

The background is a long-exposure photograph of a multi-lane highway at night. Light trails from vehicles create streaks of white and red across the road. Overlaid on the image is a network of lines connecting various points, with some lines highlighted in green and blue. The scene is illuminated by streetlights, which appear as bright starbursts.

# NPMRDS for Transportation Planning:

*Web-based Analysis and Reporting Tools for  
NYSDOT and NYS MPOs*





*Albany Visualization And Informatics Lab (AVAIL)  
Lewis Mumford Center  
University at Albany, SUNY*



# Web-based Open Source Data Science Research Tools

Open Sourcing the research products allows multiple teams to customize the software interface, develop new tools, and build upon legacy research





# Web-Based Reliability Tools using NPMRDS

## Project Partners:



University Transportation  
Research Center (UTRC)



New York State  
Department of Transportation

NYSDOT



NYSAMPO



## The NPMRDS Dashboard for NYSDOT and NYSAMPO Member Agencies

NPMRDS

Home

Measures

Routes

Networks

Bottlenecks

Reports

Account

Signout

Home

Welcome

Get started

Create A Custom Route

Use route creation tool to create routes for analysis

Create A Route

Design A Report

Use route comparison tool to create custom report

Create A Report

View Performance Measures

See custom reports on Map-21 performance measures

View Measures

Analyze Bottlenecks

View and analyze bottleneck locations

View Bottlenecks







**Albany Visualization and Informatics Lab**

Web-based Traffic Data Analytics Platforms Tailored to your Agency

## **Leveraging NPMRDS for uses beyond FHWA performance measurement requirements**

- **Corridor Analysis**
- **Network Analysis**
- **Bottleneck Identification**
- **Project Prioritization**
- **Post-Project Analysis**
- **Incident Post-mortem Analysis**





## **NPMRDS = National Performance Measurement Research Dataset**

- **NPMRDS is an aggregated dataset made by the company HERE until Feb 2017, now aggregated by INRIX.**
- **Provided by FHWA**
- **Based on passenger probe data obtained from a number of sources, including mobile phones, vehicles, and portable navigation devices, gathered in 5 minute intervals**
- **Organized spatially by Traffic Messaging Channel (TMC)**
- **There are 16,263 unique TMCs in NY State**
- **The subset being examined contains 441,000,000 Data Points**





## NPMRDS Data Structure Very Simple // Very Large

**Query Results** 11:07am, 17 Jun 2015

Row	tmc	date	epoch	travel_time_all	travel_time_passenger	travel_time_truck	weekday	
1	120P05874	20141219	232	185	185	0	friday	
2	120P05874	20141220	143	201	201	210	saturday	
3	120P05874	20141220	188	187	186	210	saturday	
4	120P05874	20141220	233	200	196	224	saturday	
5	120P05874	20141220	278	221	0	221	saturday	
6	120P05874	20141211	135	209	204	213	thursday	
7	120P05874	20141211	180	204	204	0	thursday	
8	120P05874	20141211	225	272	235	286	thursday	
9	120P05874	20141211	270	183	183	0	thursday	
10	120P05874	20141212	74	209	209	0	friday	
11	120P05874	20141212	119	205	200	221	friday	
12	120P05874	20141212	164	210	207	221	friday	

[First](#) [< Prev](#) Rows 1-12 of 100 [Next >](#) [Last](#)







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## Source of NPMRDS Probe Speed Data

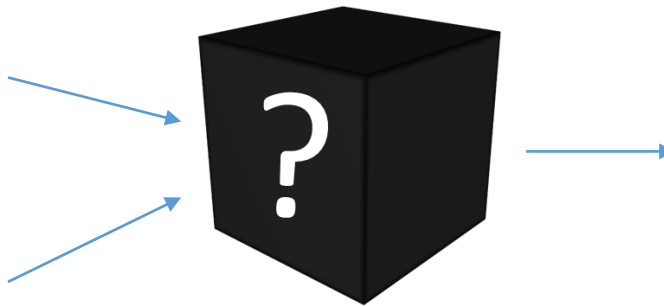
- GPS
- Phone





Raw Probe Data

## Black Box Processing



HERE - 2014-2016  
INRIX - 2017 -

Query Results 11:07am, 17 Jun 2015

Row	tmc	date	epoch	travel_time_all	travel_time_passenger	travel_time_truck	weekday
1	120P05874	20141219	232	185	185	0	friday
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First < Prev Rows 1-12 of 100 Next > Last

NPMRDS Data

## Data Quality?







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## Data Quality

### Multi-Temporal Resolution: 5 Minute (raw) → Yearly Averages

- To mitigate data quality issues, the AVAIL Tool Suite uses daily, monthly, and yearly averages as well as historic speed distributions
- AVAIL Calculates number of Epochs in a sample and % of total Epochs in a sample





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## **Multi-Temporal Resolution: 5 Minute (raw) → Yearly Averages**

- **Allows for comparisons at various temporal resolutions for customizable examinations.**
  - **Compare a day to the yearly average day**

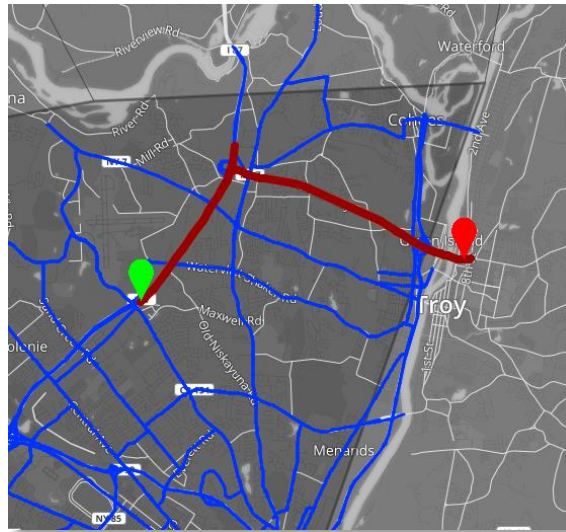
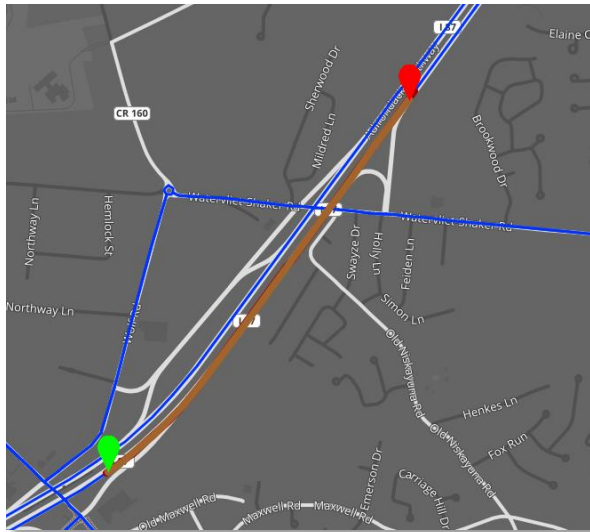






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## Multi-Geographic Resolution: TMC/Route/Multi-Route Corridor/Network



