

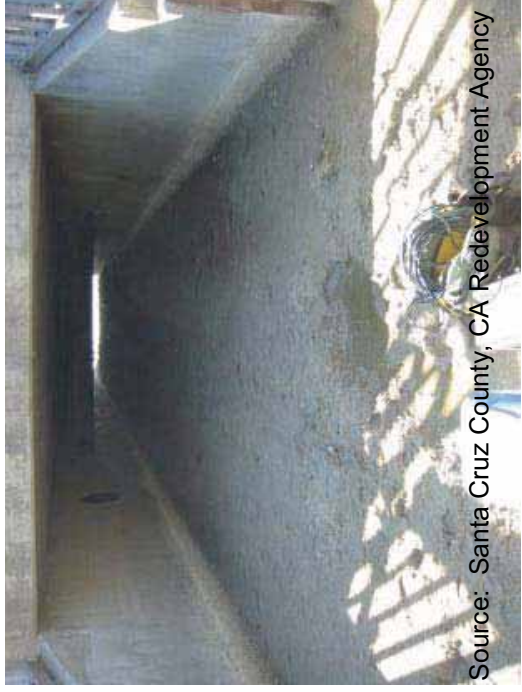
APPENDIX B – PHOTOGRAPHIC GUIDE FOR CULVERT ASSESSMENT

FHWA FLH Culvert Assessment and Decision-Making
Procedures Manual

Appendix B

Photographic Guide For Culvert Assessment Tool

Box & Arch Concrete – Good



Source: Santa Cruz County, CA Redevelopment Agency

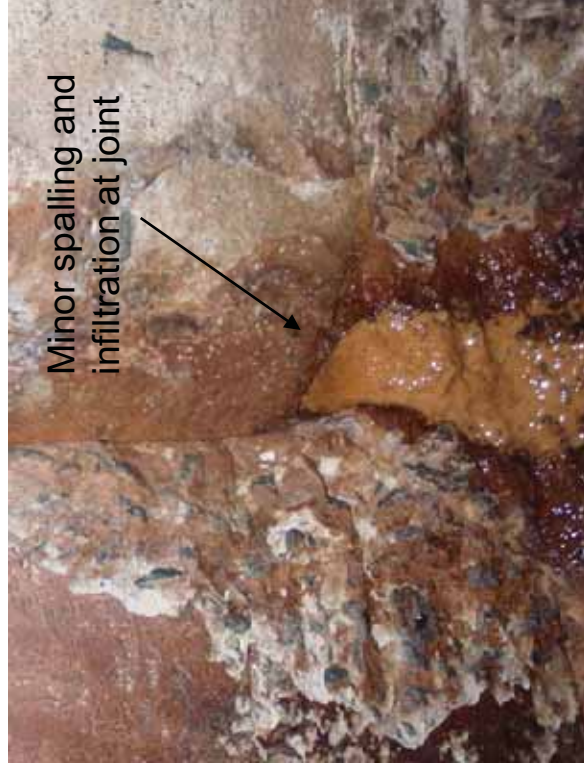
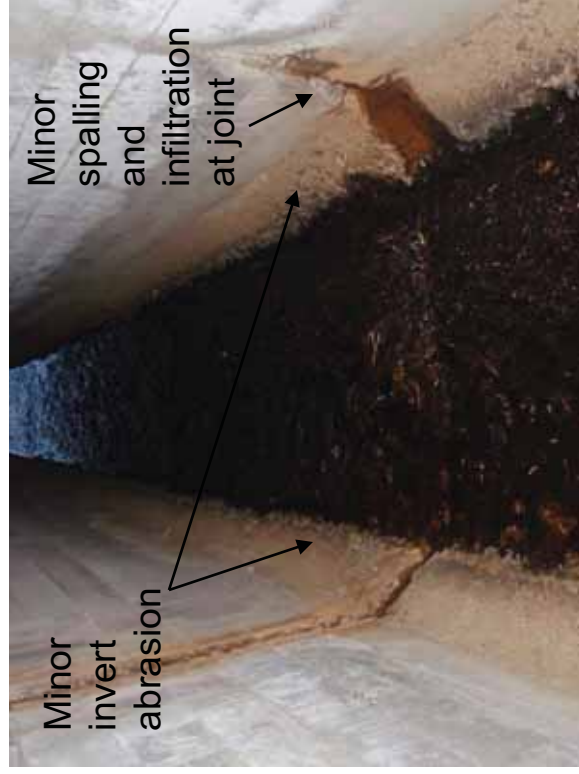
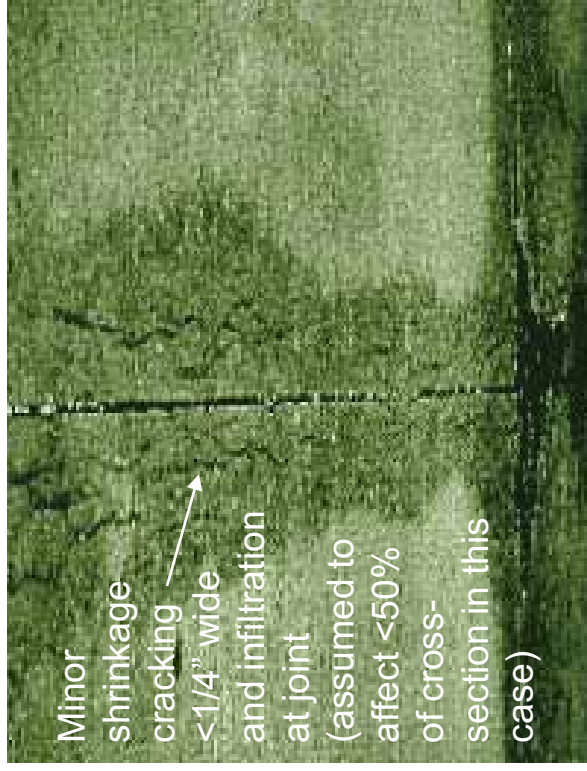
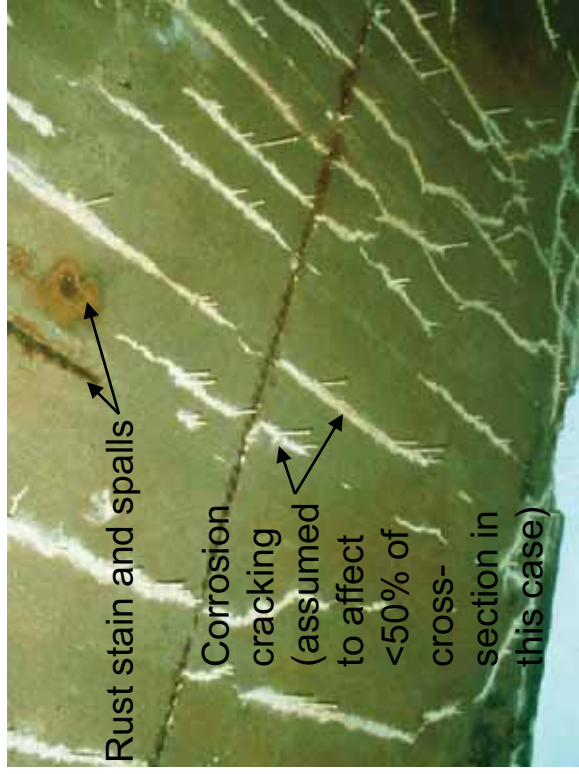


