

## **Spatial Data Management Considerations for Crash Mapping and Analysis in Wisconsin**

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April 26, 2019 - Kissimmee, FL



**Wisconsin Traffic Operations and Safety Laboratory**

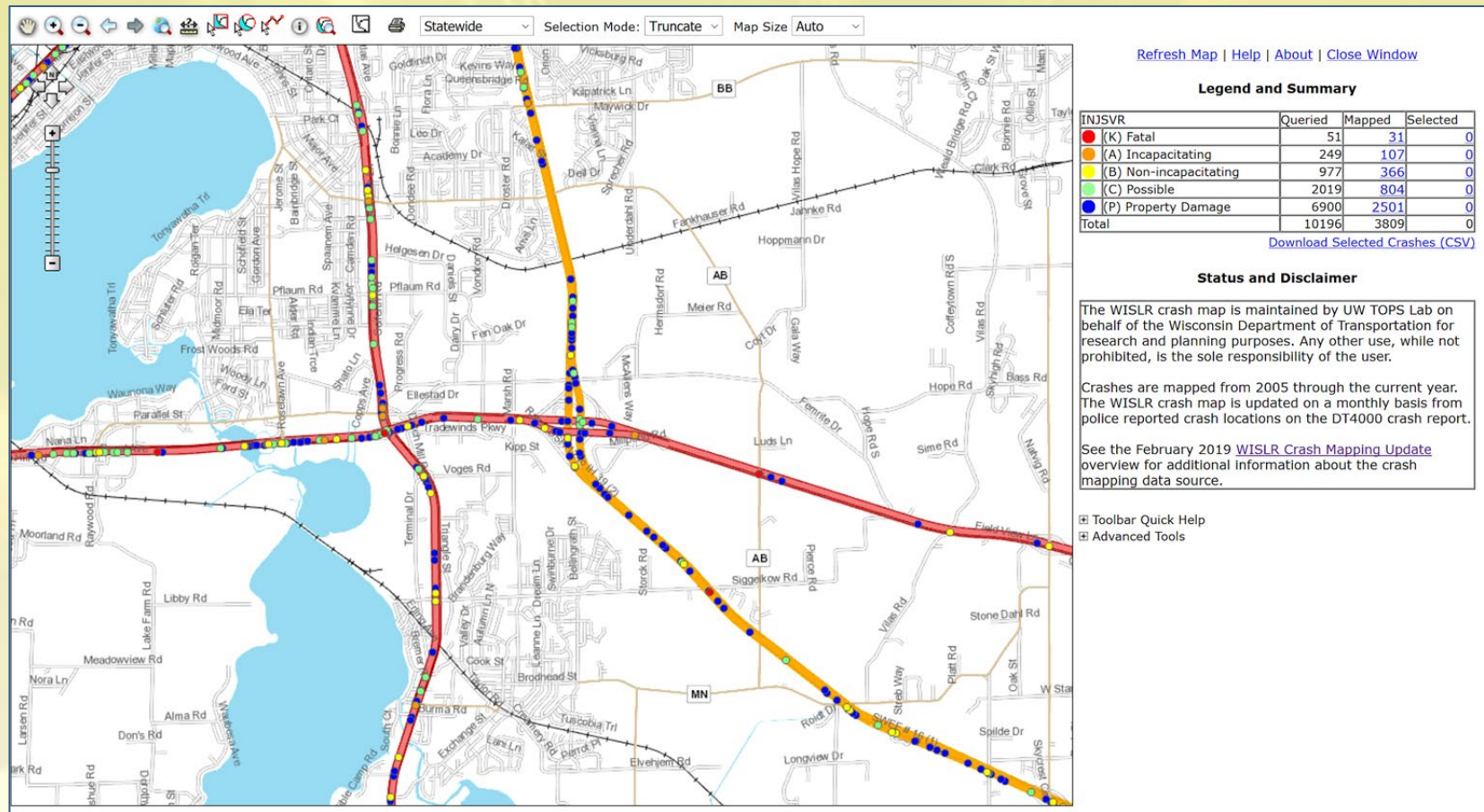
Department of Civil and Environmental Engineering  
University of Wisconsin-Madison



# Presentation Outline

- Wisconsin Crash Mapping History & Overview
- Existing Crash Mapping Applications
- CMAA Enhancements and Roadmap
- Spatial Data Management Considerations

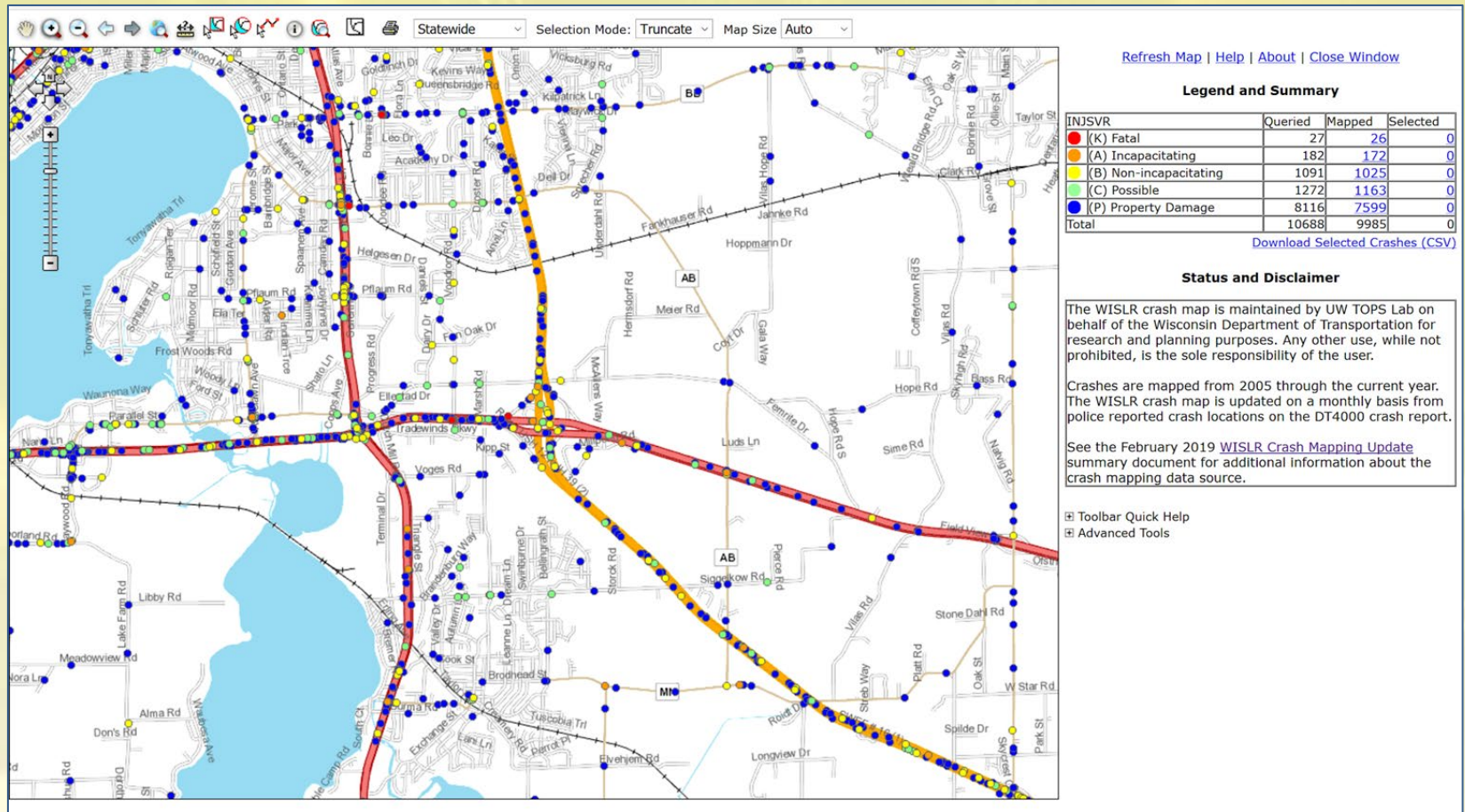
# Crash Mapping History: 1998-2010



Annual statewide shapefile of manually coded highway crashes with respect to the WisDOT State Trunk Network (STN) LRS.