**Creation and editing tools make your geographies fully  
customizable**





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Web-based Traffic Data Analytics Platforms Tailored to your Agency

**Possible Uses of the Web-based Tool Suite Include:**  
Project Prioritization, Performance Measurement, Corridor Analysis,  
Bottleneck Analysis, Post-project / Post-incident Analysis

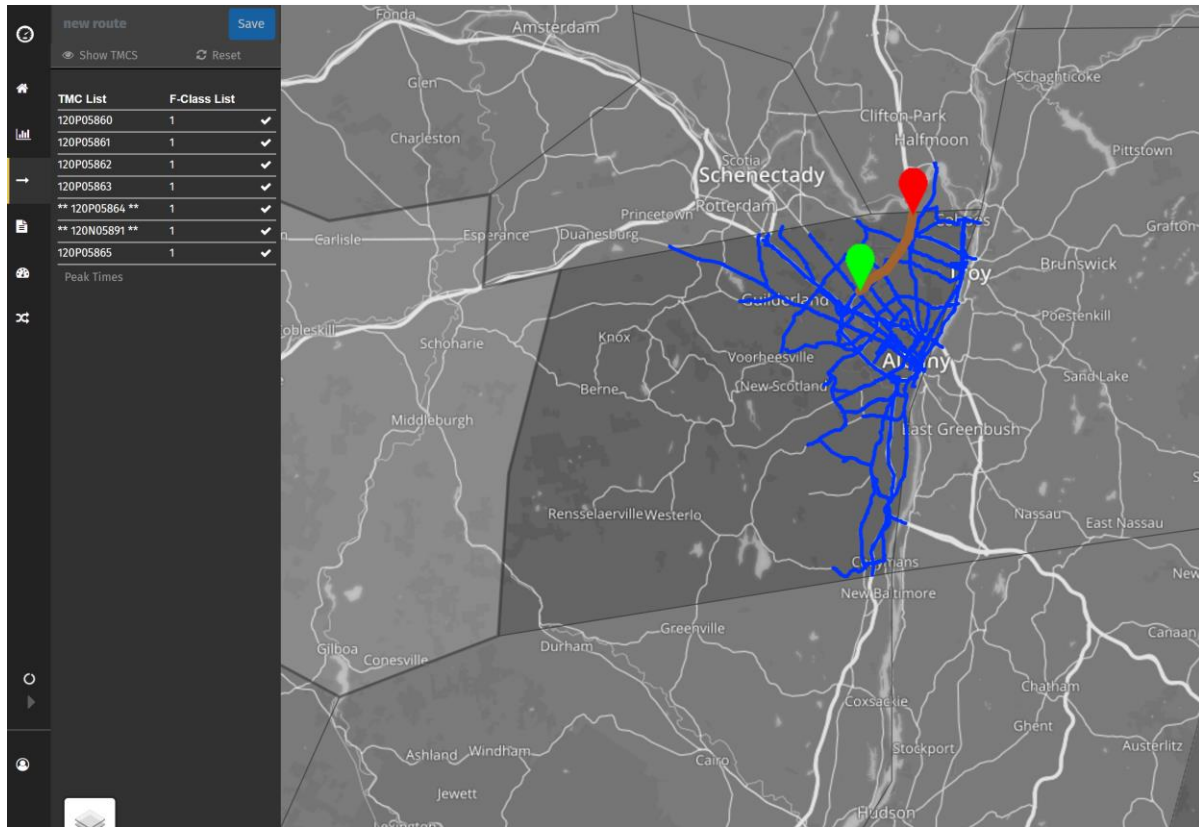






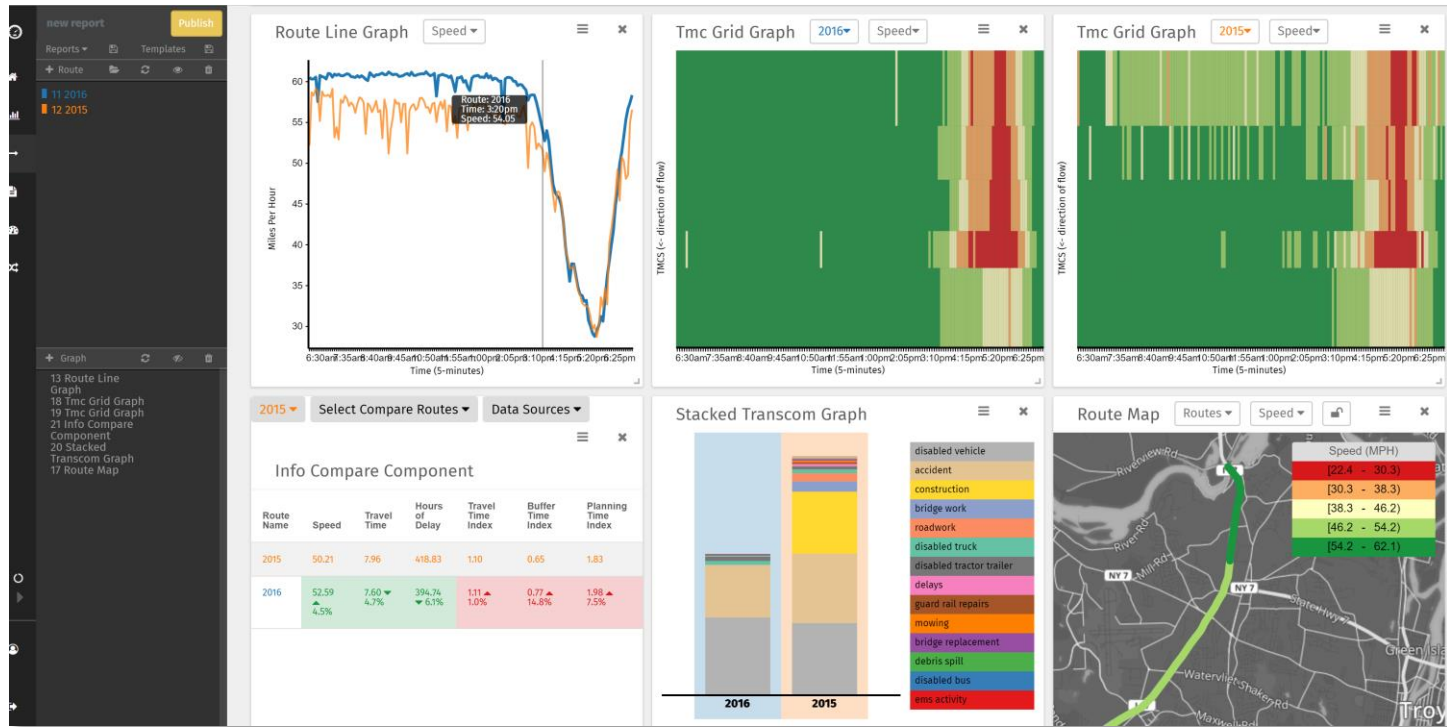
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## Corridor Analysis Tools I-87 Northbound to the Twin Bridges





## Corridor Analysis Tools I-87 Northbound to the Twin Bridges



20+ Visualization and Analysis Tools for assessing the traffic patterns of a route or corridor and for comparing the route against itself in various time aggregations as well as against other routes







## Corridor Study Tools

### I-87 Northbound to the Twin Bridges

2015 ▼ Select Compare Routes ▼ Data Sources ▼ <span>☰</span> <span>✕</span>						
Info Compare Component						
Route Name	Speed	Travel Time	Hours of Delay	Travel Time Index	Buffer Time Index	Planning Time Index
2015	50.21	7.96	418.83	1.10	0.65	1.83
2016	52.59 ▲ 4.5%	7.60 ▼ 4.7%	394.74 ▼ 6.1%	1.11 ▲ 1.0%	0.77 ▲ 14.8%	1.98 ▲ 7.5%

## Compare 2015 and 2016

For Various Metrics Including:  
Speed, Travel Time, Hours of Delay, Travel Time Index,  
Buffer Time Index, Planning Time Index, VMT, Counts, and more.

