# CONNECTICUT HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) IMPLEMENTATION PLAN FOR FFY 2021

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Bureau of Engineering and Construction
Division of Traffic Engineering – Safety Engineering
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# CONNECTICUT HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP) IMPLEMENTATION PLAN

## Executive Summary:

This Highway Safety Improvement Program (HSIP) Implementation Plan for Connecticut (CT) documents the HSIP obligations and actions the state will take for the 2021 Federal Fiscal Year (FFY). This plan is required because the Federal Highway Administration (FHWA) notified the State that we did not meet or make significant progress toward meeting our 2018 safety performance targets, based on the five (5)- year moving averages for 2014-2018. Connecticut was not alone on this assessment because FHWA determined that 24 other State DOTs also did not meet targets or make significant progress. Connecticut met the safety performance target for two out of the five categories, specifically the number of serious injuries and the serious injury rate. Although Connecticut failed to meet its projected safety performance target for the fatality rate, its fatality rate was one of the lowest rates in the country. In 2018, the rate was 0.930 per 100 million vehicles miles traveled (VMT) which was the 11$^{th}$ lowest rate nationwide. The national average was 1.13 VMT, which was 20% higher than CT's rate.

The requirement to prepare this HSIP Implementation Plan is not viewed as a penalty since the Connecticut Department of Transportation (CTDOT) has made a commitment to safety and has obligated all its annual HSIP apportionment over the past several years. Under this Plan, CTDOT plans to obligate $29,790,655 of HSIP funding which is above the requirement of $29,537,309. Also, CTDOT took this opportunity to re-evaluate its HSIP investment decisions and identify gaps and deficiencies to ensure that projects identified, prioritized, and programmed have the best potential for reducing fatalities and serious injuries. Consideration is also being made to help Connecticut meet safety performance targets in subsequent years. In order to make these decisions for this HSIP Implementation Plan, CTDOT reviewed fatality and serious injury crash data on all public roads from 2016 to 2018 utilizing the Connecticut Crash Data Repository (CTCDR).

The evaluation of the historical HSIP funded project expenditures shown in Appendix E was used to inform this plan but does not take into consideration the impacts of the HSIP funded projects that have recently been implemented. The framework for this Plan is based on FHWA Office of Safety's HSIP Implementation Plan Guidance dated October 13, 2017.

## Available Funding:

Under 23 U.S.C. 148(i)(1), Connecticut did not meet or make significant progress towards meeting safety performance targets and must obligate HSIP funds in the amount apportioned for the prior year. As a result, **Connecticut must obligate at least $29,537,309 in FFY 2021**, which is the apportionment amount for FFY 2017.

## Obligation Allocation Goals:

The HSIP Implementation Plan must describe how HSIP funds will be allocated during the plan period (23 U.S.C. 148(i)(2)(C)). In determining these obligation allocation goals, Connecticut considered obligating needs by Strategic Highway Safety Plan (SHSP) emphasis areas (e.g., critical roadway locations, non-motorized road users), as well as other categories such as roadway ownership (e.g., state vs. local roads) and improvement type (e.g., spot vs. systemic).

The obligation allocation goals shown in Figures 1, 2 and 3 are based on roadway fatality and serious injury crash data trends from 2016-2018 and are reflective of Connecticut's safety priority needs associated with the HSIP Implementation Plan. The decisions for these goals are data driven. It should be noted that there are other safety improvement projects listed in Appendix F for FFY 21 that address other safety priorities outside of the Implementation Plan. These projects are not included in Figures 1, 2 and 3.

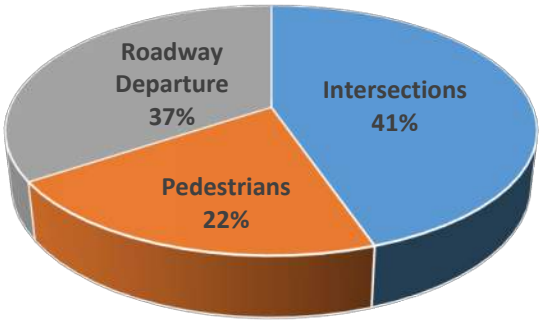



**Figure 1: HSIP Implementation Plan Obligations Summary**

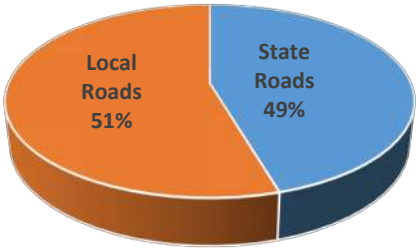



**Figure 2: HSIP Obligations by Road Ownership**

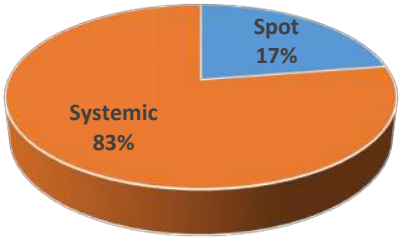



**Figure 3: HSIP Obligations by Project Type**

## HSIP Programs, Strategies, and Activities:

The State's HSIP Implementation Plan must identify a combination of programs, strategies, and activities to be funded under the HSIP that will (1) contribute to a reduction in fatalities and serious injuries [23 U.S.C. 148(b) & 150(b)(1)] and (2) help the State achieve or make significant progress towards achieving their safety performance targets in subsequent years [23 U.S.C. 148(i)(2)(D)].

The HSIP programs, strategies, and activities must address roadway features that constitute a hazard to road users, as well as highway safety improvement projects that were identified based on crash experience, crash potential, or other data-supported means. 23 U.S.C. 148(i)(2)(A)(B).

***Crash Data Trend Analysis Process and Summary***

In order to determine what programs and which strategies would be the most beneficial to reduce the number of fatalities and serious injuries, CTDOT developed crash tree diagrams. Crash tree diagrams are created by breaking down crashes into progressively more detailed categories.[1] The categories that were used on the crash trees were based on roadway data that is available such as roadway ownership, facility type, intersection versus segments, intersection control type, and location characteristics.

- There was a total of 4,663 fatalities and serious injuries from 2016 to 2018, which is at the top of the crash tree (see Appendix A, Crash Tree 1). The first level or branch on the crash tree was to determine the roadway ownership where the fatalities and serious injuries occurred. Fifty (50) percent of these crashes occurred on the state system and 48% occurred on local roads (see Appendix A, Crash Tree 2). The roadway ownership was unknown at 2% of these locations. It is important to note that CTDOT only owns and maintains appropriately 18% of the public roads in Connecticut. Since a large percentage of fatal and serious injury crashes occurred on roads outside of CTDOT's jurisdiction, it will be more challenging to implement safety related capital improvements on local roads, as municipalities must agree to participate in local road projects administered by CTDOT.
- For state roads, the next level on the crash tree was facility type, where 46% of the crashes occurred on U.S. Routes or other state numbered roadways and only 4% occurred on Interstates (see Appendix A, Crash Tree 2). Since the percentage of crashes on Interstates was very small, it was decided to concentrate on the other facility types.
- The next category in the crash tree was crash location. It was determined that 28% of crashes occurred on segments and 18% at intersections on state roads, and 27% occurred on segments and 22% occurred at intersections on local roads (see Appendix A, Crash Trees 3 and 4).
- Segment and intersection crashes were further broken down by crash type (e.g. angle, front to front, sideswipe). Based on engineering judgment, those crash types that were greater than 10% of the total fatal and serious injury crashes for either state or local roads were selected as a focus group (see Appendix A). There is a total of 13 focus groups, which for the purposes of this Plan, represent crash types where CTDOT believes there is a higher likelihood of reducing the total amount of fatalities and serious injuries. These focus groups were then condensed into three (3) broad program areas based on the crash types to be addressed within each program area. The program areas are intersection (29%), roadway departure (26%), and pedestrian (17%) which represent approximately 72% of all fatalities and serious injuries (see Appendix A). The program areas for this implementation plan coincidently align with Connecticut's current SHSP Emphasis Areas.

***Review of HSIP Expenditures***

A list of HSIP expenditures since 2013 are shown in Appendix E. The expenditures are broken down by road owner by project type, road owner by emphasis area, project type by FFY, and FFY by emphasis area. The Systemic Safety Project Selection Tool[2] provided guidance while reviewing the expenditures. The spot (or site analysis approach) resulted in large investments at relatively few locations that addressed a small percentage of the total severe crashes. The review also revealed that many of the safety investments were directed toward projects deployed along the state's highway system.

[1] https://safety.fhwa.dot.gov/systemic/fhwasa17009/
[2] https://safety.fhwa.dot.gov/systemic/fhwasa13019/

***Review of Historical Project Performance***

There were no formal before and after studies conducted in conjunction with this Plan. Many of the projects that have been implemented in the past few years do not have enough after data to determine their effectiveness, especially for the systemic projects. FHWA Proven Safety Countermeasures were chosen to address safety issues based on their national effectiveness and benefits. In some cases, specific strategies were selected (i.e. centerline rumble strips, horizontal curve signing) to treat issues on local roads because of anecdotal data on the state system. A review of project performance will be conducted when the appropriate amount of data is available. The section on noteworthy practices has additional information on evaluation of project effectiveness.

***Identification of Gaps and Deficiencies***

A review of the crash data and project expenditures revealed the need for additional focus on systemic projects on both state and local roadways and for a modification of HSIP investments to increase investments on local roads.

Systemic projects have many benefits including considering multiple locations with similar risk characteristics, which can be a more cost-effective way to correct the problem on a system-wide basis rather than by individual high crash location.[3] In the past, less than 25% of the HSIP monies on average were allocated to systemic improvement projects. This plan is proposing to spend an increased amount of HSIP monies on systemic projects with greater than 80% of the HSIP monies proposed for these projects.

Another area that is being proposed to have an increase in focus is an increase in HSIP monies to be spent on municipally owned roadways. In the past, less than 30% of HSIP monies on average were spent on local roads. Since the data analysis revealed that almost half of the fatal and serious injury crashes are occurring on municipally owned roadways, this Implementation Plan is proposing to more than double the obligation in past years.

***Identification of Noteworthy Practices and Stakeholder Outreach***

Connecticut's Roadway Safety Management System (CRSMS) web-based tool development began in 2015. It was used to perform network screening and geospatial analysis of the crash trends reviewed in this plan. Some of the geospatial data produced can be found in the maps given in Appendices B, C, and D. The tool is currently being enhanced and tested to incorporate new research and methodologies in the 2nd edition of the Highway Safety Manual, including a safety effectiveness module. The safety effectiveness module will be used in subsequent years to determine the effectiveness of the countermeasures that have been and are proposed to be implemented.

Stakeholder outreach beyond the CTDOT included the Connecticut Transportation Institute, specifically the Traffic Signal Circuit Rider program. Feedback has also been received from the Regional Transportation Agencies (Council of Governments) through the development of the Regional Transportation Safety Plans as well as a high-level presentation at a quarterly meeting.

[3] https://safety.fhwa.dot.gov/systemic/why.cfm

***Decision Support Framework***

Utilizing input from the crash data and the reviews and practices noted previously, Connecticut's HSIP Implementation Plan outlines an obligation determination framework. The percentage of fatal and serious injury crashes in the three (3) program areas were used to inform the obligations in FFY 2021 in these areas. Based on FHWA's Systemic Safety Project Selection Tool[4], there is no expectation that Connecticut's safety program will be 100% orientated to systemic projects. The obligation framework outlined below suggests a shift toward more systemic projects versus spot projects. The demographics in Connecticut vary from one region to another and safety investments cannot be uniformly applied. In other words, a specific safety treatment might work well in one part of the state but might not be effective in another.

As previously noted under the crash review, a total of 13 focus groups based on crash types were determined, which were then condensed into three (3) broad program areas. The program areas are intersection (29% of crashes), roadway departure (26% of crashes), and pedestrian (17% of crashes), which represent approximately 72% of all fatalities and serious injuries (see Appendix A). The program areas for this implementation plan coincidently align with Connecticut's current SHSP Emphasis Areas.

## Program Areas:

For each of the three program areas, there is a listing of strategies or countermeasures, including their purpose, cost, methodology, implementation (state roads and local roads), and benefits on how the strategy or countermeasure will help Connecticut make progress toward achieving the safety performance targets in subsequent years. Three figures are also included for each Program Area indicating the Program Obligations Summary, Program Obligations by Ownership, and Program Obligations by Project Type.

[4] https://safety.fhwa.dot.gov/systemic/fhwasa13019/

## Roadway Departure Program (FFY 2021 HSIP Obligations: $11,024,000)

***Overview:***

Twenty-six (26) percent of **all** fatal and serious injury crashes from 2016 and 2018 from the focus groups identified were roadway departure crashes (see Appendix A). Roadway departure crashes are part of the Critical Roadway Locations Emphasis Area in Connecticut's current SHSP.

- The crash data indicated that the most prevalent type of roadway departure crashes was single or multi-vehicle fixed object crashes involving curbs, trees, and utility poles as well as front -to front collisions.
- The distribution of fatal and serious injury was a 50/50 percent split on state and local roads and all these crashes were dispersed throughout the network with no specific pattern, which supports a systemic treatment.

Based on national best practices, the most cost-effective treatment to reduce the number of fatalities and serious injuries is to systemically focus efforts on implementing countermeasures that will keep the vehicles on roadway. The Roadway Departure Program focuses on enhancing delineation along horizontal curves, alerting drivers with centerline rumble strips, and improving pavement friction, all of which are Federal Highway Administration's Proven Safety Countermeasures[5]. **There is a total of six (6) projects on the project list in Appendix F that address roadway departure crashes, three (3) of which are new initiatives (proposed projects) for FFY 2021.**

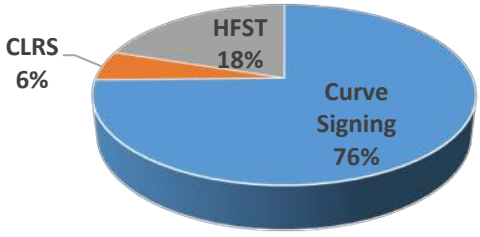



**Figure 4: Roadway Departure Program Obligations Summary**

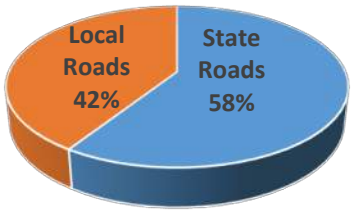



**Figure 5: Roadway Departure Program Obligations by Ownership**

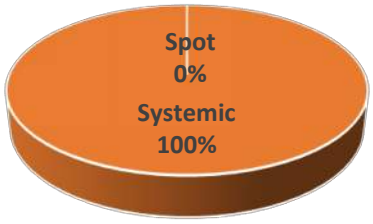



**Figure 6: Roadway Departure Program Obligations by Project Type**

[5] https://safety.fhwa.dot.gov/provencountermeasures/

### *Roadway Departure Program Proposed Countermeasure - Horizontal Alignment Signing*

Purpose:

Based on national data, the crash rate for horizontal curves is about three times that of other types of highway segments.[6] In Connecticut, approximately 50 percent of fixed object crashes on state roads occurred on horizontal curves and a similar percentage is assumed on local roads. Horizontal alignment signing is intended to provide drivers advance warning of a horizontal curve to help keep vehicles on the roadway.

HSIP cost for FFY 2021: **$8,399,000 (PE/CN)**

Methodology:

- Use risk factors (e. g. curve radius, presence of intersection within curve, visual trap, crash history, speeds, ADT) to identify curves that could benefit from signing to reduce roadway departure crashes (fixed object, sideswipe opposite direction, rollovers).
- Install horizontal alignment signing (e. g. one direction large arrow, chevrons, curve/turn advance signing) utilizing fluorescent yellow sheeting and post delineators on select warning signs. Install centerlines and edgelines where necessary.

Implementation:

- State Roads
  - Horizontal alignment signing was systemically installed on rural minor/major collectors in 2013. Horizontal alignment signing is presently being systemically installed at all other roads in Districts 3 and 4.
  - For FFY 21, complete design and advertise projects for construction for horizontal alignment signing at the remaining locations in Districts 1 and 2. **HSIP costs for CN are estimated to be $4,399,000.**
- Local Roads
  - Horizontal alignment signing was systemically installed between 2017 and 2019 on rural minor/major collectors and other local roads.
  - For FFY 21, initiate a PE phase in 2021 for a systemic horizontal alignment signing project for all other roads. Construction to be phased over the next few years. **HSIP costs for PE are estimated to be $4,000,000**.

Benefits:

- 25 percent reduction in non-intersection fatal and injury crashes.[7]
- Promotes statewide uniformity of horizontal alignment signage.
- Meets driver expectations for horizontal alignment signage.

Figure 7 (left): Example of Advance Horizontal Alignment Signing

Figure 8 (right): Example of Chevron Alignment Signing


[6] https://safety.fhwa.dot.gov/p2p/horiz_curves/jun14/

[7] https://www.fhwa.dot.gov/publications/research/safety/09046/09046.pdf

### *Roadway Departure Proposed Countermeasure - Centerline Rumble Strips (CLRS) Treatment*

Purpose:

Centerline rumble strips are used on undivided highways to reduce cross-over incidents and head-on and opposite direction sideswipe collisions. The noise and vibration generated when a vehicle drives over a CLRS alerts drivers that they are in danger of crossing into the opposing lane of traffic.

HSIP cost for FFY 2021: **$600,000 (PE/CN)**

Methodology:

Pursue CLRS on roads where the traffic volume exceeds 2,000 vehicles per day and where the speed limit is 35 mph or higher and where the roadway lane is at least 14 feet wide and, the pavement is in good condition. Treatment is expected to reduce roadway departure crashes (left), head-on collisions and sideswipe opposite crashes.

