Implementing Automated Traffic Signal Performance Measures (ATSPMs): CDOTs Experience
OUTLINE

- What Are ATSPMs
- Motivation
- Deployment Steps
- Benefits
- Use Cases
What are ATSPMs

AUTOMATED TRAFFIC SIGNAL PERFORMANCE MEASURES (ATSPMs)

- FHWA Every Day Counts (EDC-4) Initiative
- Traffic Signal Management/Data Analysis System
- Uses High-Resolution Data Logs (1/10th of a second)
- Targeted and Proactive Signal Maintenance
- Real-Time Signalized Intersection Performance Monitoring and Measurement
- 10+ Performance Measures
CDOT’s MOTIVATION

- Improve Safety; Customer Service
- Targeted and Actionable Information
- Scarce Resources – Funding/Staffing
- Preserve Capacity, Better Signal Management
SYSTEM REQUIREMENTS

ATSPM Data Flow

- Field Detection Equipment (loops, video, pucks, radar)
- High Resolution Controller
- Reliable Communications
- Database Server (10MB/controller/day)
- ATSPM Software (www.itsforge.net)

Useful Info on Signal Performance
DETECTION REQUIREMENTS

More Field Detection = More Performance Measures

- Split Monitor
- Purdue Phase Termination
- Purdue Split Failure
- Pedestrian Delay
- Preemption Details

- Purdue Coordination
- Link Pivot Analysis
- Approach Volume
- Approach Delay

- Lane by Lane Volumes
- Yellow and Red Actuations

CDOT’s Signal Performance Measures
DEPLOYMENT STEPS

01 PLAN
Research
Observe
Understand

The Planning Phase
- Reached out to other DOTs
- Assessed other performance tools
- Assessed field infrastructure

02 DESIGN
Business Process
Architecture
Use Case Scenarios

The Concept Phase
- Funding resources
- Collaboration with IT staff
- Identification of Pilot corridor

03 DEVELOP
Communication
Upgrades
Quality Check

The Development Phase
- Field infrastructure upgrades
- Establish communications with field infrastructure and Servers
- Review performance measures

04 DEPLOY
Usability Testing
Training
Monitoring

The Deployment Phase
- Training M&O Team
- Integration with TMC
- Provide quality service
- Corridor by Corridor

Feb 2016  June 2016  January 2017  March 2017
BENEFITS

• Proactive Operations and Maintenance Activities
• Continuous Monitoring of Device and System Health
• Automated Notifications by Email (Watchdog Feature)
• Before and After Comparisons
• Efficient Allocation of Scarce Resources
• Expedited Preservation of Capacity
• Improved Safety (by shifting to proactive operations and maintenance practices)
ATSPM Watchdog Alerts

Colorado Transportation Management Center (CTMC)

Watchdog Settings

Sample Watchdog Email

ATSPM Alerts for 6/4/2017

---No new missing record errors were found on 6/3/2017:
---No new force off errors were found between 1:00 and 5:00:

---The following signals had too many max out occurrences between 1:00 and 5:00:
  107400034 - SH 74 & Stagecoach Rd. - Phase 1 (Max Outs 100%)
  107400534 - SH 74 & Stagecoach Rd. - Phase 2 (Max Outs 100%)
  107400534 - SH 74 & Stagecoach Rd. - Phase 5 (Max Outs 100%)
  107400534 - SH 74 & Stagecoach Rd. - Phase 6 (Max Outs 100%)
  107400534 - SH 74 & Stagecoach Rd. - Phase 8 (Max Outs 100%)

---The following signals had unusually low advanced detection counts on 6/3/2017 between 17:00 and 18:00:
  107400296 - SH 74 & Squaw Pass - Phase 4 (Count: 28)
  107400296 - SH 74 & Squaw Pass - Phase 8 (Count: 38)
  107400444 - SH 74 & Lewis Ridge Rd. - Phase 4 (Count: 49)
  107400444 - SH 74 & Lewis Ridge Rd. - Phase 8 (Count: 43)

---No new high pedestrian activation errors between 1:00 and 5:00:
USE CASE #1

Proactive maintenance of vehicle and pedestrian detection failures

Location: SH 74 at N. Bergen Parkway

Continuous Ped Calls

Ped Button Repaired

Phase Termination Chart
USE CASE #2

Approach Traffic Volumes

Automate traffic volume counts on arterials

Location: SH 74 at Lewis Ridge Dr.

- Utilizes both Advance & Stop Bar Detection (if available)
- Approach Traffic Volumes
  - Trend Analysis
  - Troubleshoot Concerns
  - Signal Retiming
  - Before and After Studies
USE CASE #3

Split Monitor

Location: SH 74 at Bryant Drive

Improve Capacity at Intersections

Depicts the factors that terminate the phase.

Before:

• Phase 4: Too many Gap-outs
• Phase 8: Too many Force-offs

Splits Optimized

After: Improved Capacity

Programmed Split
USE CASE #4

Purdue Coordination Diagram

Location: SH 74 at Stagecoach Road
Phase 6 Southbound

• Troubleshoot Coordination-related issues
• Characterizing Arrivals on Green and Red

Improve traffic flow on arterials

CDOT’s Signal Performance Measures 13
USE CASE #5

Improve traffic flow on arterials

SH74 Corridor

Corridor Summary (Arrivals on Green)

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<th>Northbound</th>
<th>Southbound</th>
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<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
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<tr>
<td>AM Peak (6:00 – 9:00)</td>
<td>83%</td>
<td>85%</td>
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<td>(11,517)</td>
<td>(12,012)</td>
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<td>Off Peak (9:00 – 15:30)</td>
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<td>PM Peak (15:30 – 19:00)</td>
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<tr>
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<td>(9,881)</td>
<td>(10,159)</td>
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- Report shows # Arrival on Green (existing/predicted)
- Coordination Check
- Determine possible outcomes by editing offsets
Thank you!

Questions

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