Technology is Fundamentally Reinventing Transportation
Motivating cities to reinvent transportation in their cities to improve urban life

INRIX is at the center of smarter transportation by positioning ourselves at the convergence of the connected car and smart cities.
Our 450+ Customers Are Leaders in Their Industries

A proven track record of applying insight and intelligence to move people, cities and business forward

<table>
<thead>
<tr>
<th>Automotive</th>
<th>Public Sector</th>
<th>Enterprise</th>
<th>Mobile and Media</th>
</tr>
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<tr>
<td>Audi</td>
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<td>Berkshire Hathaway</td>
<td>The Weather Channel</td>
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<td>Ford</td>
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<tr>
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<td>WSDOT</td>
<td>RAND McNALLY</td>
<td>BBC</td>
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<td>morpc</td>
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<td>Samsung</td>
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<td>SAMSUNG</td>
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<td>Land Rover</td>
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<td>Mercedes-Benz</td>
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<td>FIAT</td>
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<td>Pioneer</td>
<td>Jvckenwood</td>
<td>Siemens</td>
<td>Garmin</td>
</tr>
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<td>Continental</td>
<td>HARMAN</td>
<td>GSOT</td>
<td>TCS</td>
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<tr>
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<td>RAC</td>
<td>mouchel</td>
<td>mapquest</td>
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<tr>
<td>DENSO</td>
<td>Clarion</td>
<td>TRAFIKVERKET</td>
<td>TELNAV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SWEDISH TRANSPORT ADMINISTRATION</td>
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</tr>
</tbody>
</table>
Over 60 US Transportation Agencies
INRIX Real-Time & Historical Traffic

USES FOR BIG DATA ANALYTICS:

- Identify and analyze traffic bottlenecks to meet demands of growing population.
- Identify congestion and incidents in real-time to effectively deploy emergency response units.
- INRIX GPS probe data provides real-time traffic information that covers more than what is possible with sensors.
- Provide freight-related congestion data to optimize routes for commercial vehicles.
INRIX GPS National Data Growth

Growth by a Factor of Ten in **One Year** (and we have been around 15 years...)

January 2019

January 2020

Now collecting **100 million Trips per day**
Foundational Source Data

100 million+ trips per day in the US – Multiple Types – All GPS Based

Core Source Data Elements:

• Device/Trip ID
• Location
• Heading
• Speed

Data Types:

• Consumers
  • Connected Cars
  • Mobile Phones
• Local Fleets (service, delivery, etc.)
• Long Haul Trucks
Average Daily INRIX Trips Count* (February 2020)

100 Million+ Trips/Day Total

>30 BILLION TOTAL MILES – 12%+ all of US VMT

* Number of Trips Originating in each state
Average VMT Penetration used in Signal Analytics (January 2020)

~Nationwide: 1.05 BILLION Trips, 9.75 BILLION Miles Traveled, ~3.8% of Total National VMT*

* Compared to State VMT per FHWA for January 2020: [https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm](https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm)
### Average Daily INRIX Trips Count (January 2020)

**California**

<table>
<thead>
<tr>
<th>State</th>
<th>Full INRIX Fleet Metrics - Daily/Average</th>
<th>Monthly VMT (Millions)</th>
<th>Signals Analytics Fleet - Daily Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trip Count</td>
<td>Daily VMT (MMs)</td>
<td>Trip Time (Mins)</td>
</tr>
<tr>
<td>CA</td>
<td>9,066,003</td>
<td>79.75</td>
<td>18.75</td>
</tr>
</tbody>
</table>
SCAG INRIX Roadway Network Coverage

Summary of the Six Counties

- TMC Roadway Network
  - Miles – 25,195
  - Segments – 45675
  - Average Segment Length – 0.55 miles

- XD Roadway Network
  - Miles – 32,116
  - Segments – 150,307
  - Average Segment Length - 0.21 miles
Two Segment Definition Options – Can be used interchangeably

