Agenda

• Transit Signal Priority Overview
• Project Overview
• Specification Development
• Virtual Test Tool
• Next Steps
• Questions
Transit Signal Priority (TSP) Overview

- **Goal:** Reduce traffic signal delay, improve transit schedule adherence and transit reliability

- **Active Priority:**
  - Detect the approaching transit vehicle in real-time
  - Temporarily adjust the traffic signals to benefit the transit vehicle
  - Return to normal signal operation when the transit vehicle clears the signalized intersection

- **Active Conditional Priority:**
  - TSP is only granted when certain “conditions” are met
  - Most common condition is schedule adherence
TSP Overview

• National Transportation Communications for ITS Protocol (NTCIP)
• AASHTO, ITE, and NEMA, Office of the Assistant Secretary
• A goal is to develop standards for the transportation industry (Interchangeability and interoperability)

Signal Priority Control:

• Priority Request Generator (PRG)
• Priority Request Server (PRS)
TSP Overview

- NTCIP Scenario 4
- PRG on Transit Vehicle
- PRS on Roadside
- PRS Communicates with the Traffic Signal Controller
Project Overview

- **Client:** Regional Transportation Authority (RTA)
  - Pace Suburban Bus
  - Chicago Transit Authority
  - Chicago Department of Transportation (CDOT)
  - Illinois Department of Transportation (IDOT)
  - FHWA
- **Physical requirements:**
  - Two transit CAD/AVL systems
  - 161 km of roadway over 400 signalized intersections
- **AECOM and IBI Group are the main consultant team**
- **Goal is to develop a “Regional TSP System”**
  - Competitive procurement of system components
  - Interoperability between various vendors
  - Do not limit future development
Project Overview

• Work Plan (Systems Engineering Approach):
  • User Needs
  • Functional Requirements
  • Communication Protocol Standard Development
  • PRS Specification
  • PRG (CAD/AVL) Specification
  • Virtual Test Tool
  • Procurement Support
  • Implementation Support
Specification Development

- **User Needs** – gathered through a workshop process
- **Functional Requirements** – translated User Needs into functional requirements
- Organized Functional Requirements into **five (5) TSP Subsystems**:
  - Priority Request Generator (PRG) – 23 requirements
  - Priority Request Server (PRS) – 27 requirements
  - TSP Protocols (PRO) – 23 requirements
  - Communications (COM) – 7 requirements
  - TSP Central Software (SOFT) – 18 requirements
Specification Development

- NTCIP 1211/1212, Object Definitions for Signal Control and Prioritization:
  - **Determine the Need for Priority**: Determine whether a vehicle is in need of priority according to series of user-defined criteria (e.g. lateness, passenger loading)
  - **Estimate Arrival Time**: Produce an estimate of the vehicle’s time for service desired at the signalized intersection
  - **Communicate**: Communicate the vehicle’s request for priority and its time of service desired to the PRS
  - **Event Log**: Produce a log of all priority requests
Specification Development

- Connected Vehicle:
  - Communicate and exchange information among ITS devices, vehicles, and operation centres
  - Vehicle manufacturers are early adopters – vehicle braking
  - FHWA could mandate that all new vehicles use standard
  - Aspects are being developed, with limited messaging regarding TSP
Specification Development

• Proposed Solution:
  • **NTCIP** using extended MIBS to meet functional requirements
  • Standardized Communication (**Connected Vehicle Framework**):
    • Frequency: 5 GHz, many vendors, staff knowledge
    • Technology: MIMO (multiple input/output) radios, line of sight
    • Protocol: 802.11n minimum, allows newer protocols
Published Pace PRS Specification
## Published PRS Specification

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Virtual Test Tools

- Test **PRG-PRS interface functions** through transmission of SNMP GET and SET requests, and the reception and limited processing of SNMP responses
- Development using the C# and the Microsoft .NET Framework
- Mix of NTCIP, SNMP and TCP/IP communication class libraries
- Windows Graphical User Interface (GUI)
Virtual Test Tools

- Virtual PRG and Virtual PRS tools to help vendors to test their PRG and PRS and **ensure compatibility** with the communication standard
- Virtual PRG allows the user to **submit requests** for priority with transit vehicle details
- Virtual PRS allows the user to **receive priority requests** from different PRGs, prioritize the requests and **communicate** the service request **to the traffic signal controller**
- Enable to **simulate real-life conditions**
  - TSP triggered by lateness
  - Buses receives traffic controller status responses (TSP calls in process, TSP call canceled, flash mode, etc.)
## Virtual Test Tool – PRG

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<th>Agency ID</th>
<th>Vehicle Class Type</th>
<th>Vehicle Class Level</th>
<th>Desired Time of Service</th>
<th>Time of Estimated</th>
<th>Required TSP Phase</th>
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### Notes:
- DACIA
- FIAT

### Arrows Indicate:
- Vehicle ID selection changes
- Agency ID selection changes
- Vehicle Class Type selection changes
- Vehicle Class Level selection changes
- Desired Time of Service selection changes
- Time of Estimated selection changes
- Required TSP Phase selection changes
- Lateness selection changes
Virtual Test Tool – PRG
Next Steps

• PRS Vendor Response and Selection
• PRG Vendor Development Underway
• Testing with Virtual Test Tool
• Implementation, field testing (CTA in Summer 2016), and Operation

• Goal is to develop an “Open Regional TSP System”
  • Moving Closer……..
Questions?
Thank you!

Mike Corby, IBI Group
mcorby@ibigroup.com
416-596-1930