Pedestrian/Bicyclist Warning Devices and Signs at Highway-Rail and Pathway-Rail Grade Crossings

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UTC History

- Founded as the University of Illinois Transportation Research Center in 1979.
- Resides within the UIC College of Urban Planning & Public Affairs.

UTC Research Team

Unprecedented Level of
Transportation Research Experience

Three Ph.D. Research Professors
Three Master's Level Investigators
More than 25 Graduate Assistants
Seventeen Affiliated Faculty

Five UTC Research Clusters

1. Transit
2. Funding & financing
3. Freight
4. Data development
5. Safety

Webinar Objective

- Highlight thematic areas, specific issues and context sensitive countermeasures related to pedestrian safety at rail grade crossings
- Offer an informed and focused discussion for researchers and practitioners involved with safety at rail grade crossings

The Problem

- Declining number of fatalities due to vehicle-train collisions at highway-rail grade crossings
- Non-motorist fatalities at rail-grade crossings remain relatively unchanged

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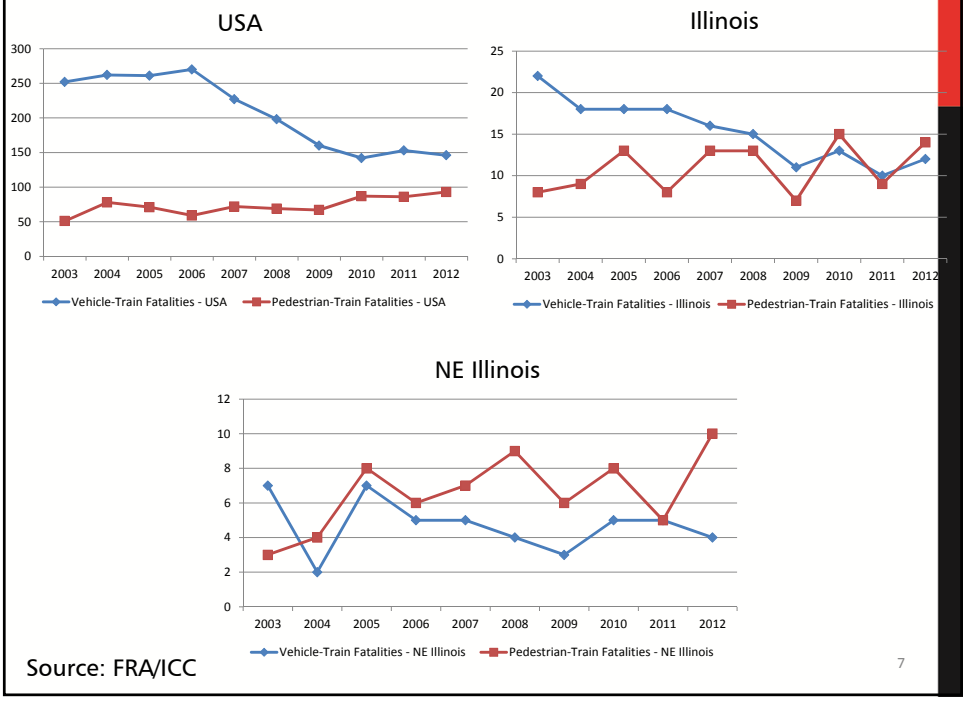

Source: FRA/ICC

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Railroad Operators and Grade Crossings in the Chicago Area

Railroad Operator	Name	Number of Crossings	2006 - 2010 Collision History
ATK (*)	Amtrak	2	2
BNSF (*)	Burlington Northern Santa Fe	193	29
BRC	Belt Ry. Co. of Chicago	38	5
CCUO	Chicago-Chemung RR Corp.	4	0
CHTT	Chicago Heights Terminal Transfer	20	5
CN (*)	Canadian National Ry.	353	36
CP (*)	Canadian Pacific Ry.	44	4
CRL	Chicago Rail Link	17	1
CSS	Chicago South Shore & South Bend	1	0
CSX (*)	CSX Transportation	71	9

Railroad Operators and Grade Crossings in the Chicago Area (cont.)

Railroad Operator	Name	Number of Crossings	2006 - 2010 Collision History
CTM	Chicago Terminal Railroad	80	2
IHB	Indiana Harbor Belt Railroad	45	6
MJ	Manufacturers' Junction Ry.	1	0
NICD/NICTD	South Shore Line	2	0
NIRC-Metra	Northeast Illinois Regional Commuter Railroad	361	54
NS (*)	Norfolk Southern Ry.	34	8
SCIH	South Chicago & Indiana Harbor Railway Company	2	0
UP (*)	Union Pacific Railroad	384	73
WSOR	Wisconsin & Southern Railroad	13	0
Total		1665	234

The Difficulty

- Crossing violations vs. trespassing
- Dedicated pedestrian crossings vs. highway-rail crossings
- Crossings with commuter/light rail vs. freight rail
- Multiple types of non-motorized users

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What We Know

- Trespassing fatalities
  - Alcohol, drugs
  - Adult Male, White
  - 23% suicides
- Countermeasures
  - Fencing, landscaping, signs

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What We Know (cont.)

