True Adaptive Signal Control
A Comparison of Alternatives
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Purpose / Agenda

- Clarify definitions and capabilities of true adaptive signal control
- Urge selection of some type of advanced signal control
  - We can do better with what we have
  - It’s not just for research any more
- Summarize approach of available technologies / products
- Not a comprehensive review and comparison of results
Deployment of Adaptive Signal Control Technologies

[Map showing deployment locations of various adaptive signal control technologies across the United States, with symbols indicating different technologies and states.]

- RHODES
- ACSLite
- InSync
- SCATS
- SCOOT
- LA ATCS
- OPAC
- State with Pending ASCT
- State with Active ASCT
Categories of Signal Control

**Definitions** (USDOT / FHWA Traffic Signal Control Handbook (Gordon and Tighe)):

- Isolated
- Time Based Coordination
- Interconnected Control
- Traffic Adjusted Control
- Traffic Responsive Control
- Traffic Adaptive Control

The primary differentiator for Traffic Adaptive Control is the use of a traffic flow model to predict demand and adapt timings to meet expected traffic flows.
What is NOT Adaptive Control

**Traffic Responsive:**
- Trigger plan or timing changes

**Volume Density:**
- Modify parameters based on demand

**Off-line Optimization:**
- Real time measurements trigger re-optimization of timing plans

**Central + Local Optimization:**
- Real time measurements trigger re-optimization of selected timing parameters (off set) then local control applies and adjusts

All approaches have value, but they are NOT adaptive signal control
# Summary of ASCT Alternatives

<table>
<thead>
<tr>
<th>Function</th>
<th>Control System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACS Lite</td>
</tr>
<tr>
<td>Action</td>
<td>P + R</td>
</tr>
<tr>
<td>Architecture</td>
<td>Dist.</td>
</tr>
<tr>
<td>Simulation Model?</td>
<td>Yes</td>
</tr>
<tr>
<td>Time Frame</td>
<td>5–10 min</td>
</tr>
</tbody>
</table>
Adaptive Traffic Signal Control Processes

Offset Optimizer
Split Optimizer
Cycle Optimizer

Traffic Engineer

Expert Rules

Offset weights
Split weights
Cycle weights

Platoon modeling

Intersection control

Volume Occupancy

A or B

A + B

A

B
Operations of Adaptive Signal Control

- Control Center
  - Traffic Flow / Queue Model
  - Intersection structure
  - Traffic data at detection points

- Operator / Traffic Engineer
  - Real Time Data
  - Mean travel time
  - Queue lengths
  - Exit flows
  - Queue capacity

Street Observer for Calibration

Pro Active Timing Changes
Weighting Factors Apply Expert Rules to Adaptive Control Strategies

• ITACA Expert Rules System
• Usable range is -10 to +10
• Positive weights apply importance to affected links
• Negative weights reduce importance of associated links
• 2 weighting parameters for each link (split and offset)
• 1 weighting parameter for each intersection (cycle)
• Can be adjusted in real time manually or by expert rules
• Each final weight may reflect adjustments by different sources

If Route A is highly congested
Then Reduce weight for Transversal Route B
Until Intersection B20 has maximum queue
OPAC Hardware Configuration

- Advanced Traffic Controllers
- OPAC Single Board Computer (local)
- Upstream Advance Detectors

![Diagram showing OPAC Hardware Configuration]

Traffic Signal Controller:
Type 2070 or NEMA (TS1 / TS2)

Cabinet

Detector Data
Force offs & Holds

Single Board Computer (Linux OS) running OPAC software

~15 secs travel time at prevailing speeds
ACS-Lite Architecture

Minimum 9600 baud Communications (serial or IP)
NTCIP

Communications Interface and/or NTCIP Translators

NTCIP controllers or Proprietary protocol controllers

On-street Master (optional)
Advantages of Predictive Modeling

- Continuous adjustment to changing demand
- Pro-active timing changes
- Optimal use of available capacity
- Adjusts to incident conditions

The primary differentiator for Traffic Adaptive Control is the use of a traffic flow model to predict demand and adapt timings to meet expected traffic flows
Cycle Length Adaptability

Mill Plain Blvd / 104th-106th Ave

- Vehicle Counts
- OPAC Cycle Length
- Pretimed Cycle Length
- Incident Occurs

Time

References:

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Thank You
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