Adaptive Signal Control Technologies (ASCT)

TM 10

Photo: Courtesy of Neil Hetherington, WTI

Description: Adaptive signal control technologies monitor performance on a roadway and automatically adjust signal timing (when and how long they should remain green) to accommodate the current traffic. This allows a signal to automatically adjust for unexpected changes such as a crash, special event, construction, or weather conditions.
ASCT

Every few minutes, ASCT uses traffic sensors to collect data. After evaluating the data, signal timing improvements are developed and then implemented. ASCT can be used to optimize signal timings at an individual intersection or can be used to evaluate an entire system as a whole.

Rural Transportation Critical Needs

- ☑ Crash Countermeasures
- ☐ Emergency Services
- ☑ Operations & Maintenance
- ☐ Rural Transit & Mobility
- ☐ Surface Transportation & Weather
- ☐ Tourism & Travel Information
- ☑ Traffic Management

Issues Addressed

- ☑ Congestion and Delays
- ☑ Inefficient Signal Operations
- ☐ Parking Challenges
- ☐ Vehicle Detection
- ☐ Road Closures
- ☑ Travel Time
- ☐ Speed
- ☐ Alternate Routes
- ☐ Dynamic Traffic Control/Operations
- ☐ Special Event Management
- ☑ Inefficient Use of Road Network

Strategies Achieved

- ☐ Road User
- ☑ Road
- ☐ Vehicle
- ☐ Safety Culture
- ☑ Engineering
- ☐ Emergency Response
- ☐ Enforcement
- ☐ Education

Applicability

- ASCT are most applicable to roadways with unpredicatable traffic demand. If traffic demand is stable during typical times of day, then normal traffic signal operations would be efficient enough.

Partnerships

- Applications benefit from collaboration among numerous agencies, which may include:
  - Departments of transportation (local, state, federal)

Key Components

- Sensors
- ASCT Software
- Communication

Examples of Implementation

- **Michigan Department of Transportation (MDOT)**

MDOT deployed ACS-Lite in two locations as part of the Every Day Counts initiative, but also has three other local agencies in Michigan using ASCT.

- **Virginia Department of Transportation (VDOT)**

In 2011, VDOT deployed ASCT on 13 corridors in Virginia. An evaluation of this pilot deployment found that ASCT “generally produced a favorable benefit/cost ratio” and also had a 17 percent decrease in total crashes.

- **Colorado Department of Transportation (CDOT)**

CDOT deployed two different ASCT systems in two difference regions as a comparison. Region 2 deployed InSync and Region 4 installed QuicTrac.

Implementation Considerations (General)

- There are ASCT systems for both small scale (30 or fewer signals) and large scale (hundreds of signals) [1].
- Incorporate ASCT into planning documents.
- Due to multiple ASCT vendors, each with their own requirements, agencies should complete a systems engineering process to identify their needs, requirements, and operations/maintenance capabilites[1].

Implementation Considerations (Pro)

- Improves signal coordination.
- Reduces in vehicle delay and congestion.
- Increases average speeds.
- Improves travel times.
- Decreases fuel consumption and emissions.
- Reduces citizen complaints and frustration[1].
- Improves average performance metrics by 10 percent or more[1].
- Reacts to unexpected events.
- Crashes could be reduced by up to 15 percent through improved signal timing[1].
- Signal timing is improved in minutes rather than months or years with a traditional signal[1].

Implementation Considerations (Con)

- Expertise is needed to implement and and maintenance of the system.
- There may be a higher cost to these systems.
- May impact the walk signal/pedestrian phase.

Opportunities for Future Expansion

- Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) technologies will allow vehicles to communicate directly with signal controllers; however, this will require significant upgrades in signal system technology across the United States.

Additional Resources

- *Every Day Counts Adaptive Signal Control Technologies*, found here: https://www.fhwa.dot.gov/innovation/everydaycounts/edc-1/asct.cfm
- *Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems, found here:* https://ops.fhwa.dot.gov/publications/fhwahop11027/mse_asct.pdf
- *Adaptive Traffic Control Systems: Domestic and Foreign State of Practice,* found here: http://www.trb.org/Publications/Blurbs/163323.aspx
- National Transportation Operations Coalition, *National Traffic Signal Report Card*, found here: http://www.ite.org/reportcard/
- *Field Evaluation of an Adaptive Traffic Signal – Using Private-Sector Probe Data,* found here: https://www.researchgate.net/publication/282965925_Field_Evaluations_of_an_Adaptive_Traffic_Signal-Using_Private-Sector_Probe_Data

Useful Tip

ACSLite was developed by FHWA through a public-private partnership It provides the operational benefits of ASCT but is cost-effective for small systems by utilizing the conventional signal system architecture.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)

Capital Costs: The total capital costs for this tool are low (Less than $50,000) to higher (above $250,000), depending on the number of signals under consideration. The cost of signal control software, processor, and detectors was $435,200 in 2012[2]. A system with 11 intersections was implemented in Colorado for $946,568 and a system in Colorado with 8 intersections was implemented for $184,296[2].

UNKNOWN

Operations Costs: The operations and maintenance costs for this tool are unknown.

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