220 Railroads

220.1 General

This chapter provides requirements for highway-railroad crossings on the State Highway System.

220.1.1 Railroad Companies

State-owned rail corridors include the Central Florida Rail Corridor and South Florida Rail Corridor.

Railroad companies currently operating in the state of Florida include:

(1) CSX Transportation, Incorporated

(2) Norfolk Southern Corporation

(3) Florida East Coast Railway Company

Short line railroad companies and terminal switching companies also operate in the state of Florida.

220.1.2 Work Near or Within Railroad R/W

A flagger must be present while any work within railroad R/W is being performed. Railroad companies often impose additional requirements as deemed necessary.

When roadway improvements are adjacent, near, above, or below the railroad R/W, there is potential for impacts to the railroad during construction or for construction materials and equipment to foul the tracks.

220.1.3 Required Coordination

Coordinate projects within or near railroad R/W as follows:

(1) New at-grade railroad crossings must be permitted in accordance with ***Section 335.141, Florida Statutes (F.S.)***. Early coordination with the Central Office is required concerning the Rail Crossing Opening/Closure Program.

(2) Coordinate the design of traffic control devices with the District Rail Coordinator who will then coordinate with the railroad company. Warning devices that are on within railroad R/W or interact with trains are installed by the railroad company.

(3) Coordinate with the District Traffic Operations Engineer to determine if a preemptive system is required.

(4) Coordinate with the Department's Central Office Freight and Multimodal Operations Office to determine if a highway-railroad at grade crossing is located within a designated Quiet Zone.

(5) Coordinate with the District Rail Coordinator when a waiver is being considered for standard lateral offset requirements for structures; see ***FDM 220.3.2***.

Some railroads may require an increase in Railroad Protective Liability Insurance greater than what is provided in the ***Standard Specifications***. The District Specifications Engineer and the District Rail Coordinator will develop a Modified Special Provision and submit it through the Central Specifications Office for special processing. For projects involving CSX Railroad use Special Provision SP0071303.

Modification for Non-Conventional Projects:
Delete ***FDM 220.1.3*** and see RFP for requirements.

220.2 Highway–Railroad At-Grade Crossing

The roadway should cross the railroad at an angle of or near 90 degrees.

Selection of the warning devices to be used is a function of the geometrics of highway-railroad at-grade crossing (e.g., alignment, profile, sight distance, cross section of both the roadway and the railroad), available R/W, and proximity to signalized intersections.

A highway-railroad at-grade crossing with a high-profiled vertical geometry is considered a "hump crossing" and can adversely affect the safety and operations of road users, posing a risk of low-clearance vehicles and trailers (e.g., low-profile vehicles, vehicles with long wheelbase, "lowboy" towing trailers) becoming stuck on the tracks. A hump crossing is defined as an at-grade crossing not meeting the dimensions and description of the detail entitled, "*Vertical Roadway Alignment Through A Railroad Crossings*" contained in ***Standard Plans***, ***Index 830-T01***.

Ensure all new construction and reconstruction at-grade crossings are in accordance with ***Standard Plans***, ***Index 830-T01***. For existing humped crossings to remain**,** install a Low Ground Clearance Grade Crossing (MUTCD W10-5) warning sign with LOW GROUND CLEARANCE (W10-5P) plaque**.**

Design considerations are discussed in the ***Florida Greenbook*** and the ***AASHTO Green Book***.

220.2.1 Traffic Control Devices

Traffic control devices (both roadway and pedestrian) for highway-railroad at-grade crossings consist primarily of signs, pavement markings, flashing light signals, and automatic gates. Consider the following when designing these devices:

(1) Roadway type

(2) Volume of vehicular traffic

(3) Volume of railroad traffic

(4) Speed of vehicular traffic

(5) Volume of pedestrian and bicycle traffic

(6) Crash data

(7) Geometrics of the crossing

Evaluate highway-railroad at-grade crossings and any of the following as a network to avoid blocking the crossing:

- Stop condition
- Roundabout
- Reduction in the number of lanes

Standards and criteria for design, placement, installment and operation of traffic control devices are located in the ***Manual on Uniform Traffic Control Devices (MUTCD),*** the Department's ***Standard Plans***, and ***Rule 14-57.013, Florida Administrative Code (F.A.C.)***.

When warning signs or signals are used in advance of a highway-railroad at grade crossing, they must be placed so as not to obstruct the view of the crossing signals.

220.2.1.1 Signing and Pavement Markings

Exhibits 220-1 through ***220-4*** provide typical signing and pavement markings for Active Grade Crossings. Refer to the ***MUTCD*** for definitions and signing and pavement markings at Passive Grade Crossings.

Do not place turning movement lane-use pavement markings on the upstream approach between the railroad crossing pavement message and the tracks.

