Designing Safety into Highway-Rail Grade Crossing Projects

February 13, 2017
Overview of Grade Crossing Safety

- A train strikes a vehicle or person **every 4 hours** in U.S.
- 2,059 crashes in 2015
- 244 fatalities
- 967 injuries
Overview of Grade Crossing Safety

WHAT TXDOT & FRA DISCOVERED
2003 – 2007 Crash Data Analysis Significant Findings

• Total of 1,328 collisions at 1,044 crossings.
• **61%** - of total collision-crossings had active warning devices in place.
• **35%** - at active crossings where multiple-collisions were reported
• **80%** - at crossings located within close proximity of a nearby highway intersections
Overview of Grade Crossing Safety

Analysis of Crossings Located Near Highway Intersections

- **229 of 803** reported RR active warning devices interconnected with nearby traffic signals
- **46%** - occurred at multi-collision crossings
- **42%** - at crossings located less than **75 feet** from adjacent highway intersection
- **69%** of the crossings had active warning devices
CONCLUSIONS

Higher incidence of collisions at crossings located adjacent to highway intersections and where railroad signals are interconnected with adjacent traffic signals, and experiencing multiple collisions.
The FRA Technical Bulletin S-12-01

Federal Railroad Administration (FRA) accident data indicates that inappropriately designed or wholly nonfunctioning pre-emption interconnections have contributed to a number of severe highway-rail grade crossing collisions.
Education – Design, maintenance and inspection

- Training of railroad and traffic signal maintenance personnel
- Minimum – yearly joint test of preemption operation system
- Joint preemption test any time changes are made to traffic signal equipment or repairs are made
Gov. Cuomo, New York legislators implement measures to improve rail safety (6/14/2016)

The legislation requires every railroad, municipality or state agency with jurisdiction of a highway that includes a crossing to conduct, at a minimum, biennial inspections of traffic-control devices. The law authorizes the New York State Department of Transportation (NYSDOT) to establish, implement and exercise oversight over a program to coordinate the joint inspection of traffic-control signals interconnected with crossing warning systems.
Traffic Signal Preemption

The Solution: Technology

- Enhanced interconnection circuits
- Preemption interface system (RPS)
- Traffic signal controller software becoming more preemption friendly
DESIGN OPTIONS FOR IMPROVING SAFETY AT HIGHWAY-RAIL GRADE CROSSINGS
Median and Channelization

Installation of concrete medians or channelization to prevent motorist from driving around gates

Not just a option for quiet zone!
SIGNS AND PAVEMENT MARKINGS
LED Signs
To Advise Motorists
Signs and Pavement Markings

Eliminate Crosswalk adjacent to track
Signs and Pavement Markings

Provide Pedestrian refuge in median

Pedestrian refuge with push buttons
Signs and Pavement Markings

Left and Right Turn Arrow approaching the track
Left and Right Turn Arrow approaching the track

- Proposed MUTCD language will recommend lane turn arrows be located a minimum of 100 feet in advance of the track.
TURNING DOWN THE TRACKS
OXNARD, Calif. (KABC) – February 25, 2015

A 54-year-old truck driver from Yuma, Arizona was arrested on suspicion of felony hit-and-run after a Metrolink train headed toward Los Angeles struck his large pickup truck, which was hauling a trailer, on the tracks in Oxnard Tuesday. No fatalities were reported, Oxnard police said.
Delineators & Lane Lines

Turning down tracks

Why?
• GPS systems
• Close proximity of downstream intersection
• Break in lane lines
• Distracted drivers
• Limited visibility
• Limited overhead lighting
Proposed New MUTCD Language

Section 8B.31 Edge Lines at Grade Crossings

Guidance:
When used, edge lines (see Section 3B.06) and lane lines (see Section 3B.04) should extend to and across the track(s) to delineate the edge of the traveled way and the separation of traffic lanes across the track(s).

Option:
The edge line may be omitted from the highway surface at a grade crossing if the surface cannot retain the application of the marking.
Proposed New MUTCD Language

Section 8B.31 Edge Lines at Grade Crossings

Option:
Where recommended by a Diagnostic Team, raised pavement markers and/or tubular markers may be used to supplement the edge line markings to delineate the edge of the traveled way across the track(s).
Delineators & Lane Lines

San Diego, California
Delineators & Lane Lines

Bedford, New York
Delineators & Lane Lines

Bedford, New York
Delineators & Lane Lines

Hinsdale, Illinois
PEDESTRIAN TREATMENTS
Pedestrian Treatments

Provide sidewalks
Pedestrian Treatments

Figure 8C-5. Example of a Shared Pedestrian/Roadway Gate

- Audible device
- Curb
- Sidewalk
- 4 inches MAX.
- 7 ft MIN.
Pedestrian Treatments

Provide pedestrians gates
Pedestrian Treatments

Provide pedestrians sidewalks
Pedestrian Treatments
Pedestrian Treatments

Provide pedestrians gates
ROUNDABOUTS NEAR HIGHWAY-RAIL GRADE CROSSING
Proposed New MUTCD Language

Section 8C.17 Grade Crossings Within or In Close Proximity to Circular Intersections

Support:
At circular intersections, such as roundabouts and traffic circles, that include or are within close proximity to a grade crossing, a queue of vehicular traffic could cause highway vehicles to stop on the grade crossing.
Proposed New MUTCD Language (cont.)

