

Transportation Network Optimization Workshop

The Data Landscape

Rick Schuman, VP/GM, Public Sector

March 10, 2014



Topics

- Background/Thesis
- Data Available and Services Enabled
- Data Coming and Services Pondered
- Gaps/Needs

Background/Thesis

- Background
 - The Doug MacDonald Challenge
 - National Traffic Signal Scorecard
- Thesis
 - If you want to make a difference (re fuel use) ...
 - Focus on influencing people/places/times at the tipping point of equilibrium

More Information

The \$1,000 Doug MacDonald Challenge - Photos

- [Challenge Home](#)
- Photos**
- [Original Announcement](#)
- [Try the Experiment](#)
- [Winning Entry and Finalists](#)



The rice passes through the right funnel much faster.

National Traffic Signal Report Card 2012

National Transportation Operations Coalition



2005

2007

2012

National Traffic Signal Report Card	
Proactive Management	F
Signal Operation in Coordinated Systems	D-
Signal Operation at Individual Intersections	C-
Detection Systems	F
Maintenance	D+
OVERALL	D-

National Traffic Signal Report Card 2007	
Management	D-
Signal Operation at Individual Intersections	C
Signal Operation in Coordinated Systems	D
Signal Timing Practices	C-
Traffic Monitoring and Data Collection	F
Maintenance	C-
OVERALL	D

National Traffic Signal Report Card 2012	
Management	D
Traffic Signal Operations	C
Signal Timing Practices	C
Traffic Monitoring and Data Collection	F
Maintenance	C
OVERALL	D+

Self Reported → Room for Improvement!

Signal Timing Improvement Example

Fuel Use Improvement

Table 1. Summary of results for Noland Rd Project

Improvement during morning and evening peak periods: (for drivers traveling the entire length of the corridor)				Approximate daily savings: (net change for all drivers impacted by the plans)	
Morning	Noon	Afternoon		Daily	
21.3%	15.2%	1.9%	less travel delay from signals	126	hours saved in travel time
27.3%	19.4%	20.1%	fewer stops	8880	fewer stops
5.5%	4.7%	4.2%	less fuel consumed	122	gallons of fuel saved
7.9%	6.8%	7.3%	fewer hydrocarbons emitted	16.1	kg less hydrocarbons emitted
5.3%	4.2%	5.8%	less carbon monoxide emitted	121	kg less carbon monoxide emitted
9.9%	8.9%	12.6%	less nitrous oxide emitted	10.5	kg less nitrous oxide emitted
Approximate economic savings from reduced travel time and fuel consumption:				Per Day	Per Year
				\$2,270	\$567,000

Benefit to Cost Ratio

The continued operations of the OGL system will cost approximately \$1800 per signal per year. Thus the cost of keeping the Noland Rd corridor a part of OGL is \$30,600 per year for the 17 signals updated. Therefore the benefit to cost ratio for this re-timing project is **18 to 1**.

<http://www.leesignaltiming.com/results.html>

Data Available/Services Enabled

Data Available

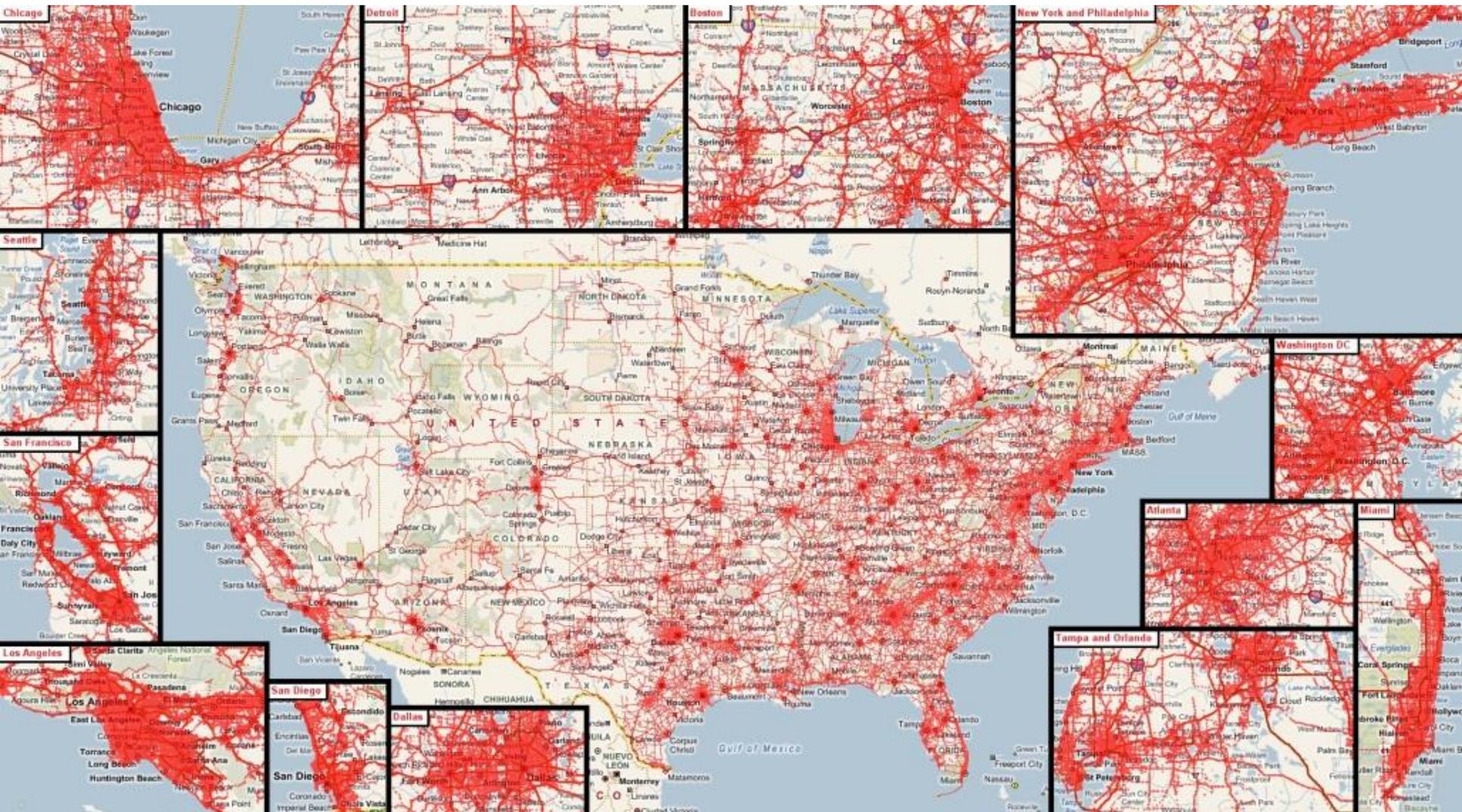
- Real-time Vehicle/Device “PHS” data
- Estimated Traffic Volumes – averages by day/time/segment
- Journalistic Data – better, not perfect
- Weather Data
- Parking (lots) – improving
- Fuel/EV Stations/Prices
- Transit alternatives – larger cities

Services Enabled

- Drivers
 - Traffic enabled routing/ETAs
 - Parking, Fuel, Charging
 - EV Range-finding
 - “Trouble ahead” alerts and re-routes
- System
 - Traffic Management
 - Performance Analysis
 - Project Planning/Assessment

