Traffic Flow For Traveler Information Systems
Problem and Opportunity

BETTER DATA IMPROVES TRAFFIC OPERATIONS

• Traffic congestion costs $70B a year
  – Road construction can’t keep up with demand
  – Congestion spreading to smaller cities
  – Many DOT data systems focus on operations not traveler information
  – Improvements compete for investment and operating funds

• Real-time flow data solutions can:
  – Improve existing infrastructure utilization
  – Improve financial efficiency and flexibility
  – Provide more comprehensive coverage at less cost
  – Enhance data quality and reliability
  – Enable actionable, real-time decision-making
  – Improve planning, modeling and reporting

• High-quality, real-time traffic data changes the game
  – Drivers make better choices saving time, money, gasoline, pollution
  – Traffic congestion load is spread over time and space
  – Public increases awareness of Transportation agency benefits
SPEEDINFO’S DVSS-100 SENSORS MEASURE TRAFFIC FLOW

- **Sensor**
  - Solar powered
  - Wireless communications
  - Fast installation
  - Lightweight, reliable, and accurate
  - Low cost
  - >800 installed to date

- **Server Farm**
  - Manages sensor network
  - Validates and formats data
  - Integrates public data sources

- **Data Client**
  - Streams XML feed to customers
SPEEDINFO’S DVSS-100 SENSOR SPECIFICATIONS

• Sensor

  – License free – 24.125GHz
  – Range 1800 ft, bi-directional
    - Single device measures both sides of roadway
  – Accuracy: 0.1mph, avg. +/- 3mph
  – Installs on existing infrastructure
    - Install time 15-20 minutes
  – Solar: 5W or 10W
    - Sealed lead acid batteries
    - 21 days of operation without photons
  – Weight: 16 lbs
    - Small profile, negligible wind loading
  – Programmable sampling rates
    - Default 2 measurements/minute
    - Adaptive reporting rates
  – Data Backhaul – ATT Wireless GPRS
    - Full Duplex
  – External Power and Communication port
USE CASE SCENARIO

SAN FRANCISCO BAY AREA – UNIQUE HYBRID APPROACH

• **Highway loops**
  – 1200 sensors
  – 15 years
  – >$120m investment
  – Half are out of service
  – 30% coverage

• **Toll Tags**
  – 780,000 toll tags
  – 5 years
  – >$18m investment
  – 10% coverage

• **SpeedInfo Sensors**
  – 324 sensors
  – 45 days
  – <$400K investment
  – 60% coverage
  – Primary 511 data source
• NDOR contract

• 70 sensor network to supplement and feed 511 system, TMC

• >200 miles coverage at 1 mile separation on I-80 metro corridors and Hwy 6

• Data used for analysis and to provide flow, travel times and construction zone coverage for bypass roads

• [Link to Map](http://map.speedinfo.com/usa/nebraska/index.php)
- dDOT Contract
- 50 sensor network to instrument all major arterial evacuation routes
- System data to be used to evaluate emergency signal timing patterns and transportation communication protocols and flow model
- SpeedInfo XML feed integrated into data center
• Travel Times
  – Install sensors every mile or less
  – Utilize data for CMS/DMS presentation of times
  – Utilize data for TMC Operations, Highway/State Patrol, Accident Response
  – Utilize data for 511 Traveler Information System

• Construction Zone Safety or By-Pass Road Congestion Mgmt

• Incident Detection
  – Real-time alerts to speed changes
  – Automatically drive video camera response
  – Alert responders and media

• Congestion Management (Operations)
  – Dynamic Ramp Metering
  – Congestion level pricing
  – HOV/HOT lane monitoring
  – Performance Metrics: congestion index and length, annual delay, cost of congestion, system bottlenecks, etc

• Emerging mobile platforms
I-80 at Ashby Ave East 3/17/06 (Friday)

Source: SpeedInfo
SAMPLE TRAFFIC DATA
REAL TIME COMMUTE – OMAHA, NE

I-80 W @ MM 412.4 (DMS) 4/30/08

Source: SpeedInfo

Oct, 2008
I-5 at Tacoma, WA 4/18/08 (Friday)

Source: SpeedInfo
Dayton, OH
Interstate and Construction Bypass route coverage

- Installed - Aug 2008
- 110 sensors
- Install time – 2 weeks
- ODOT Traffic Engineering
- SpeedInfo supplies Speed and Travel Times
- Data Supports –
  - Buckeye Traffic 511
  - DMS/CMS
  - HAR FM
## Travel Time Trial