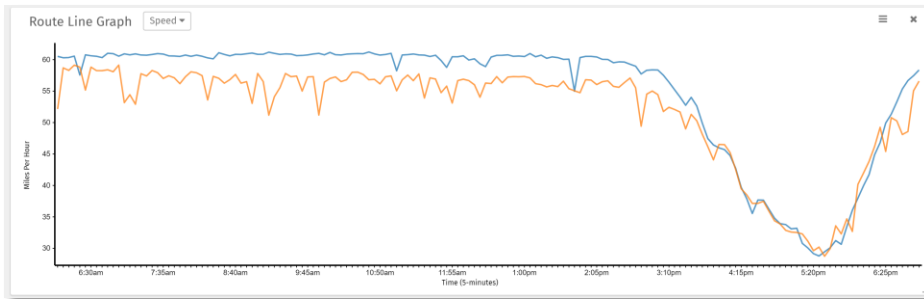




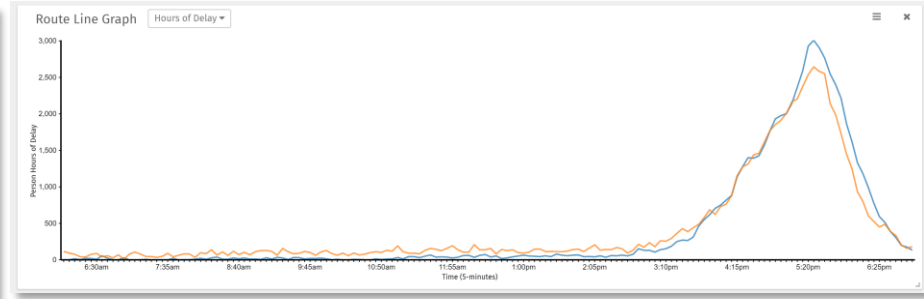
**Albany Visualization and Informatics Lab**  
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## Corridor Study Tools I-87 Northbound to the Twin Bridges

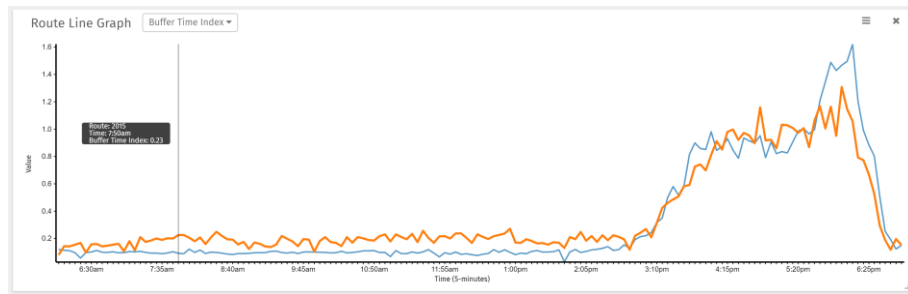
**Travel Time**



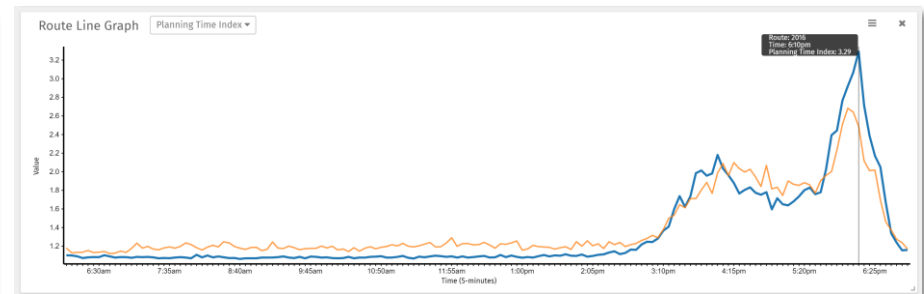
**Hours of Delay**



**Buffer Time Index**



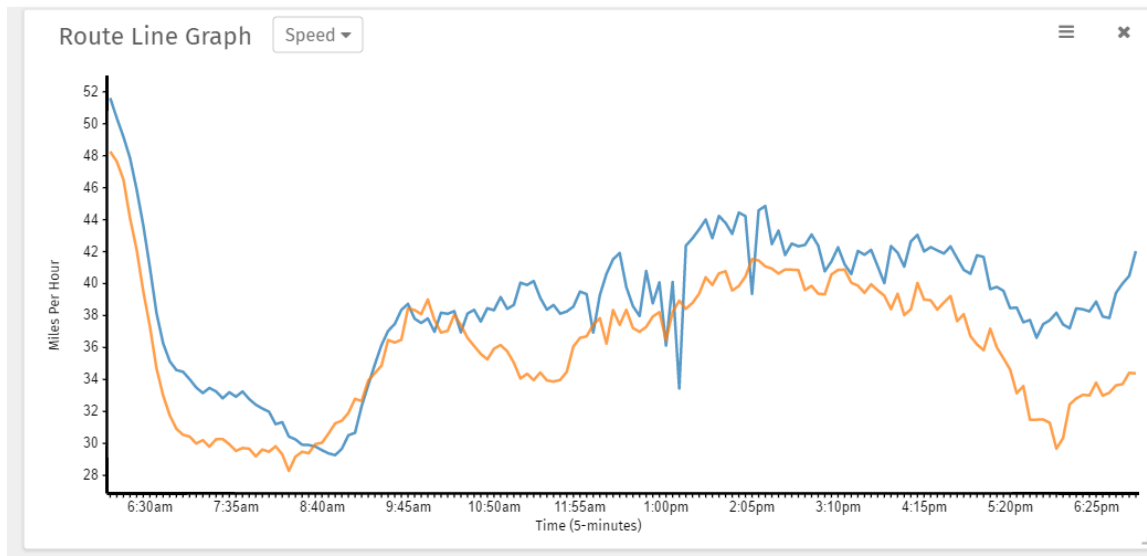
**Planning Time Index**





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## Post Project Analysis Case Study: The Tappan Zee Bridge Cashless Toll Project



The graph on the left shows an average day in five minute epochs from 6am to 7pm.  
The blue line is for 2016 data. The orange line is for 2015 data.

