
Structure Protection Guidelines

Use of this guideline

This guideline is intended to be followed with minimal deviation when designing projects with new grade separation span bridges where the piers are located within the clear zone. For rehabilitation projects on existing bridges or to the roadway passing below, when the pier is located within the clear zone, the bridge and road engineer will determine, together, the overall risk to the existing structure. The road engineer will determine the clear zone requirements, the risk of impacting the structure, guard rail need, potential traffic impedance, mowing restriction, drainage and site conditions. The bridge engineer will determine the effects of the impact on the structure and the risk of potential loss in service. Both the State Road Office and the State Bridge Office will determine how best to adhere to the guidelines.

AASHTO does not differentiate between new and existing structures when referring to the analysis of vehicular or railroad collisions. The intent is to provide a specification for the design of new structures. Bridge rehabilitation, repairs and maintenance are typically governed by specification written at the time the structure was built. Improvements to the AASHTO Bridge Design Specifications are incorporated into bridge rehabilitation work when the work can economically enhance material performances, structural durability, public safety, or improve life-cycle costs. The designer will determine if the increased investment cost is reasonable for the risk being taken.

For new structures, the flow charts follow current AASHTO Specifications. By incorporating these design requirements into the development of the project scope, such items as highway geometrics, span layout, superstructure and substructure types, and locations are all considered as variables. For existing structures, project variations are not always possible and therefore, a weight must be placed on balancing cost verses risk within the project scope.

It is not the intent of this guideline to consider structure protection when the project scope is limited to only maintenance of either the existing bridge or existing roadway passing below. Nor is the intent of this guideline to search out structures falling within this area of concern and which are not meeting current requirements, as a sole reason for retro-fitting the structure unless specifically directed to do so.

Interpretation of Current Specifications

For vehicular impact, the current AASHTO Specifications use a distance of 30'-0" and the term "clear zone" interchangeably when defining the limits required for protection of the structure. KDOT has determined that "clear zone", as defined by the State Road Office, will be the controlling distance. For railroad impact, the use of a distance 50'-0" from the centerline of the track is universal through out and will be used by KDOT.

New Structures

Use one of the following AASHTO Specifications taken from *Article 3.6.5.1* to protect the pier if the pier is within the clear zone.

- Design the pier to withstand impact.
- Use an embankment to protect the pier from vehicular impact.
- When the distance from the back of the barrier to the pier is less than or equal to 10'-0", use a 54" barrier designed for a TL-5 loading condition.
- When the distance from the back of the barrier to the pier is greater than 10'-0", use a 42" barrier designed for a TL-4 loading condition.

Note: KDOT has not crash tested a 54" barrier for TL-5 loading but, has detailed the reinforcement based on, Development of 42 and 51 in. TALL SINGLE -FACE, F-SHAPE CONCRETE BARRIERS (Faller, R. 2002) defining that reinforcement. KDOT has crash tested a 32" bridge barrier for TL-4 loading conditions and this 32" model is the basis for the design of the 42" barrier.

Existing Structures

Use this guide along with the risk of a specific structure as a method of determining the level of protection required. Evaluate the capacity of the column and the connections to the foundation and pier beam elements to determine the resistance. Factors which affect this resistance include, but are not limited to:

- The continuity of the superstructure and the ability for full or partial stress reversal and redistribution of force effects.
- The continuity of the superstructure to the substructure and any frame action which might aid in the distribution of force effects.
- The condition of the bearing devices and ability to resist translations and rotations.
- The degree of redundancy of the substructure.
- The continuity of the substructure to the foundation system.
- The amount of confinement reinforcement within the column and potential ultimate reserve capacity beyond the design capacity. Refer to KDOT LRFD Bridge Design Manual 3.5.1.6.3.
- The cost verses the risk.

Allowable Damage

The intent of this protection is so that upon impact the structure is prevented from collapsing. A repair may require closing or partial closing of the structure or the roadway passing below. The level of allowable damage and the extent which the structure is out of service must be measured verses the cost of the protection. In congested urban areas where loss of service may not be acceptable, the level of protection should be increased.











