Transportation Network Optimization Workshop

The Data Landscape

Rick Schuman, VP/GM, Public Sector

March 10, 2014

© 2014. Confidential & Proprietary

INRIX

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

- Challenge Home
- **Photos**
- Original Announcement
- Try the Experiment
- Winning Entry and Finalists

The $1,000 Doug MacDonald Challenge - Photos

The rice passes through the right funnel much faster.

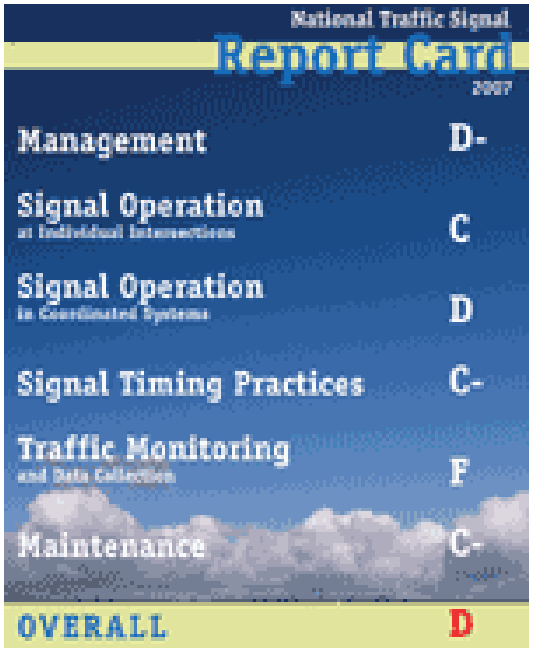
INRIX

National Transportation Operations Coalition

NTOC

2005

2007



2012

Self Reported → Room for Improvement!

INRIX

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

	Per Day	Per Year
Approximate economic savings from reduced travel time and fuel consumption:	$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

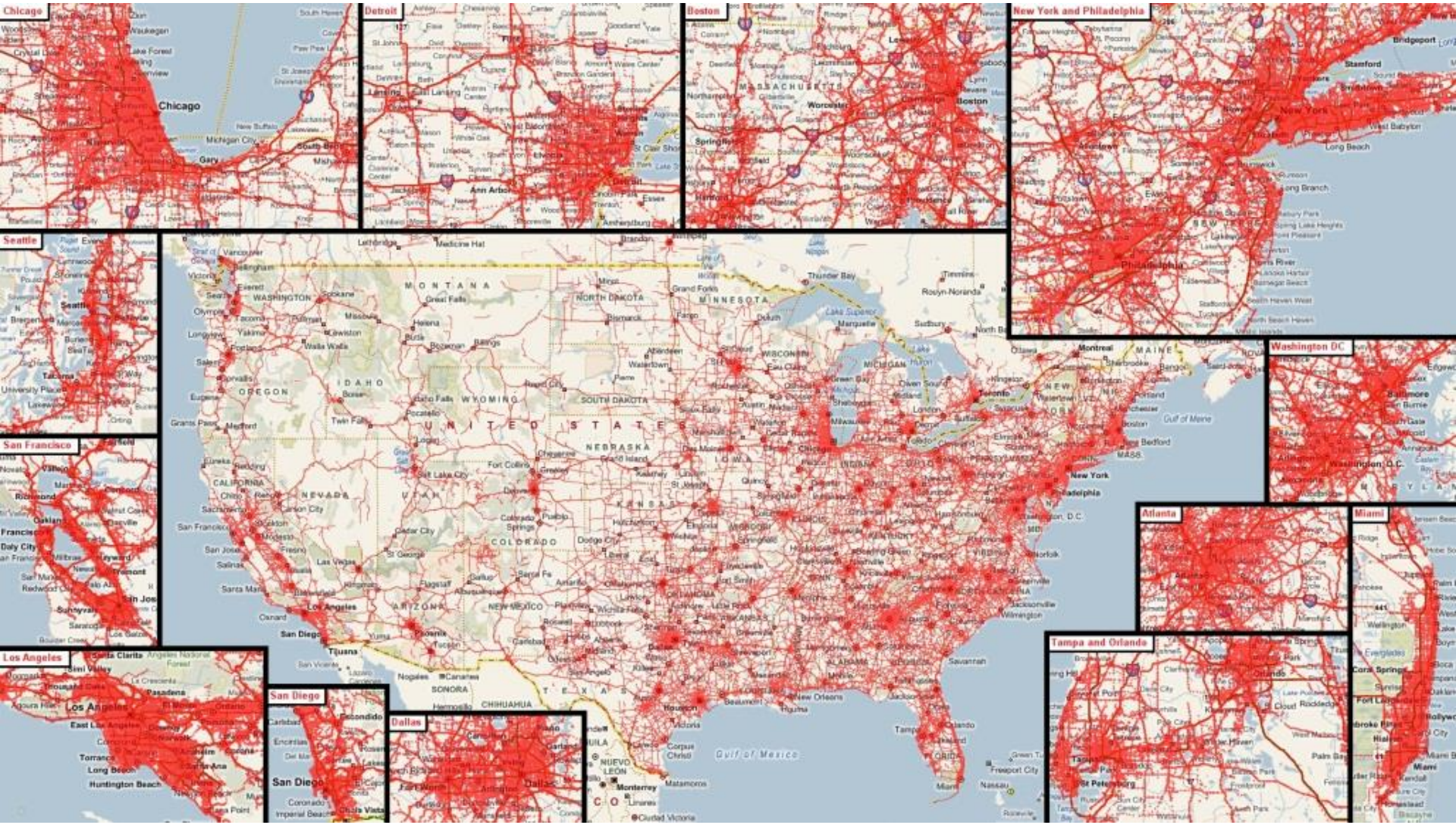
- Real-time Vehicle/Device "PHS" data
- Estimated Traffic Volumes – averages by day/time/segment
- Journalistic Data – better, not perfect
- Weather Data
- Parking (lots) – improving
- Fuel/EV Stations/Prices
- Transit alternatives – larger cities

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"

