

## DESIGN BULLETIN #37/2006 (Revised June 2007)

### Zone of Intrusion Behind Barrier Systems Protection of Critical Infrastructure Elements and Traffic

**Superseded in January 2008 by Roadside Design Guide:**

<http://www.transportation.alberta.ca/3451.htm>

#### June 2007 Update to Design Bulletin #37/2006

- Further recommended practices under High and Low Speed Conditions
  - Figure 1 and Figure 2, Revision 2
- Table 5.5 - Obstacle Set-back or Treatment for Zone of Intrusion Considerations (this is a new attachment).

#### November 2006 Update to Design Bulletin #37/2006

Recommended practices for TL-3 barrier systems for high and low speed.  
Recommended practices for less significant hazards for high and low speed.

Figure 1. Intrusion zone for TL-2 and TL-3 barriers.

Figure 2. Minimum distance for TL-4 barriers.

#### Background:

The zone of intrusion is an important consideration when using rigid or semi-rigid barriers (such as concrete barriers, three beams and bridge railings) to shield tall obstacles such as bridge piers, abutment corners, tunnel ends, overhead sign support columns, high mast lighting etc. It is also an important consideration for mounting luminaries, small sign supports, glare screens, sound barriers, or bicycle railing on top of crash tested barriers. Notwithstanding the above, some combinations of barriers and railings have been adopted for use in Alberta (such as the combination bicycle and bridge railing). Although barrier systems are crash tested to safely re-direct appropriate vehicles and prevent penetration, the performance rating is based on barriers with no obstacles on top of or immediately behind the barriers. The intrusion over the top of and behind the barrier results from a combination of vehicle body deformation on impact, vehicle roll towards the barrier, and barrier deflection. With large trucks, the roll of the cargo box can reach obstacles 3 m behind the barrier (Figure 1). Obstacles placed within the zone of intrusion may cause vehicle snagging, or attachments to separate from the barrier and fly into opposing traffic or traffic below.

Some fixed objects such as bridge piers and overhead sign bridge columns are more critical than others in terms of traffic safety and consequence of potential structural collapse. There is also significant concern with attachments such as light poles or signs attached to bridge parapets on structures overpassing high speed facilities or freeways. Designers should

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consider the probability and consequences of these objects being struck and debris falling onto the facility below.

It is desirable that a practice be developed to deal with this question in both road and bridge design in a consistent, safe, cost-effective and reasonable manner. The intent of this Design Bulletin is to discourage the placement of obstacles in close proximity to barrier systems when barriers are the only reasonable alternative that can be used. These provisions should only be used when no other reasonable alternatives are available.

### **Recommended Practice (Table H.5.5 and Figure 2):**

#### **High Speed: Design Speed $\geq$ 80 km/h**

1. Where the traffic barrier design requires a TL-4 or PL-2 system, bridge piers, abutment corners, overhead sign bridge columns, high mast lighting, etc. shall preferably be located at least 3000 mm behind the top traffic face edge of rigid barriers or behind the back of modified Thrie Beam barriers. This set back can be reduced to 610 mm by providing 1370 mm high TL-5 or PL-3 vertical faced rigid barriers ahead of the obstacle. Transition in barrier height shall be no steeper than 10:1. Transition in barrier width or flare rate shall follow AASHTO guidelines.
2. In the case of less significant hazards such as conventional light poles or smaller signs the clearances mentioned above are desirable but not critical (except where the fixed object is located directly above a major high speed highway). Where less significant objects are placed behind bridge parapets in a TL-4 or PL-2 environment, higher bridge rail heights should be considered (see standard bridge drawings S1702 or S1700) with a suggested minimum offset of 610 mm behind the barrier. Engineering judgment should be used when designing barrier systems to provide a balance between risk and cost.
3. Where the standard required for traffic barriers is TL-3, it is desirable that fixed objects projecting above the barrier be located at least 610 mm behind the top traffic face edge of rigid barriers or the design deflection allowance behind the back of flexible barriers, whichever is greater. This standard also applies to less significant hazards.
4. Unprotected structural support for bridge superstructure within 10 m from the edge of ultimate pavement shall be designed for an equivalent static vehicle collision force of 1800 kN, assumed to act in any direction in a horizontal plane, at a distance of 1200 mm above ground.

#### **Low Speed: Design Speed $<$ 80 km/h**

1. Where the standard required for traffic barriers is TL-3 or TL-4, it is desirable that fixed objects projecting above the barrier be located at least 610 mm behind the top traffic face edge of rigid barriers, or the design deflection allowance behind the back of flexible barriers, whichever is greater.
2. Where the standard required for traffic barriers is TL-2, it is desirable that fixed objects projecting above the barrier be located at least 305 mm behind the top traffic face edge of rigid barriers, or the design deflection allowance behind the back of flexible

barriers, whichever is greater.

3. In the case of less significant hazards such as conventional light poles or smaller signs the clearances mentioned above are desirable but not critical. Engineering judgment should be used when designing barrier systems to provide a balance between risk and cost. Where clearances less than 305 mm are used, these should be treated as “design exceptions” with documentation of the rationale to support the design choices.
4. Unprotected structural support for bridge superstructure within the clear zone shall be designed for an equivalent static vehicle collision force of 1400 kN, at a distance of 1200 mm above ground, and at 10 degrees to the direction of travel.

**Implementation:**

This Design Bulletin is effective immediately.

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Effective Date: October 6, 2006.

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Revised Date (2): June 7, 2007

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**Attachments:**

Figure 1: Intrusion Zones for TL Barriers

Figure 2: Obstacle Set-back Requirements

Table H.5.5: Obstacles Set-back or Treatment for Zone of Intrusion Considerations. (This Table will be included with the future INFTRA Roadside Design Guidelines currently being developed).