Section 8C.17 Grade Crossings Within or In Close Proximity to Circular Intersections

Support:
Among the actions that can be taken to keep the grade crossing clear of traffic or to clear traffic from the grade crossing prior to the arrival of rail traffic are the following:
A. Elimination of the circular intersection,
B. Geometric design revisions,
C. Grade crossing regulatory and warning devices,
D. Highway traffic signals,
E. Traffic metering devices,
F. Activated signs, or
G. A combination of these or other actions.
Roundabout Design/Location
QUEUE CUTTER SIGNALS
NEAR
HIGHWAY-RAIL GRADE CROSSING
A queue cutter signal is a traffic signal installed at a highway-rail grade crossing in a manner similar to a pre-signal.

A queue cutter signal is not connected to or operated as a part of a downstream signalized intersection.

The queue cutter’s function is to provide a means to prevent vehicles from stopping on the tracks or within the MTCD as a result of traffic queuing from a downstream signalized intersection.
Queue Cutter Signals

• Generally, a queue cutter signal is installed where the CSD exceeds 450 feet.

• A queue cutter signal installed less than 450’ from the downstream intersection WILL BE A PROBLEM.

• It is interconnected with the railroad warning system with a 3 to 5 second advance preemption time.
Queue Cutter Signals

Queue loops must use fail-safe design and vital loop processor system

Each loop wire has 2 independent loop circuits – a detect loop and a check loop

Queue cutter signal flashes red if there is a loop system failure
Queue Cutter Signals
Queue Cutter Signals
Queue Cutter Signals
Queue Cutter Signal Requirements

• A “safety critical” vehicle detection system using self check capabilities is used to activate the queue cutter control system.

• The vehicle detection system must detect the buildup of a queue of vehicles before the queue reaches MTCD.

• A queue cutter signal control system must have battery back-up.

• Any fault of the queue cutter system must result in a flashing red display.
Queue Cutter Signal Requirements

• The stop line location must be 40 feet in advance of the queue cutter signals.

• Queue cutter signals can be located upstream or downstream from the railroad crossing similar to pre-signals.

• The queue cutter signals and support structures must be located to maintain visibility of the railroad flashing-lights.
NEW TECHNOLOGY
#1 Stopping on Tracks - New Technology Solution

- Must use vehicle detection to identify a vehicle stopped on tracks
- **Must be capable of “distracting a distracted driver” to move a driver from the tracks**
- Wayside Horn produces focused high-intensity audible warning at errant driver
- Illuminated warning sign in driver’s immediate field of view provides clear and specific instruction to “Get Off the Tracks”
- Don’t Block the Box markings and signage
STOPPED ON TRACKS TECHNOLOGY

GET OFF THE TRACKS signs are LEDs, illuminated by vehicle detection system.

GET OFF TRACKS

STATE LAW

DO NOT BLOCK THE BOX

DO NOT STOP ON TRACKS

NY99-5 EXISTING

SEE DETAIL "A"

TUBULAR MARKERS
- 36" FROM EDGE LINE
- 15" Q.C. TIP

8" SOLID LINE

6" SOLID LINE

8" SOLID LINE

NOTE: 12" BETWEEN STOP LINE AND BOX

NY99-5 EXISTING
Stopped on Tracks Technology
ANOTHER TRAIN COMING
“Another Train Coming”

Enhances safety by providing additional visual and audio warning messaging at grade crossings with multiple tracks to direct pedestrian attention to the approach of trains that may not be visible.
Even when you do all you can, may not be enough:

May 15, 2016 – Wake County, North Carolina
A speeding Amtrak train hit a car stuck on the tracks in Wake County Sunday morning, and it's not the first time this driver escaped with her life.

Witnesses told authorities a woman's vehicle appeared to be stuck on the tracks after running through a crossing arm, despite it being in the down position with warning lights and bells activated.

Emergency workers said the same car and the same woman crashed through the same crossing arm two weeks ago. That day, authorities said she sped across the tracks and struck a tree to avoid being hit by the train.
CTC inc

Saving lives one crossing at a time

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