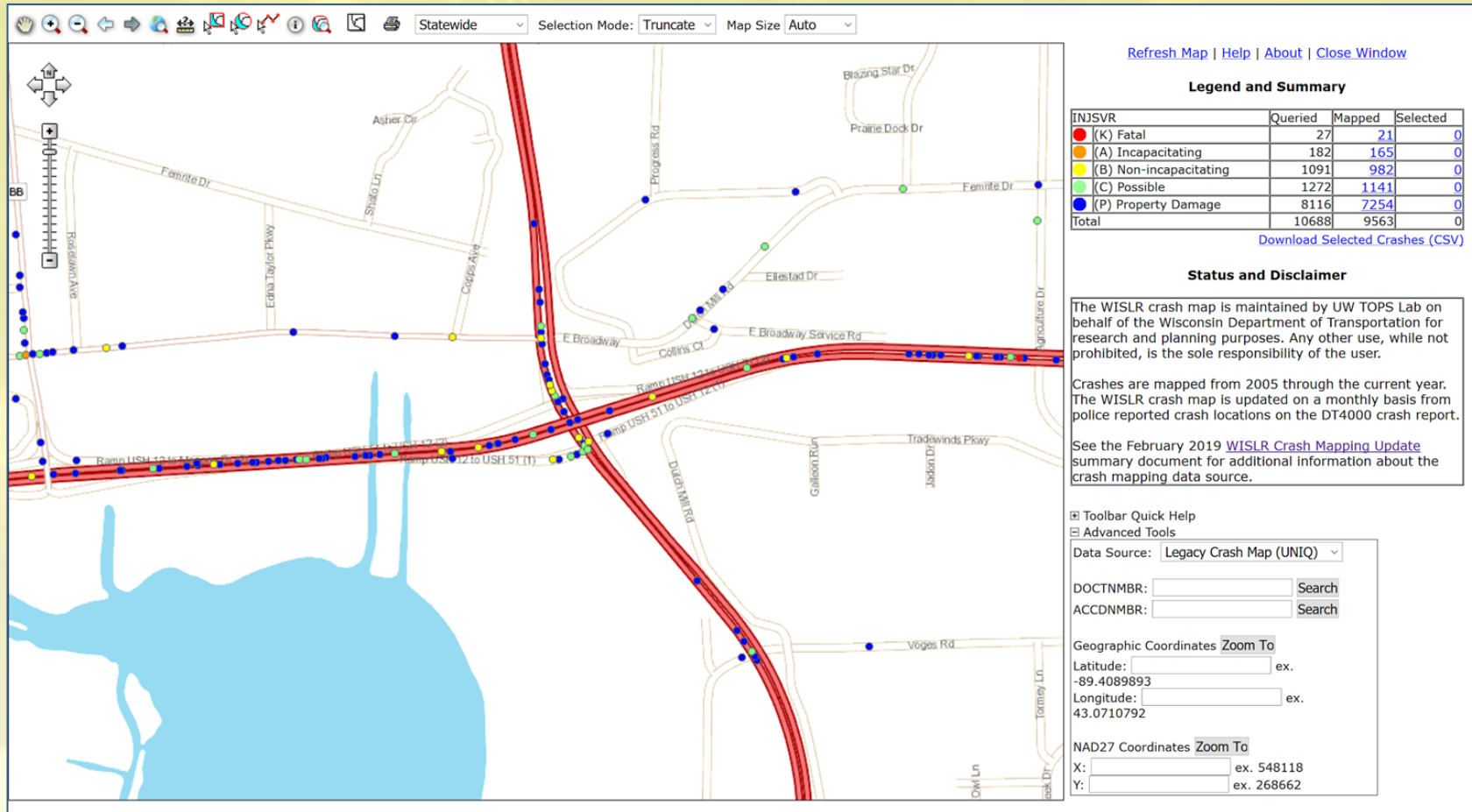


# Crash Mapping History: 2011-2016



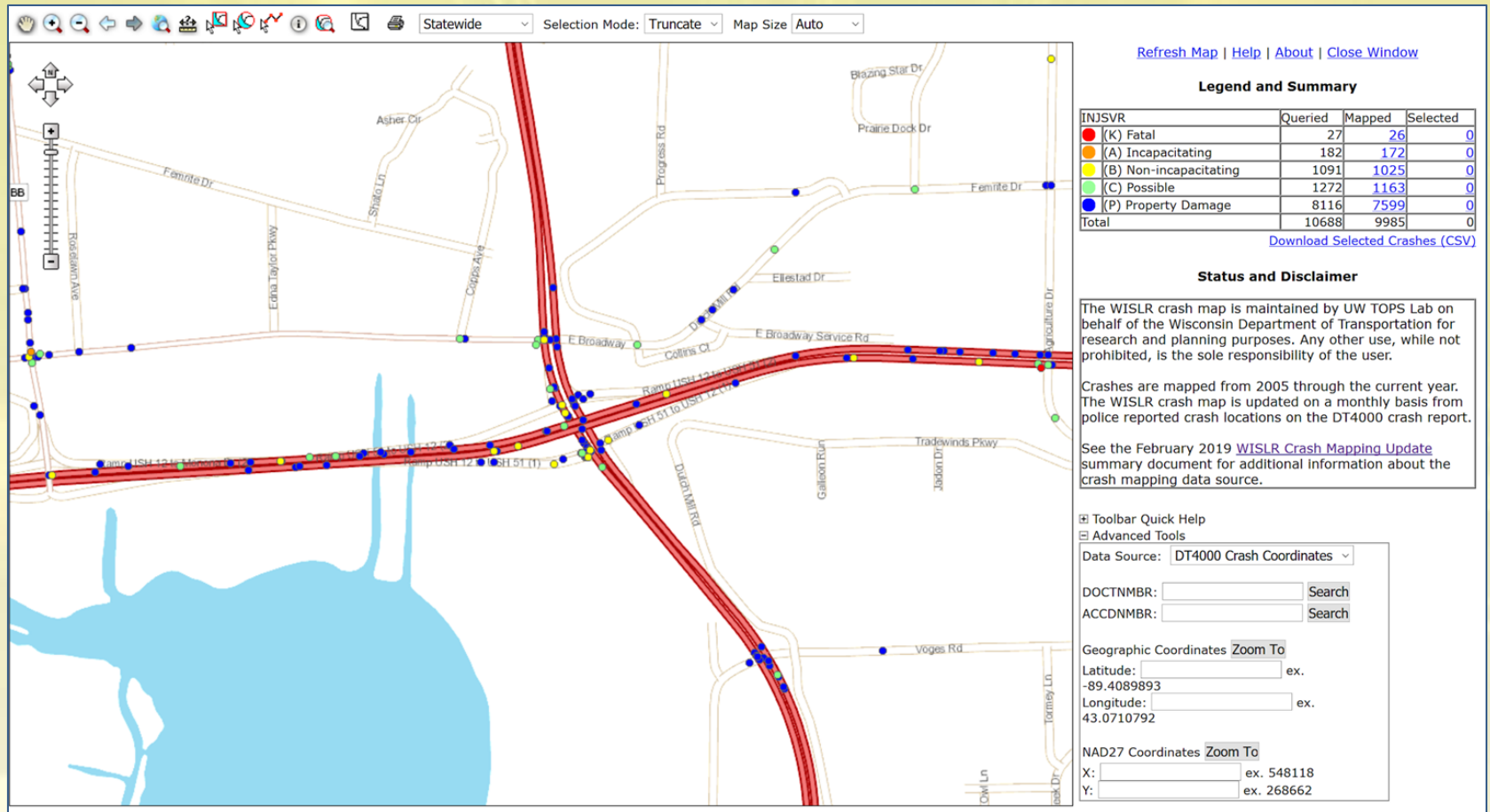
Highway and local road crashes combined onto a single LRS network (WISLR).  
 Monthly updates based on combination of manual and automated processing.

