



To: Erica Parish and George Jones
Paulding County Department of
Transportation

Date: 10/23/2024

Memorandum

Project #: 64587.00

From: Regan Hammond

Re: Paulding County Comprehensive Safety Action Plan – Safety Analysis
Summary

Introduction

This memorandum describes the data-driven safety analysis for Paulding County's Comprehensive Safety Action Plan (CSAP). Four major components make up the safety analysis:

- Crash trends
- High injury network
- Systemic analysis
- Equity analysis

The methodology and results for each of these analyses are described below, as well as a summary of previous related studies and plans in Paulding County.

Crash Trends

A comprehensive analysis of historical crash data in Paulding County was conducted to determine crash trends. VHB coordinated with the project team completing the Paulding County Major Corridors Study to utilize the same crash dataset, which had been through the data cleaning process from Georgia Department of Transportation's (GDOT) AASHTOWare Safety/Numetric (2019-2022), and GEARS (2023). VHB updated this dataset in July 2024 when 2023 crash data was transferred from GEARS to AASHTOWare Safety/Numetric.

The CSAP places a high priority on reducing fatal and severe injury crashes in Paulding County. Crash severity is defined using the KABCO scale, where K represents fatal crashes and A represents severe injury crashes. The combination of these two crash severities is referred to as KA crashes in this memorandum.

Figure 1, below, shows the spatial distribution of the crashes during that time period. The map shows higher concentrations of crashes are found in the eastern part of Paulding County, particularly along the US 278 corridor and in the cities of Dallas and Hiram.

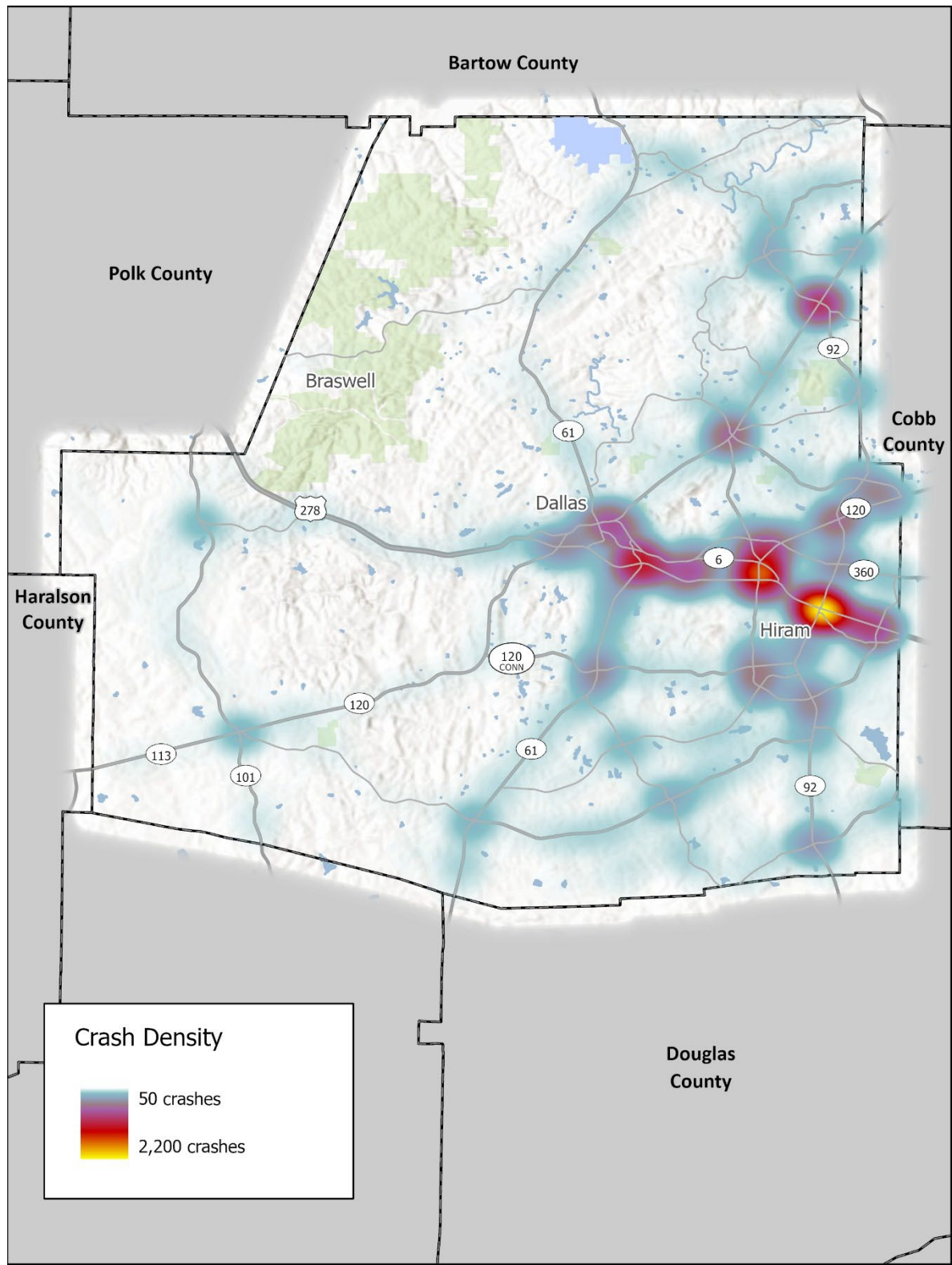


Figure 1: Paulding County Crash Heatmap

The crash trends analysis also included determining the crash types or conditions that led to the most KA crashes in the County. Factors that were overrepresented for serious crashes were identified on County and city levels. Overrepresentation refers to a greater proportion of the crash conditions occurring for severe crashes than for all crashes in that jurisdiction. Factors that were found to be overrepresented in fatal and serious injury crashes for Paulding County are shown in Figure 2.

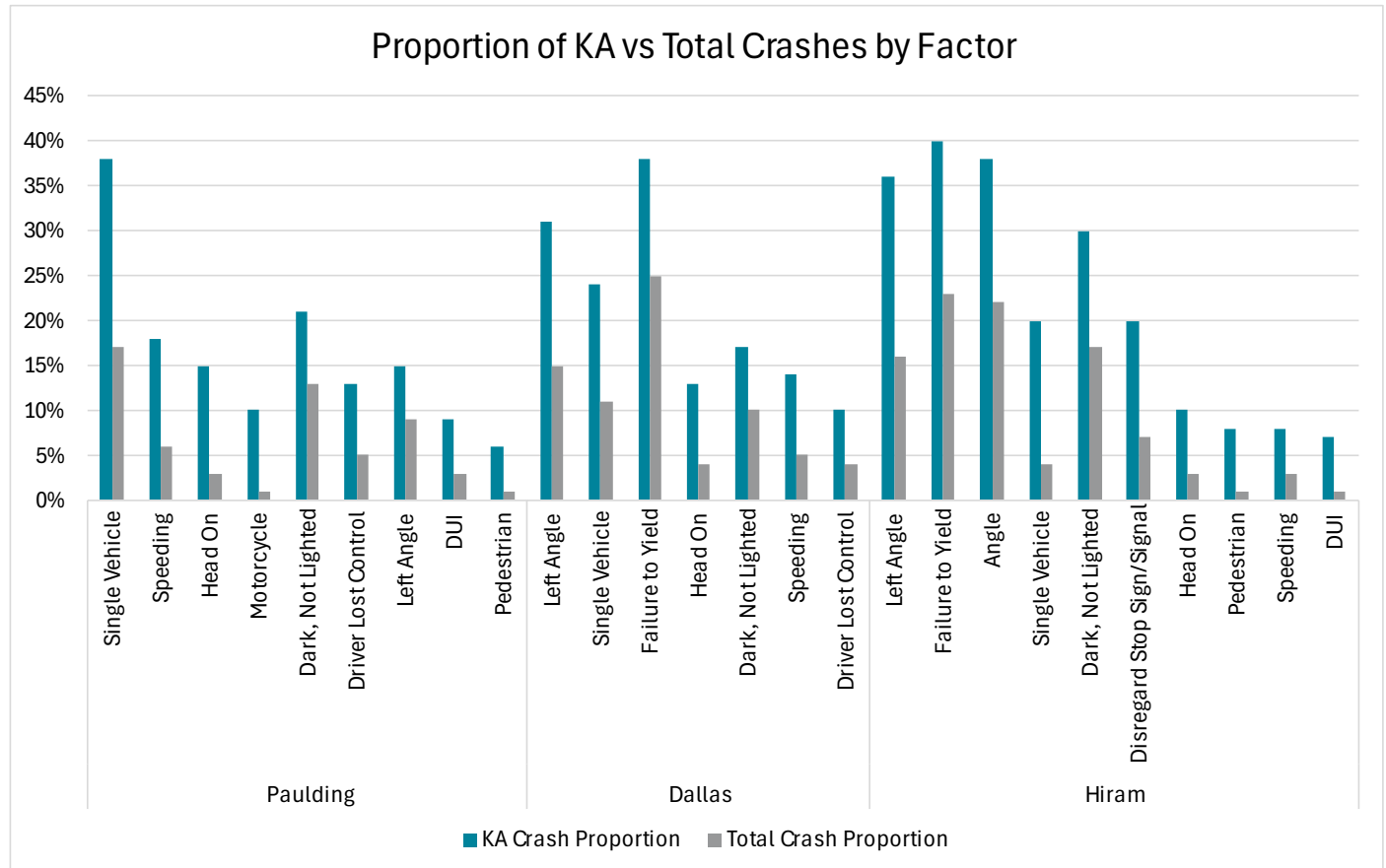


Figure 2. Comparison of KA vs Total Crashes

Figure 3 presents the ratio of KA to total crash percentages by factor, where a higher ratio indicates the crash factor is more likely to appear in more severe crashes. Several factors are overrepresented in all three jurisdictions, including:

- Head on crashes (3.3 to 5.0 ratio)
- Single vehicle (2.2 to 5.0 ratio)
- Speeding (2.7 to 3.0 ratio)
- Left angle crashes (1.7 to 2.3 ratio)
- Dark, not lighted (1.6 to 1.8 ratio)

Disregarding stop signs/signals was overrepresented only in the City of Hiram, which also had the highest percentage of dark, not lighted crashes (30%). Failure to yield was found in both cities, but not the County, while motorcycle crashes are only overrepresented on the County level at a 10:1 overrepresentation ratio, the highest of all factors.

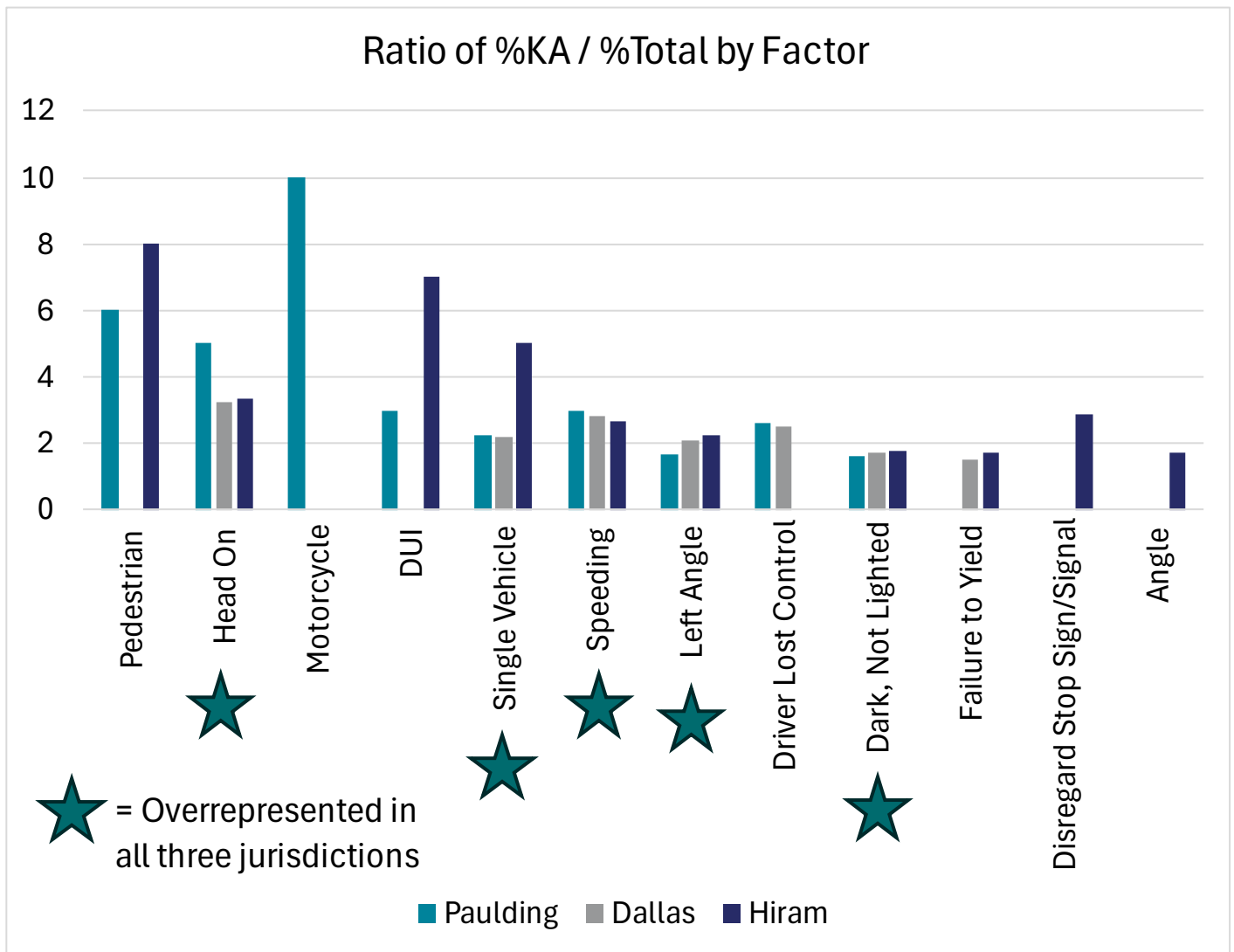


Figure 3. Ratio of KA to Total Crash Percentage by Factor

Figure 4 and Figure 5 respectively show where dark, not lighted crashes and speeding crashes are most prevalent within Paulding County. Crashes occurring during dark, not lighted conditions can be seen primarily in the eastern portion of the County, particularly along US 278, SR 120, and SR 92. Speed-related crashes are found on these same roadways, as well as local roads, such as Bill Carruth Pkwy, Harmony Grove Church Rd, and Gold Mine Rd.

