ADAPTIVE SIGNAL CONTROL
FOR CORRIDOR MANAGEMENT

AASHTO – SCOTE Meeting
Savannah, GA
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Presentation Overview

- Overview on Adaptive Signal Control
  - ASC Technology Defined
  - Data-Driven Traffic Management
  - Systems Engineering Process
  - Types of ASC Systems

- ASC Corridor Management Examples
  - Wakefield – I-95 at Salem St./Audubon Rd.
  - Dartmouth – I-195 at Faunce Corner Rd.
  - Framingham – Route 126 at Route 135
  - Burlington – Middlesex Turnpike

- Why use Adaptive Signal Control?
  - Where to use ASC
  - Stated Benefits of ASC
  - Importance of Communication
  - The “Not So Good” side of ASC
  - Open Discussion
What is Adaptive Signal Control?

- ASC Technology (ASCT) is an operations strategy utilized to address traffic signal progression.
- It is far more dynamic as it uses real-time data collected from the corridor detectors to evaluate volume demand and assign green times for optimal progression.
- Requires a communication medium to link the intersections together and capture the detection data to generate the adaptive functions.

Source: wvgazettemail.com
Data Driven Traffic Management

Adaptive, Real-Time Traffic Control

- Sense conditions:
  - Vehicle, pedestrian probes
  - Infrastructure sensors
  - Vehicle destinations

- Characterize congestion
- Identify prioritization needs

Install new timing plans

Adjust signal timings

Continual Optimization of Traffic Flows

- Extract traffic flow patterns and trends
- Refine & optimize coordinated timing plans

Guidance to Vehicles

Source: saveoakhill.com
FHWA has developed a systematic process to help DOT’s guide the ASCT implementation decisions
Types of ASC Systems

- SCOOT MMX (2010)
- SCATS (40+ years)
- ACS Lite (Arterials)
- Centracs (works w/ATMS)
- InSync (the “Black Box” approach)
- SynchroGreen (very adaptable)
Massachusetts Experience - Wakefield

Implemented in Summer 2015
Wakefield – ASC System

○ 5 Intersections (2 State Owned / 3 Town Owned)

○ Prior to installation, traffic would back up on highway ramps during peak hours due to difficulty coordination signal operations

○ Added Fleur Cameras to better manage detection in all weather conditions

○ With “Full Access” provided to the District Traffic Operations Engineer – adjustments can be made on the fly

○ SynchroGreen system
Wakefield – Remote Monitoring

Real-Time access to monitor signal detection and troubleshoot problems
Wakefield – SynchroGreen System

- How is the SynchroGreen ASC System working?
  - The traditional backups that would occur on a weekly basis during the commuting hours have dropped down to very manageable conditions
  - Public Feedback has been positive
  - District 4 Office and Town of Wakefield are very happy with system
Massachusetts Experience - Dartmouth

Faunce Corner Road: I-95 to Route 6

Adaptive System added as part of a bridge replacement & corridor project with new signalization of WB Ramps

Under Construction – Summer 2016
Dartmouth – ASC-Lite System

- 6 Intersections (4 State Owned / 2 Town Owned)
- Existing condition has congestion associated to mall, shopping plaza, college and hospital traffic all converging on this road connecting I-195 to Route 6
- All Cabinets will utilize Eagle Controllers and ACS-Lite
Dartmouth – ACS-Lite Configuration

- System will run 3 ASC plans that will address traditional peaks (M-F) and Weekends
  - Holiday Traffic Plans will be implemented mid November till mid January

- Agreement with the Town of Dartmouth for MassDOT to control their signals

- Alerts configured to notify Town directly of Comm failures
Massachusetts Experience - Framingham

- 5 Intersections (all Town owned)
  - Two north of the roundabout in the Town Center
  - Three south of the center with an at-grade RxR Crossing
  - Medical Center (North)
  - Fire Stations (North & South)
  - Police Station (North)
Framingham – Need for ASC

- Part of a Downtown Revitalization project
- Traffic Statistics
  - Route 126 – Concord St. 17,500 veh/day
  - Route 135 – Waverly St. 16,000 veh/day
- At-Grade RxR Crossing
  - Commuter Rail (50 per day)
  - CSX Freight (6-12 per day)
  - Amtrak Service (2 per day)
- Signal Preemption
  - Main corridor for EMS

Under Construction – Summer 2016
Framingham – ASC-Lite System

- Hybrid Adaptive Operation
  - Not an off-the-shelf implementation
  - Provides “On-Demand” Coordination

- Each Cycle is referenced to unique and dynamic reference point
  - Service preemptions as they occur
  - No recovery after preemption

- System Cycle Length
  - May change on a 5-minute horizon with a classic traffic responsive algorithm
  - Split times are adaptive
  - Uses donor and receiver phases to level off system
  - Exclusive Ped Phases – integral to cycle
Massachusetts Experience - Burlington

27 Intersections --> 11 State Owned / 16 Town Owned

Coming Soon – Starting Summer 2016
Burlington – Need for ASC System

- 27 Intersections (11 State Owned / 16 Town Owned)
- The area is right off of I-95 and Route 3, two major routes in Massachusetts and heavily influenced by commuter traffic
- This the Town’s business district with an abundance of corporate office complexes, moderate sized businesses and lots of retail/commercial development
- Outside of the peak hours, the area experiences high traffic volumes most of the day with the mall, shopping plazas, entertainment venues and many restaurants in addition to a large medical clinic and rehabilitation center
Burlington – SynchroGreen System

○ Run the 27 locations as three distinct sub-sections
  - Middlesex Turnpike South (7 intersections)
  - Middlesex Turnpike North (4 intersections)
  - Burlington Mall Road/Cambridge St. (16 intersections)

○ Communication Medium
  - Fiber Optic Cable
  - Copper Cable
  - Ethernet Patch
  - VPN Connection

○ ASC timing plans will have a wide variability in cycle lengths to address traffic demand
Where does ASCT make sense?

- Reacts to “unpredictable” corridor traffic flow
- Provides green time progression to reduce unnecessary stop delays
- Not intended for all situations, especially commuter routes that have daily directional peaks
- Reductions in delays are good for the environment and promote good driver behavior
Benefits of ASCT

- Adaptive signal control systems use real-time traffic data and can adjust to events that cannot be anticipated by traditional time-of-day timing plans:
  - Vehicle Crashes
  - Special Events
  - Road Maintenance/Construction

- ASCT helps improve the quality of service that travelers experience on our local roads and highways:
  - Less unnecessary delays
  - Traffic moves efficiently and smoothly
Importance of Communication

Breakdown in Communications returns the system to normal static time-of-day operations.
The “Not So Good Side” of ASC

- **Cost to Implement**
  - ASC Hardware/Software
  - Annual or Monthly License Fees
  - Additional detection needed to run
  - Communication between intersections

- **Not really just “Plug and Play”**
  - Existing Sequence and Timing charts should be evaluated to current traffic demand to establish the baseline
  - Need to establish Adaptive Timing Plans and parameters for adjusting signal (splits, offsets, cycle lengths)
  - System should be monitored to ensure all detection and communication devices are operational

- **Public and Adaptive Signal Control**
  - Be careful of what you promise
  - Technology can help, but will not solve everything
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