# Crash Mapping History: 2011-2016



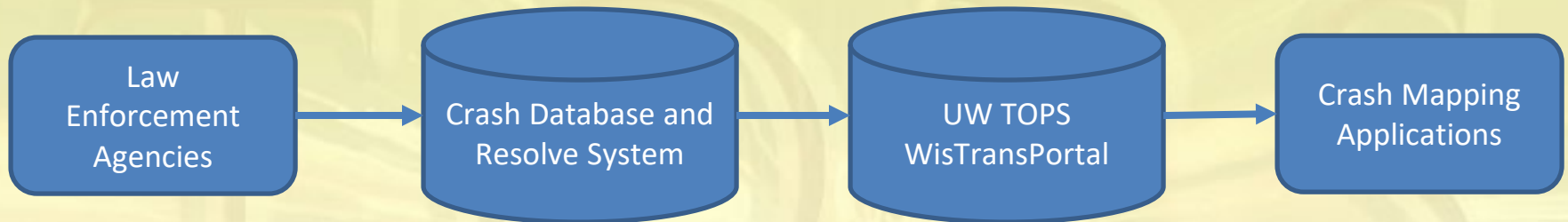
Crashes were still represented with respect to pre-ARNOLD centerline geometry.

# Crash Mapping History: 2017-Present



Crash map is updated nightly from geocoded locations on the Wisconsin DT4000 crash report. Improved accuracy, completeness, and timeliness.

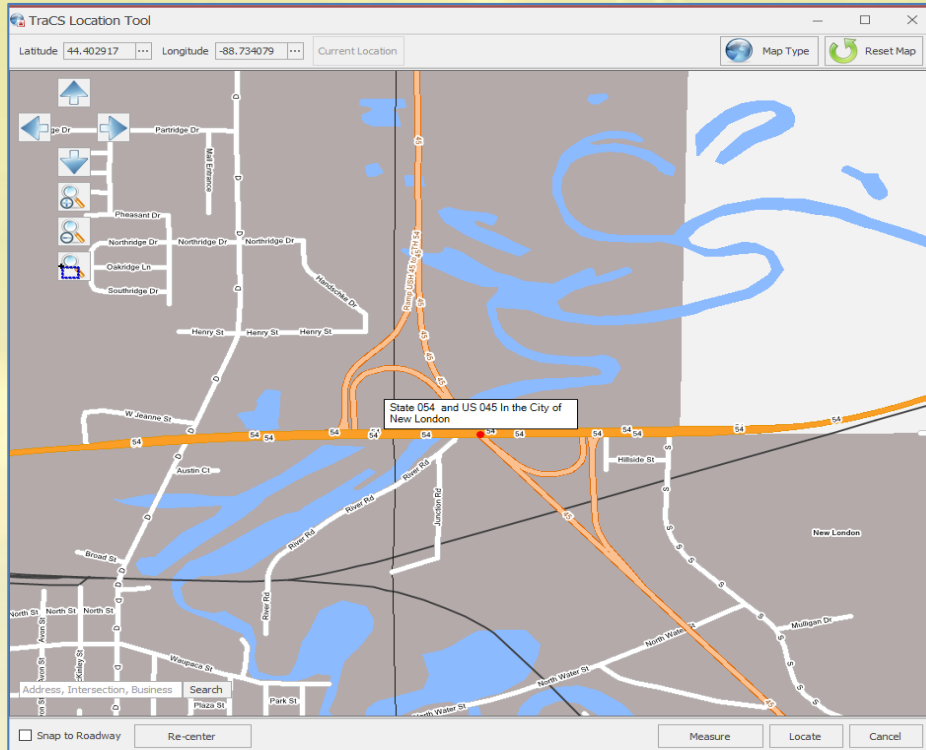
# Crash Mapping Overview: Data Flow



High level data flow with respect to UW TOPS Lab WisTransPortal supported crash mapping and analysis applications.



# Crash Mapping Overview: TraCS TLT



Location					
Map STH 153	DMV County MARATHON - 37		DMV Municipality CLEVELAND - 07, TOWN		
On Hwy Type STH	On Hwy # 153	On Hwy Dir EB	On Street Name		On F/R/B
Est. Dist. From Intersection 219 FT			Dir. From Intersection EAST		
From/At Hwy Type	From/At Hwy #	From/At Hwy Dir	From/At Street Name PAULINE'S LN		At F/R/B
Structure Type			Structure Number		
Latitude 44.800926819	Longitude -90.026559209	Latitude/LongitudeSource TLT/ILT		X Coordinate 260635.359375	Y Coordinate 4965293
Municipality Type TOWN OF	On Roadway Link ID# 5393947		On Roadway Link Offset 219		Override <input type="checkbox"/>


Location		
ON USH45 NB		Latitude
71 FT S		44.402916565
OF RAMP USHRAMNB		Longitude
IN THE CITY OF NEW LONDON		-88.734078624
IN OUTAGAMIE COUNTY		X Coordinate
		361915.625
		Y Coordinate
		4918088
		Structure Type

The TraCS Location Tool (TLT) was deployed in 2017 with the new Wisconsin DT4000 Police Crash Report and provides law enforcement agencies with a method to report crashes with geocoded latitude/longitude and LRS locations. Uses WISLR LRS as a base map.



