ADAPTIVE SIGNAL CONTROL TECHNOLOGY

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Baltimore Regional Traffic Signal Forum
May 25, 2011
Agenda

• The Signal Timing Problem
• What is ASCT
• The Benefits of ASCT
• ASCT Program Goals
• Implementation Considerations
Accelerating Technology and Innovation Deployment

- Warm Mix Asphalt
- Precast Bridge Elements
- Geosynthetic Reinforced Soil
- Safety Edge
- Adaptive Signal Control Technology
What Do Motorists Want?

• “Why do I have to wait when there’s nobody else moving”
  – Translation: Equitable distribution of green time
• “Can’t I just drive down the street?”
  – Translation: Progression—driving through successive greens
Traditional Traffic Signal Timing

Time of Day

VPH (vehicles per hour)

12:00 AM 2:00 AM 4:00 AM 6:00 AM 8:00 AM 10:00 AM 12:00 PM 2:00 PM 4:00 PM 6:00 PM 8:00 PM 10:00 PM

PEAK 15 Min

Every Day Counts

Innovation Insecurity Innovation
Variability is Normal—And the Problem

PM Peak Period Demand

Demand (VPH)

Time

3:00-3:15 3:15-3:30 3:30-3:45 3:45-4:00 4:00-4:15 4:15-4:30 4:30-4:45 4:45-5:00 5:00-5:15 5:15-5:30 5:30-5:45 5:45-6:00 6:00-6:15 6:15-6:30 6:30-6:45 6:45-7:00

PEAK 15 Min

NBLT  WBLT  SB

NB  EB  WB
The Big Box Scenario – Year 1
Year 5
Year 13
What is ASCT?
Adaptive Signal Control Technology
Signal Timing & Delay

- Do Nothing
- Periodic Retiming
- Constant Fine Tuning (ASCT)

Time (years)

Source: City of Alpharetta
Benefits of Improving Signal Timing

- Do Nothing
- Periodic Retiming
- Constant Fine Tuning (ASCT)

Time (years)

Source: City of Alpharetta
Adaptive Without Periodic Retiming

“WOW!!! 50% Improvement!!!”

Source: City of Alpharetta
Adaptive in a Well Timed System

Retiming Costs

User Costs

Time (years)

Source: City of Alpharetta
Benefits of ASCT

- Improves arterial performance by maintaining the effectiveness of Traffic Signal Timing
  - Delivers better service to road users
    - Better green time distribution: Minimizes congestion
    - Smoother flow down the street
    - More reliable travel times
    - Less time stopped: Reduced fuel consumption
  - Solves problems for operators
    - Reduces complaints
    - Tracks changes in demand
  - Provides value
    - Reduces agency costs for mundane retiming
    - Reduces road user costs
    - Fewer unexpected stops means safer operation
Program Vision

“Adaptive Signal Control Technology (ASCT) is utilized as an operations strategy to improve the performance of traffic signal timing to reduce congestion where demand conditions and agency capabilities support its implementation."
Goal

• By December 2012, The **EDC / ASCT tools** are used to guide the implementation or programming of 40 Adaptive control systems.
What are the Tools?

• Guidance, Training, Technical Assistance

• Facilitate
  – Design
  – Technology Selection
  – Operation & Maintenance
  – Resources
Why Tools?

**TRANSPORTATION INFRASTRUCTURE**

Benefits of Traffic Control Signal Systems Are Not Being Fully Realized

**HIGHWAY CONGESTION**

Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use
940.11 Rule Requirements

- **All** ITS projects must be developed using a *Systems Engineering (SE) analysis*
- The analysis shall be on a scale commensurate with the project scope
- Seven (7) Requirements
“Vee” Model
What are my next steps?

I manage a large city, with over 1000 traffic signals, I'm considering adaptive signal control for some intersections, but how do I determine *the right place for adaptive*?

I'm a technologist and want to use the latest and greatest. I just heard about adaptive control and it sounds great, *I want one! What do I do next to get it?*

I have *very old traffic control system* and with my recent grant I think I can afford a new system. *Is it time to consider adaptive control?*

Due to *new air quality standards* that are out, I need to improve my network. Is it time to consider adaptive control?

I been working with my consultant/vendor for many years and they have been telling me about new adaptive traffic control systems that I should consider. *What locations would be the best fit for an adaptive control system?*

I am getting calls on a couple of my intersections and I cannot solve the cycle/phase issues. Will adaptive control help?

I have a corridor that I run time of day coordination, but *occasionally diverting traffic overwhelms the corridor*, could adaptive control provide a better solution?

The planners are telling me that in the next 5-10 years there will be a 50% growth along the main corridor in the city, *the current traffic control system will not handle the traffic based on the current capacity*. Is it time to consider an adaptive control?

I have tried *time of day coordination and even traffic responsive plan selection*, but I feel like there could be something better. Could adaptive control be a better solution?
EDC / ASCT Tools

• Systems Engineering
  – Workshops / Technical Assistance – Currently Available
  – Guidance – June 2011
  – Training March 2012

• Planning & Funding ASCT
  – Training - August 2011

• Evaluation Methodology for Advanced Traffic Signal Operational Improvements
  Guidance - Jan 2012

• Training – Early 2012

• ASCT Outreach
  – Webinar, Showcase, Articles & Information
Long Beach Comparison
Readily Available ASCT

- ACSLite
- BALANCE
- InSync
- LA ATCS
- MOTION
- OPAC
- RHODES
- SCATS
- SCOOT
- UTOPIA

- QuicTrac
- Voyage
- Multi-criteria Adaptive Control
## Important Considerations

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<th>Agency Resources</th>
<th>Site Suitability</th>
<th>System Cost</th>
<th>Existing Infrastructure</th>
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<td>• Operational Objectives and Philosophy</td>
<td>• Arterial v. grid</td>
<td>• Capital Cost</td>
<td>• Closed loop vs Centrally managed</td>
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<td>• Operations and Maintenance</td>
<td>• Emerging congestion</td>
<td>• Operations</td>
<td>• Communications</td>
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<td>• Staff skills and abilities</td>
<td>• Traditional objectives unattainable</td>
<td>• Maintenance</td>
<td>• Sensor hardware</td>
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<tr>
<td>• Funding Sources</td>
<td>• Traditional methods failed</td>
<td>• Staff Training</td>
<td>• Overall system reliability</td>
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Capital Investment

$8,000 - $60,000 per intersection

• Fixed:
  – Software
    • License
    • Warranty
    • Support
    • Configuration
    • Calibration
  – Hardware
    • Control Equipment
    • Processors
    • Devices
  – Configuration
    • Setup
    • Calibration
    • Updates

• Variable:
  • Detection
  • Communications
Operations & Maintenance Investment

Reactive

• Manual Data Collection
• Offline Analysis & Modeling
• Travel Time Studies
• Citizen Complaints
• Detector Failures
• Communications

Proactive

• Active Monitoring
• Adjustment
• Maintenance Critical
• Reporting