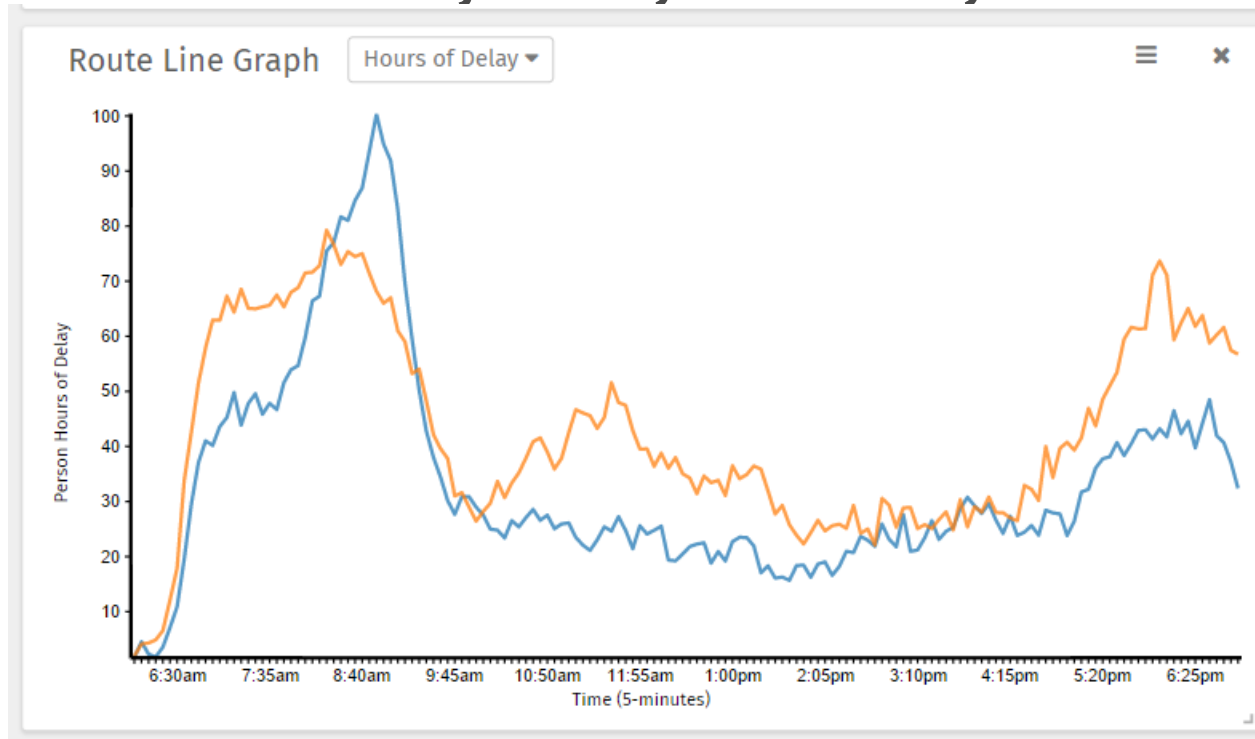






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## Post Project Analysis Case Study:

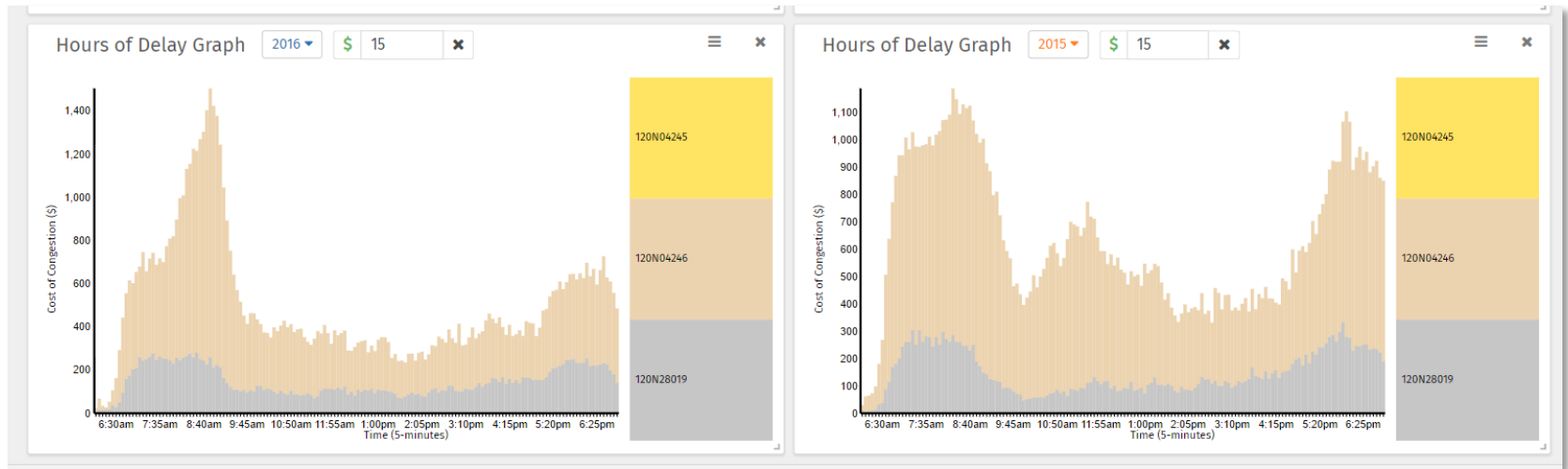


The metrics can be changed via the dropdown menu. This graph now shows hours of delay of an average day, by 5-minute epoch. Blue is 2016, Orange is 2015.





## Post Project Analysis Case Study: The Tappan Zee Bridge Cashless Toll Project

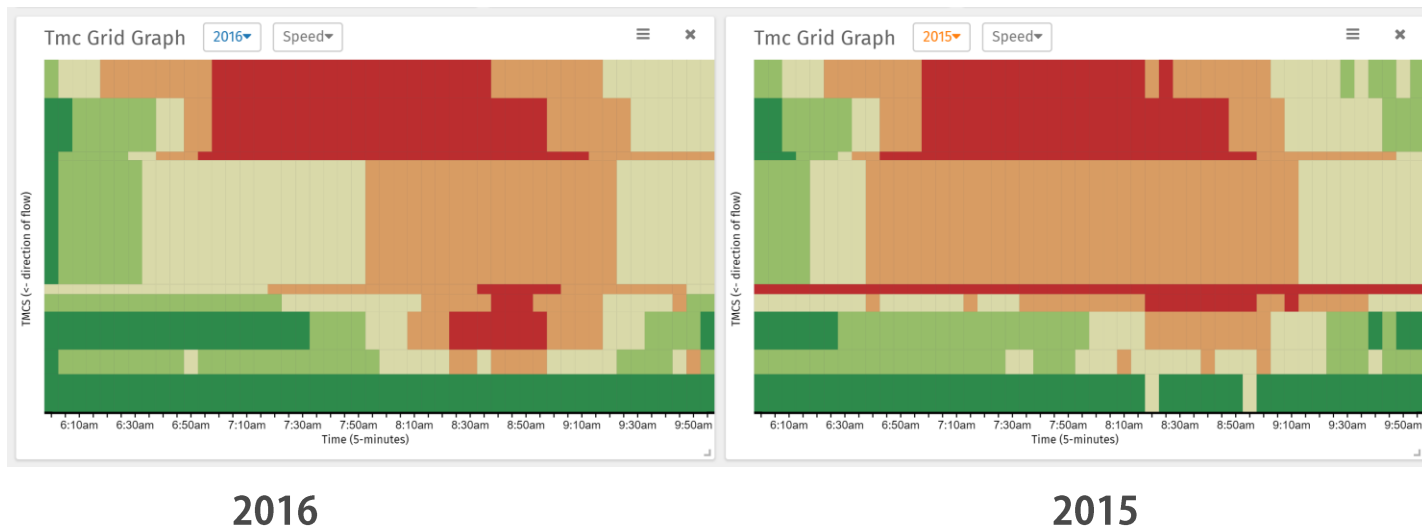


Here's another look at hours of delay, where cost of delay can be calculated.