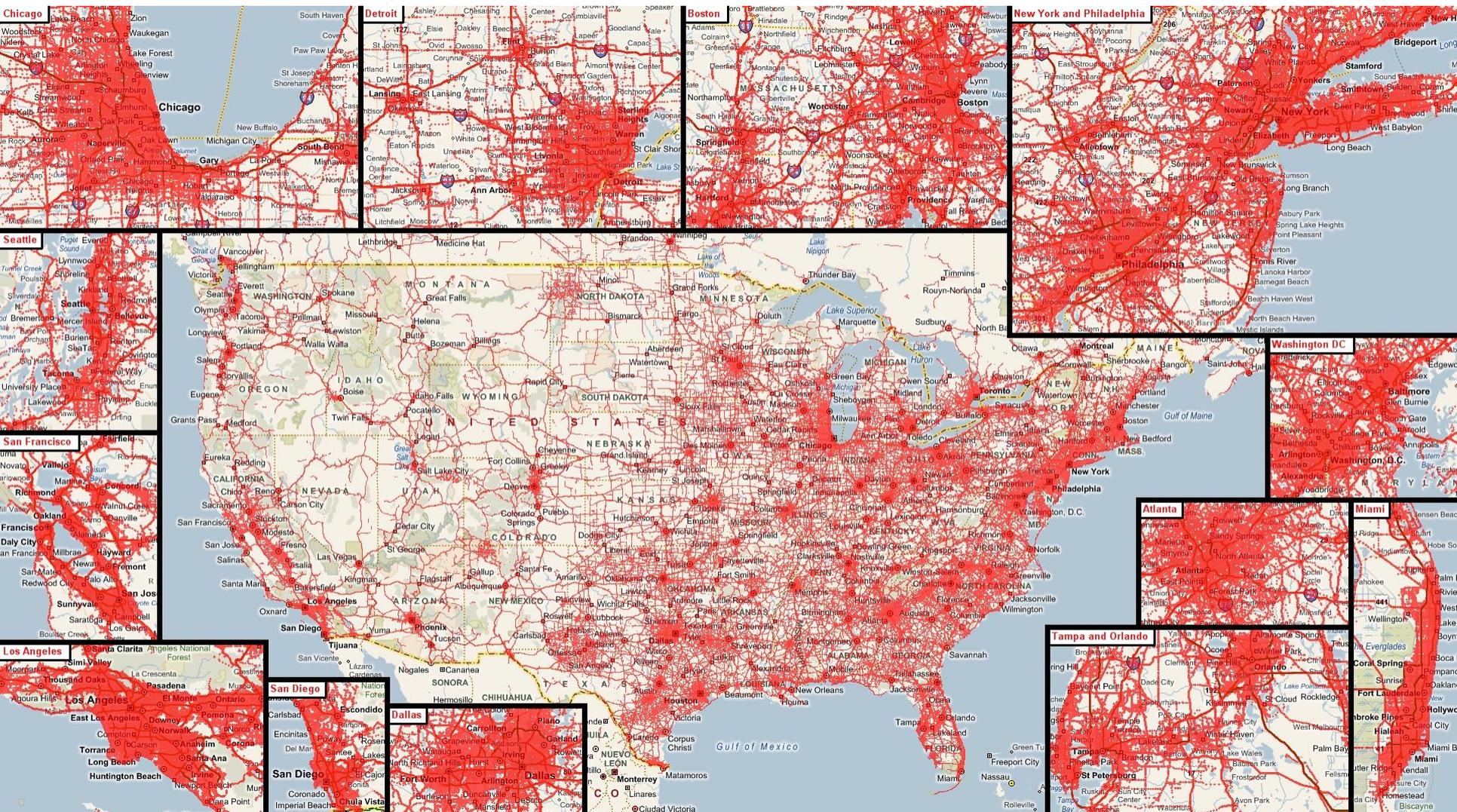
Fall 2010 – PHS “Red Dots”

15 minutes of data – Thursday PM Peak



Summer 2013 – PHS “Red Dots”

