Adaptive Signal Control Technologies (ASCT)

Systems Engineering Process

Presented by: Adam Moser, P.E.
ITS Systems Engineering Analysis

Putting the Stakeholders in Control

- FHWA does not define sample Needs or Requirements statements
- ITS covers a wide array of ‘systems’ and ‘devices’
- SEA process clearly defines system

Risk = SEA Document’s Range in Complexity & Cost
System Engineering Analysis (SEA)

23 CFR 940.11(c) Defines Seven Minimum “systems engineering analysis” Items we need to cover:

1. Regional ITS architecture
2. Stakeholders’ roles and responsibilities
3. Requirements
4. Alternative system configurations and technology
5. Procurement
6. ITS standards and testing
7. Operations and management of the system

Is a Signal System an ITS Project?
Systems Engineering Analysis for Signals?

- There exists a **Grey Area** for signal technology and signal ‘systems’
- Traditionally Traffic Signals & Equipment were left out of ITS
- The Decision Maker (aka $-man) usually determines need

**Why do an SEA?**

- “Carpetbagger” Sales led to failures
- Frustrations from Operations, Maintenance, Public
- Questions on:
  - Cost
  - Complexity
  - O&M effort
**ASCT Systems Engineering Analysis**

**A Different Bird Than ITS**

- FHWA *DOES* define sample Needs & Requirements statements
- *They WANT* you to use them
- Do *NOT* change the Needs statements
- ... or have a good reason...

**Why?**

- Local Agencies Needed Help
- General needs/objectives can be defined for ASCT Systems
- Tried to cover ‘all scenarios’
- Flexibility to tailor specific requirements
ASCT Systems Engineering Analysis

– General Outline:

- **Concept of Operations** – Define Needs and Objectives – Appendix B
  - Operational Scenarios in Appendix C
- **System Requirements** – Statements on what you need to meet your needs/objectives – Appendix D
- **Verification** – Testing of the Requirements
- **Validation** – Short and Long term testing of objectives – Performance Measures!
The ASCT Con Ops Process

- Do the homework up front
  - Operational Observations
  - Strategies to Consider
  - Data Collection
- Stakeholder Workshop
  - Identify Objectives
- Alternatives considered
- Procurement Options
- What is the Environment?
  - Signal Shop/Maintenance
  - Signal Timing staff
  - Contract Support
The ASCT Requirements Process

- Review Model Document Requirements Statements
  - Tailor to the Stakeholder needs/objectives
  - Get Specific!

- Tricky - May not be enough space in Matrices to elaborate
  - What Then?

- Write Verification Section and Statements
  - Can be part of the System Requirements Section
  - Vendor should Provide

<table>
<thead>
<tr>
<th>4.16 Training and support</th>
<th>15.0-1.0-9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.16.0-1</strong> The agency needs all staff involved in operation and maintenance to receive appropriate training.</td>
<td>The vendor shall provide a minimum of 40 hours training to a minimum of 10 staff.</td>
</tr>
<tr>
<td>15.0-1</td>
<td>The vendor shall provide the following training...</td>
</tr>
<tr>
<td>15.0-1.0-10</td>
<td>The vendor shall provide a minimum of 3 training sessions including basic Operator Training, Traffic Engineer Training, and Advanced Operation Training</td>
</tr>
</tbody>
</table>
The ASCT Validation Process

- Stakeholders should decide on Measurements of Effectiveness (MOEs) that are attainable with resources available

- MOE’s should follow your ASCT Strategies:
  - Travel Time, # of Stops, Avg. Speed
  - Intersection Control Delay
  - Detector & Signal Data (Speed, Occupancy, Volume-Cycle data)
  - Safety (Accident Data)
  - Cost/Benefit ($$)
Lessons Learned - ASCT Model Documents

- Procurement, Procurement, Procurement
  - Request For Info (RFI)
  - Request for Qualification (RFQ)
  - Request for Proposal (RFP)
    - Best Value Approach
    - Include Cost?
      - Low Bid
      - Market Research
      - Sole Source

- DOT Local Agency Reps
  - Process is confusing and often misunderstood

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

• Procure & Select based on Best Answers to Specific Requirements
  – Not Simple Yes/No Statements
• You may still need a “Special Notes/Provisions”
  – Remember the Requirements Matrices?
  – Further explanations of Requirements
  – Define General Scoring and Expectations of vendor that aren’t specifically covered in Model Docs
  – Define Expectations of Experience

• Deployed X number of systems over X years

<table>
<thead>
<tr>
<th>Requirements Reference Number</th>
<th>System Requirements</th>
<th>Comply</th>
<th>Vendor Response</th>
<th>Verification Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 Network Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0-1</td>
<td>The ASCT shall control a minimum of 75 signals concurrently</td>
<td></td>
<td></td>
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<tr>
<td>1.0-2</td>
<td>The ASCT shall support groups of signals.</td>
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</tbody>
</table>
The Future of Signal SEA Model Documents

- Continued Refinement of ASCT Needs & Requirements Sample Statements
- Advanced Signal System Model Documents
  - Not Specific to Adaptive Signal Control
- Procurement Definition and Guidance Document
  - More Clearly define Procurement Options
  - Geared towards those DOT Local Agency Reps
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