Where intersections occur between the W10-1 sign shown in ***Exhibits 220-1*** through ***220-4*** and the tracks, place an additional W10-1 sign between the intersection and the railroad gate.

Include Railroad Dynamic Envelope (RDE) pavement markings at Active and Passive Grade Crossings on:

- State Roads,
- State-owned rails, and
- State-owned property.

Design Variations to not install an RDE are to be approved by the Chief Engineer.

The determination of slightly or significantly skewed railroad crossing is at the discretion of the EOR.

Detail RDE pavement markings in the Plans in accordance with ***Standard Plans, Index 711-001*** and the details shown in ***Exhibits 220-1*** through ***220-4***. Ensure the details in the plans include the following:

(1) Orient RDE pavement markings:

(a) In the direction of the travel lanes at all approaches upstream of the crossing (i.e., transverse to the travel lanes).

i. For slightly skewed railroads extend the RDE markings transverse across all lanes, as shown in ***Exhibits 220-2*** and ***220-3***.

ii. For significantly skewed railroads, step the RDE markings transverse across each lane, as shown in ***Exhibit 220-4***.

(b) Along the railroad (i.e., parallel to the railroad tracks) for areas between tracks and downstream of the crossing.

(c) To maximize the visibility of the RDE pattern for both the upstream and downstream sides of the track. Locate markings in a manner to ensure the "X" pattern is identifiable to the motorists and bicyclists and centered in the lanes to the extent practicable.

(2) Place RDE markings through the foul area as shown in ***Exhibits 220-3*** and ***220-4***. If the railroad owner will not allow the RDE markings through the foul area, or the substrate material will not provide an appropriate bonding surface for the markings, keep the RDE markings outside of the railroad's foul area as shown in ***Exhibits 220-1*** and ***220-2***.

(3) Replace all skip lane lines with solid lines for the following distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

(4) Continue solid longitudinal edge line, lane line, and centerline markings through the RDE pattern, maintaining a 9-inch clear space between the RDE pattern and the longitudinal lane lines or gore areas.

(5) Refurbish all existing longitudinal lane lines, edge lines, and centerlines to remain in-place for the following minimum distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

(6) Place RPMs at 10' maximum on center for the following distance: From stop bar to stop bar of each approach excluding the foul area, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

(7) For conditions where multiple tracks are configured non-parallel to each other, maintain the typical RDE pattern and fill the gap between the tracks, as necessary.

(8) RDE markings must not interfere with any pedestrian crosswalk.

(9) Consider extending the RDE markings beyond any railroad gates to reduce potential for railroad gates to close on top of stopped vehicles.

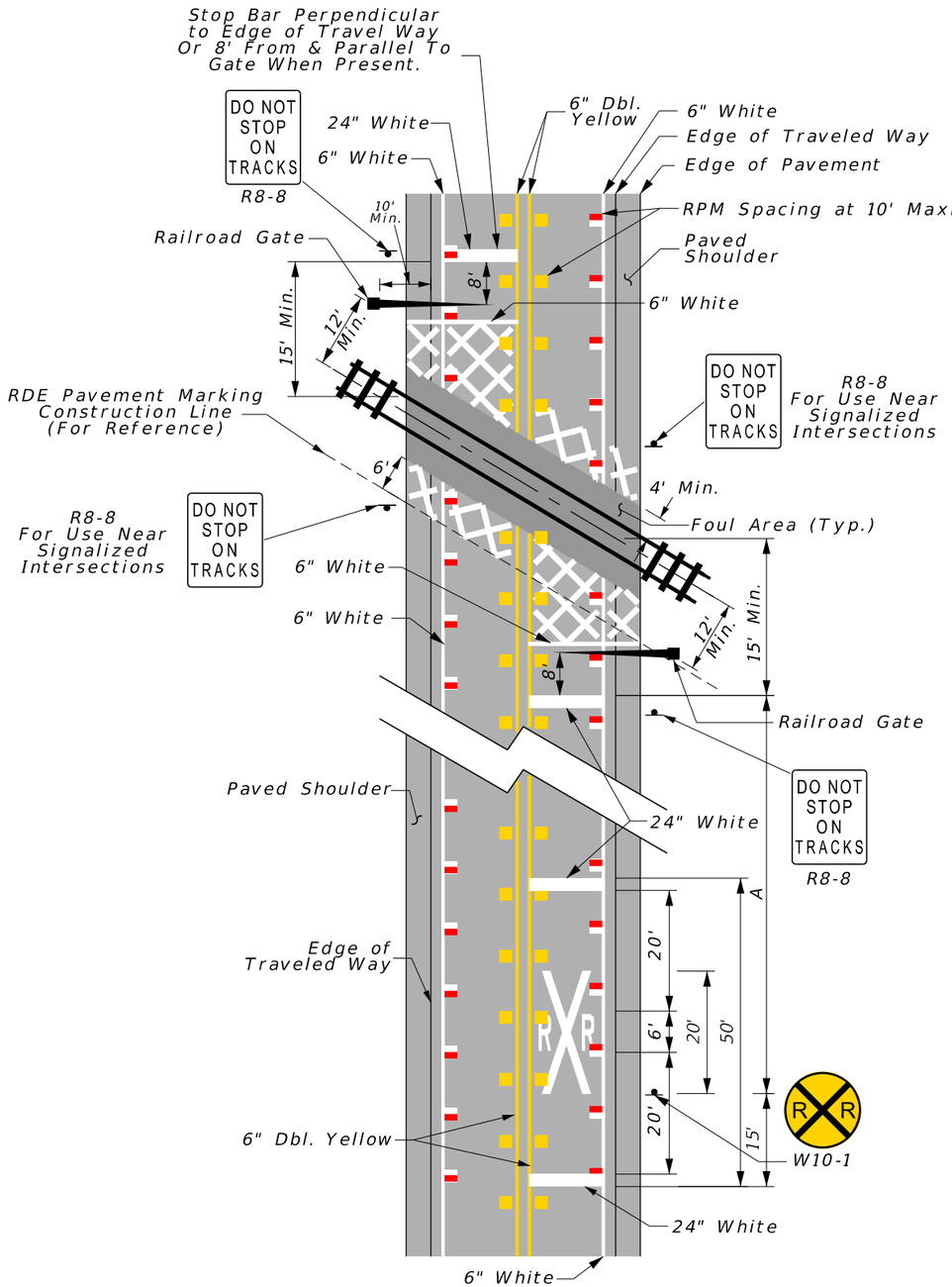
Consider the following additional provisions for Active and Passive Grade Crossings:

