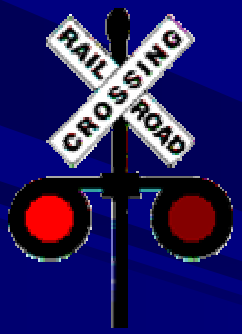
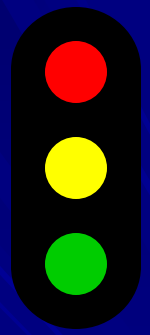
METROLINK



HIGHWAY TRAFFIC SIGNAL PREEMPTION



A Railroad Perspective

2007

Sacramento, CA

METROLINK

METROLINK SYSTEM

METROLINK SYSTEM

- 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

TRAIN VS. AUTO HISTORY

- 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.

TRAIN VS. AUTO HISTORY

- 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.

METROLINK

FOX RIVER GROVE

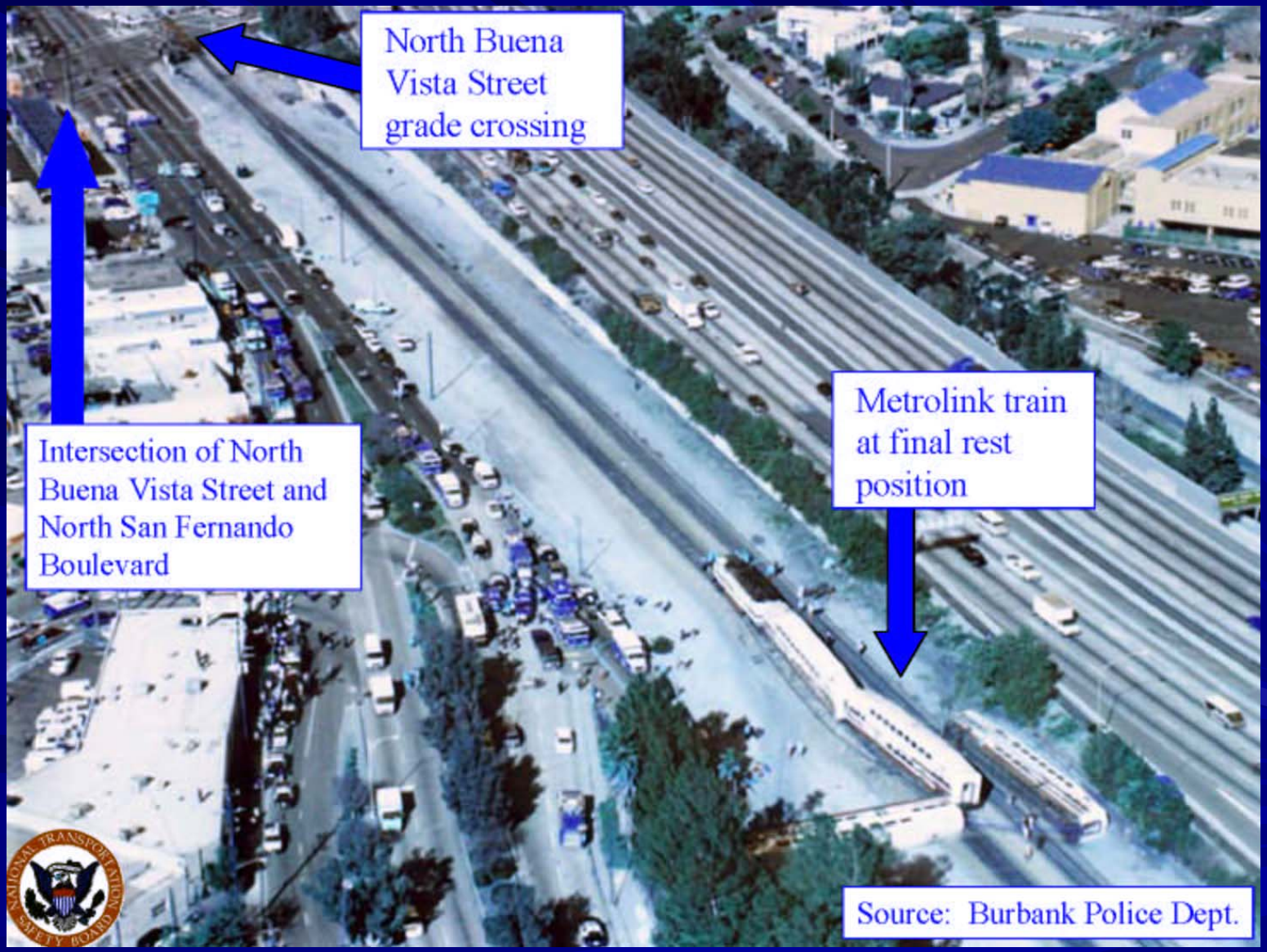
FOX RIVER GROVE : Lessons Learned

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

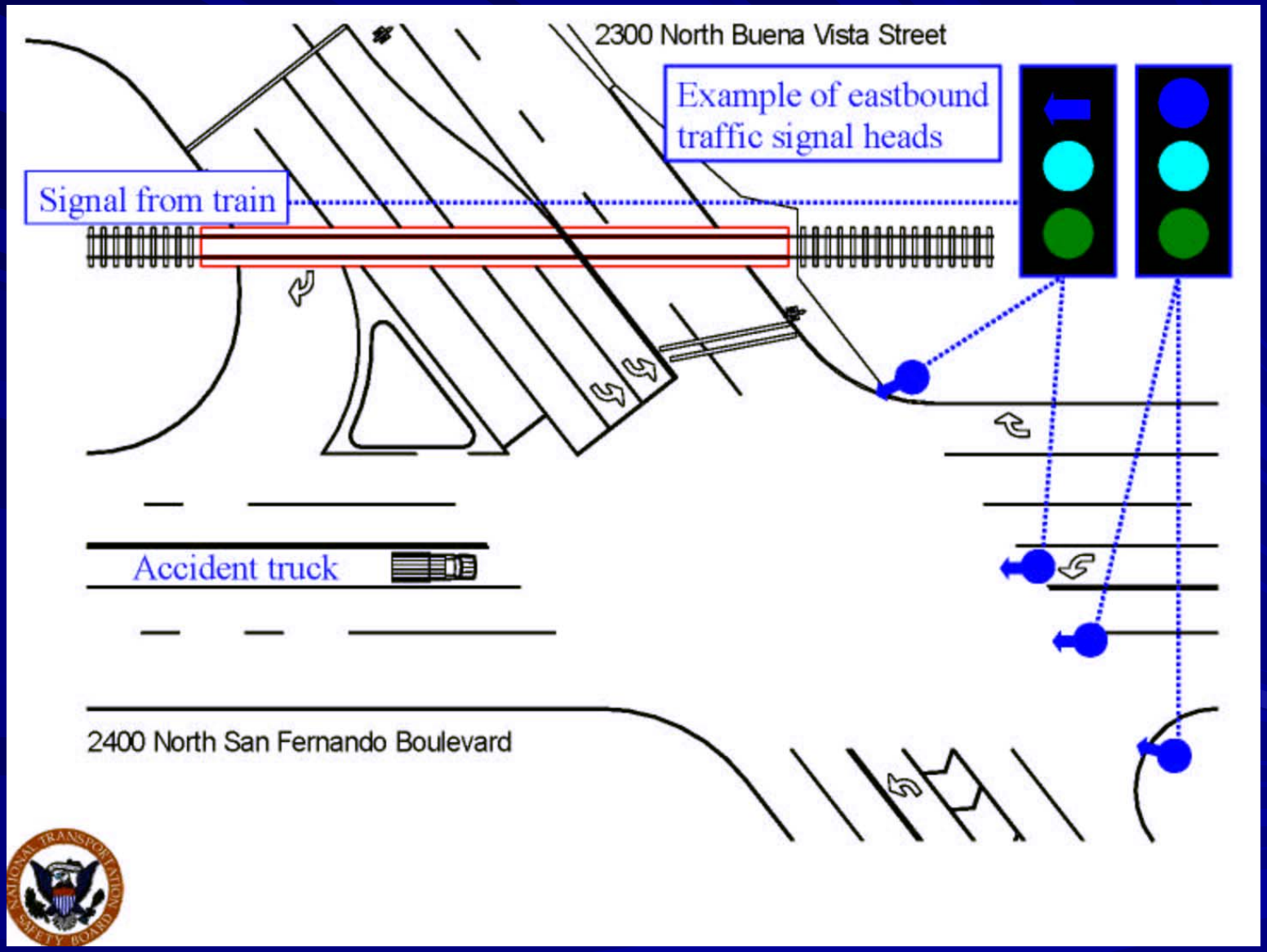
METROLINK

BUENA VISTA ST. INCIDENT



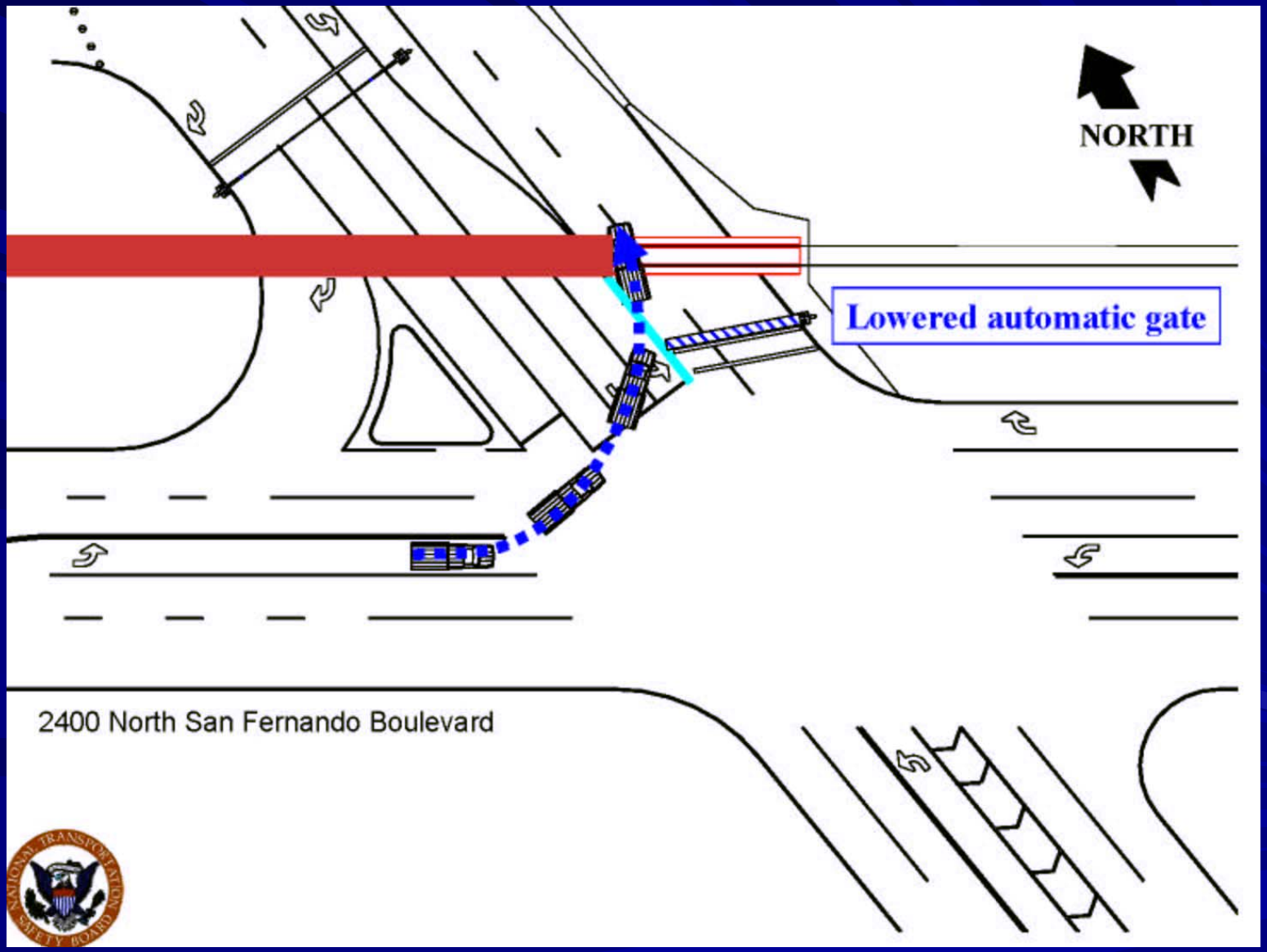
METROLINK

BUENA VISTA ST. INCIDENT



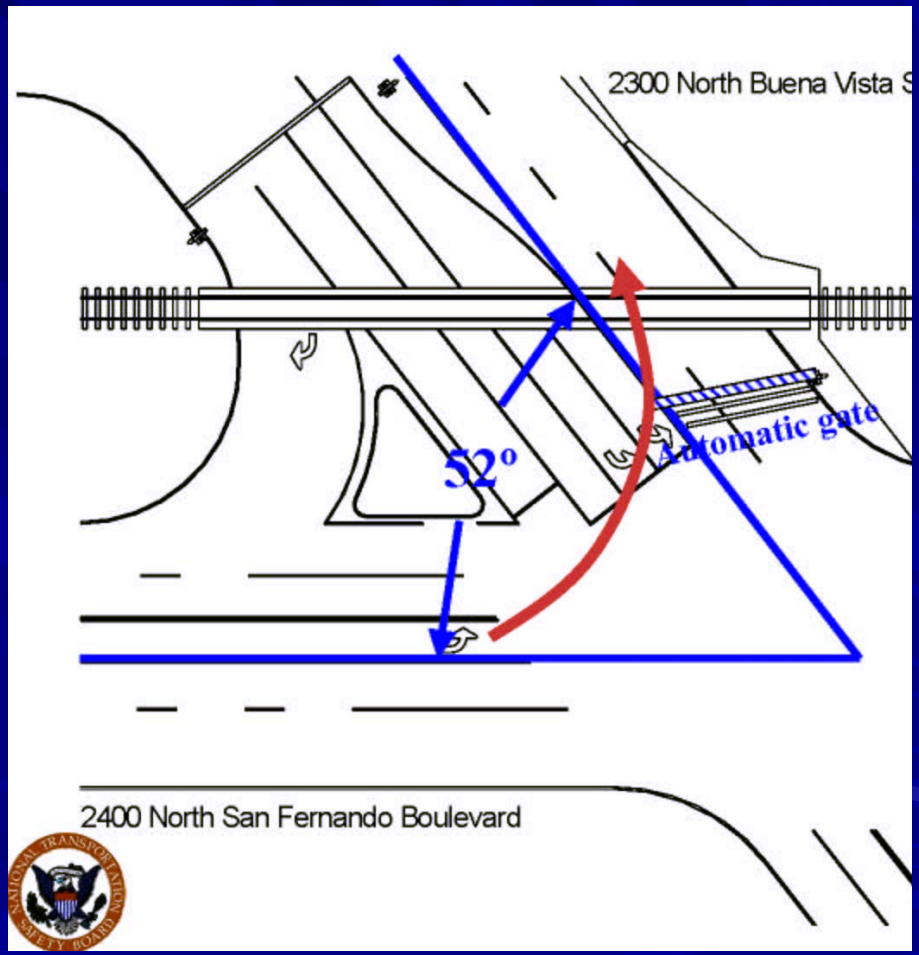
METROLINK

BUENA VISTA ST. INCIDENT

