

FAQs

Where are adaptive signal control technologies most effective?

Adaptive signal control technologies are best suited for arterials that experience highly variable or unpredictable traffic demand for which multiple signal timing solutions are necessary during a typical time-of-day period.

How well does adaptive signal control technology improve system performance?

Many studies have shown that adaptive signal control improves average performance metrics (travel time, control delay, emissions, and fuel consumption) by 10 percent or more. In systems with extremely outdated signal timing, and under saturated conditions, the improvement can be 50 percent or more. Improvement might not be as dramatic in areas where traffic demand is stable and predictable during typical time-of-day periods, performance is regularly monitored, and signal timing is well maintained.

How widely are these technologies used?

Adaptive signal control technologies are widely used in the United Kingdom, Asia, and Australia. In the United States, adaptive signal control technologies are being used on less than one percent of all signalized intersections. The cost of hardware can be an issue, but other barriers include the expertise necessary to configure and maintain the system, a lack of active performance measurement, and myths about the benefits of adaptive signal control technology.

How do I plan to implement adaptive signal control technology?

As with any traffic operations strategy, it is essential that a signal operator identify performance outcomes they wish to achieve; determine their current needs, requirements, and long-range possibilities for their system; identify and pursue regional collaboration and integration; insert into agency plans all the resources necessary to successfully deploy and maintain the system throughout its lifecycle; and monitor performance of the deployed system.

Where can I go for assistance in this planning process?

Contact your FHWA Division Office, who can help you identify experts in planning, operation, and technical issues.

Contact Information

For training or more information on this Every Day Counts Initiative, please contact your local FHWA Division Office.

To learn more about EDC, visit:
<http://www.fhwa.dot.gov/everydaycounts>



Traffic flows smoothly through green lights.

About Every Day Counts

Every Day Counts is designed to identify and deploy innovation aimed at shortening project delivery, enhancing the safety of our roadways, and protecting the environment.



ASCT

Adaptive Signal Control Technologies

What are Adaptive Signal Control Technologies?

The variability and unpredictability of traffic demand on arterial systems often outpace the ability of local and State agencies to update signal timings so that signalized intersections operate efficiently and do not cause congestion and delays to motorists and pedestrians. The 2007 National Traffic Signal Report Card rated the Nation's traffic signal management and operations practices with a letter grade of "D" and estimated that poor traffic signal timing contributes to as much traffic congestion and more than 295 million vehicle-hours of delay on major roadways alone. Conventional signal systems do not use pre-programmed, daily signal timing schedules that do not monitor system performance, nor can they adjust automatically to accommodate traffic patterns that are different from the peak periods during which they were designed to operate. Adaptive signal control technologies adjust when green lights start and end to accommodate current traffic patterns to promote smooth flow and ease traffic congestion. The main benefits of adaptive signal control technology over conventional signal systems are that it can:

- Automatically adapt to unexpected changes in traffic conditions.
- Improve travel time reliability.
- Reduce congestion and fuel consumption.
- Prolong the effectiveness of traffic signal timing.
- Reduce the complaints that agencies receive in response to outdated signal timing.
- Make traffic signal operations proactive by monitoring and responding to gaps in performance.

Adaptive Control Software Lite (ACSLite) is a specific adaptive signal control technology developed by the FHWA through a public-private partnership. ACSLite takes advantage of typical signal system architecture and works with existing control, detection, and communications configurations to cost-effectively deliver adaptive control that is easy-to-deploy and produces comparable performance to traditional adaptive systems.



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How Does It Work?

By receiving and processing data from sensors to optimize and update signal timing settings, adaptive signal control technologies can determine when and how long lights should be green. Adaptive signal control technologies help improve the quality of service that travelers experience on our local roads and highways.

The process is simple. First, traffic sensors collect data. Next, traffic data is evaluated and signal timing improvements are developed. Finally, the adaptive signal control technology implements signal timing updates. The process is repeated every few minutes to keep traffic flowing smoothly. Traditional signal retiming might only repeat this process every 3 to 5 years.