- For significantly skewed angles, corridor highway lighting for the following minimum distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

- For significantly skewed angles, curves, and intersections directly adjacent to crossings, consider using additional channelization techniques for the roadway alignment. Some channelization techniques include Internally Illuminated RPMs and Tubular Markers. When crest vertical curves impede the visibility of RPMs, Tubular Markers should be used.
- Consider excluding downstream RDE pattern when traffic queuing is not expected.
- Consider the use of through lane-use arrows. For turn lanes, a route shield may be used in conjunction with the through lane-use arrow.
- Remove all existing traffic control signs and pavement markings (e.g., turning signs and turning arrow lane-use pavement markings) from the upstream approach that may lead to driver confusion on the correct turning point for downstream turning movements.
- Ensure placement of all signs allow a clear sight line to all rail signal flasher units. Sight line distance requirements vary by rail company. Consult with the operating railroad for project-specific determination of sight line distance.

For pavement marking material selection, see ***FDM 230***.
For side roads with Active and Passive Grade Crossings within 100 feet of the edge of traveled way, include W10-2, W10-3 or W10-4 signs on the mainline state road in accordance with the ***MUTCD***. Include W10-5 with W10-5P as described above in ***FDM 220.2***.

RAILROAD CROSSING AT TWO-LANE ROADWAY

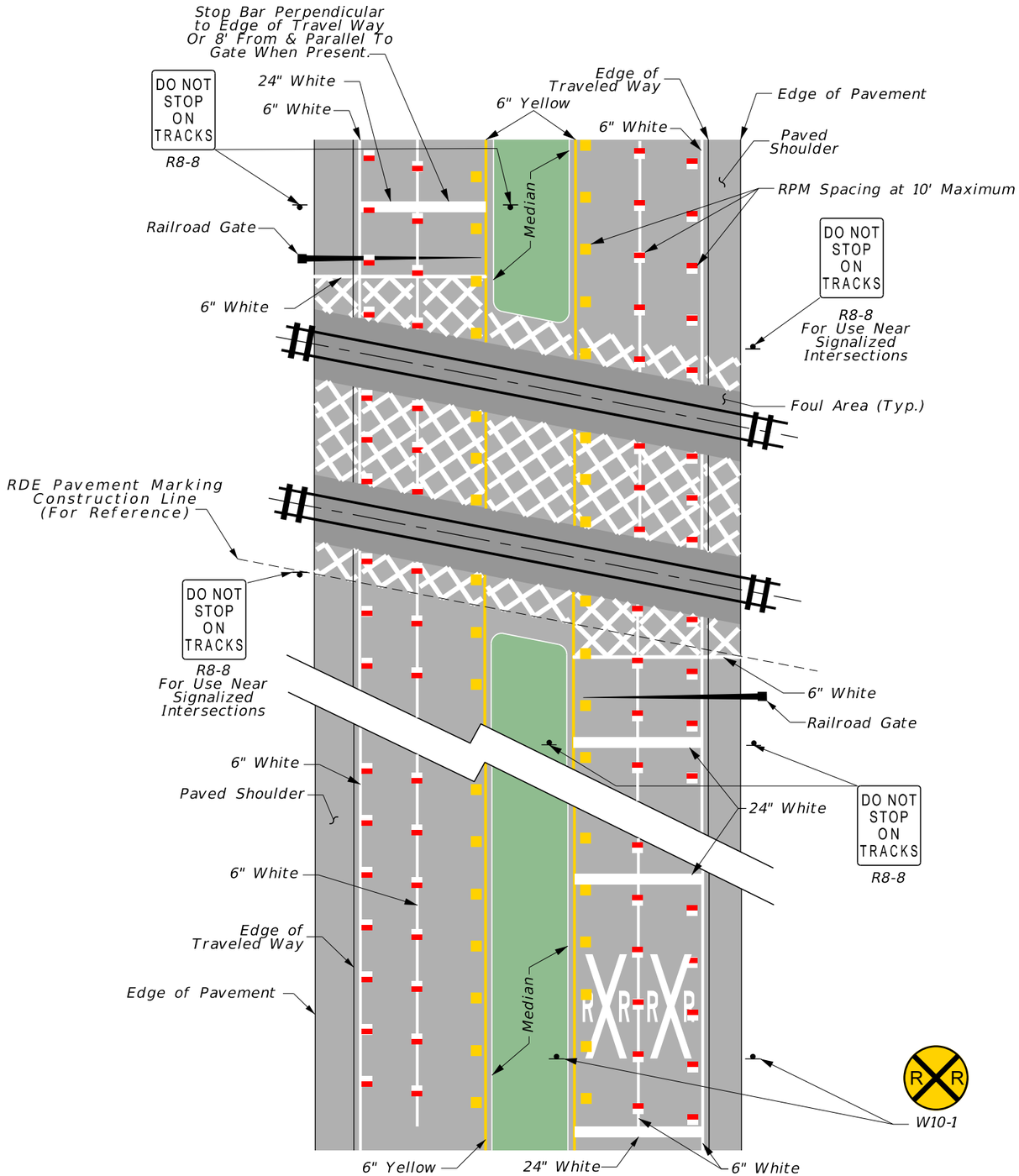


Design Speed (mph)	Distance "A" (ft)
60	400
55	325
50	250
45	175
40	125
35	100
URBAN	85 Min.