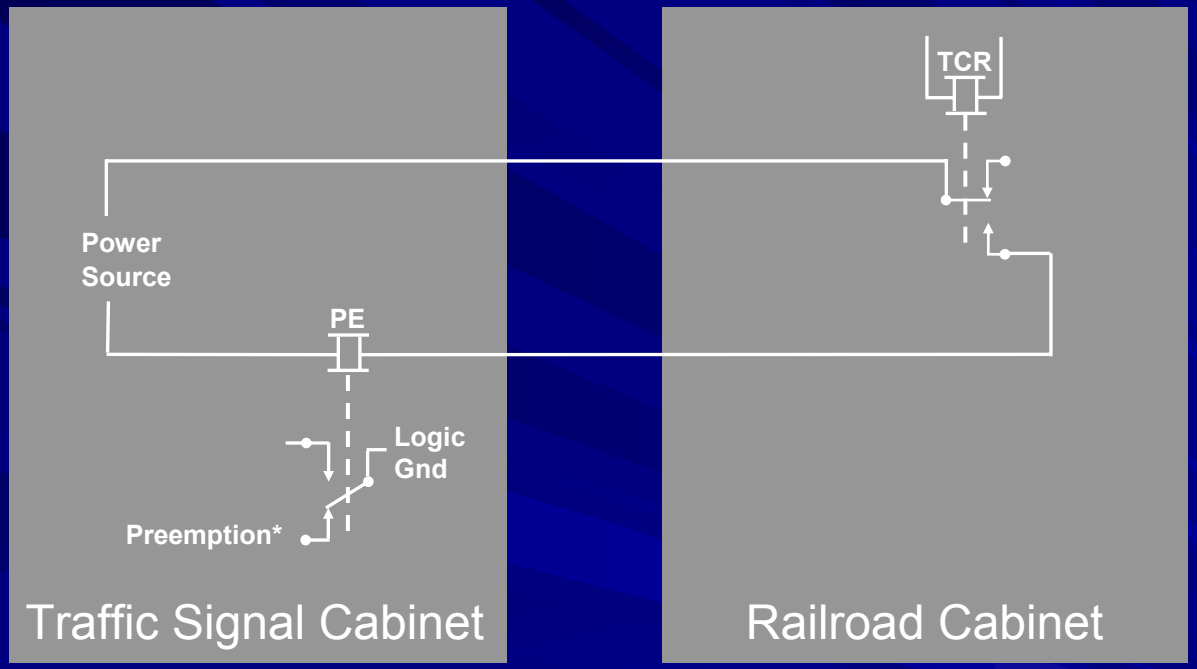


POTENTIAL INCIDENT FACTORS

- Human Factor Issues
  - Emotional State
  - Distractions
  - Driving Under the Influence
- Street Configuration
  - Wide or Angled Crossing
  - Median Islands
- Interconnected Systems Design and Operation



2 WIRE INTERCONNECTIONS



* Shown as preemption initiated by absence of logic ground

Does comply with MUTCD.