Source: US Fish & Wildlife Service, Ashland NFWCO

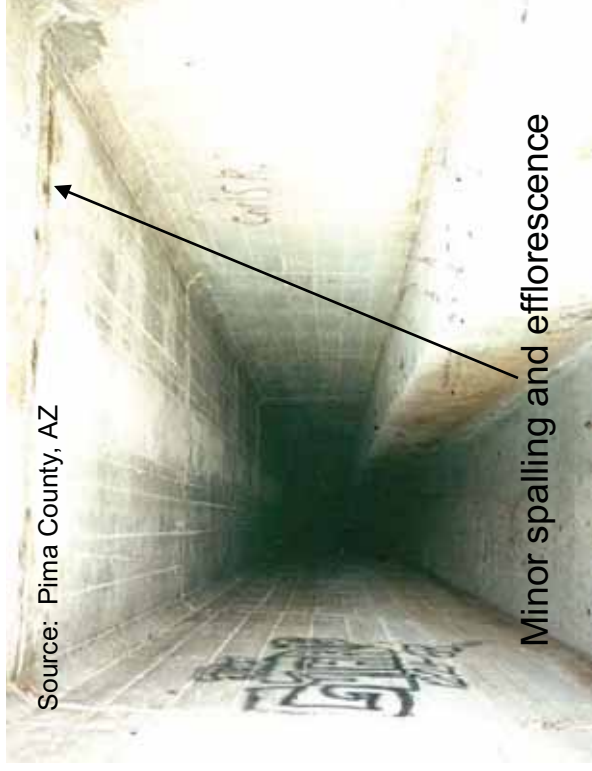
Box & Arch Concrete – Good



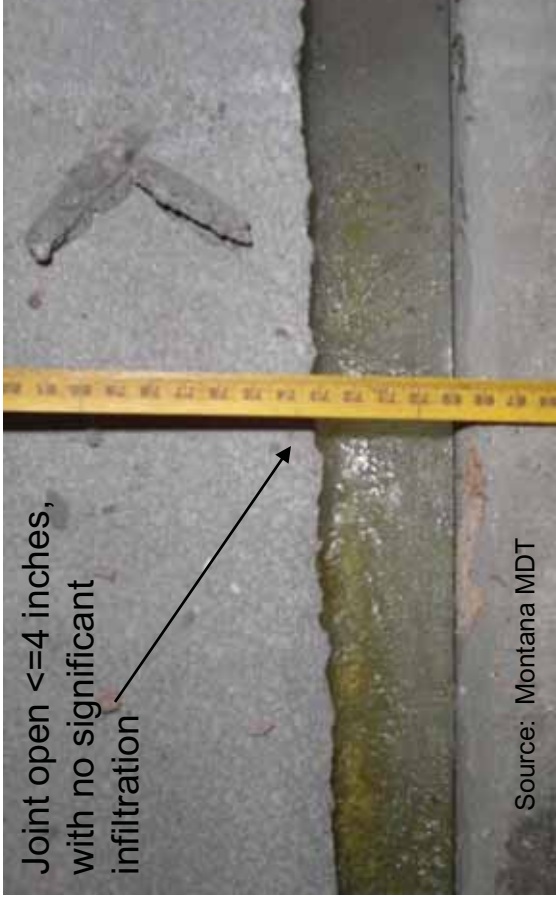
Box & Arch Concrete – Fair



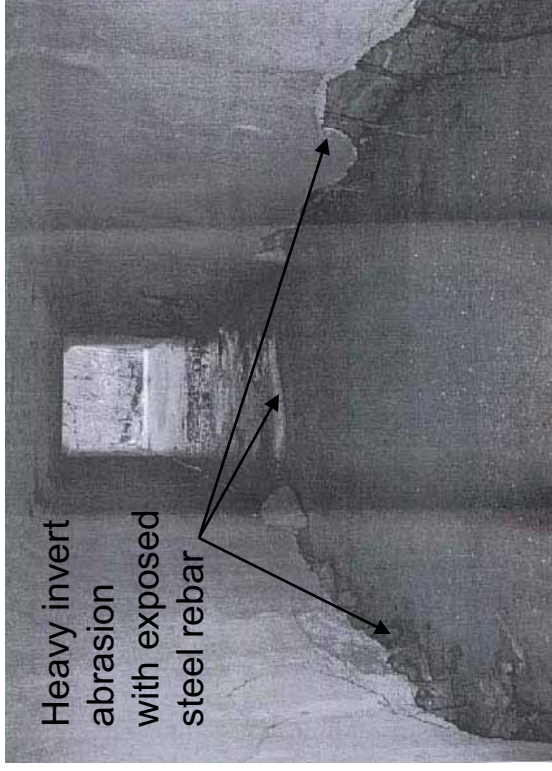
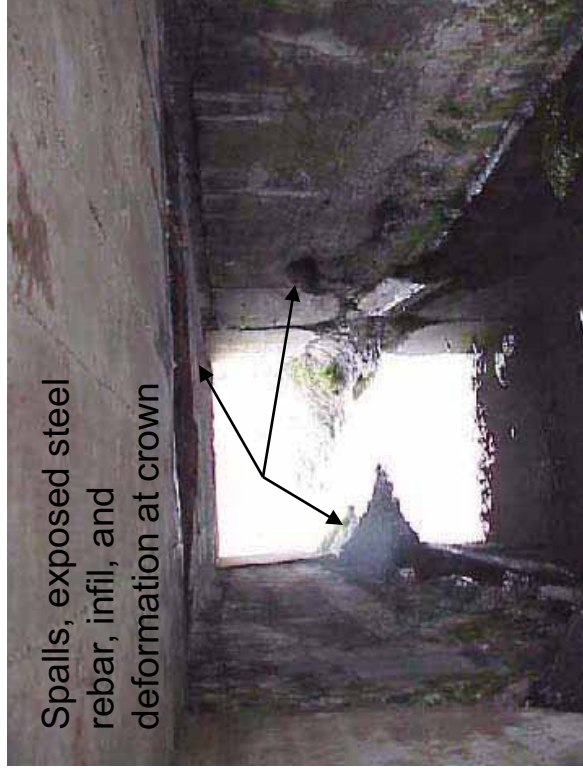
Box & Arch Concrete – Fair



Box & Arch Concrete – Fair



Box & Arch Concrete – Poor



Box & Arch Concrete – Poor



Spalls with exposed and corroding rebar

Box & Arch Concrete – Critical



Invert abrasion, cross-section deformation, open joints and extensive infill/exfil occurring beneath the roadway, with voids and risk of structural failure



Very poor joint with significant soil infill and sinkholes likely beneath roadway and risk of structural failure

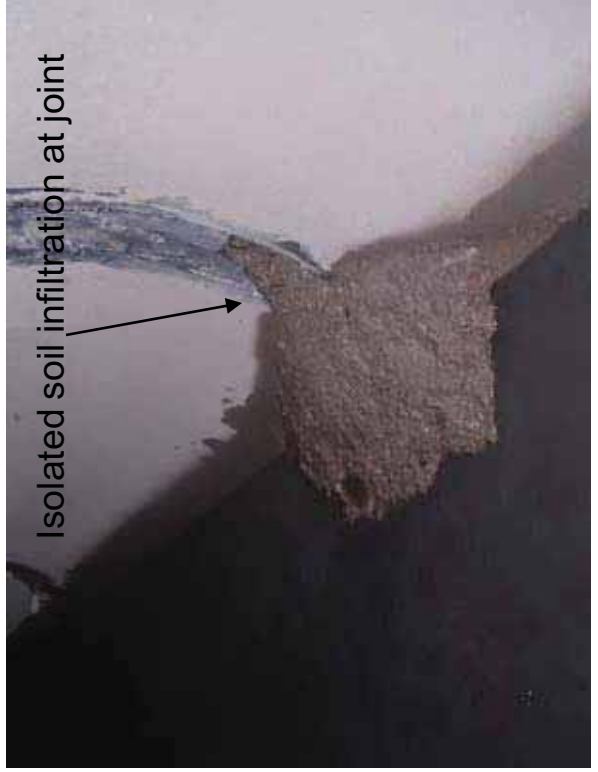
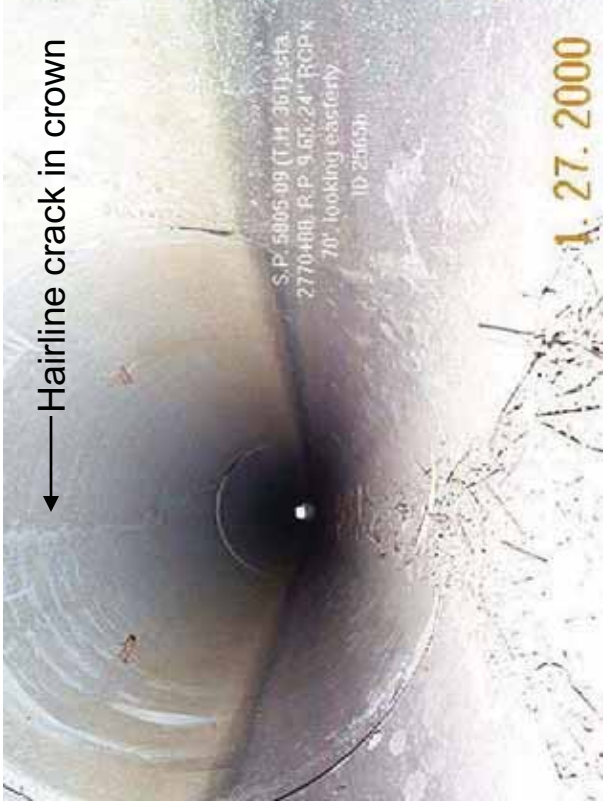
Source: Caltrans DIB 83 Supplement to FHWA Culvert Repair Manual

