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OFFICE OF TRANSPORTATION SYSTEM MANAGEMENT

IMPLEMENTATION SUMMARY

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PROJECT COST:

\$99,224



Passive railroad crossings feature painted crosswalks and stop or yield signs. Minnesota has over 2,500 crossings like this that offer no signal to motorists of an approaching train.

Putting Research into Practice: Using a New, Risk-Based Strategy for Improving Railroad Crossing Safety

What Was the Need?

The safety of road users at Minnesota's 4,000-plus railroad grade crossings has improved in recent decades. In the early 1990s, over 100 automotive crashes per year occurred at rail crossings in Minnesota. Currently, the state records about 45 crashes per year, of which five involve fatalities. MnDOT oversees crossings on all roadways, though only 5 percent of crossings are on state highways.

MnDOT's goal is zero fatalities at grade crossings. Actively controlled crossings, which combine flashing lights and lowered gates triggered by the approach of trains, represent the gold standard in safety mechanisms for MnDOT. However, over one-third of crossing-related crashes and half of the fatalities still occur at such crossings. Other solutions are needed, including education, enforcement and reduction in the number of at-grade crossings. Upgrading passive crossings—which feature only crossbucks (x-shaped signs), painted crosswalks, and yield or stop signs—to active crossings cost between \$300,000 and \$500,000 each. Grade separations cost millions. With over 2,500 passive crossings, and many active crossings at the end of their functional lives, Minnesota would need centuries at current funding levels to upgrade every crossing.

MnDOT has closed 500 redundant crossings in recent years, but the practice can meet with considerable local resistance. Stretching resources to strategically upgrade railroad crossings is critical to achieving a goal of zero deaths at such sites.

What Was Our Goal?

MnDOT has used conventional methods for prioritizing rail crossing upgrades. The models employed by these methods rely heavily on recent crash numbers. However, data for Minnesota show that more than 50 percent of crossings with injury crashes have experienced no previous crashes. MnDOT sought an approach to prioritizing grade crossing safety improvements that would anticipate where crashes might occur rather than just reflect where they had already occurred.

What Did We Implement?

Conventional spending strategies fund highway safety upgrades at the sites where most crashes occur. In Minnesota, this practice funneled the bulk of funds into the Minneapolis-St. Paul area. While the counties outside that area reported only 30 percent of highway crashes, they experienced 70 percent of the fatal and serious injury crashes. In 2011, Minnesota switched to a method of distributing safety improvement funds that was proportional to the distribution of fatal and serious injury crashes. Since employing this innovation, the state has seen its highway fatality rate fall by 25 percent, though this change cannot yet be definitively credited to safety efforts.

For the implementation described here, investigators created a similar, risk-based model for rail crossings.

Investigators created a new model for selecting railroad grade crossings for safety upgrades. The risk-based strategy, adapted from MnDOT's innovative approach to highway safety, allowed MnDOT to create a rail crossing upgrade plan based on risks of injury and death at crossings throughout Minnesota.

“We implemented this risk-based approach when we were looking at safety upgrades for our fiscal year 2018 program. This project helped us validate risk factors and identify crossings that didn’t normally come up using the Federal Railroad Administration’s accident prediction equation.”

—Maureen Jensen,
Assistant Director,
MnDOT Office of Freight
and Commercial Vehicle
Operations

“This risk-based approach identifies railroad grade crossings with characteristics that are much more likely to contribute to crashes. MnDOT has already taken this approach on the highway side, and the rest of the country is just catching up.”

—Howard Preston,
Senior Transportation
Engineer, CH2M Hill, Inc.

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Active railroad crossings feature gates that lower and lights that flash when trains approach the crossing. The best of these also include medians to discourage motorists from driving around the gates.

How Did We Do It?

Investigators conducted a thorough study of rail crossing crashes in Minnesota from 2004 through 2013. Analysis showed:

- Vehicle-train collisions are rare. Over the 10 years, 445 crashes happened at rail grade crossings; 52 involved fatalities, and 129 more included injuries. Only 9 percent of crossings experienced crashes, and only 1 percent experienced fatal crashes.
- At passive warning crossings, 83 percent of fatal crashes involved motorists not stopping.
- Over 80 percent of vehicles that crossed railroad grades did so at active crossings, where half of fatal crashes involved motorists driving around or through gates.
- Gates were the most effective crash-prevention feature. Flashing lights were slightly more effective than stop signs alone, and stop signs were slightly more effective than yield signs.

Investigators identified 10 key risk factors at grade crossings where fatal-plus-injury crashes occurred. These included vehicle traffic volume and railroad traffic volume; roadway speeds of at least 45 mph at crossings; train speeds of over 30 mph at active crossings and over 35 mph at passive crossings; and distance to nearest alternative crossing of 0.5 mile to 1 mile, suggesting that drivers sometimes attempt to outrace trains to the next crossing.

Eight percent of existing crossings feature at least seven of the 10 risk factors and should be prioritized for safety measures. Such measures would include consolidating redundant crossings and installing medians that discourage driving through or around gates.

What Was the Impact?

Investigators created a list of all of Minnesota’s railroad grade crossings with risk-factor assessments, prioritizing the 8 percent at high risk of fatal-plus-injury crashes. This list provides MnDOT with data for strategic upgrades of rail crossings throughout the state. MnDOT used this list to create its rail crossing upgrade plan for fiscal year 2018.

What’s Next?

Investing in the most effective safety measures at railroad grade crossings remains a priority. MnDOT is partnering with State Aid for Local Transportation, local road authorities and railroad companies to evaluate priority corridors and seek safety improvements such as consolidating crossings and upgrading safety mechanisms that will help Minnesota reach its safety goal of zero deaths.

This Implementation Summary pertains to Report 2016-25, “Railroad Grade Crossing Safety Project Selection,” published June 2016. The full report can be accessed at mndot.gov/research/TS/2016/201625.pdf.