## Post Project Analysis Case Study: The Tappan Zee Bridge Cashless Toll Project



The red line on the 2015 graph is the TMC segment where the toll booths were previously located. The graph from 2016 shows significant speed increases at that TMC segment.







## Post Project Analysis Case Study: The Tappan Zee Bridge Cashless Toll Project

Before ▼ Select Compare Routes ▼ Data Sources ▼ <span>☰</span> <span>✕</span>						
Info Compare Component						
Route Name	Speed	Travel Time	Hours of Delay	Travel Time Index	Buffer Time Index	Planning Time Index
Before	34.16	6.14	33.70	0.93	0.79	1.66
After	38.16 ▲ 10.5%	5.50 ▼ 11.7%	23.54 ▼ 43.2%	1.02 ▲ 8.9%	0.73 ▼ 8.0%	1.77 ▲ 6.0%

Comparison Tables can convey a lot of information relatively quickly. Here we see that Speed has increased by 10.5%, Travel Time has decreased by 11.7%, and Hours of Delay has decreased by 43.2%. Planning Time Index and Travel Time Index, however, have both increased, indicating that the bridge is somewhat less reliable.





## Performance Measurement Tools

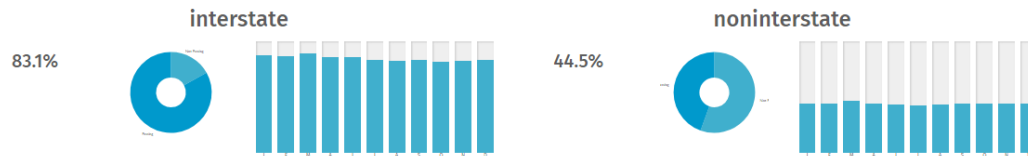
### Performance of the National Highway System

[More Info](#)

#### Level of Travel Time Reliability

[More Info](#)

The percentage of mileage of the road network that provides reliable travel.

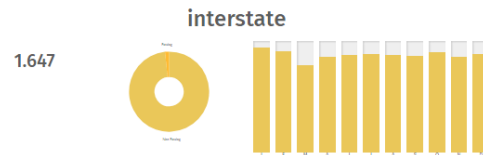


### Freight Movement on the Interstate System

#### Truck Travel Time Reliability

[More Info](#)

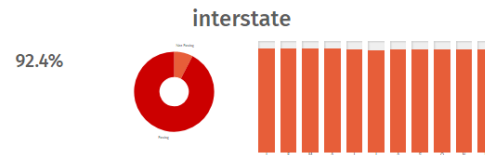
The percentage of mileage of the interstate network that provides reliable travel time for freight.



#### Mileage Uncongested

[More Info](#)

The percentage of mileage of the interstate network that provides reliable travel time for freight.



### Traffic Congestion

#### Hours of Excessive Delay

[More Info](#)

The the Total Excessive Delay for all vehicles traveling through each travel time segment on the NHS within an applicable urbanized area for a full year.





## Performance Measurement Tools at Multiple Geographic Resolutions



### Performance Measures / New York / Metro Planning Organizations

Final Rule

NPRM

State Wide MPOs Counties

Year: 2016

Full Year

Geography Info	Travel Time Reliability		Freight Reliability		Milage Uncongested		Hours of Excessive Delay	
	Name	Interstate	Interstate	Noninterstate	Interstate	Noninterstate	Controlled Access	Non-Controlled Access
A/GFTC	1	0.474	1.255	6.123	1	1	2155.95	1851960
Berkshire MPO		1		2.032		1		41.961
BMTS	0.996	0.811	1.644	6.293	0.984	1	18947.7	656320
CDTC	0.924	0.475	1.436	6.605	0.911	0.997	797399	9086410
ECTC	1	0.744	1.154	4.083	1	1	818.243	145031
GBNRTC	0.92	0.409	1.619	7.732	0.892	0.999	867472	10054500
GTC	0.948	0.523	1.403	7.395	0.951	1	229752	4894180
HOCTS	1	0.562	1.12	6.246	1	1	1669.29	1530530
HVCEO				6.816		1		413.99
ITCTC		0.586		5.577		1		768203
Kingston MPO	0.986	0.693	1.192	6.311	0.954	1	867.27	1228220
NJTPA	1	0.283	2.028	6.149	0	0.833	12320	692221
NOCTC	1	0.63	1.27	6.461	0.951	0.998	338011	3712760
NYMTC	0.597	0.35	3.029	5.713	0.673	0.996	42469400	518962000
PDCTC	0.983	0.599	1.218	5.088	1	1	47310.7	1730150







## Performance Measurement Tools at the County Level

### Performance Measures / New York / Counties

Final Rule

NPRM

[State Wide](#) [MPOs](#) [Counties](#)

Year: 2016 ▾

Full Year ▾

Geography Info		Travel Time Reliability		Freight Reliability		Milage Uncongested		Hours of Excessive Delay	
Name	Interstate			Interstate	Noninterstate	Interstate	Noninterstate	Controlled Access	Non-Controlled Access
Franklin		0.529		4.693			1		304529
Fulton		0.757		4.988			1		194824
Hamilton		0.174		10.032			1		41704.1
Lewis		0.488		7.3			1		111030
Orleans		0.504		9.205			1		217208
Schuyler		0.493		5.348			1		160598
St Lawrence		0.642		4.638			1		575722
Tompkins		0.565		4.673			1		767470
Washington		0.704		4.948			1		317457
Wayne		0.687		7.383			1		341664
Wyoming		0.631		5.279			1		27518.3
Yates		1		5.405			1		28200.6
Montgomery	1	0.632	1.107	4.897		1	0.996	216.184	321777
Cayuga	1	0.647	1.107	7.171		1	1	224.765	383921
Chenango	1	0.882	1.134	4.497		1	1	229.3	108452
Greene	1	0.478	1.107	6.572		1	1	313.512	96931.1
Tioga		0.876		8.029			1	338.846	316487