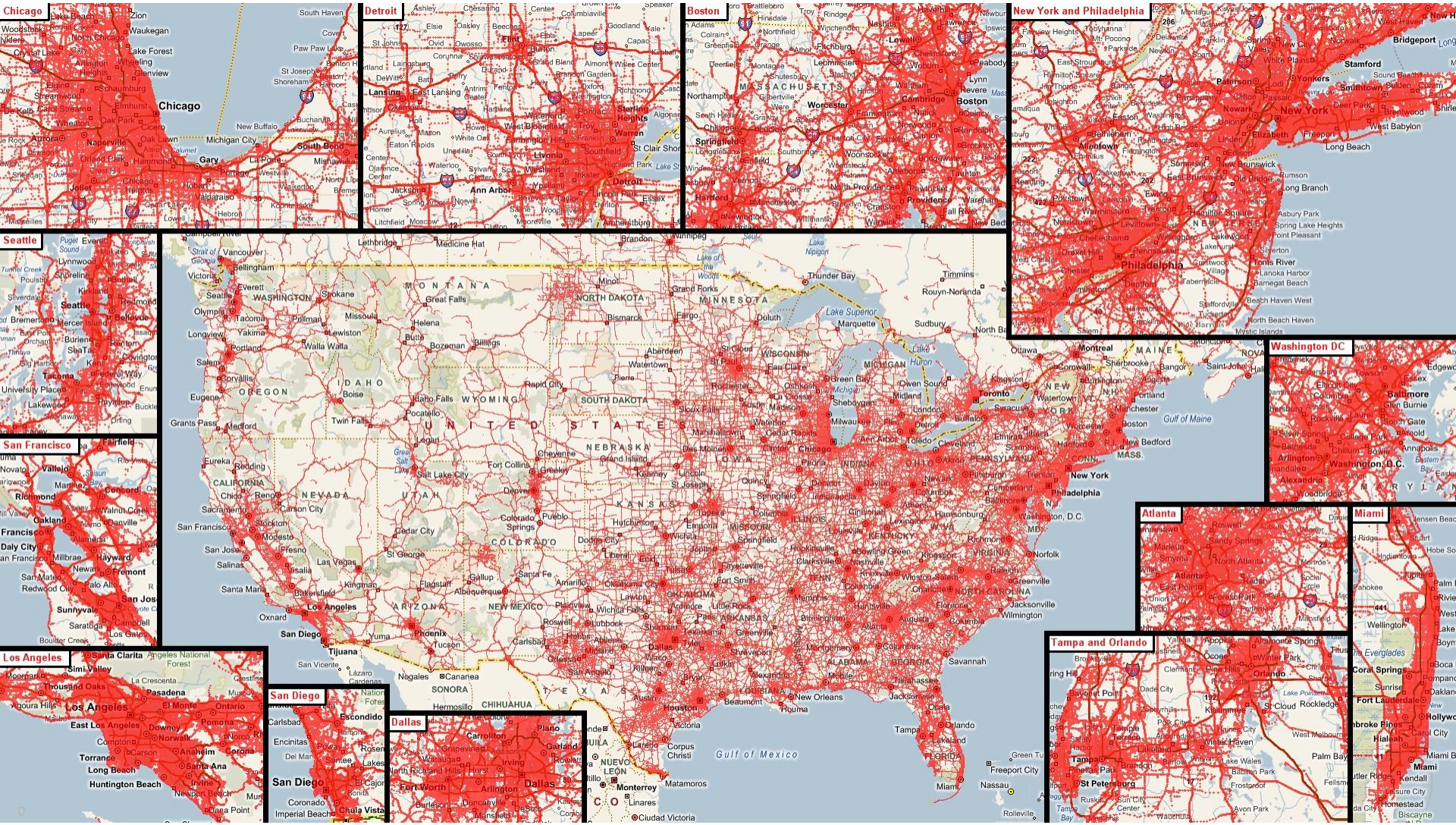
15 minutes of data – Thursday PM Peak



INRIX

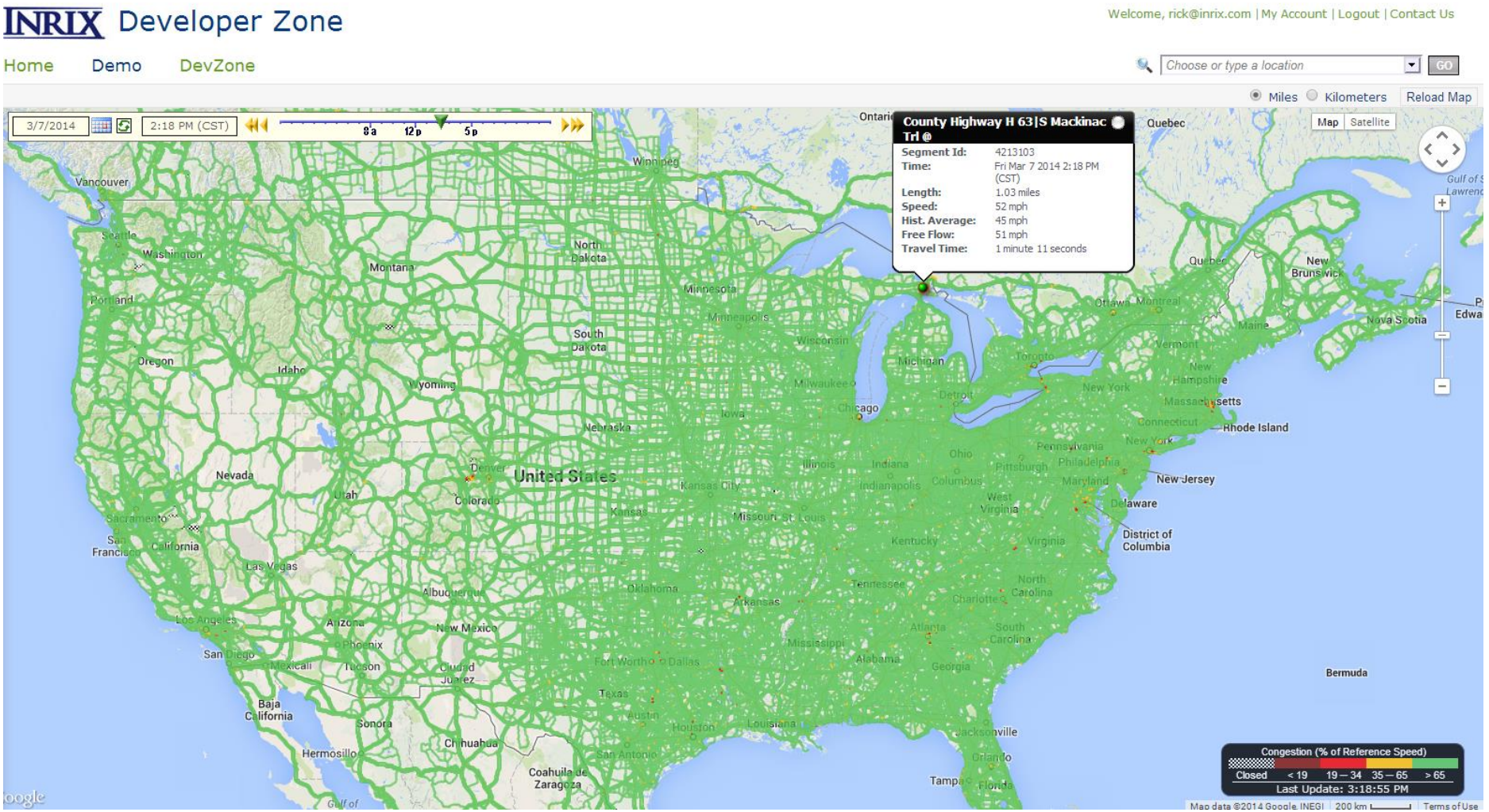
Summer 2013 – PHS “Red Dots”