Implementation:

- State Roads
  - CLRS are installed on qualifying state roads as part of other capital improvement projects.
- Local Roads
  - CLRS were systemically installed between 2016 and 2017 on select roads where town officials requested CLRS
  - For FFY 21, send letters to qualifying towns requesting participation in a systemic CLRS project for qualifying roads. Initiate PE phase in 2021 and depending on the level of participation and when PS&E is completed, it may be feasible to obligate the construction phase in 2021. **HSIP costs for PE and CN are estimated costs to be $600,000.**

Benefits:

- 44-64 percent reduction in head-on and opposite direction sideswipe fatal and injury collisions.[8]
- Improves lane delineation during adverse weather.

Figure 9: Example of Centerline Rumble Strips

Figure 10: Typical installation of Centerline Rumble Strips

[8] http://www.cmfclearinghouse.org/

### *Roadway Departure Program Proposed Countermeasure – High Friction Surface Treatments (HFST)*

Purpose:

HFST involves the application of very high-quality aggregate to the pavement using a polymer binder to restore and/or maintain pavement friction at existing or potentially high crash areas. The higher pavement friction helps motorists maintain better control in both dry and wet driving conditions.

HSIP cost for FFY 2021: **$2,025,000 (PE/CN)**

Methodology:

- Utilize Highway Safety Manual methodologies to screen state roadway network for wet pavement condition crashes.
- Screen state road network for horizontal curves that could benefit from HFST based on curve radius and length.
- Provide analysis to indicate overrepresentation of roadway departure crashes.

Implementation:

- State Roads
  - For FFY 21, initiate a PE phase (per District) in 2021 for a systemic HFST project. Accelerate design to obligate the construction phase for one of the four Districts in 2021. Construction to be phased over the next few years for the other Districts. **HSIP costs for PE and CN are estimated to be $2,025,000.**
- Local Roads
  - Depending on results and lessons learned for the state project, consider initiating a PE project in 2022.

Benefits:

- 57-100 percent reduction in total crashes.[9]
- Improves pavement friction in all driving conditions.

Figure 11: Example of High Friction Surface Treatment

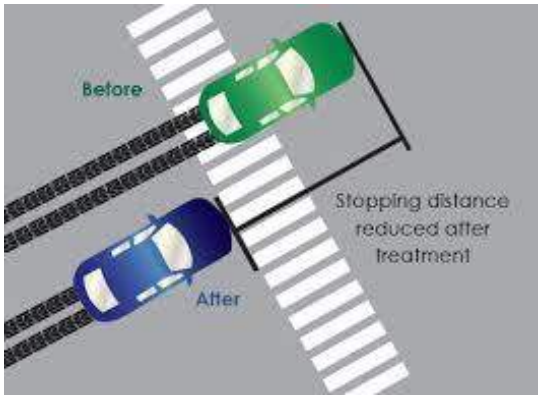



Figure 12: Stopping Distance Example Before and After High Friction Surface

[9] https://safety.fhwa.dot.gov/roadway_dept/pavement_friction/high_friction/index.cfm

## Intersection Safety Program (FFY 2021 HSIP Obligations: $12,237,005)

***Overview:***

Twenty-nine (29) percent of **all** fatal and serious injury crashes from 2016 to 2018 from the focus groups identified were intersection-related crashes (see Appendix A). Intersection crashes are included in the Critical Roadway Locations Emphasis Area in Connecticut's current SHSP.

- Twenty-two (22%) of the intersection related crashes occurred on local roads and 18% occurred on state roads (see Appendix A). Of these crashes, 19% were angle-related.
- Of the angle-related intersection crashes on local roads, 75% occurred in 10 municipalities. Across these 10 municipalities, 40% of these crashes occurred at signalized intersections and 60% occurred at stop-controlled intersections (see Appendix C).
- Of the angle-related intersections on state roads, there was no discernible pattern of specific municipalities where these crashes occurred; however, 60% of these crashes occurred at signalized intersection and 39% occurred at stop-controlled intersections (see Appendix C). Of note, CTDOT recently completed signing enhancement projects at multiway stop-controlled intersections on the state system.

Collectively, the intersection crashes were spread out throughout the network and as a result this plan primarily focuses on systemic proven safety countermeasures. At signalized locations, adding back plates with retro-reflective borders and re-timing traffic signals to optimize the change intervals are included. For stop-controlled intersections, the systemic application of multiple low-cost countermeasures such as enhanced signs and pavement markings is proposed. In some cases, spot safety improvements are proposed at locations that have experienced severe crashes over an extended period and low-cost safety treatments have not been effective. **There is a total of 20 projects on the project list in Appendix F that address intersection crashes, four (4) of which are new initiatives (proposed projects) for FFY 2021.**

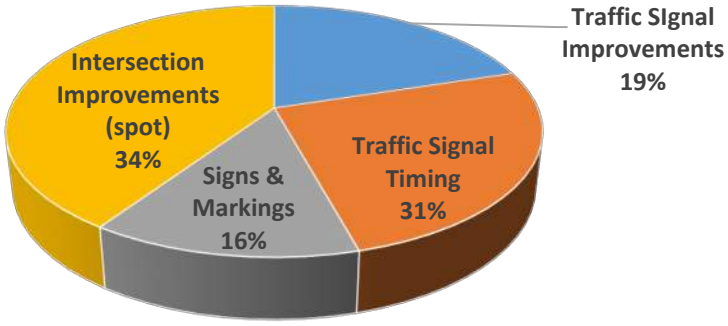



**Figure 13: Intersection Safety Program Obligations Summary**

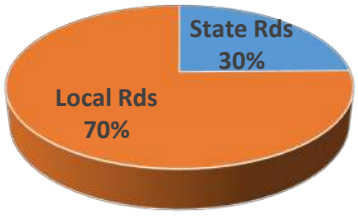



**Figure 14: Intersection Safety Program Obligations by Ownership**

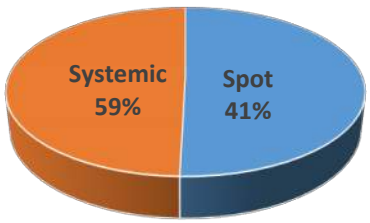



**Figure 15: Intersection Safety Program Obligations by Project Type**

### *Intersection Safety Program Proposed Countermeasure - Traffic Signal Improvements*

Purpose:

This initiative involves deploying multiple countermeasures, such as the installation of traffic signal back plates with retro-reflective yellow borders, elimination of nighttime flashing and dilemma zone detection.

HSIP cost for FFY 2021: **$2,289,000 (PE/PL/ROW/CN)**

Methodology:

Develop a detailed inventory of assets at each traffic signal and create a listing of all signals where there are no traffic signal back plates and/or have nighttime flashing operation. Locations will be prioritized based on the age of the equipment. These treatments are expected to reduce angle and rear-end crashes.

Implementation:

- State Roads
  - For FFY 21, complete PE for one (1) location (State Project 174-419) and fund CN of traffic signal upgrades at two (2) locations (State Project No. 173-487). **HSIP cost is $834,000**. Complete design for safety and technology traffic signal improvements (which includes the elimination of late night flash operation and selected installation of backplates with retroreflective borders) in District 2 (State Project Nos. 172-484/485) in 2021 and advertise for construction in 2022. **HSIP costs for PE and ROW are estimated to be $1,005,000.**
  - For FFY 21, continue design for the remaining signals in Districts 1, 3 and 4 in 2022 and beyond.
- Local Roads
  - For FFY 21, initiate a PL phase in 2021 to determine which locally owned signals that could benefit from back plates and removal of nighttime flashing operation. **HSIP cost for PL costs is estimated to be $450,000.**

Benefits:

- 52 percent reduction in nighttime crashes (47 percent for fatal & injury crashes) when discontinuing late night flash operation.[10]
- 15 percent reduction in total crashes with installation of back plates with retroreflective borders.[11]
- 39 percent reduction in fatal and injury crashes with dilemma zone detection.[12]

Figure 16 (left): Example of Retroreflective Yellow Border on Backplates

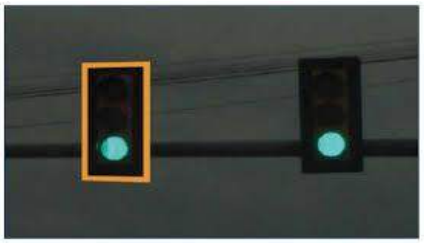


Figure 17 (right): Example of Retroreflective Yellow Border under low light conditions

[10] https://safety.fhwa.dot.gov/intersection/conventional/signalized/case_studies/fhwasa09012/fhwasa09012.pdf
[11] https://safety.fhwa.dot.gov/provencountermeasures/pdfs/fhwasa17051.pdf
[12] http://www.cmfclearinghouse.org/

### *Intersection Safety Program Proposed Countermeasure – Traffic Signal Change Interval Re-timing*

Purpose:

Based on National data, red-light running is a leading cause of severe crashes at signalized intersections and it is imperative that the change intervals be appropriately timed.[13] Too brief an interval may result in drivers being unable to stop safely and cause unintentional red-light running, while too long an interval may result in drivers treating the yellow as an extension of the green phase and invite intentional red light running.

HSIP cost for FFY 2021: **$3,750,000 (PE/CN)**

Methodology:

Collaborate with UCONN's T2 Center's Traffic Signal Circuit Rider Program to identify municipally owned traffic signals that could benefit from change interval re-timing. The re-timing would be consistent with the Manual on Uniform Traffic Control Devices (MUTCD) methods. This treatment is expected to reduce angle and rear-end type crashes.

Implementation:

- State Roads
  - Traffic signal change intervals were re-timed under four separate projects between 2017 and 2019.
- Local Roads
  - For FFY 21, send letters to towns requesting participation in a traffic signal change interval retiming project for municipally owned signals. Initiate PE phase in 2021 and depending on the level of participation and when PS&E is completed, obligate the construction phase in 2021. **HSIP cost for PE is estimated to be $2,500,000 and CN cost is estimated at $1,250,000.**

Benefits:

- 36-50 percent reduction in red light running and 12 percent reduction in injury crashes.[14]


Figure 18: Typical Traffic Signal Yellow Indications

[13] https://safety.fhwa.dot.gov/provencountermeasures/yellow_xhg_intervals/
[14] https://safety.fhwa.dot.gov/provencountermeasures/yellow_xhg_intervals/

### *Intersection Safety Program Proposed Countermeasure – Signing and Pavement Markings at Unsignalized Intersections*

Purpose:

This initiative, which is a proven safety countermeasure, involves the systemic installation of multiple low-cost countermeasures, such as enhanced signing and pavement markings, at stop-controlled intersections. The treatment generally consists of doubling up (left and right) STOP and STOP AHEAD signs, retroreflective sheeting on sign posts on the stop approach and doubling up advance intersection warning signs with street name plaques on the through approach. The treatment is designed to increase driver awareness and recognition of the intersections and potential conflicts and reduce angle crashes.

HSIP cost for FFY 2021: **$2,000,000 (PE)**

Methodology:

Connecticut's Intersection Safety Implementation Plan identified stop-controlled locations based on crash data that could benefit from the installation of multiple low-cost countermeasures.

Implementation:

- State Roads
  - For FFY 21, initiate a PE phase in 2021 for a systemic pavement marking and signing project. Construction to be phased over the next few years. **HSIP cost for PE is estimated to be $1,000,000.**
- Local Roads
  - For FFY 21, send letters to towns requesting participation in a systemic pavement marking and signing project. Initiate PE phase in 2021 and obligate the construction phase in subsequent years. **HSIP cost for PE is estimated to be $1,000,000.**

Benefits:

- 10 percent reduction in fatal and injury crashes and 15 percent reduction in nighttime crashes.[15]


Figure 19: Example of Mainline Warning Signing for Approaching Intersection


Figure 20: Example of Enhanced Warning Signing for Minor Street Stop-Control

[15] https://www.fhwa.dot.gov/publications/research/safety/17087/index.cfm

### *Intersection Safety Program Proposed Countermeasure - Intersection Improvements*

Purpose:

- Spot intersection improvements affect safety by minimizing or eliminating risk to roadway users. Typically, these are locations that have experienced severe crashes over an extended period and low-cost safety treatments have not been effective.

HSIP cost for FFY 2021: **$4,198,005 (CN/ROW)**

Methodology:

- Utilize Highway Safety Manual methodologies to perform network screening and generate annual High Frequency Crash Locations (HFCL) list for state intersections.
- Utilize Connecticut's Intersection Safety Implementation Plan as a tool to identify candidate locations.
- Further study spot locations identified in each Regional Transportation Safety Plans which are being prepared for each of the nine (9) Councils of Governments (COGs).

Implementation:

- State Roads
  - For FFY 21, fund right-of-way and construction of a spot improvement in New Haven at the intersection of State Road 745 and Kimberly Avenue (State Project 92-681), which was on the HFCL. Continue to study other locations identified on the HFCL and initiate capital projects to address safety issues as appropriate. **The HSIP costs for CN/ROW costs are estimated to be $832,500.**
- Local Roads
  - For FFY 21, fund construction of seven locations that meet the requirements under the Local Road Accident Reduction Program. **The HSIP cost for CN is estimated to be $3,365,505.**

Benefits:

- Crash reduction varies depending on type and scope of the improvement.

Figure 21: Example of a Roundabout

Figure 22: Example of an Intersection Realignment

## Pedestrian Safety Program (FFY 2021 HSIP Obligations: $6,529,650)

***Overview:***

Fifteen (15) percent of **all** fatal and serious injury crashes from 2016 and 2018 were pedestrian crashes (see Appendix A). Pedestrian safety is part of the Non-Motorized Emphasis Area in Connecticut's current SHSP.

- The distribution of the pedestrian crashes was 9% on local roads and 6% on state roads.
- On local roads, the crash data indicated 4% of the pedestrian crashes occurred at intersections and 5% occurred on roadway segments. Crashes were concentrated in urban and suburban areas.
- On state roads, 2% of the pedestrian crashes occurred at intersections and 4% occurred on roadway segments. Crashes at intersections were concentrated in urban and suburban areas, while crashes on segments were spread throughout the network.

The Department has recently completed pedestrian signing projects at uncontrolled marked crosswalks on all public roads. Additional countermeasures are proposed in this Plan such as enhancing pedestrian controls at signalized intersections to include leading pedestrian intervals, which is a proven safety countermeasure. As an alternate to pedestrian signals, Rectangular Rapid Flashing Beacon (RRFB) will be considered at select uncontrolled mid-block crosswalks. In addition, the Plan includes Road Diets which is also a proven safety countermeasure. **There is a total of 13 projects on the project list in Appendix F that address pedestrian crashes, four (4) of which are new initiatives (proposed projects) for FFY 2021.**

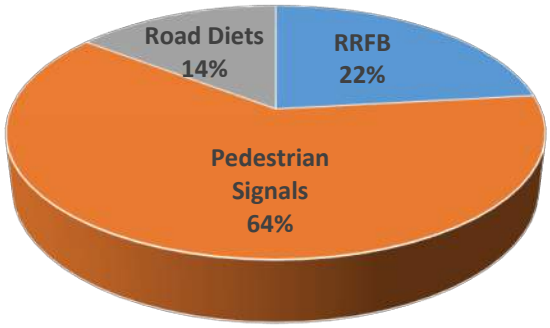



**Figure 23: Pedestrian Safety Program Obligations Summary**

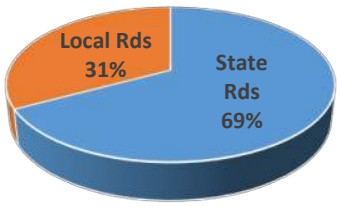



**Figure 24: Pedestrian Safety Program Obligations by Ownership**


**Figure 25: Pedestrian Safety Program Obligations by Project Type**

***Pedestrian Safety Program Proposed Countermeasure - Rectangular Rapid Flash Beacons (RRFB)***

Purpose:

RRFBs are pedestrian-actuated conspicuity enhancements used in combination with a pedestrian, school, or trail crossing warning sign to enhance safety by reducing crashes between vehicles and pedestrians at uncontrolled, marked crosswalks. The device includes rectangular shaped yellow indications, each with a Light Emitting Diode (LED) array-based light source, that flash with high frequency when activated.

HSIP cost for FFY 2021: **$1,429,650 (PE/ROW/CN)**

Methodology:

Use risk factors (e. g. number of lanes, roadway width, ADT, speeds, land use, crash history) to systemically identify uncontrolled marked midblock crosswalks that could benefit from a RRFB. Utilize the document "Pedestrian Safety Countermeasures Guidance at Marked Uncontrolled Crosswalks." This treatment is expected to reduce pedestrian crossing crashes.

Implementation:

- State Roads
  - For FFY 21, continue and complete design in all four Districts (Project Nos. 171-454, 172-454, 173-507, 174-438) and advertise RRFB project in District 1 for construction in 2021. **The HSIP costs for PE/ROW/CN are estimated to be $754,650.**
- Local Roads
  - For FFY 21, send letters to towns with qualifying locations requesting participation in a RRFB project. Initiate PE phase in 2021 and advertise and construct projects in FFY 2022. **The HSIP cost for PE is estimated to be $675,000.**

Benefits:

- 47 percent reduction in vehicle/pedestrian crashes.[16]
- RRFBs are a lower cost alternative to traffic signals and hybrid signals that are shown to increase driver yielding behavior at crosswalks significantly when supplementing standard pedestrian crossing warning signs and markings.
- The novelty and unique nature of the stutter flash may elicit a greater response from drivers than traditional methods.