Preemption feature shall have an electrical circuit of the closed-circuit principle, or a supervised communication circuit….

REGULATORY REQUIREMENTS

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.


METROLINK
PATH ENDS
YIELD TO PEDS
BIKE
PATH
SAN FERNANDO BIKE PATH PROJECT
CITY OF LOS ANGELES

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

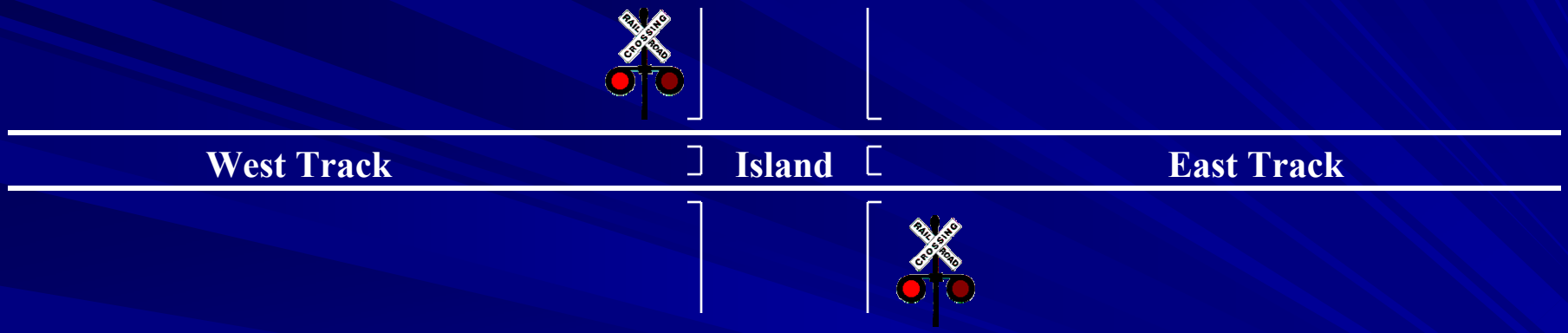
METROLINK

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?

