Weather Responsive Traffic Management (WRTM)

Weather Responsive Traffic Signal Timing

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RWMP Stakeholder Meeting
Little Rock, AR
July 16-18, 2013
Weather Responsive Traffic Signal Timing

- Currently, WRTM Strategies in existence have focused on freeways
- Limited implementation of arterial-specific strategies during weather

<table>
<thead>
<tr>
<th>Control and Treatment Strategies</th>
<th>Statewide</th>
<th>Partial</th>
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<tbody>
<tr>
<td>Employ traffic incident management practices</td>
<td>36%</td>
<td>52%</td>
</tr>
<tr>
<td>Employ ITS to manage road closure diversions</td>
<td>32%</td>
<td>20%</td>
</tr>
<tr>
<td>Employ ESS sensors for temporary restrictions</td>
<td>19%</td>
<td>31%</td>
</tr>
<tr>
<td>Employ variable speed limits</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>Adjust ramp meters</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Adjust signal timing</td>
<td>8%</td>
<td>13%</td>
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</tbody>
</table>

Percent of State DOTs Responding
WRTM Traffic Signal ConOps

- Developed a concept of operations for Weather-Responsive Traffic Signal Operations
  - Full use of weather and road weather resources
  - Performance-based weather-responsive signal timing
  - Continuous evaluation and improvements

Implementation in Utah

• Implementation Partner: Utah DOT
• Corridor: Riverdale Corridor, Ogden
• Objectives:
  – Maintain a high level of progression on the main-street approaches throughout the duration of the weather event.
  – Maintain an acceptable level of the throughput of traffic for the conditions of the roadway.
  – Maintain equitable service to cross-street traffic during inclement weather events
Traffic Signal Timing in Utah (Riverdale Corridor)

- 11 intersections
- 6-lane facility
- 30,000 ADT commercial
- Adverse weather problems
- Equipped with traffic sensors and cameras
- RWIS station
Traffic Signal Timing in Utah (Riverdale Corridor)
Critical System Components

- RWIS – Installed on Riverdale Corridor
- UDOT Meteorologist
- Setback Count Detectors
- Signal Performance Metrics System
- Traffic Estimation and Prediction System (TrEPS) /Decision Support System (to be used next winter)
UDOT Signal Performance System

- Real-Time Performance Monitoring
- Purdue Coordination Diagrams
- Speeds, Link Volumes, Turning Counts
- Written in-house by UDOT programmers
- Analyze and display high-resolution logger data

Signal Performance Metrics
Deployment Approach

• Created three special traffic signal timing plans (1 for light snow, 2 for heavy snow)
• Deployment approach relied on identifying when to transition and adjust plans
  – Pre-Event (Based on Meteorologist and RWIS data)
  – During Event (Based on Travel Speeds and Signal Performance)
  – After Event (Based on Travel Speeds, Signal Performance and Forecast)
  – Post Event Adjustments to the Plan
Evaluation Results

• Operator Assessments
• Signal Performance Data
• Modeling (forthcoming)
Matching timing plans to speeds

Riverdale Rd & Shopko, NB (1/10/2013)

Riverdale Rd Shopko Signal 5008 Phase 2 Northbound
Thursday, January 10, 2013 6:00 AM - Thursday, January 10, 2013 11:00 PM
Detector Distance from Stop Bar: 350 feet; Min Speed Filter: 5 MPH;
Time Filter: 15s after start of green to start of yellow
Speed Accuracy: ± 5 MPH

| Time (Hour of Day) | Fr... | 85% Sp 43 | Plan 1 | 85% Sp 37 | Ave Sp 36 | Std Dev 7 | 85% Sp 43 | Plan 4 | 85% Sp 42 | Ave Sp 35 | Std Dev 8 | 85% Sp 36 | Plan 13 | 85% Sp 35 | Plan 55 | 85% Sp 25 | Ave Sp 23 | Std Dev 11 | 85% Sp 25 | Plan 56 | 85% Sp 32 | Ave Sp 17 | Std Dev 9 | 85% Sp 25 | Plan 67 | 85% S... | Free... |
|-------------------|-------|-----------|--------|-----------|----------|-----------|-----------|--------|-----------|----------|-----------|-----------|--------|-----------|--------|-----------|----------|-----------|-----------|--------|-----------|----------|-----------|-----------|--------|-----------|---------|----------|-----------|--------|-----------|---------|

Progression speed for snow plans?

Snow storm starts
Operator Assessments

- Ability to fine-tune the timing plans by using the PCDs was a major benefit to the study.
- The system reduced the number of “stuck intersections”.
- Expect to continue to implement weather responsive deployments.
Signal Performance Data

- Maintained comparable or better levels of progression to non-weather days
- Arrivals on Green and Platoon Ratio were the key performance measures for progression

Average Percent Arrival on Green for Corridor -- Northbound/Eastbound

Overall Quality of Progression Achieved in the Northbound/Eastbound Direction
TRePS Modeling

• Compare the Do-Nothing to implemented weather plans
• Corridor-level measures (delays, travel times)
• Status
  – Network calibrated
  – Signal timing modeled
  – Results being extracted
Conclusions

• Operating approach to maintain a true weather responsive system in a corridor.
• System led to improved UDOT understanding of
  – how to monitor the corridor during weather events,
  – the nature and the frequency of adjustments to signal plans, and
  – the types of measurement tools needed to manage in real-time.
Lessons Learned

• Changing coordination plans most effective when conditions change travel speeds roughly 5-10 mph.
• Knowing when to deactivate a timing plan requires knowledge about actual conditions in the field. Need fairly close to real-time data to do this effectively.
• Storm intensities have a tendency to ebb and flow throughout the duration of the event. Constant monitoring is necessary.
• Keep the number of WRTM timing plans down to a manageable size.
• Avoid timing plans that utilize maximum recalls for minor and cross-street phases.
Contacts

• Final Report – Forthcoming

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