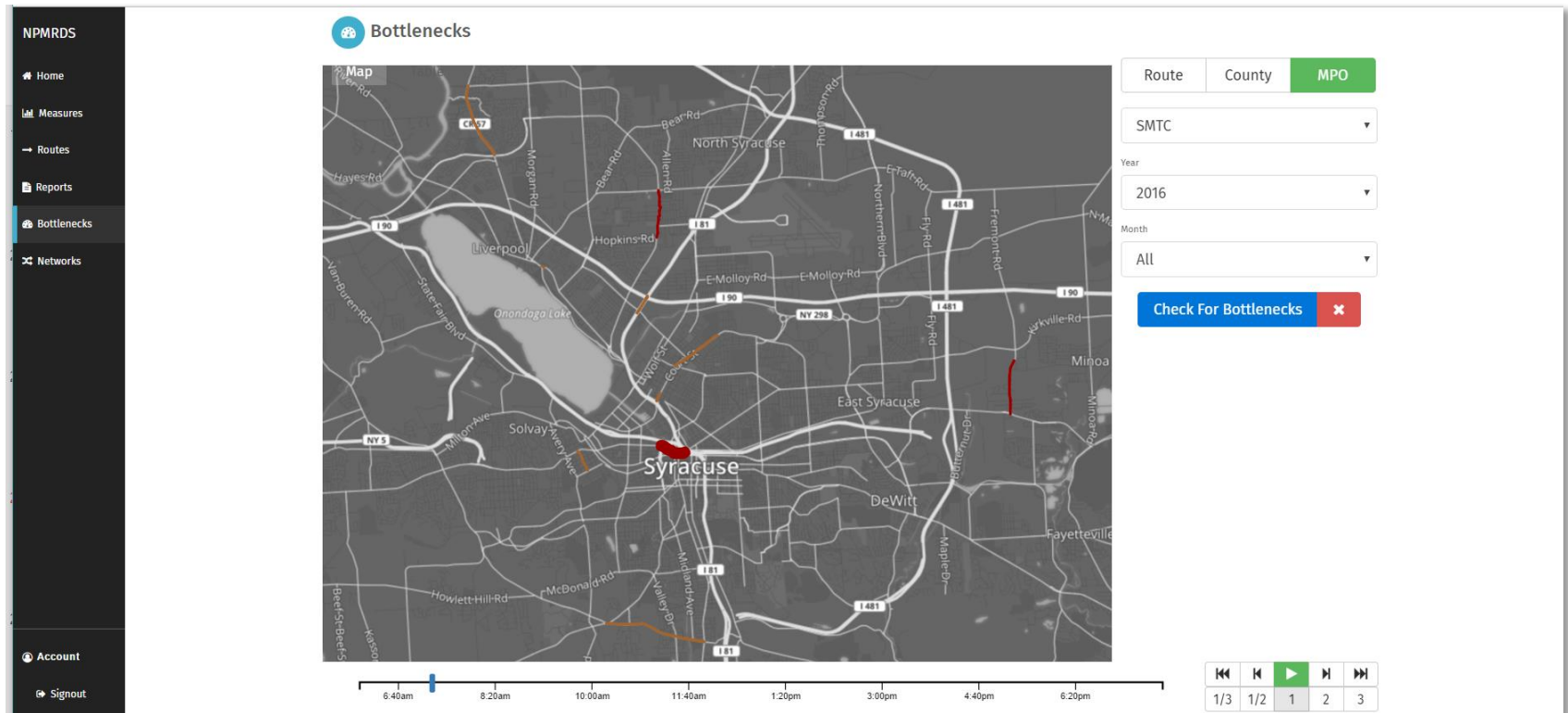




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Web-based Traffic Data Analytics Platforms Tailored to your Agency

## Bottlenecks Analysis





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## Data Integration

**AVAIL has begun to integrate many other geo-spatial transportation datasets through conflation of the NPMRDS shapefile to the LRS and HPMS shapefiles**



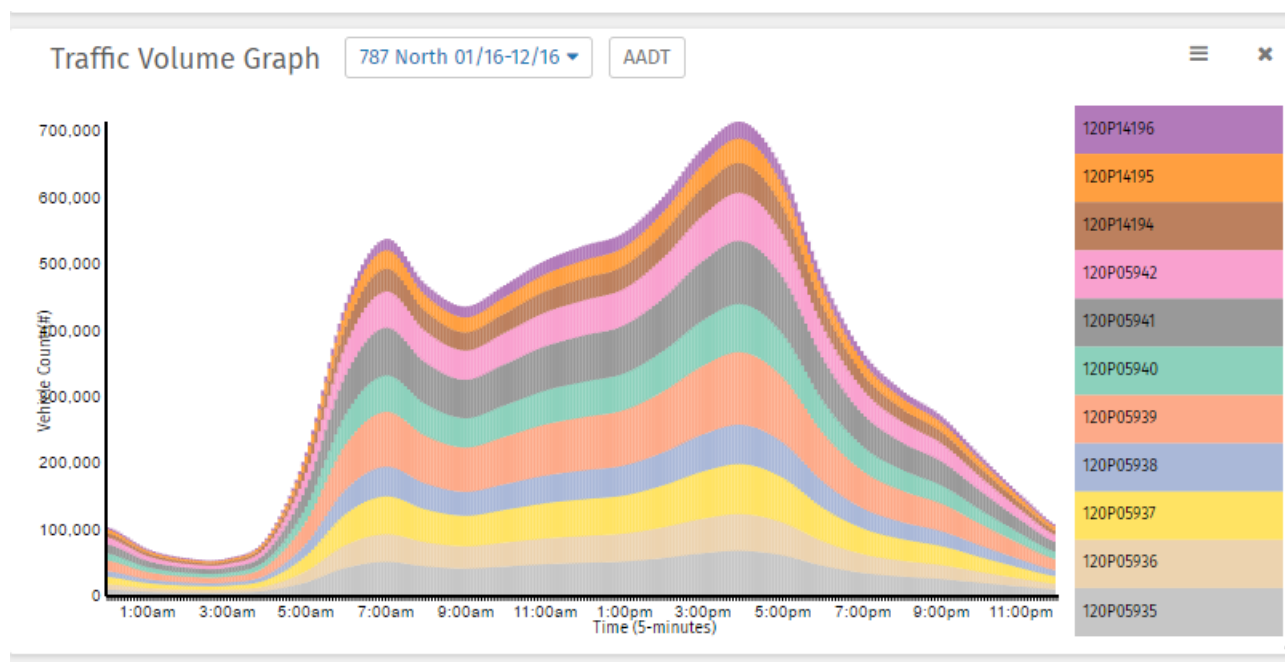




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## Data Integration and Additional Data Integration Possibilities

