



Town of Miami Trail System Study

Final Plan for Improvements

February 2026

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Introduction

The *Town of Miami Trail System Study* is a plan to provide a safe, convenient and attractive connection between the Bullion Plaza Cultural Center and Museum to the Miami Unified School District (MUSD). The plan is intended to make improvements to the safety, comfort and connectivity between key destinations in the Town of Miami (Town).

Overview

The Final Plan for Improvements consists of three distinct elements:

1. Project Area Wide Safety Improvements Plan
2. Connectivity Improvements Plan (Appendix A)
3. Town of Miami Trail System Americans with Disabilities Act Transition Plan (Appendix B)

Project Area Wide Safety Improvements Plan

The *Town of Miami Trail System Study Final Plan for Improvements* (the Plan) identifies the recommended improvements to address connectivity between the Bullion Plaza Cultural Center and Museum (Bullion Plaza) to the MUSD. The Plan identifies the recommended projects to improve bicycling and walking or rolling between these destinations and through the Miami Area. The Plan includes planning-level cost estimates for the identified improvements and identifies steps for the Town to take to accomplish these improvements.

Connectivity Improvements Plan (Appendix A)

The Connectivity Improvements Plan map identifies the regional attractions and amenities that the Plan seeks to connect, as well as other destinations in the region that the Town hopes to connect with a safe and attractive active transportation system. The project focus is on completing a route from Bullion Plaza to MUSD that is accessible to individuals with disabilities, and providing guidance for future projects that will connect between other amenities shown to improve safety and mobility for residents and visitors alike.

Town of Miami Trail System Americans with Disabilities Act Transition Plan (Appendix B)

The Town of Miami Trail System Americans with Disabilities Act (ADA) Transition Plan is a Appendix to the Plan that provides specific guidance on addressing the deficiencies and gaps in active transportation connection between Bullion Plaza and the MUSD. The accompanying workbook was created to allow use on subsequent projects, so that more amenities and destinations can be linked with ADA accessible pathways.

Background

The Town of Miami Trail System Study's purpose is to prepare a plan to improve walking, biking and rolling (e-scooters, wheelchairs and mobility devices) for the Miami community. With funding and support from the Arizona Department of Transportation (ADOT), the Town identified a conceptual alignment that extends from Bullion Plaza to MUSD. Guiding factors for the study include increasing safety for vulnerable road users (those who walk, bike and roll), improving connectivity to key community destinations and providing economic development opportunities.

During the course of the study, issues were identified with the proposed alignment along the railroad right-of-way through the town. Due to the active use of the tracks east of Latham Boulevard and plans for increased mining activity and related rail system usage, the proposed path had to be realigned. Due to the steep topography through this area and private land ownership, there is no feasible alternative to US 60 for a route connecting between Bullion Plaza and MUSD. The realigned path follows a one-mile segment of US 60 east of Miami Avenue to S Calle de Loma. At S Calle de Loma, the Plan moves active transportation off US 60 and returns to the initial trail alignment, which uses a combination of Railroad Avenue and Locomotive Drive to access the school sites.

The initial alignment is shown as an Alternative Alignment, should this option become feasible in the future.

Path Improvements

The improvements are identified along 10 discrete segments, extending from the Bullion Plaza to the west to MUSD to the east.

The 10 segments listed below are described in more detail on the following pages.

1. Sullivan Street – Bullion Plaza Cultural Center and Museum
2. Sullivan Street – Plaza Avenue to Davis Canyon Road
3. Sullivan Street – Davis Canyon Road to Miami Avenue
4. Miami Avenue – Sullivan Street to US 60
5. US 60 – Miami Avenue to S Calle de Loma¹
6. S Calle de Loma – US 60 to Railroad Avenue
7. Railroad Avenue – S Calle de Loma to Pineway Street
8. Locomotive Drive – Pineway Street to Old Oak Street
9. Railroad Avenue – Old Oak Street to Maple Leaf Street
10. Railroad Avenue – Maple Leaf Street to Ragus Road

¹ The segment along US 60, connecting Miami Avenue to S Calle de Loma, was not initially evaluated, as the preferred route followed the railroad alignment, parallel to and south of US 60. Therefore, this segment is not reflected in the data presented in the *Existing and Future Conditions*, nor in the subsequent *Needs and Gap Analysis* working paper.

Recommended Path Improvements

The proposed path improvements include various treatments. These improvements include sidewalks and shared-lane markings (sharrows), as well as signage (safety/wayfinding), lighting, fencing, drainage, signing and marking. All improvements follow existing public streets, although the right-of-way of each facility varies, and further study is necessary to determine the extent of right-of-way impacts of the proposed improvements.

While the original pathway alignment involved sections both on- and off-street, with some following the out-of-service railroad alignment; the proposed Improvements are focused on existing sidewalks and street crossings, new sections of paved pathways immediately adjacent to the roadway, and sharrows for bicycles.

These improvements are generally described on the following pages, along with additional amenities that will enhance active transportation throughout the region. Following this section, additional detail on the specific recommendations is provided, including preliminary cost estimates that will be helpful in pursuing additional funding for the construction and implementation of the path improvements.

These facilities are generally described on the following pages.

Sidewalks

Sidewalks act as conduits for pedestrian movement and access; they enhance connectivity and promote walking. There are existing sidewalks in portions of the town. However, there are sidewalk gaps and where sidewalks exist, there are areas that exhibit deterioration. Due to the age of the sidewalk facilities throughout the town, many of the existing sidewalks also have ADA issues.

Sidewalks should be delineated by a vertical and horizontal separation from moving traffic to provide an adequate buffer space and a sense of safety for pedestrians. Where sidewalks exist in the town, they are typically delineated by a vertical separation, with no separation from the curb (see Figure 1). An exception to this is Sullivan Street, from Bullion Plaza to approximately Davis Canyon Road (see Figure 2). In this segment there is a parkway strip, a strip of groundcover consisting of grass and intermittent shrubs and trees, located between a roadway and a sidewalk.

In all instances of existing sidewalks in the town and area (with a notable exception being the sidewalks along the south side of Railroad Avenue adjacent to MUSD), show deterioration including uneven surfaces, cracks, trip hazards, and vegetation growth. These issues can lead to safety hazards for pedestrians and should be addressed. For the purposes of this Study, it was generally assumed that up to 10 percent of all sidewalks are in need of repair.

It is recommended that the Town apply the information and guidance in the *Town of Miami Trail System Americans with Disabilities Act Transition Plan* (Appendix B). Documenting all ADA deficiencies along the route will enable them to be incorporated in implementation actions to remove these barriers.



Figure 1 | Railroad Avenue looking west. This is an example of a curb-adjacent sidewalk.



Figure 2 | Sullivan Street looking west. The parkway strip is shown between the sidewalk and curb and provides planting space for groundcover and shade trees.

Sharrows

Sharrows – short for shared-use arrows – are pavement markings designed to remind motorists and bicyclists where bicyclists should generally ride when sharing a standard travel lane with other traffic.

A sharrow is a designation indicating to both bicyclists and motor vehicle drivers that a bicyclist should ride closer to the center of a lane (thereby avoiding potential conflict with opening doors of parked vehicles). It is represented by a bicycle stencil with two chevrons painted in the travel lane (in the area where bicyclists are recommended to ride). Reasons for placing a sharrow stencil in the roadway include a substandard travel lane width, or where bicyclists must ride towards the middle of a lane to avoid the hazard of drivers opening doors in front of bicyclists. Sharrows work best on lower speed streets (less than 25 miles per hour).

Sharrows help bicyclists position themselves to be visible and to avoid parked cars while riding in the street. Sharrows also help to remind motorists to look for bicyclists. It is important to note that even when sharrows aren't present, bicyclists are legally allowed to ride in the travel lane.

To varying degrees, many of the street sections in the town and area show pavement distresses, including cracking (alligator cracking, transverse cracking, edge cracking) and disintegration (potholes and raveling) which has led to deterioration. While this can create problems for drivers and cyclists using the roadway, this deteriorated pavement can also create challenges for pavement markings to be applied.

For the purposes of the Plan pavement patches were included in the cost of sharrow pavement markings to address areas where pavement is deteriorated.



Figure 3 | Sharrow.

Sharrow markings alert drivers to the potential presence of bicyclists in the roadway.

Active Transportation Amenities

Providing an ADA accessible route to destinations is an important step in making the community more accessible for people of all ages and abilities. Greater use of active transportation facilities can be encouraged by making the path safe, recognizable and attractive. One way to accomplish this is through signage and wayfinding.

Signage and Marking

Signage and marking refers to traffic control devices used to indicate the presence of bicyclists and pedestrians. Signage and marking alerts motor vehicle users that active transportation users may be present along their route. It also guides users by indicating where each mode of transportation is allowed to operate.

Bicycle Signage

Bicycle signage enhances safety by improving predictability, visibility, and compliance for both bicyclists and motorists. The Manual on Uniform Traffic Control Device’s (MUTCD) 11th Edition and FHWA guidance emphasize that well-designed bicycle traffic control devices significantly reduce conflicts and crashes by creating consistent expectations among all road users.

Signage should be readable at the pedestrian scale but also provide clear guidance for motor vehicle users. Figure 4 shows the sharrow markings that alert motorists to the presence of bicycles in the street. They can also provide guidance for where bicyclists should ride within the street, to avoid obstacles like parked vehicles and open car doors.



Figure 4 | Shared Lane Marking (sharrow). Example of wayfinding sign. (Source: ADOT)



Figure 5 | Bicycle Sign. Bicycle may occupy the travel lane. (MUTCD R4-11)

Additional signage for vehicles include “Bicycles May Use Full Lane” signs to inform drivers that bicyclists may legally ride in the center of the lane.

Signage increases safety on active transportation routes by alerting both motor vehicle drivers and active transportation users alike of designated active transportation routes and crossings. Signage also improves the user experience by providing wayfinding and creating a cohesive identity for active transportation networks.

Based on MUTCD guidance, these signs and markings are included in the recommended improvements.

Wayfinding Signage

Wayfinding signage provides active transportation users with cues that help them understand their location, choose routes, and stay confidently on track. Wayfinding systems boost safety for walkers and bikers by guiding them along safer routes and reducing conflicts with vehicles.

Bike-specific wayfinding systems confirm route choices, help users follow designated bikeways, and support overall orientation within a city's active transportation network.

Wayfinding signage encourages more people to bike, walk and roll by making the system feel intuitive, connected, and comfortable. It can also highlight safe, low-stress routes suitable for all ages and abilities (when and where these facilities exist).

Wayfinding signage can also contribute to a consistent visual identity, local placemaking, and visitor friendliness, supporting economic development. For example, bike wayfinding can highlight parks, community centers, and the historic downtown. Signage should be posted at access points (e.g., the eastern and western limits of the route) or key intersections where users may join the route (e.g., local cross streets that provide connectivity to neighborhoods).

Branded trailhead signs and directional signs (with distance or time estimates) that guide users to key destinations such as the historic staircases and recreational facilities may also enhance the user experience.

A wayfinding plan is not included in this study, however, such a plan may help advance the Town's efforts to improve mobility and support economic development by linking and bringing awareness to local amenities and destinations such as those identified in the Connectivity Improvements Plan and the Town's Historic Downtown Miami Walking Tour.



Figure 6 | Wayfinding sign.
Example of wayfinding sign. (Source: ADOT)



Figure 7 | Wayfinding sign.
Example of wayfinding sign. (Source: town of Miami)

Lighting

Lighting provides safety and security for active transportation users by illuminating the surrounding area. Adequate lighting along pathways and at intersections improves the visibility of pedestrians and bicyclists at night, ensuring motor vehicle drivers see them in advance. It also makes pedestrians and bicyclists more visible to the surrounding community, creating a comfortable and inviting space with eyes on the street. Additionally, lighting can help illuminate active transportation amenities such as retroreflective signage and markings.

Streetlights and pedestrian-scale decorative lighting are present in historic downtown Miami. US 60 and MUSD have streetlights that illuminate the sidewalk, while the majority of Railroad Avenue has limited lighting. Increasing pedestrian-scale lighting in areas that may have more active transportation traffic (e.g., MUSD) can enhance the safety and viability of the route for potential users.

Aside from offering safety and security benefits, lighting can also reinforce the route alignment by highlighting maintained active transportation facilities, encouraging activity, and providing aesthetically pleasing infrastructure. The cost estimate for the project includes pedestrian-scale lighting in areas where there is no lighting present today.



Figure 8 | Pedestrian lighting.

Existing Town of Miami streetlighting is a good example of pedestrian-scale lighting.

Fencing

Fencing serves as a physical barrier between the Arizona Eastern Railway railroad tracks and active transportation facilities. Chain-link or similar fencing materials deter people from entering onto the railroad tracks, reducing potential conflict points.

Along Railroad Avenue, there is existing fencing from Calle de Loma to New Street. Extending fencing from New Street to the east is necessary in order to maintain railroad safety and create a more comfortable facility for active transportation users.



Figure 9 | Railroad fencing. Example of fencing proposed for segments along the rail line (comparable to the existing railroad fencing segments).

Drainage

Drainage may be a necessary component of any path improvements. Adequate drainage prevents undue burden on infrastructure, maintains usability of the alignment for active transportation users, and helps maintain natural flow patterns. As flood events become increasingly common, future-proofing path improvements with drainage features will help maintain infrastructure.

Rather than creating new drainage conditions, adding curb cuts to planned sidewalks along the route where separation from vehicle traffic is advisable will avoid pooling of water on the roadway.



Figure 10 | Curbing with drainage cuts. Example of curbing with breaks to allow drainage while providing separation from roadway.

Path Segmentation

This section outlines the proposed improvements for each of the 10 discrete segments along the route alignment. The segment extents are displayed on the map below, with numbers corresponding to each segment's location.

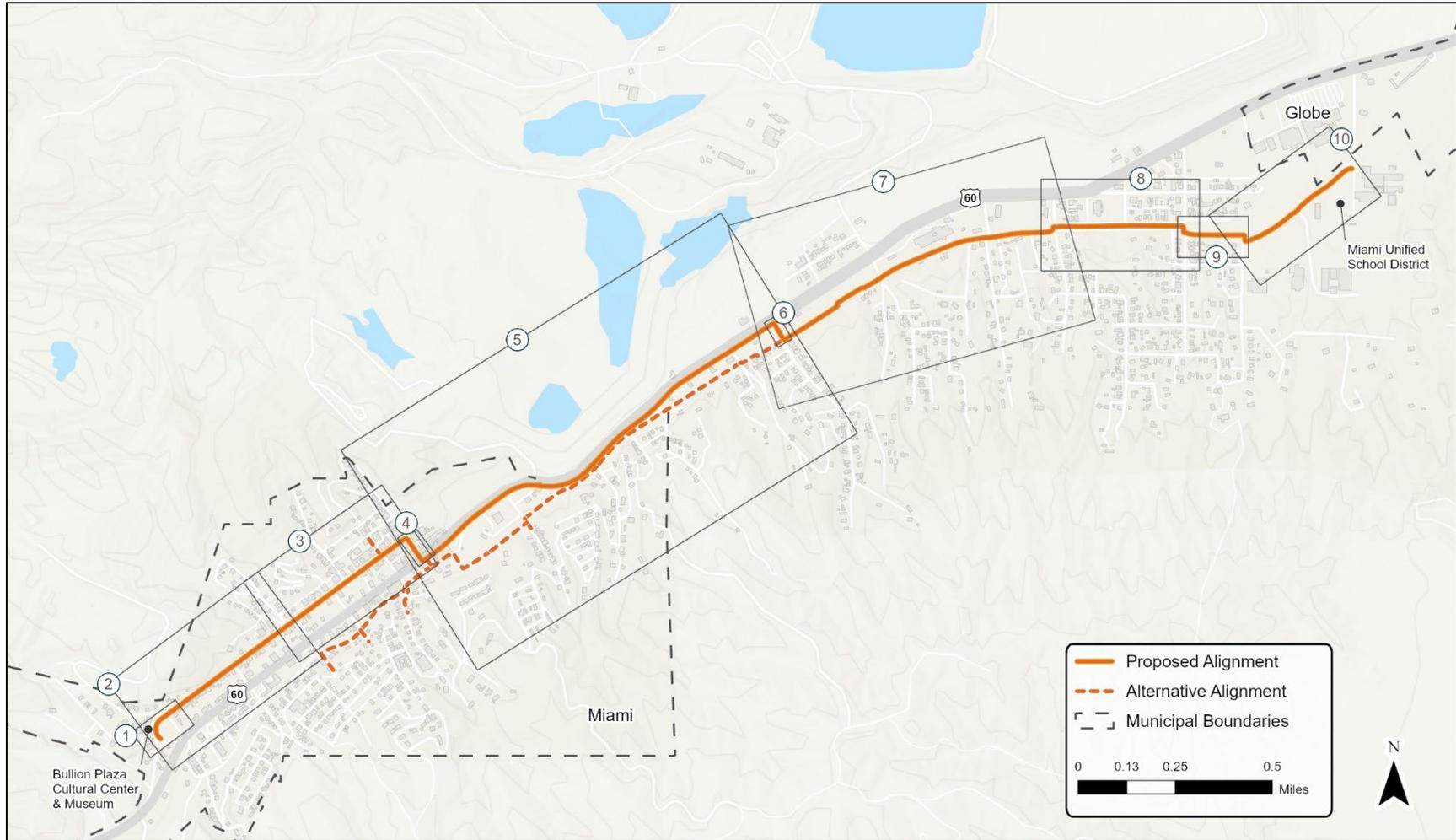


Figure 11 | Town of Miami trail alignment showing the segmentation describing the proposed improvements.

1. Sullivan Street – Bullion Plaza Cultural Center and Museum

This segment provides connectivity to Bullion Plaza, a key community destination. The area has a mix of commercially zoned and residentially zoned parcels, and there are low traffic volumes and low posted speeds (15 mph), allowing consideration of sharrows to accommodate bicycles.

Minor improvements to existing pedestrian infrastructure and amenities would increase safety and comfort for people who walk, bike and roll between Bullion Plaza and the surrounding community.



Figure 12 | Sullivan Street – Bullion Plaza Cultural Center and Museum

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA improvements to sidewalks and crossing ramps. 	Estimated Segment Cost	\$38,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments: An ADA ramp or other improvements along Plaza Circle may improve accessibility for people using the Bullion Plaza park or walking/rolling in front of the cultural center. A raised crosswalk (illustrated in the rendering), is not included in the cost, but could be considered to raise awareness of the mid-block crossing.	
Lighting	<ul style="list-style-type: none"> • None identified. 		
Drainage	<ul style="list-style-type: none"> • None identified. 		
Shade	<ul style="list-style-type: none"> • Maintain existing trees on both sides of roadway along Plaza Circle. 		
Crossings	<ul style="list-style-type: none"> • Improve street crossings at Plaza Circle/Turner Street and Plaza Avenue/Sullivan Street. • Improve street crossings on Plaza Circle at Bullion Plaza entrance. 		



Figure 13 | Conceptual view of Sullivan Street showing improvements at the Bullion Plaza Cultural Center and Museum.

2. Sullivan Street – Plaza Avenue to Davis Canyon Road

The recommended path along Sullivan Street is on the south side of the street and connects Bullion Plaza Cultural Center and Museum to historic downtown Miami. Low traffic volumes and low posted speeds (15 mph), allowing consideration of sharrows to accommodate bicycles.

Minor improvements to existing pedestrian infrastructure would benefit community members walking, rolling and bicycling through this segment.



Figure 14 | Sullivan Street – Plaza Avenue to Davis Canyon Road

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA improvements to sidewalks and crossing ramps. 	Estimated Segment Cost	\$60,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments: ADA improvements to sidewalks and crossing ramps to address cracks and uneven surfacing (areas where trees are located). ADA improvements also necessary at sloped surfaces near driveways.	
Lighting	<ul style="list-style-type: none"> • None identified. 		
Drainage	<ul style="list-style-type: none"> • None identified. 		
Shade	<ul style="list-style-type: none"> • Maintain existing trees on both sides of roadway along Plaza Circle. 		
Crossings	<ul style="list-style-type: none"> • Improve street crossings at Plaza Ave and Reppy Ave. 		



Figure 15 | Conceptual view of Sullivan Street showing improvements from Plaza Avenue to Davis Canyon Road.

3. Sullivan Street – Davis Canyon Road to Miami Avenue

This segment provides access to historic downtown Miami, a key community destination. Low traffic volumes and low posted speeds (15 mph) allow consideration of sharrows to accommodate bicycles.

Minor improvements to existing pedestrian infrastructure would benefit community members walking, rolling and bicycling through this segment.



Figure 16 | Sullivan Street – Davis Canyon Road to Miami Avenue

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA improvements to sidewalks and crossing ramps. 	Estimated Segment Cost	\$180,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments: ADA improvements to sidewalks to address cracks and uneven surfacing and crossing ramps at 5 intersections. ADA improvements also necessary at sloped surfaces near driveways. Increased cost due to multiple intersections and drives along this segment. Also shown in rendering (Figure 17) but not included in cost is a parklet, midblock on west side of street.	
Lighting	<ul style="list-style-type: none"> • None identified. 		
Drainage	<ul style="list-style-type: none"> • None identified. 		
Shade	<ul style="list-style-type: none"> • Urban development, including buildings fronting street with zero setback, creating an inviting pedestrian space. • Maintain existing trees where they exist along street. 		
Crossings	<ul style="list-style-type: none"> • Improve street crossings at 5 intersections. 		



Figure 17 | Conceptual view of Sullivan Street showing improvements through historic downtown Miami.

4. Miami Avenue – Sullivan Street to US 60

This segment includes sidewalk improvements as well as improving the signalized crossing of US 60.

Low traffic volumes and low posted speeds (15 mph) allow consideration of sharrows to accommodate bicycles.

Note: any intersection improvements will need to be coordinated with ADOT Southcentral district, ADOT Multimodal Planning Division and Central Arizona Governments (CAG).



Figure 18 | Miami Avenue – Sullivan Street to US 60.

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA improvements to sidewalks and crossing ramps. 	Estimated Segment Cost	\$32,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments:	
Lighting	<ul style="list-style-type: none"> • None identified. 	North of US 60, ADA improvements to sidewalks and crossing ramps to address cracks and uneven surfacing. Sidewalk severely deteriorated at bridge over Bloody Tanks Wash. Address street furniture and utility pole restrictions of useable sidewalk space, impacting accessibility.	
Drainage	<ul style="list-style-type: none"> • None identified. 		
Shade	<ul style="list-style-type: none"> • Urban development, including buildings fronting street with zero setback, creating an inviting pedestrian space. 		
Crossings	<ul style="list-style-type: none"> • Improve crossing at US 60 to include crosswalks and signage, relocate utility box imposing on sidewalk on northwest corner. 		



Figure 19 | Conceptual view of Miami Avenue showing improvements through historic downtown Miami.

5. US 60 - Miami Avenue to S. Calle de Loma

This segment is revised from the initial trail alignment which followed the railroad south of US 60. The proposed alignment places pedestrians adjacent to US 60 on the existing sidewalk and requires bicyclists to have to use the roadway shoulder, which is varying width and crossed by numerous business driveways.

This segment includes varying roadway widths, anywhere from 60 to 80 feet, with shoulders of varying widths. At US 60 the roadway is 4-lanes. Approximately 0.2 miles east of Miami Avenue, a two-way left turn lane begins. After an additional 0.2 miles, the turn lane is replaced by a median island with turn bays for cross streets; this condition continues to S. Calle de Loma.



Figure 20 | US 60 – Plaza Avenue to Davis Canyon Road

Element	Improvements			
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA improvements to sidewalks, driveways, and crossing ramps. 	Estimated Segment Cost	Option 1	\$205,000
			Option 2	\$95,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Option 1: roadway restriped to resize lanes (>11 feet) to accommodate 5-foot bicycle lane. • Option 2: existing shoulder to remain. 	Additional Comments:		
Lighting	<ul style="list-style-type: none"> • None identified. 	The entire US 60 corridor requires ADA improvements to sidewalks and crossing ramps to address cracks and uneven surfacing. Option 1 includes sidewalk improvements and restripe roadway with bike lanes.* Option 2 includes sidewalk improvements only.		
Drainage	<ul style="list-style-type: none"> • None identified. 			
Shade	<ul style="list-style-type: none"> • Maintain existing trees and consider adding additional shade trees along this segment (south side of US 60). 			
Crossings	<ul style="list-style-type: none"> • Improve crossing at Calle de Loma to include crosswalks. 			

* As-builts for the US 60 corridor through this segment show there may be adequate roadway width to accommodate bicycle lanes; however, this concept would have to be further discussed with ADOT prior to being advanced. Note: Improvements in the corridor will need to be coordinated with ADOT Southcentral district and ADOT Multimodal Planning Division.



Figure 21 | Conceptual view of US 60 showing existing conditions with Option 1 improvements (which include bike lanes).

6. S. Calle de Loma – US 60 to Railroad Avenue

This segment connects between US 60 and Railroad Avenue. S. Calle de Loma crosses three sets of railroad tracks cross the street in quick succession. Current Section 130 Improvements proposed at this location include removing one of the railroad crossings and improving the roadway segment.

Major improvements are necessary to create a safe, usable pathway through this segment.

All future design and construction will require railroad coordination, and must be consistent with federal, state, and railroad standards (for reference, the current versions of the MUTCD *Part 8* and the Genesee and Wyoming *Public Project Manual* are included as appendices, see Appendix C and D, respectively).



Figure 22 | S. Calle de Loma – US 60 to Railroad Avenue

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> New ADA sidewalk along east side of Calle de Loma connecting US 60 to Railroad Avenue (approximately 200 feet). 	Estimated Segment Cost	\$93,000
Bicycle Infrastructure	<ul style="list-style-type: none"> Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments: There are no pedestrian facilities along Calle de Loma, proposed sidewalk would extend the pavement over six feet, to accommodate new walking path with vertical channelizers (curbing) with cuts to accommodate drainage from street. Improvements will also require safety measures where path crosses (two) railroad tracks at crossing with Eastern Arizona Railroad.	
Lighting	<ul style="list-style-type: none"> Lighting added to improve visibility. 		
Drainage	<ul style="list-style-type: none"> Curbs with cuts (openings) to allow stormwater to flow from road; will require maintenance after rains to keep clear. 		
Shade	<ul style="list-style-type: none"> Due to the short segment length and presence of railroad, no shade proposed for this segment. 		
Crossings	<ul style="list-style-type: none"> Rail crossing improvements should be coordinated with Section 130 improvements under consideration.* 		

* Section 130 refers to the Rail-Highway Crossings Program, which provides administration for the elimination of hazards at public railway-highway crossings. A



Figure 23 | Conceptual view of S. Calle de Loma showing proposed conditions with improvements.

7. Railroad Avenue – S Calle de Loma to Pineway Street

This segment connects between S Calle de Loma and Pineway Street along Railroad Avenue through unincorporated Gila County.

Low traffic volumes and low posted speeds (25 mph) allow consideration of sharrows to accommodate bicycles.

Improvements to the existing roadway and right-of-way would support pedestrian/bicycle use and make the alignment a safer, attractive alternative to US 60, moving pedestrian and bicycle activity away from the highway and vehicle and truck traffic at the Freeport McMoRan Miami Operations entrance (north of US 60) and Miami Rod Mill (south of US 60).



Figure 24 | Railroad Avenue – S Calle de Loma to Pineway Street

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA sidewalk along south side of street, transitioning to north side mid-block. 	Estimated Segment Cost	\$1,546,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments:	
Lighting	<ul style="list-style-type: none"> • Lighting added to improve visibility. 	Greater cost of this segment due to longer length (2/3 mile) and lack of existing infrastructure. Alignment shifts to north side of street where additional separation between railroad operations and roadway occurs, to avoid drive and driveway conflicts and steep embankments. Any improvements need to be coordinated with Arizona Eastern Railway to maintain the railroads clearance requirements for any sidewalk or pathway improvements proposed by the local government entities.	
Drainage	<ul style="list-style-type: none"> • Curbs with cuts (openings) to allow stormwater to flow from road; will require maintenance after rain to keep clear. 		
Shade	No recommendations here, as: <ul style="list-style-type: none"> • Adjacent to steep slope on south side of road. • Adjacent to railroad on north side of road. 		
Crossings	<ul style="list-style-type: none"> • Crosses New Street and Grover Canyon Rd, and three T-intersections (south side, do not cross path). 		

8. Locomotive Drive – Pineway Street to Old Oak Street

This segment brings the alignment back across the railroad at Pineway Street, before crossing Pineway Street north of the tracks and continuing along the south side of Locomotive Drive. The area has a mix of residential and commercial development.

Low traffic volumes and low posted speeds (25 mph), allowing consideration of sharrows to accommodate bicycles.

Minor pedestrian/bicycle improvements in this segment would increase safety and comfort for users.



Figure 25 | Locomotive Drive – Pineway Street to Old Oak Street

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> • ADA sidewalk south side of street and separated with vertical curb. • Fencing separating sidewalk from railroad operations. 	Estimated Segment Cost	\$768,000
Bicycle Infrastructure	<ul style="list-style-type: none"> • Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments:	
Lighting	<ul style="list-style-type: none"> • Pedestrian scale lighting along entire segment. 	The route is located on the south side of street to reduce driveway conflicts and minimize impacts to the residential on-street parking that is prevalent on the north side of street throughout much of this segment. Any crossing improvements should coordinate with the Section 130 improvements under the ADOT Railroad division and the Arizona Eastern Railway representatives.	
Drainage	<ul style="list-style-type: none"> • Curbs with cuts (openings) to allow stormwater to flow from road; will require maintenance after rain to keep clear. 		
Shade	<ul style="list-style-type: none"> • Due to parallel presence of active railroad, no shade proposed for this segment. 		
Crossings	<ul style="list-style-type: none"> • Pineway Street crossed at western end of segment. 		



Figure 26 | Conceptual view of Locomotive Drive showing existing conditions with improvements.

9. Railroad Avenue – Old Oak Street to Maple Leaf Street

This segment brings the alignment across Old Oak Street then back across the railroad on the west side of street before continuing along the north side of Railroad Avenue.

Low traffic volumes and low posted speeds (25 mph), allow consideration of sharrows to accommodate bicycles.

Minor pedestrian/bicycle improvements in this segment would increase safety and comfort for users.



Figure 27 | Railroad Avenue – Old Oak Street to Maple Leaf Street

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> Replace existing substandard asphalt sidewalk on north side of street with ADA sidewalk. 	Estimated Segment Cost	\$270,000
Bicycle Infrastructure	<ul style="list-style-type: none"> Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments:	
Lighting	<ul style="list-style-type: none"> Pedestrian scale lighting along entire segment (there is existing streetlighting on south side of street; however, pedestrian-scale lighting along entire segment would improve safety for pedestrians). 	The route is located on the north side of street to take advantage of existing graded area behind curb; existing deteriorated asphalt sidewalk to be replaced and pedestrian lighting installed. Any crossing improvements should coordinate with the Section 130 improvements under the ADOT Railroad division and the Arizona Eastern Railway representatives.	
Drainage	<ul style="list-style-type: none"> No changes necessary. 		
Shade	<ul style="list-style-type: none"> Due to topography through this section, no shade proposed. 		
Crossings	<ul style="list-style-type: none"> The route crosses at Maple Leaf Street to access the existing sidewalk adjacent to the MUSD complex. 		

10. Railroad Avenue – Maple Leaf Street to Ragus Road

At Maple Leaf Street, where the existing sidewalk ends, a crosswalk leads to the south side of Railroad Avenue where existing sidewalk continues to MUSD facilities.

Pavement may be wide enough through this segment that bicycle lanes could be incorporated; however, this condition ends at Maple Leaf Street to the west and at the railroad crossing just to the east of MUSD.



Figure 28 | Railroad Avenue – Maple Leaf Street to Ragus Road

Element	Improvements		
Pedestrian Infrastructure	<ul style="list-style-type: none"> Improve crossing at Maple Leaf Street. Existing sidewalk south side of street separated with vertical curb. 	Estimated Segment Cost	\$360,000
Bicycle Infrastructure	<ul style="list-style-type: none"> Signage and markings for cars to share the road with bicycles (i.e., sharrows). 	Additional Comments: The segment is located on the south side of street to take advantage of existing concrete sidewalk behind curb; additional pedestrian scale lighting proposed to improve safety and comfort.	
Lighting	<ul style="list-style-type: none"> Pedestrian scale lighting along entire segment would improve safety for pedestrians. 		
Drainage	<ul style="list-style-type: none"> No changes necessary. 		
Shade	<ul style="list-style-type: none"> Shade trees may be added on south side of street adjacent to sidewalk. 		
Crossings	<ul style="list-style-type: none"> Improve street crossing at Maple Leaf Street. 		

Project Prioritization

During the *Evaluation of Recommended Path Improvements* phase of work, the project segments were evaluated relative to criteria defined in the *Needs and Gaps Analysis*. The evaluation used a rating category of 2-1-0, where the segments were ranked by benefit, with the higher number indicating a greater benefit.

Table 1 shows the evaluation criteria and scoring using Harvey Balls. Harvey Balls are circles filled in to different degrees to indicate scoring, with solid fill indicating the greatest benefit, half-filled indicating less benefit, and a hollow fill indicating the least benefit. For scoring, the Harvey Balls were converted to numeric values to allow quantitative assessment, with

● = 2; ◐ = 1; ○ = 0; no weighting was applied to the criteria for this exercise.

It should be noted that since the *Evaluation of Recommended Path Improvements* phase of work, planning-level cost estimates for each of the segments have been developed, which results in subtle changes to the ranking from what was reported in that earlier document.

The cost estimates were the only quantitative evaluation criteria. To keep consistent with the scoring of the other criteria the segment costs were categorized into low, medium, and high tiers² based on their position within the distribution of individual segment cost estimates.

² Segment costs were assigned low-medium-high values using the 33rd and 67th percentiles as breakpoints.

Table 1 | Evaluation of Project Segments

Segments	Criteria											
	Implementation cost	Complexity	Safety	Comfort	Community identity	Parking impacts	ROW constraints	Private property impacts	Topography / vegetation	Network connectivity	Transit access improvements	
	●	Low	Low	High	High	High	Low	Low	Low	Low	High	High
	◐	Med	Med	Med	Med	Med	Med	Med	Med	Med	Med	Med
	○	High	High	Low	Low	Low	High	High	High	High	Low	Low
1. Sullivan Street – Bullion Plaza Cultural Center and Museum	●	●	◐	◐	◐	●	◐	◐	●	◐	●	
2. Sullivan Street – Plaza Avenue to Davis Canyon Road	●	●	◐	◐	◐	●	◐	◐	●	◐	●	
3. Sullivan Street – Davis Canyon Road to Miami Avenue	◐	●	◐	◐	◐	●	◐	◐	●	◐	●	
4. Miami Avenue – Sullivan Street to US 60	●	●	◐	◐	◐	●	◐	◐	●	◐	●	
5. US 60 – Miami Avenue to Calle de Loma	◐	●	◐	○	○	●	◐	◐	●	◐	●	
6. S Calle de Loma – US 60 to Railroad Avenue	◐	○	●	◐	◐	●	◐	◐	◐	●	●	
7. Railroad Avenue – S Calle de loma to Pineway Street	○	◐	◐	◐	◐	●	○	○	○	●	●	
8. Locomotive Drive – Pineway Street to Old Oak Street	○	◐	◐	◐	◐	○	○	○	◐	●	●	
9. Railroad Avenue – Old Oak Street to Maple Leaf Street	◐	●	◐	◐	◐	●	●	●	●	◐	●	
10. Railroad Avenue – Maple Leaf Street to Ragus Road	○	●	◐	◐	◐	●	●	●	●	◐	●	

Notes: Harvey Ball scoring (circles filled in to different degrees with solid fill indicating the greatest benefit, with hollow fill indicating the least benefit) was converted to numeric values to allow quantitative assessment, with ● = 2; ◐ = 1; ○ = 0.

Based on this evaluation, the project segments are ranked as shown in Table 2. It is noted that multiple segments received the same ranking, because their scores were equal in the evaluation.

Table 2 | Segment Prioritization Ranks

Segment	Rank
9. Railroad Avenue –Old Oak Street to Maple Leaf Street	1
1. Sullivan Street –Bullion Plaza Cultural Center and Museum	2
2. Sullivan Street –Plaza Avenue to Davis Canyon Road	2
4. Miami Avenue –Sullivan Street to US 60	2
10. Railroad Avenue –Maple Leaf Street to Ragus Road	2
3. Sullivan Street –Davis Canyon Road to Miami Avenue	6
6. S Calle de Loma –US 60 to Railroad Avenue	7
5. US 60 –Miami Avenue to Calle de Loma	8
7. Railroad Avenue –S Calle de loma to Pineway Street	9
8. Locomotive Drive –Pineway Street to Old Oak Street	10

Given funding is not currently available to implement the project, and the competing infrastructure needs of the town and surrounding region, implementation phasing is suggested. Table 3 shows the proposed implementation phasing for the project. This phasing is informed by planning judgment and an understanding of the project goals, and by project groupings that provide segments of independent utility (i.e., each phase provides value on its own).

Table 3 | Implementation Phases

Phase 1	Cost	\$630,000
Segment		Segment Rank
9. Railroad Avenue –Old Oak Street to Maple Leaf Street		1
10. Railroad Avenue –Maple Leaf Street to Ragus Road		2
Phase 2	Cost	\$310,000
Segment		Segment Rank
1. Sullivan Street –Bullion Plaza Cultural Center and Museum		2
2. Sullivan Street –Plaza Avenue to Davis Canyon Road		2
4. Miami Avenue –Sullivan Street to US 60		2
3. Sullivan Street –Davis Canyon Road to Miami Avenue		6
Phase 3	Cost	\$2,612,000*
Segment		Segment Rank
6. S Calle de Loma –US 60 to Railroad Avenue		7
5. US 60 –Miami Avenue to Calle de Loma		8
7. Railroad Avenue –S Calle de loma to Pineway Street		9
8. Locomotive Drive –Pineway Street to Old Oak Street		10
Phases 1 – 3	Total Project Cost	\$3,552,000

* Phase 3 costs (and Total Project Cost) decrease by \$110,000 with Segment 5, Option 2.

Funding Sources

At this time, funding for the proposed improvements has not been identified. This section provides information on potential funding sources. The list here is not exhaustive, and the Town is encouraged to work with Central Arizona Governments (their Councils of Governments) and ADOT to identify opportunities to advance the improvements.

Funding may be available at the state and federal level, so these funding sources are grouped by state and federal resources.

State and Local Funding

Town of Miami General Fund: The money in the general fund is the Town's primary source for daily operating expenses. It is comprised primarily of local revenues and state tax collection. General fund revenues can be used where a financial match is required for grant requests. In addition, funds can be set aside over several years to build up revenues.

Arizona Highway User Revenue Fund (HURF): The state collects various fees and charges related to the registration and operation of motor vehicles. These fees and charges are deposited into the HURF and subsequently distributed to the cities, towns and counties and to the State Highway Fund. These taxes represent a primary source of revenue available to the state for highway construction, improvements and other related expenses. Within Miami, HURF funds are used for all costs related to street maintenance and repair.

ADOT 5311 Rural Transportation Program: Annually, the Federal Transit Administration allocates federal funds for the Section 5311 grant program. These funds are apportioned to the state on a formula basis, providing funding to support the administrative, operating and capital costs of public transit services in rural areas. Funds from the 5311 are used to help subsidize the cost of bus service in Miami. These funds can be used for both capital and operating costs.

In Arizona, the ADOT's Multimodal Planning Division manages the Section 5311 grant program. Funding is provided to counties, cities, towns and American Indian tribes to operate transit systems at the local level. Funds are distributed annually through a competitive application process. The application process is kicked off with a series of workshops and webinars that provide guidance on the process in September/October. Applications are submitted in December, and awards are generally made in July of each year. Cobre Valley Community Transit, which operates a demand-response/curb-to-curb service and a deviated fixed bus route in the town of Miami, is the local recipient of these funds.

Transportation Alternatives Program (TAP): ADOT TAP provides funding to Greater Arizona through a competitive grant program and a distribution formula that allocates funding to communities based on population. ADOT administers the TAP to fund pedestrian and bicycle facilities and other projects. The projects fall under several eligible categories, including "Construction, planning, and design of on-road and off-road trail facilities for pedestrians, bicyclists, and other nonmotorized forms of transportation, including sidewalks, bicycle infrastructure-related projects and systems that will provide safe routes for non-drivers".

Community Development Block Grants (CDBG): The Town receives funds from the Small Cities/Rural CDBG program, which is administered by the state, working in conjunction with rural Councils of Government. In Gila County, the Central Arizona Governments (CAG) is the representative rural Council of Government. The CDBG program is flexible and provides communities with resources to address a wide range of unique community development needs (e.g., the Keystone Stairs rehabilitation is being funded through CDBG funds).

Federal Funding

Grants: Federal, state, and private grants are available for a wide variety of public transportation projects. Most grants are competitive and cannot be considered a guaranteed revenue source. In addition, grants may require matching funds from the Town. The following are some of the examples of grants the Town may wish to pursue to help fund future improvements recommended within this plan:

United States Department of Agriculture (USDA) Rural Business Enterprise Grants: Enterprise grants must be used on projects to benefit small and emerging businesses in rural areas as specified in the grant application. The grant may be used, among other things, to fund various rural transportation improvements.

Safe Routes to School (SRTS) Program: This competitive program was established by Section 1404 of SAFETEA-LU to substantially improve the ability of students to walk and bicycle to school. Projects that may be eligible for SRTS funds include sidewalk improvements, traffic calming and speed reduction measures, pedestrian and bicycle crossings, on- and off-street bicycle routes, secure bicycle parking facilities, and traffic diversions. These projects must be implemented on any public road or any bicycle or pedestrian pathway within 2 miles of an elementary or middle school. Detailed eligibility criteria can be found in Section 1404 of the SAFETEA-LU legislation (Public Law 109-59, Title I, Section 1404).

SRTS requires no local match; however, Local Public Agencies must have the up-front funds to implement the project. The selected applicants are entitled to request reimbursements from ADOT for an amount agreed upon at the time of selection.

Federal Discretionary Grant Programs:

Safe Streets and Roads for All (SS4A)-: This competitive program provides grants to local, regional, and Tribal communities for implementation, planning, and demonstration activities as part of a systematic approach to prevent deaths and serious injuries on the nation's roadways. In order to receive implementation funds, the community must first pursue funding for a Comprehensive Safety Action Plan, which can include supplemental safety planning and demonstration activities to inform an Action Plan. The program is currently only funded through FY2026.

Better Utilizing Investments to Leverage Development (BUILD): A discretionary grant program for projects that demonstrate how the proposed pedestrian improvements will enhance safety, connectivity, and economic vitality. The application should include information from the Plan that detail the project scope, cost estimates, and evidence of community support, along with data demonstrating anticipated benefits such as reduced crashes, improved access to jobs

and services, and support for multimodal travel. Collaboration with CAG, ADOT, and stakeholders strengthens the proposal and increases the likelihood of securing funding.

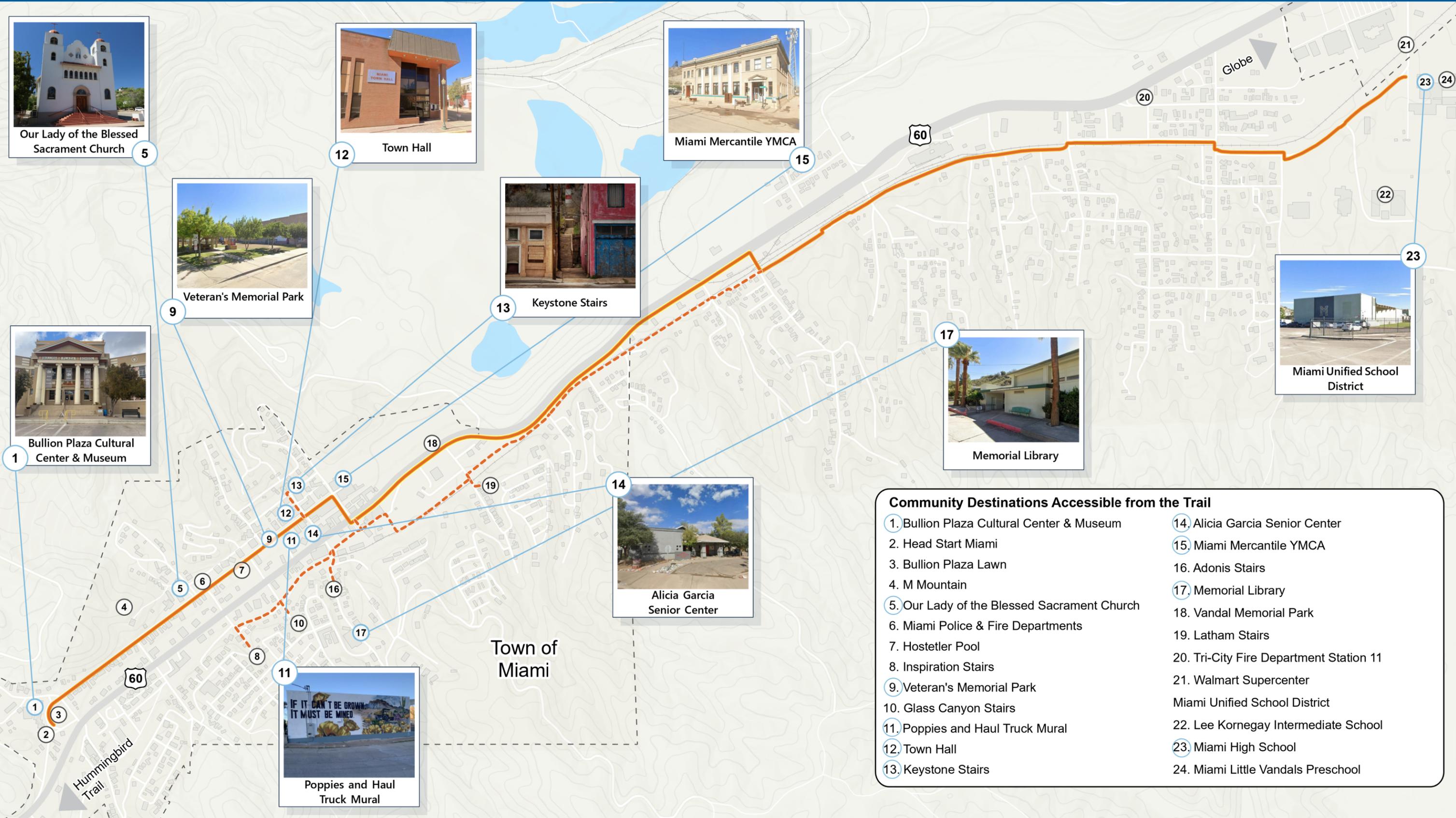
Next Steps

While the Town pursues funding for the improvements, inventorying specific ADA needs will help to ensure that when construction projects advance, they will have the information necessary to address all ADA deficiencies. To help facilitate this, the *Town of Miami Trail System Americans with Disabilities Act Transition Plan* (prepared as part of this Plan) has worksheets to prepare an ADA needs assessment for the corridor. This information will help to detail the extent and type of ADA deficiencies along the individual path segments. This information, along with the planning-level cost estimates, will be useful in identifying the specific improvements necessary to improve the walking or rolling in the area.

Appendix A – Connectivity Improvements Plan

Miami, Arizona Connectivity Improvements Plan

February 2, 2026



- Community Destinations Accessible from the Trail**
- | | |
|---|---|
| 1. Bullion Plaza Cultural Center & Museum | 14. Alicia Garcia Senior Center |
| 2. Head Start Miami | 15. Miami Mercantile YMCA |
| 3. Bullion Plaza Lawn | 16. Adonis Stairs |
| 4. M Mountain | 17. Memorial Library |
| 5. Our Lady of the Blessed Sacrament Church | 18. Vandal Memorial Park |
| 6. Miami Police & Fire Departments | 19. Latham Stairs |
| 7. Hostetler Pool | 20. Tri-City Fire Department Station 11 |
| 8. Inspiration Stairs | 21. Walmart Supercenter |
| 9. Veteran's Memorial Park | Miami Unified School District |
| 10. Glass Canyon Stairs | 22. Lee Kornegay Intermediate School |
| 11. Poppies and Haul Truck Mural | 23. Miami High School |
| 12. Town Hall | 24. Miami Little Vandals Preschool |
| 13. Keystone Stairs | |



**Appendix B –
Town of Miami Trail System Study
ADA Transition Plan Guide**



Town of Miami Trail System Study

ADA Transition Plan Guide

February 2026

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Background

The Town of Miami Trail System Study (Study) purpose is to prepare a plan to improve walking, biking and rolling (e-scooters, wheelchairs and mobility devices) for the Miami community. With funding and support from the Arizona Department of Transportation (ADOT), the Town of Miami (Town) identified a conceptual alignment that extends from Bullion Plaza Cultural Center and Museum to the Miami Unified School District (MUSD). Guiding factors for the Study include increasing safety for vulnerable road users (those who walk, bike and roll), improving connectivity to key community destinations and providing economic development opportunities.