XD and TMC Segments

• XD and TMC Coverage Options
  • Can use either/or depending on need
  • XD more roads, more granular segments
  • XD segments never more than 1 mile in length

• Sub-segments available in both XD and TMC
  • Enriches monitoring site
INRIX Public Sector Services

- **Real-Time Data**
  - Real Time Feed via API (XD/TMC)/ Web Tiles via API (XD/TMC)

- **Historical Data (Archives and Profiles)**
  - Speed/Travel Time Archives
  - Volume Profiles

- **Analytics (web-based platforms)**
  - Roadway Analytics – XD based
  - Probe Data Analytics – TMC based (in partnership w/CATT Lab)
  - Signal Analytics (brand new in partnership with CATT Lab)
  - COVID Traffic Trends

- **Origin-Destination Data/Services**
  - Trip Paths
  - Trip Analytics (in partnership with CATT Lab)

- **Safety Services**
  - HELP (Highway Emergency Link Platform) (in partnership w/Information Logistics)
  - Commercial Vehicle Safety Alerts (in partnership w/Drivewyze)
INRIX Real-Time Traffic

Speed data calculated in real time, updated approximately every minute, from current conditions based on input from the INRIX Traffic Intelligence Network. Reported at the TMC and XD Traffic Segment level.

<table>
<thead>
<tr>
<th>Field</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment Code</td>
<td>Definition of the roadway link</td>
</tr>
<tr>
<td>Speed</td>
<td>Current real time speed in MPH on the road segment</td>
</tr>
<tr>
<td>Average</td>
<td>Historical average speed in MPH on the road segment. This is the typical speed for the current day of week and hour of day (in 15 minute increments)</td>
</tr>
<tr>
<td>Reference</td>
<td>Reference speed in MPH on the road segment. This is the proxy of the free flow or uncongested speed on the roadway, defined as the 68th percentile of calculated speeds throughout the entire day</td>
</tr>
<tr>
<td>Traveltime minutes</td>
<td>Time required to travel across the road segment</td>
</tr>
<tr>
<td>Score</td>
<td>This is a score between 10 and 30 that defines how the speed on the road segment was calculated:</td>
</tr>
<tr>
<td></td>
<td>• “30” = Speed is calculated from real time data only</td>
</tr>
<tr>
<td></td>
<td>• “20” = Speed is calculated from a blend of real time and typical/average speed on the road segment</td>
</tr>
<tr>
<td></td>
<td>• “10” = Speed is calculated only from typical/average speed on the road segment</td>
</tr>
<tr>
<td>Confidence</td>
<td>This is a rating from 0 to 100% that defines INRIX’s confidence on the real time speed on the road segment</td>
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</tbody>
</table>
INRIX Traffic Key Route Travel Times

Provide current travel times along a precisely-specified route between any origins and destination in either direction
  • Based on real-time traffic conditions
  • Update frequency up to every minute

Enable travel times on dynamic message signs (DMS)

Real-time or archived basis for instantaneous & data analytics
Historical Archives

- Running archive of Real-Time speeds and Travel Times provided by INRIX for all segments in service at that time.
  - TMC: Available in 1-minute bins back to 1/1/15
  - XD: Available in 1-minute bins back to 1/1/14
- Data Available Through Yesterday

### Table

<table>
<thead>
<tr>
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<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>XD/TMC Code</td>
<td>Definition of the roadway link</td>
</tr>
<tr>
<td>Speed</td>
<td>The Real Time speed in MPH on the road segment recorded at one minute intervals.</td>
</tr>
<tr>
<td>Average</td>
<td>Historical average speed in MPH on the road segment. This is the typical speed for the current day of week and hour of day (in 15 minute increments)</td>
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<tr>
<td>Reference</td>
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</table>