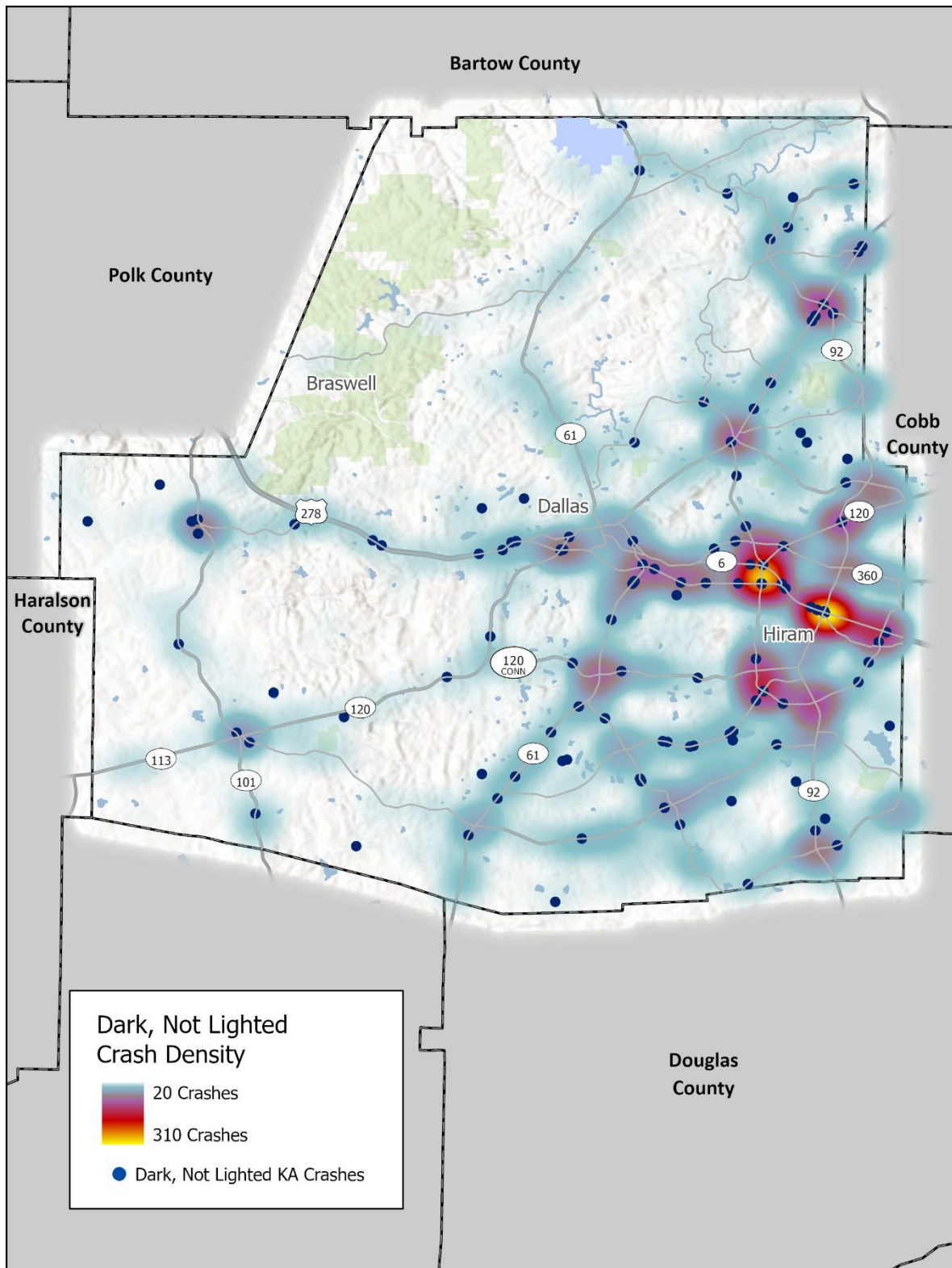


Figure 4. Dark, Not Lighted Crash Heat Map

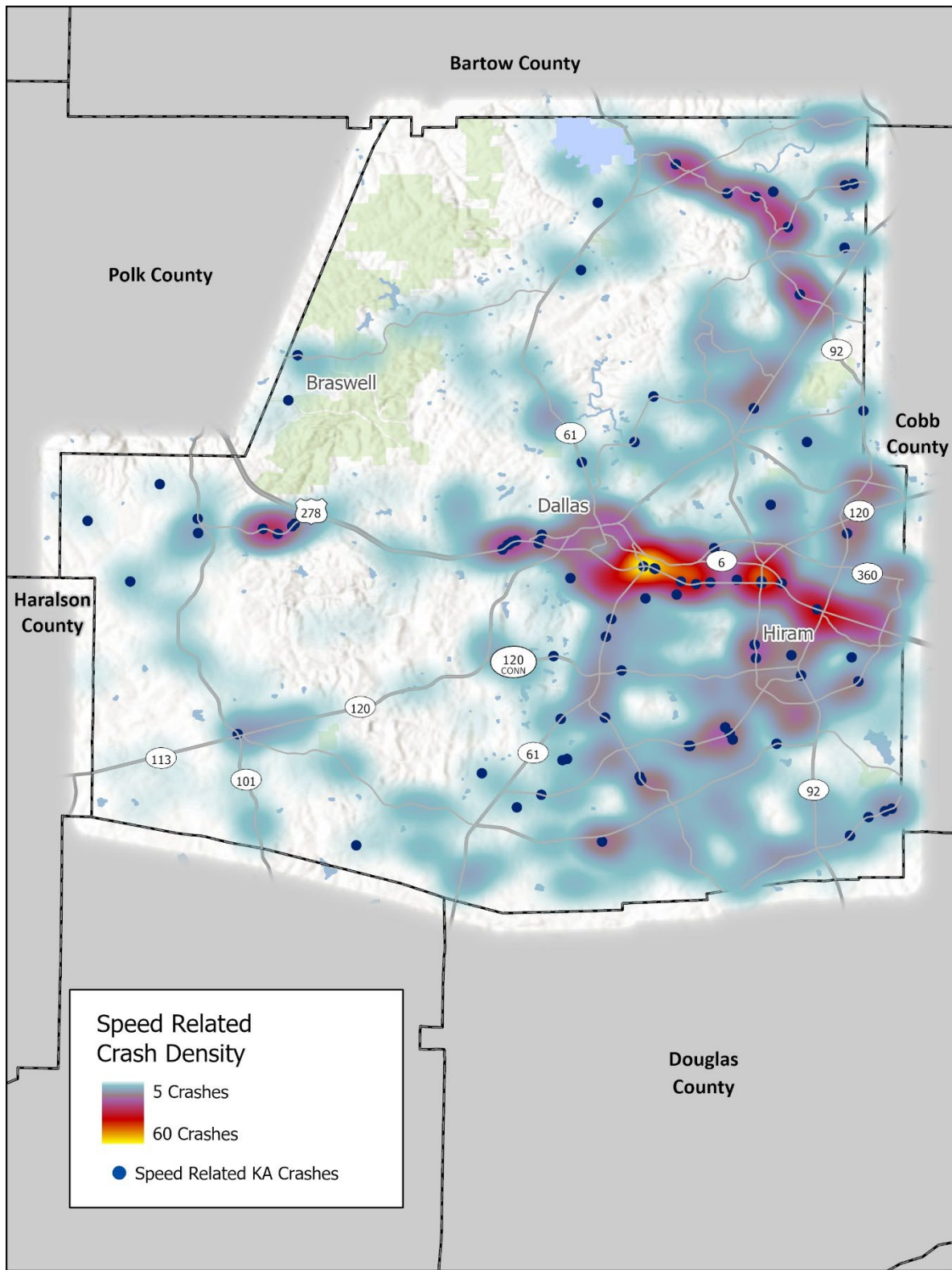


Figure 5. Speeding Related Crash Heat Map

Demographic Comparison

An analysis of the characteristics of people involved in fatal crashes and the overall demographics of Paulding County was conducted. The intent of this analysis was to determine if any populations were overrepresented in fatal crashes. Figure 6, below, shows the comparison of characteristic of drivers involved in fatal crashes from Numetric, and the Fatality Analysis Reporting System (FARS) hosted by the United States Department of Transportation (USDOT) compared to the US Census demographic data for Paulding County. The two groups that were overrepresented in fatal crashes, in comparison to County demographics, are male drivers (14.5% difference) and older drivers (4.5% difference).

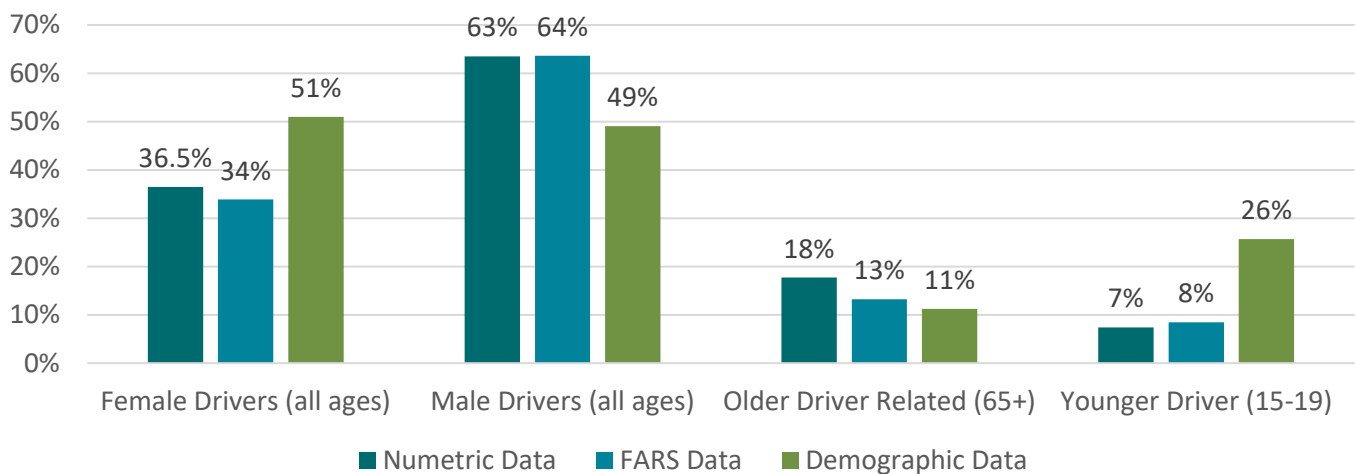


Figure 6. Fatal Crash Driver Characteristics

Figure 7, below, compares the characteristics of the fatalities caused in both vehicle crashes and pedestrian crashes to Paulding County demographic data. The largest population overrepresented as fatalities is male pedestrians, followed by males in vehicular crashes and older populations in vehicle crashes. It is important to note the FARS pedestrian crash data has a limited sample size, with nine pedestrian fatalities occurring in the County between 2017-2022. This is slightly higher than AASHTOWare/Numetric's total of eight pedestrian fatalities in the same time period.

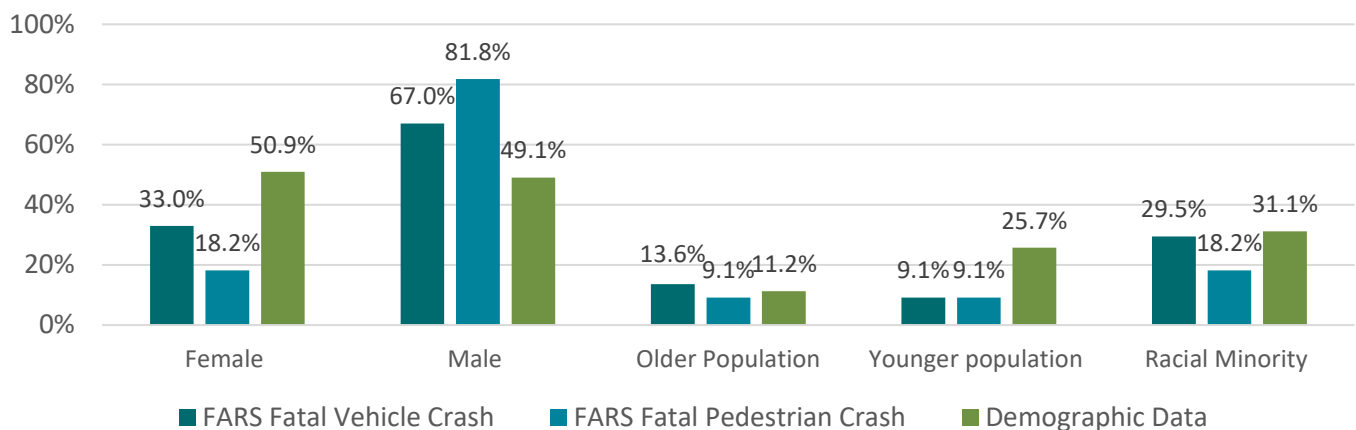


Figure 7. Fatalities Characteristics

High Injury Network

The section of this memorandum defines the general methodology used for the CSAP High Injury Network (HIN). The HIN defines stretches of roadways, or corridors, and intersections within the County’s jurisdiction that had the highest concentration of severe crashes. The HIN highlights locations that have experienced a high number of severe crashes in the past 5 years (2018-2022).

Methodology

The equivalent property damage only (EPDO) method (also known as crash severity weighted frequency) was used to create the HIN. The EPDO method employs the societal costs of fatal, injury, and property damage-only crash severities. A blended crash cost and weight for fatal (K) and suspected serious injury (A) severity crashes, which is consistent with the Atlanta Regional Commission (ARC) Regional Safety Strategy. These costs allowed for the use of a single average crash cost (and associated weight) for both K and A crashes. Blending EPDO weights for K and A crashes reduces the impact of a single fatality on a facility’s score. One fatality is equivalent to approximately 17 severe injury crashes; if these crash types were analyzed with separate weights, the results of the HIN may be skewed. This weighted average for K and A crashes was computed as follows:

$$\text{Blended KA EPDO Weight} = \frac{\text{Blended KA Crash Cost}}{\text{PDO Crash Cost}} = \frac{\$2,999,068}{\$11,415} = 263$$

Table 1 presents the average crash costs for Paulding County and the associated EPDO weight for each crash severity level. These costs were calculated for Paulding County specifically by totaling the number of County crashes (and persons involved in crashes) at each severity level.

Table 1. Paulding County Crash Costs

Crash Severity Category	Average Crash Cost	EPDO Weight
KA: fatal and serious injury	\$2,999,068	263
BC: suspected minor injury	\$173,206	15
O: property damage only	\$11,415	1

Although this approach differs slightly from the Georgia Department of Transportation’s (GDOT’s) EPDO calculations in terms of costs associated with each injury severity level, it follows State and national guidance related to the Highway Safety Improvement Program (HSIP) by focusing the HIN on K and A crashes. The GDOT method uses the person-injury unit costs from the United States Department of Transportation (USDOT) Valuation of a Statistical Life (VSL) guidance in safety benefit-cost analysis. Rather than converting from maximum abbreviated injury scale (MAIS) to KABCO, GDOT uses the AIS 3 person-injury unit cost (i.e., severe injury) from the 2013 USDOT guidance as a weighted crash unit cost for all KABCO A, B, and C crash unit costs. Further information on the GDOT method is found here: [Crash Costs for Highway Safety Analysis \(dot.gov\)](https://www.fhwa.dot.gov/safety/crash_costs_for_highway_safety_analysis.dot.gov).

