Applying Systems Engineering to Implementation of Adaptive Signal Control Technology

Jeffrey A. Lindley
Associate Administrator for Operations USDOT, Federal Highway Administration (FHWA)
jeffrey.lindley@dot.gov

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Outline

- ASCT Benefits
- ASCT Deployment Penetration
- Barriers to ASCT Adoption
- Overcoming Barriers by Managing Risks
- The Role of Systems Engineering
- Your Questions
Adaptive Signal Control Technology

1. Monitor Traffic
2. Evaluate Performance
3. Update Timing

- Trigger Event
- Data Collection
- Modeling / Optimization
- Implement & Fine Tune
- Reporting
ASCT Benefits

- Better
  - Benefits to both road users & public agencies
    - Travel time reduction 13% - 50%
    - Fuel Consumption 8% - 38%
  - Ongoing performance measurement

- Smarter
  - Solves problems that are difficult to address with time-of-day and traffic responsive timing
  - Saves cost of mundane data collection and retiming

- Faster
  - Reduces retiming intervals from years to minutes

Source: NCHRP 403 2010 & FHWA Arterial Management Program
Lessons from ASCT Demonstrations

- Substantial benefits over coordinated TOD operation
  - Travel time, Delay, Emissions,
  - Congestion, Safety
- Most effective where demand conditions are variable and unpredictable
- Most effective on linear arterials, limited success within tight grids
- Most effective in under-saturated conditions
Identified Barriers to ASCT Adoption

- Complexity
- Cost
- Uncertainty about Benefits
Every Day Counts – Better, Faster, Smarter

- **FHWA Initiative focused on Shortening Project Delivery and Deploying Innovative Technology**

- **Two year effort (2011-2012) focused on 5 technologies including ASCT**
Successful Technology Deployment

- Goals well understood
- Agency describes its needs
- Positive response to requirements in RFP
- Requirements are verified
- Performance objectives are validated
- System is effective over entire life cycle
What are the Risks - ASCT?

- Problem could be solved with other strategies
- Functional objectives of the system may not align with agency objectives
- Loss of other critical functions / features
- Constraints not properly addressed
- Cost
- Maintenance
Other ASCT Risk Issues

- Technology NEW to most
- Technology still evolving
- Most systems have very limited track record
- Documented history of failed ASCT projects (40%+)
- Significantly increased complexity
- Extremely dependent on infrastructure
  - Communications systems
  - Detection
  - Staff
- Not “one size fits all”
- Marketing exceeds performance in many cases
The Role of Systems Engineering

Understanding the problem

• Projects getting bogged down with shifting requirements
• Acquisitions being challenged by unsuccessful bidders/proposers/vendors
• Projects not meeting agency needs

Managing risk

• Projects getting bogged down with shifting requirements
• Acquisitions being challenged by unsuccessful bidders/proposers/vendors
• Projects not meeting agency needs

+ it is mandatory for U.S. federal-aid projects
Purpose of SE Model Documents

- Evaluate need for Adaptive Control
- Help agencies identify verifiable, needs-driven requirements for evaluating design and implementation choices
- Model documents greatly reduce systems engineering effort by providing wording and documentation...
- ...but agencies still must identify their needs
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 2010 - 2012

Alaska

Puerto Rico

ACDSS
Centracs Adaptive
ACSLite/Siemens
InSync
LA - ATCS
QuicTrac
SCATS
SCOOT
SynchroGreen
Planned
FHWA EDC/ASCT Influence 2010-2012

- Alaska
- Puerto Rico

Legend:
- ACDSS
- Centrac Adaptive
- ACSLite/Siemens
- InSync
- LA - ATCS
- QuicTrac
- SCATS
- SCOOT
- SynchroGreen
- Planned
Summary

- ASCT investments can produce significant benefits
- Barriers to more widespread adoption still exist
- Barriers can be overcome by focusing on managing risks and using systems engineering process
- Use of systems engineering process has helped spur a dramatic increase in ASCT deployments in the United States
Questions?