- Warning Devices
  - Active devices reduce risky behavior
  - Selection criteria
    - Collision experience
    - Pedestrian volumes
    - Train speeds, # trains
    - Sight distance
    - Crossing/track angle

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What We Know (cont.)

- Accessible Signals
- Intelligent Grade Crossings
- Engineering, Education & Enforcement
- Cost breakdown for active warning systems
  - 25% to35% for installation (Class I)
  - 20% to 25% for train detection (could be lowered)

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What We Know (cont.)

- Engineering Standards and Guidelines
  - Guidance (FHWA Handbook, MUTCD, AREMA, CalTrain, Metrolink, CPUC, APTA)
  - TCRP Report 69: decision tree for selecting suitable treatments
  - Risk-scoring methodology to evaluate safety factors at station pedestrian crossings
  - Operational models that account for pedestrian volumes (e.g., ALCAM)

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Findings from a Survey of Experts

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Prioritization of Safety Upgrades

- Safety upgrades at dedicated pedestrian crossings are not prioritized as highly as those at rail-highway grade crossings unless these two types of crossings are adjacent to each other (e.g., adjacent sidewalks on one or either side of a rail-highway crossing extending to the other side of the tracks).

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Engineering Standards

- States with substantial passenger, commuter and freight rail operations are leading the effort to develop guidelines and engineering standards for safety improvements.
- It is likely that pedestrian safety at rail grade crossings will benefit in the longer term by the increasing consistency in standards for warning devices and treatments among organizations responsible for this task.

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Cost Considerations

- Cost estimates and/or actual costs of the warning systems already installed are not readily available despite federal (Section 130) requirements to the contrary.
- This is probably due to the fact that such funds are usually absorbed into much larger projects (e.g., grade separation).

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Cost Considerations (cont.)

- A cost breakdown for design, installation, component, maintenance and operating costs is rarely finalized as the actual costs keep changing as they move from the planning stage, to the design stage, to the design & build stage.
- With the low number of fatalities at grade crossings it would be very difficult to assign a cost-effectiveness value to a particular treatment.

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Cost Considerations (cont.)

- Finally, cost oversight from state departments of transportation may be needed to effectively manage targeted funding for grade crossings safety improvements.

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Funding Availability

- The vast majority of funding available for safety improvements is programmed for rail-highway crossings, and very rarely exclusively for dedicated pedestrian grade crossings.
- It would be critical that Section 130 funding remain exclusive to railroad safety and not rolled back with other highway funds.
- Continuing this source of support would help maintain the level of expertise for rail safety at the FRA as well at state departments of transportation.

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Selection Criteria

- Criteria for the selection of warning devices are used in a rather ad hoc manner on a case-by-case basis likely due to a lack of available methods to assess criteria tradeoffs.
- In practice, the process happens as a consensus-building exercise among the diagnostic team members.

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Accessible Pedestrian Signals

- The lack of Accessible Pedestrian Signals at pedestrian-rail grade crossings is mainly due to the shortage of dedicated funding for such crossings.
- Another reason for the infrequent use of accessible signals at rail grade crossings is the lack of standardization among manufacturers.

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Education and Enforcement Campaigns

- Strong local advocacy and adequate funding are needed for effective education, outreach and enforcement safety campaigns.
- Such campaigns should continue unmitigated with additional service improvements in different geographic locations.
- Campaigns for LR grade crossing safety can be more effective with the active participation of a transit agency and a captive local audience exposed to the frequency of transit operations.

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Risk Management

- There is no consistent approach for managing the risk at pedestrian-rail grade crossings to assure:
  - uniformity/continuity of data collection programs
  - analysis of risks at such crossings;
  - prioritization of crossing upgrades;
  - introduction of suitable risk controls;
  - assessment of cost effectiveness of such measures.

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Public and Private Stakeholders Responsibilities

- Regulatory authorities make the selection of safety upgrades and want to maximize the public investment in the long run
- Operating railroads are responsible for the installation and life-cycle costs and want to minimize the life-cycle costs of a technology to become obsolete before the end of its life and thus expensive to maintain.

