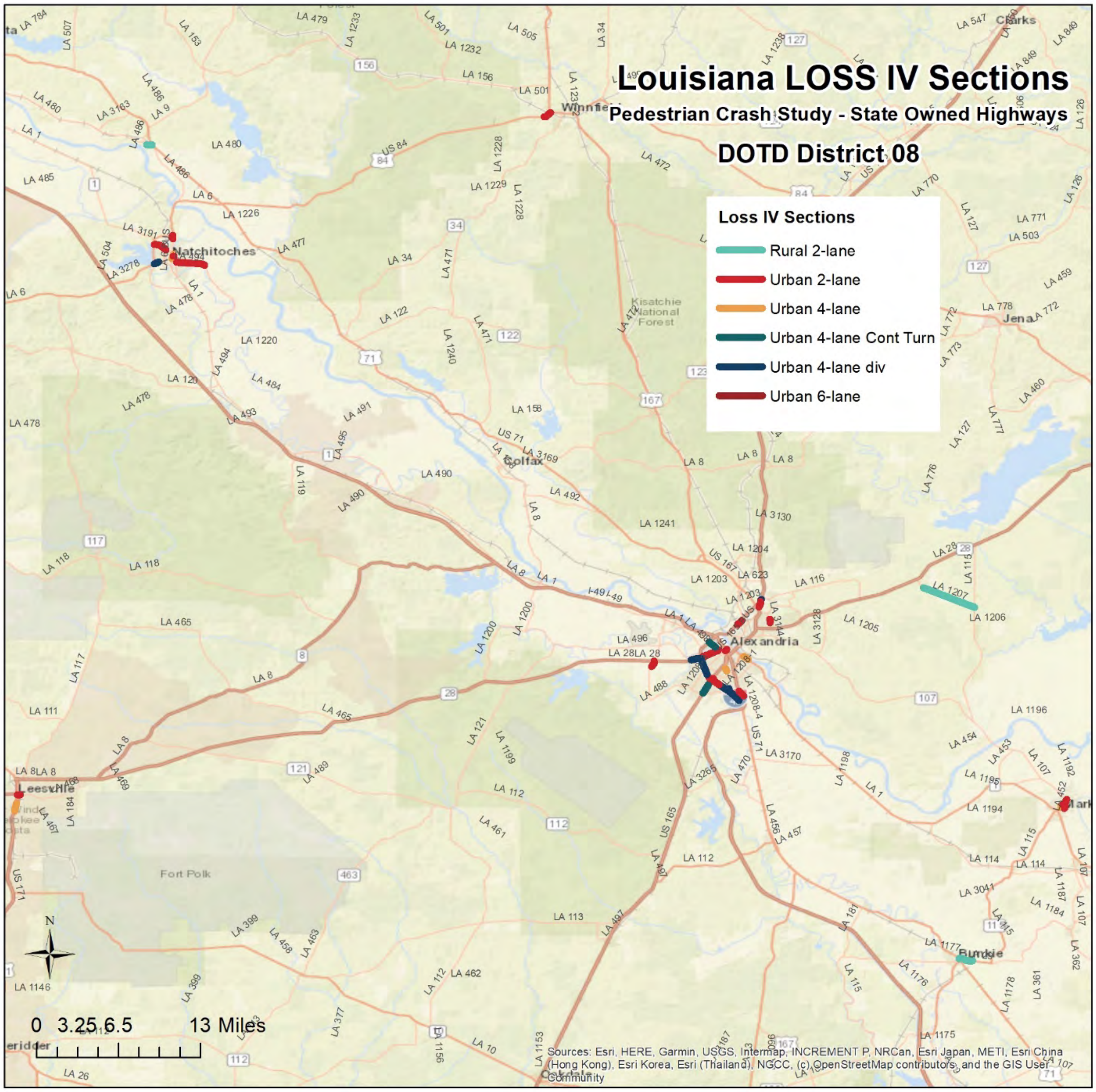

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
West Carroll Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Old Kilbourne Rd
Oak Grove Cemetery
Nix St
Lamont St
Cheatham St
Pippens St
Herring St
Purvis St
Carroll Aly
W Noble St
N Castleman St
Bayne St
Holloway St
McIntyre St
Pie Aly
Dave L Pearce St
Front St
Oak
W Jefferson St
W Main St
LA 2
LA 879
879
2
Fiske St
Tiger Dr
S Chatman St
E McIntosh St
S Castleman St
S Front St
Collins Aly
McIntosh St
W McIntosh St
Dye St
Neely St
Mill St
Willis St
Kay St
Reeves St
Industrial Blvd
Constitution Ave
LA 17
17
Washington St
Owens St
Waters St
Cemetery St
Newman
N
0
0.075
0.15
0.3 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

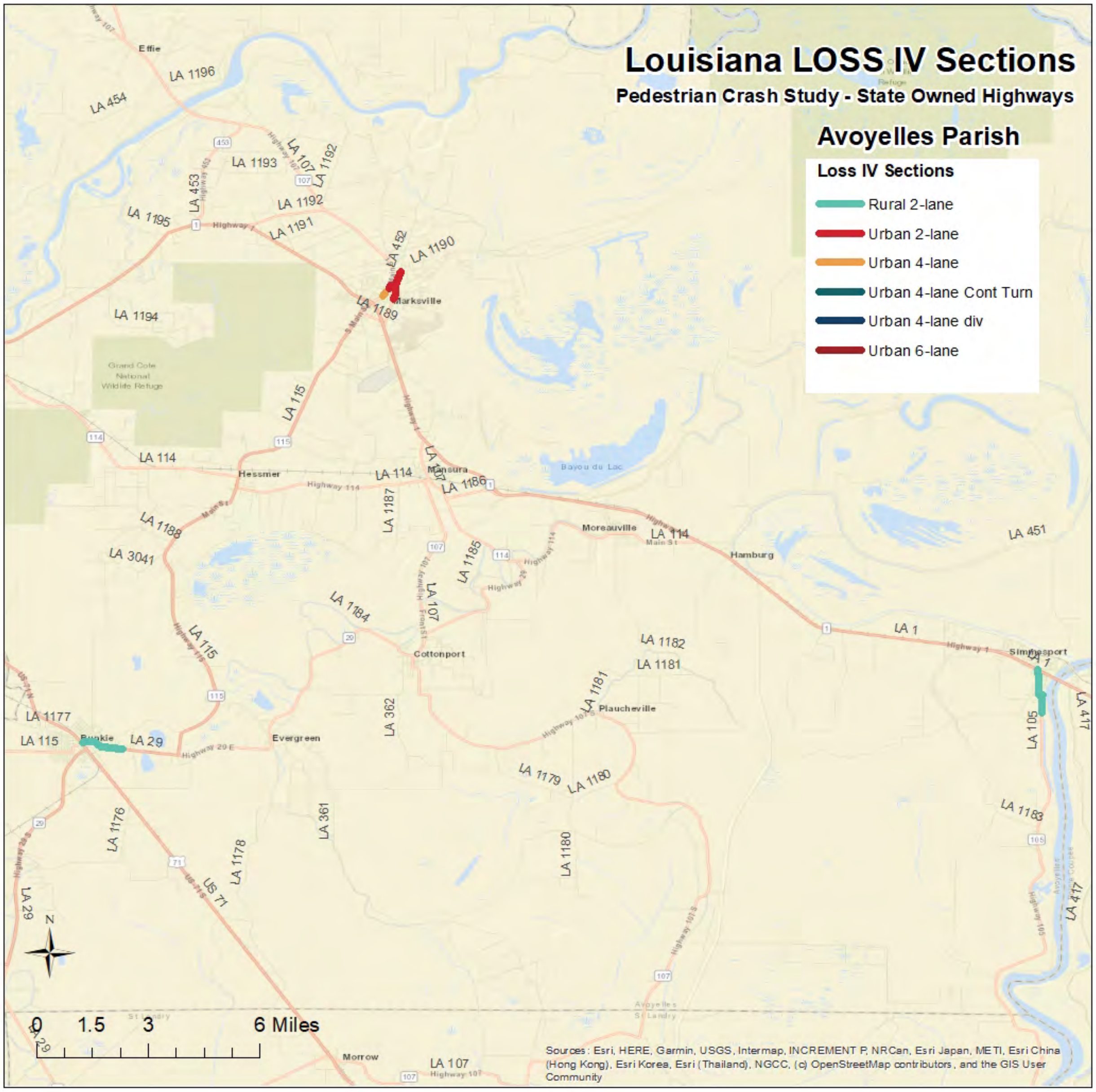

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
DOTD District 07
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
N
0 2.5 5 10 Miles
Dequincy
Moss Bluff
Sulphur
Lake Charles
Vinton
Carlyss
Iowa
Welsh
Jennings
Kinder
Lake Arthur
Hackberry
Cameron
Sabine National Wildlife Refuge
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Beauregard Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Tilley St
Bilbo St
Ellis Rd
Dick Allen St
N Frusha D
US 190
Highway 190 W
190
Azalea
Dr
Idlewood Ln
S Frusha Dr
Dogwood Dr
Honeysuckle St
Palmetto Creek
Blankenship Dr
LA 3099
3099
Sunnyside Dr
N
0
0.04
0.08
0.16 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Calcasieu Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
LA 389
LA 109
LA 27
Dequincy
LA 12
US 190
US 171
LA 379
Sulphur
US 90
I-10
Westlake
Lake Charles
LA 378
LA 3020
LA 3059
LA 3256
LA 3258
Iowa
LA 383
LA 101
US 165
LA 3063
Vinton
LA 1256
LA 108
Carlyss
LA 1133
Prien
LA 1138-2
LA 3186
LA 3092
I-210
LA 397
LA 14
LA 385
LA 384
LA 1144
LA 390 Hackberry
0 2 4 8 Miles
N
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Jefferson Davis Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
LA 395
I-10
LA 102
LA 97
LA 100
Evangeline
Roanoke
Highway 90
LA 26
LA 3055
Jennings
LA 1126
LA 3166
Mermentau
US 90
LA 92
LA 1119
LA 380
LA 14
Lake Arthur
LA 714
N
0
1
2
4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
DOTD District 08
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Natchitoches
Winnfield
Colfax
Alexandria
Jena
Leesville
Bunkie
Marksville
Kisatchie National Forest
Fort Polk
N
0 3.25 6.5 13 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Louisiana LOSS IV Sections