RCP – Good

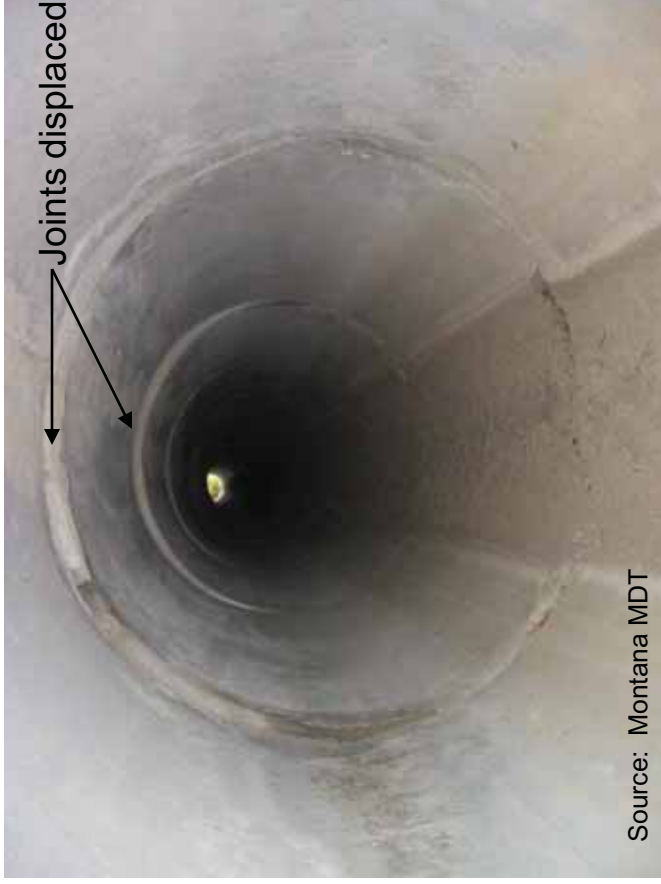


RCP – no cracks

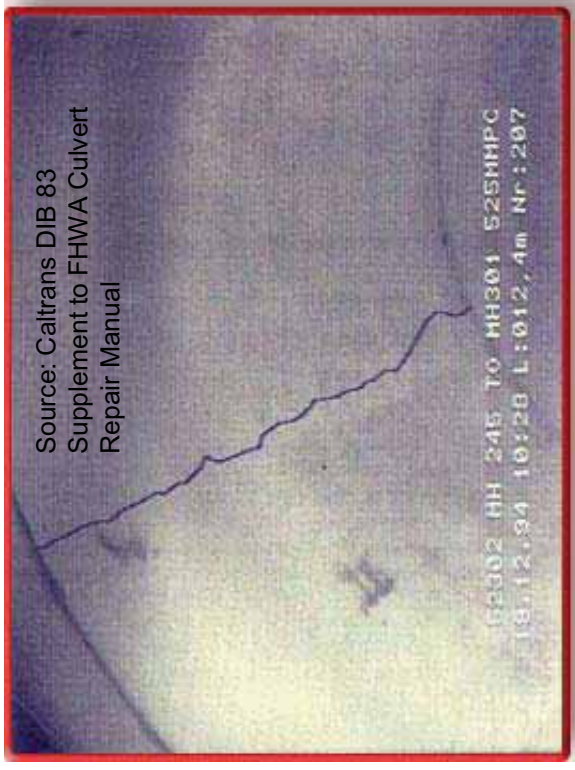
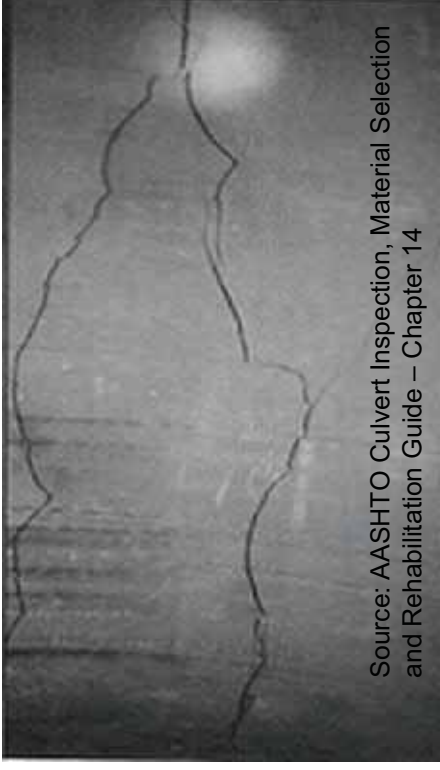
RCP – Fair



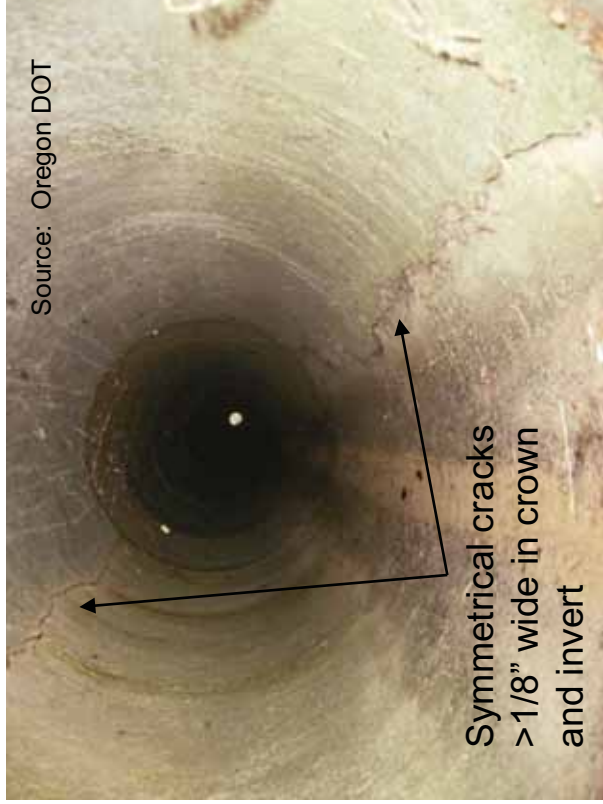
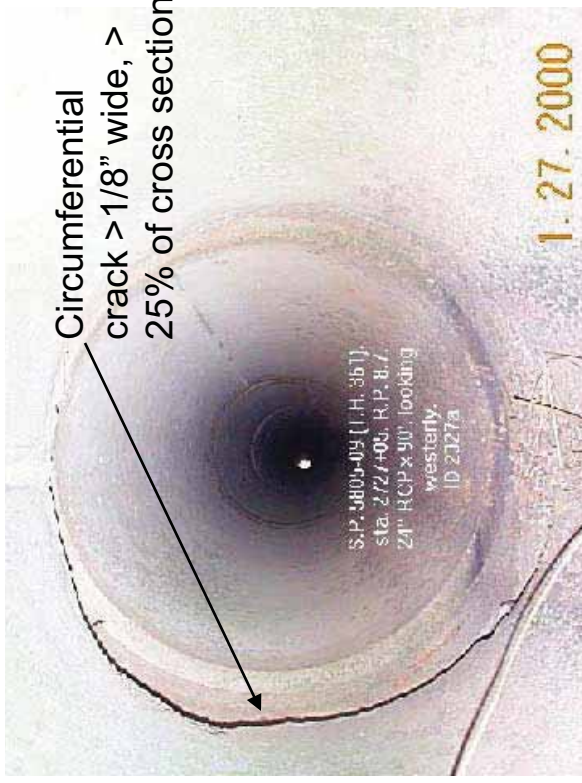
RCP – Fair



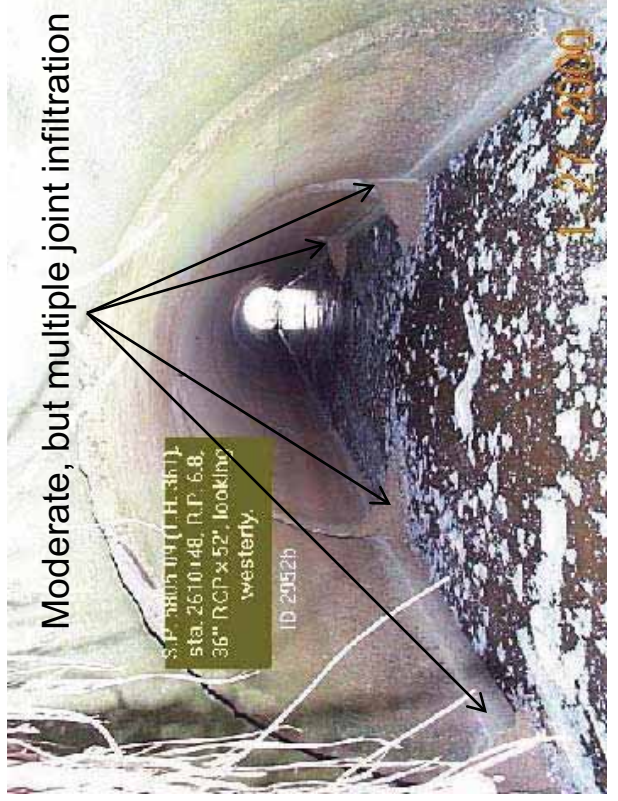
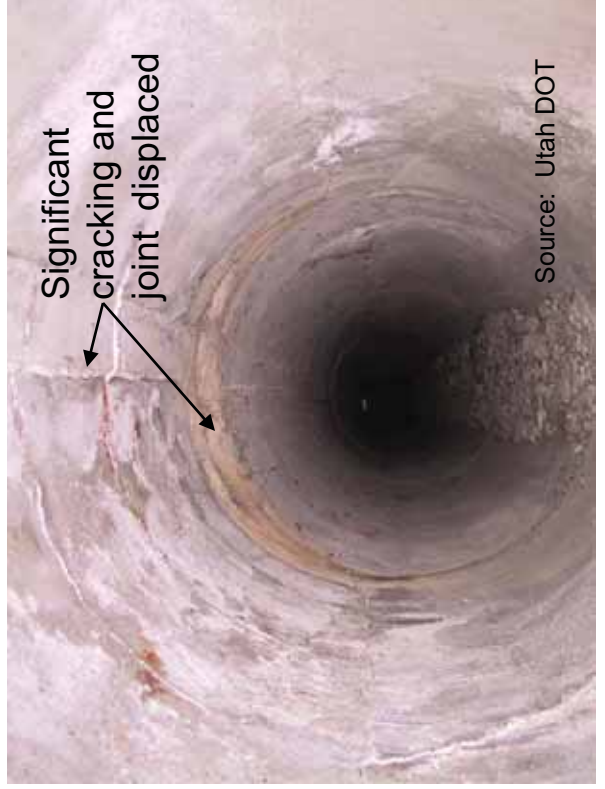
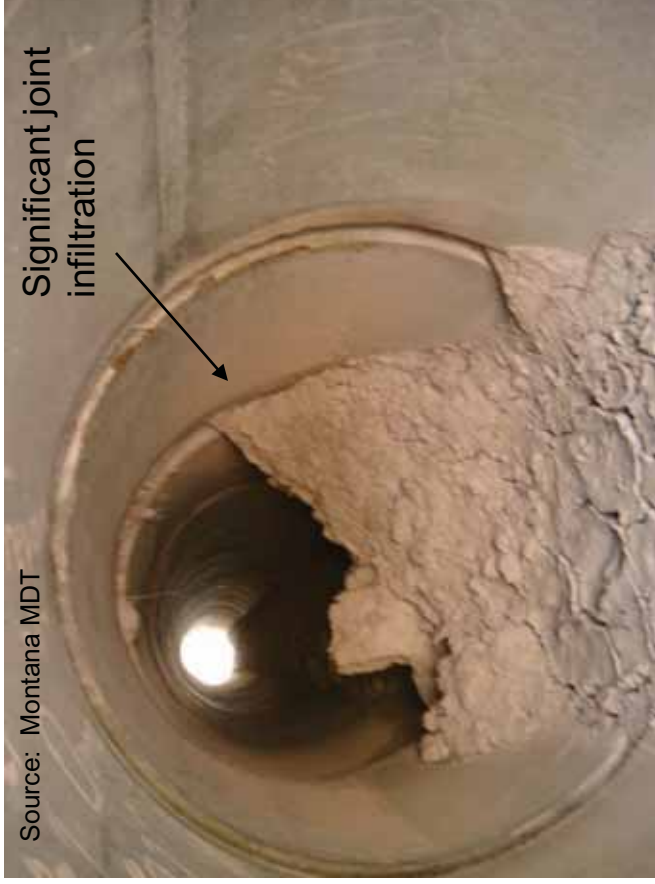
RCP – Poor (Longitudinal and Circumferential > 1/8” Wide Cracks)