**INRIX was selected by FHWA to provide the NPMRDS data set through 2022**
Volume Profiles

Provides direct access to dataset that powers volume-weighted analyses

Key Benefits
- Day-parted and direction-parted vehicle counts
- By time of day
- Day of week
- 15-minute bins
- Every XD road segment

Created
- Raw counts from INRIX GPS data aggregated to generate crossing counts by road segment, travel direction, day of week, time of day
- Crossing counts represent a scaled-down version of a volume profile; scale = penetration rate of contributing devices
- INRIX compares the observed vehicle population with the true vehicle count at a set of locations to generate unique scaling factors for different spatial regions and road types

© INRIX, 2020
INRIX Roadway Analytics/ Probe Data Analytics

XD and TMC Options to Address Different Needs and use Cases

- **Integrated tools** to perform on-demand analytics and create visualizations for the particular situation you wish to study

- Real-time and historical data in a **single platform** (either Roadway Analytics or Probe Data Analytics)

- Conveniently create and share analysis sets with team members

- Utilize visualization and trending tools to more easily share findings with decision makers.
Real Time View

Includes:

- Traffic Flow
  - ✓ Congestion
  - ✓ Comparative Speed
  - ✓ Actual Speed

- Incidents
- Construction
- Events
- Dangerous Slowdowns
Data Downloader

Easy access for all of the underlying data

- Customize queries (per road, region, zip code, etc.)
- Save XD sets for streamlined analysis and coordination
- Customize time and date for multiple study periods
Performance Charts

Easily visualize data in graphical layouts

- Communicate findings using bar or line, charts
- Identify trends with year-over-year or before and after studies
- Select speed, travel time and other performance metrics (TTI/PTI/BTI)
- Export charts and complete data files
Congestion Scan

Pinpoint locations of sub-optimal conditions

- Extract and communicate details using customizable time & color sliders
- Generate multi-period, side by side comparisons
- View speed, travel time and performance metrics
- Identify pain points along travel corridors including multiple contiguous roads
Bottleneck Ranking
Identify and rank pain points

- Identify daily trends to:
  - Optimize work zones
  - Understand peak hours

- Identify daily, weekly or monthly trends

- Review detailed bottleneck occurrence information
INRIX Signal Analytics

Vastly richer data set means signal analytics is finally possible

Data

3-second frequency

Data Set

3 - 5% sample size

Solution
Computation Process and Parameters

- Inbound Length: 150 meters
- Outbound Length: 80 meters
- Speed: 5th Percentile
- Reference Travel Time
- Delay
- Travel Time

Sample Intersection

NB
Initial Metrics

Aggregated from individual trajectories

- Percent Arrival on Green (POG): Minimum vehicle speed above 10 kph
- Vehicle Count and Stopped Vehicle Count
  - Observed vehicle crossings
- Travel Times through the intersection, average and maximum
- Travel Speeds through the intersection, average and maximum
- Control Delay, average and maximum (the extra time required at an intersection due to slowing attributed to the signal compared to measured free-flow speeds).
Signal Data Collection Pricing Example

- Capital Cost (4-way Intersection): $250,000 - $500,000
- Capital Cost of Sensors (4-way Intersection): $10,000 - $30,000
- Annual O&M + Electric Cost: $8,000
- Annual Communications/Data Storage Cost (50 meg plan): $350

1 – From WASHDOT: https://www.wsdot.wa.gov/Operations/Traffic/signals.htm
2 – Review of various online actual bids
Image source: York, CA. Region - https://www.york.ca/wps/portal/yorkhome/newsroom/CampaignsProjects/technologyattrafficsignals/lu/p/o/TY3/DehrFEW_vQVL8gBDEuiUKoksLDIDbyvMNShwY58PdWPo0dPtd3MA45cIvWVSfh/sB0/XD/7UB_xhLmLZzpaQIRKU2eD9B4jQn
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Trip Trends Dashboard

