The Synergy of Road Weather Information And Near Real-time Traffic Data

Jon Tarleton
Marketing Manager
Quixote Transportation Technologies (QTT)

National Rural ITS Conference
August 25, 2009
Weather and Our Transportation System
Weather and Traffic Sensor Integration

- In the world of ITS sensor technologies, two of the most significant sensor networks are road weather sensors and traffic sensors.
- Need and benefit of integrating the two systems.
- Benefits include:
  - One impacts the other.
  - Systems are “handicapped” by the reasons for their deployment.
  - Increases return on investment for entire sensor network.
- Most ITS sensor conditions “overlap” or interact with each other.
- By combining technologies into a single platform you increase the benefits of each piece of the network.
- Economic conditions today require economical solutions.
Major issue for today’s ITS

How to increase their coverage of ITS systems with limited budgets?
Road Weather Information Systems (RWIS)

- Reason for deployment:
  - Monitor areas prone to snow and ice development on roadway.
Weather Sensors

- Primarily done through Road Weather Information Systems (RWIS)
- Network of weather stations across North America
  - 2300+ Station in the U.S.
  - Average Cost $30-50K (installed)
  - Sensor deployment is not uniform due to state usages/budgets and heavy winter need vs. milder climates
- Typical conditions measured:
  - Atmospheric
  - Pavement (temperature, condition)
  - Visibility
  - Flooding
Coverage?
All Conditions Impact Traffic

- Atmospheric
  - Wind - blowing snow/dust
  - Precipitation rate - flooding/hydroplaning

- Pavement
  - Temperature / moisture - ice/snow
  - Temperature / dew point - frost / black ice
  - Amount of road chemicals - ice/snow
  - Water Thickness - hydroplaning

- Visibility
  - Fog
  - Blowing snow / dust / sand

- Flooding
  - Water
Traffic Sensor Network

- Reason for deployment:
  - Monitor traffic flow in heavily congested areas.
Traffic Sensors

- Performed through a wide assortment of technologies
  - Loops
  - Radar
  - Infrared
  - Magnetic
  - Video
  - Laser
  - Acoustic
- Most data collection occurs in urban areas and is focused on traffic flow
  - Data is used by Traffic Management Centers (TMC) and Media outlets
- 41% of the urban areas are covered by real-time traffic sensors*
- Rural and secondary road coverage is minimal

Problems with Current Networks

- **Weather**
  - Non-uniform coverage
    - Usage and economics of individual agencies differ
    - RWIS deployment highest in areas with significant winter conditions
  - Return on investment for small agencies and “warmer” regions
    - Need year-round justification

- **Traffic**
  - Networks are heaviest on freeways and in urban areas
    - Little coverage exists for rural and secondary road networks
Other Issue - Economics

- Agencies are under increasing pressure to do more with less.
- Weather systems are not typically inexpensive to deploy.
- Weather and traffic systems require ongoing costs such as maintenance and power / communication.
Proposed Solution - Customer Examples

- Ohio DOT - a fairly populated state with significant winter weather (both system weather and local lake effect)
  - Has a deployment of 160+ RWIS stations spaced fairly uniformly across Ohio.
  - Each site feature atmospheric, pavement and traffic sensors.
  - Traffic sensors consist of wireless in-pavement sensors using Vehicle Magnetic Imaging (VMI) to measure traffic speed, count, and classification by Quixote Transportation Technologies.

- Main usage of the combined system is by ODOT:
  - (INTERNAL) for operations or maintenance:
    1. Drawing correlations between pavement conditions and traffic speeds.
    2. Tracking speed recovery times following an event.
    3. Training
  - (EXTERNAL) Public Information:
Integrated Weather and Traffic

- Traffic sensors monitor weather’s impact on traffic
- QTT has two integrated sensors:
  - Wireless WxT Sensor
    - Measures
      - Traffic Count
      - Traffic Speed
      - Traffic Length
      - Measures lid temperature “Skin temperature”
      - External temperature probe for accurate pavement temperature
      - External temperature probe for Subsurface temperature
      - Basic Chemical Index / wet - dry
Typical Installation