RCP – Poor

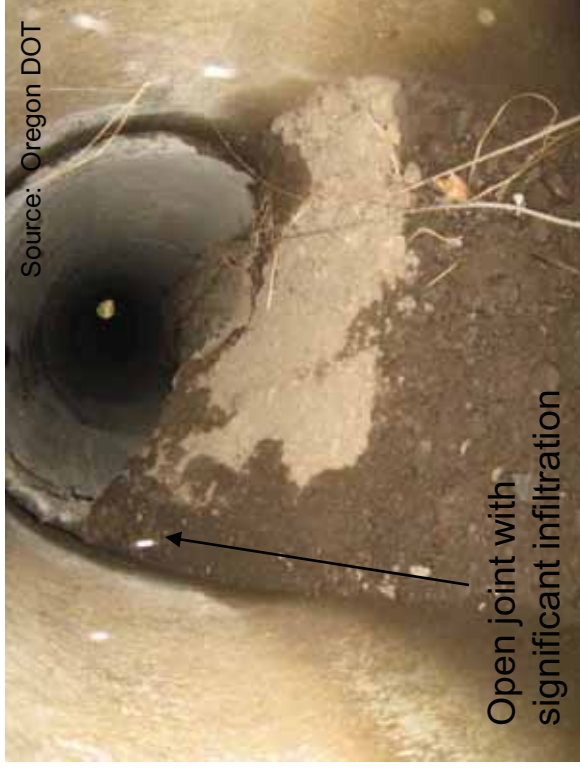
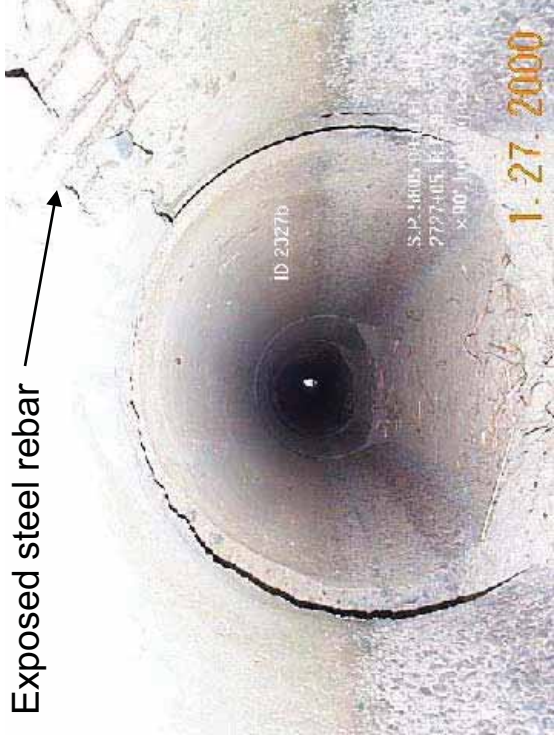


RCP – Poor

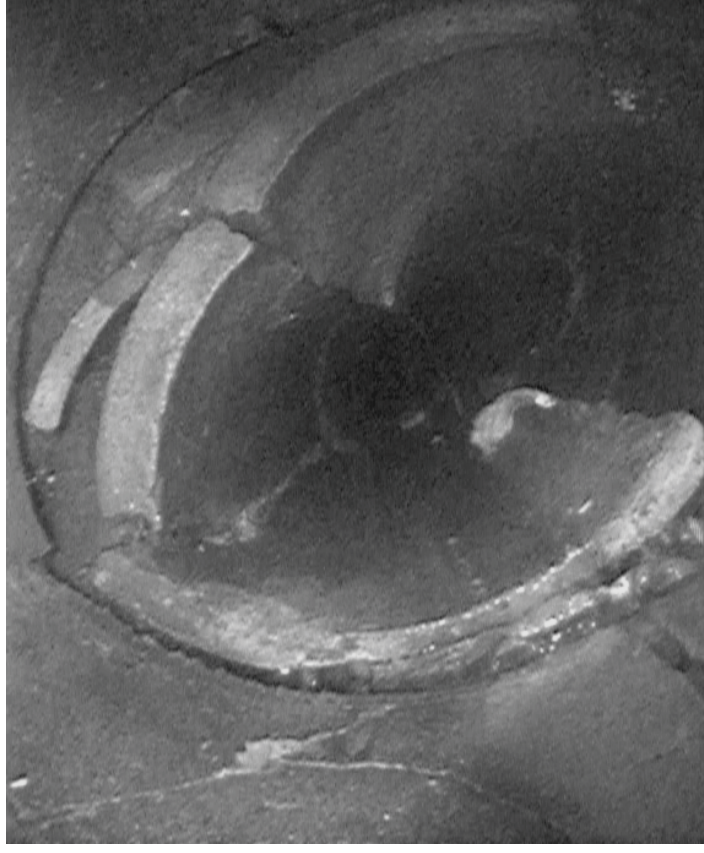
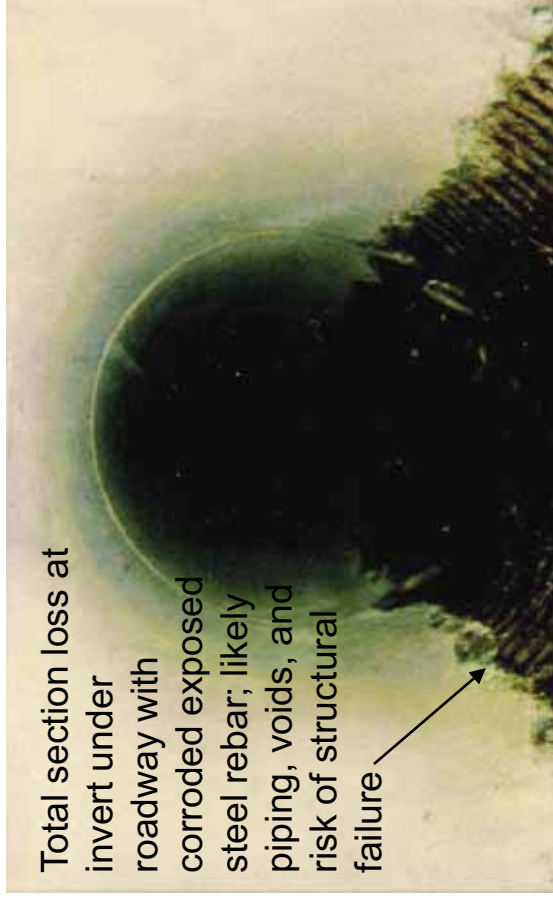


