

Culvert Opening Safety Treatments

Design Manual
Chapter 8
Roadside Safety

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This section describes culvert safety treatments. The preferred options are:

- Eliminating the opening (such as by connecting multiple culverts in the median).
- Locating or relocating a culvert opening beyond the clear zone (or relocating an opening to a point where it is less likely to be struck).
- Treating a culvert opening to make it traversable.

Shielding a culvert opening with a barrier should be considered only if the above options are not feasible.

Culvert openings, in most cases, should be made flush with the embankments from which they emerge. Where traversable openings can be provided within the clear zone, no further treatment is necessary. In order to be traversable, any portion of the culvert's headwall or wing walls must not extend more than 4 inches above the surrounding terrain and the opening must be 36 inches or less.

Cross-Drainage Culverts vs. Parallel Culverts

Whether a culvert is considered cross drainage or parallel depends on its orientation relative to travel on the main highway.

- Cross drainage culverts carry water from one side of the highway to the other and are oriented perpendicular or nearly perpendicular to the main flow of traffic. Roadway pipes are considered cross drainage culverts. The openings of cross drainage culverts are typically located within or at the base of the highway's foreslope.
- Parallel culverts are oriented parallel to the main flow of traffic and carry water under side roads, driveways, field entrances, and median crossings. Entrance pipes are considered parallel culverts. The openings of parallel culverts are typically located at the base of a transverse slope, usually in line with the highway's ditch.

Culvert Extensions

For larger cross drainage culverts (those with openings that exceed 36 inches), extending them so their openings are outside the clear zone is preferred. Designers should also flatten and extend the foreslope to cover the culvert, as shown on Typical [4311](#) and [4312](#). Extending the culvert normally does not interfere with the culvert's hydraulic function. However, in some cases, extending a culvert may not be practical due to economic or environmental considerations, or right-of-way limitations. In those cases, treatment options such as the apron guards and safety grates discussed below can be used.



When treating the outlet end of a culvert using apron guards or safety grates, the inlet end must also be treated in some manner to prevent debris intruding into and clogging the culvert. The presence of guards or grates may result in additional maintenance needs in order to prevent clogging, especially in large drainage areas where corn is planted. Therefore, consult the District Office for guidance on whether grates would be appropriate at a particular location.

Pipe Culvert Treatments

Cross Drainage Pipe Culverts (Roadway Pipes)

The ends of cross drainage pipe culverts typically consist of pipe aprons to improve drainage efficiency. Concrete aprons with an F dimension (see Standard Road Plans [DR-201](#), [DR-202](#), [DR-205](#), and [DR-206](#)) larger than 36 inches, and metal aprons with a W dimension (see Standard Road Plans [DR-203](#) or [DR-204](#)) larger than 36 inches, are considered objects if located within the clear zone and require safety treatments.

Safety treatments for cross drainage pipe culvert openings are as follows:

- For circular concrete roadway pipes, use a [DR-201](#) pipe apron with a [DR-213](#) apron guard.
- For low clearance concrete roadway pipes, use a [DR-202](#) pipe apron with a [DR-213](#) apron guard.
- For circular corrugated metal or polyethylene roadway pipes, or for unclassified roadway pipes, use a [DR-201](#) pipe apron with a [DR-213](#) apron guard. A [DR-122](#) Type “C-3” or “C-4” (depending on flow direction) adaptor must be used to connect the concrete apron to the pipe. Note this in the tabulation and/or in the estimate reference notes.

For situations not covered above, contact the [Roadside Safety Engineer](#) for guidance.

Parallel Pipe Culverts (Entrance and Median Pipes)

Parallel pipe culvert openings are treated differently than cross drainage pipe openings. Special aprons have been developed for use in certain situations. Openings smaller than 24 inches are considered traversable and typically do not require safety treatments, except in medians.

Safety treatments for parallel pipe culvert openings are as follows:

- For circular entrance pipes up to 60 inches in diameter, use a [DR-211](#) Metal Safety Slope Apron. This design is a combination apron/guard. When used with concrete or unclassified pipe culverts, a [DR-122](#) Type “C-3” or “C-4” (depending on flow direction) adaptor must be used. Note this in the tabulation and/or in the estimate reference notes.
- For circular entrance pipes greater than 60 inches in diameter, use a [DR-201](#) pipe apron with a [DR-213](#) apron guard. When used with corrugated metal, polyethylene, or unclassified pipe culverts, a [DR-122](#) Type “C-3” or “C-4” (depending on flow direction) adaptor must be used. Note this in the tabulation and/or in the estimate reference notes.
- For corrugated parallel pipes within the median, use a [DR-212](#) Beveled Pipe and Guard. This design is a combination apron/guard and is available in sizes ranging from 12 through 24 inches.
- For concrete parallel pipes within the median, use a [DR-211](#) Metal Safety Slope Apron. A [DR-122](#) Type “C-3” or “C-4” (depending on flow direction) adaptor must be used to connect the metal apron to the concrete pipe. Note this in the tabulation and/or in the estimate reference notes.

For situations not covered above, contact the [Roadside Safety Engineer](#) for guidance.

Box Culvert Treatments

The openings of cross drainage box culverts can be made traversable through the use of safety grates. This treatment is shown on Standard Road Plan [DR-503](#) and is adaptable to many sizes and shapes of openings.

Safety grates should not be used on foreslopes steeper than 3:1.

If the decision is made to use safety grates, contact the Preliminary Bridge Design Section of the Bridges and Structures Bureau for assistance in filling out Tabulation [108-24](#).

One additional safety concern that must be addressed relates to the culvert’s headwall. Ensure that the headwall does not protrude above the surrounding ground by more than 4 inches (flush with the

surrounding ground is preferred). This can be accomplished either by shaping the surrounding ground or cutting off the headwall to be flush with the ground.

Safety grates should not be applied to the openings of box culverts that are oriented parallel to the flow of traffic on the main highway. A different treatment method should be used.

Chronology of Changes to Design Manual Section: 008B-002 Culvert Opening Safety Treatments

11/12/2020	Revised Updates throughout the section.
6/25/2019	Revised Added reference to DR-206 in Cross Drainage Pipe Culverts (Roadway Pipes) subsection.
1/5/2017	Revised Changed title. Added in information regarding culvert extensions.
8/21/2015	NEW New. Replaces 8B-4.
6/18/2004	Previously Updated.