15 minutes of data – Thursday PM Peak

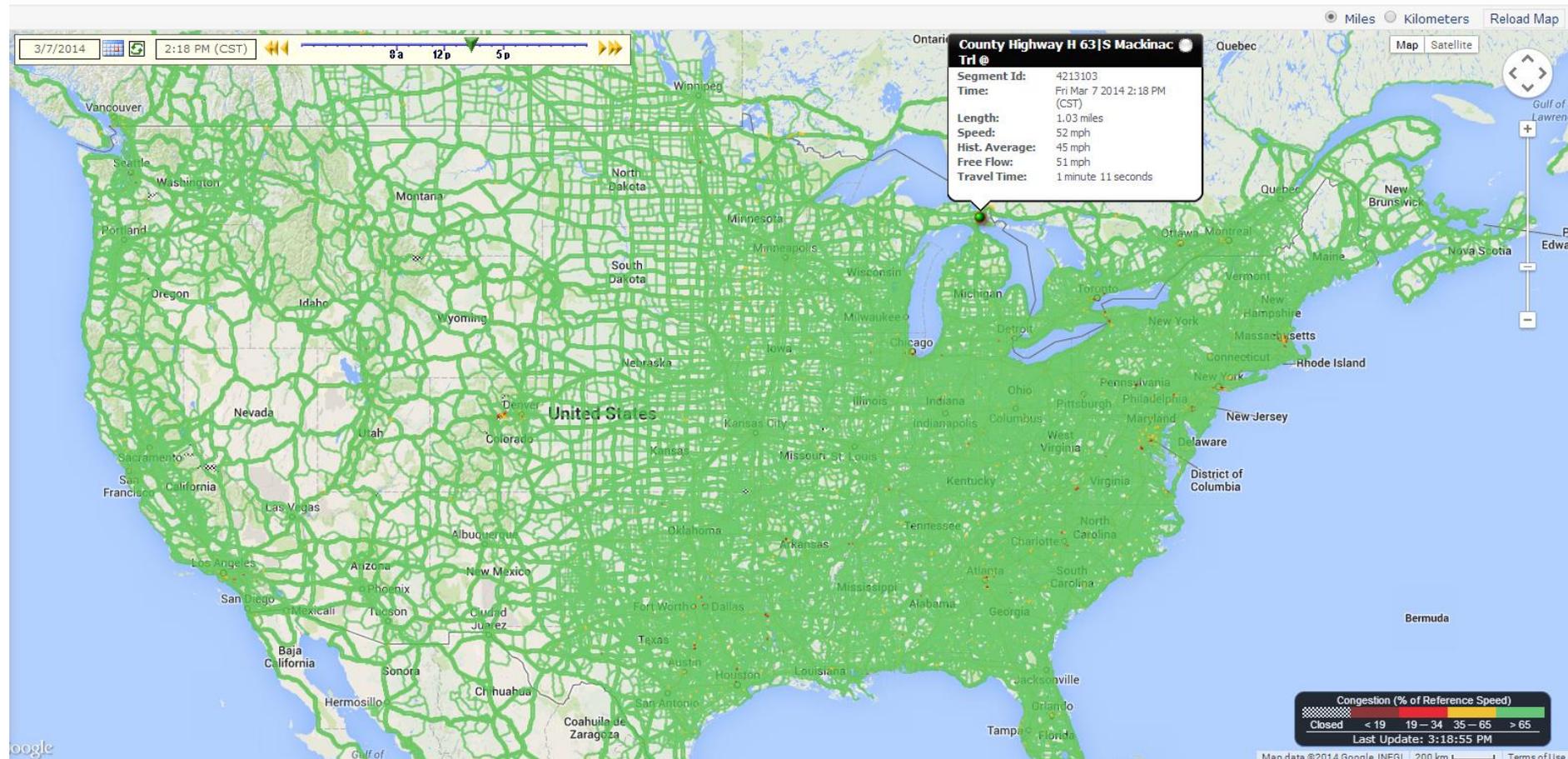


Enables 1M+ miles, 1M+ segments of Real-time speeds, updated every minute

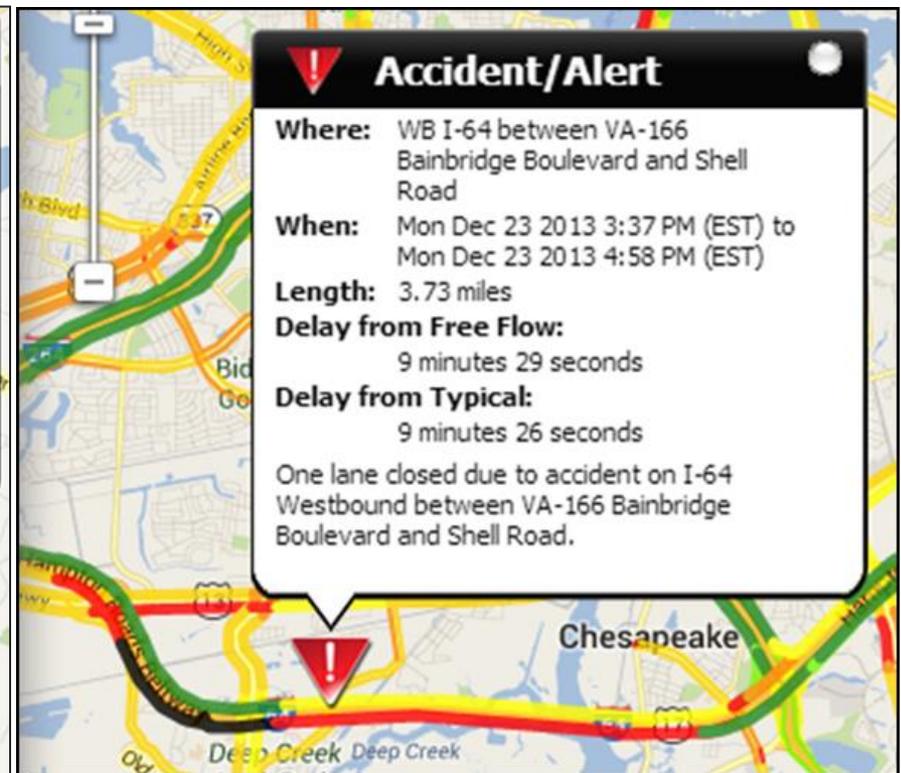
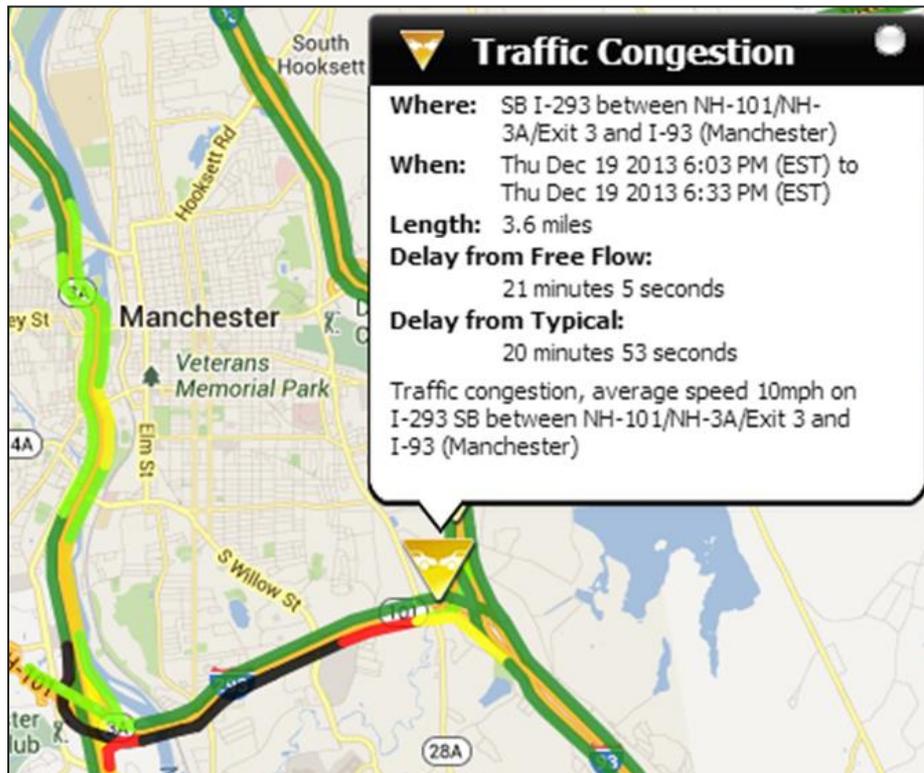
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State-of-the-Art: Combining Journalistic Incidents and Impact



Traffic-Aware Routing – From/To Anywhere

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New York City, NY

Traffic Routing Alerts DriveTimePolygons

3/3/2014 2:10 PM (EST) 8a 12p 5p

Miles Kilometers Reload Map

Map Satellite

Saved Routes

Route 1*

Waypoints

undefined JFK Intl Airport, New York, NY

undefined Terminal Access Rd

Add a waypoint

Display Total Fusion Traffic

Use Traffic in Creating the Route

Route 1 (Not Saved)

Via Belt Pkwy, Cross Island Pkwy N and I-495

Travel Time: **Currently: 26 minutes**
Uncongested: 24 minutes
Distance: 20.2 miles
Average Speed: 48 mph

Via I-678, Grand Central Pkwy

Travel Time: **Currently: 28 minutes**
Uncongested: 15 minutes
Distance: 11.6 miles
Average Speed: 26 mph

Via I-678, JFK Expy N and Grand Central Pkwy

Travel Time: **Currently: 31 minutes**
Uncongested: 19 minutes
Distance: 12.4 miles
Average Speed: 25 mph

Maneuvers

- Continue**
Starting from undefined JFK Intl Airport, New York, NY, 11430 head NW. At JFK Intl Airport continue, go NW for 0.2 miles.
- Bear Right**
At I-678 bear right, go WSW for 0.1 miles.

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...Though not all routes are avoidable!

