2.1.4 BUILDINGS (2005)

Unless otherwise specified by local governing ordinances or state codes, all concrete railway buildings shall be designed in accordance with the latest "Building Code Requirements for Reinforced Concrete (ACI 318)" of the American Concrete Institute, subject to design loads conforming to railway requirements.

2.1.5 PIER PROTECTION (2005)

2.1.5.1 Adjacent to Railroad Tracks\(^1\)

a. To limit damage by the redirection and deflection of railroad equipment, piers supporting bridges over railways and with a close distance of 25 feet (7600 mm) or less from the centerline of a railroad track shall be of heavy construction (defined below) or shall be protected by a reinforced concrete crash wall. Crash walls for piers from 12 to 25 foot (3600 to 7600 mm) clear from the centerline of track shall have a minimum height of 6 feet (1800 mm) above the top of rail. Piers less than 12 feet (3600 mm) clear from the centerline of track shall have a minimum crash wall height of 12 feet (3600 mm) above the top of rail.

b. The crash wall shall be at least 2'-6" (760 mm) thick and at least 12 feet (3600 mm) long. When two or more columns compose a pier, the crash wall shall connect the columns and extend at least 1 foot (300 mm) beyond the outermost columns parallel to the track. The crash wall shall be anchored to the footings and columns, if applicable, with adequate reinforcing steel and shall extend to at least 4 feet (1200 mm) below the lowest surrounding grade.

c. Piers shall be considered of heavy construction if they have a cross-sectional area equal to or greater than that required for the crash wall and the larger of its dimensions is parallel to the track.

d. Consideration may be given in providing protection for bridge piers over 25 feet (7600 mm) from the centerline of track as conditions warrant. In making this determination, account shall be taken of such factors as horizontal and vertical alignment of the track, embankment height, and an assessment of the consequences of serious damage in the case of a collision.

2.1.5.2 Over Navigable Streams

Piers located adjacent to channels of navigable waterways shall have a protection system in accordance with Part 23 Pier Protection Systems at Spans Over Navigable Streams.

2.1.6 SUPERSTRUCTURE PROTECTION (2010)\(^2\)

2.1.6.1 General Requirements

a. An evaluation of a railroad bridge over a roadway should be performed when the risk potential and consequence from a vehicular collision with a railroad superstructure is deemed necessary by the Engineer. Factors to be considered in the evaluation should include but not limited to railroad safety and operational requirements, vertical clearance over roadway surface, roadway functional classification, roadway design speed, roadway sight distance, traffic data, and other reasonable data for the specific location. Reasonable protection of the superstructure should be determined based upon results from the evaluation and approval by the Engineer.

b. A re-evaluation of the grade separation requirements should be performed when changes in conditions at the location or other factors warrant.

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\(^1\) See Commentary

\(^2\) See Commentary

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2.40.2 SUPERSTRUCTURE DEPTH LIMITATIONS (1992)

The minimum thicknesses stipulated in Table 8.2-10 are recommended unless computation of deflection indicates that lesser thickness may be used without adverse effects.

C - COMMENTARY

The purpose of this part is to furnish the technical exposition of various paragraphs in Part 2 Reinforced Concrete Design. In the numbering of paragraphs of this section, the numbers after the “C-” correspond to the section/paragraph being explained.

C - SECTION 2.1 GENERAL

C - 2.1.5 PIER PROTECTION (2005)

C - 2.1.5.1 Adjacent to Railroad Tracks

a. The provisions of this section are not intended to create a structure that will resist the full impact of a direct collision by a loaded train at high speed. Rather, the intent is to reduce the damage caused by shifted loads or derailed equipment. This is accomplished by: deflecting or retarding the force from the pier; providing a smooth face; providing resisting means; and distributing the collision forces over several columns.

b. Research by the National Transportation Safety Board found no clear break point in the distribution of the distance traveled from the centerline of the track by derailed equipment. It was therefore decided to retain the existing 25 feet (7600 mm) distance within which collision protection is required. In addition, it is recognized that the distance traveled by equipment in a derailment is related to the speed of the train, the weight of the equipment, whether the side slopes tend to restrain or displace the equipment and the alignment of the track. In cases where these factors would cause the equipment to travel farther than normal in a derailment, the required distance should be increased. Structures not otherwise requiring protection under this section along the railroad right-of-way may also warrant protection by using crash walls or earthen berms.

c. Where the risk of serious damage to the overhead structure is estimated to be higher than normal in case of an impact, this distance should also be increased. Among the factors to be considered in this evaluation are: the height of the pier, bearing type, redundancy of the structure, length of the span and consequences of loss of use of the structure.

d. Examples of crash walls and pier protection for tracks on one side of piers are shown in Figure C-8.2-1. Where tracks are on both sides of the pier the wall shall protect both sides.

C - 2.1.6 SUPERSTRUCTURE PROTECTION (2010)

C - 2.1.6.1 General Requirements

a. The purpose for this guideline stems from the fact that many existing railroad bridge superstructures have been struck by trucks and other over-height loads and vehicles. Many of these bridges play a pivotal role in the day-to-day operations of the railroads and the transportation of goods. Railway networks are less extensive than those of other modes of transportation to the extent that unplanned shutdowns can have an adverse impact on railroad operations, particularly along core routes of a railway network. Protection of railroad bridge superstructures to abate impacts to daily railroad operations is critical and should be evaluated.

Parameters that affect railroad operational requirements include:
Figure C-8-2-1. Pier Protection: Minimum Crash Wall Requirements (Not To Scale)