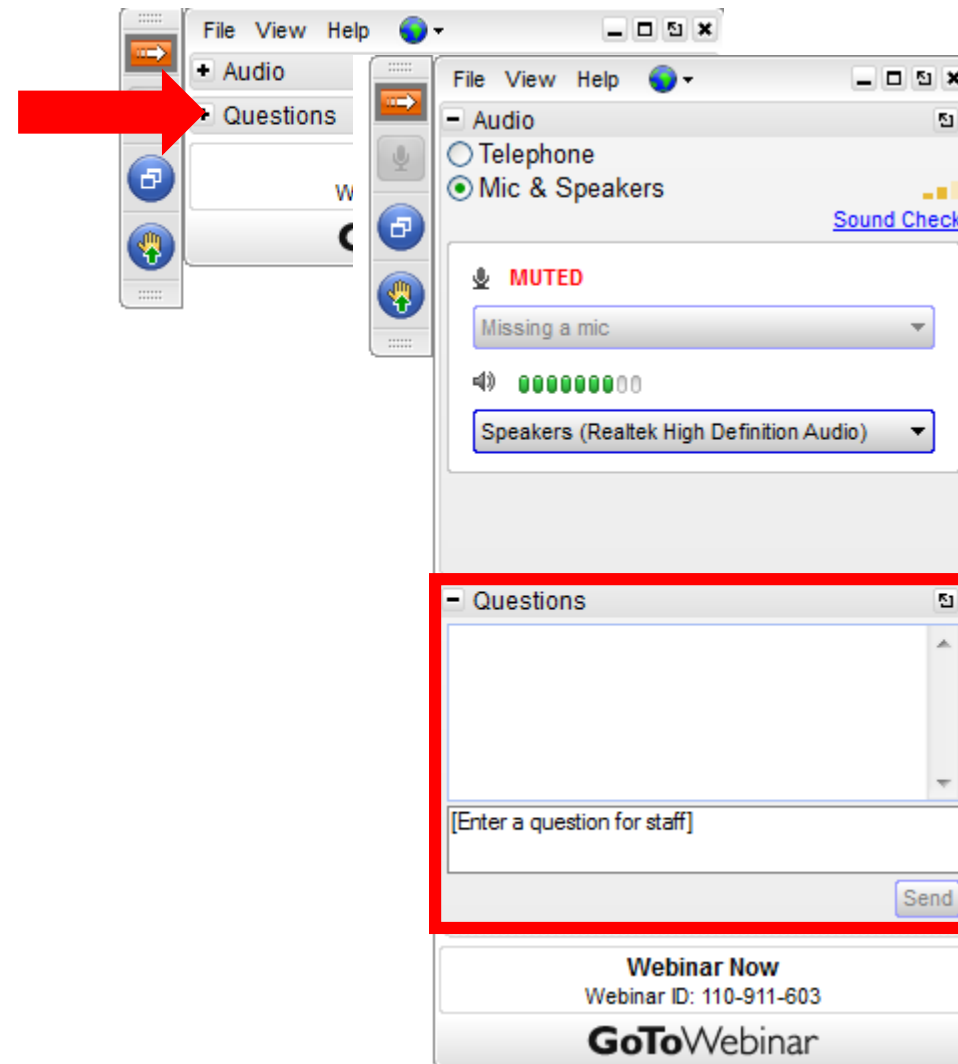




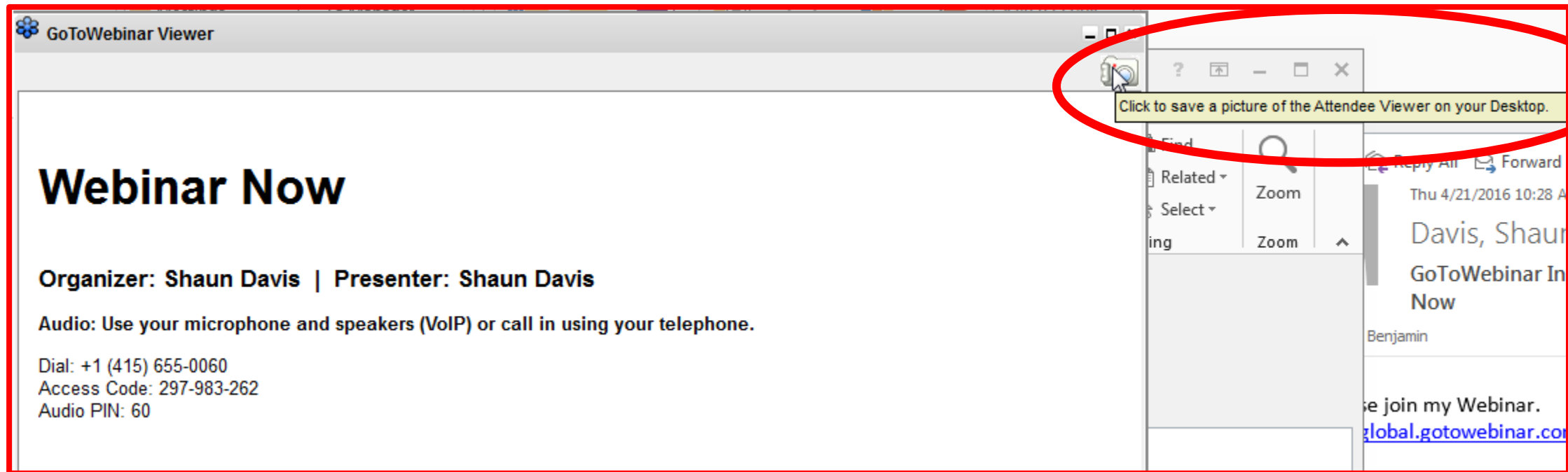
Crash Data Academy

Florida Department of Transportation
State Safety Office

How to ask a question:



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Crash Data Academy 9: High Crash Location Analysis on the State Highway System

Presenters:

Benjamin Jacobs
Crash Records and Research Administrator
FDOT State Safety Office



Rupert Giroux
Public Transportation Specialist
FDOT State Safety Office



Agenda

- What is High-Crash Analysis?
- How does High-Crash Analysis work?
- How do I interpret the high-crash analysis data?
- How can I get the high-crash analysis output?
- Other questions.

What is High-Crash Analysis?



Background:

The FDOT's High-Crash Analysis programs were created around 2002.

- GIS was new and was not yet available as a resource for development.
- The federal mandate for crash rate monitoring only encompassed state roads – changed to all public roads in 2006.
- The system was developed using tabular (non-spatial) data against a linear referencing system for the actively maintained state roadways. More on this later...

6

What is High-Crash Analysis?



Background:

The District Safety Engineers use the crash rate results to help identify locations for safety improvements.