Pedestrian Crash Study - State Owned Highways

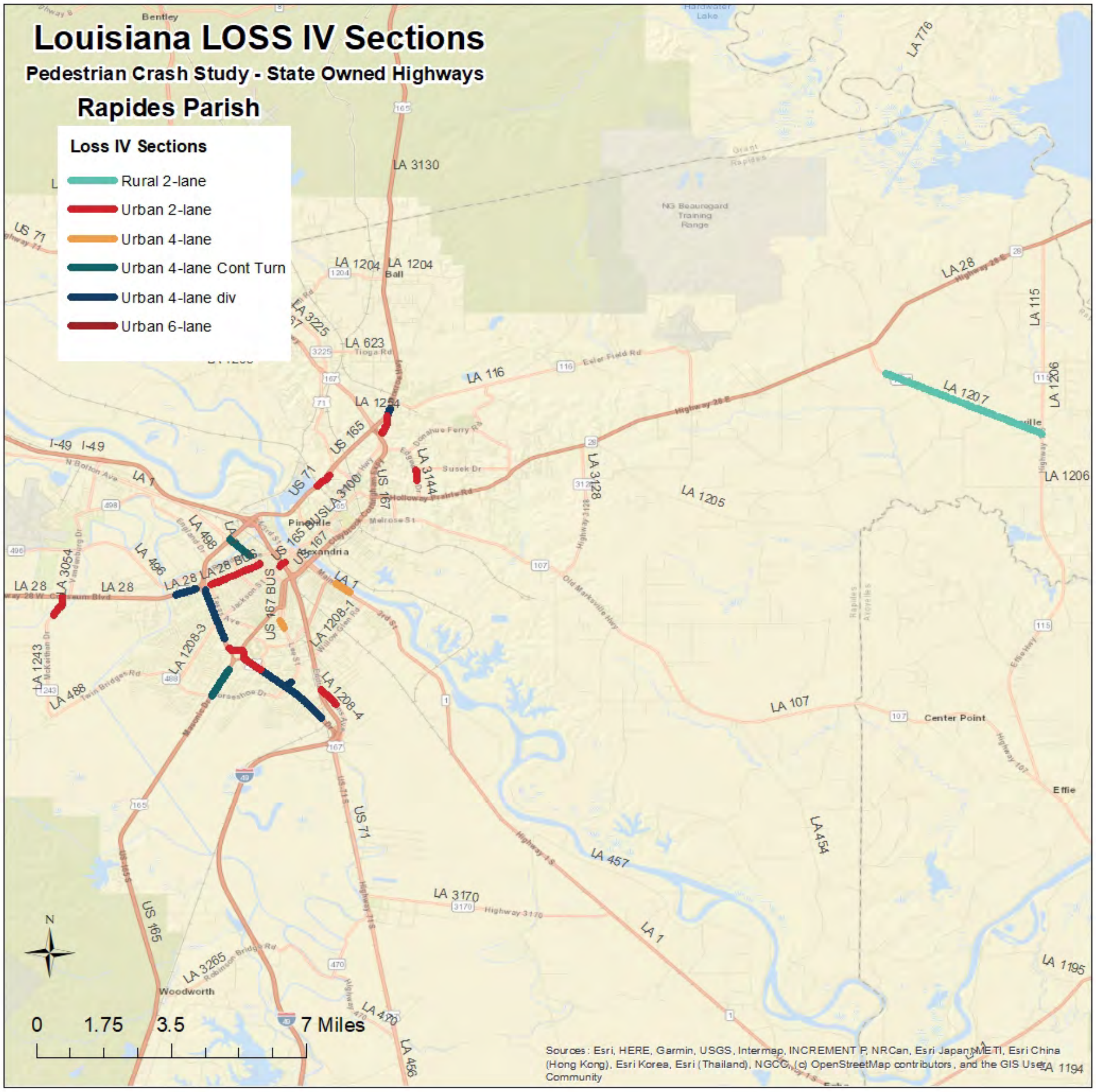
Avoyelles Parish

Loss IV Sections

- Rural 2-lane
- Urban 2-lane
- Urban 4-lane
- Urban 4-lane Cont Turn
- Urban 4-lane div
- Urban 6-lane

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Natchitoches Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
LA 480
Mill St
Highway 71
486
LA 486
Camps Cutoff
71
US 71
Highway 71 84
Highway 6
Highway 6 W
LA 6
Clarence
US 84
71
LA 1226
LA 1225
LA 1
Highway 1
1
6
La 3175 Byp
LA 3191
LA 6 BUS
Washington
LA 1224
Bypass
Lee St
3rd St
Natchitoches
Sibley Lake
LA 504
N
LA 1
LA 6 BUS
College Ave
LA 494
LA 494
LA 1223
LA 3278
0
0.5
1
2 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

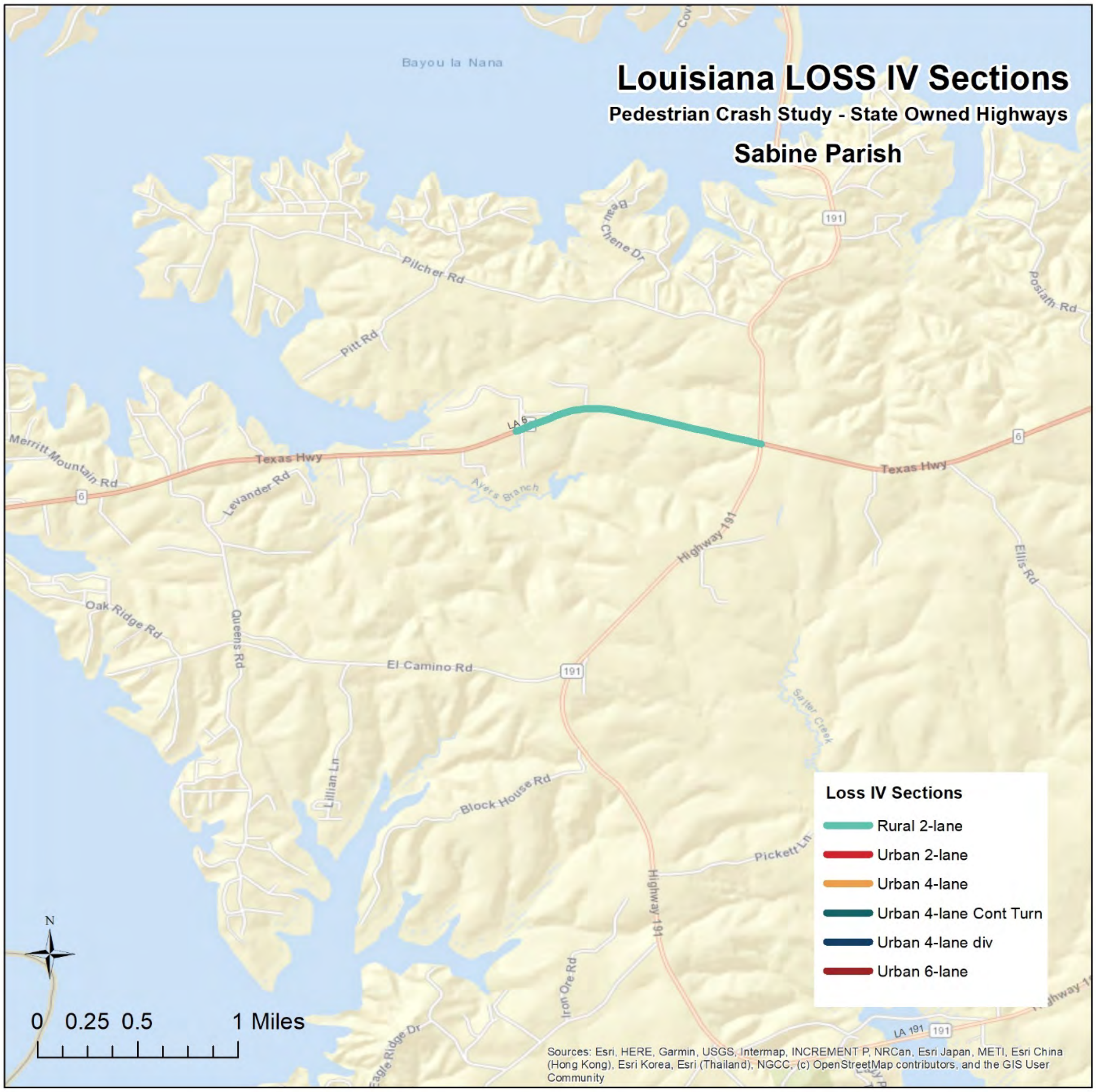


Louisiana LOSS IV Sections

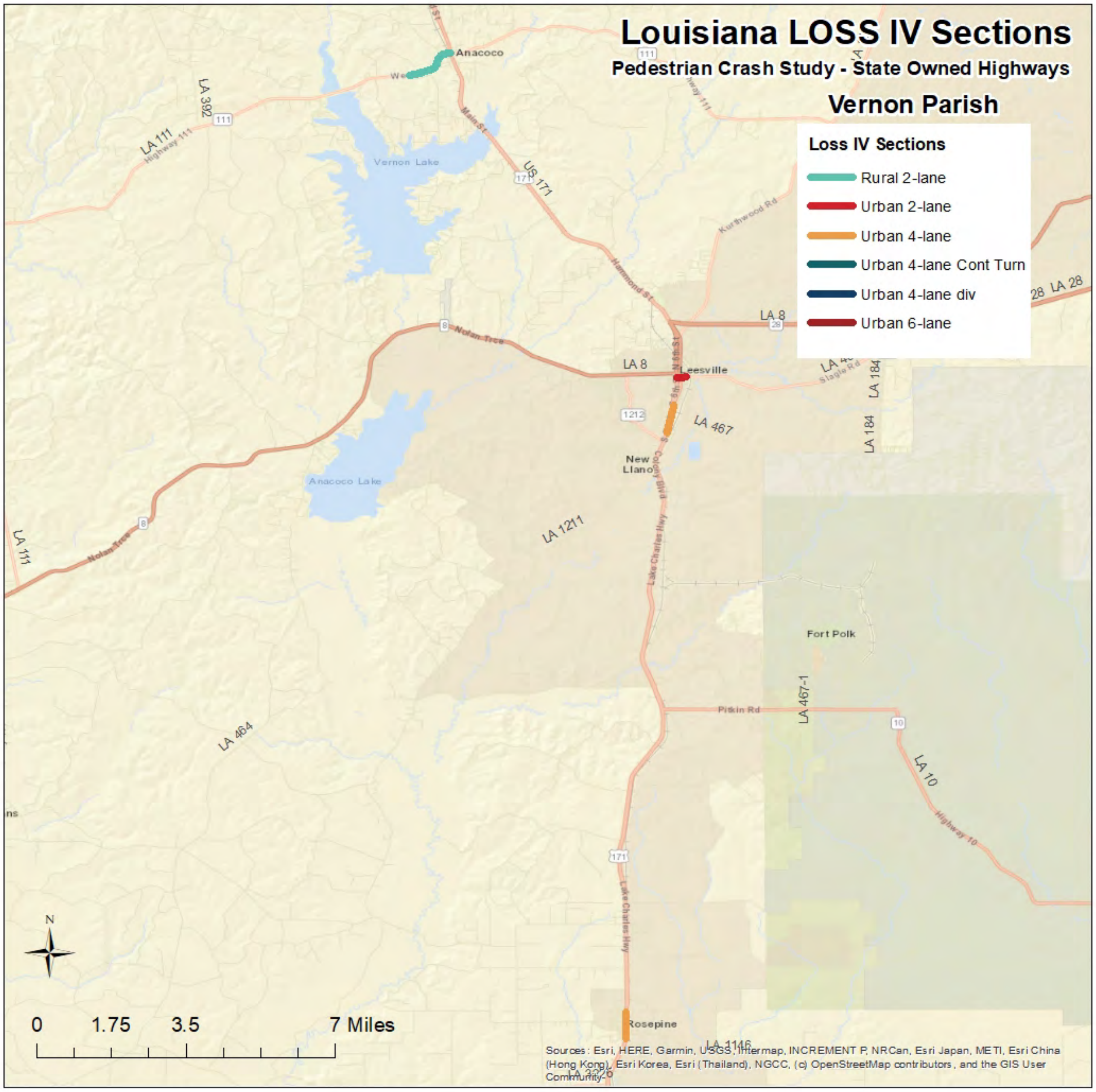
Pedestrian Crash Study - State Owned Highways