Figure 26: Typical Installation - RRFB School Crossing

Figure 27: Typical Installation - RRFB Pedestrian Crossing

[16] http://cmfclearinghouse.org/

## ***Pedestrian Safety Program Proposed Countermeasure - Pedestrian Improvements at Signalized Locations***

Purpose:

The upgrade of pedestrian facilities at signalized intersections to include countdown pedestrian signals with leading pedestrian intervals (LPIs), where appropriate. Upgrades to also include accessible pedestrian signals (APS) , sidewalk ramps, and marked crosswalks.

HSIP cost for FFY 2021: **$4,200,000 (PE/PL)**

Methodology:

Systemically upgrade traffic signals following standards and guidelines in Manual on Uniform Traffic Control Devices and CTDOT's Traffic Control Signal Design Manual to ensure that all pedestrian signals have countdown heads, both audible and vibrotactile walk indications, and LPIs at appropriate locations. These features are expected to improve pedestrian compliance at traffic signals and reduce pedestrian/vehicle conflicts.

Implementation:

- State Roads
  - Accessible pedestrian signal (APS) improvements were completed in Districts 1 and 4 between 2017 and 2019 at locations where there were non-compliant audible buzzers.
  - For FFY 21, initiate a PE phase in 2021 for each District to include countdown pedestrian signals with APS features and LPIs at all other locations that could benefit from the countermeasures. **The HSIP cost for PE is estimated to be $3,750,000.**
- Local Roads
  - For FFY 21, initiate a PL phase in 2021 to determine which locally owned signals that could benefit from installation of countdown signals with APS, LPI, and marked crosswalk improvements. **The HSIP cost for PL is estimated to be $450,000.**

Benefits:

- Improved understanding and compliance of a pedestrian phase.
- Pedestrian countdown signals have been shown to have a 25 percent reduction in pedestrian injury collisions.[17]
- LPIs increased visibility of crossing pedestrians and enhanced safety for pedestrians who may be slower to start into the intersection.
- LPIs can reduce pedestrian-vehicles crashes at intersections by 60 percent.[18]

Figure 28 (left): Example of a Leading Pedestrian Interval

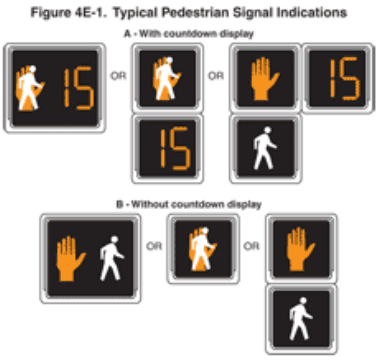



Figure 29 (right): Example of a Countdown Pedestrian Signal Indication

[17] http://www.cmfclearinghouse.org/study_detail.cfm?stid=332
[18] https://nacto.org/docs/usdg/safety_effectiveness_of_lpi_fayish.pdf

### *Pedestrian Safety Program Proposed Countermeasure - Road Diets*

Purpose:

A Road Diet typically involves converting an existing four-lane, undivided roadway segment to a three-lane segment consisting of two through lanes and a center, two-way left-turn lane. Road Diets enhance safety, mobility, and access for all road users.

HSIP cost for FFY 2021: **$900,000 (PL)**

Methodology:

Conduct a feasibility assessment for a road diet on all multilane undivided arterials with average daily traffic of 22,000 vehicles or less[i]. Potential segments from the initial screening process to be studied further to confirm that the implementation of a road diet will provide the desired results. This treatment reduces numerous crash types such as angle, rear-end, sideswipe and pedestrian.

Implementation:

- State Roads
  - For FFY 21, implement road diet in conjunction with planned Vendor-In-Place or Pavement Preservation paving projects. In 2019, a road diet was implemented on Route 156 in Waterford and four candidate segments are being reviewed in this year.
  - Include road diet improvements as part of other planned construction projects
- Local Roads
  - For FFY 21, send letters to towns with qualifying roads requesting participation in a road diet. Initiate PL phase in 2021. The road diet could be incorporated in a planned paving project or a stand-alone project can be initiated. **The HSIP cost for PL is estimated to be $900,000.**

Benefits:

- An overall crash reduction of 19 to 47 percent.[19]
- Fewer lanes for pedestrians to cross.
- Opportunity to install pedestrian refuge islands, bicycle lanes, on-street parking, or transit stops.
- Traffic calming and more consistent speeds.
- A more community-focused, "Complete Streets" environment that better accommodates the needs of all road users.

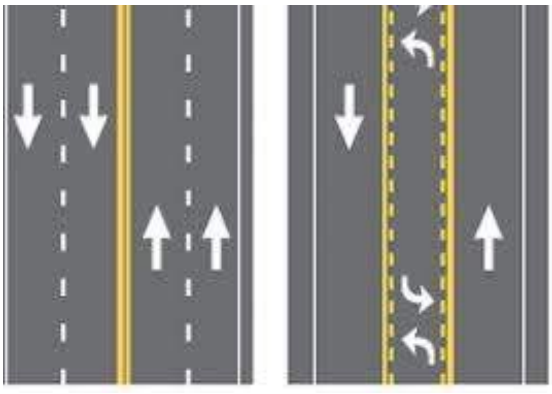


Figure 30: Typical Before and After Road Diet


Figure 31: Example of a Road Diet

[19] https://safety.fhwa.dot.gov/provencountermeasures/road_diets/

# HSIP Planning Activities

## *Overview:*

Transportation Safety Planning and similar activities use data and information to reduce fatalities and serious injuries. Planning is a proactive process that better integrates safety into transportation decision-making. The programs and initiatives listed below are **previously obligated** which further demonstrates Connecticut's commitment to safety.

## *Safety Circuit Rider Program*

Purpose:

The Safety Circuit Rider program, which is part of the T2 Center at UCONN, provides safety-related information, training, and direct technical assistance to agencies responsible for local roadway safety.

Benefits:

A no cost program to local agencies that provides services such as Road Safety Audit (RSA), collection and analysis of traffic volume data, identification of low-cost safety improvements, development of roadway safety briefs, and delivery of local road safety training.

## *Regional Transportation Safety Plans*

Purpose:

Regional transportation safety plans, which is a proven safety countermeasure, are intended to identify the region's critical safety needs and guide investment decisions to reduce fatalities and serious injuries on secondary roadways for all road users, while promoting safe travel for all modes including bike and pedestrians. The plans will also assist local agencies in addressing traffic safety issues at the local level. Plans are being developed for all nine COGs and funds to prepare the plans have been previously obligated.

Benefits:

- Proactive approach to safety by showing the public and policy makers that something is being done to reduce severe crashes.
- Multidisciplinary cooperation by improving relationships across governmental agencies.
- Provides a list of prioritized improvements that can help agencies better justify obligation requests by documenting specific needs.

### *Safety Analysis Improvement Program*

Purpose:

Connecticut's Roadway Safety Management System (CRSMS) web-based tool is being enhanced to incorporate new research and methodologies in the 2nd edition of the Highway Safety Manual. Additional critical safety data necessary for CTDOT to take full advantage of the data-driven safety analysis methods will also be collected. It is anticipated within the next few years that Connecticut will be able to utilize Connecticut specific data for analysis of countermeasures implemented instead of only national reference to make data driven decisions for both project programming and for setting safety performance measure targets.

Benefits:

The tools and methods generated by the CTSRC will help CTDOT make better safety decisions and investments on all public roads. For example, one of the planned modules will be systemic safety analysis which will replace the current tedious process of manually creating crash trees. The new module will also assist to identify risk factors associated with crash types, to select and evaluate proven low-cost countermeasure that can be implemented systemically, and to prioritize locations for safety improvement investments.

## Project List:

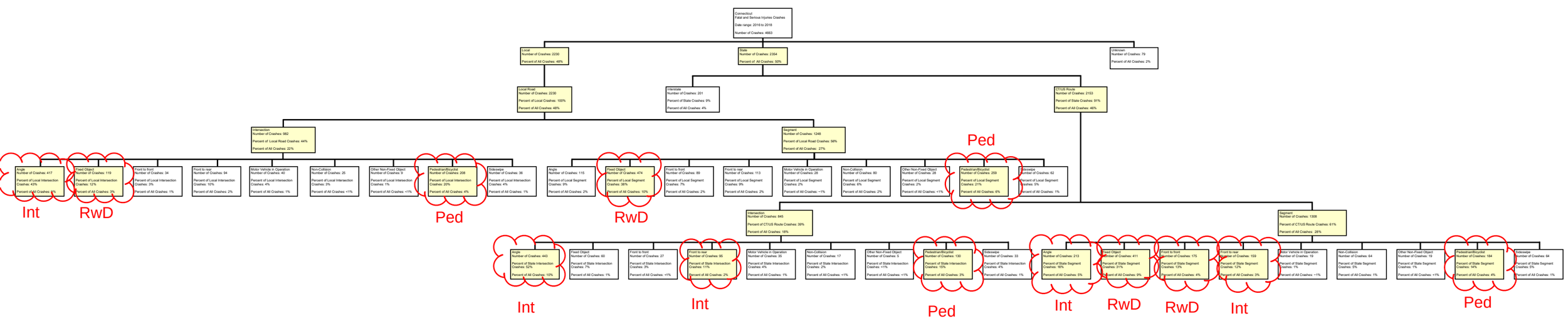
A detailed list of projects that will be obligated during the 2021 fiscal year is provided in Appendix F. The list includes the project name, project number, project cost, relationship to program type, SHSP Emphasis Area, and roadway ownership. As previously indicated, there are other safety improvement projects, which do not appear on Appendix F, but listed in the STIP under the HSIP for FFY 21 because they address other safety needs.

## Summary of Actions:

In accordance with 23 U.S.C. 148(i)(2)(E), this Highway Safety Improvement Program Implementation Plan for Connecticut describes the actions that the State will undertake in FFY 2021 and reaffirms the Connecticut Department of Transportation's commitment towards achieving our safety performance targets in subsequent years. This Plan identifies three program areas (Roadway Departure, Intersections, and Pedestrians) and specific countermeasures under each program, that when implemented, will save lives and prevent serious injuries. The Plan blends the deployment of intersection improvements at high-crash locations with a systemic approach that involves deploying large numbers of relatively low-cost, proven safety countermeasures at high risk locations on select public roads in Connecticut. Once the safety effective module within the CRSMS is completed, CTDOT will be able to evaluate the effectiveness of past safety projects. This evaluation will help CTDOT determine if our efforts are reducing the number of fatal and serious injury crashes, or if a different course of action should be pursued.

# Appendix A:
# Crash Trees

# CRASH TREE 1 - CT FATAL/SERIOUS INJURY CRASH TREE (2016-2018)

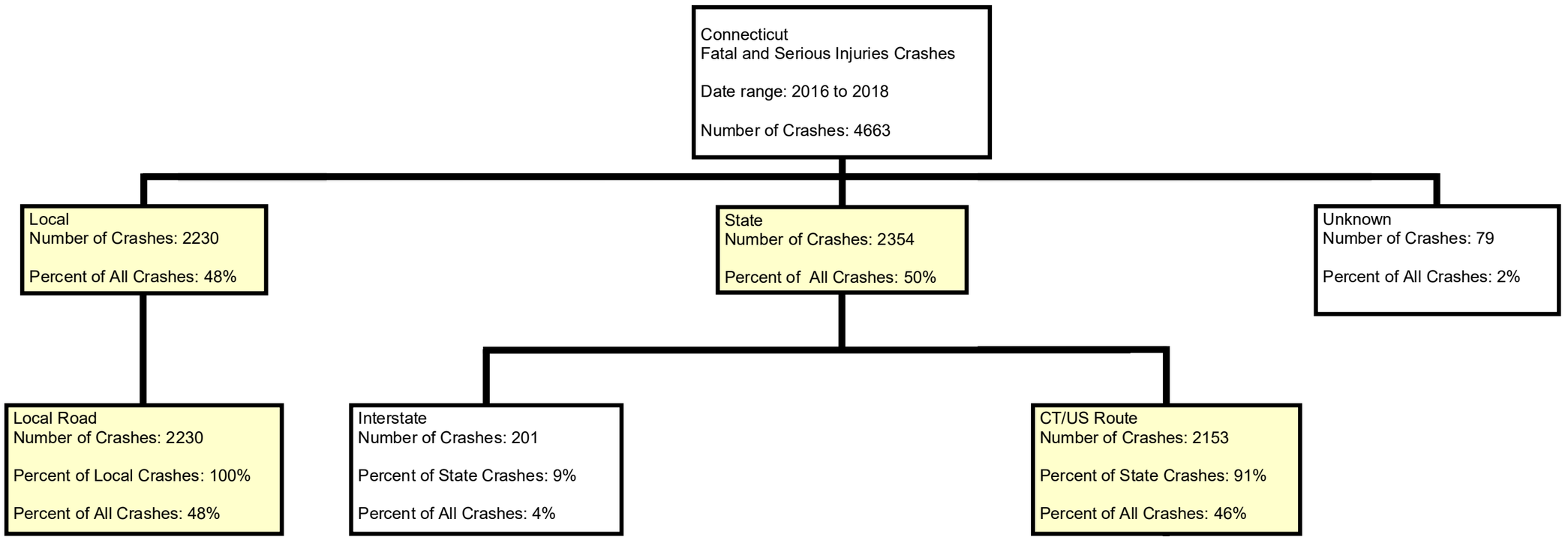



Intersection (Int): 9+10+2+5+3=29%
Roadway Departure (RwD): 3+10+9+4=26%
* Pedestrian (Ped): 4+6+3+4=17%

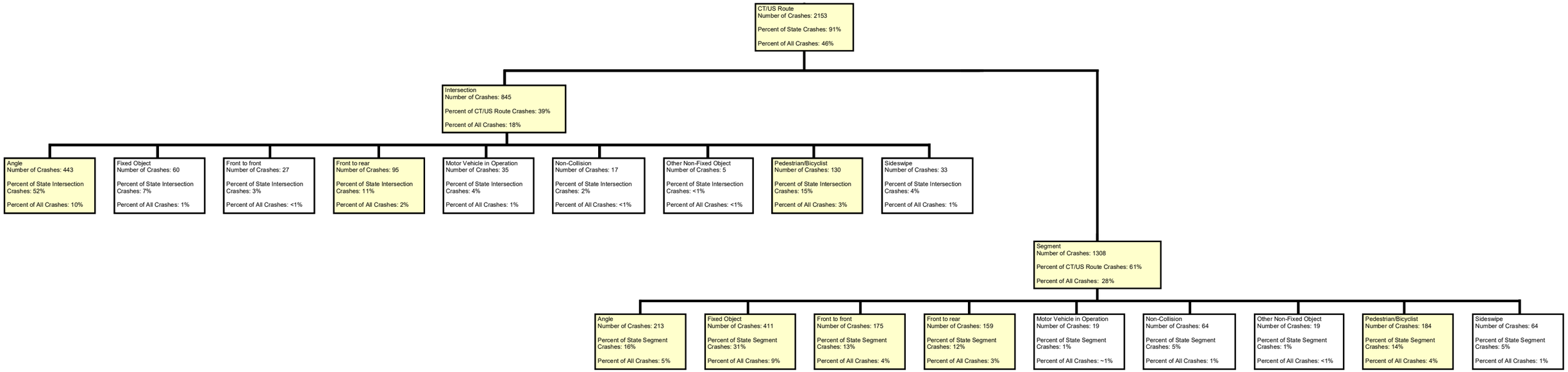
72%

* Note: Bicycle crashes are included in the Pedestrian/Bicycle boxes above. Bicycle crashes account for less than 2% of the total fatal and serious injury crashes.

