

Visualizing and Communicating Sensitive First Responder and Public Safety Data for Ops. & Planning



Michael L. Pack
Univ. of Maryland CATT Laboratory



What is the CATT Lab

30 Full-Time Employees

5 Graduate Students

**60+ Undergrad
Student Researchers**

- Computer Science
- Mechanical Engineering
- Aerospace Engineering
- Computer Engineering
- Geography & GIS
- Telecommunications
- Electrical Engineering
- Art & Graphic Design
- Digital Entertainment
- English
- Archaeology
- Civil Engineering



Presentation



Researchers



Media/3rd Parties

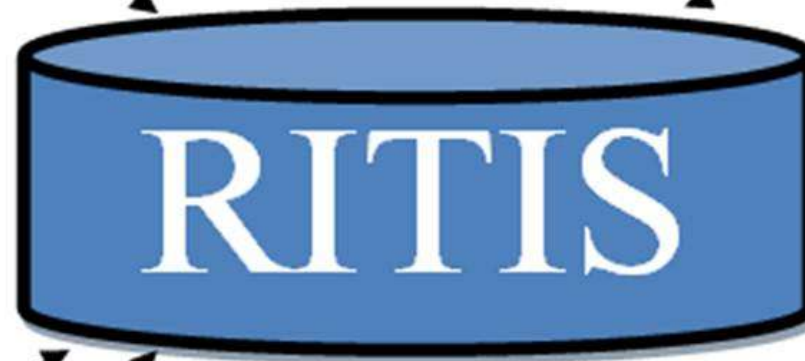


Operations



Travelers

Integration



Data



Traffic



Events



Parking



Weather



Signals



CAD



Transit

CATT Lab Transportation Data

- RITIS Today

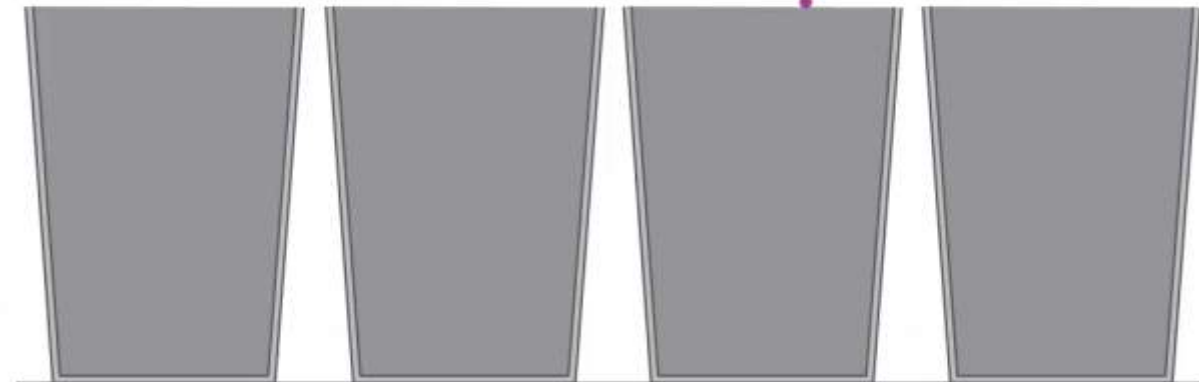
- Traffic accidents: 20,000 records per day: 0.001 Gb/day
- Traffic detectors: 35,000,000 records per day: 5 Gb/day
- Probe vehicle data: 4,200,000,000 records per day: 550 Gb/day
- CCTV, weather, radio, etc: NO,STA,TSK,EPT records per day: ??? Tb/day
- V2X & Automation data: ?,???,???,???,??? records per day: ??? ?b/day

EVENT

DETECTOR

PROBE

CONNECTED
VEHICLE



Our Challenge

- Our mission is to make ALL of this data
 - **easily accessible,**
 - **usable, and**
 - **understandable**to end users—whomever they may be...



Why Visualization?



- **Visual bandwidth is enormous**

- Human perceptual skills are remarkable
 - Trend, cluster, gap, outlier...
 - Color, size, shape, proximity...
- Human image storage is fast and vast

Visualization is so effective and useful because it utilizes one of the channels to our brain that have the highest bandwidths: our eyes.

- Robert Kosara

Who is your audience?

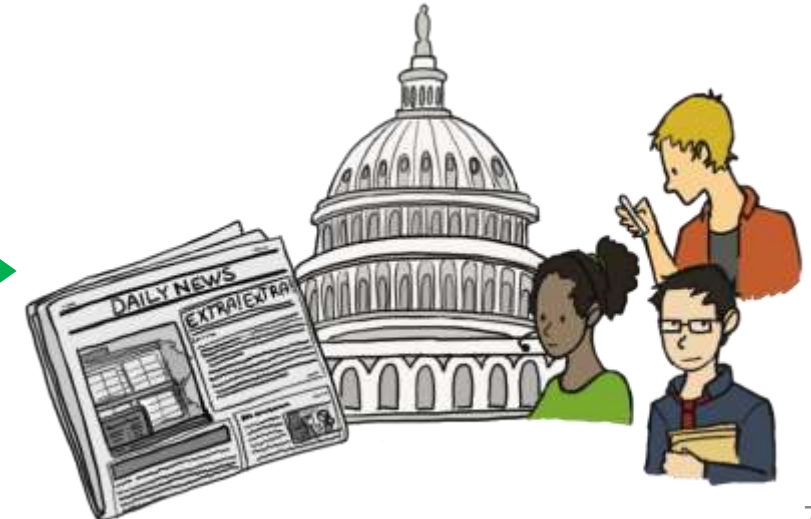


- Engineers
- Planners
- Operators

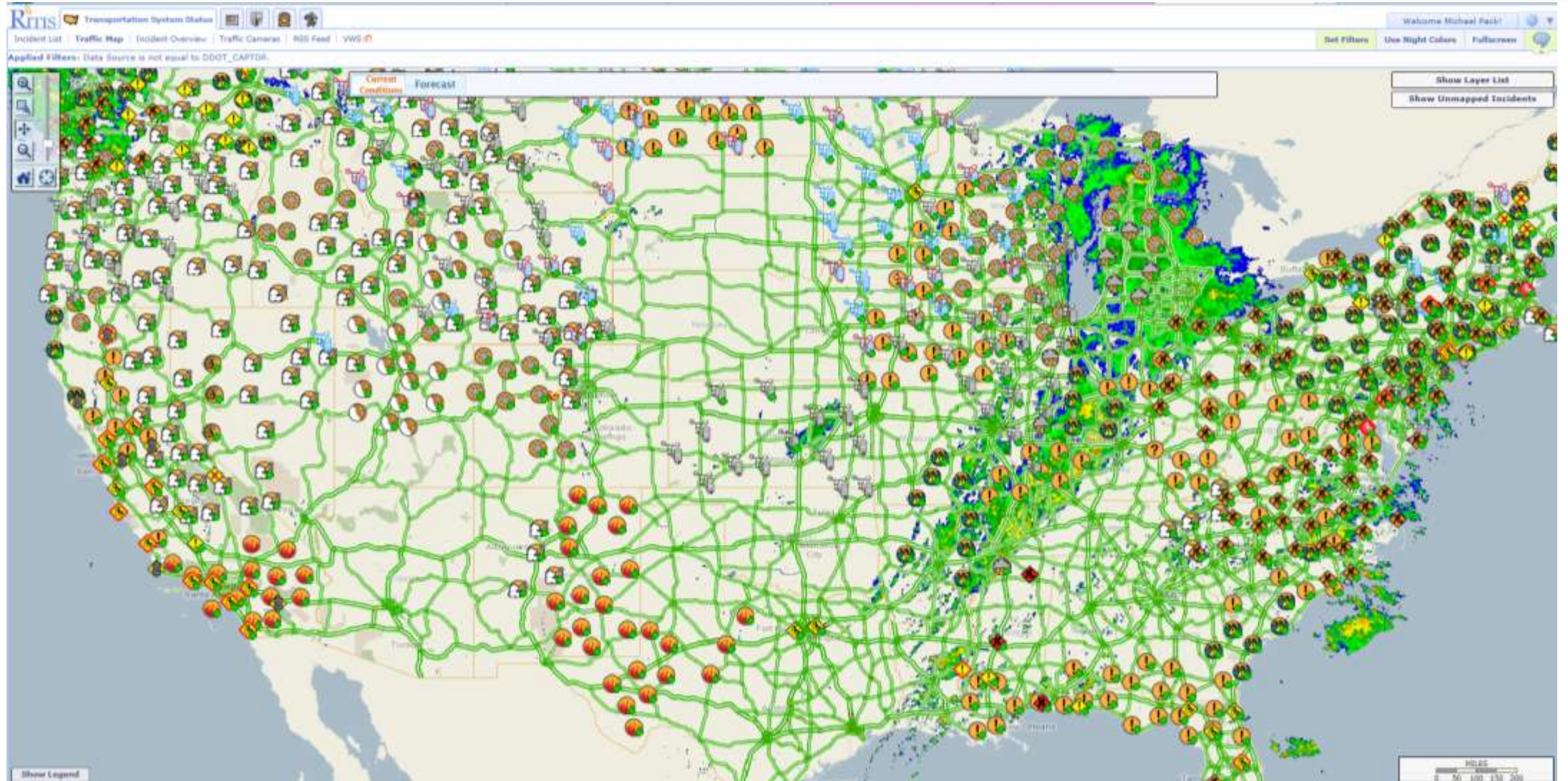


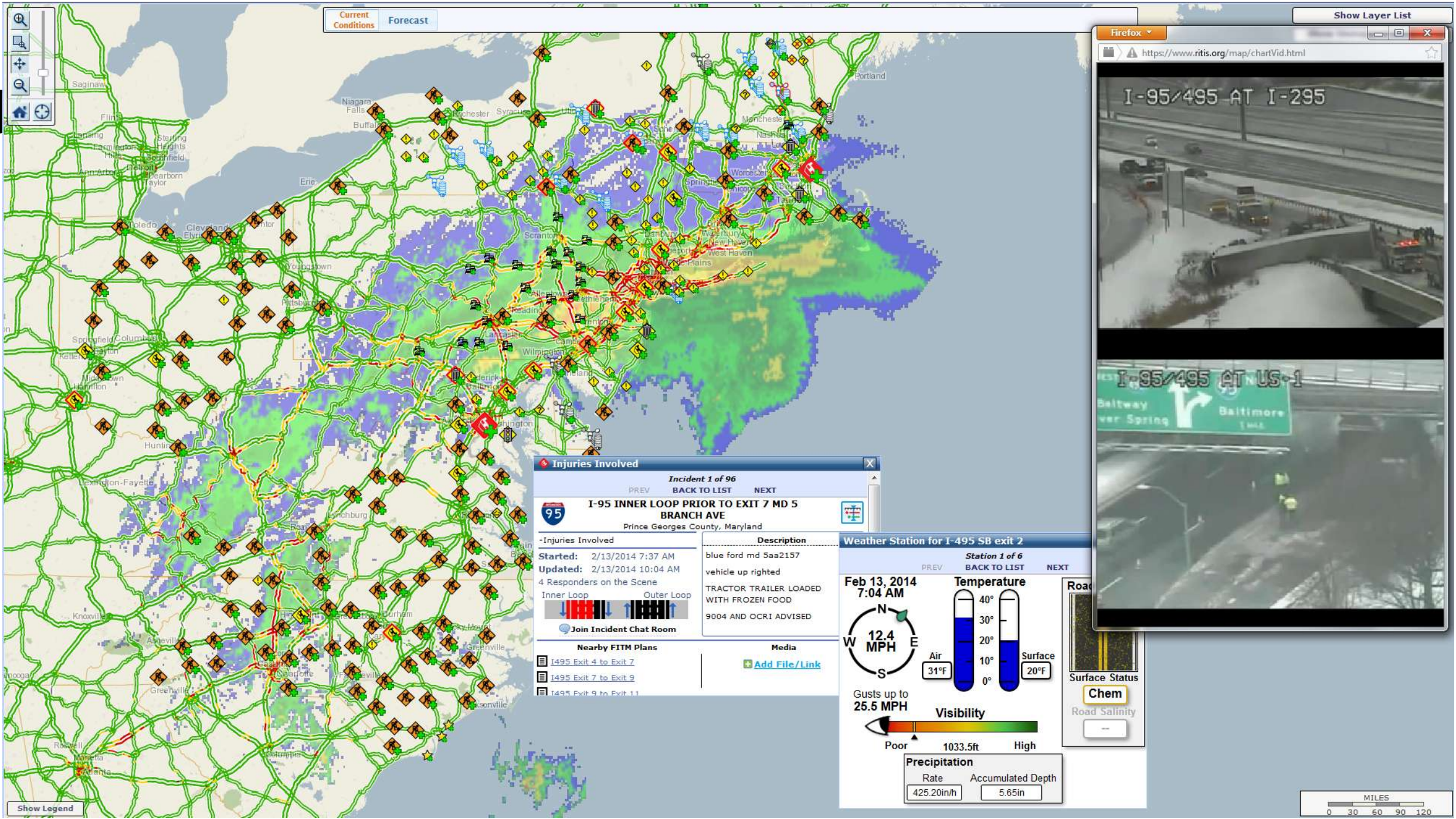
Vs.

