Choosing a Barrier

Design Manual
Chapter 8
Roadside Safety
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Once the decision has been made to shield an object, the next step is to select an appropriate barrier system. This section discusses factors that influence barrier choice. The systems discussed in this section include permanent concrete barrier rail, steel beam guardrail, and high tension cable guardrail. Sections 8C-1 (Concrete Barrier Rail), 8C-2 (Steel Beam Guardrail), and 8C-3 (High Tension Cable Guardrail) provide more information regarding these systems.

High tension cable guardrail is the Department's preferred traffic barrier. It has passed crash tests with a wide range of vehicles, is more aesthetically pleasing than concrete barrier or steel beam guardrail, and drifts snow less than other barriers. When faced with an object that must be shielded, consider using high tension cable guardrail first. A permanent concrete barrier rail is usually chosen when deflection of the barrier needs to be minimized, high truck traffic is expected, bridge piers or sign trusses are being protected (see Section 8C-1), or when penetration of the barrier by some vehicles must be avoided.

In restricted areas where a long barrier installation is not feasible, a crash cushion may be an acceptable option. Refer to Section 8C-5 for details.

Primary Factors that Influence Barrier Choice

Three primary factors are involved when choosing an appropriate barrier: deflection of the system when impacted, the system's cost, and the types of vehicles the system can be expected to contain and redirect. Table 1 below summarizes these characteristics for the three most common barrier types.

Table 1: Barrier characteristics.

Barrier System	Deflection	Initial Cost	Maintenance Cost	Passed Crash Tests with the following
High Tension Cable Guardrail	10 feet	Low	High	Cars, pickups, single unit trucks[1]
Steel Beam Guardrail	4 feet	Low	Medium	Cars, pickups
Permanent Concrete Barrier	0 feet	High	Low	Cars, pickups, single unit trucks, semi-trucks[2]

[1] Designed to contain single unit trucks when installed on a 6:1 or flatter slope.
[2] Barrier heights of 42 inches and greater have been shown to contain semi-trucks.

Other Factors that Influence Barrier Choice

Other factors that may influence barrier choice include: expected frequency of impacts into the barrier; ease of maintenance/repairs; exposure of workers when conducting maintenance/repairs; impact on snow removal operations; tendency to cause snow drifts; aesthetics; and options for terminating the barrier or transitioning to other barriers.

Expected Frequency of Impacts into the Barrier

In areas where a high number of impacts are expected, barrier that does not require repairs (or requires only minimal repairs) is desired. Concrete barrier rail rarely requires repairs after impacts. Steel beam guardrail and high tension cable guardrail often do.

Ease of Maintenance/Repairs

Concrete Barrier Rail

Concrete barrier rail rarely requires maintenance or repair. Repair is usually required only after an extreme impact by a heavy vehicle. However, when it does require repair, it is costly and time consuming.

Steel Beam Guardrail

Maintenance for steel beam guardrail requires the steel beams and posts be inspected for damage, such as tears to the beams or rotted posts. Repairs for steel beam guardrail often involve replacing posts and steel beam, which can be time consuming. Minor impacts may not require repairs.

High Tension Cable Guardrail

Maintenance for high tension cable guardrail requires the posts be inspected for damage and tension in the cables be checked. Repairs for high tension cable guardrail normally involve only replacing posts and checking cable tension. Since the posts are placed in sockets rather than being driven into the ground, post replacement typically takes little time to do.

Exposure of Workers when Conducting Maintenance/Repairs

Anytime workers are exposed to traffic, their safety is at risk. The higher the traffic volumes, the higher the safety risk for the workers. Systems that involve quick repairs and/or maintenance reduce exposure time to traffic for workers, which increases safety – especially in high traffic areas.

Impact on Snow Removal Operations

Storing snow next to concrete barrier rail should be avoided due to the potential to launch a vehicle either on top of or over the barrier. This can result in the need to haul snow away. The more open design of steel beam guardrail and high tension cable guardrail is easier to push snow through. This reduces the need to haul snow away, which reduces the time and inconvenience of snow operations on traffic.

Tendency to Cause Snow Drifts

The solid design of concrete barrier rail can cause drifts to develop on both sides of the barrier. The more open design of steel beam guardrail and high tension cable guardrail allows snow to pass through, so they are less likely to cause drifting. High tension cable guardrail uses cables and thin posts, which allows snow to pass through easily making it the least likely to cause drifting.

Aesthetics

The cable and posts used in high tension cable guardrail are thin, so they are less of an obstruction to views than concrete barrier rail and steel beam guardrail. Aesthetic concrete barrier rail and steel beam guardrail are available, but at a high cost.

Terminating the Barrier

Concrete barrier rail requires some kind of crash cushion (most of which are expensive and require a concrete pad) or a transition to steel beam guardrail. Steel beam guardrail requires an end treatment. These are somewhat expensive but are relatively easy to install. High tension cable guardrail systems require end anchors. These involve constructing large concrete blocks underground, which can require several days to construct.

Choosing an Appropriate Barrier

Barrier choice involves balancing the above factors. Allowable defection is typically the governing factor. For example, if a median barrier is needed on a high traffic road with a high volume of trucks and there is no room for deflection of the system, a concrete barrier rail will be required. Conversely, if a median barrier is needed on a divided roadway located in a rural area with a higher allowable deflection, high tension cable guardrail might be the best alternative due to its lower initial cost and quicker repair time. For objects located between 5 and 10 feet from the edge of traveled way, steel beam guardrail is

commonly used since it has a lower initial cost than concrete barrier rail and less deflection than high tension cable guardrail.

In high traffic areas, ease of maintenance/repairs is a very important factor. As noted, the less time workers are exposed to traffic, the better. This may result in a system that is more expensive to install but easier to maintain (e.g. concrete barrier rail) being chosen over a system which is less costly to install, but would require workers to be exposed to high levels of traffic for an extended period of time when being repaired (e.g. steel beam guardrail).

Occasionally, systems will need to be mixed in order to provide the best protection. For example, an object may need to be shielded with concrete barrier rail (for example BA-102) due to limited allowable deflection. Upstream of the object is a high fill area that can be protected with high tension cable guardrail (see BA-351). High tension cable guardrail cannot be connected to a rigid barrier, so steel beam guardrail consisting of BA-201 with BA-206 is used to transition from concrete barrier to high tension cable barrier.

Chronology of Changes to Design Manual Section:

008B-005 Choosing a Barrier

3/4/2021	Revised Added in CBR is typically used when protecting bridge piers and sign trusses.
11/12/2020	Revised Updates throughout the section.
2/18/2020	Revised Moved information regarding the various types of barrier out to Sections 8C-1, 8C-2, and 8C-3 to focus section more on barrier choice. Expanded on other factors influencing barrier choice.
7/23/2019	Revised Deleted material better suited in Sections 8B-1, 8B-2, and 8B-3. Rewrote to focus on choosing a barrier system.
6/25/2019	Revised Updated hyperlinks. Updated header logo and text.
11/30/2011	NEW New