15 minutes of data – Thursday PM Peak

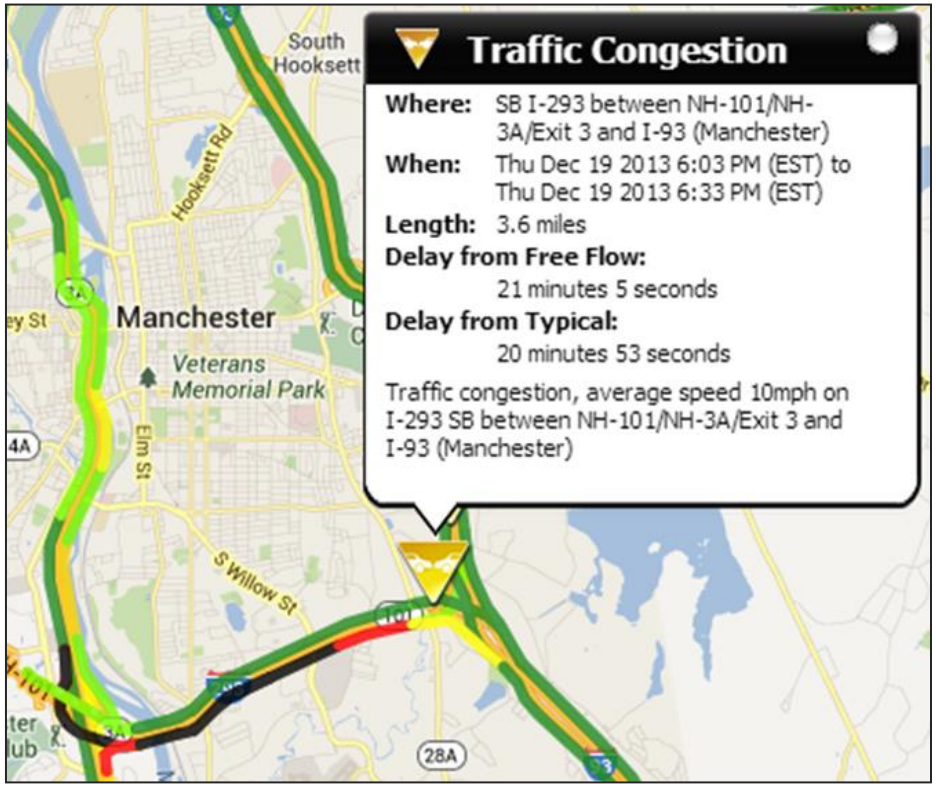


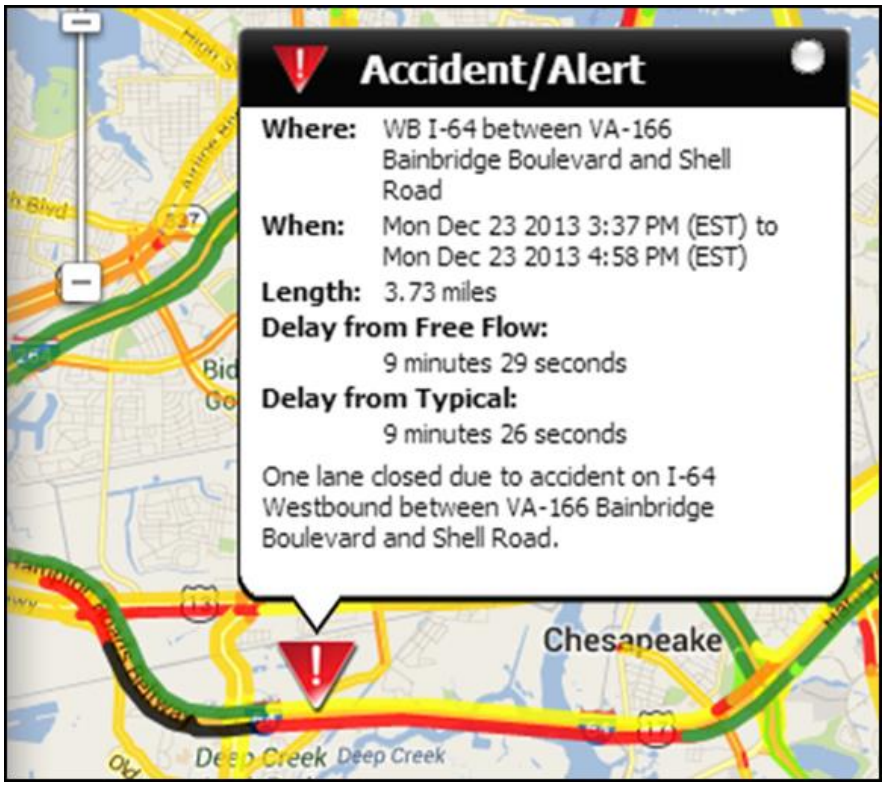
INRIX

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



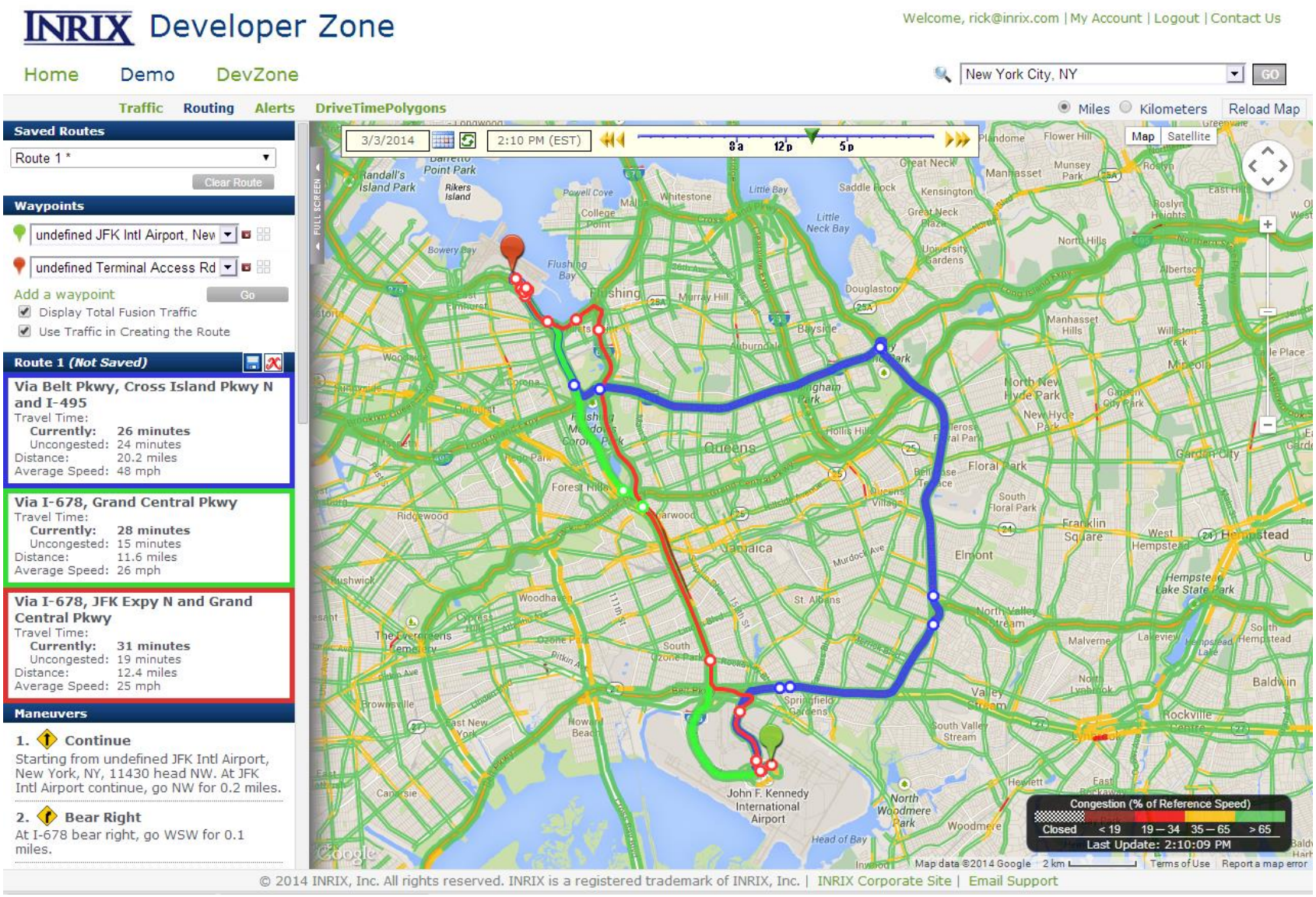
State-of-the-Art: Combining Journalistic Incidents and Impact



