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## Inspection and Evaluation of RCP Before Installation

"Using National Standard's to Inspect and Evaluate RCP"

By Al Hogan, P.E. Region Engineer – American Concrete Pipe Association



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## FIND A WAY, MAKE A WAY

### Why INSPECT AT ALL?



Simply Put - Proper Inspection Ensures 100+ YEARS Of Proper Service!

### Outcome/Take-A-Ways

- Review Important Inspection Milestones
- Focus on Pre-Installation Inspection & Evaluation of RCP
- Introduction to Evaluation and Inspection Tool for Precast Products Prior to Installation (AASHTO R-73)



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## FIND A WAY, MAKE A WAY

#### Important Inspection Milestones For Underground Infrastructure



Production Phase

PRE-INSTALLATION Phase





Installation Phase

Post-Installation Phase











### **Pre-Installation - RCP**













#### Poll Question!

In your experience which of the following are the most common issues that cause concern prior to installation in RCP?

- A. Damaged Bells and Spigots (End Damage)
- B. Poor Consolidation of Concrete in Pipe Walls
- C. Cracks in the Pipe wall
- D. Exposed Steel in the Pipe Wall
- E. Rough Surface on the interior of the Pipe

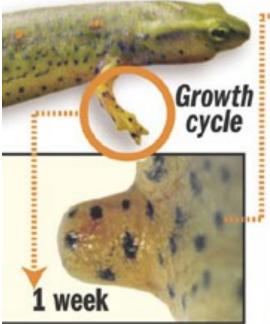








# Regenerating a limb A newt can regenerate an entire limb within 7-10 weeks.







**RCP WE WISH...** 





**REALITY – NO GOOD REASON** 

Broken Soil Visible 16.9 FT









## SO......When & WHO Should Inspect Pipe for Damage On Job Site?















#### Insert Poll?

- Do your current specifications address the issue of inspection and acceptance of pipe prior to installation?
- Yes
- NO
- Don't Know









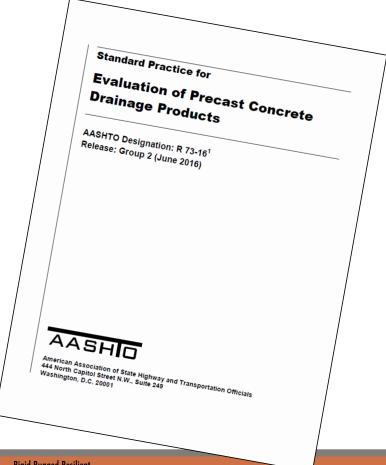
Put Pre-Installation Inspection in your Specs.

#### USE A NATIONAL STANDARD!!!!!!!!

#### **Example -** Spec. or Standard Drawing Note:

"RCP shall be inspected and accepted for use or repaired in accordance with AASHTO R-73 prior to Installation. The inspection of preinstalled RCP is the responsibility of the [Installer, Inspector, Owners Representative, Owner]. Inform [Engineer of Record, owner] of any issue that cannot be resolved prior to placement of any pipe in question for their approval prior to installation.

### A LIFE CHANGING TOOL FOR OUR INDUSTRY



Inspection & Evaluation for Pre-

#### **Installed Pipe**

- •Eval. Guidelines:
  - Cracks
  - Joints/Damaged Ends
  - Manufacturing Defects
- •Gives Solutions:
  - Acceptable
  - •Repairs Allowed/Required
  - Not Acceptable for Use

In your experience which of the following are the most common issues that cause concern prior to installation in RCP?

- A. Damaged Bells and Spigots (End Damage)
- B. Poor Consolidation of Concrete in Pipe Walls
- C. Cracks in the Pipe wall
- D. Exposed Steel in the Pipe Wall
- E. Rough Surface on the interior of the Pipe