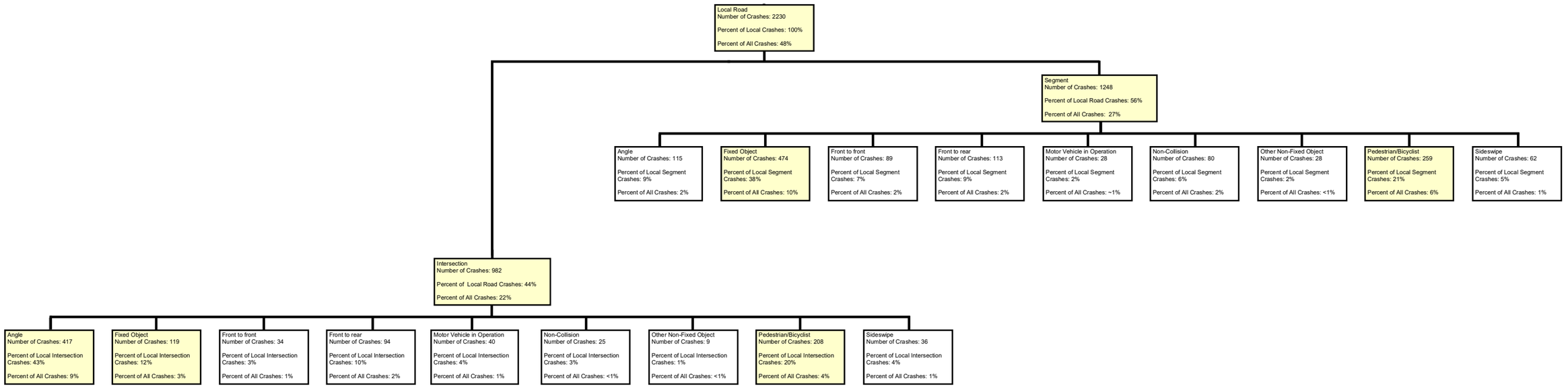
# CRASH TREE 2 - STATE VS. LOCAL ROUTES & INTERSTATE VS. CT/US ROUTES (2016-2018)



# CRASH TREE 3 - STATE INTERSECTION VS. SEGMENT & CRASH TYPES (2016-2018)



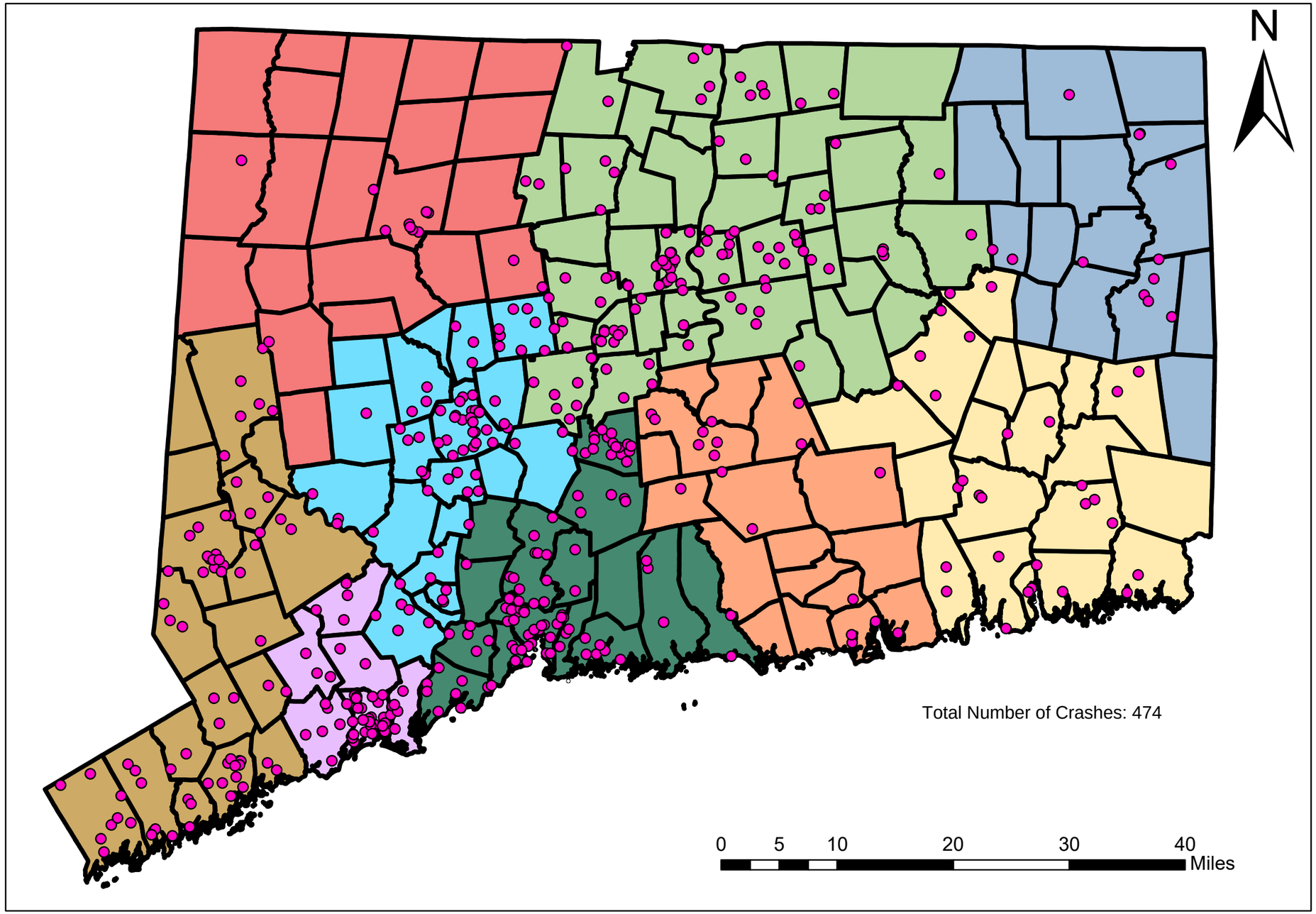
# CRASH TREE 4 - LOCAL INTERSECTION VS. SEGMENT & CRASH TYPES (2016-2018)



# Appendix B:

## Roadway Departure Program Crash Trees and Maps

# Fatal and Serious Injury Fixed Object Crashes on Local Road Segments (2016-2018)



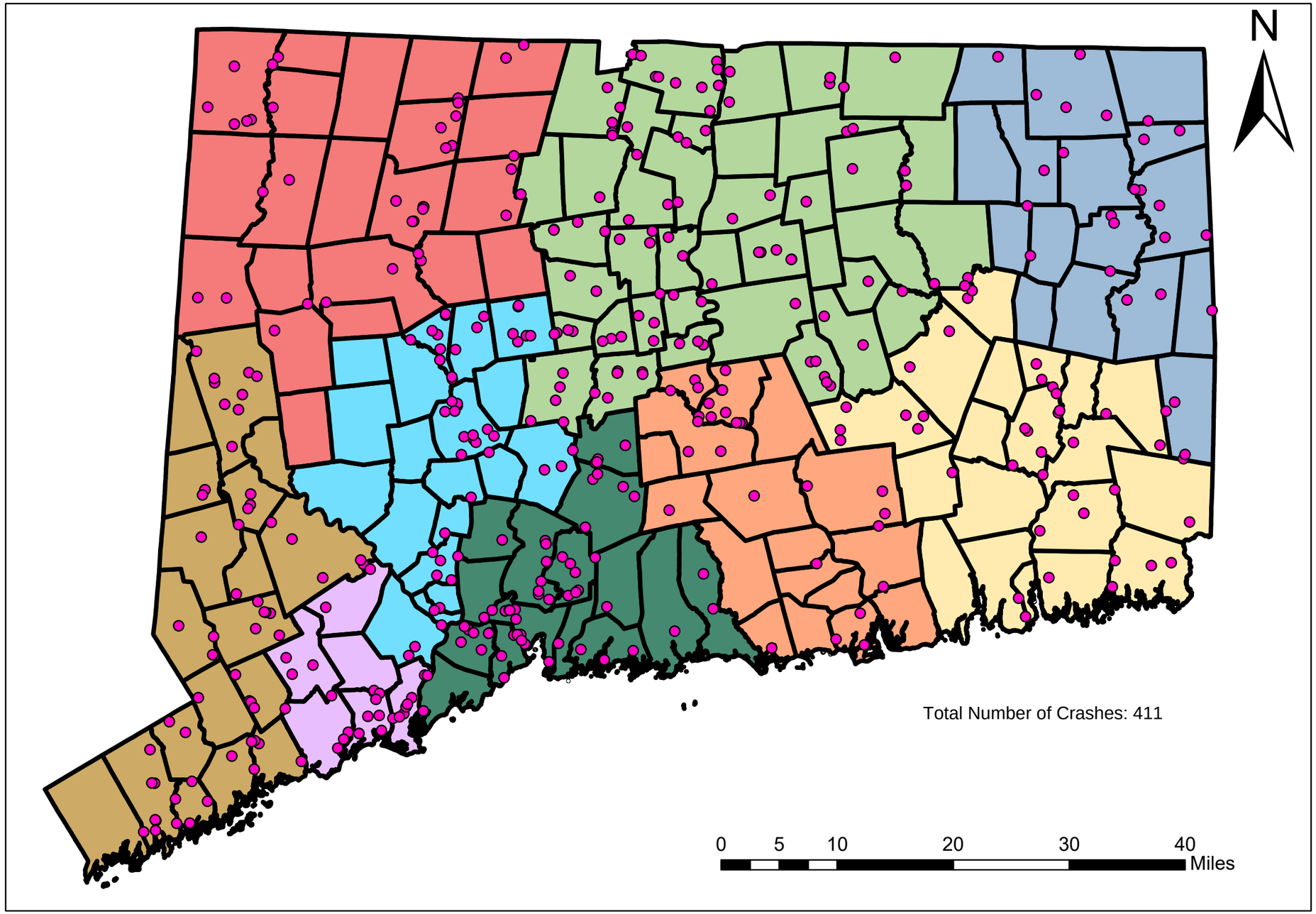

**Legend:**

- Crash

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Fixed Object Crashes on CT/US Route Segments (2016-2018)



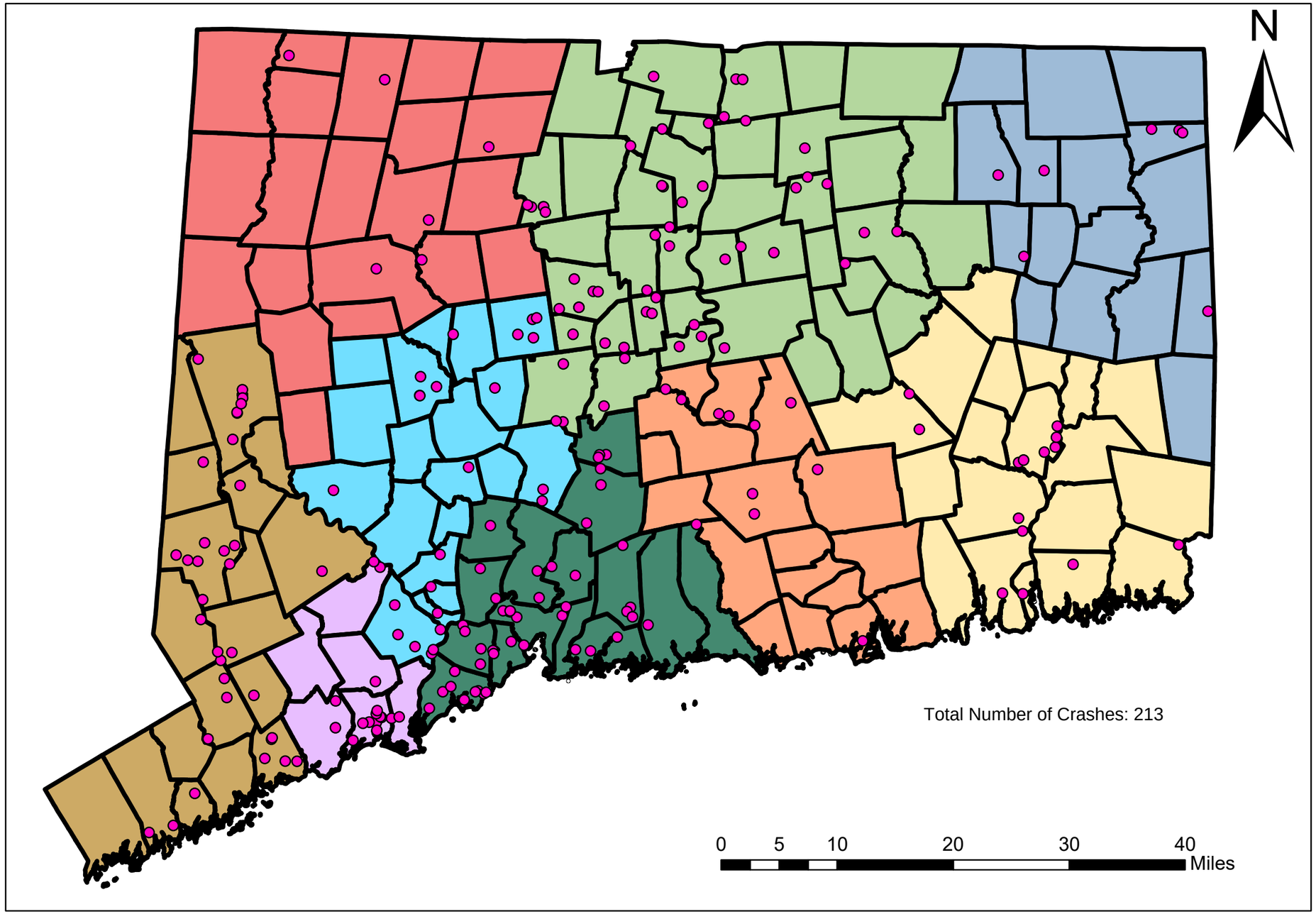

**Legend:**

- Crash

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Angle Crashes on CT/US Route Segments (2016-2018)



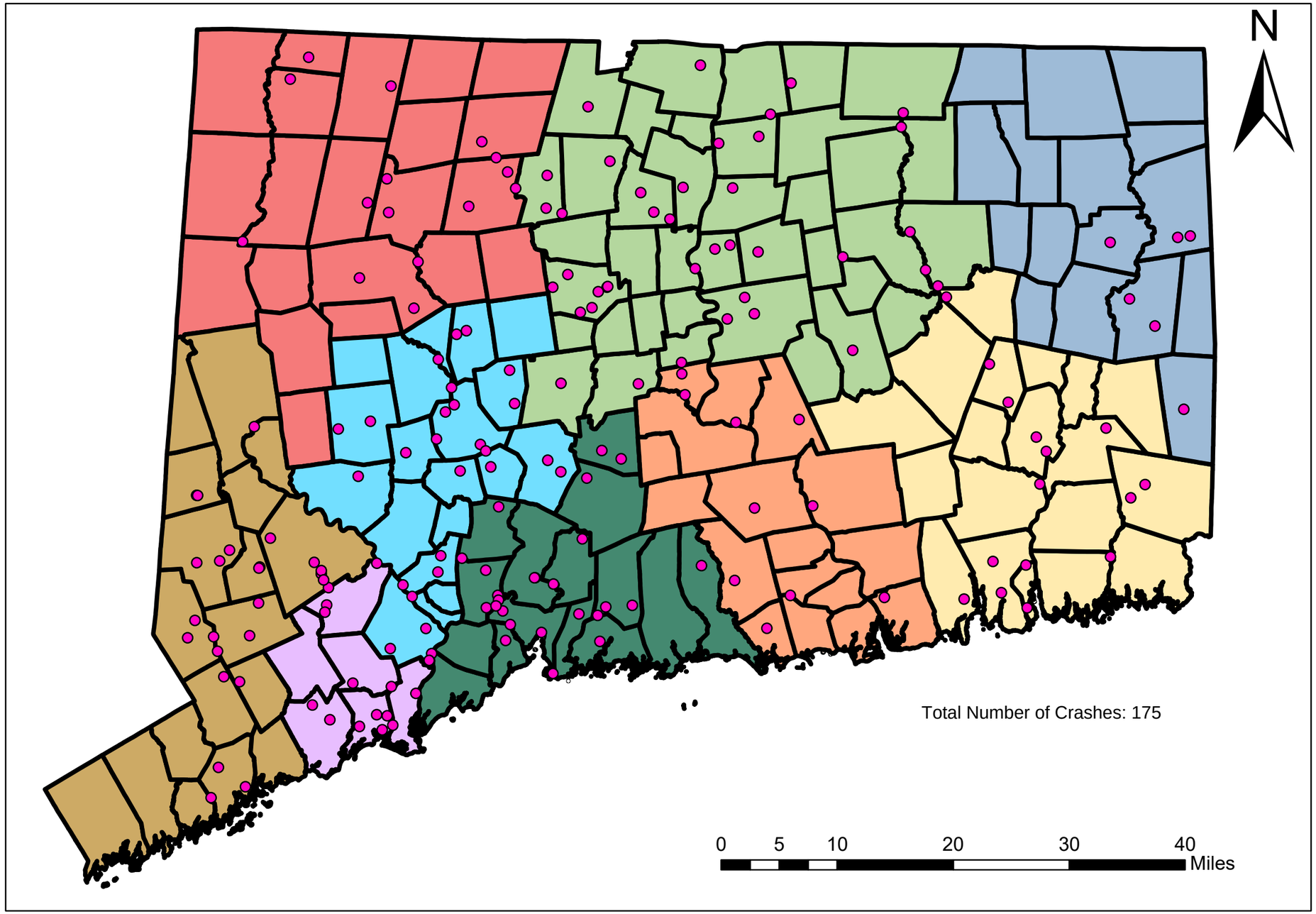

**Legend:**

- Crash

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Head-On Crashes on CT/US Route Segments (2016-2018)