B.15

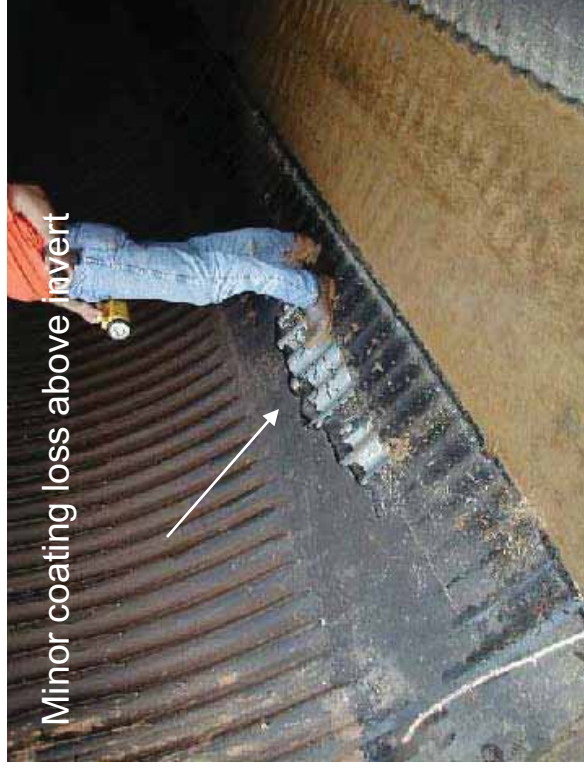
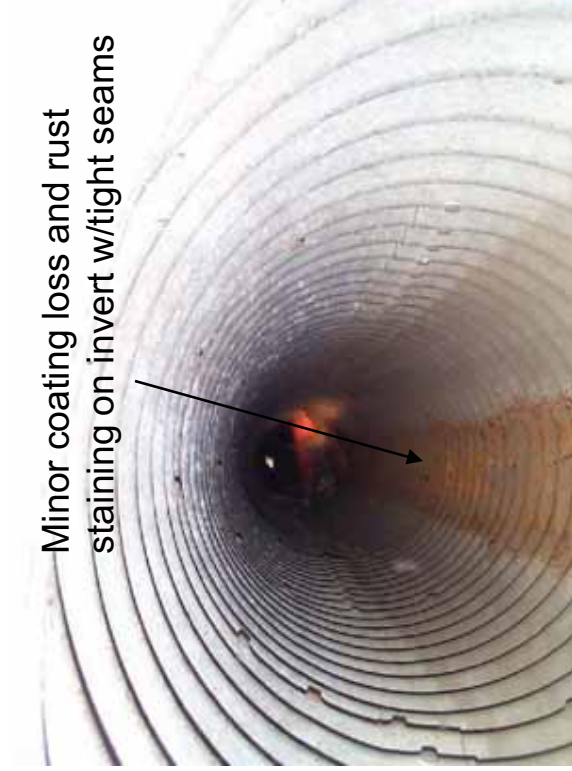
RCP – Poor



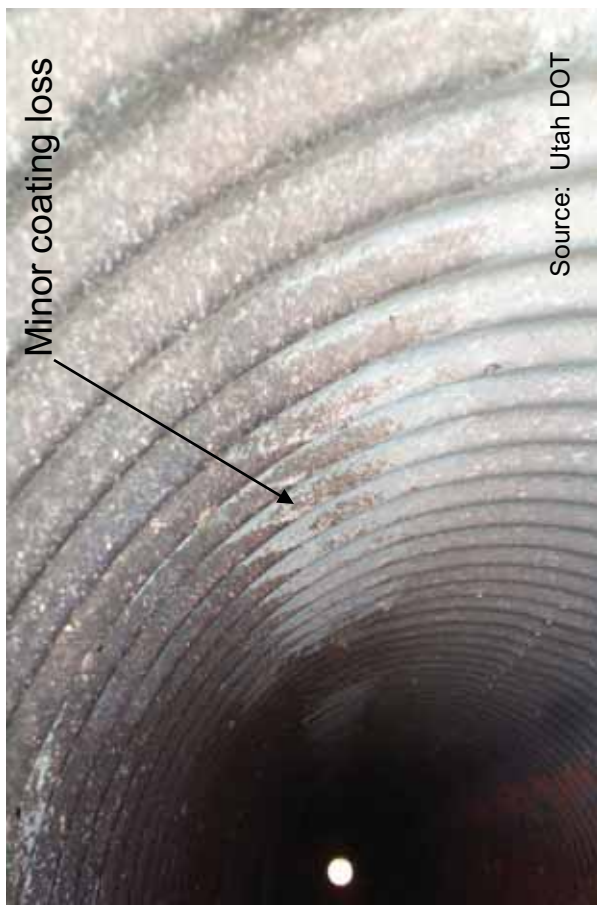
RCP – Critical



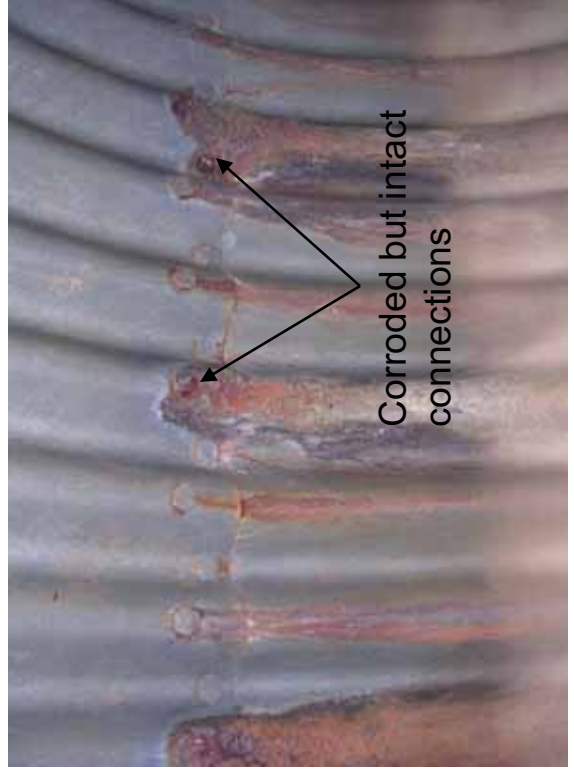
CMP – Good



CMP – Good

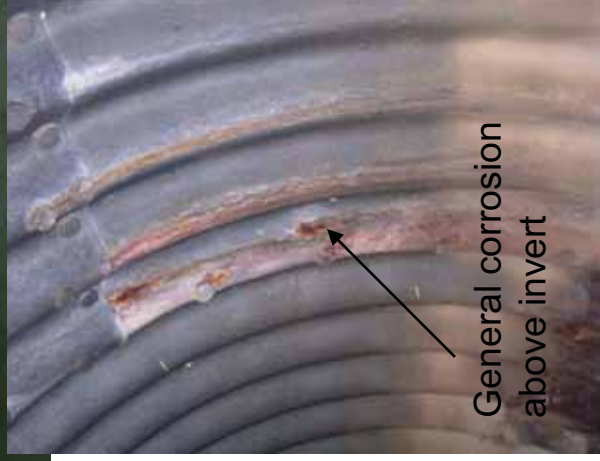
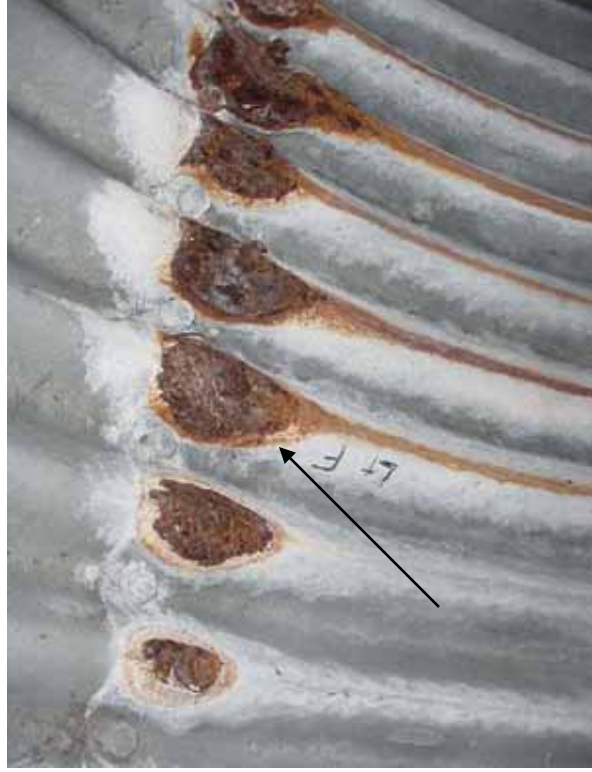


CMP – Fair

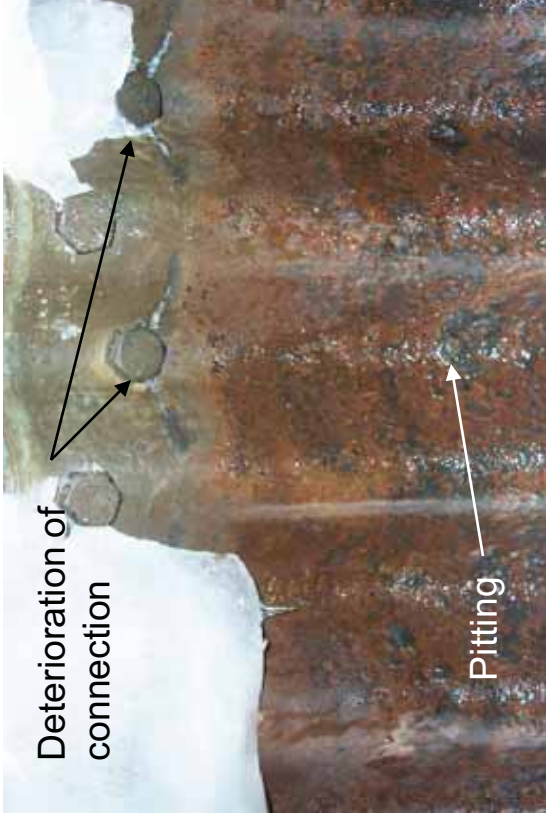


CMP – Fair

(Local corrosion at seam edges and hardware)