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Quiet Zones

- Distracted non-motorized users, especially when traveling in groups, at grade crossings within quite zones may not be sufficiently alerted to an incoming train, especially when a second-train is coming from the opposite direction.

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Findings from a Survey of Non-motorized Users

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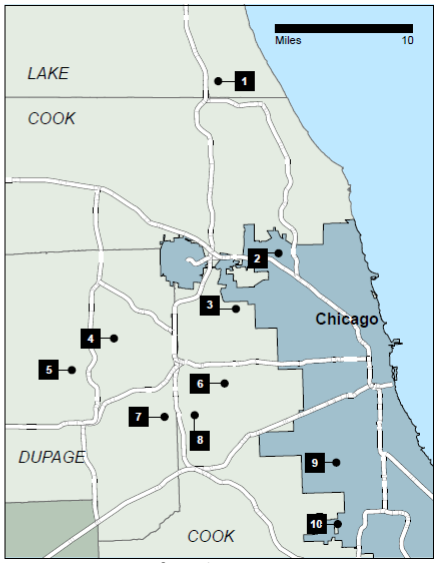
Crossings with Collision History and Crossings where Conditions are Ripe for Accidents

SURVEY SITES

Railroad crossing intersection	Collisions 2006-10
1 Osterman Ave. and Elm St. (Deerfield)	0
2 Nagle Ave. and Northwest Hwy. (Chicago)	5
3 75th Ave. and Marwood Ave. (Elmwood Park)	0
4 Ardmore St. and Terrace St. (Villa Park)	0
5 Park Blvd. and Crescent Blvd. (Glen Ellyn)	0
6 Harlem Ave. and East Ave. (Riverside)	3
7 Symonds Dr. and Park Ave. (Hinsdale)	0
8 La Grange Rd. and Burlington Ave. (La Grange)	3
9 Marquette Blvd. and Kolmar Ave. (Chicago)	0
10 119th St. and Vincennes Rd. (Chicago)	0



Courtesy of Jordan Snow, UTC

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US DOT Inventory No.	County Name	City Name	Railroad Line (Operator)	Operating Railroad (Type of Train)	Street Name	Crossing Type and Pedestrian Warning Device	2006–10 Collision History
608830M	Cook	Chicago	NIRC RIM (Metra)	Metra (Metra only)	119th St	Highway-rail crossing with no pedestrian gates	0
079493L*	Cook	Riverside	BNSF A (Amtrak & Metra)	BNSF (Metra, Amtrak, Freight)	ILL43/Harlem Ave	Highway-rail crossing with pedestrian gates	3
173887G*	Cook	Chicago	UP CNWO (Metra)	UP (Metra, Freight)	Nagle Ave	Highway-rail crossing with pedestrian gates	5
079508Y*	Cook	La Grange	BNSF A (Amtrak & Metra)	BNSF (Metra, Amtrak, Freight)	US12/La Grange Rd	Highway-rail crossing with pedestrian gates	3
174948Y*	DuPage	Glen Ellyn	UP CNWA (Metra)	UP (Metra, Freight)	Park Blvd	Highway-rail crossing with pedestrian gates	0
843811C	Cook	Chicago	BRC M	Belt Railway Company (Freight only)	Marquette Rd	Highway-rail crossing with pedestrian gates	0
388040W	Lake	Deerfield	NIRC A (Amtrak & Metra)	Metra (Metra, Amtrak, Freight)	Osterman Ave	Highway-rail crossing with pedestrian gates	0
079521M	DuPage	Hinsdale	BNSF A	BNSF (Metra, Amtrak, Freight)	Ped/Park St	Stand-alone pedestrian crossing with gates	0
174937L*	DuPage	Villa Park	UP CNWA (Metra)	UP (Metra, Freight)	Ped/Villa Park Depot	Pedestrian crossing with pedestrian gates, another train warning sign and channelization	0
372128W*	Cook	Elmwood Park	NIRC L6 (Metra)	Metra (Metra, Freight)	Ped/Elmwood Pk Depot	Platform crossing with pedestrian flashers	0

*High-risk crossing with an APF value ≥ 0.05.

Camera location at the crossing on 119th Street in Chicago.

Crossing 608830M – A view from the ground.

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Camera location at the crossing on Harlem Avenue in Riverside.

Crossing 079493L – A view from the ground.

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Camera location at the crossing on Nagle Avenue in Chicago.

Crossing 173887G – A view from the ground.

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Camera location at the crossing on LaGrange Road in LaGrange.

Crossing 079508Y – A view from the ground.

