How Freight Probe Data is Revolutionizing the Industry

Rick Schuman, Ryan Glancy
March 2015
Topics

- **INRIX Background**
- Freight Probe Data History and Trends
- Implications for Public Sector
INRIX Overview
Leading Global Provider of Traffic Information, Analytics & Connected Car Services

- **World’s largest driver network**
  - 175M real-time vehicles & devices; Hundreds of distinct data sources

- **Across 40 countries**
  - Covering 4M+ miles; Expanding across South America, the Middle East and Asia

- **Delivering breakthrough Connected Car services & transportation analytics**
  - Traffic, Fuel, Parking, EV, Multi-Modal; Transportation & Population Analytics

- **Serving 300+ B2B customers worldwide**

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Automotive

- Audi
- Ford
- BMW
- Toyota
- Nissan
- Volkswagen
- Jaguar
- RAC
- DENSO
- Clarion
- Pioneer
- Continental
- JVC KENWOOD
- Bosch
- Aston Martin
- Mapbox

Mobile/Internet

- Deutsche Telekom
- Samsung
- Telenav
- Nuance
- Intel
- MapQuest
- Telmap
- Garmin
- fullpower
- OPTUS
- Group
- OXYGEN

Public Sector

- Transport for London
- ViaSuisse
- Cubic
- Transporgroup
- Highways Agency
- MIT
- Mouchel
- Mapbox
- Transport for Greater Manchester
- ODOT
- MDOT
- Jacobs
- TCS

Enterprise

- Berkshire Hathaway
- ATKINS
- SuperShuttle
- CDK
- Telogis
- Atkins
- RAND
- Windermere
- Purdue
- Telvent
- MIT
- Texas A&M Transportation Institute

Media

- The Weather Channel
- NBC
- WSI
- PELMOREX
- Gannett
- CNN
- INRIX
INRIX Traffic Intelligence Platform
Driving a Revolution in Data & Analytics for the Traffic Market

Massive input data

Technology Platform

Applications & Solutions

Real-time

Predictive

Historical

UBIQUITOUS

ACURATE

PREDICTIVE

ACTIONABLE

Big data

Analytics

Crowd source

Cloud based

Consumer vehicle GPS data

Mobile data

Incident data

Road sensors

Weather data

Cell Tower Data

Historical traffic data

Fleet data

Parking data

Event data

Cell Tower Data

INRIX INTELLIGENCE

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Cell Tower Data
Traffic Data a Decade Ago

Traditional Methods of Collection are Inadequate

- Limited Coverage
- Inaccurate
- Not Personally Applicable
- High Latency
- Static
- Expensive

Unfiltered Data
INRIX Timeline

Setting the Pace of Innovation

- **2005**
  - We launch the world’s first crowd-sourced traffic network with sensors in fleet vehicles
  - Dynamic Fuel Pricing starts
  - Europe’s transformation begins with our UK launch

- **2006**
  - Our Partnership with Clear Channel Total Traffic Network adds the how and why to slowdowns

- **2007**
  - The world’s first real-time predictive traffic app alters travel planning forever
  - Our patents for predictive analytics help people avoid incidents sooner

- **2008**
  - We launch traffic-influenced routing for all roads
  - Tom Tom and TeleMap Navigator adopt INRIX in their devices

- **2009**
  - Ford Launches Sync with INRIX, enriching the speed and accuracy of the network
  - Navigon launches INRIX across Europe

- **2010**
  - SpeedWaves technology improves accuracy on side streets and arterials by 70%
  - The INRIX Pro app reaches the iTunes Top 10
  - Ford launches INRIX fleet wide

- **2011/12**
  - Toyota, BMW and Audi bring INRIX into their vehicles
  - Ford and Pioneer use INRIX to power their mobile apps
  - INRIX acquires ITIS Holdings and are selected as the UK’s primary provider

- **2013**
  - Lexus Launches INRIX Traffic as a standard feature
  - Dynamic parking and fuel arrives in our app

- **2014**
  - Launch of BMW Multi-Modal, an industry first
  - Population Analytics, the first real-time tool for the movement of people
  - INRIX Drive Time™ launches the only Real Estate tool to measure in minutes vs. miles

**ENABLED BY FREIGHT DATA**

- **36 US Markets**
- **15 US Markets**
- **100 Countries**
- **8 Countries**
- **17 Countries**
- **28 Countries**
- **32 Countries**
- **37 Countries**
- **40 Countries**
INRIX Product Suites

Automotive Suite
Cloud-based traffic information & personalized driver services globally