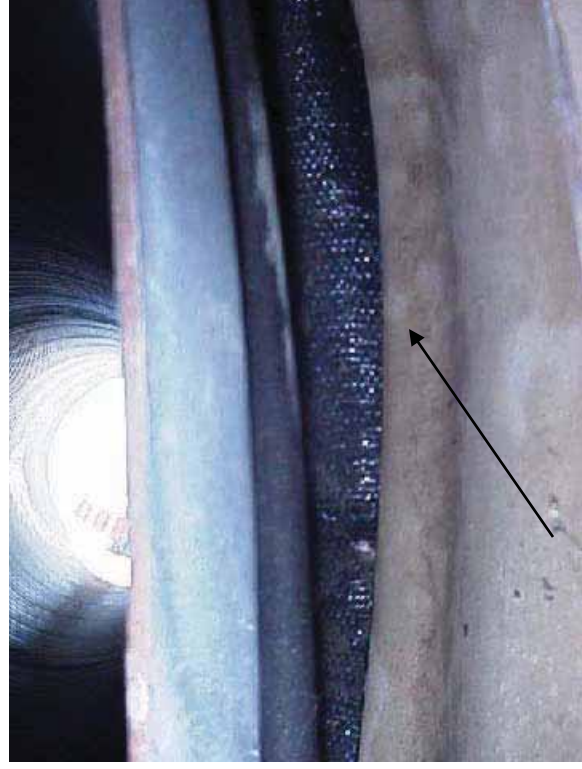


CMP – Fair



CMP – Fair

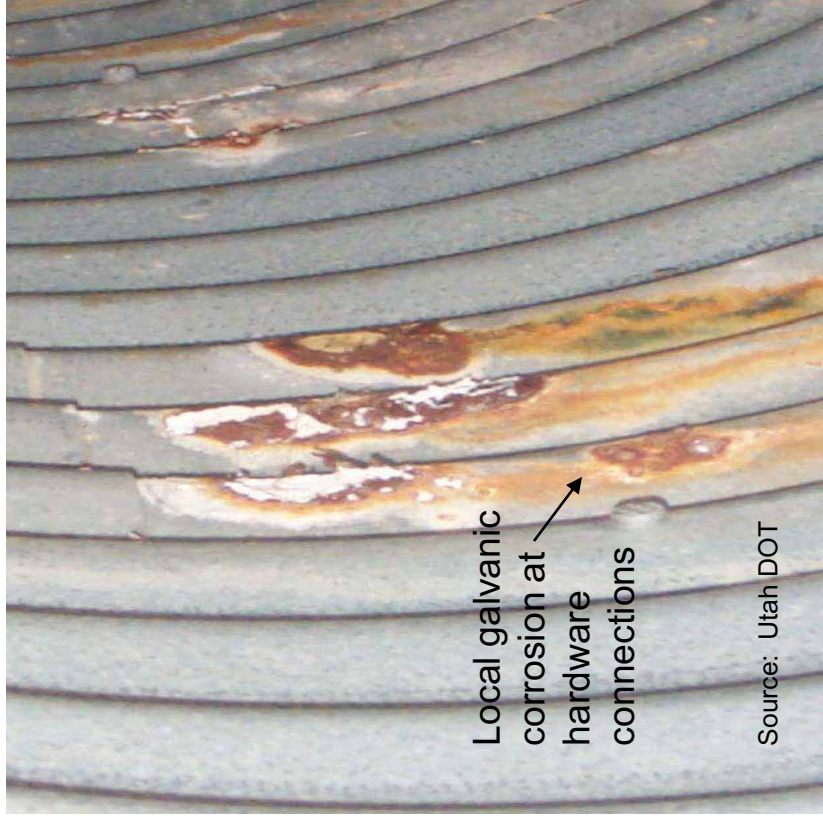
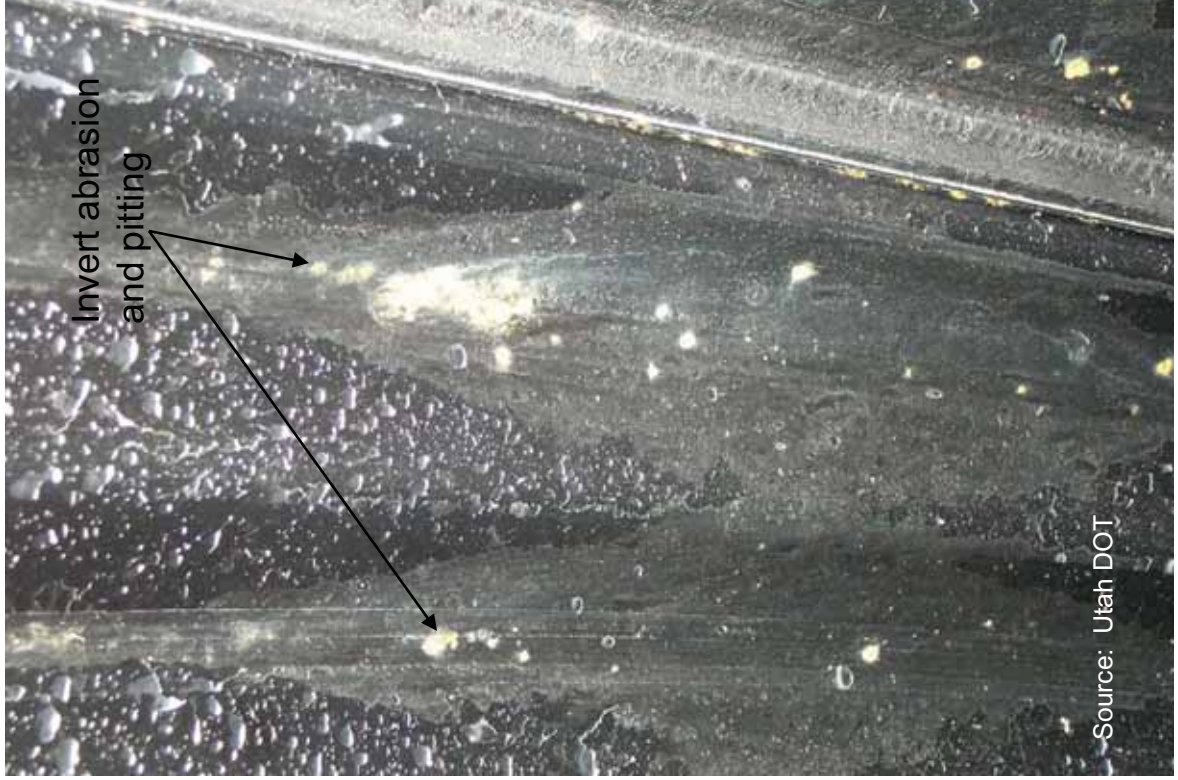
(Open joint separation with minor infil/exfil and gasket visible)



