Measure Name: Crossing alignment adjustment for motor vehicles

Definition: Horizontal or vertical alignment of the roadway and/or track so that the crossing is as close to perpendicular as possible for safer and more easily navigated crossing.

Tags:

Type of Incident:

- ☐ Non-Motorized Users Only
- ☒ Motor Vehicles Only
- ☐ Both

Intervention Strategy:

- ☐ Data: application and planning
- ☐ Education: outreach and messaging
- ☐ Enforcement: policy development and rulemaking
- ☒ Engineering: technological and physical deterrents

Type of Problem:

- ☐ Non-Motorized Users Violating Warning Devices
- ☒ Motor Vehicles Violating Warning Devices
- ☐ Vehicle ROW Incursion
- ☐ Vehicle Congestion
- ☐ Blocked Crossing
- ☒ Vehicle Hang-up

Measure Category:

- ☐ Risk Assessment
- ☐ Policy and Enforcement
- ☐ Collaboration, Training, and Education
- ☐ Public Communication
- ☐ Physical Barriers
- ☐ Detection and Lighting
- ☒ Infrastructure Modification
- ☐ Post-Incident Management
- ☐ Warning Devices

Description

This measure involves aligning a crossing horizontally or vertically to increase motor vehicle safety. The Federal Highway Administration Highway-Rail Crossing Handbook notes that "the ideal crossing geometry is a 90-degree intersection of track and highway with slight ascending grades on both highway approaches to reduce the flow of surface water toward the crossing" [1]. Horizontally aligning a grade crossing to be near perpendicular to the railroad tracks as possible provides drivers with a clearer view of the railroad approaches and helps to prevent issues where intersections, driveways, or other entry points located close to the crossing [1]. The alignment can include the roadway, railway tracks, or both. Vertically aligning a grade crossing to reduce its vertical profile (or "hump") reduces the likelihood of vehicles "hanging-up" on the grade crossing and ensures an adequate view of the grade crossing by approaching vehicles [1].

When a crossing angle is skewed, visibility can be greatly decreased and drivers may have difficulty turning to see the tracks to look for an oncoming train. This can create a situation where a driver may be more likely to quickly glance down the tracks rather than diligently checking for signs of a train [1]. For this reason, crossings should also not be located where the road or the track curves [2].

When a crossing has a high vertical profile, the risk of vehicles getting stuck on the tracks increases. Vertical alignment should be as level as possible to prevent vehicle hang-ups. This is of particular concern for vehicles with axles that are low to the ground [1]. Over time with regular maintenance, crossings originally constructed on an embankment for drainage can begin to transform into a humped crossing, posing safety risks to vehicle traffic. Though it should be noted that modern maintenance techniques reduce the development of a humped crossing [1]. In these cases, without realignment it may be necessary to post warning signs and a "low ground clearance" sign (e.g., W10-5 and W10-5P) prior to approaching the crossing or prohibit certain vehicles from traversing the crossing [1]. The Association of State Highway and Transportation Officials (AASHTO) presents a guideline which is traversable by a wide range of vehicles including those with long wheelbases and/or low ground clearance [2]. This is also provided as a standard by the American Railway Engineering and Maintenance-of-Way Association [1].

Additional search terms: *geometry, hump, vertical profile*

Advantages

- Horizontal crossing alignment adjustment improves the line of sight for vehicles approaching the crossing.
- Vertical crossing alignment adjustment can reduce the likelihood of vehicle hang-ups and improve traffic flow.

Drawbacks

- Grade crossing alignment adjustments may be costly, especially if significant construction is required. [1]

Notable Practices

- Include proper drainage when implementing crossing realignment. [1]
- Any work performed on a crossing should be coordinated with all relevant parties, including rail and highway authorities in states, cities, and counties, prior to beginning any construction or paving. [1]
- For new construction, the "crossing surface should be in the same plane as the top of rails for a distance of 2 feet outside of the rails," and the surface of the highway should not be greater or less than 3 inches from the top of the nearest rail for at least 30 feet outside of the rail. [1, p. 23]
- "When a right-angle highway-rail grade crossing cannot be achieved due to physical constraints, the interior angle shall be designed as close to 90 degrees as practical, but shall not be less than 75 degrees". [2, p.30]
- If changes to crossing the horizontal alignment are not a viable option due to cost or other constraints, at a minimum, active traffic controls should be implemented. [1]

References

[1] U.S. Department of Transportation. (2019). Highway-Rail Grade Crossing Handbook – Third Edition.

> Abstract: The purpose of the Highway-Rail Crossing Handbook, 3rd Edition is an information resource developed to provide a unified reference document on prevalent and best practices as well as adopted standards relative to highway-rail grade crossings. The handbook provides general information on highway-rail crossings; characteristics of the crossing environment and users; and physical and operational changes that can be made at crossings to enhance the safety and operation of both highway and rail traffic over such intersections. The guidelines identified and potential alternative improvements presented in this handbook reflect current best practices nationwide.