Rapides Parish

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

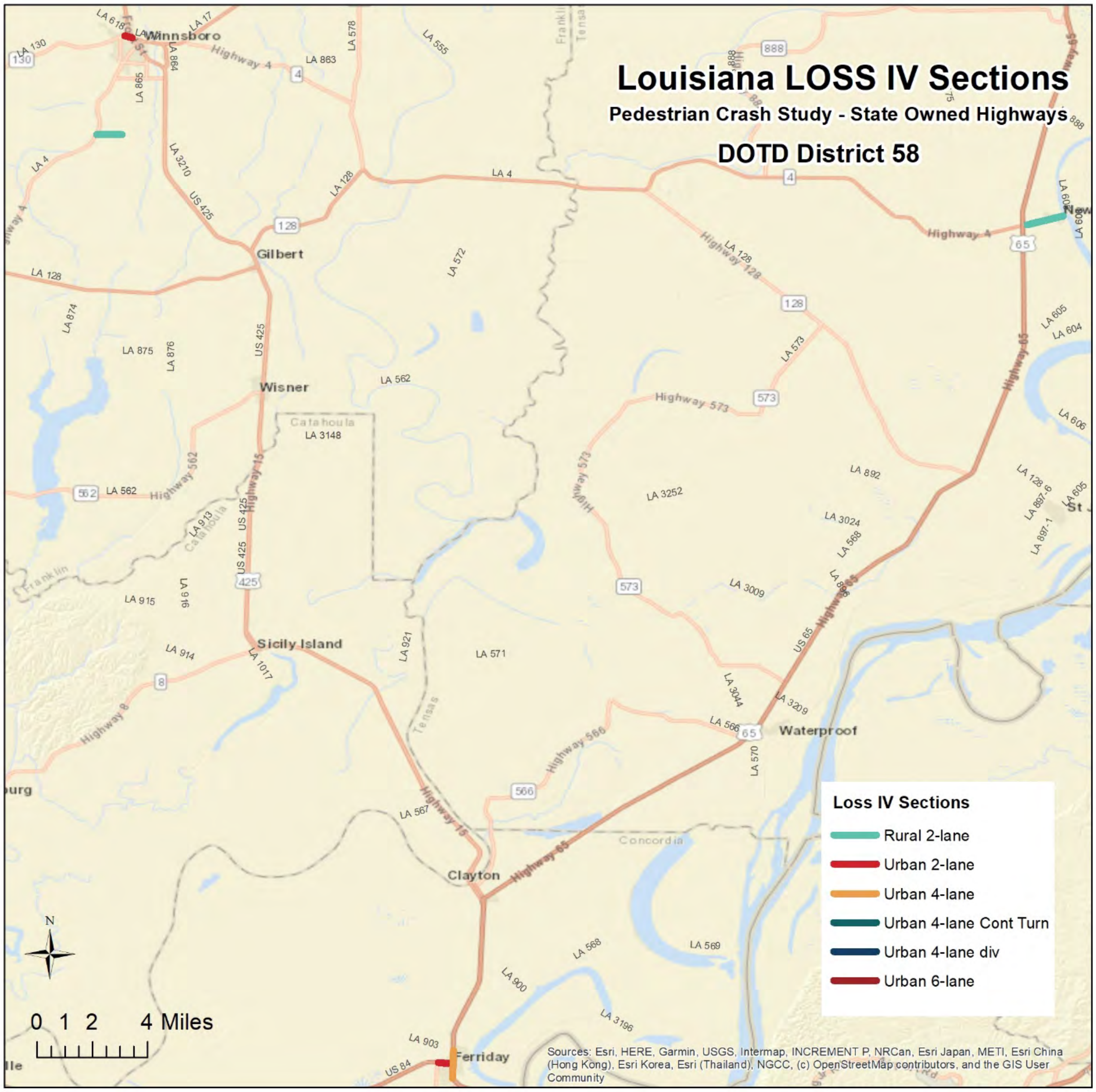


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Winn Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Pompey St
W Court St
US 167
Machen St
N Faith Dr
Faith Dr
W
167
Tupelo St
South St
San Pedro St
Claiborne Ave
Eugene St
Ogden St
Ridgewood Dr
Lenox Ave
Lenox Ave
US 84
Country Club Rd
Pine Terrace Dr
N
0
0.05
0.1
0.2 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