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Home Demo DevZone New York City, NY

Traffic Routing Alerts DriveTimePolygons Miles Kilometers Reload Map

3/6/2014 4:00 PM (EST) 8a 12b 5p

Saved Routes

Route 1 *

Waypoints

2587 Miles Ave, New York, NY

190 Oakdene Ave, Clifside Pa

Add a waypoint

Display Total Fusion Traffic

Use Traffic in Creating the Route

Route 1 (Not Saved)

Via I-295, I-95 and US-9

Travel Time: **Currently: 32 minutes**
Uncongested: 24 minutes
Distance: 13.1 miles
Average Speed: 25 mph

Via I-95, US-9 and Bergen Blvd

Travel Time: **Currently: 39 minutes**
Uncongested: 26 minutes
Distance: 13.5 miles
Average Speed: 21 mph

Via I-95, US-1 and County Hwy-505

Travel Time: **Currently: 40 minutes**
Uncongested: 27 minutes
Distance: 13.5 miles
Average Speed: 20 mph

Maneuvers

- Continue**
Starting from 2587 Miles Ave, New York, NY, 10465 head ENE. At Miles Ave continue, go ENE for 0.6 miles.
- Turn Left**
At E Tremont Ave turn left, go NNW for 0.3 miles.
- Bear Left**
At Cross Bronx Expy bear left, go WNW for 0.4 miles.

Real-Time Parking Information

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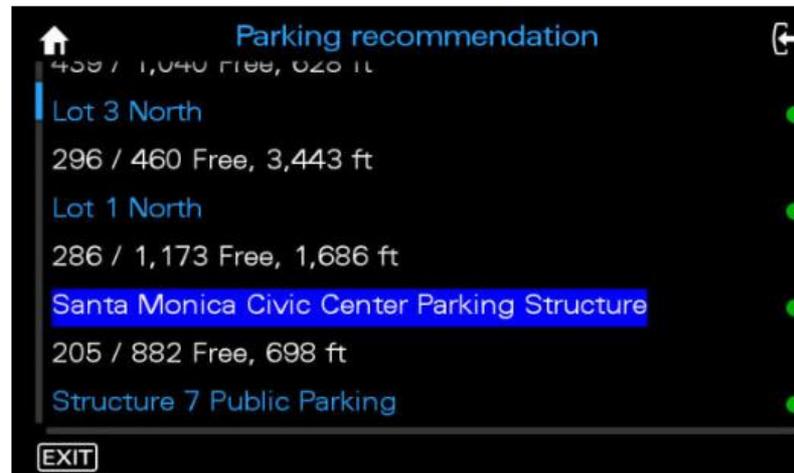
[GADGETS](#)  [CARS](#)  [SC](#)

[GALLERIES](#)  [VIDEOS](#)  [BLOGS](#) 

Starting This Week, Audis Will Find Parking Spaces Automatically

One of the greatest frustrations of urban life and holiday mall shopping, solved.

By [Shaunacy Ferro](#) Posted 06.06.2013 at 4:01 pm [1 Comment](#)



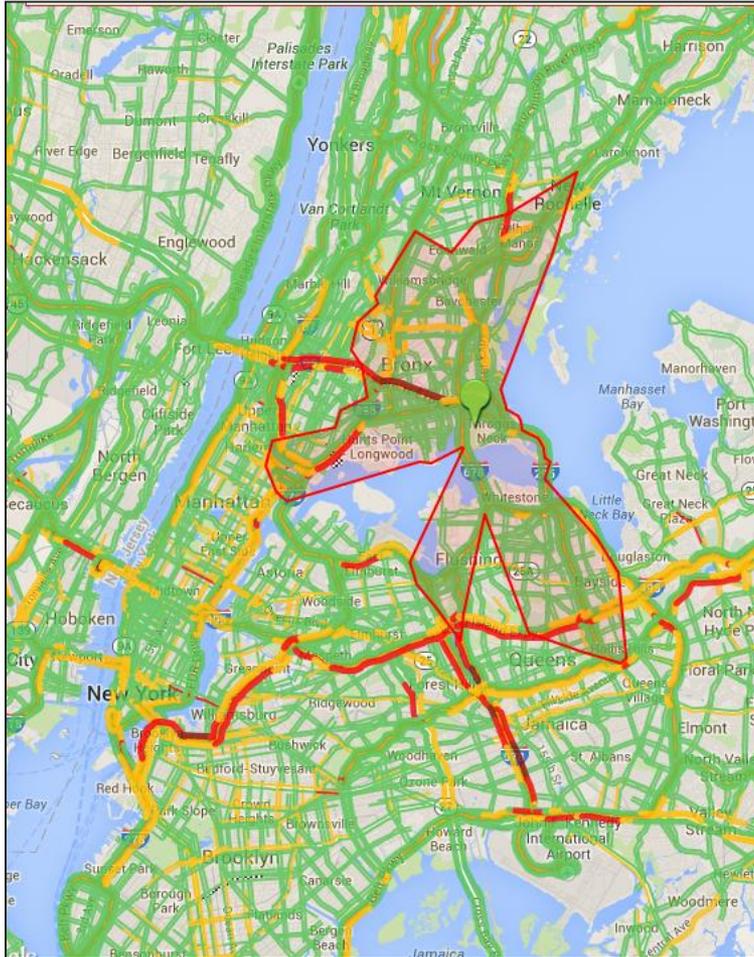
Connect With That Parking Space *Audi*

Audi is a company that loves to make its cars **do the work for you**. Its self-driving car may not be on the market yet, but its latest addition to its Audi Connect service solves a greater headache than having to actually steer: Finding parking.

Rather than blindly meandering through the streets looking for a garage, only to find one that's overflowing with cars, Audi drivers can now flip through a list of nearby garages in the car's navigational system. The service launched yesterday for all cars already equipped with **Audi**

EV Range Estimation

PM Rush Hour Range



Overnight Range



INRIX Analytics – Home Page

inrixtraffic.us/Analytics.aspx

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INRIX Analytic Tools

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What's New
01/22/14

- INRIX System Monitoring Dashboard**
Explore the relationships between bottlenecks and traffic events in real-time and in the past.
- Massive Raw Data Downloader**
Download raw probe data from our archive for offline analysis.
- Congestion Scan**
Analyze the rise and fall of congested conditions on a stretch of road.
- Trend Map**
Create animated maps of roadway conditions.
- Performance Charts**
Chart performance metrics over time.
- Performance Summaries**
Report on Buffer Time Index, Planning Time Index, and other performance metrics.
- Bottleneck Ranking**
Rank bottlenecks and discover which ones have the greatest impact.
- User Delay Cost Analysis Beta** [My reports](#)
Put a dollar amount on how much a road's performance impacts its users.
- FAQs**
Frequently asked questions and their answers.
- Tutorials**
Learn how to use each of the tools in the suite.

Need to reach out to us? [Feedback](#) [Support](#)

Arterial Retiming Cost – Benefit Analysis using Crowd Sourced Data



MARCH 2012						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Before Retiming