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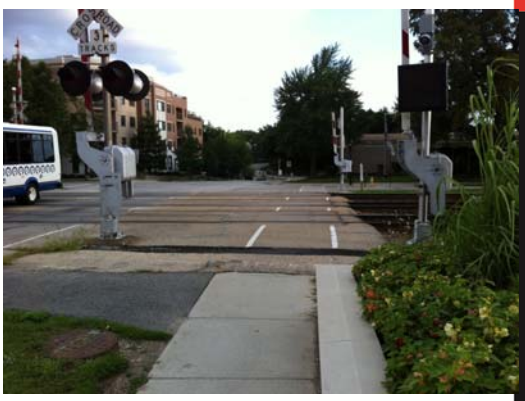
Camera location at the crossing on Park Boulevard in Glen Ellyn.



Crossing 174948Y – A view from the ground.

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Camera location at the crossing on Marquette Road in Chicago.

Crossing 843811C – A view from the ground (courtesy of ICC).

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Camera location at the crossing on Osterman Avenue in Deerfield.

Crossing 388040W – A view from the ground.

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Camera location at the crossing on Park Street in Hinsdale.

Crossing 079521M – A view from the ground.

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Camera location at the Villa Park Depot crossing in Villa Park.

Crossing 174937L – A view from the ground.

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Camera location at the Elmwood Park Depot crossing in Elmwood Park.

Crossing 372128W – A view from the ground.

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Findings

- Talking on a cell phone, pushing a stroller, or listening to music on earphones, may interfere with environmental awareness while traveling across a grade crossing.
- Active warning signs at grade crossings are noticed more often than passive warning signs.

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Findings (cont.)

- Younger users are more likely to notice active warning signs.
- Older users notice passive warning signs more often.

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Findings (cont.)

- Pedestrian gates had the highest level of awareness of all warning signs and devices.
- Half of all respondents did not suggest anything to improve safety.
- Of the half that did: adding pedestrian gates was the most popular response, followed by increased enforcement and grade separation.

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Findings (cont.)

- Being a regular user (at least a few times annually) at pedestrian-rail grade crossings appears to help with awareness of signs and warning devices.
- Regular users appear to be more safety conscious compared with irregular users.

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Findings (cont.)

- Overall, female respondents in all age groups appear to be more safety conscious than male respondents when using a crossing.
- Young males (under 21 years old) appear to be the only group in this sample more likely to cross the tracks against activated signals/warning devices.

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Findings (cont.)

- Trespassing by crossing the tracks at locations other than a pedestrian crossing is still a habit of a small minority of users that merits attention.
- Safety improvements at pedestrian grade crossings should always consider the special needs of people with disabilities, who constitute a sizable minority of users.

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Findings (cont.)

- More intensified educational and enforcement campaigns may be necessary to convince all pedestrian users that it is illegal (1) to cross against activated signals/devices, and (2) crossing the tracks at locations other than a pedestrian crossing constitutes trespassing.

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Findings (cont.)

- Survey respondents admitted a higher violation propensity in rail grade crossings with passenger-only operations, followed by crossings with freight-only operations, and, lastly, by crossings with combined passenger and freight operations.

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Findings from Video Monitoring of Non-Motorized Users

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Findings

- Pedestrians who took the most risk by ignoring lowered gates found themselves in need to have to cross the tracks in a hurry compared with pedestrians who adhere to the rules.
- Larger groups of pedestrians are more likely to commit a violation against activated devices or signs compared with lone or groups of two pedestrians.

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Findings (cont.)

- In certain situations with larger platoons crossing the tracks at the same time (e.g., getting on/off commuter/light rail, school start/end times), the clearance interval would be longer, which has potential implications for extending the warning times by providing more advanced warning.

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Findings (cont.)

- Pedestrian gates have an even stronger effect on deterring actual (compared with stated) pedestrian behavior of crossing the tracks illegally, even after controlling for variations between crossings and train direction.

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Conclusions

- As consistency of engineering standards improves it would be important to monitor the impact on pedestrian safety.
- High speed passenger rail service will require re-education of pedestrian users regarding safety impacts at or in the vicinity of or away from grade crossings.
- It is increasingly important to better track the programming and the expenditure for safety upgrades at grade crossings.

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Conclusions (cont.)

- There is a need to develop a cost-effectiveness evaluation process to facilitate the activities of a diagnostic team.
- It is important addressing the needs of users with disabilities at grade crossings to better manage the risk for catastrophic incidents.
- Continuation of adequate funding for strong local advocacy toward education and enforcement activities is critical to pedestrian safety.

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Conclusions (cont.)

- Development of an appropriate risk management approach would better support the planning, programming and implementation of safety upgrades at pedestrian grade crossings.

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Thank You!

Questions?

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