Stopped on the Tracks... And No Place to Go

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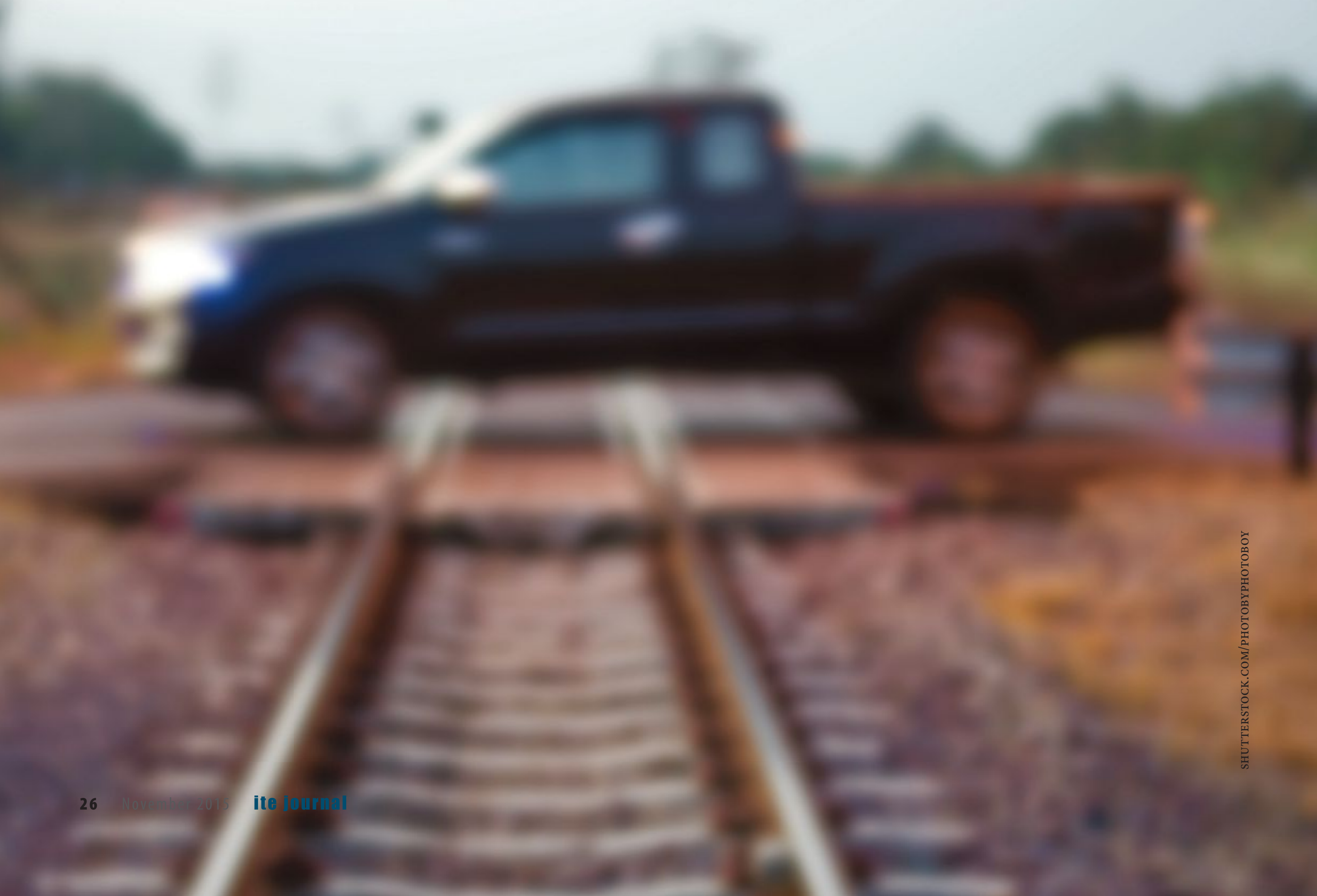
A train strikes a vehicle or person on average every three hours in the United States, resulting in more than 2,200 accidents each year. In 2014 alone, these accidents resulted in 269 fatalities and more than 840 injuries. While the number of injuries is on the decline, the number of fatalities has increased by more than 15 percent in just the last year.[1]



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A vehicle is stopped on tracks at a crossing.