The Planning and Design offices use the results of the analyses to help integrate safety into their processes.

What is High-Crash Analysis?



Analysts at the State Safety Office review crash reports.

- Each crash gets attached to coordinates on the State Highway System (SHS).

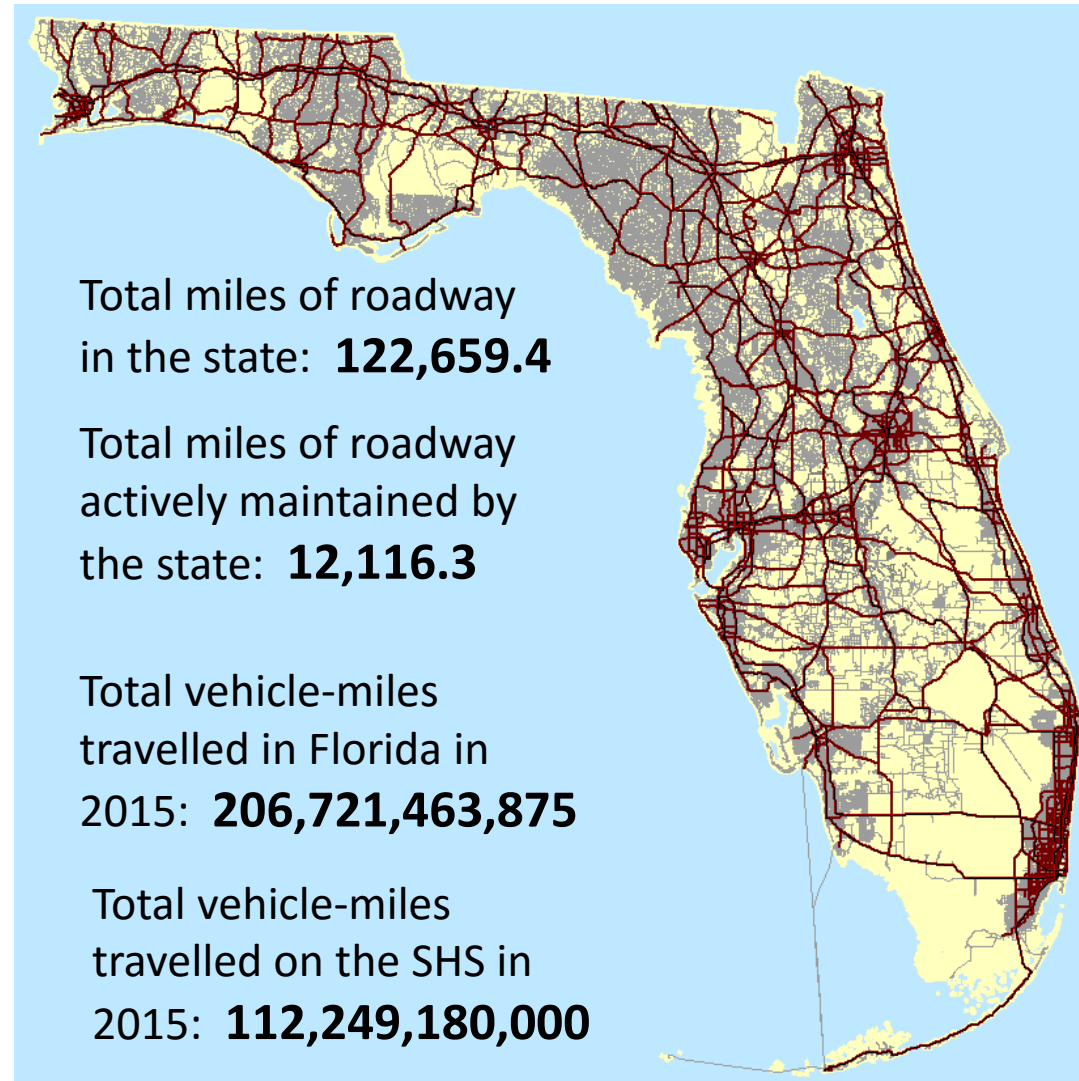


What is High-Crash Analysis?



Each crash gets coordinates on the SHS:

- The State Highway System (SHS) covers about 10% of roadways in the state and carries about 50% of the traffic.



What is High-Crash Analysis?



The State Highway System (SHS) covers about 10% of roadways in the state and carries about 50% of the traffic.

	2015
State Highway System	12,116.3
County Road System	70,434.3
City Street System	37,830.2
Bureau of Indian Affairs Roads	182.9
Indian Nation Roads	26.4
USDA Forest Service Roads	1241.2
National Park Service Roads	188.0
US Army Corps of Engineers Roads	32.2
US Army Roads (other)	6.5
US Department of Defense Roads (excluding Army)	415.0
US Fish and Wildlife Service Roads	126.4
National Aeronautics and Space Administration Roads	60.0
Total Mileage	122,659.4

FDOT
 Department of Transportation
 1111 Gandy Street
 Tallahassee, Florida 32399-0450
 JIM BOXGOLD
 SECRETARY

Following is a summary of the existing mileage of public road mileage of Title 23, United States Code.

	2015
State Highway System	12,116.3
County Road System	70,434.3
City Street System	37,830.2
Bureau of Indian Affairs Roads	182.9
Indian Nation Roads	26.4
USDA Forest Service Roads	1241.2
National Park Service Roads	188.0
US Army Corps of Engineers Roads	32.2
US Army Roads (other)	6.5
US Department of Defense Roads (excluding Army)	415.0
US Fish and Wildlife Service Roads	126.4
National Aeronautics and Space Administration Roads	60.0
Total Mileage	122,659.4

Thomas C. Byron, P.E.
 Assistant Secretary for Intermodal Systems Development

TB:eb
 Attachments (2)

www.dot.state.fl.us

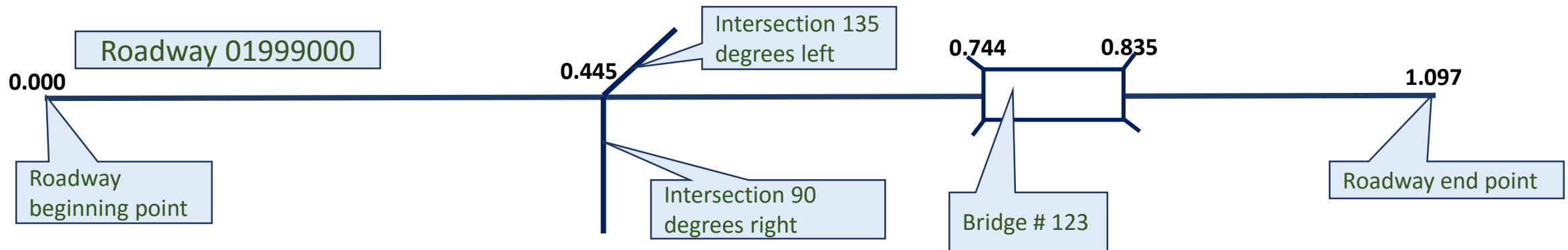
<http://www.fdot.gov/planning/statistics/mileage-rpts/CertifiedPublicRoadMileage.pdf>

What is High-Crash Analysis?