### I-75 – Dayton, OH GPS Probe Vehicle Test

<table>
<thead>
<tr>
<th>ERROR DATA TABLE</th>
<th>MM 55</th>
<th>MM 55.8</th>
<th>MM 57.6</th>
<th>North</th>
<th>South</th>
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<td><strong>TOTAL - OVERALL</strong></td>
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<tr>
<td>MM 55</td>
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<td>8.50%</td>
<td>10.10%</td>
<td>9.04%</td>
<td>8.72%</td>
<td>8.91%</td>
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<td><strong>TOTAL - NORTH</strong></td>
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<tr>
<td>MM 55</td>
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<tr>
<td>MM 55</td>
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<td>8.73%</td>
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<tr>
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<tr>
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<td>9.35%</td>
<td>10.76%</td>
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<td>10.25%</td>
<td>8.93%</td>
<td>7.20%</td>
<td>8.09%</td>
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</tbody>
</table>

### Error Sources – First Pass

- Stop and Go Traffic
- Cosine Error
- Sensor Placement
- Statistical Variation
- Laptop clock error
- Driver variables

### Expected results – Next Pass

- Algorithm improvements for stop and go traffic
- Improve GPS probe accuracy using direct real-time GPS speed
- Expected error – < 5%

*source: Ohio DOT
## Dayton Travel Time Verification

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Road</th>
<th>Direction</th>
<th>Segment</th>
<th>Actual Travel Time by Floating Car Method</th>
<th>Speed Info Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/12/2008</td>
<td>9:16 AM</td>
<td>I-70</td>
<td>W</td>
<td>SR 4 (South) to SR 4 (Enon)</td>
<td>5.9</td>
<td>6</td>
</tr>
<tr>
<td>9/12/2008</td>
<td>9:16 AM</td>
<td>I-70</td>
<td>W</td>
<td>SR 49 to I-75</td>
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<td>8</td>
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<tr>
<td>9/12/2008</td>
<td>10:38 AM</td>
<td>I-675</td>
<td>S</td>
<td>I-75 to US-35</td>
<td>12.1</td>
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<tr>
<td>9/12/2008</td>
<td>12:44 PM</td>
<td>I-75</td>
<td>S</td>
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<td>2.3</td>
<td>NOT AVAILABLE</td>
</tr>
<tr>
<td>9/12/2008</td>
<td>12:44 PM</td>
<td>I-75</td>
<td>S</td>
<td>County Line (Warren) to US-35</td>
<td>11.5</td>
<td>13</td>
</tr>
<tr>
<td>9/12/2008</td>
<td>12:44 PM</td>
<td>I-75</td>
<td>S</td>
<td>US-35 to I-70</td>
<td>9.5</td>
<td>10</td>
</tr>
<tr>
<td>9/12/2008</td>
<td>11:10 AM</td>
<td>I-75</td>
<td>N</td>
<td>I-70 to County Line (Miami) to I-675</td>
<td>3.6</td>
<td>3</td>
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<tr>
<td>9/12/2008</td>
<td>11:10 AM</td>
<td>I-70</td>
<td>N</td>
<td>County Line (Warren) to US-35</td>
<td>2.5</td>
<td>NOT AVAILABLE</td>
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<tr>
<td>9/12/2008</td>
<td>11:10 AM</td>
<td>I-70</td>
<td>N</td>
<td>County Line (Warren) to US-35</td>
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<tr>
<td>9/12/2008</td>
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<td>I-70</td>
<td>N</td>
<td>US-35 to I-70</td>
<td>8.8</td>
<td>9</td>
</tr>
</tbody>
</table>

### Results – 2nd Pass

- Java client algorithm improvements for stop and go traffic and milepost information
- Without “no car” individual sensor adjustments
- Testing continues to include more rain and stop and go traffic
- Error – < 5%

* source: Ohio DOT
SpeedInfo technology application supports a unique business model

- Public-Private partnership based on DOTs funding/financial model

- Equipment Purchase or Data Service with/without data sharing
  - Capital purchase, service contract, lease, rent, private industry pay or free

- Turn-key Data Service includes:
  - Service Level Agreements with availability guarantee and penalty
  - All installation, communication and maintenance costs
  - Low monthly payment or pre-pay

- Data sharing provides for private sector offsetting DOT costs
  - Use data rights to limit costs or not
## DATA BUSINESS MODEL

<table>
<thead>
<tr>
<th></th>
<th>Private</th>
<th>Partnership</th>
<th>Public</th>
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<tbody>
<tr>
<td><strong>Funding</strong></td>
<td>100% Industry</td>
<td>50% / 50% Split</td>
<td>100% Government</td>
</tr>
<tr>
<td><strong>Commercial Data</strong></td>
<td>Radio / TV Web Subscribers</td>
<td>Web Subscribers</td>
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<tr>
<td><strong>Public Data Use</strong></td>
<td>Operations Emergency 511 Phone</td>
<td>Add: 511 Web CMS</td>
<td>Unrestricted</td>
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<tr>
<td><strong>Public Savings</strong></td>
<td>100%</td>
<td>95%</td>
<td>90%</td>
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</tbody>
</table>
• Leverage network infrastructure and design to manage additional detection technologies:
  – Car counting and classification
  – Camera to capture pictures on demand
  – Road surface temperature sensor
  – Micro-climate weather conditions

• Designed to support optional communication platforms

• Data Warehousing and Analysis