- Legislators
- Media
- Decision Makers
- Public

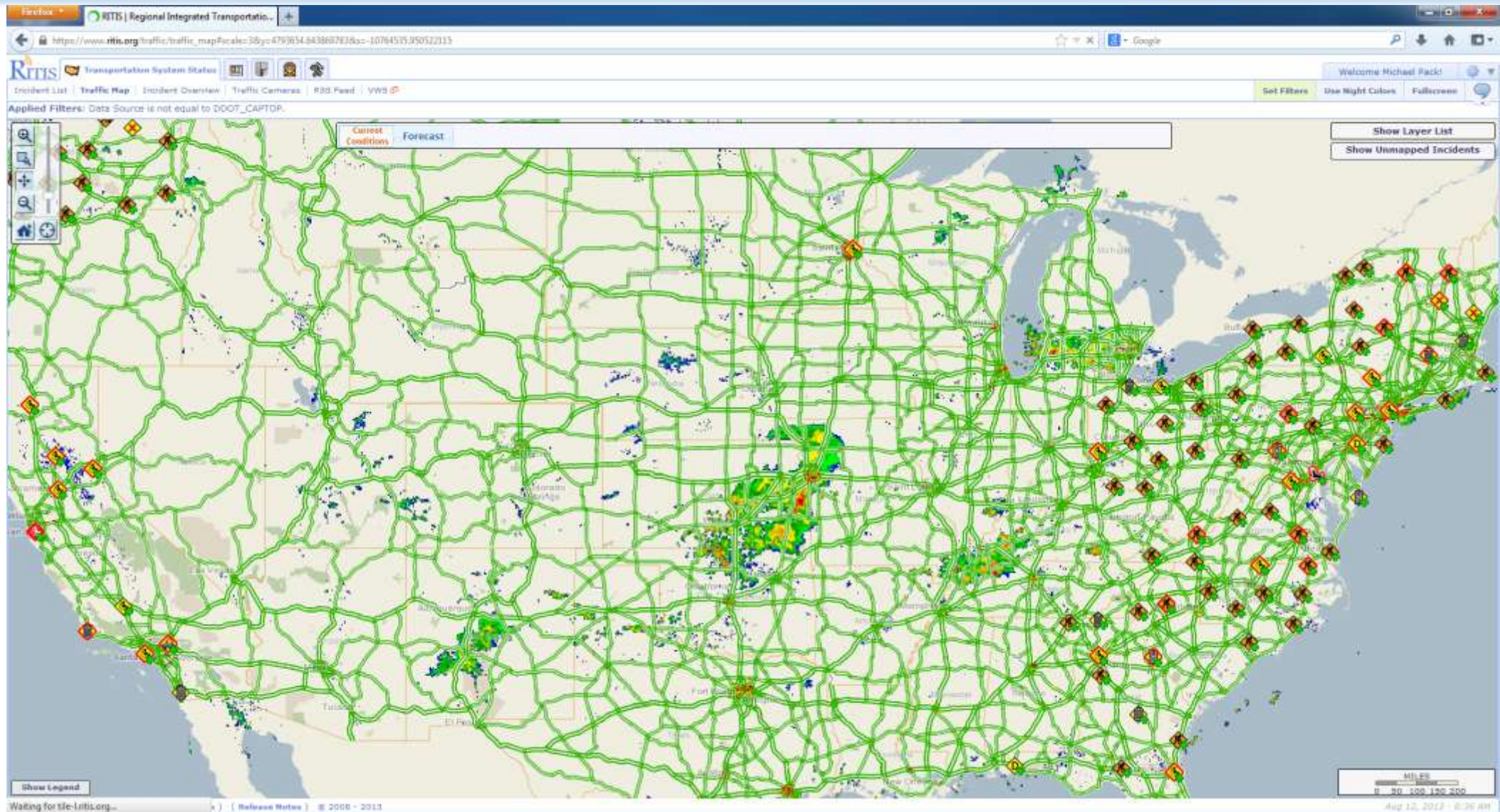


National System

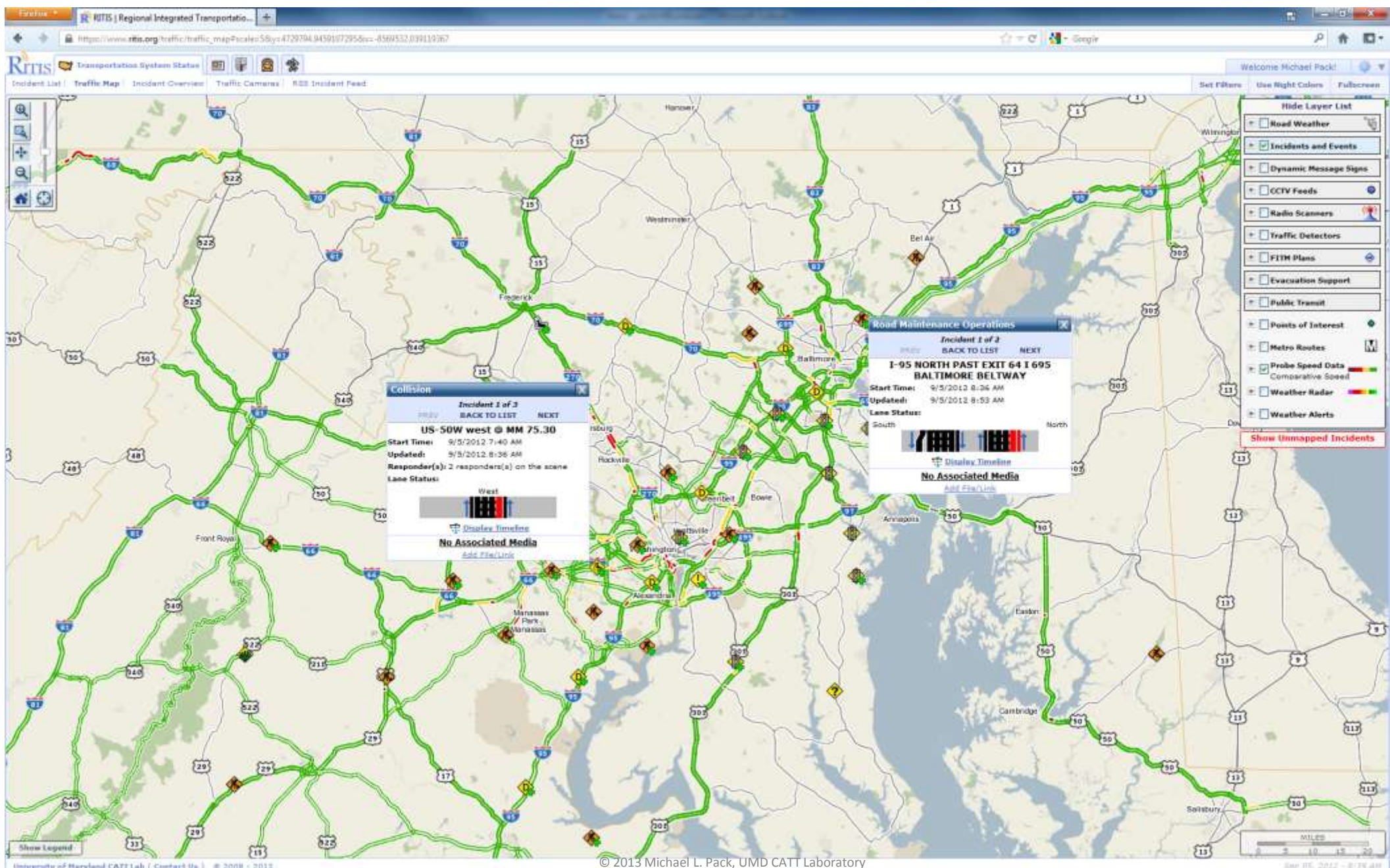




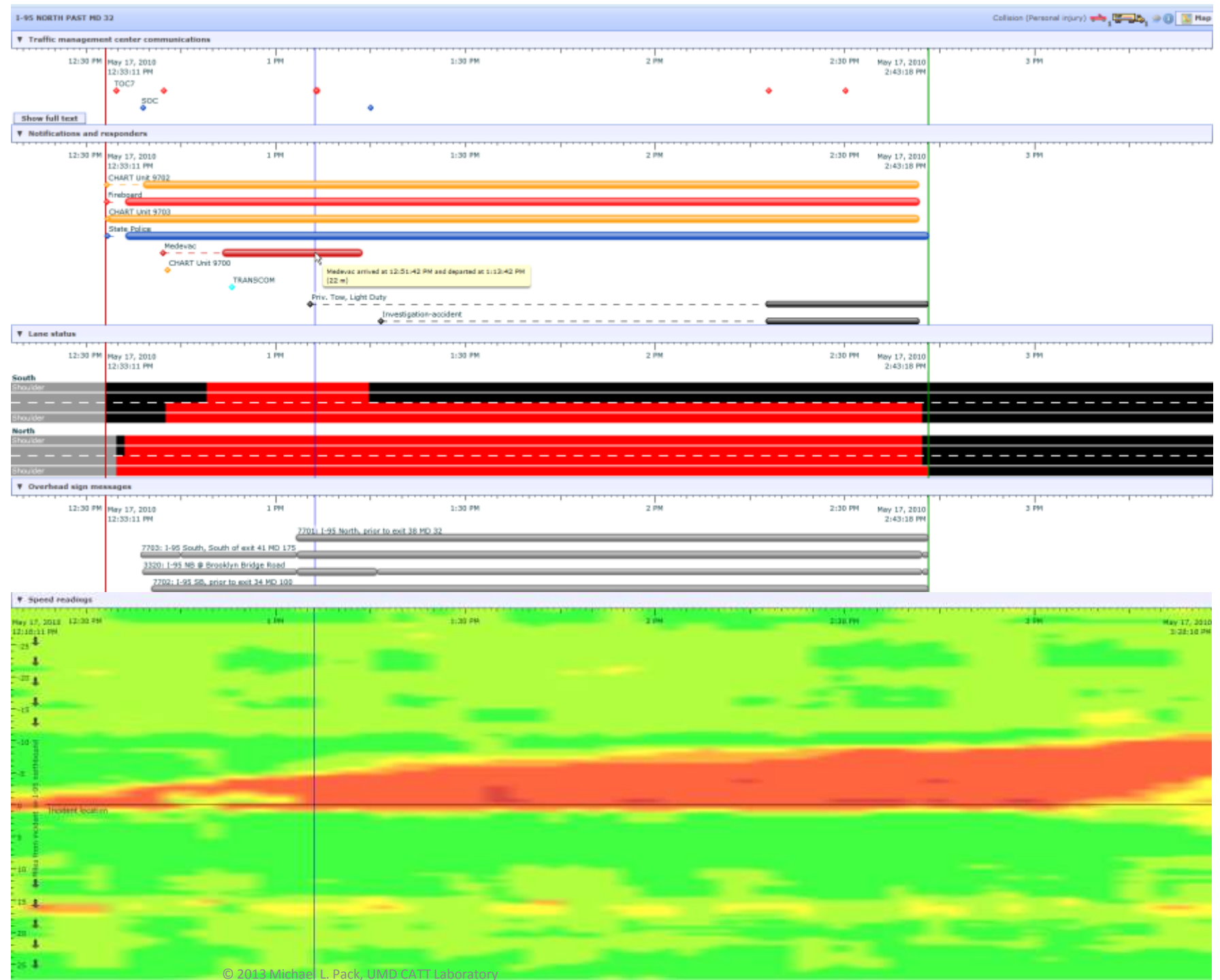
Map View



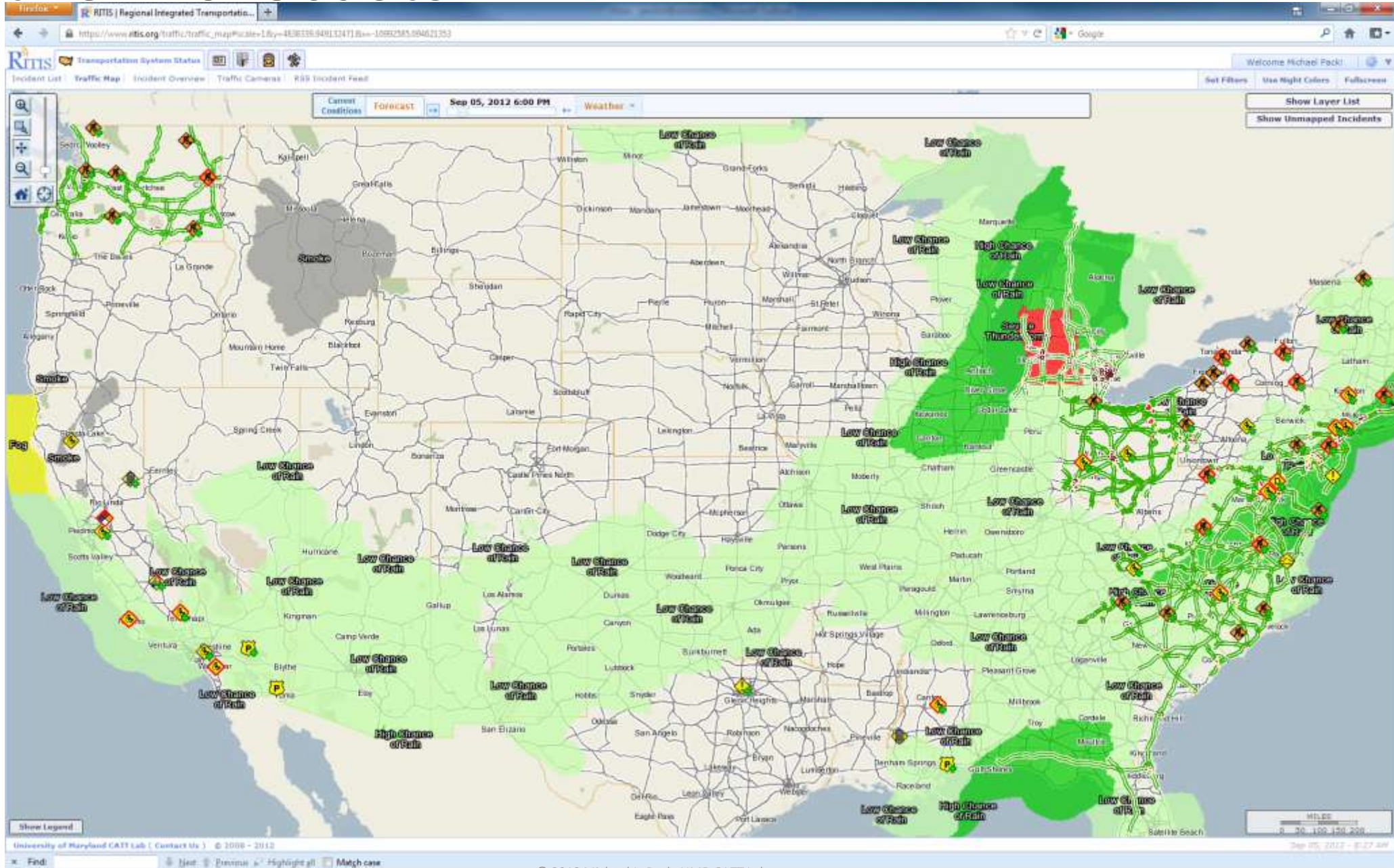
Incident Details



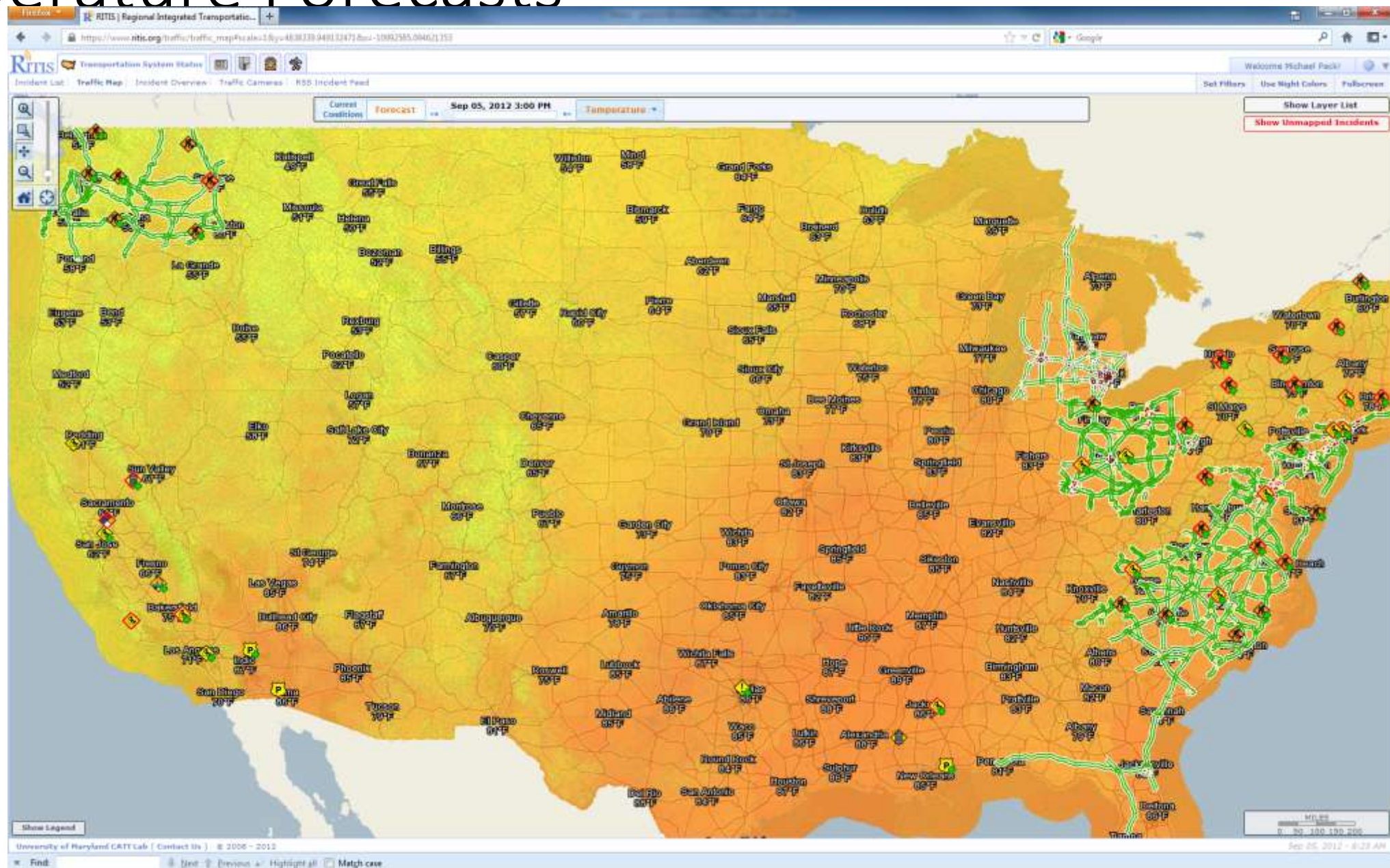
Real-time and Historic Timeline of Incident Activity