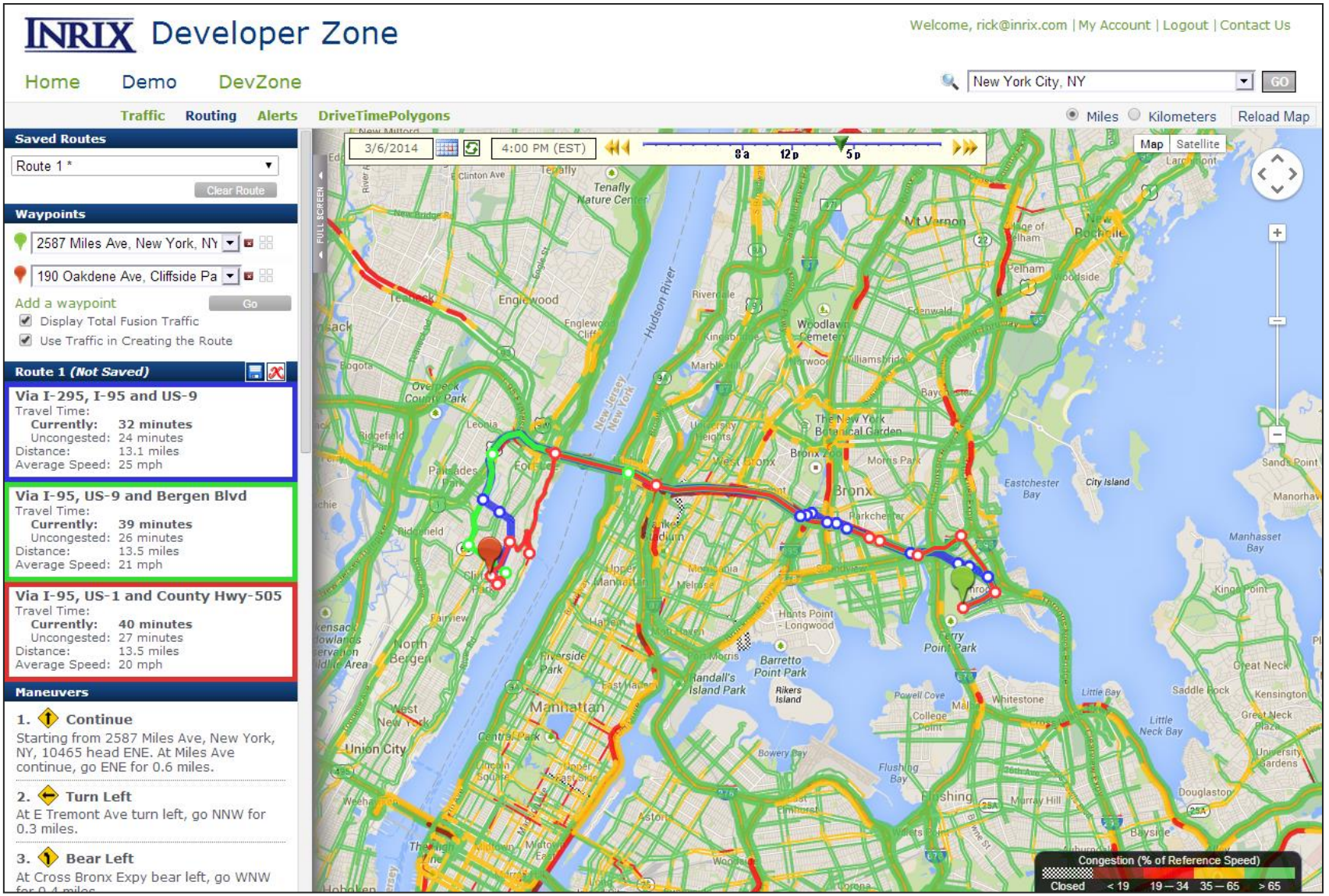


INRIX

Traffic-Aware Routing – From/To Anywhere



…Though not all routes are avoidable!



Real-Time Parking Information

POPULAR SCIENCE

Login/Register | Newsletter | Subscribe

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

147

Connect With That Parking Space *Audi*

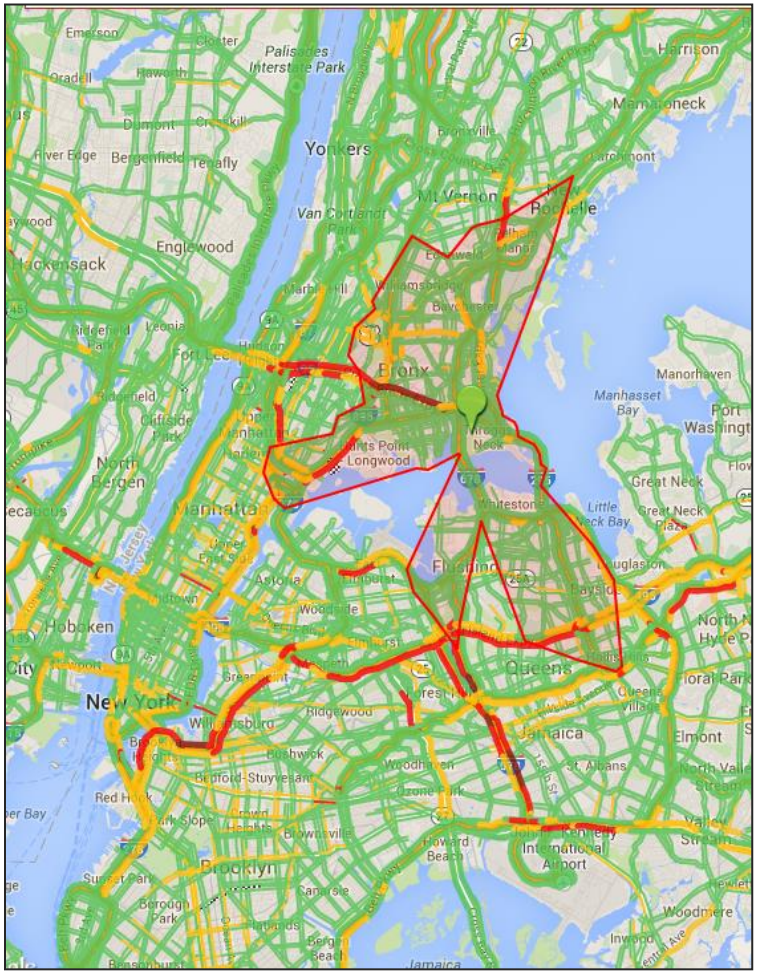
Audi is a company that loves to make its cars do the work for you. Its self-driving car may not be on the market yet, but its latest addition to its Audi Connect service solves a greater headache than having to actually steer: Finding parking.