Mobile & Internet Suite
Traffic insights anytime, anywhere via mobile apps & services

Public Sector Suite
Traffic platform for planning, analysis and operations of road networks

Fleet & Commercial Suite
Traffic, driver behavior & route intelligence

Media Suite
Real-time & predictive traffic and congestion info for broadcast media

Enterprise Suite
Investment decisions based on traffic analytics
INRIX Public Sector Suite

A traffic platform for planning, analysis and operations of road networks

**Real Time Traffic**
*Effectively manage daily roadway traffic*

- Traffic Speeds, Travel Times
- Traffic Tiles (Maps)
- Traffic Incidents
- Traffic Cameras
- Drive Time Polygons
- XD Monitoring
- Roadwatch™

**Historical Traffic**
*Determine how to best leverage infrastructure investments to optimize long term flow*

- Traffic/Freight Profiles
- Traffic Data Archive
- OD: Trip Records, Matrices

**Analytics**
*Assessing performance of roadways and impact of investments in infrastructure*

- Traffic Monitoring Dashboard
- Bottleneck & Congestion Analysis
- Historical Traffic Analysis
Incoming Data – April 2009
Topics

• INRIX Background
• Freight Probe Data History and Trends
• Implications for Public Sector
Freight Vehicles as Traffic Probes
Probe Reporting

- Capture and reporting frequencies vary by partner
- Example: Capture data every 1 minute and report 5 positions (every 5 minutes)

1) Store Data Point(s):
   - Lat, Long, Speed, Heading, Time stamp

2) Upload Data:
   - Every Y minutes
   - Each package contains [Z] data points

Vehicle with Telematics Device

Web application for Fleet

Telematics Server / Cloud

X minute(s) between Data Points
Commercial Telematics Penetration

- 15-20% growth YoY
- ~25% penetration (8 million of 25 million equipped)
- Long Haul Trucking penetration higher - ~45%
Freight Data → 24x7 Coverage

Top 5 Data Sources by Time of Day
(DC Area Avg Weekday - Spring 2013)

- Consumer: 34%
- Service/Local: 42%
- Freight/Long Haul: 24%
Increasing Data Frequency

- Consumer Vehicles: 10 sec
- Local Fleet Vehicles: 60 min
- Freight Trucks 2005: 2 X 5, 15,000
- Freight Trucks Today: 24 X 7, 100,000 +
- Freight Trucks Future: 30X
Increased Adoption - Government Legislation

- Hours of Service Requirements
- Pending ELD Mandate

Table 2: Top Industry Issue Rankings, 2005 – 2014

<table>
<thead>
<tr>
<th>Issue Rank</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
<td>2014</td>
<td>Hours-of-Service</td>
<td>Driver Shortage</td>
<td>CSA</td>
<td>Driver Retention</td>
<td><strong>ELD Mandate</strong></td>
<td>Truck Parking</td>
<td>Infrastr./Congestion/Funding</td>
<td>Driver Health/Wellness</td>
<td>Economy</td>
<td>Driver Distraction</td>
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<td>Driver Health/Wellness</td>
<td>Fuel Supply/Fuel Prices</td>
<td>Driver Health/Wellness</td>
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<tr>
<td>2012</td>
<td>CSA</td>
<td>Hours-of-Service</td>
<td>Economy</td>
<td>Driver Shortage</td>
<td>Fuel Supply/Fuel Prices</td>
<td><strong>ELD Mandate</strong></td>
<td>Driver Retention</td>
<td>Truck Parking</td>
<td>Driver Health/Wellness</td>
<td>Congestion/Truck Bottlenecks</td>
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<tr>
<td>2011</td>
<td>Economy</td>
<td>Hours-of-Service</td>
<td>Driver Shortage</td>
<td>CSA</td>
<td>Fuel Issues</td>
<td>Congestion</td>
<td>Transportation Funding</td>
<td>Tort Reform</td>
<td>Onboard Truck Technology</td>
<td>Truck Size and Weight</td>
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<tr>
<td>2010</td>
<td>Economy</td>
<td>CSA</td>
<td>Government Regulation</td>
<td>Hours-of-Service</td>
<td>Driver Shortage</td>
<td>Fuel Issues</td>
<td>Transportation Funding/Infrast.</td>
<td>Onboard Truck Technology</td>
<td>Environmental Issues</td>
<td>Truck Size and Weight</td>
</tr>
</tbody>
</table>

Source: ATRI
What Does the Future Hold

• Increased adoption of telematics expected over the next 5 years
  • Driven by new reporting requirements