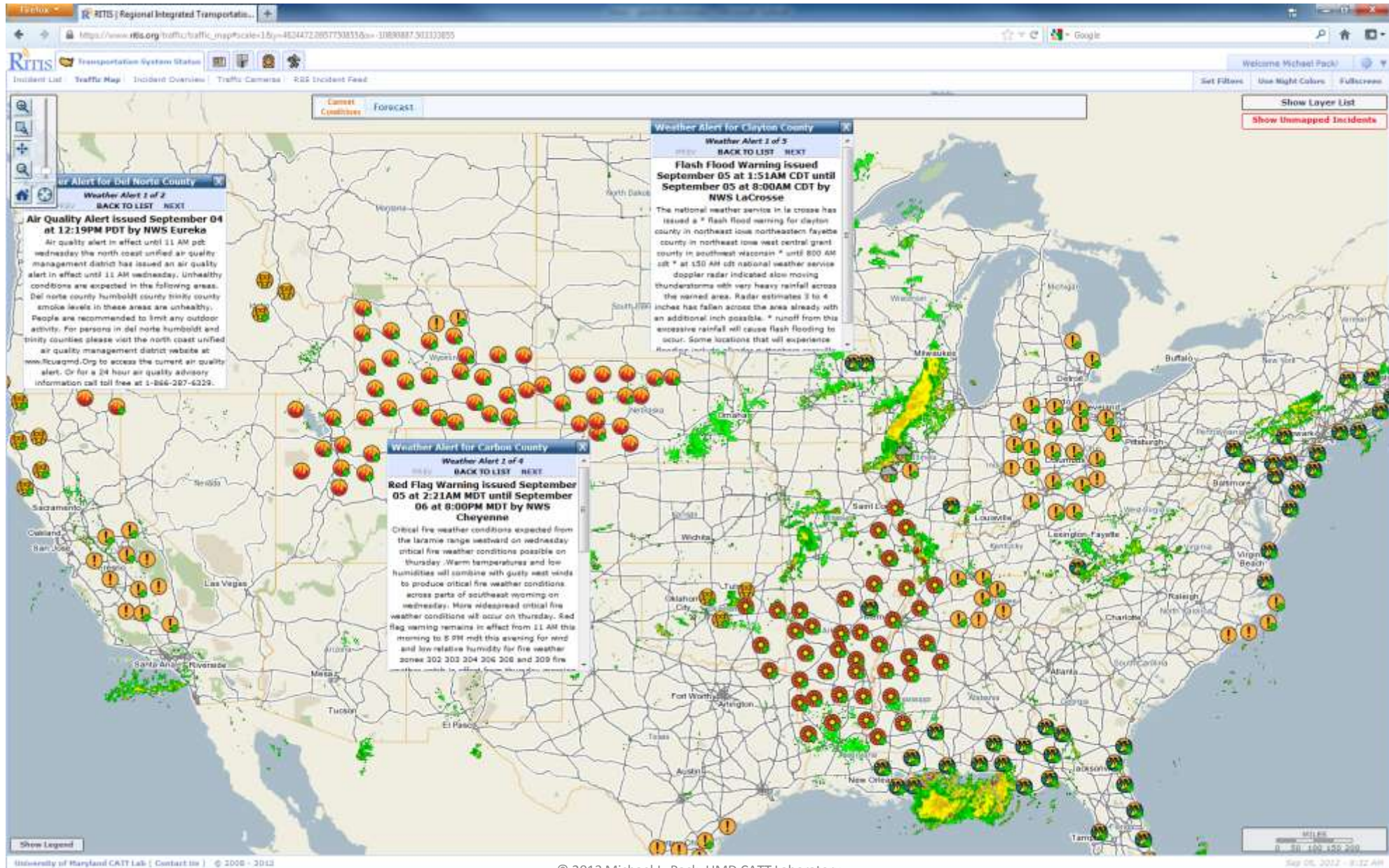
Weather Forecasts



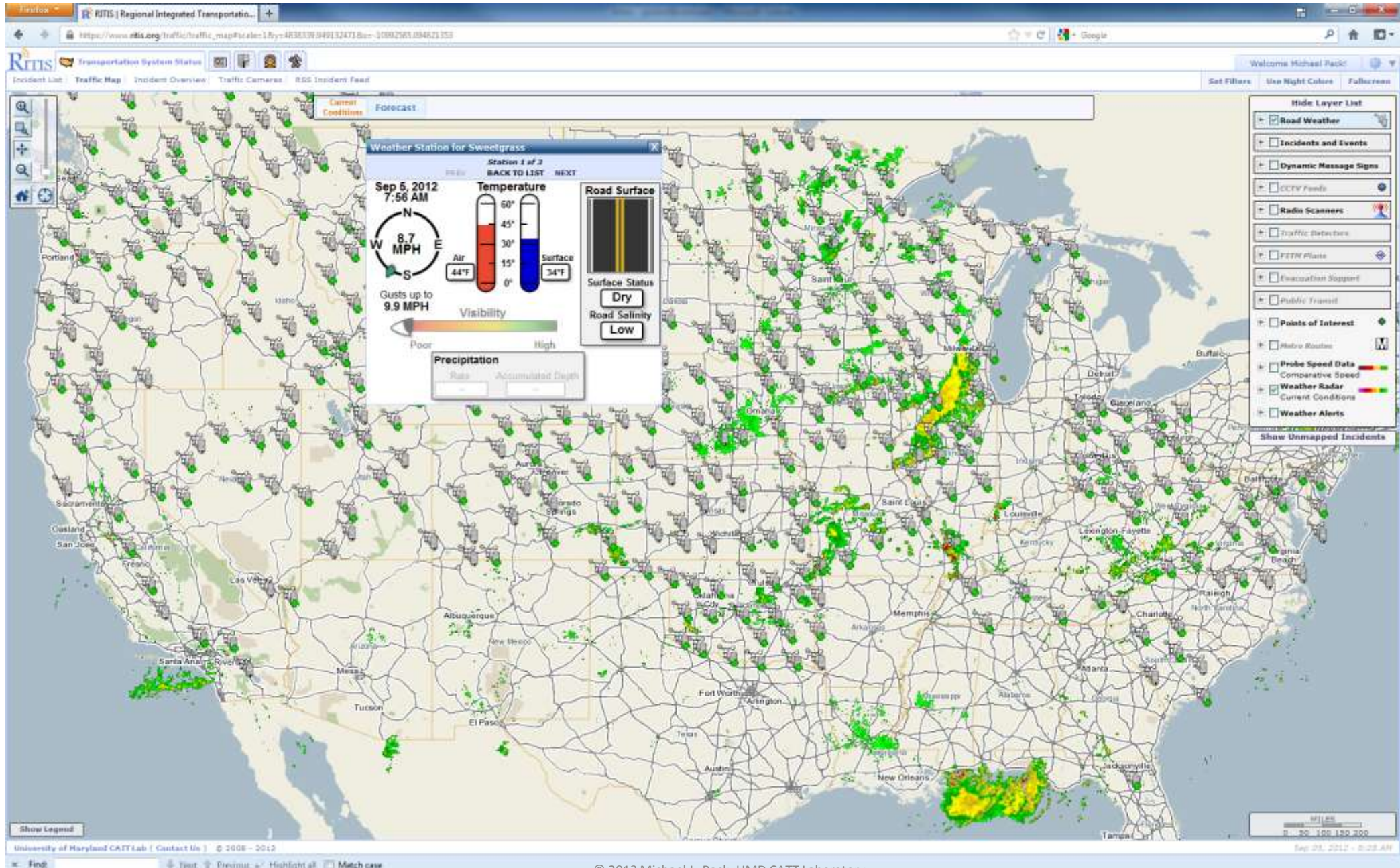
Temperature Forecasts



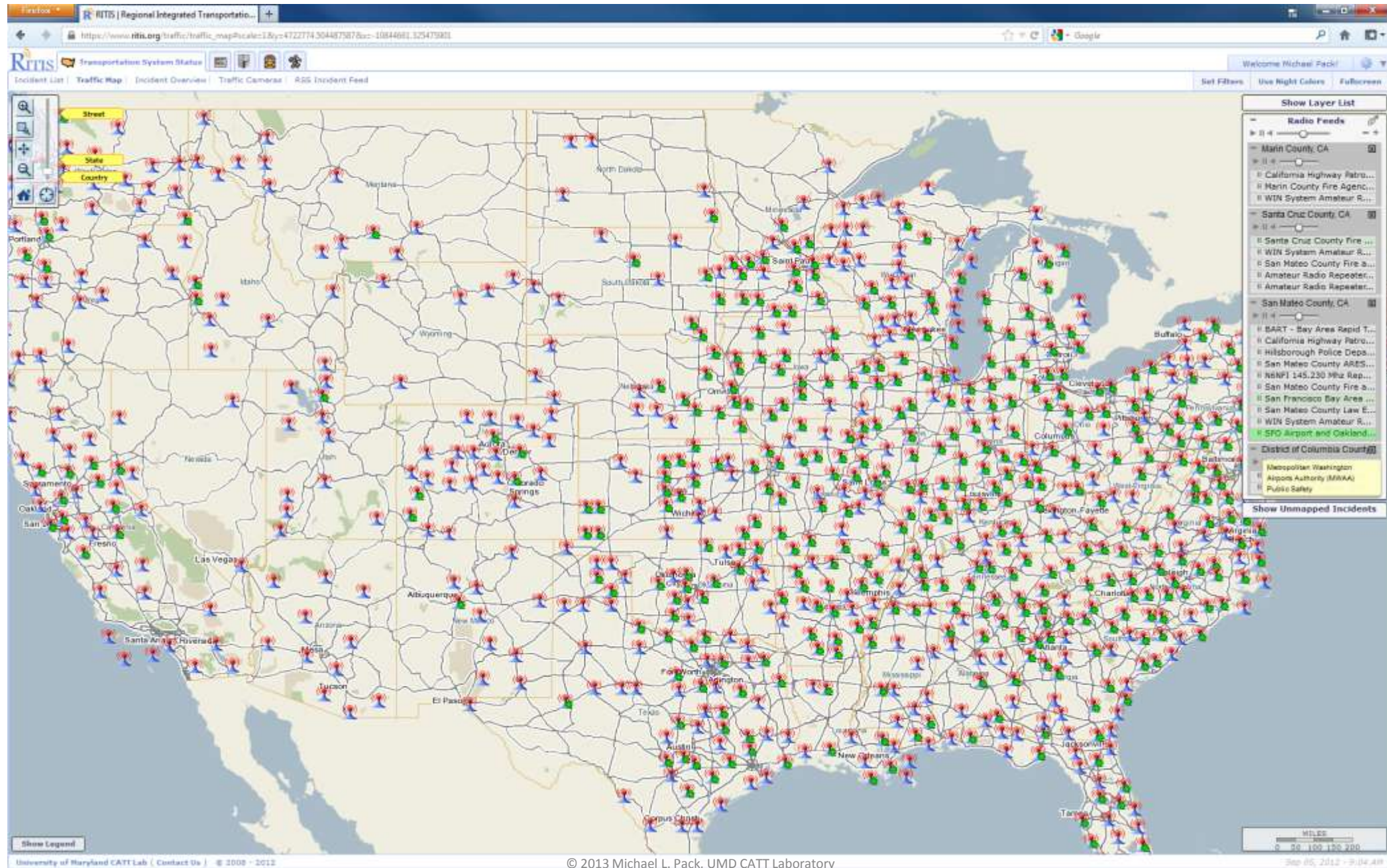
Weather Alerts



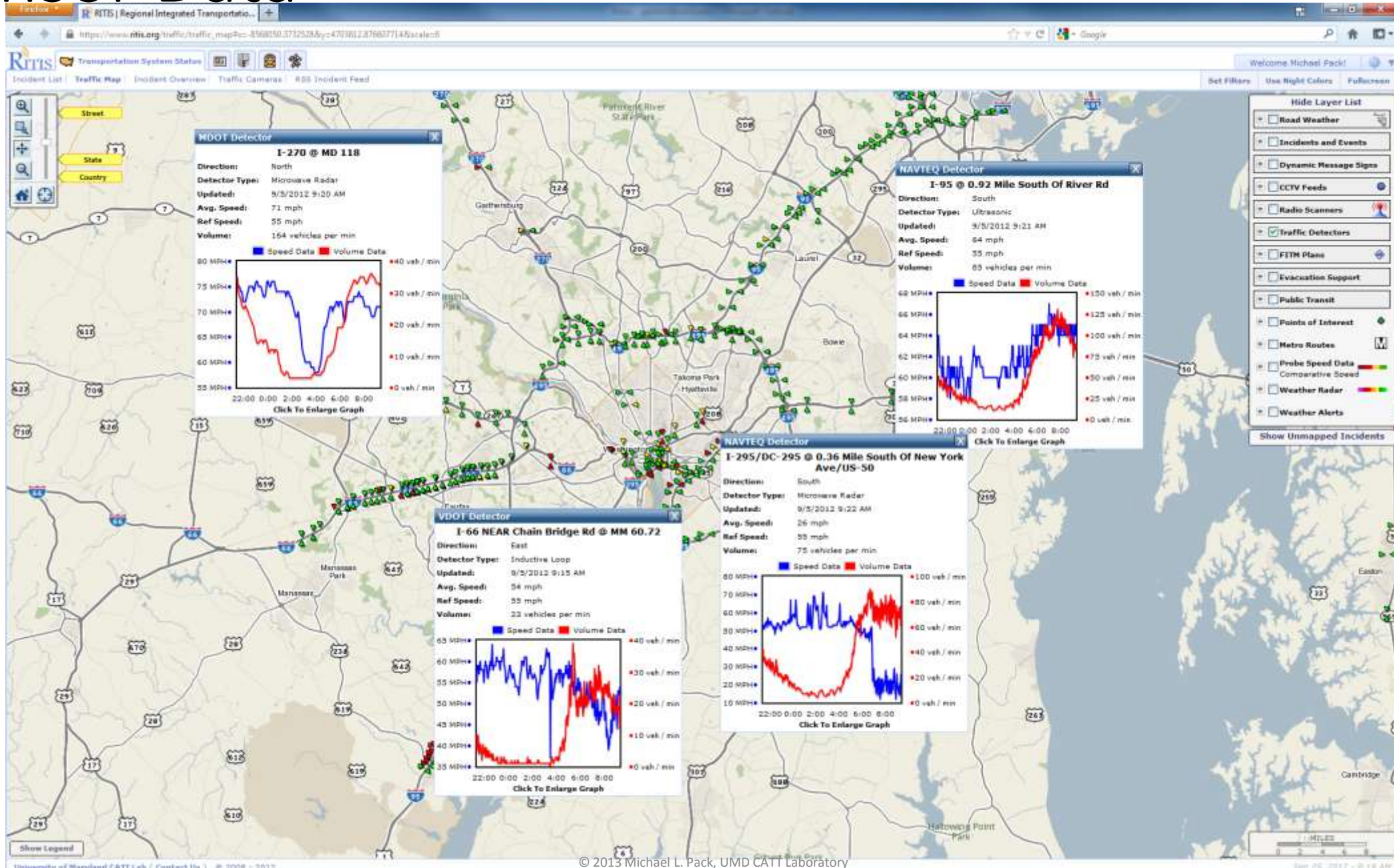
Road Weather Data



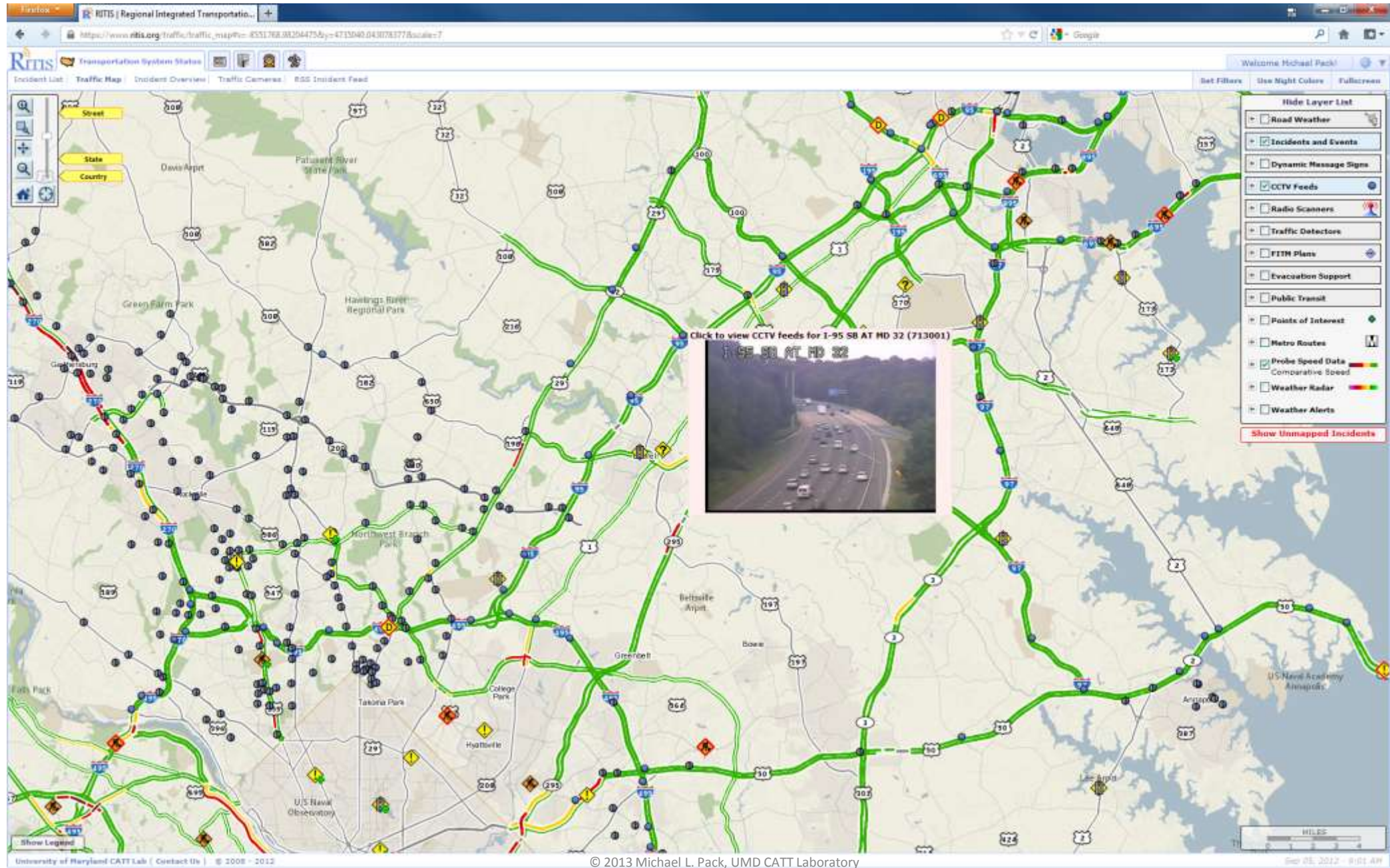
Radio/Scanners



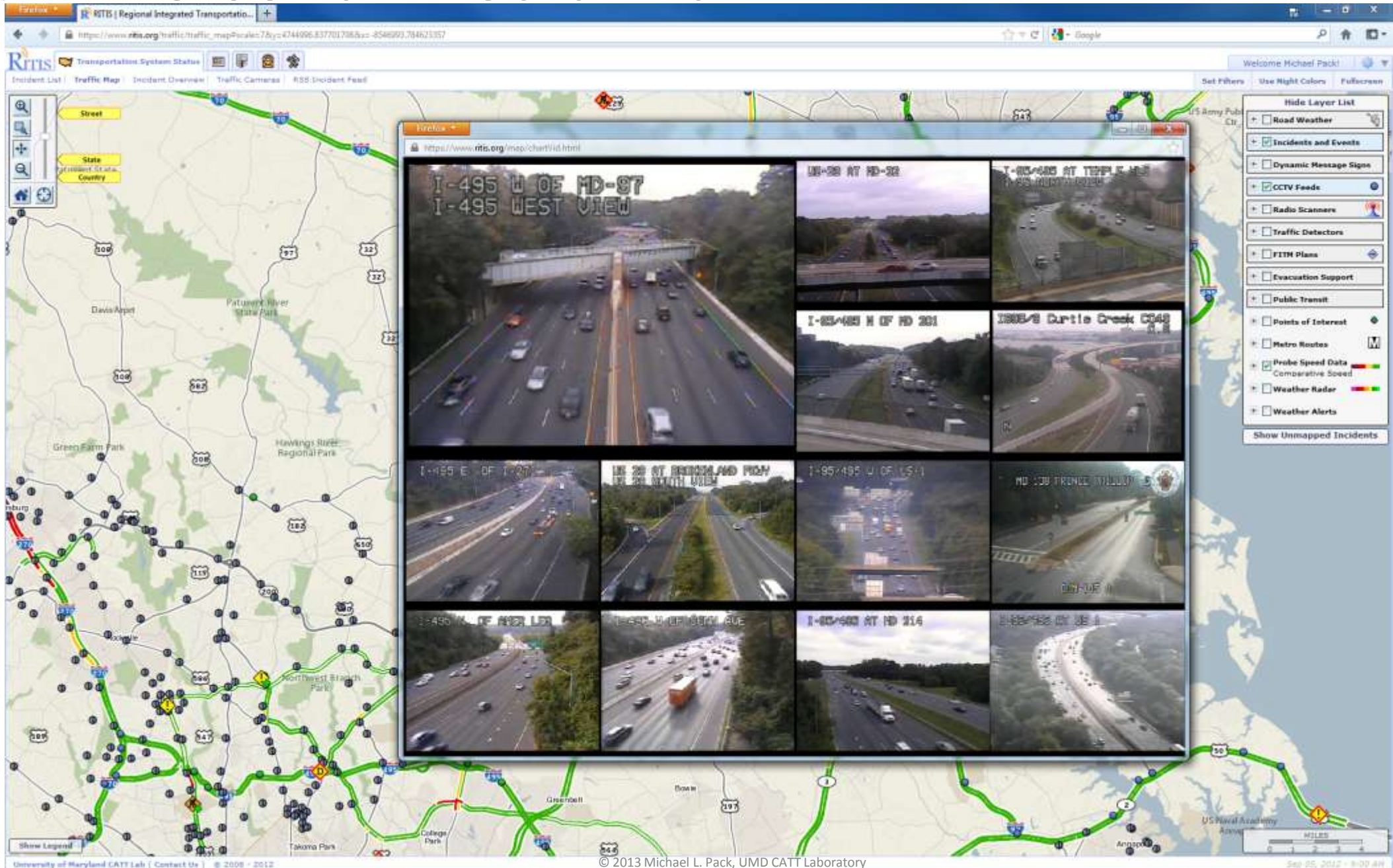
Sensor Data



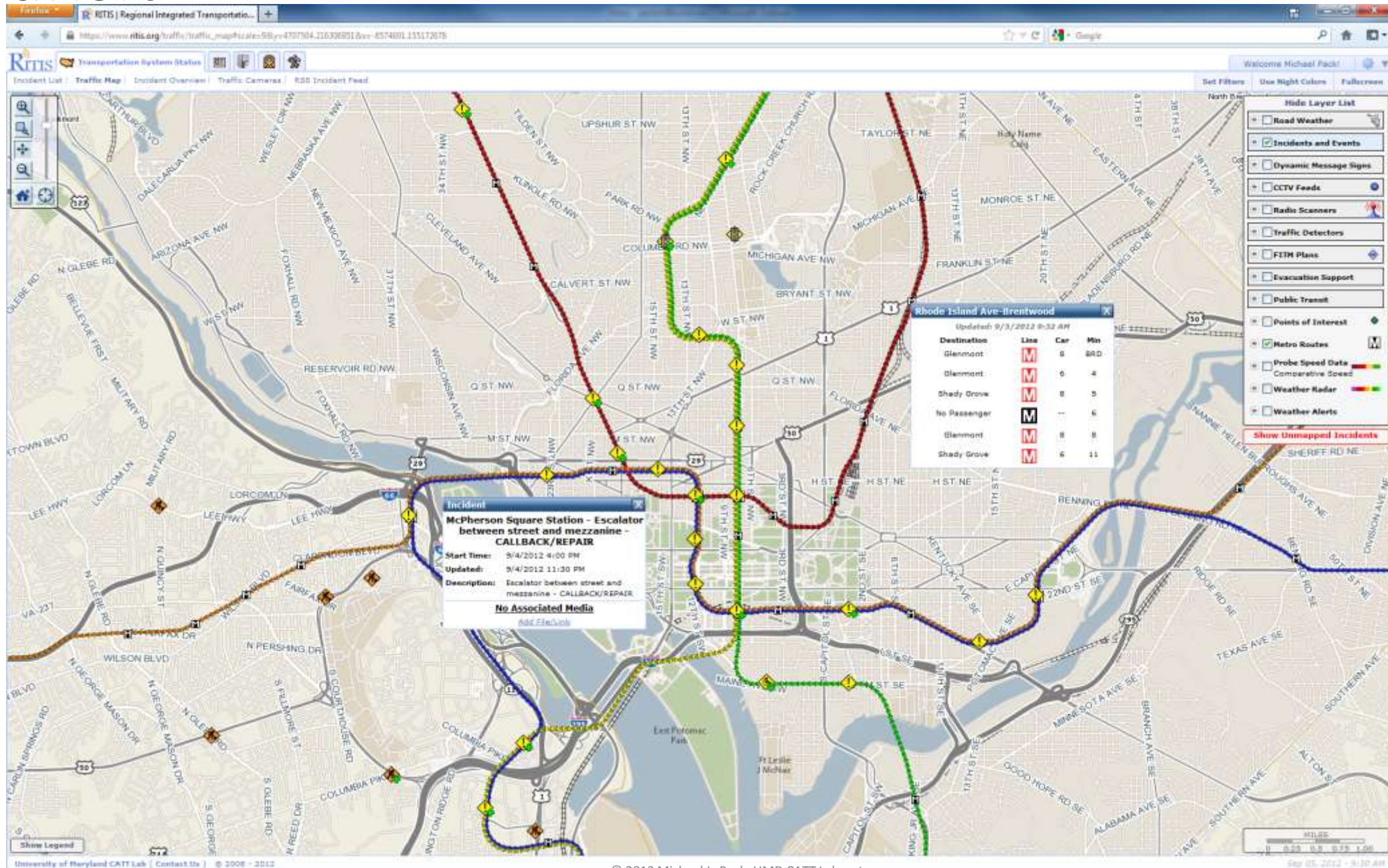
CCTV Overlay



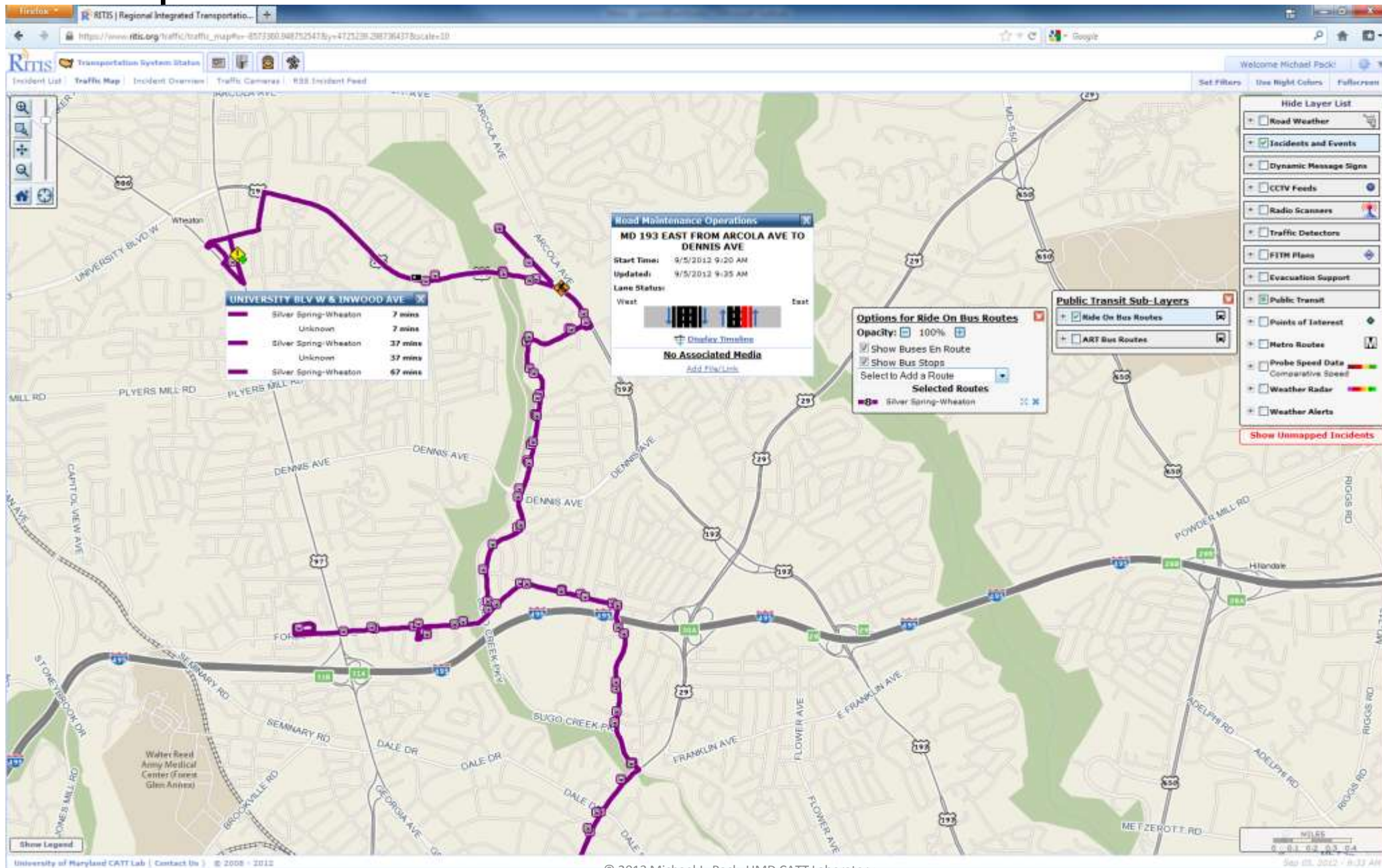