METROLINK

WARNING TIME CALCULATION

Minimum Warning Time (Regulatory)	**20 sec.**
	+
Speed Variances and Ballast Conditions (Buffer)	**10 sec.**
	+
Clearance Time for Wide or Angled Crossings	**0 sec.**
Railroad Programmed Warning Time	**30 sec.**
	+
Advanced Preemption Time (APT)	**20 sec.**
	+
Equipment Reaction Time	**5 sec.**
TOTAL Warning Time	**55 sec.**

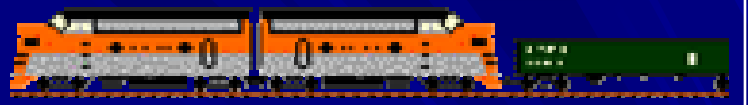
APPROACH DISTANCE CALCULATION

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

TOTAL Warning Time	**55 sec.**
District Speed	**60 mph** ***- or -*** **88 ft/s**
55 sec. x 88 ft/s = **4840’**	

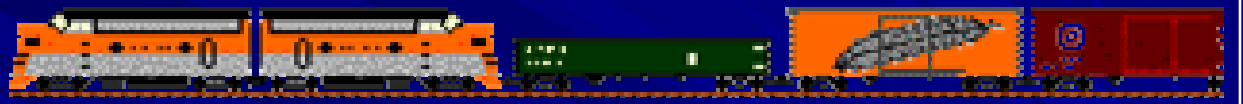
Required Approach Distance = 4840 feet

APPROACH DISTANCE CALCULATION



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

As RRWT and max. train speeds increase, approach distance increases.