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

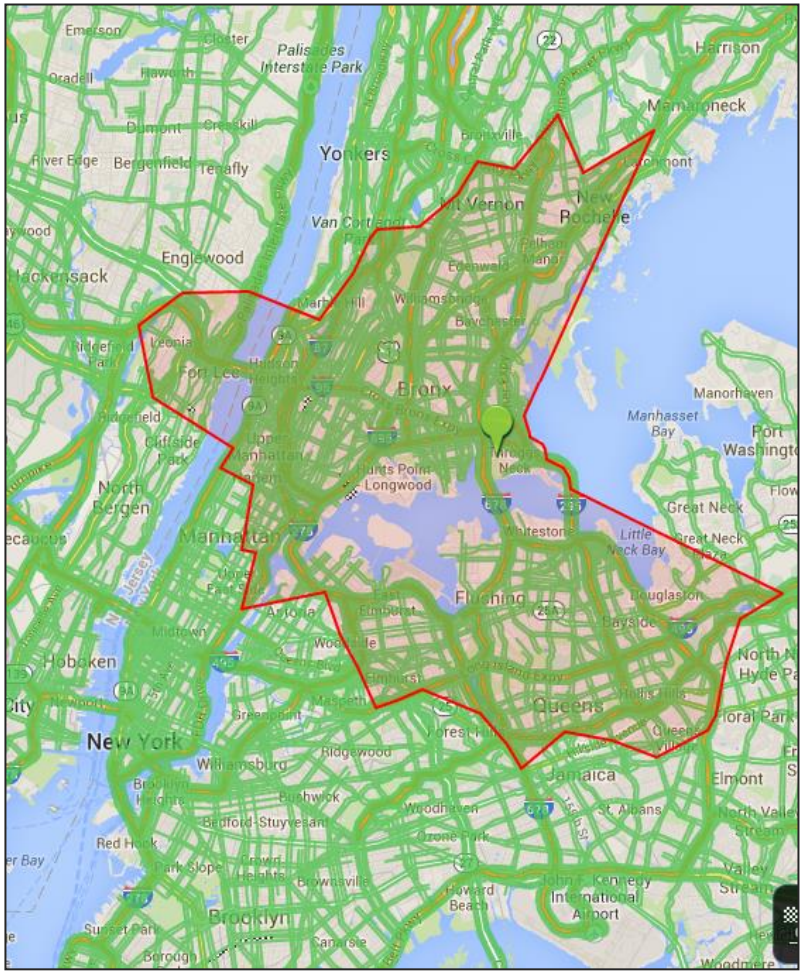
INRIX

EV Range Estimation

PM Rush Hour Range



Overnight Range



INRIX

INRIX Analytics – Home Page

Arterial Retiming Cost – Benefit Analysis using Crowd Sourced Data

PURDUE UNIVERSITY

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

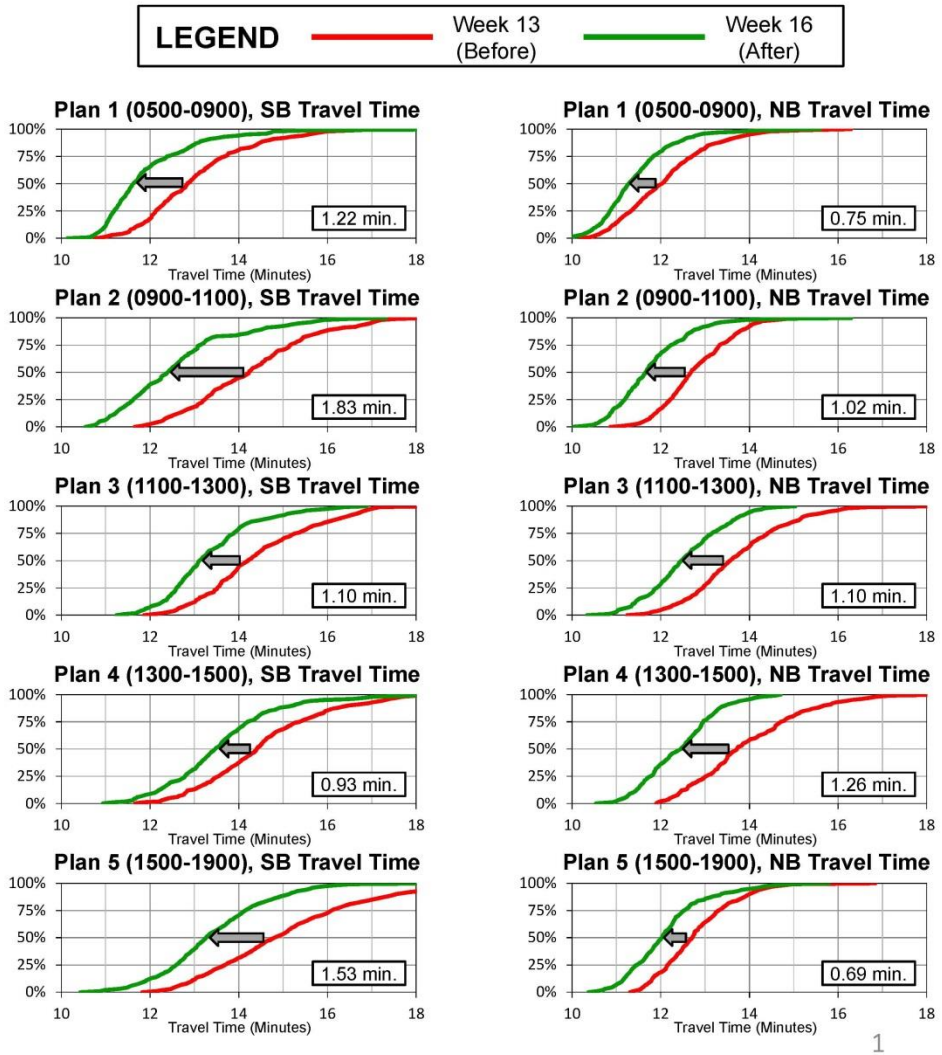
APRIL 2012						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Retiming

Week 15

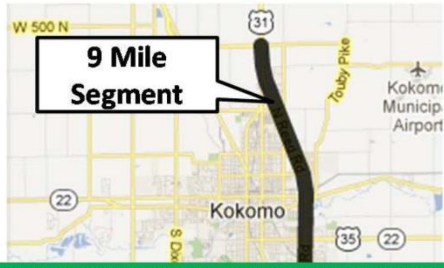
Week 16

After Retiming



Arterial Retiming Cost – Benefit Analysis using Crowd Sourced Data

PURDUE
UNIVERSITY



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 ($)	CO2 Reduction (tons)	CO2 Emission Savings ($)
[illegible]d US 31	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 – 1[illegible]00)	1.1	6.7%	8246.25	$ 194,779.77	69.59	$ 1,530.98
	Plan 4 (1300 – 1[illegible]00)	0.93	6.6%	6886.14	$ 162,653.47	58.11	$ 1,278.47
	[illegible]00)	1.53	13.5%	23311.22	$ 550,620.34	196.72	$ 4,327.91
	Plan 6 (1900 – 2[illegible]00)	0.91	7.1%	7319.89	$ 172,898.62	61.77	$ 1,359.00
North[illegible]	[illegible]00)	0.58	2.2%	1462.30	$ 34,540.02	12.34	$ 271.49
	[illegible]	0.75	7.6%	6420.27	$ 151,649.25	54.18	$ 1,191.97
	[illegible]	1.02	5.5%	6316.57	$ 149,199.92	53.31	$ 1,172.72
	[illegible]00)	[illegible]	7.0%	8627.08	$ 203,775.18	72.80	$ 1,601.69
	Plan 4 (1300 – 1500)	[illegible]	[illegible]	9881.93	$ 233,415.21	83.39	$ 1,834.66
	Plan 5 (1500 – 1900)	0.69	[illegible]	[illegible]040.76	$ 260,787.26	93.17	$ 2,049.81
	Plan 6 (1900 – 2400)	0.45	7.9%	[illegible]	$ 94,906.91	33.91	$ 745.97
	Total		100.0%	116321.6	$ 2,747,562	981.64	$ 21,596.03