CCTV Personal Media Wall



Transit



Bus Stops & AVL



Virtual Weigh Stations

Virtual Weigh Station

Lock selection to newest vehicle



11:30:38 AM | Class 7



11:29:51 AM | Class 5



11:28:56 AM | Class 9



11:25:43 AM | Class 7

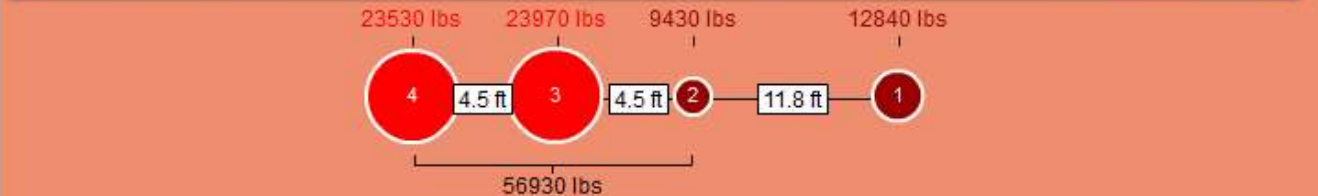


11:24:30 AM | Class 9

Over-weight axle
Over-weight bridge
Over-weight (tandems)

Class 7
Speed: 34.1 mph
Length: 21 ft
Gross: 69770 lbs

11:25:43 AM



Evacuation Data

Welcome Michael Pack!