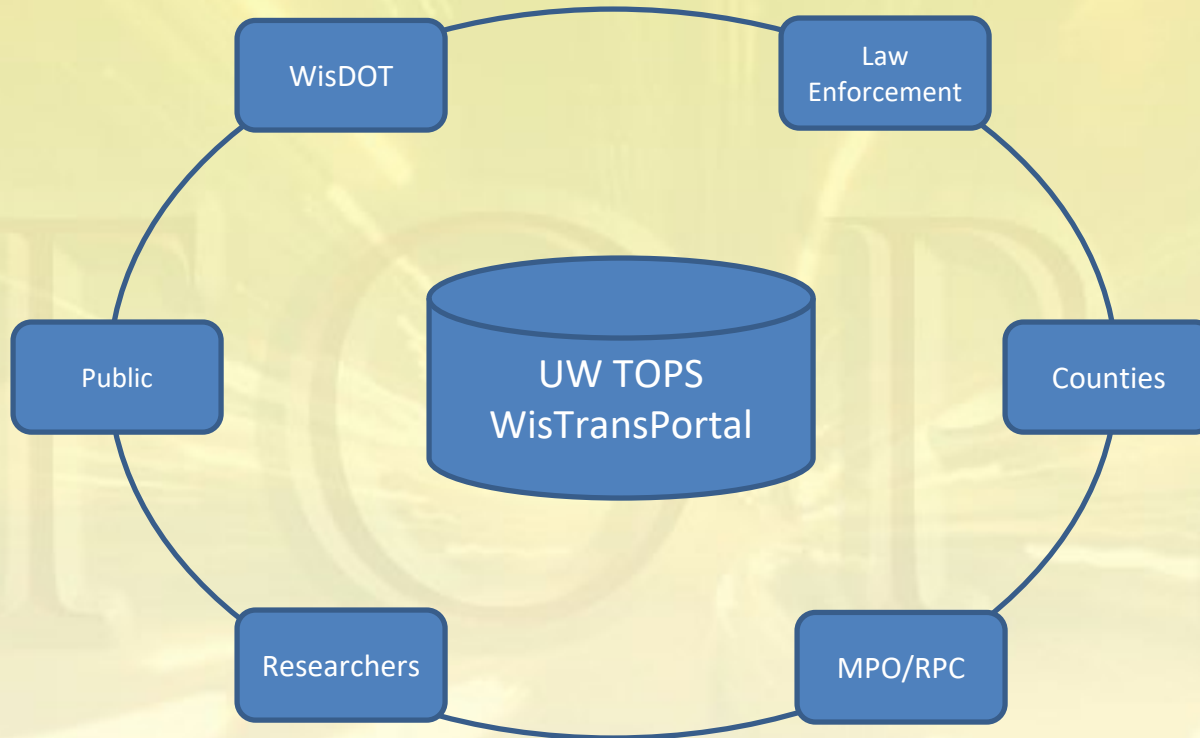
# Crash Mapping Overview: RP Coding

RP Coding Search	Basic Information
Effective Date: <input type="text" value="04/25/2018"/>	Crash Number: 180411247
Reference Point Type: <input type="text" value=""/>	Last Modified by: Wesolowski, Doug
Route Designation Type: <input type="text" value=""/>	Last Modified on: 08/17/2018 02:38 PM
Roadway Route Number: <input type="text" value="018"/>	STN Rdwy Route ID: 21
Roadway Route Direction: <input type="text" value="E"/>	STN Rdwy Link ID: 58354
Reference Point Number Letter: <input type="text" value="151M"/>	STN Link Offset: 0.07
Offset Positive / Negative: <input type="text" value="+"/>	Municipality - County: MADISON (C) - DANE
Offset From Reference Point: <input type="text" value="0.07"/>	On Highway: USH 018 EB
Alternate Latitude: <input type="text" value=""/>	From / At Highway:
Alternate Longitude: <input type="text" value=""/>	On Street Name: VERONA RD
Alternate Lat / Lon Source: <input type="text" value=""/>	Lat, Lon: 43.031483255, -89.45991864
	Lat / Lon Source: TLT



Highway crashes are hand coded to WisDOT State Trunk Network (STN) LRS locations through the Crash Database and Resolve System using STN Reference Points (RP Coding).

# Crash Mapping Overview: WisTransPortal



The UW TOPS Lab WisTransPortal system serves as a “data hub” to support multiple end user crash mapping and analysis applications.

# Applications: WisTransPortal Crash Map

## Crash Data Retrieval Facility, Version 1.2.6, January 31, 2019

SELECT \* FROM CRASHPRD.V\_COMBINED\_GIS C WHERE C.ACDDATE BETWEEN TO\_DATE('2019-JAN','YYYY-MM') AND LAST\_DAY(TO\_DATE('2019-DEC','YYYY-MM')) AND C.CNTYCODE IN ('13') AND C.ACCLC IN ('I','N') ORDER BY C.ACDDATE, C.NTFYHOUR, C.COUNTY, C.MUNICIPALITY, C.MUNTYPE, C.ONHWYRP, C.ONHWYDIR, C.RPNMBR, C.RPDIS, C.ONHWY, C.ONSTR, C.ATHWY, C.ATSTR, C.INTDIR, C.INTDIS

The Total Number of Records for this Query is 949.

Refine Location Summarize Data Show WISLR Map Show RP Map New Query Exit

View additional crash detail View the crash report Crash report is not available Crash report is restricted

[Crash Data User Guide \(PDF\)](#)

First Previous Next Last Rows Per Page: 50 Order By: ACCDDATE Column List: GENERAL PURPOSE COORDS Customize

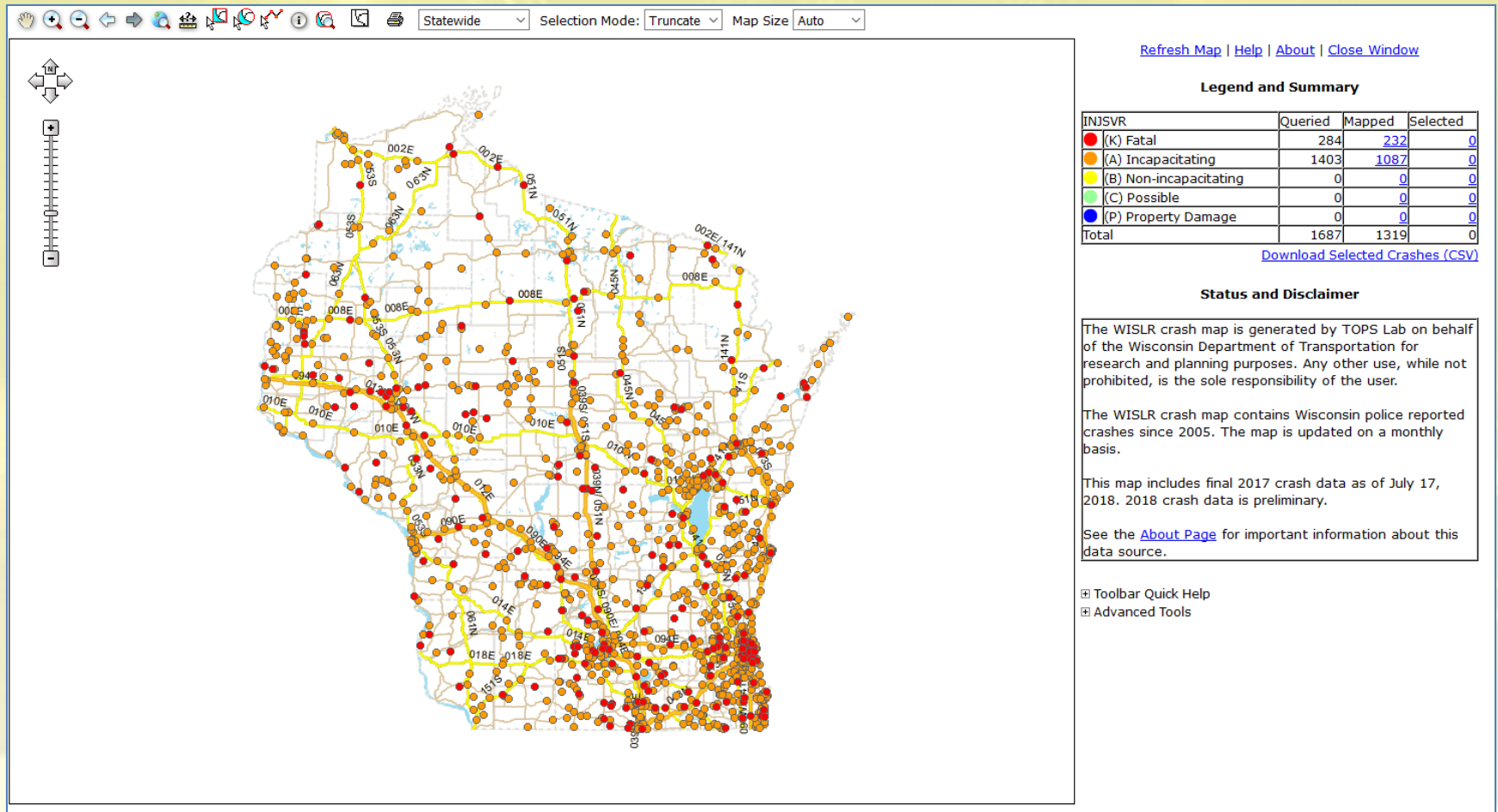
[Download Result Set \(Text/CSV\)](#)

