Zone of Intrusion

Design Manual
Chapter 8
Roadside Safety
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Trucks or similar high-center-of-gravity vehicles typically lean over a barrier upon impact. Designers need to account for this when shielding objects taller than the barrier, for example bridge piers or sign trusses. Space may be needed between the back of a barrier and the object being protected. The space needed depends on the zone of intrusion (ZOI). The Roadside Design Guide defines the ZOI as the region measured above and behind the face of a barrier system where an impacting vehicle or any major part of the system may extend during an impact, see Figure 1.

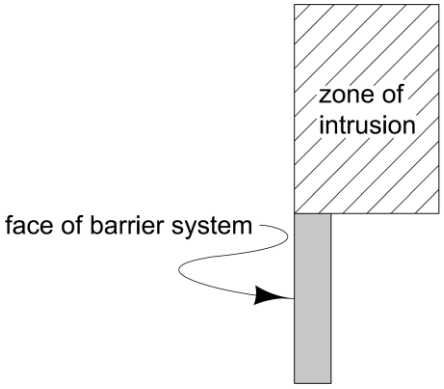

Figure 1: Zone of intrusion.

ZOI is related to vehicle type, barrier type, barrier height, and impact angle and speed. As noted above, high-center-of-gravity vehicles lean more than low center-of-gravity vehicles. Rigid barriers tend to result in tall vehicles leaning more than do flexible systems. Taller barriers reduce vehicle lean. Vehicles impacting barriers with sloped faces climb up the face of the barrier, resulting in increased lean. High impact angles and high impact speeds also increase vehicle lean. Designers need to consider all these factors when choosing and placing a barrier system.

The Roadside Design Guide provides ZOI estimates for permanent barrier rail similar to F-shaped concrete barrier rail used by the Iowa DOT:

- For single unit trucks, the ZOI for the cargo box can extend as far as 80 inches behind the face of a permanent concrete barrier system and as much as 120 inches above the roadway surface. The ZOI for the cab can extend as far as 34 inches behind the face of a permanent concrete barrier system and as much as 96 inches above the roadway surface.
- For pickup trucks, the ZOI can extend as far as 18 inches behind the face of a concrete barrier system and 78 inches above the roadway surface.

Bridge Piers and Sign Trusses

The most prevalent situation of concern for Iowa DOT projects is bridge piers and sign trusses located behind permanent concrete barrier rail. Section 8C-1 provides information pertaining to permanent concrete barrier rail height related to distance from object. Typically, the guidelines in Section 8C-1 will address ZOI issues related to bridge piers and sign trusses for new construction. For reconstruction, taller barrier (44 inch) may need to replace shorter barrier (34 inch).

Temporary Barrier Rail

Designers also need to consider ZOI when placing temporary barrier rail (see Sections 8C-1 and 9B-9 for more on temporary barrier rail). Pinned temporary barrier rail (TBR) will behave similar to permanent barrier rail. Unpinned TBR is more flexible than permanent concrete barrier rail, so the ZOI will typically be less than permanent concrete barrier rail; however, deflection will be much greater. Designers will need to keep in mind the deflection of the rail plus ZOI when placing TBR in front of tall objects. Using ZOI values for permanent concrete barrier rail will yield conservative results.

Chronology of Changes to Design Manual Section:

008A-006 Zone of Intrusion

3/4/2021	NEW New.