As the Town strives to improve facilities for walking, biking, and rolling along the trail alignment, accessibility will be a critical part of increasing safety and connectivity for vulnerable road users of all ability levels.

Purpose and Need

The Americans with Disabilities Act of 1990 (ADA) and Rehabilitation Act of 1973 are civil rights laws that prohibit discrimination on the basis of disability. Title II of the ADA requires public entities with 50 or more employees to complete a self-evaluation of the accessibility of pedestrian facilities in their public rights-of-way and to correct deficiencies by making necessary modification plans, while Section 504 of the Rehabilitation Act prohibits discrimination based on disability in programs receiving federal financial assistance. These legal requirements are fulfilled through the development of an ADA Transition Plan—a document that translates federal civil rights obligations into actionable steps for accessibility.

This guide is designed to help the Town develop and implement its own ADA Transition Plan. It explains the steps for conducting a self-evaluation of services, programs, activities, and facilities; identifying accessibility barriers; and outlining strategies to achieve ADA compliance. The self-evaluation of existing facilities assesses the Town's ability to provide access and services for individuals with disabilities, while the inventory of barriers and strategies for removal outline structural changes needed to achieve accessibility. By following this guidance, the Town will be equipped to create a plan that ensures pedestrian routes are accessible and safe for people of all abilities.

Regulatory Standards

ADA standards are issued by the Department of Justice (DOJ) and Department of Transportation (DOT). Both standards are closely based on the Architectural and Transportation Barriers Compliance Board's (Access Board) ADA Accessibility Guidelines (ADAAG). The DOT's current ADA Standards for Transportation Facilities was adopted in 2006. The following section outlines key accessibility standards related to pedestrian facilities in the public right-of-way, compiled using DOJ/DOT accessibility standards and the Access Board's Public Right-of-Way Accessibility Guidelines ([PROWAG](#)). The Architectural Barriers Act (ABA) also has developed accessibility guidelines on the design of public trails, which may serve as an additional resource for accessible pedestrian access route design ([ABA](#)). This guide also references the Federal Highway Administration's ([FHWA](#)) *Designing Sidewalks and Trails for Access* guide, and *Sidewalk Assessment* guidelines (Appendix A of this document).

Accessibility Standards

- Pedestrian Access Routes
 - Continuous Clear Width: 48 inches, exclusive of curb.
 - Grade: No steeper than 1:20 (5%), except where grades for the established adjacent street exceed 1:20.
 - Cross Slope: No steeper than 1:48 (2.1%).
 - Cross slopes for crosswalks with yield or stop control devices may be 1:48 (2.1%) maximum.
 - Cross slopes for crosswalks at uncontrolled approaches, traffic control signals, or pedestrian hybrid beacons may be 1:20 (5%) maximum.
 - Changes in Level:
 - Up to ¼ inch maximum: Permitted to be vertical.
 - ¼ inch to ½ inch: Beveled with a slope not steeper than 1:2 (50%). Changes greater than ½ inch up to 6 inches shall have a 1:12 (8.3%) maximum slope.
 - Horizontal Openings (such as gratings): Shall not allow passage of sphere larger than ½ inch in diameter.
 - Shared Use Paths: Clear width shall extend full width. Obstructions such as bollards shall not reduce clear width to less than 48 inches. Surfaces at pedestrian at-grade rail crossings: Where path crosses rail, shall be level and flush with top of rail at outer edges.
- Ramps
 - Required along accessible routes to span changes in level greater than ½ inch. Portions of accessible routes with running slopes steeper than 5% also must be treated as ramps.
 - Ramp Runs: Running slope not steeper than 1:12 (8.3%). Cross slopes shall not be steeper than 1:48 (2.1%). The maximum rise is 30 inches.
 - Handrails: Required on ramp runs with a rise greater than 6 inches and shall be provided on both sides of stairs and ramps. Clear width between handrails shall be 36 inches minimum.
- Curb Ramps
 - Figure 2 illustrates accessible curb ramp dimensions.

Figure 1 | Illustration describing sidewalk slopes. (Source: U.S. Access Board – PROWAG)

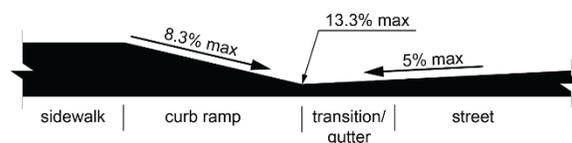
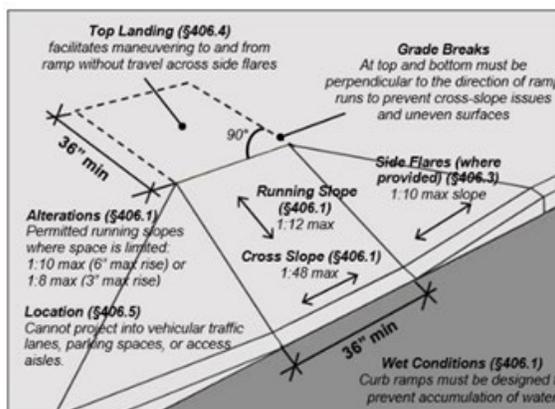
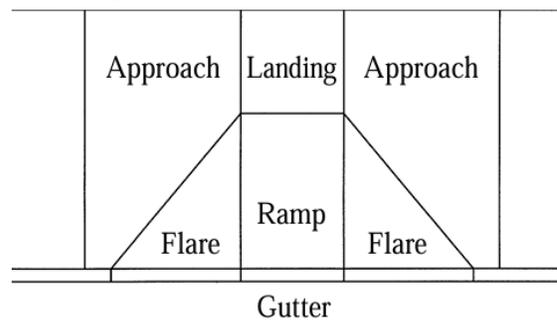


Figure 2 | Illustration highlighting curb ramp components and accessible dimensions. (Source: U.S. Access Board – PROWAG)



- Required at newly constructed or altered streets, highways, and street-level pedestrian walkways to provide an accessible route for pedestrians at intersections.
 - Running Slope: Shall be 1:12 (8.3%) maximum.
 - Cross Slope: Shall be 1:48 (2.1%) maximum.
 - Change of Grade: Shall be 13.3% maximum.
 - Counter Slopes (of adjoining gutters/roadway surfaces): No steeper than 1:20 (5%). The adjacent surfaces at transitions at curb ramps to walks, gutters, and street shall be at the same level.
 - Clear Area: Shall be provided beyond the bottom grade break of the curb ramp run and shall be 48 x 48 inches minimum outside active traffic lanes of the roadway, with running slopes no greater than 1:20 (5%).
 - Ramps with flared sides shall have a segment of curb 24 inches long minimum on each side of the curb ramp and within any marked crossings.
 - Landings: Shall be provided at the top of curb ramps when a change in direction is necessary to access a curb ramp from a pedestrian access route. Shall be 48 x 48 inches minimum and must be designed to prevent the accumulation of water.
 - Flares: Where a pedestrian path crosses the side of a curb ramp, the side of the curb ramp shall be flared with a maximum slope of 1:10 (10%), measured parallel to the adjacent curb line.
 - Figure 3 illustrates the position of curb ramps in relation to the sidewalk, curb, and gutter.
- Detectable Warning Surfaces: Shall consist of truncated domes in a square or radial grid pattern that extend the full width of the curb ramp. They shall contrast visually with adjacent walking surfaces (light-on-dark or dark-on-light).
 - Shall extend either the full depth of the curb ramp or 24 inches deep minimum.
 - Perpendicular curb ramps are recommended over diagonal curb ramps, as it can be difficult to locate the clear space at the bottom of diagonal curb ramps that is outside of active traffic lanes. People with vision impairments who use curb slopes as a cue to crossings may also be misled by the orientation of diagonal ramps.

Figure 3 | Illustration describing curb ramps in relation to sidewalks. (Source: FHWA – Designing Sidewalks and Trails for Access)



Transition Plan Elements

This section provides an overview of the core elements required in an ADA Transition Plan, with guidance for developing each element on the following pages.

While ADA Transition Plans typically evaluate public agencies' entire programs (e.g., physical accessibility, as well as program and technical accessibility), this guide focuses on physical requirements for facilities in public rights-of-way. The self-evaluation may include a quantified list of existing facilities in the Town's transportation network (e.g., sidewalks, curb ramps, crosswalks, traffic control signals, bus stops).

The Town should also identify the person or office responsible for executing the ADA Transition Plan, which will provide accountability and consistency when striving for ADA accessibility compliance.

Inventory of Barriers: Public agencies shall identify obstacles in pedestrian infrastructure.

Methods for Barrier Removal: Public agencies shall describe in detail how barriers will be addressed (i.e., outline methods to make facilities accessible).

Schedule for Improvements: Agencies shall provide a timeline or phasing plan for implementing accessibility upgrades.

Public Involvement: Agencies shall provide an opportunity to interested persons, including individuals with disabilities or organizations representing individuals with disabilities, to participate in the development of the ADA Transition Plan by submitting comments.

Inventory of Barriers

The inventory of barriers is conducted through field observations of existing pedestrian facilities within public rights-of-way. It is recommended that the Town conduct field surveys to identify physical conditions that may limit accessibility, such as missing pedestrian facilities, changes in surface level, excessive slopes, poor surface condition, or obstructions.

Data Collection Methods

Town staff may collect information on existing pedestrian facilities using standardized forms and visual documentation (see Appendix B). Measurements should be taken as needed to record key infrastructure characteristics, such as widths, slopes, and changes in elevation. Photographs may be used to document observed barriers and provide visual context for future evaluation and prioritization.

Inventory records may be linked to geographic location data to support barrier documentation and future analysis or improvement prioritization. Locations of observed barriers can be mapped using readily available tools, such as mobile mapping applications, GPS-based data collection platforms, or geographic information system (GIS) software. These tools allow the Town to visualize barrier locations, group improvement needs by location or facility type, and support prioritization and project implementation.

Examples of data collection tools may include:

- Mobile devices or tablets capable of capturing georeferenced photos.

- Measuring devices such as a measuring tape or wheeled distance measurer.
- Mapping tools or software (e.g., web-based maps, GPS applications, or GIS Platforms such as Google Maps, ArcGIS, Gaia GPS, and QGIS).

Example field survey checklists are included as Appendix B. The following subsections describe access characteristics for public rights-of-way, providing context and key considerations for typical pedestrian infrastructure elements. Accessibility terms are defined in the Glossary at the end of this guide.

Sidewalks

Sidewalks provide essential pedestrian access throughout portions of the Miami community. Barriers may include uneven surfaces, cracks, obstructions, insufficient width, or lack of connectivity.

Access characteristics to consider while inventorying barriers include:

- **Surface Material:** What is the sidewalk composed of? Does it provide a smooth, slip-free surface for users?
- **Design Width:** Is the typical sidewalk width for this segment known?
- **Minimum Clear Width:** What is the width of the most narrow section of this segment?
- **Grade:** What is the slope parallel to the direction of pedestrian travel? Maximum grade should be measured over 24-inch intervals.
- **Cross Slope:** What is the slope perpendicular to the direction of pedestrian travel?
- **Changes in Level:** Are there any steep sections, severe cross slopes, or other changes in grade? Are there locations where sidewalk joints show heaving (e.g., one section higher than another) or gaps?
- **Vertical Clearance:** Are there any vertical obstructions that may impact users (e.g., building overhangs, tree branches, signs, awnings)?
- **Obstructions:** Are there any objects that limit clear width (e.g., utility poles, street signs, benches, fire hydrants, business signs, newspaper vending machines, landscaping)?



Figure 4 | Bullion Plaza Cultural Center and Museum sidewalk. A segment of sidewalk with a joint gap and uneven widths.

Curb Ramps

Curb ramps allow people using wheelchairs, walkers, strollers, or other wheeled devices to transition between sidewalks and streets safely. Barriers may include missing ramps, steep slopes, inadequate landing areas, or lack of detectable warning surfaces.

Access characteristics to consider while inventorying barriers include:

- **Ramp Material:** Is the surface smooth, stable, and slip resistant?
- **Ramp Direction:** Is the curb ramp aligned with the direction of pedestrian travel?
 - *Perpendicular curb ramps* are perpendicular to the curblines.
 - *Directional curb ramps* are similar to perpendicular curb ramps but align parallel with the crosswalk (or direction of pedestrian travel, if no crosswalk is present).
 - *Parallel curb ramps* run parallel to the curblines and are a continuation of the sidewalk. They consist of two ramps joined in the middle by a landing that is level with the roadway.
 - *Diagonal curb ramps* are typically installed at the apex of a corner and may direct users into the intersection before aligning with a crosswalk, requiring marked clear space for maneuvering.
- **Approach Slope:** Is the slope of the sidewalk approaching the curb ramp gentle enough for users to access the ramp safely?
- **Ramp Slope:** Is the running slope of the curb ramp excessively steep/difficult to navigate?
- **Landing Area:** Is there a level landing at the top and bottom of the ramp to allow users to maneuver safely?
- **Landing Length:** Does the landing provide adequate clear space for people using wheeled devices, without encroaching into the roadway or pedestrian path?
- **Counter Slope:** Is the slope at the base of the curb ramp (e.g., gutter slope) steep? Does it cause difficulty for users transitioning into the street?
- **Cross Slope:** Is the slope perpendicular to the curb ramp or landing direction of travel gentle enough for users to navigate?
- **Detectable Warnings:** Are detectable warning surfaces present at the curb ramp to help people with visual impairments detect upcoming intersections? Are they properly placed, visually contrasting, and in good condition?
- **Obstructions:** Are utility poles, signal cabinets, signs, or other objects obstructing access to the curb ramp or landing area?



Figure 5 | Miami Ave/US 60 Intersection.
A curb ramp with limited ramp width and no ADA-compliant detectable warning surface.

Pedestrian Crossings

Pedestrian crossings occur at both marked and unmarked locations throughout the town, primarily at intersections. Marked crosswalks provide safe, accessible passage at crossing locations. There are several marked crosswalks throughout the Miami community, but unmarked crossings at stop-controlled or uncontrolled intersections represent the majority of pedestrian crossing locations.

Crossing barriers may include faded or missing markings, lack of accessible curb ramps, poor visibility, insufficient crossing time, or absence of accessible pedestrian signals.



Figure 6 | Bullion Plaza Cultural Center and Museum. While the crosswalk in front of Bullion Plaza has handrails on either side, there are no ramps to guide the transition from sidewalk to street level.

Access characteristics to consider while inventorying barriers include:

- **Crossing Type:** Is the pedestrian crossing marked or unmarked?
- **Traffic Control:** Is the crossing at an intersection or midblock? If at an intersection, is the crossing signalized, stop-controlled, or uncontrolled?
- **Marking Condition:** If present, are crosswalks clearly marked and visible? Are markings faded, worn, or missing?
- **Crossing Width:** Does the crosswalk align directly with pedestrian paths on both sides of the roadway?
- **Surface Condition:** Is the crossing surface smooth, stable, and slip-resistant? Are there any cracks, potholes, or uneven pavement sections?
- **Grade and Cross Slope:** Is the crosswalk excessively sloped in any direction?
- **Curb Ramps:** Are curb ramps present at both ends of the crosswalk? Do the ramps align with the direction of travel?
- **Visibility:** Is the crossing visible to drivers, especially at night? Is there adequate lighting in the crossing area?
- **Pedestrian Signals:** Are there pedestrian signals at the crossing? Is there a lack of tactile or audible clues, excessive button heights, or insufficient crossing time?
- **Obstructions:** Are there any utility covers, grates, or debris within the crossing area?

Driveways

Driveways intersecting sidewalks can create barriers if slopes are too steep or surfaces are uneven. Barriers may include abrupt changes in grade, poor surface condition, or lack of detectable warnings where pedestrian paths cross vehicular routes.

Access characteristics to consider while inventorying barriers include:

- **Surface Material:** Is the driveway surface smooth, stable, and slip-resistant where it crosses the pedestrian path?
- **Cross Slope:** Is the slope through the driveway minimal enough for people with wheeled devices to maneuver?
- **Changes in Level:** Do steep sections or changes in grade make the path difficult for users to navigate?
- **Path Continuity:** Is the pedestrian path visually and functionally continuous through the driveway?
- **Path Width:** Is the minimum clear width of the pedestrian path maintained through the driveway crossing?
- **Vehicle Presence:** Do vehicles frequently block or encroach upon the pedestrian path?
- **Visibility:** Is the pedestrian crossing area visible to drivers entering or exiting the driveway?



Figure 7 | Sullivan Street near Miami Ave. Driveways that do not provide level landings cause uneven sidewalk surfaces that may be difficult for wheelchair users to navigate.

Bus Stops

Bus stops should provide safe, accessible boarding and alighting areas for public transit users. Barriers may include a lack of firm and level boarding surfaces, inadequate shelter clearance, or inaccessible paths leading to the bus stop.

The Miami community is served by two fixed-route transit lines. Bus stops are present at select locations within the town, including near key destinations such as the Miami Memorial Library. The amenities (e.g., shelters, benches) offered vary by stop. Although existing accessibility barriers at bus stops were not evaluated as part of this Study, accessibility considerations are listed here for the Town to evaluate accessibility in coordination with transit providers in the future.



Figure 8 | Adonis Ave near Miami Memorial Library. A Copper Mountain Transit bus stop with limited amenities and steep, uneven surfaces on the sidewalk approach.

Access characteristics to consider while inventorying barriers include:

- **Path Connectivity:** Is there a continuous, accessible path connecting the bus stop to nearby sidewalks or other pedestrian routes?
- **Boarding Area:** Is there a level, stable, slip-resistant surface where passengers can board and exit the bus?
- **Clear Space:** Is sufficient clear space provided for wheelchair users to maneuver and wait for the bus?
- **Surface Condition:** Are there cracks or uneven surfaces at the stop location?
- **Amenities:** If amenities such as benches or bus shelters are present, do they obstruct pedestrian access or clear space? Are they accessible by people with wheeled devices?
- **Vertical Clearance:** Are shelters or signage mounted high enough to avoid hazards for pedestrians?
- **Sign Placement:** Is the bus stop sign accessible and visible without obstructing the pedestrian path?
- **Obstructions:** Do stop amenities, signs, or other elements obstruct access to the bus stop or adjacent pedestrian path?

Methods for Barrier Removal

The Town should describe in detail how barriers will be addressed (i.e., outline methods to make facilities accessible). The Town may consider methods such as guidelines to include ADA upgrades during the construction of funded street improvements, or the development of ADA design guidelines for new transportation facilities. Such guidelines may be based on national standards and best practices—such as PROWAG—as well as alignment with local, state, and federal regulations.

Schedule for Improvements

Agencies shall provide a timeline or phasing plan for implementing accessibility upgrades identified through the ADA Transition Plan. It is recommended that the town show a strong commitment to both short-term and long-term ADA improvements, consistent with applicable accessibility standards and available funding.

Short-Term Improvements

Short-term improvements are actions that can be implemented relatively quickly using existing resources, routine maintenance activities, or planned projects. Short-term actions may include:

- Addressing accessibility barriers in areas of higher pedestrian use or near key community destinations.
- Integrating ADA improvements into scheduled street, sidewalk, utility, or drainage projects, including those included in the Town's Capital Improvement Program.
- Constructing or rehabilitating ADA facility elements concurrently with other infrastructure improvements, where feasible.

Long-Term Improvements

Long-term improvements may include planning, design, and capital investments directed at eliminating accessibility barriers over time. It is recommended that the Town pursue a phased approach to long-term implementation, guided by a prioritization methodology that considers community needs, available resources, and opportunities to coordinate with other projects.

Long-term actions may include:

- Developing and applying an ADA improvement prioritization methodology to guide future infrastructure investments.
- Constructing new pedestrian facilities (such as those proposed in this Study) that align with the most recent ADA accessibility standards and best practices.
- Addressing accessibility barriers that require more extensive design, right-of-way coordination, or funding.

Prioritization Considerations

The Miami Trails Framework Plan for Improvements identifies an implementation plan based on a prioritization process that considered a number of criteria. These criteria were developed through the planning process. While the Plan recommends a sequence of implementing the improvements, other factors may impact the prioritization of ADA improvements (e.g., new development or redevelopment of properties). The Town should consider opportunities to

coordinate improvements with other planned or funded projects to address gaps in the pedestrian infrastructure network.

Public Involvement

Public involvement is a critical component of the ADA Transition Plan. Providing opportunities for residents and stakeholders to engage during the accessibility planning and implementation process ensures that accessibility needs are identified and addressed in a manner that reflects community priorities.

Public involvement efforts for the ADA Transition Plan may include:

- Conducting outreach to residents and community stakeholders to understand accessibility needs and priorities.
- Coordinating with accessibility-focused local organizations, service providers, and community advocates.
- Creating opportunities for the public to share input on accessibility concerns, priorities, and barriers.
- Providing plan and outreach materials in accessible formats upon request.

The ADA Transition Plan also requires the development of a formal ADA grievance procedure that allows individuals to report accessibility concerns or file complaints related to the Town's programs, services or facilities. The grievance procedure outlines the steps for submitting a complaint, the process for complaint review and response, and timelines for resolution.

Copper Mountain Transit—the Town's regional transit service provider—has developed ADA-related documents and public feedback materials to comply with federal, state, and local regulations. These materials (e.g., Non-Discrimination Notice, Discrimination Complaint Forms, Non-Discrimination Complaint Procedures) align with the ADA grievance process. It is recommended that the Town coordinate with Copper Mountain Transit to develop complementary grievance reporting procedures for the ADA Transition Plan.

Existing ADA Conditions

This section provides a high-level overview of ADA barriers observed over the course of this Study for each of the 10 discrete segments along the route alignment. The segment extents are displayed on the map below, with numbers corresponding to each segment's location.

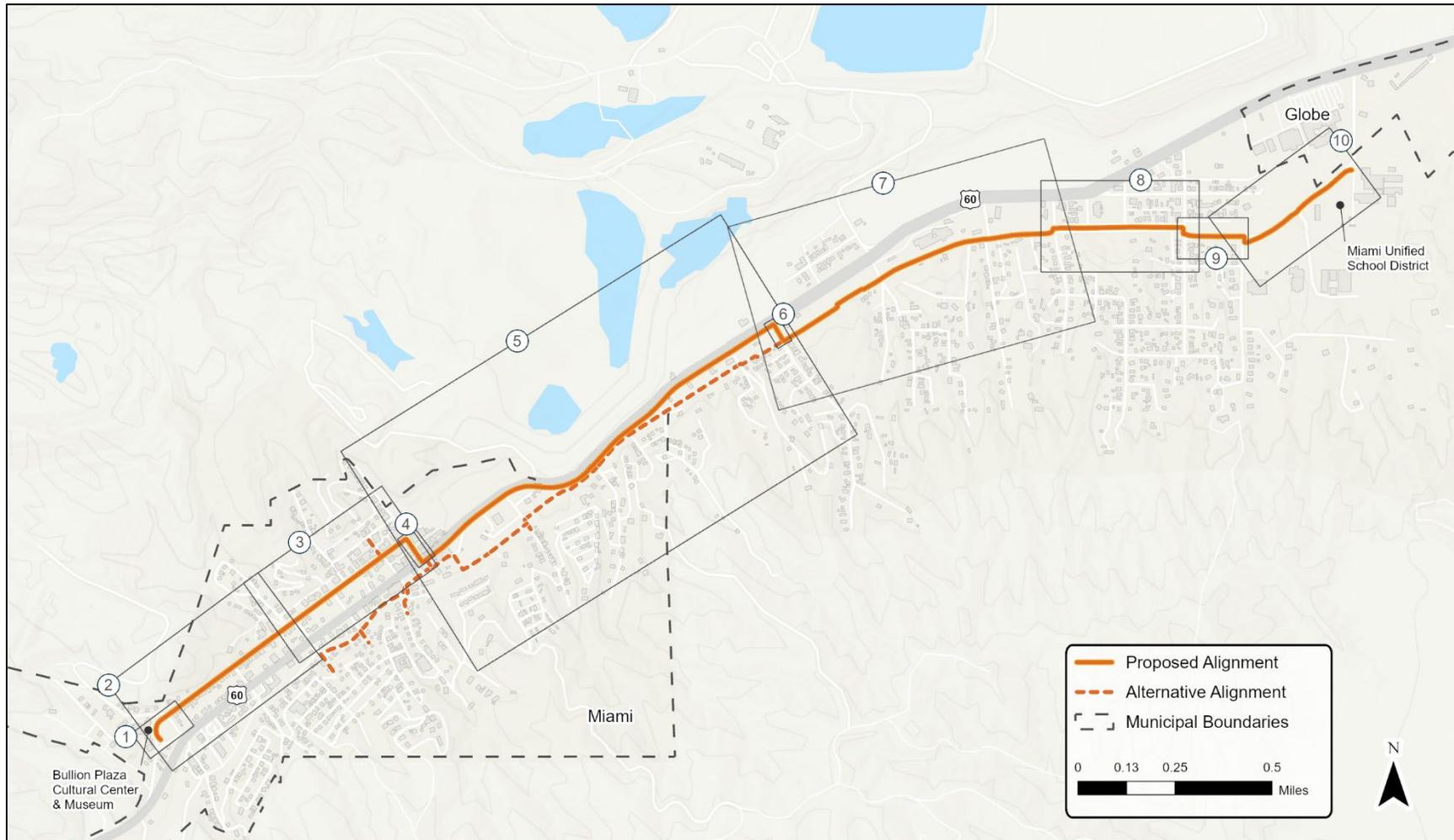


Figure 9 | Town of Miami trail alignment showing the segmentation describing the proposed improvements.

1. Sullivan Street – Bullion Plaza Cultural Center and Museum



Figure 10 | Sullivan Street – Bullion Plaza Cultural Center and Museum

This segment has existing sidewalks on both sides of the street and older ADA infrastructure in select locations. Barriers to address may include poor sidewalk surface conditions, non-compliant curb ramps, and excessive slopes or changes in level.

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> Cracks, uneven surfacing and joint heaving in some locations Excessive changes in level (e.g., high curbs from sidewalk to street level)
Curb Ramps	<ul style="list-style-type: none"> 2 existing directional curb ramps at Plaza Ave / Sullivan St intersection Lack of compliant detectable warning surfaces and visually contrasting material The Plaza crosswalk has handrails on either side of the street, but the lack of a compliant ramp still presents challenges for people using wheeled devices
Pedestrian Crossings	<ul style="list-style-type: none"> Faded crosswalk markings at Bullion Plaza building entrance Stop-controlled intersection at Plaza Circle/Turner Street, with an unmarked crossing
Driveways	<ul style="list-style-type: none"> None
Additional Comments	<ul style="list-style-type: none"> Limited lighting on the east side of Turner Street may limit visibility

2. Sullivan Street – Plaza Avenue to Davis Canyon Road



This segment has an existing sidewalk on the south side of the roadway, with varying surface conditions. Residential driveways cross the sidewalk throughout the segment. Barriers to address may include poor sidewalk conditions, non-compliant curb ramps, unmarked crossings, and sloped surfaces near driveways.



Figure 11 | Sullivan Street – Plaza Avenue to Davis Canyon Road

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> Cracks and uneven surfacing in some locations Changes in level and joint heaving where street tree roots have caused the material to shift
Curb Ramps	<ul style="list-style-type: none"> Existing directional curb ramps Lack of compliant detectable warning surfaces and visually contrasting material
Pedestrian Crossings	<ul style="list-style-type: none"> 2 stop-controlled, unmarked crossings at Plaza Ave and Reppy Ave
Driveways	<ul style="list-style-type: none"> Residential driveways along the length of the segment, with sloped surfaces in some locations that may cause issues for people using wheeled devices
Additional Comments	

3. Sullivan Street – Davis Canyon Road to Miami Avenue



This segment has existing sidewalks on both sides of the roadway. While most sections are generally in good condition, obstructions such as street furniture and utility poles are present throughout. Driveways also cause sloping in some locations. Improving crossings with ADA-compliant ramps and crosswalks will create a more accessible pedestrian environment.



Figure 12 | Sullivan Street – Davis Canyon Road to Miami Avenue

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> Obstructions such as street furniture (benches, planters, business signs) and utility poles limit clear width in some locations
Curb Ramps	<ul style="list-style-type: none"> Existing diagonal curb ramps Lack of compliant detectable warning surfaces and visually contrasting material
Pedestrian Crossings	<ul style="list-style-type: none"> 4 stop-controlled, unmarked crossings at Forest Avenue, Cordova Avenue, Inspiration Avenue, and Keystone Avenue On-street parking obstruct visibility for pedestrians and approaching motorists
Driveways	<ul style="list-style-type: none"> Commercial driveways cause sloped sidewalk surfaces in several locations
Additional Comments	<ul style="list-style-type: none"> Although the alignment is on the south side of the roadway, curb ramp and marked crossing improvements on the north approach of the three-legged, stop-controlled Davis Canyon Rd intersection will increase safety and accessibility for pedestrians ADA on-street parking spaces are present in some locations, but nearby curb ramps are still non-compliant

4. Miami Avenue



This segment has sidewalks on both sides of the roadway. Changes in level and a lack of curb ramps and handrails on the eastern sidewalk make the western sidewalk a more viable option for pedestrians. However, obstructions, limited clear space, and poor infrastructure conditions present accessibility challenges near the US 60 intersection.

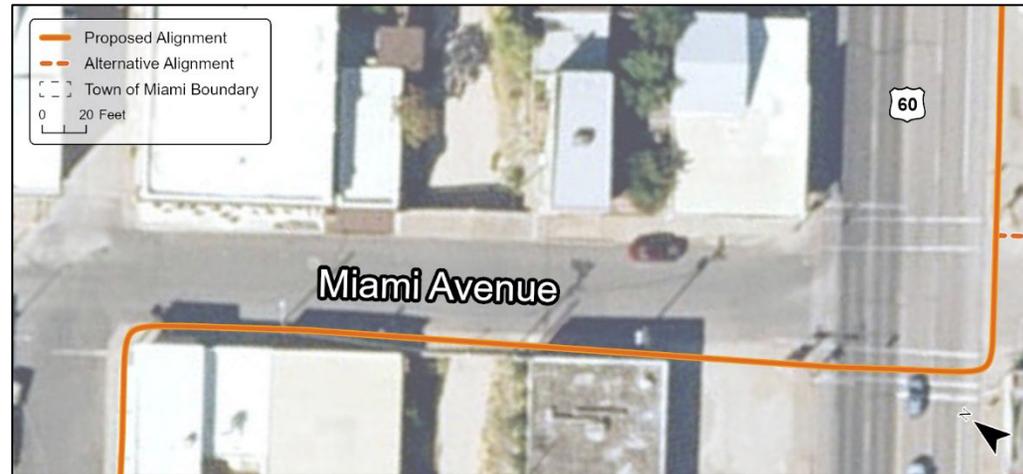


Figure 13 Miami Avenue – Sullivan Street to US 60.

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> Fair to poor surface conditions with extensive cracking, uneven surfaces, and abrupt changes in level Steep slopes near the Luten arch bridge crossing Bloody Tanks Wash Obstructions such as street furniture (benches, planters, business signs) and utility poles limit clear width in some locations
Curb Ramps	<ul style="list-style-type: none"> Existing diagonal curb ramps Lack of compliant detectable warning surfaces and visually contrasting material No clear landing area at US 60 curb ramp
Pedestrian Crossings	<ul style="list-style-type: none"> 1 stop-controlled, unmarked intersection at Sullivan St 1 signalized intersection at US 60, with existing crosswalk in fair condition (cracks in the pavement near crossing) Pedestrian push button at all 4 corners of the US 60 intersection Existing curb ramps do not align with the direction of pedestrian travel
Driveways	<ul style="list-style-type: none"> Driveway for lot on the northwest corner of US 60 intersection in poor condition
Additional Comments	<ul style="list-style-type: none"> Signal cabinet and poles on the northwest corner of US 60 intersection obstruct existing sidewalk, severely limiting clear width and reducing access to the existing curb ramp

5. US 60 - Miami Avenue to S. Calle de Loma



This segment has existing continuous sidewalks on southside of street, with intermittent sidewalks on north side. Varying sidewalk surface conditions, non-compliant curb ramps, and numerous commercial driveways interrupting the pedestrian path present accessibility challenges.



Figure 14 US 60 – Miami Avenue to S Calle de Loma

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> • Debris and vegetation in some locations may create an unsafe surface for users • Obstructions such as utility poles limit sidewalk clear width in some locations
Curb Ramps	<ul style="list-style-type: none"> • Where present, curb ramps are directional • Lack of compliant detectable warning surfaces and visually contrasting material
Pedestrian Crossings	<ul style="list-style-type: none"> • 7 stop-controlled, unmarked crossings • Railroad crossing at Marion St presents a challenge for wheeled device users, with tracks creating an uneven crossing surface and no crosswalk markings • Pavement condition varies at crossings, with some having poor condition (e.g., cracks, uneven surfacing, patchwork pavement)
Driveways	<ul style="list-style-type: none"> • Commercial driveways cause sloping and uneven sidewalk surfaces in some locations • Sidewalks visually appear discontinuous near driveways that are unpaved or covered in dirt/debris • Frequent vehicles turning into commercial driveways along US 60 increase risk of pedestrian/vehicle conflict
Additional Comments	<ul style="list-style-type: none"> • Any crossing improvements at Marion St would require close coordination with Arizona Eastern Railway (AZER) and other stakeholders

6 S. Calle de Loma – US 60 to Railroad Avenue



This segment does not have existing pedestrian facilities. ADA-compliant improvements such as a sidewalk separated from the street and curb ramps would improve pedestrian access and safety between US 60 and Railroad Ave.



Figure 15 | S. Calle de Loma – US 60 to Railroad Avenue

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> No existing sidewalk. Roadway shoulder has uneven pavement near commercial driveway, with vegetation and debris causing uneven ground surfacing throughout the segment
Curb Ramps	<ul style="list-style-type: none"> Directional curb ramps are present at US 60, but ramps are missing at Railroad Ave Lack of compliant detectable warning surfaces and visually contrasting material
Pedestrian Crossings	<ul style="list-style-type: none"> 2 stop-controlled, unmarked crossings at US 60 and Railroad Ave Railroad crossing near Railroad Ave travels over multiple sets of active railroad tracks, causing uneven surfacing
Driveways	<ul style="list-style-type: none"> Commercial driveway near US 60 has worn, uneven pavement
Additional Comments	<ul style="list-style-type: none"> Any sidewalk improvements would require crossing multiple sets of railroad tracks and close coordination with AZER and other stakeholders

7. Railroad Avenue – S Calle de Loma to Pineway Street



This segment does not have existing pedestrian facilities. Steep hillside slopes and limited shoulder space in some areas may present challenges for constructing ADA-compliant pedestrian infrastructure. Improvements such as sidewalks separated from the street would improve pedestrian access and safety.



Figure 16 | Railroad Avenue – S Calle de Loma to Pineway Street

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> No existing sidewalks Built-up dirt and debris create steep slopes and limit shoulder space Utility poles and street signs obstruct useable right-of-way space
Curb Ramps	<ul style="list-style-type: none"> No existing curb ramps
Pedestrian Crossings	<ul style="list-style-type: none"> 5 stop-controlled, unmarked intersections (including 3 three-legged intersections used to access hillside neighborhoods) No stop signs present for northbound/southbound traffic Poor to fair pavement conditions where alignment transitions from south to north side of roadway midblock Limited streetlighting lowers pedestrian visibility for oncoming motorists
Driveways	<ul style="list-style-type: none"> Residential driveways throughout the segment create conflict points Vehicles parked in driveways and along adjacent right-of-way obstruct shoulder space
Additional Comments	

8. Locomotive Drive – Pineway Street to Old Oak Street



This segment does not have existing pedestrian facilities. ADA-compliant improvements such as sidewalks separated from the street, curb ramps, and adequate railroad crossings would improve pedestrian access and safety.



Figure 17 | Locomotive Drive – Pineway Street to Old Oak Street

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> No existing sidewalks Steep slope between roadway and railroad tracks presents difficulties for constructing pedestrian path improvements Obstructions such as utility boxes and vehicles parked in the right-of-way are present in some locations
Curb Ramps	<ul style="list-style-type: none"> No existing curb ramps
Pedestrian Crossings	<ul style="list-style-type: none"> 2 stop-controlled, unmarked intersections Railroad crossings at Pineway St and Old Oak St, with uneven surfacing over tracks Limited lighting north of the roadway may not provide adequate visibility for pedestrians traveling south of the roadway
Driveways	<ul style="list-style-type: none"> Trail south of roadway does not conflict with driveways along the segment, but vehicles parking in right-of-way may create conflict
Additional Comments	

9. Railroad Avenue – Old Oak Street to Maple Leaf Street



This segment has an existing asphalt sidewalk in poor repair on the north side of the roadway, and an existing crosswalk. Poor pedestrian infrastructure conditions create accessibility barriers.



Figure 18 | Railroad Avenue – Old Oak Street to Maple Leaf Street

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> Existing asphalt sidewalk in poor condition, with extensive cracks, uneven surfacing, and crumbling in some locations Inadequate clear width (sidewalk is 4 feet wide) with vegetation and debris encroaching on clear space
Curb Ramps	<ul style="list-style-type: none"> Existing diagonal curb ramp at Maple Leaf St; lacks compliant detectable warning surfaces and visually contrasting material Curb ramps missing along asphalt sidewalk
Pedestrian Crossings	<ul style="list-style-type: none"> 2 stop-controlled intersections; Old Oak St is unmarked, while Maple Leaf St is a marked crosswalk but has fading paint Limited lighting near Maple Leaf St intersection may limit pedestrian visibility for oncoming motorists
Driveways	<ul style="list-style-type: none"> None north of roadway along alignment
Additional Comments	<ul style="list-style-type: none"> An improved asphalt sidewalk on north side of street will provide pedestrian pathway free of conflicts with existing driveways on south side of street

10. Railroad Avenue – Maple Leaf Street to Ragus Road



This segment has an existing sidewalk on the south side of the roadway. Pedestrian facilities are generally in good condition but may benefit from ADA-compliant curb ramps and crossing improvements.



Figure 19 | Railroad Avenue – Maple Leaf Street to Ragus Road

Element	Existing Conditions
Sidewalks	<ul style="list-style-type: none"> No barriers observed
Curb Ramps	<ul style="list-style-type: none"> Directional curb ramps Lack of compliant detectable warning surfaces and visually contrasting material
Pedestrian Crossings	<ul style="list-style-type: none"> 1 stop-controlled, marked crossing Crosswalk markings in fair condition
Driveways	<ul style="list-style-type: none"> MUSD entrance is stop-controlled and has crosswalk markings
Additional Comments	

Glossary

Approach: Section of an accessible route flanking the landing of a curb ramp. The approach may be slightly graded if the landing level is below the elevation of the adjoining sidewalk.

Changes in Level: Vertical height transitions between adjacent surfaces or along the surface of a path (e.g., curbs without ramps, drainage grates, heaving and settlement, railroad tracks, tree roots, uneven transitions between streets, gutters, and ramps).

Cross Slope: The slope that is perpendicular to the direction of pedestrian travel.

Counter Slope: A grade that is opposite to the general running grade of a path (e.g., the slope of roadway gutters is generally counter to the slope of curb ramps).

Curb Ramp: Sloped transition between the street and the sidewalk where the grade is constant and the cross-slope is at a minimum (preferably less than 2 percent).

Design Width: The width specification the sidewalk was intended to meet, extending from the curb or planting strip to any buildings or sidewalks that form the opposite borders of the sidewalk.

Detectable Warning Surface: A standardized surface feature built in or applied to pedestrian circulation paths and other pedestrian facilities to warn of hazards.

Flare: Sloped transition between the curb ramp and the sidewalk.

Grade (Slope): The slope parallel to the direction of travel (calculated by dividing the vertical change in elevation by the horizontal distance covered).

Gutter: Trough or dip used for drainage purposes that runs along the edge of the street and the curb or curb ramp.

Landing: Level area of sidewalk at the top of a curb ramp facing the ramp path.

Minimum Clear Width: The narrowest point on a sidewalk.

Obstructions: Objects that limit the vertical passage space, protrude into the circulation route, or reduce the clearance width of a pedestrian path.

Ramp: A sloped walking surface with a running slope steeper than 1:20 (5.0%) that accomplishes a change in level and is not part of a pedestrian circulation path that follows the roadway grade. A curb ramp is not a ramp.

Running Slope: The slope that is parallel to the direction of pedestrian travel.

Vertical Clearance: The minimum unobstructed vertical passage space required along a sidewalk.

**Appendix ADA–A –
Federal Highway Administration’s (FHWA) Designing
Sidewalks and Trails for Access Guide**

Sidewalk Assessment

Sidewalk planners and designers need an objective method to assess the conditions of sidewalks. With such information, sidewalk professionals can evaluate conditions experienced by pedestrians in the public right-of-way and identify sites requiring accessibility and maintenance improvements. The information can also be used to develop transition plans, verify compliance with design guidelines, provide information to pedestrians, and continue improving sidewalk conditions for all users.



Figure 11-1. Collecting objective information about sidewalk conditions is a critical step towards improving the accessibility of existing pedestrian networks.

11.1 Benefits of assessment

Inventorying the existing pedestrian facilities and assessing the accessibility of the travelway is the first step towards providing access for all pedestrians. Objective data obtained from sidewalk assessments enables managers to create signs and other informational guides that will assist users in selecting the best routes for travel. Conducting sidewalk assessments is also beneficial because they allow managers to inventory sidewalk conditions and plan for projects, in order to:

- Determine if the sidewalk meets intended design specifications and guidelines;
- Prioritize sidewalk maintenance projects;
- Revise and update Americans with Disabilities Act (ADA) transition plans;

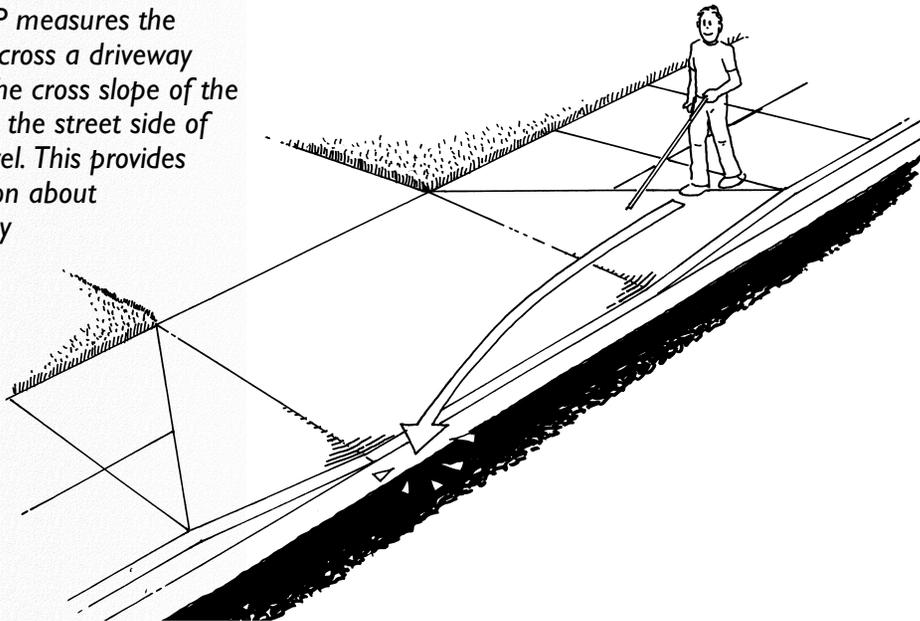
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- Budget for sidewalk projects;
- Identify portions of sidewalks needing accessibility improvements;
- Develop maintenance schedules;
- Quantify the extent of the work required;
- Catalog feature and maintenance information;
- Share data and project plans with disability focus groups;
- Create objective sidewalk information that can be provided to users in various formats such as signage, maps, and Websites;
- Add pedestrian information to Geographic Information Systems (GIS) mapping and inventories; and
- Justify maintenance funding.

Figure 11-2. SWAP measures the best path of travel across a driveway crossing, as well as the cross slope of the driveway crossing on the street side of the best path of travel. This provides important information about whether the driveway crossing has a cross slope that will be detectable by people with vision impairments.



11.2 Sidewalk Assessment Process overview

The Sidewalk Assessment Process (SWAP) is a prototype system developed to inventory the dimensions, locations, and conditions experienced by pedestrians in the public right-of-way in a reliable, consistent, and comprehensive manner. Measurement techniques from the Universal Trail Assessment Process (Chapter 12) were modified and adapted to record sidewalk conditions.

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Pedestrian coordinators, sidewalk designers, and ADA experts were enlisted to ensure that the Sidewalk Assessment Process accurately recorded information in a usable format about all sidewalk features and dimensions affecting pedestrian access. Conditions identified in accessibility guidelines, pedestrian facility guidelines, and municipal transportation planning documents were also used. The terminology and measurement procedures for the SWAP were developed to ensure consistency in assessments.

Quick measurements of sidewalk components that impact access are recorded on a *Stroll Sheet*, which contains *Station*, *Features*, and *Curb Ramp* forms. Intersections are evaluated using the Intersection Checklist. Complex sidewalk elements such as curb ramps, driveway crossings, and medians identified on the *Stroll Sheet* are measured in more detail and recorded on the *Sidewalk Element Analysis* form. A complete set of the Sidewalk Assessment Process forms is contained in Appendix A.

The Sidewalk Assessment Process is intended to be a modular system. Transportation agencies should identify the components that are most appropriate to their assessment needs. For example, if an agency wanted to determine where access improvements are needed, they would use the basic evaluation recorded on the *Stroll Sheet*. However, if an agency has already determined that a driveway crossing is problematic, they would conduct a complete evaluation using the *Sidewalk Element Analysis* form for driveway crossings.

11.3 Sidewalk access characteristics

During the development of the Sidewalk Assessment Process, the following characteristics were identified to be most critical to sidewalk access:

- Grade;
- Cross slope;
- Changes in grade and cross slope;

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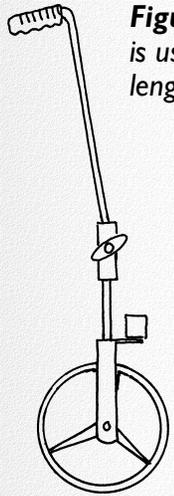


Figure 11-3. A rolatape is used to measure the length of the sidewalk.

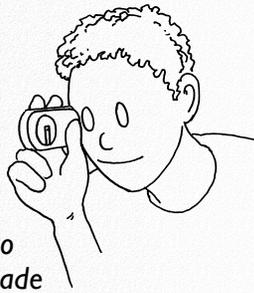


Figure 11-4. A clinometer is used to measure running grade between stations.

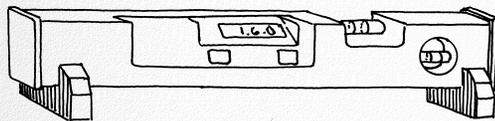


Figure 11-5. A digital inclinometer (level) is used to measure maximum grades, cross slopes, and changes in grade and cross slopes.

- Sidewalk design width;
- Minimum clear width;
- Vertical clearance;
- Location of protruding objects;
- Detectable warnings; and
- Changes in level.

General information about these characteristics including type, dimensions, and location with respect to other sidewalk elements are recorded on the *Stroll Sheet*.

The following complex elements are measured in more detail on the *Element Analysis* forms:

- Curb Ramps;
- Medians;
- Refuge Islands; and
- Driveway Crossings.

11.4 Data collection

Inexpensive and easy-to-use tools have been selected to simplify the process of measuring sidewalk access characteristics. The tool kit should include a rolatape, tape measure, clinometer, inclinometer, and profile gauge. It is recommended that the assessment team wear safety vests to increase their visibility to motorists. A brief description of each tool follows:

1. A **rolatape**, which is a wheeled measurement device, is used to roll down the center of the sidewalk for measuring the length of the sidewalk.
2. A hand-held **clinometer** is used to measure running grade between stations (the measurement reference points).
3. A **digital inclinometer** (level) is used to measure cross slope, maximum cross slope, maximum grade, and changes in grade and

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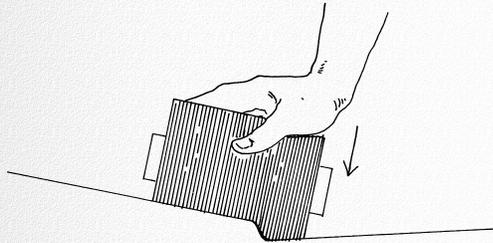


Figure 11-6. A profile gauge is used to measure small changes in level, such as shifts in sidewalk cracks and the lip of driveway and crosswalk crossings.

