

2. *Concrete Barrier*: When glare screen is determined appropriate, the standard permanent glare screen is the 56-inch tall Type 60G concrete barrier.
3. *Emergency Openings*: When glare screen is included with the barrier, openings may be provided at approximately 600-foot intervals if requested by local emergency agencies. In areas with above average traffic collision rates, openings may be spaced at 300-foot intervals. Spacing may be varied to provide such

an opening at each structure crossing over the highway.

7-04.10 Delineation

To provide enhanced delineation, approved retro-reflective units may be placed on three-beam and concrete barrier where the clearance from the barrier to the edge of traveled way is less than 8 feet. For further details regarding delineation for median barriers, refer to the California MUTCD.

Topic 7-05 – Outer Separation Barrier

7-05.1 Introduction

The need for outer separation barrier between a freeway and a frontage road should be considered when there are concerns regarding collisions of vehicles crossing these separated facilities. Installation of an outer separation barrier is generally studied at locations where the freeway volume/width warrant or the collision warrant is met. Refer to Topics 7-04.4 and 7-05.2 for more information about these study warrants.

7-05.2 Outer Separation Barrier Criteria

The following criteria shall be satisfied for installation of outer separation barrier:

1. The direction of travel of the frontage road opposes freeway traffic, and
2. The opposing frontage road traffic volume is greater than or equal to 5,000 annual average daily traffic (AADT), and
3. The location meets the criteria described in Figure 7-12: Freeway Median Barrier Study

Warrant. Use the distance from the freeway edge of traveled way to the frontage road edge of traveled way for the width, and for the traffic volume, use one-half the freeway AADT plus the opposing AADT on the frontage road. Or:

4. If a location does not meet the above three criteria, but can be shown to meet either of the two criteria below, then a barrier may be recommended if:
 - a. A collision study warrant for any severity is based on a location having three or more collisions involving frontage road and freeway vehicles, and a total frontage road and freeway collision rate of at least 0.5 collisions per mile per year in a five year period, or
 - b. The Fatal collision study warrant is based on a location having three or more fatal collisions involving frontage road and freeway vehicles, and a fatal frontage road and freeway collision rate of at least 0.12 collisions per mile per year in a five year period.

Topic 7-06 – Crash Cushions

7-06.1 Purpose

Crash cushions, also known as impact attenuators, are intended to shield fixed objects that cannot be removed or where other protective systems such as guardrail are not suitable. When a vehicle strikes a crash cushion it decelerates by the transfer of inertia in displacing sand or water, expending kinetic energy through compressing a hydraulic cylinder or collapsible material, tearing metal,

or moving a metal cable or strap through a restricted path.

7-06.2 Available Crash Cushion Types

The various types of crash cushions currently available include several mechanical systems previously mentioned, arrays of sand-filled plastic drums, and water-filled modules. These types vary in regard to costs of installation, size, ease of repair and maintenance. These aspects should be

carefully evaluated in order to select an appropriate crash cushion or equal alternatives for a location based on site geometrics, anticipated repair and maintenance effort. For more information on which crash cushions are approved for use on California State Highways, contact your District Traffic Safety Systems Coordinator or refer to the Qualified Products List.

7-06.3 Placement

Crash cushions are to be installed at fixed objects that cannot be economically removed or made breakaway and where other protective systems such as guardrail are not suitable, such as at the gore point on a separated structure. Crash cushions are also generally used to shield objects such as piers, columns, overhead signs supports, and median barrier installations.

Concrete barriers or walls that are taller than shielding crash cushions require modification at the connecting ends of the barriers. The top of the wall or barrier should be tapered at maximum of 4:1 to meet no more than 1 inch above the top of the crash cushion.

