Large-Scale Transit Signal Priority Implementation:

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Overview

- Background
- TSP System Components and Functionality
- Effective Planning
- Implementing a System
- Lessons Learned
Transit Signal Priority (TSP) Defined

- TSP is a tool used to improve transit performance and reliability
- Facilitates the movement of transit vehicles through traffic signals, resulting in:
  - Reduced transit travel times
  - Improved schedule adherence
  - Improved transit efficiency
  - Increased road network efficiency
Transit Signal Priority (TSP) Defined

- The most common TSP strategies:
  - Extend a phase to allow a transit vehicle to pass, or
  - Terminate conflicting phases to allow early service
- The result is reduced transit delay

HOW DOES TSP WORK?

- Vehicle
- Detection system
- Communication
- Signal equipment
**Regional Project**

- WMATA supported, local agency driven
- Multijurisdictional, TIGER-funded
- DC, Virginia DOT, Alexandria, Falls Church
- 200+ intersections
Vision to Fruition
Effective Planning

- Traffic and Transit Systems
- Aligning goals and objectives
- Finding win-win situations
Controller Testing

- TSP algorithms vary widely between vendors and firmware versions
- Multiple scenarios
- Test, test, and test again
Intersection

- Cabinet space
- Bus stop locations
- Lane configuration
- User demands
Operations: Transit

- Line route assessment
- Performance measures
  - On time performance
  - Delays
  - Headway adherence
Operations: Timings

- Individual intersection assessments
- Corridor
Implementing a System
Systems Engineering: High-Level Design

High-Level Design

- Bus Stop Location
- Variable Green Time
- Spatial Distance
- Traffic Operations
- Intersection Screening
- On-Board Equipment Parameter Development

TSP Communication Zones at Closely Spaced Intersections
Washington, DC
Detailed Design

- In-cabinet component needs
- Component configuration
- Communications diagram
- Technical specifications

Install cellular antenna on top of cabinet

NOTE: Phase selector cards to be double-wide. Face of phase selector card covers slot #11.

Install 14-slot Input file rack for Model Series 336 Cabinet below output file rack. Install Phase selector in input file slot #12 (“I” file)

Relocate equipment approximately 8” down, adjacent to communication panel

Relocate communication panel to back of cabinet (Proposed equipment location)
System Testing

- Key success driver
- Objective to verify and validate end-to-end functionality
- Four-stage acceptance testing regimen
Systems Engineering Driven Testing Process

Prototype Testing
- **Purpose:** Proof of Concept
- **Scale:** Single intersection

Stand-Alone Testing (SAT)
- **Purpose:** Verification
- **Scale:** Each intersection wayside equipment

Final System Acceptance Testing (FSAT)
- **Purpose:** Verification
- **Scale:** Each intersection, end-to-end

Operational Acceptance Testing (OAT)
- **Purpose:** Validation
- **Scale:** System-wide
Sample Testing Scenarios:
Prototype Testing

- Bus Running On Time
- Bus Running Late
- Red Light Stop Simulation
- Cancel Request Simulation
- Clear Message Simulation
- Bus Running On Time, Then Late
Sample Testing Scenarios: 
Stand-Alone Testing (SAT)

- Verify Hardware Installation
- Verify Modem Functionality
- Verify Cellular Modem Connection
- Verify TSP Configuration in Traffic Controller
- Verify Phase Selector Configuration
Sample Testing Scenarios: Final System Acceptance Testing (FSAT)

Communications Series 1:
The bus was behind schedule. A priority request was sent and received upon entering the TSP window.

Communications Series 2:
Two additional priority updates were sent and received as the bus approached the intersection.

Communications Series 3:
Based on the time stamp, the bus continued through the intersection on green. The bus exited the TSP window, and a priority request clear message was sent.
Sample Testing Scenarios: Operational Acceptance Testing (OAT)

- Objective: full operation validation of the TSP system for a predetermined span of time

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DDOT TSP 30-Day OAT Tracking Sample
Lessons Learned
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- Establish formal agency roles and responsibilities prior to the commencement of the project
- Collaborative assessment: Opportunities and Constraints for Traffic and Transit
- Highlight the importance of oversight and review
- Plan for evaluation and refinement
Thank You

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