NOT TO SCALE

EXHIBIT 220-1
02/05/2021

RAILROAD CROSSING AT MULTILANE ROADWAY

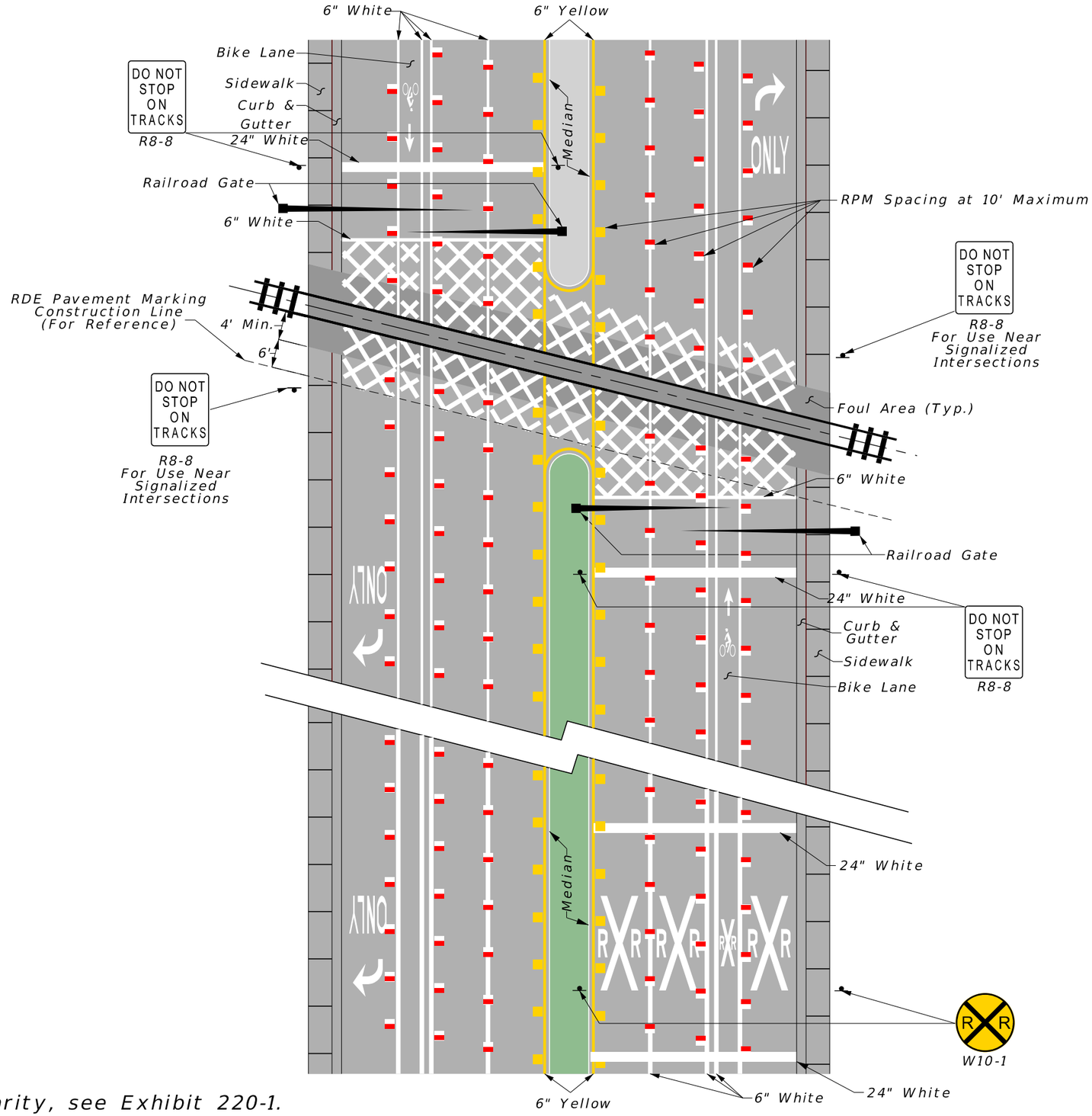


Dimensions not shown for clarity, see Exhibit 220-1.