[2] Association of State Highway and Transportation Officials. (2018). A Policy on Geometric Design of Highway and Streets, 7th Edition.

> Excerpt: A Policy on Geometric Design of Highways and Streets, 7th Edition, 2018, commonly referred to as the Green Book, contains the current design research and practices for highway and street geometric design.

[3] Southern California Regional Rail Authority. (2021). SCRRA Highway – Rail Grade Crossing Manual. Southern California Regional Rail Authority.

> Excerpt: The primary purpose of the Manual is to provide SCRRA standards, criteria, practices, procedures, and policies that reflect current regulations, proven and accepted technological developments, and best available highway and rail industry design practices. This Manual provides users with the safest and most efficient standard design requirements and practices when improving or modifying highway-rail grade crossings. The Manual user will apply these standards and criteria to SCRRA's highway-rail grade crossings. Applying the design standards, procedures, and criteria in this Manual will enhance the safety and efficiency of the highway-rail grade crossing and result in a highway-rail crossing that reflects "best

practices" on a national basis. When considering the standards and criteria in this Manual, all design teams must exercise sound judgment and take into consideration the unique conditions that may exist at each highway-rail crossing.

Additional Resources

Florida Department of Transportation. (2006). Design Guidelines for Highway Railroad Grade Crossing Profiles in Florida.

> Excerpt: The goal of this research project can be generally described as the revision of the current Florida Department of Transportation (FDOT) manual on profile evaluation of grade crossings, including the development of computer tool(s) for evaluating existing profiles and use for design by professionals such as roadway designers, inspectors, and railroad flagmen.

Related Measures

- Crossing alignment adjustment for bicycle crossing and other wheeled devices

Images

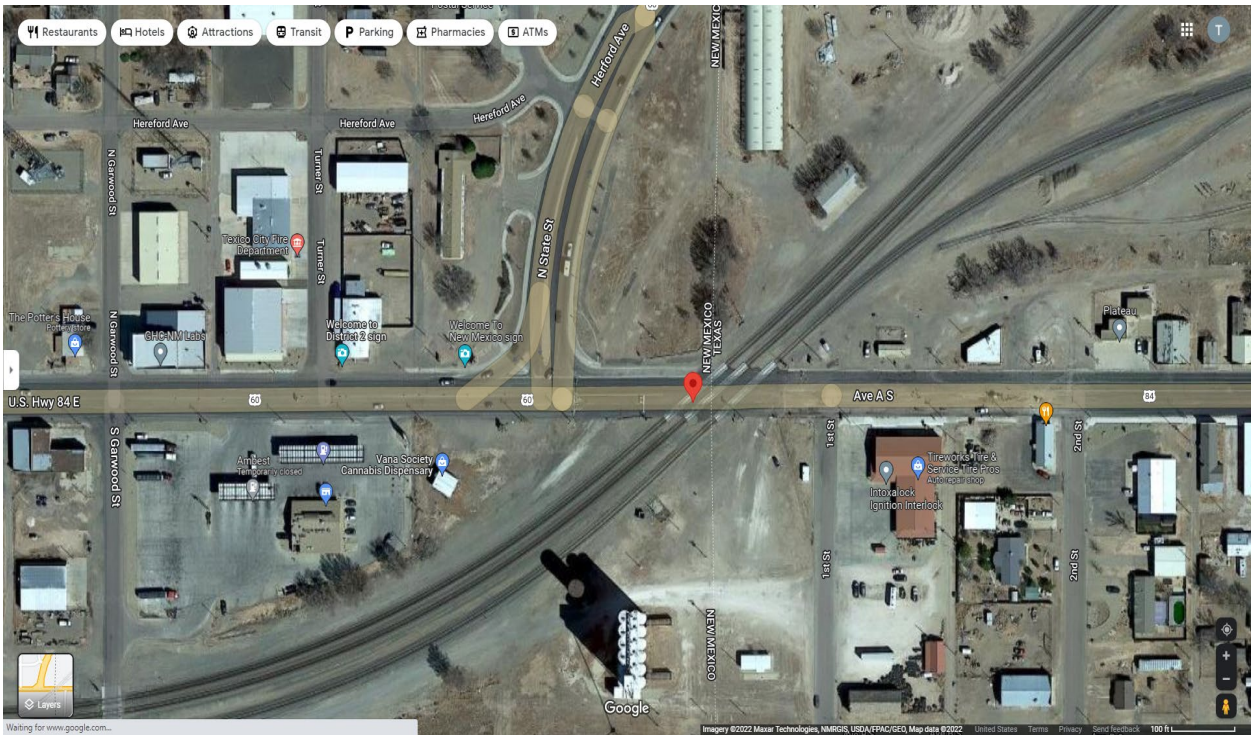

Figure 1. Example of a skewed angle crossing in Texico, NM from Google Satellite View

Figure 2. Example of a humped crossing in Gloucester, MA from Google Street View

Figure 3. Example of a humped crossing in Suffolk, VA
Image Credit: Volpe Center