A blended weight for suspected minor injury (B) and possible injury (C) crashes was developed instead of using separate weights. This addresses concerns with police reported crashes and the accuracy of lower severity injuries in the crash data, since police officers must use their discretion on how to report these less severe injuries. Additionally, this method provides a greater emphasis on KA crashes in the HIN. As a result, the following equation determined the EPDO score of a corridor or intersection:

$$\text{EPDO Score} = (\text{Blended KA Weight} * \text{Number of KA Crashes}) + (\text{Blended BC Weight} * \text{Number of BC Crashes}) + (\text{PDO Weight} * \text{Number of PDO Crashes})$$

Corridor Considerations

The EPDO scores were applied to all corridors and intersections within Paulding County. The highest-ranking corridors were used to generate an HIN for the County. If the HIN output produced small gaps in the network along a contiguous corridor, these segments were aggregated into contiguous corridors based on a quarter-mile proximity buffer, professional judgment, and feedback from the County. Figure 8 shows an example of small gaps in the HIN along SR 120/Buchanan Hwy that were aggregated into a continuous segment.

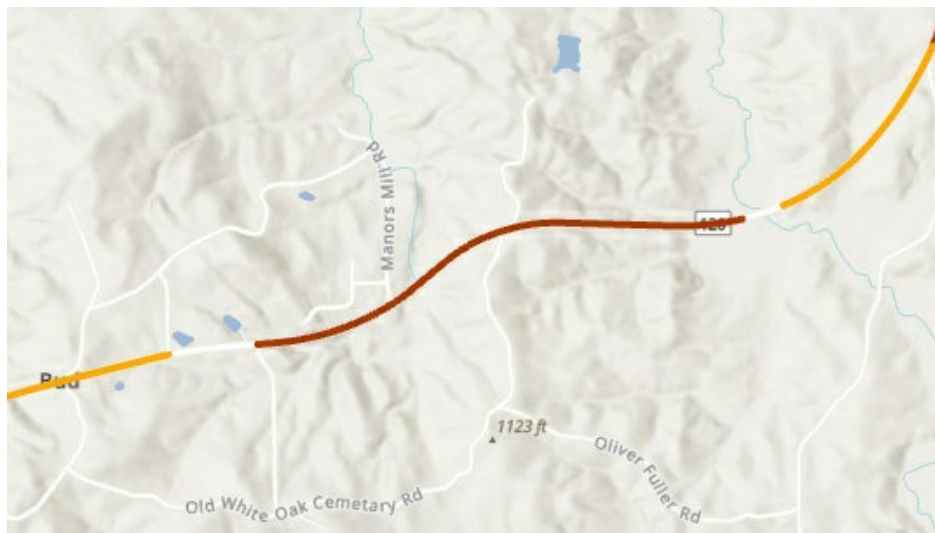


Figure 8. Example of short gaps in the HIN along SR 120/Buchanan Hwy

Short crossroad segments were also excluded as entries in the HIN. These locations were indicative of high crash intersections, and these were not treated as segment-related crashes for the purposes of generating HIN corridors. Figure 9 shows an example of crossroad segments aggregated to form HIN corridors east of SR 92.

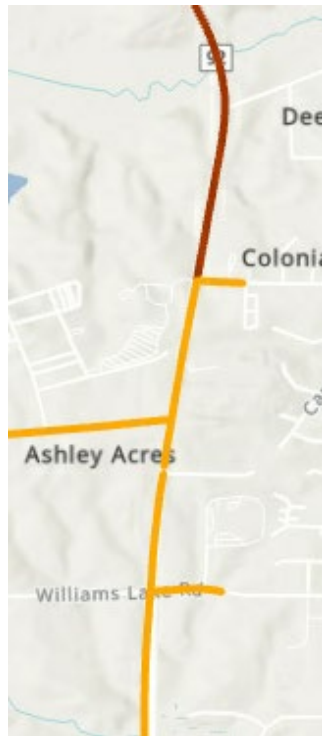


Figure 9. Example of crossroads aggregated to the HIN based on high crash intersections

Intersection Influence Area

In aggregating the high crash intersections, a general intersection influence area had to be determined. The intersection influence area was used to identify intersection crashes, compared to corridor crashes near the intersections. The average block length within the Census Block Group was used as the determining factor for the influence area (see Table 2Table).

Table 2. Assumed Intersection Influence Area by Average Block Length

Average Block Length in GIS (Feet)	Assumed Intersection Influence Area (Feet)
<400	75
400-650	100
>650	150

Results

The segments and intersections that are in the top 10% and top 5% of the HIN are marked in Figure 10 and Figure 11, respectively. An orange corridor or intersection is in the top 10% EPDO score, while a red corridor or intersection is in the top 5%.

The state and local route segments that make up the 10 segments with the highest EPDO scores in the HIN are shown in Table 3. A map of these segments is shown in Figure 12. In addition, the state route segments in the top 10 of the HIN, excluding US 278, are listed in Table 3. The top 10 local segments are also represented in Table 3. A map of state route segments, excluding US 278, and the local route segments is shown in Figure 13. This analysis was conducted because US 278 makes up 8 of the top 10 state route segments. Excluding US 278 allowed other corridors in the County to show up in the Top 10 list.

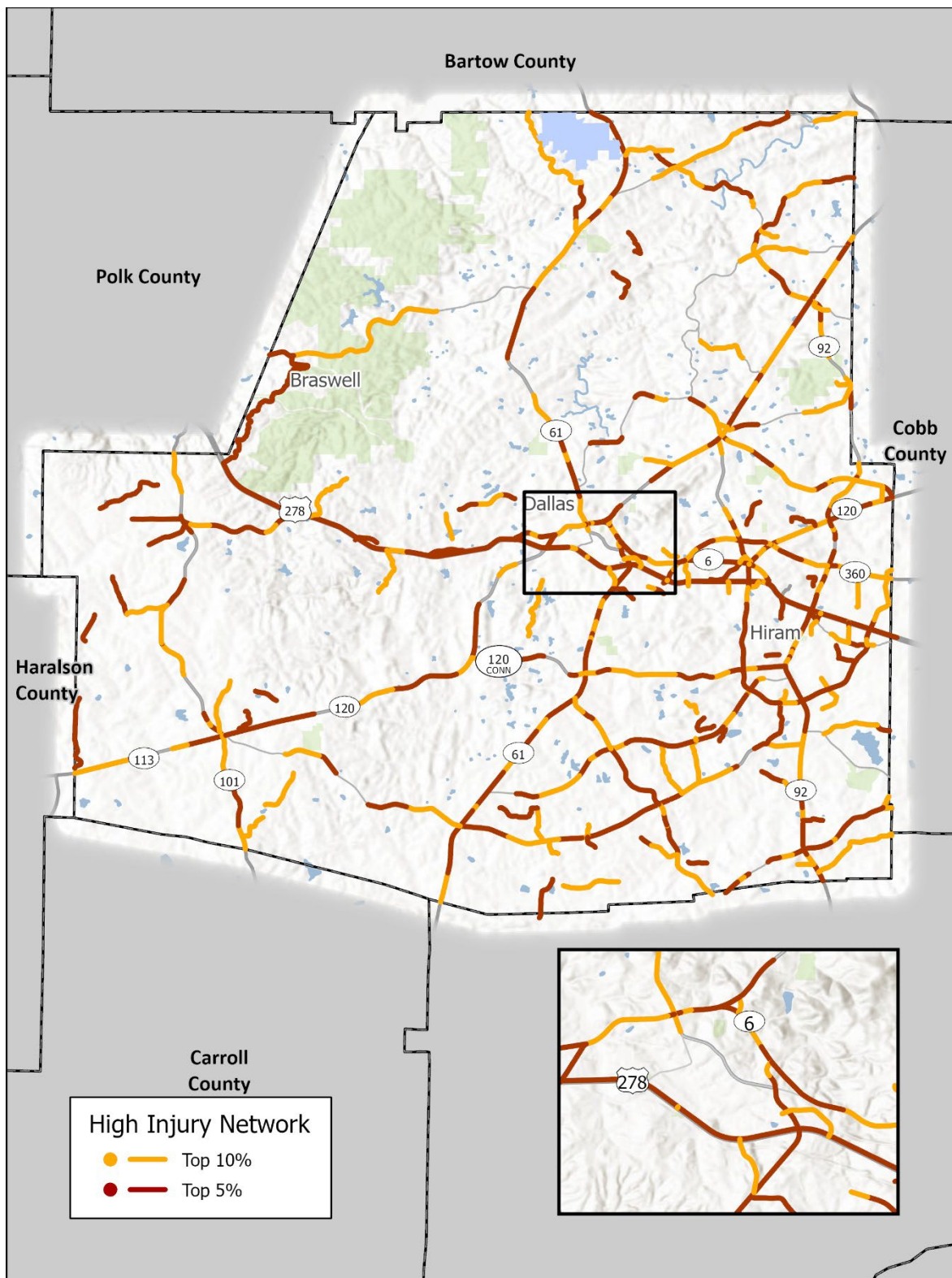


Figure 10. Segments in the HIN

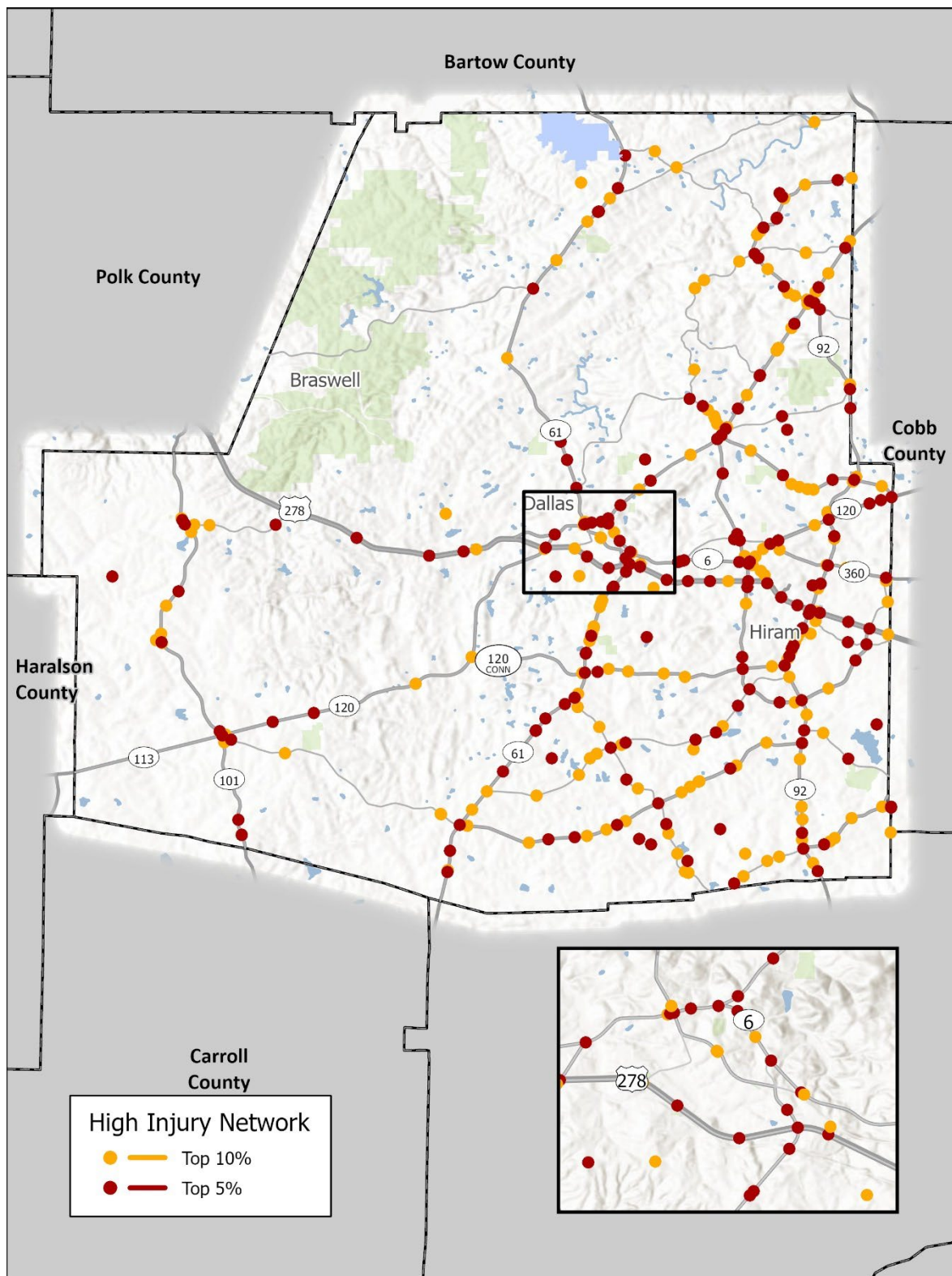


Figure 11. Intersections in HIN

Table 3. Top 10 Segments in the HIN

State Routes				State Routes (excluding US 278)				Local Routes			
#	Road	from	to	#	Road	from	to	#	Road	from	to
1	US 278	Lake Rd	Greenfield Rd	1	SR 61/Villa Rica Hwy	Campground School Rd	Hiram Sudie Rd	1	Bill Carruth Pkwy	Willow Bend Dr	Nebo Rd
2	US 278	Pace Rd	SR 92	2	SR 120/Charles Hardy Pkwy	US 278	Atlanta Hwy	2	Bill Carruth Pkwy	Nebo Rd	Laird Rd
3	US 278	Paris Rd	SR 120	3	SR 92	US 278	0.25 mi n/o US 278	3	Bill Carruth Pkwy	US 278	Breezy Valley Conn
4	US 278	Homer Cochran Rd	W Memorial Dr	4	SR 61/Merchants Dr	Hampton Dr	USPS Driveway	4	Nebo Rd	Wall Rd	McClung Rd
5	US 278	SR 61	Thomas B Murphy Dr	5	SR 61/Nathan Dean Blvd	US 278	Thomas B Murphy Dr	5	Bill Carruth Pkwy	Regency Dr	SR 120
6	US 278	Old Harris Rd	Butler Industrial Dr	6	SR 6 BUS/Merchants Dr	Coach Bobby Dodd Rd	Macland Rd	6	Nebo Rd	Riverstone Dr	Normas Way
7	US 278	Metromont Rd	Bill Carruth Pkwy	7	SR 61/E Memorial Dr	Old Acworth Rd	Lester Dr	7	W Memorial Dr	Johns Rd	Buchanan St
8	US 278	Academy Dr	SR 61	8	SR 61/Villa Rica Hwy	Vernoy Aiken Rd	Winndale Rd	8	Cedarcrest Rd	Kingsford Way	Highcrest Dr
9	SR 61	Campground School Rd	Hiram Sudie Rd	9	SR 6 BUS/Merchants Dr	Summerhill Rd	SR 120	9	Holly Springs Rd	Woodwind Dr	SR 101
10	SR 120	US 278	Atlanta Hwy	10	SR 6 BUS/Merchants Dr	Wilbanks Cir	Summerhill Rd	10	E Memorial Dr	Legion Rd	Croker Dr