NOT TO SCALE

EXHIBIT 220-2
02/05/2021

RAILROAD CROSSING AT URBAN MULTILANE ROADWAY WITH TURN LANE

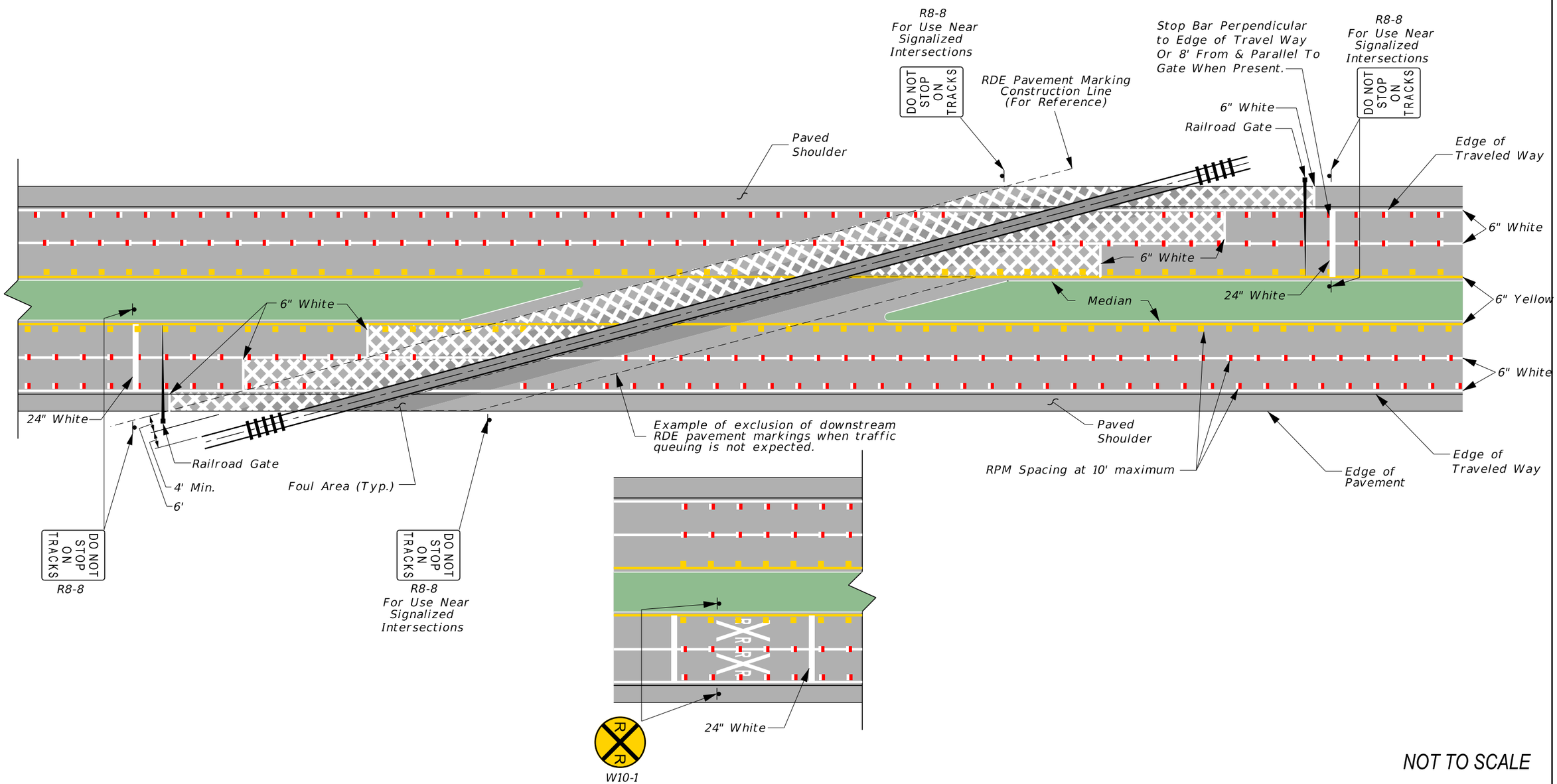


Dimensions not shown for clarity, see Exhibit 220-1.

NOT TO SCALE

EXHIBIT 220-3
02/05/2021

RAILROAD CROSSING WITH SIGNIFICANT SKEW TO THE ROADWAY



Dimensions not shown for clarity, see Exhibit 220-1.

NOT TO SCALE

EXHIBIT 220-4
02/05/2021

220.2.1.2 Preemption

Highway-railroad at grade crossings may require preemption of traffic signals where signalized highway intersections are in close proximity to a railroad crossing. Preemption requires the railroad and traffic signal control equipment to be interconnected with the traffic signal preempted to operate in a special control mode when trains are approaching. Preemption is required for any of the following conditions:

(1) Traffic Signal is within 200 ft of a highway-railroad at-grade crossing

(2) Highway traffic queues have the potential for extending across a nearby railroad crossing, or

(3) Highway traffic backed up from a nearby downstream railroad crossing could interfere with signalized highway intersections. A study to determine the need for preemption is required for a traffic signal within 500ft of a highway-railroad at-grade crossing

220.2.2 Surfaces

The roadway travel lanes at a highway-railroad at-grade crossing should be constructed for a suitable length with all-weather surfacing. A roadway section equal to the current or proposed cross section of the approach roadway, including any existing or proposed pedestrian walkways, should be carried through the railroad crossing. The railroad crossing surface itself should have a riding quality equivalent to that of the approach roadway. When selecting the type of crossing and the material to be used in its construction, consideration should be given to the character and volume of traffic using the roadway.

220.2.3 Quiet Zones

An at-grade railroad crossing within a designated Quiet Zone must comply with the ***Code of Federal Regulations (C.F.R.), Part 222*** and the ***Standard Plans, Index 509-070***. Quiet Zone means a segment of a rail line that includes public highway-railroad crossings at which locomotive horns are not routinely sounded.

A public highway-railroad at-grade crossing within a Quiet Zone should be equipped with a Supplemental Safety Measure identified in ***C.F.R., Part 222, Appendix A***. Allowable measures include:

(1) Gates with medians, or channelization using Type IV concrete traffic separators or Type F curb and gutter. Use of temporary channelization devices is not permitted.

(2) Four quadrant gate and three quadrant gates systems

(3) One-way streets with gates

(4) Permanent crossing closures

The railroad crossing should be evaluated to determine if driveways, minor side streets, or turn lanes in close proximity to the crossing require an additional gate.

220.2.4 Railroad Crossing Near or Within Project Limits

Review Federal-aid projects to determine if a railroad-highway at-grade crossing is within the limits of or near the terminus of the project. If such crossing exists, the project must be upgraded to meet the latest ***MUTCD*** requirements in accordance ***Title 23 United States Code (U.S.C.), Chapter 1, Section 109(e)*** and ***C.F.R. 646.214(b)***. These requirements are located in ***Chapter 8*** of the ***MUTCD***. "Near the terminus" is defined as being either of the following:

(1) If the project begins or ends between the crossing and the MUTCD-mandated advanced placement distance for the advanced (railroad) warning sign. See ***MUTCD, Table 2C-4*** (Condition B, column "0" mph) for this distance.

(2) An intersection traffic signal within the project is connected to the crossing's flashing light signal and gate.

220.2.5 Bicycle and Pedestrian Facilities

Extend proposed or existing sidewalks, bike lanes or shared use paths through the rail crossing. See ***FDM 222.2.4*** for additional information.