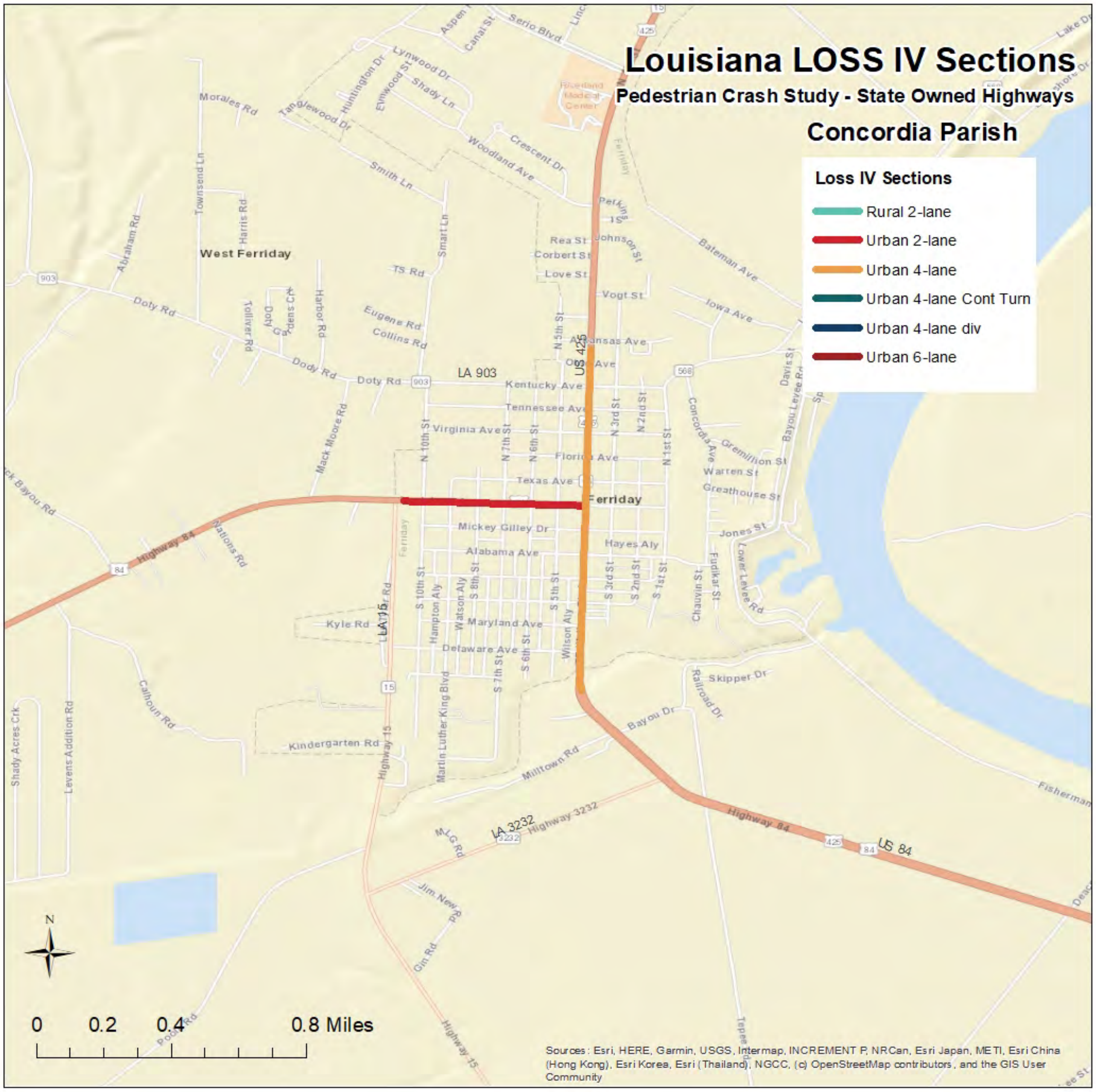


Louisiana LOSS IV Sections

Pedestrian Crash Study - State Owned Highways

DOTD District 58

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

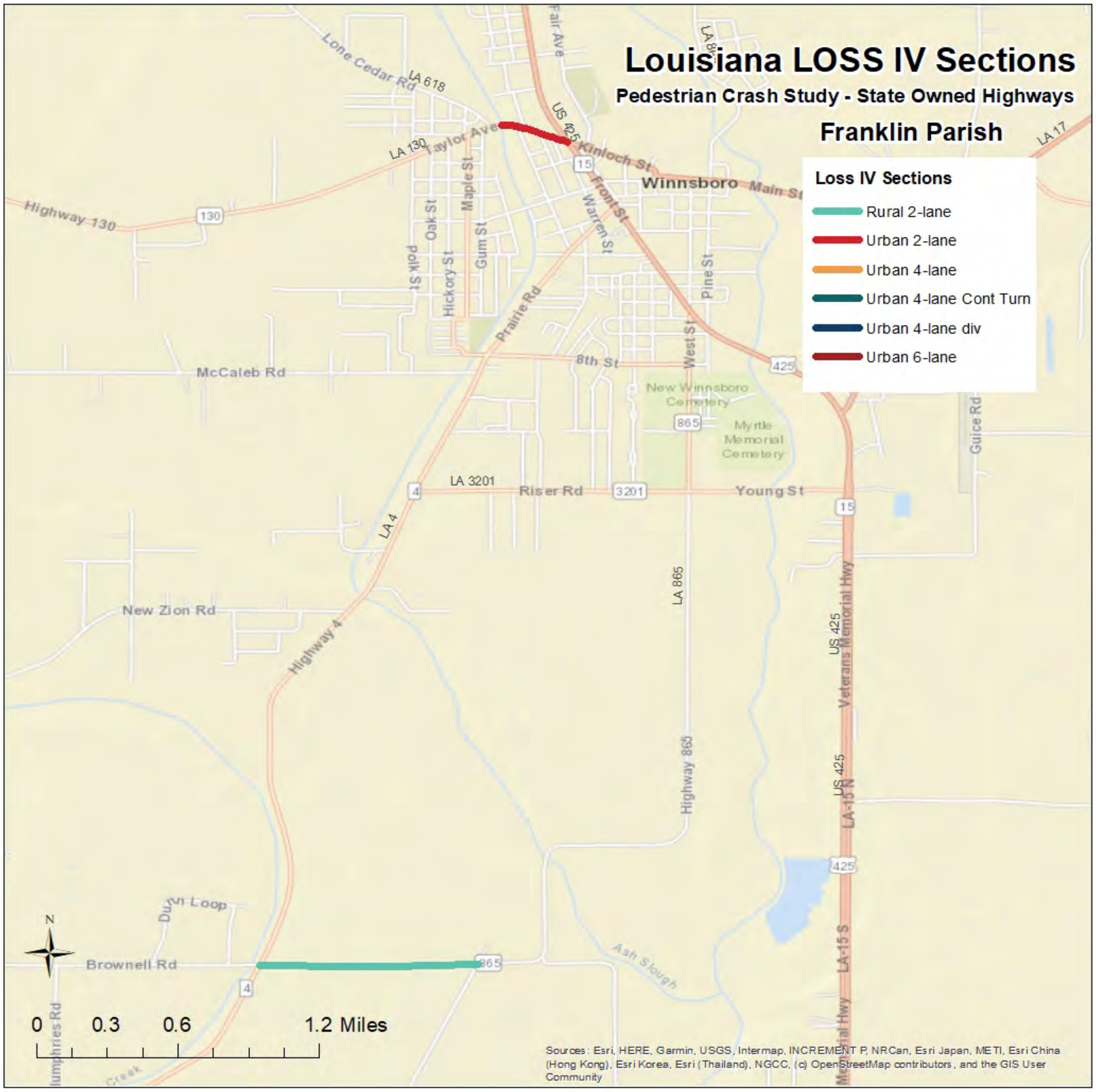


Louisiana LOSS IV Sections

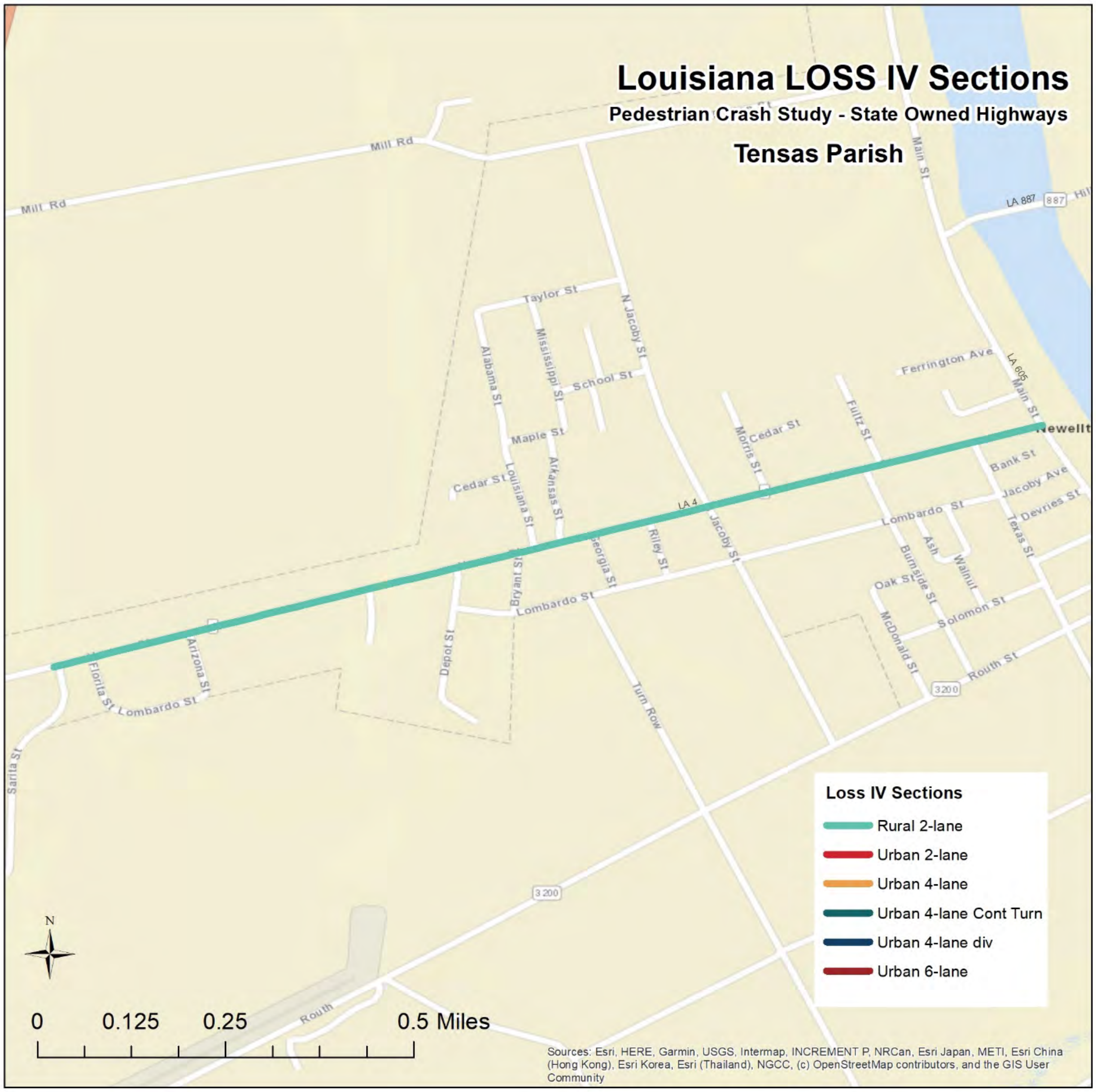
Pedestrian Crash Study - State Owned Highways