Each crash gets coordinates on the SHS:

- The FDOT keeps an inventory of all the major roadways in the state. It is called the Roadway Characteristics Inventory (RCI).
- The RCI uses a linear reference system to document relative locations of features along a route.

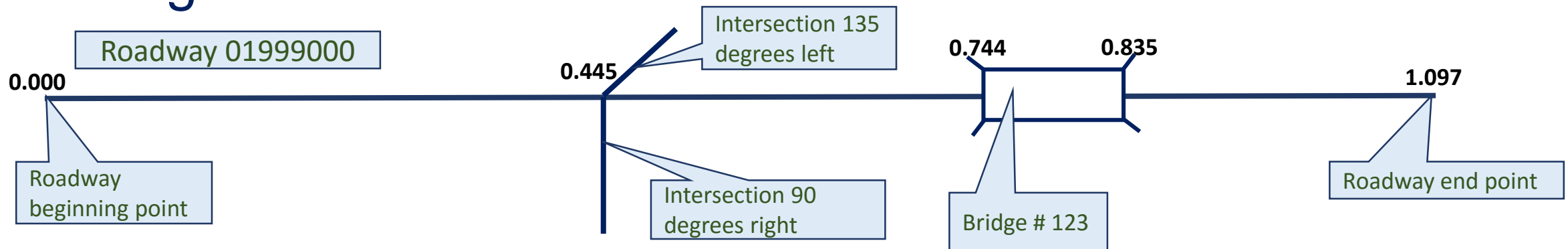


What is High-Crash Analysis?



The RCI linear reference system:

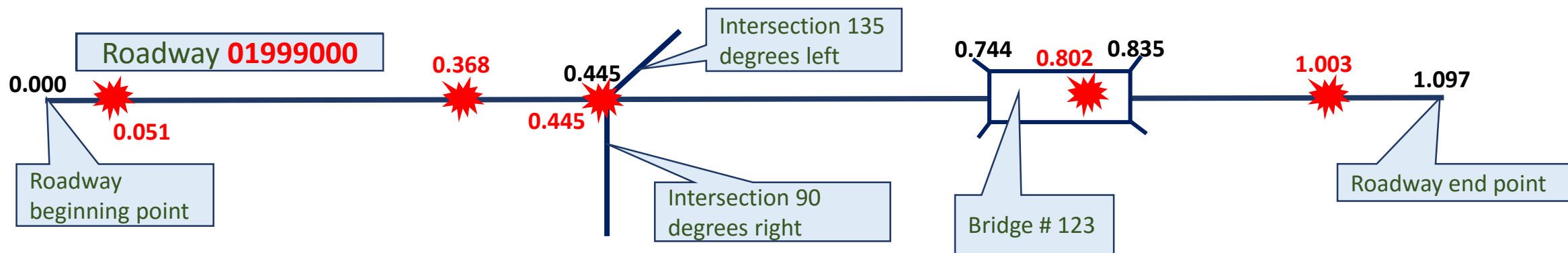
- Features like intersections and city limits (and including the beginning and ending of roadway segments) are given a mile-point or, for length features like bridges, a beginning mile-point and an ending mile-point that is a measure of how far the feature is from the origin of the segment.



What is High-Crash Analysis?

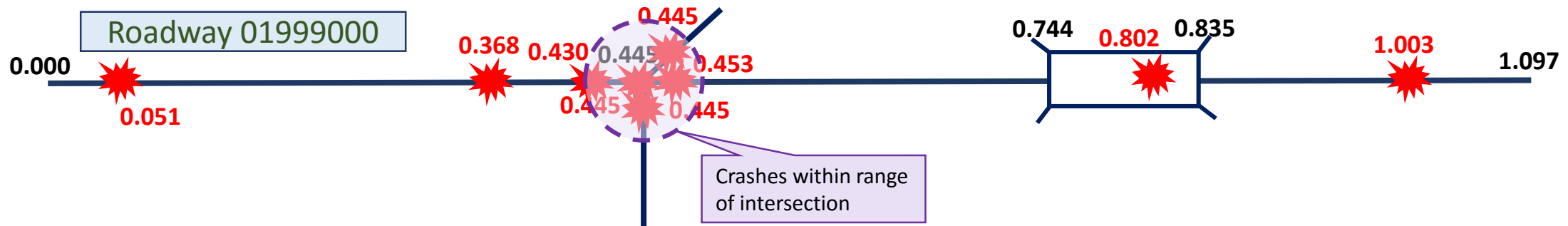
The RCI linear reference system:

- Linear reference coordinates for crashes are a segment identifier and a mile-point.



