LADOT’S ADAPTIVE TRAFFIC CONTROL SYSTEM
(ATCS)

Presentation at the TRB Workshop on Adaptive Traffic Signal Control Systems, Sponsored by Signal Systems Committee

January 7, 2001
GENERAL DESCRIPTION

- PC-based real-time adaptive traffic control system
- Developed by LADOT staff
- UTCS database and Operator Interface Language (OIL)
- Window NT with real-time extension
- Distributed client-server architecture
- Prototype system was operational in 1996. PC Window based system was completed in 1999.
- Currently 375 intersections on-line in three systems
WORKSTATION DISPLAY
DYNAMIC AREA MAP
GUI-Signal Timing Parameters
GUI-Adaptive Parameters

### Kernel parameters

| VS | st | flag | pck flag | op | st | sect | dph | CLC | CIC | plan | fixed | cycle | local | cycle | mas cycle | mas timer | local timer | cur ofs | next ofs | CLC ofs | last local | gm entr | ph 1 split | ph 2 split | ph 3 split | ph 4 split | ph 5 split | ph 1 min | ph 2 min | ph 3 min | ph 4 min | ph 5 min |
|----|----|------|----------|----|----|------|-----|-----|-----|------|-------|-------|-------|-------|-----------|-----------|-------------|--------|----------|--------|-----------|--------|------------|------------|------------|------------|------------|-----------|-----------|-----------|
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| 2  | 0  | 0    | 5        | 2  | 0  | 0    | 1   | 4   | 0   | 60  | 60   | 40   | 18   | 30   | 30         | 30         | 60          | 10     | 60       | 60     | 10         | 36     | 24         | 0          | 0          | 0          | 0          | 26        | 24        | 0         |
| 3  | 0  | 0    | 5        | 2  | 0  | 0    | 1   | 4   | 0   | 60  | 60   | 40   | 18   | 30   | 30         | 30         | 60          | 10     | 60       | 60     | 10         | 36     | 24         | 0          | 0          | 0          | 0          | 26        | 24        | 0         |
| 4  | 0  | 0    | 5        | 2  | 0  | 0    | 1   | 4   | 0   | 60  | 60   | 40   | 18   | 30   | 30         | 30         | 60          | 10     | 60       | 60     | 10         | 36     | 24         | 0          | 0          | 0          | 0          | 26        | 24        | 0         |
| 5  | 0  | 0    | 5        | 2  | 0  | 0    | 1   | 4   | 0   | 60  | 60   | 40   | 18   | 30   | 30         | 30         | 60          | 10     | 60       | 60     | 10         | 36     | 24         | 0          | 0          | 0          | 0          | 26        | 24        | 0         |
| 6  | 0  | 0    | 5        | 2  | 0  | 0    | 1   | 4   | 0   | 60  | 60   | 40   | 18   | 30   | 30         | 30         | 60          | 10     | 60       | 60     | 10         | 36     | 24         | 0          | 0          | 0          | 0          | 26        | 24        | 0         |
| 7  | 0  | 0    | 5        | 2  | 0  | 0    | 1   | 4   | 0   | 60  | 60   | 40   | 18   | 30   | 30         | 30         | 60          | 10     | 60       | 60     | 10         | 36     | 24         | 0          | 0          | 0          | 0          | 26        | 24        | 0         |
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### Section parameters

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CONTROL STRATEGIES

- Calculations of Cycle Length, Splits and Offset are three separate but dependent functions
- Volume and occupancy data are collected every second, but used every cycle
- Apply heuristic formulas based on extensive operational experience
- Use critical link/intersection approach
- Include a traffic projection module
- Parameters can be easily adjusted to adapt to different street configurations
- Transit priority system
SYSTEM ARCHITECTURE

- Centralized area computers (PC Server) communicate to local controllers.
- Multi-port serial cards connect to communication lines.
- GUI Client running on area computers and workstations.
- Main Data Server provides central traffic data base and coordinates area computers.
COMMUNICATIONS SYSTEM

- Dedicated communication path between host and local controllers
- Time division multiplexing
- Local controllers polled once per second at 1200 bps
- Four intersections per communication line.
- Multiple communication protocols
- Download/Upload to local controllers
CENTRAL HARDWARE REQUIREMENTS

- Rack mounted server with a backup PC.
  - 350 MHz PC with 192 MB RAM
- Workstation with two 21-inch monitors.
- Multi-port PCI serial cards.
- Ethernet network.
WHY ADAPTIVE?

- Needs to update timing plans
- Basic 3 timing plans (AM, MD and PM) are not sufficient
- Incident management
- Special events
- Already has extensive detection system
- Land development initiatives
A total of 375 signals in three separate systems:
- Mar Vista area: 99 signals
- South Park area: 109 signals
- Boyle Heights area: 167 signals

All future ATSAC systems will be ATCS

Plan to convert existing UTCS into ATCS systems
HOW MANY SIGNAL TIMING ENGINEERS?

- ATSAC Implementation Group
  - 7 Signal Timing Engineers
- ATSAC Operation Center
  - 6 Traffic Engineers
- ATCS Research and Development
  - 2 Communications Specialists
  - 2 Software Engineers
  - 2 System Engineers
LEARNING CURVE

- Central database:
  - Signal timing: mostly automated
  - Link/Detector: Tedious and error prone, needs to be automated

- Detector diagnostics
  - Initial setup: requires a stringent QC process
  - Repair and maintenance: a dedicated loop crew is needed
Control strategies
- Control parameters: Moderately difficult
- Adaptive functions: Time consuming

Signal timing charts: no more complicated than before

System support and upgrade: need PC-Window based system specialists
CHALLENGES

- Signal grouping
  - Currently pre-determined by engineers
  - Dynamic grouping based on traffic conditions is being developed

- Network optimization

- Over-saturated conditions
SUCCESS STORIES

- Improve corridor operations
  - Reduce delays by up to 7% over existing UTCS system
  - Increase total throughput
- Respond to special events more effectively
  - Flush out Lakers traffic in less than 30 minutes
- Handle minor to moderate incidents well
FUTURE ENHANCEMENTS

- Refine network optimization logic
- Develop advanced incident detection system
- Integrate CMS and CCTV control functions
- Combine newly developed transit priority system
CONTACT PERSONS

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