AN INTRODUCTION TO
INTELLIGENT TRANSPORTATION SYSTEMS

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LECTURE 18

ADVANCED PUBLIC TRANSPORTATION SYSTEMS (APTS)

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PASSENGER LOS VARIABLES

- Cost
- Travel time
- Total journey time
- Reliability
- Comfort
- Safety
- Security

-- *Introduction to Transportation Systems*, Joseph M. Sussman, Artech House, Boston and London, 2000.

ISSUES WITH U.S. PUBLIC TRANSPORTATION I

- Financially marginal
  - Cash-poor
  - Usually subsidized
- Not known for innovation
- Public-sector dominated
- Subject to political pressure
- Poor labor relations

-- *Introduction to Transportation Systems*, Joseph M. Sussman, Artech House, Boston and London, 2000.

ISSUES WITH U.S. PUBLIC TRANSPORTATION II

- Poor public image
  - “Not the service for *me*!”
  - Low-tech
- Not market-oriented
  - Captive riders
  - Information to travelers
  - Intermodal connections
- Marginalized by sprawl and low-density land-use patterns
- Safety concerns
- Security concerns

-- *Introduction to Transportation Systems*, Joseph M. Sussman, Artech House, Boston and London, 2000.

The Challenges

- Create more efficient (cost-orientated) and effective (service-orientated) transit system -

  “The last buggy whip factory was no doubt a model of efficiency”

  - Peter Drucker

- How can we use ITS to save money *and* improve service?

Consider Bus Service - What do we want to know?

- Where the buses are in real-time?
- How many people are riding the buses - where they board and alight?
- What the traffic conditions are on the route?
- Anything else?

Basic Operations/Service Functions

- Headway keeping (as an antidote to bus bunching)
- Provide arrival time information to passengers
- Provide route information to passengers - How do you get from here to there on the system?
- Anything else?

Issues ITS/APTS Addresses

- Costs
  - Enhance Fleet Productivity
  - Enhance Labor Productivity
  - Route Planning
  - Fleet Maintenance

Issues ITS/APTS Addresses

- Customer Level of Service (LOS)
  - Improve
    - Travel Time
    - Travel Time Reliability
  - Via
    - Headway Control
    - “Green lights”
    - Connections
      - Intramodal
      - Intermodal
    - Enhanced Security
    - Information
      - Static - (Clymer Quote)
      - Dynamic - Real-Time
    - Electronic Fare Payment

Refer to Hard-Copy Handouts

- Chapter 7
  - Intelligent Transportation Primer
- Chapter 5
  - What have we learned about ITS?

“Pushing the Envelope”

- The Bus Rapid Transit (BRT)/High-Occupancy Toll (HOT) Lanes Connection as an ITS-Enabled concept
- Poole and Wachs
  - Semi - Dedicated Lanes for Buses funded by tolls from HOT lanes.

ITS DATA RELEVANT TO TRANSPORTATION PLANNING AND OPERATIONS: BACKGROUND INFORMATION

ITS Data Source	Example Data Elements	Features of the Data Source: Collection Equipment	Spatial Coverage	Temporal Coverage	Use of the Data by ITS Activities	Possible Non-ITS Uses
Transit and Rideshare						
Transit usage	• Vehicle boardings (by time and location) • Station O/D • Paratransit O/D	Electronic fare payment systems	Transit routes	Usually full-time	Used for electronic payment of transit fares	• Route planning /run-cutting • Ridership reporting (e.g., Section 15)
Transit route deviations and advisories	• Route number • Time of advisory • Route segments taken	TMC software	Transit routes	Usually full-time	Transit route revisions	• Transit route and schedule planning
Rideshare requests	• Time of day • O/D	CAD	Usually area-wide	Day time, usually peak periods	Dynamic rideshare matching	• Travel demand estimation • Transit route and service planning

Transit Planning and Typology, Lerner-Lam, et al.

- **Capital planning and budgeting** (what is the plan for funding new projects?)
- **Corridor analysis planning** (what mix of transportation modes should be used to provide desired travel capacity and quality of service between specified origin-destination pairs?)
- **Financial planning**
- **Maintenance planning** (what maintenance activities and skills will be required to support each offered service?)
- **Management systems**
- **Market research** (what quality of transit service should be provided between specified origin-destination pairs throughout the day/year?)
- **New project planning** (what is the plan for development, acquisition, construction and renewal of required infrastructure and transit vehicles?)

-- *Transit Planning and Typology*, Lerner-Lam, et al.

- **Operations planning** (what headway, running time and vehicle capacity is appropriate for each route segment throughout the day? what resources are required to allow for contingencies and variation?)
- **Performance analysis planning**
- **Research and development planning** (what technologies/methods might be appropriate for shaping or support of future operations, and what resources will be required to support them?)
- **Service planning** (what transit modes should be used, what paths should the routes take and what capacity should be provided between each origin-destination pair throughout the day/year?)
- **Strategic/Business planning** (which origin-destination pairs should be served, and with what quality of service?)