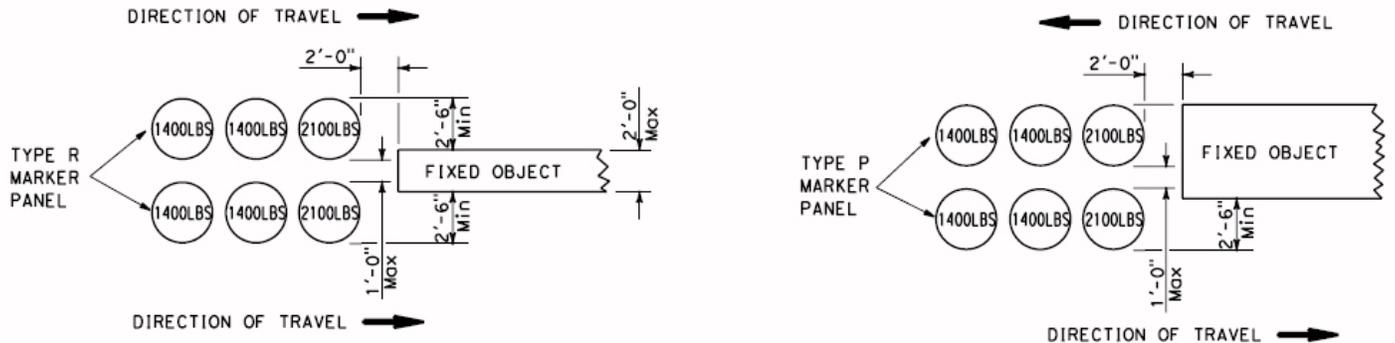
The District Traffic Safety Engineer must approve the decision to install or not to install a crash cushion and the approval must be documented in the project files.

7-06.4 Temporary Crash Cushions

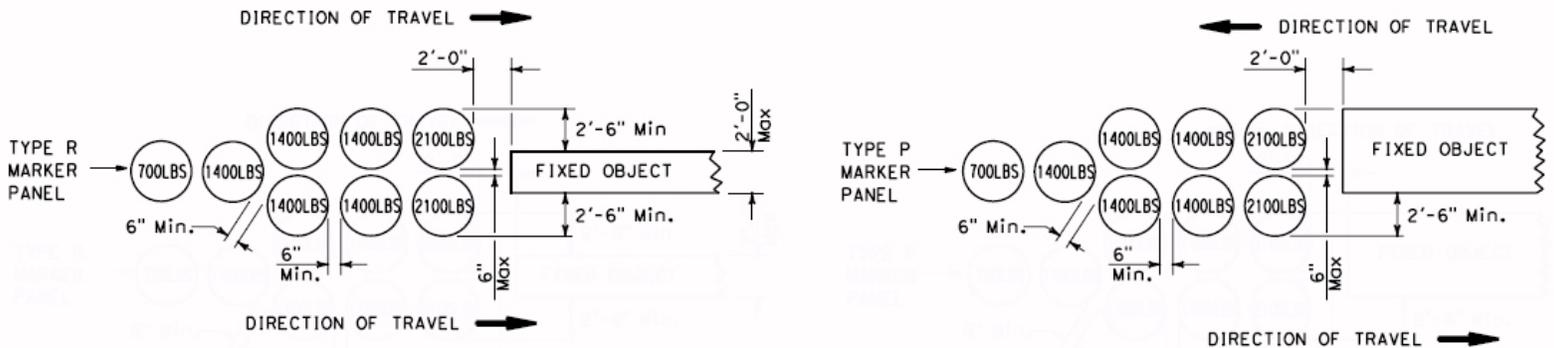
Temporary crash cushions can be practical in construction staging where temporary fixed objects are shielded, such as Temporary Railing (Type K). Proprietary crash cushions have been developed that use expedient methods for installation and removal, such as base plate mountings for the attenuators with pre-drilled holes for pavement anchor rods or stakes. These features are useful for moving attenuators between locations and typically allow anchorage in existing pavements. Refer to the Qualified Products List for options of proprietary, temporary crash cushions on state highways.

Commonly used non-proprietary crash cushions are arrays of sand-filled modules. Sand-filled modules are lower cost attenuators, but are also more maintenance intensive. Figure 7-18 shows arrays of sand-filled modules for temporary use on highways in unidirectional travel and where approach speeds are less than 25 and 35 mph. See the Standard Plans for details of arrays of sand-filled modules for approach speeds of 45 mph or greater.

Figure 7-18: Sand Barrel Arrays



**TEMPORARY CRASH CUSHION
SAND BARREL ARRAY
25 MPH OR LESS**



**TEMPORARY CRASH CUSHION
SAND BARREL ARRAY
35 MPH OR LESS**

Notes:

1. ## indicates sand filled module location and weight of sand in pounds for each module. Module spacing is based on the greater diameter of the module.
2. All sand weights are nominal.
3. Temporary crash cushion arrays shall not encroach on the traveled way.
4. Place the Type P marker panel so that the bottom of the panel rests upon the ground.
5. Refer to Standard Plan A73B for marker details.
6. Approach speeds indicated conform to NCHRP 350 Report criteria.
7. Use of pallets is optional.