Daily Index by Vehicle Type and Geography

Indices included:
• VMT – Total vehicle miles traveled
• Total Trips
• Average Trip Length

Geographical Summaries
• 8 Countries
• 50 States plus DC
• 98 Markets – Major Metro Areas

“Typical Days”
• 5-week period, January 20 thru February 28, 2020, excluding school holidays
• Average created for each day of the week

Vehicle Types:
• Local Fleets
• Long-Haul Trucks
• Passenger Vehicles

Time of Day Filters:
• AM Peak
• PM Peak
• Off-Peak
Trip Path Datasets

Billions of GPS pings from moving devices, cleaned up and map-matched to ensure the complete path of travel is represented.

- Matching trips by road segment
- Highly reliable, ready-to-query data
- Easy to compute corridor travel times and turn ratios
- Full corridor view on a map
- Easy segment ordering

**Trip Paths files**

- Trip Start/End Time
- Trip Start/End Latitude & Longitude
- Trips Start/End Zone
- Anonymous Device ID
- Provider ID and Type
- Trip Mean Speed, Max Speed, Distance
- Endpoint Quality

Trip represented as a series of road segment crossings over time
### Trip Paths Provides A Variety of Insights

<table>
<thead>
<tr>
<th>Transportation Demand Management</th>
<th>Internal/External Studies</th>
<th>Project Performance Evaluations</th>
<th>Congestion Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Quantify the relative volume of travel in each target situation</td>
<td>• Understand how many pass-through trips are occurring</td>
<td>• Easily and cost-effectively evaluate the impact of decisions</td>
<td>• Evaluate congested routes by times of day, types of day &amp; more</td>
</tr>
<tr>
<td>• Determine the impact of project on level of service and other metrics</td>
<td>• Plan to minimize or attract more drivers to stop</td>
<td>• Show results of work in terms of travel time, trip speed and more</td>
<td>• Realize the causes of congestion and plan to better optimize driving</td>
</tr>
</tbody>
</table>

#### Typical Use Cases

- **Origin-Destination Analysis**
- **Transportation Demand Management Modeling/ Travel Demand Modeling**
- **Congestion Studies**
- **Performance Measures**
- **Freight Movement**
- **Project Impact Studies**
- **Detour Planning**
- **Work Zone Analysis**
INRIX Trip Analytics

INRIX Trajectory Analytics

OD MATRIX
Set up an Origin-Destination matrix by choosing geographies and dates available

SEGMENT ANALYSIS
Analyze the different origins and destinations of trips that passed through selected road segments

ROUTE ANALYSIS
Analyze the routes between different geographies during different dates and time periods

Currently using the MD Data Set
Switch Data Set
## Origin Destination Matrix

### Origin and Destination Matrix

<table>
<thead>
<tr>
<th>Origin</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland</td>
<td>Destinations</td>
</tr>
<tr>
<td>Anne Arundel</td>
<td>0%</td>
</tr>
<tr>
<td>Baltimore</td>
<td>0%</td>
</tr>
<tr>
<td>Carroll</td>
<td>0%</td>
</tr>
<tr>
<td>Cecil</td>
<td>0%</td>
</tr>
<tr>
<td>Dorchester</td>
<td>0%</td>
</tr>
<tr>
<td>Frederick</td>
<td>0%</td>
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<tr>
<td>Garrett</td>
<td>0%</td>
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<tr>
<td>Harford</td>
<td>0%</td>
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<tr>
<td>Howard</td>
<td>0%</td>
</tr>
<tr>
<td>Kent</td>
<td>0%</td>
</tr>
<tr>
<td>Montgomery</td>
<td>0%</td>
</tr>
<tr>
<td>Prince George's</td>
<td>0%</td>
</tr>
<tr>
<td>Prince Edward</td>
<td>0%</td>
</tr>
<tr>
<td>Queen Anne's</td>
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<tr>
<td>Somerset</td>
<td>0%</td>
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<tr>
<td>Talbot</td>
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<tr>
<td>Washington</td>
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<tr>
<td>Wicomico</td>
<td>0%</td>
</tr>
<tr>
<td>Worcester</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Top Ten OD Pairs