Week 13	25	26	27	28	29	30	31
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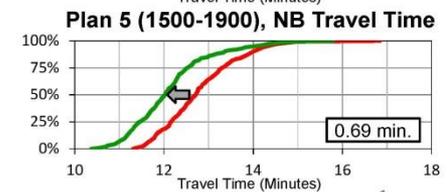
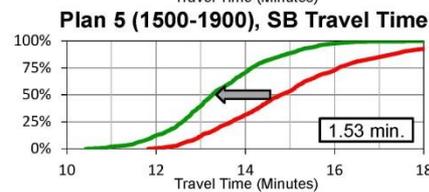
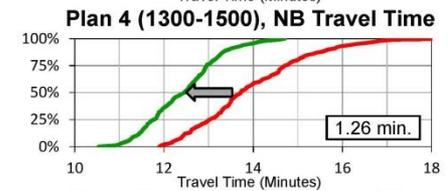
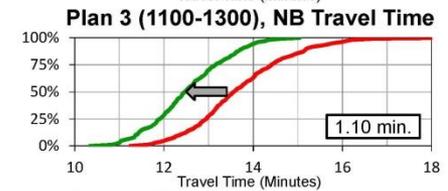
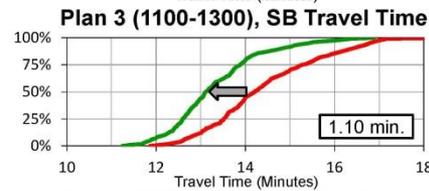
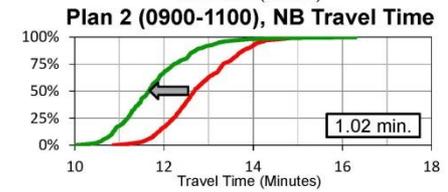
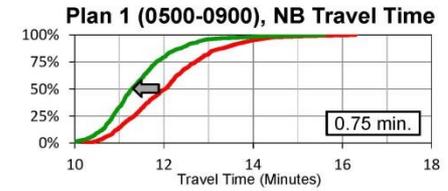
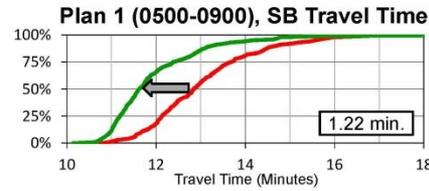
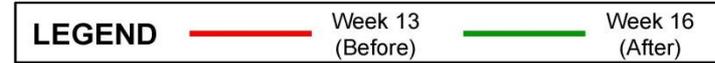
APRIL 2012						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Retiming

Week 15	1	2	3	4	5	6	7
Week 16	15	16	17	18	19	20	21

After Retiming

Week 16	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30					



Arterial Retiming Cost – Benefit Analysis using Crowd Sourced Data



Using TTI Travel Time Savings Calculations: Expected Yearly Savings are \$2.7 Million

	Plan	Median TT Savings (min)	% of Daily Traffic	TT Savings (h)	TTI Travel Time Savings (\$)	CO2 Reduction (tons)	CO2 Emission Savings (\$)
North	Plan 0 (0000 – 0500)	0.79	2.2%	1987.34	\$ 46,941.69	16.77	\$ 368.96
	Plan 1 (0500 – 0900)	1.22	7.2%	9925.88	\$ 234,453.24	83.76	\$ 1,842.82
	Plan 2 (0900 – 1100)	1.83	5.3%	10877.93	\$ 256,941.12	91.80	\$ 2,019.58
	Plan 3 (1100 – 1300)	1.1	6.7%	8246.25	\$ 194,779.77	69.59	\$ 1,530.98
	Plan 4 (1300 – 1500)	0.93	6.6%	6886.14	\$ 162,653.47	58.11	\$ 1,278.47
	Plan 5 (1500 – 1900)	1.53	13.5%	23311.22	\$ 550,620.34	196.72	\$ 4,327.91
	Plan 6 (1900 – 2400)	0.91	7.1%	7319.89	\$ 172,898.62	61.77	\$ 1,359.00
South	Plan 7 (0000 – 0500)	0.58	2.2%	1462.30	\$ 34,540.02	12.34	\$ 271.49
	Plan 8 (0500 – 0900)	0.75	7.6%	6420.27	\$ 151,649.25	54.18	\$ 1,191.97
	Plan 9 (0900 – 1100)	1.02	5.5%	6316.57	\$ 149,199.92	53.31	\$ 1,172.72
	Plan 10 (1100 – 1300)	0.7	7.0%	8627.08	\$ 203,775.18	72.80	\$ 1,601.69
	Plan 11 (1300 – 1500)	1.2	14.2%	11040.76	\$ 260,787.26	93.17	\$ 2,049.81
	Plan 12 (1500 – 1900)	0.69	7.9%	4011.66	\$ 94,906.91	33.91	\$ 745.97
	Plan 13 (1900 – 2400)	0.45	7.9%	4011.66	\$ 94,906.91	33.91	\$ 745.97
	Total		100.0%	116321.6	\$ 2,747,562	981.64	\$ 21,596.03

MARCH 2012

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
Week 13	25	26	27	28	29	30
						31

APRIL 2012

Retiming	S	M	T	W	T	F	S
Week 15	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
Week 16	15	16	17	18	19	20	21
After Retiming	22	23	24	25	26	27	28
	29	30					

Identifying Congested Corridors Possible...Nationwide

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Bottleneck Ranking

New search **Bottleneck locations from Fairfax County, VA (1079 tmcs) between January 1, 2014 and January 31, 2014 (508 total)** Export to CSV

Rank	Map	Location	Average duration	Average max length (miles)	Occurrences	Impact factor
1	<input checked="" type="checkbox"/>	I-66 W @ VA-234/EXIT 47	2 h 17 m	13.27	41	74,523
2	<input checked="" type="checkbox"/>	I-495 CW @ AMERICAN LEGION BRIDGE	2 h 30 m	6.67	60	60,075
3	<input checked="" type="checkbox"/>	VA-28 S @ PRESCOTT AVE/SUDLEY RD	3 h 36 m	9.01	22	42,817
4	<input checked="" type="checkbox"/>	I-395 N @ 2ND ST	3 h 43 m	12.00	12	32,106
5	<input checked="" type="checkbox"/>	I-95 S @ VA-3/EXIT 130	4 h 18 m	38.82	3	30,046
6	<input checked="" type="checkbox"/>	I-495 CCW @ WOODROW WILSON MEMORIAL BRIDGE	5 h 28 m	41.61	2	27,297
7	<input checked="" type="checkbox"/>	US-1 S @ I-95 (LORTON)	2 h	6.63	34	27,047

VA-28 S @ PRESCOTT AVE/SUDLEY RD

Show ranks Highlight selected bottleneck

Occurrences

Spiral Table Export to CSV

In this time spiral each trip around the circle represents a day

The center represent January 1, 2014 and the outer edge represents February 1, 2014.

Maximum queue length < 1 ■ ■ ■ ■ ■ > 10 miles

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As is Detailed Analysis of Each Corridor

Congestion Scan Open Report As... 

Time Range
12:00 AM 6:00 AM 12:00 PM 6:00 PM 12:00 AM
12:00 AM 12:00 AM

Color Thresholds
0 50
15% 33% 50% 66% 85%

Data Type
Congestion
   



TTI Assessed Congested Freeway Corridors



Table 2. Congestion Leaders (Top 40)

