How Freight Probe Data is Revolutionizing the Industry

Rick Schuman, Ryan Glancy
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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**
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

Big data
Analytics
Crowd source
Cloud based

UBIQUITOUS
ACCURATE
PREDICTIVE
ACTIONABLE

Consumer vehicle GPS data
Historical traffic data
Fleet data
Parking data
Mobile data
Incident data
Weather data
Road sensors
Cell Tower Data
Event data
Historical traffic data
Fleet data
Parking 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

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

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

Our patents for predictive analytics help people avoid incidents sooner

We launch traffic-influenced routing for all roads

The world’s first real-time predictive traffic app alters travel planning forever

The INRIX Pro app reaches the iTunes Top 10

Navigon launches INRIX across Europe

Navigon launches INRIX across Europe

SpeedWaves technology improves accuracy on side streets and arterials by 70%

Ford launches INRIX fleet wide

Ford Launches Sync with INRIX, enriching the speed and accuracy of the network

Toyota, BMW and Audi bring INRIX into their vehicles

INRIX XD™ launches giving greater detail of traffic on any map

Lexus Launches INRIX Traffic as a standard feature

Dynamic parking and fuel arrives in our app

Toyota, BMW and Audi bring INRIX into their vehicles

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

2005

2006

2007

2008

2009

2010

2011/12

2013

2014

3 Countries

8 Countries

17 Countries

28 Countries

32 Countries

37 Countries

40 Countries

36 US Markets

100 Countries

100 US Markets

15 Countries

Enabled by Freight Data
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 infrastructure investments*

- Traffic Monitoring Dashboard
- Bottleneck & Congestion Analysis
- Historical Traffic Analysis
Incoming Data – April 2009
Incoming Data – April 2014
Topics

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Freight Vehicles as Traffic Probes
Probe Reporting

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

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

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

Vehicle with Telematics Device

Telematics Server / Cloud

Web application for Fleet

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

- **Consumer Vehicles**: 10 sec
- **Local Fleet Vehicles**: 60 min
- **Freight Trucks Today**: 24 X 7, 100,000 +
- **Freight Trucks 2005**: 2 X 5, 15,000
- **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>Year</th>
<th>Issue Rank 1</th>
<th>Issue Rank 2</th>
<th>Issue Rank 3</th>
<th>Issue Rank 4</th>
<th>Issue Rank 5</th>
<th>Issue Rank 6</th>
<th>Issue Rank 7</th>
<th>Issue Rank 8</th>
<th>Issue Rank 9</th>
<th>Issue Rank 10</th>
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</thead>
<tbody>
<tr>
<td>2014</td>
<td>Hours of Service</td>
<td>Driver Shortage</td>
<td>CSA</td>
<td>Driver Retention</td>
<td>ELD Mandate</td>
<td>Truck Parking</td>
<td>Infrast / Congestion / Funding</td>
<td>Driver Health / Wellness</td>
<td>Economy</td>
<td>Driver Distraction</td>
</tr>
<tr>
<td>2013</td>
<td>Hours of Service</td>
<td>CSA</td>
<td>Driver Shortage</td>
<td>Economy</td>
<td>ELD Mandate</td>
<td>Truck Parking</td>
<td>Driver Retention</td>
<td>Fuel Supply / Fuel Prices</td>
<td>Infrast / Congestion / Funding</td>
<td>Driver Health / Wellness</td>
</tr>
<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>ELD Mandate</td>
<td>Driver Retention</td>
<td>Truck Parking</td>
<td>Driver Health / Wellness</td>
<td>Congestion / Truck Bottlenecks</td>
</tr>
<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>
</tr>
<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>
<tr>
<td>2009</td>
<td>Economy</td>
<td>Government Regulation</td>
<td>Fuel Issues</td>
<td>Congestion / Highway Infrastr.</td>
<td>Hours of Service</td>
<td>Commercial Driver Issues</td>
<td>Environmental Issues</td>
<td>Tolls / Highway Funding</td>
<td>Truck Size and Weight</td>
<td>Onboard Truck Technology</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

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- 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 (Activity/Mile)</th>
<th>State (Pop Rank)</th>
<th>Activity/Mile Compared to Average</th>
<th>Rank of Overall Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tennessee (17)</td>
<td>222%</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Nebraska (38)</td>
<td>218%</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>Indiana (16)</td>
<td>208%</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Arkansas (32)</td>
<td>203%</td>
<td>12</td>
</tr>
<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>
</tr>
<tr>
<td>9</td>
<td>Illinois (5)</td>
<td>152%</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Virginia (12)</td>
<td>149%</td>
<td>10</td>
</tr>
</tbody>
</table>

### Metropolitan Areas

<table>
<thead>
<tr>
<th>Rank (Activity/Mile)</th>
<th>Area (Pop Rank)</th>
<th>Activity/Mile Compared to Average</th>
<th>Rank of Overall Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chattanooga TN-GA (98)</td>
<td>282%</td>
<td>28</td>
</tr>
<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>
</tr>
<tr>
<td>4</td>
<td>Austin-Round Rock TX (35)</td>
<td>240%</td>
<td>33</td>
</tr>
<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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<table>
<thead>
<tr>
<th>Ground Truth Speed Range, in MPH</th>
<th>2008 - 2009 (16 Tests, 5 States)</th>
<th>2010 - 2011 (19 Tests, 8 States)</th>
<th>2012 - 2013 (7 Tests, 7 States)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>5.9</td>
<td>4.4</td>
<td>2.5</td>
</tr>
<tr>
<td>30 - 45</td>
<td>7.5</td>
<td>5.0</td>
<td>3.9</td>
</tr>
<tr>
<td>45 - 60</td>
<td>2.6</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>2.6</td>
<td>1.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Overall</td>
<td>2.8</td>
<td>2.3</td>
<td>1.5</td>
</tr>
</tbody>
</table>

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*Error in MPH (<10 MPH Contract Requirement)*

- 2008 - 2009: 5.9, 4.4, 2.5
- 2010 - 2011: 7.5, 5.0, 3.9
- 2012 - 2013: 2.6, 2.1, 1.9

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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

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
Incident Detection Application

**Explanation**

**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.

Real Time Data (every minute)

- **Segment 1**: 70 MPH
- **Segment 2**: 68 MPH
- **Segment 3**: 35 MPH

Delta Speed

- **Segment 1 to Segment 2**: -2 mph
- **Segment 2 to Segment 3**: -33 mph
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
    • http://www.txdot.gov/inside-txdot/projects/100-congested-roadways.html
  • Indiana Mobility Report – Purdue/INDOT
    • http://docs.lib.purdue.edu/imr/
  • Maryland Mobility Report – MDDOT/MDSHA/UMD
    • http://sha.maryland.gov/OPPEN/2013_Maryland__Mobility.pdf
  • 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.mwcog.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
Example: Texas Congested Freight Corridors (Freight Profile Enabled)
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

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