- Traditional wired sensors
- Wireless Sensors

- Saves on installation Costs
- Adds traffic Sensing
Customer Examples - Iowa DOT

- Iowa DOT - Maintenance and operations is considering monitoring “level of service” based on traffic speeds before, during and after winter events
  - Traffic sensors will provide additional traffic data in areas that may not have been considered in the past.
  - Iowa DOT has chosen to deploy a non-intrusive traffic sensor, but use existing infrastructure provided by RWIS to save on costs.
  - Iowa DOT chose the Wavetronix’s Smart Sensor due to past successes during testing and evaluation.
Advantages of Solution

Assume:
Every 30 miles for weather
Every 10 miles for traffic

City A

100 miles of roadway

City B

Weather Network
Initial Costs:
Purchase Price
Price to Install
On Going Costs:
Communication Costs
Maintenance Costs

Traffic Network
Initial Costs:
Purchase Price
Price to Install
On Going Costs:
Communication Costs
Maintenance Costs
Advantages of Solution

City A

100 miles of roadway

City B

**Combined Network**

Initial Costs:
- Purchase Price – Slight Reduction
- Price to Install - Reduced

On Going Costs:
- Communication Costs – Significantly Reduced
- Maintenance Costs – Significantly Reduced

www.qttinc.com
By the numbers...

Table 1 – Upfront Equipment and Installation Costs

<table>
<thead>
<tr>
<th></th>
<th>RWIS (1)</th>
<th>Traffic (1)</th>
<th>Combined</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Capital Per Site</td>
<td>$36,000</td>
<td>$10,000</td>
<td>$42,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Installation Per Site</td>
<td>$16,000</td>
<td>$4,000</td>
<td>$16,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Total Cost (3 sites)</td>
<td>$156,000</td>
<td>$42,000</td>
<td>$174,000</td>
<td>$24,000</td>
</tr>
</tbody>
</table>

Table 2 – Yearly System Operating Costs

<table>
<thead>
<tr>
<th></th>
<th>RWIS (1)</th>
<th>Traffic (1)</th>
<th>Combined</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Maintenance Per Site Per Year</td>
<td>$2,900</td>
<td>$350</td>
<td>$2,900</td>
<td>$350</td>
</tr>
<tr>
<td>Data Communication Per Site Per Year</td>
<td>$600</td>
<td>$600</td>
<td>$600</td>
<td>$600</td>
</tr>
<tr>
<td>Total Cost Per Year (3 sites)</td>
<td>$10,500</td>
<td>$2,850</td>
<td>$10,500</td>
<td>$2,850</td>
</tr>
</tbody>
</table>
Summary of the Savings

- This amount of savings may seem fairly low or insignificant; however, remember that in this example we are talking about only three systems. What if we were talking something closer to a full statewide system of 100 combined sensor locations?

- 100 Site Upfront Savings = $800,000
- 100 Site Yearly Operating Savings = $95,000

- This savings is much more significant, and the cost savings could be passed on to other projects or the savings could be used to fund an additional 15 sites.
Increasing Applications is the Key

Winter Weather

Traffic Monitoring

RWIS is one of the largest rural deployed ITS applications

Non-Winter
Flooding, low visibility, road washout, high winds

Air Quality and Pollution

wwwqttinc.com
Conclusion

- Creating an “ITS Sensor Platform” will be important for the future of data collection.
- Road weather sensors and traffic sensor current situation:
  - Most sensor systems were not designed for regional views of data
  - Gaps in weather and traffic data may seem insignificant unless that is where the problem is occurring
- Increasing the ROI on sensor networks allows for greater deployment and increased usage.
  - Weather + traffic
  - Weather + traveler information (HAR, VMS, 511)
  - Weather + traffic + transportation gas monitoring
- Reduced costs such as installation, communication, and maintenance allows for agencies to expand networks for multiple reasons.
Questions?

Jon Tarleton
Quixote Transportation Technologies, Inc.
Marketing Manager
Jon.tarleton@quixotecorp.com
Booth 731