
Standard Practice for Evaluation of Precast Concrete Drainage Products

AASHTO Designation: R 73-16 (2024)¹

First Published: 2016

Reviewed but Not Updated: 2024

Editorially Revised: 2024

Technical Subcommittee: 4a, Concrete Drainage Structures



**American Association of State Highway and Transportation Officials
555 12th Street NW, Suite 1000
Washington, DC 20004**

Evaluation of Precast Concrete
Drainage Products

AASHTO Designation: R 73-16 (2024)¹



First Published: 2016 Reviewed but Not Updated: 2024 Editorially Revised: 2024

Technical Subcommittee: 4a, Concrete Drainage Structures

1. SCOPE
- 1.1.

This standard practice describes the evaluation of precast concrete pipe, box culverts, manholes, and drainage inlets. This standard also describes criteria for acceptable products, repairable products, and the rejection of defective products. All repairs shall conform to the criteria found in this document or to contract documents as applicable.
- 1.2.

This standard practice is applicable to storm water management precast concrete products, manufactured by both the wet cast and dry cast production methods, after curing and prior to installation.
- 1.3.

This standard practice covers the inspection of finished products manufactured per M 86M/M 86, M 170, M 199M/M 199, M 206M/M 206, M 207M/M 207, M 242M/M 242, and M 259; and ASTM C443, C858, C913, C985, C1417, C1433, C1504, and C1577.
- 1.4.

Evaluation guidelines are included for the following conditions:

■ Cracks,

■ Manufacturing defects, and

■ Damaged ends.
- 1.5.

This standard practice is not intended for the evaluation of installed precast concrete pipe, box culverts, three-sided structures, manholes, drainage inlets, or other precast products.

2. REFERENCED DOCUMENTS
- 2.1.

AASHTO Standards:

■ M 86M/M 86, Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe

■ M 170, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

■ M 199M/M 199, Precast Reinforced Concrete Manhole Sections

■ M 206M/M 206, Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe

■ M 207M/M 207, Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

■ M 242M/M 242, Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

■ M 259, Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to the AASHTO LRFD Bridge Design Specifications

2.2.

ASTM Standards:

- C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- C858, Standard Specification for Underground Precast Concrete Utility Structures
- C913, Standard Specification for Precast Concrete Water and Wastewater Structures
- C985, Standard Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe
- C1417, Standard Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design
- C1433, Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
- C1504, Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts and Storm Drains
- C1577, Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD

3. TERMINOLOGY

- 3.1. *0.01-in. crack*—the crack has reached 0.01 in. in width when the point of the measuring gauge shown in Figure 1 will, without forcing, penetrate $\frac{1}{16}$ in. at close intervals throughout the 12 in. in length as shown in Figure 2.

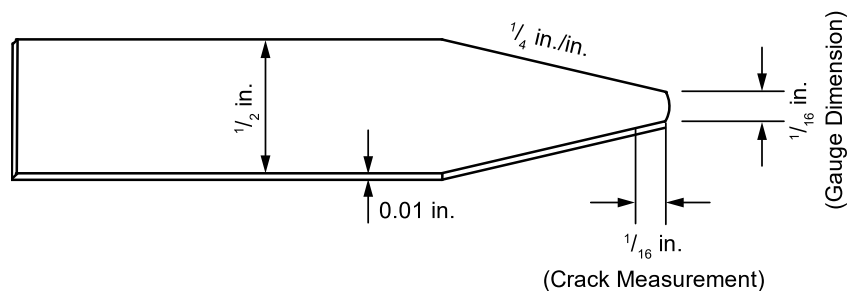


Figure 1—Measuring/Leaf Gauge; Gauge Made from Machinist Leaf of 0.01 in. in Thickness, Ground to a Rounded Point of $\frac{1}{16}$ in. in width with a taper of $\frac{1}{4}$ in./in. (*Courtesy of ACPA*)



Figure 2—0.01-in. Crack Measurement
(Photo Courtesy of ACPA)

- 3.2. *bleedout*—leakage of the paste (cement, water, air, and fine aggregate particles) through form gaps and seams of the form that results in small voids or openings between coarse aggregate particles.
- 3.3. *bug holes*—bug holes are small irregular cosmetic cavities typically resulting from entrapment of air bubbles or water on the surface of formed concrete during placement and consolidation.
- 3.4. *chip*—physical damage (breakage) of the corner or edges of the product.
- 3.5. *damage*—physical harm which impairs the product's normal performance.
- 3.6. *dry cast/packerhead concrete*—a low water–cementitious materials ratio concrete (zero slump) cast by a method in which the product is demolded immediately after consolidating.
- 3.7. *honeycomb*—failure of mortar to completely surround coarse aggregate in concrete, leaving empty spaces (voids) between the coarse aggregate particles.
- 3.8. *rifling*—a series of tool marks resembling spiral grooves on the interior of a round structure. These grooves are caused by the manufacturing process and are not typically an indication of insufficient reinforcement cover.
- 3.9. *sealing surface*—area of the joint which the gasket is capable of sealing.
- 3.10. *semi-dry cast concrete*—greater than zero slump concrete that is consolidated with or without vibration in which the product is demolded once the concrete stiffens to the point where it can stand on its own.
- 3.11. *slab off*—a result of separation (delamination) of freshly placed concrete, prior to initial set, which typically occurs at a steel reinforcement plane.
- 3.12. *spall*—the chipping or splintering of a localized area of cured concrete (usually in a circular or oval shape) breaking loose from the steel reinforcement plane.
- 3.13. *wet cast concrete*—greater than zero slump concrete that is consolidated with or without vibration in which the product is demolded after reaching a specified stripping and handling strength.

