OPAC Adaptive Engine
Pinellas County Deployment

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Presentation Agenda

- Adaptive control systems - expected benefits
- An overview of OPAC
- Case Study – Pinellas County Project
Expected Benefits

- Mitigate effects of the capacity reduction through efficient use of the existing capacity (Proactive traffic management)
- Adjusts to traffic fluctuations and surges
- Continuously adjust signal timing parameters
- Reduce stops/delay, fuel consumption, and emissions
Adaptability - Cycle Optimization

Mill Plain Blvd / 104th-105th Ave

Pretimed Cycle Length (Sec)

OPAC Cycle Length (Sec)

Vehicle Counts

Time

90 100 110 120 130 140 150 160 170 180 190 200

Adaptability - Cycle Optimization

Time of Day

Cycle (sec)

veh/hr

TBC
OPAC
Total Volume
Adaptive Control Systems Design

- Fully Adaptive vs. Partially Adaptive
- Centralized vs. Distributed
- Proactive vs. Reactive

Traffic Responsive (TRSP) is not an adaptive system
OPAC Adaptive Control

- Optimized Policies for Adaptive Control (OPAC)
- A fully adaptive, proactive, and distributed real time traffic control system
- Deployed as part of FHWA 1992-1995 RT-TRACS program
OPAC Fundamental Features

- Optimization of any or all phase splits designed to minimize total intersection delay and/or stops
- Support for phase skipping in the absence of demand
- Multiple sets of configuration parameters for customizing the resulting timing to weight certain movements for special circumstances or by time of day
- Configurable to respond to changes in left turn lead/lag phasing by time of day
- Special considerations for phase timing in the presence of congestion (high detector occupancy)
Control Layers in OPAC

- **Network Synchronization Layer** (cycle optimization)
- **Coordination Layer** (offsets optimization)
- **Local Control Layer** (splits optimization)

- **Split** – Distributed to each intersection
- **Offset** – Distributed to each intersection
- **Cycle Length** – Section-wide; calculated at central
  - Background cycle (Dominant intersections)
Performance Measures

- Real-time estimates of phase-specific parameters such as queue length, speed, travel-time from detectors to standing queues, delay and stops
- Logged measures of effectiveness, including average cycle lengths, vehicle counts by phase, and average phase green times and estimated speeds.
Data Requirements

- Upstream detectors on each lane
- Once/sec vehicle count and occupancy data
Hardware Requirement

- Advanced traffic controllers, NTCIP (e.g., 2070 or NEMA TS-2)
- Communication media: copper, fiber, wireless
- Serial or Ethernet communications
- Local processor board (Distributed system)
Integration with Current Infrastructure – Traffic Management System
Case Study – City of Clearwater, Pinellas County, FL

- 25 intersections along US-19 Corridor
- 29 intersection along McMullen Booth Corridor
- 7 intersections along 49th St (to be installed this year)

- Initial Deployment: 2006
- Installed as part of FHWA 1996 RT-TRACS project
- Currently runs OPAC and RHODES under MIST platform
Project Area
Communications

- **Communications**
  - Initial deployment: serial comm
  - Communication media: fiber
  - Converted to Ethernet based comm since 2010

- **Detections Technologies:**
  - Magnetic loops, RTMS, Sensys

- **Signal System Platform**
  - MIST traffic management platform
  - 2070 controllers with Econolite ASC/3-2070 firmware
Success of the system *

- Independent before/after study to determine the RT-TRACS software operation versus traditional time-of-day signal plans started October 2006 and was completed in 2007.
- Study determined that OPAC US19 travel times were reduced by an average of 7.5%, with peak travel times dropping 25%.
- The results determined there was over $1 million in annual fuel savings alone as a result of the new system, and a benefit/cost ratio of approximately 7:1.

* Courtesy of Pinellas County Public Works
Success of the system *(don’t stop there!)*

- 2008 changes to adaptive parameters resulted in an additional reduction of 10%, on average, to the travel times across the corridors

What about safety?

- Total accidents are down by 30%, pre-adaptive year crash data vs. post-adaptive year crash data
  - Rear-end accidents decreased by 18%
  - Serious injuries have been reduced by 40%

*Courtesy of Pinellas County Public Works*
Green Corridors: Adaptive Control and Air Quality

- Traditional approach: travel time & stops/delays
- Environmental evaluation: Air quality parameters
Initial Results: OPAC Adaptive vs. TOD
Particulate Matter (PM)

Avg Weekly Improvement: 17.56%
Initial Results: OPAC Adaptive vs. TOD
Carbon Monoxide (CO)

**CO Emission - Weekly**

**Avg Weekly Improvement: 11.04%**
Conclusions

- Growing interest in deployment of adaptive signal systems
- Proven technologies for effective arterial corridor management
- Enhanced features utilizing on going advancements in communication systems, detection technologies and traffic control devices
- “Given the appropriate technical staff and an eagerness to learn, one cannot deny the benefits adaptive signal control software can provide.”

*Pinellas County Public Works*
Thank You

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