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

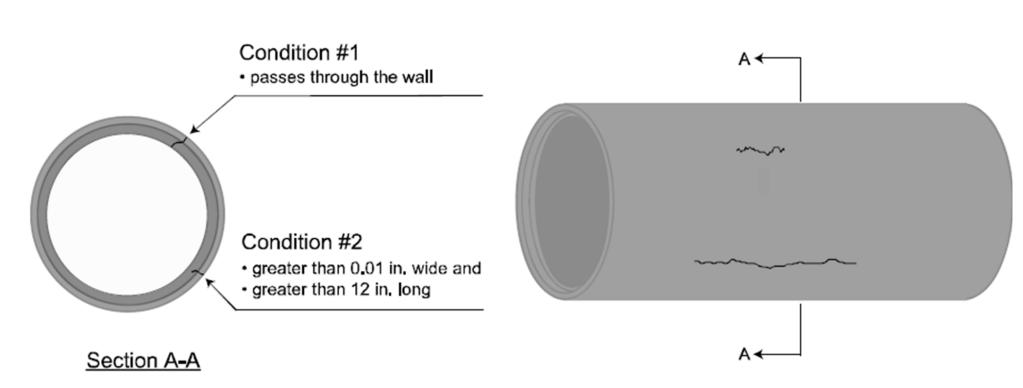
- 4.3.3. Any continuous crack having a surface width of 0.01 in. or greater and less than 12 in. long, provided it does not pass through the wall, shall be acceptable.
- 4.4. Acceptable Cracks for Precast Concrete Products Other Than Pipe:
- 4.4.1. A single end crack that does not exceed the depth of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

4.4.2. Cracks not passing through the wall shall be acceptable.

provided it does not pass

#### 5. REPAIRABLE DEFECTS IN PRECAST CONCRETE PRODUCTS

- 5.1. Defects which can affect the function or design life of the precast product that can be adequately repaired to meet specification requirements shall be acceptable for repair as described in Sections 5.2 to 5.4. Any repairs made must be performed such that the structural integrity is not compromised and does not change the dimensional requirements of the product. Repairs made using commercially approved materials must be performed in accordance with the manufacturer's recommendations.
- 5.2. Repairable Cracks in Reinforced Products:
- Cracks can be repaired in accordance with Sections 5.2.2 and 5.2.3.
- 5.2.2. For pipe, cracks 0.01 in. or wider and longer than 12 in. that are not passing through the wall can be repaired with an approved repair material as described in the contract or approved by the owner.
- 5.2.3. For other products, cracks passing through the wall can be repaired with an approved repair material as described in the contract or approved by the owner.
- 5.3. Repairable Uncured Manufacturing Defects:
- 5.3.1. Repairs specific to uncured dry cast, packerhead, and semi-dry cast product for slab off areas extending to the reinforcing steel shall commence within 1 h of casting the product by trowel-applying batched concrete from the same mix design, or approved concrete mix into the slab off area.
- 5.3.2. Repairs of Surface Defects in Cured Products:
- 5.3.2.1. Honeycombing and bleedout surface conditions less severe than stated in Section 6.4.4, as shown in Figures 12, 13, and 14, are repairable. The repair area of any single defect must be less than 4 percent of the total external surface area. The cumulative repair area must be less than 10 percent of the external surface area in a product.



#### Notes:

- Condition #1—Any visible crack passing through the wall, regardless of length or width.
- 2. Condition #2— Crack is at least 0.01 in. wide and at least 12 in. long, even though it does not visibly pass through the wall.



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

Pipe:

fround the circumference of the pipe, nor than 5 percent of the entire shipment or

the joint as shown in Figure 9 shall be s, and spalls.

- 5.4.2. Repair of Damaged or Chipped Ends for Gasketed Joints:
- 5.4.2.1. Damage or chips in gasketed round structures can be repaired provided the repaired sealing surface is free of spalls, cracks, or imperfections that would adversely affect the performance of the joint and the total cumulative damage or chip (L1 + L2 + L3) does not involve more than 50 percent of a round structure's circumference, and no individual damage or chip (L1, L2, or L3) can be more than 25 percent of a round structure's circumference as shown in Figure 17 and Figures 22 through 25.



Figure 22—Repairable Chipped End of Spigot (Photo Courtesy of ACPA)



Figure 23—Repairable Chipped End of Spigot (Photo Courtesy of ACPA)

#### **APPENDIXES**

(Nonmandatory Information)

### X1. PERMISSIBLE REPAIR CRITERIA FOR DAMAGED AND CHIPPED ENDS

Table X1.1—Permissible Repair Criteria for Non-Gasketed Joints (End Damage 1 in. and Greater in Depth within the Joint)