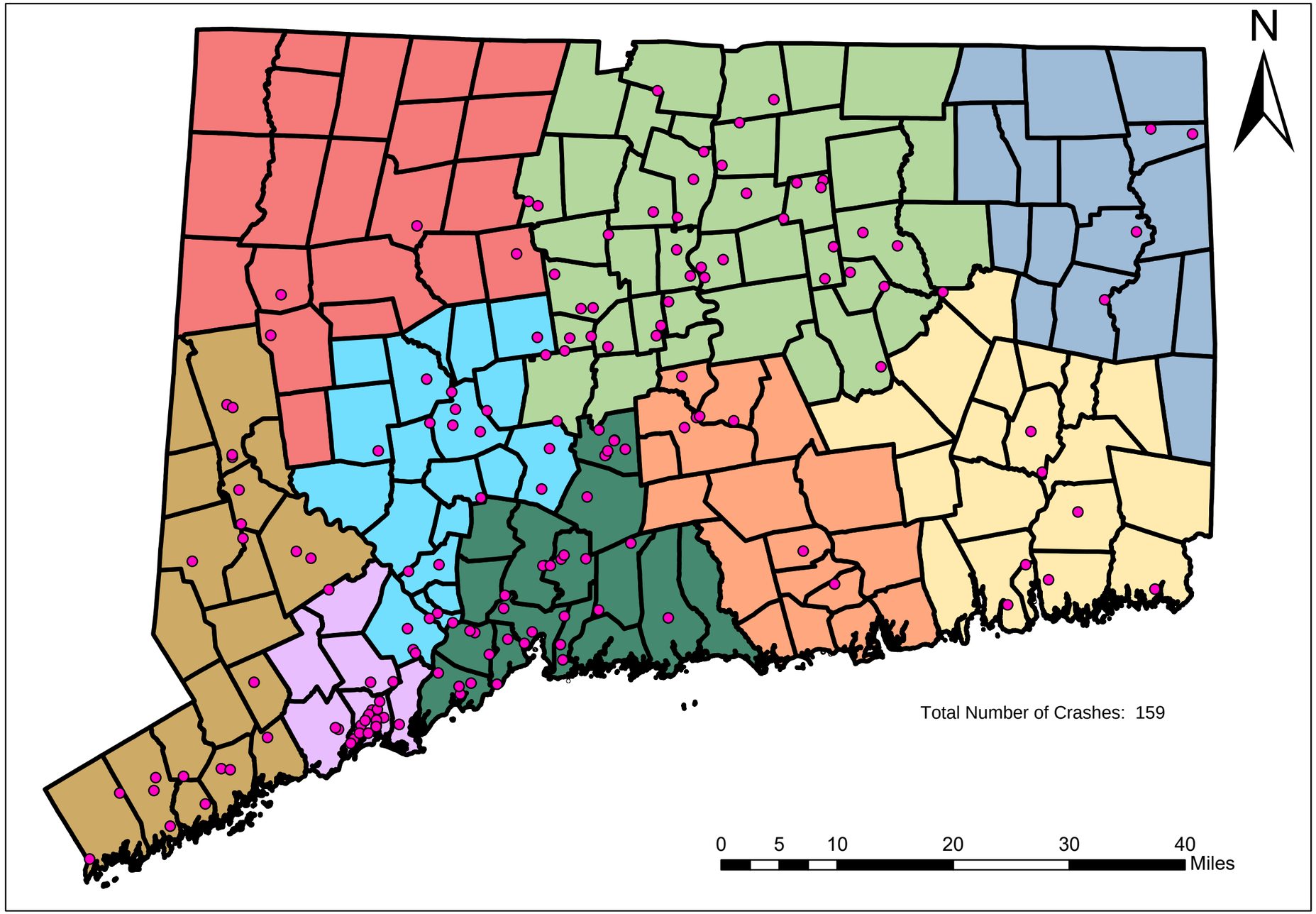

**Legend:**

- Crash

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Rear-End Crashes on CT/US Route Segments (2016-2018)



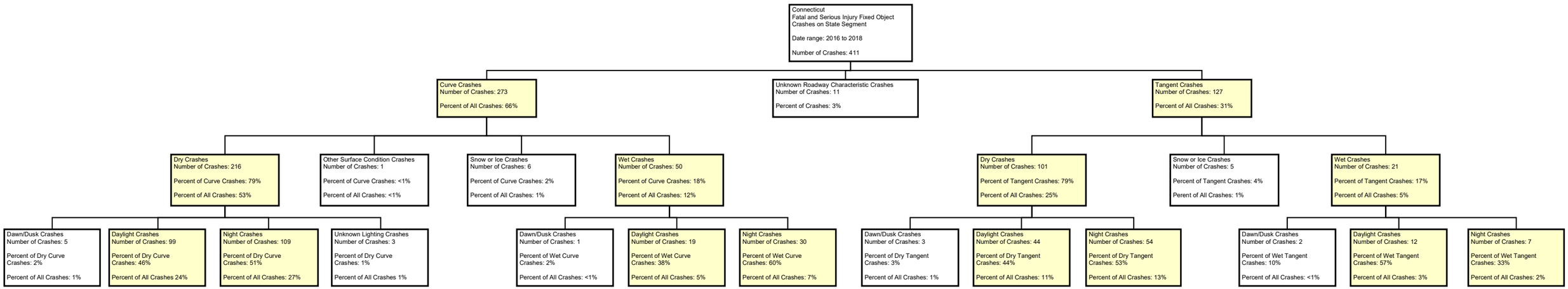

**Legend:**

- Crash

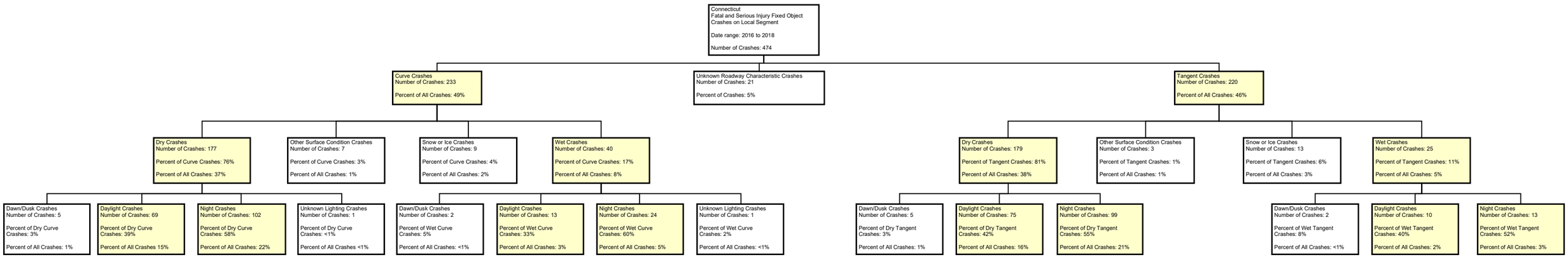
**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

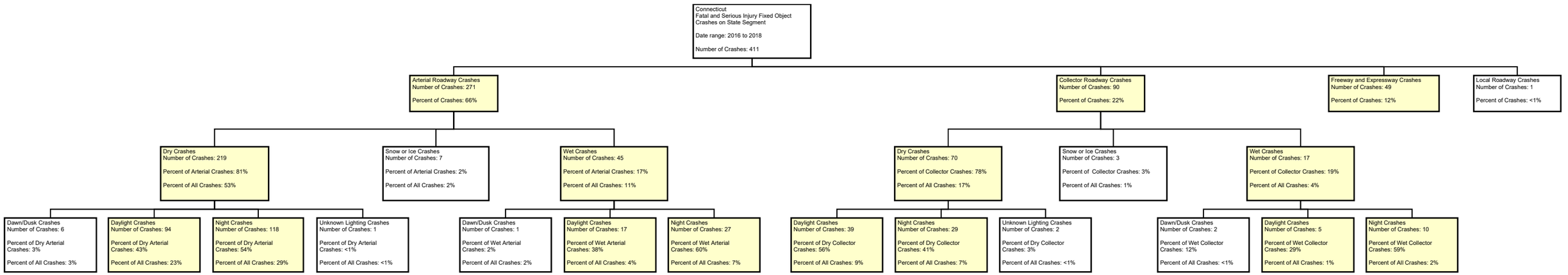
# Fatal and Serious Injury Fixed Object Crashes on State Segment (2016-2018) - Curve vs. Tangent



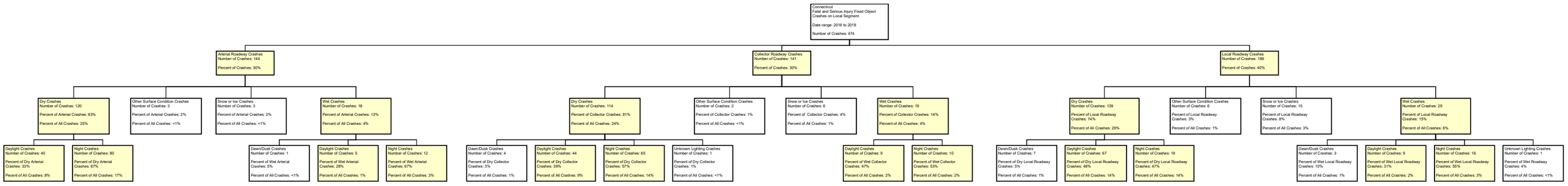
# Fatal and Serious Injury Fixed Object Crashes on Local Segment (2016-2018) - Curve vs. Tangent



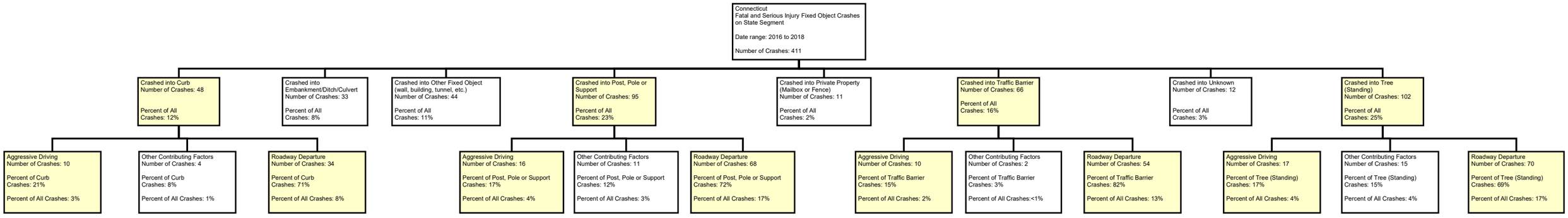
# Fatal and Serious Injury Fixed Object Crashes on State Segment (2016-2018) -Functional Class



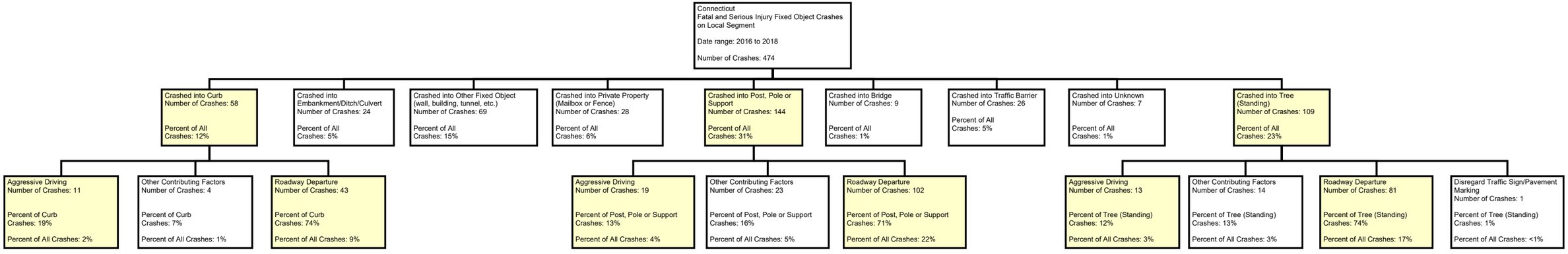
# Fatal and Serious Injury Fixed Object Crashes on Local Segment (2016-2018) - Functional Class



# Fatal and Serious Injury Fixed Object Crashes on State Segments (2016-2018)



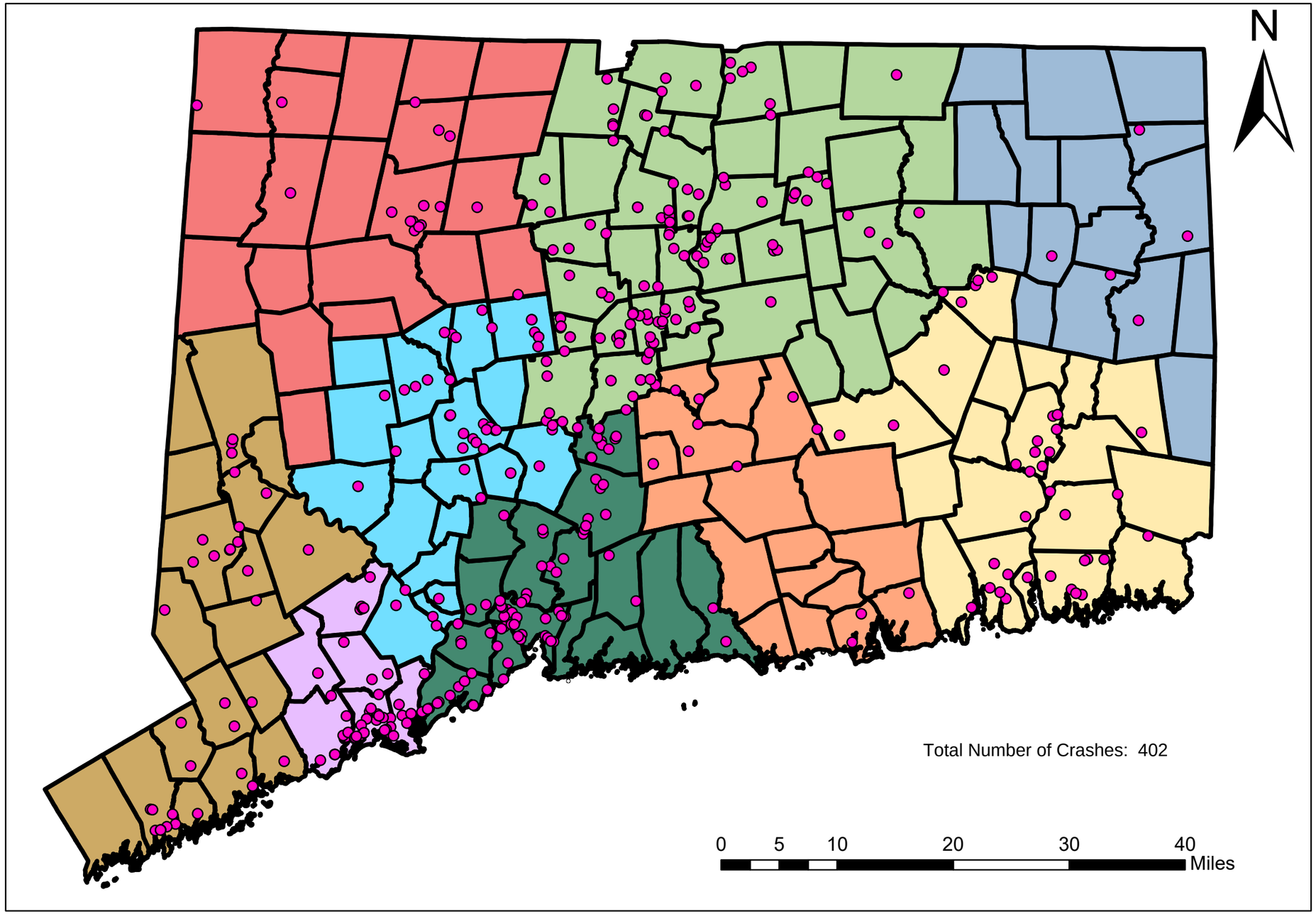
# Fatal and Serious Injury Fixed Object Crashes on Local Segments (2016-2018)



# Appendix C:

## Intersection Program Crash Trees and Maps

# Fatal and Serious Injury Angle Crashes at CT/US Route Intersections (2016-2018)



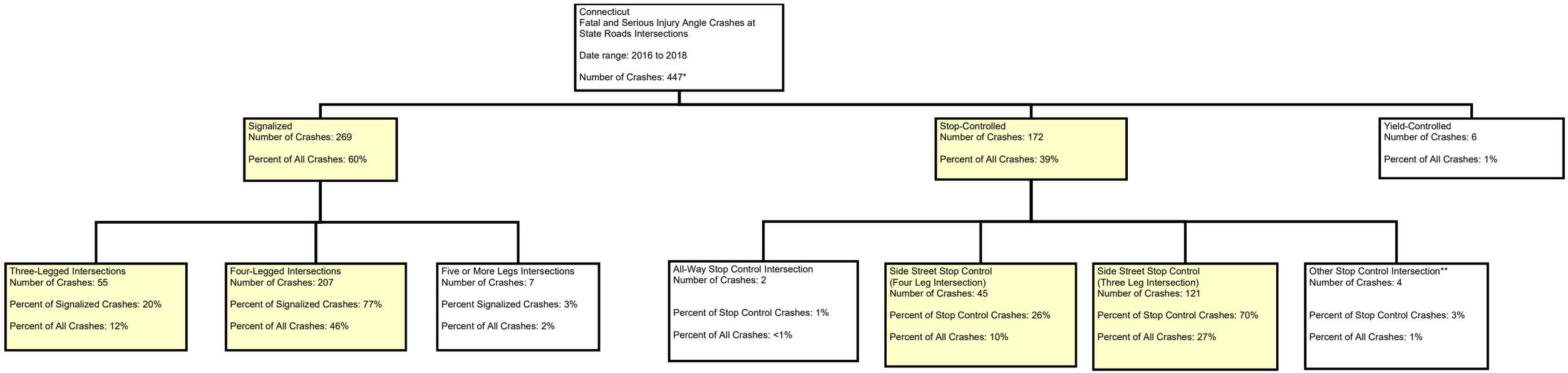

**Legend:**

- Crash

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

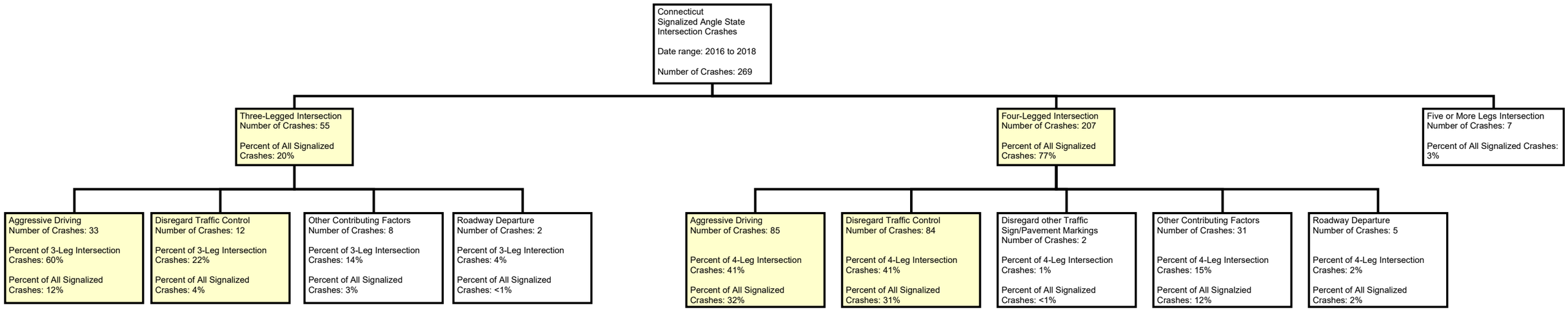
# Fatal and Serious Injury Angle Crashes at State Intersections (2016-2018)



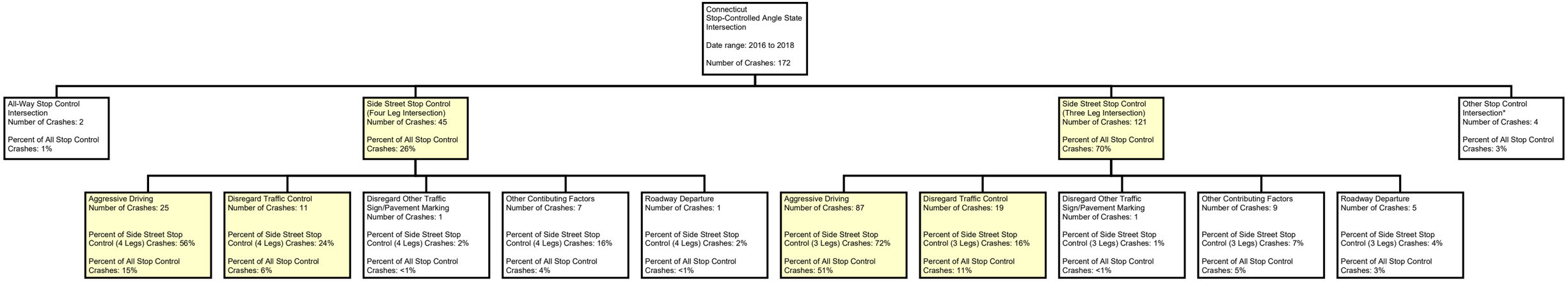

*Four Interstate crashes could be attributed to State intersections instead, change number of crashes from 443 to 447.