Station Measurements:

Distance	Design Width	Cross Slope	Running Grade
m	cm	%	%

Figure 11-7. Station measurements are recorded on this form that is contained within the Stroll Sheet form.

cross slope. The inclinometer is 610 mm (24 in) long, and it provides measurements over the same distance covered by the length and width of an average wheelchair, walker, crutch span, or pedestrian stance.

4. A **tape measure** is used to record:
 - Sidewalk width at each station;
 - Width and length of segments narrower than specified for the sidewalk (minimum clear width); and
 - Dimensions of features, obstacles, and protruding objects that might obstruct passage or require maintenance or repair.
5. A **profile gauge** is used to measure small changes in level, such as sidewalk cracks, and to record the shape and spacing of truncated domes (i.e., detectable warnings).

11.4.1 Stroll Sheet station measurements

Stations are established as reference points along the block for taking sidewalk measurements. The rolatape measures the length of the sidewalk between stations. The distance of each station is recorded on the *Station Measurements* form that is contained within the *Stroll Sheet*. Stations are established frequently to increase the number of data points and ensure a higher degree of accuracy.

The first station along each block is established 2.030 m (80 in) from the curb edge of the intersection at an area not considered part of a curb ramp (such as flares and landing). Establishing a station directly at the corner is avoided to prevent atypical measurements created by the presence of a curb ramp and to exclude the corner from the average grade measurement and calculation because the corner is generally more level than the rest of the sidewalk. Subsequent stations are established at regular intervals no greater than 50 m (164 ft) apart. The last station along a block is established approximately

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2.030 m (80 in) from the edge of the intersection at a point not considered part of a curb ramp. Stations should not be established at a point considered part of a driveway crossing; instead, the station is set up before or after the driveway crossing. This is also done to exclude the generally level section of the driveway crossing from decreasing the average grade calculation of the sidewalk. It also prevents poorly designed driveway crossings with steep cross

11.4.2 Stroll Sheet feature measurements

The measurements for features encountered between stations are recorded on the *Feature Measurements* form, which is part of the *Stroll Sheet*. A standard set of abbreviations is used to identify the type of feature. The distance to each feature, its dimensions, and any comments are recorded.

Feature Measurements:

Feature Distance m	Feature	Dimension	Units	Comments

Figure 11-8. Feature measurements are recorded in this form which is contained within the *Stroll Sheet* form.

slopes from impacting the average cross slope calculations.

Sidewalk design width, cross slope, and running grade between stations are measured at each station and recorded in the *Station Measurements* form. Only the portions of the sidewalk that are available for travel are included in width measurements; elements such as grass planting strips should not be measured.

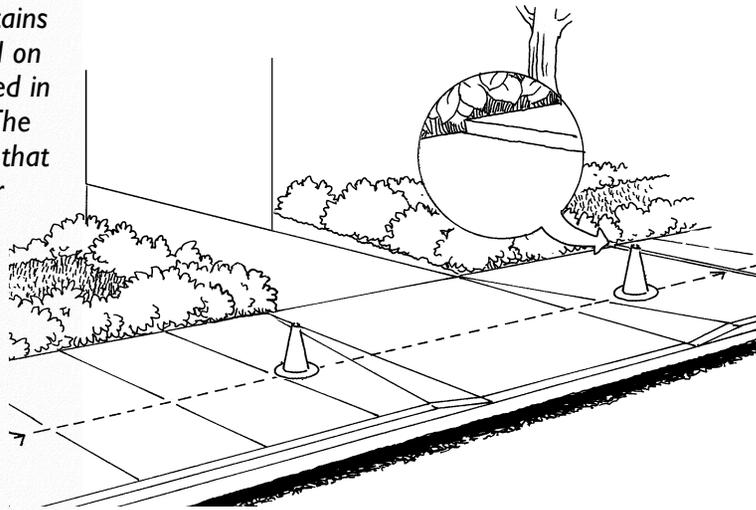
- The cross slopes of **driveway crossings (DC)** are measured within the best path of travel as well as adjacent to the roadway and the property line. The best path of travel is the space that has the least cross slope and is therefore the area that most people will use for walking. However, it is also important to measure the cross slope of the driveway crossing on the street side of the best path of travel. This will provide information about whether the driveway crossing has a cross slope that will be identifiable by individuals with vision impairments.

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Figure 11-9. This illustration contains two features that might be located on the sidewalk and would be recorded in the Feature Measurement Form. The first feature is a driveway crossing that creates a significant cross slope for pedestrians; both the cross slope and change of cross slope would be recorded. The second feature is a sidewalk crack which would be recorded as a change in level and would be measured using the profile gauge.



In addition, if the driveway crossing leads into a parking lot or some other open area, the cross slope should also be recorded on the property line side of the best path of travel. Gradual cross slopes at driveway crossings make it difficult for people with vision impairments to realize when they accidentally drift into the street or parking lot. However, if the cross slope at the best path of travel is greater than 2.0 percent, driveway crossings may cause people who use wheelchairs

to lose control, veer into the street, and/or tip over.

- **Maximum grades (MG)** are recorded if they exceed the running grade by more than 5 percent. The distance over which the maximum grade occurs is also recorded.
- **Maximum cross slopes (MCS)** are recorded if they exceed the station cross slope by more than 2 percent. The distance over which the maximum cross slope occurs is also recorded.
- **Changes in cross slope (CCS)** are recorded in conjunction with maximum cross slope. Changes in cross slopes are calculated by recording the measurements of cross slope 610 mm (24 in) in front of and behind the maximum cross slope. This is done at steep driveway crossings and sidewalk segments with cross slopes greater than 5 percent.

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- **Minimum clear width (MCW)** is measured with the tape measure when the clear space is narrower than 915 mm (36 in).
- **Minimum vertical clearance (MVC)** is measured with a tape measure when the vertical clear space is less than 2.030 m (80 in).
- The distance **protruding objects (PO)** intrude into the pathway is recorded if the object protrudes more than 101 mm (4 in) into the sidewalk between a height interval

are recorded anywhere a pedestrian could potentially walk because pedestrians with vision impairments often do not travel along the intended path of travel.

- **Changes in level (CL)** greater than 13 mm (0.5 in) are recorded with a profile gauge. The profile is traced from the profile gauge to paper and then measured to record the height transition and any surface beveling.

11.4.3 Stroll Sheet curb ramp measurements

Curb Ramp Measurements:

CR Distance m	Number of Ramps #	Type (L I D C B)	Approach Slope %	Ramp Slope %	Ramp Length cm	Landing Length cm	Detectable Warning y/n

Figure 11-10. Curb ramp measurements are recorded in this form, which is contained within the Stroll Sheet form.

of 685 mm to 2.030 m (27 in to 80 in). Protruding objects are things such as tree branches and hedges, low street and business signs, and telephones mounted on posts and walls. Protruding objects

Aspects of curb ramps critical for determining whether or not a ramp is accessible are recorded on the *Curb Ramp Measurements* form, which is part of the *Stroll Sheet*. If information is recorded during the stroll that identifies a major element of a curb ramp should be replaced, the curb ramp is reevaluated using the *Curb Ramp Element Analysis* form. Both the *Stroll Sheet* and the *Element Analysis* forms capture information to

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determine how the curb ramp can be retrofitted. The following curb ramp characteristics are recorded on the *Stroll Sheet* between stations:

- Distance to the curb ramp (CR);
- Number of curb ramps (0, 1, 2) at every corner. When there are no curb ramps at an intersection, a zero is recorded and no additional information is included on that line of the data form. If there are two curb ramps at the corner, each curb ramp is evaluated and two separate lines are completed on the data form;
- Type of curb ramp (parallel, perpendicular, diagonal, combination, built-up);
- Street approach slope (generally the gutter and part of the street) over a

610 mm (24 in) distance and the slope of the ramp in the upward direction;

- Ramp slope parallel to the ramp path;
- Ramp length if the ramp slope exceeds 8.3 percent.
- Landing length; and
- The presence or absence of a detectable warning as defined in ADAAG 4.29.2. Other attempts at providing tactile information on the surface are noted and identified for replacement as they provide limited benefits to people with vision impairments.

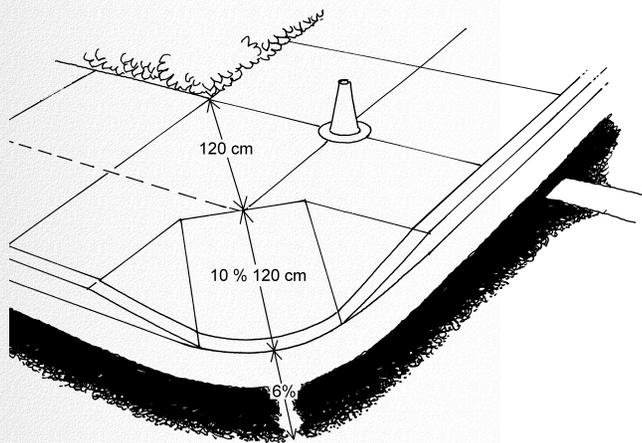


Figure 11-11. Some curb ramp measurements are recorded as part of the *Stroll Sheet*. More detailed measurements for curb ramps are recorded using the *Element Analysis Form*. As part of the stroll, the slope of the ramp, the slope of the roadway approach, the length of the ramp, and the length of the landing are all recorded. If the ramp slope is less than 8.3 percent, the length of the ramp should not be measured.

11.4.4 Intersection Checklist

The conditions at an intersection are a key factor in determining how usable the pedestrian network is for people with disabilities. If renovations are planned for

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Intersection Checklist:

Name of primary street:	
Name of cross street:	
Total number of lanes on primary street:	
Total distance across primary street (measure with rolatape):	
Total number of lanes on cross street:	
Total distance across street (measure with rolatape):	
Are there any left turn only lanes?	yes--no
Are there any right turn only lanes?	yes--no
Is a right turn on red permitted?	yes--no
Is there a right turn island?	yes--no
Is parking permitted on the primary street?	yes--no
Is parking permitted on the cross street?	yes--no
How many corners have curb extensions (bulbouts)?	
Is there a median?	yes--no
If so, is it designed as a pedestrian refuge?	yes--no
Is it identifiable to people with vision impairments?	yes--no
Is it accessible to people with mobility impairments?	yes--no
Does the intersection have four way stop signs?	yes--no
Does the intersection have two way stop signs?	yes--no
Is the intersection signalized?	yes--no
Is there a pedestrian actuated control signal?	yes--no
Location of control:	
Information emitted: audible vibrotactile infrared	
Is there a high contrast between the button and post color?	yes--no
Is there a tactile arrow indicating the street crossing direction?	yes--no
Height of control:	
Dimension of pedestrian button?	
Is 5 lbs of force or less required to operate the signal?	yes--no
Is the crosswalk marked?	yes--no
If so, what are the conditions of the markings?	
Duration of WALK interval:	
Comments:	

Figure 11-12. The Intersection Checklist allows an assessment team to quickly evaluate an intersection based on the availability of accessible information and the probability of a safe crossing for people with disabilities.

an intersection, engineers should use the *Intersection Checklist* that is available as part of the SWAP to identify areas that need improvement. The *Intersection Checklist* consists of a brief series of questions that focus on the availability of information to assist in safe crossings. Most of the questions on the checklist are recorded as “yes” or “no” to allow the assessment team to quickly evaluate the intersection. Evaluators are also encouraged to sketch a map of the intersection at the bottom of the checklist to facilitate future evaluations of the same site.

The primary street is defined on the checklist as the street from which the assessment team approached the intersection; the cross street is defined as the street perpendicular to the primary street. The total number of lanes and the crossing distance are recorded for both the primary street and the cross street. The presence of traffic

signals, stop signs, parked cars, medians, and marked crosswalks are recorded to gain a better understanding of how difficult the intersection would be to cross for people with slower walking speeds. The length of the walk interval is also recorded if a pedestrian signal is located at the corner. The accessibility of pedestrian actuated control signals and the patterns of right and left turning automobiles are recorded to evaluate the information available to people with vision impairments. The sound of automobile traffic is another important cue used by people with vision impairments at intersections; however, the presence of traffic is not recorded because it often fluctuates based on a variety of factors including the time of day and the weather conditions at the intersection. Additional intersection observations should be recorded as comments at the bottom of the checklist. Signal types, timing, and crosswalk configuration all affect usability of a pedestrian route. TEA-21 requires consideration of accessible (audible and vibrotactile) pedestrian signals.

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Figure 11-13. Segment of the Element Analysis Form for driveway crossings used to measure slope in the plus/minus direction (see Appendix A).

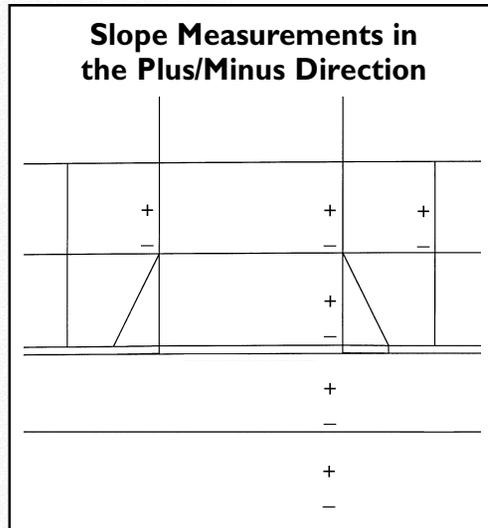
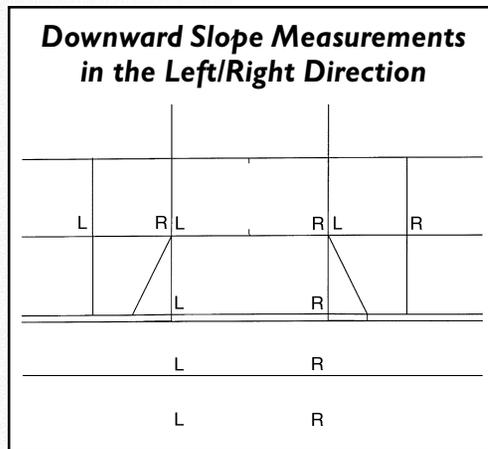


Figure 11-14. Segment of the Element Analysis Form for driveway crossings used to measure slope in the left/right direction (see Appendix A).



11.4.5 Sidewalk Element Analysis Forms

Sidewalk Element Analysis Forms are used to record information about complex sidewalk elements, such as medians and curb ramps, that are identified by the *Stroll Sheet* measurements as warranting further evaluation. Depending on the element being evaluated, dimensions are recorded on forms depicting schematic diagrams of:

- Curb ramps;
- Driveway crossings;
- Medians; and
- Islands.

A complete set of Sidewalk Element Analysis forms is included in Appendix A. The following example reviews the Driveway Crossing Sidewalk Element Analysis form. To completely analyze a driveway crossing, each of the following measurements are recorded. Some of the measurements explained below may not be applicable to every complex element. Furthermore, some additional measurements that are not applicable to driveway crossings may be recorded for some of the other complex elements. For example, the location of a detectable warning would be recorded for a curb ramp but is not recorded for driveway crossings.

- **Slope measurements parallel to ramp path** — The slope parallel to the driveway ramp path is recorded with an inclinometer for the street, gutter, ramp, landing, and approaches. The surface is considered to have a positive slope when it slopes up from the street. (These measurements are recorded

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Figure 11-15.
Segment of the
Element Analysis
Form for driveway
crossings used to
measure dimension
in the X direction
(see Appendix A).

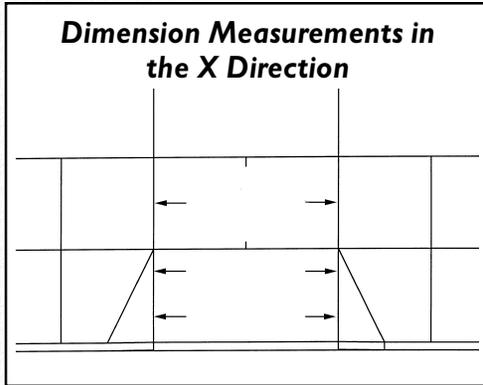
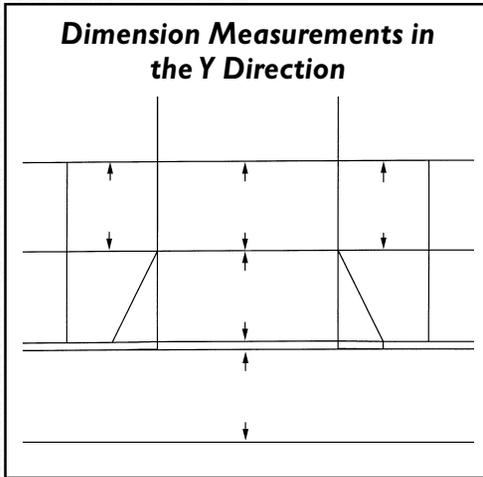


Figure 11-16.
Segment of the
Element Analysis
Form for driveway
crossings used to
measure dimension
in the Y direction
(see Appendix A).



on the Slope
Measurements in the
Plus/Minus Direction
segment.)

- **Slope measurements perpendicular to ramp path** — the slope perpendicular to the driveway ramp path is recorded with an inclinometer for the street, gutter, ramp, landing, and approaches. The measurements are taken facing the driveway from the street, and slope direction is recorded as left or right to correspond with the surface sloping down to the left or down to the right. (These measurements are recorded in the Downward Slope Measurements in the Left/Right Direction segment.)

- **Dimension measurements in the X direction** — The dimensions of the top of the driveway ramp, bottom of the driveway ramp, and landing are recorded with a tape measure. The “X” direction is typically measured as the width with respect to a person facing the driveway.
- **Dimension measurements in the Y direction** — Dimensions of the gutter, driveway ramp, landing, and approach parallel to the ramp length are recorded with a tape measure. The “Y” direction is typically measured as the length with respect to a person facing the driveway.
- **Height of transition points** — The transition points between street and gutter, gutter and ramp, ramp and landing, and landing and approaches are measured with a profile gauge. The transition is quickly traced from the edge of the profile gauge onto the back of the data form.

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Figure 11-17. The curb ramp slope is being measured for positive slope with a digital inclinometer.

- **Flare slopes** — The flare slope is measured along the steepest part of the flare and parallel to the sidewalk path of travel.
- **Change of cross slope** — When the slope of the driveway crossing exceeds 5 percent and a level landing is not provided, or the width of the level landing is less than 915 mm (36 in), users will be forced to travel over a significant cross slope. Furthermore, as the user transitions from the level sidewalk to the cross slope, they will encounter a rapid change in cross slope. The change in cross slope is measured at the flare when the landing is less than 915 mm (36 in) wide and the cross slope exceeds 5 percent. Change in cross slope is measured with an inclinometer by recording the cross slope 610 mm (24 in) in front of and behind the maximum cross slope.
- **Curb height** — The height of the curb is measured with a tape measure.

11.5 Presentation of sidewalk assessment information

The SWAP is a tool that produces valuable data and may assist designers and planners to make targeted access improvements to bring their communities into compliance with the ADA. Sidewalk assessment data can also be used to create useful information for pedestrians. The following ideas are based on Universal Trail Assessment Process products, such as the Trail Access Information strip, and have not yet been developed for sidewalks. Additional information about Universal Trail Assessment Products is contained in Section 12.5. The following information formats should be considered for future development because they would benefit many sidewalk users:

- **Geographic Information Systems (GIS) maps** — Maps that integrate sidewalk assessment data into existing GIS systems. GIS maps could serve as a valuable planning tool for evaluating accessibility

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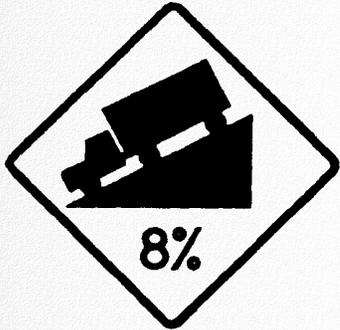


Figure 11-18. Grade information that is provided to motorists would also be beneficial to pedestrians.



Figure 11-19. Potential sidewalk signage indicating upcoming steep grades. This sign is not currently included in the Manual on Uniform Traffic Control Devices (MUTCD).

improvements through public involvement. GIS maps could also serve transportation agencies with internal planning for the improvement of sidewalk facilities;

- **Sidewalk signage** — Signs (similar to those for motorists) directed at pedestrians to communicate audible and visual information of sidewalk construction and closures providing alternative routes;
- **Universally designed street maps** — Street maps that integrate grade information into standard maps to improve route planning for people with disabilities;
- **District accessibility directory** — A directory sign similar to those found in shopping malls containing a top view map of the district highlighting potential barriers and identifying commercial services. Information that is

Main Street ↑
300bk
East **1200 ft**

Skateboards Bikes

Grade
Average 2%
 200 ft is over 5%

Cross Slope
Average 3%
 Max. 11% for 15 ft
 30 ft is over 5%

Path Width
Minimum 45"
 Average 60"

2" Change in level

WARNING: Conditions may have changed since this sidewalk was assessed. Temporary barriers were not mapped.

Sidewalk Access Information

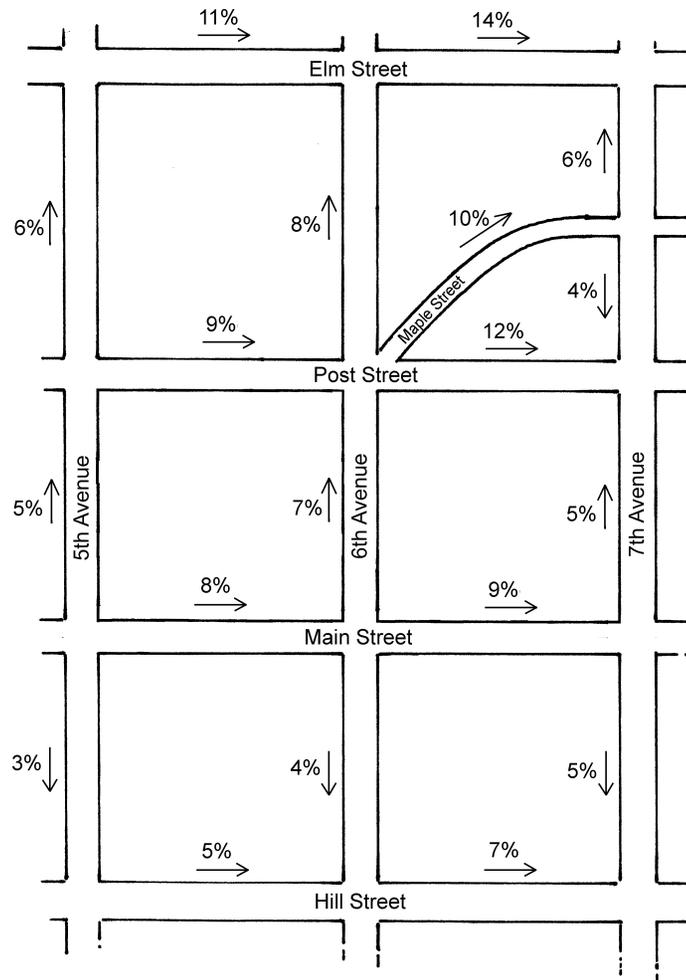
Figure 11-20. This type of sign has been used in trail settings. Pedestrians could benefit from objective information about sidewalk conditions, such as steep grades and cross slopes.

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Figure 11-21. Street maps that include grade information would improve route planning for people with mobility impairments.



provided in text format should also be provided in an audible format;

- **Computer kiosks** — Information on the accessibility of specific routes could be integrated into existing computer kiosks that are currently installed in many locations such as transit stations. Standards for making kiosks accessible to people with vision impairments are available from the U.S. Access Board; and
- **Website** — A site where Internet users could obtain accessibility information about a given municipality. Websites should be designed to accommodate speech access.

Appendix ADA-B – ADA Accessibility Inventory of Barriers Checklist



Town of Miami Trail System Study

Appendix ADA–B

ADA Accessibility Inventory of Barriers Checklist

January 2026

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Background

The Town of Miami Trail System Study (Study) purpose is to prepare a plan to improve walking, biking and rolling (e-scooters, wheelchairs and mobility devices) for the Miami community. With funding and support from the Arizona Department of Transportation (ADOT), the Town of Miami (Town) identified a conceptual alignment that extends from Bullion Plaza Cultural Center and Museum to the Miami Unified School District (MUSD). Guiding factors for the Study include increasing safety for vulnerable road users (those who walk, bike and roll), improving connectivity to key community destinations and providing economic development opportunities.

As the Town strives to improve facilities for walking, biking, and rolling along the trail alignment, accessibility will be a critical part of increasing safety and connectivity for vulnerable road users of all ability levels.

Purpose and Need

The Americans with Disabilities Act of 1990 (ADA) and Rehabilitation Act of 1973 are civil rights laws that prohibit discrimination on the basis of disability. Title II of the ADA requires public entities with 50 or more employees to complete a self-evaluation of the accessibility of pedestrian facilities in their public rights-of-way and to correct deficiencies by making necessary modification plans, while Section 504 of the Rehabilitation Act prohibits discrimination based on disability in programs receiving federal financial assistance. These legal requirements are fulfilled through the development of an ADA Transition Plan—a document that translates federal civil rights obligations into actionable steps for accessibility.

This ADA Accessibility Assessment Checklist is intended to support field data collection for the Town of Miami's ADA Transition Plan. The checklist provides a structured framework for documenting existing pedestrian facilities and identifying potential accessibility barriers within public rights-of-way.

This workbook is organized by facility type, with individual tabs corresponding to sidewalks, curb ramps, pedestrian crossings, driveways, and bus stops. Each tab is designed to capture key characteristics observed during field surveys, including physical conditions, dimensions, and the presence or absence of accessibility features. Information recorded in this checklist is intended to document existing conditions and inform prioritization of future ADA improvements.

Field survey data collected using this checklist may be used to support mapping, analysis, and the development of implementation strategies as part of the ADA Transition Plan. Example checklists and guidance provided within this workbook are intended to be flexible and may be adapted based on field conditions, available resources, and Town needs.

How to Use These Forms

Cover sheets are provided for each of the 10 segments identified in this Study. For each segment, surveyors should fill out a barrier identification form for each issue identified.

1. Sullivan Street – Bullion Plaza Cultural Center and Museum

This segment has existing sidewalks on both sides of the street and older ADA infrastructure in select locations. Barriers to address may include poor sidewalk surface conditions, non-compliant curb ramps, and excessive slopes or changes in level.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	<i>Number of curb ramps</i>	
Driveways	<i>Number of driveways</i>	
	<i>Total length</i>	
Pedestrian Crossings	<i>Number of crossings</i>	
	<i>Total length</i>	
Bus Stops	<i>Number of bus stops</i>	

Notes

2. Sullivan Street – Plaza Avenue to Davis Canyon Road

This segment has an existing sidewalk on the south side of the roadway, with varying surface conditions. Residential driveways cross the sidewalk throughout the segment. Barriers to address may include poor sidewalk conditions, non-compliant curb ramps, unmarked crossings, and sloped surfaces near driveways.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

3. Sullivan Street – Davis Canyon Road to Miami Avenue

This segment has existing sidewalks on both sides of the roadway. While most sections are generally in good condition, obstructions such as street furniture and utility poles are present throughout. Driveways also cause sloping in some locations. Improving crossings with ADA-compliant ramps and crosswalks will create a more accessible pedestrian environment.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

4. Miami Avenue

This segment has sidewalks on both sides of the roadway. Changes in level and a lack of curb ramps and handrails on the eastern sidewalk make the western sidewalk a more viable option for pedestrians. However, obstructions, limited clear space, and poor infrastructure conditions present accessibility challenges near the US 60 intersection.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
	<input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

6. S Calle de Loma – US 60 to Railroad Avenue

This segment does not have existing pedestrian facilities. ADA-compliant improvements such as a sidewalk separated from the street and curb ramps would improve pedestrian access and safety between US 60 and Railroad Ave.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

7. Railroad Avenue – S Calle de Loma to Pineway Street

This segment does not have existing pedestrian facilities. Steep hillside slopes and limited shoulder space in some areas may present challenges for constructing ADA-compliant pedestrian infrastructure. Improvements such as sidewalks separated from the street would improve pedestrian access and safety.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

8. Locomotive Drive – Pineway Street to Old Oak Street

This segment does not have existing pedestrian facilities. ADA-compliant improvements such as sidewalks separated from the street, curb ramps, and adequate railroad crossings would improve pedestrian access and safety.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

9. Railroad Avenue – Old Oak Street to Maple Leaf Street

This segment has an existing asphalt sidewalk in poor repair on the north side of the roadway, and an existing crosswalk. Poor pedestrian infrastructure conditions create accessibility barriers.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> Surface Material <input type="checkbox"/> Clear Width <input type="checkbox"/> Slope <input type="checkbox"/> Changes in Level <input type="checkbox"/> Vertical Clearance <input type="checkbox"/> Obstructions	Quantify percentage of replacement needed <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	Number of curb ramps	
Driveways	Number of driveways	
	Total length	
Pedestrian Crossings	Number of crossings	
	Total length	
Bus Stops	Number of bus stops	

Notes

10. Railroad Avenue – Maple Leaf Street to Ragus Road

This segment has an existing sidewalk on the south side of the roadway. Pedestrian facilities are generally in good condition, but may benefit from ADA-compliant curb ramps and crossing improvements.



Element	Barrier Identification	Quantity / Length
Sidewalks	<input type="checkbox"/> <i>Surface Material</i> <input type="checkbox"/> <i>Clear Width</i> <input type="checkbox"/> <i>Slope</i> <input type="checkbox"/> <i>Changes in Level</i> <input type="checkbox"/> <i>Vertical Clearance</i> <input type="checkbox"/> <i>Obstructions</i>	<i>Quantify percentage of replacement needed</i> <input type="checkbox"/> < 25% <input type="checkbox"/> 25% - 50% <input type="checkbox"/> > 50%
Curb Ramps	<i>Number of curb ramps</i>	
Driveways	<i>Number of driveways</i>	
	<i>Total length</i>	
Pedestrian Crossings	<i>Number of crossings</i>	
	<i>Total length</i>	
Bus Stops	<i>Number of bus stops</i>	

Notes

Sidewalk, Curb Ramp, and Driveway Form

 Full Replacement
 Needed

Segment Details	
Location	<i>Provide coordinates, if known</i>
From Street	
To Street	
Segment Length	
Jurisdiction / Maintenance Responsibility	<input type="checkbox"/> <i>Town of Miami</i> <input type="checkbox"/> <i>ADOT</i> <input type="checkbox"/> <i>Gila County</i>
Attachments	<i>Image file name(s)</i>

General Elements	Summary of Barriers
Surface Material	<i>Surface material and condition (cracks, uneven surfacing, gaps)</i>
Grade (Slope) / Approach Slope	<i>Slope in direction of pedestrian travel, or approach for curb ramps</i>
Cross Slope	<i>Slope perpendicular to the direction of pedestrian travel</i>
Changes in Level	<i>Steep sections, severe cross slopes, or other changes in grade</i>
Vertical Clearance	<i>Vertical obstructions that may impact users</i>
Obstructions	<i>Objects that limit clear width (utility poles, street signs, street furniture, landscaping)</i>

Sidewalk Elements	Summary of Barriers
Design Width	<i>Typical sidewalk width</i>
Minimum Clear Width	<i>Width of most narrow section of sidewalk</i>
Curb Ramp Elements	
Ramp Slope / Counter Slope	<i>Running slope of ramp, slope at the base of the ramp</i>
Detectable Warnings	<i>Placement, visual contrast, condition</i>
Ramp Type / Direction	<input type="checkbox"/> <i>Directional</i> <input type="checkbox"/> <i>Diagonal</i>
Landing Area	<i>Presence, level landing at top and bottom of ramp, landing clear space</i>
Driveway Elements	
Path Continuity	<i>Path visually and functionally continuous through driveway</i> <input type="checkbox"/> Yes <input type="checkbox"/> No
Vehicle Presence	<i>Vehicles blocking or encroaching upon pedestrian path</i> <input type="checkbox"/> Yes <input type="checkbox"/> No
Visibility	<i>Pedestrian crossing area visible to drivers entering or exiting driveway</i> <input type="checkbox"/> Yes <input type="checkbox"/> No

Pedestrian Crossing Form

 Full Replacement
 Needed

Element	Summary of Barriers
Attachments	<i>Image file name(s)</i>
Location	<i>Coordinates, if known</i>
Primary Street	<i>Street being surveyed</i>
Cross Street	<i>Intersecting street</i>
Crossing Type	<i>Location relative to street, presence of crosswalk markings</i> <input type="checkbox"/> <i>Intersection</i> <input type="checkbox"/> <i>Marked</i> <input type="checkbox"/> <i>Midblock</i> <input type="checkbox"/> <i>Unmarked</i>
Traffic Control	<i>Signalized vs un-signalized</i> <input type="checkbox"/> <i>Signalized</i> <input type="checkbox"/> <i>Stop-Controlled</i> <input type="checkbox"/> <i>Uncontrolled</i>
Surface Condition	<i>Pavement uneven, slippery; cracks, potholes present</i>
Crossing Distance	<i>Length across primary and cross street</i>
Walk Interval Duration	<i>At signalized crossings, seconds for pedestrian walk signal</i>
Crossing Width	<i>Length, alignment with pedestrian path</i>
Grade (Slope)	<i>Slope in direction of pedestrian travel</i>
Cross Slope	<i>Slope perpendicular to direction of pedestrian travel</i>
Crosswalk	<input type="checkbox"/> <i>Yes</i> <input type="checkbox"/> <i>No</i>
Crosswalk Marking Condition	<input type="checkbox"/> <i>Minimal Paint Fading / Cracks</i> <input type="checkbox"/> <i>Excessive Paint Fading / Cracks</i>
Curb Ramps	<input type="checkbox"/> <i>Directional</i> <input type="checkbox"/> <i>Diagonal</i> <input type="checkbox"/> <i>None</i>
Pedestrian Signal	<input type="checkbox"/> <i>Yes</i> <input type="checkbox"/> <i>No</i>
Accessible Push Button	<i>Lack of tactile or audible cues, excessive height</i> <input type="checkbox"/> <i>Yes</i> <input type="checkbox"/> <i>No</i>
Visibility	<i>Crossing visibility to drivers, adequate lighting</i>
Obstructions	<i>Utility covers, grates, debris within crossing area</i>

Notes

Bus Stop FormFull Replacement
Needed

Element	Summary of Barriers
Attachments	<i>Image file name(s)</i>
Stop Location	<i>Associated destination and/or address</i>
Sign Placement	<i>Bus stop sign location</i> <input type="checkbox"/> <i>Too High (Not Visible)</i> <input type="checkbox"/> <i>Too Low (Not Visible)</i> <input type="checkbox"/> <i>No Sign</i>
Surface Condition	<i>Pedestrian path condition at stop (cracks, uneven surfacing, no sidewalk)</i>
Boarding Area	<i>Level, stable, slip-resistant surface for boarding</i> <input type="checkbox"/> <i>Adequate</i> <input type="checkbox"/> <i>Inadequate</i>
Clear Space	<i>Sufficient space for wheelchair users to maneuver and wait for bus</i> <input type="checkbox"/> <i>Yes</i> <input type="checkbox"/> <i>No</i>
Path Connectivity	<i>Continuous, accessible path connecting stop to nearby pedestrian routes</i> <input type="checkbox"/> <i>Yes</i> <input type="checkbox"/> <i>No</i>
Amenities	<i>Shelters, benches, trash receptacles, etc.; note whether they are accessible for wheelchair users</i>
Vertical Clearance	<i>Shelters or signage mounted high enough to avoid hazards for pedestrians</i>
Obstructions	<i>Stop amenities, signs, other elements obstructing access to stop or adjacent pedestrian path</i>

Notes

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Appendix C – Manual on Uniform Traffic Control Device's Part 8

Note: This is an excerpt from the Manual on Uniform Traffic Control Device's Part 8; always reference the latest manual when projects are designed and constructed.

PART 8

TRAFFIC CONTROL FOR RAILROAD AND LIGHT RAIL TRANSIT GRADE CROSSINGS

CHAPTER 8A. GENERAL

Section 8A.01 Introduction

Support:

- 01 Whenever the acronym “LRT” is used in Part 8, it refers to “light rail transit.”
- 02 Part 8 describes the traffic control devices that are used at highway-rail and highway-LRT grade crossings. Unless otherwise provided in the text or on a figure or table, the provisions of Part 8 are applicable to both highway-rail and highway-LRT grade crossings. When the phrase “grade crossing” is used by itself without the prefix “highway-rail” or “highway-LRT,” it refers to both highway-rail and highway-LRT grade crossings.
- 03 Traffic control for grade crossings includes all signs, signals, markings, other warning devices, and their supports along highways approaching and at grade crossings. The function of this traffic control is to promote safety and provide effective operation of rail and/or LRT and highway traffic at grade crossings.
- 04 For purposes of design, installation, operation, and maintenance of traffic control devices at grade crossings, it is recognized that the crossing of the highway and rail tracks is situated on a right-of-way available for the joint use of both highway traffic and railroad or LRT traffic.
- 05 The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable, jointly determine the need and selection of devices at a grade crossing.
- 06 In Part 8, the combination of devices selected or installed at a specific grade crossing is referred to as a “traffic control system.”

Standard:

- 07 **The traffic control devices, systems, and practices described in this Manual shall be used at all grade crossings open to public travel, consistent with Federal, State, and local laws and regulations.**

Support:

- 08 Part 8 also describes the traffic control devices that are used in locations where light rail LRT vehicles are operating along streets and highways in mixed traffic with automotive vehicles.
- 09 LRT is a mode of metropolitan transportation that employs LRT vehicles (commonly known as light rail vehicles, streetcars, or trolleys) that operate on rails in streets in mixed traffic, and LRT traffic that operates in semi-exclusive rights-of-way, or in exclusive rights-of-way. Grade crossings with LRT can occur at intersections or at midblock locations, including public and private driveways.
- 10 An initial educational campaign along with an ongoing program to continue to educate new drivers is beneficial when introducing LRT operations to an area and, hence, new traffic control devices.
- 11 LRT alignments can be grouped into one of the following three types:
- A. Exclusive: An LRT right-of-way that is grade-separated or protected by a fence or traffic barrier. Motor vehicles, pedestrians, and bicycles are prohibited within the right-of-way. Subways and aerial structures are included within this group. This type of alignment does not have grade crossings and is not further addressed in Part 8.
 - B. Semi-exclusive: An LRT alignment that is in a separate right-of-way or along a street or railroad right-of-way where motor vehicles, pedestrians, and bicycles have limited access and cross at designated locations only.
 - C. Mixed-use: An alignment where LRT operates in mixed traffic with all types of road users. This includes streets, transit malls, and pedestrian malls where the right-of-way is shared.

Standard:

- 12 **Where LRT and railroads use the same tracks or adjacent tracks, the traffic control devices, systems, and practices for highway-rail grade crossings shall be used.**

Support:

- 13 To promote an understanding of common terminology between highway and railroad and LRT signaling issues, definitions and acronyms pertaining to Part 8 are provided in Sections 1A.13 and 1A.14.

Section 8A.02 Use of Standard Devices, Systems, and Practices at Highway-Rail Grade Crossings

Support:

- 01 Because of the large number of significant variables to be considered, no single standard system of traffic control devices is universally applicable for all highway-rail grade crossings.

Guidance:

- 02 *The appropriate traffic control system to be used at a highway-rail grade crossing should be determined by an engineering study involving both the highway agency and the railroad company.*

Option:

- 03 The engineering study may include the Highway-Rail Intersection (HRI) components of the National Intelligent Transportation Systems (ITS) architecture, which is a USDOT accepted method for linking the highway, vehicles, and traffic management systems with rail operations and wayside equipment.

Support:

- 04 More detail on Highway-Rail Intersection components is available from the USDOT's Federal Railroad Administration, 1200 New Jersey Avenue, SE, Washington, DC 20590, or www.fra.dot.gov.

Standard:

- 05 **Traffic control devices, systems, and practices shall be consistent with the design and application of the Standards contained in this Manual.**

- 06 **Before any new highway-rail grade crossing traffic control system is installed or before modifications are made to an existing system, approval shall be obtained from the highway agency with the jurisdictional and/or statutory authority, and from the railroad company.**

Guidance:

- 07 *To stimulate effective responses from road users, these devices, systems, and practices should use the five basic considerations employed generally for traffic control devices and described fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.*

Support:

- 08 Many other details of highway-rail grade crossing traffic control systems that are not set forth in Part 8 are contained in the publications listed in Section 1A.11, including the "2000 AREMA Communications & Signals Manual" published by the American Railway Engineering & Maintenance-of-Way Association (AREMA) and the 2006 edition of "Preemption of Traffic Signals Near Railroad Crossings" published by the Institute of Transportation Engineers (ITE).

Section 8A.03 Use of Standard Devices, Systems, and Practices at Highway-LRT Grade Crossings*Support:*

- 01 The combination of devices selected or installed at a specific highway-LRT grade crossing is referred to as a Light Rail Transit Traffic Control System.
- 02 Because of the large number of significant variables to be considered, no single standard system of traffic control devices is universally applicable for all highway-LRT grade crossings.
- 03 For the safety and integrity of operations by highway and LRT users, the highway agency with jurisdiction, the regulatory agency with statutory authority, if applicable, and the LRT authority jointly determine the need and selection of traffic control devices and the assignment of priority to LRT at a highway-LRT grade crossing.
- 04 The normal rules of the road and traffic control priority identified in the "Uniform Vehicle Code" govern the order assigned to the movement of vehicles at an intersection unless the local agency determines that it is appropriate to assign a higher priority to LRT. Examples of different types of LRT priority control include separate traffic control signal phases for LRT movements, restriction of movement of roadway vehicles in favor of LRT operations, and preemption of highway traffic signal control to accommodate LRT movements.

Guidance:

- 05 *The appropriate traffic control system to be used at a highway-LRT grade crossing should be determined by an engineering study conducted by the LRT or highway agency in cooperation with other appropriate State and local organizations.*

Standard:

- 06 **Traffic control devices, systems, and practices shall be consistent with the design and application of the Standards contained in this Manual.**

- 07 **The traffic control devices, systems, and practices described in this Manual shall be used at all highway-LRT grade crossings.**

- 08 **Before any new highway-LRT grade crossing traffic control system is installed or before modifications are made to an existing system, approval shall be obtained from the highway agency with the jurisdictional and/or statutory authority, and from the LRT agency.**

Guidance:

- 09 *To stimulate effective responses from road users, these devices, systems, and practices should use the five basic considerations employed generally for traffic control devices and described fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.*

Support:

- 10 Many other details of highway-LRT grade crossing traffic control systems that are not set forth in Part 8 are contained in the publications listed in Section 1A.11.

Standard:

- 11 **Highway-LRT grade crossings in semi-exclusive alignments shall be equipped with a combination of automatic gates and flashing-light signals, or flashing-light signals only, or traffic control signals, unless an engineering study indicates that the use of Crossbuck Assemblies, STOP signs, or YIELD signs alone would be adequate.**

Option:

- 12 Highway-LRT grade crossings in mixed-use alignments may be equipped with traffic control signals unless an engineering study indicates that the use of Crossbuck Assemblies, STOP signs, or YIELD signs alone would be adequate.

Support:

- 13 Sections 8B.03 and 8B.04 contain provisions regarding the use and placement of Crossbuck signs and Crossbuck Assemblies. Section 8B.05 describes the appropriate conditions for the use of STOP or YIELD signs alone at a highway-LRT grade crossing. Sections 8C.10 and 8C.11 contain provisions regarding the use of traffic control signals at highway-LRT grade crossings.

Section 8A.04 Uniform Provisions**Standard:**

- 01 **All signs used in grade crossing traffic control systems shall be retroreflectorized or illuminated as described in Section 2A.07 to show the same shape and similar color to an approaching road user during both day and night.**
- 02 **No sign or signal shall be located in the center of an undivided highway, unless it is crashworthy (breakaway, yielding, or shielded with a longitudinal barrier or crash cushion) or unless it is placed on a raised island.**

Guidance:

- 03 *Any signs or signals placed on a raised island in the center of an undivided highway should be installed with a clearance of at least 2 feet from the outer edge of the raised island to the nearest edge of the sign or signal, except as permitted in Section 2A.19.*
- 04 *Where the distance between tracks, measured along the highway between the inside rails, exceeds 100 feet, additional signs or other appropriate traffic control devices should be used to inform approaching road users of the long distance to cross the tracks.*

Section 8A.05 Grade Crossing Elimination*Guidance:*

- 01 *Because grade crossings are a potential source of crashes and congestion, agencies should conduct engineering studies to determine the cost and benefits of eliminating these crossings.*

Standard:

- 02 **When a grade crossing is eliminated, the traffic control devices for the crossing shall be removed.**
- 03 **If the existing traffic control devices at a multiple-track grade crossing become improperly placed or inaccurate because of the removal of some of the tracks, the existing devices shall be relocated and/or modified.**

Guidance:

- 04 *Any grade crossing that cannot be justified should be eliminated.*
- 05 *Where a roadway is removed from a grade crossing, the roadway approaches in the railroad or LRT right-of-way should also be removed and appropriate signs and object markers should be placed at the roadway end in accordance with Section 2C.66.*
- 06 *Where a railroad or LRT is eliminated at a grade crossing, the tracks should be removed or covered.*

Option:

- 07 Based on engineering judgment, the TRACKS OUT OF SERVICE (R8-9) sign (see Figure 8B-1) may be temporarily installed until the tracks are removed or covered. The length of time before the tracks will be removed or covered may be considered in making the decision as to whether to install the sign.

Section 8A.06 Illumination at Grade Crossings**Support:**

- 01 Illumination is sometimes installed at or adjacent to a grade crossing in order to provide better nighttime visibility of trains or LRT equipment and the grade crossing (for example, where a substantial amount of railroad or LRT operations are conducted at night, where grade crossings are blocked for extended periods of time, or where crash history indicates that road users experience difficulty in seeing trains or LRT equipment or traffic control devices during hours of darkness).
- 02 Recommended types and locations of luminaires for illuminating grade crossings are contained in the American National Standards Institute's (ANSI) "Practice for Roadway Lighting RP-8," which is available from the Illuminating Engineering Society (see Section 1A.11).

Section 8A.07 Quiet Zone Treatments at Highway-Rail Grade Crossings**Support:**

- 01 49 CFR Part 222 (Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule) prescribes Quiet Zone requirements and treatments.

Standard:

- 02 **Any traffic control device and its application where used as part of a Quiet Zone shall comply with all applicable provisions of the MUTCD.**

Section 8A.08 Temporary Traffic Control Zones**Support:**

- 01 Temporary traffic control planning provides for continuity of operations (such as movement of traffic, pedestrians and bicycles, transit operations, and access to property/utilities) when the normal function of a roadway at a grade crossing is suspended because of temporary traffic control operations.

Standard:

- 02 **Traffic controls for temporary traffic control zones that include grade crossings shall be as outlined in Part 6.**
- 03 **When a grade crossing exists either within or in the vicinity of a temporary traffic control zone, lane restrictions, flagging (see Chapter 6E), or other operations shall not be performed in a manner that would cause highway vehicles to stop on the railroad or LRT tracks, unless a flagger or uniformed law enforcement officer is provided at the grade crossing to minimize the possibility of highway vehicles stopping on the tracks, even if automatic warning devices are in place.**

Guidance:

- 04 *Public and private agencies, including emergency services, businesses, and railroad or LRT companies, should meet to plan appropriate traffic detours and the necessary signing, marking, and flagging requirements for operations during temporary traffic control zone activities. Consideration should be given to the length of time that the grade crossing is to be closed, the type of rail or LRT and highway traffic affected, the time of day, and the materials and techniques of repair.*
- 05 *The agencies responsible for the operation of the LRT and highway should be contacted when the initial planning begins for any temporary traffic control zone that might directly or indirectly influence the flow of traffic on mixed-use facilities where LRT and road users operate.*
- 06 *Temporary traffic control operations should minimize the inconvenience, delay, and crash potential to affected traffic. Prior notice should be given to affected public or private agencies, emergency services, businesses, railroad or LRT companies, and road users before the free movement of road users or rail traffic is infringed upon or blocked.*
- 07 *Temporary traffic control zone activities should not be permitted to extensively prolong the closing of the grade crossing.*
- 08 *The width, grade, alignment, and riding quality of the highway surface at a grade crossing should, at a minimum, be restored to correspond with the quality of the approaches to the grade crossing.*

Support:

- 09 Section 6G.18 contains additional information regarding temporary traffic control zones in the vicinity of grade crossings, and Figure 6H-46 shows an example of a typical situation that might be encountered.