METROLINK

REMOTE APPLICATION

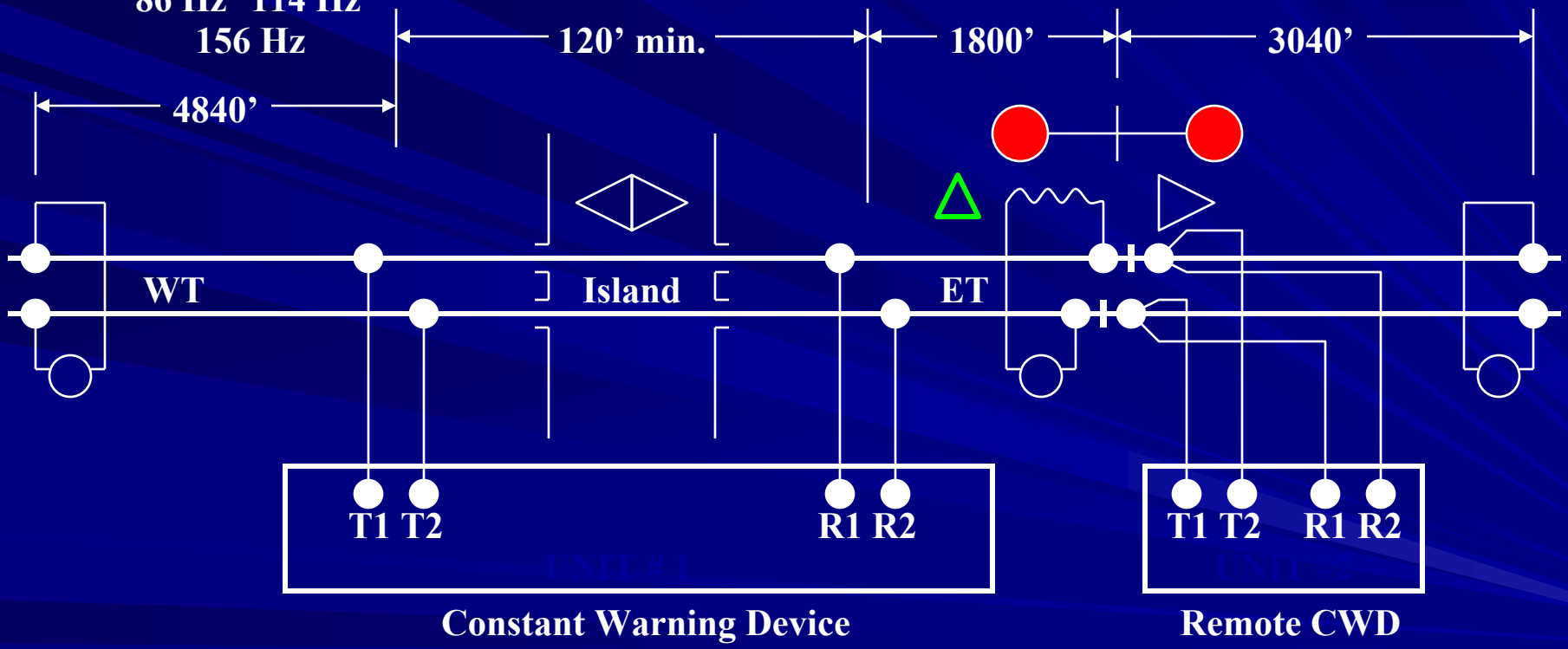
Unit 1 Usable Frequencies

86 Hz 114 Hz
156 Hz

Unit 2 Usable Frequencies

86 Hz 211 Hz
114 Hz 285 Hz
156 Hz 348 Hz
430 Hz

SEMI BI-DIRECTIONAL APPLICATION



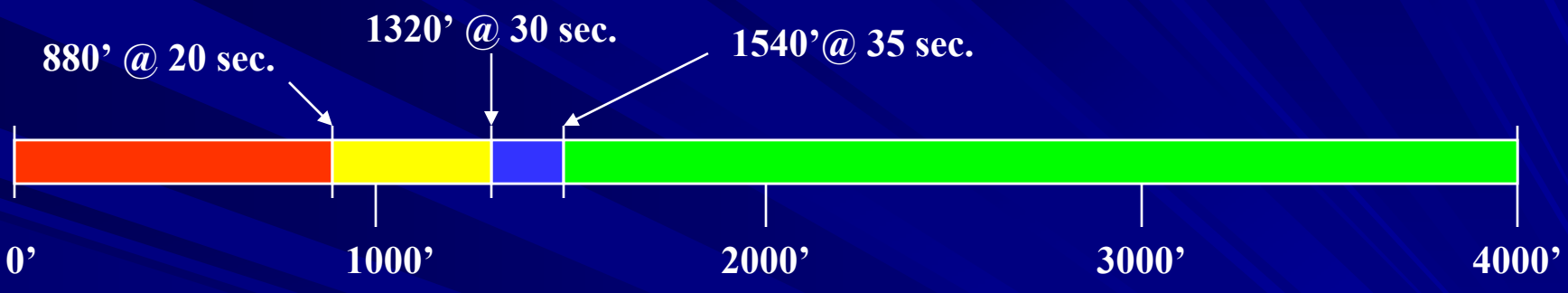
Constant Warning Device

Remote CWD

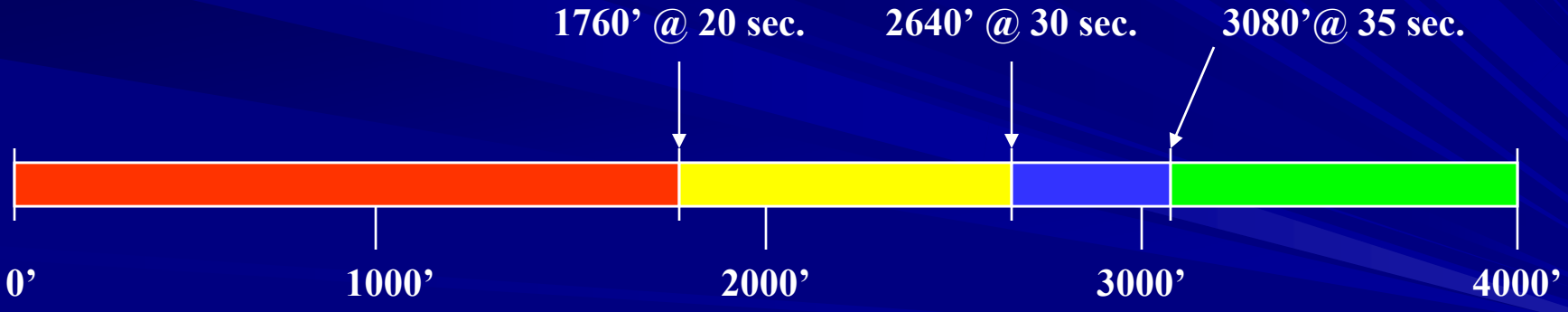
✻ For this application there are only 3 usable frequencies that can accommodate the required approach distance of Unit # 1. There are 7 usable frequencies that can accommodate Unit # 2.

