Weather-Responsive Traffic Signal Control in Utah

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2014 Road Weather Management Stakeholder Meeting – SLC Utah
August 14, 2014
Utah Department of Transportation

- Population 2.9 Million (34th largest state)
  - 2nd fastest growth
  - Projects up to 2.5 million more by 2050
- Land Area: 84,900 sq. mi (13th largest state)
- 1900 Traffic Signals in Utah
  - 1150 owned by UDOT
  - 750 owned by cities /counties
WRTM Signal Timing Research In Utah

1) “Modifying Signal Timing During Inclement Weather”
   University of Utah – January 2001

2) “Utah DOT Weather Responsive Traffic Signal Timing”
   Texas A&M Transportation Institute & Battelle – Sept. 2013

3) “SR-36 Snow Event using Link Pivot”
   Purdue University – April 2014

4) “Implementation of a Weather Responsive Traffic “Estimation and Prediction System (TrEPS) for Signal Timing at Utah DOT”
   Northwestern University & SAIC – July 2014
Conclusions of Research

- Saturation flows decrease by 20%
- Speeds decrease by 30%
- Start-up lost times increase by 23%

UDOT Outcome

- Generated WRTM signal timing plans
  - Model 10 mph reduction in speed
  - Duration of speed reduction estimated 20+ minutes
  - Developed WRTM plans for several corridors
  - Had no way evaluating the “effect” of the plans

What We Did

- Used in-house meteorologist to identify best time to implement weather based plans.
- Automated Signal Performance Metrics to actively adjust signal timing plans for each event.
  - Near real-time speed metrics to start / stop plans.
  - Purdue Coordination Diagrams (PCD’s) to measure and fine-tune plans.
  - Percent Arrivals on Green and Platoon Ratios

- UDOT Outcome:
  Maintained traffic conditions during adverse weather to near non-weather levels
Approach Speeds using Radar at Intersections
(Riverdale Rd & Shopko – January 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

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85% Sp: 85th Percentile Speed
Ave Sp: Average Speed
Std Dev: Standard Deviation

UDOT utah.gov
Purdue Coordination Diagram (PCD)

- Fine-tuning new coordination plans at traffic signals

![Diagram showing cycle time vs time with phases of green and red, and vehicle arrivals highlighted]
Coordination: Improving Progression

Purdue Coordination Diagrams

Platoon arrives on red

Platoon arrives on green
Automated Traffic Signal Performance Measures

AASHTO Innovation Initiative (formally TIG)
2013 Focus Technology

Mission: Investing time and money to accelerate technology adoption by agencies nationwide
What We Did

- Automatic offset optimization using Purdue’s “Link Pivot”.
- In development at UDOT is a program to calculate this automatically using data from the PCD’s.

UDOT Outcome

- New offsets generate a 5% increase of Percent Arrivals on Green.
- Using historical measured data is a convenient way to develop WRTM plans in the future.
Before AOG: 6136

Study Corridor:
SR-36 Tooele

Data Sampled:
December 3, 2013
Snow event
1100-1300 (Plan 7)

Cycle Length:
100 seconds
Predicted

Before AOG: 6136
Predicted AOG: 6437
Difference: +301 (+5%)

Study Corridor:
SR-36 Tooele

Data Sampled:
December 3, 2013
Snow event
1100-1300 (Plan 7)

Cycle Length:
100 seconds

What We Did

- NW University developed a model that interacts continuously to traffic data and provides real-time estimates of traffic conditions, network flow patterns and routing information. It predicts up to 1 hour in advance.

UDOT Outcome:

Loaded program onto UDOT computer during spring of 2014. Have not yet had a snow storm to run the estimation and prediction model.
Thank You!

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