The traditional signal timing process is time-consuming and requires substantial amounts of manually collected traffic data. Traditional time-of-day signal timing plans do not accommodate variable and unpredictable traffic demands. This results in customer complaints, frustrated drivers, excess fuel consumption, increased delays, and degraded safety. Customer complaints is the most frequently cited performance measure in operations surveys conducted by the FHWA. In the absence of complaints, months or years might pass before inefficient traffic signal timing settings are updated. With adaptive signal control technologies, information is persistently collected and signal timing is updated continually.



A wide variety of adaptive signal control technologies are available to operate in varied environments.

Why Adaptive Signal Control Technologies?

- Adaptive signal control technologies deliver improved service to road users.
 - Outdated traffic signal timing currently accounts for more than 10 percent of all traffic delays. On average, adaptive signal control technologies improve travel time by more than 10 percent. In areas with particularly outdated signal timing, improvements can be 50 percent or more.
 - Adaptive signal control technologies also react to unexpected events, such as crashes and special events. By adjusting traffic signal timing in real-time to reflect actual conditions on the road, travelers enjoy a more reliable trip.
 - Studies indicate that crashes could be reduced by up to 15 percent through improved signal timing. Adaptive signal control technology can reduce the intersection congestion that causes many crashes.
- Adaptive signal control technologies solve problems for signal operators.
 - Performance management and acquiring the information necessary to measure performance are challenges facing many transportation agencies. Adaptive signal control technologies capture a rich set of data that signal operators can use to monitor their performance.
 - By solving traffic problems as they occur, adaptive signal control can reduce citizen complaints and frustration. Adaptive signal control technology is a proactive step that signal operators can take to improve service.
- Adaptive signal control technologies provide value.
 - The costs of congestion and delay to road users are substantial, and adaptive signal control technology delivers benefits to users that far outweigh its cost.
 - Adaptive signal control technologies also provide value directly to signal operators. By extending the effectiveness of traffic signal timing plans, implementing adaptive signal control technologies can yield direct savings by reducing the frequency of manually retiming signals.

ACSLite and Alternative Adaptive Traffic Signal Control Technologies

ACSLite was developed to improve progression and phase utilization for small scale arterial systems of 30 or fewer traffic signals, producing smoother flow and fewer traffic delays. Large scale adaptive signal systems can handle hundreds of traffic signals, are typically fully integrated into central systems, and operate on a second-by-second basis. ACSLite makes timing updates every few minutes while large scale systems are capable of making timing updates every cycle. The Lite in ACSLite implies that it has less of a communications and detection burden, and utilizes empirical methods that do not need to be calibrated, thereby making it less complex to operate and maintain.

Like other systems, ACSLite operates in real time, adjusting signal timing to accommodate changing traffic patterns and ease traffic congestion. However, ACSLite works with conventional control equipment,



When adaptive signal control technologies are used, overall travel times decrease.

communications, and traffic sensors from a range of manufacturers, making it a cost-effective and flexible alternative.

In the United States, several adaptive systems are available from multiple vendors. Agencies should evaluate their needs, system requirements and operations, and maintenance capabilities through a system engineering process to evaluate if and which adaptive signal control technology will work best for their situation. Each system has specific requirements, and each will produce improved levels of performance that are consistent with agency commitment to management and operations programs.

Split Cycle Offset Optimization Technique (SCOOT) is the most widely deployed adaptive system in existence. It was developed in the United Kingdom. The Sydney Coordinated Adaptive Traffic System (SCATS) was developed in Australia, and matches traffic patterns to a library of signal timing plans and scales split plans over a range of cycle times. Another effective system is the Real Time Hierarchical Optimized Distributed Effective System (RHODES), which uses a peer-to-peer communications approach to communicate traffic volumes from one intersection to another in real time. There are many others in existence and in development.



Adaptive signal control technologies can reduce stop time at intersections.