

# Predicting Gate Down Violations at Crossings

*Dr. Robert A. Rescot, P.E.*

*Assistant Professor of Civil Engineering*

**PURDUE**  
UNIVERSITY

CALUMET

2014 Global Level Crossing  
Safety and Trespass Prevention Symposium  
University of Illinois at Urbana-Champaign



*Paper #GLXS2014-1134*

# 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



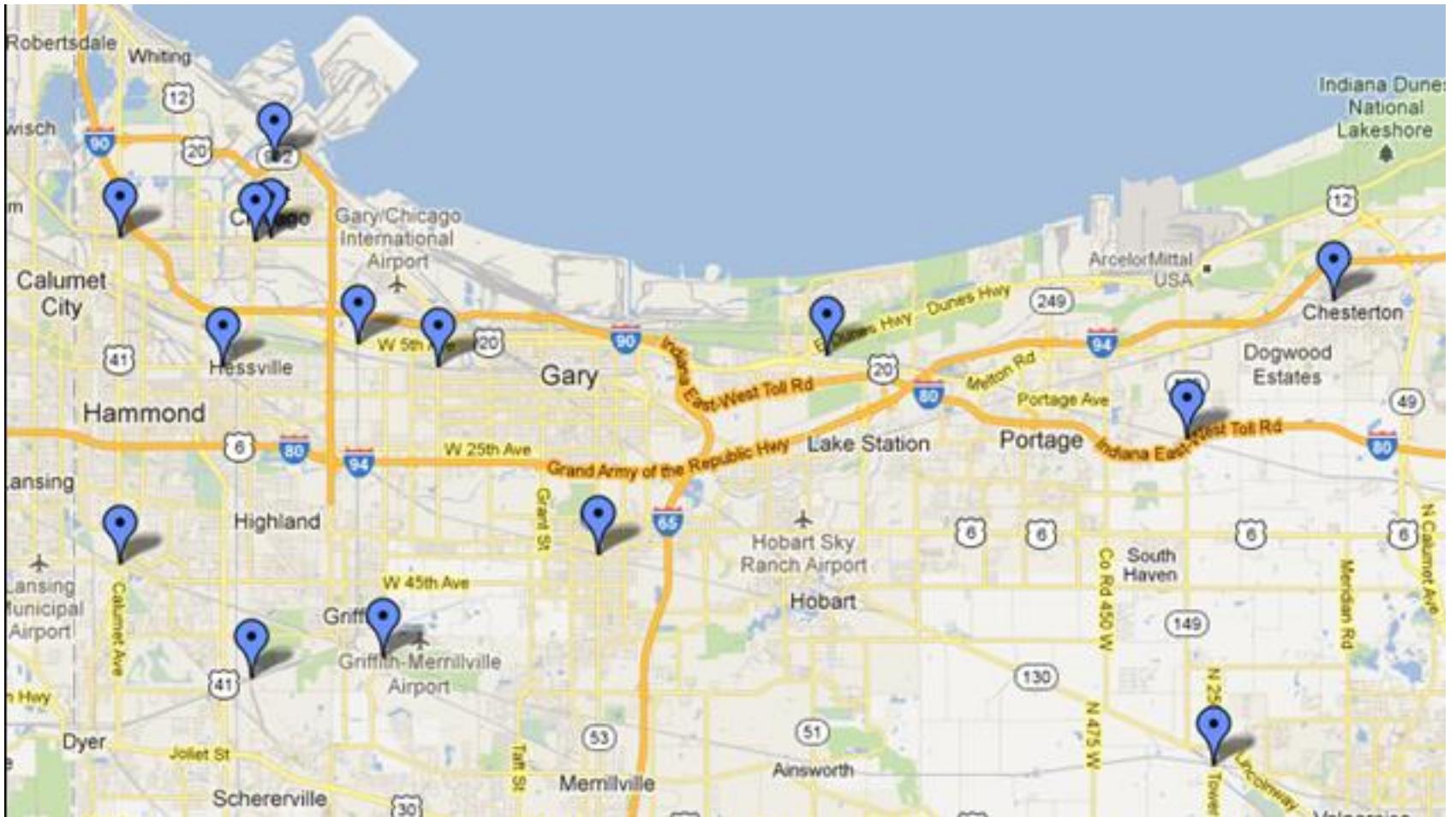
# NWI Rail Vision Working Group

- 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<sup>nd</sup> Train issue at several locations)
  - Vehicles crossing tracks during moving gates
  - Vehicles crossing tracks around down gates

# Result of Statistical Analysis

---

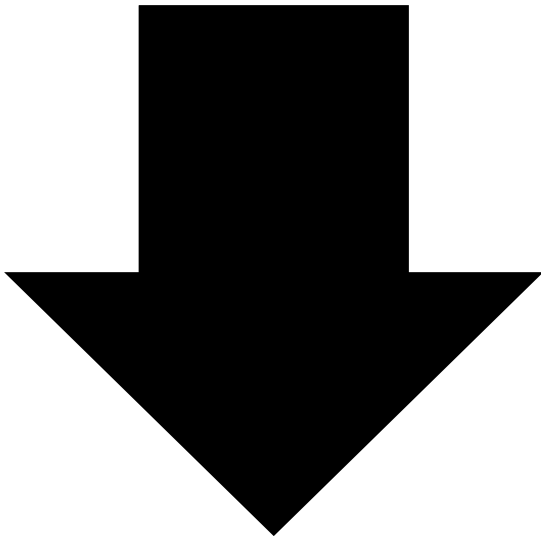
- Multivariate regression preformed
- Variables were added and removed checking p-values
- Interaction between pairs of variables checked using p-values
- Only a variable was statistically significant with 95% confidence
  
- Resulting Model:
  - Predicted number of violations per crossing event =  $0.0102 * \text{Advanced Warning Time in Seconds}$  (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

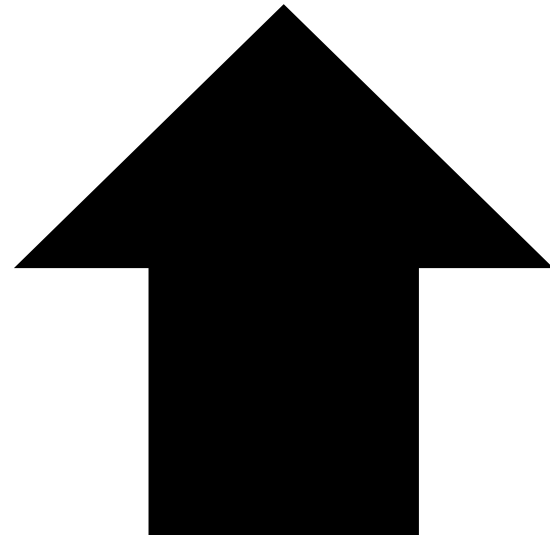
---

- 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

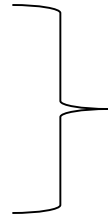


# Solutions

---

- Education

- Drivers
- Pedestrians
- Children



**OPERATION  
LIFESAVER®**

---

**Look, Listen & Live**

- 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?

---

**PURDUE**  
UNIVERSITY  
CALUMET

Robert A. Rescot, Ph.D., P.E.  
219-989-3147  
[robert.rescot@purduecal.edu](mailto:robert.rescot@purduecal.edu)