When a new bicycle or pedestrian crossing is added to an existing roadway, it is considered a new crossing if it is separated from the roadway. See ***FDM 220.1.3*** for information on coordinating new crossings.

220.3 Grade Separated Highway- Railroad Crossing

For railroad crossing over a roadway, the bridge must be designed to carry railway loadings in conformance with the ***American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering***. See ***FDM 260.6*** for required vertical clearances between the facilities.

Coordinate the following with the governing railroad company:

- Clearances, Geometrics and Utilities
- Provisions for future tracks
- Maintenance road requirements for off-track equipment
- Need for, and location of crash walls

The railroad company's review and approval is based on the completed Bridge Development Report (BDR)/30% Structures Plans.

Prepare the Structures Plans in accordance with the criteria obtained from the railroad company, the ***Structures Manual***, the ***Standard Plans***, and this manual.

Figure 220.3.1 illustrates the dimensions that are to be obtained from or approved by the railroad company before preparing the BDR/30% Structures Plans.

220.3.1 Bridge Width

For railroad over roadway crossing, the railroad bridge typical section is based on project requirements. For roadway over railroad crossings, see ***FDM 210*** for information on highway typical sections.

220.3.2 Lateral Offset to Face of Structure

For a roadway over a railroad crossing, measure lateral offset in accordance with ***Figure 220.3.1*** and ***Table 220.3.1***. The railroad company may accept a waiver from standard lateral offset requirements for the widening or replacement of existing bridges.

Lateral offset is measured from the centerline of outside track to the face of pier cap, bent cap, or any other adjacent structure. Minimum lateral offsets are shown in ***Table 220.3.1***.

