Construction Traveler Information System for I-35 Widening in Central Texas
Overview: I-35 expansion project

- 200 directional miles – Central Texas
- 14 segments / 19 projects
- Costs: ~$2.1B
- Traffic Volumes
  - 55,000 – 111,000 vehicles/day
  - 66% through trips
  - Trucks: 25% – 30% (75% at night)
  - Over 5 years, ~ 185 million trips
- TxDOT mitigation of impacts
  - Limited lane closures
  - Blackout dates
  - Completion incentives
- Complete 2017
Identifying the Problems/Constraints

1. Potential for queues during nighttime main lane closures
2. Ramp, frontage road, and cross-street closures affecting local access
3. Potential for multiple nighttime lane closures along corridor
   - Localized delays
   - Cumulative delays for through travelers
4. Accelerated construction schedule
   - Limited coordination of lane closures
   - Lane closure locations constantly changing
   - ROW cross-section constantly changing
## Specifying User Needs

<table>
<thead>
<tr>
<th>Issue</th>
<th>Travelers Affected</th>
<th>Information Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nighttime freeway lane closures creating traffic queues and speed differentials</td>
<td>All</td>
<td>Real-time warning about downstream queue presence and location</td>
</tr>
<tr>
<td>Ramp, frontage road, and cross-street closures hindering local access and limiting traffic flow</td>
<td>Local residents, regional travelers</td>
<td>Access to closure information, “pushed” to those who want it</td>
</tr>
<tr>
<td>Freeway lane closures and incidents creating localized delays</td>
<td>Local residents, regional travelers</td>
<td>Current travel times on I-35</td>
</tr>
<tr>
<td>Multiple lane closures along corridor on same night causing significant delays to overall trip</td>
<td>Regional, long-distance travelers</td>
<td>Cumulative predicted delays to be encountered along I-35</td>
</tr>
</tbody>
</table>

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*Texas A&M Transportation Institute*
System Requirements

• Identification and tracking of planned lane closures
• Current travel time monitoring
• Forecasted travel conditions
• End-of-queue notification
• Information dissemination
  – Pre-trip, En-route
  – Email, Web, Social Media
• Integration to existing traffic management centers
• Operational and maintenance monitoring
Identifying Alternatives

- Standard TxDOT/contractor traveler information dissemination methods

- Commercial-Off-The-Shelf (COTS) systems

✓ Customized solution involving the integration of technologies
Concept of Operations
Systems Diagram
System Design Components

- Actively managed lane closure database (PCNS)

![Lane Closure Notification](image)

- Automated analysis of potential impacts of lane closures (LCAS)

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Expected Queue (mi)</th>
<th>Expected Delay (min/veh)</th>
<th>Worse Case* Queue (mi)</th>
<th>Worse Case* Delay (min/veh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07:00 PM</td>
<td>08:00 PM</td>
<td>0.5</td>
<td>2.7</td>
<td>1.5</td>
<td>7.3</td>
</tr>
<tr>
<td>08:00 PM</td>
<td>09:00 PM</td>
<td>1.0</td>
<td>4.6</td>
<td>3.0</td>
<td>13.9</td>
</tr>
<tr>
<td>09:00 PM</td>
<td>10:00 PM</td>
<td>0.3</td>
<td>2.0</td>
<td>3.1</td>
<td>14.8</td>
</tr>
<tr>
<td>10:00 PM</td>
<td>11:00 PM</td>
<td>0.0</td>
<td>0.0</td>
<td>3.0</td>
<td>14.8</td>
</tr>
<tr>
<td>11:00 PM</td>
<td>12:00 AM</td>
<td>0.0</td>
<td>0.0</td>
<td>2.4</td>
<td>12.5</td>
</tr>
<tr>
<td>12:00 AM</td>
<td>01:00 AM</td>
<td>0.0</td>
<td>0.0</td>
<td>0.5</td>
<td>3.2</td>
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<tr>
<td>01:00 AM</td>
<td>02:00 AM</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
</tr>
<tr>
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<td>0.0</td>
<td>0.0</td>
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<td>05:00 AM</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>05:00 AM</td>
<td>06:00 AM</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>06:00 AM</td>
<td>07:00 AM</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Components (cont’d)

- Bluetooth monitoring of current travel times over 2-5 mile segments

- Deployment of end-of-queue warning technology when and where needed (based on queue analysis)
Components (cont’d)

• Advance notification of lane closure impacts
  – Up to 7 days out
  – Updated daily

• Email and feed to TxDOT websites
  – My35.org
  – DriveTexas.org

• Future corridor impacts under development
Components (cont’d)

• Current travel times via PCMS
  – 21 signs
  – 7-10 mile spacing

• Integrated with TxDOT LoneStar software
  – C2C communication
  – Allows TxDOT personnel to take over sign control
Components (cont’d)

• Hybrid forecasted delay signs
  – Targeting long-distance travelers en-route
  – Based on expected arrival times to queues

![Diagram of delay signs with expected arrival times]

![Graph of delay estimation with predicted worst-case, best-case, and expected delays]
Implementation/Procurement

• Field monitoring devices procured and deployed through a contract with TTI
• End-of-queue warning technology procured through project change orders
• Corridor delay forecasting development and calibration continues
• Corridor performance metrics development continues
Evaluation - Lane closure notifications

• 1100 email recipients
• Usefulness
  – 81% useful
  – 91% easy to understand
  – 93% abbreviations easy to understand
  – 90% right amount of detail
• Format:
  – 67% continue current
  – 33% customize for my location
  – Points to through nature of trips
Evaluation – Travel Times via PCMS

- 91% had seen
- 83% useful
- 82% frequent enough
- 92% agree with appropriateness of destination cities
Evaluation – Performance Metrics

Distribution of I-35 main-lane closures per night
March 2012 excluding weekend black-out days

<table>
<thead>
<tr>
<th>Number of Days</th>
<th>Mainlane closures per night</th>
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<tbody>
<tr>
<td>0</td>
<td>14%</td>
</tr>
<tr>
<td>1</td>
<td>27%</td>
</tr>
<tr>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>3</td>
<td>32%</td>
</tr>
<tr>
<td>4</td>
<td>14%</td>
</tr>
<tr>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>6</td>
<td>5%</td>
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Performance Metrics (cont’d)
Performance Metrics (cont’d)

Percent of Lane Closures with Delay

<table>
<thead>
<tr>
<th>Project Section</th>
<th>&gt; 0 min</th>
<th>&gt;= 10 min</th>
<th>&gt; 20 min</th>
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<tr>
<td>5C</td>
<td>7%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>5B</td>
<td>10%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>5A</td>
<td>13%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>4</td>
<td>11%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>3C</td>
<td>15%</td>
<td>7%</td>
<td>3%</td>
</tr>
<tr>
<td>3B</td>
<td>13%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>3A-2</td>
<td>12%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>3A-1</td>
<td>17%</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>1C</td>
<td>28%</td>
<td>17%</td>
<td>9%</td>
</tr>
<tr>
<td>1B</td>
<td>15%</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>1A</td>
<td>18%</td>
<td>8%</td>
<td>2%</td>
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Lessons learned

• Balancing lane closure advance notification time versus accuracy is a challenge

• Field infrastructure locations have to move quickly with phasing
  – Temporary deployments critical
  – Geolocate and track via GPS

• BT spacing can go 5-8 miles in rural settings

• Public does pay attention to real-time information, prefers specifics
Lessons learned (Cont.)

- Change ordering in technologies to existing projects continues to be a challenge
- Ensuring good data exchange protocols is critical → XML