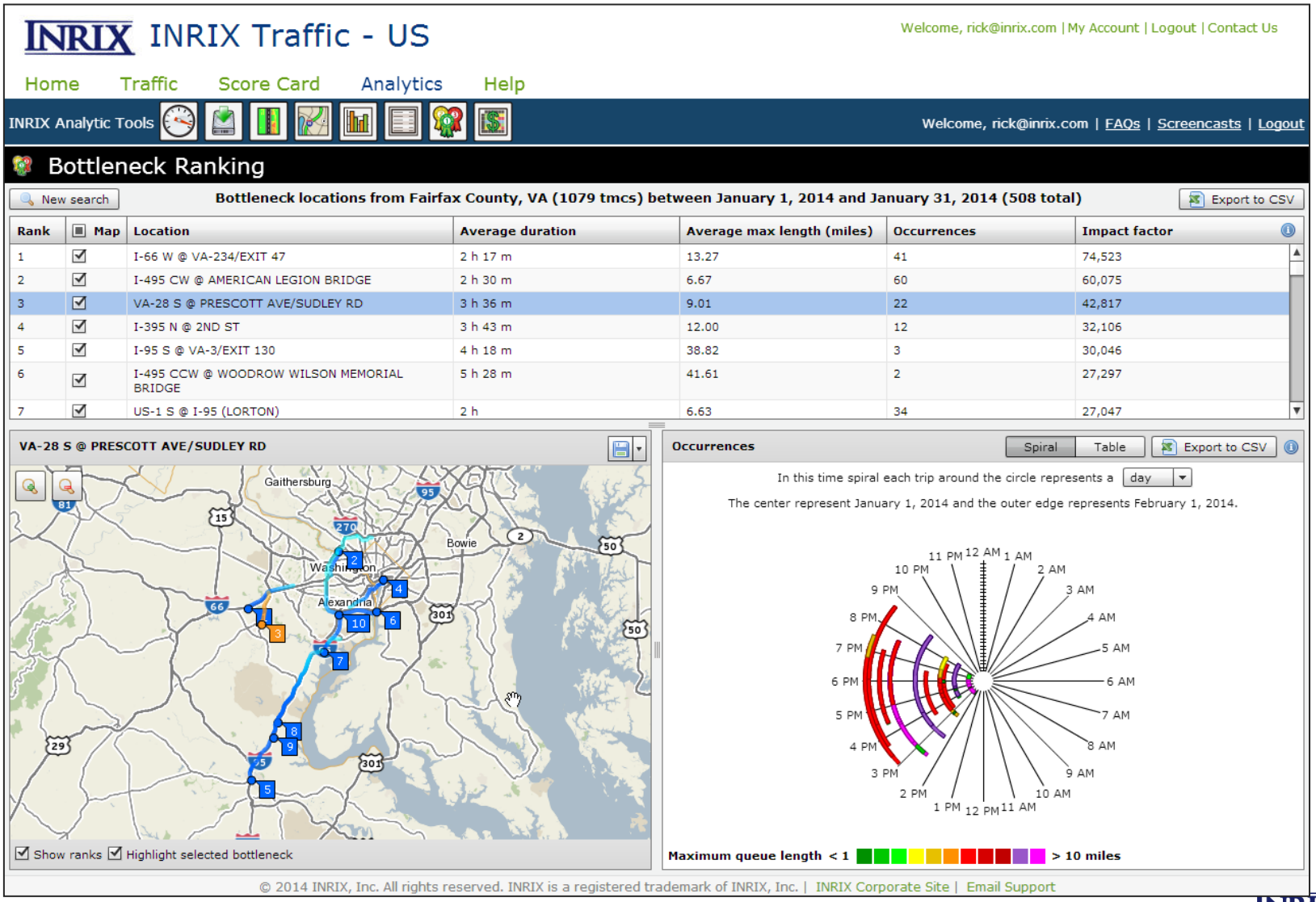
MARCH 2012

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

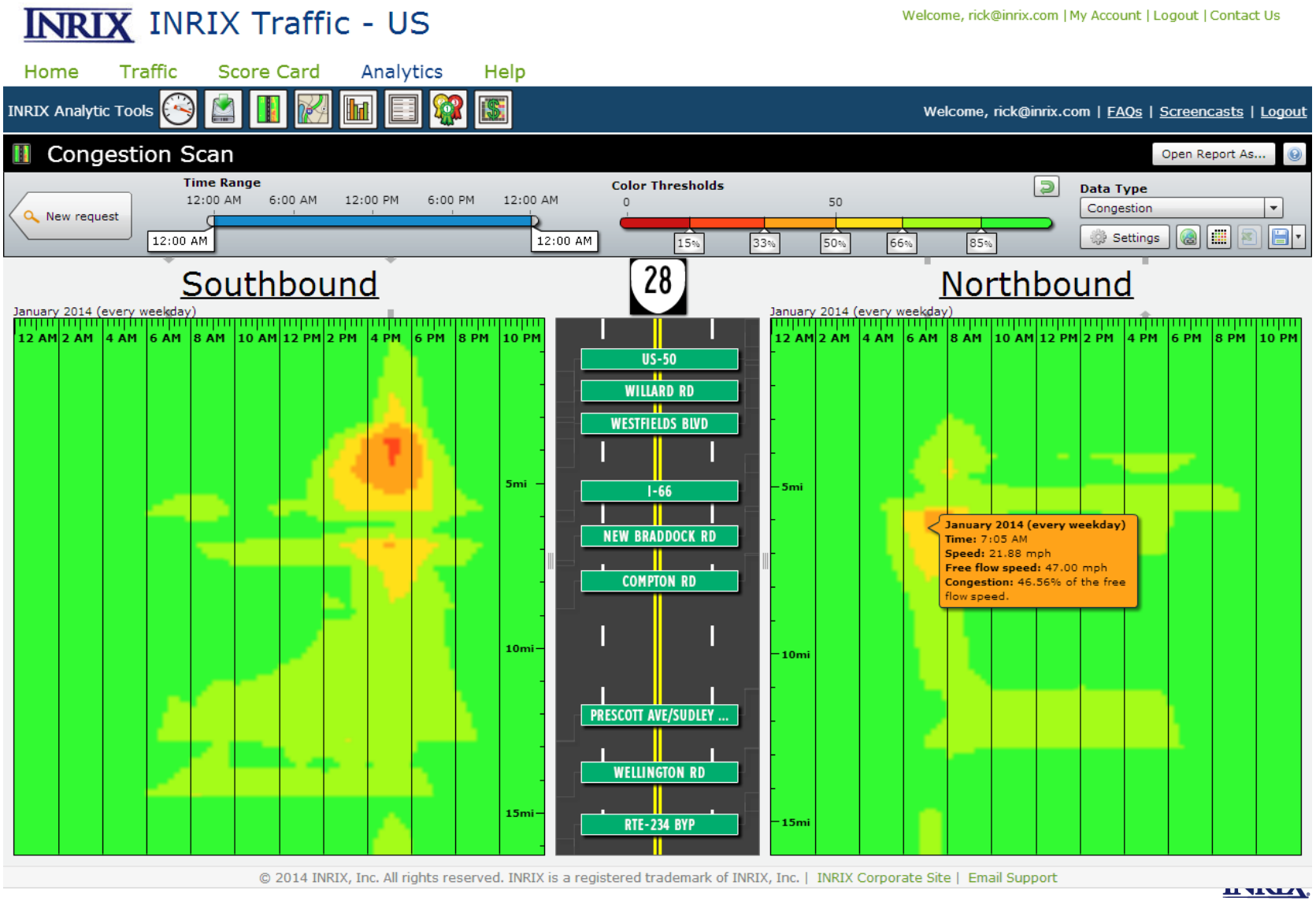
APRIL 2012

	S	M	T	W	T	F	S
Retiming 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



As is Detailed Analysis of Each Corridor



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	3.1	1,440	1	2,170	28	95,020	27
Los Angeles	Harbor Fwy/I-110 NB	111th Pl I-110/I-10/Santa Monica Fwy	6.5	1,126	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-678 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 Brdg)	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/Meeker 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	5					
San Francisco	Eastshore Fwy/I-80 EB/I-580 WB	Cypress St University Ave	3.3	5					
Austin	I-35 NB	Shelby Ln/St Elmo Rd/Exit 230 Martin Luther King Blvd/19th St/Exit 235	4.7	5					
Los Angeles	CA-110 SB (Pasadena/Harbor Fwys)	Avenue 60 Olympic Blvd/9th St	6.6	5					
Los Angeles	I-5 SB (Santa Ana/Golden St Fwys)	East Ceasar Chavez Ave Valley View Ave	17.5	5					
New York	Van Wyck Expy/I-678 SB	Horace Harding Expy/Exit 12A Linden Blvd/Exit 3	6.2	5					
San Francisco	Eastshore Fwy/I-80 WB/I-580 EB	Cutting Blvd Bay Bridge Toll Plz	8.5	5					