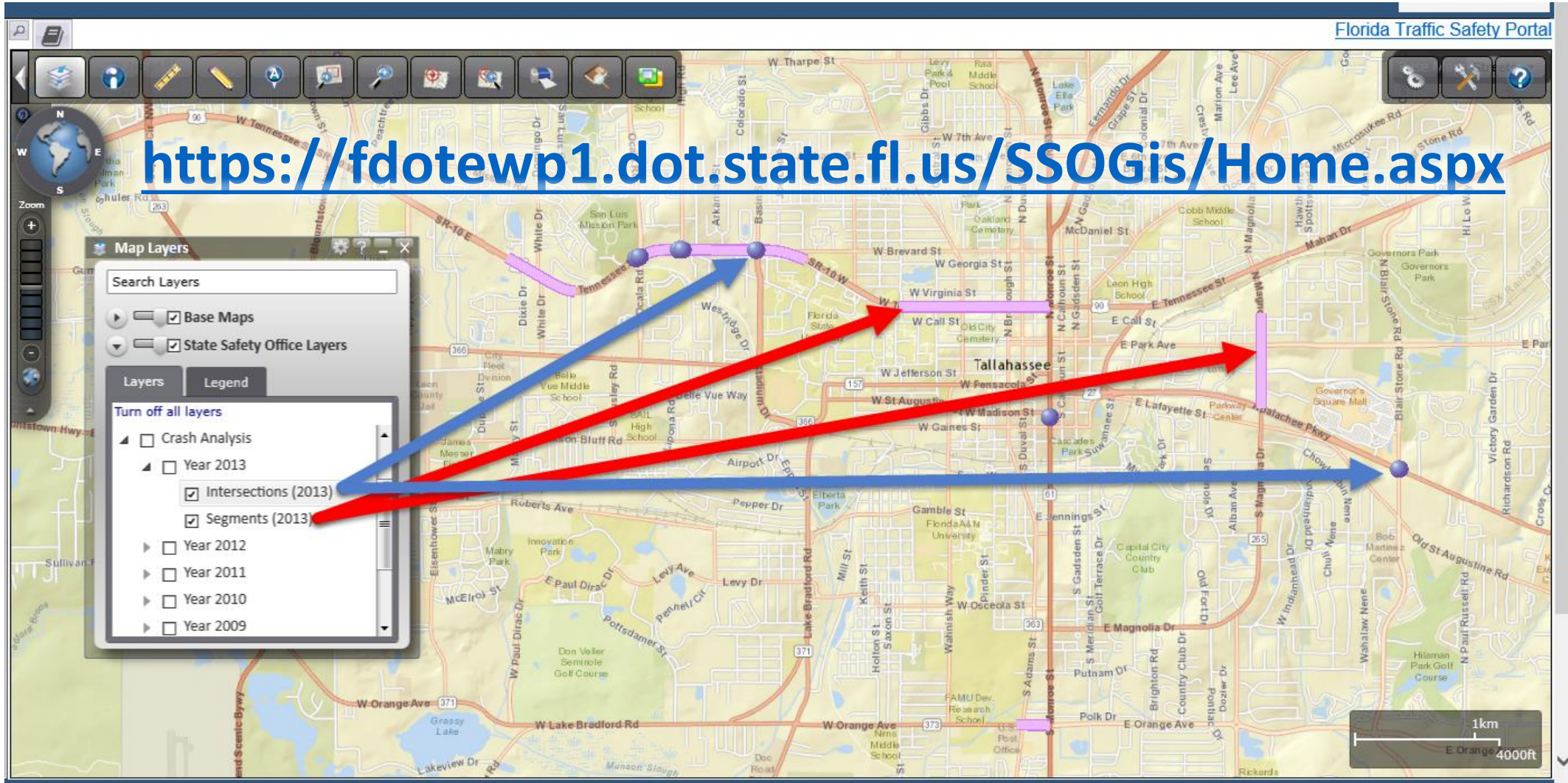
What is High-Crash Analysis?

- Analysis programs compare the sites on the SHS with crash incidents within range (using the linear reference coordinates) to identify locations with the highest concentrations of crashes.



- The results can be mapped against the reference system.

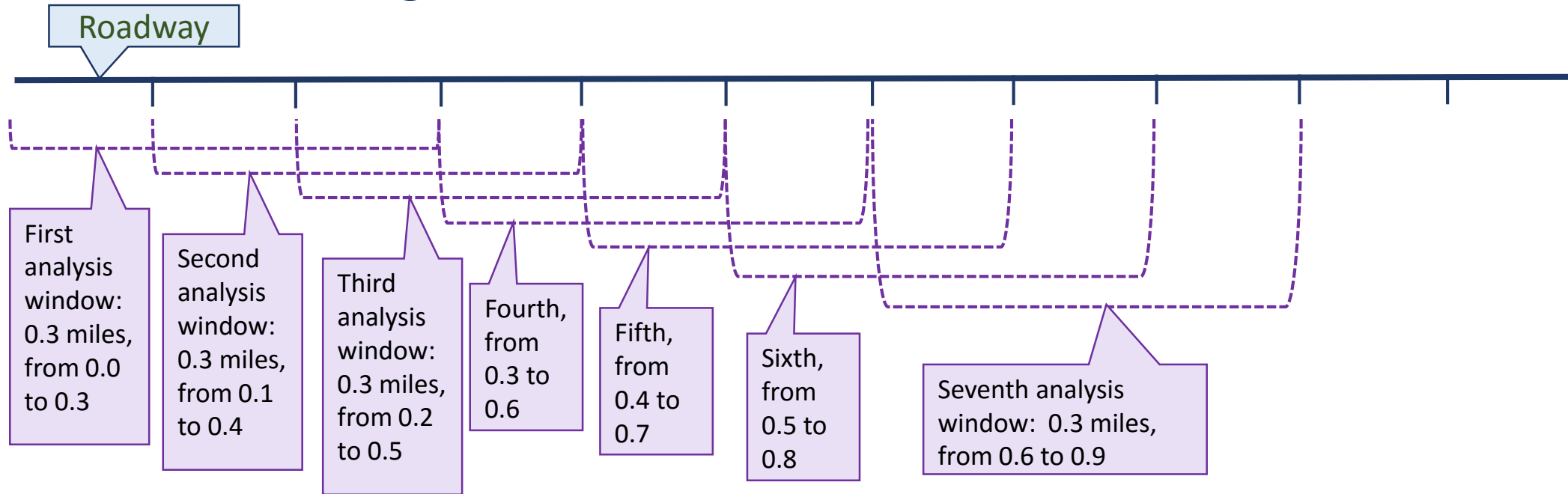
What is High-Crash Analysis?



How does High-Crash Analysis work?



Segment analysis walks down each roadway – the “sliding window” approach.



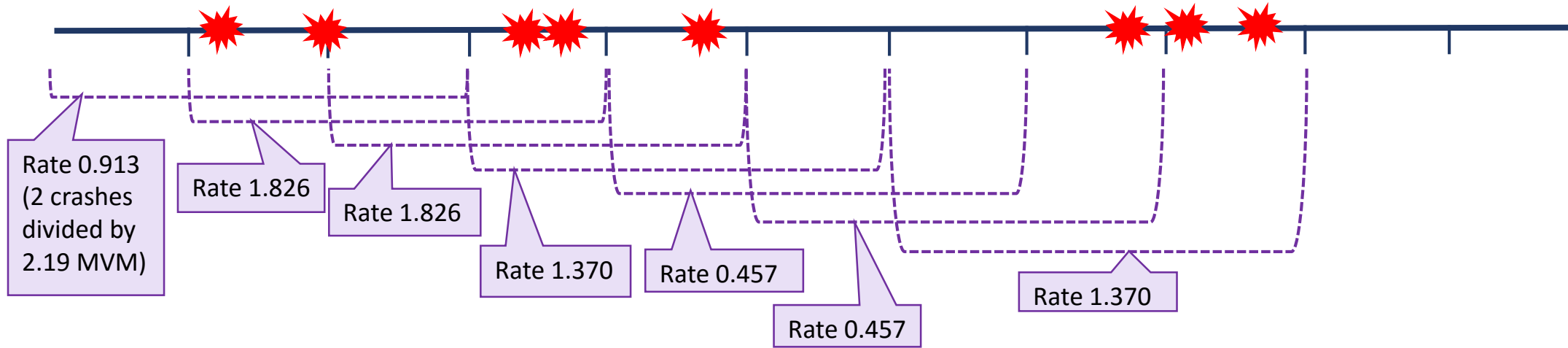
How does High-Crash Analysis work?



