Performance you can see

Features and benefits of Siemens SCOOT® and ACS Lite Adaptive Signal Coordination software
As the volume of traffic on highways and roadways continues to grow at a greater rate than our roads can accommodate, the effect of traffic congestion will become an ever-increasing burden on city infrastructure. Cities need more effective tools to improve traffic flow and minimize disruptions caused by incidents and special events. We need a solution that is cost-effective, reliable and flexible.

One solution is an adaptive system using real-time signal control to optimize signal timings and minimize delays.

**Customized control**

Using a network of detectors, SCOOT® continually monitors approaching traffic and provides a customized response to each individual intersection. SCOOT® provides individual algorithms for cycle, offset and split allowing for a more calibrated adjustment of timing plans. SCOOT® automatically recognizes opportunities for double-cycling minor intersections when traffic is light enough, a feature unique to SCOOT®. Using upstream detection and customized response to each intersection demand, SCOOT® is able to handle a more complicated network of traffic configuration with increased benefits in traffic management.

Adaptive signal times have been proven to reduce congestion in complicated networks, reduce stops and delays 20%, travel time 31%, carbon monoxide emissions 4% and fuel usage by 6%.

SCOOT® times are continuously updated eliminating the need for a signal timing plan. SCOOT® can even be programmed with limits to ensure that no approach gets excessive time allocation even under unusual circumstances.

Adaptive signal times have been proven to improve traffic flow and reduce congestion in complicated network situations. Field trials held worldwide resulted in:

- 20% reduction in stops and delays
- Up to 31% reduction in travel time
- 4% reduction of carbon monoxide emissions
- 6% reduced fuel emissions

When managing traffic situations such as conventions, sporting events or unexpected traffic delays due to accidents or construction, SCOOT® provides a significant increase in benefits through a reduction in delay, stops, queue length and travel time. Benefits of the system increase with the complexity of the network application making this type of adaptive control the ideal choice in for both single arterial streets and complex grid networks.

**Use with Transit Priority**

In applications where Transit Priority is in use SCOOT® has proved even more beneficial. SCOOT® reduces transit delay with minimal impact on surrounding traffic. In a simulation based study in Salt Lake City a nine-
The intersection corridor was analyzed both with and without the use of Transit Priority. With Transit Priority in use delay was reduced 27% versus only 5% when Transit Priority was not in use.

**Benefits of SCOOT®**

There are many advantages to implementing an adaptive control system, not only for traffic in the town or city, but also for the local economy and environment.

- Reduced equipment and maintenance costs;
- Real IP communications;
- Maximized network efficiency;
- Improved access to management data;
- Reductions in delay of over 20%;
- Ease of use for new users;
- Simple installation and migration.

SCOOT® allows systems integration and commonality of hardware across the range of traffic management and control systems. This in turn reduces maintenance requirements and provides more opportunities for implementing a range of ITS solutions:

- World-leading adaptive control;
- Increased standardization within traffic control centers;
- Customized congestion management tool kit;

"Improving congestion and minimizing transients in network control improves safety by reducing stops, thus decreasing collision risk and driver frustration."

**Part of a larger solution**

ITS is the keystone of urban traffic management and Siemens offers a variety of solutions ranging from a single system to a comprehensive integrated package including on-street equipment and complementary adaptive, central and regional systems networked together.

SCOOT® operates as part of a larger solution, working in tandem with other Siemens advanced transportation management systems (ATMS). The ATMS provides traffic management and control, and prepares the controller’s timing plans for interaction and adjustment by SCOOT®.

**Benefits for public transport**

Public transport priority is increasingly seen as crucial in maintaining the effectiveness of buses and light rail systems as viable alternatives to the private car. Siemens provides effective priority through SCOOT®, allowing public transport vehicles to adhere to their schedule while minimizing the disruption to other vehicles. Recent developments in SCOOT® have enhanced the provision of public transport priority, reducing delay to buses while also minimizing the effects on normal traffic.

**Communications**

A new communications interface has been implemented within SCOOT®. This enhancement will allow current and future users to make much better...
use of all modern communications systems, even those that were previously unavailable to SCOOT systems.

