Berkeley University of California
Traffic Safety Center SETTING NEW DIRECTIONS IN TRAFFIC SAFETY
Newsletter

Spring 2008
Vol. 4, No. 4

Other stories—

What Did Your Walk to School Today Do to (or for) You?...

Making the Way to School Safer...

TRB 2008 Posters

How San Francisco's Public Health Department Found Its Voice...

The Graduate Student Researchers at the TSC

Search ALL Issues of the *TSC Newsletter*

Go

The Safety Run-Around that Happens at Rail Crossings

TSC researcher Doug Cooper presenting his paper, "Addressing Inappropriate Driver Behavior at Rail-Highway Crossings," at the session on "Assessment of Technology and Geospatial Location Effects on Highway-Rail Grade Crossing Safety" at the 2008 Annual Meeting of the Transportation Research Board.

At-grade rail crossings are regularly the scenes of gambles by drivers that they are simply not physically capable of winning: they are wagering that they can correctly measure the speed of an approaching train and get across the tracks before it arrives. These drivers' behavior and how to protect them from themselves are the subject of TSC researcher Doug Cooper.

"Our starting point is that there is a group of people that, for whatever reason, run gates. Rather than try to figure out why they do it, we want to know why they're so bad at it—and what we can do to stop them," Cooper said as he introduced his talk, "Addressing Inappropriate Driver Behavior at Rail-Highway Crossings," at the 2008 annual meeting of the Transportation Research Board.

Cooper has been studying rail crossing safety for the **California Department of Transportation** (Caltrans) as part of the TSC's rail crossing safety research program. "In California, we have approximately 7,700 public at-grade railroad crossings." About 40 percent of them have gates, but, discouragingly for safety advocates, gate-protected crossings is where 73 percent of the nearly 600 train-vehicle crashes from 2000 to 2004 occurred.

Lowering the Gates Doesn't Always Send a Clear Signal

"Clearly for some people, lowered gates are merely the starting point of a decision-making process rather than a sign they should stop," Cooper said.

Cooper played videos illustrating the more common crossing violations. In one, cars stopped at a conventional crossing gate start, one by one, to peel out of the line and drive across the tracks, before the train appears. A second video was shot from the front of the northern California Napa wine train. The train moves relatively slowly along a route that takes it across numerous passive crossings, where the road goes directly over the tracks with no more warning than the standard cross-buck. At one point a driver barely clears the tracks in time; in another image, a truck driver pulls out in front of the train, not realizing at first that the end of his vehicle is still on the tracks. No crashes take place in part because there is time to react because the train moves so slowly.

On a more serious note, two videos captured fatal collisions. In one, a car drives around the lowered gates and is hit by a train, killing four young people inside.

The other shows a car driving down a street that is blocked by a train crossing at the end of the block. The car turns left through a parking lot so that it is running parallel to

the train, in essence, racing the train to the next crossing. The driver, a woman, is winning the race.

Cooper narrated the next sequence: "Unfortunately, there's another train coming from the other direction. She's got four kids in the car. When she starts her slight swing left to exit the parking lot, you can see the other train coming. She starts her hard right hand turn and doesn't see that train at all, she's looking at the one she's racing. So the second train hits her, knocks her into the first, the one she was actually racing. As I mentioned, there were four kids in the car: two girls that were not strapped in, two boys that were. The mother was not strapped in. The three females were ejected. The two girls died immediately. The mother died about a week later. The boys survived; they were hurt but they survived."

The images, Cooper said, "serve as a reminder of why we are here today and what we are trying to do."

Decisions, Decisions, Decisions: what happens at a rail crossing

Cooper is studying the driver's decision-making process. He described a simple two-part model:

- First, the driver tries to judge how long it will take the train to arrive at a rail crossing. That involves familiarity with crossings in general, familiarity with this particular rail crossing and finally the driver's physical abilities.
- Second, the driver tries to figure out how long it will take him to cross. There's a built-in buffer, along with the perceived delay cost, the perceived crash cost and the driver's risk-tolerance.

"What I'd like to do is to take a closer look at the first part of this equation, which is, judging time to arrival," Cooper said.

"Humans start out with two strikes against them," he said. Detecting speed from changes in an object's size is very difficult.

"We judge the speed of an object coming directly at us by how quickly it grows in size." But the growth in size is not linear.

In this animation made by the National Transportation Safety Board, the train is approaching at 40 mph from 1,000 feet away. The entire sequence is 17 seconds long. It illustrates how slowly the train size increases at first and then suddenly blooms. By the time the driver realizes how close the train is, it is too late, even though the train is traveling at a relatively moderate speed of 40 miles per hour.

The second "strike" against humans is the inability of the human eye to correctly judge the speed of large objects, known as the Leibowitz hypothesis.

"If you've ever watched a 747 come in for a landing, it looks like it's barely moving, when obviously, it's moving very fast," Cooper explained. The same principal is at work.

"So what to we do with people who trust their own judgment and go around gates?" Cooper asked.

Possible—and Practical—Solutions

Ideally, crossings would be blocked off so securely that cars could not go through them when a train approached. Installing such devices at all the crossings in the country would cost too much. And train crashes are so random, it's not possible to target the improvements. In California, of the more than 900 crossing crashes that happened over 10 years, nearly three-quarters occurred at site where that was the only crash in that decade.

Other options are outlined in Cooper's paper: long-arm gates that cover at least three-quarters of the roadway, media separators, four-quadrant gates and photo enforcement.

Of the four, long-arm gates and media separators seem the most practical for a variety of reasons. Long-arm gates are effective, but there are limits on where they can be located, and maintenance and installation costs could be high.

Median separators would be one way to prevent drivers from going around lowered gates without incurring high costs.

Median separators are less costly and more adaptable to different settings (though transportation agencies in snowy climates have

encountered difficulties in snow-clearing when they are installed). They cost about one-tenth of the more expensive treatments.

They consist of mountable centerline medians with channelization devices that can be applied directly to the existing roadway, often without requiring street widening, or can be added as part of a more complex structure consisting of an island with reflectors mounted on the top. Such systems present drivers with a visual impediment to crossing into the opposing traffic lane yet are designed to allow emergency vehicles to cross over.

"There are always going to be people who will make bad decisions at rail-highway crossings, Cooper said. If we can't eliminate gate-running completely, then the key is to make it more difficult to cross the tracks when it's not safe to do so, and the low-tech median separator would be a good start.

—Phyllis Orrick