At each analysis step the process calculates the crash rate per Millions of Vehicle-Miles (MVM).

20,000 cars per day means 2.19 million vehicle-miles is the volume at each 0.3 mile analysis window (20,000 cars per day times 0.3 mile segment length times 365 days for a standard year)

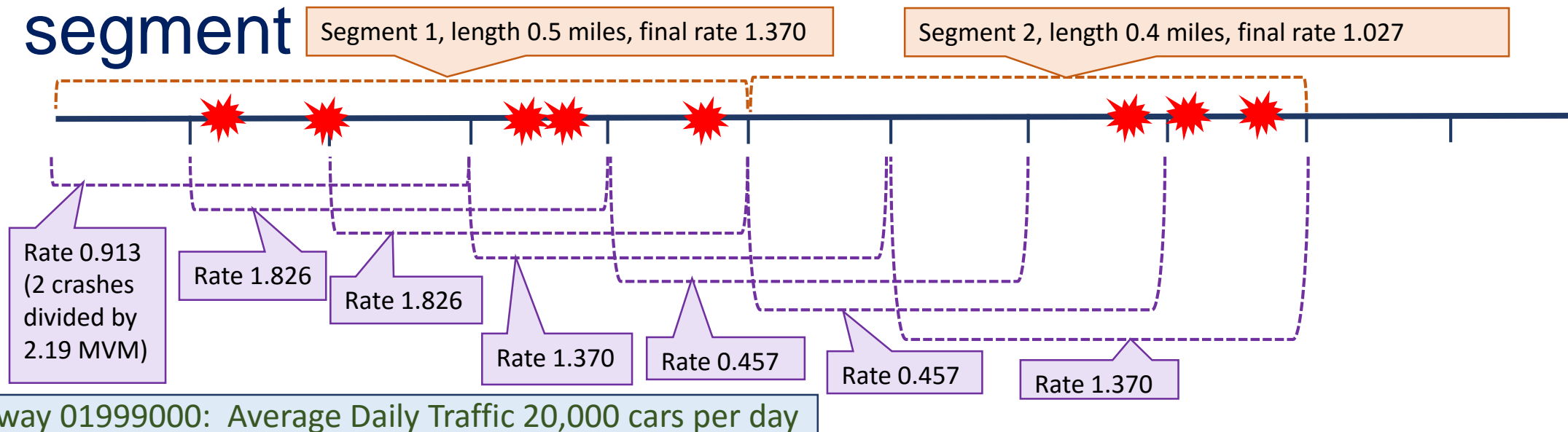
Roadway 01999000: Average Daily Traffic 20,000 cars per day



How does High-Crash Analysis work?



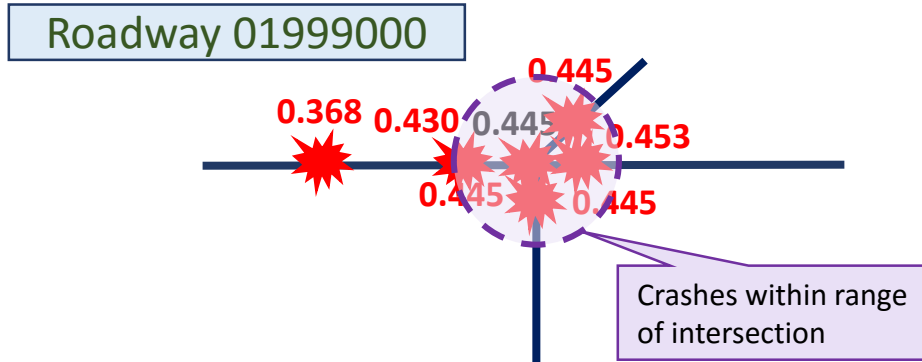
Segments that overlap have the same rate or show an increase in rate from the previous step are joined to each other to create a longer segment



How does High-Crash Analysis work?



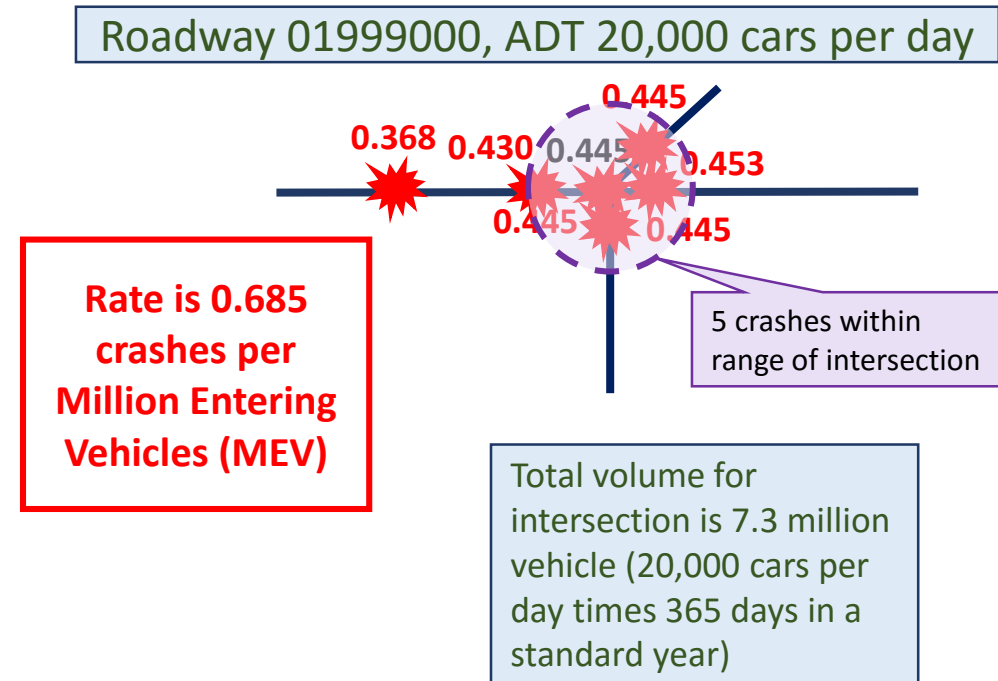
Intersection analysis focuses on identified intersections.



How does High-Crash Analysis work?



Crashes within the influence area of the intersection are divided by the number of cars passing through the intersection in order to get an intersection crash rate per Million Entering Vehicles (MEV).



How does High-Crash Analysis work?



Each analysis uses the crash rate (crashes per traffic volume) to evaluate whether a specific location has a higher-than-average rate.



How does High-Crash Analysis work?