Concordia Parish

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

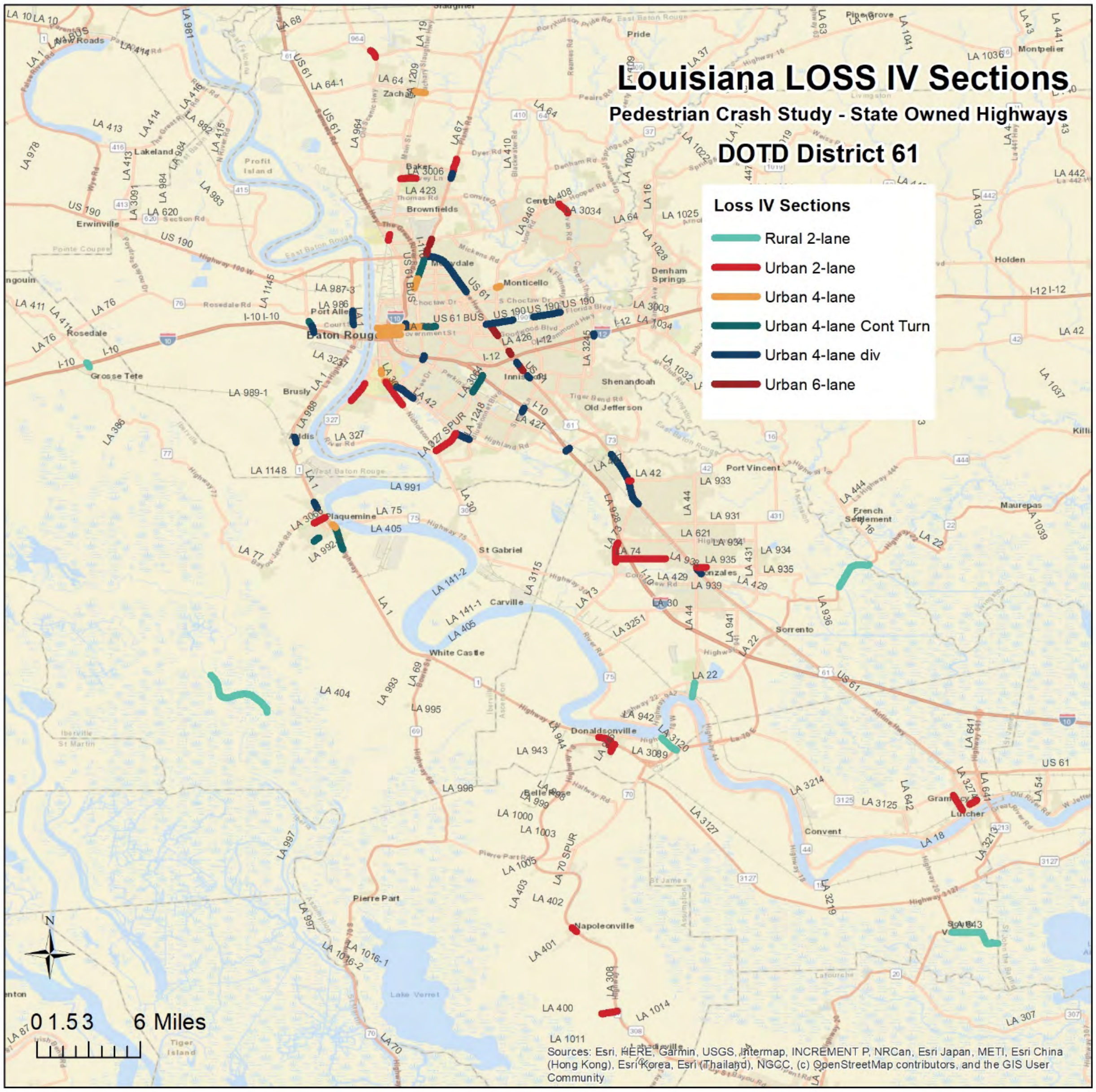


Louisiana LOSS IV Sections

Pedestrian Crash Study - State Owned Highways

Tensas Parish

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

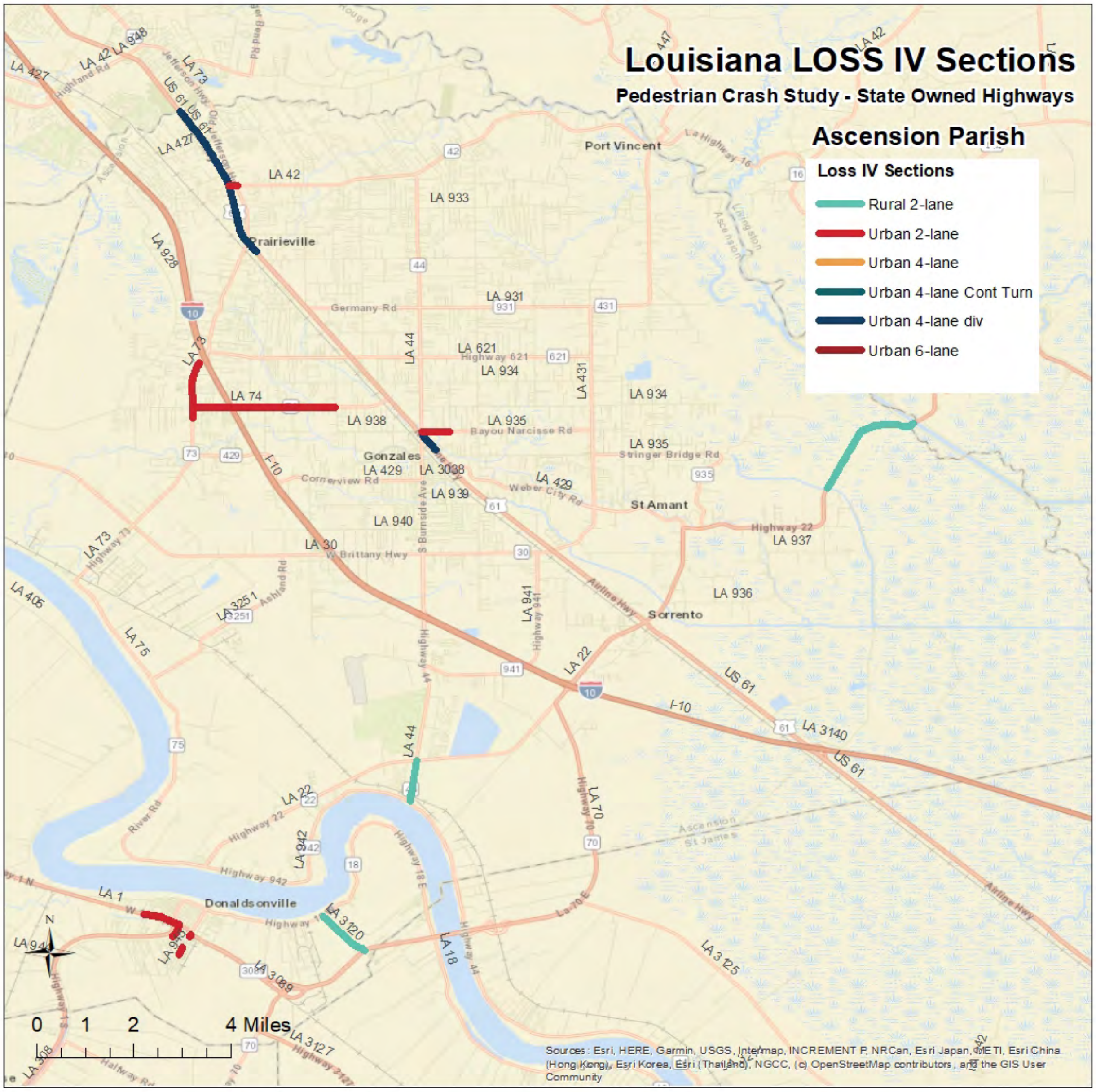


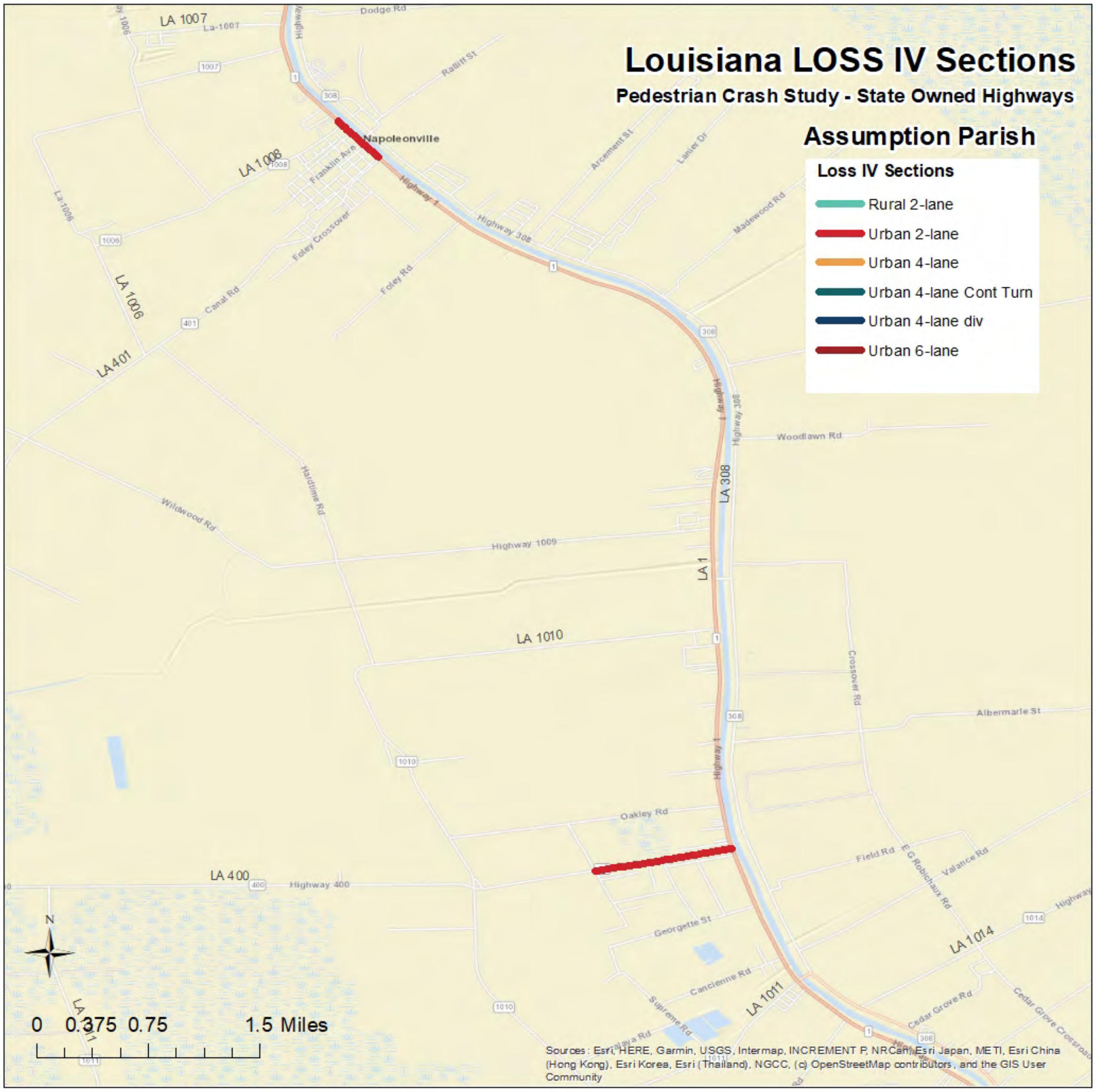
Louisiana LOSS IV Sections

Pedestrian Crash Study - State Owned Highways

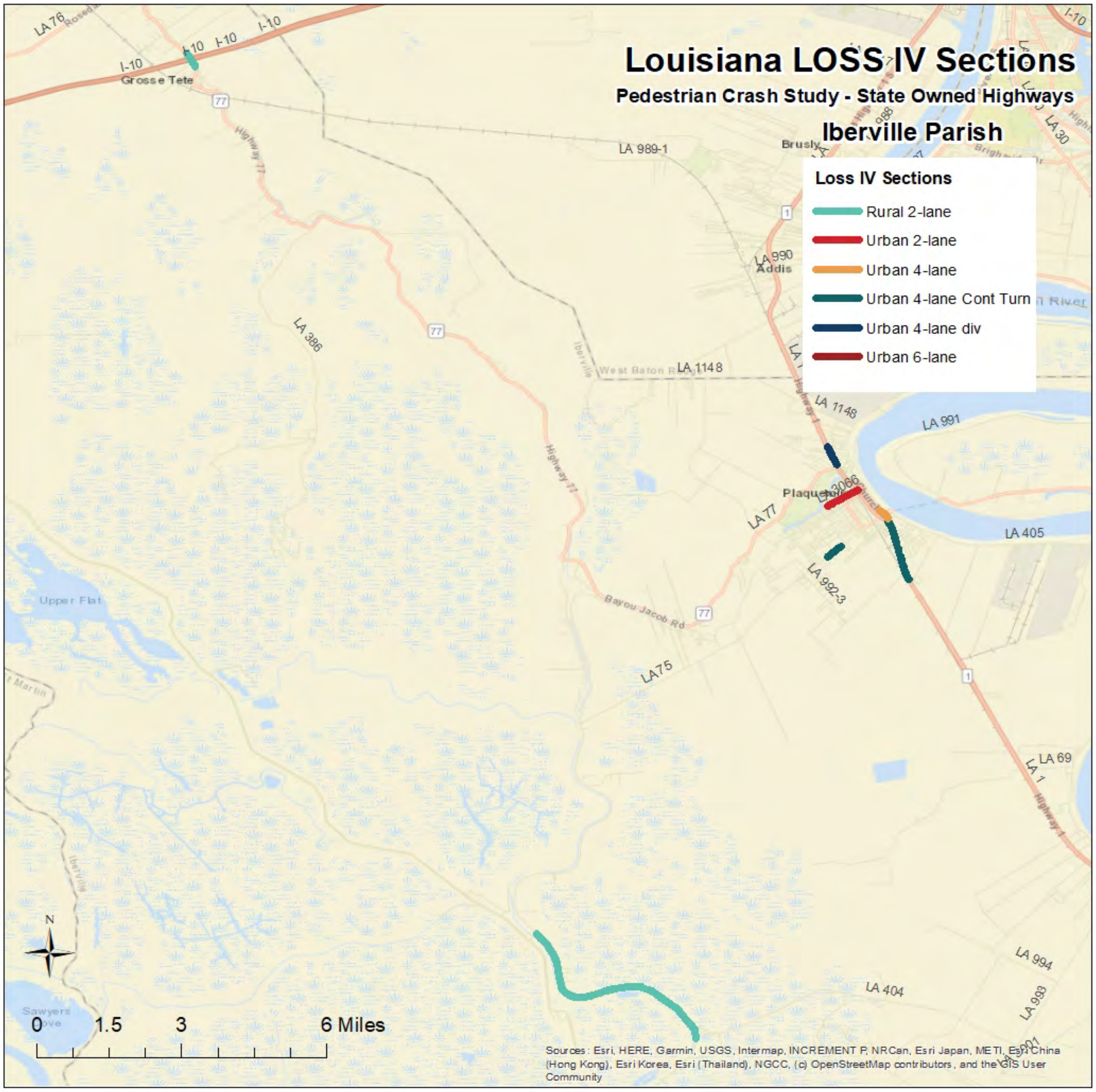
DOTD District 61

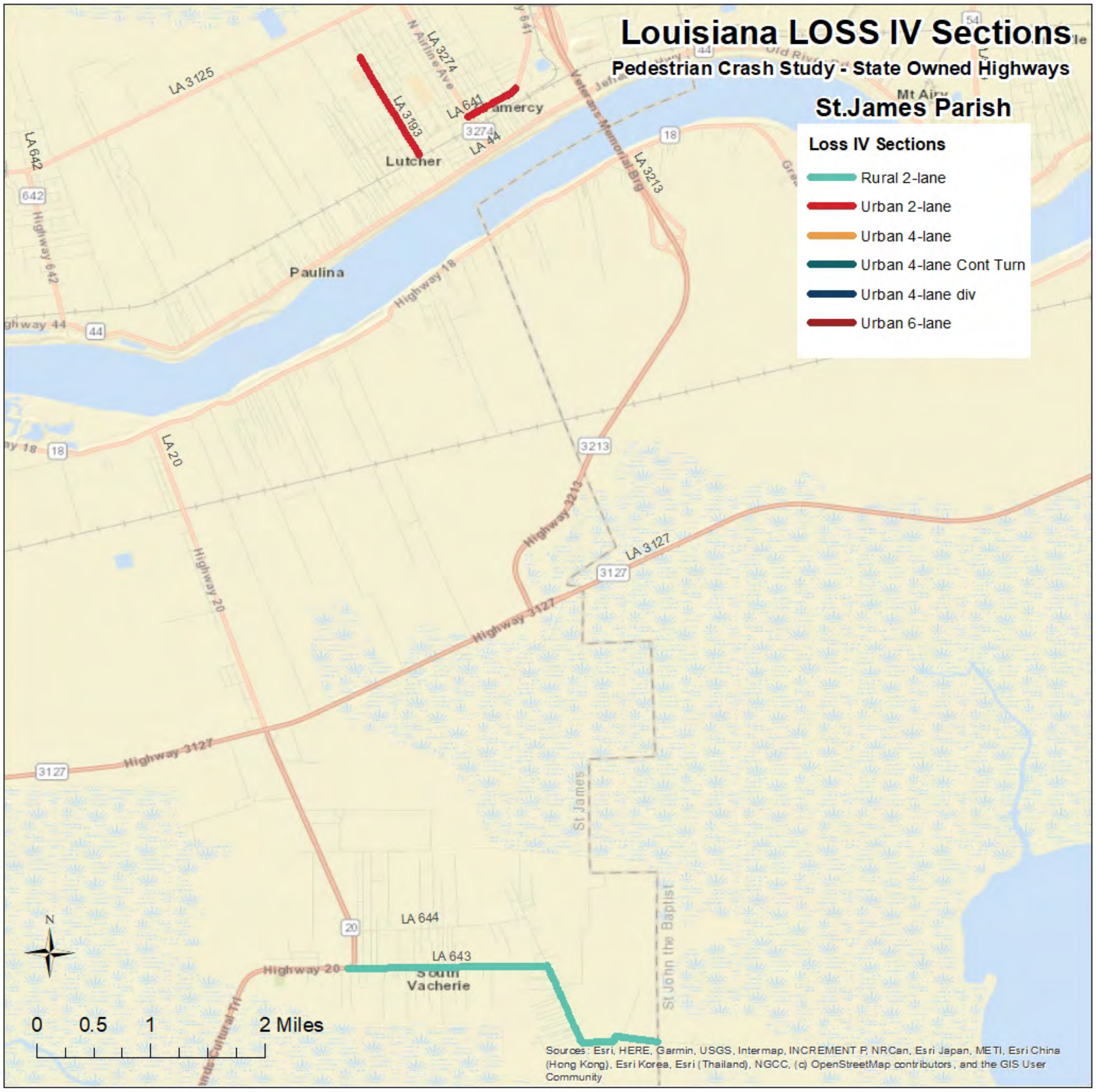
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Ascension Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Port Vincent
Prairieville
Gonzales
St Amant
Sorrento
Donaldsonville
LA 42
LA 933
LA 931
LA 621
LA 934
LA 74
LA 938
LA 935
LA 429
LA 3038
LA 939
LA 940
LA 30
LA 73
LA 928
LA 427
US 61
LA 44
LA 431
LA 937
LA 936
LA 941
LA 22
I-10
LA 3140
LA 70
LA 3251
LA 405
LA 75
LA 942
LA 1
LA 3120
LA 18
LA 3089
LA 3125
LA 3127
N
0 1 2 4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Assumption Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Napoleonville
LA 1007
LA 1008
LA 1006
LA 401
LA 308
LA 1
LA 1010
LA 400
LA 1011
LA 1014
Highway 1
Highway 308
Highway 1009
Highway 400
Woodlawn Rd
Oakley Rd
Albermarle St
Georgette St
N
0 0.375 0.75 1.5 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

This document and the information contained herein were prepared solely for the purpose of identifying, evaluating, and planning safety improvements on public roads which may be implemented utilizing federal aid highway funds; and are therefore exempt from discovery or admission into evidence pursuant to 23 U.S.C. 409.


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Iberville Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
I-10
LA 76
Grosse Tete
77
Highway 77
LA 989-1
Brusly
LA 990
Addis
LA 386
West Baton Rouge
LA 1148
LA 1
Highway 1
LA 991
Plaquemine
LA 3066
LA 77
LA 405
LA 992-3
Bayou Jacob Rd
LA 75
Upper Flat
LA 69
LA 994
LA 404
LA 993
Sawyers Cove
N
0
1.5
3
6 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