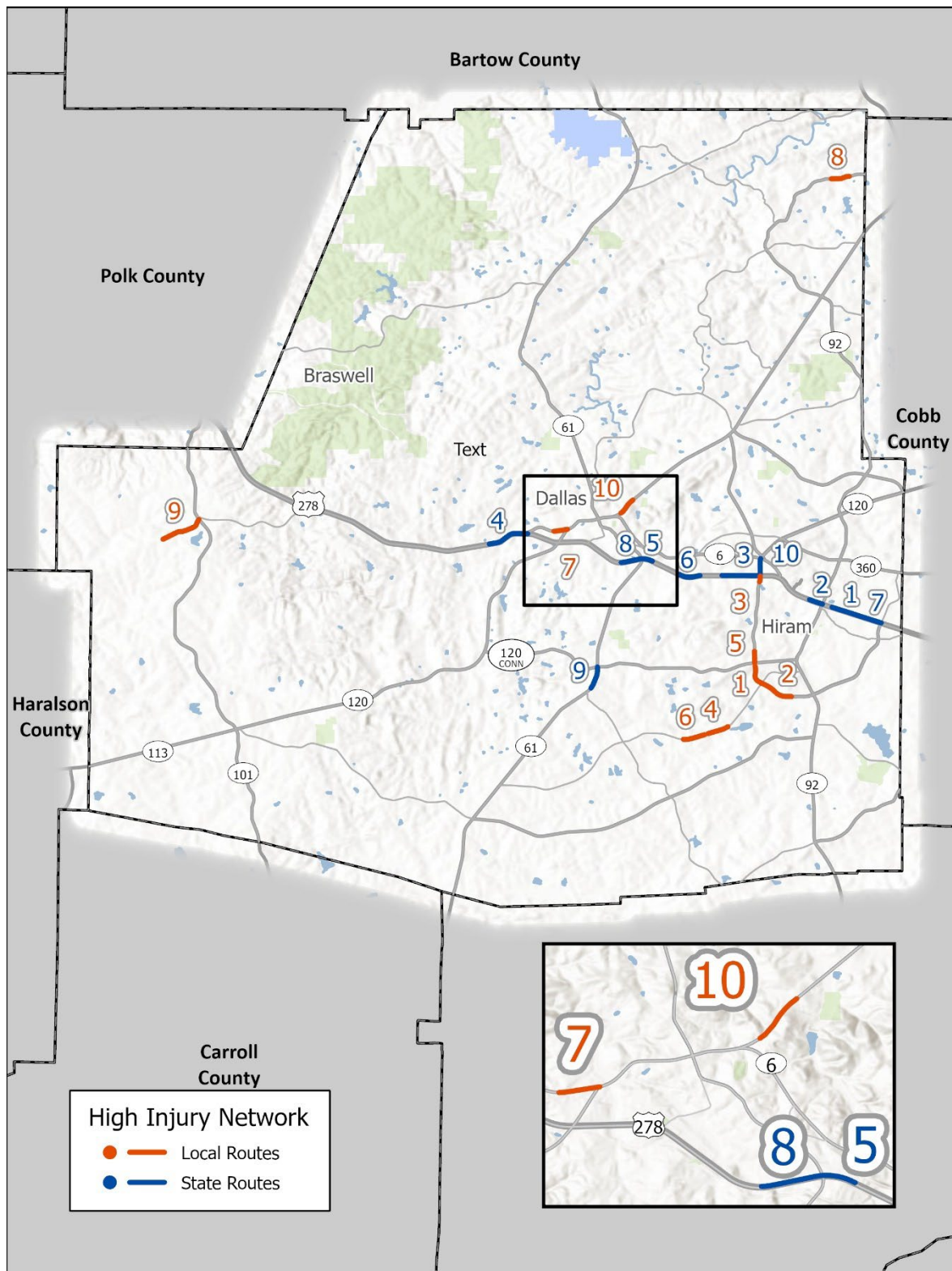


Figure 12. Map of Top 10 Segments in HIN

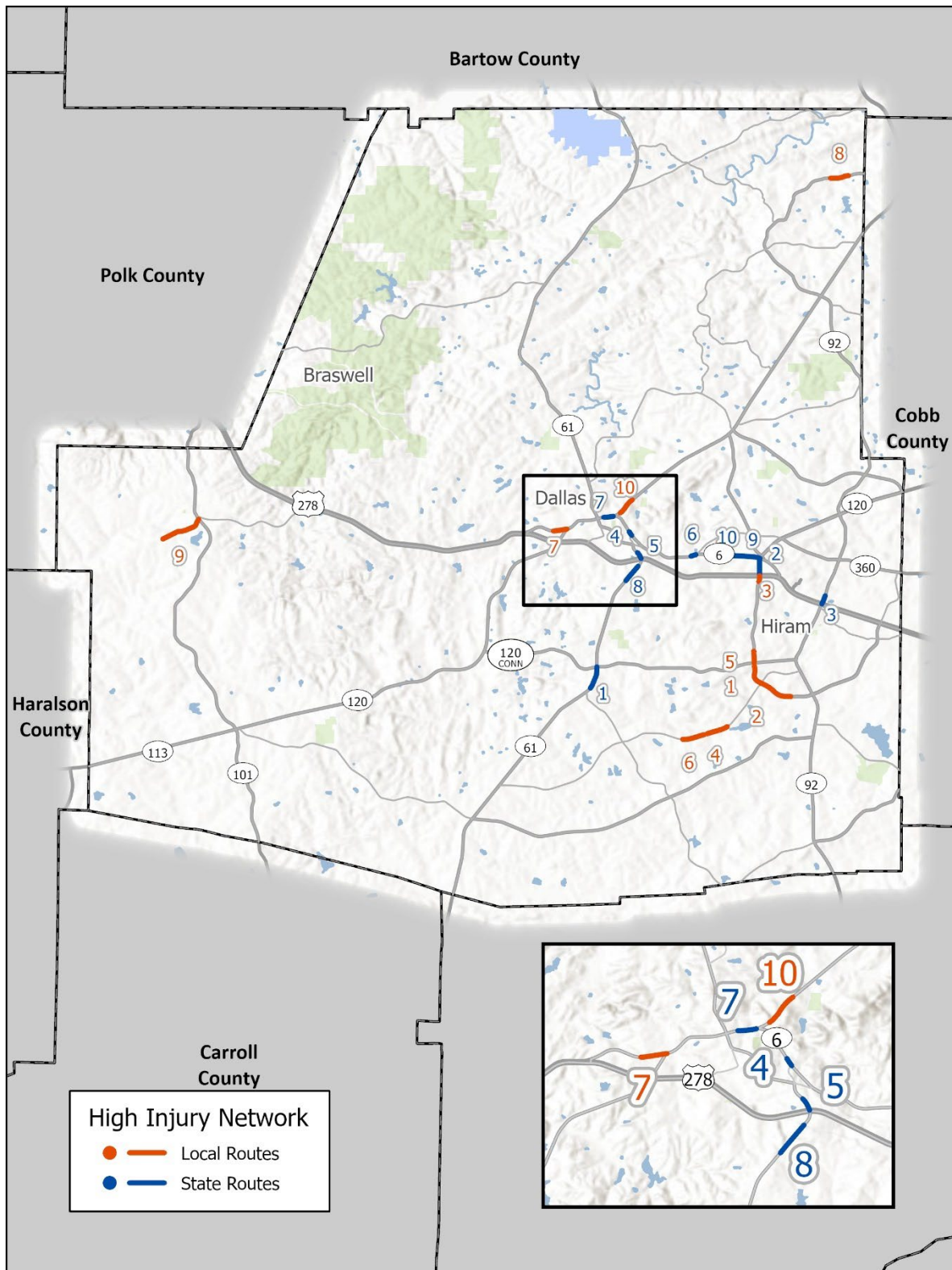


Figure 13. Map of Top 10 Segments in HIN (Excluding US 278)

The intersections that make up the top 10 of the HIN are shown in Table 4. The table is split into intersections that contain at least one state route and intersections that contain only local routes. A map showing the locations of the intersections is shown in Figure 14.

Table 4. Top 10 Intersections in HIN

State Routes		Local Routes	
#	Intersection	#	Intersection
1	US 278 & SR 120/Charles Hardy Pkwy	1	Bill Carruth Pkwy & Nebo Rd*
2	US 278 & SR 61/Nathan Dean Blvd	2	Dallas Acworth Hwy & Bobo Rd
3	US 278 & SR 92	3	Bill Carruth Pkwy & Virgie Ballentine Dr
4	US 278 & Old Harris Rd	4	Bill Carruth Pkwy & Rosedale Dr
5	SR 120/Charles Hardy Pkwy & SR 92	5	E Memorial Dr & Legion Rd
6	SR 120/Charles Hardy Pkwy & SR 6 BUS/Atlanta Highway	6	Nebo Rd & Wall Rd
7	US 278 & Thomas B Murphy Dr	7	Dallas Nebo Rd & Ridge Rd
8	US 278 & Poplar Springs Rd	8	Macland Rd & Mount Tabor Church Rd
9	US 278 & Butler Industrial Dr	9	Cedarcrest Rd & Meadows Dr
10	SR 120 & Bill Carruth Pkwy	10	Austin Bridge Rd & Mein Mitchell Rd
*Intersection improvements occurred in January 2024, which is not reflected in the data.			

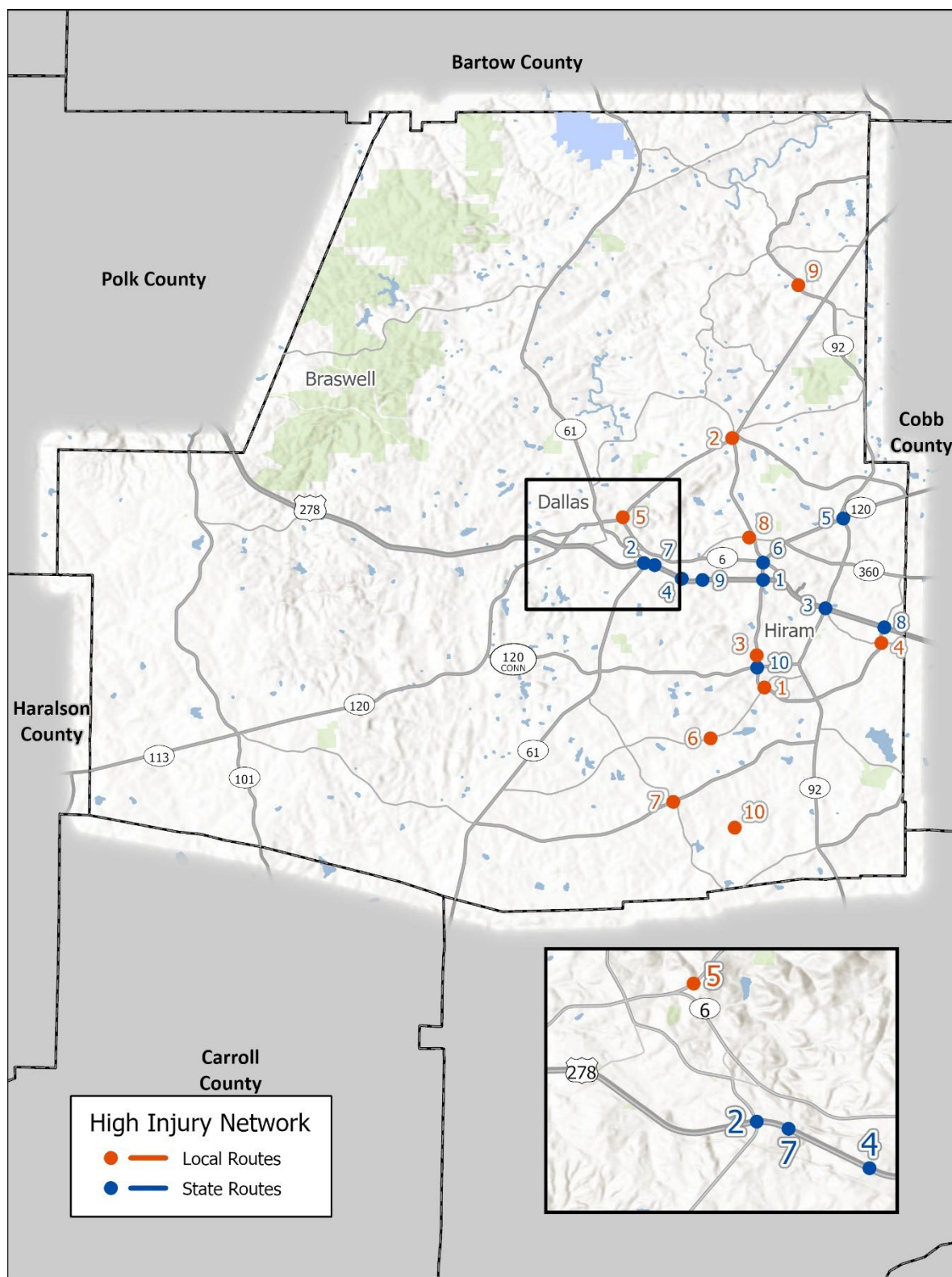


Figure 14. Map of Top 10 Intersections In HIN

Systemic Analysis

This section of the memorandum defines the general methodology and results of the CSAP's systemic analysis. The results of this analysis allow Paulding County to target high risk locations, particularly those that haven't seen a fatal or serious injury (KA) crash in recent years but exhibit characteristics that make them susceptible to such incidents in the future.

Methodology

Using the R scripting language, binary logistic regression was used to assess each focus crash type on its respective facility. This method is widely used to analyze data where a binary outcome is modeled using predictors. It represents the odds of a KA crash occurring on a segment. An "odds ratio" greater than one indicates a positive correlation between an independent variable (risk factor) and the dependent variable (a KA crash occurring on a segment); meaning, an increase or presence in a variable is associated with an increase in crash likelihood. Conversely, an odds ratio less than one indicates a negative correlation; meaning, a decrease or absence of a variable is associated with an increase in crash likelihood.

The project team segmented focus facilities into individual blocks, between two intersecting roads. The segments were only further segmented if road characteristics or census data changed midblock. A 150-foot influence area was used for intersections.