• Increased Reporting Rates
  • Data costs are dropping and more value is created by increasing GPS frequency

• Additional Data will be sent from the Truck to power new applications
  • Outside Temperature
  • Traction control
  • Parking Status
We’ve got it good...comparatively

**France:** 110 mile traffic jam between Paris and Lyon – world’s longest

**China:** 60-mile, 11-day Chinese traffic jam sets world record

**Brazil:** 295km of traffic jam accumulated in Sao Paulo, meaning over 35% of the city's roads
Topics

• INRIX Background
• Freight Probe Data History and Trends
• Implications for Public Sector
Long Haul Freight Volume Intensity, 2010

Legend
Relative to Average National Intensity

<1x 1-2x 2-3x 3-4x 4-5x 5-6x 6-7x 7-8x
Some Regions Benefit from Freight Data More than Others (2010 Analysis)

### States

<table>
<thead>
<tr>
<th>Rank</th>
<th>State (Pop Rank)</th>
<th>Activity/Mile Compared to Average</th>
<th>Rank of Overall Activity</th>
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<tbody>
<tr>
<td>1</td>
<td>Tennessee (17)</td>
<td>222%</td>
<td>7</td>
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<tr>
<td>2</td>
<td>Nebraska (38)</td>
<td>218%</td>
<td>22</td>
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<tr>
<td>3</td>
<td>Indiana (16)</td>
<td>208%</td>
<td>6</td>
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<tr>
<td>4</td>
<td>Arkansas (32)</td>
<td>203%</td>
<td>12</td>
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<tr>
<td>5</td>
<td>Georgia (9)</td>
<td>174%</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Missouri (18)</td>
<td>159%</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Kentucky (26)</td>
<td>156%</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Pennsylvania (6)</td>
<td>155%</td>
<td>4</td>
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<tr>
<td>9</td>
<td>Illinois (5)</td>
<td>152%</td>
<td>3</td>
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<tr>
<td>10</td>
<td>Virginia (12)</td>
<td>149%</td>
<td>10</td>
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### Metropolitan Areas

<table>
<thead>
<tr>
<th>Rank</th>
<th>Area (Pop Rank)</th>
<th>Activity/Mile Compared to Average</th>
<th>Rank of Overall Activity</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Chattanooga TN-GA (98)</td>
<td>282%</td>
<td>28</td>
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<tr>
<td>2</td>
<td>Indianapolis-Carmel IN (34)</td>
<td>258%</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Knoxville TN (73)</td>
<td>257%</td>
<td>30</td>
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<tr>
<td>4</td>
<td>Austin-Round Rock TX (35)</td>
<td>240%</td>
<td>33</td>
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<tr>
<td>5</td>
<td>Nashville-Davidson--Murfreesboro--Franklin TN</td>
<td>222%</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Atlanta-Sandy Springs-Marietta GA (9)</td>
<td>195%</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Chicago-Naperville-Joliet IL-IN-WI (3)</td>
<td>194%</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Columbus OH (32)</td>
<td>190%</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>Harrisburg-Carlisle PA (96)</td>
<td>189%</td>
<td>23</td>
</tr>
<tr>
<td>10</td>
<td>Dayton OH (61)</td>
<td>184%</td>
<td>26</td>
</tr>
</tbody>
</table>
Implications for Public Sector

- Improves All Products
  - Road Coverage – Statewide/Nationwide
  - 24x7 Coverage – Nights/Weekends
  - Data Quality – Consistently improving
  - Improves
    - Real-Time Data
    - Analytics
    - Archives/Profiles
- Enables New Products
  - Queue Warning
  - Freight Speed Profiles
  - Freight OD
- Future Possibilities
  - “XFCD” Enabled Services
2008 Road Coverage Example
Freight Data ➔ Nationwide Coverage
Freight Data ➔ Quality Improvements
(*I-95 Corridor Coalition Vehicle Probe Project Freeway Validation Results*)

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<tr>
<td>0 - 30</td>
<td>5.9</td>
<td>4.4</td>
<td>2.5</td>
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<td>30-45</td>
<td>7.5</td>
<td>5.0</td>
<td>3.9</td>
<td></td>
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<td>45 - 60</td>
<td>2.6</td>
<td>2.1</td>
<td>1.9</td>
<td></td>
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<tr>
<td>&gt; 60</td>
<td>2.6</td>
<td>1.9</td>
<td>1.1</td>
<td></td>
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<tr>
<td>Overall</td>
<td>2.8</td>
<td>2.3</td>
<td>1.5</td>
<td></td>
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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

Most of this Data is Freight Data

Outlier data that must be detected and discarded
Possible/likely opening; Candidates for INRIX operator review
Possible closures; Candidates for INRIX operator review
Freight Data ➔ Better Precision
**Delta Speed**: Difference in speed from an initial segment to the adjacent segment downstream.