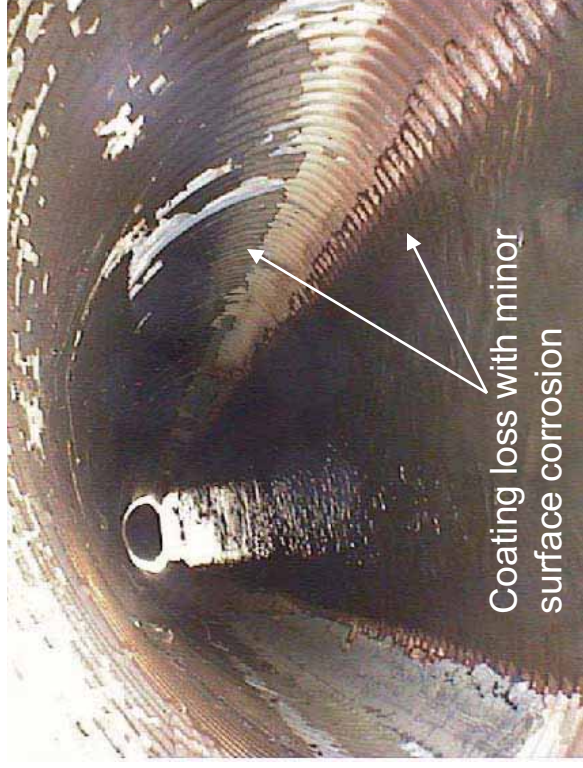
CMP – Fair



CMP – Fair

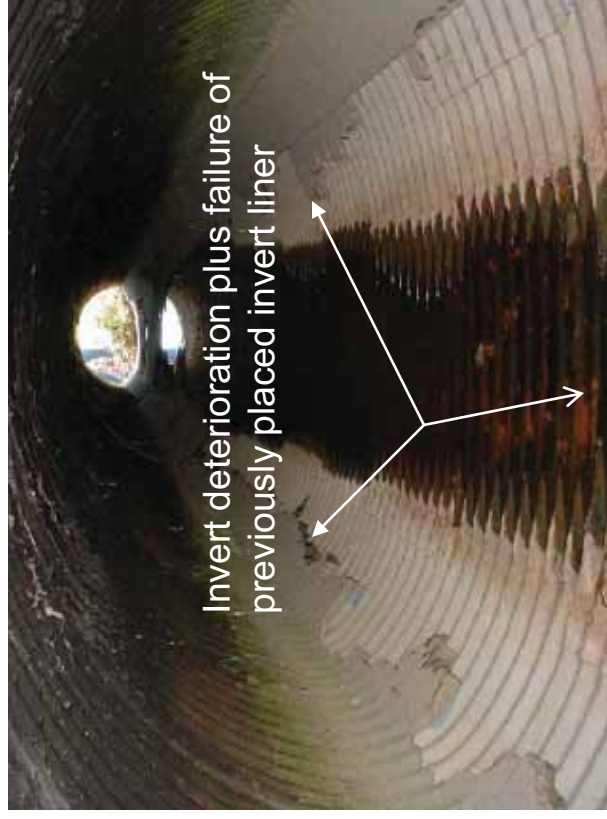
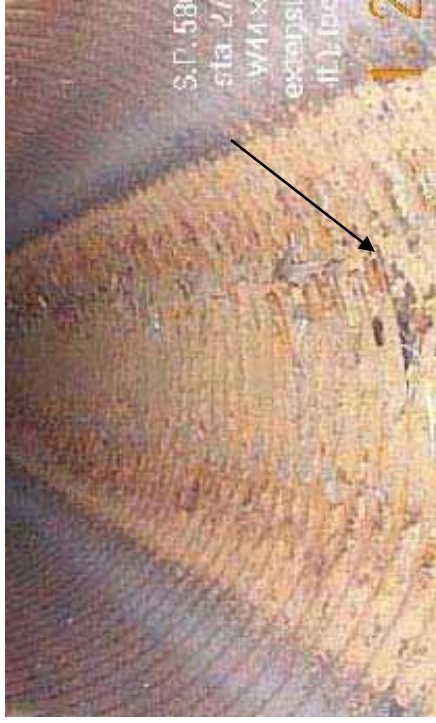


CMP – Fair

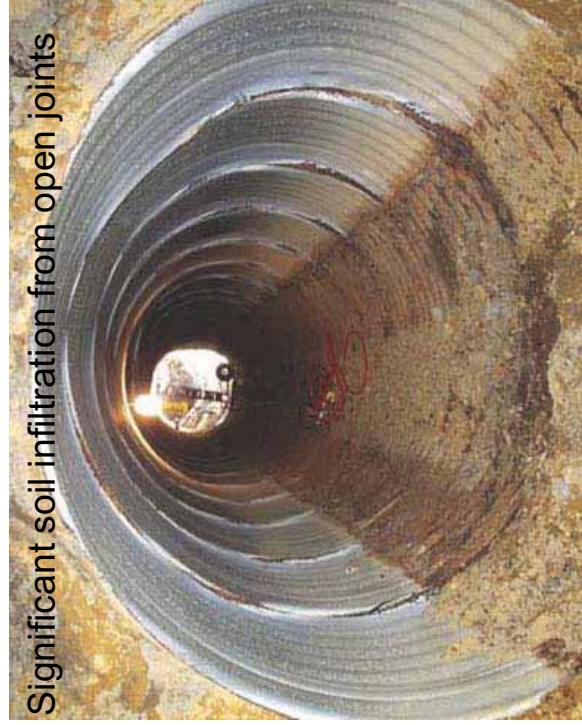


CMP – Poor

(Invert deterioration and perforation, and deformation with cracking)

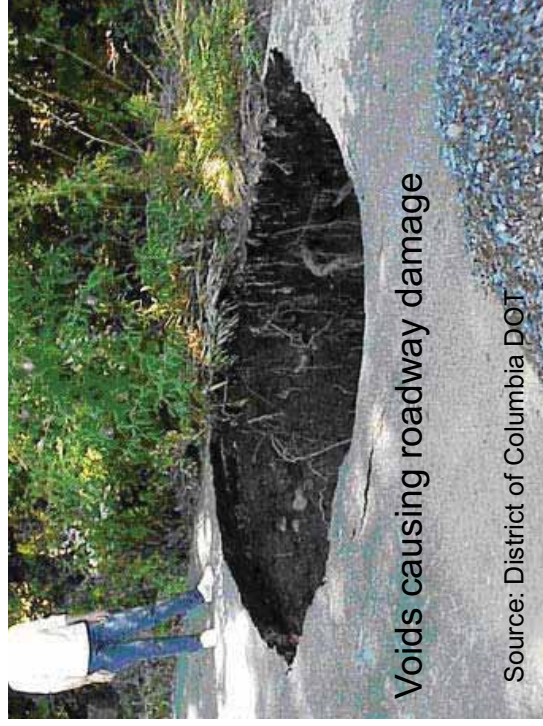
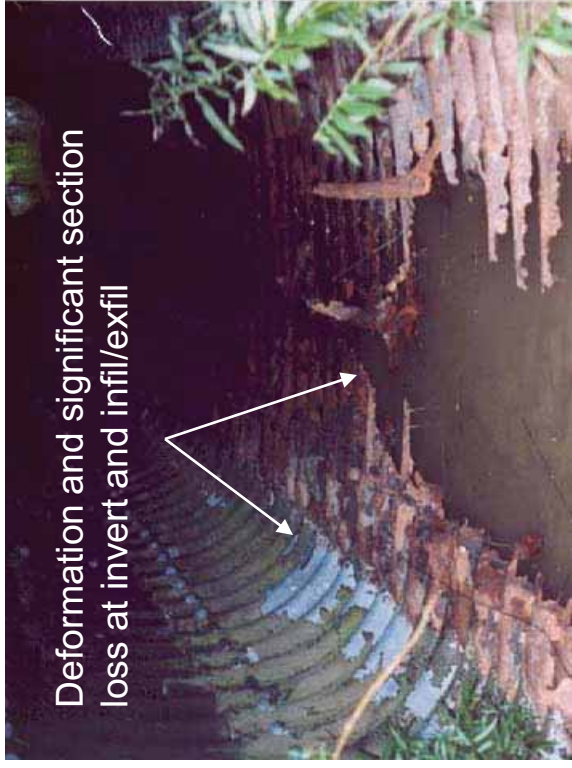


CMP – Poor



CMP – Critical

(Significant Invert section loss, voids and roadway damage)



Voids causing roadway damage

Source: District of Columbia DOT

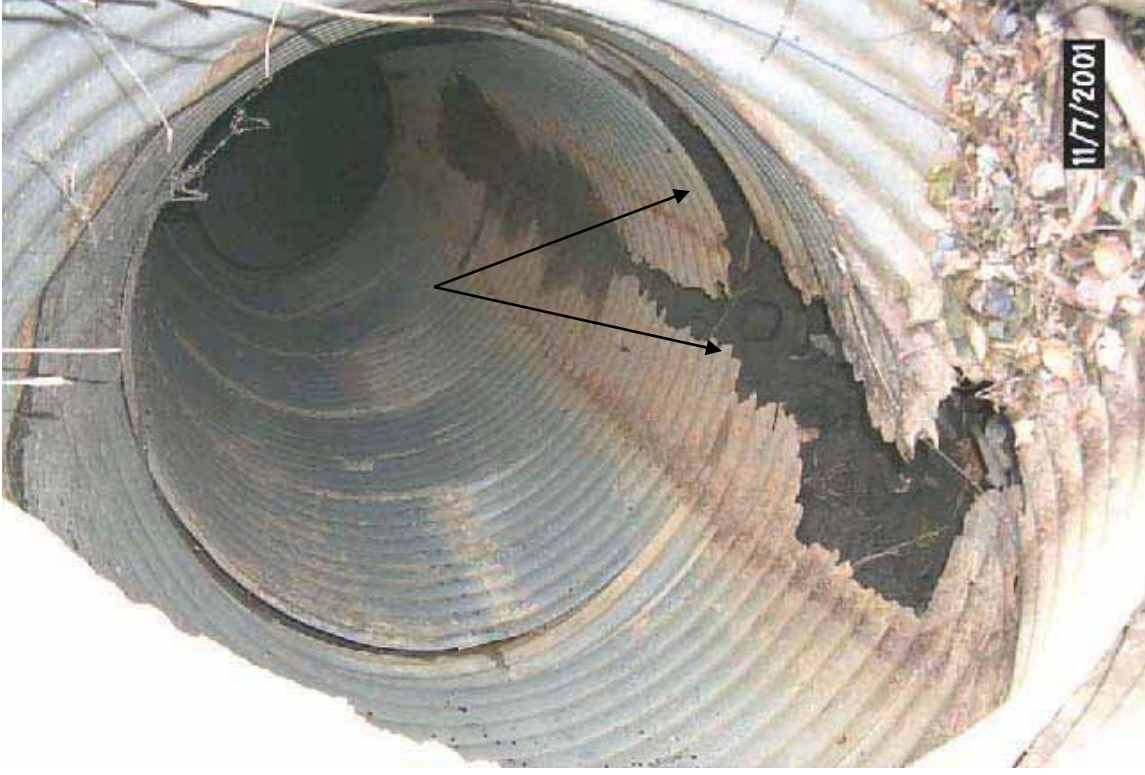


Source: City of Loveland, CO

Deformation, open seam, heavy corrosion and section loss, infiltration of soil

CMP – Critical

(Significant Invert section, soil infiltration and voids)