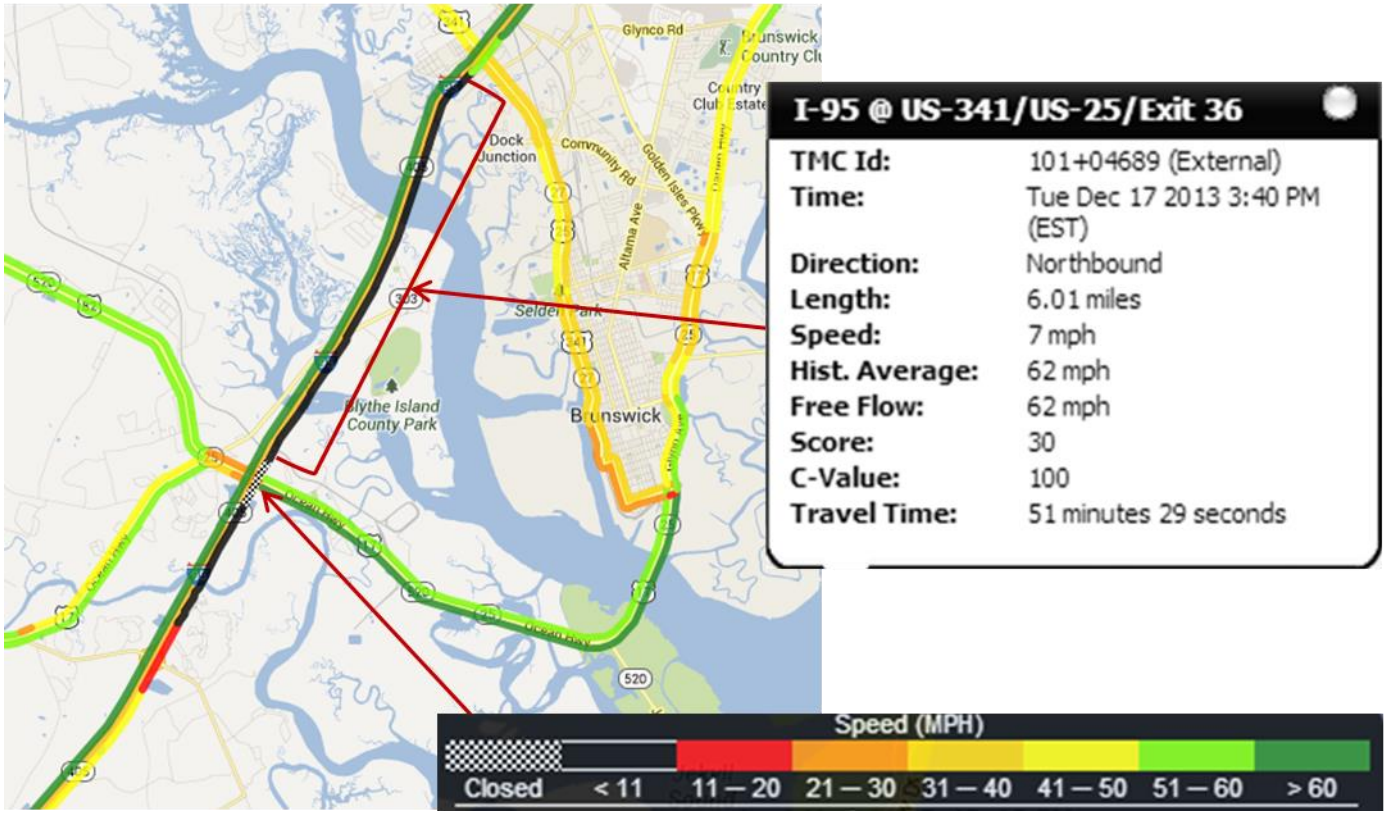
Delay Per Mile—Extra travel time during the year due to congestion, divided by the corridor length. Wasted Fuel—Increased fuel consumption due to travel in
Cost—Value of travel time delay (estimated at $16 per hour for person travel and $88 per hour for truck time) and excess fuel consumption (estimated using s
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 v

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

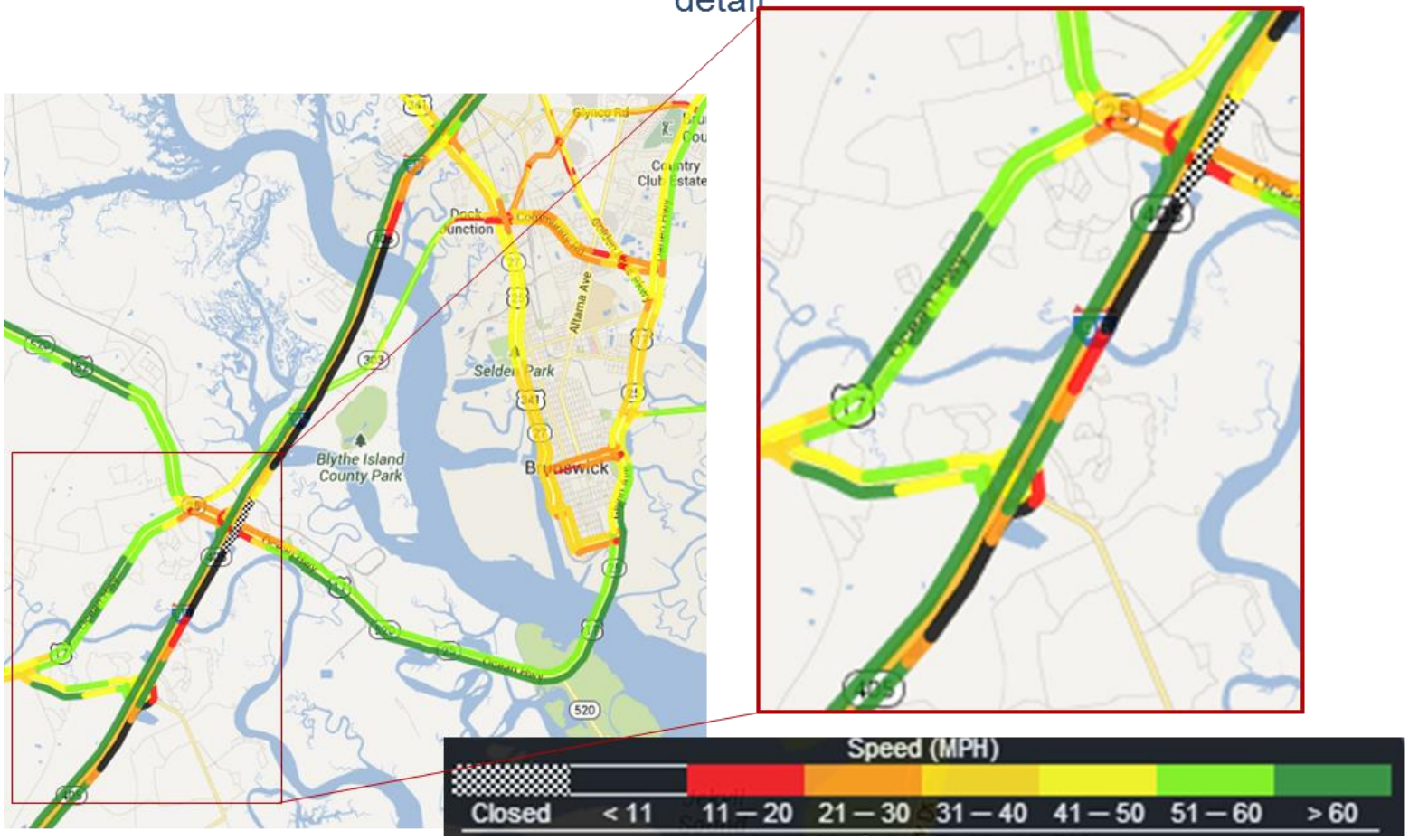
INRIX Data using TMC segments clearly shows two back-ups and the road closure