This is where we as an industry need to focus our attention. High speed to low speed indicates the back of a queue.
XD Segments Supporting Queue Detection (Indiana DOT/Purdue) – “Game Changing Fidelity”

http://tinyurl.com/purdue-indot-queue-warning
http://youtu.be/5eFwSBGZkql
INRIX Analytics
(4+ Years, 1 Trillion+ Records, Nationwide)
Examples of Analytics/Archived Data Uses

• Statewide Reports
  • “Texas 100 Most Congested Corridors” – TTI/TxDOT
  • Indiana Mobility Report – Purdue/INDOT
    • [http://docs.lib.purdue.edu/imr/](http://docs.lib.purdue.edu/imr/)
  • Maryland Mobility Report – MDDOT/MDSHA/UMD
  • Bottlenecks on the Florida SIS – FDOT/CDM Smith
    • 2014 ITE Transportation Planning Council Best Project Award winner

• Metropolitan Area Reports
  • DC Congestion Management Process (MWCOG)
    • [www.mwcoog.org/cmp/](http://www.mwcoog.org/cmp/)
  • Baltimore Quarterly Congestion Analysis Report (BMC)
  • Philadelphia Area “Using Operations Data for Planning in the Delaware Valley: First Steps” (DVRPC)
    • [http://www.dvrpc.org/reports/11049.pdf](http://www.dvrpc.org/reports/11049.pdf)
Example: Texas Congested Freight Corridors (Freight Profile Enabled)

<table>
<thead>
<tr>
<th>2014 Rank</th>
<th>2014 Rank Truck</th>
<th>Roadway</th>
<th>From</th>
<th>To</th>
<th>County</th>
<th>Annual Hrs of Delay per Mile</th>
<th>Annual Hrs of Truck Delay per Mile</th>
<th>TCI</th>
<th>PTI</th>
<th>CSI</th>
<th>Annual Congestion Cost (Millions)</th>
<th>Truck Congestion Cost (Millions)</th>
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<tr>
<td>2</td>
<td>1</td>
<td>IH 35</td>
<td>US 290 N</td>
<td>SH 71</td>
<td>Travis</td>
<td>950.795</td>
<td>116,251</td>
<td>2.54</td>
<td>10.00</td>
<td>3.33</td>
<td>$196.14</td>
<td>$72.12</td>
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<tr>
<td>3</td>
<td>2</td>
<td>US 59</td>
<td>IH 610</td>
<td>SH 288</td>
<td>Harris</td>
<td>777.146</td>
<td>72,337</td>
<td>2.01</td>
<td>9.54</td>
<td>2.12</td>
<td>$105.22</td>
<td>$32.15</td>
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<tr>
<td>15</td>
<td>3</td>
<td>IH 10/US 90</td>
<td>N Eldridge Pky</td>
<td>SL 8</td>
<td>Harris</td>
<td>420.653</td>
<td>72,181</td>
<td>1.78</td>
<td>7.11</td>
<td>1.91</td>
<td>$43.38</td>
<td>$20.09</td>
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<tr>
<td>1</td>
<td>4</td>
<td>IH 610</td>
<td>IH 10/US 90</td>
<td>IH 59/US 59</td>
<td>Harris</td>
<td>1,184,702</td>
<td>70,579</td>
<td>2.43</td>
<td>8.70</td>
<td>3.20</td>
<td>$81.35</td>
<td>$17.12</td>
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<tr>
<td>5</td>
<td>5</td>
<td>IH 35E/US 183</td>
<td>SH 183</td>
<td>IH 30</td>
<td>Dallas</td>
<td>708,365</td>
<td>70,187</td>
<td>1.96</td>
<td>7.63</td>
<td>2.48</td>
<td>$79.65</td>
<td>$26.25</td>
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</tbody>
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Chicago Freight Study

• Study Area:
  • Greater Chicagoland Area, and beyond
  • 154 zones

• Study Period:
  • July – Sept 2013 (3 months)

• Total Data Points Analyzed:
  • ~1.5 billion

• Freights Trips Identified:
  • 4.8 million

• Results provided as OD Matrix
Questions

rick@inrix.com