4. ACCEPTABLE DEFECTS IN PRECAST CONCRETE PRODUCTS

- 4.1. Minor defects, which do not affect the performance or design life of the product as described in Sections 4.2 through 4.8, will not be cause for rejection or repair.
- 4.2. *Acceptable Cracks for Nonreinforced Pipe:*
- 4.2.1. Fractures or cracks not passing through the wall or joints, or a single end crack less than 2 in. in length at either end of a pipe, unless these defects exist in more than five percent of the entire shipment or delivery, shall be acceptable.
- 4.3. *Acceptable Cracks for Reinforced Pipe:*
- 4.3.1. A single end crack that does not exceed the depth of the joint as, shown in Figure 3, shall be acceptable.



Figure 3—Acceptable Single End Crack (*Photo Courtesy of ACPA*)

- 4.3.2. Any continuous crack having a surface width less than 0.01 in. wide, provided it does not pass through the wall as shown in Figure 4, shall be acceptable.



Figure 4—Acceptable Surface/Curing Crack (*Photo Courtesy of ACPA*)

- 4.3.3. Any continuous crack having a surface width of 0.01 in. or greater and less than 12 in. long, provided it does not pass through the wall, shall be acceptable.
- 4.4. *Acceptable Cracks for Precast Concrete Products Other Than Pipe:*
 - 4.4.1. A single end crack that does not exceed the depth of the joint as shown in Figure 5 shall be acceptable.
 - 4.4.2. Cracks not passing through the wall shall be acceptable.

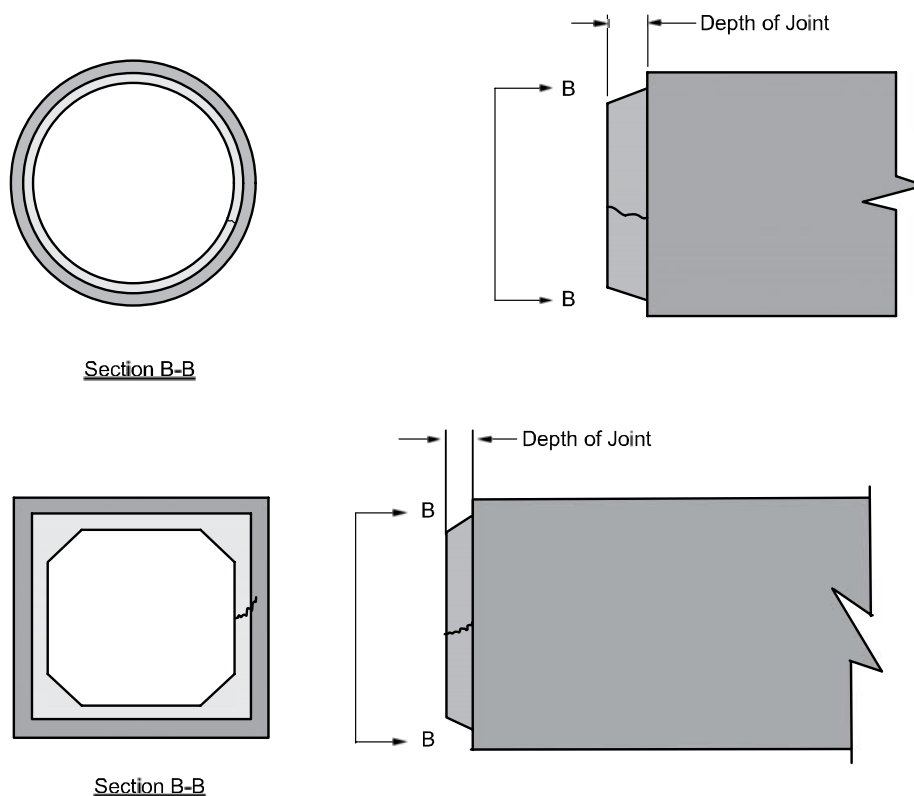


Figure 5—Acceptable Cracks; Single End Crack Does Not Exceed Depth of Joint

4.5. *Acceptable Manufacturing Defects:*

- 4.5.1. Minor defects that do not affect the strength, durability, or function shall be acceptable. Examples include, but are not limited to: bug holes as shown in Figure 6 or imperfections as shown in Figure 7 inherent in the manufacturing process, or rifling as shown in Figure 8 less than $\frac{1}{4}$ in. in height. Acceptable cosmetic dimensions of bug holes may be determined by the owner. Bug holes more severe than a cosmetic defect shall be subject to criteria in Section 5.3.2.1 and Section 6.4.4.



Figure 6—Acceptable Bug Holes and Shallow Pitting (*Photo Courtesy of ACPA*)



Figure 7—Acceptable Lines Caused by Form Jacket during Stripping (*Photo Courtesy of ACPA*)



Figure 8—Acceptable Rifling (*Photo Courtesy of ACPA*)

4.6. *Acceptable Damage and Chips to Ends of Non-Reinforced Pipe:*

- 4.6.1. A single fracture or spall in the joints not exceeding 3 in. around the circumference of the pipe, nor 2 in. in length into joint, unless these defects exist in more than five percent of the entire shipment or delivery, shall be acceptable.

4.7. *Acceptable Damage and Chips to Ends:*

- 4.7.1. Damage or chips to ends that do not affect the function of the joint as shown in Figure 9 shall be acceptable. This damage can include handling marks, chips, and spalls.



Figure 9—Acceptable Chip on Bell End (*Photo Courtesy of ACPA*)

4.8. *Exposed Positioning Devices:*

- 4.8.1. The exposure of the ends of longitudinals, stirrups, or spacers that have been used to position the cages during the placement of the concrete, as shown in Figures 10 and 11, shall be acceptable.



Figure 10—Acceptable Exposed Longitudinal Reinforcement (*Photo Courtesy of ACPA*)