- Crash rates are the number of crashes per unit of traffic volume: **crashes divided by the amount of traffic.**
- Segment analyses analyze a length of roadway. Volume of traffic for segment analyses is expressed as vehicle-miles travelled: **number of cars times the length of the segment in miles.**
- Volume of traffic for intersection analyses is expressed as volume of entering vehicles: **number of cars passing through the intersection.**

How does High-Crash Analysis work?



An average rate is determined for each roadway and intersection type. We calculate countywide, district-wide and statewide averages for each of the roadway and intersection categories.

- The road network is analyzed to determine the crash rates along each segment and at every intersection.
- The crash rates at all of the sites are compared to an average rate and those with the highest confidence that they have an above-average rate are identified as “high-crash” segments or intersections.

How does High-Crash Analysis work?



Pardon the Nerding



The analyses use the equations below to compare the actual crash rates at each site to the average crash rate for similar sites within the area of comparison:

- Segments:
$$\text{CONLV} = (\text{ACTUAL} - \text{AVERAGE} + (1 \div (2 \times \text{MVM}))) \div \sqrt{(\text{AVERAGE} \div \text{MVM})}$$
- Intersections:
$$\text{CONLV} = (\text{ACTUAL} - \text{AVERAGE} + (1 \div (2 \times \text{MEV}))) \div \sqrt{(\text{AVERAGE} \div \text{MEV})}$$

These equations attempt to factor in the exposure to account for variability in the events being measured.

How does High-Crash Analysis work?



- Segments:

$$k = \frac{\text{actual rate} - \text{average rate} + \frac{1}{2(\text{Millions of Vehicle-Miles})}}{\sqrt{\text{average rate} / \text{Millions of Vehicle-Miles}}}$$

- Intersections:

$$k = \frac{\text{actual rate} - \text{average rate} + \frac{1}{2(\text{Millions of Entering Vehicles})}}{\sqrt{\text{average rate} / \text{Million of Entering Vehicles}}}$$

How does High-Crash Analysis work?



- The original equation solves for a “critical rate” using a constant, “k” and any rate would be compared to the calculated critical rate. In our case, we plug the actual rate in for the critical rate and solve for “k” and use that value to determine the confidence using the table at the right.



Confidence Level Lookup Table	
Computed Confidence Level (K)	Value Assigned
$K < 0.6740$	50%
$0.6740 \leq K < 0.8416$	75%
$0.8416 \leq K < 1.0360$	80%
$1.0360 \leq K < 1.2816$	85%
$1.2816 \leq K < 1.6449$	90%
$1.6449 \leq K < 1.9600$	95%
$1.9600 \leq K < 2.3263$	97.5%
$2.3263 \leq K < 2.5758$	99%
$2.5758 \leq K < 2.8070$	99.5%
$2.8070 \leq K < 3.0902$	99.75%
$3.0902 \leq K < 3.2905$	99.9%
$3.2905 \leq K < 3.7190$	99.95%
$3.7190 \leq K$	99.99%

How do I interpret the high-crash analysis data?

```

REPORT..CARPJ66-                FLORIDA - DEPARTMENT OF TRANSPORTATION                PAGE NO      0
DATE...12/21/2015              C A R - CRASH ANALYSIS REPORTING SYSTEM
TIME...13:09:42                HIGH CRASH ROADWAY SEGMENTS        USING:  DISTRICT AVERAGES        AS OF:  12/08/2015
COMMENT: _____            USERID:  SF945BJ                    DISTRICT:



```

MINIMUM CRASHES USED IN CONFIDENCE LEVEL CALCULATIONS (RURAL) : 8
(SUBURBAN) : 8
(URBAN) : 8

```

AVAILABLE YEARS  2014  2013  2012  2011  2010
1 YEAR RATES    -      -      -      -      -
2 YEAR RATES    -      -      -      -      -
3 YEAR RATES    -      -      -      -      -
4 YEAR RATES    -      -      -      -      -
5 YEAR RATES    X
"X" STATE WIDE:  -      "X" PAGE BREAK ON:  DISTRICT COUNTY
DISTRICT #S:  1  -      "X" PAGE BREAK ON COUNTY:  X
COUNTY #S:
1 RANK OPTION:  1 CONF LVL  2 CRASHES  3 INJS  4 CRASH RATE
5 SORT OPTION:  1 CONF LVL  2 CRASHES  3 INJS  4 CRASH RATE  5 RDWY MP
-----\
LIMIT  \      MIN CONF LVL      MIN CRASHES      RURAL
BY     /      95.00%      8
      /      99.00%      8      SUBURBAN
-----/      99.95%      8      URBAN

```

How do I interpret the high-crash analysis data?

```

AVAILABLE YEARS  2014  2013  2012  2011  2010
1 YEAR RATES    -      -      -      -      -
2 YEAR RATES    -      -      -      -
3 YEAR RATES    -      -      -
4 YEAR RATES    -      -
5 YEAR RATES    X
"X" STATE WIDE:  -      "X" PAGE BREAK ON:  -  DISTRICT  -  COUNTY
DISTRICT #S:  1  -      "X" PAGE BREAK ON COUNTY:  X
COUNTY #S:
1 RANK OPTION:  1 CONF LVL  2 CRASHES  3 INJS  4 CRASH RATE
5 SORT OPTION:  1 CONF LVL  2 CRASHES  3 INJS  4 CRASH RATE  5 RDWY MP
----->
LIMIT          MIN CONF LVL          MIN CRASHES          RURAL
BY             95.00%             8             SUBURBAN
----->             99.00%             8             URBAN
----->             99.95%             8
  
```



How do I interpret the high-crash analysis data?

REPORT..CARPJ66- FLORIDA - DEPARTMENT OF TRANSPORTATION PAGE NO 1
 DATE...12/21/2015 C A R - CRASH ANALYSIS REPORTING SYSTEM
 TIME...13:09:42 HIGH CRASH ROADWAY SEGMENTS FOR 2010 - 2014 USING: DISTRICT AVERAGES AS OF: 12/08/2015
 COMMENT: USERID: 97945RT DISTRICT: 01

NUMB	COSECSUB	BMP	EMP	STROAD	LEN	CC	CRASHES	ADT	ACTUAL	AVERAGE	CONLV	FTL	INJ	PRTY	CL-2	CL-3
907	01010000	6.858	7.058	SR	45	0.200	S-4DR	15	14,753	2.785	1.298	99.90	0	13	8	
1094	01010000	8.458	8.758	SR	45	0.300	S-4DR	19	15,258	2.274	1.298	99.50	0	16	8	
723	01010000	9.358	9.558	SR	45	0.200	S-4DR	18	15,620	3.157	1.298	99.99	2	16	6	
927	01010000	10.058	10.258	SR	45	0.200	S-4DR	18	15,620	3.157	1.298	99.99	2	16	6	
770	01050000	16.277	16.677	SR	776	0.400	U-4DR	53	22,164	3.275	1.298	99.90	0	11	9	

Rank relative to average area

Inventory roadway identifier (county, section, subsection)

Segment beginning mile-point

Segment end mile-point

Segment state route number

Segment length in miles

Segment crash rate category

Total number of crashes on segment

Annual Average Daily Traffic (cars per day)

Actual crash rate (crashes per MVM)

High-crash confidence level (%)

Total fatalities

Total injuries

Total property damage only

Identifies High Crash or Reference

Identifies Segments or Intersections

Gives the year span

Identifies which set of average rates used for comparison

Shows the date on which the analyses were run (snapshot capture date)

Average crash rate for other roadways in the same category within the area indicated in the header (County/District/State)

How can I get the high-crash analysis output?

