Weather-Responsive Traffic Signal Management in Utah

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Utah Department of Transportation

- Population 2,800,000 (34th largest state)
  - 80% live along the Wasatch Front
- Land Area: 84,900 sq. mi (13th largest state)
- 1883 Traffic Signals in the State of Utah
  - 1144 owned and operated by UDOT
  - 739 owned and operated by cities /counties
- All partners share same ITS communications
  - 81% of UDOT signals connected
  - 725 Closed-Circuit TV
  - 165 Dynamic Message Boards
  - 65 Ramp Meters
  - 79 Remote Weather Information Systems
Project Goals & Operational Objectives

- Proactive management of traffic signal operations during weather events.
  - Maintain a high level of progression on the main-street.
  - Maintain an acceptable level of the throughput of traffic for the conditions of the roadway.
  - Maintain equitable service to cross-street.

Maintained operational objectives by:

- Keeping cycle length and splits the same as used in “Normal Time-of-Day” plans.
- Changed only offsets and sequences due to reduction in “normal” speeds caused by the weather event.
How was WRTM Accomplished?

- Central Traffic Management System – Developed special weather plans to change the traffic signal timing along the study corridor (Riverdale Rd).
  - AM-Peak, Off-peak, PM-peak
  - No recall, Minimum Recall, Maximum Recall

- In-house UDOT Meteorologists provided specific daily forecasts for Riverdale Rd.
  - Start / Stop times of weather event when impacting traffic

- Real-Time Traffic Signal Performance Measures
  - Start / Stop times of special weather plans
  - Fine-tuning of weather plans
Project Limits: Riverdale Rd near Ogden, Utah
Setback Count Detectors – Wavetronix Advance SmartSensor

- Used for:
  - Dilemma Zones
  - Purdue Coordination Diagrams
  - Approach Speeds
  - Approach Volume Counts

- Vehicle Arrivals and Speeds are time stamped
- 10’ count zone placed ~350’ behind stop bar
- No additional expense if already in place for dilemma zones
- May undercount dense traffic
Signal Performance Metrics

Metric Settings
- Metric Type: Purdue Coordination Diagram
- Time Y Axis Maximum: 150
- Volume Y Axis Maximum: 2000
- Volume Bin Size: 15
- Dot Size: Small
- Show Statistics: Checkbox
- Show Volume: Checkbox
- Upload Current Data: Checkbox

Dates
- Start Date: 7/19/2013
- End Date: 7/19/2013
- Date Range: July 2013

Map
- Region 1
- Region 2
- Region 3
- Region 4 (Richfield)
- Region 4 (St. George)

Signal List

Create Metrics, Log Action Taken, Action Reports, Export Data
Map of Signals with Performance Metrics

Salt Lake Valley
Approach Speeds using Radar at Intersections
(Riverdale Rd & Shopko – January 10, 2013)
### Approach Volumes for Offset Directional Bias

Volume report for Riverdale Rd Shopko on the Northbound and Southbound approaches.
1/24/2013 12:00:00 AM - 1/24/2013 11:59:00 PM
Approach count accuracy: undercounts by 5-25%

- **Northbound**
- **Southbound**
- **Northbound D-Factor**
- **Southbound D-Factor**
Coordination: Improving Progression

Purdue Coordination Diagrams

Platoon arrives on red

Platoon arrives on green
Purdue Coordination Diagram
(used for offset adjustments after event)
Results: Percent Arrival On Green (Northbound / Westbound)

<table>
<thead>
<tr>
<th>Time</th>
<th>Non-Weather</th>
<th>No Recall</th>
<th>Maximum Recall</th>
<th>Minimum-Recall</th>
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</thead>
<tbody>
<tr>
<td>A.M. Peak</td>
<td>73.3</td>
<td>74.6</td>
<td>62.8</td>
<td>65.7</td>
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<tr>
<td>Off-Peak</td>
<td>77.0</td>
<td>70.4</td>
<td>66.2</td>
<td>65.5</td>
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<tr>
<td>P.M. Peak</td>
<td>73.6</td>
<td>70.4</td>
<td>62.5</td>
<td>67.7</td>
</tr>
</tbody>
</table>
### Results: Percent Arrival On Green (Southbound / Eastbound)

<table>
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<tr>
<th>Time Period</th>
<th>Non-Weather</th>
<th>No Recall</th>
<th>Maximum Recall</th>
<th>Minimum-Recall</th>
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</thead>
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<tr>
<td>A.M. Peak</td>
<td>66.5</td>
<td>67.3</td>
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<td>64.9</td>
<td>67.0</td>
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<tr>
<td>P.M. Peak</td>
<td>68.2</td>
<td>72.8</td>
<td>72.1</td>
<td>68.2</td>
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</table>
Final Conclusion

Overall the quality of progression was not severely degraded as a result of implementing the different weather responsive timing plan strategies and UDOT was able to maintain traffic conditions similar to non-weather levels.
Future of WRTM at UDOT

- UDOT currently has 275 intersections with PCD’s, Speeds and Approach Volumes.
- Other metrics currently in use, such as:
  - Lane-by-Lane Volume Counts
  - Approach Delays
  - Arrivals-on-Red
- Other metrics coming soon, such as:
  - Travel Time Data (INRIX)
  - LOS Grades for each Corridor
  - Automatic Offset Optimization
- Expanding WRTM program to other corridors will occur.
Questions?