Predicting Gate Down Violations at Crossings

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About Northwest Indiana

- Heavy rail dependent industries
  - One of the largest Steel Production regions in US
  - Two large Oil refineries
  - Great lakes maritime shipping of raw materials
- Many Chicago bound commuters
- Major eastern gateway into Chicago for westbound railroad freight
NWI Rail Vision Working Group

- Representatives of the rail industry, local governments, INDOT, economic development, academics
- Charged with assessing region’s at-grade railroad crossings
  - Safety improvements
  - Economic and environmental impacts
  - Provide regional coordination for acquiring funding
  - Implement NIRPC’s 2040 regional plan
Limited Resources Require More Data for Better Decisions
21 Crossing Sites
Data Collection
Data Summary

- 24 hours 14 minutes of data collected over two spring seasons (2012, 2013)
- 21 crossings observed – All with twin gates and lights
- Data only collected during clear weather with dry pavement
- 229 Ticketable violations observed
- 0 Citations issued
  (No law enforcement present during data collection at all sites)
Sample of Issues
Data Analysis

- Additional data collected for each site
  - AADT (MPO/INDOT data)
  - Trains per day (FRA data)
  - Width of pavement
  - Number of lanes across tracks
  - Number of tracks
  - Flag for yard proximity if applicable
  - Advanced warning times tabulated from video
  - Post warning times tabulated from video
Types of Violations Identified

- **Pre-Train Violations**
  - Vehicles crossing tracks during moving gates
  - Vehicles crossing tracks around down gates

- **Post-Train Violations**
  (Potential 2\textsuperscript{nd} Train issue at several locations)
  - Vehicles crossing tracks during moving gates
  - Vehicles crossing tracks around down gates
Result of Statistical Analysis

- Multivariate regression preformed
- Variables were added and removed checking p-values
- Interaction between pairs of variables checked using p-values
- Only a variable was statistically significant with 95% confidence

- Resulting Model:
  - Predicted number of violations per crossing event = 0.0102 * Advanced Warning Time in Seconds (p-value 0.002)
  - 0.306 Violations expected per 30 seconds of advanced warning time
  - **1 violation expected for every 98 seconds** of advanced warning time
Advanced Warning Time

- Observations
  - Min: 25 seconds
  - Max: 147 seconds

- Standard Deviation Per Crossing
  - Min: 27.3 seconds
  - Max: 50.1 seconds
Voluntary Driver Compliance at Crossing

Average Gate Down Time
Example #2
Contributing Issues

- Mix of rail traffic operations at varying speeds
  - Switching operations
  - Siding entrances
  - Industrial
  - Through freight
  - Through passenger

- Driver “familiarity” with crossing
- Phasing of traffic single following preemption call
Gate Down Time Issues

- Railroad switching operations can create extended closures
- False positive gate activations
- Extended advanced warning time before train arrives
- Driver comfort / “knowledge” of crossing

- Mix of passenger and freight rail operations in region
- High(er) speed rail requirements
This Requires a team effort
Solutions

• Education
  • Drivers
  • Pedestrians
  • Children

• Advanced warning systems able to detect approach speed and acceleration to provide uniform warning time for all trains on all tracks
• Median Barriers
• 4 quadrant gates
• Enforcement
• Photo enforcement
Thank You!
Questions?

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