

ITS Luncheon

Adaptive Traffic Control

Discussion of tools, techniques, and the implementation of intelligent signal systems.

Presented by: Eric Raamot
VP, Engineering
Econolite Control Products, Inc.
eraamot@econolite.com

Adaptive Control Systems

Discussion Goals:

1. Define “Adaptive” relative to levels of intelligent system control.
2. Given the heavy dependence upon infrastructure cost and availability, present the 3 core dependencies for Adaptive Control:
 - Detection
 - Communications
 - Software: Control Equipment & Systems

Control Systems - Definitions

Spectrum of intersection control:

- Uncoordinated Control (Free / Fixed Time)
- Time Based Coordinated Control (TBC)
- Interconnected Control
 - Time Reference for TBC
- Traffic Adjusted Control
 - Predominant V+kO - Plan Selection
- Traffic Responsive Control
 - Directional V+kO - COS selection
 - Approx 15 minutes COS changes based upon aggregated VO data.
- Traffic Adaptive Control
 - "Near real time" changes based upon up traffic data. Cycle Length oftentimes not fixed.

Detection Dependencies: Sensor Density Levels

Density Level	Description	Infrastructure Costs
0.0	Pre-Timed	None
0.5	Semi-Actuated & Pre-Timed	Per-Actuated Approach
1.0	Up to 1 system sensor per link.	Small
1.5	Up to 1 system sensor per link + Actuated local detectors	Small (assuming existence of Local Detectors)
2.0	1 system sensor per approach	Medium
2.5	1 system sensor per lane per approach	Moderate
3.0	2 or more system sensors / lane. Upstream & Downstream	High
3.5	Addition of Vehicle ID, Classification, Tracking data	Very High – Vehicle + Roadside
4.0	Hypothetical availability of data from vehicles who report location and possibly destination.	DSRC Research

Adaptive Control Methods: Sensor Density Levels

Density Level	Description	Control Methods
0.0	Pre-Timed	Un-coordinated Control TBC, UTCS 1G
0.5	Semi-Actuated & Pre-Timed	Un-coordinated Control, TBC, UTCS 1G
1.0	Up to 1 system sensor per link.	Traffic Adjusted, UTCS 1.5G
1.5	Up to 1 system sensor per link + Actuated local detectors	Traffic Adjusted, Traffic Responsive UTCS 1.5G
2.0	1 system sensor per approach	UTCS 2.0G (fixed cycle), Traffic Adaptive: ACS Lite SCOOT(Limited)
2.5	1 system sensor per lane per approach	Traffic Adaptive SCATS, SCOOT
3.0	2 or more system sensors / lane. Upstream & Downstream	Traffic Adaptive: SCATS, SCOOT, OPAC, RHODES
3.5	3.0 + Vehicle ID, Classification, Tracking data	Future?
4.0	Hypothetical availability of data from vehicles who report location and possibly destination.	Future? Traffic Predictive

Communications Dependencies:

Infrastructure Level	Control Methodologies Available	Communications Infrastructure
None	Semi-Actuated & Pre-Timed	None
TBC reference	Coordinated	Per cabinet – GPS/WWV
Closed Loop	OSM-level Traffic Responsive ACS Lite	Data service to OSM, TP/FO to local
Dedicated Serial	Traffic Adjusted System Level Traffic Responsive Traffic Adaptive	Re-use of existing infrastructure
IP Network	All Methodologies Available	Conversion of dedicated serial Wireless ISP Installation of dedicated lines
Peer-Peer	RHODES	IP Network Design

Control Dependencies:

Adaptive System	Local Controllers Supported	System Requirements
ACS Lite	Econolite, Eagle, Peek, McCain	OSM – Web Interface
OPAC	PEEK, Econolite	MIST
RHODES - ACS	Eagle (Next Phase), Econolite (ASC/2)	Distributed algorithm, independent monitoring software.
SCATS	SCATS Controller (170, 2070 1B) SOTU interface to controller	SCATS central system software – available interface to Transuite
SCOOT	Eagle, PEEK	SCOOT central system software

Conclusions

- Intelligent control exists as a spectrum of methodologies/technologies.
- Infrastructure costs are a large consideration and delineate levels of control.
- Value achieved where lesser methodologies do not meet operational demands.
 - Maximized efficiency
 - Temporal traffic uncertainty
 - Signal resynchronization needs

Questions ? / Contacts

Eric Raamot
VP Engineering
Econolite Control Products, Inc.
eraamot@econolite.com
714-392-9794

Doug Henderson
Western Regional Sales Manager
Econolite Group, Inc
dhenderson@econolite.com
702-528-5768