Damage Length (in.)	The state of the s
Daninge Dength (III.)	Damage Length (in.)
(50% Circumference Maximum)	(25% Circumference Maximum)
18 <sup>1</sup> / <sub>2</sub>	9
231/2	113/4
281/4	14
37 <sup>3</sup> / <sub>4</sub>	19
421/4	211/4
	18 <sup>1</sup> / <sub>2</sub> 23 <sup>1</sup> / <sub>2</sub> 28 <sup>1</sup> / <sub>4</sub> 37 <sup>3</sup> / <sub>4</sub>

6.6.2. Any unrepaired damage that affects the seal of a gasketed product, as shown in Figure 34, is cafor rejection.

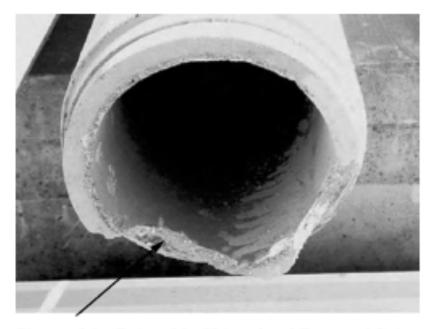


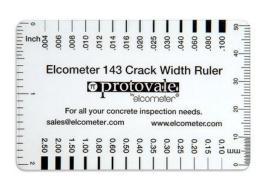
Figure 34—Rejectable Chipped and Damaged Spigot (Photo Courtesv of ACPA)

### Tools for Job Site Application of R-73

- Copy of AASHTO R-73
  - <a href="https://store.transportation.org/ltem/PublicationDetail?ID=2629">https://store.transportation.org/ltem/PublicationDetail?ID=2629</a>
  - Tape Measure, Calculator, Crack Comparator or Feeler gage









### APPLICATION POP-QUIZ! YOU DECIDE - ARE THE FOLLOWING Conditions...

- >ACCEPTABLE As Is (per R-73)?
- **➢ Needs REPAIR?**
- ➤ REJECT DO NOT USE?



#### **Poll Question**

Based upon AASHTO R-73 Is condition shown on photo?

A. = Acceptable

B. = Repairable

C. = Reject



- 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 5 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.





#### **Poll Question**

Based upon AASHTO R-73 Is condition shown on photo?

A. = Acceptable

B. = Repairable

C. = Reject

- 5.4.2. Repair of Damaged or Chipped Ends for Gasketed Joints:
- 5.4.2.1. Damage or chips in gasketed round structures can be repaired provided the repaired sealing surface is free of spalls, cracks, or imperfections that would adversely affect the performance of the joint and the total cumulative damage or chip (L1 + L2 + L3) does not involve more than 50 percent of a round structure's circumference, and no individual damage or chip (L1, L2, or L3) can be more than 25 percent of a round structure's circumference as shown in Figure 17 and Figures 22 through 25.



Figure 22—Repairable Chipped End of Spigot (Photo Courtesy of ACPA)



Figure 23—Repairable Chipped End of Spigot (Photo Courtesy of ACPA)

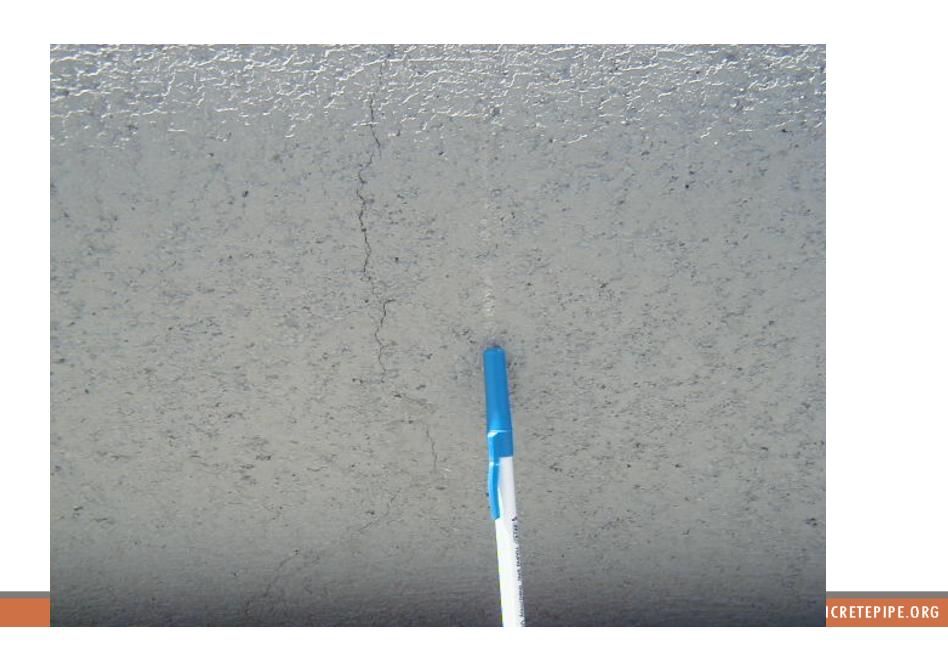
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### X1. PERMISSIBLE REPAIR CRITERIA FOR DAMAGED AND CHIPPED ENDS