Urban Area	Corridor	Corridor Endpoints From To	Corridor Length (miles)	2010 All-day Everyday Congestion					
				Delay Per Mile		Wasted Fuel		Congestion Cost	
				Person-hrs (1000)	Rank	Gallons (1000)	Rank	(\$1000)	Rank
Los Angeles	Harbor Fwy/CA-110 NB	I-10/Santa Monica Fwy Stadium Way/Exit 24C 111th Pl	3.1	1,440	1	2,170	28	95,020	27
Los Angeles	Harbor Fwy/I-110 NB	I-110/I-10/Santa Monica Fwy	6.5	1,128	2	3,665	13	158,173	14
Los Angeles	San Diego Fwy/I-405 NB	I-105/Imperial Hwy Getty Center Dr	13.1	965	3	6,057	2	269,925	2
New York	Van Wyck Expy/I-878 NB	Belt Pkwy/Exit 1 Main St/Exit 8	3.1	690	4	1,086	68	46,928	69
Los Angeles	San Gabriel River Fwy/I-605 SB	Beverly Blvd Florence Ave	4.8	681	5	1,644	43	70,454	43
Los Angeles	Santa Monica Fwy/I-10 EB	CA-1/Lincoln Blvd/Exit 1B Alameda St	14.9	640	6	4,664	8	203,998	8
Los Angeles	Santa Monica Fwy/I-10 WB	I-5/Golden State Fwy National Blvd	12.6	633	7	3,831	11	169,842	11
San Francisco	I-80 EB (James Lick Fwy/Bay Bldg)	US-101 Treasure Island Rd	3.6	600	8	1,005	76	43,711	79
San Francisco	Grove Shafter Fwy/CA-24 WB	Saint Stephens Dr Caldecott Tunnel	3.5	600	8	934	84	43,359	82
Los Angeles	I-110 SB	W Vernon Ave 51st St	2.5	582	10	670	124	30,929	114
New York	I-278 EB (Gowanus Expy/Brooklyn Queens)	92nd St/Exit 17 Apollo St/Meecker Ave/Exit 34	11.6	581	11	3,618	15	149,860	15
Los Angeles	Riverside Fwy/CA-91 EB	CA-55/Costa Mesa Fwy Mckinley St	20.7	576	12	5,698	3	260,647	3
New York	I-278 WB (Brooklyn Queens/Gowanus Expy)	NY-25A/Northern Blvd/Exit 41 NY-27/Prospect Expy/Exit 24	10.2	550	13	2,966	19	124,355	20
Austin	I-35 SB	US-183/Exit 239-240 Woodland Ave	6.7	545	14	1,000	100	30,000	100
San Francisco	Eastshore Fwy/I-80 EB/I-580 WB	Cypress St University Ave	3.3	535	15	930	86	43,359	82
Austin	I-35 NB	Shelby Ln/St Elmo Rd/Exit 230 Martin Luther King Blvd/19th St/Exit 235	4.7	525	16	920	88	43,359	82
Los Angeles	CA-110 SB (Pasadena/Harbor Fwys)	Avenue 60 Olympic Blvd/9th St	6.6	515	17	910	90	43,359	82
Los Angeles	I-5 SB (Santa Ana/Golden St Fwys)	East Cesar Chavez Ave Valley View Ave	17.5	510	18	900	92	43,359	82
New York	Van Wyck Expy/I-878 SB	Horace Harding Expy/Exit 12A Linden Blvd/Exit 3	6.2	505	19	890	94	43,359	82
San Francisco	Eastshore Fwy/I-80 WB/I-580 EB	Cutting Blvd Bay Bridge Toll Plz	8.5	500	20	880	96	43,359	82



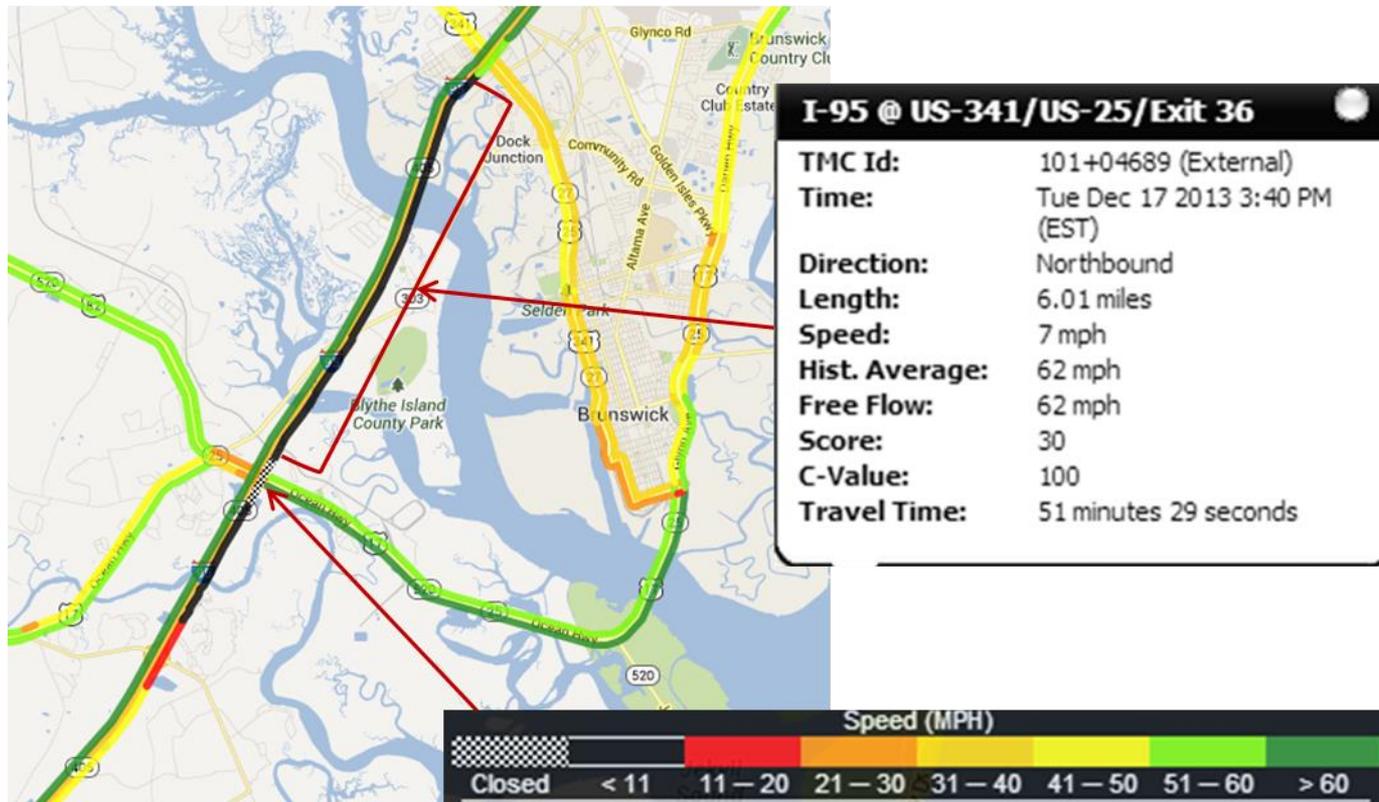
Delay Per Mile—Extra travel time during the year due to congestion, divided by the corridor length. Wasted Fuel—Increased fuel consumption due to travel in congested conditions. Congestion Cost—Value of travel time delay (estimated at \$16 per hour for person travel and \$88 per hour for truck time) and excess fuel consumption (estimated using \$2.50 per gallon). Do not place too much emphasis on small differences in the rankings. There may be little difference between (for example) 5th and 10th. The actual measure

Data Coming and Services Pondered

- Speed Data – More roads, More granular
- Traffic Volumes – better estimates, actual volumes during incidents
- Origin/Destination
 - GPS Trip Traces
 - Cellular Network Data
 - Enable “route demographics?”
- Connected Vehicles – “XFCD”