CHAPTER 8B. SIGNS AND MARKINGS

Section 8B.01 Purpose

Support:

- 01 Passive traffic control systems, consisting of signs and pavement markings only, identify and direct attention to the location of a grade crossing and advise road users to slow down or stop at the grade crossing as necessary in order to yield to any rail traffic occupying, or approaching and in proximity to, the grade crossing.
- 02 Signs and markings regulate, warn, and guide the road users so that they, as well as LRT vehicle operators on mixed-use alignments, can take appropriate action when approaching a grade crossing.

Standard:

- 03 **The design and location of signs shall comply with the provisions of Part 2. The design and location of pavement markings shall comply with the provisions of Part 3.**

Section 8B.02 Sizes of Grade Crossing Signs

Standard:

- 01 **The sizes of grade crossing signs shall be as shown in Table 8B-1.**

Option:

- 02 Signs larger than those shown in Table 8B-1 may be used (see Section 2A.11).

Section 8B.03 Grade Crossing (Crossbuck) Sign (R15-1) and Number of Tracks Plaque (R15-2P) at Active and Passive Grade Crossings

Standard:

- 01 **The Grade Crossing (R15-1) sign (see Figure 8B-1), commonly identified as the Crossbuck sign, shall be retroreflectorized white with the words RAILROAD CROSSING in black lettering, mounted as shown in Figure 8B-2.**

Support:

- 02 In most States, the Crossbuck sign requires road users to yield the right-of-way to rail traffic at a grade crossing.

Standard:

- 03 **As a minimum, one Crossbuck sign shall be used on each highway approach to every highway-rail grade crossing, alone or in combination with other traffic control devices.**

Option:

- 04 A Crossbuck sign may be used on a highway approach to a highway-LRT grade crossing on a semi-exclusive or mixed-use alignment, alone or in combination with other traffic control devices.

Standard:

- 05 **If automatic gates are not present and if there are two or more tracks at a grade crossing, the number of tracks shall be indicated on a supplemental Number of Tracks (R15-2P) plaque (see Figure 8B-1) of inverted T shape mounted below the Crossbuck sign in the manner shown in Figure 8B-2.**
- 06 **On each approach to a highway-rail grade crossing and, if used, on each approach to a highway-LRT grade crossing, the Crossbuck sign shall be installed on the right-hand side of the highway on each approach to the grade crossing. Where restricted sight distance or unfavorable highway geometry exists on an approach to a grade crossing, an additional Crossbuck sign shall be installed on the left-hand side of the highway, possibly placed back-to-back with the Crossbuck sign for the opposite approach, or otherwise located so that two Crossbuck signs are displayed for that approach.**
- 07 **A strip of retroreflective white material not less than 2 inches in width shall be used on the back of each blade of each Crossbuck sign for the length of each blade, at all grade crossings where Crossbuck signs have been installed, except those where Crossbuck signs have been installed back-to-back.**

Guidance:

- 08 *Crossbuck signs should be located with respect to the highway pavement or shoulder in accordance with the criteria in Chapter 2A and Figures 2A-2 and 2A-3, and should be located with respect to the nearest track in accordance with Figure 8C-2.*
- 09 *The minimum lateral offset for the nearest edge of the Crossbuck sign should be 6 feet from the edge of the shoulder or 12 feet from the edge of the traveled way in rural areas (whichever is greater), and 2 feet from the face of the curb in urban areas.*

Table 8B-1. Grade Crossing Sign and Plaque Minimum Sizes

Sign or Plaque	Sign Designation	Section	Conventional Road		Expressway	Minimum	Oversized
			Single Lane	Multi-Lane			
Stop	R1-1	8B.04, 8B.05	30 x 30	36 x 36	36 x 36	—	48 x 48
Yield	R1-2	8B.04, 8B.05	36 x 36 x 36	48 x 48 x 48	48 x 48 x 48	30 x 30 x 30	—
No Right Turn Across Tracks	R3-1a	8B.08	24 x 30	30 x 36	—	—	—
No Left Turn Across Tracks	R3-2a	8B.08	24 x 30	30 x 36	—	—	—
Do Not Stop on Tracks	R8-8	8B.09	24 x 30	24 x 30	36 x 48	—	36 x 48
Tracks Out of Service	R8-9	8B.10	24 x 24	24 x 24	36 x 36	—	36 x 36
Stop Here When Flashing	R8-10	8B.11	24 x 36	24 x 36	—	—	36 x 48
Stop Here When Flashing	R8-10a	8B.11	24 x 30	24 x 30	—	—	36 x 42
Stop Here on Red	R10-6	8B.12	24 x 36	24 x 36	—	—	36 x 48
Stop Here on Red	R10-6a	8B.12	24 x 30	24 x 30	—	—	36 x 42
Grade Crossing (Crossbuck)	R15-1	8B.03	48 x 9	48 x 9	—	—	—
Number of Tracks (plaque)	R15-2P	8B.03	27 x 18	27 x 18	—	—	—
Exempt (plaque)	R15-3P	8B.07	24 x 12	24 x 12	—	—	—
Light Rail Only Right Lane	R15-4a	8B.13	24 x 30	24 x 30	—	—	—
Light Rail Only Left Lane	R15-4b	8B.13	24 x 30	24 x 30	—	—	—
Light Rail Only Center Lane	R15-4c	8B.13	24 x 30	24 x 30	—	—	—
Light Rail Do Not Pass	R15-5	8B.14	24 x 30	24 x 30	—	—	—
Do Not Pass Stopped Train	R15-5a	8B.14	24 x 30	24 x 30	—	—	—
No Motor Vehicles On Tracks Symbol	R15-6	8B.15	24 x 24	24 x 24	—	—	—
Do Not Drive On Tracks	R15-6a	8B.15	24 x 30	24 x 30	—	—	—
Light Rail Divided Highway Symbol	R15-7	8B.16	24 x 24	24 x 24	—	—	—
Light Rail Divided Highway Symbol (T-Intersection)	R15-7a	8B.16	24 x 24	24 x 24	—	—	—
Look	R15-8	8B.17	36 x 18	36 x 18	—	—	—
Grade Crossing Advance Warning	W10-1	8B.06	36 Dia.	36 Dia.	48 Dia.	—	48 Dia.
Exempt (plaque)	W10-1aP	8B.07	24 x 12	24 x 12	—	—	—
Grade Crossing and Intersection Advance Warning	W10-2,3,4	8B.06	36 x 36	36 x 36	48 x 48	—	48 x 48
Low Ground Clearance	W10-5	8B.23	36 x 36	36 x 36	48 x 48	—	48 x 48
Low Ground Clearance (plaque)	W10-5P	8B.23	30 x 24	30 x 24	—	—	—
Light Rail Activated Blank-Out Symbol	W10-7	8B.19	24 x 24	24 x 24	—	—	—
Trains May Exceed 80 MPH	W10-8	8B.20	36 x 36	36 x 36	48 x 48	—	48 x 48
No Train Horn	W10-9	8B.21	36 x 36	36 x 36	48 x 48	—	48 x 48
No Train Horn (plaque)	W10-9P	8B.21	30 x 24	30 x 24	—	—	—
Storage Space Symbol	W10-11	8B.24	36 x 36	36 x 36	48 x 48	—	48 x 48
Storage Space XX Feet Between Tracks & Highway	W10-11a	8B.24	30 x 36	30 x 36	—	—	—
Storage Space XX Feet Between Highway & Tracks Behind You	W10-11b	8B.24	30 x 36	30 x 36	—	—	—
Skewed Crossing	W10-12	8B.25	36 x 36	36 x 36	48 x 48	—	48 x 48
No Gates or Lights (plaque)	W10-13P	8B.22	30 x 24	30 x 24	—	—	—
Next Crossing (plaque)	W10-14P	8B.23	30 x 24	30 x 24	—	—	—
Use Next Crossing (plaque)	W10-14aP	8B.23	30 x 24	30 x 24	—	—	—
Rough Crossing (plaque)	W10-15P	8B.23	30 x 24	30 x 24	—	—	36 x 30

- Notes: 1. Larger signs may be used when appropriate
2. Dimensions in inches are shown as width x height
3. Table 9B-1 shows the minimum sizes that may be used for grade crossing signs and plaques that face shared-use paths and pedestrian facilities

Figure 8B-1. Regulatory Signs and Plaques for Grade Crossings



R1-1



R1-2



R3-1a
Activated Blank-Out



R3-2a
Activated Blank-Out



R8-8



R8-9



R8-10



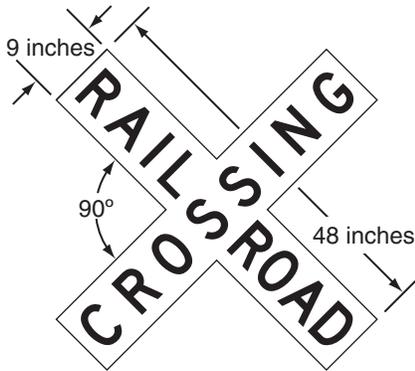
R8-10a



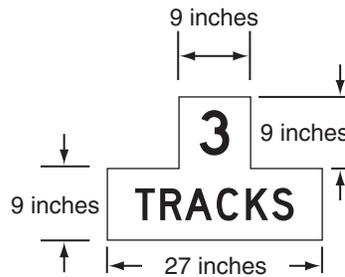
R10-6



R10-6a



R15-1



R15-2P



R15-3P



R15-4a



R15-4b



R15-4c



R15-5



R15-5a



R15-6



R15-6a



R15-7

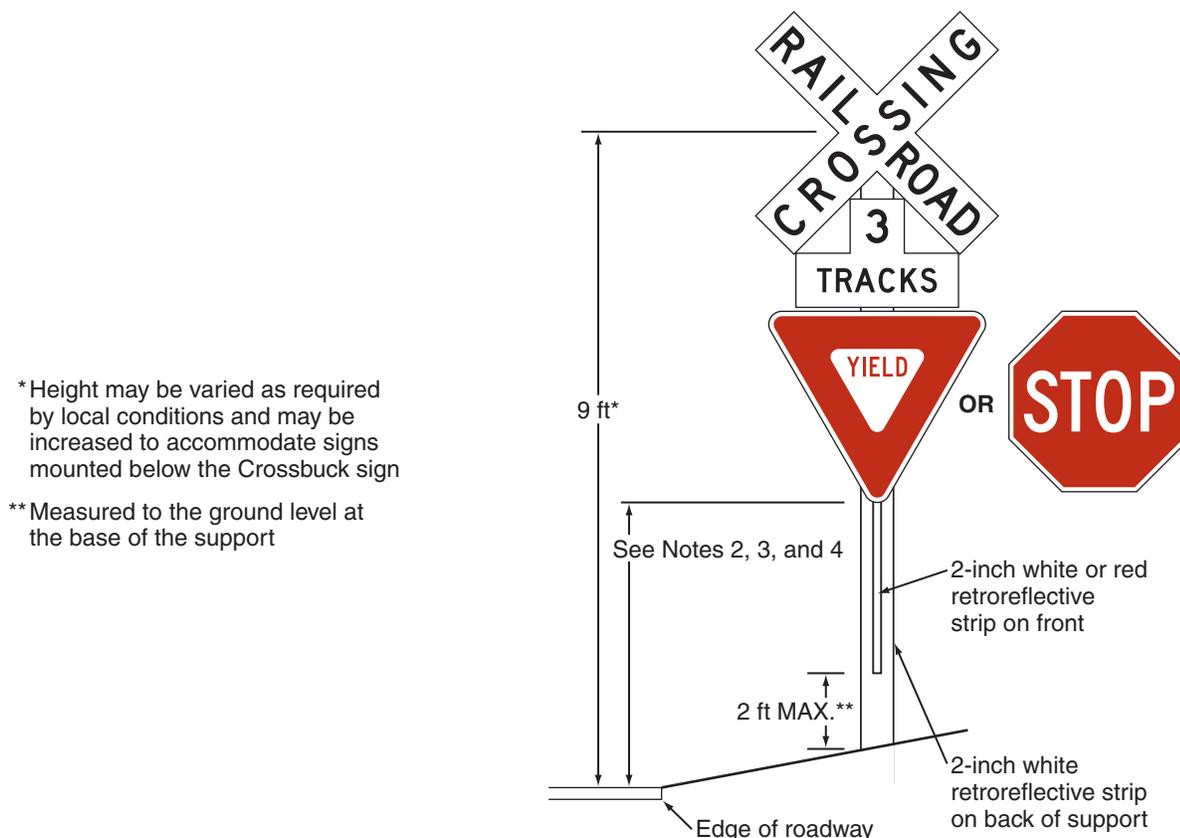


R15-7a



R15-8

Figure 8B-2. Crossbuck Assembly with a YIELD or STOP Sign on the Crossbuck Sign Support



Notes:

1. YIELD or STOP signs are used only at passive crossings. A STOP sign is used only if an engineering study determines that it is appropriate for that particular approach.
2. Mounting height shall be at least 4 feet for installations of YIELD or STOP signs on existing Crossbuck sign supports.
3. Mounting height shall be at least 7 feet for new installations in areas with pedestrian movements or parking.

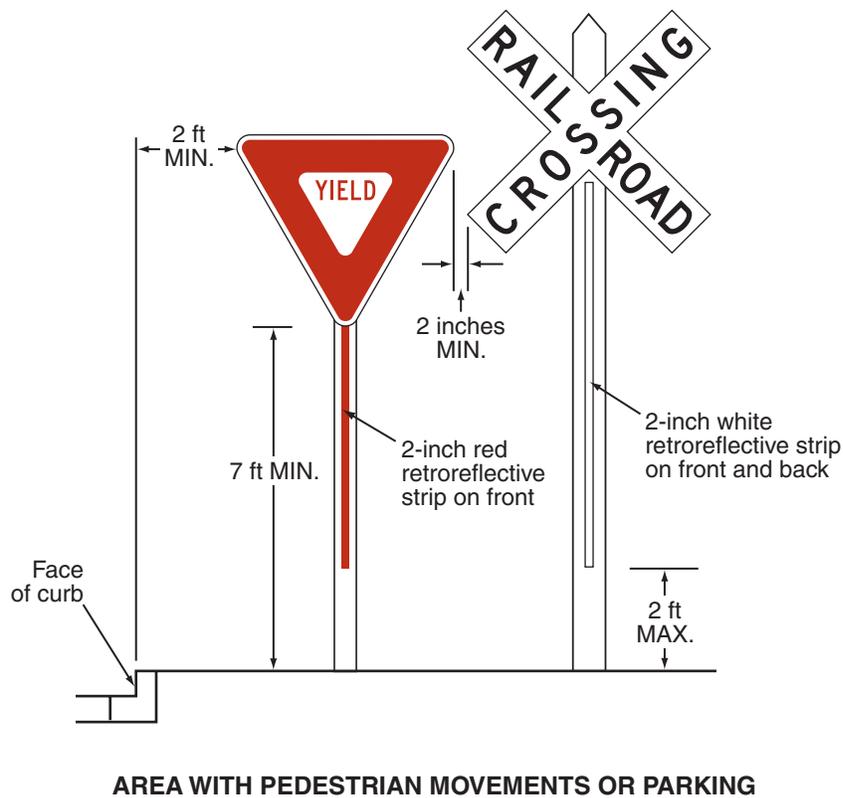
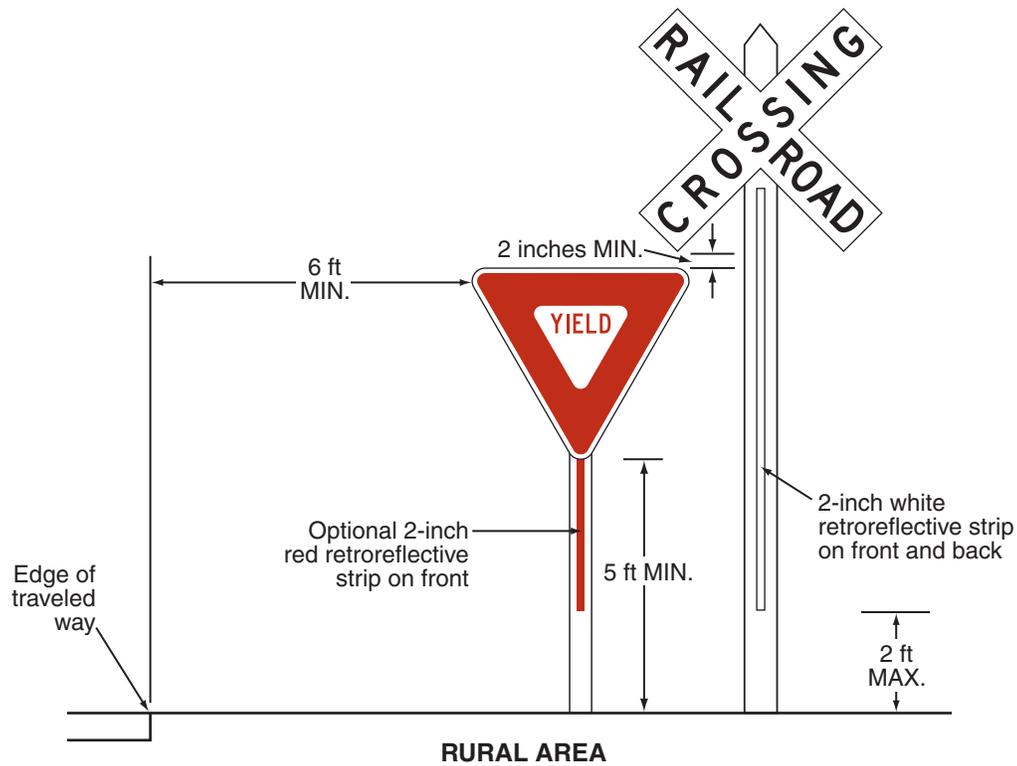
¹⁰ Where unusual conditions make variations in location and lateral offset appropriate, engineering judgment should be used to provide the best practical combination of view and safety clearances.

Section 8B.04 Crossbuck Assemblies with YIELD or STOP Signs at Passive Grade Crossings

Standard:

- ⁰¹ A grade crossing Crossbuck Assembly shall consist of a Crossbuck (R15-1) sign, and a Number of Tracks (R15-2P) plaque if two or more tracks are present, that complies with the provisions of Section 8B.03, and either a YIELD (R1-2) or STOP (R1-1) sign installed on the same support, except as provided in Paragraph 8. If used at a passive grade crossing, a YIELD or STOP sign shall be installed in compliance with the provisions of Part 2, Section 2B.10, and Figures 8B-2 and 8B-3.
- ⁰² At all public highway-rail grade crossings that are not equipped with the active traffic control systems that are described in Chapter 8C, except crossings where road users are directed by an authorized person on the ground to not enter the crossing at all times that an approaching train is about to occupy the crossing, a Crossbuck Assembly shall be installed on the right-hand side of the highway on each approach to the highway-rail grade crossing.
- ⁰³ If a Crossbuck sign is used on a highway approach to a public highway-LRT grade crossing that is not equipped with the active traffic control systems that are described in Chapter 8C, a Crossbuck Assembly shall be installed on the right-hand side of the highway on each approach to the highway-LRT grade crossing.

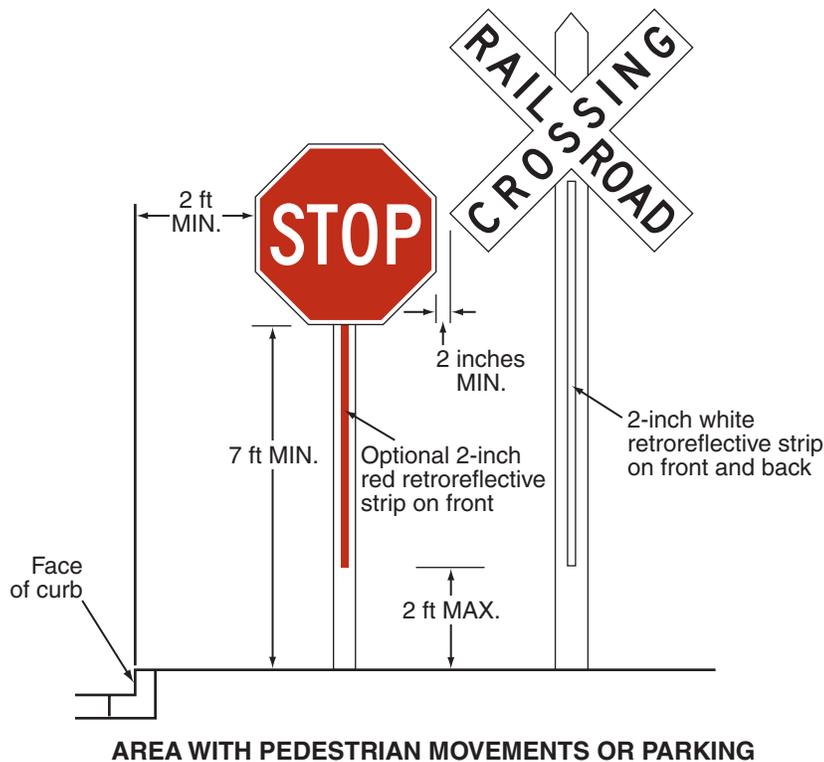
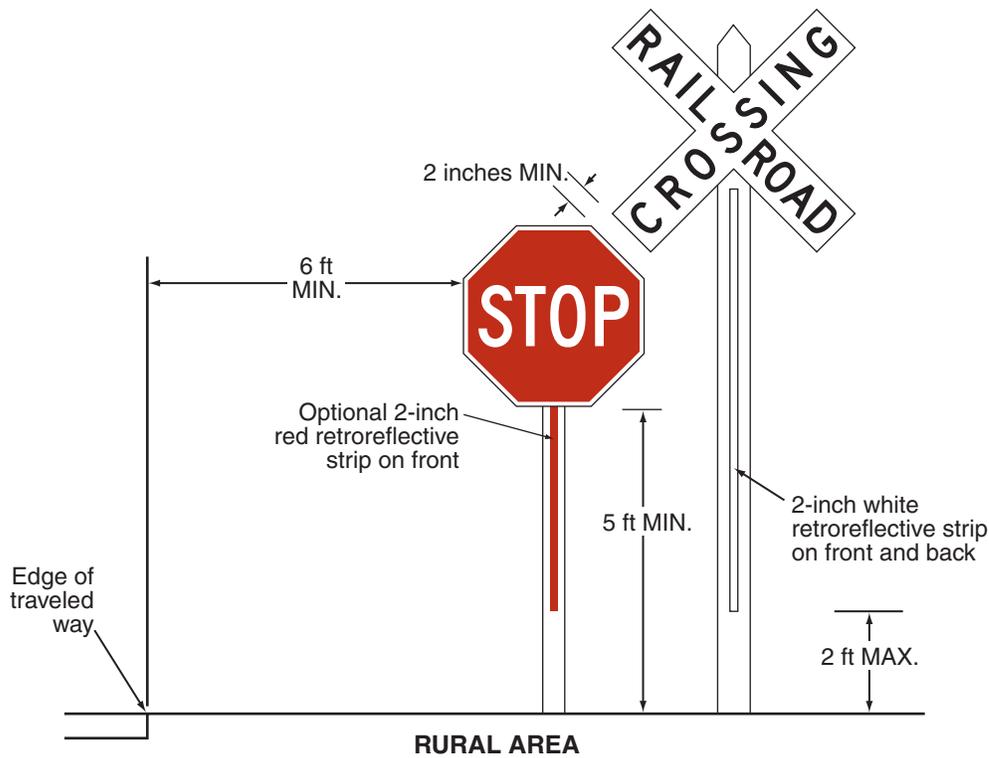
Figure 8B-3. Crossbuck Assembly with a YIELD or STOP Sign on a Separate Sign Support (Sheet 1 of 2)



Notes:

1. YIELD signs are used only at passive crossings.
2. Place the face of the signs in the same plane and place the YIELD sign closest to the traveled way. Provide a 2-inch minimum separation between the edge of the Crossbuck sign and the edge of the YIELD sign.

Figure 8B-3. Crossbuck Assembly with a YIELD or STOP Sign on a Separate Sign Support (Sheet 2 of 2)



Notes:

1. STOP signs are used only at passive crossings and only if an engineering study determines that it is appropriate for that particular approach.
2. Place the face of the signs in the same plane and place the STOP sign closest to the traveled way. Provide a 2-inch minimum separation between the edge of the Crossbuck sign and the edge of the STOP sign.

04 **Where restricted sight distance or unfavorable highway geometry exists on an approach to a grade crossing that has a Crossbuck Assembly, or where there is a one-way multi-lane approach, an additional Crossbuck Assembly shall be installed on the left-hand side of the highway.**

05 **A YIELD sign shall be the default traffic control device for Crossbuck Assemblies on all highway approaches to passive grade crossings unless an engineering study performed by the regulatory agency or highway authority having jurisdiction over the roadway approach determines that a STOP sign is appropriate.**

Guidance:

06 *The use of STOP signs at passive grade crossings should be limited to unusual conditions where requiring all highway vehicles to make a full stop is deemed essential by an engineering study. Among the factors that should be considered in the engineering study are the line of sight to approaching rail traffic (giving due consideration to seasonal crops or vegetation beyond both the highway and railroad or LRT rights-of-ways), the number of tracks, the speeds of trains or LRT equipment and highway vehicles, and the crash history at the grade crossing.*

Support:

07 Sections 8A.02 and 8A.03 contain information regarding the responsibilities of the highway agency and the railroad company or LRT agency regarding the selection, design, and operation of traffic control devices placed at grade crossings.

Option:

08 If a YIELD or STOP sign is installed for a Crossbuck Assembly at a grade crossing, it may be installed on the same support as the Crossbuck sign or it may be installed on a separate support at a point where the highway vehicle is to stop, or as near to that point as practical, but in either case, the YIELD or STOP sign is considered to be a part of the Crossbuck Assembly.

Standard:

09 **If a YIELD or STOP sign is installed on an existing Crossbuck sign support, the minimum height, measured vertically from the bottom of the YIELD or STOP sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the YIELD or STOP sign to the elevation of the near edge of the traveled way, shall be 4 feet (see Figure 8B-2).**

10 **If a Crossbuck Assembly is installed on a new sign support (see Figure 8B-2) or if the YIELD or STOP sign is installed on a separate support (see Figure 8B-3), the minimum height, measured vertically from the bottom of the YIELD or STOP sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the YIELD or STOP sign to the elevation of the near edge of the traveled way, shall be 7 feet if the Crossbuck Assembly is installed in an area where parking or pedestrian movements are likely to occur.**

Guidance:

11 *If a YIELD or STOP sign is installed for a Crossbuck Assembly at a grade crossing on a separate support than the Crossbuck sign (see Figure 8B-3), the YIELD or STOP sign should be placed at a point where the highway vehicle is to stop, or as near to that point as practical, but no closer than 15 feet measured perpendicular from the nearest rail.*

Support:

12 The meaning of a Crossbuck Assembly that includes a YIELD sign is that a road user approaching the grade crossing needs to be prepared to decelerate, and when necessary, yield the right-of-way to any rail traffic that might be occupying the crossing or might be approaching and in such close proximity to the crossing that it would be unsafe for the road user to cross.

13 Certain commercial motor vehicles and school buses are required to stop at all grade crossings in accordance with 49 CFR 392.10 even if a YIELD sign (or just a Crossbuck sign) is posted.

14 The meaning of a Crossbuck Assembly that includes a STOP sign is that a road user approaching the grade crossing must come to a full and complete stop not less than 15 feet short of the nearest rail, and remain stopped while the road user determines if there is rail traffic either occupying the crossing or approaching and in such close proximity to the crossing that the road user must yield the right-of-way to rail traffic. The road user is permitted to proceed when it is safe to cross.

Standard:

15 **A vertical strip of retroreflective white material, not less than 2 inches in width, shall be used on each Crossbuck support at passive grade crossings for the full length of the back of the support from the Crossbuck sign or Number of Tracks plaque to within 2 feet above the ground, except as provided in Paragraph 16.**

Option:

- 16 The vertical strip of retroreflective material may be omitted from the back sides of Crossbuck sign supports installed on one-way streets.
- 17 If a YIELD or STOP sign is installed on the same support as the Crossbuck sign, a vertical strip of red (see Section 2A.21) or white retroreflective material that is at least 2 inches wide may be used on the front of the support from the YIELD or STOP sign to within 2 feet above the ground.

Standard:

- 18 **If a Crossbuck sign support at a passive grade crossing does not include a YIELD or STOP sign (either because the YIELD or STOP sign is placed on a separate support or because a YIELD or STOP sign is not present on the approach), a vertical strip of retroreflective white material, not less than 2 inches in width, shall be used for the full length of the front of the support from the Crossbuck sign or Number of Tracks plaque to within 2 feet above the ground.**
- 19 **At all grade crossings where YIELD or STOP signs are installed, Yield Ahead (W3-2) or Stop Ahead (W3-1) signs shall also be installed if the criteria for their installation in Section 2C.36 is met.**

Support:

- 20 Section 8B.28 contains provisions regarding the use of stop lines or yield lines at grade crossings.

Section 8B.05 Use of STOP (R1-1) or YIELD (R1-2) Signs without Crossbuck Signs at Highway-LRT Grade Crossings**Standard:**

- 01 **For all highway-LRT grade crossings where only STOP (R1-1) or YIELD (R1-2) signs are installed, the placement shall comply with the requirements of Section 2B.10. Stop Ahead (W3-1) or Yield Ahead (W3-2) Advance Warning signs (see Figure 2C-6) shall also be installed if the criteria for their installation given in Section 2C.36 is met.**

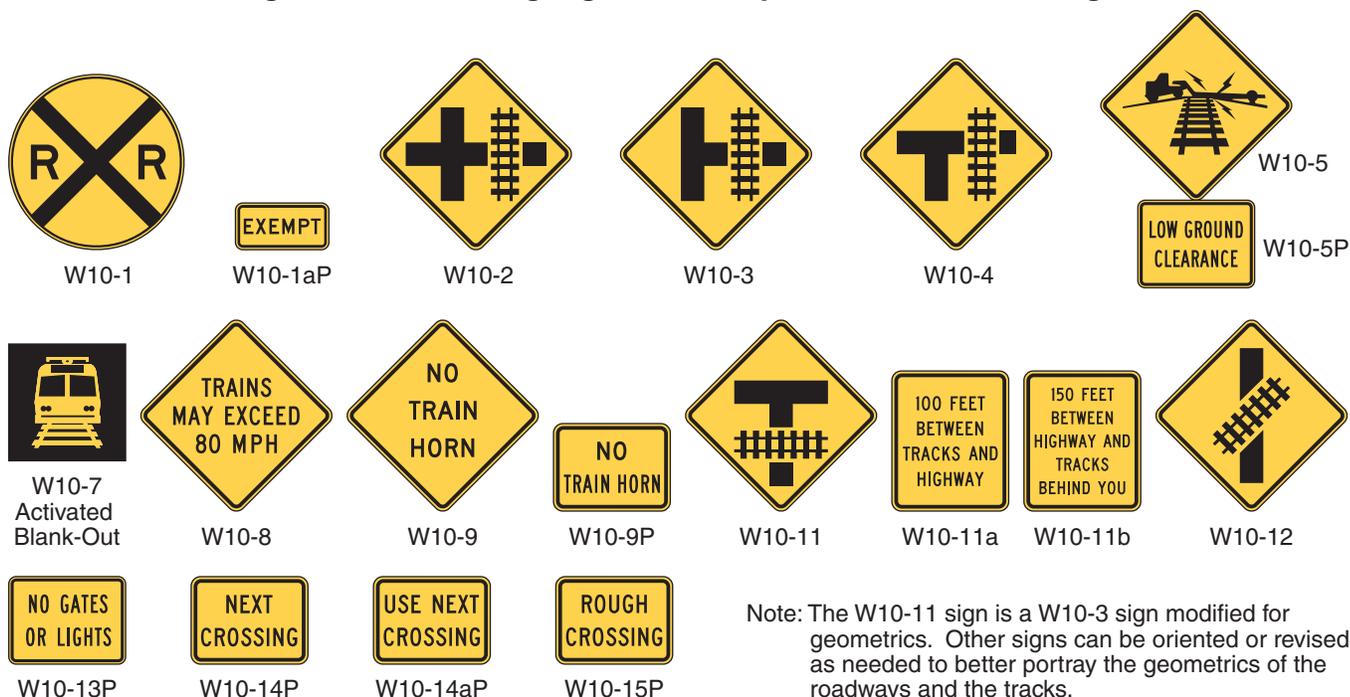
Guidance:

- 02 *The use of only STOP or YIELD signs for road users at highway-LRT grade crossings should be limited to those crossings where the need and feasibility is established by an engineering study. Such crossings should have all of the following characteristics:*
- A. *The crossing roadways should be secondary in character (such as a minor street with one lane in each direction, an alley, or a driveway) with low traffic volumes and low speed limits. The specific thresholds of traffic volumes and speed limits should be determined by the local agencies.*
 - B. *LRT speeds do not exceed 25 mph.*
 - C. *The line of sight for an approaching LRT operator is adequate from a sufficient distance such that the operator can sound an audible signal and bring the LRT equipment to a stop before arriving at the crossing.*
 - D. *The road user has sufficient sight distance at the stop line to permit the vehicle to cross the tracks before the arrival of the LRT equipment.*
 - E. *If at an intersection of two roadways, the intersection does not meet the warrants for a traffic control signal as provided in Chapter 4C.*
 - F. *The LRT tracks are located such that highway vehicles are not likely to stop on the tracks while waiting to enter a cross street or highway.*

Section 8B.06 Grade Crossing Advance Warning Signs (W10 Series)**Standard:**

- 01 **A Highway-Rail Grade Crossing Advance Warning (W10-1) sign (see Figure 8B-4) shall be used on each highway in advance of every highway-rail grade crossing, and every highway-LRT grade crossing in semi-exclusive alignments, except in the following circumstances:**
- A. **On an approach to a grade crossing from a T-intersection with a parallel highway if the distance from the edge of the track to the edge of the parallel roadway is less than 100 feet and W10-3 signs are used on both approaches of the parallel highway;**
 - B. **On low-volume, low-speed highways crossing minor spurs or other tracks that are infrequently used and road users are directed by an authorized person on the ground to not enter the crossing at all times that approaching rail traffic is about to occupy the crossing;**
 - C. **In business or commercial areas where active grade crossing traffic control devices are in use; or**
 - D. **Where physical conditions do not permit even a partially effective display of the sign.**
- 02 **The placement of the Grade Crossing Advance Warning sign shall be in accordance with Section 2C.05 and Table 2C-4.**

Figure 8B-4. Warning Signs and Plaques for Grade Crossings



03 A Yield Ahead (W3-2) or Stop Ahead (W3-1) Advance Warning sign (see Figure 2C-6) shall also be installed if the criteria for their installation given in Section 2C.36 is met. If a Yield Ahead or Stop Ahead sign is installed on the approach to the crossing, the W10-1 sign shall be installed upstream from the Yield Ahead or Stop Ahead sign. The Yield Ahead or Stop Ahead sign shall be located in accordance with Table 2C-4. The minimum distance between the signs shall be in accordance with Section 2C.05 and Table 2C-4.

Option:

04 On divided highways and one-way streets, an additional W10-1 sign may be installed on the left-hand side of the roadway.

Standard:

05 If the distance between the tracks and a parallel highway, from the edge of the tracks to the edge of the parallel roadway, is less than 100 feet, W10-2, W10-3, or W10-4 signs (see Figure 8B-4) shall be installed on each approach of the parallel highway to warn road users making a turn that they will encounter a grade crossing soon after making a turn, and a W10-1 sign for the approach to the tracks shall not be required to be between the tracks and the parallel highway.

06 If the W10-2, W10-3, or W10-4 signs are used, sign placement in accordance with the guidelines for Intersection Warning signs in Table 2C-4 using the speed of through traffic shall be measured from the highway intersection.

Guidance:

07 If the distance between the tracks and the parallel highway, from the edge of the tracks to the edge of the parallel roadway, is 100 feet or more, a W10-1 sign should be installed in advance of the grade crossing, and the W10-2, W10-3, or W10-4 signs should not be used on the parallel highway.

Section 8B.07 EXEMPT Highway-Rail Grade Crossing Plaques (R15-3P, W10-1aP)

Option:

01 When authorized by law or regulation, a supplemental EXEMPT (R15-3P) plaque (see Figure 8B-1) with a white background may be used below the Crossbuck sign or Number of Tracks plaque, if present, at the grade crossing, and a supplemental EXEMPT (W10-1aP) plaque (see Figure 8B-4) with a yellow background may be used below the Grade Crossing Advance Warning (W10 series) sign.

02 Where neither the Crossbuck sign nor the advance warning signs exist for a particular highway-LRT grade crossing, an EXEMPT (R15-3P) plaque with a white background may be placed on its own post on the near right-hand side of the approach to the crossing.

Support:

- 03 These supplemental plaques inform drivers of highway vehicles carrying passengers for hire, school buses carrying students, or highway vehicles carrying hazardous materials that a stop is not required at certain designated grade crossings, except when rail traffic is approaching or occupying the grade crossing, or the driver's view is blocked.

Section 8B.08 Turn Restrictions During Preemption*Guidance:*

- 01 *At a signalized intersection that is located within 200 feet of a highway-rail grade crossing, measured from the edge of the track to the edge of the roadway, where the intersection traffic control signals are preempted by the approach of a train, all existing turning movements toward the highway-rail grade crossing should be prohibited during the signal preemption sequences.*

Option:

- 02 A blank-out or changeable message sign and/or appropriate highway traffic signal indication or other similar type sign may be used to prohibit turning movements toward the highway-rail grade crossing during preemption. The R3-1a and R3-2a signs shown in Figure 8B-1 may be used for this purpose.

Support:

- 03 LRT operations can include the use of activated blank-out sign technology for turn prohibition signs. The signs are typically used on roads paralleling a semi-exclusive or mixed-use LRT alignment where road users might turn across the LRT tracks. A blank-out sign displays its message only when activated. When not activated, the sign face is blank.

Guidance:

- 04 *An LRT-activated blank-out turn prohibition (R3-1a or R3-2a) sign should be used where an intersection adjacent to a highway-LRT crossing is controlled by STOP signs, or is controlled by traffic control signals with permissive turn movements for road users crossing the tracks.*

Option:

- 05 An LRT-activated blank-out turn prohibition (R3-1a or R3-2a) sign may be used for turning movements that cross the tracks.
- 06 As an alternative to LRT-activated blank-out turn prohibition signs at intersections with traffic control signals, exclusive traffic control signal phases such that all movements that cross the tracks have a steady red indication may be used in combination with No Turn on Red (R10-11, R10-11a, or R10-11b) signs (see Section 2B.53).

Standard:

- 07 **Turn prohibition signs that are associated with preemption shall be visible or activated only when the grade crossing restriction is in effect.**

Section 8B.09 DO NOT STOP ON TRACKS Sign (R8-8)*Guidance:*

- 01 A DO NOT STOP ON TRACKS (R8-8) sign (see Figure 8B-1) should be installed whenever an engineering study determines that the potential for highway vehicles stopping on the tracks at a grade crossing is significant. Placement of the R8-8 sign should be determined as part of the engineering study. The sign, if used, should be located on the right-hand side of the highway on either the near or far side of the grade crossing, depending upon which position provides better visibility to approaching drivers.
- 02 If a STOP or YIELD sign is installed at a location, including at a circular intersection, that is downstream from the grade crossing such that highway vehicle queues are likely to extend beyond the tracks, a DO NOT STOP ON TRACKS sign (R8-8) should be used.

Option:

- 03 DO NOT STOP ON TRACKS signs may be placed on both sides of the track.
- 04 On divided highways and one-way streets, a second DO NOT STOP ON TRACKS sign may be placed on the near or far left-hand side of the highway at the grade crossing to further improve visibility of the sign.

Section 8B.10 TRACKS OUT OF SERVICE Sign (R8-9)**Option:**

- 01 The TRACKS OUT OF SERVICE (R8-9) sign (see Figure 8B-1) may be used at a grade crossing instead of a Crossbuck (R15-1) sign and a Number of Tracks (R15-2P) plaque or instead of a Crossbuck Assembly when

railroad or LRT tracks have been temporarily or permanently abandoned, but only until such time that the tracks are removed or covered.

Standard:

02 **When tracks are out of service, traffic control devices and gate arms shall be removed and the signal heads shall be removed or hooded or turned from view to clearly indicate that they are not in operation.**

03 **The R8-9 sign shall be removed when the tracks have been removed or covered or when the grade crossing is returned to service.**

Section 8B.11 STOP HERE WHEN FLASHING Signs (R8-10, R8-10a)

Option:

01 The STOP HERE WHEN FLASHING (R8-10, R8-10a) sign (see Figure 8B-1) may be used at a grade crossing to inform drivers of the location of the stop line or the point at which to stop when the flashing-light signals (see Section 8C.02) are activated.

Section 8B.12 STOP HERE ON RED Signs (R10-6, R10-6a)

Support:

01 The STOP HERE ON RED (R10-6, R10-6a) sign (see Figure 8B-1) defines and facilitates observance of stop lines at traffic control signals.

Option:

02 A STOP HERE ON RED sign may be used at locations where highway vehicles frequently violate the stop line or where it is not obvious to road users where to stop.

Guidance:

03 *If possible, stop lines should be placed at a point where the highway vehicle driver has adequate sight distance along the track.*

Section 8B.13 Light Rail Transit Only Lane Signs (R15-4 Series)

Support:

01 The Light Rail Transit Only Lane (R15-4 series) signs (see Figure 8B-1) are used for multi-lane operations, where road users might need additional guidance on lane use and/or restrictions.

Option:

02 Light Rail Transit Only Lane signs may be used on a roadway lane limited to only LRT use to indicate the restricted use of a lane in semi-exclusive and mixed alignments.

Guidance:

03 *If used, the R15-4a, R15-4b, and R15-4c signs should be installed on posts adjacent to the roadway containing the LRT tracks or overhead above the LRT only lane.*

Option:

04 If the trackway is paved, preferential lane markings (see Chapter 3D) may be installed but only in combination with Light Rail Transit Only Lane signs.

Support:

05 The trackway is the continuous way designated for LRT, including the entire dynamic envelope. Section 8B.29 contains more information regarding the dynamic envelope.

Section 8B.14 Do Not Pass Light Rail Transit Signs (R15-5, R15-5a)

Support:

01 A Do Not Pass Light Rail Transit (R15-5) sign (see Figure 8B-1) is used to indicate that motor vehicles are not allowed to pass LRT vehicles that are loading or unloading passengers where there is no raised platform or physical separation from the lanes upon which other motor vehicles are operating.

Option:

02 The R15-5 sign may be used in mixed-use alignments and may be mounted overhead where there are multiple lanes.

03 Instead of the R15-5 symbol sign, a regulatory sign with the word message DO NOT PASS STOPPED TRAIN (R15-5a) may be used (see Figure 8B-1).

Guidance:

04 *If used, the R15-5 sign should be located immediately before the LRT boarding area.*

Section 8B.15 No Motor Vehicles On Tracks Signs (R15-6, R15-6a)**Support:**

- 01 The No Motor Vehicles On Tracks (R15-6) sign (see Figure 8B-1) is used where there are adjacent traffic lanes separated from the LRT lane by a curb or pavement markings.

Guidance:

- 02 *The DO NOT ENTER (R5-1) sign should be used where a road user could wrongly enter an LRT only street.*

Option:

- 03 A No Motor Vehicles On Tracks sign may be used to deter motor vehicles from driving on the trackway. It may be installed on a 3-foot flexible post between double tracks, on a post alongside the tracks, or overhead.
- 04 Instead of the R15-6 symbol sign, a regulatory sign with the word message DO NOT DRIVE ON TRACKS (R15-6a) may be used (see Figure 8B-1).
- 05 A reduced size of 12 x 12 inches may be used if the R15-6 sign is installed between double tracks.

Standard:

- 06 **The smallest size for the R15-6 sign shall be 12 x 12 inches.**

Section 8B.16 Divided Highway with Light Rail Transit Crossing Signs (R15-7 Series)**Option:**

- 01 The Divided Highway with Light Rail Transit Crossing (R15-7) sign (see Figure 8B-1) may be used as a supplemental sign on the approach legs of a roadway that intersects with a divided highway where LRT equipment operates in the median. The sign may be placed beneath a STOP sign or mounted separately.

Guidance

- 02 *The number of tracks displayed on the R15-7 sign should be the same as the actual number of tracks.*

Standard:

- 03 **When the Divided Highway With Light Rail Transit Crossing sign is used at a four-legged intersection, the R15-7 sign shall be used. When used at a T-intersection, the R15-7a sign shall be used.**

Section 8B.17 LOOK Sign (R15-8)**Option:**

- 01 At grade crossings, the LOOK (R15-8) sign (see Figure 8B-1) may be mounted as a supplemental plaque on the Crossbuck support, or on a separate post in the immediate vicinity of the grade crossing on the railroad or LRT right-of-way.

Guidance:

- 02 *A LOOK sign should not be mounted as a supplemental plaque on a Crossbuck Assembly that has a YIELD or STOP sign mounted on the same support as the Crossbuck.*

Section 8B.18 Emergency Notification Sign (I-13)**Guidance:**

- 01 *Emergency Notification (I-13) signs (see Figure 8B-5) should be installed at all highway-rail grade crossings, and at all highway-LRT grade crossings on semi-exclusive alignments, to provide information to road users so that they can notify the railroad company or LRT agency about emergencies or malfunctioning traffic control devices.*

Standard:

- 02 **When Emergency Notification signs are used at a highway-rail grade crossing, they shall, at a minimum, include the USDOT grade crossing inventory number and the emergency contact telephone number.**
- 03 **When Emergency Notification signs are used at a highway-LRT grade crossing, they shall, at a minimum, include a unique crossing identifier and the emergency contact telephone number.**
- 04 **Emergency Notification Signs shall have a white legend and border on a blue background.**
- 05 **The Emergency Notification signs shall be positioned so as to not obstruct any traffic control devices or limit the view of rail traffic approaching the grade crossing.**

Figure 8B-5. Example of an Emergency Notification Sign

I-13

Guidance:

- 06 *Emergency Notification signs should be retroreflective.*
- 07 *Emergency Notification signs should be oriented so as to face highway vehicles stopped on or at the grade crossing or on the traveled way near the grade crossing.*
- 08 *At station crossings, Emergency Notification signs or information should be posted in a conspicuous location.*
- 09 *Emergency Notification signs mounted on Crossbuck Assemblies or signal masts should only be large enough to provide the necessary contact information. Use of larger signs that might obstruct the view of rail traffic or other highway vehicles should be avoided.*

Section 8B.19 Light Rail Transit Approaching-Activated Blank-Out Warning Sign (W10-7)*Support:*

- 01 The Light Rail Transit Approaching-Activated Blank-Out (W10-7) warning sign (see Figure 8B-4) supplements the traffic control devices to warn road users crossing the tracks of approaching LRT equipment.

Option:

- 02 A Light Rail Transit Approaching-Activated Blank-Out warning sign may be used at signalized intersections near highway-LRT grade crossings or at crossings controlled by STOP signs or automatic gates.

Section 8B.20 TRAINS MAY EXCEED 80 MPH Sign (W10-8)*Guidance:*

- 01 *Where trains are permitted to travel at speeds exceeding 80 mph, a TRAINS MAY EXCEED 80 MPH (W10-8) sign (see Figure 8B-4) should be installed facing road users approaching the highway-rail grade crossing.*
- 02 *If used, the TRAINS MAY EXCEED 80 MPH signs should be installed between the Grade Crossing Advance Warning (W10 series) sign (see Figure 8B-4) and the highway-rail grade crossing on all approaches to the highway-rail grade crossing. The locations should be determined based on specific site conditions.*

Section 8B.21 NO TRAIN HORN Sign or Plaque (W10-9, W10-9P)*Standard:*

- 01 **Either a NO TRAIN HORN (W10-9) sign (see Figure 8B-4) or a NO TRAIN HORN (W10-9P) plaque shall be installed in each direction at each highway-rail grade crossing where a quiet zone has been established in compliance with 49 CFR Part 222. If a W10-9P plaque is used, it shall supplement and be mounted directly below the Grade Crossing Advance Warning (W10 series) sign (see Figure 8B-4).**

Section 8B.22 NO GATES OR LIGHTS Plaque (W10-13P)*Option:*

- 01 The NO GATES OR LIGHTS (W10-13P) sign plaque (see Figure 8B-4) may be mounted below the Grade Crossing Advance Warning (W10 series) sign at grade crossings that are not equipped with automated signals.