This public safety issue has risen to the forefront among not only engineers, transportation safety experts, and legislators, but also among the general public, largely due to several severe and highly publicized crashes at railroad crossings throughout the country.

While the loss of lives is devastating and unbearable to families and communities, it is even more tragic because, in many cases, these accidents are preventable with engineering design and technology that exists today.

With more passenger vehicles and more trains crisscrossing the country, the risk factor has increased substantially. Just over half of the 250,000 railroad crossings are public at-grade crossings; only half of those have automatic warning systems, and less than a third have flashing-lights and gates.

Surprisingly, more than 60 percent of train-vehicle collisions occurred at crossings that had active warning devices in place, which indicates that drivers are not exercising enough caution—or paying attention to warning systems at railroad crossings—and are literally stopped on the tracks with no place to go. It's easy to point to driver error; we all know stopping on the tracks is illegal. But, does all the blame fall on the driver? Or can the system design be improved to help prevent motorists from being stopped on the tracks?

So what is the answer?

Changing human behavior, while the obvious solution, is easier said than done. No amount of public education will eliminate reckless behavior, such as driving around lowered gates, racing to cross the tracks to "beat" the train, or simply not paying attention to one's surroundings. Increased enforcement at railroad crossings, while preventive, is not a broad-scale solution due to the exorbitant amount of resources it would require to monitor the nation's quarter-million crossings.

Other solutions, like increasing the waiting time at crossings from the current 20 to 25 seconds to more than 3 minutes, do not have wide-spread support in the industry or with roadway authorities. Research has shown that excessive warning times can lead to undesirable driver action such as driving around lowered gates, increasing the likelihood of train-vehicle interaction. An extended

Critical design elements to consider when interconnecting the traffic signal equipment:

- Complete an on-site diagnostic meeting with knowledgeable representatives to make determinations concerning safety needs at the crossing.
- Determine and request an appropriate amount of preemption time from the railroad.
- Determine type of railroad preemption operation desired (advance or simultaneous).
- Incorporate enhanced preemption circuitry (supervised, gate down, crossing active, and traffic signal health)
- Provide adequate track clearance green interval to clear a motorists that may be stopped on the tracks.
- Test the functionality of the traffic signal controller prior to placing the system into operation.

Each crossing location is unique. The agency should perform due diligence to determine the solution(s) or product(s) that best meet site-specific conditions for the highway-rail grade crossing.

warning time can also lead to additional safety issues such as lengthy vehicle queues extending back through nearby intersections or freeway exit ramps, resulting in severe gridlock near these crossings.

The solutions, therefore, need to rely on current and emerging technology and best design practices that can provide opportunities to improve safety and reliability of the integrated preemption system at railroad crossings and help reduce the chance of motorists being "stopped on the tracks…and no place to go."

The key lies in educating the industry on how best to make use of this technology and design practices to reduce train-vehicle collisions. Improving the traffic operations and working together with the railroad is the first step.

Improved Traffic Operations

Analysis of incident data shows that a substantial number of collisions occur at crossings located in close proximity to a nearby highway intersection. This underscores one of the biggest challenges and most significant needs: how to improve safety technology between roads and rails to mitigate, as much as possible, the effects of human behavior. Addressing safety through only one modality—addressing traffic engineering along the road without considering the effect on a railroad crossing or vice versa—does little to reduce risks. The two systems must work together to improve the overall safety at the crossing. The following are key elements which should be coordinated with the railroad:

Traffic Control

Grade crossings that have experienced multiple crashes are often found at locations where there is greater potential for vehicles to stop on the tracks due to downstream queuing from an intersection with a parallel roadway. The intersection may be signalized, but in many cases is controlled by a stop sign. Other contributing factors may include roadway geometry, limited sight distance, and the possible need for a change in the intersection traffic control devices. Although the grade crossing may already be equipped with flashing-lights and automatic gates, these railroad warning devices alone do not address the issue of a vehicle queue extending over the track.

In the case of a stop-controlled intersection located near a highway-rail grade crossing, installing a traffic signal and incorporating properly designed railroad preemption may be a solution. Warrant 9 of the U.S. *Manual on Uniform Traffic Control Devices* designates that a traffic signal may be installed at locations where none of the other eight traffic signal warrants are met, but where the intersection is located near the grade crossing. Other possible alternatives to consider include widening the pavement to provide increased storage space between the track and the parallel roadway, prohibiting turns near the crossing, installing an acceleration lane or reassigning the stop signs at the intersection to make the approach across the track non-stopping.