A major benefit of the new communications interface is that it can absorb inconsistencies and delays in data delivery with less impact on the system. This reduces dependency on traditional leased line communications techniques, making for a much more optimized, cost-effective infrastructure.

Handling Pedestrian Traffic
SCOOT provides improved control of intelligent pedestrian facilities.

Field Tests
Following the introduction of SCOOT®-based systems, ‘before-and-after’ studies have shown substantial reductions in both journey times and delays. Vehicles are detected on all approaches to each junction under SCOOT® control, measuring occupancy every quarter second. This creates a profile for each link, which the SCOOT® model uses to predict queue behavior at each stop line. This in turn is used in the optimization calculation. The model also predicts delays and the build-up of congestion as part of the efficiency index.

SCOOT® models traffic detected on-street to adapt three key traffic control parameters continuously: the duration of green for each approach...
(Split), the time between adjacent signals (Offset), and the time allowed for all approaches to a signalled intersection (Cycle time). As a result the signal timings evolve with the changing traffic situation.

**Congestion Supervisor**

SCOOT® introduces a number of key new features which provide invaluable assistance to the traffic manager in maximizing the efficiency of traffic flow. A new Congestion Supervisor feature provides early warning of congestion, as well as providing recommendations for action to reduce congestion as a result of repeatable, predictable conditions which occur within the network.

The Congestion Supervisor feature continuously monitors the SCOOT® network, evaluating overall performance levels and identifying congestion and wasted capacity. When congestion levels exceed a defined threshold, the system automatically investigates the likely cause. It looks for the critical link and follows the congested route though the network, analyzing reasons for the degradation in performance and suggesting changes to system configuration to improve efficiency.

The Congestion Supervisor feature uses information already available within the SCOOT® system and does not require any additional equipment or detection. Having diagnosed a congestion problem, the recommended action will then be reported to the user either directly from SCOOT® or through an integrated ATMS. Overall, the SCOOT® Congestion Supervisor feature aims to target regularly recurring congestion rather than congestion caused as a result of incidents.

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### Simulation Based Studies in Salt Lake City (Univ. of Utah, 2003)

<table>
<thead>
<tr>
<th>Network Type</th>
<th>Simulator</th>
<th>Compared to</th>
<th>Incident Duration</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CORSIM</td>
<td>SYNCHRO fixed-time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28-int (SLC CBD) and 15-int. (Fort Union)</td>
<td></td>
<td></td>
<td>15 min</td>
<td>Delay</td>
</tr>
<tr>
<td></td>
<td>CORSIM</td>
<td>SYNCHRO fixed-time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 min</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>CORSIM</td>
<td>SYNCHRO fixed-time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>45 min</td>
<td>28%</td>
</tr>
</tbody>
</table>

### Simulation-Based Studies in Salt Lake City (Univ. of Utah, 2003)

<table>
<thead>
<tr>
<th>Network Type</th>
<th>Simulator</th>
<th>Compared to</th>
<th>Incident Duration</th>
<th>Benefits: (delay reduction)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VISSIM</td>
<td>SYNCHRO fixed-time (actuated-coordinated)</td>
<td>45 min.</td>
<td>With Bus-Priority</td>
</tr>
<tr>
<td>9-int. (SLC corridor)</td>
<td></td>
<td></td>
<td></td>
<td>Non-Bus Delay Reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16%</td>
</tr>
</tbody>
</table>
As the volume of traffic on highways and roadways continues to grow at a greater rate than the capacity of the road network, the effect of traffic congestion is an ever increasing problem in towns and cities throughout North America. Adaptive Systems provide continual updates to signal timings and respond to congestion levels in real time.

Commuting to work is taking less work

In Fulton County, Georgia, through a five-intersection corridor, drivers experienced up to 32% reduced travel time while driving to work and 14% reduced travel time coming home. Adaptive systems can offer dramatic improvement in reduced travel times and queue length, even when traffic volume stays the same.