The three focus crash types of the systemic analysis were segment-related crashes, intersection-related crashes, and active transportation crashes. Several crash trends aligned with segment crashes, including speeding, single vehicle, and head on crashes. Intersection crashes include left turn crashes, angle crashes, and failure to yield. An active transportation crash model was also developed to determine which segments were a greater risk to pedestrians and bicyclists. Facility types were used as a risk factor (functional classification of arterials) in this analysis, rather than limiting the scope of the systemic analysis.

Based on the risk factor analysis, a summary of the risk factors per focus crash type was created. Segments and intersections with a greater number of risk factors can be targeted for safety improvements, regardless of crash history. This represents a proactive approach as opposed to a reactive approach represented by the HIN.

Results

Three binomial logistic regression models were developed to determine risk factors for crashes within Paulding County. Detailed model results, including the model summary outputs, pseudo R-squared values, and odds ratios, can be found in the appendix of this memorandum.

The segment crash risk factors are presented in Table 5, along with their significance to the prediction of KA crashes. According to the results, roadway characteristics, such as the length of the segment, AADT, functional classification of arterial, and number of through lanes, were all very significant indicators for KA segment crashes. Additionally, risk factors related to the surrounding environment, such as employment density, median home value, and the percentage of zero household cars, were statistically significant crash predictors. The natural log was taken for several variables, which prevented large outliers from affecting the model for variables that were unconstrained.

These risk factors, except for segment length, were then totaled for each segment or intersection and mapped to visualize where the greatest number of risk factors occur within the County. Breakpoints for variables that have a range of values, such as AADT, were determined by taking the 90th percentile of all segments or intersections in

Paulding County, and any value greater than this was considered at-risk. Since median home value has a negative coefficient, i.e. greater home values indicate lower likelihood of crashes, the 10th percentile was taken, and any values less than this were considered at-risk.

Table 5. Segment-Related Risk Factors

Input	Risk Value	Significance
Segment Length	N/A	+++
AADT	At least 4,000 vpd	+++
Functional Classification	Principal or Minor Arterial	+++
Speed Limit	At least 45 MPH	+++
Number of Through Lanes	At least 4 lanes	+++
Employment Density	At least 550 jobs / sq. mi	+++
Median Home Value	\$170,000 or less	---
Percentage of Zero Car Households	5% or greater	+++
Land Use	Multi-Use or Office	+++
+++ / --- = $p < 0.01$ ++ / -- = $p < 0.05$ +/- = $p < 0.2$		

The segment related risk factors were mapped in Figure 15 to show which segments posed the greatest risk. Segment length was not shown as a risk factor in this map, since the length of the roadway is somewhat arbitrary (intersection to intersection length). This means that a maximum of eight risk factors could appear for one roadway segment.

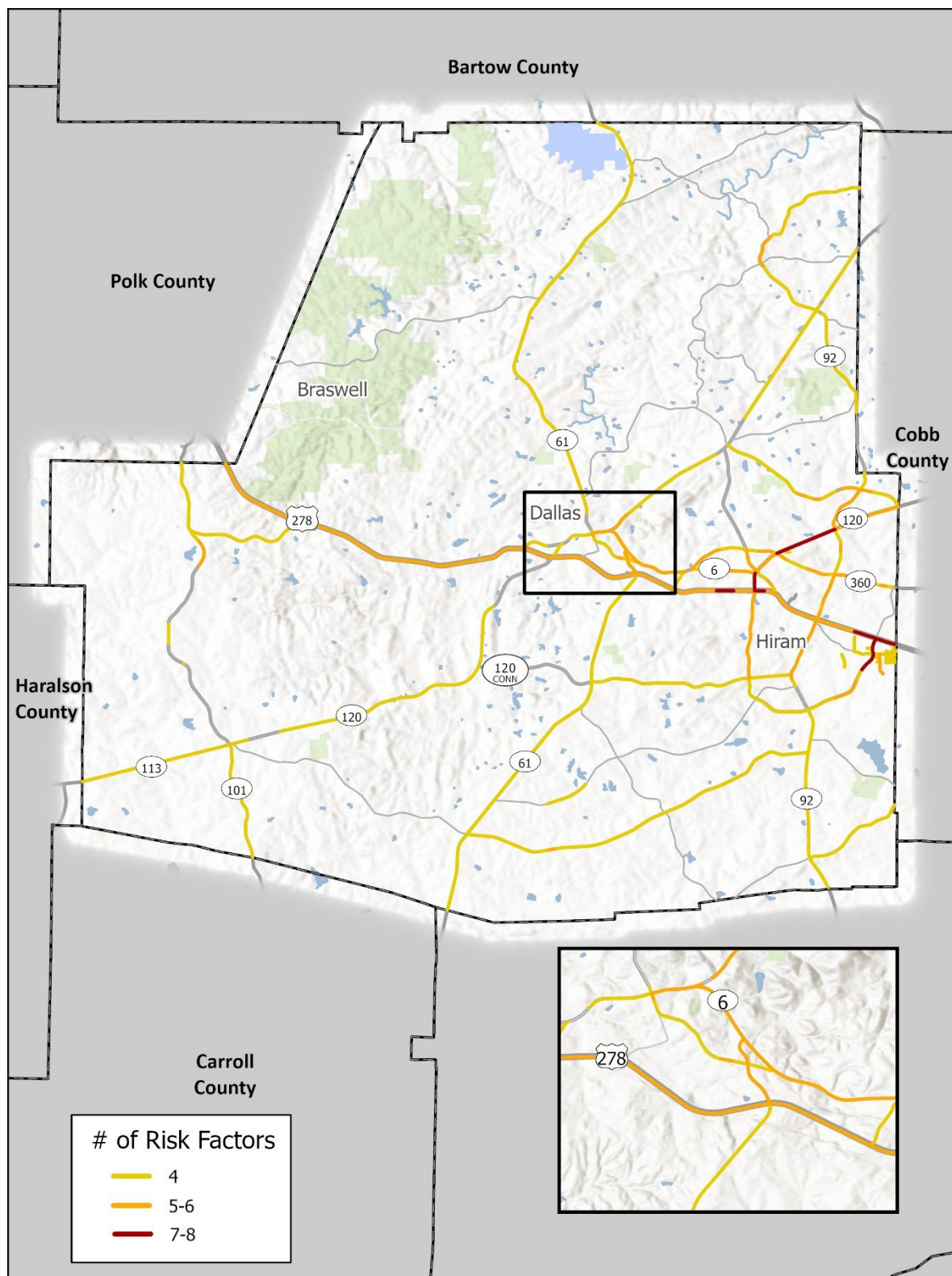


Figure 15. Segment Risk Map

The segments with the greatest amount of risk factors (7-8 factors) are presented in Table 6. The segment with 8 risk factors is bolded. These high-risk segments are also found in the HIN, meaning they are of the highest priority to address safety needs. Roadways with many of the same characteristics can be found in 5-6 risk factor range, which include the major state routes near Dallas and Hiram, and the entirety of US 278 in Paulding County. Other state routes, such as SR 120, SR 101, SR 61, and SR 92 have four risk factors, along with major local routes, such as Ridge Rd, Gold Mine Rd, and Cedarcrest Rd.

Table 6. High-Risk Segments

Road	From	To	Road	From	To
SR 120	Macland Rd	SR 92	US 278	Paris Rd	International Pkwy
SR 360	SR 6	US 278	US 278	Greenfield Rd	Isley Stamper Rd
US 278	SR 360	Hiram Dr	Bill Carruth Pkwy	US 278	Angham Rd

The risk factors for intersection-related crashes are listed below in Table 7. For several of the risk factors, the maximum or average values of the intersection legs was taken. The most significant risk factors include the number of legs, functional classification, speed limit, and population density.

Table 7. Intersection-Related Risk Factors

Input	Risk Value	Significance
AADT (Max of legs)	At least 9,000 vpd	++
Signalized	Yes	+
Number of Legs	At least 4 legs	+++
Functional Classification	Principal or Minor Arterial (average of legs)	+++
Intersection w/ State Route	Yes	+
Speed Limit (Max of Legs)	At least 45 MPH	+++
Median Home Value	\$170,000 or less	-
Percentage of Zero Car Households	At least 5%	++
Population Density	At least 1800 persons/sq mile	+++
+++/- = $p < 0.01$ ++/-- = $p < 0.05$ +/- = $p < 0.2$		

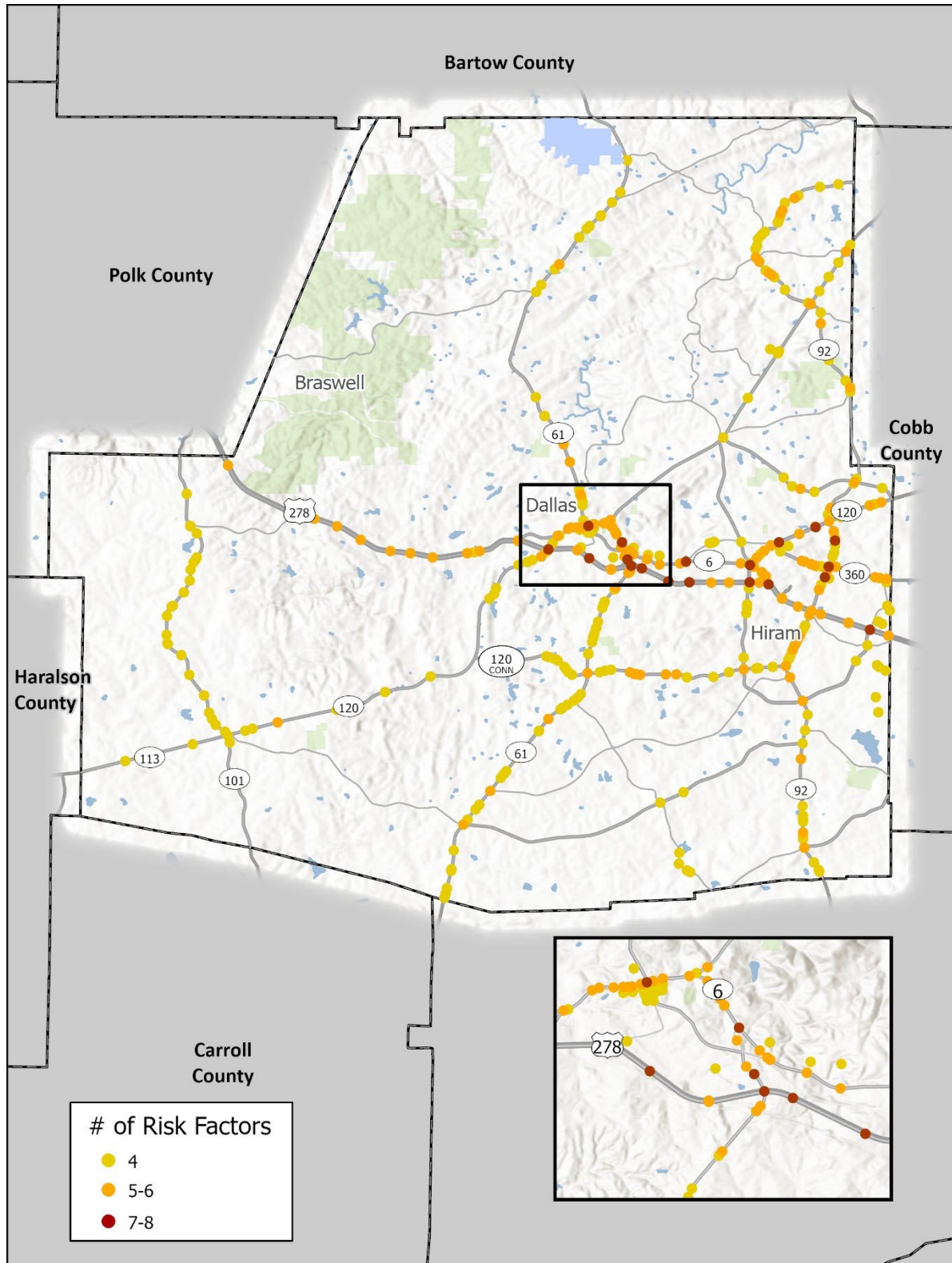


Figure 16. Intersection Risk Map

Figure 16 maps the intersections in Paulding County by the number of risk factors. The intersections with the greatest amount of risk factors (7-8 factors) are shown in Table 8. The intersections with 8 risk factors have been bolded.

Table 8. High-Risk Intersections

US 278 & SR 120/Buchanan St	SR 61 & Main St
US 278 & Seaboard Dr	SR 61 & Merchants Dr
US 278 & SR 61	SR 61 & Thomas B Murphy Dr
US 278 & Thomas B Murphy Dr	SR 61 & Nathan Dean Blvd
US 278 & Old Harris Rd	SR 120 & Merchants Dr
US 278 & Butler Industrial Dr	SR 120 & Evans Mill Dr
US 278 & SR 120	SR 120 & Sedgefield Dr
US 278 & Atlanta Hwy	SR 92 & Hanover Ave
US 278 & Bill Carruth Pkwy	SR 92 & SR 360
SR 360 & Merchants Dr	SR 92 & Dailey Rd

An active transportation risk model was developed to predict pedestrian and bicycle crashes of all severities, due to a lower sample size of these crash types. The risk factors for these crash types are presented in Table 9. The most significant risk factors include number of through lanes, employment density, and land use. The road segments are mapped in Figure 17 by their number of active transportation risk factors.