1. Montgomery → Montgomery: 10,730,997
2. Baltimore → Baltimore: 8,354,986
3. Prince Georges → Prince Georges: 7,402,334
4. Anne Arundel → Anne Arundel: 6,320,267
5. Baltimore City → Baltimore City: 4,586,722
6. Howard → Howard: 3,721,508
7. Hartford → Hartford: 2,405,948
8. Frederick → Frederick: 2,310,010
10. Baltimore → Baltimore City: 1,474,783
Segment Analysis Results: Origins
Example: Heavy Truck Route Selection from Boston to Providence

- Evaluate Routes Selected by Heavy Freight
- Determine if Designated Truck Routes are being used
- Allows for Better Planning of Designated Truck Routes and Freight Improvement Projects
INRIX Safety Services
Real Time - Commercial Vehicle Safety Alerts (NEW)

Partnering with Drivewyze

• New unique service to reduce truck crashes
• Safety Messages to Trucks in real-time on limited access roads

• Alert types:
  • Queues and Slowdowns (from INRIX)
  • Truck-relevant restrictions/detour (from Agency)

• Drivewyze ‘geo-fences’ each alert, sends to approaching trucks
  • Drivewyze partners with leading Electronic Logging Device (ELD) terminal operators
  • All trucks in ‘Drivewyze Network’ opting-in for safety notifications will get appropriate message
  • Network is 2.1 million trucks, and growing
Real Time - HELP Alerts

- Establishes 1-way or 2-way communications during road closures or other emergencies
- No app needed – no preregistration needed
- Efficiently pushes official messages to geo-targeted customers
- Approved by the Federal Emergency Management Agency (FEMA) as an effective service for communicating with travelers in emergency situations
- PA511 Connect was original deployment
- NJDOT has launched & GDOT and MDSHA currently implementing system

DOT Initiates Event

Website, Text Message, and IVR Systems Activated

Event is sent to EMA for WEA approval

Two-way communications and information sharing

Travelers register for the duration of the event

WEA sent to travelers in focus area
Evaluating COVID Impacts
Example: Impact of COVID Travel Restrictions on National VMT

- Can Clearly Track National, State and Local Travel Patterns
- Allows DOTs to plan for estimated reductions in Gas Tax Revenue
- See Impacts of Re-Openings and Travel Restrictions
Example: COVID Travel Restriction Impacts
On I-80 WB from Omaha to Lincoln, NE; First Full Week of April 2019 vs, 2020

- Can Clearly See Before/After Changes
- Compare “New” Speeds vs. Historical Free Flow and Average Speeds
Case Study: Intersection Changes due to COVID-19

- **Location:**
  - Crooks Road and W. Wattles Road
  - Intersection 213
  - Detroit, MI

- **Dates:**
  - March 2, 2020 – March 6, 2020
  - March 23, 2020- March 27, 2020

- **Time:** 4:00 PM – 7:00 PM

- **Signal Metric Comparison:**
  - Volume Count and Ranking
  - Percent on Green
  - Average Control Delay
  - Approach Speed
  - Average Travel Time
Case Study: Intersection Ranking and Volume Comparisons

Comparison for NB Straight
- Rank: 74 to 91
- Vehicle count: 2,735 to 709, 74% Reduction in Volume

March 2nd through March 6th

March 23rd through March 27th
Case Study: Signal Metric Comparison – NB Straight

Percent on Green
38% to 49%

Average Control Delay
37.5 to 21.2 sec.

Average Approach Speed
40.5 to 44.7 mph

Average Travel Time
59.5 to 42.2 sec.
Questions?

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Director, Public Sector Services
Gary.carlin@inrix.com
425-495-5476