- The crash rate analyses, including the averages, the high-crash listings and the reference analysis data (all the actual crash rate calculations for the entire network) are available on request from your local FDOT Safety Office.
- The mapped analysis data can be downloaded from the FDOT's Unified Basemap Repository (UBR) for authorized users or are available on request from the FDOT State Safety Office.
<https://www3.dot.state.fl.us/unifiedbasemaprepository/>

How can I get the high-crash analysis output?



- Some of the mapped analysis data are available on ESRI's ArcGIS Online – search for FDOT Crash Rates (<https://www.arcgis.com/home/index.html>)

The screenshot shows the ArcGIS Online search results page for the query 'FDOT Crash'. The page displays 81 results. The first result is 'Top 10 Pedestrian Crash Locations', which is a map showing the top pedestrian involved crash locations by FDOT District using data from years 2008 to 2012. The second result is 'Florida High Crash Intersections - 2013', a feature layer representing mapped roadway 'high crash' intersections on the Florida State Highway System (SHS) with 5-year crash rates. The third result is 'Florida State Intersection Crash Rates - 2014', a feature layer representing intersections on the SHS with their 5-year crash rates as analyzed by the Florida Department of Transportation (FDOT) State Safety Office's Crash Analysis Report (CAR) system. The fourth result is 'Fatal and Serious Injury Crash Density - State Roads - 2011 to 2014', a feature layer representing density and counts of fatal and serious injury crashes on state roads from 2011 through 2014.

How can I get the high-crash analysis output?

- Some of the mapped analysis data can be viewed on the State Safety Office's Traffic Safety Web Portal (TSWP) using the SSOGis Query Tool (<https://fdotewp1.dot.state.fl.us/SSOGis/Home.aspx>)

Accessing SSOGis

- Open access
- Public internet website
 - Direct link:
<https://fdotewp1.dot.state.fl.us/SSOGis/>.
- Florida Traffic Safety Portal
 - <https://fdotewp1.dot.state.fl.us/TrafficSafetyWebPortal/>

The screenshot shows the Florida Department of Transportation (FDOT) website. At the top, there is the FDOT logo and the text "Florida Department of TRANSPORTATION". To the right, there are links for "E-Updates | FL511 | Mobile | Site Map" and a search bar labeled "Search FDOT...". Below this is a navigation menu with links for "Home", "About FDOT", "Contact Us", "Maps & Data", "Offices", "Performance", and "Projects".

The main content area is titled "Web Application" and "FLORIDA TRAFFIC SAFETY PORTAL". It includes a "WELCOME" message, "LOGIN" and "HELP" links, and a large image of a road with cars. Below the image, there is a "Home" section with a list of links: "SSOGis - State Safety Office Map Based Query Tool" (circled in red), "ARCA - All Roads Crash Analysis", and "News". A "Welcome" message follows, stating: "This web portal is developed and maintained by the State Safety Office of the Florida Department of Transportation. Its purpose is to serve as a central location for the exchange and sharing of tools, data, information, and ideas among the traffic safety professionals in Florida." There is a "Read More" link below this message. On the right side, there is a "Search Portal" bar and a "Mailing List" section with fields for "Enter your name" and "Enter your e-mail".

SSOGis: Main View



SSOGis [About](#)

[Florida Traffic Safety Portal](#)

Crashes Projects

Map Reset

Crash Filters

Calendar Year (Post 2010)*:
All, choose at most five

Crash Date*:
From [] to []

Crash Time:
From [] to []

Highest Injury in Crash:
All

Relation to Junction:
All

Crash Harmful Event Location:
All

Intersection Type:
All

Crash Harmful Event:
All

Driver Action Vehicle 1 or 2:
All

DHSMV City:
All

Location Filters

Safety Office Supplemental Layers

Legend

Contact Us Employment MyFlorida.com Performance Statement of Agency Web Policies & Notices

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Florida Department of Transportation
100 Years of Innovation, Mobility and Economic Development

SSOGis: Help Menu



The screenshot displays the SSOGis application interface. On the left is a sidebar with filters for crashes. The main area shows a map of Florida. Five 'Help Viewer' windows are overlaid, each with a red border and a red label: 'INTRODUCTION', 'APPLICATION', 'TOOLS', 'DATA VISUALIZERS', and 'DATA EXPORTERS'. A large red arrow points from the help icon in the top right of the map area to the 'DATA VISUALIZERS' window. The 'DATA EXPORTERS' window shows options for exporting to Shape File, Word, and Excel.

SSOGis: Sidebar Options



The image displays four sidebar panels from the SSOGis application, each with a red header and a red border. The top navigation area is also highlighted with a red box.

- CRASH FILTERS:** Includes filters for Calendar Year (Post 2010), Crash Date, Crash Time, Highest Injury in Crash, Relation to Junction, Crash Harmful Event Location, Intersection Type, Crash Harmful Event, and Driver Action Vehicle 1 or 2. It also has expandable sections for Location Filters, Safety Office Supplemental Layers, and Legend.
- LOCATION FILTERS:** Includes filters for Geometry, FDOT Managing District & County, Roadway Search Type, and FDOT Roadway. It also has expandable sections for Safety Office Supplemental Layers and Legend.
- ADDITIONAL LAYERS:** Includes a list of Safety Office Supplemental Layers such as Crashes (2013-2007), Crash Analysis, and various intersection and segment data for the years 2010-2013.
- LEGEND:** Lists map layers including Cities, Urban Areas, FDOT Districts, Detailed County, Alabama - Georgia, SSO Streets, and Crashes (2013-2009).