Section 8B.23 Low Ground Clearance Grade Crossing Sign (W10-5)*Guidance:*

- 01 *If the highway profile conditions are sufficiently abrupt to create a hang-up situation for long wheelbase vehicles or for trailers with low ground clearance, the Low Ground Clearance Grade Crossing (W10-5) sign (see Figure 8B-4) should be installed in advance of the grade crossing.*

Standard:

- 02 **Because this symbol might not be readily recognizable by the public, the Low Ground Clearance Grade Crossing (W10-5) warning sign shall be accompanied by an educational plaque, LOW GROUND CLEARANCE. The LOW GROUND CLEARANCE educational plaque shall remain in place for at least 3 years after the initial installation of the W10-5 sign (see Section 2A.12).**

Guidance:

- 03 *Auxiliary plaques such as AHEAD, NEXT CROSSING, or USE NEXT CROSSING (with appropriate arrows), or a supplemental distance plaque should be placed below the W10-5 sign at the nearest intersecting highway where a vehicle can detour or at a point on the highway wide enough to permit a U-turn.*
- 04 *If engineering judgment of roadway geometric and operating conditions confirms that highway vehicle speeds across the tracks should be below the posted speed limit, a W13-1P advisory speed plaque should be posted.*

Option:

- 05 If the grade crossing is rough, word message signs such as BUMP, DIP, or ROUGH CROSSING may be installed. A W13-1P advisory speed plaque may be installed below the word message sign in advance of rough crossings.

Support:

- 06 Information on ground clearance requirements at grade crossings is available in the “American Railway Engineering and Maintenance-of-Way Association’s Engineering Manual,” or the American Association of State Highway and Transportation Officials’ “Policy on Geometric Design of Highways and Streets” (see Section 1A.11).

Section 8B.24 Storage Space Signs (W10-11, W10-11a, W10-11b)**Guidance:**

- 01 *A Storage Space (W10-11) sign supplemented by a word message storage distance (W10-11a) sign (see Figure 8B-4) should be used where there is a highway intersection in close proximity to the grade crossing and an engineering study determines that adequate space is not available to store a design vehicle(s) between the highway intersection and the train or LRT equipment dynamic envelope.*
- 02 *The Storage Space (W10-11 and W10-11a) signs should be mounted in advance of the grade crossing at an appropriate location to advise drivers of the space available for highway vehicle storage between the highway intersection and the grade crossing.*

Option:

- 03 A Storage Space (W10-11b) sign (see Figure 8B-4) may be mounted beyond the grade crossing at the highway intersection under the STOP or YIELD sign or just prior to the signalized intersection to remind drivers of the storage space between the tracks and the highway intersection.

Section 8B.25 Skewed Crossing Sign (W10-12)**Option:**

- 01 The Skewed Crossing (W10-12) sign (see Figure 8B-4) may be used at a skewed grade crossing to warn road users that the tracks are not perpendicular to the highway.

Guidance:

- 02 *If the Skewed Crossing sign is used, the symbol should show the direction of the crossing (near left to far right as shown in Figure 8B-4, or the mirror image if the track goes from far left to near right). If the Skewed Crossing sign is used where the angle of the crossing is significantly different than 45 degrees, the symbol should show the approximate angle of the crossing.*

Standard:

- 03 **The Skewed Crossing sign shall not be used as a replacement for the required Advance Warning (W10-1) sign. If used, the Skewed Crossing sign shall supplement the W10-1 sign and shall be mounted on a separate post.**

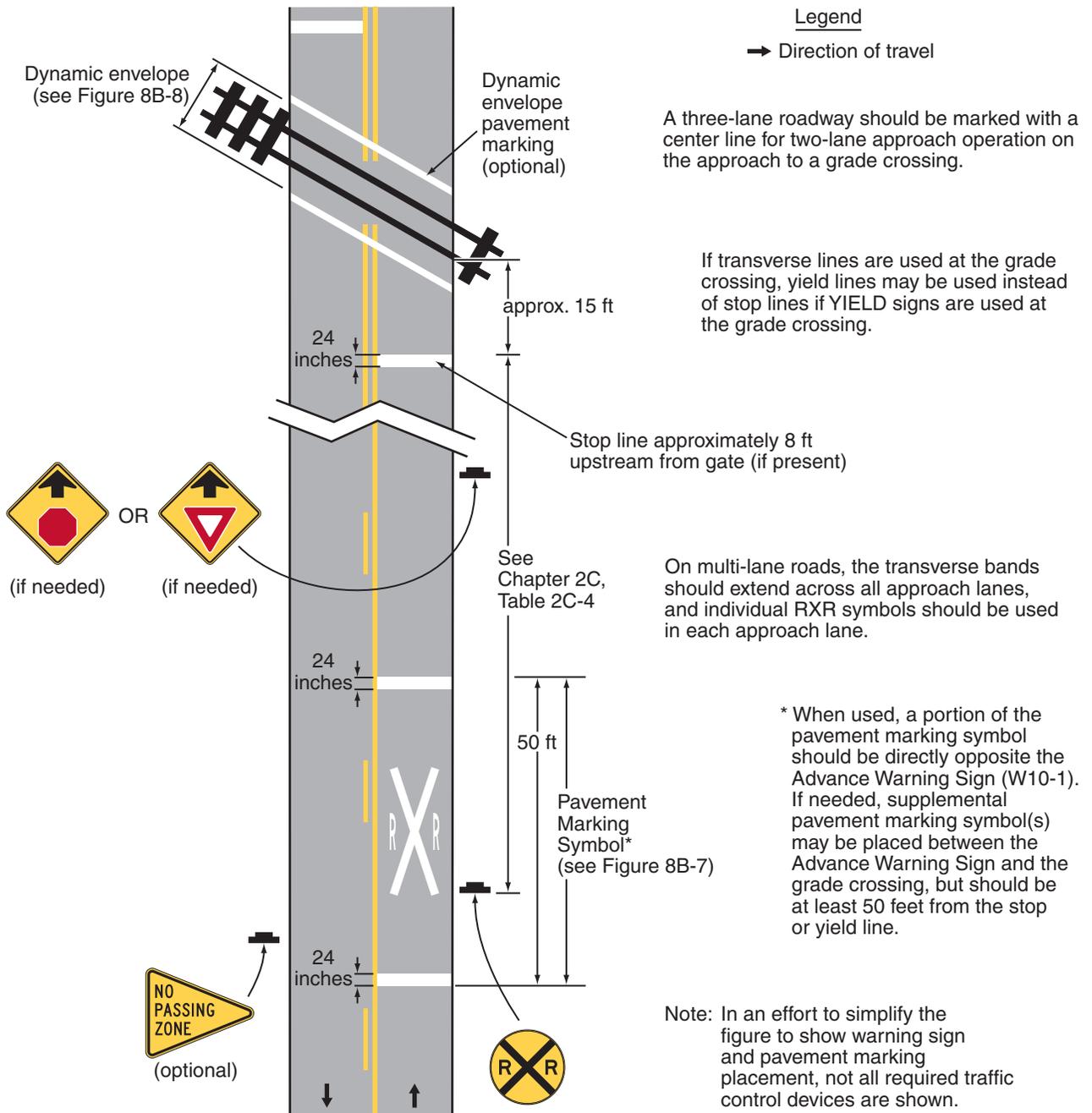
Section 8B.26 Light Rail Transit Station Sign (I-12)**Option:**

- 01 The Light Rail Transit Station (I-12) sign (see Figure 2H-1) may be used to direct road users to an LRT station or boarding location. It may be supplemented by the name of the transit system and by arrows as provided in Section 2D.08.

Section 8B.27 Pavement Markings**Standard:**

- 01 **All grade crossing pavement markings shall be retroreflectorized white. All other markings shall be in accordance with Part 3.**
- 02 **On paved roadways, pavement markings in advance of a grade crossing shall consist of an X, the letters RR, a no-passing zone marking (on two-lane, two-way highways with center line markings in compliance with Section 3B.01), and certain transverse lines as shown in Figures 8B-6 and 8B-7.**
- 03 **Identical markings shall be placed in each approach lane on all paved approaches to grade crossings where signals or automatic gates are located, and at all other grade crossings where the posted or statutory highway speed is 40 mph or greater.**
- 04 **Pavement markings shall not be required at grade crossings where the posted or statutory highway speed is less than 40 mph if an engineering study indicates that other installed devices provide suitable**

Figure 8B-6. Example of Placement of Warning Signs and Pavement Markings at Grade Crossings



warning and control. Pavement markings shall not be required at grade crossings in urban areas if an engineering study indicates that other installed devices provide suitable warning and control.

Guidance:

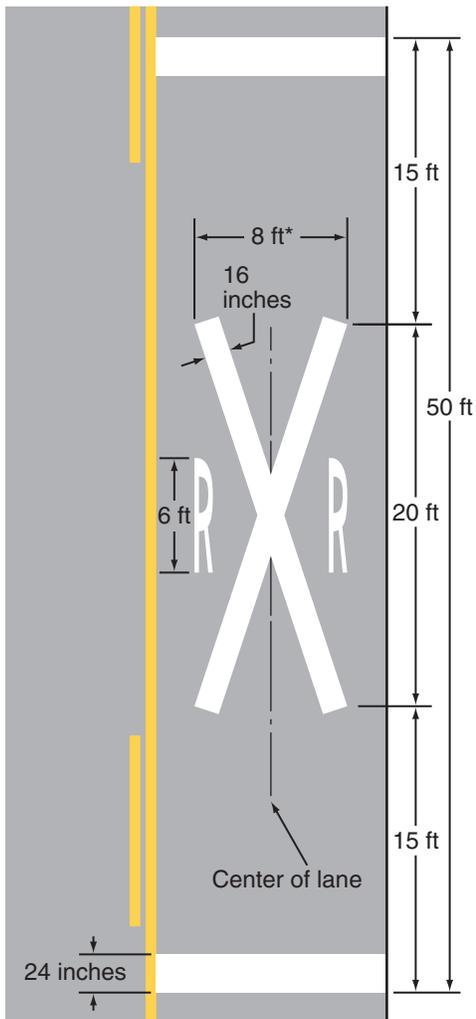
05 When pavement markings are used, a portion of the X symbol should be directly opposite the Grade Crossing Advance Warning sign. The X symbol and letters should be elongated to allow for the low angle at which they will be viewed.

Option:

06 When justified by engineering judgment, supplemental pavement marking symbol(s) may be placed between the Grade Crossing Advance Warning sign and the grade crossing.

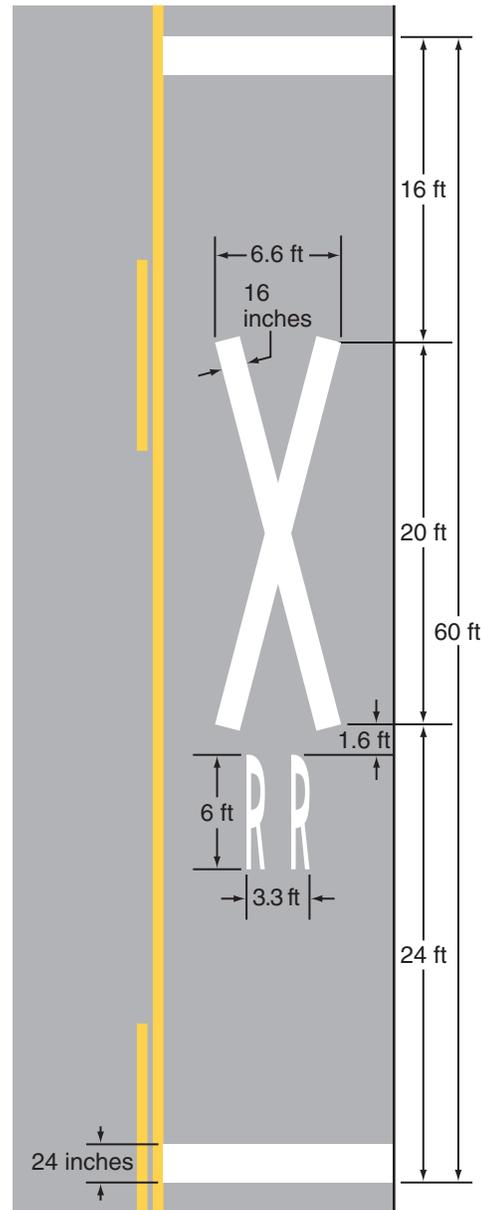
Figure 8B-7. Grade Crossing Pavement Markings

A - Grade crossing pavement marking symbol



*Width may vary according to lane width

B - Grade crossing alternative (narrow) pavement marking symbol



Note: Refer to Figure 8B-6 for placement

Section 8B.28 Stop and Yield Lines

Standard:

- 01 **On paved roadways at grade crossings that are equipped with active control devices such as flashing-light signals, gates, or traffic control signals, a stop line (see Section 3B.16) shall be installed to indicate the point behind which highway vehicles are or might be required to stop.**

Guidance:

- 02 *On paved roadway approaches to passive grade crossings where a STOP sign is installed in conjunction with the Crossbuck sign, a stop line should be installed to indicate the point behind which highway vehicles are required to stop or as near to that point as practical.*
- 03 *If a stop line is used, it should be a transverse line at a right angle to the traveled way and should be placed approximately 8 feet in advance of the gate (if present), but no closer than 15 feet in advance of the nearest rail.*

Option:

- 04 On paved roadway approaches to passive grade crossings where a YIELD sign is installed in conjunction with the Crossbuck sign, a yield line (see Section 3B.16) or a stop line may be installed to indicate the point behind which highway vehicles are required to yield or stop or as near to that point as practical.

Guidance:

- 05 If a yield line is used, it should be a transverse line (see Figure 3B-16) at a right angle to the traveled way and should be placed no closer than 15 feet in advance of the nearest rail (see Figure 8B-7).

Section 8B.29 Dynamic Envelope Markings

Support:

- 01 The dynamic envelope (see Figures 8B-8 and 8B-9) markings indicate the clearance required for the train or LRT equipment overhang resulting from any combination of loading, lateral motion, or suspension failure.

Option:

- 02 Dynamic envelope markings may be installed at all grade crossings, unless a Four-Quadrant Gate system (see Section 8C.06) is used.

Standard:

- 03 **If used, pavement markings for indicating the dynamic envelope shall comply with the provisions of Part 3 and shall be a 4-inch normal solid white line or contrasting pavement color and/or contrasting pavement texture.**

Guidance:

- 04 If pavement markings are used to convey the dynamic envelope, they should be placed completely outside of the dynamic envelope. If used, dynamic envelope pavement markings should be placed on the highway 6 feet

Figure 8B-8. Example of Dynamic Envelope Pavement Markings at Grade Crossings

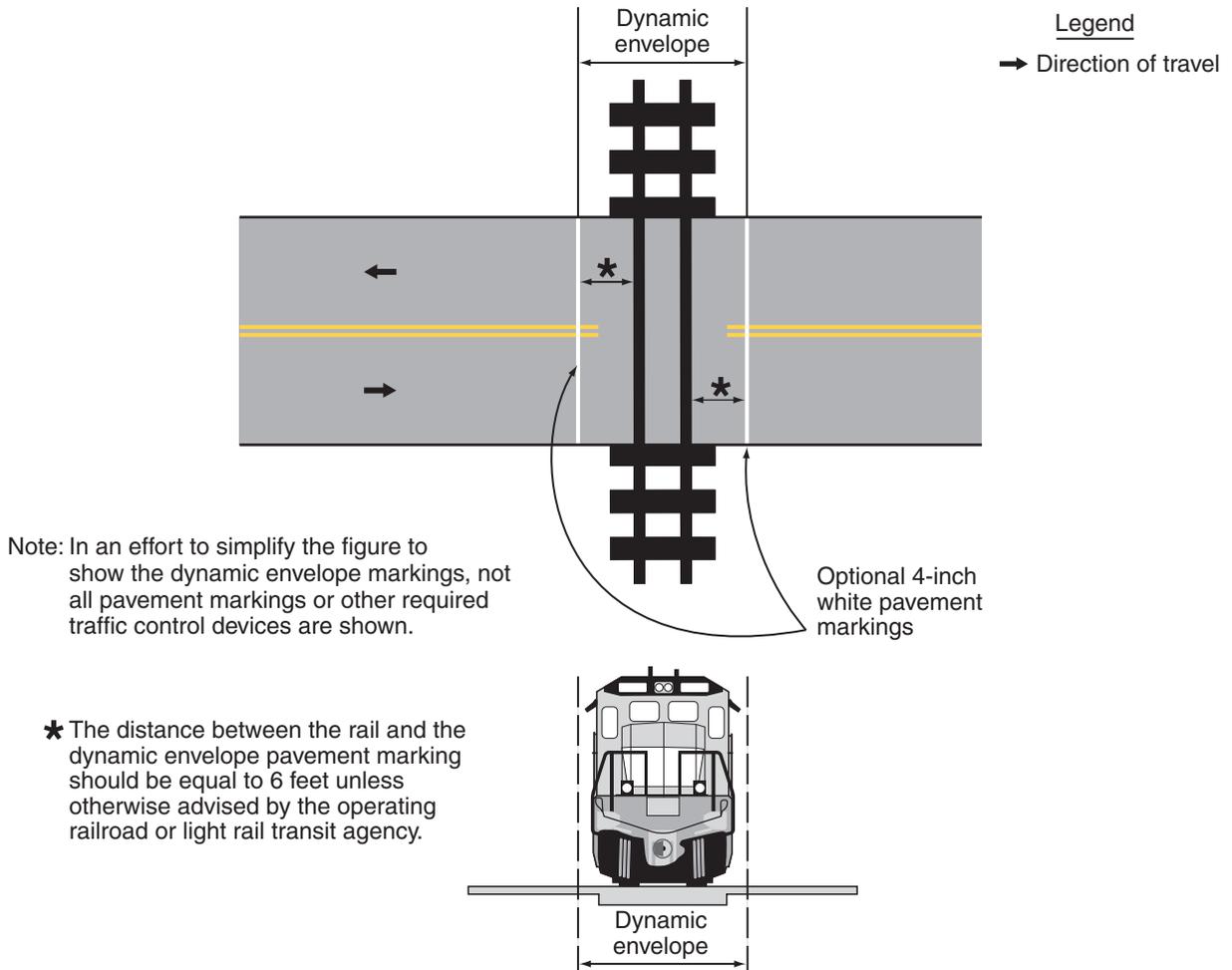
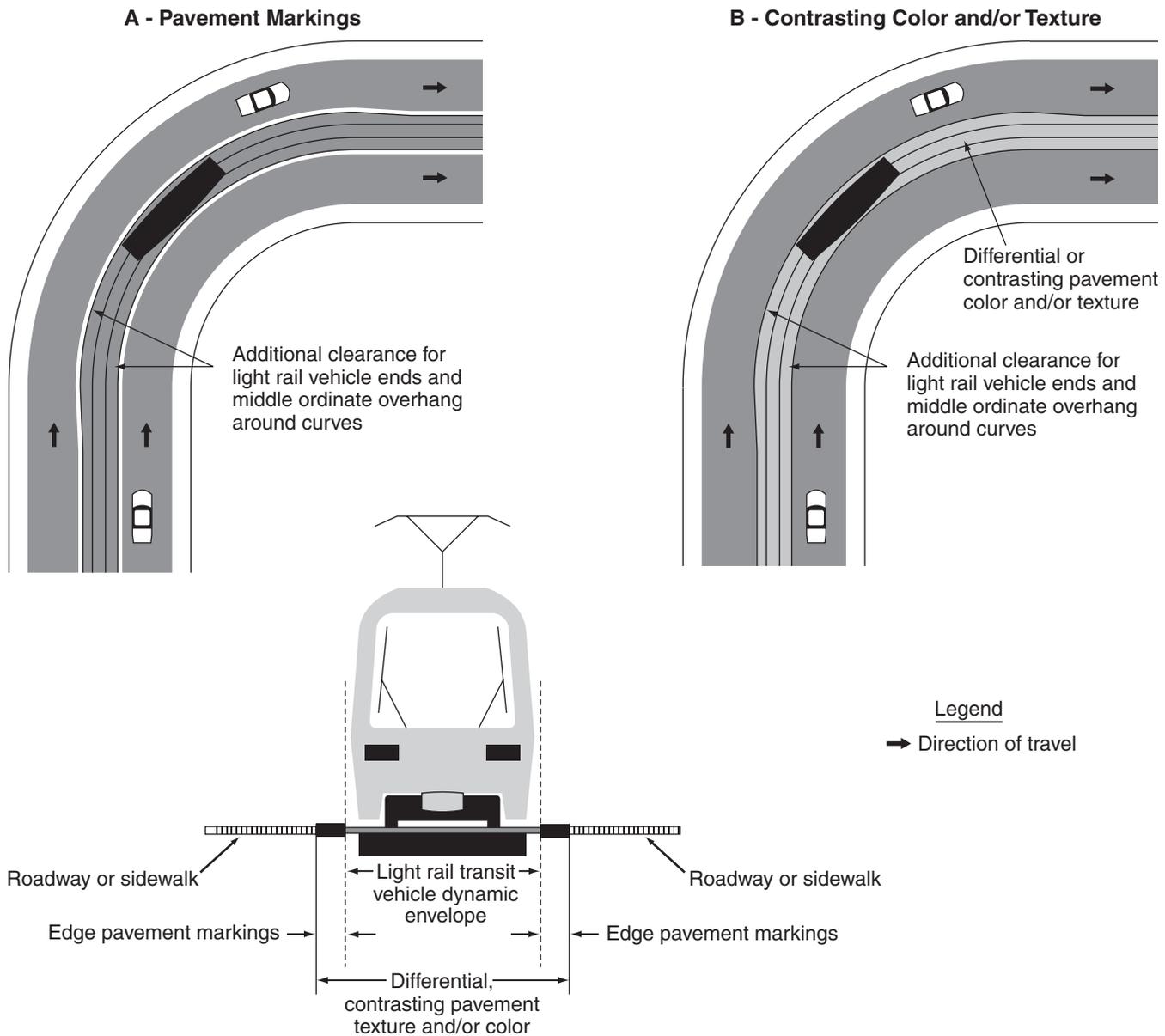


Figure 8B-9. Examples of Light Rail Transit Vehicle Dynamic Envelope Markings for Mixed-Use Alignments



from and parallel to the nearest rail unless the operating railroad company or LRT agency advises otherwise. The pavement markings should extend across the roadway as shown in Figure 8B-8. The dynamic envelope pavement markings should not be placed perpendicular to the roadway at skewed grade crossings.

Option:

05 In semi-exclusive LRT alignments, the dynamic envelope markings may be along the LRT trackway between intersections where the trackway is immediately adjacent to travel lanes and no physical barrier is present.

06 In mixed-use LRT alignments, the dynamic envelope markings may be continuous between intersections (see Figure 8B-9).

07 In mixed-use LRT alignments, pavement markings for adjacent travel or parking lanes may be used instead of dynamic envelope markings if the lines are outside the dynamic envelope.

CHAPTER 8C. FLASHING-LIGHT SIGNALS, GATES, AND TRAFFIC CONTROL SIGNALS

Section 8C.01 Introduction

Support:

- 01 Active traffic control systems inform road users of the approach or presence of rail traffic at grade crossings. These systems include four-quadrant gate systems, automatic gates, flashing-light signals, traffic control signals, actuated blank-out and variable message signs, and other active traffic control devices.
- 02 A composite drawing (see Figure 8C-1) shows a post-mounted flashing-light signal (two light units mounted in a horizontal line), a flashing-light signal mounted on an overhead structure, and an automatic gate assembly.

Option:

- 03 Post-mounted and overhead flashing-light signals may be used separately or in combination with each other as determined by an engineering study. Also, flashing-light signals may be used without automatic gate assemblies, as determined by an engineering study.

Standard:

- 04 **The meaning of flashing-light signals and gates shall be as stated in the “Uniform Vehicle Code” (see Sections 11-701 and 11-703 of the UVC), which is available from the National Committee on Uniform Traffic Laws and Ordinances (see Page i for the address).**
- 05 **Location and clearance dimensions for flashing-light signals and gates shall be as shown in Figure 8C-1.**
- 06 **When there is a curb, a horizontal offset of at least 2 feet shall be provided from the face of the vertical curb to the closest part of the signal or gate arm in its upright position. When a cantilevered-arm flashing-light signal is used, the vertical clearance shall be at least 17 feet above the crown of the highway to the lowest point of the signal unit.**
- 07 **Where there is a shoulder, but no curb, a horizontal offset of at least 2 feet from the edge of a paved or surfaced shoulder shall be provided, with an offset of at least 6 feet from the edge of the traveled way.**
- 08 **Where there is no curb or shoulder, the minimum horizontal offset shall be 6 feet from the edge of the traveled way.**

Guidance:

- 09 *Equipment housings (controller cabinets) should have a lateral offset of at least 30 feet from the edge of the highway, and where railroad or LRT property and conditions allow, at least 25 feet from the nearest rail.*
- 10 *If a pedestrian route is provided, sufficient clearance from supports, posts, and gate mechanisms should be maintained for pedestrian travel.*
- 11 *When determined by an engineering study, a lateral escape route to the right of the highway in advance of the grade crossing traffic control devices should be kept free of guardrail or other ground obstructions. Where guardrail is not deemed necessary or appropriate, barriers should not be used for protecting signal supports.*
- 12 *The same lateral offset and roadside safety features should apply to flashing-light signal and automatic gate locations on both the right-hand and left-hand sides of the roadway.*

Option:

- 13 In industrial or other areas involving only low-speed highway traffic or where signals are vulnerable to damage by turning truck traffic, guardrail may be installed to provide protection for the signal assembly.

Guidance:

- 14 *Where both traffic control signals and flashing-light signals (with or without automatic gates) are in operation at the same highway-LRT grade crossing, the operation of the devices should be coordinated to avoid any display of conflicting signal indications.*

Support:

- 15 LRT typically operates through grade crossings in semi-exclusive and mixed-use alignments at speeds between 10 and 65 mph.
- 16 When LRT speed is cited in this Part, it refers to the maximum speed at which LRT equipment is permitted to traverse a particular grade crossing.

Section 8C.02 Flashing-Light Signals

Support:

- 01 Section 8C.03 contains additional information regarding flashing-light signals at highway-LRT grade crossings in semi-exclusive and mixed-use alignments.

Standard:

- 02 **If used, the flashing-light signal assembly (shown in Figure 8C-1) on the side of the highway shall include a standard Crossbuck (R15-1) sign, and where there is more than one track, a supplemental Number of Tracks (R15-2P) plaque, all of which indicate to motorists, bicyclists, and pedestrians the location of a grade crossing.**

Option:

- 03 At highway-rail grade crossings, bells or other audible warning devices may be included in the assembly and may be operated in conjunction with the flashing lights to provide additional warning for pedestrians, bicyclists, and/or other non-motorized road users.

Standard:

- 04 **When indicating the approach or presence of rail traffic, the flashing-light signal shall display toward approaching highway traffic two red lights mounted in a horizontal line flashing alternately.**
- 05 **If used, flashing-light signals shall be placed to the right of approaching highway traffic on all highway approaches to a grade crossing. They shall be located laterally with respect to the highway in compliance with Figure 8C-1 except where such location would adversely affect signal visibility.**
- 06 **If used at a grade crossing with highway traffic in both directions, back-to-back pairs of lights shall be placed on each side of the tracks. On multi-lane one-way streets and divided highways, flashing-light signals shall be placed on the approach side of the grade crossing on both sides of the roadway or shall be placed above the highway.**
- 07 **Each red signal unit in the flashing-light signal shall flash alternately. The number of flashes per minute for each lamp shall be 35 minimum and 65 maximum. Each lamp shall be illuminated approximately the same length of time. Total time of illumination of each pair of lamps shall be the entire operating time. Flashing-light units shall use either 8-inch or 12-inch nominal diameter lenses.**

Guidance:

- 08 *In choosing between the 8-inch or 12-inch nominal diameter lenses for use in grade crossing flashing-light signals, consideration should be given to the principles stated in Section 4D.07.*

Standard:

- 09 **Grade crossing flashing-light signals shall operate at a low voltage using storage batteries either as a primary or stand-by source of electrical energy. Provision shall be made to provide a source of energy for charging batteries.**

Option:

- 10 Additional pairs of flashing-light units may be mounted on the same supporting post and directed toward vehicular traffic approaching the grade crossing from other than the principal highway route, such as where there are approaching routes on highways closely adjacent to and parallel to the track(s).

Standard:

- 11 **References to lenses in this Section shall not be used to limit flashing-light signal optical units to incandescent lamps within optical assemblies that include lenses.**

Support:

- 12 Research has resulted in flashing-light signal optical units that are not lenses, such as, but not limited to, light emitting diode (LED) flashing-light signal modules.

Option:

- 13 Flashing-light signals may be installed on overhead structures or cantilevered supports as shown in Figure 8C-1 where needed for additional emphasis, or for better visibility to approaching traffic, particularly on multi-lane approaches or highways with profile restrictions.
- 14 If it is determined by an engineering study that one set of flashing lights on the cantilever arm is not sufficiently visible to road users, one or more additional sets of flashing lights may be mounted on the supporting post and/or on the cantilever arm.

Standard:

- 15 **Breakaway or frangible bases shall not be used for overhead structures or cantilevered supports.**
- 16 **Except as otherwise provided in Paragraphs 13 through 15, flashing-light signals mounted overhead shall comply with the applicable provisions of this Section.**

Section 8C.03 Flashing-Light Signals at Highway-LRT Grade Crossings

Support:

- 01 Section 8C.02 contains additional provisions regarding the design and operation of flashing-light signals, including those installed at highway-LRT grade crossings.

Standard:

- 02 **Highway-LRT grade crossings in semi-exclusive alignments shall be equipped with flashing-light signals where LRT speeds exceed 35 mph. Flashing-light signals shall be clearly visible to motorists, pedestrians, and bicyclists.**
- 03 **If flashing-light signals are in operation at a highway-LRT crossing that is used by pedestrians, bicyclists, and/or other non-motorized road users, an audible device such as a bell shall also be provided and shall be operated in conjunction with the flashing-light signals.**

Guidance:

- 04 *Where the crossing is at a location other than an intersection and LRT speeds exceed 25 mph, flashing-light signals should be installed.*

Option:

- 05 Traffic control signals may be used instead of flashing-light signals at highway-LRT grade crossings within highway-highway intersections where LRT speeds do not exceed 35 mph. Traffic control signals or flashing-light signals may be used where the crossing is at a location other than an intersection, where LRT speeds do not exceed 25 mph, and when the roadway is a low-volume street where prevailing speeds do not exceed 25 mph.

Section 8C.04 Automatic Gates

Support:

- 01 An automatic gate is a traffic control device used in conjunction with flashing-light signals.

Standard:

- 02 **The automatic gate (see Figure 8C-1) shall consist of a drive mechanism and a fully retroreflectorized red- and white-striped gate arm with lights. When in the down position, the gate arm shall extend across the approaching lanes of highway traffic.**
- 03 **In the normal sequence of operation, unless constant warning time detection or other advanced system requires otherwise, the flashing-light signals and the lights on the gate arm (in its normal upright position) shall be activated immediately upon detection of approaching rail traffic. The gate arm shall start its downward motion not less than 3 seconds after the flashing-light signals start to operate, shall reach its horizontal position at least 5 seconds before the arrival of the rail traffic, and shall remain in the down position as long as the rail traffic occupies the grade crossing.**
- 04 **When the rail traffic clears the grade crossing, and if no other rail traffic is detected, the gate arm shall ascend to its upright position, following which the flashing-light signals and the lights on the gate arm shall cease operation.**
- 05 **Gate arms shall be fully retroreflectorized on both sides and shall have vertical stripes alternately red and white at 16-inch intervals measured horizontally.**

Support:

- 06 It is acceptable to replace a damaged gate with a gate having vertical stripes even if the other existing gates at the same grade crossing have diagonal stripes; however, it is also acceptable to replace a damaged gate with a gate having diagonal stripes if the other existing gates at the same grade crossing have diagonal stripes in order to maintain consistency per the provisions of Paragraph 24 of the Introduction.

Standard:

- 07 **Gate arms shall have at least three red lights as provided in Figure 8C-1.**
- 08 **When activated, the gate arm light nearest the tip shall be illuminated continuously and the other lights shall flash alternately in unison with the flashing-light signals.**
- 09 **The entrance gate arm mechanism shall be designed to fail safe in the down position.**

Guidance:

- 10 *The gate arm should ascend to its upright position in 12 seconds or less.*
- 11 *In its normal upright position, when no rail traffic is approaching or occupying the grade crossing, the gate arm should be either vertical or nearly so (see Figure 8C-1).*
- 12 *In the design of individual installations, consideration should be given to timing the operation of the gate arm to accommodate large and/or slow-moving highway vehicles.*

- 13 *The gates should cover the approaching highway to block all highway vehicles from being driven around the gate without crossing the center line.*

Option:

- 14 The effectiveness of gates may be enhanced by the use of channelizing devices or raised median islands to discourage driving around lowered automatic gates.
- 15 Where gates are located in the median, additional median width may be required to provide the minimum clearance for the counterweight supports.
- 16 Automatic gates may be supplemented by cantilevered flashing-light signals (see Figure 8C-1) where there is a need for additional emphasis or better visibility.

Section 8C.05 Use of Automatic Gates at LRT Grade Crossings

Guidance:

- 01 *Highway-LRT grade crossings in semi-exclusive alignments should be equipped with automatic gates and flashing-light signals (see Sections 8C.02 and 8C.03) where LRT speeds exceed 35 mph.*

Option:

- 02 Where a highway-LRT grade crossing is at a location other than an intersection, where LRT speeds exceed 25 mph, automatic gates and flashing-light signals may be installed.
- 03 Traffic control signals may be used instead of automatic gates at highway-LRT grade crossings within highway-highway intersections where LRT speeds do not exceed 35 mph. Traffic control signals or flashing-light signals without automatic gates may be used where the crossing is at a location other than an intersection and where LRT speeds do not exceed 25 mph and the roadway is a low-volume street where prevailing speeds do not exceed 25 mph.

Section 8C.06 Four-Quadrant Gate Systems

Option:

- 01 Four-Quadrant Gate systems may be installed to improve safety at grade crossings based on an engineering study when less restrictive measures, such as automatic gates and median islands, are not effective.

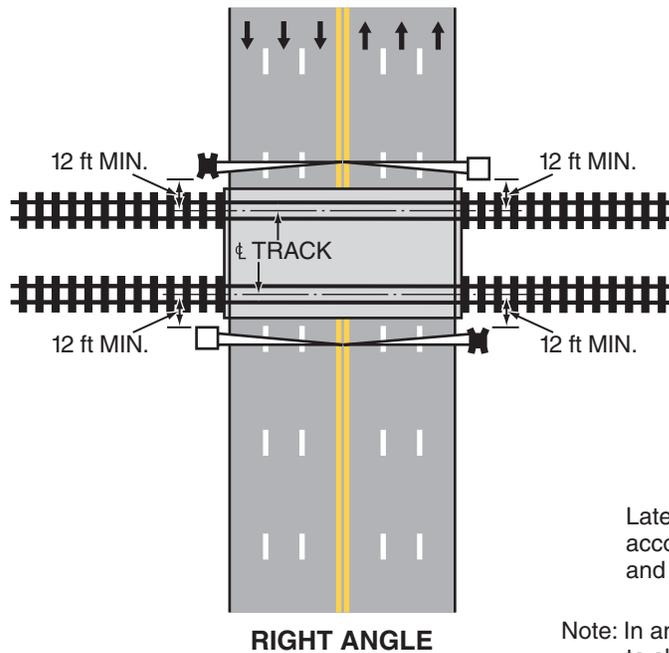
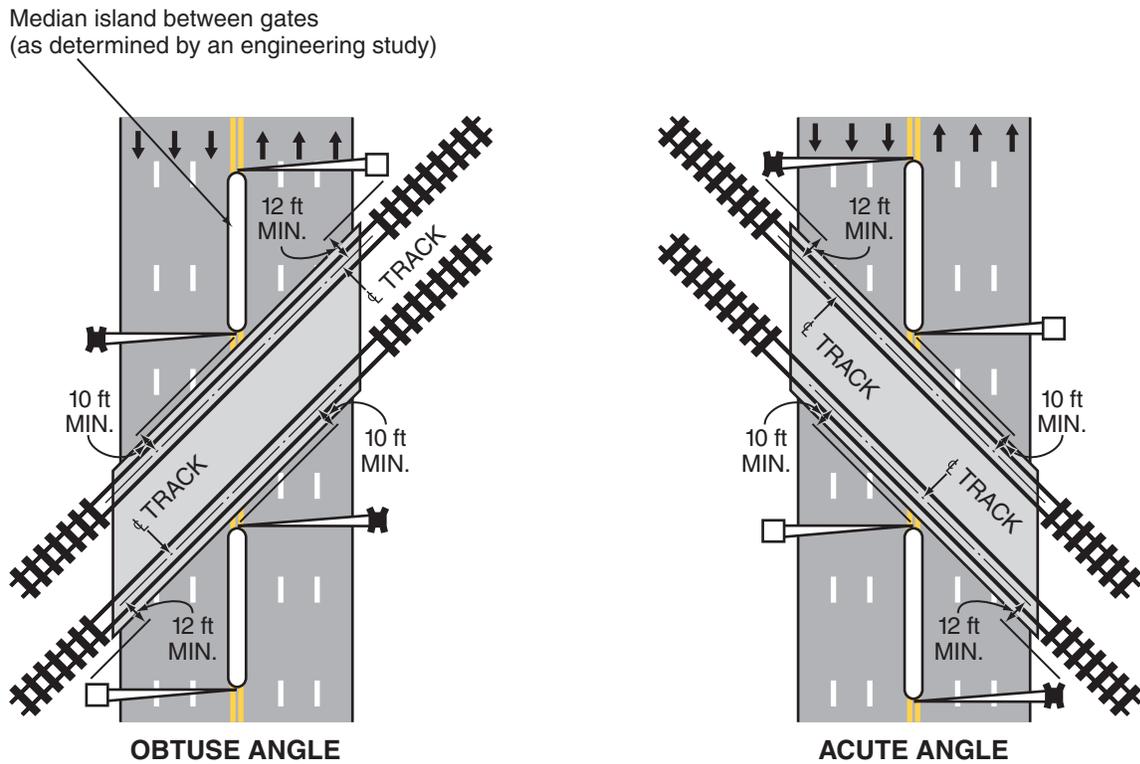
Standard:

- 02 **A Four-Quadrant Gate system shall consist of entrance and exit gates that control and block road users on all lanes entering and exiting the grade crossing.**
- 03 **The Four-Quadrant Gate system shall use a series of drive mechanisms and fully retroreflectorized red- and white-striped gate arms with lights, and when in the down position the gate arms extend individually across the entrance and exit lanes of the roadway as shown in Figure 8C-2. Standards contained in Sections 8C.01 through 8C.03 for flashing-light signals shall be followed for signal specifications, location, and clearance distances.**
- 04 **In the normal sequence of operation, unless constant warning time detection or other advanced system requires otherwise, the flashing-light signals and the lights on the gate arms (in their normal upright positions) shall be activated immediately upon the detection of approaching rail traffic. The gate arms for the entrance lanes of traffic shall start their downward motion not less than 3 seconds after the flashing-light signals start to operate and shall reach their horizontal position at least 5 seconds before the arrival of the rail traffic. Exit gate arm activation and downward motion shall be based on detection or timing requirements established by an engineering study of the individual site. The gate arms shall remain in the down position as long as the rail traffic occupies the grade crossing.**
- 05 **When the rail traffic clears the grade crossing, and if no other rail traffic is detected, the gate arms shall ascend to their upright positions, following which the flashing-light signals and the lights on the gate arms shall cease operation.**
- 06 **Gate arm design, colors, and lighting requirements shall be in accordance with the Standards contained in Section 8C.04.**
- 07 **Except as provided in Paragraph 19, the exit gate arm mechanism shall be designed to fail-safe in the up position.**
- 08 **At locations where gate arms are offset a sufficient distance for highway vehicles to drive between the entrance and exit gate arms, median islands (see Figure 8C-2) shall be installed in accordance with the needs established by an engineering study.**

Guidance:

- 09 *The gate arm should ascend to its upright position in 12 seconds or less.*

Figure 8C-2. Example of Location Plan for Flashing-Light Signals and Four-Quadrant Gates



Lateral clearances shall be in accordance with Figure 8C-1 and Chapter 8C.

Note: In an effort to simplify the figure to show typical location plans for flashing-light signals and four-quadrant gates, not all traffic control devices are shown on this figure.

Legend

- Direction of travel
- ⊠ Entrance gate
- Exit gate

- 10 *Four-Quadrant Gate systems should only be used in locations with constant warning time detection.*
- 11 *The operating mode of the exit gates should be determined based upon an engineering study, with input from the affected railroad company or LRT agency.*
- 12 *If the Timed Exit Gate Operating Mode is used, the engineering study, with input from the affected railroad company or LRT agency, should also determine the Exit Gate Clearance Time (see definition in Section 1A.13).*
- 13 *If the Dynamic Exit Gate Operating Mode is used, highway vehicle intrusion detection devices that are part of a system that incorporates processing logic to detect the presence of highway vehicles within the minimum track clearance distance should be installed to control exit gate operation.*
- 14 *Regardless of which exit gate operating mode is used, the Exit Gate Clearance Time should be considered when determining additional time requirements for the Minimum Warning Time.*
- 15 *If a Four-Quadrant Gate system is used at a location that is adjacent to an intersection that could cause highway vehicles to queue within the minimum track clearance distance, the Dynamic Exit Gate Operating Mode should be used unless an engineering study indicates otherwise.*
- 16 *If a Four-Quadrant Gate system is interconnected with a highway traffic signal, backup or standby power should be considered for the highway traffic signal. Also, circuitry should be installed to prevent the highway traffic signal from leaving the track clearance green interval until all of the gates are lowered.*
- 17 *At locations where sufficient space is available, exit gates should be positioned downstream from the track a distance that provides a safety zone long enough to accommodate at least one design vehicle between the exit gate and the nearest rail.*
- 18 *Four-Quadrant Gate systems should include remote health (status) monitoring capable of automatically notifying railroad or LRT signal maintenance personnel when anomalies have occurred within the system.*
- Option:
- 19 Exit gate arms may fail in the down position if the grade crossing is equipped with remote health (status) monitoring.
- 20 Four-Quadrant Gate installations may include median islands between opposing lanes on an approach to a grade crossing.
- Guidance:
- 21 *Where sufficient space is available, median islands should be at least 60 feet in length.*

Section 8C.07 Wayside Horn Systems

Option:

- 01 A wayside horn system (see definition in Section 1A.13) may be installed in compliance with 49 CFR Part 222 to provide audible warning directed toward the road users at a highway-rail or highway-LRT grade crossing or at a pathway grade crossing.

Standard:

- 02 **Wayside horn systems used at grade crossings where the locomotive horn is not sounded shall be equipped and shall operate in compliance with the requirements of Appendix E to 49 CFR Part 222.**

Guidance:

- 03 *The same lateral clearance and roadside safety features should apply to wayside horn systems as described in the Standards contained in Section 8C.01. Wayside horn systems, when mounted on a separate pole assembly, should be installed no closer than 15 feet from the center of the nearest track and should be positioned to not obstruct the motorists' line of sight of the flashing-light signals.*

Section 8C.08 Rail Traffic Detection

Standard:

- 01 **The devices employed in active traffic control systems shall be actuated by some form of rail traffic detection.**
- 02 **Rail traffic detection circuits, insofar as practical, shall be designed on the fail-safe principle.**
- 03 **Flashing-light signals shall operate for at least 20 seconds before the arrival of any rail traffic, except as provided in Paragraph 4.**

Option:

- 04 On tracks where all rail traffic operates at less than 20 mph and where road users are directed by an authorized person on the ground to not enter the crossing at all times that approaching rail traffic is about to occupy the crossing, a shorter signal operating time for the flashing-light signals may be used.

05 Additional warning time may be provided when determined by an engineering study.

Guidance:

06 *Where the speeds of different rail traffic on a given track vary considerably under normal operation, special devices or circuits should be installed to provide reasonably uniform notice in advance of all rail traffic movements over the grade crossing. Special control features should be used to eliminate the effects of station stops and switching operations within approach control circuits to prevent excessive activation of the traffic control devices while rail traffic is stopped on or switching upon the approach track control circuits.*

Section 8C.09 Traffic Control Signals at or Near Highway-Rail Grade Crossings

Option:

01 Traffic control signals may be used instead of flashing-light signals to control road users at industrial highway-rail grade crossings and other places where train movements are very slow, such as in switching operations.

Standard:

02 **The appropriate provisions of Part 4 relating to traffic control signal design, installation, and operation shall be applicable where traffic control signals are used to control road users instead of flashing-light signals at highway-rail grade crossings.**

03 **Traffic control signals shall not be used instead of flashing-light signals to control road users at a mainline highway-rail grade crossing.**

Guidance:

04 *If a highway-rail grade crossing is equipped with a flashing-light signal system and is located within 200 feet of an intersection or midblock location controlled by a traffic control signal, the traffic control signal should be provided with preemption in accordance with Section 4D.27.*

05 *Coordination with the flashing-light signal system, queue detection, or other alternatives should be considered for traffic control signals located farther than 200 feet from the highway-rail grade crossing. Factors to be considered should include traffic volumes, highway vehicle mix, highway vehicle and train approach speeds, frequency of trains, and queue lengths.*

06 *The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable, should jointly determine the preemption operation and the timing of traffic control signals interconnected with highway-rail grade crossings adjacent to signalized highway intersections.*

Support:

07 Section 4D.27 includes a recommendation that traffic control signals that are adjacent to highway-rail grade crossings and that are coordinated with the flashing-light signals or that include railroad preemption features be provided with a back-up power supply.

Standard:

08 **Information regarding the type of preemption and any related timing parameters shall be provided to the railroad company so that they can design the appropriate train detection circuitry.**

09 **If preemption is provided, the normal sequence of traffic control signal indications shall be preempted upon the approach of trains to avoid entrapment of highway vehicles on the highway-rail grade crossing.**

10 **This preemption feature shall have an electrical circuit of the closed-circuit principle, or a supervised communication circuit between the control circuits of the highway-rail grade crossing warning system and the traffic control signal controller. The traffic control signal controller preemptor shall be activated via the supervised communication circuit or the electrical circuit that is normally energized by the control circuits of the highway-rail grade crossing warning system. The approach of a train to a highway-rail grade crossing shall de-energize the electrical circuit or activate the supervised communication circuit, which in turn shall activate the traffic control signal controller preemptor. This shall establish and maintain the preemption condition during the time the highway-rail grade crossing warning system is activated, except that when crossing gates exist, the preemption condition shall be maintained until the crossing gates are energized to start their upward movement. When multiple or successive preemptions occur, train activation shall receive first priority.**

Guidance:

11 *If a highway-rail grade crossing is located within 50 feet (or within 75 feet for a highway that is regularly used by multi-unit highway vehicles) of an intersection controlled by a traffic control signal, the use of pre-signals to control traffic approaching the grade crossing should be considered.*

Standard:

- 12 **If used, the pre-signals shall display a steady red signal indication during the track clearance portion of a signal preemption sequence to prohibit additional highway vehicles from crossing the railroad track.**

Guidance:

- 13 *Consideration should be given to using visibility-limited signal faces (see definition in Section 1A.13) at the intersection for the downstream signal faces that control the approach that is equipped with pre-signals.*

Option:

- 14 The pre-signal phase sequencing may be timed with an offset from the downstream signalized intersection such that the railroad track area and the area between the railroad track and the downstream signalized intersection is generally kept clear of stopped highway vehicles.

Standard:

- 15 **If a pre-signal is installed at an interconnected highway-rail grade crossing near a signalized intersection, a STOP HERE ON RED (R10-6) sign shall be installed near the pre-signal or at the stop line if used. If there is a nearby signalized intersection with insufficient clear storage distance for a design vehicle, or the highway-rail grade crossing does not have gates, a No Turn on Red (R10-11, R10-11a, or R10-11b) sign (see Section 2B.53) shall be installed for the approach that crosses the railroad track, if applicable.**

Option:

- 16 At locations where a highway-rail grade crossing is located more than 50 feet (or more than 75 feet for a highway regularly used by multi-unit highway vehicles) from an intersection controlled by a traffic control signal, a pre-signal may be used if an engineering study determines a need.

- 17 If highway traffic signals must be located within close proximity to the flashing-light signal system, the highway traffic signals may be mounted on the same overhead structure as the flashing-light signals.

