Number of Routes = 7
Stations in Service = 54
Route Miles
  - Shared = 512
  - Owned = 388
Average Trains Operated
  - Weekday = 145
  - Saturday = 40
  - Sunday = 22
Average Speed = 40mph
Maximum Speed = 90mph
Control Points = 92
RR Crossings = 298
METROLINK CROSSINGS

- 298 Total RR Crossings
  - 255 – Public at-grade crossings
  - 33 – Private at-grade crossings
  - 10 – Pedestrian at-grade crossings

- 73 Public At-Grade Crossings are Interconnected with City Traffic Signals

- Almost 29% Public At-Grade Crossings are Interconnected with City Traffic Signals
Over a sample period of 5 years, almost 47% of interconnected public crossings had a Train vs. Auto Incident.

Over the same 5 year period, 12% of non-interconnected public crossings had a Train vs. Auto incident.
Over the last five years, Metrolink has experienced almost 4 TIMES the amount of Train vs. Auto incidents at an interconnected crossing, as compared to a non-interconnected crossing.
Recognized the need to:

- Communicate and coordinate requirements of interconnection between Railroad and Local Agencies
- Jointly perform operational test and inspection of equipment and systems
- Educate both Railroad and Local Agency personnel
BUENA VISTA ST. INCIDENT

North Buena Vista Street grade crossing

Intersection of North Buena Vista Street and North San Fernando Boulevard

Metrolink train at final rest position

Source: Burbank Police Dept.
BUENA VISTA ST. INCIDENT

NORTH

Lowered automatic gate

2400 North San Fernando Boulevard
POTENTIAL INCIDENT FACTORS

- Human Factor Issues
  - Emotional State
  - Distractions
  - Driving Under the Influence
- Street Configuration
  - Wide or Angled Crossing
  - Median Islands
- Interconnected Systems
  Design and Operation
Preemption feature shall have an electrical circuit of the closed-circuit principle, or a supervised communication circuit….
CPUC General Order No. 75-D Part 9.7 – *Traffic Signal Interconnection*

At an at-grade crossing with automatic warning devices where a diagnostic team determines that pre-emption is necessary, for example where vehicular traffic queues from traffic signal controlled intersections exceed the Clear Storage Distance (as defined in the CA MUTCD), the traffic signals shall be interconnected with the automatic warning devices.

49 CFR 234.261 – *Highway traffic signal pre-emption*

“Highway traffic signal pre-emption interconnections, for which a railroad has maintenance responsibilities, shall be tested at least once each month.”
RESPONSIBILITY

Railroad: Provide preemption call. Responsible for RR equipment and associated operation.

Local Agency: Responsible for continuity of interconnection wire/cable (underground), traffic signal phasing and timing, and traffic signal enclosure and field equipment.
SAN FERNANDO BIKE PATH

- Modified 3 Existing Crossings to provide advance preemption to the City (Up to 27 seconds)
- Upgraded Interconnection circuitry to utilize 3 wire supervisory circuit and serial interface IEEE 1570
- Vital serial communications between crossing control and traffic control equipment
SAN FERNANDO BIKE PATH

- Provides traffic signal equipment additional information not available through relay circuits.
- Provides railroad signal equipment with additional information on the status of traffic signals.
- Designed for restart moves and accelerating trains.
- Information can be used to manage the crossing by omitting traffic phases prior to train arrival and extending track clearance green until gates are fully lowered.
PROJECT PLANNING ISSUES

- Adjacent Crossings
- Control Point
- Multiple Tracks
- Passenger Station Within Corridor
- Warning Time
- Advanced Pre-emption Time
- Train Handling
- District speed and variation of maximum district speeds through project.
CONSTANT WARNING DEVICES

Two Questions need to be asked prior to configuring CWD:

What is the desired amount of railroad warning time and/or advance preemption time required?