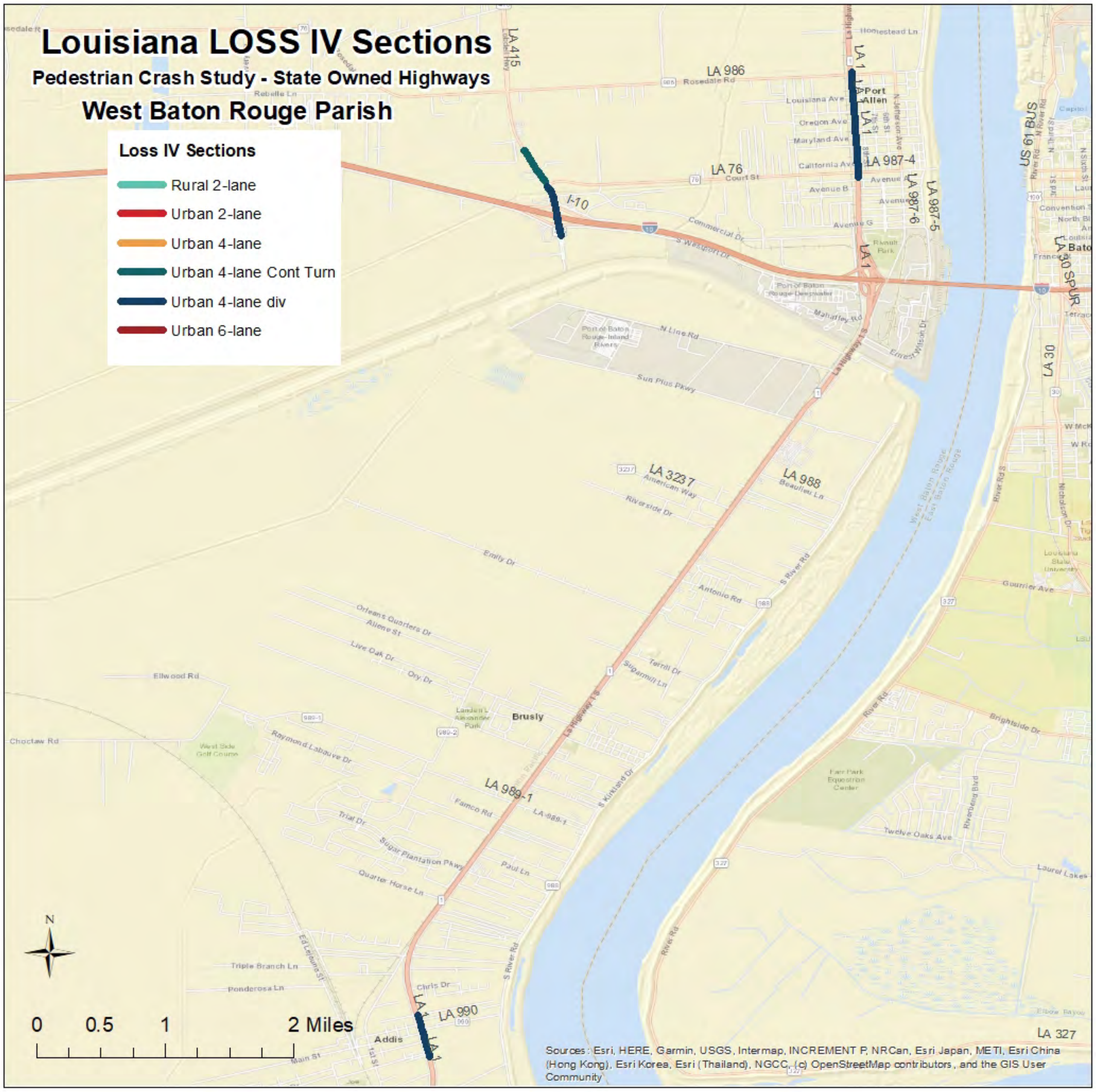


Louisiana LOSS IV Sections

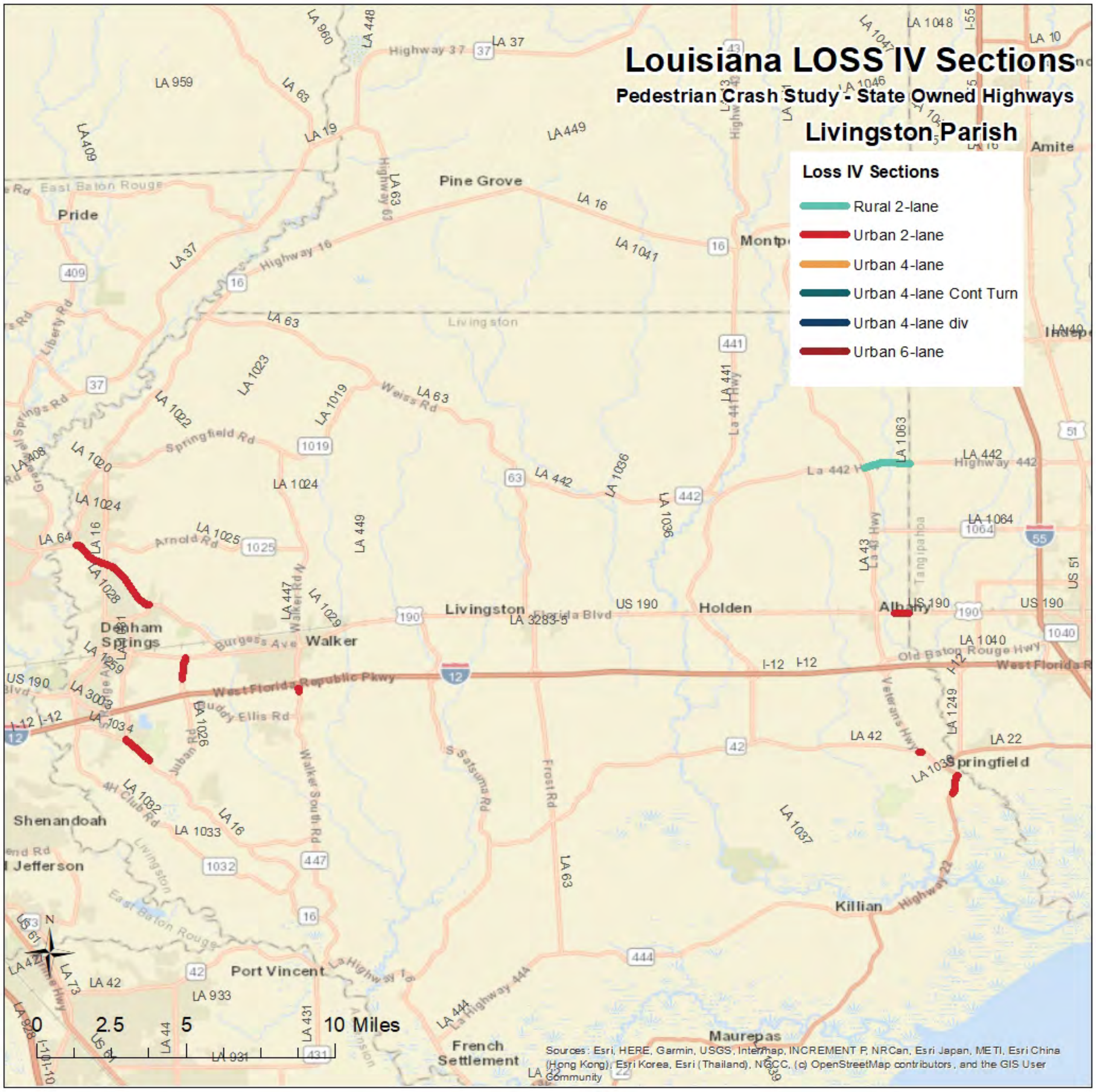
Pedestrian Crash Study - State Owned Highways

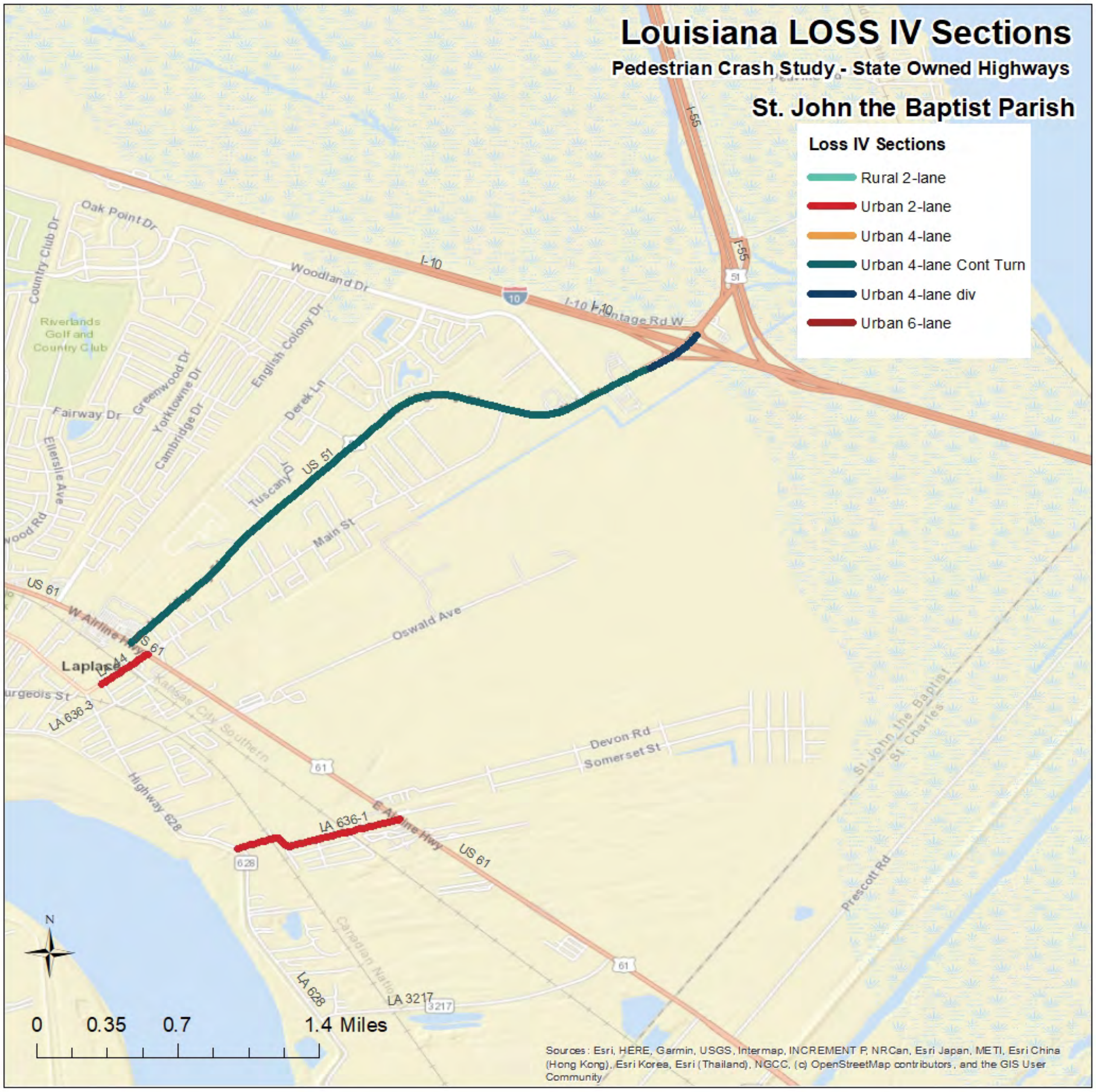
St.James Parish

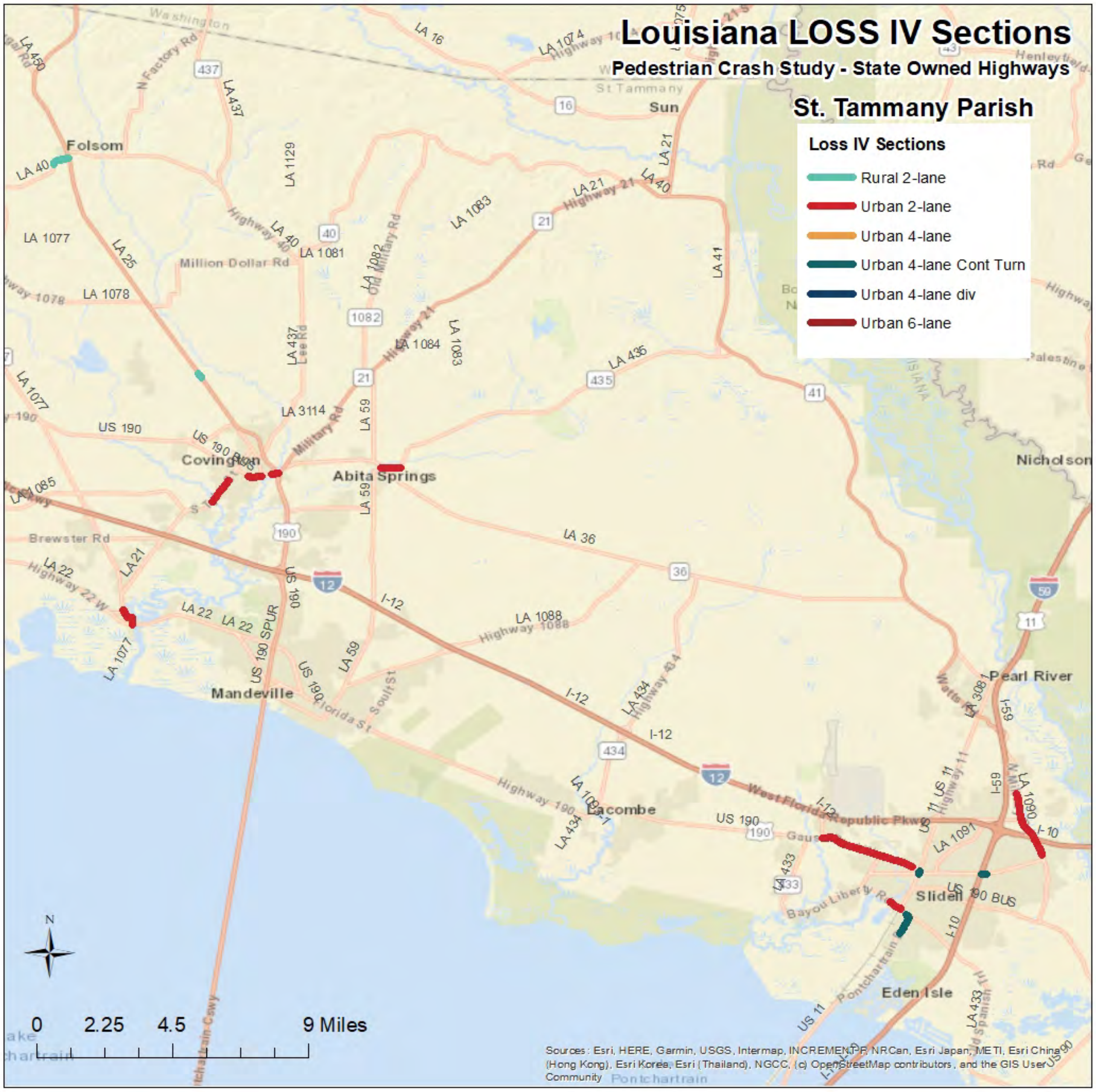
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