△ 3000' Of Simulated Track to Balance Approaches

CONSTANT WARNING TIME/TRAIN HANDLING



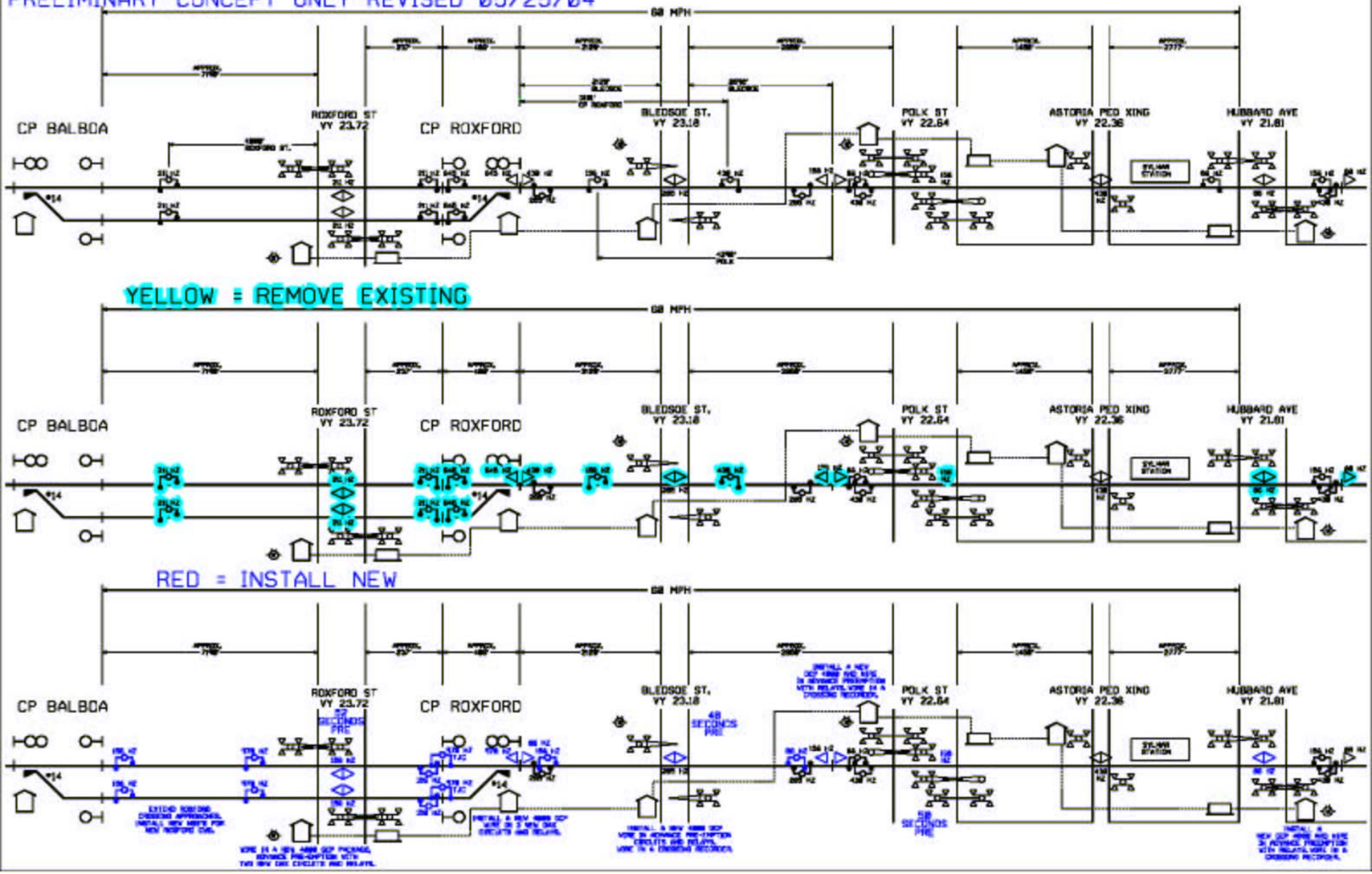
Train traveling at 30 mph



Train traveling at 60 mph

MWT Buffer Equip. Response End of Approach

PRELIMINARY CONCEPT ONLY REVISED 05/25/04



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

METROLINK

I-SPI

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

