Rail System Wireless Interconnect Between Traffic Signal and Train Control Cabinets

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Agenda

• Background
• Metro Gold Line Eastside Extension
• Overview of Location
• Train Control 101
• Train Operational Issue (Overruns)
• The Proposal & Challenges
• Solution & Additional Benefits
• Current Status / Results of Pilot
Los Angeles County

- 88 Cities, including the City of Los Angeles
- 10 million people, more populous than 42 States
- Economy would rank in top 20 Countries
- Ports of Los Angeles/Long Beach busiest in the nation
- 500 miles of freeway
- Congestion consistently ranks tops in the Nation
LA Metro Service Area

The Service Area includes:

- 14,041 Bus Stops
- 164 Bus Routes
- 93 Rail Stations
- 105 Miles of Rail Service
LA Metro Ridership

- 357,892 average weekday rail boardings
- 913,280 average weekday bus boardings
- 329 rail cars
- 2,270 buses
• Service began on November 5, 2009
• 5.9 miles from Union Station to East Los Angeles
• An elevated viaduct, underground & median track alignment
• Offset Signalized Intersection
Third Street and Rowan Avenue

• Traffic Signal Operation
Train Control 101

> The Metro Rail Systems is a Right Hand Double Track System with Left Hand Signaling.
> Normally Rail Transit Signals shall be placed to the Left Side of the respective track so that all wayside signals are easily distinguished for the appropriate track that that signal is to govern.
> In some cases, due to ROV constraints and clearance issues, signals are placed on the right side of track or even between the rails.

![Typical Universal Interlocking Diagram](image)
Train Control 101

- Train control installation consists of track circuits, signals, switch machines, vital controller & relays and various supporting elements
- Example below shows equipment at East Los Angeles’ Ditman Interlocking
Train Control 101

> **Track Circuit** – detects presence of train, ensures rail continuity and transmits speed commands to train (latter not applicable to Ditman since it’s a street running area)

> **Signals** – pole-mounted signal heads with R/Y/G aspects

> **Train to Wayside Communications** – exchanging non-vital information with the train such as route requests, gate crossing activation/cancellation, Train ID & other

> **Vital Controller** – dual-processor system which runs application program specific to the location and communicates with adjacent controllers as well as with Rail Operations Control
Train Operational Issue

- Location of Interlocking to Traffic Signal

3rd Street @ Rowan Av Traffic Signal

Ditman Interlocking
Train Operational Issue

- Train operators "overrunning red light signals"
DITMAN SIGNAL 2N WHITE PAPER

Overview

Ditman interlocking is located within street-running territory on the Eastside portion of the Pasadena Gold Line. An added complication is that this interlocking is located within an existing split intersection between 3rd street and Rowan Avenue.

3rd and Rowan

The challenge with Signal 2N is that it is located to the Track North/Compass West of the intersection between 3rd and Rowan. This means that train operators have to observe the wayside signal, traffic intersection bar signal, automobiles and pedestrians all at the same time. Since the interlocking is located in street-running territory, the interlocking signals are not enforced by cab signal ATP.
Recommendations

• Install additional signing and markings along tracks for train operators
Recommendations

• When train control signals 2N and 4N (Reverse Running) are Red, the traffic signal controller will not grant a vertical bar (proceed) signal.
• No Existing Interconnect between the Traffic Signal Controller & Train Controller Cabinets
The Challenges

- Existing Type 170 Traffic Signal Controller with LACO-4E Program unable to handle proposed operation
- Unique Controller Cabinet Wiring
The Solution

- Install a wireless interconnect between the Traffic Signal and Train Controller Cabinets

Proxim “Tsunami” Wireless Ethernet Broadband radios

6-ch Digital Input and 6-ch Relay Modbus TCP Module
The Solution

• Software and circuit modifications to the Metro interlocking case
The Solution

• Upgrade Traffic Signal Controller and Controller Program
The Solution

- Develop Revised Traffic Signal Operation
Train Control Logic & Circuits

Train Control Relay-Equivalent Logic

Circuit Diagram

Field Implementation
Metrics

Before & After Studies

• Compare Train Overruns
• Compare natural traffic signal cycle lengths
• Compare Train Pre-emption durations at 60 Fwy Ramp and Downey Road locations
Additional Benefits

- Improved overall efficiency of traffic signal operation
- Reduced intersection delays for all users (Train, Motorists & Pedestrians)
- Improved train operation at 60 Fwy Ramp and Downey Road
Current Status / Results

- Wireless Communication Equipment Installed
- Controller & Controller program Installed
- Initial Testing of Components Completed
- Pending Final Evaluation
What’s Next?

• Consider a permanent hardwire interconnect
• Upgrade other Traffic Signal Controller along 3rd Street

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Thank You!
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