-- *Transit Planning and Typology*, Lerner-Lam, et al.

TRANSIT SIGNAL PRIORITY

“An Overview of Transit Signal Priority”, Advanced Traffic Management Systems Committee and Advanced Public Transportation Systems Committee of the Intelligent Transportation Society of America (ITS America), Washington, DC.

PRIORITY VS. PRE-EMPTION

- Signal Priority: *Modifies* normal signal operation
- Signal Pre-emption: *Interrupts* normal signal operation (e.g., for emergency event)

-- “An Overview of Transit Signal Priority”

BENEFITS AND NEGATIVE INPUTS OF SIGNAL PRIORITY

- Benefits
  - Reduced travel time and improved schedule adherence for buses/streetcars
- Negative Impacts
  - Cross-street traffic delayed

-- “An Overview of Transit Signal Priority”

PRIORITY TREATMENTS

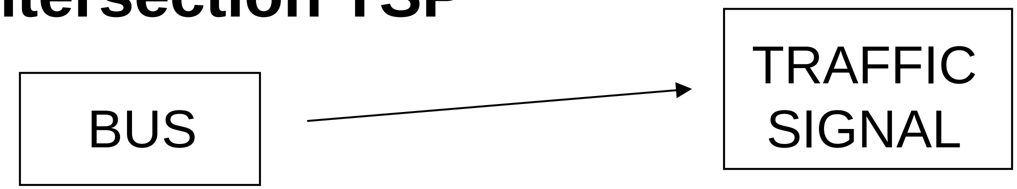
There are several possible signal priority treatments possible to provide priority to the transit vehicles. These include:

- ◆ Passive priority
- ◆ Early green (red truncation)
- ◆ Green extension
- ◆ Actuated transit phase
- ◆ Phase insertion
- ◆ Phase rotation
- ◆ Adaptive/real-time control

-- “An Overview of Transit Signal Priority”

TYPES OF TSP

- **Local Intersection TSP**

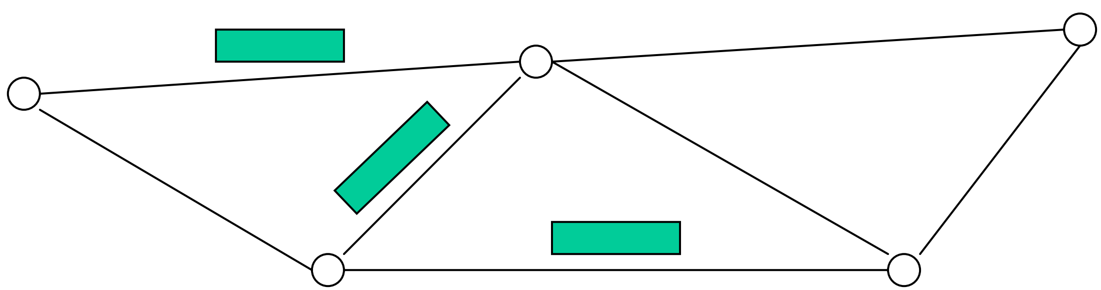


Driver requests priority

- Detector
- Controller

Bus communicates with individual signal

- **Street Network-Based TSP**



Locate buses by AVL; transmit request to signal

-- “An Overview of Transit Signal Priority”

RECOMMENDATION FOR DEPLOYING A TSP PROJECT

- Identify a champion.
- Establish a multi-department team of leaders with responsibility to carry out the project.
- Establish the goals and objectives. Set measurable levels of performance in these goals.
- Make sure all of the partners have been identified who will be impacted by the project.
- Identify funding opportunities.
- Make sure that system objectives and requirements are clearly articulated in requests for bids.
- Require pre-installation testing before acceptance of a system.