INRIX

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

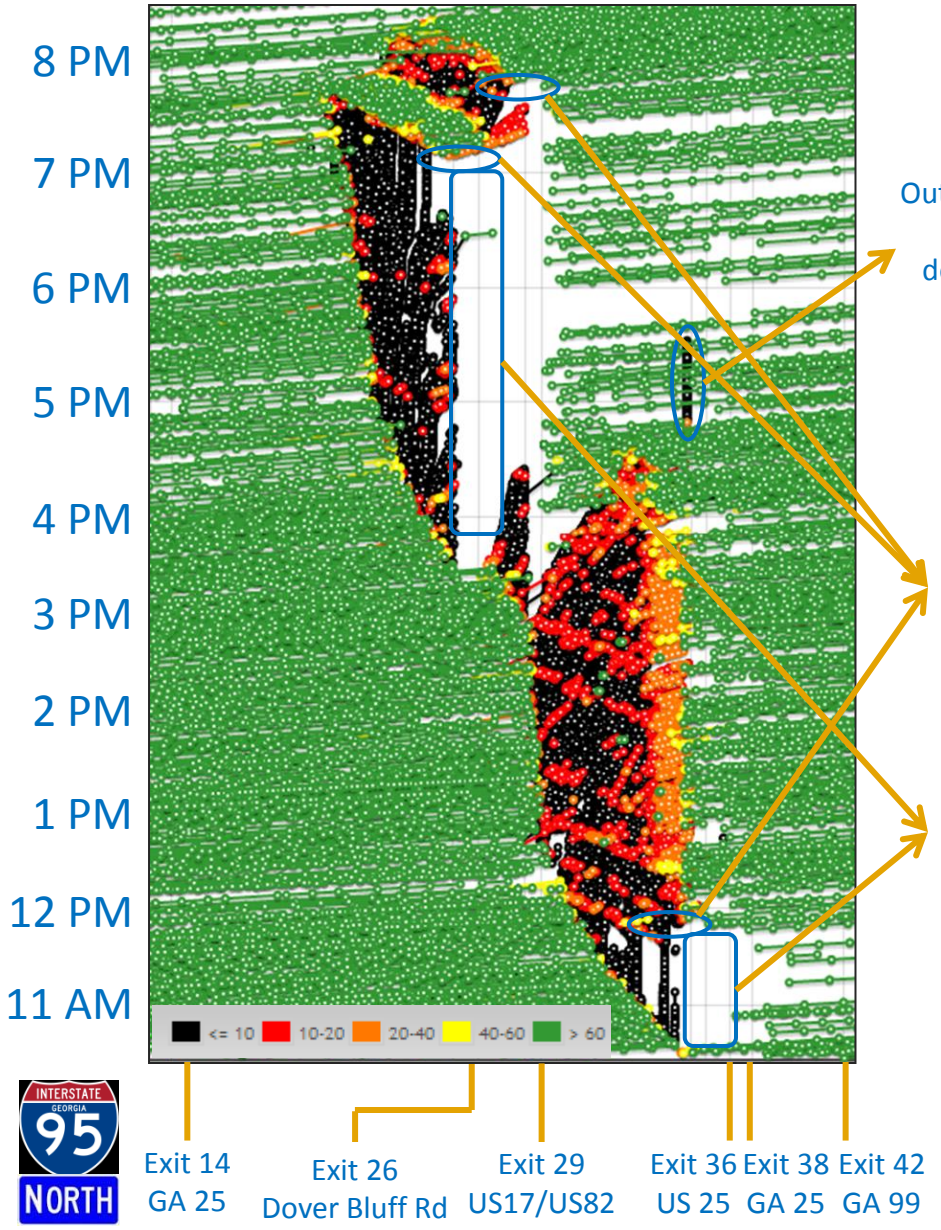
INRIX Data using XD Sub-Segments shows
highest queue resolution, increased XD coverage, and better detour route flow detail



INRIX

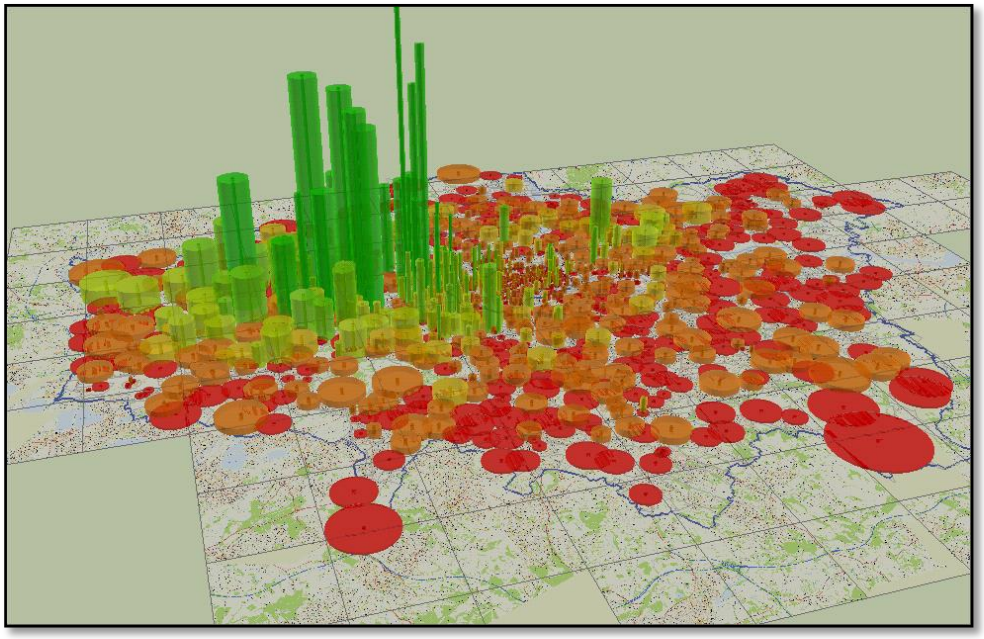
INRIX Vehicle Probe Trajectories
December 17, 2013
I-95 NB, Brunswick, GA

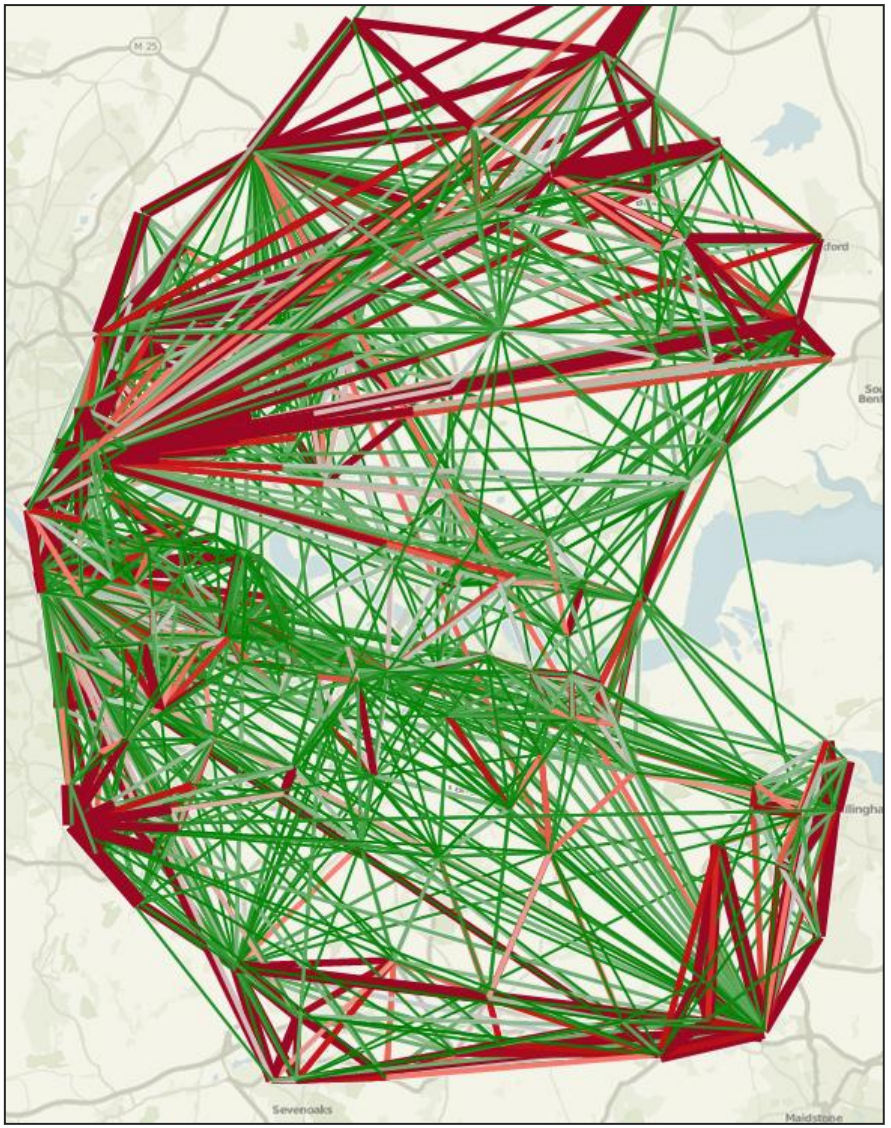
- Little circles are specific vehicle readings
- Lines connect data from the same vehicle
  - "Vehicle trajectory"
- Color of dot/line indicate specific vehicle speed/travel time
  - Dot is speed for single reading
  - Line is travel time between multiple readings
- This is the base data the powers INRIX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





INRIX

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

rick@inrix.com

© 2014. Confidential & Proprietary

INRIX