ADAPTIVE SIGNAL CONTROL - When is it the right choice?

JOINT TSITE/ITS TN FALL MEETING
Clarksville, TN

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Agenda

- What is adaptive signal control?
- Benefits
- Is adaptive signal control the right choice, then…
- Things to consider when selecting your system
What is Adaptive Signal Control?

*Technologies that capture current traffic demand data to adjust traffic signal timing to optimize traffic flow in coordinated traffic signal systems*

*Capability of adjusting signal timing based on current conditions which may include adjustments to:*

  - **Cycle Length**
  - **Split**
  - **Offset**
  - **Phasing Modifications**
What is Adaptive Signal Control?

- How does adaptive signal control technology (ASCT) generally work?
  - Collect data in real-time from sensor systems to identify traffic conditions
  - Evaluate alternative signal timing strategies on a model of traffic behavior
  - Implement the “best” strategy according to some performance metric
  - Repeat …
Benefits of Adaptive Signal Control

- Reduced travel time along corridor
- Reduced intersection stop delay
- Increased average speeds
- Reduced fuel consumption
- Reduced emissions
- More efficient use of the roadway network

Will **not**
- Add capacity to the roadway
- Eliminate saturation if roadway is over capacity
The first step…

● Use the system engineering process to determine your:
  - Needs
  - Issues
  - Problems
  - Objectives

● Develop functional requirements

● Don’t identify a solution and then look for a problem!
Criteria for Selection

- Variability – little to no clear consistency in traffic volumes over a period of time
- Predictability – Historical data cannot be used to define consistent traffic trends
Is ASCT the Appropriate Solution?

Identify and Validate Issues

- Do you have the staff and/or budget to operate and maintain?
- Is traffic highly variable and unpredictable?
- Are side street volumes low?
- Is the volume-to-capacity ratio less than 1?

YES

ASCT might be the appropriate solution

Identify Potential Candidate ASCT (System Engineering Process)

Implement ASCT

Evaluate ASCT (Before & After Study)

NO

Identification of other Potential Solutions
- Traffic Responsive System
- Regularly Scheduled Signal Timing Optimization
Adaptive Signal Control

- Not all ASCT are the same!
  - Detection type and placement
  - Central software
  - Algorithms – how they optimize signal operations
  - Hardware needs
  - Software features
  - Cost – both initial and long-term
Adaptive Signal Control Technologies

- SCOOT
- SCATS
- InSync
- RHODES
- OPAC
- ACS Lite
- Trafficware SynchroGreen
Differences

● Each vendor solution may have pros and cons:
  - How to accommodate over-capacity conditions
  - Quantity or specific type of detection needed
  - Value of side street movements
  - Phasing flexibility
  - Set up time
  - On-going maintenance
  - Preemption/prioritization accommodations

● Corridor vs. grid deployment
Agency impacts

- Initial cost ($30k to $65k / intersection)
  - Central software
  - Hardware
  - Detection
  - Communications
- Weekly maintenance (6 to 14 hours/week)
- Yearly operations and maintenance costs ($1k to $25k / intersection)
- Percent downtime (2% - 9%)
- Training (40 – 60 hours)
Things to consider

- Without vehicle detection – system won’t work
- Without communications – system won’t work
- Increased level of training for signal staff
- Larger up front cost when compared to more traditional methods
- Not always popular with your regular commuter who expects consistency day to day – education / awareness campaigns can help this
More things to consider

- Emergency preemption, pedestrian calls, and transit priority can create difficulties for some systems
- Working with a “black box” which may require heavy vendor reliance
- Steep learning curve
- Most adaptive systems require more detection than would be deployed for semi-actuated traffic control and traffic responsive plan selection methods
Lessons Learned

- Generally good return on investments
- Detection is **everything**
- Basic signal timing plans must still be developed for when detection fails
- Economy of scale
- Adaptive is not a cure-all
- Adaptive is not a set it and forget it
- **Another tool for the traffic engineer’s toolbox**
Points to Remember

● Don’t identify a solution and then look for a problem!
● Deployment should be based on sound engineering needs analysis
● Understand the long term implications of deployment
● Select the system that best addresses your problem and needs
● Go in with your eyes wide open
● Adaptive is not a cure-all – IT IS ANOTHER TOOL!!
So, when is Adaptive the right solution?

- And the answer is:

SOMEWHERE BETWEEN NEVER AND ALWAYS!
Thank you

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Understanding the limitations

● ASCT…
  - Over-saturation conditions
  - Pedestrian and bike volumes
  - Heavy reliance on detection and communications
  - Vendor support

● The agency…
  - Sufficient staff and budget to maintain the system
  - Long term commitment