Set Filters Use Night Colors Fullscreen



Hide Layer List

- ☐ Road Weather
- ☐ Incidents and Events
- ☐ Dynamic Message Signs
- ☐ CCTV Feeds
- ☐ Radio Scanners
- ☐ Traffic Detectors
- ☐ FITM Plans
- ☒ Evacuation Support
- ☐ Public Transit
- ☐ Points of Interest
- ☐ Metro Routes
- ☐ Probe Speed Data
Comparative Speed
- ☐ Weather Radar
- ☐ Weather Alerts

Evacuation Support Sub-Layers

- ☒ Staging Areas
- ☐ Comfort Station/Travel Services
- ☐ Public Shelters
- ☐ Hospitals
- ☐ Traffic Control Points
- ☐ Gov't Vehicle Fueling Stations
- ☐ Evacuation Routes

Show Unmapped Incidents




Staging Areas

RTIS | Regional Integrated Transportation Information System

Incident List | Traffic Map | Incident Overview | Traffic Cameras | RSS Incident Feed

Staging Area at Holy Family Anglican Church

MG-S72: MD 355 (Fredrick Rd) SB



MG-S72

Street

State

Country

Staging Area at Holy Family Anglican Church

Staging Area 2 of 3

PREV BACK TO LIST NEXT

Holy Family Anglican Church

26200 Frederick Rd

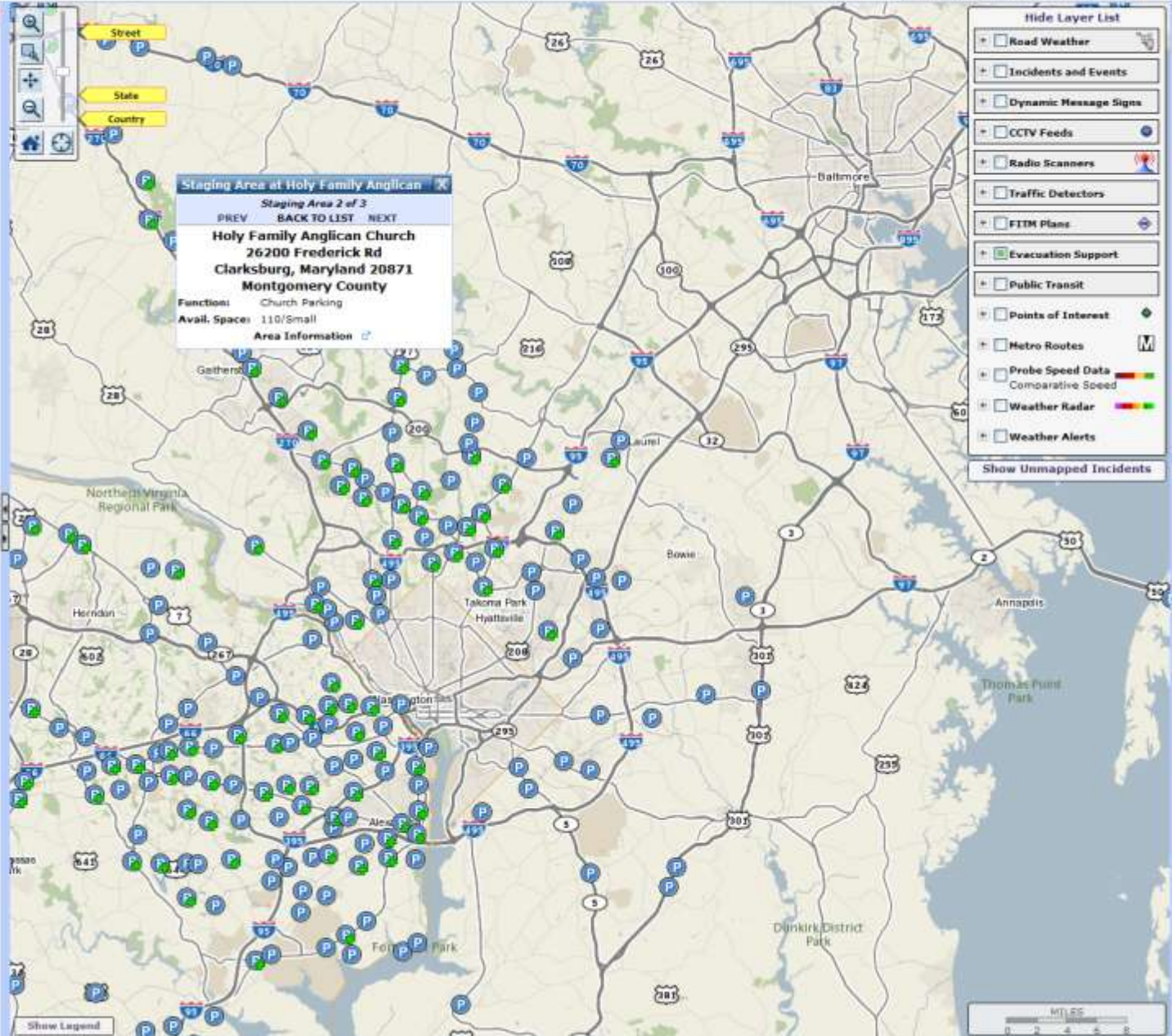
Clarksburg, Maryland 20871

Montgomery County

Function: Church Parking

Avail. Space: 110/Small

Area Information



Hide Layer List

☐ Road Weather

☐ Incidents and Events

☐ Dynamic Message Signs

☐ CCTV Feeds

☐ Radio Scanners

☐ Traffic Detectors

☐ FITM Plans

☒ Evacuation Support

☐ Public Transit

☐ Points of Interest

☐ Metro Routes

☐ Probe Speed Data

☐ Weather Radar

☐ Weather Alerts

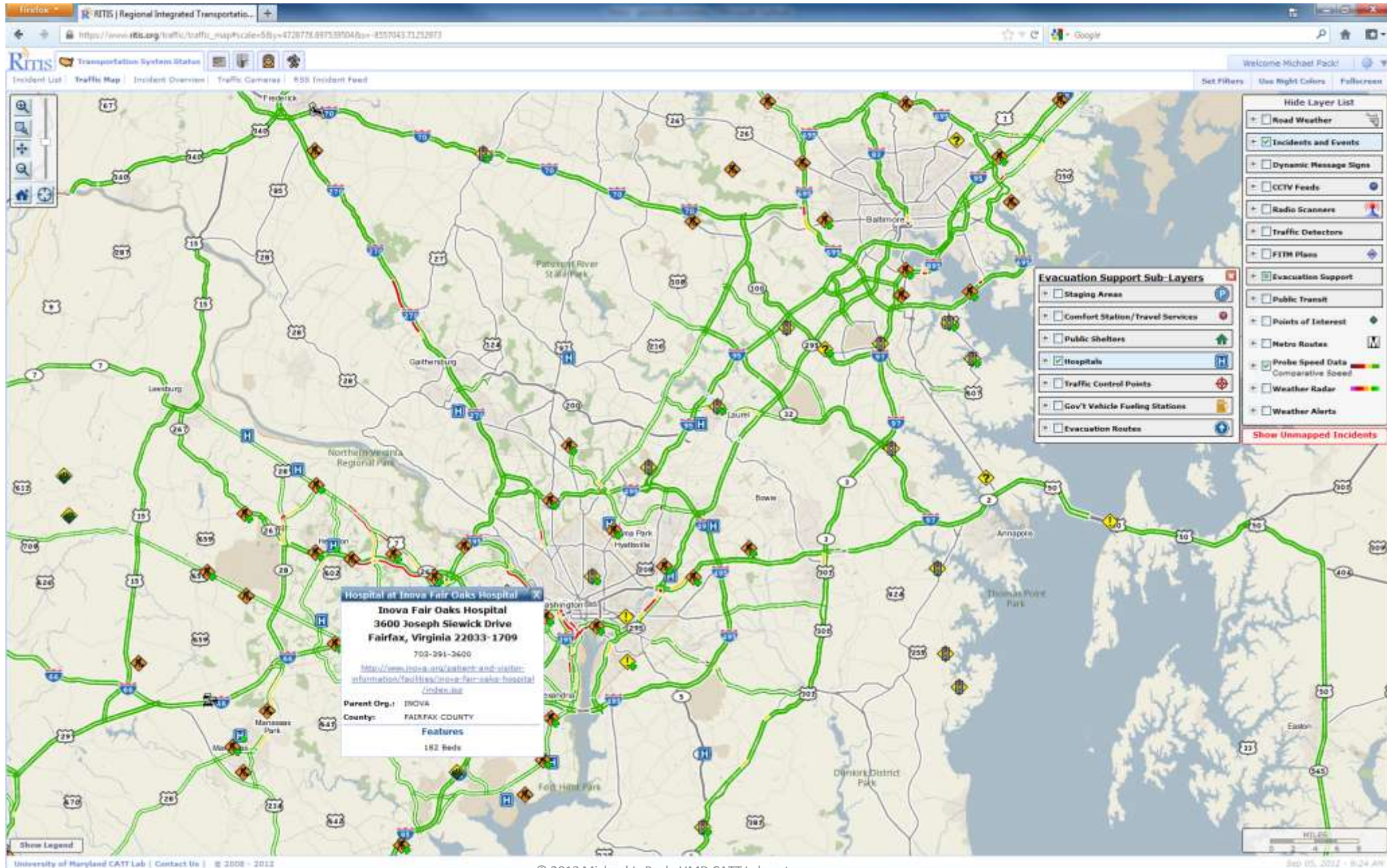
Show Unmapped Incidents

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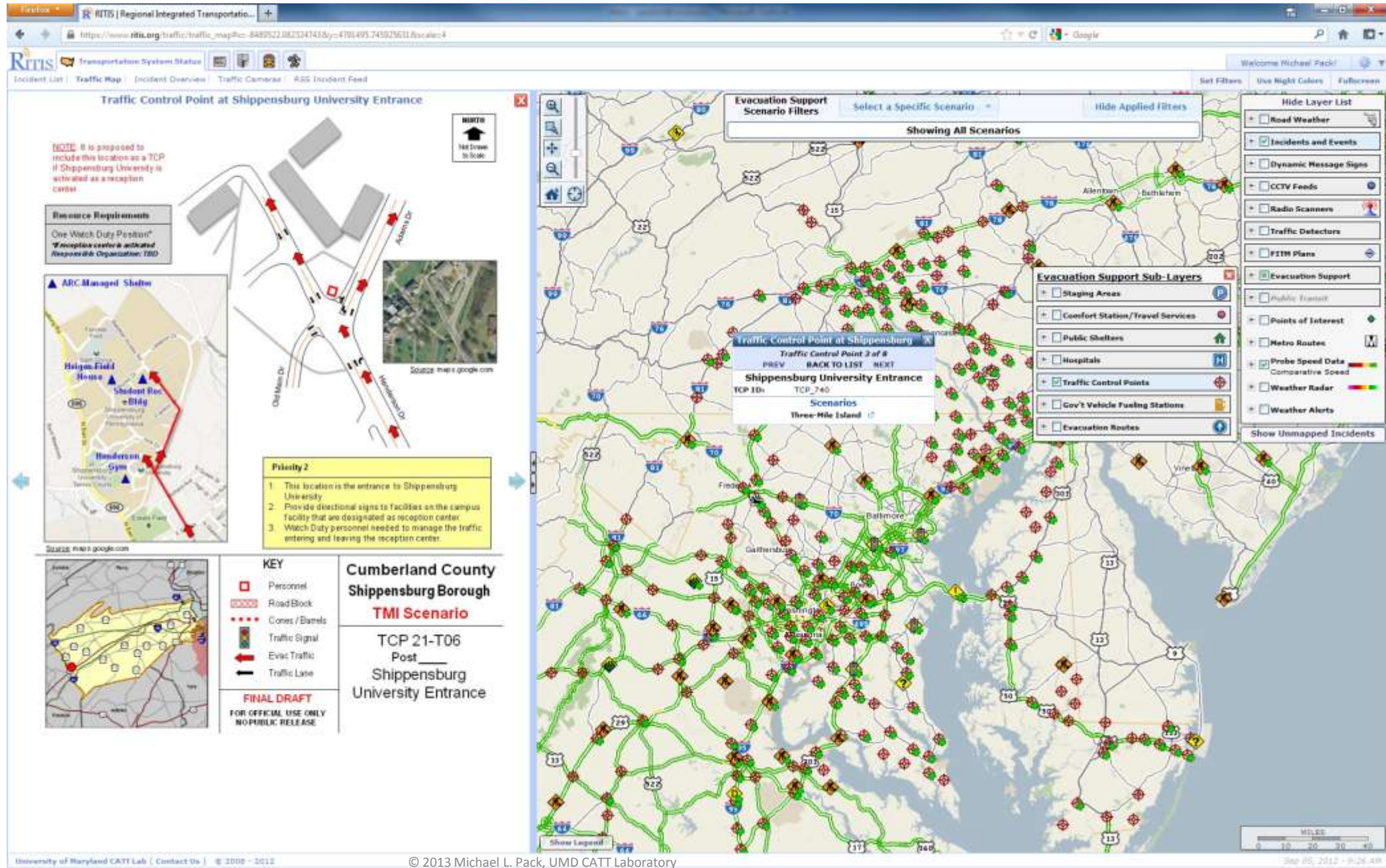
© 2013 Michael L. Pack, UMD CATT Laboratory

