

TRANSMITTAL MEMORANDUM 19-03

To: Division of Structural Design Staff
Design Consultants

From: Bart Asher
Director
Division of Structural Design

Date: September 13, 2019

Subject: Pier Protection

Pier Protection

Effective with this memorandum, all substructures within 30' of the edge of the roadway, shall be investigated for collision in accordance with Section 3.6.5 of the AASHTO LRFD Bridge Design Specifications. This protection shall be provided on all new designs. Protection shall also be applied to the entire existing substructures when the roadway is widened or the bridge is rehabilitated unless the project team dictates otherwise.

In accordance with Section 3.6.5, the designer must choose whether to isolate the pier from collision with an embankment or structurally independent barrier or to provide a crashwall and design the pier for the collision force. Design for vehicular collision for the final condition and not temporary traffic conditions during phased construction. A bridge deck adjacent to a column (such as may be found on tiered overpasses) is considered an adjacent roadway for collision purposes.

The designer may use the commentary and forego collision investigation if the calculated annual frequency of being hit by a heavy vehicle (AF_{HBP}) is less than 0.001 using equation C3.6.5.1-1 for a normal bridge or AF_{HBP} is less than 0.0001 for critical or essential bridges. Unless project team dictates otherwise, all bridges spanning or carrying interstates and freeways shall be considered critical or essential.

Any structurally independent barrier must be offset at least 6" from the pier and shall not be connected to the pier in any manner. A structurally independent barrier with the gutterline set 10 feet or less from any portion of the pier must be at least 54" tall. A barrier with the gutterline set more than 10 feet from the pier may be 42" tall. The barrier must be crash tested and designed to MASH TL-5 minimum.

When the designer chooses to design for the collision force, design for the 600 kip equivalent static load. The load shall be applied to the substructure in a direction of 0 to 15 degrees with the direction of traffic at a distance of 5 feet above the ground. In accordance with the code, this loading is to be considered an Extreme Event II limit state. Design the column to withstand the collision force in shear only. Do not design for flexure and do not transfer the load to other elements such as caps, footings, piles, drilled shafts, etc. Use a 0.9 load factor for all dead load and do not include any live load that produces axial compression for the shear check. For piers with three or more columns that provide sufficient redundancy against partial or total collapse of the bridge if one column were removed or damaged, use two shear planes to distribute the collision force. For piers with two or fewer columns, piers with column spacing greater than 15 feet, straddle bents, or other non-redundant substructures, use only one shear plane for the collision force resistance. A crashwall poured between all columns may be used to distribute the shear force between all columns for the component of the force that is in line with the pier. Each column or crashwall spanning between columns must be designed to resist the component of the collision force perpendicular to the centerline of the substructure. Any crashwall must extend at least 8 feet above the ground and a minimum of 2 feet below ground and shall be connected to the columns and footings as required by the design.

Any column with a gross cross sectional area of 40 square feet minimum, no dimension less than 5 feet, and transverse reinforcement of at least #4 ties at 12 inch maximum spacing or a #4 spiral at 9 inch maximum pitch may be assumed to have sufficient mass to meet the requirements of Article 3.6.5 and no collision analysis is required. A solid concrete breastwall abutment with the wall at least 2' thick shall be assumed to meet all collision/protection requirements with no further analysis.

Bridges over railroads shall incorporate substructure protection required by the railroad or AREMA requirements.

BA/JVZ/CVZ