MODEL SYSTEM ENGINEERING DOCUMENTS FOR TRAFFIC SIGNAL SYSTEMS

WA ITE/IMSA Conference
February 8, 2016
Starting Quarterback

• Eddie Curtis, P.E., FHWA
  • Traffic Management & Operations Engineer
  Office of Operations & Resource Center,
  Operations Technical Services Team
Starting Quarterback

- Eddie Curtis, P.E., FHWA
  - Traffic Management & Operations Engineer
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Backup Quarterback

- Kevin Fehon, P.E., PTOE, DKS
  - Principal Investigator for FHWA Model Documents for Adaptive Signal Control Technology (ASCT) and Traffic Signal Systems (TSS)
Third String Quarterback

• Pam O’Brien, P.E., PTOE, DKS
  • Principal doer for Model SE Documents for ASCT Update and new Model SE Documents for TSS
Outline

• Background

• Update to Model SE Documents for Adaptive Signal Control Technology

• New Model SE Documents for Central Traffic Signal Systems

• What’s Next
Background

- Signal Timing Report Card

Very few agencies actively monitor and measure the signal system performance outside of citizen complaints.
Every Day Counts Initiative 2010-2012

**Goal:** Mainstream the use of ASCT

**Barriers:**
- *Uncertainty about benefits*
- *Cost*
- *Complexity*
- *Clear understanding of operation and maintenance requirements*
Implementation Approach

**Mission:** Provide tools to address risk, characterize ASCT as a strategy to improve operations.

- **Objective 1:** ASCT/Tools will be used by 40 agencies to guide planning and implementation
- **Objective 2:** Develop Performance Measures, data needs and methodology to support evaluation of ASCT
Why Systems Engineering?

• Federal regulation **23 CFR 940** mandates that a systems engineering analysis be performed for all ITS systems deployed using Federal funds, and that the level of effort be commensurate with the scale of the project.

• Systems engineering is a tool that helps the agency articulate its needs.
Background – Systems Engineering
Model Documents for ASCT

• Evaluate need for Adaptive Control
• Limitations of Existing System
• Objectives & Needs for Improved System
• Requirements to guide procurement and acceptance testing
• Basis for validation testing
Model SE Documents for ASCT

- Concept of Operations
- Requirements
- Verification Plan
- Validation Plan
- Templates
- Sample Statements
Model Document *Process*

### Build Requirements
- Answer questions
- About the situation
- About you
- Select and tailor ConOps statements
- Select and tailor requirements

### Evaluate Alternatives
- Evaluate proposed approaches/products against requirements
- Solution feasible given constraints?

### Continue Tailoring Until Solutions...
- Fulfill requirements
- Are feasible
US Implementation 2015
Application of Systems Engineering
Before and After MSED

8%

62%
# Model Documents for ASCT - Update

- Minor edits to User Needs and Requirements sample statements
- Customized Tables?
- Vendors like the Model Documents
- Adaptive Operations for one corridor vs. agency wide?

<table>
<thead>
<tr>
<th>Con Ops Reference Number</th>
<th>Concept of Operations Sample Statements</th>
<th>System Requirements (Tailor as required - See Guidance)</th>
<th>Guidance Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5.0.3</td>
<td>The system operator needs to detect queues propagating outside its boundaries from within the ASCT boundaries, and modify its operation to accommodate the queueing.</td>
<td>2.1.3.0.2 When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode.</td>
<td>4.4</td>
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<tr>
<td></td>
<td>The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation</td>
<td>2.1.3.0.2 When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode.</td>
<td>4.4</td>
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<tr>
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<td></td>
<td>2.1.3.0.1 The ASCT shall detect the presence of queues at pre-configured locations.</td>
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<tr>
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<td></td>
<td>2.1.3.0.3 When queues are detected at user-specified locations, the ASCT shall execute user-specified adaptive operation strategy.</td>
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<td></td>
<td>2.1.3.0.4 When queues are detected at user-specified locations, the ASCT shall omit a user-specified phase at a user-specified signal controller.</td>
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<td>2.1.3.0.5 The ASCT shall meter traffic into user-specified bottlenecks by storing queues at user-specified locations.</td>
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<td>2.1.3.0.6 The ASCT shall store queues at user-specified locations.</td>
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<td>2.1.3.0.7 The ASCT shall maintain capacity flow through user-specified bottlenecks.</td>
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Model Documents for ASCT - Update

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Model Documents for ASCT - Update

- Procurement has caused some trouble

http://www.fhwa.dot.gov/federal-aidessentials/catmod.cfm?id=100
Model Documents for ASCT - Update

• Detection technology/location

• Communications

• Operational Scenarios are key!
Model Documents for Central TSS

- Focused on Commercial Off-the-Shelf Traffic Signal Systems
- Aimed at smaller agency
- Focuses on central signal system function
Central TSS Functions

• Database Management
• Intersection Status Monitoring/Map
• Performance Measurements/Reports
• Intersection Control?
Model SE Documents for Central Signal System

- Concept of Operations
- Requirements
- Verification Plan
- Validation Plan
- Templates
- Sample Statements
- Procurement
What’s Next?

• Automated Traffic Signal Performance Measures – Game Changer

Pooled Fund Study Products (FHWA, Purdue and Agency Partners)

PERFORMANCE MEASURES FOR TRAFFIC SIGNAL SYSTEMS
An Outcome-Oriented Approach

“Volume 1”
Defining Performance Measures...
Download at: tinyurl.com/signalmoe

Integration of Performance Measures into Traffic Signal Systems Business Practices

“Volume 2”
Business Practices, Use Cases, and Implementation...
Estimated to publish in March 2016
Application to Automated Traffic Signal Performance Measures

Hi Resolution Data is Critical for Identifying Levers

- Slide from Darcy Bullock
Application to Automated Traffic Signal Performance Measures

- Slide from Darcy Bullock
Final Thoughts
Questions?

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