SSOGis: Exporting Data

- All crashes
- Latitude, longitude
- Export options:
 - Shapefile
 - Word document
 - Excel document

Query Result Data Export

819653030
 Object ID: 1212152
 Calendar Year: 2013
 FDOT Crash Number: 819653030
 Reporting Agency Case Number: FHP0130FF007541
 Reporting Agency Type: FHP
 FDOT Managing District: 05
 County: 79
 Crash Date: 02/28/2013
 Crash Time: 1430
 Day: MONDAY
 District City: 7936
 Crash Report City Code: 0836
 In Town: Y
 On Roadway Name: STATE ROAD 44
 FDOT Roadway: 79070000
 Nearest Inventory MP: 12.2299992
 Nearest Node From Crash: 05272
 State Road #: SR 44
 US HWY: 1
 Crash Side Of Road: L
 Crash Lane Number: 2
 1st Vehicle Travel Direction: W
 FDOT Road Category: 27
 DMSM Road System ID: 03

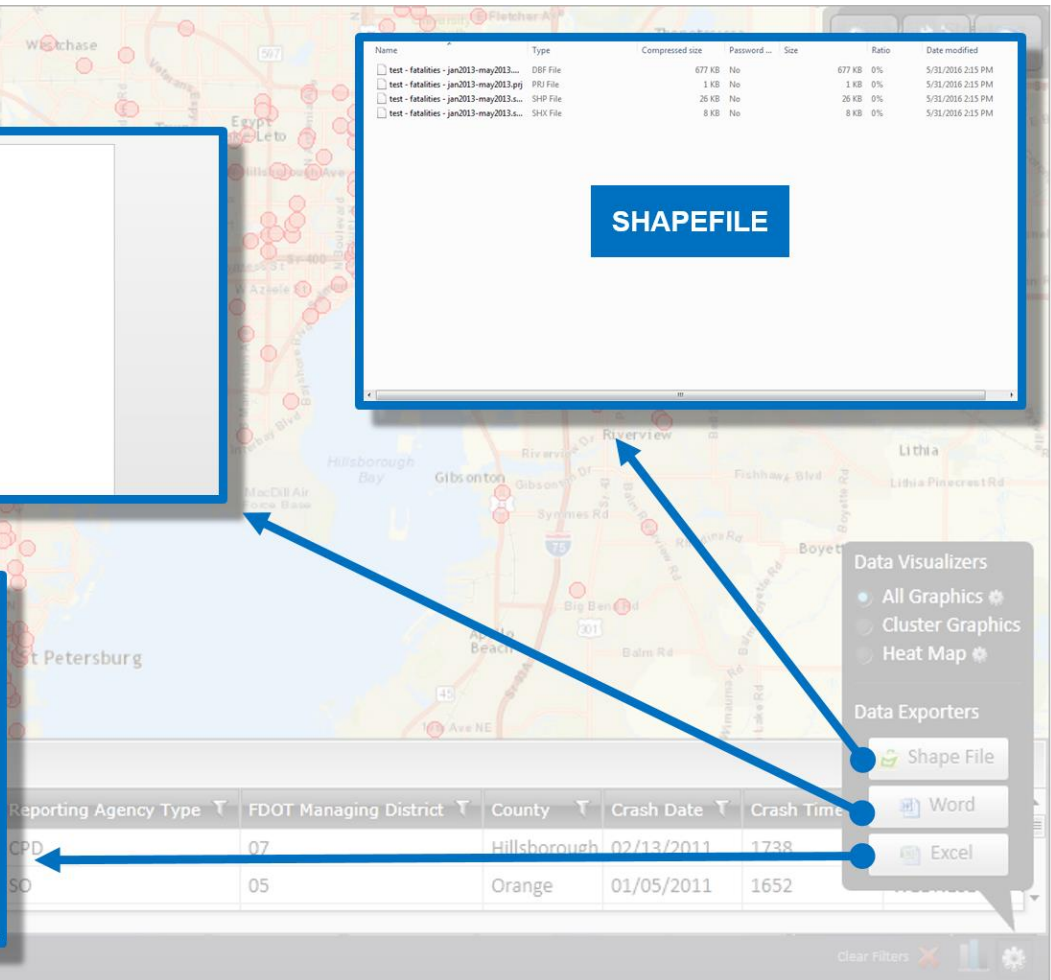
WORD

Name	Type	Compressed size	Password	Size	Ratio	Date modified
test - fatalities - jan2013-may2013...	DBF File	677 KB	No	677 KB	0%	5/31/2016 2:15 PM
test - fatalities - jan2013-may2013.pj	PRI File	1 KB	No	1 KB	0%	5/31/2016 2:15 PM
test - fatalities - jan2013-may2013...	SHP File	26 KB	No	26 KB	0%	5/31/2016 2:15 PM
test - fatalities - jan2013-may2013...	SHX File	8 KB	No	8 KB	0%	5/31/2016 2:15 PM

SHAPEFILE

EXCEL

Object ID	Calendar Year	Reporting Agency Case Number	Reporting Agency Type	FDOT Managing District	County	Crash Date	Crash Time	Day	District City	Crash Report City Code	In Town	On Roadway Name	FDOT Roadway	Nearest Inventory MP	Nearest Node From Crash	State Road #	US HWY	Crash Side Of Road	Crash Lane Number	1st Vehicle Travel Direction	FDOT Road Category	DMSM Road System ID
1	2013	819653030	FHP	05	79	02/28/2013	1430	MONDAY	7936	0836	Y	STATE ROAD 44	79070000	12.230272	SR 44	L	2	W	27	03	03	
2	2013	819653030	FHP	05	79	02/28/2013	1430	MONDAY	7936	0836	Y	STATE ROAD 44	79070000	12.230272	SR 44	L	2	W	27	03	03	



Presentation links:

FDOT State Safety Office GIS Query Tool:

<https://fdotewp1.dot.state.fl.us/SSOGis/Home.aspx>

FDOT State Safety Office Safety Engineering:

<http://www.fdot.gov/safety/11A-SafetyEngineering/SafetyEngineering1.shtm>

Certification of Mileage by System:

<http://www.fdot.gov/planning/statistics/mileage-rpts/CertifiedPublicRoadMileage.pdf>

FDOT UBR: <https://www3.dot.state.fl.us/unifiedbasemaprepositary/>

ESRI ArcGIS Online: <https://www.arcgis.com/home/index.html>



Contacts:

FDOT State Safety Office Data Requests:
FDOT.CrashData@dot.state.fl.us

Questions?

Future Crash Data Academy Webinars

March 23rd – Vulnerable Road Users Part 2:

Motorcycle Crash Data (tentative)

April 27th – Commercial Vehicle Enforcement (tentative)

May 25th – Vulnerable Road Users Part 3:

Crossing Guard and Safe Routes to School Programs

June 22nd – TBD

Dates and topics are
subject to change

Further Questions:

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Rupert Giroux

(850) 414 – 4072

rupert.giroux@dot.state.fl.us