Table 9. Active Transportation Related Risk Factors

Input	Risk Value	Significance
Segment Length	N/A	+++
AADT	At least 4,000 vpd	n/a
State Route	Yes	++
Functional Classification	Principal or Minor Arterial	++
Number of Through Lanes	At least 4 lanes	+++
Population Density	At least 1800 persons/sq mile	++
Employment Density	At least 550 jobs / sq. mi	+++
Percentage of Zero Car Households	At least 5%	n/a
Land Use	Office or Education	+++
+++/- = p < 0.01 ++/-- = p < 0.05 +/- = p < 0.2		

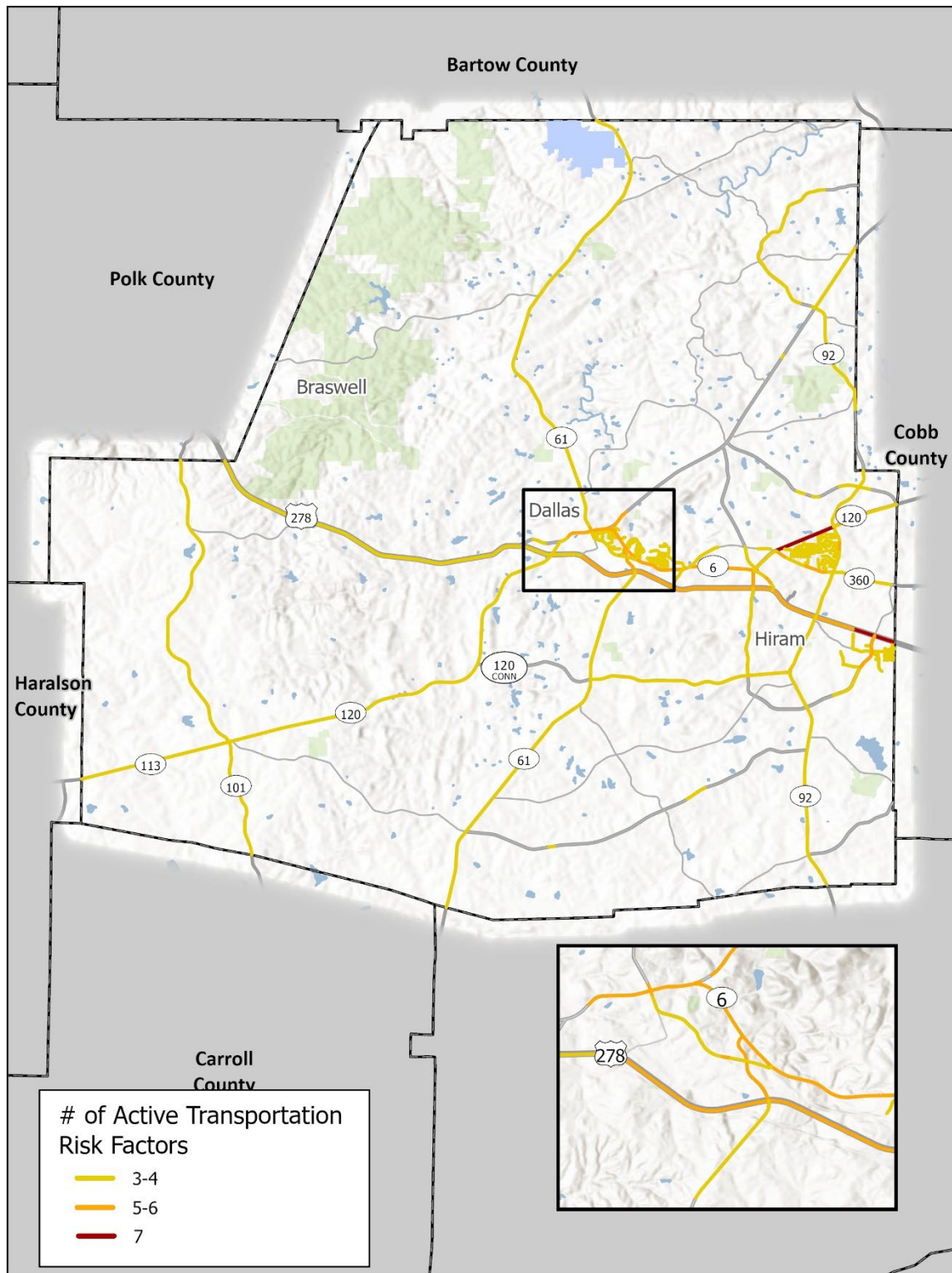


Figure 17. Active Transportation Risk Map

The segments with the greatest amount of active transportation risk factors (5-7 factors) are shown in Table 10. The segments with 7 risk factors are bolded. These segments are focused between and within the cities of Dallas and Hiram, where there is a combination of high vehicular volume and greater pedestrian activity.

Table 10. High-Risk Active Transportation Segments

Road	From	To	Road	From	To
SR 120	SR 360	SR 92	SR 120 / Charles Hardy Pkwy	Atlanta Hwy	US 278
US 278	Greenfield Rd	Isley Stamper Rd	SR 61 / Nathan Dean Blvd	Merchants Dr	US 278
US 278	S Main St	Greenfield Rd	SR 360 / Macland Rd	SR 120	SR 92
Bill Carruth Pkwy	Angham Rd	US 278	Merchants Dr	W Memorial Dr	SR 120 / Charles Hardy Pkwy
W Memorial Dr	Pinecrest Cir	SR 61 / Merchants Dr	SR 120 / Charles Hardy Pkwy	Atlanta Hwy	US 278
Merchants Dr	W Memorial Dr	SR 120 / Charles Hardy Pkwy			

Equity Analysis

This section of the memorandum defines the general methodology and results of the CSAP's equity analysis. The equity analysis identified the concentration of Historically Disadvantaged Populations (HDPs) in census tracts across the County. Crash data from 2018-2022 was disaggregated including race and age to identify both under- and over-representation of crash victims compared to demographics averages. This analysis helped identify underlying contributing factors to crashes and recommended strategies to mitigate impacts to persons disproportionately affected by traffic crashes.

Methodology

An equity standard deviation model was used to calculate the concentration of HDPs in every census tract relative to the County. The model employs a criteria bin scoring for each variable and a cumulative scoring of all the bins to create a final index score. The criteria bin scoring classifies each variable in each census tract on a scale of 0 to 4 based on the standard deviations relative to the County mean. A score of 0 signifies that the variable is "well below the County average" while a score of 4 signifies that the variable is "well above the County average". A cumulative score, or index, was calculated by adding all 13 variable scores in each census tract resulting in a score between 0 and 52.

The standard deviation model was recommended, which is consistent with the Atlanta Regional Commission (ARC) *Equity Analyses*. Augmentation to the model includes using the County instead of the region as a benchmark and the inclusion of 4 additional variables. The additional variables include Transit Commuters, Walking Commuters, Cycling Commuters, and Workers with No Car Available. These additional variables follow internal and nationwide best practices including the Minnesota DOT SPACE tool.

The equity portion of the CSAP consists of a crash victim analysis and a crash location analysis. These analyses look at different metrics to determine which crash victims in the County are over-represented and where the crashes are happening. The crash victim analysis uses metrics including race, age, gender and ethnicity to identify the

demographics of crash victims. This is then compared to the demographics for the County to determine under- and over-representation of crash victims.

The crash location analysis uses the HIN developed for the County to examine the degree of over-representation of HDPs living in proximity to high-crash and high-risk areas. This analysis distinguishes between the physical conditions of the place that contributes to serious injury and fatal crashes and the demographics of the crash victims. Areas with higher-than-average concentration of HDPs were compared to geographies with high representation of crash emphasis areas, the HIN, high-risk roadways, and areas identified as part of the systemic analyses.

Data

The model uses 13 variables which are available in the U.S. Census American Community Survey. Data for each of the variables were pulled from the 2022 5-year estimates for all census tracts in Paulding County. Table 11 summarizes all the variables included in the creation of the analysis. The "Cycling Commuters" variable was removed from the model due to no cycling commuters reported in the census for Paulding County. Therefore, the highest attainable index score was lowered to 48.

Table 11. Variables Use in the Equity Analysis

Variable	Measure	Data Source
Youth	Population under the age of 18	B09001_001
Senior	Population over the age of 65	S0101_C01_030
Female	Population Female	S0101_C05_001
Race	Non-White population	B02001_003 to B02001_008
Ethnic Minorities	Hispanic population	B03002_012
Foreign Born	Foreign Born population	B05012_003
Limited English Proficiency	Population that speaks English "Not Well" or worse	S1601_C05_001
Poverty Status	Population below Poverty Status	S1701_C01_042
People with Disabilities	Population with a disability	S1810_C02_001
Transit Commuters	Workers utilizing transit to commute	B08006_008
Walking Commuters	Workers commute by walking	B08006_014
Cycling Commuters	Workers commute by cycling	B08006_015
Workers with No Car	Workers with no car	B08014_002

Results

Figure 18 shows the equity analysis index developed for Paulding County. The average index score in Paulding County is 20. The highest score is 30, and the lowest score is 13. High scores (denoted in dark blue in the map) reflect census tracts that have higher HDP populations than the County average. Low scores (denoted in light blue in the map) reflect census tracts that have lower HDP populations than the County average.

Overall, census tracts in southeast Paulding County and the City of Dallas have higher HDP populations than the rest of the County. The tracts in the southeastern portion of County have above average concentrations of Foreign-born populations that are ethnic minorities, limited-English proficiency, and have no car. The two census tracts in the City of Dallas had the same demographics as the southeastern tracts but had higher concentrations of low-income population and youth resulting in higher scores.

In terms of commute methods, census tracts along SR 92 had a higher than average number of transit commuters, with most of these census tracts located north of the City of Dallas. Meanwhile, census tracts along Villa Rica Hwy and Buchanan Hwy had a higher than average walking commuters.

Figure 19 shows the HIN corridors overlaid on top of the equity analysis. This allows for visual correlations to be identified between the Top 10% of EPDO scores with the areas that have high concentrations of populations of interest. It is important to note that while the HDP populations might not be involved in the crashes, they are impacted by the high rates of crashes in the regions they live. The likelihood and severity of crashes can be reflected by many factors, including the state of the infrastructure, increased commute times, and access to emergency services. Correlations can be seen along the major corridors of SR 120, Bill Carruth Pkwy, and US 278.

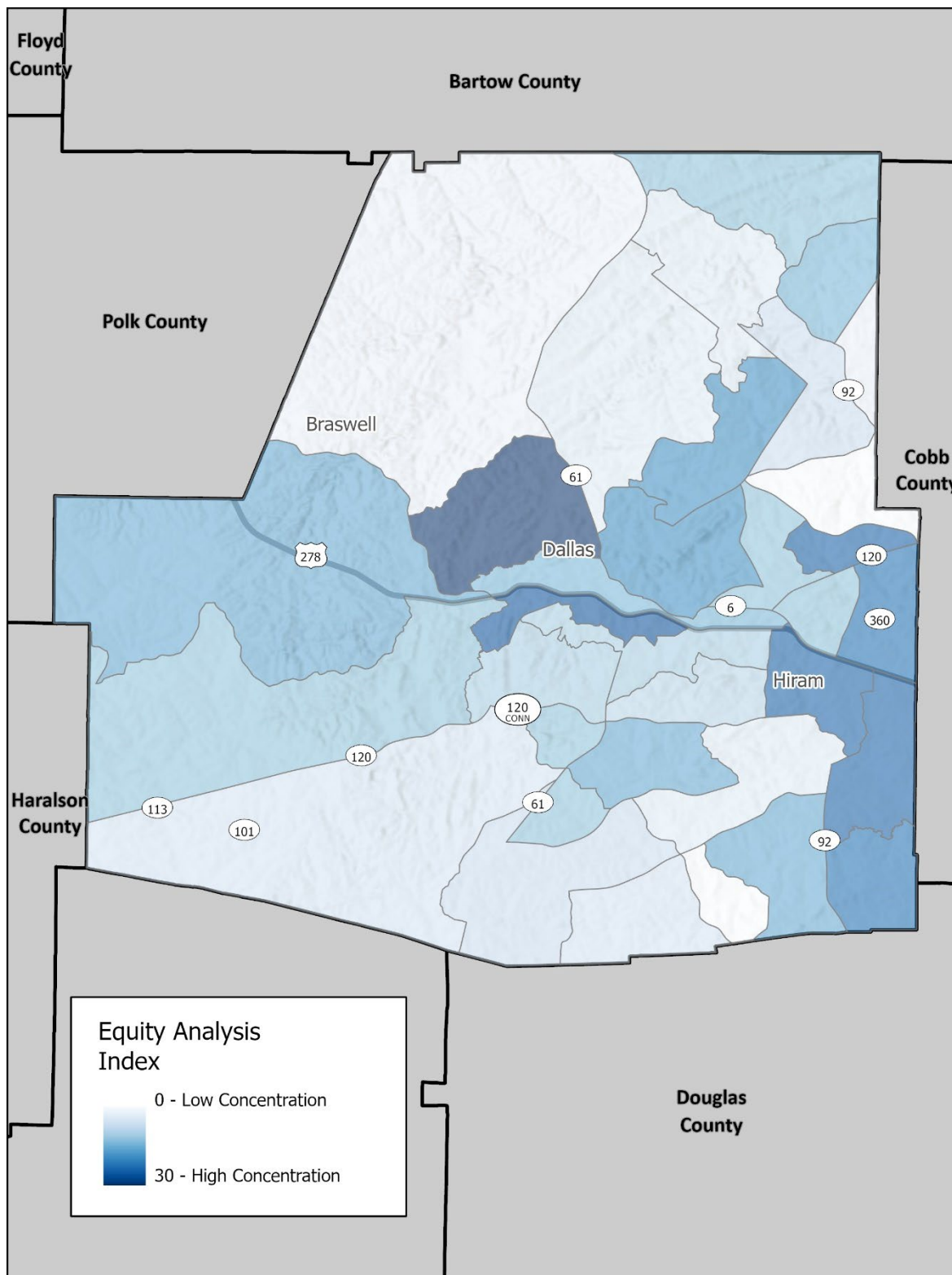


Figure 18. Equity Analysis Index

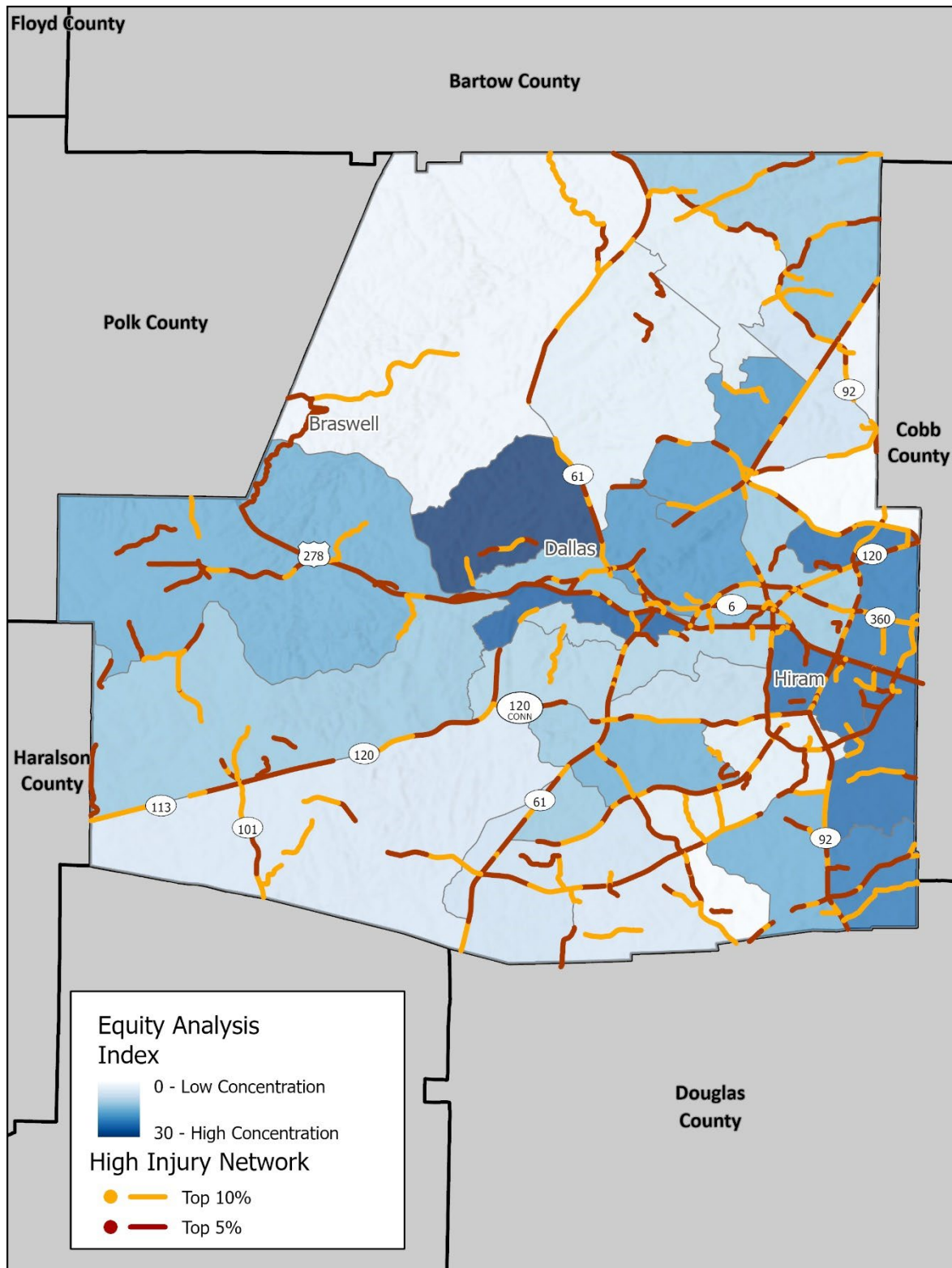


Figure 19. Equity Analysis and the HIN

Previous Study Review

As a part of the development of the CSAP, prior studies were reviewed for relevant safety initiatives and projects. A summary of the documents reviewed and key takeaways important to the safety plan efforts are in the sections below. A detailed plan review can be found in the upcoming Previous Plans and Studies document.