Support:

- 18 Section 4C.10 describes the Intersection Near a Grade Crossing signal warrant that is intended for use at a location where the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

- 19 Section 4D.27 describes additional considerations regarding preemption of traffic control signals at or near highway-rail grade crossings.

Section 8C.10 Traffic Control Signals at or Near Highway-LRT Grade Crossings*Support:*

- 01 There are two types of traffic control signals for controlling vehicular and LRT movements at interfaces of the two modes. The first is the standard traffic control signal described in Part 4, which is the focus of this Section. The other type of signal is referred to as an LRT signal and is discussed in Section 8C.11.

Standard:

- 02 **The provisions of Part 4 and Section 8C.09 relating to traffic control signal design, installation, and operation, including interconnection with nearby automatic gates or flashing-light signals, shall be applicable as appropriate where traffic control signals are used at highway-LRT grade crossings.**

- 03 **If traffic control signals are in operation at a crossing that is used by pedestrians, bicyclists, and/or other non-motorized road users, an audible device such as a bell shall also be provided and shall be operated in conjunction with the traffic control signals.**

Guidance:

- 04 *When a highway-LRT grade crossing equipped with a flashing-light signal system is located within 200 feet of an intersection or midblock location controlled by a traffic control signal, the traffic control signal should be provided with preemption in accordance with Section 4D.27.*

- 05 *Coordination with the flashing-light signal system should be considered for traffic control signals located more than 200 feet from the crossing. Factors to be considered should include traffic volumes, highway vehicle mix, highway vehicle and LRT approach speeds, frequency of LRT traffic, and queue lengths.*

- 06 *If the highway traffic signal has emergency-vehicle preemption capability, it should be coordinated with LRT operation.*

- 07 *Where LRT operates in a wide median, highway vehicles crossing the tracks and being controlled by both near and far side traffic signal faces should receive a protected left-turn green phase from the far side signal face to clear highway vehicles from the crossing when LRT equipment is approaching the crossing.*

Option:

- 08 Green indications may be provided during LRT phases for highway vehicle, pedestrian, and bicycle movements that do not conflict with LRT movements.
- 09 Traffic control signals may be installed in addition to four-quadrant gate systems and automatic gates at a highway-LRT crossing if the crossing occurs within a highway-highway intersection and if the traffic control signals meet the warrants described in Chapter 4C.
- 10 At a location other than an intersection, when LRT speeds are less than 25 mph, traffic control signals alone may be used to control road users at highway-LRT grade crossings only when justified by an engineering study.
- 11 Typical circumstances may include:
- A. Geometric conditions preclude the installation of highway-LRT grade crossing warning devices.
 - B. LRT vehicles share the same roadway with road users.
 - C. Traffic control signals already exist.

Support:

- 12 Section 4D.27 contains information regarding traffic control signals at or near highway-LRT grade crossings that are not equipped with highway-LRT grade crossing warning devices.
- 13 Section 4C.10 describes the Intersection Near a Grade Crossing signal warrant that is intended for use at a location where the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Guidance:

- 14 *When a highway-LRT grade crossing exists within a signalized intersection, consideration should be given to providing separate turn signal faces (see definition in Section 1A.13) for the movements crossing the tracks.*

Standard:

- 15 **Separate turn signal faces that are provided for turn movements toward the crossing shall display a steady red indication during the approach and/or passage of LRT traffic.**

Guidance:

- 16 *When a signalized intersection that is located within 200 feet of a highway-LRT grade crossing is preempted, all existing turning movements toward the highway-LRT grade crossing should be prohibited.*

Support:

- 17 Section 8B.08 contains information regarding the prohibition of turning movements toward the crossing during preemption.
- 18 Part 4 contains information regarding signal phasing and timing requirements.

Section 8C.11 Use of Traffic Control Signals for Control of LRT Vehicles at Grade Crossings*Guidance:*

- 01 *LRT movements in semi-exclusive alignments at non-gated grade crossings that are equipped with traffic control signals should be controlled by special LRT signal indications.*
- 02 *LRT traffic control signals that are used to control LRT movements only should display the signal indications illustrated in Figure 8C-3.*

Support:

- 03 Section 4D.27 contains information about the use of the signal indications shown in Figure 8C-3 for the control of exclusive bus movements at “queue jumper lanes” and for the control of exclusive bus rapid transit movements on semi-exclusive or mixed-use alignments.

Option:

- 04 Standard traffic control signals may be used instead of LRT traffic control signals to control the movement of LRT vehicles (see Section 8C.10).

Standard:

- 05 **If a separate set of standard traffic control signal indications (red, yellow, and green circular and arrow indications) is used to control LRT movements, the indications shall be positioned so they are not visible to motorists, pedestrians, and bicyclists (see Section 4D.12).**
- 06 **If the LRT crossing control is separate from the intersection control, the two shall be interconnected. The LRT signal phase shall not be terminated until after the LRT vehicle has cleared the crossing.**

Option:

- 07 LRT signals may be used at grade crossings and at intersections in mixed-use alignments in conjunction with standard traffic control signals where special LRT signal phases are used to accommodate turning LRT vehicles or where additional LRT clearance time is desirable.

Guidance:

- 08 LRT signal faces should be separated vertically or horizontally from the nearest highway traffic signal face for the same approach by at least 3 feet.

Figure 8C-3. Light Rail Transit Signals

	Three-Lens Signal	Two-Lens Signal
<p>SINGLE LRT ROUTE</p> 	<p>STOP </p> <p>PREPARE TO STOP  Flashing</p> <p>GO </p>	<p>STOP </p> <p>GO  ⁽²⁾</p>
<p>TWO LRT ROUTE DIVERSION</p> 	<p></p> <p> Flashing</p> <p>  ⁽¹⁾</p>	<p></p> <p>  ^{(1),(2)}</p>
	<p></p> <p> Flashing</p> <p>  ⁽¹⁾</p>	<p></p> <p>  ^{(1),(2)}</p>
<p>THREE LRT ROUTE DIVERSION</p> 	<p></p> <p> Flashing</p> <p>   ⁽¹⁾</p>	<p></p> <p>   ^{(1),(2)}</p>

Notes:

All aspects (or signal indications) are white.

(1) Could be in single housing.

(2) "Go" lens may be used in flashing mode to indicate "prepare to stop".

Section 8C.12 Grade Crossings Within or In Close Proximity to Circular Intersections

Support:

- 01 At circular intersections, such as roundabouts and traffic circles, that include or are within close proximity to a grade crossing, a queue of vehicular traffic could cause highway vehicles to stop on the grade crossing.

Standard:

- 02 **Where circular intersections include or are within 200 feet of a grade crossing, an engineering study shall be made to determine if queuing could impact the grade crossing. If traffic queues impact the grade crossing, provisions shall be made to clear highway traffic from the grade crossing prior to the arrival of rail traffic.**

Support:

- 03 Among the actions that can be taken to keep the grade crossing clear of traffic or to clear traffic from the grade crossing prior to the arrival of rail traffic are the following:
- A. Elimination of the circular intersection,
 - B. Geometric design revisions,
 - C. Grade crossing regulatory and warning devices,
 - D. Highway traffic signals,
 - E. Traffic metering devices,
 - F. Activated signs, or
 - G. A combination of these or other actions.

Section 8C.13 Pedestrian and Bicycle Signals and Crossings at LRT Grade Crossings

Guidance:

- 01 *Where LRT tracks are immediately adjacent to other tracks or a road, pedestrian signalization should be designed to avoid having pedestrians wait between sets of tracks or between the tracks and the road. If adequate space exists for a pedestrian refuge and is justified based on engineering judgment, additional pedestrian signal heads, signing, and detectors should be installed (see Section 4E.08).*

Standard:

- 02 **When used at LRT crossings, pedestrian signal heads shall comply with the provisions of Section 4E.04.**

Guidance:

- 03 *Flashing-light signals (see Figure 8C-4) with a Crossbuck (R15-1) sign and an audible device should be installed at pedestrian and bicycle crossings where an engineering study has determined that the sight distance is not sufficient for pedestrians and bicyclists to complete their crossing prior to the arrival of the LRT traffic at the crossing, or where LRT speeds exceed 35 mph.*
- 04 *If an engineering study shows that flashing-light signals with a Crossbuck sign and an audible device would not provide sufficient notice of an approaching LRT traffic, the LOOK (R15-8) sign (see Figure 8C-4) and/or pedestrian gates should be considered (see Figures 8C-5 through 8C-7).*

Support:

- 05 A pedestrian gate is similar to an automatic gate except the gate arm is shorter.
- 06 The swing gate alerts pedestrians to the LRT tracks that are to be crossed. Swing gates are designed to open away from the tracks, requiring users to pull the gate open to cross, but permitting a quick exit from the trackway, and to automatically close.

Option:

- 07 Swing gates may be installed across pedestrian and bicycle walkways (see Figure 8C-8).
- 08 Pedestrian barriers at offset crossings may be used at pedestrian and bicycle crossings as passive devices that force users to face approaching LRT before entering the trackway (see Figures 8C-9 and 8C-10).

Figure 8C-4. Example of Flashing-Light Signal Assembly for Pedestrian Crossings

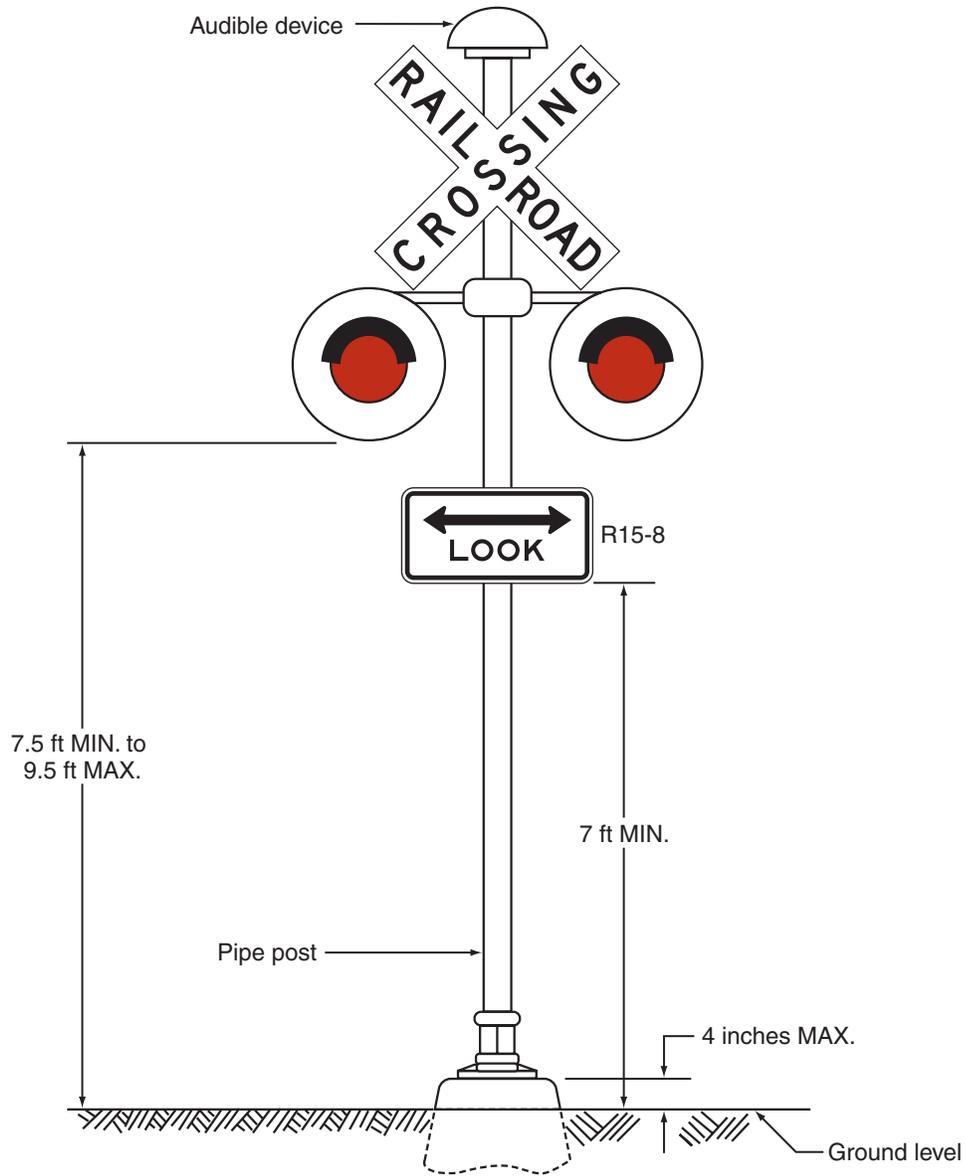


Figure 8C-5. Example of a Shared Pedestrian/Roadway Gate

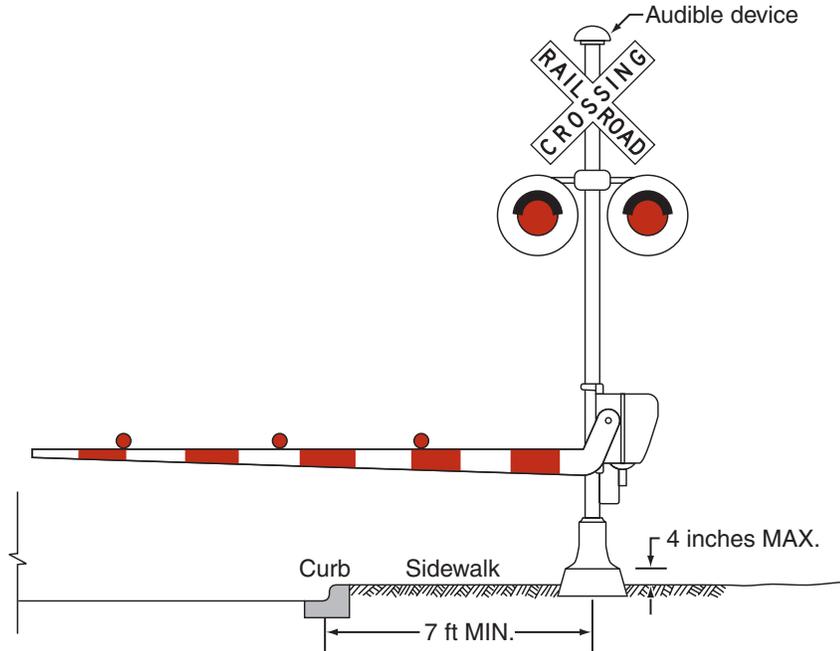


Figure 8C-6. Example of a Separate Pedestrian Gate

Note: The provision of a separate pedestrian gate is optional based upon site-specific conditions. If a separate pedestrian gate is provided, the need for a separate Crossbuck sign, audible device, and flashing-light signals should be determined based upon site-specific conditions such as the proximity of the sidewalk or shared-use path to the roadway grade crossing devices.

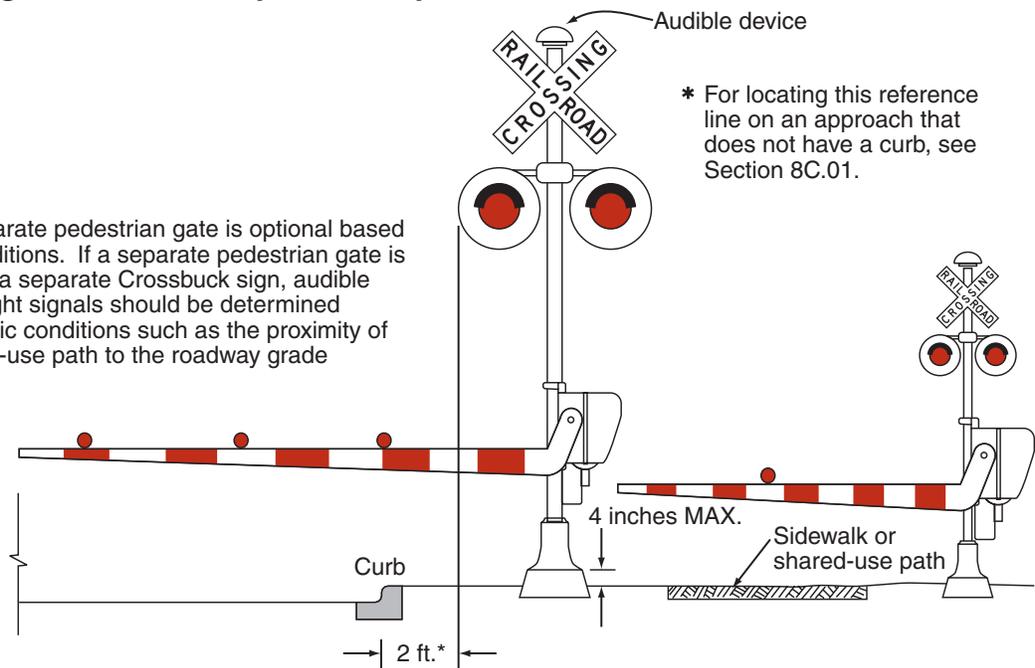


Figure 8C-7. Examples of Placement of Pedestrian Gates

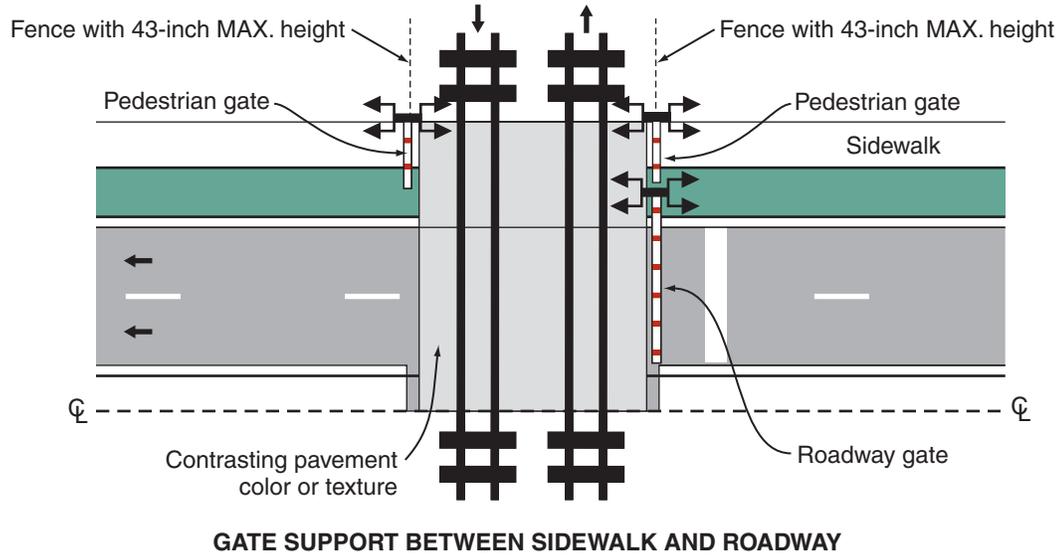
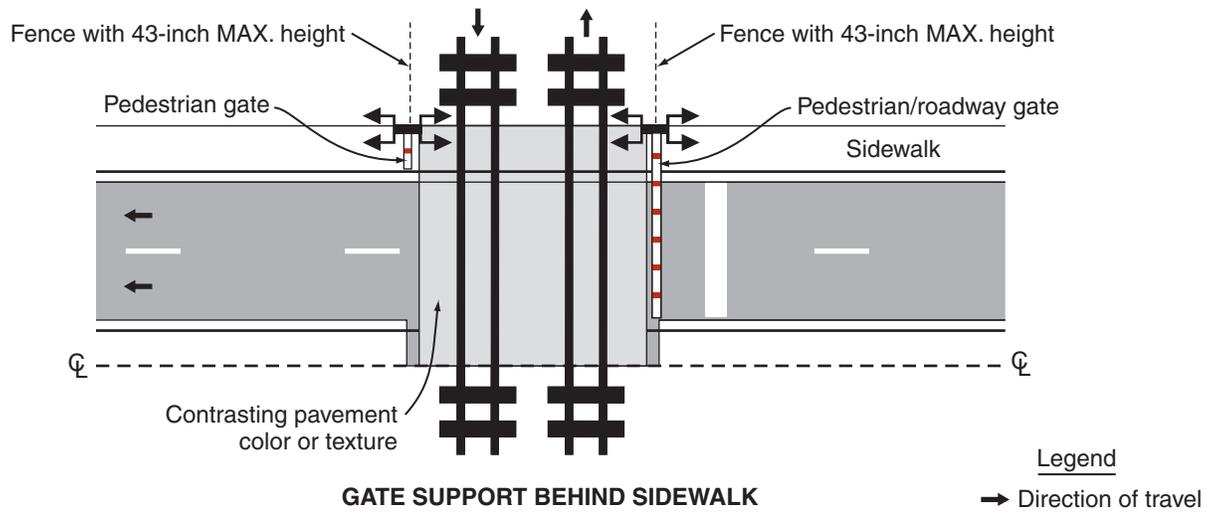


Figure 8C-8. Example of Swing Gates

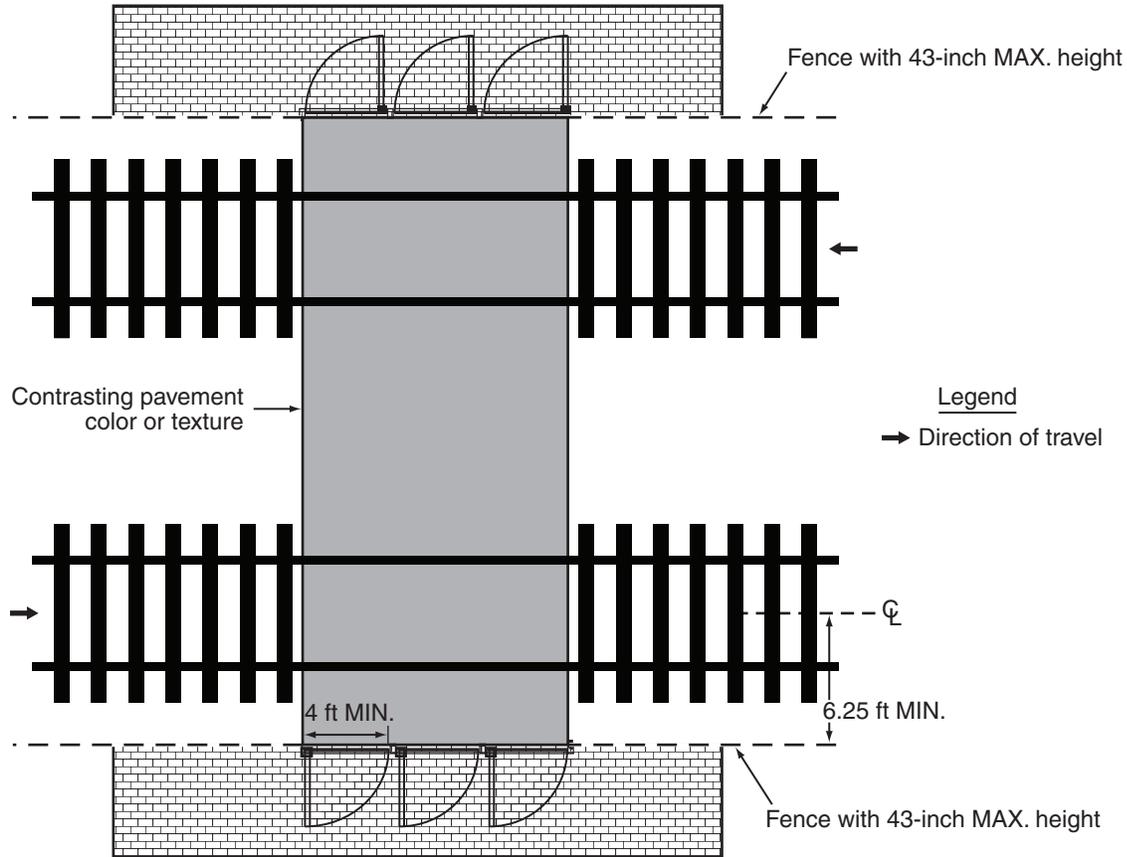


Figure 8C-9. Example of Pedestrian Barriers at an Offset Grade Crossing

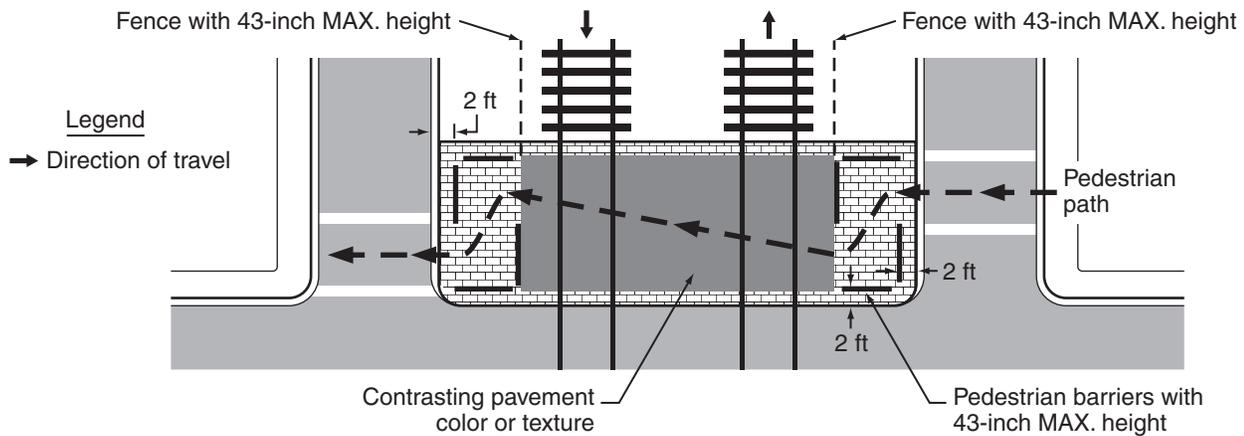
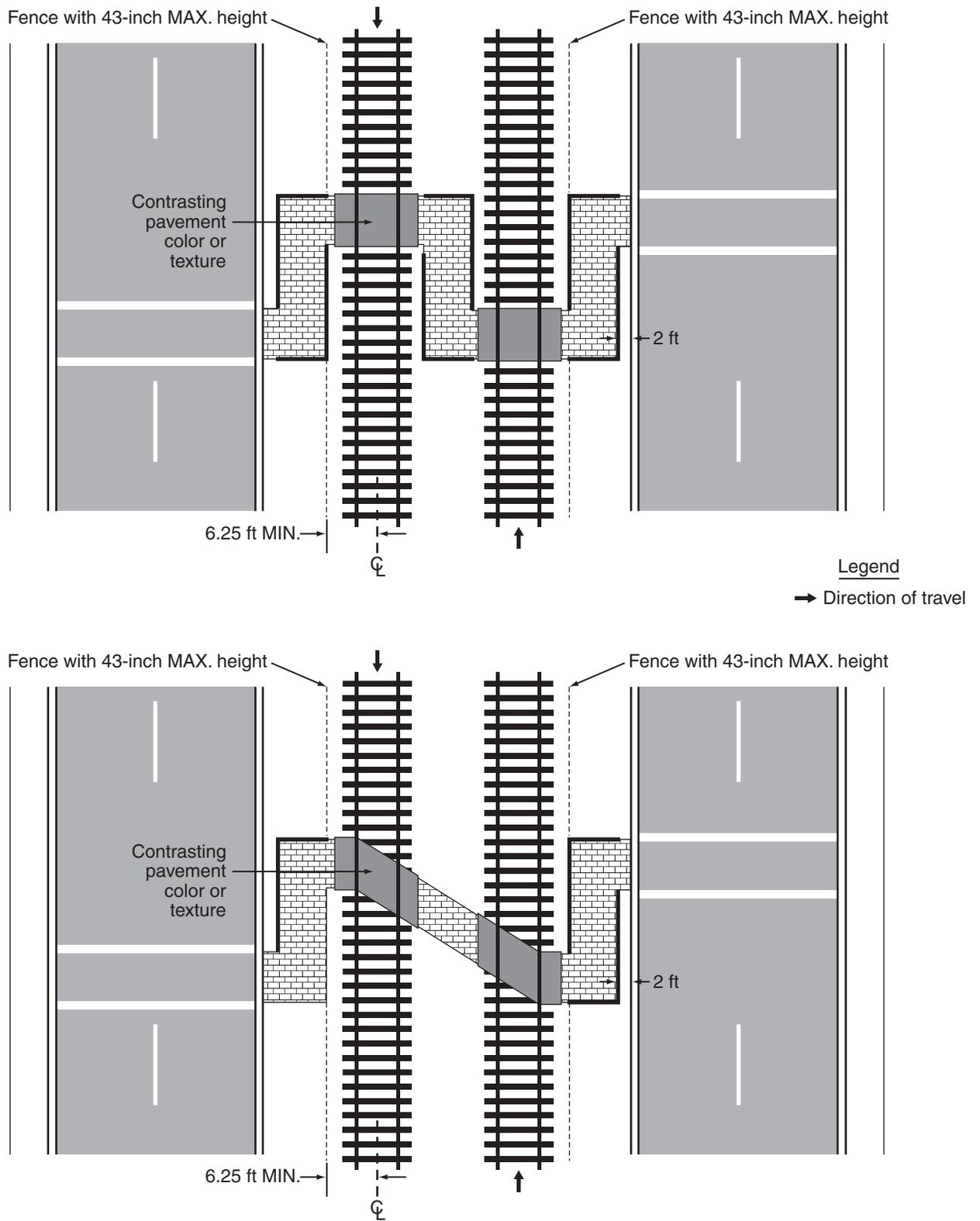


Figure 8C-10. Examples of Pedestrian Barrier Installation at an Offset Non-Intersection Grade Crossing



CHAPTER 8D. PATHWAY GRADE CROSSINGS

Section 8D.01 Purpose

Support:

- 01 Traffic control for pathway grade crossings includes all signs, signals, markings, other warning devices, and their supports at pathway grade crossings and along pathway approaches to grade crossings. The function of this traffic control is to promote safety and provide effective operation of both rail and pathway traffic at pathway grade crossings.
- 02 Except as specifically provided in this Chapter, sidewalks are considered to be part of a highway-rail or highway-LRT grade crossing rather than a pathway grade crossing, and are covered by the provisions of Chapters 8B and 8C rather than by the provisions of this Chapter. However, many of the treatments outlined in this Chapter are applicable to sidewalks adjacent to highway-rail or highway-LRT grade crossings, including detectable warnings, swing gates, and automatic gates.
- 03 Crosswalks at intersections where pedestrians cross LRT tracks in mixed-use alignments are covered by the provisions of Section 3B.18 rather than by the provisions of this Chapter.

Section 8D.02 Use of Standard Devices, Systems, and Practices

Guidance:

- 01 *The public agency with jurisdiction over the pathway and the regulatory agency with statutory authority, if applicable, should jointly determine the need and selection of devices at a pathway grade crossing, including the appropriate traffic control system to be used.*

Section 8D.03 Pathway Grade Crossing Signs and Markings

Standard:

- 01 **Pathway grade crossing signs shall be standard in shape, legend, and color.**
- 02 **Traffic control devices mounted adjacent to pathways at a height of less than 8 feet measured vertically from the bottom edge of the device to the elevation of the near edge of the pathway surface shall have a minimum lateral offset of 2 feet from the near edge of the device to the near edge of the pathway (see Figure 9B-1).**
- 03 **The minimum mounting height for post-mounted signs on pathways shall be 4 feet, measured vertically from the bottom edge of the sign to the elevation of the near edge of the pathway surface (see Figure 9B-1).**
- 04 **Pathway grade crossing traffic control devices shall be located a minimum of 12 feet from the center of the nearest track.**
- 05 **The minimum sizes of pathway grade crossing signs shall be as shown in the shared-use path column in Table 9B-1.**
- 06 **When overhead traffic control devices are used on pathways, the clearance from the bottom edge of the device to the pathway surface directly under the sign or device shall be at least 8 feet.**

Guidance:

- 07 *If pathway users include those who travel faster than pedestrians, such as bicyclists or skaters, the use of warning signs and pavement markings in advance of the pathway grade crossing (see Figure 8D-1) should be considered.*

Section 8D.04 Stop Lines, Edge Lines, and Detectable Warnings

Guidance:

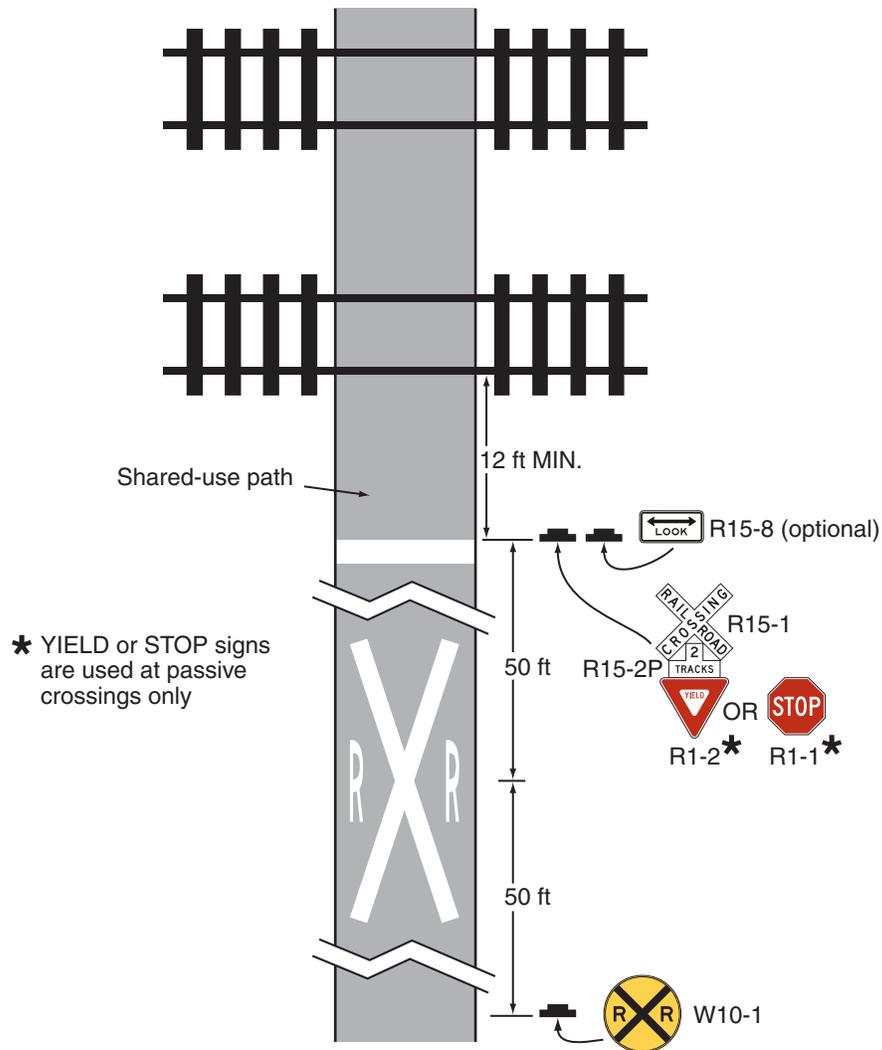
- 01 *If used at pathway grade crossings, the pathway stop line should be a transverse line at the point where a pathway user is to stop. The pathway stop line should be placed at least 2 feet further from the nearest rail than the gate, counterweight, or flashing-light signals (if any of these are present) is placed, and at least 12 feet from the nearest rail.*

Option:

- 02 Edge lines (see Section 3B.06) may be used on approach to and across the tracks at a pathway grade crossing, a sidewalk at a highway-rail or highway-LRT grade crossing, or a station crossing to delineate the designated pathway user route.

Support:

- 03 Edge line delineation can be beneficial where the distance across the tracks is long, commonly because of a skewed grade crossing or because of multiple tracks, or where the pathway surface is immediately adjacent to a traveled way.

Figure 8D-1. Example of Signing and Markings for a Pathway Grade Crossing

- 04 Detectable warning surfaces (see Section 3B.18) that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light, can be used to warn pedestrians about the locations of the tracks at a grade crossing. The “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (see Section 1A.11) contains specifications for design and placement of detectable warning surfaces.

Section 8D.05 Passive Devices for Pathway Grade Crossings

Standard:

- 01 Except as provided in Paragraph 2, where active traffic control devices are not used, a Crossbuck Assembly shall be installed on each approach to a pathway grade crossing.

Option:

- 02 The Crossbuck Assembly may be omitted at station crossings and on the approaches to a pathway grade crossing that is located within 25 feet of the traveled way at a highway-rail or highway-LRT grade crossing.

Guidance:

- 03 *The pathway user’s ability to detect the presence of approaching rail traffic should be considered in determining the type and placement of traffic control devices or design features (such as fencing or swing gates).*
- 04 *Nighttime visibility should be considered if design features (such as fencing or swing gates) are used to channelize pathway users.*
- 05 *If automatic gates and swing gates are used, the pathway should be channelized to direct users to the entrance to and exit from the pathway grade crossing.*

Standard:

- 06 **If used, swing gates shall be designed to open away from the track(s) so that pathway users can quickly push the gate open when moving away from the track(s). If used, swing gates shall be designed to automatically return to the closed position after each use.**

Option:

- 07 When used in conjunction with automatic gates at pathway grade crossings, swing gates may be equipped with a latching device that permits the gate to be opened only from the track side of the gate.

Support:

- 08 The “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (see Section 1A.11) contains information regarding spring hinges and door and gate opening forces for swing gates.

Section 8D.06 Active Traffic Control Systems for Pathway Grade Crossings**Standard:**

- 01 **If used at a pathway grade crossing, an active traffic control system shall include flashing-light signals for each direction of the pathway. A bell or other audible warning device shall also be provided.**

Option:

- 02 Separate active traffic control devices may be omitted at a pathway grade crossing that is located within 25 feet of the traveled way of a highway-rail or highway-LRT grade crossing that is equipped with an active traffic control system.

Standard:

- 03 **If used at pathway grade crossings, alternately flashing red lights shall be aligned horizontally and the light units shall have a diameter of at least 4 inches. The minimum mounting height of the flashing red lights shall be 4 feet, measured vertically from the bottom edge of the lights to the elevation of the near edge of the pathway surface.**

Option:

- 04 Traffic control devices may be installed between the tracks at multiple track crossings at stations.

Standard:

- 05 **The mounting height for flashing lights that are installed between the tracks at multiple track crossings at stations shall be a minimum of 1 foot, measured vertically from the bottom edge of the lights to the elevation of the near edge of the pathway surface.**

Option:

- 06 Automatic gates may be used at pathway grade crossings.

Guidance:

- 07 *If used at a pathway grade crossing, the height of the automatic gate arm when in the down position should be a minimum of 2.5 feet and a maximum of 4 feet above the sidewalk.*

- 08 *If used, the gate configuration, which might include a combination of automatic gates and swing gates, should provide for full width coverage of the pathway on both approaches to the track.*

Standard:

- 09 **Where a sidewalk is located between the edge of a roadway and the support for a gate arm that extends across the sidewalk and into the roadway, the location, placement, and height prescribed for vehicular gates shall be used (see Section 8C.04).**

Guidance:

- 10 *If a separate automatic gate is used for a sidewalk, the height of the gate arm when in the down position should be a minimum of 2.5 feet and a maximum of 4 feet above the sidewalk.*

- 11 *If a separate automatic gate is used for a sidewalk at a highway-rail or highway-LRT grade crossing, instead of a supplemental or auxiliary gate arm installed as a part of the same mechanism as the vehicular gate, a separate mechanism should be provided for the sidewalk gate to prevent a pedestrian from raising the vehicular gate.*

Appendix D – Genesee and Wyoming Public Project Manual

Note: This is the Genesee and Wyoming Public Project Manual (dated April 2019); always reference the latest manual when projects are designed and constructed.

Public Project Manual

*For any activity or project
that may involve the railroad*



a Genesee & Wyoming Company

Prepared by Public Projects Department
Revision: April 2019

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Section 1.02 – Introduction

Arizona Eastern Railway (AZER) (the Railroad) is a subsidiary of Genesee & Wyoming Inc. (G&W), the largest holding company in the U.S. of regional and short line railroads. G&W has more than 100 subsidiary railroads in 41 U.S. states and four Canadian provinces serving thousands of communities and customers. G&W also has a major rail freight presence in Australia and Europe.

Each G&W subsidiary railroad is its own separate legal entity with local decision making to best meet customers' needs. G&W's North American railroads are organized in six operating regions that provide a consistent focus on safety, operating standards, and marketing.

G&W railroads receive corporate staff support in areas such as accounting, engineering, legal, mechanical, real estate, and other functions.

The Public Projects Department (PPD) at G&W is part of Engineering Services with the goal to support the railroads. PPD is also tasked to support outside agencies by streamlining the flow of outside party projects and initiatives.

PPD is involved in a wide variety of projects initiated by government agencies, local businesses, and others. Accurate and timely communication of information between the Railroad and these parties improves planning, relationships, and successful completion of projects. The information in this manual explains important steps project sponsors should follow to streamline their projects and proposals.

G&W railroads place the highest priority on the safety of the public and their employees. Therefore, any activity that has the potential to adversely impact safe railroad operations must be evaluated by the Railroad. This manual is intended to be a general guide for reference to the Railroad's minimum requirements and standards. The Railroad reserves the right to deviate from any of the requirements or standards set forth in this manual.

We look forward to working together to serve the common goal of the safe operation of trains. We hope the information provided in this manual makes it easier to work together as a team.

Jacob Smith
Director of Public Projects

Section 1.03 – Basic Information in this Manual

This manual is intended to be a general guide, but it in no way overrides the express guidance, requirements, or standards of the Railroad. As a tool only, the information herein is intended for broad use and each project will be reviewed by PPD and the Railroad to ensure the safest actions are taken.

Any subject not covered in the manual should be routed to PPD for review.

Any activity that either directly or indirectly impacts railroad property must have approval by the Railroad.

Common Types of Public Projects

- **Highway-Rail Grade Crossings:** Closure, removal, installation, and alterations of public highway-rail grade crossings.
- **Bridges Over Railroad:** Construction, reconstruction, rehabilitation, repair, removal, painting, and maintenance of bridges over the Railroad by outside parties.
- **Parallel Roads/Facilities:** Construction, reconstruction, modification, removal, and maintenance of parallel roads or other public facilities affecting railroad property or operations.
- **Entry on to Railroad Property:** Temporary rights of entry onto railroad property and utility installation licenses.
- **Other Projects Involving Rail Corridors:** Publicly sponsored projects involving or altering railroad facilities or its property. These projects may be on, above, adjacent to, or otherwise have the potential to impact the property.
- **General Engineering Consultants (GEC):** Although the PPD is the primary point of contact, GECs provide additional engineering services as directed by the Railroad to assist the Railroad in managing public projects.

Section 1.04 – Definitions and Common Terms

- **Agency** – The project sponsor (i.e., state DOT, local agencies, private developer, etc.)
- **AREMA** – American Railway Engineering and Maintenance-of-Way Association – the North American railroad industry standards group. The use of this term shall be in specific reference to the AREMA Manual for Railway Engineering.
- **Basis for Design (BOD)** – The developed scope of a project needed to bid out the project.
- **Construction Engineering Inspection (CEI)** – Consultant who oversees the construction operations who is authorized to act on behalf of the Railroad to ensure that only the safest and least impactful practices are being performed.
- **Contractor** – The agency’s representative retained to perform the project work.
- **Engineer** – G&W engineering representative or a GEC authorized to act on their behalf.
- **Employee in Charge (EIC)** – An employee or designated contractor qualified to protect a project team during an operation, activity, or project.
- **Flagman/Flagger** – A qualified EIC with the sole responsibility protect the outside public and contractors while facilitating the safe passage of trains.
- **General Engineering Consultant (GEC)** – Consultant who has been authorized to act on the behalf of the Railroad. GECs perform preliminary engineering, construction inspection, and monitoring under the direction of the engineering personnel. GEC personnel also perform day-to-day administration of certain types of projects.
- **Notice to Proceed (NTP)** – Authorization by the project sponsor allowing the Railroad, its appointed consultants, and subcontractors to proceed out of PE and move into construction.
- **Order of Magnitude (OOM)** – A high-level estimate to quantify the estimated total value of the project. Typically the estimate is marked up to account for the project unknowns.
- **Potential to Encroach** – Any activity having the possibility of impacting railroad property or operations, defined as one or more of the following:
 - Any activity where access onto railroad property is required.
 - Any activity where work is being performed on the Railroad’s Right of Way (ROW).
 - Any excavation work adjacent to railroad tracks or facilities, within the theoretical railroad live load influence zone, or where the active earth pressure zone extends within railroad property.
 - The use of any equipment that, if tipped and laid flat in any direction (360 degrees) about its center pin, can encroach within twenty-five feet (25’-0”) of the nearest track. This is based upon the proposed location of the equipment during use and may be a function of the equipment boom length.
 - Note that hoisting equipment with the potential to foul must satisfy the 150% factor of safety requirement for lifting capacities.
 - Any activity where the scatter of debris or other materials has the potential to encroach within twenty-five feet (25’-0”) of the nearest track.
 - Any activity where significant vibration forces may be induced upon the track structure or existing structures located under, over, or adjacent to the track structure.

- Any other work that poses the potential to disrupt rail operations, threaten the safety of railroad employees, or otherwise negatively impact railroad property, as determined by the Railroad.
- **Preliminary Engineering (PE)** – The review and development of the project scope or project discovery that typically includes a site visit, design or design review, and estimate to complete the project.
- **Public Projects Department (PPD)** – A member of the G&W Public Projects team or assigned GEC representative.
- **Request for Proposal (RFP)** – The process by which a design-build contractor is selected and awarded to complete the project.
- **Right of Entry (ROE)** – Formal document applied for through the G&W Real Estate Department.
- **Right of Way (ROW)** – Railroad Right of Way as well as any railroad property and facilities. This includes all aerial space within the property limits and any underground facilities.
- **Theoretical Railroad Live Load Influence Zone** – 1 horizontal to 1 vertical theoretical slope line starting at bottom corner of tie.
- **Top of Rail (TOR)** – This is the base point for clearance measurements. It refers to the crown (top) of the steel rail, the point where train wheels bear on the steel rails. Use the higher of the two rails when track is superelevated.
- **Track Structure** – All load-bearing elements that support the train. This includes, but is not limited to, the rail, ties, appurtenances, ballast, sub-ballast, embankment, retaining walls, and bridge structures.
- **Vertical Clearance** – Distance measured from TOR to the lowest obstruction, within six feet (6'-0") of the track centerline, in either direction.

Section 1.05 – Payment of Railroad Cost and Expenses

Summary

The project types addressed in this manual typically do not directly benefit railroad operations. In some cases, they create risk to and challenges for railroad operations and impact the Railroad's ability to serve its customers and the American economy. For these reasons, the Railroad seeks payment for its costs and expenses incurred in connection with project reviews and construction.

Types of Reimbursable Costs and Expenses

Costs reimbursable by the project sponsor in connection with the project include, but are not limited to:

- The Railroad's labor and support services
- Sums paid to railroad consultants and subcontractors
- Engineering reviews and CEI
- All out-of-pocket expenses
- Costs for equipment, tools, materials, and supplies
- Telephone, facsimile, and mailing expenses
- Real estate or legal reviews
- Cost for flagging or other action to protect rail operations and infrastructure

Key Points

- Preliminary engineering is usually initiated by the project sponsor with a commitment to reimburse for the project discovery and engineering services.
- The Railroad will not begin its preliminary engineering review until a PE agreement or other legal reimbursable agreement is provided.
- PE costs typically range between \$10,000 to \$30,000 depending on the project.
- All funding sources must be identified up front, and any time funding sources change, the Railroad must be immediately informed. All special funding requirements must be identified prior to the commencement of any project, such as "Buy America" or "Buy American" requirements.
- All costs billed will be actual cost and no profit will be gained by performing services on behalf of the project.
- Construction and CEI will be estimated prior to getting an NTP.
- The Railroad will not begin construction until all applicable contracts are provided along with an NTP.

Section 1.06 – Insurance Requirements for Public Projects

Summary

For any project that is performed on, above, or adjacent to railroad property, proper insurance must be obtained, submitted, and approved prior to work commencing. Insurance requirements will be incorporated in all applicable contracts.

The insurance requirements will be determined based on site-specific location as well as level of impact to the Railroad. Those specific requirements can be requested at the initiation of the project once the scope and project limits have been determined.

If during the project the insurance coverage expires or lapses, the agency or its contractor, as applicable, is responsible for notifying the Railroad and ceasing all work until the requirements have once again been met and approved by the Railroad.