Sep 05, 2012 - 9:23 AM

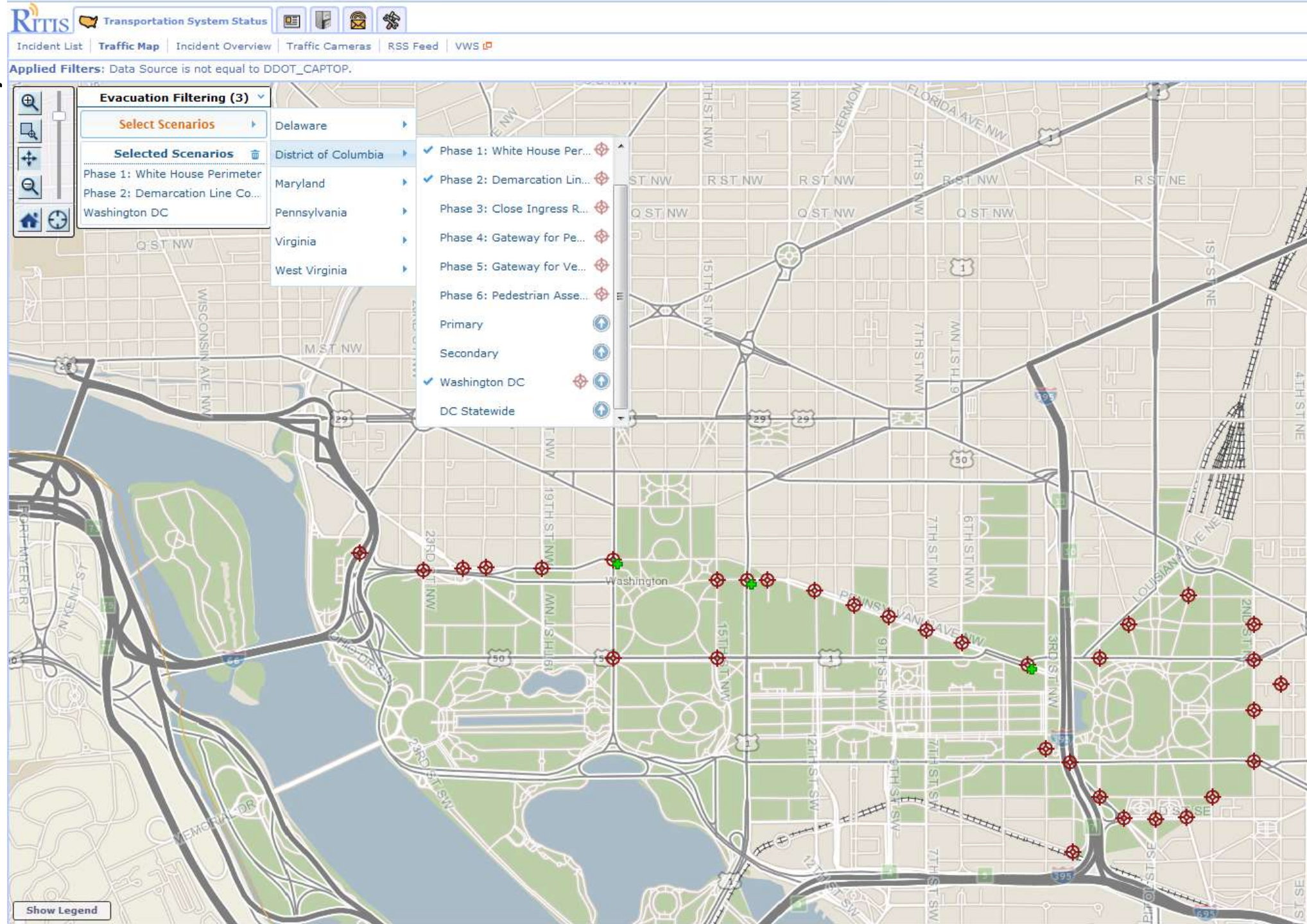
Hospitals & Beds



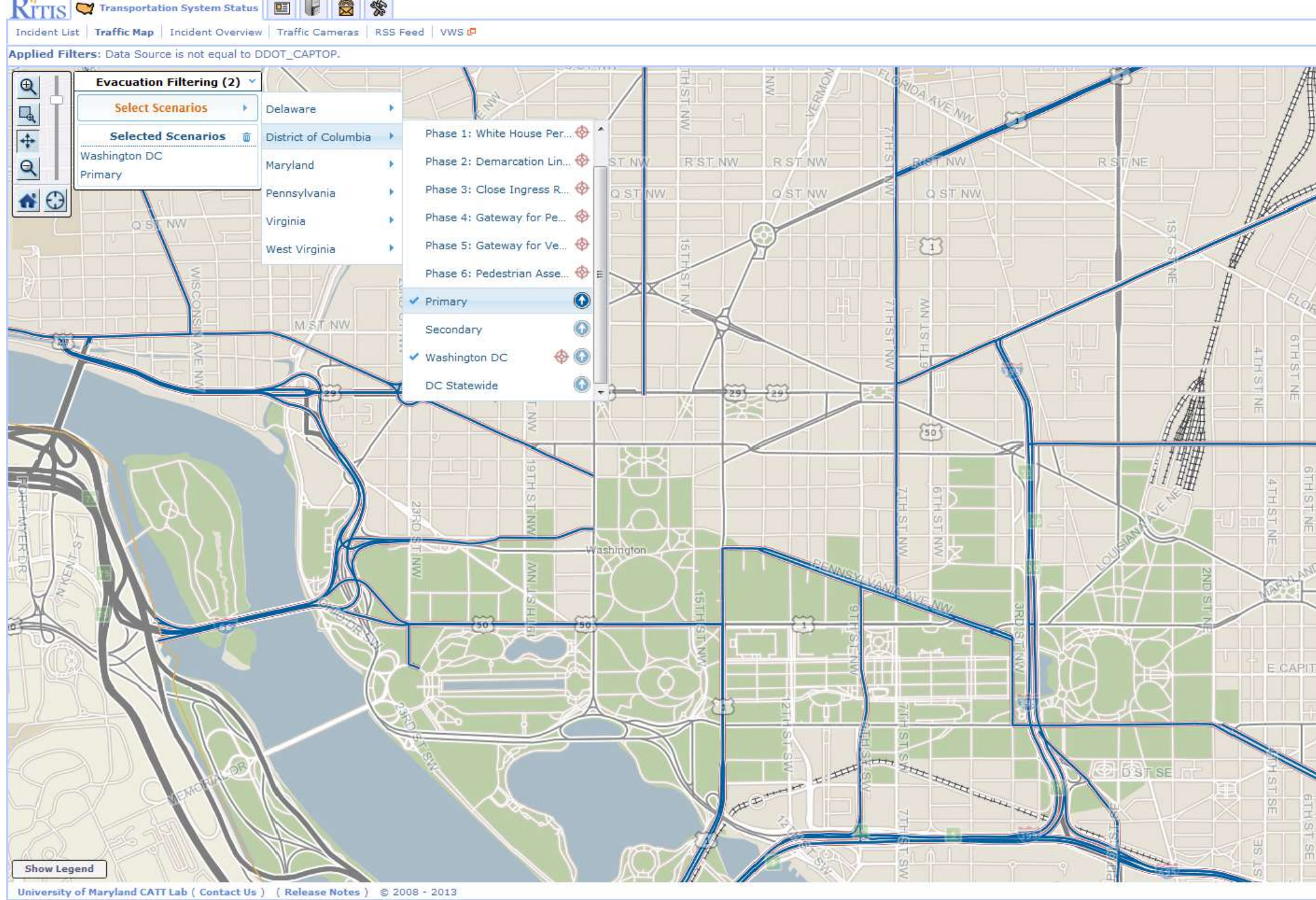
Traffic Control Points



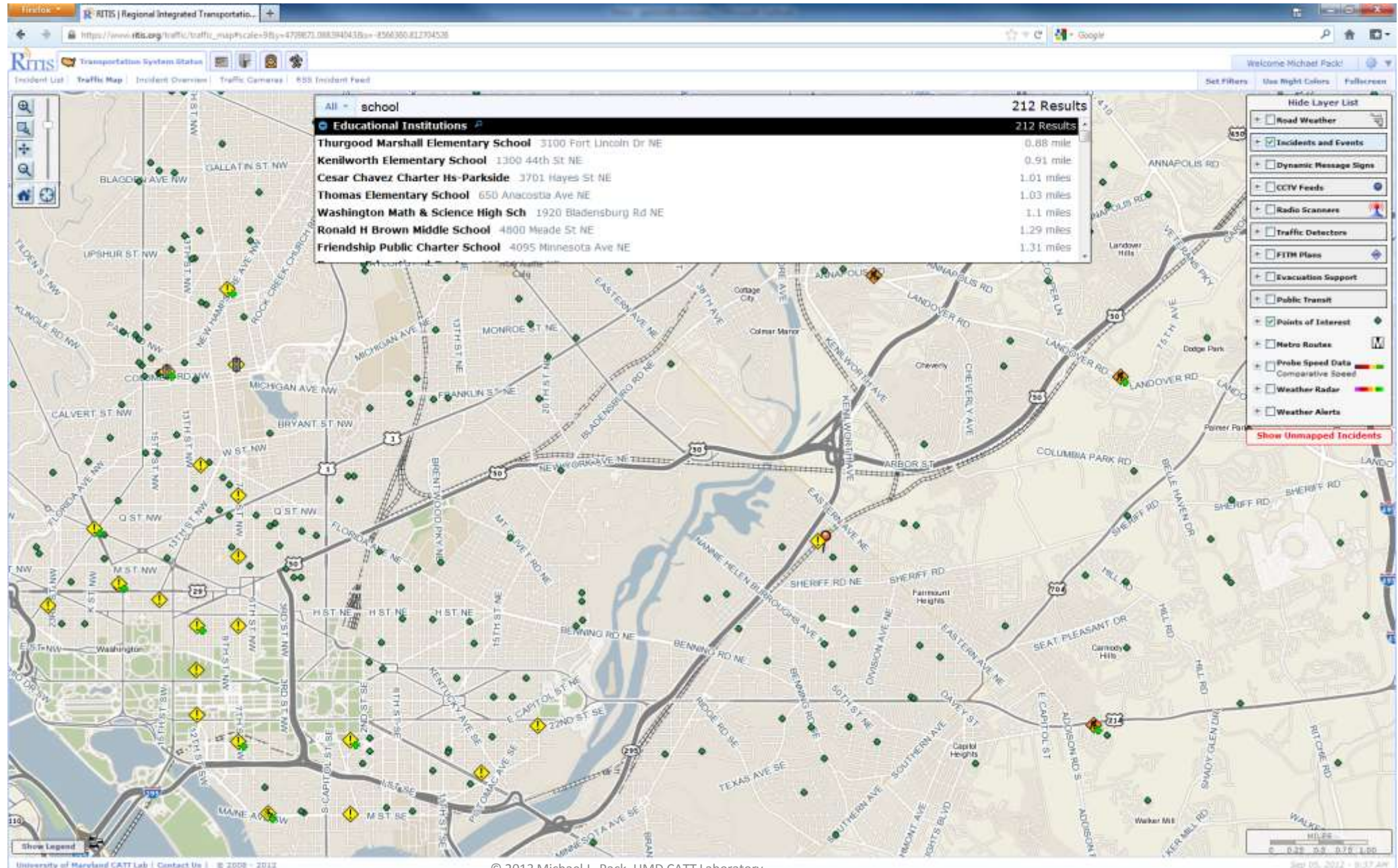
Filtering of Evacuation Data



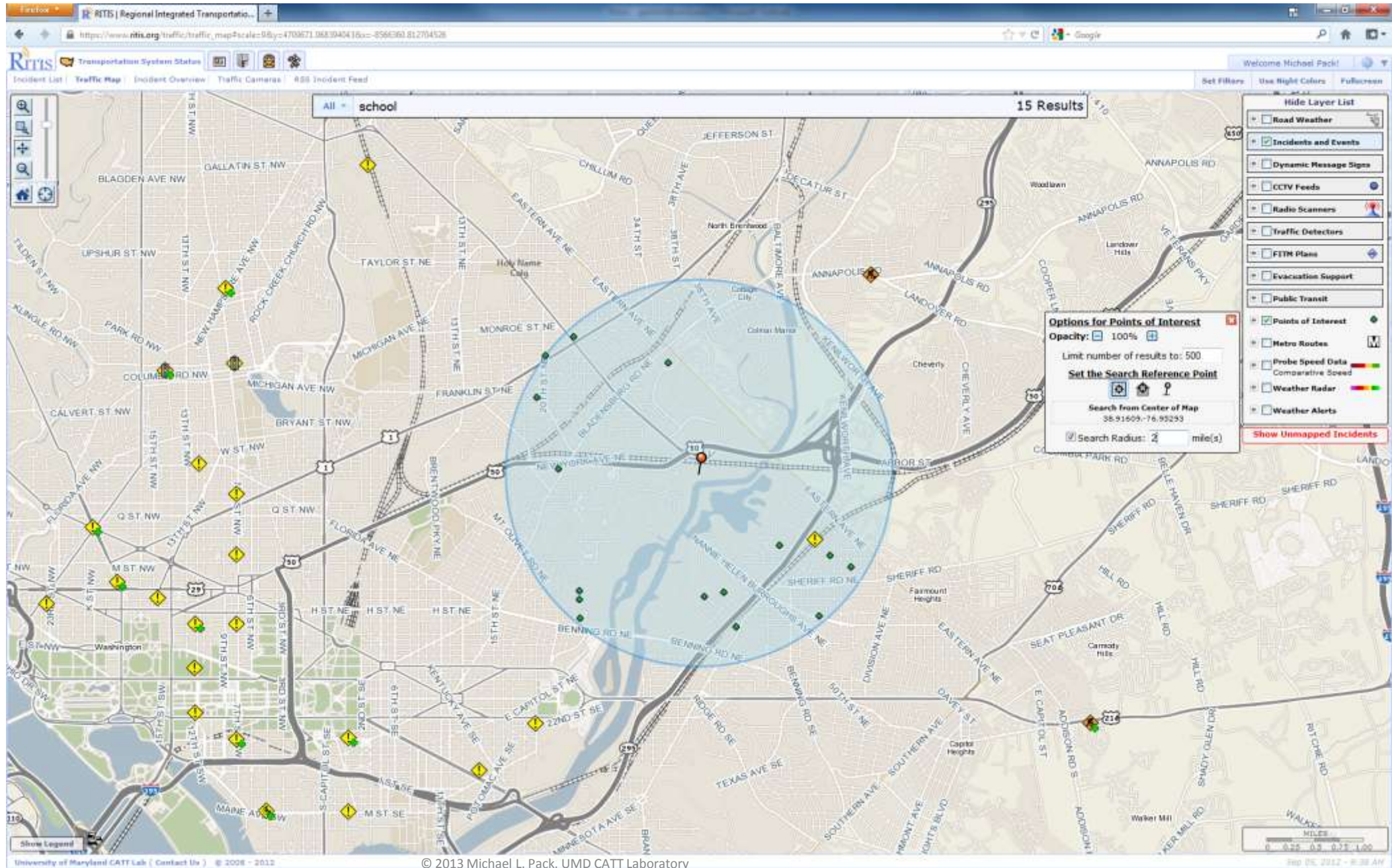
Routes



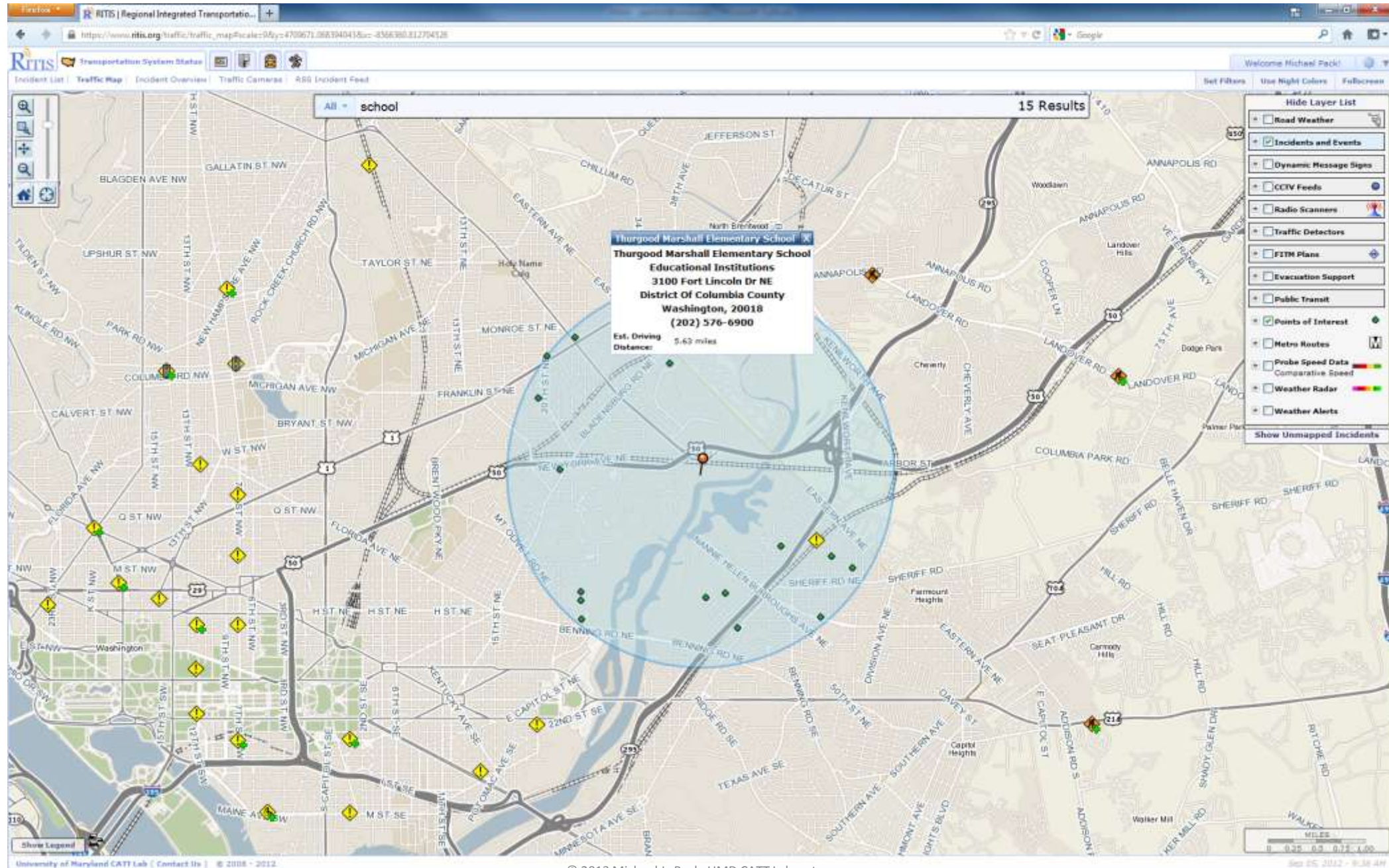
Who is affected?