#	ACCDNMBR	DOCTNMBR	ACCDDATE	NTFYHOUR	REGION	COUNTY	MUNICIPALITY	MUNTYPE	ONHWYRP	ONHWYDIR	ONHWY	ONSTR	ATHWY	ATSTR	ATNMBR	INTDIR	INTDIS	ACCD
1	190103780	01L0245WXW	01/01/2019	0	SW	DANE	MADISON	C			012			SCHROEDER RD		E	19	GR FA
2	190102164	01L05S26SX	01/01/2019	0	SW	DANE	MADISON	C				VEITH AVE		W SAUTHOFF RD	4101	W	45	OT PS
3	190104367	02L021L4RD	01/01/2019	0	SW	DANE	VERMONT	T			JG			ANDREW LN	3533	E	2	OTHF
4	190100019	1LL0NXCTLK	01/01/2019	2	SW	DANE	FITCHBURG	C				CARLING DR		VERONA RD FRONTAGE			0	
5	190100560	J0L09XQXVW	01/01/2019	2	SW	DANE	MADISON	C			113	PACKERS AVE		SCHLINGEN AVE			0	LTPOL
6	190102467	01L0CS9M0R	01/01/2019	2	SW	DANE	MADISON	C			D			GREENWAY CROSS			0	
7	190102151	01L0FW8HJS	01/01/2019	3	SW	DANE	MADISON	C			012			TODD DR		E	30	
8	190101140	01L0WQ2XWC	01/01/2019	3	SW	DANE	MADISON	C				W JOHNSON ST		N PARK ST			0	
9	190102150	01L0H32KRH	01/01/2019	4	SW	DANE	MADISON	C			014		012			E	10	CURB
10	190103781	01L0GNQ6NP	01/01/2019	4	SW	DANE	MADISON	C			151			HUGHES PL			0	
11	190104059	02L0ZDPGNJ	01/01/2019	8	SW	DANE	BURKE	T				FIELD STONE LN		DENNIS DR		S	0	OTHF
12	190100315	DGL0474SGG	01/01/2019	8	SW	DANE	MOUNT HOREB	V				N EIGHTH ST		SPRINGDALE ST			0	LTPOL
13	190102147	01L0D7W14R	01/01/2019	9	SW	DANE	MADISON	C			113	NORTHPORT DR		DRYDEN DR		W	12	FENCI
14	190103793	02L0ZFXHPM	01/01/2019	11	SW	DANE	DANE	T			P			STEWART RD		N	24	DITCH
15	190104057	02L101719D	01/01/2019	12	SW	DANE	DUNKIRK	T				TAYLOR LN (2)		WESTCHESTER CIR		N	1	PK VE
16	190100018	03L0CZ7RFR	01/01/2019	12	SW	DANE	SUN PRAIRIE	C				LINNERUD DR		CLARMAR DR		W	3	TREE
17	190104056	02L0ZDPGNK	01/01/2019	12	SW	DANE	SUN PRAIRIE	T				TWIN LANE RD	019			N	1	TFSIG
18	190100017	03L0J7MM0G	01/01/2019	13	SW	DANE	SUN PRAIRIE	C				W MAIN ST	151				0	TF SIC
19	190100264	7H00KR71XR	01/01/2019	14	SW	DANE	MC FARLAND	V			MN	RASHEFORD		EXCHANGE ST			0	

WisTransPortal crash data query results page, tabular view.

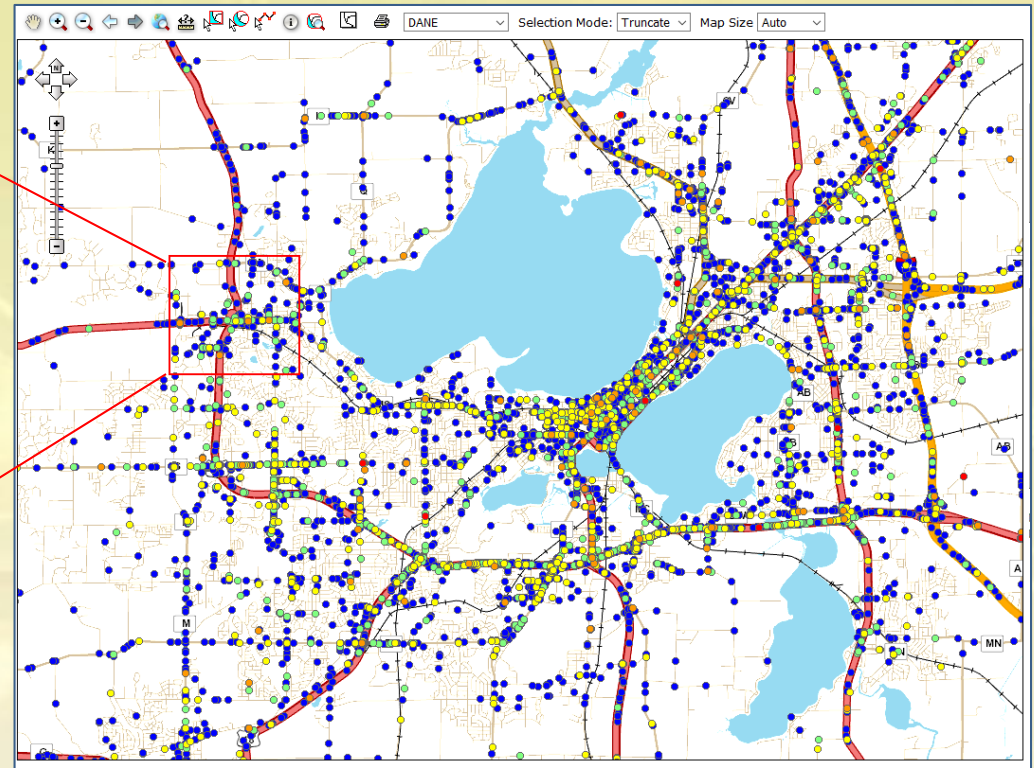


# Applications: WisTransPortal Crash Map

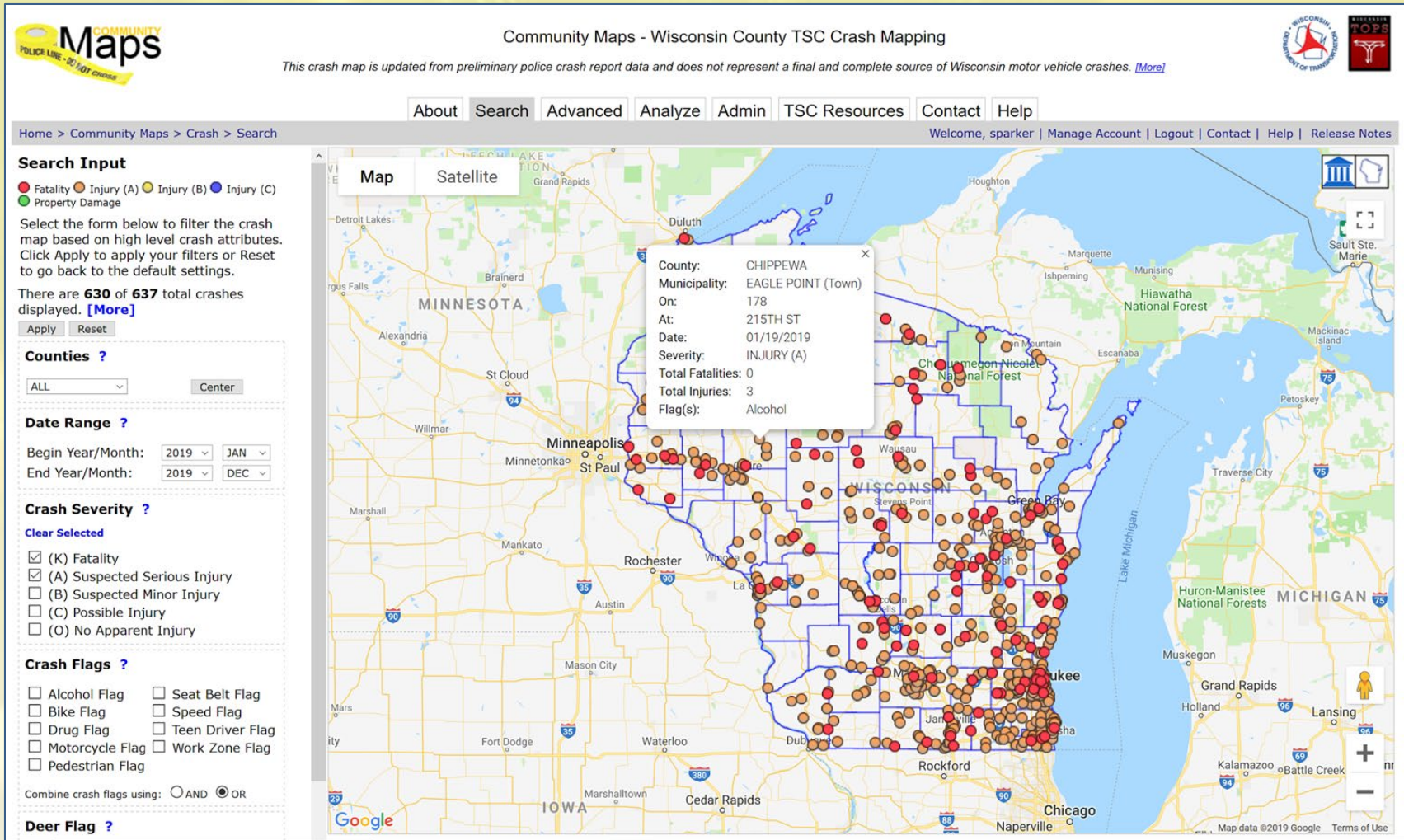


WisTransPortal WISLR crash map, statewide view.