**Includes stop-control intersections where there are one or more one-way roads and only the side street is stop control.

# Fatal and Serious Injury Signalized Angle Crashes at State Intersections (2016-2018)

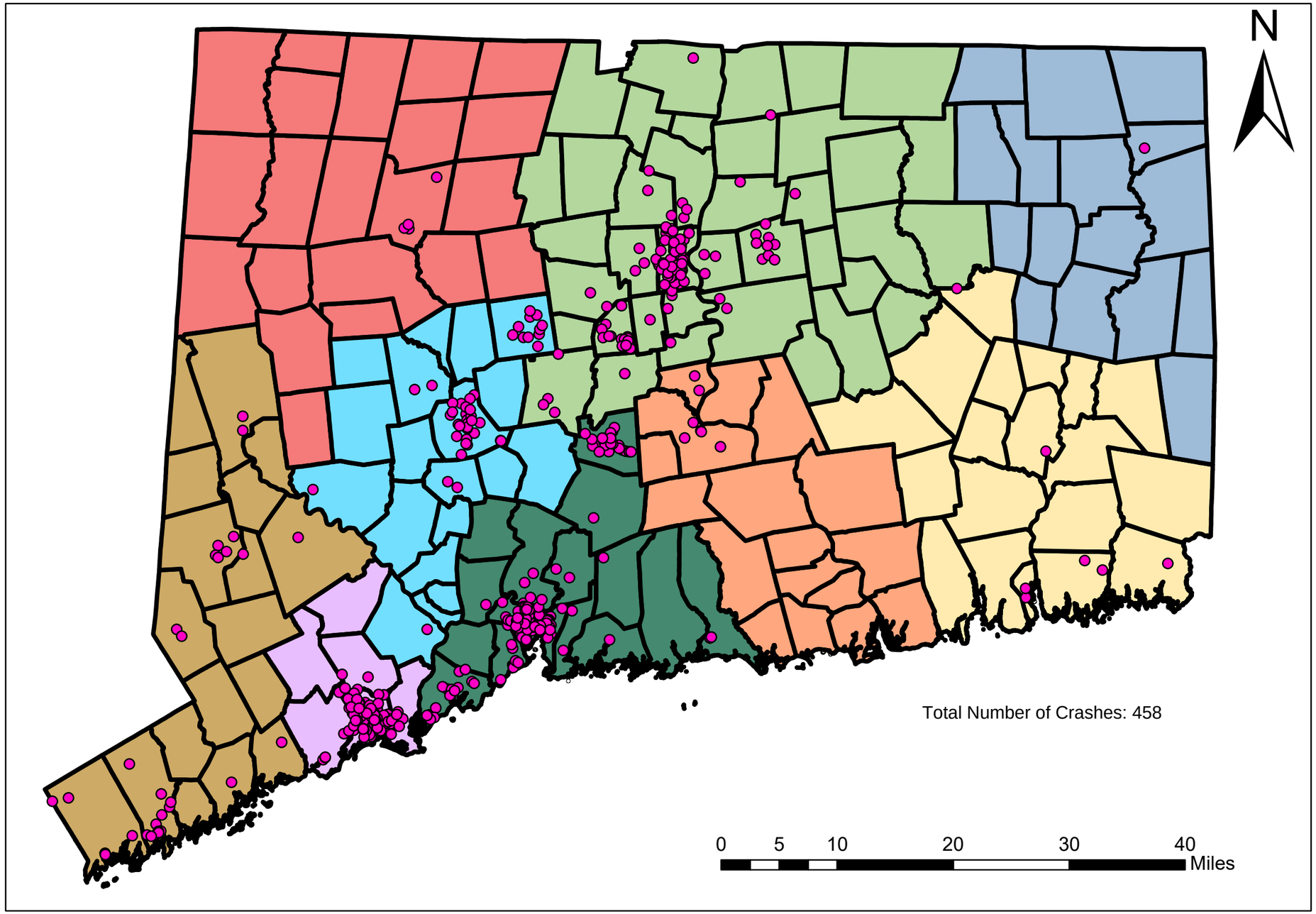


# Fatal and Serious Injury Stop-Controlled Angle Crashes at State Intersections (2016-2018)




*Includes stop-control intersections where there are one or more one-way roads and only the side street is stop control.

# Fatal and Serious Injury Angle Crashes at Local Intersections (2016-2018)



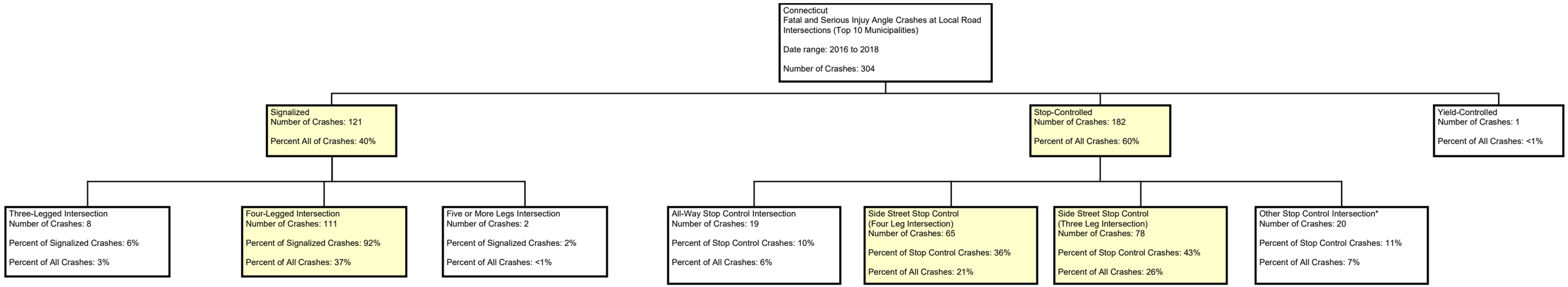

**Legend:**

- Crash

**Regional_COG**

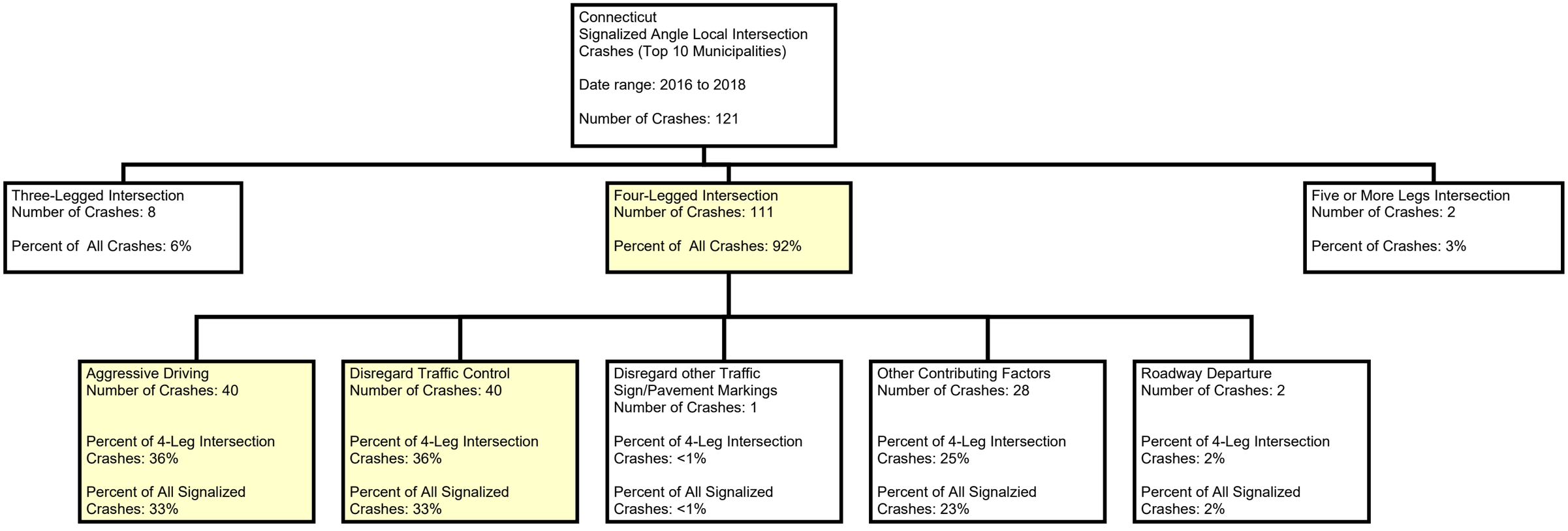
- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Angle Crashes at Local Intersections (2016-2018) - Top 10 Municipalities

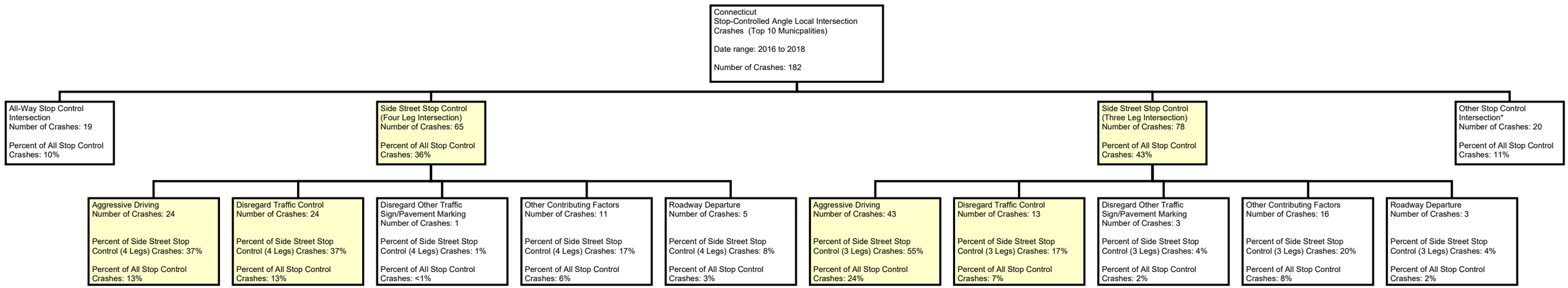



*Includes stop-control intersections where there are one or more one-way roads and only the side street is stop control.

# Fatal and Serious Injury Signalized Angle Crashes at Local Intersections (2016-2018) - Top 10 Municipalities



# Fatal and Serious Injury Stop-Controlled Angle Crashes at Local Intersections (2016-2018) - Top 10 Municipalities




*Includes stop-control intersections where there are one or more one-way roads and only the side street is stop control.

## Fatal and Serious Injury Angle Crashes
## At Local Road Intersection

| Town | K | A | Total Crashes | Crash Percent |
|---|---|---|---|---|
| New Haven | 6 | 73 | 79 | 17% |
| Bridgeport | 6 | 73 | 79 | 17% |
| Hartford | 10 | 63 | 73 | 16% |
| Waterbury | 2 | 26 | 28 | 6% |
| Meriden | 1 | 25 | 26 | 6% |
| New Britain | 1 | 13 | 14 | 3% |
| Milford | 0 | 14 | 14 | 3% |
| Stamford | 1 | 11 | 12 | 3% |
| Bristol | 2 | 9 | 11 | 2% |
| Manchester | 0 | 9 | 9 | 2% |
| West Haven | 4 | 4 | 8 | 2% |
| Fairfield | 0 | 7 | 7 | 2% |
| Stratford | 1 | 5 | 6 | 1% |
| Greenwich | 1 | 4 | 5 | 1% |
| Danbury | 0 | 5 | 5 | 1% |
| Middletown | 0 | 5 | 5 | 1% |
| Hamden | 2 | 3 | 5 | 1% |
| Southington | 2 | 2 | 4 | 1% |
| West Hartford | 0 | 4 | 4 | 1% |
| Trumbull | 1 | 3 | 4 | 1% |
| Windsor | 0 | 4 | 4 | 1% |
| Torrington | 0 | 4 | 4 | 1% |
| East Hartford | 0 | 3 | 3 | 1% |
| East Haven | 0 | 2 | 2 | <1% |
| Farmington | 0 | 2 | 2 | <1% |
| Naugatuck | 0 | 2 | 2 | <1% |
| New London | 0 | 2 | 2 | <1% |
| New Milford | 0 | 2 | 2 | <1% |
| Groton | 0 | 2 | 2 | <1% |
| Glastonbury | 0 | 2 | 2 | <1% |
| Bloomfield | 0 | 2 | 2 | <1% |
| Cromwell | 0 | 2 | 2 | <1% |
| North Haven | 0 | 2 | 2 | <1% |
| Watertown | 0 | 2 | 2 | <1% |
| Wethersfield | 0 | 2 | 2 | <1% |
| Ridgefield | 0 | 2 | 2 | <1% |
| Madison | 1 | 1 | 2 | <1% |
| Berlin | 0 | 1 | 1 | <1% |
| Vernon | 0 | 1 | 1 | <1% |
| Wallingford | 0 | 1 | 1 | <1% |
| Stonington | 0 | 1 | 1 | <1% |

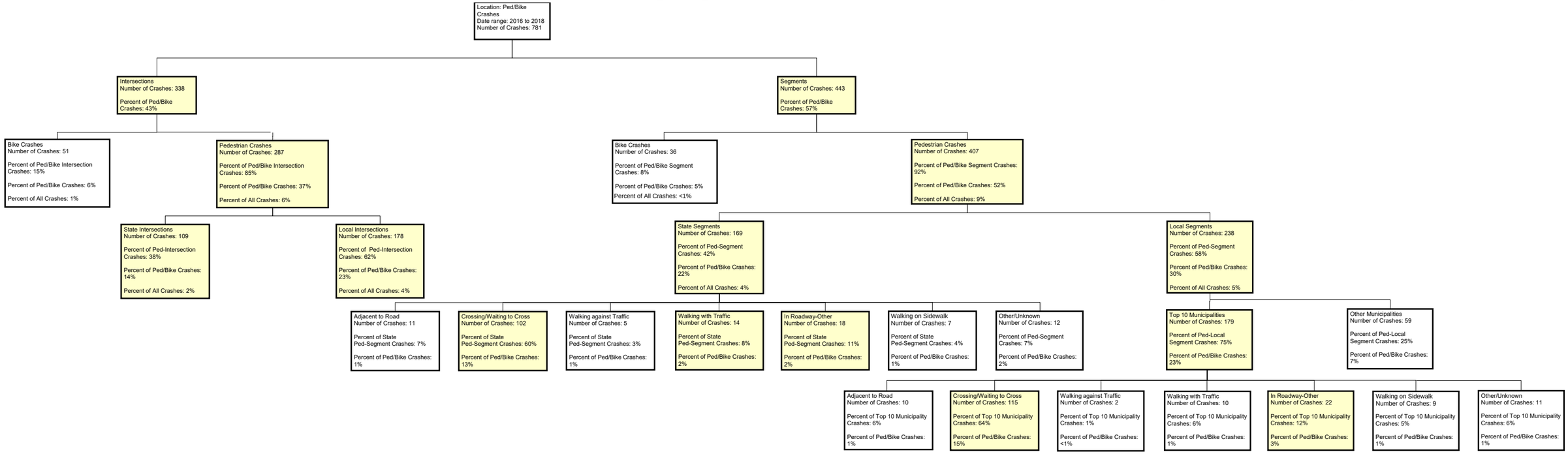
## Fatal and Serious Injury Angle Crashes
## At Local Road Intersection

| Town | K | A | Total Crashes | Crash Percent |
|---|---|---|---|---|
| **Windham** | 0 | 1 | 1 | <1% |
| **Norwalk** | 0 | 1 | 1 | <1% |
| **Bethel** | 0 | 1 | 1 | <1% |
| **Branford** | 0 | 1 | 1 | <1% |
| **Shelton** | 0 | 1 | 1 | <1% |
| **South Windsor** | 0 | 1 | 1 | <1% |
| **North Branford** | 0 | 1 | 1 | <1% |
| **Suffield** | 0 | 1 | 1 | <1% |
| **Woodbridge** | 0 | 1 | 1 | <1% |
| **Norwich** | 0 | 1 | 1 | <1% |
| **Newington** | 0 | 1 | 1 | <1% |
| **Putnam** | 0 | 1 | 1 | <1% |
| **Newtown** | 0 | 1 | 1 | <1% |
| **Southbury** | 0 | 1 | 1 | <1% |
| **Westport** | 0 | 1 | 1 | <1% |
| **Rocky Hill** | 0 | 1 | 1 | <1% |
| **Enfield** | 0 | 1 | 1 | <1% |
| **Total** | 41 | 417 | 458 | 100% |