Search within a radius



See Details of POI



Chat & File Sharing Functionality



Welcome Michael Pack!

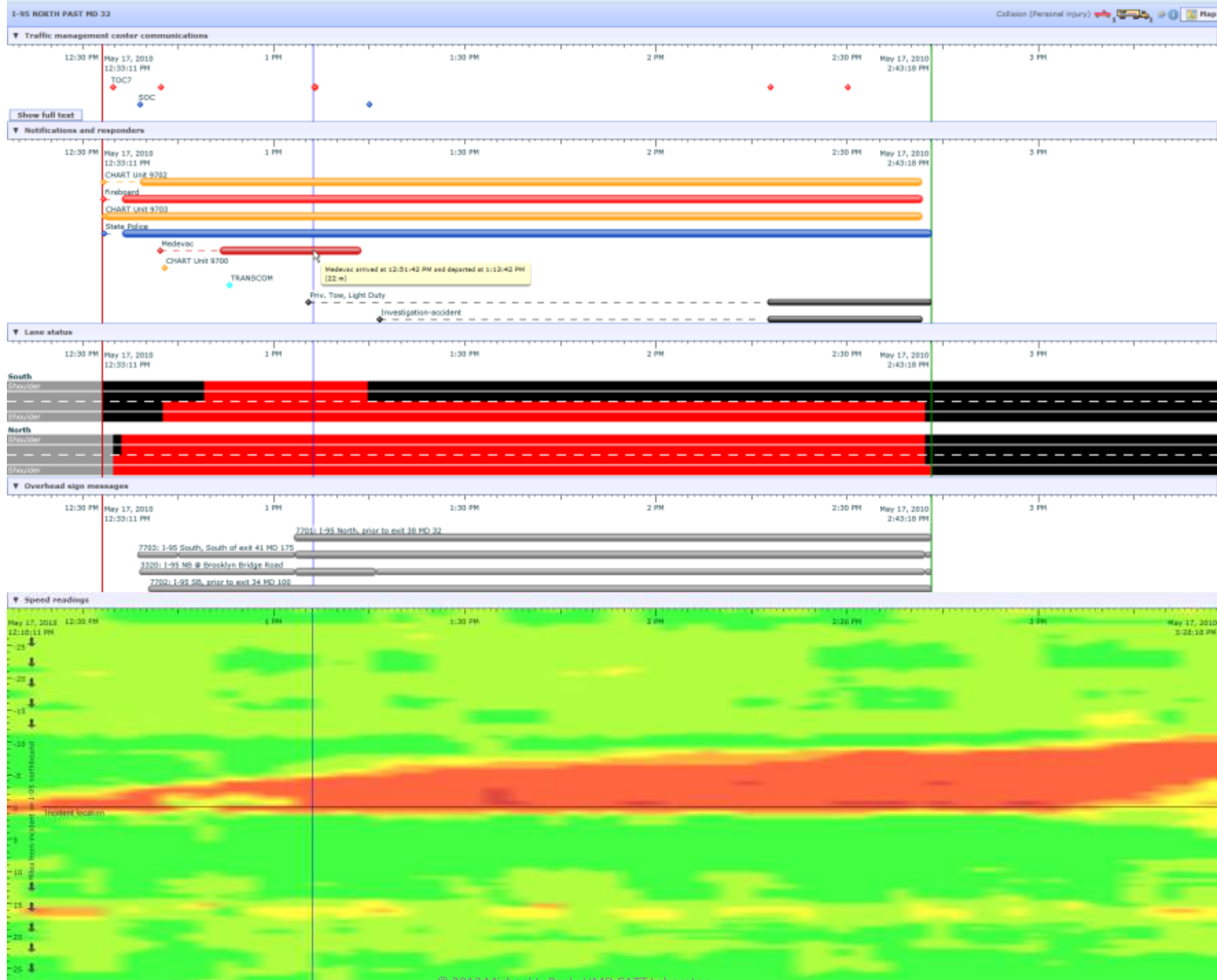
Set Filters Use Night Colors Fullscreen

Status | Room List | Sign Out

Search

- RITIS - DC HSEMA
 - bobby smith
- RITIS - DHS
 - FEMA NWC-NCR
- RITIS - FDOT Contractors
 - Kathryn Ortega
- RITIS - Federal Reserve Boa...
 - John Nash
- RITIS - JFHQ-NCR-NorthCom
 - William Hegedusich
- RITIS - Maryland State Poli...
 - Quindell Hudson
- RITIS - MATOC
 - MATOC Instructor
 - Valerie Weeks
 - William Truong
- RITIS - MD SHA
 - CHART GenericUser
 - Mohammed Raqib
- RITIS - MEMA or MIEMS
 - Jordan Nelms
- RITIS - Metric Engineering
 - Mark Askins
- RITIS - Montgomery County
 - Matthias Miziorko
- RITIS - pa.gov
 - Shawn Sanders
- RITIS - PRTC / OmniRide
 - Doris Chism
- RITIS - US Army
 - Kenneth Lyons
- RITIS - US DOT
 - Richard Jurey
- RITIS - VDOT
 - Nancy Jones
 - Tonya Vaughan

All conversations on RITIS Chat are logged.



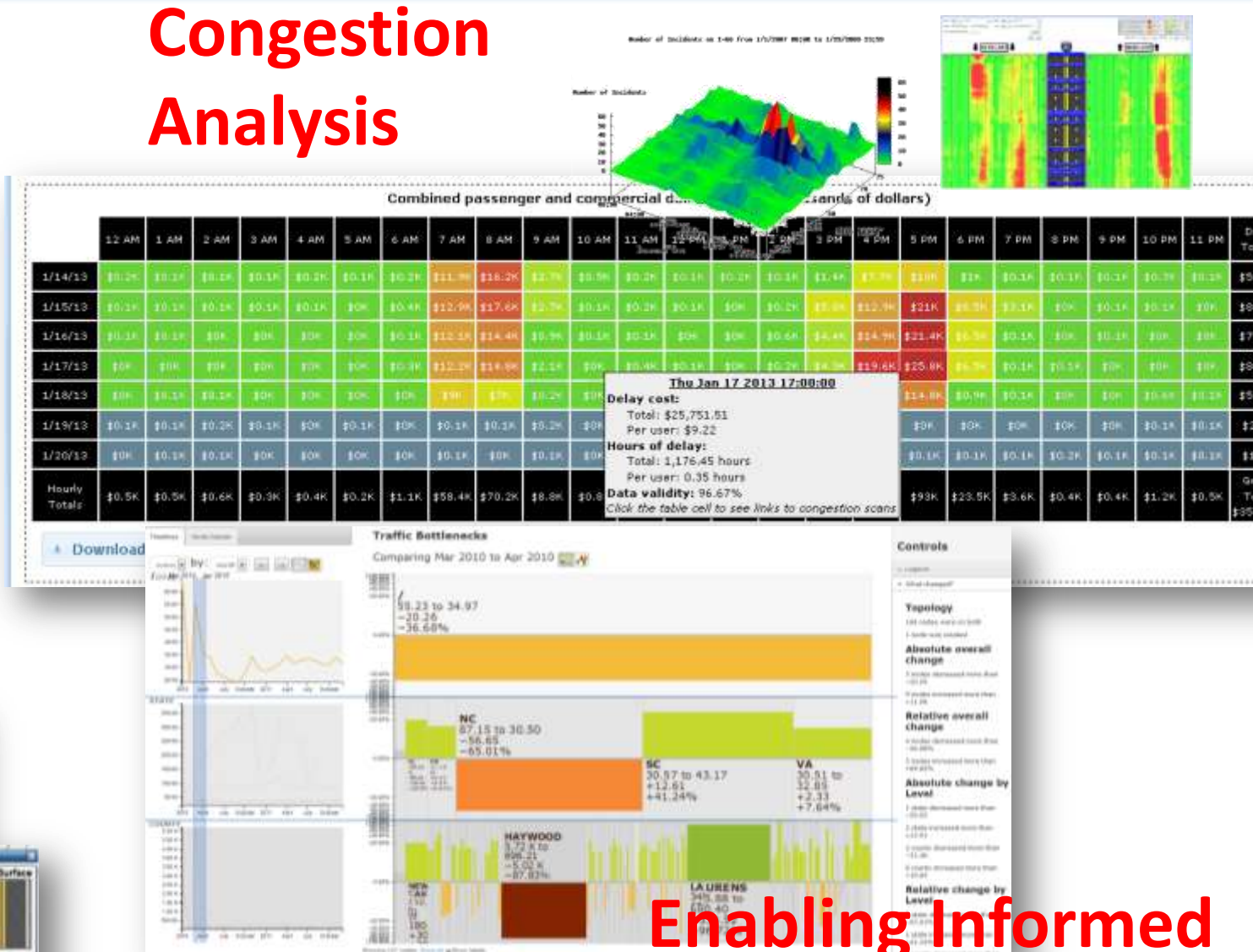
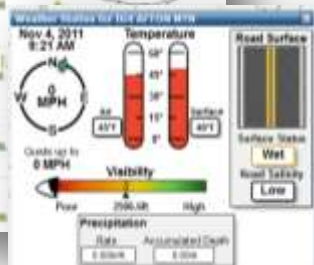
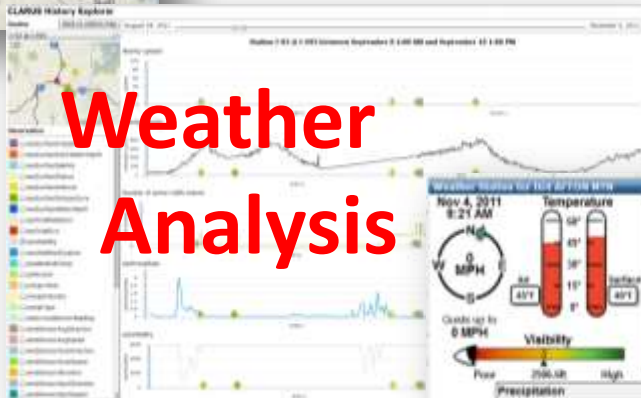
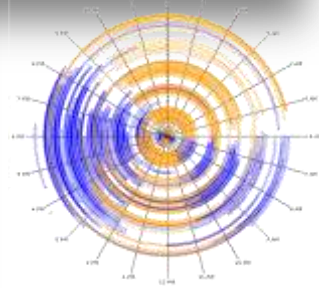
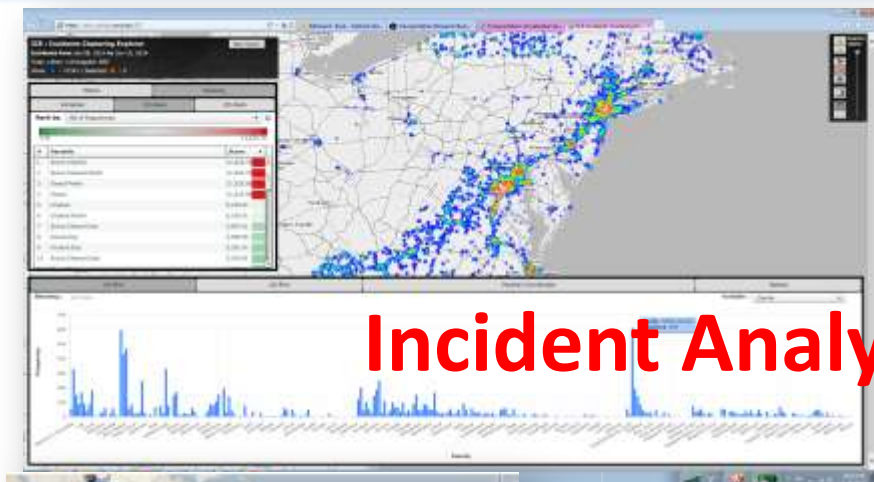
Our Growing Suite of Empowering Visual Analytics

Congestion Analysis

Incident Analysis

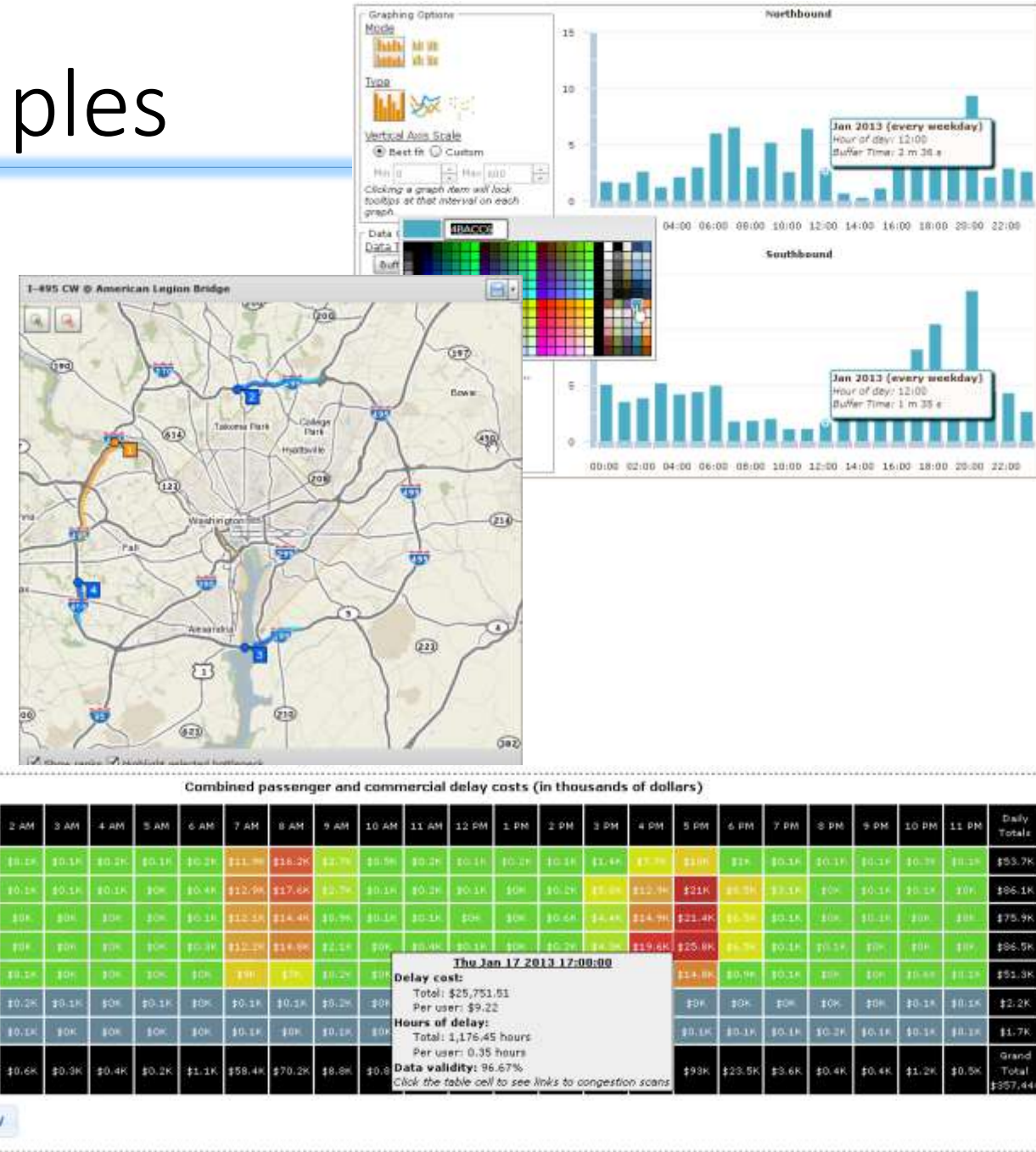
Weather Analysis

Enabling Informed Decision Making



Congestion Reporting Examples

- System Performance Reporting
- Problem Identification
- Project Prioritization
- After Action Incident Review
- Before & After Studies
- Operations
- Travel Time Analysis
- Work Zone Monitoring



Winter Weather Worries

- Snowmageddon 2011. There's been a request from the Governor's office to produce some examples that depict how bad traffic was during the January 26th, 2011 snow storm compared to normal weekday traffic. What can you show in just a few minutes?