What is the maximum allowable train speed through the crossing?
### WARNING TIME CALCULATION

<table>
<thead>
<tr>
<th>Time Component</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Warning Time (Regulatory)</td>
<td>20 sec.</td>
</tr>
<tr>
<td>Speed Variances and Ballast Conditions (Buffer)</td>
<td>10 sec.</td>
</tr>
<tr>
<td>Clearance Time for Wide or Angled Crossings</td>
<td>0 sec.</td>
</tr>
<tr>
<td>Railroad Programmed Warning Time</td>
<td>30 sec.</td>
</tr>
<tr>
<td>Advanced Preemption Time (APT)</td>
<td>20 sec.</td>
</tr>
<tr>
<td>Equipment Reaction Time</td>
<td>5 sec.</td>
</tr>
<tr>
<td><strong>TOTAL Warning Time</strong></td>
<td><strong>55 sec.</strong></td>
</tr>
</tbody>
</table>
APPROACH DISTANCE CALCULATION

Total WT x District Speed Feet per Second = Required Approach Distance

<table>
<thead>
<tr>
<th>TOTAL Warning Time</th>
<th>55 sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>District Speed</td>
<td>60 mph</td>
</tr>
<tr>
<td></td>
<td>- or -</td>
</tr>
<tr>
<td></td>
<td>88 ft/s</td>
</tr>
</tbody>
</table>

55 sec. x 88 ft/s = 4840’

Required Approach Distance = 48400 feet
As RRWT and max. train speeds increase, approach distance increases.

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Feet per Second</th>
<th>Approach Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>44</td>
<td>2,420'</td>
</tr>
<tr>
<td>60</td>
<td>88</td>
<td>4,840'</td>
</tr>
<tr>
<td>75</td>
<td>110</td>
<td>6,050</td>
</tr>
</tbody>
</table>

Train traveling @ 30mph = 44 feet per second.  
44 ft/s x 55 seconds RRWT = 2,420’ approach distance

Train traveling @ 60mph = 88 feet per second.  
88 ft/s x 55 seconds RRWT = 4,840’ approach distance

Train traveling @ 75mph = 110 feet per second.  
110 ft/s x 55 seconds RRWT = 6,050 approach distance
REMOTE APPLICATION

Unit 1 Usable Frequencies
86 Hz  114 Hz  156 Hz

120’ min.  1800’  3040’

4840’

SEMI BI-DIRECTIONAL APPLICATION

Unit 2 Usable Frequencies
86 Hz  211 Hz
114 Hz  285 Hz
156 Hz  348 Hz
430 Hz

For this application there are only 3 usable frequencies that can accommodate the required approach distance of Unit # 1. There are 7 usable frequencies that can accommodate Unit # 2.

3000’ Of Simulated Track to Balance Approaches
CONSTANT WARNING TIME/TRAIN HANDLING

Train traveling at 30 mph

- 880’ @ 20 sec.
- 1320’ @ 30 sec.
- 1540’ @ 35 sec.

Train traveling at 60 mph

- 1760’ @ 20 sec.
- 2640’ @ 30 sec.
- 3080’ @ 35 sec.

Legend:
- MWT
- Buffer
- Equip. Response
- End of Approach
GCP 4000

- Latest technology
- Increased functionality and flexibility due to modular design
- Greater number of assignable Inputs/Outputs than on previous models
- Provides RR ability to program internal and I/O vital configuration logic
- Allows RR the option of sending a variety of information to I-SPI interface
I-SPI

- Intelligent Serial Pre-emption Interconnection
- Used as Railroad / City Traffic Interconnection Interface
REAL TIME MONITORING

SAN FERNANDO ROAD CROSSING STATUS

ROXFORD
BLEDSOE
POLK

SYLMAR STATION
CONTACT INFORMATION DECAL

WARNING!
Highway-Rail Grade Crossing Warning System and Highway Traffic Signals are Interconnected.

BEFORE MODIFICATION is made to any operation which connects to or controls the timing of an active railroad warning system and/or timing and phasing of a traffic signal the appropriate party(ies) shall be notified and, if necessary, a joint inspection conducted.

U.S. DOT/AAR Crossing Number: __________________________
1. Highway Agency: __________________________
   Phone Number: __________________________
2. Railroad: __________________________
   Phone Number: __________________________
3. Other: __________________________
   Phone Number: __________________________

To be located in:
- Highway Traffic Signal Case
- Railroad Signal Enclosure

Purpose
- Adjustments are not made by either entity that may impact the safe operation of either system
- Coordination of Joint Testing and Inspection

Information
- Contact information for timely notification of changes or problems

Result
- Ensures intended operation of interconnected systems
CONCLUSION

- Railroad Crossing and Traffic Signal Equipment information exchange is essential for optimized operation of Highway-Rail Intersections

- Understanding the dynamics to optimize how these two systems work together is key to decision making

- Joint diagnostics of Highway-Rail Intersection operation should be conducted prior to modifications or changes to either system

- While cost is always a factor, the technology is available to improve the safety of the public, train crews, passengers, and goods

- Overall, the use of this advanced technology is a win-win situation as it will improve safety