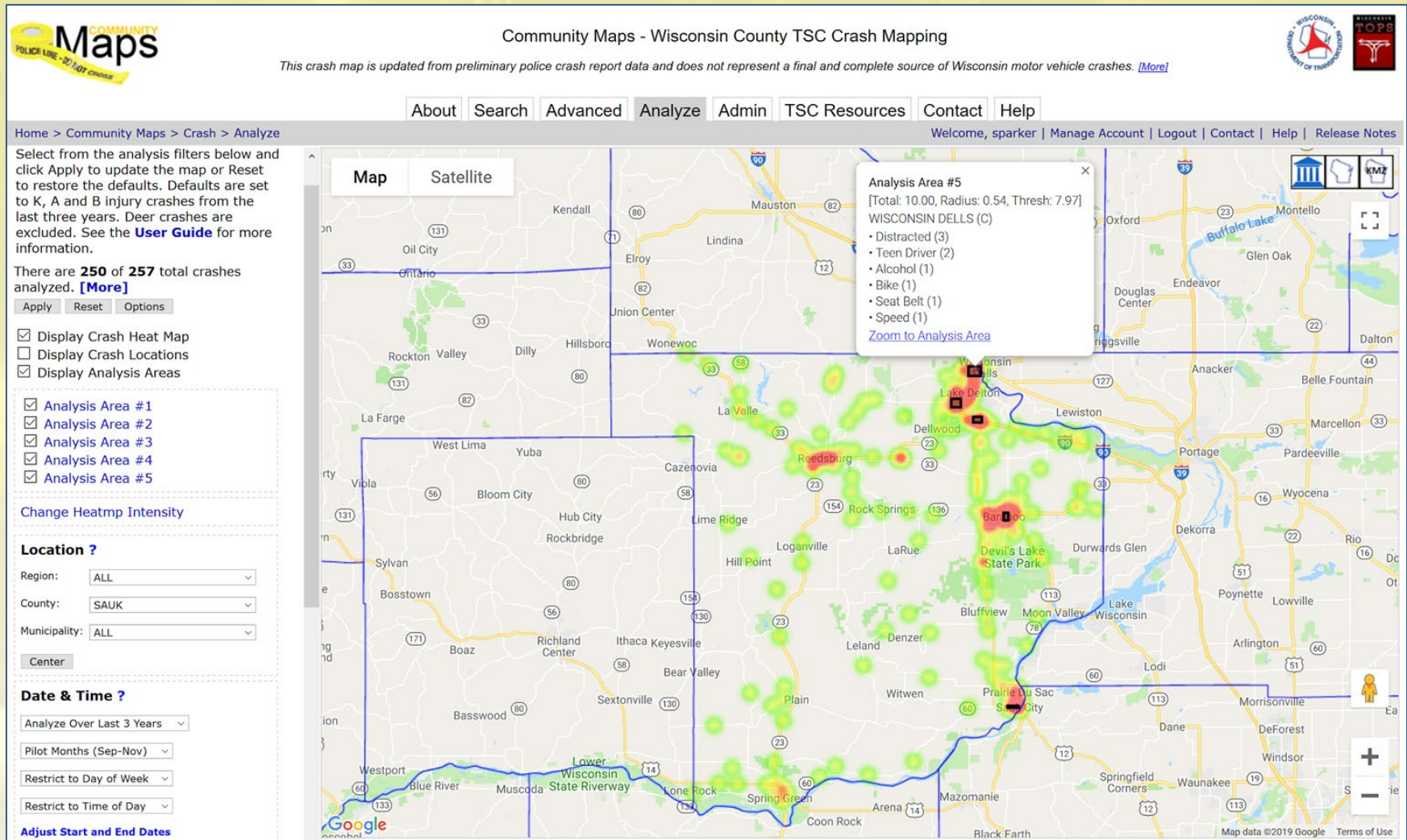
[illegible]The logo for Wisconsin TOPS (Tobacco Orphan Placement System) is located in the top left corner. It features the word "WISCONSIN" in a small, black, sans-serif font above the word "TOPS" in a large, bold, red, serif font. Below "TOPS" is a red square containing a white graphic of a three-pronged fork or a stylized 'Y' shape with arrows pointing outwards from the top and downwards from the bottom.

# Applications: Community Maps





# Applications: LEA Predictive Analytics



# Applications: Safety Certification Mapping

Corridor #1	Highway	Start County	End County	Start RP	End RP
	I-90 EB	Sauk	Sauk	090E089M033	090E092M000

Corridor #2	Highway	Start County	End County	Start RP	End RP
	I-90 WB	Sauk	Sauk	090W092M000	090W090G024

+

-

Search

Country

County

Legend

- 16441 Crash Rate,
- 16443 KAB, Crash Rate,
- 16476 Crash Rate,
- 16478 KAB,
- 16479 KAB, Crash Rate,

