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# Guardrail Installations at Intersections or Other Access Points

**CATEGORY:** Design

ISSUE: Intersecting highways, streets, driveways, or other access points that must remain open to traffic frequently prevent the installation of fully effective guardrail installations. In many cases, there are other warranting obstacles present besides the one closest to the roadway – a typical example of this would be a bridge (the railing) over a cross stream or canal as shown in Photo A. The ability to adequately shield all of the warranting obstacles under this restrictive condition presents the designer with a difficult challenge.

**OBJECTIVE:** Establish general guidelines that enable designers to provide the most effective guardrail installation practical at these restricted locations.

**METHODOLOGY:** Present several common problem situations and identify approaches taken to mitigate them. In each case, the performance characteristics and/or limitations of the installation will be discussed.

**GENERAL:** Effectively shielding the identified obstacle(s) is the primary consideration in any guardrail installation. For the most common guardrail installations, these obstacles may include: bridge ends; a portion of the road, stream, or river that a bridge (or culvert) spans; steep embankments; trees; or non-breakaway signs, street lights, or traffic signal supports. Challenges arise when the full guardrail length of need (LON) cannot be installed due to an intervening access point that cannot be closed or relocated. A practical design to solve this challenge has been the goal of several research projects conducted over three and a half decades.

Illinois Department of Transportation
ARTBA American Road & Transportation Builders Association
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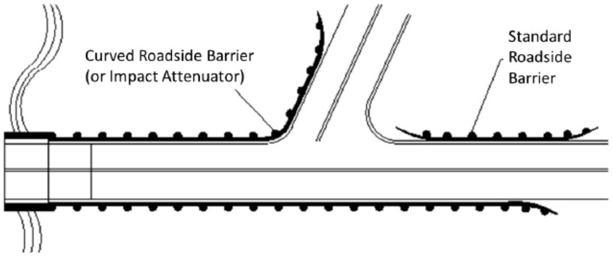
## EXPECTED RESULTS:

Designers have enough background information to allow them to develop curved barrier installations that effectively shield all potential obstacles to the maximum extent practicable.

**Situation 1 (Photo A):** Bridge (rail end) very close beyond access point. Although a crash cushion would satisfactorily shield the bridge rail end, it would not prevent a vehicle that just missed it from entering the drainage channel. The AASHTO Roadside Design Guide, 2011 - Figure 5-50 (below and referenced in BDE Manual Ch. 38-6.09) illustrates a possible solution using standard w-beam barrier that curves around the intersection and has a separate guardrail run on the upstream side of the access point. The purpose of the upstream barrier is to somewhat reduce the risk to the motorist by narrowing the angle at which the curved barrier could be hit, as well as shield the downstream obstacle; its length is determined by the standard LON calculation. Of course, the first preference is to move the approach roadway.




It is also recognized that there are many instances where there is barely space for the barrier to be bent around a radius, let alone extending down the access point as shown in the figure above. Impacts into this non-crashworthy treatment are still possible. Some designers eliminate this non-crashworthy aspect by using an energy-absorbing terminal (if there is room) along the main highway, offset as far as possible; although crashworthy, there is still the risk of a vehicle gating through or passing behind it to enter the drainage/area of concern. In any case of using a radius rail, an in-line (breakaway) anchor parallel to the main road is recommended just downstream of the radius to provide tension along the main road.

**Situation 2 (Photo B):** Weak post radius treatment. Because the situation was so pervasive, a design was developed – in the 1980's - that successfully sustained the direct hit – although only at 50 mph. The design, which can go from an 8.5 foot to a 35 foot radius, used weakened wood posts (CRT) through the radius; on impact the rail wrapped around the vehicle, safely decelerating it. The design requires a special anchor to develop adequate tension and a large clear area behind the rail (though it could have a 2:1 slope). This design has not met NCHRP 350 or MASH testing.

With the movement to MASH, and with the continued need to have an acceptable design to address this common situation (with or without a nearby bridge), there is ongoing research to develop a practical treatment. One recent design shown in Photo C has successfully passed MASH TL-3 testing but it is a complicated installation; it has been tested with a 3:1 slope behind the radius beyond the shelf necessary to support the sand barrels. Further testing is being conducted to develop less involved designs.

Although any successful radius designs may seem to be the panacea for the access problem, they need to be used appropriately. In Photo D, it appears the designer may have become too enamored with the design. Providing a very minor amount of grading (if any) would have allowed the guardrail to be flared and terminated with a crashworthy terminal, easily satisfying LON criteria. For Photo E, the designer did not understand how the system worked (need for a large deflection area), resulting in this failure.


A


B


C


D


E