Paulding County Comprehensive Transportation Plan (2022)

The Paulding County Comprehensive Transportation Plan (CTP) is a long-range plan for Paulding County and the cities of Dallas, Hiram, and Braswell. Previously completed in 2008 and 2015, the 2022 CTP reevaluates the recommendations of the previous plans considering recent data, planning initiatives, and changing conditions that have an impact on the County's transportation systems. Approximately 115 projects were recommended for short-term, mid-term, or long-term implementation. While safety was not a named category of improvement in this plan, it was considered for every project through the evaluation framework. The following performance measures impacted scoring for every project that made it into the recommendations list:

- Is the project located at an intersection that is a crash hotspot?
- Is the project locations on a high crash corridor or contains multiple crash hotspots?
- Is the project locations at a high crash risk location?

As part of the CTP analysis, historical crash data for all of Paulding County between 2015 and 2020 was analyzed. The majority of the high crash corridors were found to be concentrated in the City of Dallas and the City of Hiram, as they have some of the highest traffic volumes. Several of these findings become a focus point in the Crash Trends and HIN analysis. Some rural corridors that were also found to have relatively high crash rates included US 278/SR 6 west of Dallas, and the intersection of Dallas Acworth Highway and Cedarcrest Road.

Paulding County Comprehensive Plan (2022)

The 2022 Paulding Comprehensive Plan (Comp Plan) is an update to the 2017 Comp Plan. The goal of the plan is to prepare Paulding County for the future and compete in a regional market. This Comp Plan was developed in tandem with the County's Comprehensive Transportation Plan (CTP) which enabled key transportation projects to be planned closely with land use and other community considerations.

The Comp Plan developed Future Development Character Areas for Paulding County that create a vision for the future of development and growth that builds upon existing services and infrastructure. Four character areas outline key development patterns which guide land use form and integration between automobile, pedestrian, and cycling infrastructure. Additionally, the Supporting Policy Map provides guidance to key locations around the County and supersedes policies identified for underlying character areas demarked on the Future Development Map.

Several short-term recommendations include a variety of "Create Connection" projects for the County and its municipalities. These projects include bike/pedestrian facilities, intersections, ITS, and other projects which focus on safety and efficiency. These projects in Crossroad Areas of Influence and Community Character Corridors should be refined and emphasized to take into consideration findings from the Crash Trends and High Injury Networks findings in these areas.

ARC Regional Safety Strategy (2022)

The ARC Regional Safety Strategy (RSS) is a data-driven action plan to proactively achieve a safe transportation system for all users in the metropolitan Atlanta region. The RSS identified and mapped risk factors for the region in the following emphasis area crashes:

- Intersection Crashes
- Roadway Departure Crashes
- Pedestrian Crashes
- Bicycle Crashes

Per the risk factor analysis, Paulding County was found to have an overrepresentation of roadway departure crashes. The RSS provides a toolbox of proven countermeasures for each crash emphasis area to help jurisdictions address their local risk in a context sensitive manner and is a good reference when developing the CSAP.

US 278/SR 6 Corridor Study, including Road Safety Audit (2022)

In 2023 a Scoping Study was published for the 8.2 mile stretch of US 278/SR 6 between the Paulding County line and SR 120/Buchanan Street, seen in Figure 20 below. The intent of the scoping study was to assess the transportation needs on the corridor and recommend short- and long-term improvements for both the corridor and the surrounding network. This study built off the Road Safety Audit (RSA) conducted in 2015, discussed below.

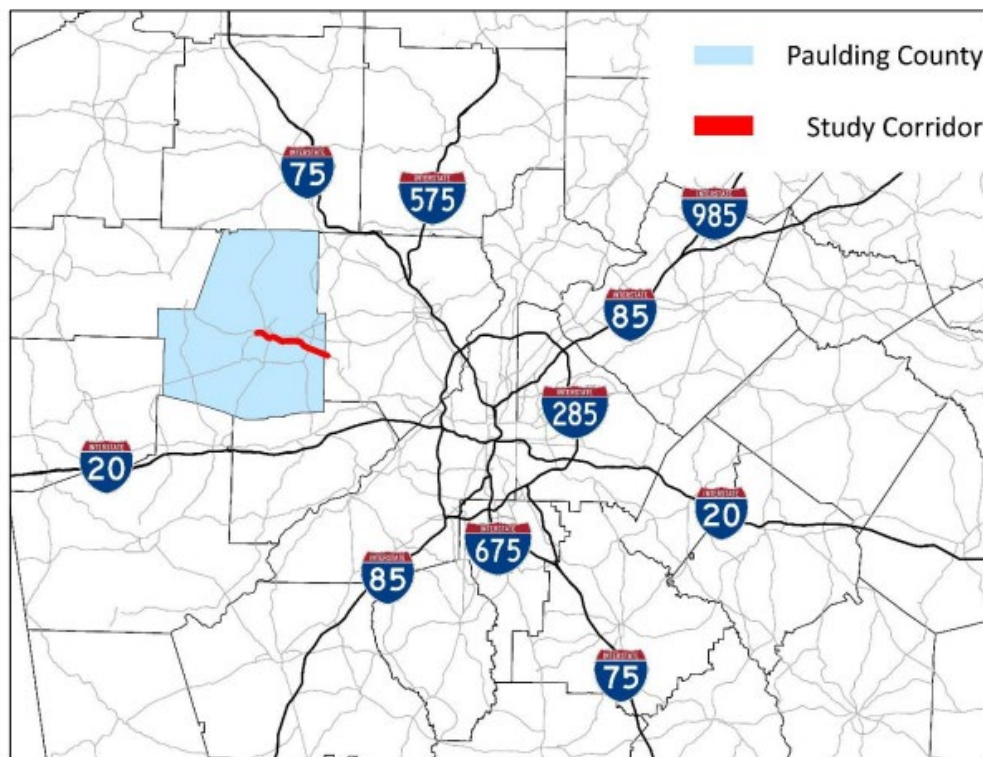


Figure 20. US 278/SR 6 Corridor Study Location and Extents
(source: 2022 US 278/SR 6 Corridor Study)

The study included a safety review, which analyzed crashes between 2016 and 2020 and identified intersections with high crash occurrences. These intersections are marked in Figure 21 below. Of these intersections, the following six are in this CSAP's HIN for state routes:

- US 278 & SR 61
- US 278 & Old Harris Rd
- US 278 & Butler Industrial Dr
- US 278 & SR 120/Bill Carruth Pkwy
- US 278 & SR 92
- US 278 & Poplar Springs Rd

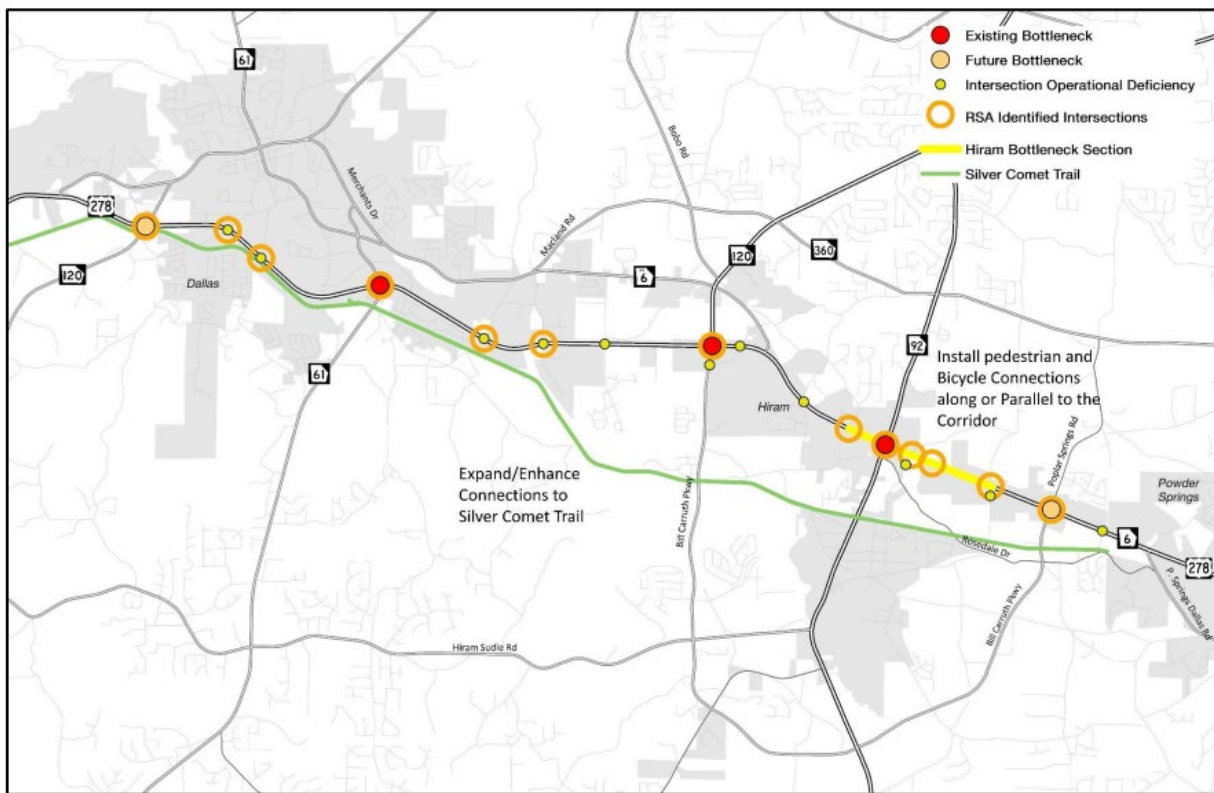


Figure 21. Overview of US 278 Corridor Needs
(source: 2022 US 278/SR 6 Corridor Study)

A summary of safety recommendations in this report include:

- Installing sidewalks and ADA accommodations
- Restriping
- Implementing a local Vision Zero Program

Both the 2022 US 278/SR 6 Corridor Study and the 2015 US 278/SR 6 RSA analyze safety along US 278 in Paulding County. The 2022 Scoping Study spans an 8-mile length from the County line to the SR 6 BUS/SR 120/Buchanan Highway/Buchanan Street intersection, while the 2015 RSA runs approximately 4 miles from Cadillac Parkway/Butler Industrial Drive to SR 6 BUS/SR 120/Buchanan Highway/Buchanan Street. The entire 2015 study corridor is encompassed in the 2022 study corridor.

While these studies were conducted seven years apart, several high crash intersections were identified in both reports. In the 2015 RSA the Old Harris Road intersection had the highest number of crashes on the corridor, followed by SR 61/Villa Rica Highway/Nathan Dean Boulevard, then SR 120/Buchanan Highway/Buchanan Street. All three of these intersections also made the top ten crash locations in the 2022 report. When looking at the severity of crashes, the 2015 report lists SR 61/Villa Rica Highway/Nathan Dean Boulevard with the most injuries, followed by Old Harris Road. The 2022 scoping study also shows both these intersections as high injury. One difference between the reports to note is that Seaboard Drive and South Main Street/West Avenue make the Top Ten crash location in the 2022 report, while not recording a significant crash rate in the 2015 study.

Several of the safety-oriented recommendations from the reports overlapped as well. The safety recommendations that were mentioned in both reports include:

- Installing pedestrian facilities and creating physical separation between pedestrians and travel lanes at the intersection of SR 120/Buchanan Highway/Buchanan Street
- Restriping at Seaboard Drive and Old Harris Road

US 278/SR 6 Road Safety Audit (2015)

An RSA was conducted in 2015 for SR 6/SR 120/US 278/Jimmy Campbell Parkway from SR 6 BUS/SR 120/Buchanan Highway/Buchanan Street to Cadillac Parkway/Butler Industrial Drive. The study area is seen in Figure 22 below. The main safety concerns found during the audit include:

- Consistency in signalization
- Length of left turn lanes and their ability to accommodate turning traffic volumes
- The impact of skewed intersections and cross-slopes along the corridor
- Vehicle speeds
- Side Street Turning Movements
- Pedestrian Safety

Recommendations from the study included new signage, signal upgrades, restriping and intersection redesign, including the addition of turn lanes.