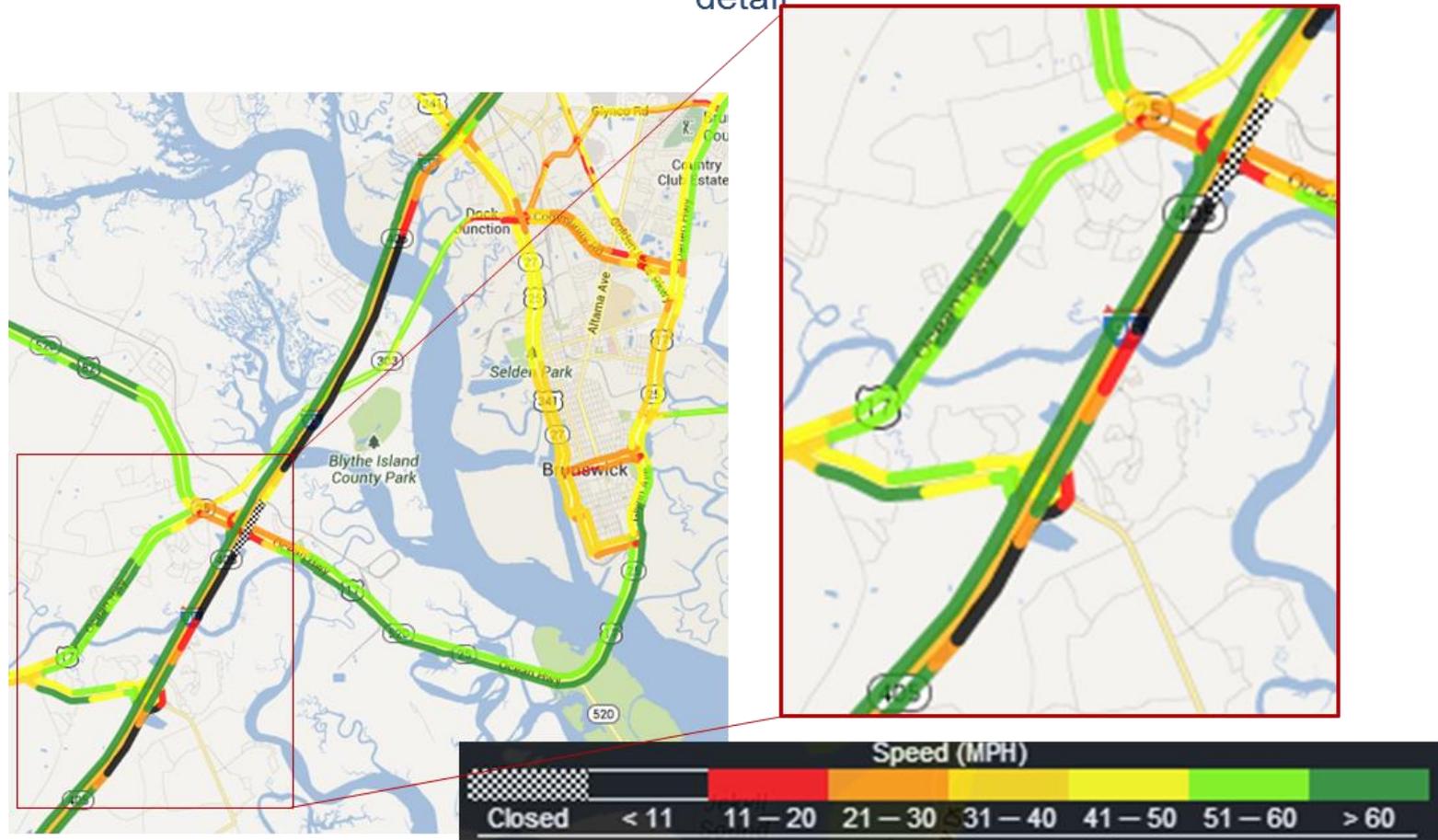
Better Speed Data: State-of-the-Practice: TMC Segments

INRIX Data using TMC segments clearly shows
two back-ups and the road closure



Better Speed Data: State-of-the-Art: XD Sub-Segments

INRIX Data using XD Sub-Segments shows highest queue resolution, increased XD coverage, and better detour route flow detail