ACS Lite is an adaptive control software application that was developed by Siemens under contract to the Federal Highway Administration (FHWA) Research, Development and Technology Operations Program to upgrade or replace legacy closed-loop systems with adaptive control capability. The purpose of the project was to provide a more accessible way to implement adaptive control.

Siemens identified four criteria for the project:
- Make it easy
- Utilize existing infrastructure
- Make it cost-effective
- Maximize efficiency

Ideal for arterial applications

The ACS Lite software is designed to adapt the splits and offsets of signal control patterns/plans along an arterial application. ACS Lite optimizes splits and offsets resulting in reduced delay, stops and fuel consumption. ACS Lite also has the flexibility to be deployed as an on-street master or as a centralized system.

Initial field testing of ACS Lite with Siemens control equipment in Houston, Texas, produced remarkable results. In the eight-intersection corridor along Highway 6 results showed:
- 35% less delay;
- 29% fewer stops;
- 7% less fuel consumption;
- First year benefits of $577K;
- Benefit-cost ration of 8:1 in the first year.

Travel time was also calculated along the corridor. Comparing times before and after implementation a reduction of times was indicated across the board in each study.

Since then, additional sites including Tyler, Texas, and Pickerington, Ohio, have since deployed the system and realized remarkable benefits.

In Tyler the average number of stops heading northbound on Broadway during peak evening traffic during the week was four. Wait time averaged 2.5 minutes. After the system was installed, the average number of stops dropped to two and wait time was a minute less.
Overall savings seen with the ACS Lite system has included:

- significant reductions in vehicle delay (21%), stops (25%), and fuel consumption (5%);
- 35% reduction in delays on a section of State Highway 6 in Houston, Texas;
- $787,000 in benefits to the public for one year of operation in Bradenton, Florida.

This approach to adaptive control provides a significant amount of benefit for a minimum amount of agency investment in additional infrastructure, training and maintenance by using existing stop bar detection and advanced loops.

**Fine tuning splits and offsets**

Like traditional traffic control systems, ACS Lite adapts the splits and offsets of signal control plans with changes to cycle time handled on a time-of-day schedule. At each optimization step, which occurs about every ten minutes, the system changes the splits and offsets a small amount (e.g. 2–5 seconds) to accommodate changes in traffic flow.

ACS Lite downloads new splits and offsets for the currently running pattern every five to 15 minutes, maintaining the same cycle length as determined by the traffic engineer and implemented by the Time-of-Day scheduler.

During each cycle, the local SEPAC® controller software manages the duration of each split using gap-out and coordination logic. If communication is interrupted, the local controller still maintains full operation of the intersection.

ACS Lite performs its optimizations by polling each local controller for custom NTCIP detector and phase status data once per minute. 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 the detector serves. This allows the software to assess whether traffic is arriving to a green light (used for tuning the intersection offset), determine whether an earlier or later offset would be more effective for traffic progression. ACS Lite then downloads the new values to each controller in the system.

Since the changes to the split and offset values are small (2–5 seconds), transition from the current settings to the new settings is typically completed within one cycle.

**Browser-based user interface**

ACS Lite is easy to configure through an HTML browser-based user interface. With no additional data entry 75% of the configuration data is uploaded directly from the local controllers. After uploading this configuration data, the user configures links, ring sequences and detectors through the browser, then the system is ready to use for adaptive control.

Web pages are updated each cycle providing information regarding intersection performance.

The software archives its performance measures and decisions to a data store for future analysis and retrieval.

Browser-based access to operations is available not only locally, but also via the internet if the master is equipped with an IP-addressable cellular modem.
Siemens provides leading-edge traffic technology for the fast-paced world of Intelligent Transportation Systems. Whether providing local controllers, video detectors, controller firmware, central systems, system analysis, design, integration, or consulting services, Siemens brings innovative and reliable solutions to customers. Siemens has a long history of quality and innovation in transportation control and management.

Coupled with proven products and development experience, as well as highly regarded consulting services, we form the world’s foremost traffic control and transportation management company.

Siemens is very active in the development of new industry standards and “state-of-the-art” products, including the NTCIP C2C protocol and the Advanced Traffic Controller Specification.

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