Filters/Layers

☐ Crashes

☒ K - Fatality

☒ A - Suspected Major Injury

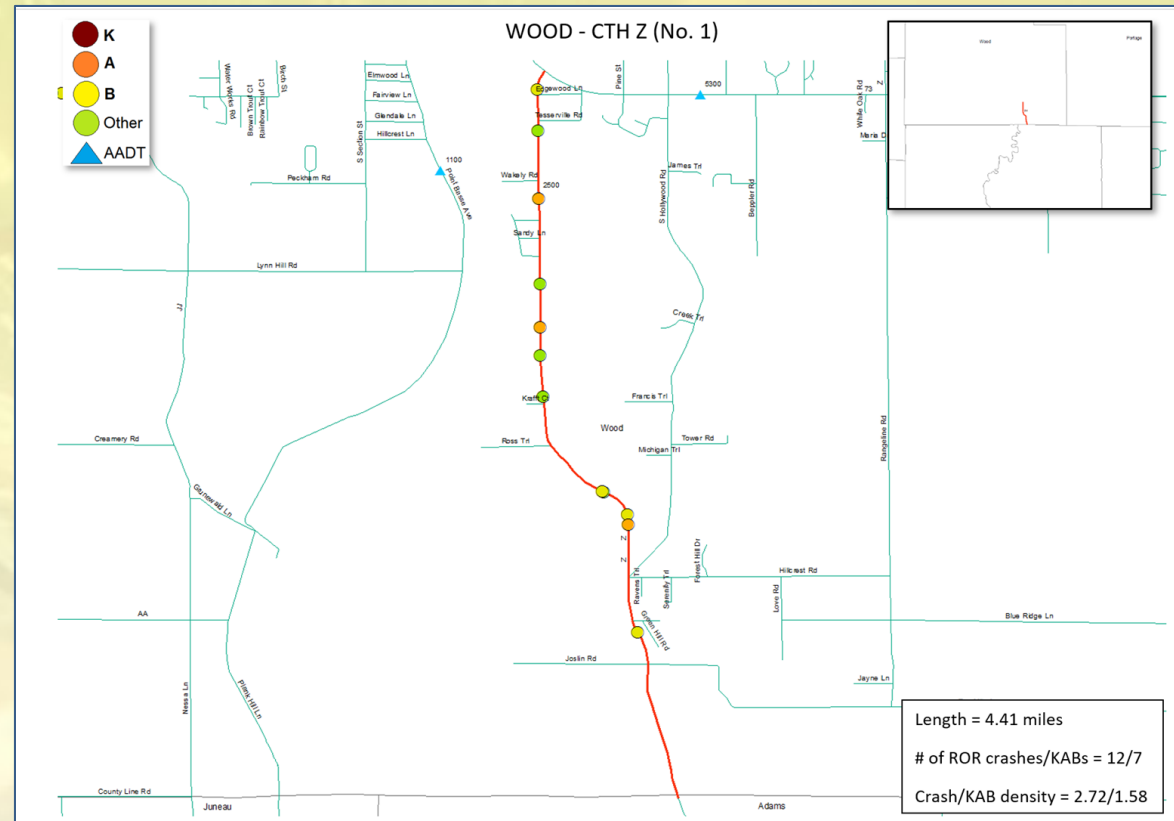
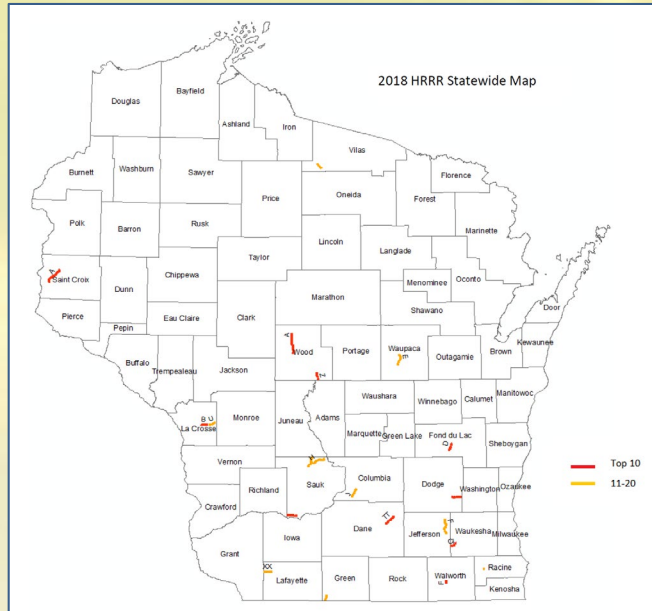
☒ B - Suspected Minor Injury

☐ C - Possible Injury

☐ O - No Apparent Injury



# Applications: High Risk Rural Roads



# Applications: Regional Planning

## East Central Wisconsin Regional Crash Analysis Application (2013-2017)

Adjust the filters to refine the results in the map. Only one point is shown per accident regardless of the number of individuals involved. When multiple modes of travel were involved in the crash Pedestrian will be assigned before Bicyclist which will be assigned before Motorists. As you pan and zoom the graphs will update to reflect the collisions in current map extent.

### Mode

- ☐ Bicyclist
- ☐ Motorist
- ☐ Pedestrian

### Severity

- ☒ Incapacitating
- ☒ Fatal
- ☐ Non-Incapacitating
- ☐ Possible Injury

### Factors

- ☐ Alcohol
- ☐ Construction Zone

### Highway Name

None

### Street Name

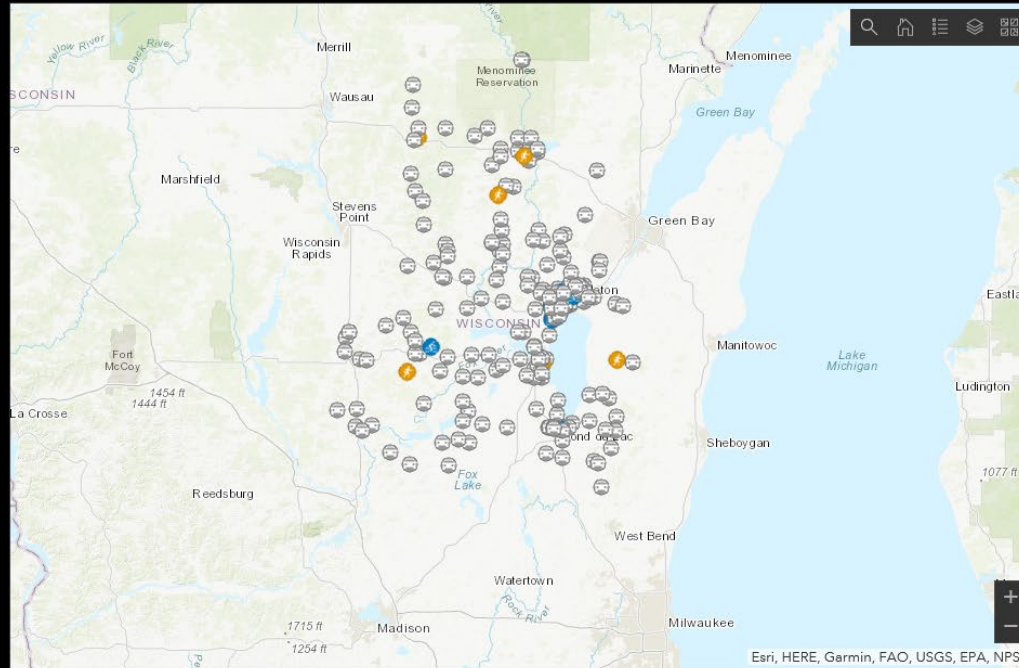
None

### Accident Type

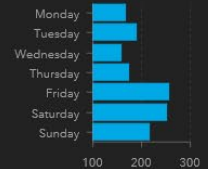
None

### Road Conditions

None



### Day of Week



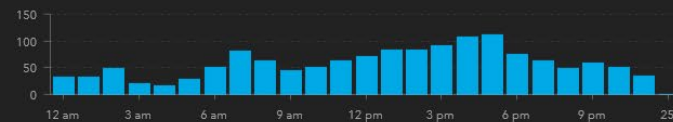
### Month of Year



### Total Crashes

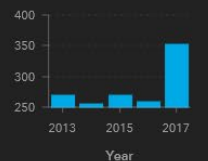
1,407

### Hour of Day



\* 12 am is the default recording time, so 12 am times may be misleading.

### Year



# CMAA Enhancements and Roadmap

- Near term crash data quality improvements
- Near term crash mapping application improvements
- Roadmap planning for future CMAA spatial data management:
  - Identify key stakeholders
  - Needs assessment / use cases
  - Spatial data models and architectures to support those use cases