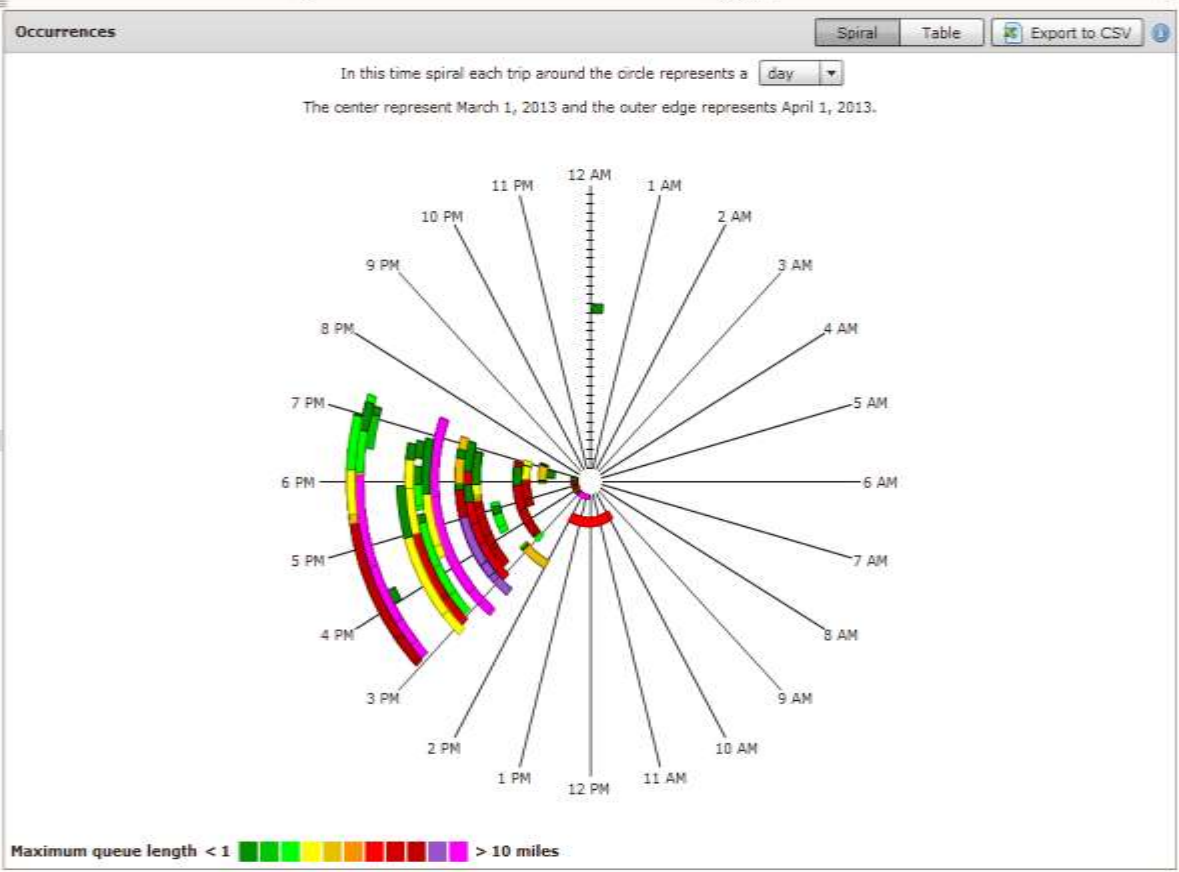
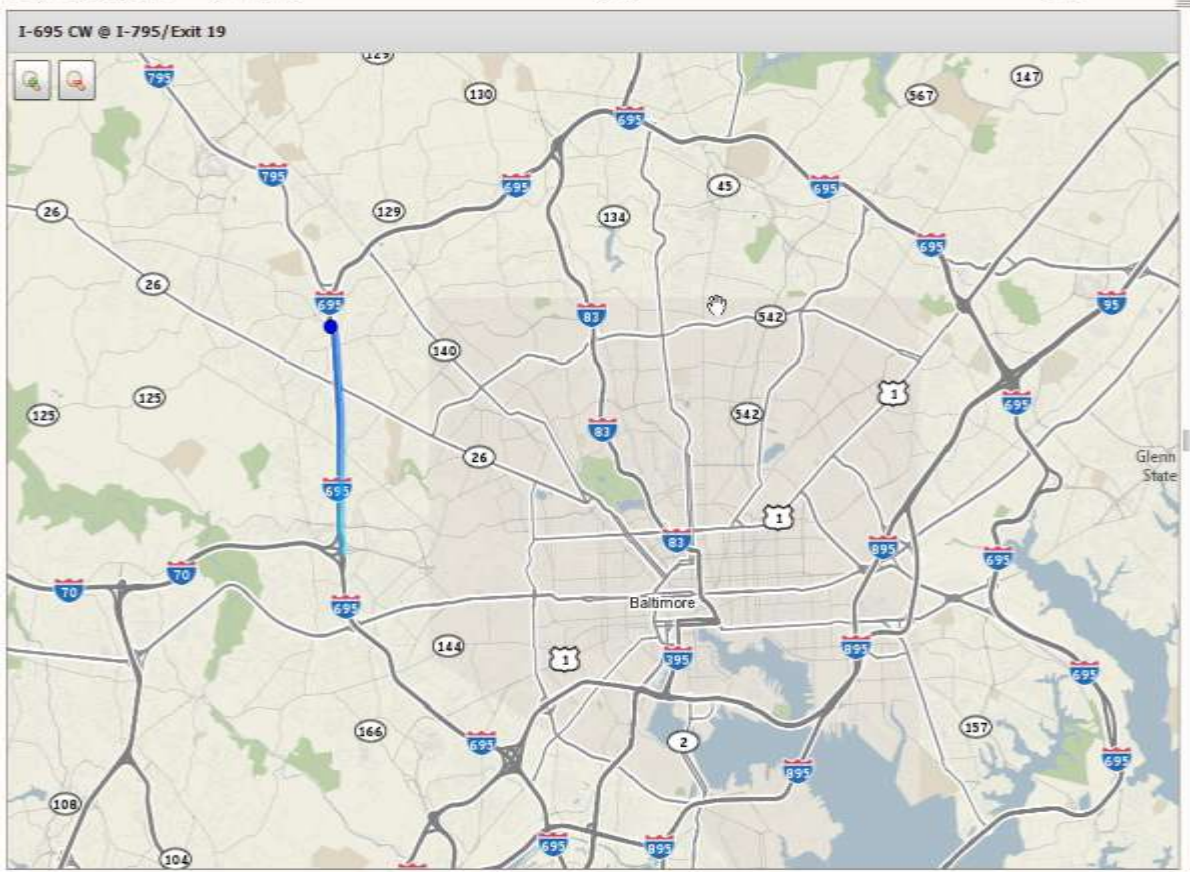
Statewide Reporting

- You've been asked to provide a monthly state-wide congestion report to the Secretary. This report only needs to cover the interstates, but it needs to highlight where the worst congestion occurred (top 10 locations) and some basic stats about the severity of the congestion at each of these locations. You also need to let the Secretary know if the congestion is about the same, better, or worse than the previous 2-weeks. What do you do?

Bottleneck Ranking

New search Bottleneck locations on Maryland Interstates between March 1, 2013 and March 31, 2013 (702 total) Export to CSV

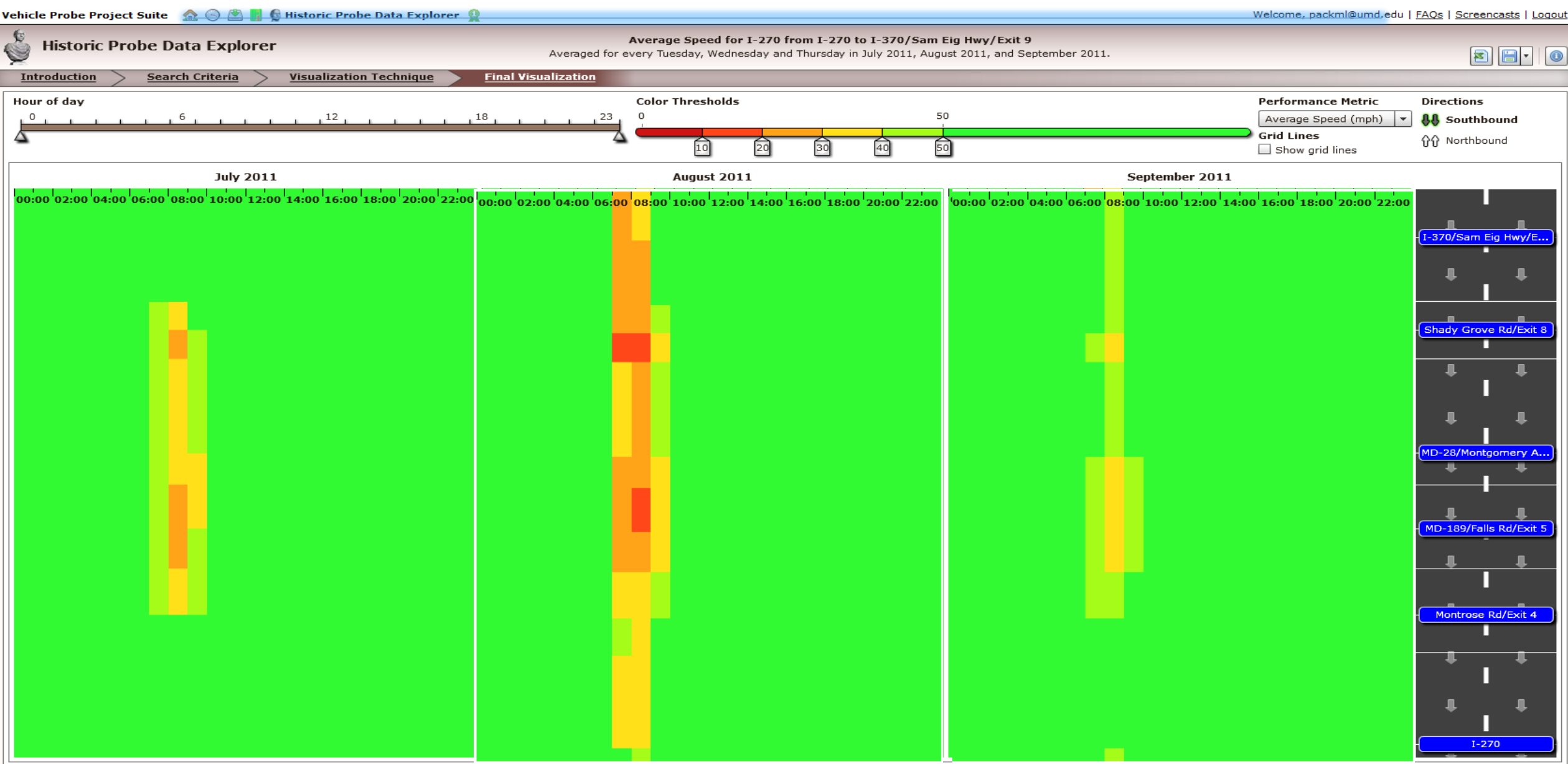
Location	Average duration	Average max length (miles)	Occurrences	Impact factor
I-95 N @ MD-100/Exit 43	2 h 6 m	10.74	39	52,769
I-495 CCW @ MD-185/Connecticut Ave/Exit 33	2 h 33 m	8.07	32	39,499
I-695 CCW @ MD-144/Frederick Rd/Exit 13	1 h 51 m	16.55	19	34,898
I-695 CW @ MD-147/Harford Rd/Exit 31	2 h 25 m	9.73	24	33,852
I-695 CW @ I-795/Exit 19	2 h 5 m	5.37	49	32,893
I-270 N @ I-70/US-40	1 h 29 m	8.71	40	31,009
I-270 N @ Middlebrook Rd/Exit 13	1 h 43 m	6.77	43	29,964



I just spend \$200M, and all I got was this...

- You just spent \$200M on a 6-month major road widening project along that corridor you (and everybody else) hate. Some commuters are now complaining that things haven't improved---in fact, they claim things have gotten worse. You can see the headlines now: "\$200M fattens road, shrinks commuter patience!"
- What can you produce to show the true impact of this recent investment (positive or negative).

Answer #1: better or worse?



Public Consumption

Total Cost														
	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Daily Totals
8/29/13	\$0.7K	\$1.4K	\$3.1K	\$40.3K	\$103.2K	\$195.2K	\$211.9K	\$171.7K	\$62.5K	\$3.7K	\$1.7K	\$3.6K	\$1.3K	\$1,004K
8/30/13	\$6.3K	\$7.1K	\$24.4K	\$86.2K	\$277.1K	\$228.8K	\$111.8K	\$14.8K	\$1.4K	\$4.2K	\$7.2K	\$4.7K	\$2.2K	\$873.1K
8/31/13	\$20.1K	\$12.8K	\$70.2K	\$2.4K	\$1K						\$3.4K	\$3.2K	\$1.8K	\$174.5K
9/01/13	\$2.1K	\$2.1K	\$1.8K	\$3.5K	\$3K						\$2.4K	\$2.3K	\$2.1K	\$47.2K
9/02/13	\$1.3K	\$2.1K	\$1.5K	\$1.9K	\$3.3K						\$1.8K	\$2K	\$1.1K	\$53.3K
9/03/13	\$1K	\$2K	\$1.3K	\$11.3K	\$183.5K						\$8.8K	\$7.4K	\$3.3K	\$1,092.8K
Hourly Totals	\$31.6K	\$27.5K	\$102.2K	\$145.7K	\$571K						\$25.3K	\$23.1K	\$11.9K	Grand Total \$3,244,788.26


Friday, August 30, 2013 3:00 PM

Delay cost:
Total: \$277,124.39
Per vehicle: \$35.54
Per person: \$29.93

Hours of delay:
Person-hours: 8,788.94 hours
Vehicle-hours: 7,401.21 hours
Per vehicle: 0.95 hours

Volume:
Passenger: 5145 vph
Commercial: 1715 vph

Data validity: 100.00%
Click the table cell to see links to congestion scans

 **Exp**

Usage Statistics & Growth Plans

- 4000+ Website Users
- Hundreds of active feed subscribers (both public & private sector)
- 50% Transportation
- 50% “Other” – **This is VERY Important!!!**
- 25 State DOTs
- 300+ Agencies & Private Sector Providers
- Over 1-Trillion Records Downloaded in 6-months

Users Include:

- DOTs (Federal, State, and Local)
- Transit Providers
- Metropolitan Planning Organizations
- Emergency Management Agencies
- FEMA
- US Army, Air Force, Navy, Coast Guard
- NorthCom
- U.S. Secret Service
- U.S. Capitol & Park Police
- Fire & Rescue
- Law Enforcement (state & local)
- U.S. Joint Forces Headquarters
- NSA
- US Office of Personnel Management
- 3rd Party Trav Info Providers
- University Researchers
- Consultants working on projects for the DOTs
- Social Security
- Pentagon Force Protection
- Etc.

Thank you!

- Michael L. Pack
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301.405.0722