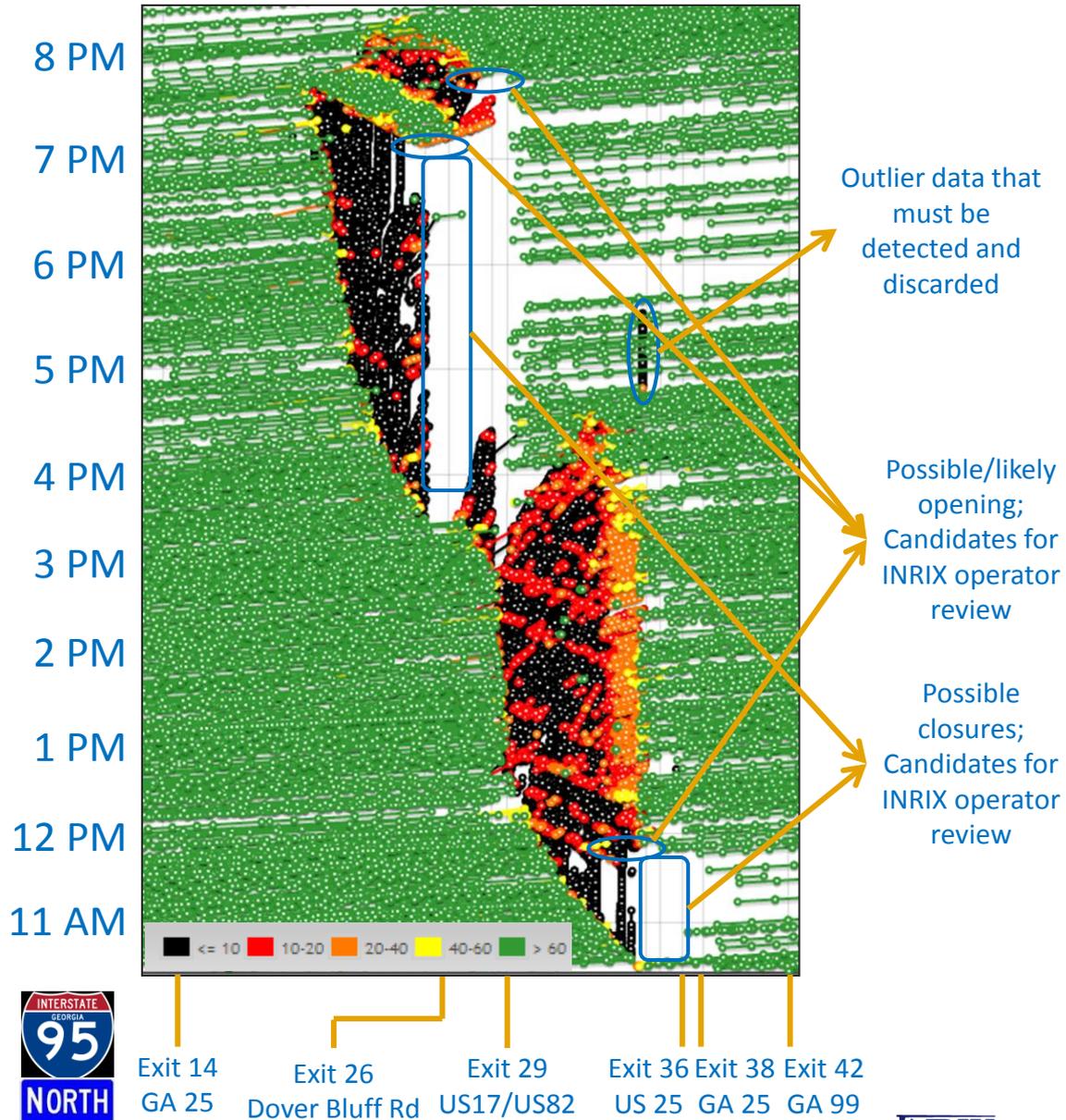


INRIX Vehicle Probe Trajectories

December 17, 2013

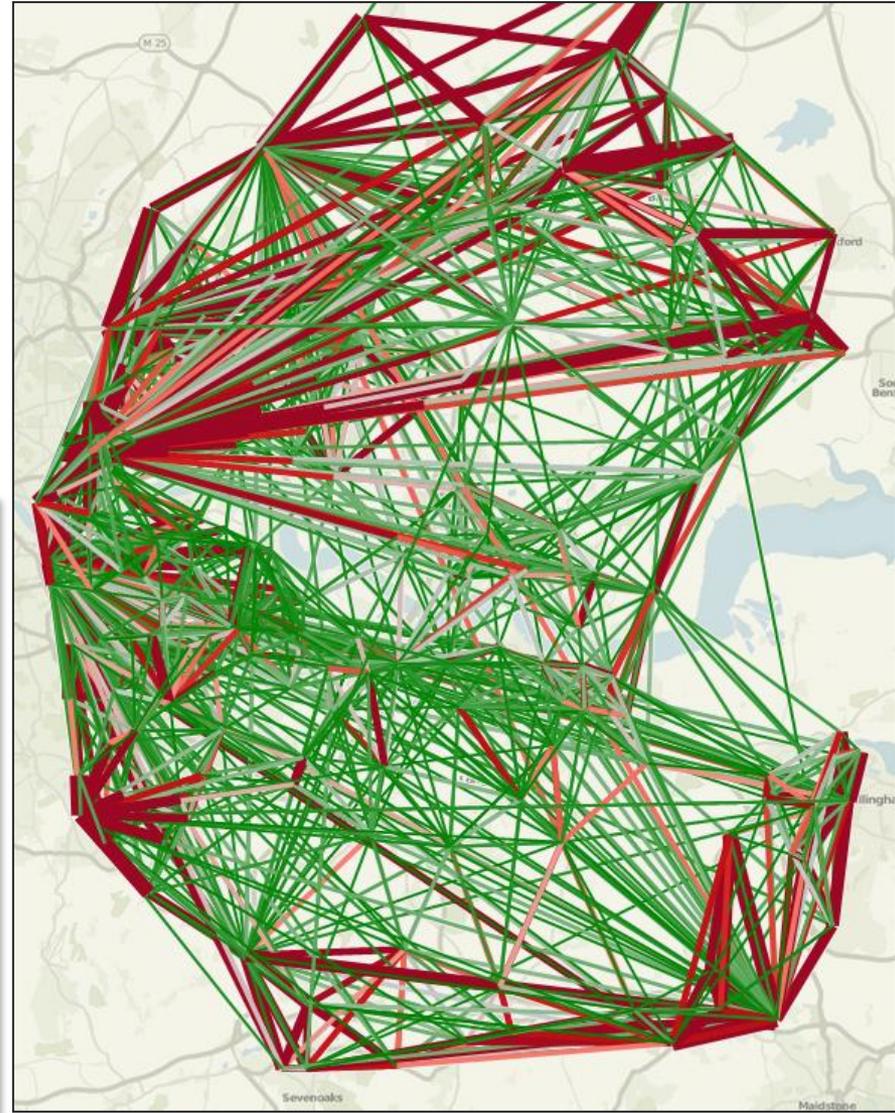
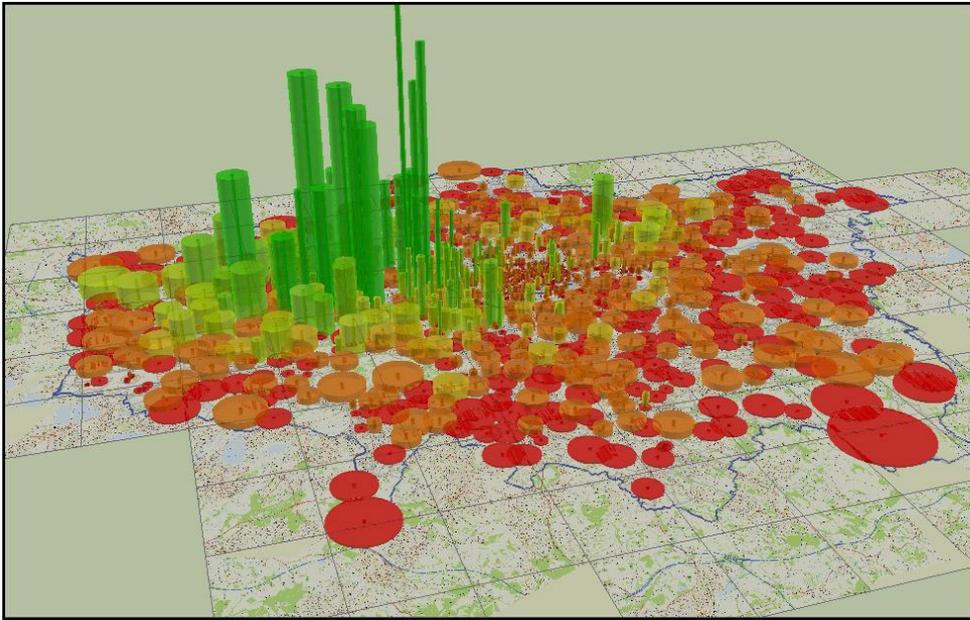
I-95 NB, Brunswick, GA

- Little circles are specific vehicle readings
- Lines connect data from the same vehicle
 - “Vehicle trajectory”
- Color of dot/line indicate specific vehicle speed/travel time
 - Dot is speed for single reading
 - Line is travel time between multiple readings
- This is the base data the powers INRIX processing



Origin Destination Data

- GPS or Cell Network Data
- Not just start and end, but route too
- Analyze from road segment viewpoint?
 - Where users are coming from and going to?
 - Use in key corridors?



XFCD: eXtended Floating Car Data

- Connected Vehicles can provide more than “PHS” data
 - One OEM example:
 - 72 real-time parameters readily available
 - Wide ranging:
 - Usual suspects: ABS, weather, etc.
 - More arcane: Mobile carrier signal strength/band
- What data is useful for energy use purposes...in real-time, in real-world operation?

Gaps/Needs

- Only modest data issues
 - Better volumes – real-time in particular
 - Better agency incident reporting
 - Better parking data – particularly street parking
- Existing business models will continue to extract more useful data from vehicles and mobile devices – in user agreeable ways
- More emphasis needed on data analysis, particularly at national level

Conclusions

- Raw Data (mostly) here now or coming soon
- Need to tolerate and accept license restrictions
 - Protects privacy
 - Fosters market development (products, not trails/projects)
- Re fuel impact of mobility/congestion
 - Little focus nationally
 - Tools/data can enable this focus now
 - Target Corridors for improvements/incentives
 - Address question: fuel use impact of “conditions aware” traveler?
 - Ongoing national program: alert agencies when signal timing has gone bad?

Thank you

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