Section 1.07 – Railroad Flagging Requirements

Summary

In the interest of public safety and the safety of the Railroad's and project sponsor's employees and property, the Railroad will work cooperatively with agencies, consultants, contractors, and others who need to access railroad property when work brings them in close proximity to active railroad tracks to determine the appropriate flagging services needed and to make arrangements for those services.

Flagging services may only be performed by personnel qualified by the Railroad who are trained in the proper procedures related to rail operations and safety requirements, familiar with rail operations and procedures in a project area and able to communicate directly with dispatching personnel and train crews.

All costs and expenses associated with railroad flagging services are the sole responsibility of the agency, consultant, or contractor. The GEC will provide its estimated costs prior to the start of the project work or its assignment of flagging personnel, but it is up to the agency to provide the estimated number of days the flagmen are needed.

Once flagging personnel are formally assigned to a specific work location, the period of assignment can only be changed with appropriate advanced arrangements. Charges for providing flagging services beyond a normal eight-hour weekday are calculated and billed at an overtime rate.

The GEC will coordinate the flagmen and should be the primary point of contact for scheduling, including changing the working schedule or duration the flagmen are required.

Conditions

The following are conditions that may require the use of a flagman by the Railroad:

- When any entity is working on, near, or adjacent to active railroad tracks.
- When an outside party is using railroad property or performing operations that may affect railroad property or facilities (including occasions when a party has been given express permission to enter railroad property or perform such operations under the terms of the applicable contracts).
- When work off railroad property has the potential to impact railroad property or operations.
- When off-highway construction equipment is crossing the railroad at a private or public crossing.
- When oversized equipment or highway vehicles are to cross the railroad at a private or public crossing.
- In other instances, as determined by the Railroad.

Section 1.08 – Engineering Reviews and Construction Monitoring

Summary

Any project proposals that may affect or be near the Railroad's right of way must be evaluated by the Railroad. To initiate a project, a PE agreement or other applicable contract is required to identify the project sponsor and the scope, define the tasks to be accomplished, and specify the payment required. Once the plans and scope are approved by the Railroad, the project can proceed into construction.

The purpose of PE is to identify issues related to safety, engineering, customer service, operations, legal and regulatory matters, expense, risk, and other considerations specific to any proposed project. The Railroad's review is only to determine that the plans and improvements constructed are in accordance with the Railroad standards and satisfy the Railroad's requirements. Plans should be submitted early in project development to ensure that the Railroad requirements can be incorporated up front. If property is leased, the review might require additional party signoff.

Cost and Timing

Prior to commencing with engineering, design, or reviews, a legal document or associated PE agreement must be executed where the outside party will bear the cost of the design or design reviews (**see Section 1.05**). This includes the cost of railroad employees as well as GEC support. The scope includes attending meetings, site surveys, reviewing plans, preparing plans, correspondence, and any other activity to support the review of the project and development of scope.

It is the goal of PPD to have a design review turned around within 30 to 45 days depending on the level of effort. It is in the interest of all parties to complete the PE review before commitments are made or construction steps begin. The Railroad and its GEC will work with the project sponsor to schedule PE and construction to meet project schedule objectives whenever possible, considering available resources.

Construction Monitoring

To ensure the safety of the public and railroad employees, maintain quality rail service to customers, and to protect railroad assets, the Railroad may require construction monitoring (in addition to flagman protection) of the project. The construction monitoring will be conducted by the Railroad and its GEC at the expense of the project sponsor.

Construction monitoring includes intermittent or continuous on-site presence of the Railroad or its GEC during construction activities. The following typically applies:

- The construction project sponsor, owner, or agency in charge will pay for the cost of construction monitoring. Construction monitoring will be specified, and the estimated cost will be included in the construction agreement for the project.
- Construction monitoring is in addition to railroad-required flagging.
- Construction monitoring includes the Railroad's review and approval of all plan changes and required contractor submissions during the construction phase of the project.
- The project sponsor is responsible for its safety and the safety of its property, contractors, and employees. The GEC, as part of its construction monitoring, will review the work site for activities that could interfere with safe operation of the Railroad.
- The GEC is only responsible for monitoring the general work activities for safety and impact to the Railroad and its property and not for managing the overall project work. Any observed unsafe acts or conditions will be reported immediately to the project sponsor or contractor representative.

Section 1.09 – Real Estate

Summary

All projects that modify or impact the Railroad's property must be reviewed by the G&W Real Estate Department to determine property descriptions, ownership, and implications. Any rail line requiring special handling due to a lease or property agreement must be taken into consideration when performing engineering reviews and providing project acceptance.

All parties accessing the Railroad's ROW for investigative activities or for the performance of construction work are required to have a written agreement with the Railroad fully detailing each party's responsibilities. Activities by others with the potential to affect the Railroad's property, operations, and/or personnel without actually entering the Railroad's property must also be reviewed by the Railroad and appropriate arrangements and agreements completed.

If a right of entry or utility license, or any applicable agreement is required for the project, the agency or its contractor, as applicable, will need to work directly with the G&W Real Estate Department to enter all contracts into place prior to commencing work on the property.

Construction and improvement projects involving railroad property may require a conveyance of property rights, subject to adequate consideration and corporate approvals. Such projects include, but are not limited to:

- Highway – rail grade crossings
- Bridges over/under the railroad
- Parallel roads/facilities
- Road/bridge widening projects

Further clarification can be requested by contacting the PPD and the appropriate G&W Real Estate Department specialist.

Section 1.10 – Project Requirements

Summary

The project requirements set forth in this Section 1.10 shall apply to any project, subject to the terms or conditions of any applicable contracts. The Railroad representative shall have final authority in all matters affecting the safe maintenance of railroad operations and property, and his or her approval shall be obtained by the agency or its contractor for methods of construction to avoid interference with railroad operations and property and all other matters contemplated by these requirements.

The agency or its contractor shall arrange and conduct its work so that there will be no interference with railroad operations, including train, signal, telephone, and telegraphic services, or damage to railroad property or to poles, wires, and other facilities of tenants on its property or right of way. The agency or its contractor shall store materials so as to prevent trespassers from causing damage to trains or property. Whenever work is likely to affect the operations or safety of trains, the method of doing such work shall first be submitted to the Railroad for approval, but such approval shall not relieve the agency or its contractor from liability in connection with such work. No work shall be performed without it first being approved by the Railroad.

If conditions arising from or in connection with the project require that immediate and unusual provisions be made to protect train operation or property, the agency or its contractor shall make such provisions. If the Railroad determines that such provisions are insufficient, the Railroad may, at the expense of the agency or its contractor, require or provide such provisions as may be deemed necessary, or cause the work to cease immediately.

If the agency or its contractor violate or fail to comply with any of the requirements in the section, the Railroad may:

- Require the agency and/or the contractor to vacate its property;
- Withhold monies due the agency and/or the contractor;
- Require the agency to withhold monies due to the contractor; and
- Cure such failure, and the agency and/or any contractor shall reimburse the Railroad for the cost of curing such failure.

Notice to Start Work

The agency or its contractor shall not commence any work on railroad property or ROW until it has entered into all applicable contracts and received all requisite approvals from the Railroad. Thereafter, unless otherwise specified in such applicable contracts, the agency or its contractor must:

- Notify the Railroad in writing of the date that it intends to commence work on the project. Such notice must be received at least 10 business days in advance of the date the agency or its contractor proposes to begin work on railroad property. The notice must refer to the specific project agreement. If flagging service is required, such notice shall be submitted at least thirty (30) business days in advance of the date scheduled to commence the work.
- Obtain authorization from the Railroad to begin work on the property, such authorization to include an outline of specific conditions with which it must comply.
- Obtain from the Railroad the names, addresses, and telephone numbers of railroad personnel who must receive notice under provisions in the construction agreement. Where more than one individual is designated, the area of responsibility of each shall be specified.

Hauling across Railroad

If the agency or its contractor desires access across the Railroad's property or tracks at a location other than an existing and open public road crossing in or adjacent to the construction of the project, the agency or contractor must first obtain the permission of the Railroad and shall execute any applicable contracts as described in **Section 1.09** Real Estate herein.

Cooperation & Delays

The agency or its contractor shall arrange a schedule with the Railroad for accomplishing stage construction involving work by the Railroad. In arranging its schedule, the agency or contractor shall ascertain from the Railroad the lead time required for assembling crews and materials and shall make due allowance therefore.

The agency or its contractor may not charge any costs or submit any claims against the Railroad for hindrance or delay caused by railroad traffic; for any work done by the Railroad or other delay incident necessary for safe maintenance of railroad traffic; or for any delays due to compliance with these requirements. Agency and contractor shall cooperate with others participating in the construction of the project to the end that all work may continue to move forward.

The agency and its contractor understand and agree that the Railroad does not assume any responsibility for work performed by others in connection with the project. The agency and contractor further understand and agree that they shall have no claim whatsoever against the Railroad for any inconvenience, delay, or additional cost incurred by the agency or contractor on account of operations by others.

Storage

The agency and its contractor shall not store their materials or equipment on railroad property or where they may potentially interfere with operations unless the agency or contractor has received prior written permission. The agency and contractor understand and agree that the Railroad will not be liable for any damage to such materials and equipment from any cause and that the Railroad may move, or require the agency or its contractor to move, such material and equipment at the agency's or contractor's sole expense. To minimize the possibility of damage to the Railroad tracks resulting from the unauthorized use of equipment, all grading or other construction equipment that is left parked near the tracks unattended shall be immobilized to the extent feasible so that it cannot be moved by unauthorized persons.

Construction

Construction work on railroad property shall be subject to the Railroad's inspection and approval. Work shall be in accordance with written specific conditions and with these requirements. The agency or its contractor shall obtain the Railroad and agency representative's prior written approval for use of explosives on or adjacent to railroad property. If permission for use of explosives is granted, the agency or contractor must comply with the following:

- Blasting shall be done with light charges under the direct supervision of a responsible officer or employee of agency or contractor.
- Electric detonating fuses shall not be used because of the possibility of premature explosions resulting from operation of two-way train radios.
- No blasting shall be done without the presence of the Railroad's CEI. At least 30 days' notice to the Railroad is required to arrange for site presence.
- Explosives shall not be stored on railroad property.

The Railroad will:

- Determine the approximate location of trains and advise the agency or contractor of the approximate amount of time available for the blasting operation and cleanup.
- Have the authority to order discontinuance of blasting if, in the Railroad's opinion, blasting is too hazardous or is not in accord with these requirements.

The agency or its contractor shall maintain all ditches and drainage structures free of silt or other obstructions that may result from their operations. The agency or contractor shall provide erosion control measures during construction and use methods that accord with applicable state standard specifications for road and bridge construction, including (1) silt fence; (2) hay or straw barrier; (3) berm or temporary ditches; (4) sediment basin; (5) aggregate checks; and (6) channel lining. All such maintenance and repair of damages due to agency's or contractor's operations shall be performed at agency's expense.

The agency shall arrange, upon approval from the Railroad, to have any utility facilities on or over railroad property changed as may be necessary to provide clearances for the proposed trackage.

The agency or its contractor, upon completion of the project, shall remove from railroad property any temporary grade crossings; any temporary erosion control measures used to control drainage; and all machinery, equipment, surplus materials, falsework, rubbish, or temporary buildings belonging to the agency or contractor. The agency or contractor, upon completion of the project, shall leave railroad property in neat condition, satisfactory to the Railroad.

Section 1.11 – Construction Submission Criteria

Summary

The intent of this manual is to guide outside parties and their contractors when performing work on, over, or with potential to impact railroad property. Work plans shall be submitted for review to the Railroad for all work that presents the potential to affect railroad property or operations. All work shall be performed in a manner that does not adversely impact the Railroad operations or safety; as such, the requirements of this manual shall be strictly adhered to, in addition to all other applicable standards associated with the construction.

General

- A construction work plan is required to be submitted by the agency or the Railroad for review and acceptance prior to accessing or performing any work with potential to foul.
- The agency or its representative shall submit sets of plans, specifications, supporting calculations, detailed means and methods, and procedures for the specific proposed work activity.
- Construction submissions shall include all information relevant to the work activity and shall clearly and concisely explain the nature of the work, how it is being performed, and what measures are being taken to ensure that railroad property and operations are continuously maintained.
- All construction plans shall include a map of the work site depicting the tracks, the ROW, proposed means of access, proposed locations for equipment and material staging (dimensioned from nearest track centerline), as well as all other relevant project information. An elevation drawing may also be necessary to depict clearances or other components of the work.
- Please note that the Railroad will not provide pricing to individual contractors involved in bidding projects. Bidding contractors shall request information from the agency only.
- The contractor shall install a geotextile fabric ballast protection system to prevent construction or demolition debris and fines from fouling ballast. The geotextile ballast protection system shall be installed and maintained by the contractor to the satisfaction of the Railroad.
- The Railroad shall be kept aware of the construction schedule. The contractor shall provide timely communication to the Railroad when scheduling the work such that a representative may be present during the work. The contractor's schedule shall not dictate the work plan review schedule, and flagging shall not be scheduled prior to receipt of an accepted work plan.

- At any time during construction activities, the Railroad may require revisions to the previously approved procedures to address weather, site conditions, or other circumstances that may create a potential hazard to rail operations or facilities. Such revisions may require immediate interruption or termination of ongoing activities until such time the issue is resolved to the Railroad's satisfaction. The Railroad shall not be responsible for any additional costs or time claims associated with such revisions.
- Blasting will not be permitted to demolish a structure over or within railroad property. When blasting off railroad property but with potential to foul, vibration monitoring, track settlement surveying, and/or other protective measures may be required as determined by the Railroad.
- Blasting is not permitted adjacent to the Railroad's ROW without written approval from the Railroad.
- Mechanical and chemical means of rock removal must be explored before blasting is considered. If written permission for the use of explosives is granted, the agency or contractor must submit a work plan (see **Section 1.08 & Section 1.10**).

Hoisting

All proposed hoisting operations with potential to foul shall be submitted in accordance with the following:

- A plan view drawing shall depict the work site, the track(s), the proposed location(s) of the lifting equipment, as well as the proposed locations for picking, any intermediate staging, and setting the load(s). All locations shall be dimensioned from the centerline of the nearest track. Crane locations shall also be dimensioned from a stationary point at the work site for field confirmation.
- Computations showing the anticipated weight of all picks. Computations shall be made based upon the field-verified plans of the existing structure. Pick weights shall account for the weight of concrete rubble or other materials attached to the component being removed; this includes the weight of subsequent rigging devices/components. Rigging components shall be sized for the subsequent pick weight.
- All lifting equipment, rigging devices, and other load bearing elements shall have a rated (safe lifting) capacity that is greater than or equal to 150% of the load it is carrying, as a factor of safety. Supporting calculations shall be furnished to verify the minimum capacity requirement is maintained for the duration of the hoisting operation.
- Dynamic hoisting operations are prohibited when carrying a load with the potential to foul. Cranes or other lifting equipment shall remain stationary during lifting (i.e., no moving picks).
- For lifting equipment, the manufacturer's capacity charts, including crane, counterweight, maximum boom angle, and boom nomenclature are to be submitted.
- A schematic rigging diagram must be provided to clearly call out each rigging component from crane hook to the material being hoisted. Copies of catalog or information sheets shall be provided to verify rigging weights and capacities.
- For built-up rigging devices, the contractor shall submit the following:
 - Details of the device, calling out material types, sizes, connections, and other properties.
 - Load test certification documents and/or design computations bearing the seal and signature of a professional engineer. Load tests shall be performed in the configuration of its intended use as part of the subject demolition procedure.
 - Copies of the latest inspection reports of the rigging device. The device shall be inspected within one (1) calendar year of the proposed date for use.
- A detailed drawing shall be provided showing the crane outrigger setup, including dimensions from adjacent slopes or facilities. The drawing shall indicate requirements for bearing surface preparation, including material requirements and compaction efforts. As a minimum, outriggers and/or tracks shall bear on mats positioned on level material with adequate bearing capacity.

- A complete written narrative shall be provided that describes the sequence of events, indicating the order of lifts and any repositioning or re-hitching of the crane(s).

Demolition

The agency or its contractor shall submit a detailed procedure for a controlled demolition of any structure on, over, or adjacent to the ROW. The controlled demolition procedure must be approved by the Railroad prior to beginning work on the project.

Existing condition of the structure being demolished:

- The contractor shall submit as-built plans for the structure(s) being demolished.
- If as-built plans are unavailable, the contractor shall perform an investigation of the structure, including any foundations, substructures, etc. The field measurements are to be made under the supervision of the professional engineer submitting the demolition procedure. Findings shall be submitted as part of the demolition means and methods submittal for review by the Railroad.
- Any proposed method for temporary stabilization of the structure during the demolition shall be based on the existing plans or investigative findings and submitted as part of the demolition means and methods for review by the Railroad.

Demolition work plans shall include a schematic plan depicting the proposed locations of the following at various stages of the demolition:

- All cranes and equipment, calling out the operating radii.
- All proposed access and staging locations with all dimensions referenced from the centerline of the nearest track.
- Proposed locations for stockpiling material or locations for truck loading.
- The location, with relevant dimensions, of all tracks, other railroad facilities, and wires, poles, adjacent structures, or buried utilities that could be affected, showing that the proposed lifts are clear of these obstructions.
- Note that no crane or equipment may be set on the rails or track structure and no material may be dropped on railroad property.

Demolition submittal shall also include the following information:

- A time schedule for each of the various stages must be shown as well as a schedule for the entire lifting procedure and hoisting. The proposed time frames for all critical subtasks (i.e., torch/saw cutting various portions of the superstructure or substructure, dismantling splices, installing temporary bracing, etc.) shall be furnished so that the potential impact(s) to operations may be assessed and eliminated or minimized.
- The names and experience of the key contractor personnel involved in the operation shall be included in the contractor's means and methods submission.
- Design and supporting calculations shall be prepared, signed, and sealed by the professional engineer for items including the temporary support of components or intermediate stages and shall be submitted for review. A guardrail will be required to be installed in the proximity of temporary bents or shoring towers when located within twelve feet (12'-0") from the centerline of the track. The guardrail will be installed at the expense of the agency or its contractor.

Girders or girder systems shall be stable at all times during demolition. Temporary bracing shall be provided at the piers, abutments, or other locations to resist overturning and/or buckling of the member(s). The agency shall submit a design and details of the proposed temporary bracing system for review by the Railroad. Lateral wind forces for the temporary conditions shall be considered in accordance with the current version of AREMA.

Existing obsolete bridge piers shall be removed to a minimum of three feet (3'-0") below the finished grade, final ditch line invert, or as directed by the Railroad.

A minimum quantity of twenty-five (25) tons of approved granite track ballast may be required to be furnished and stockpiled on-site by the contractor or as directed by the Railroad.

The use of acetylene gas is prohibited for use on or over railroad property. Torch cutting shall be performed utilizing other materials such as propane.

Tracks, signals, structures, and other railroad facilities shall be protected from damage during demolition of existing structure or replacement of deck slab.

Demolition Debris Shield

- On-track or ground-level debris shields (such as crane mats) are prohibited for use.
- The demolition debris shield shall be installed prior to the demolition of the bridge deck or other relevant portions of the structure. The demolition debris shield shall be erected from the underside of the bridge over the track area to catch all falling debris. The debris shield shall not be the primary means of debris containment.
 - The demolition debris shield design and supporting calculations, all signed and sealed by a professional engineer, shall be submitted for review and acceptance.
 - The demolition debris shield shall have a minimum design load of 50 pounds per square foot (50 psf) plus the weight of the equipment, debris, personnel, and all other loads.
 - The contractor shall verify the maximum particle size and quantity of the demolition debris generated during the procedure does not exceed the shield design loads. Shield design shall account for loads induced by particle impact; however, the demolition procedure shall be such that impact forces are minimized. The debris shield shall not be the primary means of debris containment.
 - The contractor shall include installation/removal means and methods for the demolition debris shield as part of the proposed controlled demolition procedure submission.
 - The demolition debris shield shall provide twenty-three feet (23'-0") minimum vertical clearance or maintain the existing vertical clearance if the existing clearance is less than twenty-three feet (23'-0").
 - Horizontal clearance to the centerline of the track should not be reduced unless approved by the Railroad.
 - The contractor shall clean the demolition debris shield daily or more frequently as dictated either by the approved design parameters or as directed by the Railroad.

Vertical Demolition Debris Shield

This type of shield may be required for substructure removals in close proximity to tracks and other facilities, as determined by the Railroad.

The agency or its contractor shall submit detailed plans with detailed calculations prepared, signed, and sealed by a professional engineer of the protection shield.

Erection

The agency or its contractor shall submit a detailed procedure for erection of a structure with potential to foul. The erection procedure must be approved by the Railroad prior to beginning work on the project.

Erection work plans shall include a schematic plan depicting the following, at all stages of the construction:

- All proposed locations of all cranes and equipment, calling out the operating radii.

- All proposed access and staging locations with all dimensions referenced from the centerline of the nearest track.
- All proposed locations for stockpiling material or locations for truck loading.
- The location, with relevant dimensions, of all tracks, other railroad facilities, and wires, poles, adjacent structures, or buried utilities that could be affected, showing that the proposed lifts are clear of these obstructions.
- No crane or equipment may be set on the rails or track structure and no material may be dropped on railroad property.

For erection of a structure over the tracks, the following information shall be submitted for review and acceptance by the Railroad at least thirty (30) days prior to erection:

- As-built beam seat elevations – field surveyed upon completion of pier/abutment construction.
- Current top of rail (TOR) elevations – field measured at the time of as-built elevation collection.
- Computations verifying the anticipated minimum vertical clearance in the final condition that account for all deflection and camber based upon the current TOR and as-built beam seat elevations. The anticipated minimum vertical clearance shall be greater than or equal to that which is indicated by the approved plans. Vertical clearance (see definitions) is measured from TOR to the lowest point on the overhead structure at any point within six feet (6'-0") from the centerline of the track. Calculations shall be signed and sealed by a professional engineer.

Girders or girder systems shall be stable at all times during erection. No crane may unhook prior to stabilizing the beam or girder.

- Lateral wind forces for the temporary conditions shall be considered in accordance with the current version of AREMA.
- Temporary bracing shall be provided at the piers, abutments, or other locations to resist overturning and/or buckling of the member(s). The agency shall submit a design and details of the proposed temporary bracing system for review by the Railroad.
- Temporary bracing shall not be removed until sufficient lateral bracing or diaphragm members have been installed to establish a stable condition. Supporting calculations furnished by the professional engineer shall confirm the stable condition.

Erection procedure submissions shall also include the following information:

- A time schedule for each of the various stages must be shown as well as a schedule for the entire lifting procedure. The proposed time frames for all critical subtasks (i.e., performing aerial splices, installing temporary bracing, installation of diaphragm members, etc.) shall be furnished so that the potential impact(s) to operations may be assessed and eliminated or minimized.
- The names and experience of the key contractor personnel involved in the operation shall be included in the contractor's means and methods submission.
- A guardrail will be required to be installed in a track in the proximity of temporary bents or shoring towers when these are located within twelve feet (12'-0") from the centerline of the track.
- Design and supporting calculations prepared by the professional engineer for items including the temporary support of components or intermediate stages shall be submitted for review.

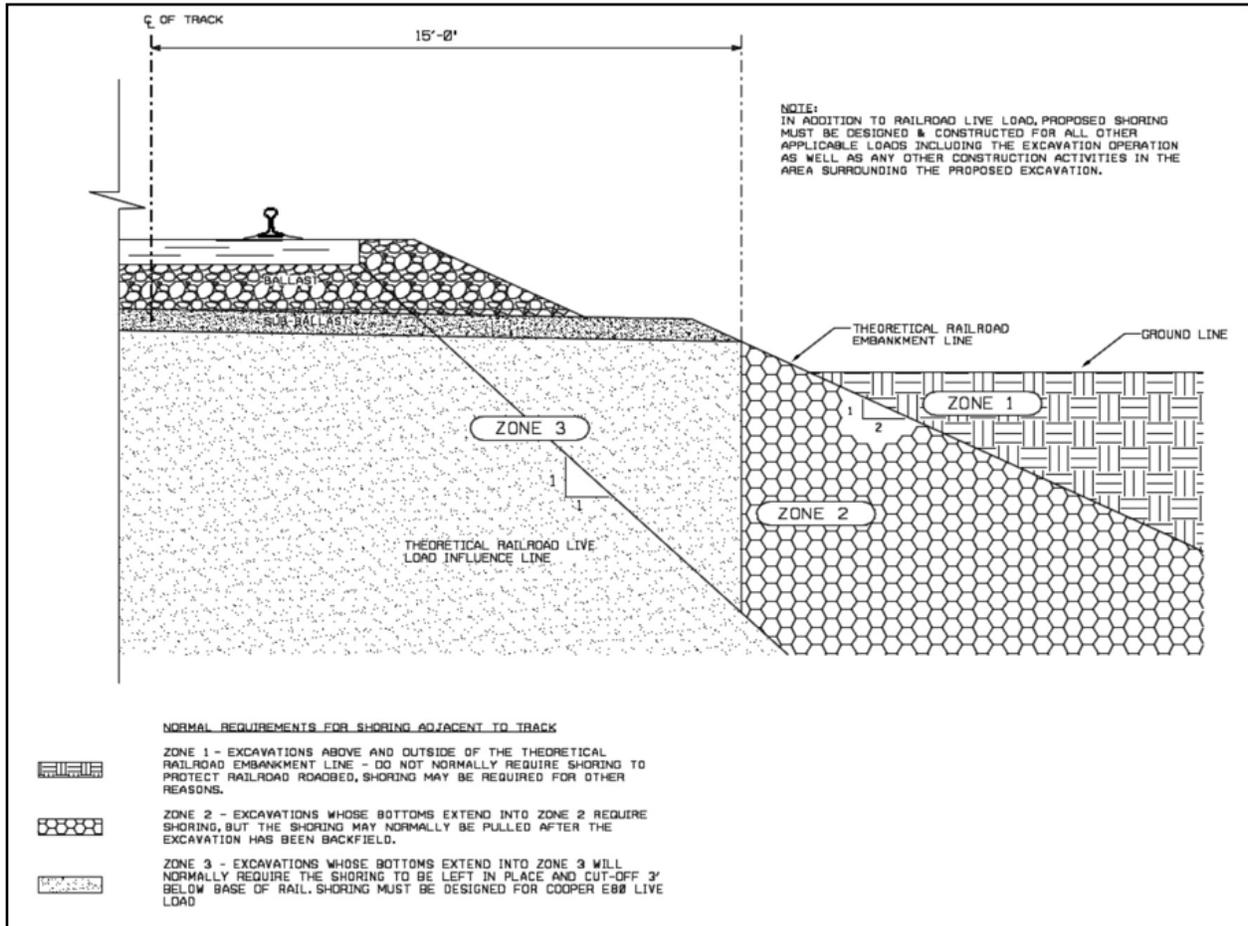
Excavation and Shoring

The agency or its contractor shall submit a detailed design and procedure for the installation of a sheeting/shoring system adjacent to the tracks. Shoring protection shall be provided when excavating with

potential to foul, or as otherwise determined by the Railroad. Shoring shall be provided in accordance with AREMA, except as noted below.

Shoring may not be required if all of the following conditions are satisfied:

- The excavation does not encroach within the theoretical live load influence zone. Please refer to figure below.



- The track structure is situated on level ground, or in a cut section, and on stable soil.
- The excavation does not adversely impact the stability of a railroad facility (i.e., signal bungalow, drainage facility, undergrade bridge, building, etc.), or the stability of any structure on, over, or adjacent to railroad property with potential to foul.
- Shoring is not required by any governing federal, state, local, or other construction code.

Shoring is required when excavating the toe of an embankment. Excavation of any embankment that supports an active track structure without shoring will not be permitted.

Trench boxes are not an acceptable means of shoring. Trench boxes are prohibited for use on railroad property or within the theoretical railroad live load influence zone.

Shoring shall be a cofferdam-type, which completely encloses the excavation. However, where justified by site or work conditions, partial cofferdams with open sides away from the track may be permissible, as determined by the Railroad.

Cofferdams shall be constructed using interlocking steel sheet piles, or when approved by the engineer, steel soldier piles with timber lagging. Wales and struts shall be included when dictated by the design.

The use of tiebacks can be permissible for temporary shoring systems when conditions warrant. Tiebacks shall have a minimum clear cover of six feet (**6'-0"**), measured from the bottom of the rail. Upon completion of the work, tiebacks shall be grouted, cut off, and remain in place.

All shoring systems on or adjacent to the Railroad's ROW shall be equipped with railings or other fall protection and be compliant with the governing federal, state, or local requirements. The area around pits shall be graded to eliminate all potential tripping hazards.

Interlocking steel sheet piles shall be used for shoring systems that qualify with one or more of the following conditions:

- Within eighteen feet (**18'-0"**) of the nearest track centerline
- Within the theoretical live load influence zone
- Within slopes supporting the track structure
- As otherwise deemed necessary by the Railroad

Sheet piles qualifying for one or more of the requirements listed in this document shall not be removed. Sheet piles shall be left in place and cut off a minimum of three feet (**3'-0"**) below the finished grade, the ditch line invert, or as otherwise directed by the Railroad. The ground shall be backfilled and compacted immediately after sheet pile is cut off.

The following design considerations shall be considered when preparing the shoring design package:

- Shoring shall be designed to resist a vertical live load surcharge of **1,882 lbs.** per square foot, in addition to active earth pressure. The surcharge shall be assumed to act on a continuous strip, eight feet six inches (**8'-6"**) wide. Lateral pressures due to surcharge shall be computed using the strip load formula shown in the current version of AREMA.
- Allowable stresses in materials shall be in accordance with the current version of AREMA.
- A minimum horizontal clearance of ten feet (**10'-0"**) from the centerline of the track to face of nearest point of shoring shall be maintained, provided twelve feet (**12'-0"**) of roadbed is maintained with a temporary walkway and handrail system.
- For temporary shoring systems with potential to foul, piles shall be plumb under full dead load. Maximum deflection at the top of wall, under full live load, shall be as follows:
 - One-half inch (**.5"**) for walls within twelve feet (**12'-0"**) of track centerline (measured from the centerline of the nearest track to the nearest point of the supporting structure).
 - One inch (**1"**) for walls located greater than twelve feet (**12'-0"**) from track centerline.

Shoring work plans shall be submitted in accordance with this document, as well as the following additional requirements:

- The work plan shall include detailed drawings of the shoring systems, calling out the sizes of all structural members and details of all connections. Both plan and elevation drawings shall be provided, calling out dimensions from the face of shoring relative to the nearest track centerline. The elevation drawing shall also show the height of shoring and track elevation in relation to the bottom of excavation.
- Full design calculations for the shoring system shall be furnished.
- A procedure for cutting off the sheet pile, backfilling, and restoring the embankment shall be included.

Track Monitoring

When work being performed has the potential to disrupt the track structure, a work plan must be submitted detailing a track monitoring program that will serve to monitor and detect both horizontal and vertical movement of the track and roadbed.

The program shall specify the survey locations, the distance between the location points, and frequency of monitoring before, during, and after construction. The Railroad reserves the right to modify the survey locations and monitoring frequency as necessary during the project.

The survey data shall be collected in accordance with the approved frequency and immediately furnished to the Railroad for analysis.

If any movement has occurred as determined by the Railroad, the Railroad, at its sole discretion, shall have the right to immediately require all contractor operations to be ceased, have the excavated area immediately backfilled, and/or determine what corrective action is required.

Soil and Water Management

The Railroad must review and approve reuse of soil on railroad property.

If the soil cannot be reused on railroad property, it must be properly disposed of at an approved disposal facility. The Railroad prohibits any contractor from taking soils for off-property for reuse. Coordinate with the Railroad to handle waste characterization and profiling into an approved disposal facility. The Railroad prohibits any environmental sampling of its property unless approved in writing. If the agency has arrangements with a disposal facility not approved by the Railroad, the agency can request to evaluate the disposal facility. A request to evaluate alternate disposal facilities should take place prior to work being initiated on railroad property.

If dewatering is planned for a public project, the Railroad must review and approve the dewatering plan prior to work being initiated on or near railroad property. The Railroad prohibits the discharge of water onto its property without prior approval. The Railroad prohibits environmental sampling of groundwater or surface water.

All materials discarded by or on behalf of the Railroad will be managed in accordance with local, state, and federal regulations as well as best management practices and sustainability goals. To ensure that these goals are achieved, the Railroad has mechanisms in place to monitor waste management activities.

The cleanup and disposal of material from the surface preparation for painting and actual painting must comply with all appropriate regulations. The materials removed during the surface preparation must not impact the surrounding area, including ground, water, or air impacts. Materials must not be stored on railroad property.

Drainage

For the installation of temporary or permanent shoring systems, including but not limited to soldier piles and lagging, and interlocked steel sheeting on or adjacent to the Railroad's ROW, the contractor may be required to submit a detailed track monitoring program for approval prior to performing any work near the Railroad's ROW.

When water is known or expected to be encountered, all plans and specifications must be submitted to the Railroad for approval before the process begins. Pumps of sufficient capacity to handle the flow shall be maintained at the site, provided the contractor has received approval to operate them. Pumps in operation shall be constantly attended on a 24-hour basis until, in the sole judgment of the Railroad, the operation can be safely halted. When dewatering, a process for monitoring for any settlement of track or structures must be in place.

If any track movement has occurred as determined by the Railroad, the Railroad, at its sole discretion, shall have the right to immediately require all contractor operations to be ceased, have the excavated area immediately backfilled, and/or determine what corrective action is required. Any corrective action required or performed by the Railroad, including the monitoring of corrective action of the contractor, will be at project expense.

All pipes, ditches, and other structures carrying surface drainage on railroad property and/or under track(s) shall be designed to carry the runoff from the **100-year, 24-hour design** storm without ponding of water against the roadbed.

Pipe(s) used to carry surface drainage on the Railroad's ROW shall have a minimum diameter of 24 inches (24").

When calculating the capacity of existing or proposed drainage structures under track(s), the headwater calculation at the structure shall not be greater than one (1):

$$HW/D \leq 1.$$

Rate and quantity of storm water runoff from any proposed development shall not exceed the rate and quantity of runoff prior to development. This standard shall be maintained for all design storms up to the **100-year storm event**.

Pipes (casing or carrier) placed under tracks shall not be less than five feet six inches (5'-6") from base of rail to top of pipe at its shallowest point.

Pipelines laid longitudinally on ROW fifty feet (50'-0") or less from the centerline of the track shall be buried not less than four feet (4'-0") from ground surface to top of pipe. Where the pipeline is laid more than fifty feet (50'-0") from the centerline of the track, the minimum cover shall be at least three feet (3'-0").

Erosion prevention methods shall be used to protect railroad ditches and other drainage facilities during construction on and adjacent to ROW.

Permanent erosion and sediment pollution control facilities shall be designed for the **100-year storm**. Provide calculations and details of any riprap outlet protection and channel linings as needed within ROW.

Pipes and culverts within the theoretical live load influence zone shall conform to current AREMA recommendations and ASTM specifications. All such structures shall be designed to carry **Cooper E80** loading with diesel impact.

ROW shall not be utilized for retention, detention, or settling basins. Also, the Railroad embankment must not be used as any part of a detention pond structure.

Track roadbed fills shall not be used as dams or levees for retention of runoff.

Temporary sediment basins/traps shall not be constructed against track roadbed fill.

Formal approval of the proposed design by the appropriate governmental agency having jurisdiction shall be submitted to the Railroad for their review and acceptance.

Pipes and culverts are not to be located within the limits of a turnout or nor closer than fifty feet (50'-0") to any railroad bridge, building, or any other important structure.

When excavation for a pipeline or other structure will be within the theoretical railroad embankment line of an adjacent track, interlocking steel sheet piling will be required to protect the track(s). Trench boxes are prohibited for use on ROW within the theoretical railroad live load influence zone.

Blasting is not permitted on or adjacent to the Railroad's ROW without prior written approval.

Crossing of tracks at grade by equipment and personnel is prohibited except by prior arrangement with and as directed by the Railroad.

Temporary track supports may be required when a jacking, boring, or tunneling method of installation is used, depending upon the size and location of the drainage crossing. The agency's contractor shall furnish and supply the approved track supports, with the installation and removal performed by a person approved by the Railroad. The agency shall reimburse the Railroad for all costs associated with the installation and removal of the track supports.

Plans submitted to the Railroad for approval shall be prepared by a professional engineer and should indicate design, suitable topographic plan, and outline of total drainage area.

If the drainage is to discharge into an existing drainage channel on ROW and/or through a drainage structure under track(s), the computations must include the hydraulic analysis of any existing ditch and/or structure.

Extension of pipes, culverts, and other drainage structures previously installed under tracks shall be made with culvert or drainage structure having the same size, shape, and dimensions as the existing pipe. In no case shall the existing drainage structure be extended so that the hydraulic capacity is decreased or obstructed. In some cases, it may be necessary to extend existing outlets with pipe or culvert of a larger size. Details of connections to mismatched culverts shall be submitted for approval.

The agency may be required to provide reasonable corrective measures to alleviate an existing drainage problem within railroad property that may be affected by the proposed development. It shall be the responsibility of the agency to obtain all drainage easements and permits. The Railroad shall be indemnified and held harmless of any liability.

The agency is to provide information on groundwater recharge if infiltration is proposed adjacent to railroad property. Soils testing and certification by a registered professional engineer shall be required.

Emergency spillways discharging onto railroad property are to be designed and constructed so that the basin berm is protected against erosion.

Energy dissipating devices are to be placed at all outlets discharging to railroad property.

Concrete end walls shall be placed at outlets discharging to railroad property. All concrete outlet pipes on property must be equipped with a trash rack.

Under no conditions shall any person be allowed to modify, alter, or change a previously approved storm water management (SWM) facility discharging to railroad property unless an approved alternate facility is approved.

Design of the drainage system, including alterations of the existing drainage system on ROW, is the responsibility of the agency. Drainage shall not be diverted, directed toward the Railroad, or increased in quantity without prior written approval.

Supporting calculations must be provided for all proposed drainage and storm water management facilities that discharge onto or impact property.

Occupancies shall be designed, and their construction shall be accomplished, so that adequate and uninterrupted drainage of the Railroad's ROW is maintained.

If, in the course of construction, it may be necessary to block a ditch, pipe, or other drainage facility, temporary pipes, ditches, or other proposed drainage facilities shall be installed to maintain adequate drainage, as approved. Upon completion of the project, the temporary facilities shall be removed, and the permanent facilities restored.

Temporary and permanent erosion control and sedimentation (E&S) devices must be provided to prevent the flow of sediment onto and adjacent to railroad property.

The design shall take into account and provide upstream areas within the entire watershed in computing discharge, sizing of pipes, inlets, and other structures.

When applicable, the agency is to provide maintenance and operation of E&S/storm water facilities.

Plans shall include, but not be limited to, the following:

- Existing property boundaries, easements, etc.
- Existing drainage features and topography.
- Existing utility locations.
- Existing structures, tracks, roads, features, etc.
- Existing topography, including wetlands and all environmental features.
- Delineation & dimension of proposed property acquisition or property easements.
- Dimension distances from all temporary and proposed E&S and SWM facilities to railroad property line and/or easement.
- Dimension distances from all temporary and proposed E&S and SWM facilities to tracks.
- Dimension of all temporary and proposed encroachments within property.
- Existing contours.
- TOR elevations.
- Proposed contours, site grading, and drainage facilities.
- Proposed improvements, including easements and property lines and limit of disturbance.
- Details for all temporary and proposed drainage structures, SWM, and E&S best management practices (BMP) devices.
- Details for proposed E&S, SWM, and drainage collection and conveyance systems (pipes, ditches, etc.).
 - Location, size, slope, and type of pipe.
 - Ditch cross sections.
 - Invert elevations.
 - Grate and rim elevations.
- If applicable, identification of the 100-year floodplain if project is within a specified flood zone.
- E&S plans in compliance with all state and local requirements.
- Signature and seal of state-licensed professional engineer.

Design Calculations

Pre- and post-development drainage area maps.

- Provide soils boundary lines & soil types.
- Delineate drainage areas.
- Provide time of concentration (T_c) flow path.
- Provide weighted CN and c-values (as applicable to design method).

Pre-development 100-year runoff volume and flows for all facilities draining to or on ROW.

Post-development 100-year runoff volume and flows for all facilities draining to or on ROW.

- Verify no increase in rate or quantity of runoff to property from pre-development conditions.
- Provide hydraulic analysis (depth and velocity calculations) for all facilities draining to or on ROW (existing and proposed) and verify sufficient capacity for proposed flow is provided.

Design of proposed collection and conveyance systems (pipes, ditches, etc.)

- Required capacity for a **100-year, 24-hour storm**.
- Required a minimum diameter of **24-inches** for pipes within ROW.

Provide all temporary and permanent E&S and SWM BMP calculations.

Signature and seal of state-licensed professional engineer.

Project narrative/summary describing proposed improvements, drainage design, SWM and E&S methodologies, site soil and geological conditions (if known), flooding characteristics (if applicable), and state and local requirements used to produce designs.

Recommended: Photographs of the site and adjacent property as well as discharge locations and drainage facilities on property to receive runoff from the proposed development.

Section 1.12 – Railroad Property Safety

All work on or near railroad property shall be conducted in accordance with the Railroad’s safety rules and regulations. Specifically, all agency’s employees and contractors, while on railroad property, shall be required to wear a hard hat, safety glasses with side shields, 6” lace up boots with a distinct heel, shirts with sleeves, and long pants; additional personal protective equipment may be required based on certain operations. The contractor and its employees shall always comply with the safety rules while occupying railroad property. Operations will be subject to inspection at any time. All personnel operating equipment must be qualified on it to perform task at hand.

The agency, its contractors, or any person refusing to comply with the Railroad’s safety rules may be removed from the property at the Railroad’s discretion. Although the GEC and the Railroad may perform site visits to verify compliance to safety rules and regulations, it is up to the agency and its contractors to adhere to all safety rules and regulations at all times.

Additionally, all equipment shall be used only in the manner it was designed for. All applicable safety rules shall be followed, including the use of seat belts on all equipment equipped with such. Equipment operators shall only operate equipment for which they are trained, certified, and qualified to operate. Operators shall have such credentials on their person anytime in which they operate on railroad property.

If an onsite flagman (**see Section 1.07**) is assigned, a job briefing must be performed by all persons entering the property even if no work is being performed. If a job function is being performed outside the view of the flagman, it is the responsibility of the agency and its contractors to brief with the flagman.

For additional safety requirements, please refer to “Contractor Safety Rules” document. It is the goal of the Railroad to have zero safety incidents every day.

Section 2.01 – Public Road Crossing Openings and Closures

Summary

The Railroad understands the importance of highway-rail grade crossings and their relevance to such priorities as economic development, emergency vehicle access, and other growth opportunities in the communities through which we operate. Because of the safety concerns associated with highway-rail grade crossings, however, every effort must be made to obtain alternative access or additional capacity using grade separations, or by other roads leading to existing crossings.

The Railroad shares the goal of eliminating at grade crossings with both the state DOTs and the Federal Railroad Administration (FRA). Likewise, the Federal Highway Administration (FHWA) Railroad-Highway Grade Crossing Handbook acknowledges that the first alternative that should always be considered for a highway-rail at-grade crossing is elimination. Elimination of a crossing provides the highest level of crossing safety because the point of intersection between highway and railroad is removed. Closing adjacent crossings simplifies the design, installation, and operation of highway-rail grade crossing warning systems.

The addition of any grade crossing brings the potential for incidents involving trains and motor vehicles. For this reason, both federal and state government policies discourage the creation of new grade crossings. As such the Railroad, other railroads, the United States Department of Transportation, and most state DOTs encourage communities to carefully consider all alternatives, including grade separations (crossings that go over or under railroad tracks), as opposed to the creation of new at-grade crossings.

The cost of a grade separation should not outweigh the enhanced safety it would provide for motorists.

Before agreeing to the establishment of a new crossing, the Railroad encourages communities to engage in a study with the purpose of identifying existing redundant public crossings for closure. To comply with and in support of the federal initiative to reduce grade crossings, the Railroad requires that the community identify the closure of three (3) or more comparable active public at-grade crossings.

As discussed above, the appropriate public authority will be expected to reimburse the Railroad for its cost of design, installation, and future maintenance of the crossing.

Process

- Appropriate public authority provides a written request to PPD outlining the reason for the new crossing or for seeking to convert a private crossing to a public one. Include the following:
 - A description of the proposed highway project, including proposed passive or active traffic control devices, and the need for preemption and/or interconnection with traffic signals, together with a scale drawing or sketch of the proposed highway and vicinity.
 - Expected annual average daily traffic (AADT), proposed vehicular speed limit, photographs, and aerial map. Please include any expected future development.
 - Identification of at-grade crossings to be closed. Include their vehicular speed limit, AADT, and traffic type.
 - The determination by the highway or regulatory authority of the need for passive or active traffic control devices and other safety treatments (i.e., signage, roadway medians, etc.), as selected by the highway authority consistent with applicable federal, state, and Manual on Uniform Traffic Control Devices (MUTCD) guidelines and requirements.
 - A plan to satisfy any appropriate regulatory authority's requirements, procedures, and approval. The project sponsor should coordinate with all applicable agencies (state, county, city, etc.) to ensure proper procedures are followed.

- Authorization for the Railroad to incur costs for its preliminary engineering to review the crossing request (whether or not its approved), design and construction expenses, and for the ongoing maintenance of the crossing surface and related grade crossing warning devices.
- PPD will review the request and follow up with appropriate state authorities.
- If it is approved by the Railroad, the state DOT, and appropriate roadway authorities, PPD will proceed with creating a project and starting the design review process. The design process will include, but is not limited to, the following:
 - Assignment of temporary DOT number.
 - Site survey & diagnostic review to determine level of protection.
 - Basis for design.
 - Estimate to complete.
 - Agency/sponsor and the Railroad enter into all applicable contracts.
 - RFP and vendor selection.
 - Design and order material.
 - Construct surface (must remain closed and inaccessible).
 - Install level of protection as indicated by DOT.
 - Testing and DOT signoff.
 - Open crossing and close offset crossings.
 - Update FRA to make DOT number permanent.

Section 2.02 – Highway-Rail Grade Crossing Warning Devices

Summary

PPD will process all projects proposing alterations to public highway-rail grade crossing warning systems. Included will be projects for opening new crossings, closing existing crossings, modifying or widening of existing crossings, installing new warning systems, removing and/or relocating existing warning systems and modifying/upgrading existing warning systems. This also pertains to preemption projects.

Each crossing has a unique DOT inventory identification number posted at the crossing. There is often more than one crossing on the same road. The number (i.e., DOT 654321D) must be used to identify the specific crossing in all communications with the Railroad to reduce possible confusion about the specific location.

Highway-rail grade crossing warning systems must adhere to all applicable federal and state standards and regulations; all local policies, laws, and ordinances; as well as the Railroad's standards. The state DOT and highway agency, not the Railroad, is responsible for determining the level of protection and configuration of warning devices for a public highway-rail grade crossing. In addition, the highway agency or other governmental agency responsible for making warning system and equipment determinations is responsible for selecting appropriate vehicular traffic control signs and/or devices for a specific public highway. Loop detection circuitry will not be designed, installed, owned, or maintained by the Railroad.

The highway agency must determine whether advanced or simultaneous preemption is needed. The agency must also provide a traffic study to determine how much advanced preemption time is required if needed. The Railroad as well as AREMA and MUTCD discourage the use of excessive preemption times. The Railroad will furnish one preemption interconnection circuit of a normally closed contact that is designed to open upon the approach or presence of a train and will terminate the closed preemption interconnection circuit in a common cable junction box (set at ROW line) to be used for the interconnection of the traffic signals and the grade crossing warning devices.

Recommended practices and additional information are available in AREMA and the MUTCD.

The Railroad will provide engineering reviews, signal designs, and cost estimates for the installation of highway-rail grade crossing warning devices at the expense of the project sponsor as part of the preliminary engineering for a project. Changes to highway-rail grade crossing surfaces may also require engineering and pre-approval by the Railroad. Installation or modification of warning devices must be supervised and performed by a qualified entity as determined by the Railroad.

The Railroad typically does not allow the mixing of different equipment. If additional gates or equipment is added to a location, the entire location should be redesigned and upgraded to the latest standard.

If the roadway footprint changes in width, including adding a sidewalk or multiuse path, an easement review must be completed prior to the project construction start (**see Section 1.09**).

Process

- Agency requests a diagnostic review.
- Agency sends review results, and PPD supplies agency with OOM estimate.
- Agency/sponsor and the Railroad enter into applicable contracts.
- PPD assigns a GEC to develop BOD, estimate to complete, and RFP.
- GEC solicits bids for design-build contractor.
- Contractor completes design and orders material.
- Utility concerns are resolved.
- Construct warning system.
- Testing and DOT signoff and update FRA.