Table X1.1—Permissible Repair Criteria for Non-Gasketed Joints (End Damage 1 in. and Greater in Depth within the Joint)

Pipe Size (in.) Designation	Permissible Cumulative Damage Length (in.) (50% Circumference Maximum)	Permissible Individual Damage Length (in.) (25% Circumference Maximum)
12	181/2	9
15	231/2	113/4
18	281/4	14
24	37 <sup>3</sup> / <sub>4</sub>	19
27	421/4	21 <sup>1</sup> / <sub>4</sub>



#### **Poll Question**

Based upon AASHTO R-73 Is condition shown on

photo?

A. = Acceptable

B. = Repairable

C. = Reject

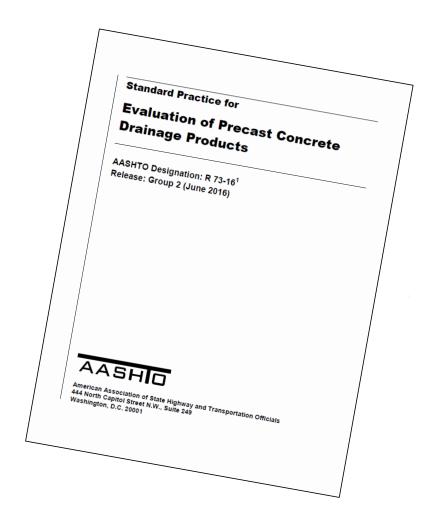


4.3.2. Any continuous crack having a surface width less than 0.01 in. wide, provided it does not pass through the wall as shown in Figure 4, shall be acceptable.



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.



#### LIFE CHANGING – You Bet.....

- Written & Vetted By AASHTO DOT M&T Engineers - A National Standard
- Technically Correct, Objective, & Provides Consistency in evaluation and acceptance
- Easy "Check-List" Application by Contractor, Inspectors, Owners, Industry!
- Industry Supported for Evaluation @ Plant and on Job Site
- Can use for evaluation of RCP, Box Culverts, Structures

### Outcome/Take-A-Ways

- Review Important Inspection Milestones
- Focus on Inspection @ the Job Site Prior to Backfill
- Introduction to AASHTO R-73 New Evaluation and Inspection Tool for Precast Products Prior to Installation
- ACPA Office 972-894-2904
- ACPA Website <u>www.concretepipe.org</u>
  - Find Producer = website Association Tab Contact a Producer US- select state
  - Find ACPA Contact for your area = website Association Tab Meet the Team Staff
     Find Region/State Engineer contact info
- Al Hogan 615-351-3017, <a href="mailto:ahogan@concretepipe.org">ahogan@concretepipe.org</a>

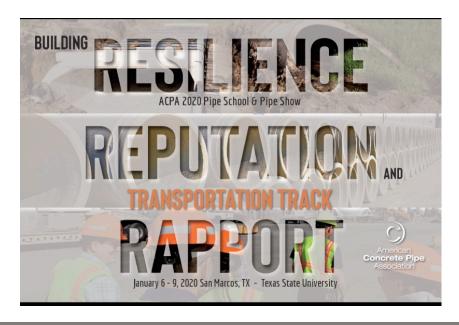








- No Webinar in Nov.
- Next Webinar will be in December
- Topic: Engineering Ethics



- February Webinar: Post Installation Inspection and Evaluation
- ASTM C-1840
- Inspection & Evaluation Installed Pipe (PII)
- Eval. Guidelines:
  - Cracks
  - Joints
  - Infiltration
  - Pictorial examples
- Solutions:
  - Acceptable
  - · Need Further Evaluation
  - Remediation/Replacement