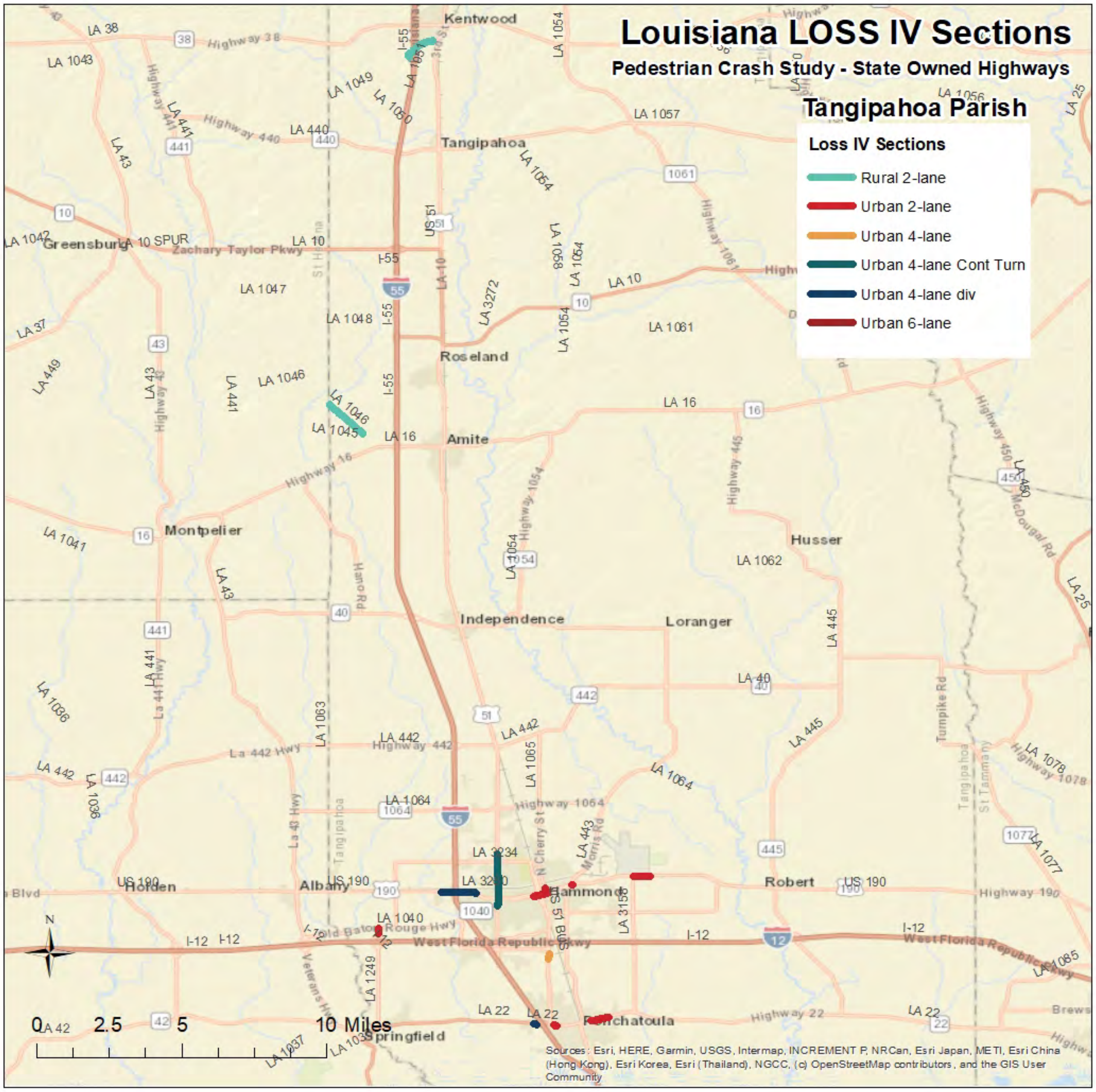

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
West Baton Rouge Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
LA 415
LA 986
LA 1
Port Allen
LA 987-4
LA 76
I-10
LA 987-6
LA 987-5
US 61 BUS
LA 30 SPUR
LA 30
LA 3237
LA 988
Brusly
LA 989-1
LA 990
Addis
LA 327
N
0
0.5
1
2 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

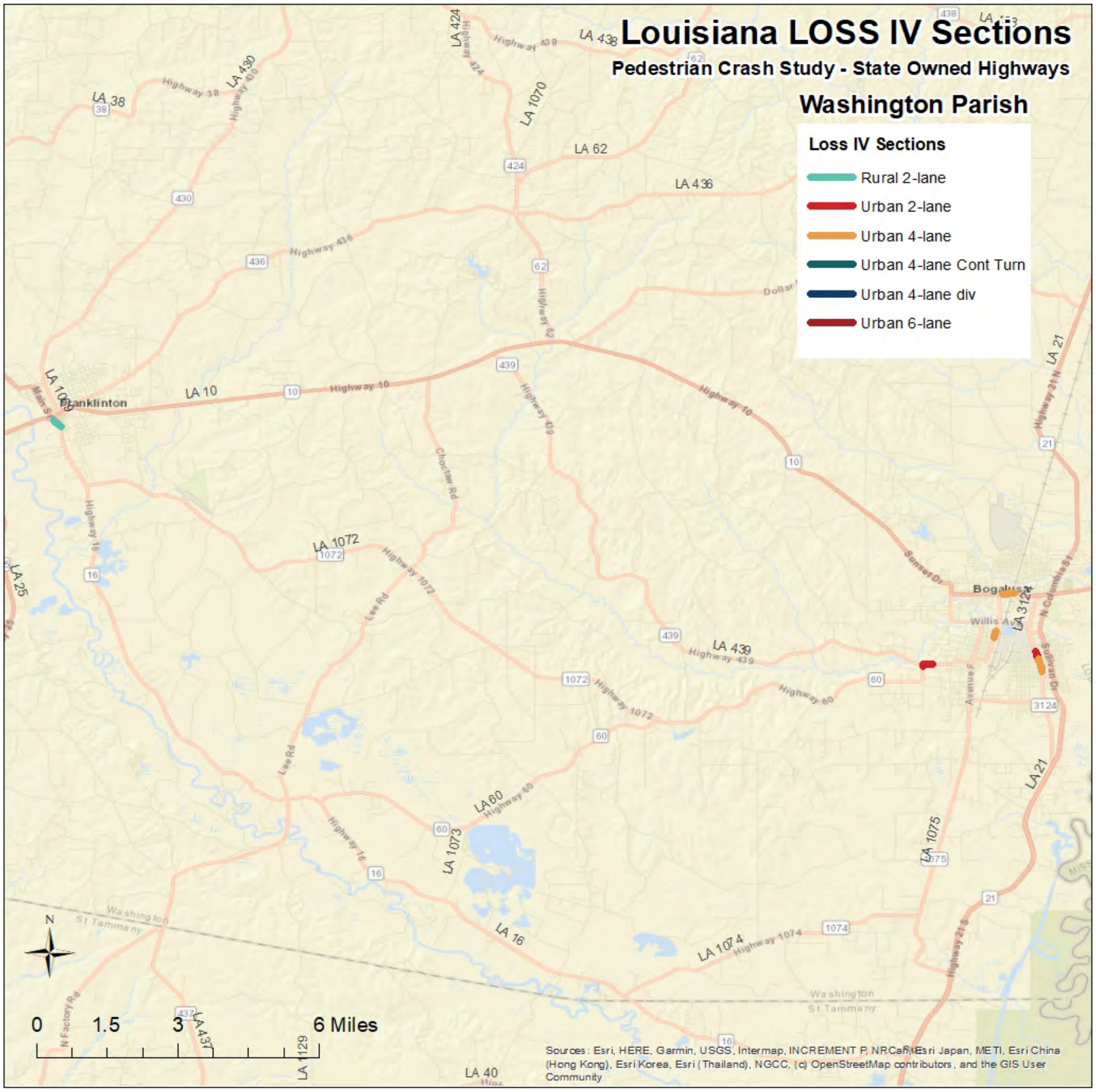

Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
DOTD District 62
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
N
0 4 8 16 Miles
Mississippi
Louisiana
Kentwood
Clinton
Franklinton
Bogalusa
Amite
Denham Springs
Walker
Hammond
Covington
Abita Springs
Mandeville
Lacombe
Slidell
Gonzales
Donaldsonville
Gramercy
Lutcher
Laplace
Destrehan
Luling
Kenner
Metairie
New Orleans
Westwego
Estelle
Des Allemands
Labadieville
Thibodaux
Lake Maurepas
Lac des Allemands
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Livingston Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Pine Grove
Pride
Denham Springs
Walker
Livingston
Holden
Albany
Springfield
Killian
Shenandoah
Port Vincent
French Settlement
Maurepas
Amite
I-12
US 190
N
0 2.5 5 10 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
St. John the Baptist Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
I-55
I-10
I-10 Frontage Rd W
Woodland Dr
Oak Point Dr
Country Club Dr
Riverlands Golf and Country Club
Fairway Dr
Greenwood Dr
Yorktowne Dr
Cambridge Dr
English Colony Dr
Derek Ln
Ellerslie Ave
US 51
Tuscany
Main St
US 61
W Airline Hwy
Laplace
LA 44
Oswald Ave
LA 636-3
Kansas City Southern
Devon Rd
Somerset St
Highway 628
LA 636-1
E Airline Hwy
St. John the Baptist
St. Charles
Prescott Rd
Canadian National
LA 628
LA 3217
N
0
0.35
0.7
1.4 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
St. Tammany Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Folsom
Covington
Abita Springs
Mandeville
Lacombe
Slidell
Pearl River
Eden Isle
Nicholson
Sun
0
2.25
4.5
9 Miles
N
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Tangipahoa Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Kentwood
Tangipahoa
Greensburg
Roseland
Amite
Montpelier
Husser
Independence
Loranger
Holden
Albany
Hammond
Robert
Ponchatoula
Springfield
I-55
I-12
US 51
US 190
LA 10
LA 16
LA 22
LA 1045
LA 1046
LA 1051
LA 3234
LA 1040
N
0 2.5 5 10 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community


Louisiana LOSS IV Sections
Pedestrian Crash Study - State Owned Highways
Washington Parish
Loss IV Sections
Rural 2-lane
Urban 2-lane
Urban 4-lane
Urban 4-lane Cont Turn
Urban 4-lane div
Urban 6-lane
Franklinton
Bogalusa
LA 10
LA 21
LA 16
LA 60
LA 439
LA 1072
LA 1073
LA 1074
LA 1075
LA 3124
LA 38
LA 430
LA 62
LA 436
LA 424
LA 1070
LA 438
LA 25
LA 437
LA 1129
LA 40
Washington
St Tammany
N
0
1.5
3
6 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community