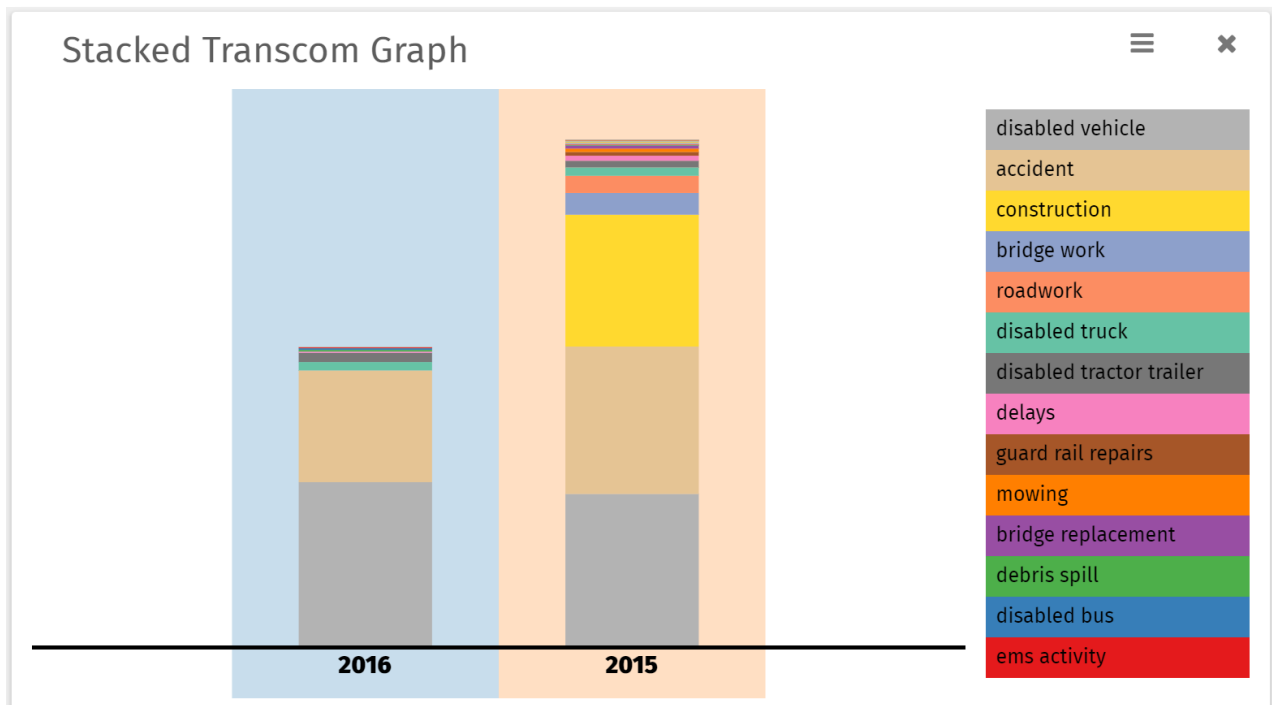


### AADT and Continuous Counts





## Data Integration



Transcom Incidents





## Data Integration

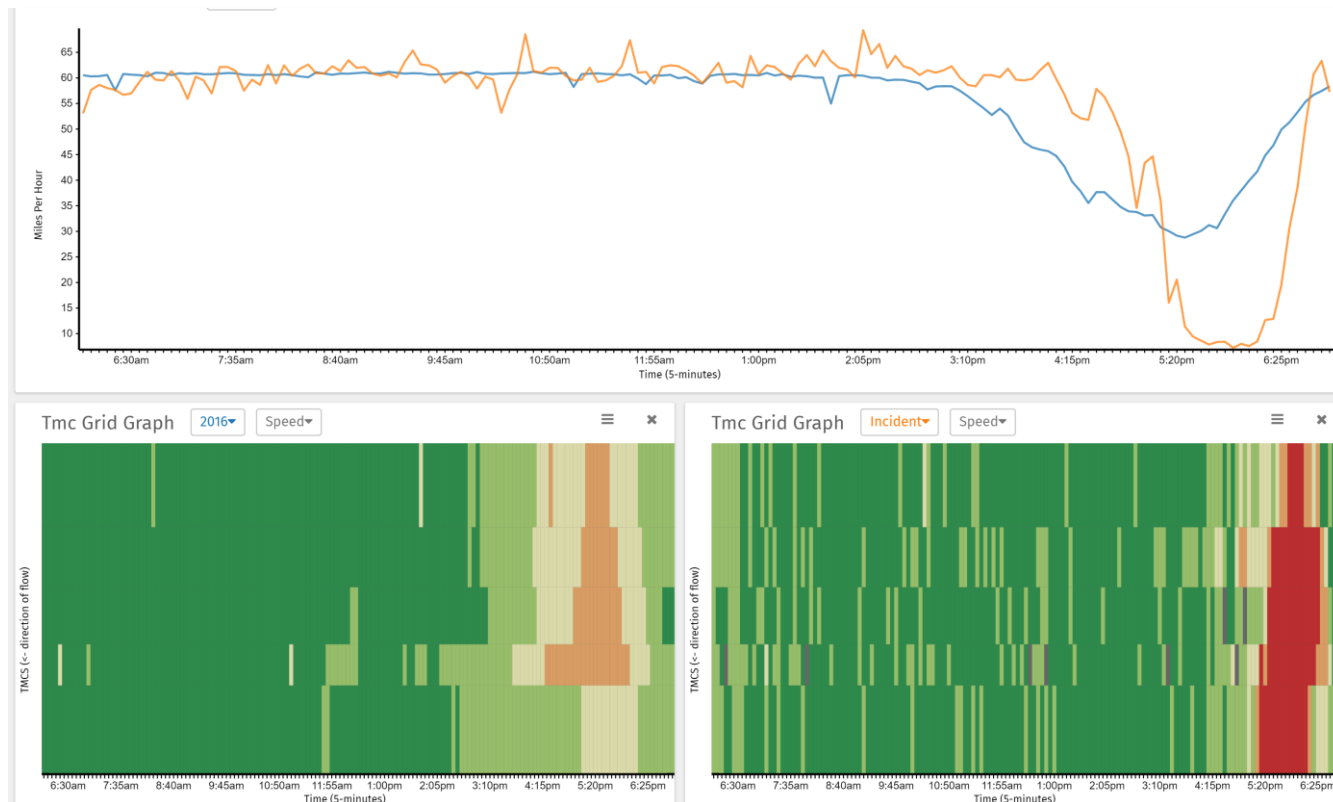
Transcom Events Chart				
2016 ▼		Event Types ▼		
120P05861 ▼	accident	Nov. 20, 2016 3:00pm	Nov. 20, 2016 3:00pm	NYSDOT TMC - Albany: Accident on I-87 Northway northbound ramp from Exit 4; Wolf Road; Albany International Airport (Colonie) right shoulder blocked
120P05865 ▼	accident	Nov. 25, 2016 3:10pm	Nov. 25, 2016 3:45pm	NYSDOT TMC - Albany: Accident on I-87 Northway southbound before Twin Bridges; Town of Halfmoon; Town of Colonie Line (Colonie) right shoulder blocked
120P05862 ▼	accident	Nov. 22, 2016 6:10pm	Nov. 22, 2016 6:25pm	NYSDOT TMC - Albany: Accident on I-87 Northway southbound between Exit 5; NY 155 (Colonie) and Exit 4; Wolf Road; Albany International Airport (Colonie) left shoulder blocked
120P05865 ▼	accident	Nov. 21, 2016 5:10pm	Nov. 21, 2016 6:25pm	NYSDOT TMC - Albany: Accident on I-87 Northway northbound on Twin Bridges; Town of Halfmoon; Town of Colonie Line (Colonie) left lane blocked