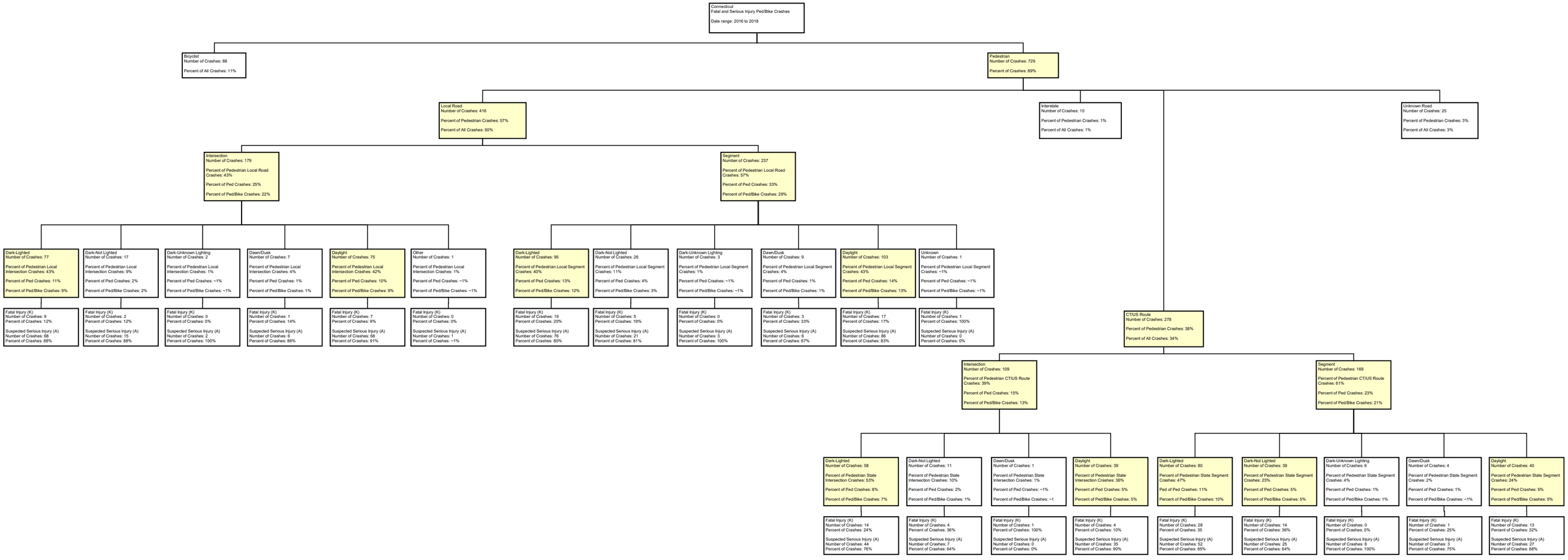
# Appendix D:

## Pedestrian Program Crash Trees and Maps

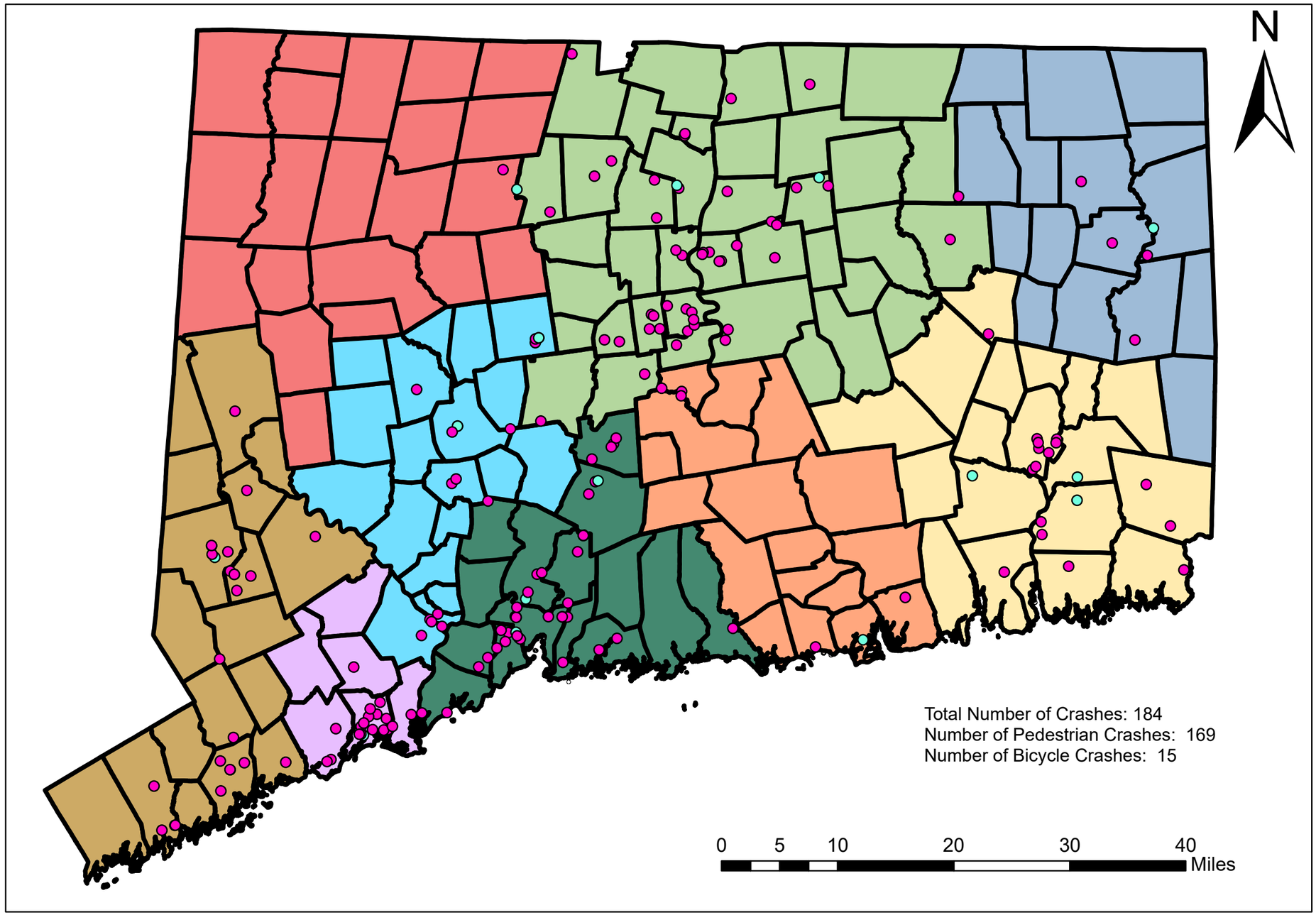
# Fatal and Serious Injury Ped/Bike Crashes in CT (2016-2018)



# CT FATAL/SERIOUS INJURY PEDESTRIAN AND BICYCLE CRASH TREE (2016-2018)



# Fatal and Serious Injury Pedestrian/Bicycle Crashes on CT/US Route Segments (2016-2018)




**Legend:**

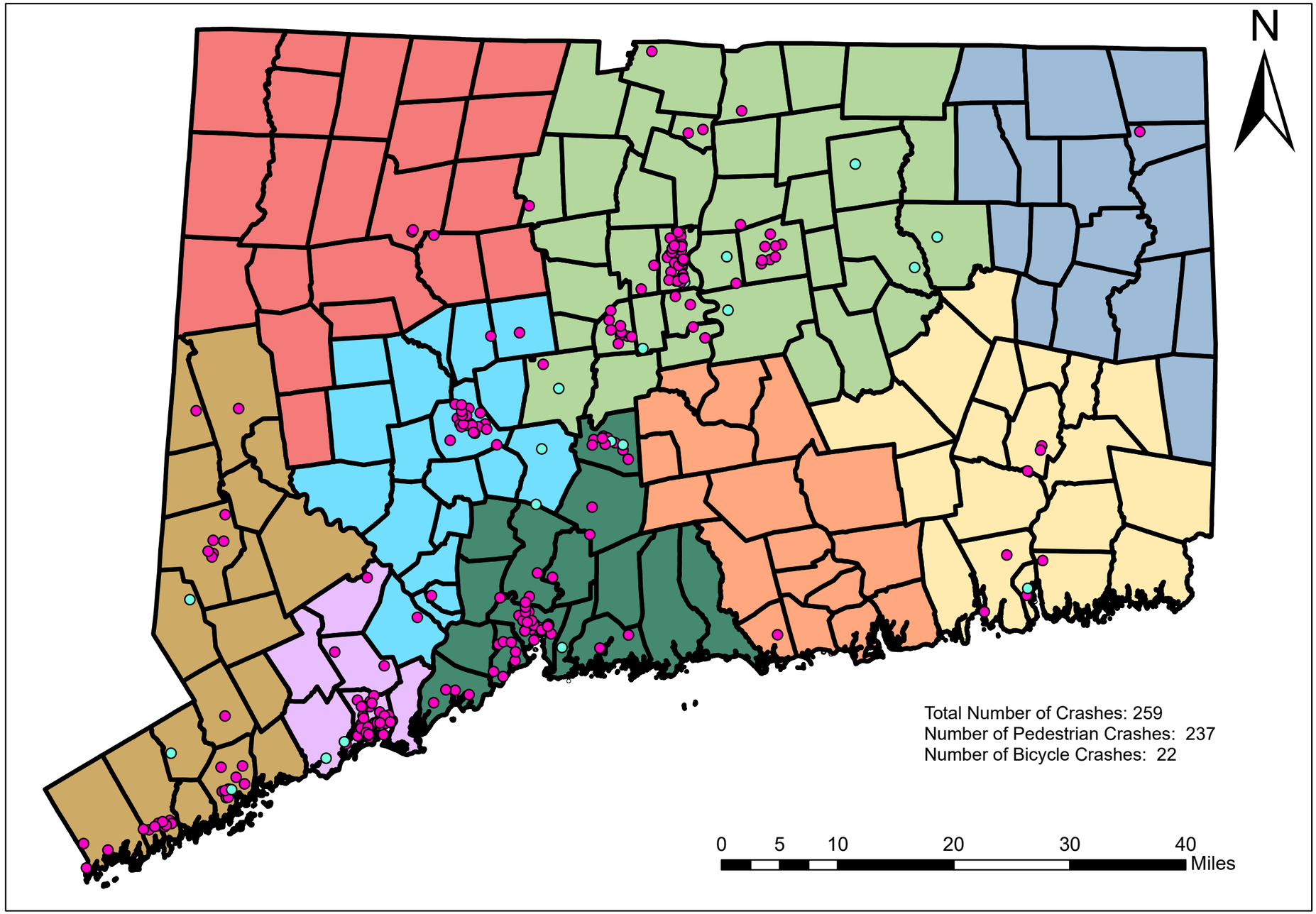
**Crash_Type**

- Bicyclist
- Pedestrian

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Pedestrian/Bicycle Crashes on Local Segments (2016-2018)




**Legend:**

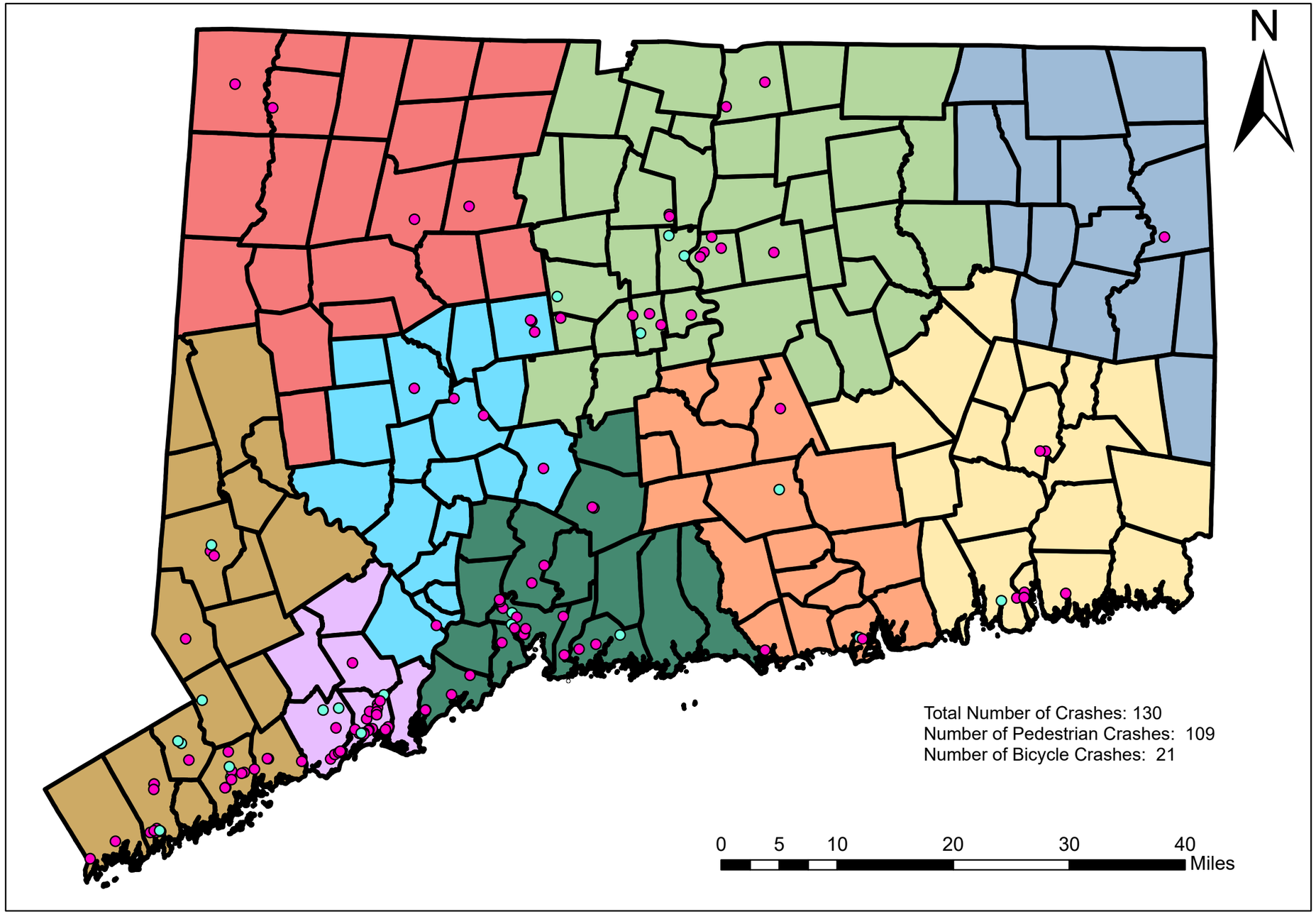
**Crash_Type**

- Bicyclist
- Pedestrian

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Pedestrian/Bicycle Crashes at CT/US Route Intersections (2016-2018)