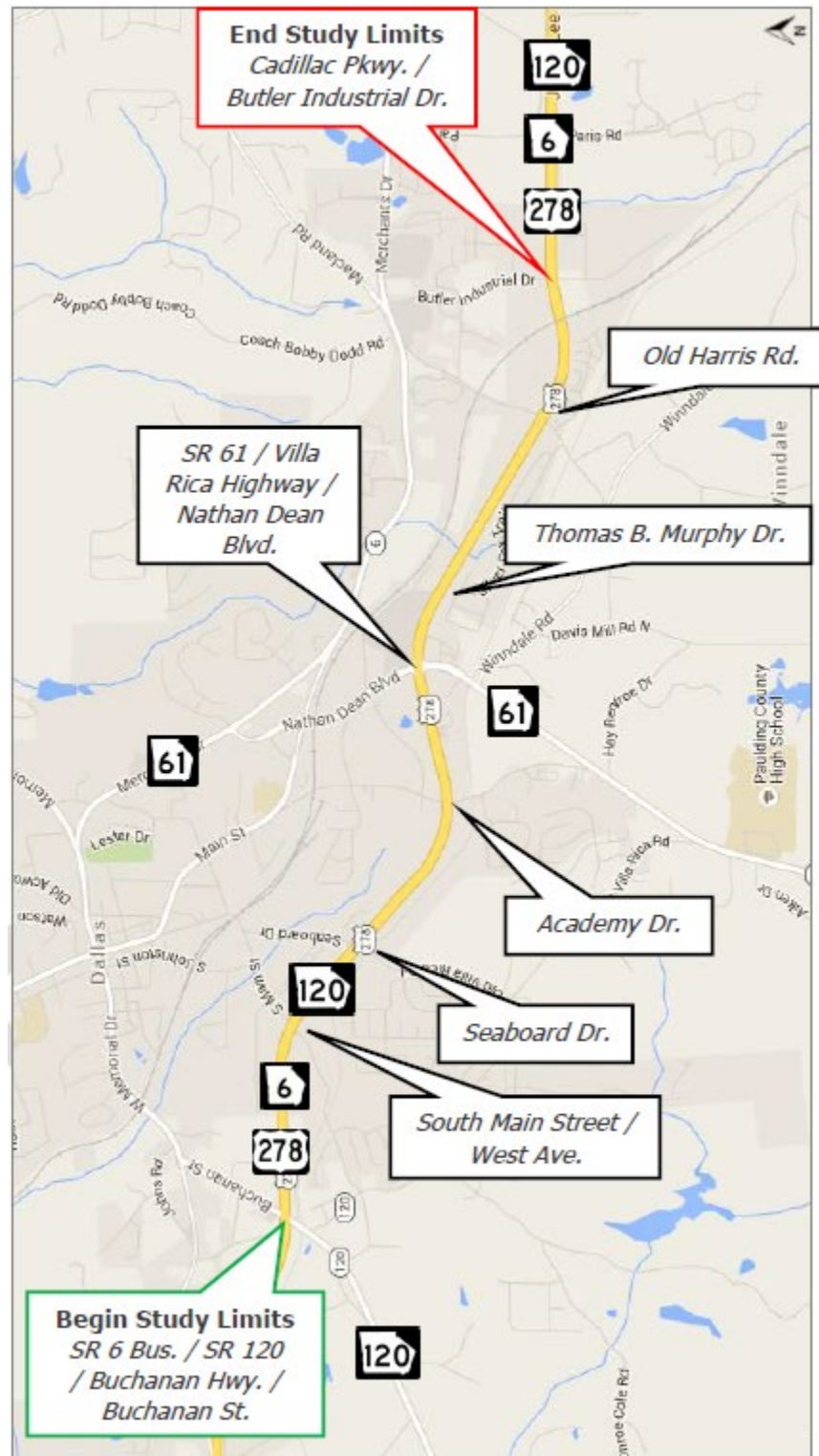


Figure 22. US 278 RSA location map
(source: 2015 US 278/SR 6 RSA)

SR 61 Road Safety Audit (2020)

An RSA was conducted for the SR 61/Villa Rica Highway Corridor from Belmont Road to Tack Cole Road in 2019, as seen in Figure 23 below.



Figure 23. SR 61 RSA Study Area (source: SR 61 RSA)

For this project, crash data from 2013 to 2018 was analyzed. 157 crashes occurred over five years on the 1.5 mile corridor. Of these 157 crashes, 52% were rear ends, followed by 22% angle crashes. Only 2 crashes resulted in fatalities, and 66 results in injuries. Of the 6 intersections along the corridor, the intersection of SR 61 and Mulberry Rock Road/Ridge Road had the most crashes with 64 and the intersection with the second most crashes was SR 61 at Belmont Road with 16 crashes. While SR 61 and both of these intersections are included in this CSAP's HIN, these intersections are not included in the Top 10 intersections on the HIN.

The overall themes of the SR 61 RSA's recommendations include:

- Adding rumble strips and lighting along the length of the corridor
- Removing or repairing broken signage
- Adding additional signage at intersections to reinforce correct movements and prohibitions
- Refreshing striping at intersections
- Add concrete islands to reinforce movement prohibitions
- Adding pedestrian facilities, including adding or moving bulb-outs

Downtown Dallas Livable Centers Initiative Study (2020)

The Downtown Dallas Livable Centers Initiative (LCI) Study provides a vision for the redevelopment of Downtown Dallas, with the goal of creating a vibrant downtown district that will promote a suitable business environment and create connections to the region via the Silver Comet Trail. The plan recommendations specifically focus on providing seven policies that can be implemented within 28 projects over the next five years to redevelop Downtown Dallas, including transit enhancements. These enhancements include improved parking management, traffic calming strategies, streetscaping and the creation of additional streets or intersection improvements aimed at reducing congestion and improving the quality of life for residents and visitors in the community, as seen below in Figure 24. Specific short-term implementation recommendations include:

- Bicycle racks along Main Street
- Parallel parking along W. Griffin St, S. Johnson St, and W. Spring St.
- Confederate Avenue traffic calming (speed tables and sidewalk improvements)
- Memorial Drive streetscape
- Silver Comet trail connection

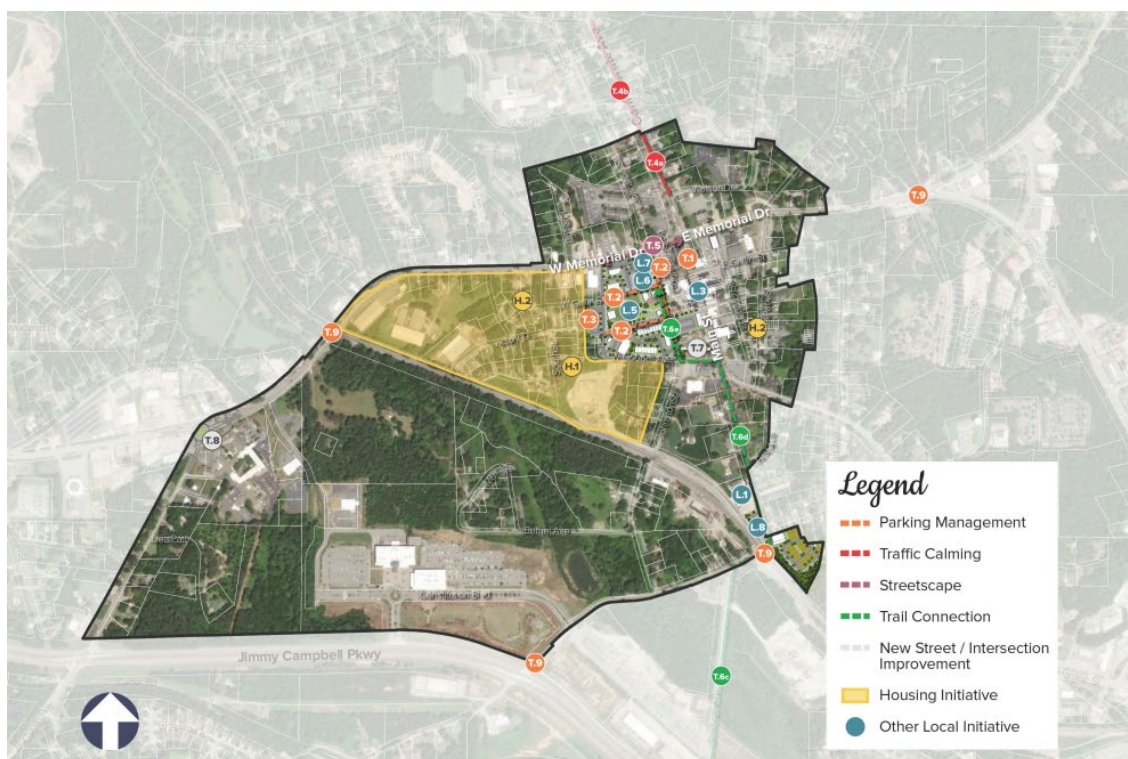


Figure 24. Downtown Dallas LCI Study, Implementation Plan
(source: *Downtown Dallas LCI Study*)

City of Hiram Livable Centers Initiative (2015)

The City of Hiram LCI Study sought to encourage smart growth principals through increased economic investment in existing activity centers and multi-modal focused transportation improvements. The study focused on Downtown Hiram and provided recommendations for streetscape improvements and potential connections to the Silver Comet Trail. The Master Plan recommendations followed a vision that aimed at improving pedestrian infrastructure, discouraging sprawl development, addressing traffic calming and beautifying the downtown area through recommendations by both citizen and business public input. Some of the design recommendations geared to promote safety include:

- Pedestrian buffer and furnishing zones in urban and residential areas
- Designated pedestrian and/or bicycle right to cross a street at intersections
- Traffic signal and pedestrian signal enhancement opportunities
- Traffic calming measures in Downtown Hiram to narrow lanes and increase safety (reducing street lanes to a minimum 11 feet, street planting strips, paved crosswalks, and pedestrian lighting improvements)
- Develop standards in the Land Development Code
- Adherence to Complete Street Principles.

Conclusion

Safety recommendations from the studies reviewed include site-specific infrastructure improvements, system/corridor-wide programmatic infrastructure improvements, and recommendations that are more policy, program, or quality of life focused. The CSAP's analyses reconfirm many corridors segment and intersection locations across the county that were identified as having safety challenges and issues in the prior studies reviewed, including the entirety of US 278, SR 61 south of Dallas, the downtown Dallas and Hiram areas, SR 6 BUS, SR 120 east of Hiram, Dallas Acworth Hwy at SR 92/Cedarcrest Rd, and the area of Dallas Acworth Hwy at Old Cartersville Rd/E Paulding Dr.

The previous study recommendations provide a solid starting point for the identification, development, and refinement of safety strategies for the CSAP. While the US 278/SR 6 Corridor Study and RSA and the SR 61 RSA identified several detailed project recommendations, the Paulding County CTP's project recommendations are more high-level in nature and those from the Paulding County Comp Plan and Dallas and Hiram LCI studies are more quality of life focused. Each relevant recommendation from these prior studies will be examined in the context of the CSAP's safety trends, systemic, and equity analyses. It will be important to understand if and what previously proposed safety countermeasures have been identified in relation to the CSAP's updated analyses, including the identified overall HIN and the Top 10 HIN segments and intersections. Those previously proposed countermeasures will be assessed to determine if they are the most proven and effective at addressing the known crash contributing factors and focus crash types or if other countermeasures should be considered. Lastly, the CSAP will reveal any potential gaps in previous studies, based on results from the HIN and systemic analyses, which include historically high crash locations and high-risk locations.

Appendix: Systemic Analysis Results

Segment Model Results

Model Summary					
	Estimate	Std.	Error	z value	Pr(> z)
(Intercept)	-7.9590	0.6569	-12.1150	< 2E-16	***
Segment Length (LOG)	0.3555	0.0459	7.7370	1.02E-14	***
AADT (LOG)	0.1439	0.0513	2.8060	0.0050	**
Arterial	0.7585	0.2075	3.6560	0.0003	***
Speed Limit	0.0470	0.0072	6.5560	5.55E-11	***
Through Lanes	0.3144	0.1132	2.7770	0.0055	**
Employment Density (LOG)	0.1406	0.0324	4.3340	1.46E-05	***
Median Home Value (LOG)	-0.1052	0.0345	-3.0540	0.0023	**
Households Zero Car %	0.0326	0.0112	2.9090	0.0036	**
Land Use - Multi or Office	0.8131	0.2984	2.7240	0.0064	**
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Pseudo R Squared	
McFadden	0.2483
Cox and Snell (ML)	0.1255
Nagelkerke (Cragg and Uhler)	0.3008

Odds Ratio				
(Intercept)	Segment Length (LOG)	AADT (LOG)	Arterial	Speed Limit
0.0003	1.4269	1.1547	2.1351	1.0482
Through Lanes	Employment Density (LOG)	Median Home Value (LOG)	Households Zero Car %	Land Use - Multi or Office
1.3694	1.1510	0.9001	1.0331	2.2549

Intersection Model Results

Model Summary					
	Estimate	Std.	Error	z value	Pr(> z)
(Intercept)	-5.9745	4.0842	-1.4630	0.14351	
AADT Max (LOG)	0.1873	0.1314	1.4260	1.54E-01	
Signalized	0.8074	0.4712	1.7140	0.0866	.
Legs - Four Or More	1.2094	0.2495	4.8470	0.0000	***
Arterial (Average of Legs)	1.8902	0.4690	4.0300	5.57E-05	***
State Route	0.7428	0.3829	1.9400	0.0524	.
Speed Limit (Max of Legs)	0.0589	0.0183	3.2200	1.28E-03	**
Median Home Value (LOG)	-0.2974	0.3368	-0.8830	0.3773	
Households Zero Car Percent	0.0402	0.0207	1.9410	0.0523	.
Population Density (LOG)	0.2588	0.1595	1.6230	0.1046	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Pseudo R Squared	
McFadden	0.3350
Cox and Snell (ML)	0.0872
Nagelkerke (Cragg and Uhler)	0.3657

Odds Ratio				
(Intercept)	AADT Max (LOG)	Signalized	Legs - Four Or More	Arterial (Average of Legs)
0.0025	1.2060	2.2421	3.3513	6.6209
State Route	Speed Limit (Max of Legs)	Median Home Value (LOG)	Households Zero Car Percent	Population Density (LOG)
2.1018	1.0606	0.7427	1.0410	1.2954

Active Transportation Model Results

Model Summary					
	Estimate	Std.	Error	z value	Pr(> z)
(Intercept)	-10.7916	1.1037	-9.7780	< 2E-16	***
Segment Length (LOG)	0.2620	0.0709	3.6950	2.20E-04	***
AADT (LOG)	0.1000	0.0864	1.1570	0.2471	
Arterial	0.8204	0.3631	2.2590	0.0239	*
Through Lanes	0.4010	0.1327	3.0220	2.51E-03	**
Population Density (LOG)	0.2760	0.1327	2.0800	0.0375	*
Employment Density (LOG)	0.3247	0.0624	5.2020	1.97E-07	***
Households Zero Car Percent	0.0033	0.0145	0.2260	0.8210	
State Route	0.5707	0.2855	1.9990	0.0456	*
Land Use - Office or Edu	1.5953	0.3825	4.1710	0.0000	***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Pseudo R Squared	
McFadden	0.1786
Cox and Snell (ML)	0.0433
Nagelkerke (Cragg and Uhler)	0.1972

Odds Ratio				
(Intercept)	Segment Length (LOG)	AADT (LOG)	Arterial	Through Lanes
0.0000	1.2995	1.1051	2.2714	1.4933
Population Density (LOG)	Employment Density (LOG)	Households Zero Car %	State Route	Land Use - Office or Edu
1.3178	1.3836	1.0033	1.7695	4.9297