Railroad Preemption

Railroad preemption addresses the issue of vehicles stopped on the tracks by a downstream traffic signal. When properly designed and maintained, it has proven to effectively reduce the risk and number of vehicle-involved train accidents, as well as increase the safety of motorists, train operators, and passengers. The fundamental purpose of railroad preemption is to clear the track area before the train arrives at a crossing. The technology coordinates the flow of traffic, traffic signals, railroad gates, and flashing-light signals to afford an opportunity for a motorist to move clear of the tracks before potential impact.

While the concept of preemption has been around for decades, the technology has improved dramatically in recent years, particularly with the implementation of enhanced circuitry to improve the safety of the crossing. Today's highway-rail grade crossings can deploy a multitude of interconnection circuits, which can be used individually or in combinations to ensure that the railroad warning devices and traffic signal are operating together as one. A full array of programmable and wiring options in the traffic signal equipment further simplifies the interconnection process.

Railroad Warning Time

While providing an interconnection between the railroad and traffic signal equipment is a first step, the advantages of railroad preemption are essentially negated without the proper amount of

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A stop-controlled intersection located near a highway-rail grade crossing.

Automatic gates should be installed to provide effective railroad preemption.

railroad warning time. It is imperative that the agency perform due diligence in calculating and requesting the amount of time required for optimum preemption to safely clear vehicles queued over the tracks. There are several existing preemption calculation forms to assist agencies in determining the amount of additional preemption time needed from the railroad above the minimum 20 seconds mandated by the Federal Railroad Administration.

It is also essential to understand how trains operate when approaching each railroad crossing. In the event that trains perform switching moves or stop and restart from stations near crossings, the time provided for preemption may be substantially reduced; through trains will usually dictate the design time. To address the issue of reduced time for preemption, additional enhanced circuitry from the railroad becomes necessary. This circuitry permits the traffic signal sequence to advance to the track clearance interval more rapidly when reduced time occurs.

Track Clearance Green

The track clearance interval is another essential element of the preemption system; it is the period of time programmed into the traffic signal controller that the green indication is displayed to vehicles stopped between the railroad automatic gate and the parallel roadway. The track clearance green indication affords an opportunity for these vehicles to start and move clear of the track, provided there is adequate railroad warning time. It is critical that the track clearance green not change until after the flashing-lights have started their operation and the automatic gate arms have reached the horizontal position. The recommended practice to ensure that the traffic signal sequence does not terminate the track clearance interval early is to properly implement a gate-down circuit.

Automatic Gates

Designing a railroad warning system that does not include automatic gates at a preempted traffic signal location is not a recommended practice. Ideally during preemption, the traffic signal operation displays a track clearance green indication to clear vehicles stopped within the track area and then the gates descend to prevent other vehicles from entering. However, when the crossing is not equipped with gates, the track clearance green display sends conflicting messages to roadway users approaching the grade crossing as the train approaches: drivers see the railroad flashing red lights concurrently with the track clearance green indication. In order to eliminate any possible misinterpretation which may result, automatic gates should be installed to provide effective railroad preemption.

Collaboration is Key to Success

There is no solitary, fail-safe answer from any company, organization, or agency to stem the tide of train accidents; everyone owns the problem. Collaboration is the key to successfully finding and implementing effective, life-saving solutions.

Promoting and regulating interconnectivity and proper preemption operation among state and local road authorities, while no small challenge, is an essential first step in advancing safety at railroad crossings. Securing broad-based acceptance of the proven effectiveness of enhanced preemption technology is also critical; while railroad preemption is a small percentage of what takes place in the operation of a traffic signal, it has the greatest potential of preventing injuries and loss of life when motorists are stopped on the tracks and a train is approaching.

We need to get our drivers and vehicles off the tracks and to safety. One more fatality is too many with proven, viable design and technological solutions at hand. **itej**

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Additional Resources

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For more on this topic, participate in an ITE Learning Hub Webinar:

Stopped on the Tracks: Preventing Accidents with Engineering Design & Technology Webinar

Date: November 17, 2015

Time: 12:00 p.m.–1:30 p.m. (ET)

Register: http://ecommerce.ite.org/imis/Event.aspx?EventKey=LMSW06

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