## Transcom Incidents





## Data Integration



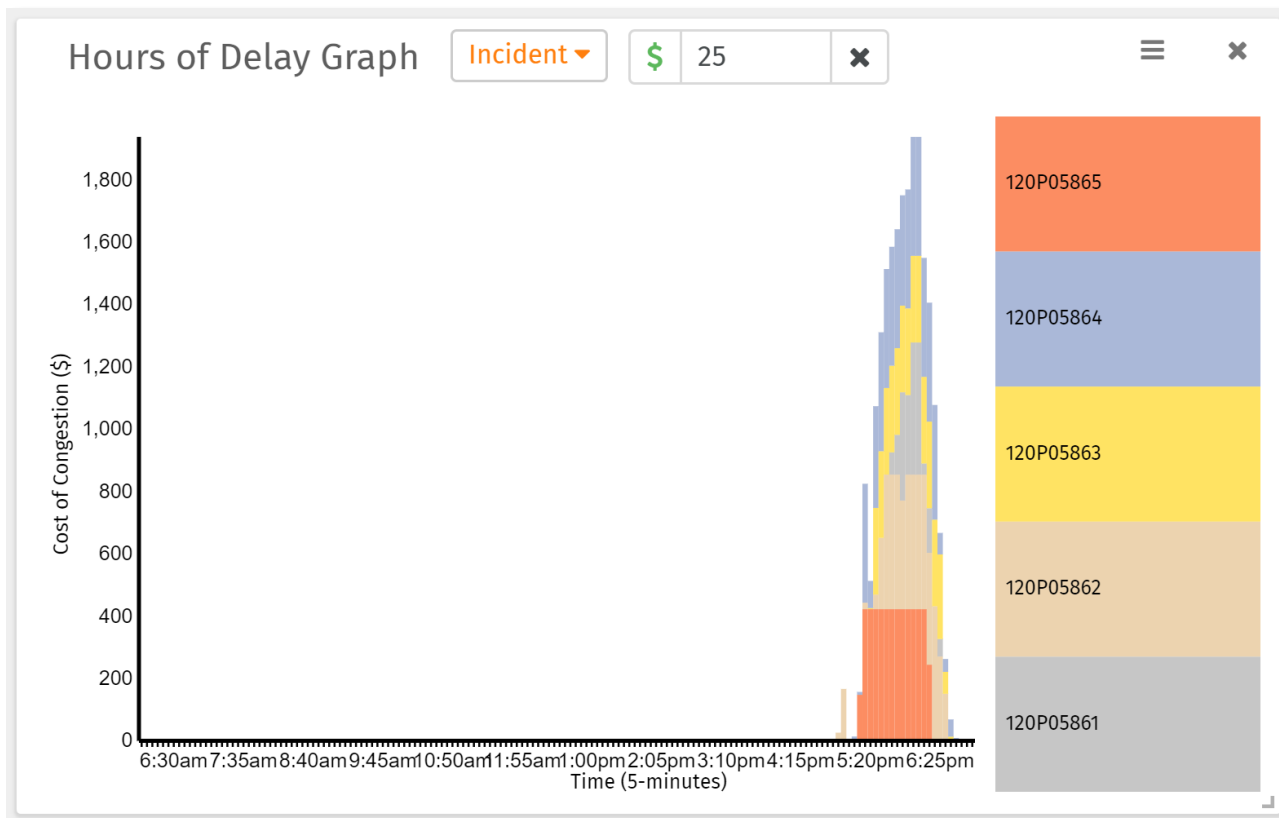
Incident Template showing I-87 Northbound Incident from November 21, 2016







## Data Integration



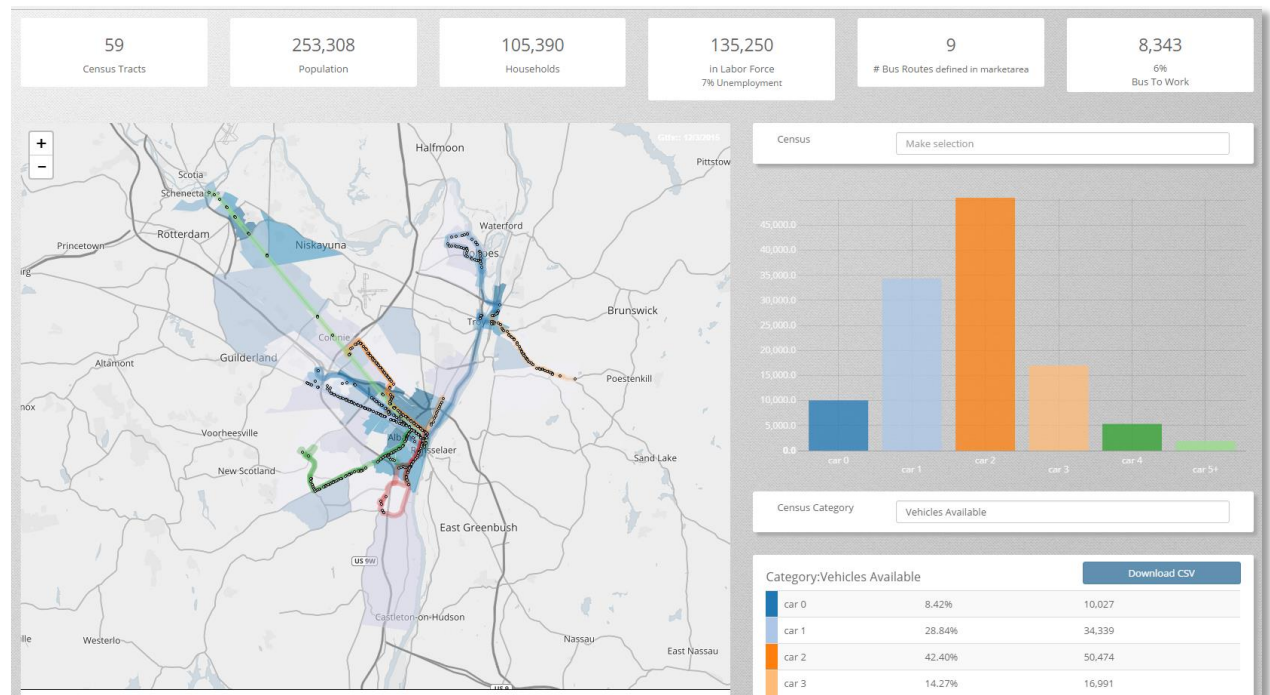
**Hours of Delay and Cost of Delay associated with the selected incident**





## Forward Looking

- **Transearch**
- **Socio-economic-demographic effects of transportation network,**
  - Census/Infogroup etc.
- **Site-Specific Volume Delay Functions**
- **Imputed Counts using Probe Data**
- **Multi-modal GTFS/Rail**
- **Merging real-time probe data with historic analytics for forecasting**
  - **Statistical Probability Distributions based on time of day and current counts/speeds,**





# Web-Based Reliability Tools using NPMRDS Dashboard

## Project Partners:



University Transportation  
Research Center (UTRC)



NYSDOT



NYSAMPO





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Lewis Mumford Center  
University at Albany, SUNY*