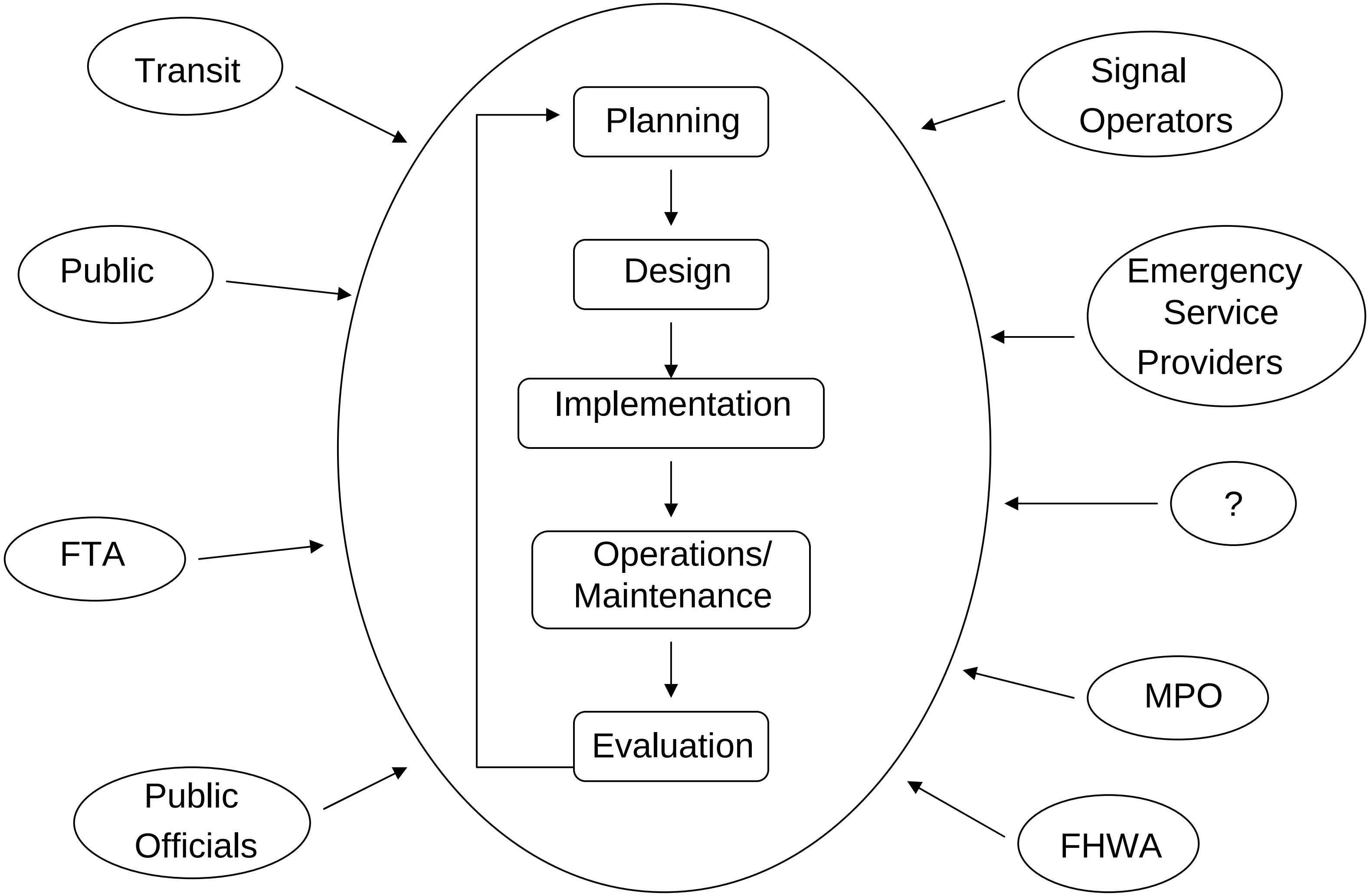
-- “An Overview of Transit Signal Priority”

LESSONS LEARNED

- In general, the case studies reveal that implementing TSP results in:
  - Reductions in transit travel times, transit delay, stops, and schedule unreliability; and
  - Minor impacts to cross-street traffic and buses.
- TSP strategies with higher customer and operational benefits of transit attempt to provide consistently faster and/or less variable travel times and improved on-time performance.
- Impacts are difficult to measure in the field when differences between before and after TSP data are small.

-- "An Overview of Transit Signal Priority"

STEPS AND STAKEHOLDERS IN TSP DEPLOYMENT



-- “An Overview of Transit Signal Priority”

Stakeholder Requirements for Traffic Signal Preemption and Priority: Preliminary Results from the Washington, DC, Area", Gifford, et al., ITS America 2001 Annual Meeting

- Deployment across two states (VA, MD) -- opportunity to consider differences
- Accountability -- when it's used -- is there really a need?
- Interoperable
- Keep coordination simple
- Priority for "underutilized" buses ?!

Lessons on APTS Field Operational Tests

"Beyond Benefits and Costs: Understanding Outcomes of ITS Deployments in Public Transit" -- Giuliano and O'Brien

1. Goals and Objectives should be clear, appropriate, understood by all parties, and agreed upon by all parties, especially those charged with carrying out the FOT. The proposed solution should match the goals and objectives.

Lessons on APTS Field Operational Tests from Giuliano and O'Brien II

2. Institutional arrangements should be formal, clearly specified and should allocate responsibility and risk appropriately. Similarly, technology works best in the context of pre-existing institutional relationships.
3. Technology adoption occurs within a more comprehensive systems framework. The adopting agency must exhibit a certain degree of technological capacity and organizational flexibility.

Lessons on APTS Field Operational Tests from Giuliano and O'Brien III

4. New technology tests should be as incremental as possible.
5. The FOT should provide benefits to all participants.

Some Concluding Ideas

- Information is the key -- real-time and static
  - For passengers and management
- ATMS/ATIS/APTS integration
- Positioning of Public Transportation
  - More Hi-Tech
  - More reliable
  - More secure
- Professional Capacity Building (PCB)
- Need for organizational change.