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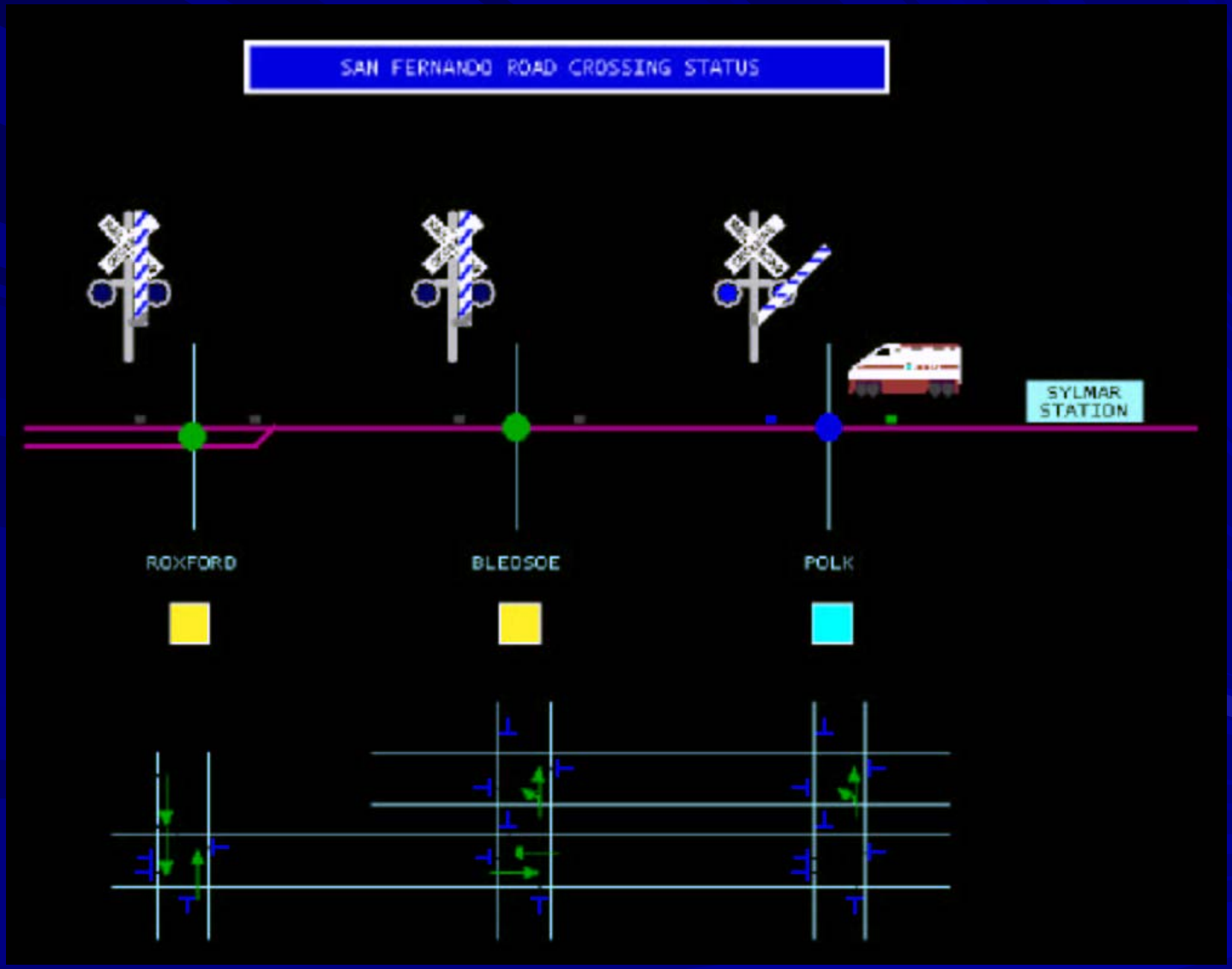
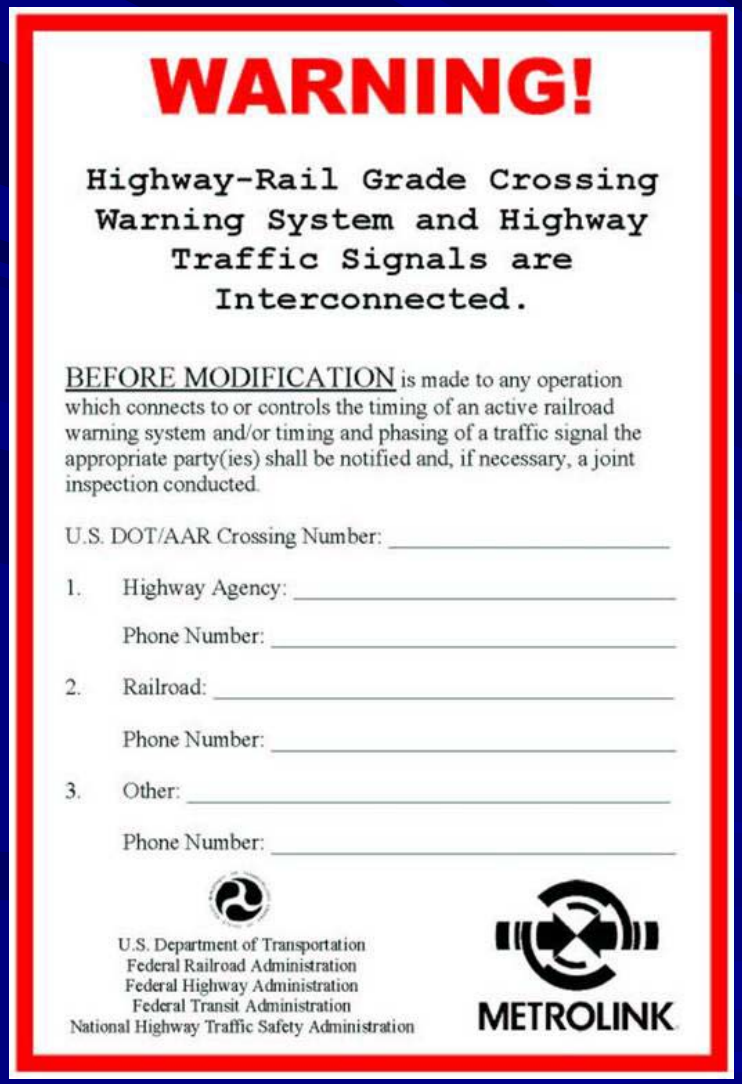
REAL TIME MONITORING



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: _____

U.S. Department of Transportation
Federal Railroad Administration
Federal Highway Administration
Federal Transit Administration
National Highway Traffic Safety Administration

METROLINK

- 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