Figure 220.3.1 Track Section

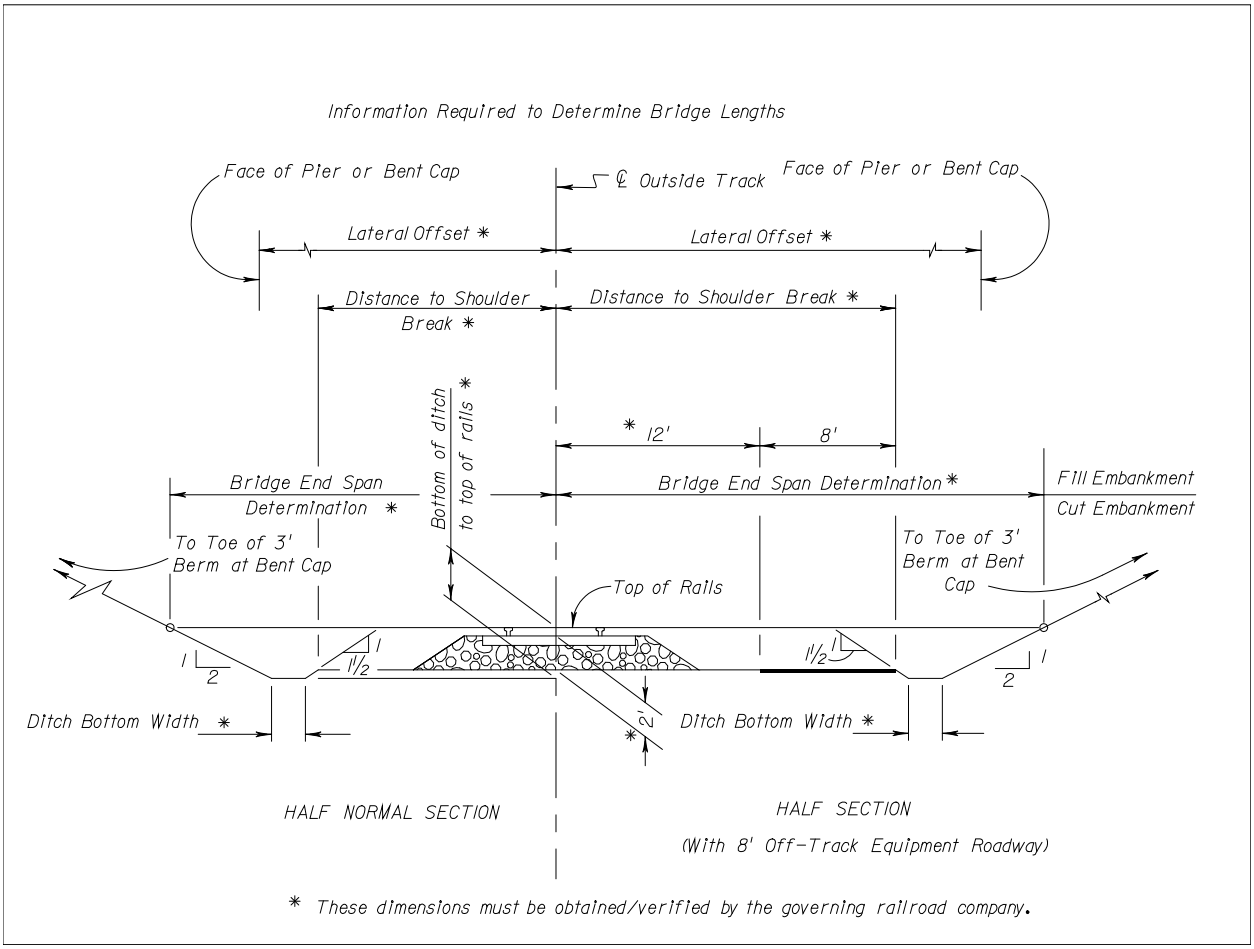


Table 220.3.1 Lateral Offsets for Railroads

Minimum Clearance Requirements	Normal Section	With 8 ft. Required Clearance for Off-Track Equip.	Temporary Falsework Opening
With Crash Walls*	18 ft.	22 ft.	10 ft.
Without Crash Walls	25 ft.	25 ft.	N/A

* See the ***Structures Design Guidelines, Section 2.6.7*** for crash wall requirements.

Provide an additional 8-ft. clearance for off-track equipment only when requested by the railroad company.

220.3.2.1 Adjustments for Track Geometry

Increase the minimum lateral offset by a rate of 1.5 inches for each degree of curvature when the track is on a curve.

Increase the minimum lateral offset on the inside of the curve by 3.5 inches horizontally per inch of superelevation when the track is superelevated.

Meet lateral offset requirements found in the ***AREMA Manual for Railway Engineering*** for extremely short radius curves.

220.3.2.2 Adjustments for Physical Obstructions

Columns or piles should be kept out of the ditch to prevent obstruction of drainage. Provide adequate lateral offset to avoid the need for crash walls unless extenuating circumstances dictate otherwise.

Figure 220.3.1 shows horizontal dimensions from the centerline of track to the points of intersection of a horizontal plane at the rail elevation with the embankment slope. This criteria may be used to establish the preliminary bridge length which normally is also the length of bridge eligible for FHWA participation; however, surrounding topography, hydraulic conditions, and economic or structural considerations may warrant a decrease or an increase of these dimensions.

220.3.2.3 Required Foundation Clearances

Place edges of footings no closer than 11 feet from centerline of the track to provide adequate room for sheeting.

220.3.3 Crash Walls

See the ***Structures Design Guidelines*** for crash wall requirements.

220.3.4 Special Considerations

Projects may include any of the following special considerations:

(1) Shoring and Cribbing requirements during construction should be accounted for in the preparation of the preliminary plans to assure compliance with required

clearances. Anything within the railroad R/W (e.g., cofferdams, footings, excavation) requires coordination with the District Rail Coordinator for approval by the railroad company.

(2) Overpasses for electrified railroads may require protection screens.

