24. Railroads

24.1. Highway Bridges Over Railroads (Overheads)

24.1.1. Design Policies and Practices

Design highway bridges constructed over railroads to be consistent with the requirements of the following sources:

- FHWA
- AREMA
- Railroad Companies
- AASHTO LRFD Specifications

FHWA

The Code of Federal Regulations (23 CFR 646 Subpart B "Railroad-Highway Projects") prescribes the FHWA policies, procedures, and design criteria for preparing federal-aid projects involving railroad facilities.

AREMA

The American Railway Engineering and Maintenance-of-Way Association (AREMA) provides recommended practices pertaining to the design, construction and maintenance of railway infrastructure. The organization publishes the *AREMA Manual for Railway Engineering*, which has approximately the same status to railroad engineers as the AASHTO *LRFD Specifications* has to highway bridge engineers.

Railroad Companies

The Alaska Railroad Corporation (the Railroad) is the predominant railroad company that operates in Alaska. The Railroad has adopted specific criteria that could impact the structural or geometric design of a highway bridge over a railroad. The most recent version of *Technical Standards for Roadway, Trail, and Utility Facilities in the AARC Right-of-Way* contains Railroad standards for facilities not owned by the Railroad but located within their right-of-way. The White Pass Yukon Railroad, which runs into Skagway, also operates in Alaska.

AASHTO LRFD Specifications

LRFD Article 3.6.5.1 presents criteria for designing bridge abutments and piers over highways or railroads.

For each highway-bridge-over-railroad project, the bridge engineer's responsibility is to evaluate each of the above during project development. Chapter 24 has been organized by project design element and, as applicable, references one or more of the above sources for the information.

24.1.2. Structure Type and Configuration

Chapter 11 of the *Alaska Bridges and Structures Manual* presents DOT&PF criteria on selecting and configuring highway bridge structure types. Specifically for highway bridges over railroads, the following apply:

Span Length/Configuration

The typical span configuration over a railroad is a single-span or three-span bridge. As part of a cost comparison analysis, the bridge engineer should evaluate a short span versus a long span, which eliminates the need for crash walls.

Falsework

The bridge engineer must work with the project manager and the Railroad early in project development to determine minimum clearance requirements.

Skew

Often, highway bridges over railroads must be designed with a skew greater than 30 degrees. These cases require the approval of the Chief Bridge Engineer in accordance with the *Alaska Highway Preconstruction Manual*.

Bridge Alternatives

In lieu of a highway bridge, the bridge engineer should consider a tube to span a railroad.

See Chapter 11 for more information on structure type selection.

24.1.3. Geometrics

Basic Configuration

The following elements determine the basic geometric configuration of the railroad cross section passing beneath a highway bridge:

- number and type of tracks
- potential for future tracks
- drainage treatments
- access/maintenance roadway (if present)

- Railroad right-of-way
- lateral clearances
- vertical clearances

FHWA will not participate in providing additional width for future tracks unless the Railroad has a documented plan for expansion along that rail line.

Review the following articles, the *AREMA Manual* and current Railroad criteria for additional information.

Lateral Clearances

The Appendix to Subpart B of 23 CFR 646 presents FHWA federal-aid participation limits for lateral clearances. These dimensions are not necessarily consistent with AREMA or the Railroad requirements. The following summarizes the FHWA criteria:

1. **Basic Clearance**. FHWA will fully participate in the cost of a 20-foot horizontal distance measured at right angles from the centerline of track at the top of rails to the face of the embankment slope at a height equal to the elevation of the top of the outside rail.
2. **Additional Clearance**. FHWA will participate in lateral clearances greater than 20 feet to:
   a. provide for drainage, if justified by a hydraulic analysis; or
   b. allow adequate room to accommodate special conditions, if the Railroad demonstrates that this is normal practice.
3. **Piers**. Place all piers at least 9.25 feet horizontally from the centerline of the track and, preferably, beyond the drainage ditch.
4. **Multiple Tracks**. For multiple track facilities, all dimensions apply to the centerline of the outside tracks.

Vertical Clearances

See Table 1130-1 in the *Alaska Highway Preconstruction Manual* for DOT&PF vertical clearance criteria for highway bridges over railroads.

The Appendix to Subpart B of 23 CFR 646 presents FHWA federal-aid participation limits for vertical clearances. Realize that these dimensions are not necessarily consistent with AREMA or the Railroad requirements. The following summarizes the FHWA criteria:

1. **Basic Clearance**. FHWA will fully participate in the costs of a vertical clearance of 23.3 feet above the top of rails, which includes an allowance for future ballasting of the railroad tracks.
2. **Additional Clearance**. Vertical clearances greater than 23.33 feet may be approved on a site-by-site basis where justified by the Railroad to the satisfaction of DOT&PF and FHWA. The Railroad's justification for increased vertical clearance should be based on an analysis of engineering, operational, and economic conditions at a specific structure location.
3. **Temporary Vertical Clearance**. For temporary applications, the bridge engineer may reduce the minimum vertical clearance for a highway over railroad to 21 feet upon approval of the Railroad.

Fencing

If the Railroad requires a protective fence across the highway bridge, use on both sides of highway bridges over railroads. Extend the limits of the fence with barrier rail to the limits of the railroad right-of-way or a minimum of 25 feet beyond the centerline of the outermost existing track, whichever is greater.

24.1.4. Control of Drainage from Highway Bridge Deck

Do not allow deck drains to discharge onto railroad right-of-way without the Railroad's permission. Section 16.4 discusses bridge deck drainage.

24.1.5. Construction Requirements

For information on shoring for construction excavations, see the *AREMA Manual for Railway Engineering*.

Use permanent or temporary steel casings in the construction of drilled shafts that are in load influence zones of railroad tracks. Use casings for the entire length of drilled shafts. Determine the required thickness of casings on a case-by-case basis.

24.1.6. DOT&PF Procedures

Right-of-Way

The Right-of-Way Unit within each Region is responsible for coordinating with the Railroad where DOT&PF projects impact railroads. Right-of-Way's responsibilities include obtaining cost estimates for securing agreements with the Railroad for the

relocation and adjustment of their facilities, as required for highway construction, and conducting direct negotiations with the Railroad. The Right-of-Way Unit within each Region will develop and process agreements between the Railroad and DOT&PF. The Railroad and DOT&PF have adopted a Master Agreement for any highway work that impacts Railroad right-of-way.

Project Development

Because of the unique nature of highway-railroad grade separations, special coordination is necessary where a railroad alignment and a highway alignment intersect or where these alignments are in close proximity to each other. The bridge engineer must prepare a preliminary design considering the minimum required horizontal and vertical clearances and submit it to the regional project manager. The Region will coordinate with representatives from the Railroad throughout all phases of the project. The regional project manager will provide the Railroad with final bridge plans for final construction approval.

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