# Near Term Data Requirements

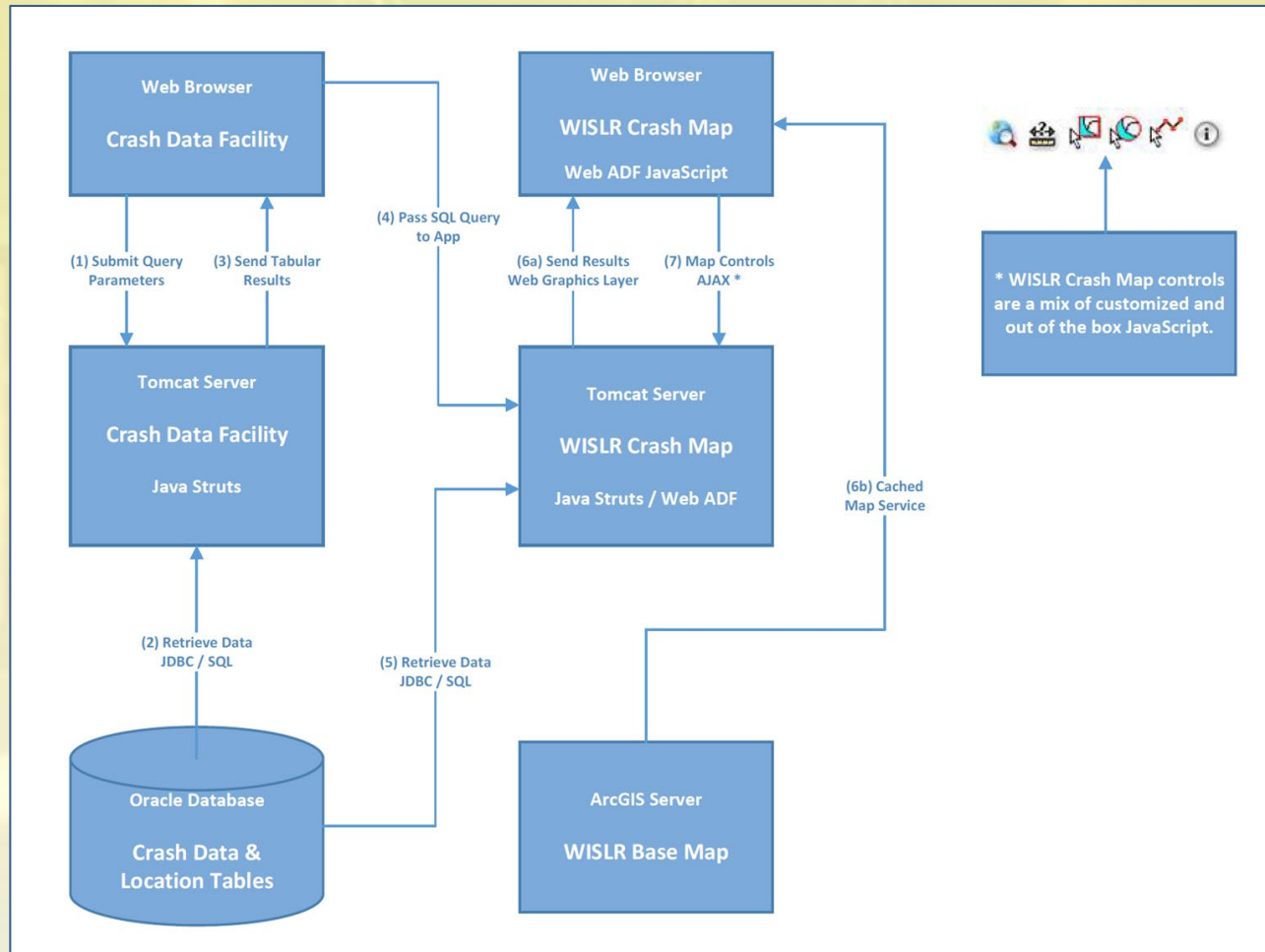
- Display “real-world” crash coordinates from the DT4000 police crash report
- Update the crash map on a nightly basis with the other DT4000 ETL processes
- Use the same data source consistently across mapping applications
- Continue to manage STN and WISLR coded crash locations for LRS based analysis
- Automate the STN “RP” crash coding process



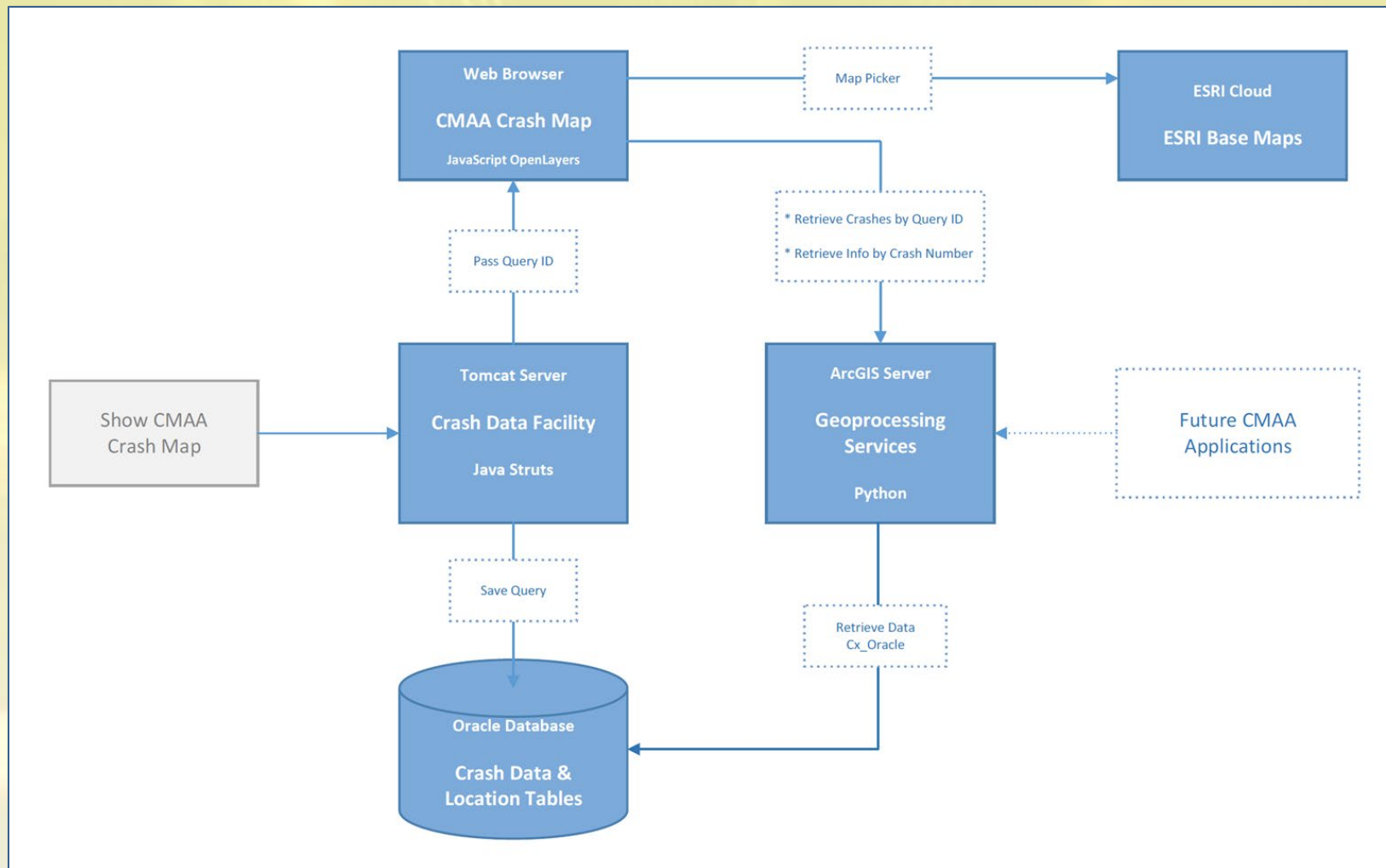
# Near Term Application Requirements

- Replace locally hosted base map with cloud-based map services
- Replace ESRI WebADF components with a modern web mapping framework
- Incorporate the new, nightly crash data source (DT4000)
- Support complex, multi-year crash queries (display minimally five years of data on the map)
- Support complex selections (free form polygon, buffered roadway)
- Support a service based architecture
- Use out of the box tools to the extent possible

# Crash Mapping “As Is” Diagram



# Crash Mapping “Proposed” Diagram



# Spatial Data Management Considerations

- Need to manage “real-world” and LRS network crash locations
  - Wisconsin has three basic sources: real-world, WISLR, STN
  - Multiple sources of crash data confusing to users
  - Crash map dataset != crash analysis dataset
- Work towards an authoritative crash mapping data source
  - Enabled through service based architecture
  - How to address errors in the crash data
- Source data management
  - Managed in a relational database (Oracle)
  - Spatially enabled through ESRI geoprocessing services



# Questions?

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The CMAA Project is sponsored by the Wisconsin Department of Transportation (WisDOT) Bureau of State Highway Programs (BSHP).