(3) Substructure supports may be located between adjacent tracks or an outside track and the off-track equipment road.

(4) Convey drainage from the bridge above the railroad away from the railroad R/W. Open scuppers are to be no closer than 25 feet to the centerline of the nearest track.

(5) The District Rail Coordinator must be contacted to see if there are any other requirements when constructing in or near their R/W.

(6) Additional consideration should be given to any utilities that may be located within the railroad R/W

220.3.5 Widening of Existing Bridge over Railroad

The requirements for widening an existing roadway or pedestrian bridge over railroad are as follows:

(1) If existing horizontal or vertical clearances are less than those required for a new structure, the design of the new portion of the structure is not to encroach into the existing clearances.

(2) Minimum vertical clearance should take into account the track grade and the cross slope of the bridge superstructure. It is desirable to widen on the ascending side of the bridge cross slope.

(3) Minimum lateral offset should take into account future changes to track geometry, physical obstructions or foundation clearances.

(4) Temporary construction vertical clearances less than 22 feet and lateral offsets less than 10 feet must be approved by the railroad company. It may not be possible to reduce already restricted vertical clearances on high volume rail lines.

(5) Meet drainage design requirements for new bridges when widened approach fills are necessary.

(6) Evaluate the need for crash wall protection if new substructures provide less than 25 feet lateral offset from center line of track.

(7) If the existing railroad is in a cut section, special considered should be given to the length, depth, and type material of the existing cut section.

(8) In cases where demolition of the existing structure is required for attachment of the new structure over the railroad's tracks, a method of debris collection should be provided so as not to encroach within the railroad R/W.

Provide a cross section at a right angle to the centerline of the track where the centerline of bridge intersects the centerline of track in the BDR/30% Structures Plans. Where the substructure is not parallel to the track, or the track is curved, provide a section perpendicular to the centerline of the track at each substructure end.

Figure 220.3.2 Section Thru Tracks