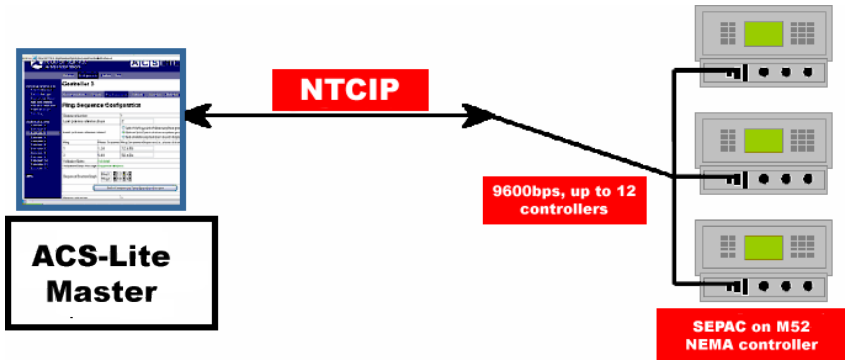
SIEMENS

ACS-Lite
Adaptive Control Software

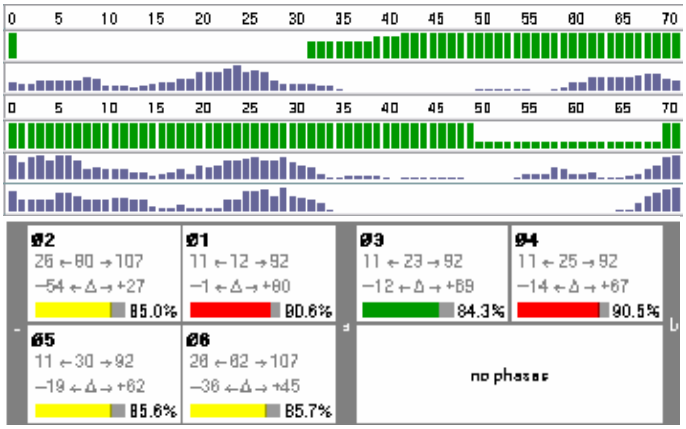
ACS-Lite is an adaptive control software application that has been developed for use with on-street (field) master sytems by Siemens under contract to the FHWA Research, Development and Technology Traffic Operations program. The project began in February 2002. The first phase of research and field deployment tests will be complete in July of 2006.

The ACS-Lite software is designed to adapt the **splits** and **offsets** of signal control patterns/plans in a "closed-loop" system. Changes to **cycle time** are handled on a time-of-day schedule like traditional traffic control systems. At each optimization step, which occurs about every 10 minutes, the system changes the splits and offsets a small amount (e.g. 2-5 seconds) to accommodate changes in traffic flows. Initial field testing of ACS-Lite with Siemens control equipment in Houston, TX 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 detection and advanced loops commonly used for intersection control.



ACS-Lite System Architecture

The ACS-Lite application downloads new splits and offsets for the currently-running pattern every five to fifteen minutes, maintaining the same cycle length as determined by the traffic engineer and implemented by the Time-of-Day scheduler. Each cycle, the local SEPAC controller software manages the duration of each split using gap-out and coordination logic, as designed by the traffic engineer. If communication between ACS-Lite and the local controllers is interrupted, the local controller still maintains full operation of the intersection.



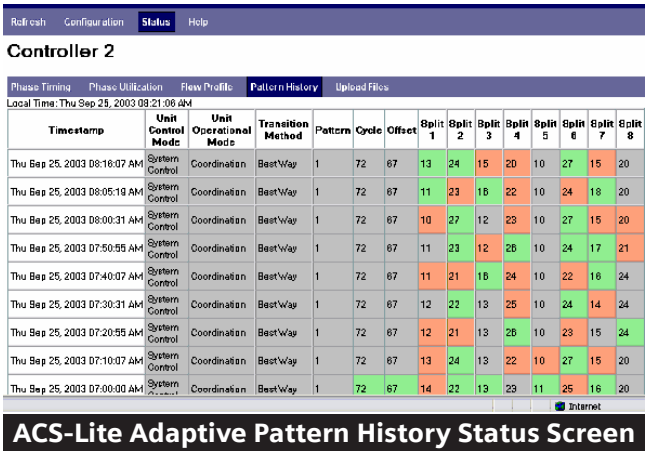
Split and Offset Performance Display Screens

ACS-Lite performs its optimizations by polling each local controller for custom ACS-Lite NTCIP detector and phase status data once per minute. This allows the system to poll many local controllers (up to 12) at 9600bps. Up to 32 controllers can be supported on one ACS-Lite management computer at higher communication rates. 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 allows ACS-Lite to assess whether or not traffic is arriving to a green light (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 computing these measures of phase/split utilization and determining how effective the offset is at each intersection, ACS-Lite runs optimization algorithms to reallocate split time from phases that are not using all of their 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 only very small (2-5 seconds), transition from the current settings to the new settings is typically 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.

ACS-Lite is easy to configure through an HTML browser-based user interface. 75% of the configuration data is uploaded directly from the local controllers, with no additional user data entry. After uploading this configuration data, the user configures links, ring sequences, and detectors through the browser and then the system is ready to use for adaptive control. As the system is running, web pages are updated each cycle to provide status of each intersection performance and track the changes that ACS-Lite makes to the splits and offsets. In addition, the software archives its performance measures and decisions to a data store for future analysis and retrieval.

Browser-based access to ACS-Lite operations is available not only locally, but also via the Internet if the master is equipped with an IP-addressable cellular modem.



ACS-Lite Adaptive Pattern History Status Screen

Technical Requirements

To upgrade or convert an existing Siemens closed loop system the following is **required**:

- Replacement of the SeMARC master controller with the Siemens ACS-Lite master controller
- 9600bps (or faster) serial modems or IP communications at each local intersection over any communication media (twisted-pair, wireless, fiber, etc.)
- Replacement or conversion of existing controllers to SEPAC 4.02 (or later) NTCIP running on 2070, M52 NEMA, or ATCnx hardware
- Conversion of signal control plans from SEPAC vendor-specific format to NTCIP format

For adaptive tuning of intersection **splits** the following is **required** (not all intersections need to have splits tuned):

- At least one detector for each phase at the stop bar (any detector length is supported and any detection technology)

For adaptive tuning of intersection **offsets** the following is **required**:

- At least one advanced detector on each coordinated phase (any detection technology including loops, video, and radar at typical standard placements 150ft+ from stop bar)

To upgrade or convert an existing Siemens/Eagle closed loop system the following is **recommended**:

- Individual detector lead-in cables and amplifier cards/channels/zones for each lane
- Installation of IP-addressable GPRS/CDMA modem for upload/download of controller databases (with Siemens NextEdit or Siemens ACTRA), and remote management/ support from Siemens

Future Features

In line with the Siemens policy of product improvement, the following features will appear in future releases:

- Real-time cycle-time tuning
- Tuning of pattern switch times (e.g. when PM peak pattern parameters should start)
- Saving of effective time-of-day splits, offsets, and cycle times to track seasonal and day-of-week traffic patterns
- Estimation of link travel times
- C2C link

For more information on Siemens products call (512) 837-8310 or call your local dealer (see website for the dealer in your area).

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