

## ACS Lite

ACS Lite is the Federal Highway Administration's (FHWA) Adaptive Control Software (ACS), offering communities a low-cost adaptive control system.

### Description

ACS Lite is an arterial-based adaptive control software application that was developed for use with on-street master systems under contract to the FHWA Research, Development and Technology Traffic Operations program.

Econolite now offers the ACS Lite software as an optional module for *Centrac*™ ATMS software. ACS Lite was originally designed to adapt the splits and offsets of signal control patterns/plans in a closed-loop system, using arterial masters. That same functionality for adaptive control of arterials is now available from a central system. Changes to cycle time are handled on a Time-Of-Day (TOD) schedule or through Traffic Responsive (TR) plan selection, just like traditional traffic control systems. At each optimization step, which occurs about every 10 minutes, the ACS Lite system changes the splits and offsets by small increments (e.g. 2-5 seconds) to accommodate changes in traffic flows.

The ACS Lite application downloads new splits and offsets for the currently-running traffic plan (cycle-offset-split pattern) every five to fifteen minutes, while continuing to run the currently active cycle length as determined by the traffic engineer and implemented by the *Centrac* TOD or TR plan. During each cycle, the local controller software manages the duration of each split using gap-out and coordination logic, as designed by the traffic engineer. If communications between ACS Lite and the local controllers is interrupted, the local controller still maintains full coordinated operation of the intersection using the pre-existing plans stored in the controller.

ACS Lite performs its optimizations by polling each local controller for both standard NTCIP and ACS Lite objects that provide detector and phase data. Polling typically occurs once per minute to allow using ACS Lite with slow serial communications channels (9600bps). ACS Lite takes these minute-by-minute polls and matches the occupancy measured on each detector with the red and green intervals of each phase that the detector serves. This data

allows ACS Lite to assess whether or not traffic is arriving on a green (used for tuning the intersection offset), and whether or not traffic is using all of a phase's split time (used for split adjustment).

After measuring phase and split utilization ACS Lite then determines how effective the offset is at each intersection, ACS Lite then runs optimization algorithms to reallocate split time from phases that are not using their entire split to other phases that need more time and to determine whether an earlier or later offset would be more effective for traffic progression. Then, ACS Lite downloads the new values to each controller in the system. Since the changes to the split and offset values are small (typically 2-5 seconds), transition from the current setting to the new setting is usually completed within one cycle. The frequency of optimizations and the maximum amount of split and offset to be added or subtracted from the current values is controlled by the traffic engineer.

Initial field testing of ACS Lite has shown 5-25% improvement in arterial travel times, significant reduction in stops, and 5%-50% improvements in delays at side streets and left turns. The ACS Lite approach to adaptive control has been designed to provide a significant amount of benefit for a minimum amount of agency investment in additional infrastructure, training, and maintenance by using stop bar and advanced detection commonly found at fully actuated intersections.

### Benefits

- Eases traffic congestion
- Easily deployed
- Needs little maintenance
- Makes use of existing detection
- Operates in real time
- Requires no calibration

## User Interface

*ACS Lite* is easy to configure through the *Centracs* Windows-based Graphical User Interface (GUI). Much of the configuration data is uploaded directly from local controllers, with minimal additional user data entry. After uploading this configuration data, the user configures links, ring sequences, and detectors through the *Centracs* GUI. After the configuration is completed the system is ready to use for adaptive control. As the system is running, status screens are updated to provide intersection performance information and track changes that *ACS Lite* makes to the splits and offsets.

## Detector Requirements

*ACS Lite* is flexible with respect to the size, location, and requirements of the local detectors used to provide the data needed to adjust offsets and splits. Any detection technology can be used (*Autoscope*<sup>®</sup>, loop detectors, etc.).

*ACS Lite* has the ability to record trends and shifts in traffic demand. This allows the signal timing to remain up to date and reduces the need for signal retiming.

## Architecture

The *ACS Lite* algorithms have been incorporated into *Centracs* in order to enable zones or groups of intersections to operate under TOD, TR, or *ACS Lite* control as determined by the traffic engineer. When a zone is enabled to operate under *ACS Lite* control the current TOD or TR plan in effect serves as the starting plan values (cycle, offset,

and splits). The *ACS Lite* algorithms then use data collected from the intersections to assess the effectiveness of the current offset and splits at each intersection in the zone. The *ACS Lite* algorithms then optimize the offset and splits for each intersection. These optimized offset and split values are then downloaded to the controllers using the system communication channels (serial or Ethernet).

Each of the local controllers can be individually enabled or disabled to respond to the changes being requested by *ACS Lite*. This allows the user to easily override *ACS Lite* at any time or to establish when (by local time-of-day schedule) adaptive control will be allowed. When *ACS Lite* releases control of the local intersection it automatically restores the original offset and split values so that the controller database remains unaffected.

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