**Legend:**

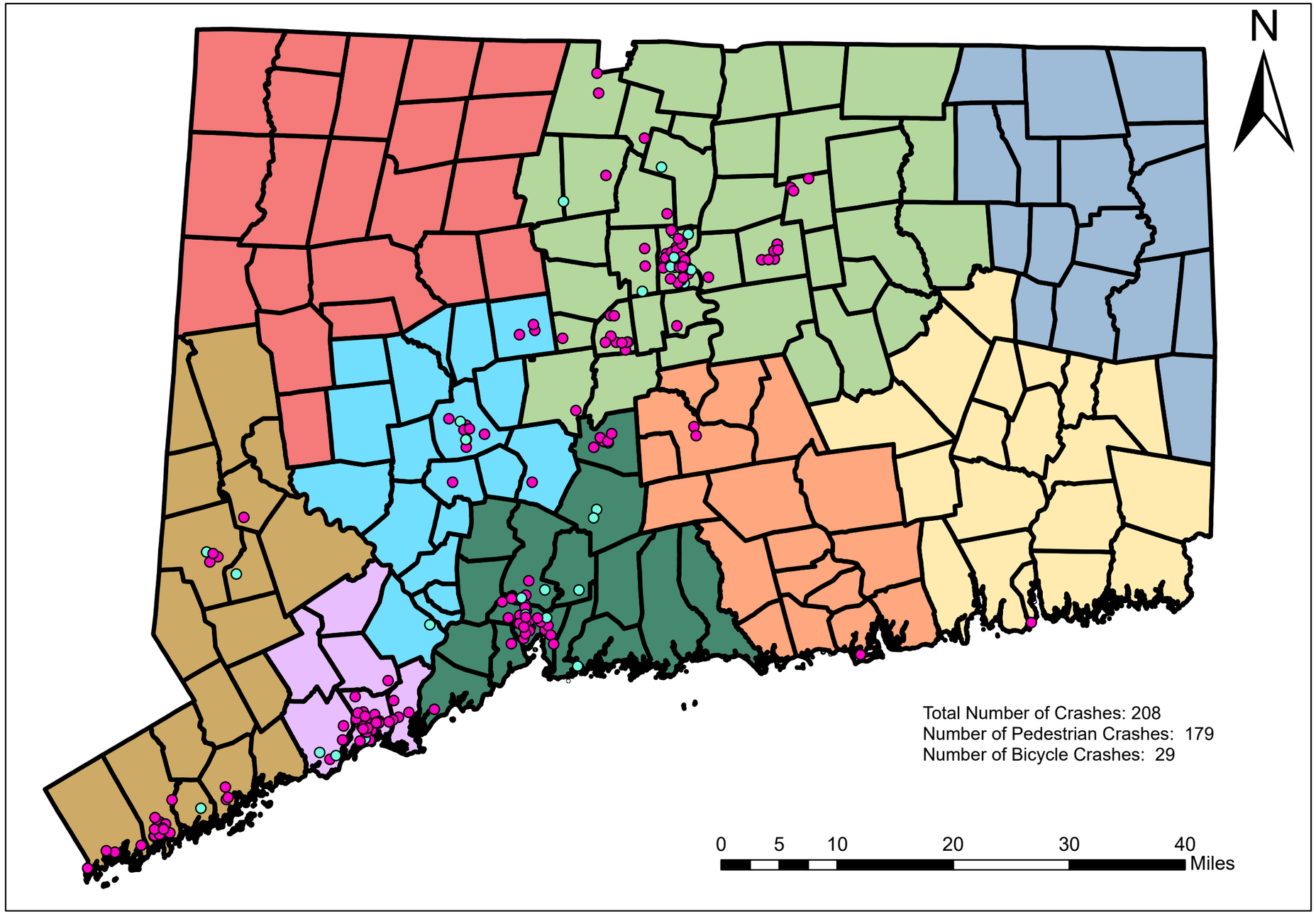
**Crash_Type**

- Bicyclist
- Pedestrian

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

# Fatal and Serious Injury Pedestrian/Bicycle Crashes at Local Intersections (2016-2018)




**Legend:**

**Crash_Type**

- Bicyclist
- Pedestrian

**Regional_COG**

- Capitol
- Lower CT River Valley
- Metropolitan
- Naugatuck Valley
- Northeast CT
- South Central
- Northwest Hills
- Southeastern CT
- Western CT

(2016-2018)

Fatal and Injury Pedestrian Crashes on Local Road Segments

| Town | K | A | Total Crashes | % Total |
|---|---|---|---|---|
| Hartford | 6 | 29 | 35 | 15% |
| Bridgeport | 4 | 31 | 35 | 15% |
| New Haven | 3 | 26 | 29 | 12% |
| Waterbury | 8 | 17 | 25 | 11% |
| Meriden | 1 | 12 | 13 | 5% |
| New Britain | 3 | 7 | 10 | 4% |
| Norwalk | 1 | 9 | 10 | 4% |
| Stamford | 2 | 6 | 8 | 3% |
| Manchester | 0 | 8 | 8 | 3% |
| Danbury | 1 | 5 | 6 | 3% |
| West Haven | 1 | 5 | 6 | 3% |
| Milford | 0 | 4 | 4 | 2% |
| Greenwich | 1 | 2 | 3 | 1% |
| Hamden | 1 | 2 | 3 | 1% |
| Norwich | 0 | 3 | 3 | 1% |
| Wethersfield | 0 | 3 | 3 | 1% |
| West Hartford | 2 | 0 | 2 | 1% |
| Windsor Locks | 1 | 1 | 2 | 1% |
| Branford | 0 | 2 | 2 | 1% |
| South Windsor | 0 | 2 | 2 | 1% |
| Trumbull | 0 | 2 | 2 | 1% |
| Bristol | 1 | 0 | 1 | <1% |
| Clinton | 1 | 0 | 1 | <1% |
| Groton | 1 | 0 | 1 | <1% |
| Shelton | 1 | 0 | 1 | <1% |
| Sherman | 1 | 0 | 1 | <1% |
| Suffield | 1 | 0 | 1 | <1% |
| Wallingford | 1 | 0 | 1 | <1% |
| Wilton | 1 | 0 | 1 | <1% |
| Ansonia | 0 | 1 | 1 | <1% |
| Avon | 0 | 1 | 1 | <1% |
| Brookfield | 0 | 1 | 1 | <1% |
| Canton | 0 | 1 | 1 | <1% |
| East Hartford | 0 | 1 | 1 | <1% |
| Enfield | 0 | 1 | 1 | <1% |
| Fairfield | 0 | 1 | 1 | <1% |
| Harwinton | 0 | 1 | 1 | <1% |
| Monroe | 0 | 1 | 1 | <1% |
| New London | 0 | 1 | 1 | <1% |
| New Milford | 0 | 1 | 1 | <1% |
| North Haven | 0 | 1 | 1 | <1% |
| Plymouth | 0 | 1 | 1 | <1% |
| Putnam | 0 | 1 | 1 | <1% |
| Rocky Hill | 0 | 1 | 1 | <1% |
| Southington | 0 | 1 | 1 | <1% |
| Stratford | 0 | 1 | 1 | <1% |
| Torrington | 0 | 1 | 1 | <1% |
| Waterford | 0 | 1 | 1 | <1% |
| **Total** | **43** | **195** | **238** | **100%** |

# Appendix E:

## HSIP Expenditure History

# HSIP Expenditures (2013-2019)

## Road Owner by Project Type

| Road Owner | Project Type | | | | | % of total |
|---|---|---|---|---|---|---|
| | spot | systematic | systemic | other | totals | |
| state | 73,690,000 | 20,830,000 | 45,606,000 | 14,311,000 | 154,437,000 | 67% |
| town | 20,201,000 | 7,275,000 | 12,181,000 | 3,370,000 | 43,027,000 | 19% |
| other | 0 | 0 | 0 | 32,700,000 | 32,700,000 | 14% |
| totals | 93,891,000 | 28,105,000 | 57,787,000 | 50,381,000 | 230,164,000 | 100% |

| FFY | Project Type | | | | |
|---|---|---|---|---|---|
| | spot | systematic | systemic | other | totals |
| 2013 | 14,891,000 | 2,718,000 | 4,299,000 | 2,032,000 | 23,940,000 |
| 2014 | 10,796,000 | 7,802,000 | 4,324,000 | 3,290,000 | 26,212,000 |
| 2015 | 13,777,000 | 8,295,000 | 11,976,000 | 5,229,000 | 39,277,000 |
| 2016 | 3,740,000 | 611,000 | 3,513,000 | 5,374,000 | 13,238,000 |
| 2017 | 15,675,000 | 1,121,000 | 11,465,000 | 10,288,000 | 38,549,000 |
| 2018 | 22,081,000 | 4,681,000 | 15,706,000 | 10,384,000 | 52,852,000 |
| 2019 | 12,931,000 | 2,877,000 | 6,504,000 | 13,784,000 | 36,096,000 |
| totals | 93,891,000 | 28,105,000 | 57,787,000 | 50,381,000 | 230,164,000 |

# HSIP Expenditures (2013-2019)

| | Road Owner by Emphasis Area | | | | | | |
|---|---|---|---|---|---|---|---|
| | critical roadway locations | non-motorized | TIM | Data | Other | totals | % of total |
| state | 114,333,000 | 25,590,000 | 13,814,000 | 0 | 700,000 | 154,437,000 | 67% |
| town | 34,518,000 | 8,132,000 | 377,000 | 0 | 0 | 43,027,000 | 19% |
| none | 2,000,000 | 0 | 0 | 1,024,000 | 29,676,000 | 32,700,000 | 14% |
| totals | 150,851,000 | 33,722,000 | 14,191,000 | 1,024,000 | 30,376,000 | 230,164,000 | 100% |

| FFY by Emphasis Area | | | | | | |
|---|---|---|---|---|---|---|
| FFY | critical roadway locations | non-motorized | TIM | Data | Other | totals |
| 2013 | 18,475,000 | 3,433,000 | 0 | 0 | 2,032,000 | 23,940,000 |
| 2014 | 19,715,000 | 3,717,000 | 0 | 0 | 2,780,000 | 26,212,000 |
| 2015 | 27,255,000 | 6,590,000 | 203,000 | 1,024,000 | 4,205,000 | 39,277,000 |
| 2016 | 6,583,000 | 2,331,000 | 0 | 0 | 4,324,000 | 13,238,000 |
| 2017 | 25,484,000 | 3,177,000 | 4,537,000 | 0 | 5,351,000 | 38,549,000 |
| 2018 | 34,484,000 | 9,384,000 | 4,661,000 | 0 | 4,323,000 | 52,852,000 |
| 2019 | 18,855,000 | 5,090,000 | 4,790,000 | 0 | 7,361,000 | 36,096,000 |
| totals | 150,851,000 | 33,722,000 | 14,191,000 | 1,024,000 | 30,376,000 | 230,164,000 |

# Appendix F:

## Project List for HSIP Implementation Plan

| Project List for HSIP Implementation for FFY 2021 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Project Name** | **Project No.** | **Project Phase** | **Improv. Type** | **HSIP Cost** | **Total Cost** | **Program** | **SHSP Emphasis Area** | **Roadway Ownership** | **systemic /spot** |
| Intersection Improvements (LRARP) | 102-364 | CN | intersection geometry | 272,160 | 302,400 | intersection | critical roadway locations | local | spot |
| Traffic Calming Improvements (LRARP) | 102-365 | CN | intersection geometry | 119,070 | 132,300 | intersection | critical roadway locations | local | spot |
| Replace signal Rte 63 @ Rubber Ave | 174-419 | PE | Intersection Traffic Control | 24,000 | 24,000 | intersection | critical roadway locations | state | spot |
| Replace signal Rte 63 @ Rubber Ave | 174-419 | RW | Intersection Traffic Control | 10,000 | 10,000 | intersection | critical roadway locations | state | spot |
| Traffic Signal Safety Impr-D2 | 172-484 | PE | Intersection Traffic Control | 450,000 | 450,000 | intersection | critical roadway locations | state | systemic |
| Traffic Signal Safety Impr-D2 | 172-484 | RW | Intersection Traffic Control | 50,000 | 50,000 | intersection | critical roadway locations | state | systemic |
| Traffic Signal Safety Impr-D2 | 172-485 | PE | Intersection Traffic Control | 475,000 | 475,000 | intersection | critical roadway locations | state | systemic |
| Traffic Signal Safety Impr-D2 | 172-485 | RW | Intersection Traffic Control | 30,000 | 30,000 | intersection | critical roadway locations | state | systemic |
| Replace Traffic Signal - 2 locations | 173-487 | CN | Intersection Traffic Control | 800,000 | 800,000 | intersection | critical roadway locations | state | spot |
| SR 745 @ Kimberly Ave-Intersection Impr | 92-681 | RW | intersection geometry | 225,000 | 250,000 | intersection | critical roadway locations | state | spot |
| SR 745 @ Kimberly Ave-Intersection Impr | 92-681 | PE | intersection geometry | 607,500 | 675,000 | intersection | critical roadway locations | state | spot |
| Flax Hill Rd-Intersection Impr (LRARP) | 102-359 | CN | intersection geometry | 403,830 | 448,700 | intersection | critical roadway locations | local | spot |
| Walnut St-Intersection Impr (LRARP) | 151-337 | CN | intersection geometry | 448,335 | 498,150 | intersection | critical roadway locations | local | spot |
| Replace signal Brass Mill Dr (LRARP) | 151-338 | CN | Intersection Traffic Control | 675,000 | 750,000 | intersection | critical roadway locations | local | spot |
| Broad St-Intersection Impr (LRARP) | 135-342 | CN | intersection geometry | 558,900 | 621,000 | intersection | critical roadway locations | local | spot |
| Intersection Improvements (LRARP) | 76-224 | CN | intersection geometry | 888,210 | 986,900 | intersection | critical roadway locations | local | spot |
| Traffic Signal Impr. | new initiative | PL | Intersection Traffic Control | 450,000 | 500,000 | intersection | critical roadway locations | local | systemic |
| Traffic Signal Change Interval Re-timing | new initiative | PE/CN | Intersection Traffic Control | 3,750,000 | 3,750,000 | intersection | critical roadway locations | local | systemic |
| Signing/Striping @ Unsignalized Intersections | new initiative | PE | Intersection Traffic Control | 1,000,000 | 1,000,000 | intersection | critical roadway locations | state | systemic |
| Signing/Striping @ Unsignalized Intersections | new initiative | PE | Intersection Traffic Control | 1,000,000 | 1,000,000 | intersection | critical roadway locations | local | systemic |
| ***subtotal for intersection*** | | | | **12,237,005** | **12,753,450** | | | | |
| RRFB-D1 | 171-454 | RW | Pedestrians | 7,200 | 8,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D1 | 171-454 | PE | Pedestrians | 49,500 | 55,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D2 | 172-495 | RW | Pedestrians | 55,800 | 62,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D2 | 172-495 | PE | Pedestrians | 166,050 | 184,500 | pedestrian | non-motorized road | state | systemic |
| RRFB-D3 | 173-507 | RW | Pedestrians | 19,800 | 22,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D3 | 173-507 | PE | Pedestrians | 81,900 | 91,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D4 | 174-438 | RW | Pedestrians | 7,200 | 8,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D4 | 174-438 | PE | Pedestrians | 117,000 | 130,000 | pedestrian | non-motorized road | state | systemic |
| RRFB-D1 | 171-454 | CN | Pedestrians | 250,200 | 278,000 | pedestrian | non-motorized road | state | systemic |
| RRFB | new initiative | PE | Pedestrians | 675,000 | 750,000 | pedestrian | non-motorized road users | local | systemic |
| Ped Impr. @ Signalized Intersections | new initiative | PL | Pedestrians | 450,000 | 500,000 | pedestrian | non-motorized road users | local | systemic |
| Ped Impr. @ Signalized Intersections | new initiative | PE | Pedestrians | 3,750,000 | 3,750,000 | pedestrian | non-motorized road users | state | systemic |
| Road Diets | new initiative | PL | Pedestrians | 900,000 | 1,000,000 | pedestrian | non-motorized road users | local | systemic |
| ***subtotal for pedestrian*** | | | | **6,529,650** | **6,838,500** | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| horizontal curve signing-D1 | 171-440 | PE | roadway signing | 281,000 | 281,000 | roadway departure | critical roadway locations | state | systemic |
| horizontal curve signing-D2 | 172-477 | PE | roadway signing | 641,000 | 641,000 | roadway departure | critical roadway locations | state | systemic |
| horizontal curve signing-D1 | 171-440 | CN | roadway signing | 3,477,000 | 3,477,000 | roadway departure | critical roadway locations | state | systemic |
| High Friction Surface Treatments | new initiative | PE/CN | skid resistant surface | 2,025,000 | 2,250,000 | roadway departure | critical roadway locations | state | systemic |
| Horizontal Alignment Signing | new initiative | PE | roadway signing | 4,000,000 | 4,000,000 | roadway departure | critical roadway locations | local | systemic |
| Centerline Rumble Strips | new initiative | PE/CN | rumble strips | 600,000 | 600,000 | roadway departure | critical roadway locations | local | systemic |
| ***subtotal for roadway departure*** | | | | **11,024,000** | **11,249,000** | | | | |
| **total** | | | | **29,790,655** | **30,840,950** | | | | |
| ***Other proposed safety projects for FFY 2021*** | | | | | | | | | |
| CHAMP Safety Service Patrol | TBD | Other | | 4,083,300 | 4,537,000 | | | | |
| HFCL from Active Trans Plan | TBD | PE | | 900,000 | 1,000,000 | | | | |
| WW pavement markings-D1 | TBD | PE | | 34,000 | 34,000 | | | | |
| WW pavement markings-D2 | TBD | PE | | 29,000 | 29,000 | | | | |
| WW pavement markings-D3 | TBD | PE | | 36,000 | 36,000 | | | | |
| WW pavement markings-D4 | TBD | PE | | 25,000 | 25,000 | | | | |
| Replace/Install One-way Signs-D2 | 172-488 | FD | | 50,000 | 50,000 | | | | |
| Replace/Install One-way Signs-D3 | 173-502 | FD | | 75000 | 75000 | | | | |
| Replace/Install One-way Signs-D1 | 171-450 | CN | | 900,000 | 900,000 | | | | |
| Replace/Install One-way Signs-D4 | 174-432 | FD | | 60,000 | 60,000 | | | | |
| Replace/Install One-way Signs-D2 | 172-488 | CN | | 525,000 | 525,000 | | | | |
| Replace/Install One-way Signs-D3 | 173-502 | CN | | 675,000 | 675,000 | | | | |
| Replace/Install One-way Signs-D4 | 174-432 | CN | | 600,000 | 600,000 | | | | |
| subtotal | | | | 7,992,300 | 8,546,000 | | | | |

| Project Summary Table | | |
|---|---|---|
| *Program Area* | *Number of Projects* | *Estimated HSIP Obligations* |
| Roadway Departure Program | 6 (3 are new initiatives) | 11,024,000 |
| Intersection Safety Program | 20 (4 are new initiatives) | 12,237,005 |
| Pedestrian Safety Program | 13 (4 are new initiatives) | 6,529,650 |
| Total | 40 (11 are new initiatives) | 29,790,655 |