Section 2.03 – Highway-Rail Grade Crossing Surface Maintenance

Summary

The crossing surface provides a path for highway vehicles to cross railroad tracks. The objective is to provide a safe, smooth, and cost-effective crossing for highway and railroad traffic. Highway and railroad maintenance work near highway-rail grade crossings must consider safety concerns for both highway and railroad traffic before, during, and after the work is implemented.

Each public crossing has a unique DOT inventory identification number posted at the crossing. There is often more than one crossing on the same road. The number (i.e., DOT 654321D) must be used to identify the specific crossing in all communications with the Railroad to reduce possible confusion about the specific location.

Railroad track is continuous through the crossing and includes railroad ties, rail, and fasteners below the surface of the crossing (joints shall not be made within the crossing). The crossing surface for highway traffic can be made of several different materials. Drainage is required for all four quadrants at a crossing.

Crossing surface material and construction methods are selected for each crossing based on the type of highway and railroad traffic, past experience, and funding available from highway agencies for individual projects. Highway agencies seeking replacement of crossing surfaces should contact PPD. The request for the work and the recommended surface must be reviewed and approved by the Railroad.

Crossing work requires closing the entire highway-rail grade crossing. Replacement of track components through a crossing requires removal of the crossing surface, replacement of track ballast, and surfacing the

track through the crossing prior to replacement of the crossing surface. If the subgrade needs to be improved, the application of a hot mixed asphalt underlayment should be considered. Drainage will be reestablished for all four quadrants. After the crossing surface is replaced, the highway approach paving is completed and then the road is opened to highway traffic. Replacement of the track and crossing surface usually requires that the highway be closed for several days. In the event the agency wants to reopen the crossing prior to allowing the asphalt to properly cool, the agency is responsible for any rutting that may occur.

If the roadway footprint changes in width, including adding additional lanes, a sidewalk, or a multiuse path, an easement review must be completed prior to the project construction start (**see Section 1.09**).

Process

- Agency submits request to PPD.
- Agency and PPD research existing contractual requirements.
- Agency/sponsor and the Railroad enter into applicable contracts.
- The Railroad assigns GEC to develop estimate.
- The Railroad orders materials and schedules work.
- Reconstruct crossing:
 - Place barricades and close roadway.
 - Sawcut roadway.
 - Remove existing track panel, ballast, and sub-ballast.
 - Establish new foundation.
 - Install new track panel.
 - Run tonnage to settle system.
 - Install surface materials.
 - Install asphalt (and concrete if needed).
 - Let cool and cure.
 - Remove barricades.
- Cleanup.
- Agency signoff and update FRA.

Section 2.04 – Parallel Road Construction and Maintenance

Summary

New Roadway Construction

In the interest of public safety, parallel public roads shall be located off railroad property. Parallel roads involving intersections with existing or proposed highways where public or private crossings are present should be aligned to provide sufficient distance from the crossing for the largest vehicle (design vehicle) permitted to use the road to stop between the Railroad and the parallel road traffic control signs, markings, and warning devices without interfering with railroad operations, obstructing or preventing the operation of traffic control devices, or obstructing the crossing in any manner.

The design of highways and highway intersections and configuration of highway-rail grade crossings is the responsibility of the highway agency. Drainage for highway runoff, the railroad corridor, and adjacent property must be designed to reduce or maintain existing railroad drainage and to prevent standing water

and potential erosion. Access for railroad equipment to railroad property, structures, and track cannot be restricted or prevented.

Federal and state design manuals, the Manual on Uniform Traffic Control Devices (MUTCD), and additional recommended practices available in American Railway Engineering and Maintenance-of-Way Association (AREMA) manuals provide design information to be considered by the highway agency responsible for the project engineering. The table of contents of this document has additional information on the MUTCD and AREMA manuals and information.

If new construction encroaches on railroad property, an easement review must be completed prior to the project construction start (see **Section 1.09**).

Maintenance of Existing Roadway

Projects that are either parallel or bisect as roadway crossings within the Railroad's ROW require both a ROE and the use of a qualified flagman at the cost of the project sponsor (see **Section 1.09**).

Process

- Request a ROE through G&W Real Estate.
- Agency/sponsor and the Railroad will enter into applicable contracts, including contractor ROE agreement.
- Submit executed ROE and insurance documents to PPD.
- PPD coordinate with region to provide flagman.

Section 2.05 – Overhead and Undergrade Bridges

Summary

The Railroad requires that new overhead bridges (including existing bridge replacements) span the Railroad's right of way and have a minimum twenty-three feet (**23'-0"**) vertical clearance above top of rail. The Railroad requires that new undergrade bridges provide accommodations for future operating needs, as determined by the Railroad.

During project construction, rail operations must not be impeded. Temporary run-around track(s) and/or phased construction may be necessary as determined by the Railroad.

All bridge projects over or under the Railroad's ROW shall be governed by the appropriate criteria found in this document. This includes, but is not limited to, replacements, new construction, substructure modifications and/or repairs, superstructure replacement or repair, and deck replacement or overlay. The following criteria must be reviewed and approved by the Railroad prior to construction:

- Temporary and final drainage plans must be approved by the Railroad.
- The Railroad's access to its property must be maintained.
- Plans must show all tracks and horizontal and vertical track clearances for both the existing conditions and the proposed project.
- Bridge demolition criteria are found in the Construction Submission Criteria (see **Section 1.11**) in this document.
- Upon completion of construction, a full set of as-built drawings, showing actual measured vertical and horizontal clearances, shall be furnished to the Railroad.

If new construction is bisecting railroad property, an easement review must be performed prior to the project construction start (see **Section 1.09**). Please note that the project may require both a temporary construction easement and a permanent easement.

Process

- Agency/sponsor and the Railroad enter into applicable contracts.
- PPD assigns GEC.
- GEC works with the agency to gather easement documentation and ROE.
- GEC works directly with the agency and its contractor on submittal reviews.
- GEC sends agency an estimate to complete project.
- Agency schedules construction.
- The Railroad supplies flagman.
- GEC provides CEI services.
- Project completion when both the Railroad and agency signoff.
- Agency submits as-built plans.

Overhead Bridge Criteria

The Railroad has minimum requirements for outside parties constructing, rehabilitating, or replacing bridges over the Railroad's ROW. These requirements are intended to provide safe and continuous passage of all train traffic during and after construction of bridges over its tracks. Part of these requirements is for the outside party to submit a detailed plan of the project as well as provide details of the construction methodology. This document provides information on the requirements for overhead bridges over railroad property.

Plans and specifications for new or reconstructed bridges over the Railroad's ROW shall meet the following requirements:

General

- The Railroad's valuation station and the distance from the nearest milepost at the intersection of the centerline of the track and the centerline of the bridge shall be shown on the general plan.
- The existing and proposed minimum horizontal and vertical clearances shall be marked clearly on the general plan and elevation.
- At least one subsurface exploration boring for each substructure unit adjacent to the track shall be furnished to the Railroad during the design submittal. Borings shall provide enough information to design shoring and foundations.
- Prior to construction activities, all overhead bridge projects will require the procurement of the appropriate property rights from G&W Real Estate.
- All lifting equipment and connection devices shall have capacity for 150% of the actual lifting load. The factor of safety provided by the manufacturer in the lifting capacity data shall not be considered in the 150% requirement. A licensed professional engineer familiar with lifting and rigging and in the state where the construction work is proposed must sign and seal all plans and calculations related to critical lifting on the project.

Clearance

- Horizontal Clearance: Standard horizontal clearance from the centerline of the track to the face of the pier or abutment shall typically be twenty-five feet (25'-0") or greater, but never less than eighteen feet (18'-0"), measured perpendicular to the track. Provisions for future tracks, access roads, other railroad facilities, and drainage may require the minimum clearance be increased or the use of multi-span

structures. The toe of footings shall not be closer than eleven feet (11'-0") from the centerline of the track to provide adequate room for sheeting.

- Vertical Clearance: A standard vertical clearance of twenty-three feet (23'-0") shall be provided, measured from top of high rail to lowest point of structure in the horizontal clearance area, which extends six feet (6'-0") either side of the centerline of the track.
- Temporary construction clearances to be used shall be subject to approval by the Railroad, (typically reductions in clearance for construction are not permitted).
- As-built drawings showing actual clearances as constructed are to be provided to the Railroad.

Crashwalls

- Reference the AREMA specifications that cover the requirements for crashwalls. Crashwalls are required when the face of the pier is closer than twenty-five feet (25'-0") from the centerline of the track, measured perpendicular to the track, except as noted below.
- Crashwalls shall meet the following requirements:
 - Crashwalls for single column piers shall be minimum two feet six inches (2'-6") thick and shall extend a minimum of six feet (6'-0") above the top of high rail for piers located between eighteen feet (18'-0") and twenty-five feet (25'-0") from the centerline of the nearest track. The wall shall extend minimum six feet (6'-0") beyond the column on each side in the direction parallel to the track.
 - For multi-column piers, the columns shall relate to a wall of the same thickness as the columns or two feet six inches (2'-6"), whichever is greater. The wall shall extend a minimum of two feet six inches (2'-6") beyond the end of the outside columns in a direction parallel to the track.
 - Reinforcing steel to adequately anchor the crashwalls to the column and footing shall be provided. For piers of heavy construction, crashwalls may be omitted. Solid piers with a minimum thickness of two feet six inches (2'-6") and length of twenty feet (20'-0"), single column piers of minimum four feet by twelve feet six inches (4'-0" x 12'-6") dimensions, or any other solid pier sections with equivalent cross sections and minimum two feet six inches (2'-6") thickness are considered as heavy construction.

Drainage

Drainage from the bridge shall be preferably collected with drain pipes and drained away from the Railroad's ROW. When open scuppers are provided on the bridge, none shall be closer than twenty-five feet (25'-0") from the centerline of nearest track. Flow from the scuppers shall be directed away from railroad drainage ditches.

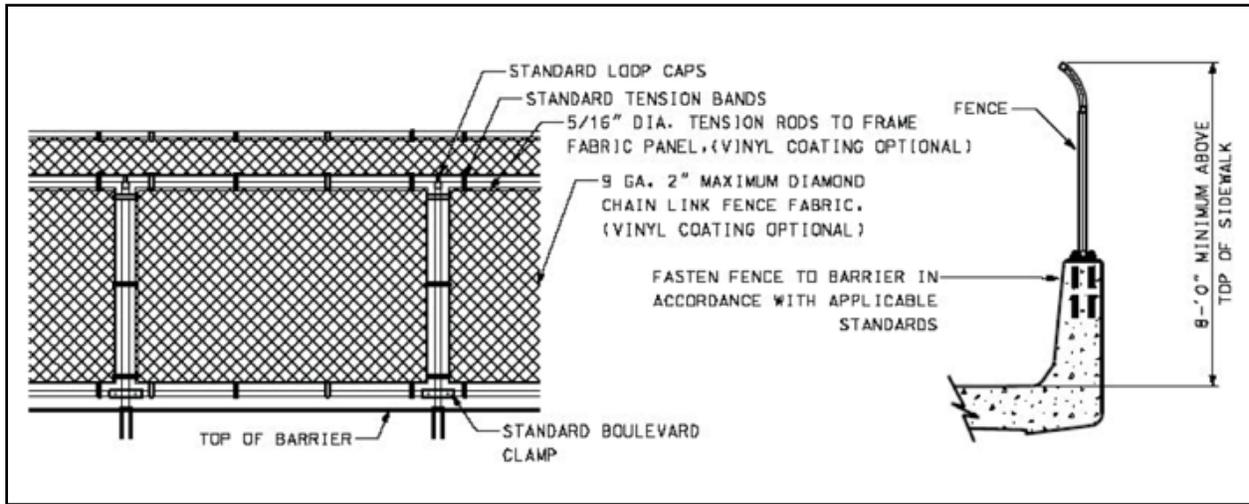
Projects including storm water systems shall be designed for a **100-year storm event** as a minimum. If storm water is drained on or to the Railroad ROW, calculations must be submitted to the Railroad to verify the **100-year storm event** is properly handled. Improvements to the adjacent drainage systems may be required at project expense to ensure the impacted system will meet the **100-year storm event** minimum condition.

During and after completion of construction, the outside party or its contractor must clear the Railroad's drainage ditches of all debris to the satisfaction of the Railroad.

Fencing

All highway structures shall have a protective barrier fence to extend at least eight feet (8'-0") from the top of the sidewalk or driving surface adjacent to the barrier wall. The fence may be placed on top of the barrier wall. The fence shall be capable of preventing pedestrians from dropping debris onto the Railroad's ROW.

Openings in the fence shall not exceed two inches by two inches (2" x 2"). Fencing should also include anti-climb shields or be of a configuration to minimize the likelihood of climbing on the outside of the protective fencing. A chain link fence option is shown below.



Excavation and Shoring

Shoring protection shall be provided when excavating adjacent to an active track. Shoring will be provided in accordance with AREMA, except as noted below.

Shoring will not be required if both the following conditions are satisfied:

- Excavation does not encroach upon a 1 horizontal to 1 vertical theoretical slope line starting at bottom corner of tie (theoretical live load influence zone).
- Track is on level ground or in a cut section and on stable soil.

When the track is on an embankment, excavating the toe of the embankment without shoring may affect the stability of the embankment. Therefore, excavation of the embankment toe without shoring will not be permitted.

Preferred protection is the cofferdam type that completely encloses the excavation. Where dictated by conditions, partial cofferdams with open sides away from the track may be used. Cofferdams shall be constructed using steel sheet piling or steel soldier piles with timber lagging. Wales and struts shall be provided as needed. The following shall be considered when designing cofferdams:

- Shoring shall be designed to resist a vertical live load surcharge of **1,882 lbs.** per square foot, in addition to active earth pressure. The surcharge shall be assumed to act on a continuous strip eight feet six inches (**8'-6"**) wide. Lateral pressures due to surcharge shall be computed using the strip load formula shown in AREMA.
- Allowable stresses in materials shall be in accordance with AREMA.
- A construction procedure for temporary shoring shall be shown on the drawing.
- Safety railing shall be installed when temporary shoring is within fifteen feet (**15'-0"**) of the centerline of the track.
- A minimum distance of ten feet (**10'-0"**) from the centerline of the track to the face of nearest point of shoring shall be maintained.

The contractor shall submit the following drawings and calculations for the Railroad's review and approval:

- Detailed drawings of the shoring systems showing sizes of all structural members, details of connections, and distances from the centerline of the track to the face of shoring. Drawing shall show a section that includes the height of shoring and track elevation in relation to the bottom of excavation.
- One set of calculations of the shoring design.
- The drawings and calculations shall be prepared by and bear the seal and signature of a licensed professional engineer in the state where the shoring is to be constructed. Shoring plans shall be approved by the Railroad.
- For sheeting and shoring within eighteen feet (18'-0") of the centerline of the track, within the theoretical live load influence zone, and in slopes, the contractor shall use sheet pile. No sheet pile in slopes or within eighteen feet (18'-0") of the centerline of the track shall be removed. Sheet piles shall be cut off three feet (3'-0") below the finished ground line. The remaining three feet (3'-0") shall be backfilled and compacted immediately after cutting off.

Demolition of Existing Structure

The contractor shall submit a detailed procedure for demolition of existing structures over or adjacent to the Railroad's ROW. The procedure shall clearly indicate the capacity of cranes, location of cranes with respect to the tracks, and calculated lifting loads. The demolition procedure shall be approved by the Railroad.

The Railroad's tracks, signals, structures, and other facilities shall be protected from damage during demolition of existing structure or replacement of deck slab. As a minimum, both of the following methods shall be used:

- During demolition of the deck, a debris shield shall be erected from the underside of the bridge over the track area to catch falling debris. The shield shall be supported from girders or beams. The deck shall be removed by cutting it in sections and lifting each section out. The shield shall be designed, with supporting calculations, for a minimum of **50 pounds** per square foot plus the weight of the equipment, debris, personnel, and other loads to be carried.

Large pieces of deck shall not be allowed to fall on the debris shield:

- A ballast protection system consisting of geofabric or canvas shall be placed over the track structure to keep the ballast clean. The system shall extend along the track structure for a minimum of twenty-five feet (25'-0") beyond the limits of the demolition work, or farther if required by the Railroad.
- The contractor shall submit detailed plans, with supporting calculations, of the debris shield and ballast protection systems for approval prior to the start of demolition.
- Blasting will not be permitted to demolish a structure over or within the Railroad's ROW.

Erection

The contractor shall submit a detailed procedure for erecting over or adjacent to ROW. The procedure shall clearly indicate the capacity of cranes, location of cranes with respect to the tracks, and calculated lifting loads. The erection procedure shall be approved by the Railroad.

Pile Installation

For the installation of piles and sheeting for abutment foundations, pier foundations, retaining wall foundations, temporary and permanent shoring, and other structures on or adjacent to the Railroad's ROW, the contractor may be required to submit a detailed track monitoring program for review and approval by the Railroad.

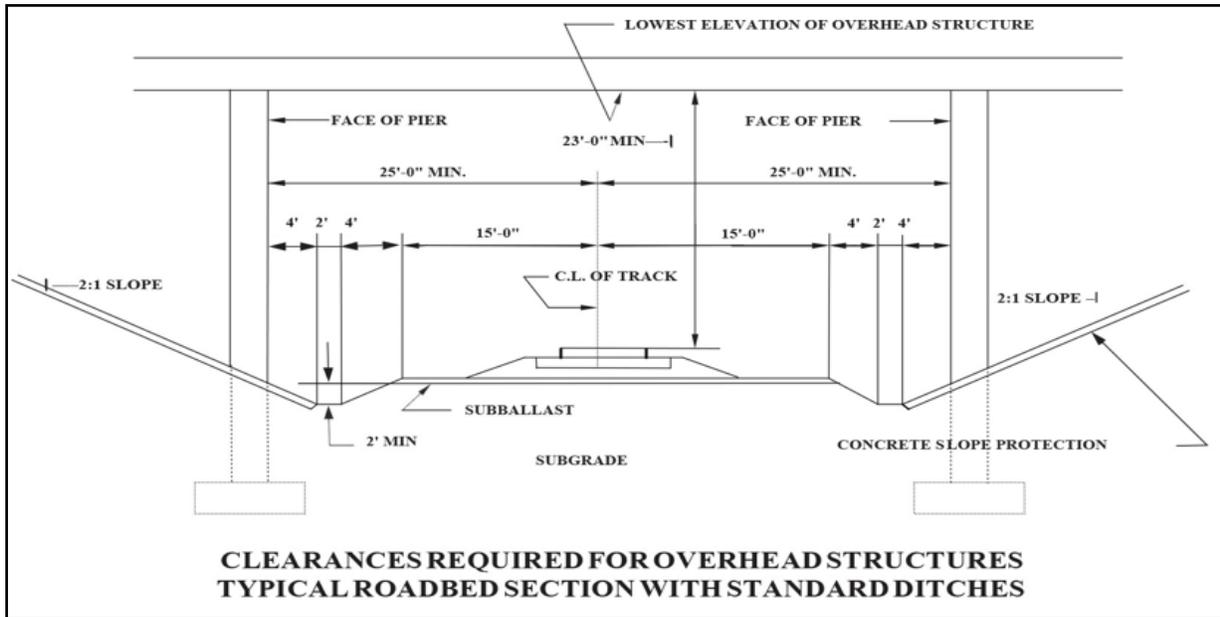
The program shall specify the survey locations, the distance between the location points, and the frequency of monitoring before, during, and after construction. The Railroad shall have the capability of modifying the survey locations and monitoring frequency as needed during the project.

If any settlement is observed, the Railroad shall be immediately notified. The Railroad shall have the right to immediately require all contractor operations to be ceased, have the excavated area immediately backfilled,

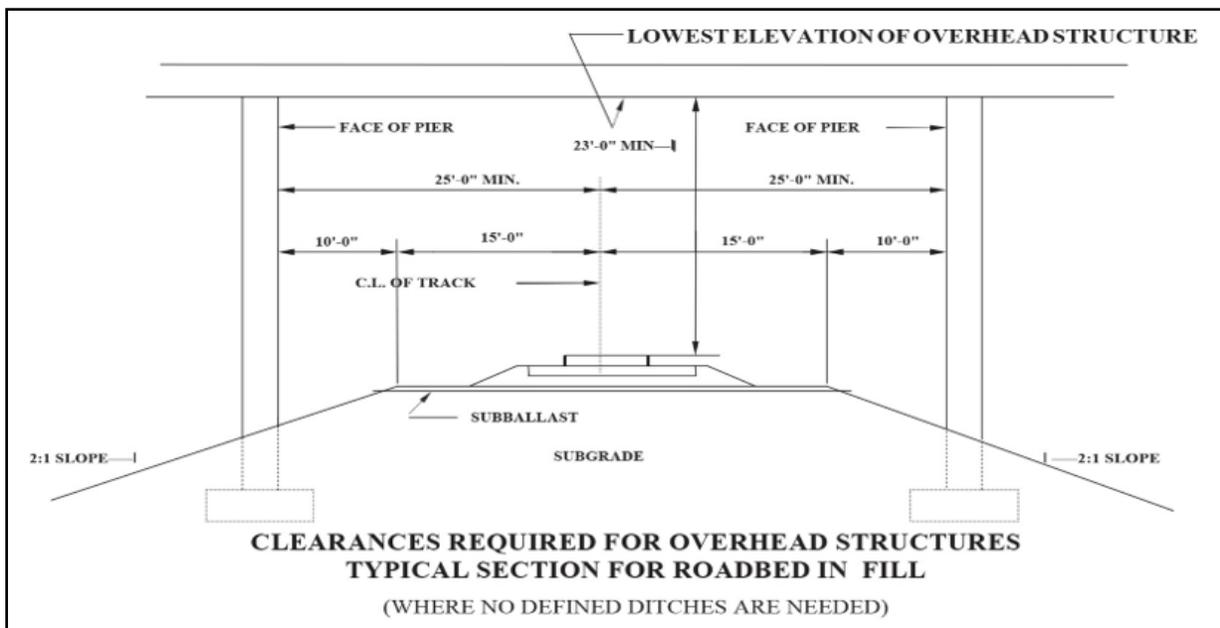
and/or determine what corrective action is required. Any corrective action required by the Railroad or performed by the Railroad, including the monitoring of corrective action of the contractor, will be at project expense.

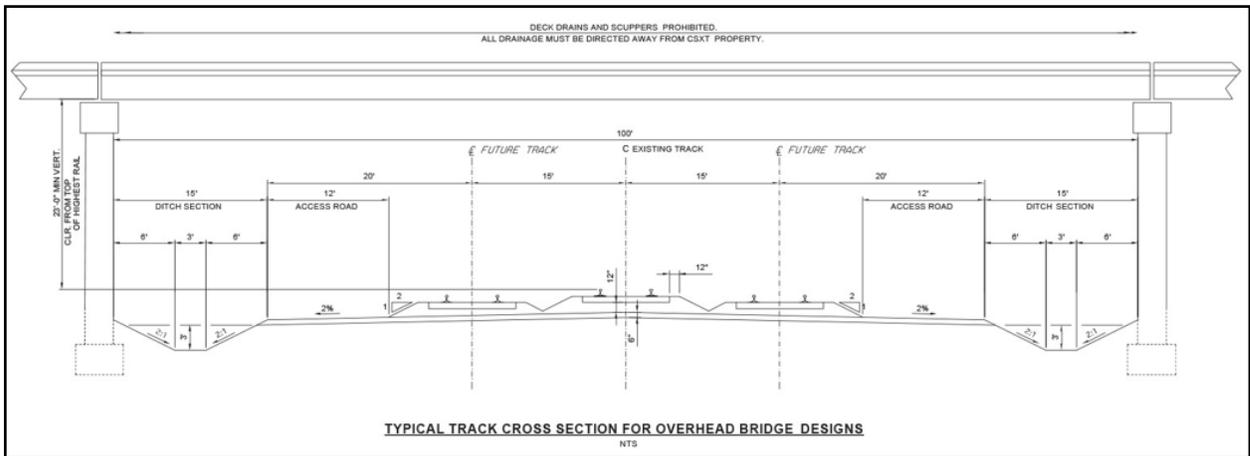
Pedestrian Bridge

- Pedestrian overhead bridges shall span the entire width of the Railroad’s ROW. Intermediate piers or other supports will not be permitted.
- Pedestrian overhead bridges shall be completely enclosed with protective canopy or by other means to prevent users from dropping debris onto the Railroad’s ROW.



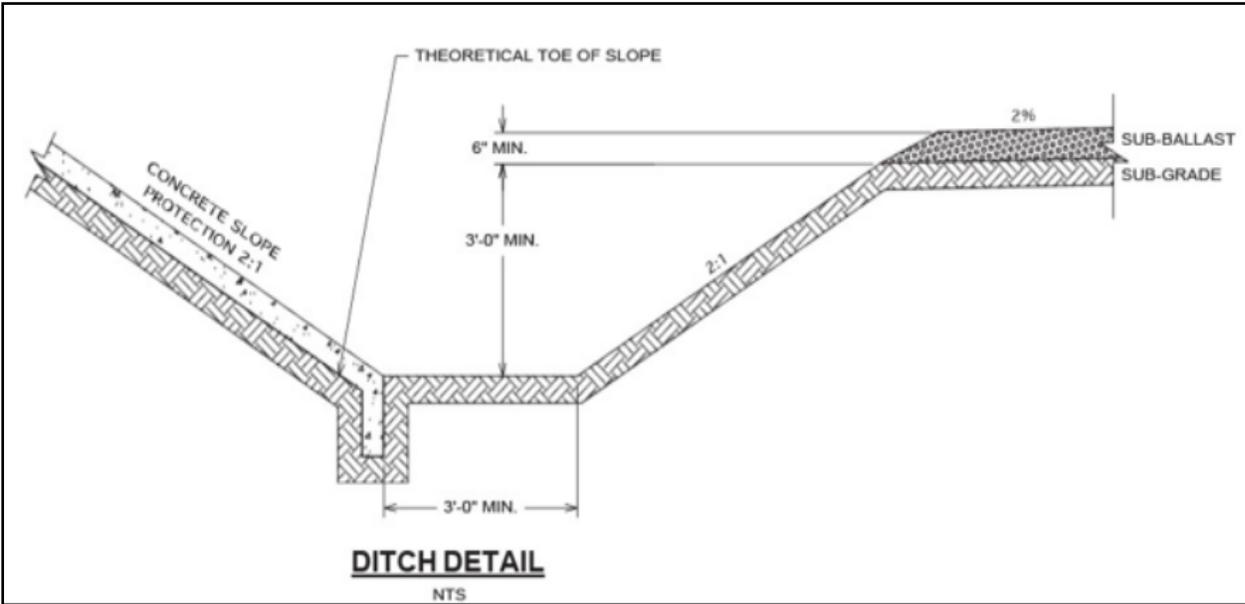
For multiple tracks, standard track centers are fifteen feet (15'-0") wide. An access road may be required to provide thirty-three feet (33'-0") minimum distance from the centerline of the track to the face of the pier.





The following applies to the typical cross section for bridges:

- Clear span width should account for the number of existing tracks at the specific project site. Each additional track adds fifteen feet (**15'-0"**) to the clear span width calculation.
- Horizontal dimensions shown are perpendicular to center of track.
- Crashwalls may be required based on specific parameters.
- Actual required horizontal clearances may need to be increased due to existing roadbed section, location of parallel ditches, hydrological conditions, and future track requirements.
- Theoretical toe of slope is based on the standard roadbed section. Actual toe of slope may vary due to ground line.
- The ditch section shown is the minimum acceptable section.
- The ditch section is to be increased as required by local conditions, based on hydrological and hydraulic studies.
- Horizontal dimensions shown are the minimum that will allow the construction of railroad standard roadbed section.



Undergrade Bridge Criteria

AREMA shall serve as the overarching authority for recommended practice in designing railroad bridges. The intent of this document is to provide criteria that supplements, modifies, and/or supersedes the applicable sections of AREMA for designing undergrade railway bridges that are to be owned and/or operated on by the Railroad. Additionally, these requirements help guide an outside party through the necessary procedures for interacting with the Railroad and delivering an acceptable structure that is constructible, inspectable, maintainable, long lasting, and reliable.

General

Bridge shall be designed in accordance with the applicable specifications from the current edition of AREMA. Applicable sections may include, but are not limited to, the following:

- Chapter 8 Concrete Structures and Foundations
- Chapter 9 Seismic Design for Railway Structures
- Chapter 15 Steel Structures

Special Considerations

- AREMA recommendations for dampproofing and deck waterproofing.
- Coating of structural steel shall be performed in accordance with AREMA.
- Bridge shall be located to provide optimal railroad geometry.

Construction Specifications

- Shall be in accordance with AREMA recommendations for fabrication and erection.
- Items not covered by shall be governed by applicable DOT specifications from the commonwealth, district, province, or state where the bridge is being constructed.

Non-traditional bridge systems require written notice of acceptance by the Railroad. The proposed use of such a system shall be presented for review with thorough investigation, data, and detailed engineering justification.

Bridge Layout

The general plan drawing of the bridge shall show the Railroad valuation stations at the front face of backwalls, and centerline of piers or bents, along the centerline of the bridge. Distance from front face of low milepost backwall to low milepost nearest the bridge shall also be shown. The following criteria will serve as a guide for labeling the bridge layout.

- Railroad bridges are laid out in direction of increasing milepost, increasing from left to right on plans.
- Plans should denote the railroad direction and the nearest significant terminal or junction leading away from either end of the bridge.
- For through plate and truss bridges, the substructures are numbered starting with zero and increasing in the direction of increasing mileposts.
- Superstructures are numbered starting with 1 and increasing in the direction of increasing mileposts.
- Floor systems of through plate girder, through truss, and deck truss spans are numbered starting with 0 and increasing in the direction of increasing mileposts.
- Bridge components are numbered from left to right facing the direction of increasing milepost.

Low mile post backwall GPS coordinates shall be detailed on plans in degrees-minutes-seconds or decimal format with precision to six decimal places.

For bridges on curves, the girders, abutments, and piers shall be located with reference to chords.

Clearances

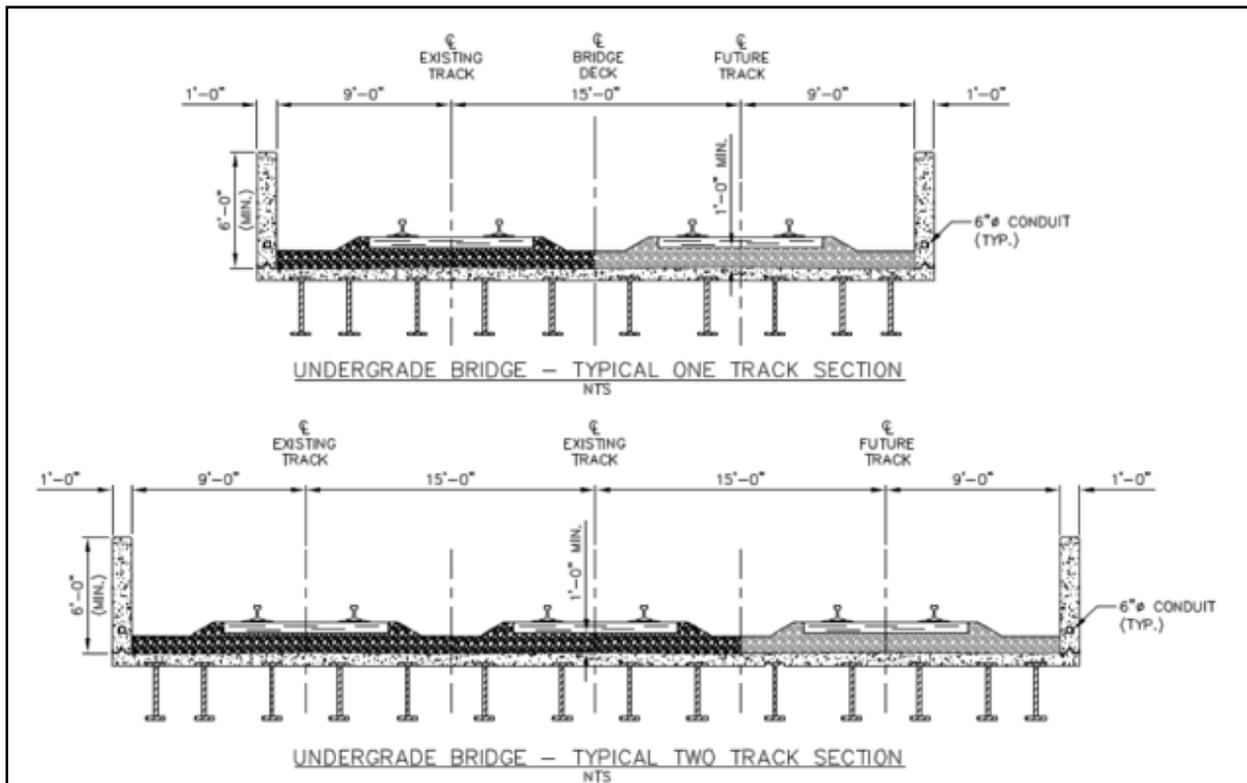
Under Bridge Vehicular Clearances

- Undergrade structures shall be designed to ensure that the structure will be protected from oversized or unauthorized loads by providing sufficient vertical clearance and protective devices. Provide a minimum vertical clearance over the entire roadway width for all new or reconstructed structures as follows:
 - Sixteen feet six inches (**16'-6"**) for steel superstructure with 5 or more beams or 4 or more deck plate girders per track.
 - Seventeen feet six inches (**17'-6"**) for steel through plate girders or less than 4 deck plate girders per track with bolted bottom flanges.
 - Twenty feet (**20'-0"**) for steel through plate girders or less than 4 deck plate girders per track with welded bottom flanges.
 - Vertical clearance must not be violated due to the deflection of the superstructure.
- Roadway profile and design roadway vehicle information shall be provided and considered in vertical clearance design.

Bridge Clearances

- Standard clearances on the bridge shall not be modified without written notice of approval by the Railroad. Any proposed modification shall be furnished with detailed engineering justification for review.
- Commonwealth, district, provincial, or state clearance laws must not be violated. Legal requirements must be upheld unless written permission for waiver is provided by the appropriate regulatory authority.
- Adequate clearance and capacity shall be provided for a future track.
- Track centers shall not be closer than fifteen feet (**15'-0"**).

- Minimum horizontal clearance on the bridge shall be provided as shown below:



- Standard clearances are for tangent track and increases must be provided to account for effects from curvature and superelevation.

Design Loads

Railroad bridges shall be designed for all loads specified in AREMA.

Live loads for steel structures shall consider both the **Cooper E80** loading and the alternate live load with full diesel impact, whichever produces the greater stress. Live loads for concrete structures shall consider **Cooper E80** loading with full diesel impact.

All bridges shall be designed with non-composite interaction between superstructure and deck. Mechanical connections shall be provided as necessary to satisfy design load requirements.

The weight of the minimum ballast depth one foot (**1'-0"**) plus an additional two feet (**2'-0"**) of ballast below the tie shall be included when computing the dead load of the structure.

Plans and Submittals

Preliminary Plans

- An electronic copy of type, size, and location (TS&L) plans shall be submitted to the Railroad for review and acceptance. The TS&L plan shall show plan view, elevation, and typical cross section of the proposed structure. Railroad acceptance must be granted before proceeding with design.
- Furnish cross sections showing the AREMA clearance envelope, topographic map with contours, and soil exploration data along with TS&L plans. Railroad acceptance must be granted before proceeding with design.

- The Railroad will assign a bridge designation (railroad, region, subdivision, MP) when TS&L plans are reviewed. This bridge designation shall be shown on all drawings.

Construction Work Plans

- The Railroad may require construction work plans to be submitted, particularly when work is being performed in the proximity of an active track, with potential to foul.
- All construction work plans shall be submitted in accordance with the Construction Submission Criteria (see Section 1.11).

Material Submissions

- Structural steel shop drawings shall be provided for review and acceptance prior to ordering material. Welding procedures shall be submitted with the structural steel shop drawings.
- Concrete mix designs shall be submitted for review and acceptance prior to ordering material.
- Third party testing reports shall be provided for review and acceptance in a timely manner.
- All other materials shall be provided in accordance with the plans. All materials shall be reviewed and approved by the agency or its representative. Proposed changes are subject to review and acceptance. Approved material submissions shall be furnished to the Railroad for confirmation and project documentation.

Final Plans

- Provide electronic set of final signed and sealed design plans and calculations for acceptance.
- Submit special provisions or special specifications for acceptance.
- Provide an electronic set of as-built plans to the Railroad upon completion of construction. All changes shall be noted and clearly called out on a redlined set of as-built plans. All pages shall be clearly marked "AS-BUILT" and include the date of completion.

Construction Considerations

After a construction contract is awarded, a copy of the contract shall be provided to the Railroad.

Maintenance of Railroad Traffic

- It is essential that the construction be performed with minimum interference to rail traffic. Continuity of safe rail operations will be required for the duration of the project.
- The agency's design engineer should contact the PPD in the preliminary design stage to determine railroad operational requirements. The most effective method of maintaining traffic is to temporarily reroute traffic around the construction site using detour tracks. Detour tracks will be required where feasible. If detour tracks cannot be provided, the new superstructure shall be constructed adjacent to final location and rolled into place. Construction plans shall show complete details of temporary bridges and/or roll-in structure.
- A detailed construction procedure for maintaining traffic shall be shown on the plans. When construction requires total interruption of rail traffic, an estimate of the time required will be shown in the procedure. This interval must be within the approved time frame furnished by PPD.
- Prior to the start of construction, written approval from the Railroad for the construction procedure must be secured.

Bridge Decks

Walkways and Parapets

- Deck shall be a uniform ballast pan across all tracks and provide for a ballast walkway between all tracks and on the field side of the exterior tracks. Intermediate curbs shall not be permitted.
- All exterior walkways shall utilize the uniform ballast pan and be equipped with a **72-inch**-tall parapet wall, measured from top surface of bridge deck. Parapet walls should each include two six-inch ducts to accommodate signal and utility needs.
- Walkways and parapets shall be designed to satisfy the requirements specified by AREMA.

Minimum ballast depth shall be one foot (**1'-0"**) measured from top of deck waterproofing to the bottom of tie at the centerline of the low rail. This dimension shall be clearly labeled on cross section drawings.

On bridges, timber crossties (**7" x 9" x 8'6"**) shall be used, spaced at **19"** centers. Alternatively, concrete crossties may be used also at **20"** centers or steel crossties may be used at **24"** centers.

Track material shall be subject to review by the Railroad at project expense.

Steel Deck Plates

- Steel deck plates shall be shop welded with a pair of **5/16-inch** continuous fillet welds to each floor beam or deck girder. Deck units shall be shop assembled with multiple beams per unit, and areas to be field welded shall be masked and field painted after welding is complete.
- The closing deck plate between adjacent deck units shall be fillet welded to the beams with continuous **5/16-inch** fillet welds at each beam. After deck plates are welded to the beam, space between deck plates shall be filled at the joint with material compatible with deck waterproofing membrane.
- The minimum thickness of steel deck plates shall be as follows:

<u>Plate Thickness</u>	<u>Maximum Clear Distance Between Beams</u>
½ inch	1'-6"
5/8 inch	2'-0"
¾ inch	2'-4"

- For multiple deck girders with steel deck plates:
 - Provide a welded field splice in the deck plate at or near the centerline of bearing of the girders. Provide a closing deck plate from the abutments to this field splice that is normal to the girders and normal to the long direction of the main deck plates. This will avoid splicing deck plates over the back wall.
 - Outside girders shall be spaced such that deck plates will not overhang the flange of the outside girders by more than 2 inches and a concrete parapet wall shall be provided. The wall shall be securely anchored to the deck girder and have a minimum width of **12 inches** at the top.

Concrete Decks

- Bridge deck shall have adequate anchorage to the bridge superstructure. Shear studs shall not be permitted.
- The outside edge of the slab shall be not more than one foot six inches (**1'-6"**) from the centerline of the outside (fascia) girder.
- Provide a drip edge on the outside edge, bottom face of the deck slab.

Deck Drainage & Waterproofing

- Top surface of waterproofing protection shall have a minimum transverse slope of **1/8"** per foot with a crown at the centerline of the deck.
- Top surface of waterproofing protection shall have a minimum longitudinal slope of **0.5%**.
- Concrete decks shall be designed and constructed to provide the required slopes and to direct water to deck drains.
- When the deck is level or slopes less than **0.5%**, underlayment is to be used to provide required slopes.
- Deck drains shall be cast iron and downspouts shall be ductile iron. Deck drains shall have a grate or perforated cover. Downspouts shall be provided with cleanouts at each change in direction.
- All bridge decks shall be waterproofed using membrane waterproofing.
- All deck joints between spans shall be watertight.
- Waterproofing shall be applied to the entire surface of the deck and the bottom three feet (**3'-0"**) of inside faces of parapets or curb plates. Materials and construction are to be in accordance with AREMA, Chapter 8.

Superstructure

All bridges shall be composed of simple spans. Continuous spans are prohibited, and skewed spans are discouraged.

Design shall provide accommodations for future maintenance. Jacking locations as well as jack sizing shall be specifically denoted and laid out in the bridge plans. Jacks shall be sized to accommodate full dead load, including future ballast.

Welded Plate Girders

- A full penetration groove weld shall be used for flange to web connection.
- No more than two flange section transitions will be permitted without special permission.
- When a lateral bracing system is required as recommended by AREMA, girder connections shall be bolted.
- Jacking stiffeners are required at all end diaphragms. These locations must be specifically called out in the plans.
- Bearing stiffeners shall be welded or milled to bear for both top and bottom flanges.
- All cross frames shall be designed in accordance with AREMA recommendations.

Through Plate Girders

- Through plate girder bridges are only permitted for double track bridges. The use of intermediate girders in double track applications will not be permitted.
- Floor beam brackets (or knee braces) are stiffened diagonal plates that are bolted to the top flange of the floor beams and to vertical stiffeners on the through girder and shall be designed to satisfy AREMA recommendations.
- All stringers shall frame into floor beams.
- End floor beams and connections shall be designed such that the bridge can be jacked up by placing jacks between the end floor beams and pier or abutment. Jacking stiffeners shall be provided at points of jacking.

- Intermediate floor beams shall frame into the girder web using double connection angles and high strength bolts.
- All stringers shall have top and bottom flanges clipped at an angle not greater than **45 degrees** to permit field removal and installation.

Substructure

Design shall provide accommodations for future maintenance. Jacking locations as well as jack sizing shall be specifically denoted and laid out in the bridge plans.

Abutments and Wing Walls

- Abutment shall be designed in accordance with recommendations of AREMA, Chapter 8.
- The minimum abutment width shall be sufficient to provide for fifteen feet (**15'-0"**) track centers and standard road bed section.
- Wing walls shall be designed to support 2 horizontal to 1 vertical embankment slope as well as a level approach to the bridge walkways. MSE and sheet pile walls are not permissible.
- Provide minimum clearance necessary between end of structural steel and face of backwalls to accommodate expansion, but not less than two inches at each end.
- Provide keyways and water stops at all construction joints. Water stops shall be a hollow bulb **PVC 9" X 3/8"** (**bulb ¾ inch inside diameter, 1½ inch outside diameter**) continuous across joint.
- Two feet of porous backfill, measured horizontally, shall be provided full height below sub-ballast, behind all abutments and wing walls.
- Provide adequate drainage behind abutments and wing walls utilizing perforated pipe drains at the base of the abutments and wing walls. When abutment geometry does not allow for perforated pipe drains, weep holes may be required.
- Non-perforated pipe shall be connected to the perforated pipe and drain away from the bridge with a **1% minimum slope**.

Piers

- Width of pier shall be minimum four feet (**4'-0"**), measured at the bearing seat.

Section 2.06 – Cleaning and Painting of Bridges

Summary

Requests are occasionally made by outside parties for various beautification projects, including painting of overhead and undergrade bridges. These requests are considered on a case-by-case basis by the Railroad. The cost of painting and future aesthetic maintenance will be the responsibility of the project sponsor proposing to paint the bridge.

All work over railroad property has the potential to impact rail operations. The Railroad will review bridge painting and cleaning projects to ensure environmental and engineering standards are met. This review, flagging protection, and construction monitoring costs will be paid for by the project sponsor.

Process

- Project sponsor engages a public entity (unless the public entity is the sponsor).
- Sponsor contacts PPD to identify objective.

- Agency/sponsor and the Railroad enter into applicable contracts.
- PPD assigns GEC to receive and review submittals.
- Agency contractor to request ROE.
- Agency/sponsor indicates number of days on/over/around railroad property.
- GEC supplies estimate to complete, including flagmen coverage.
- GEC helps to coordinate an onsite flagman.
- Project work (onsite CEI may be required).
- Site cleanup.
- The Railroad and agency signoff.

General

All proposals must comply with the Railroad's safety and environmental regulations and must not impact railroad property or operations. The public agency or its designee will be responsible for maintenance of the painted surfaces, including aesthetic damage caused by highway vehicles and vandalism. The Railroad will incur no costs or liabilities as a result of the project.

A written request by the party wishing to undertake such a project should be forwarded to the PPD for handling. The request should include information about the situation and the project objectives to assist with completion of the review. The following information should be included:

- The project sponsor and public agency that will execute appropriate agreements for implementation as well as future maintenance of the painted surfaces.
- Paint specifications, including color of the paint, that meet the Railroad's standards and methods for surface preparation, cleanup, and paint application.
- Qualifications and experience of the painting contractor. The Railroad will accept state qualified bridge painting contractors working for the responsible agency or company.
- The materials removed during the surface preparation must not impact the surrounding area, including ground, water, or air. Materials must not be stored on railroad property.
- Control of paint overspray and vapors during application. The work must be done complying with appropriate regulations and overspray controlled to prevent damage to adjacent property and vehicles in the area.
- Containment system cleanup and disposal of all paint and other material removed from the bridge. The cleanup and disposal of material from the surface preparation for painting and actual painting must comply with all appropriate regulations.
- Pictures and conceptual drawing should be submitted with the initial request from the community to simplify the initial review and comment by the Railroad.
- Work site safety plan, including keeping all personnel away from the tracks and fall protection measures where required.

Section 2.07 – Quiet Zones

Summary

The Railroad will fully comply with the train horn rules as specified by the FRA, which provides requirements for the sounding of locomotive horns when approaching public highway-rail grade crossings.

The rule also provides guidance for conditions under which a public authority with jurisdiction over the roadway crossing railroad tracks may apply for and establish Quiet Zones. A Quiet Zone is a section of a rail line that contains one or more consecutive public crossings at which locomotive horns are not routinely sounded. (For full details on the rules, please visit the FRA web site at www.fra.dot.gov or contact the FRA's Office of Safety at 202-493-6299). While the complete responsibility for completion of a Quiet Zone analysis and application rests with the public authority, it should be done in conjunction with the Railroad.

Each crossing has a unique DOT inventory identification number posted at the crossing. There is often more than one crossing on the same road. The crossing number (i.e., 654321D) must be used to identify the specific crossing in all communications with the Railroad to reduce possible confusion about the specific location. The rule clearly defines requirements that must be satisfied by the public authority requesting that a Quiet Zone be established or continued.

Process

- Agency contacts the FRA on intent.
- Agency contacts PPD on intent.
- Agency/sponsor issues a legal reimbursement document or PE agreement.
- PPD assigns GEC.
- GEC will schedule a diagnostic review with agency/PPD/FRA/state DOT.
 - Please plan out your SSMs and ASMs in the FRA calculator prior to the site review.
- PPD to provide OOM for all SSMs and ASMs dictated by the review.
- Agency works with FRA to establish a notice of intent (NOI).
- Agency mails NOI and FRA calculator to PPD.
 - Please note that the estimate for ASMs and SSMs in the calculator is to not account for actual railroad expenses. For these, refer to OOM from PPD.
- All designs of ASMs and SSMs are reviewed by the Railroad at the expense of the agency.
- All ASMs and SSMs requiring modifications to the Railroad or signal system will be designed by the Railroad at the agency's expense (see Section 2.03).
- GEC supplies estimate to complete (including flagmen coverage if needed).
- Agency issues NTP for construction with a legal reimbursement document or construction agreement.
- Project work is completed (CEI may be required).
- The Railroad places "No Horn" signs.
- Agency and the Railroad signoff.
- Agency coordinates with FRA for final review.
- Agency works with FRA on notice of establishment (NOE).
- Agency mails certified copy of NOE to FRA/PPD/and state DOT.
- The Railroad complies within timeframe set in the rule.
- FRA database is updated.