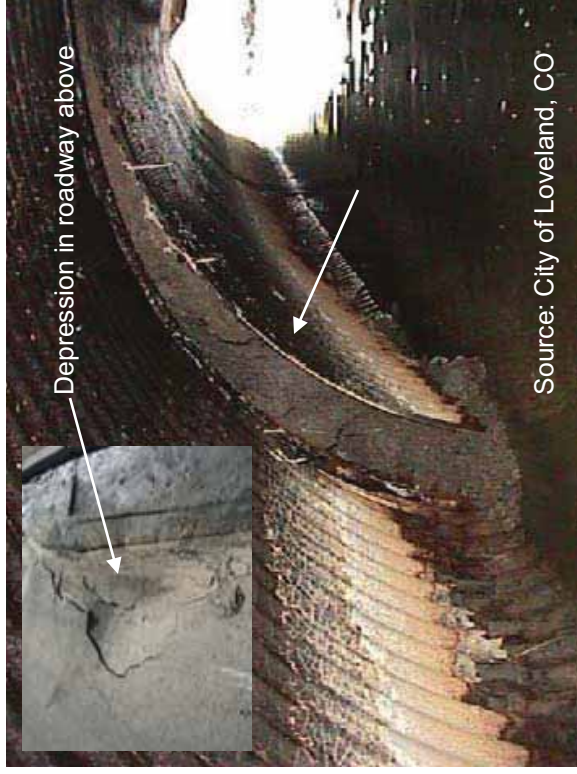


CMP – Critical



CMP – Critical

(Significant deformation, joint displacement, voids and sinkholes, with risk of embankment and roadway failure)

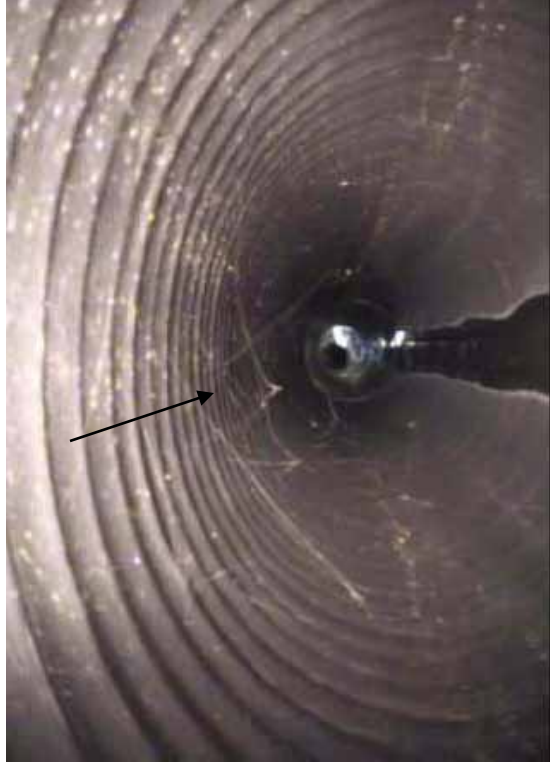
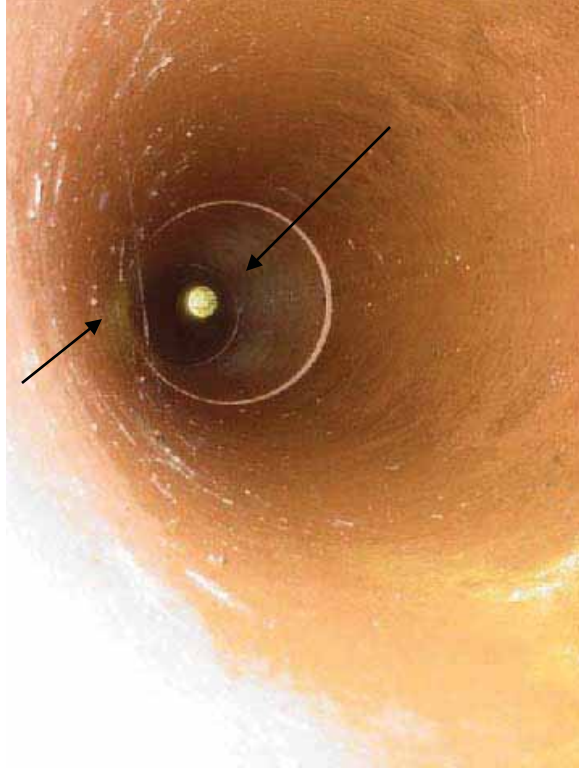
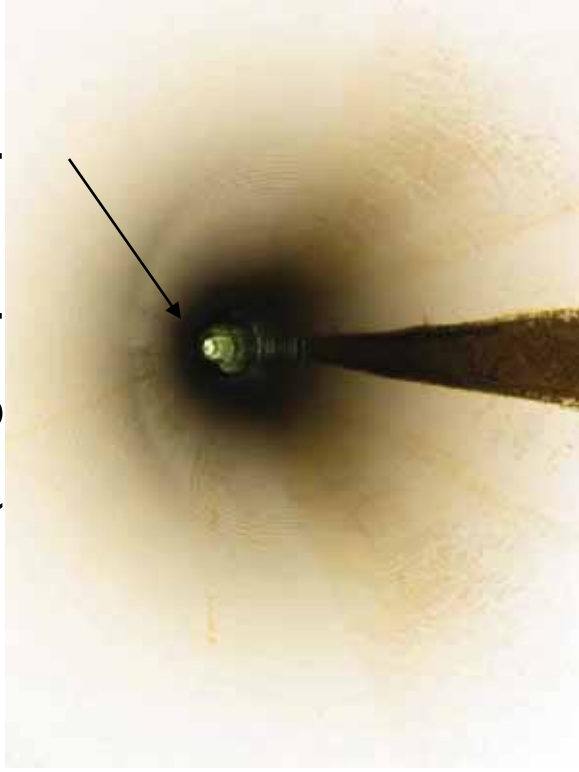


Plastic – Good



Plastic – Fair

(Slight perceptible deformations and bulging)



Plastic – Fair

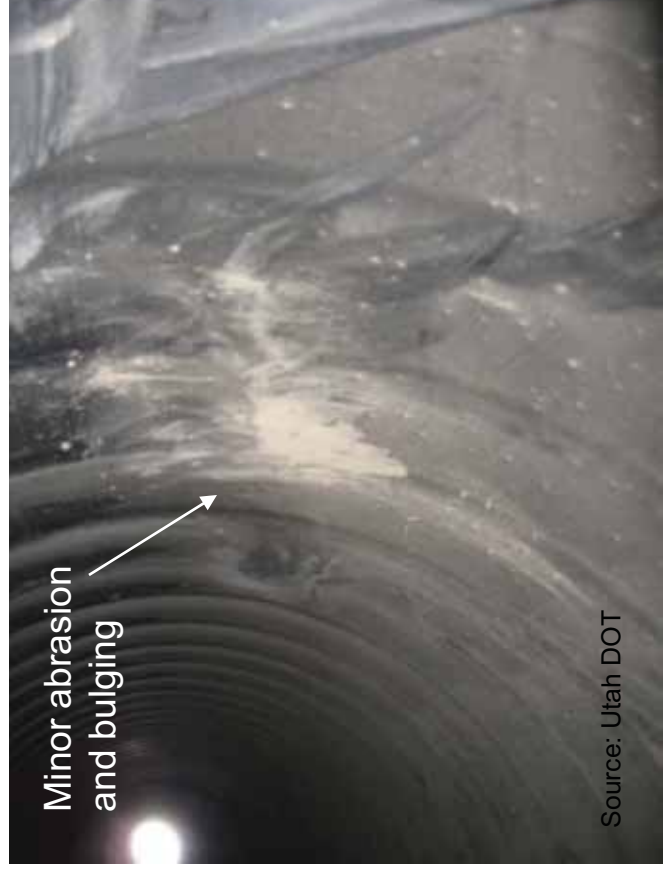
(Joint separations with minor infil/exfil)



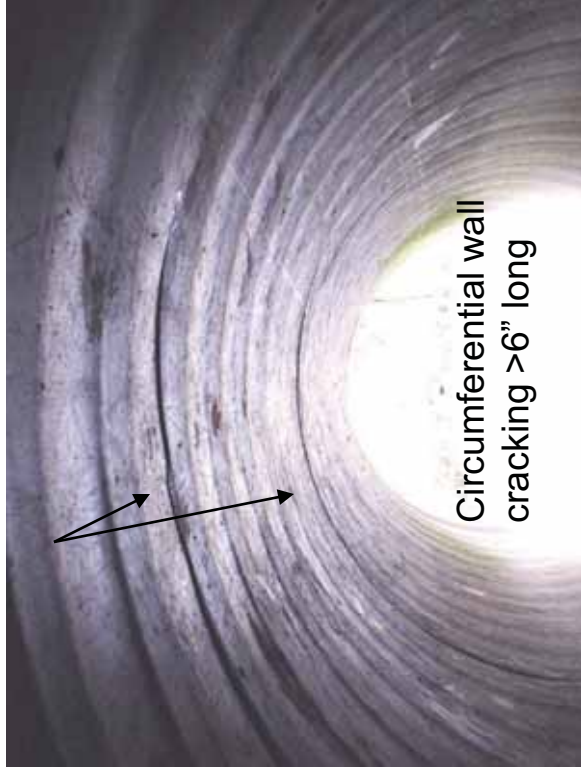
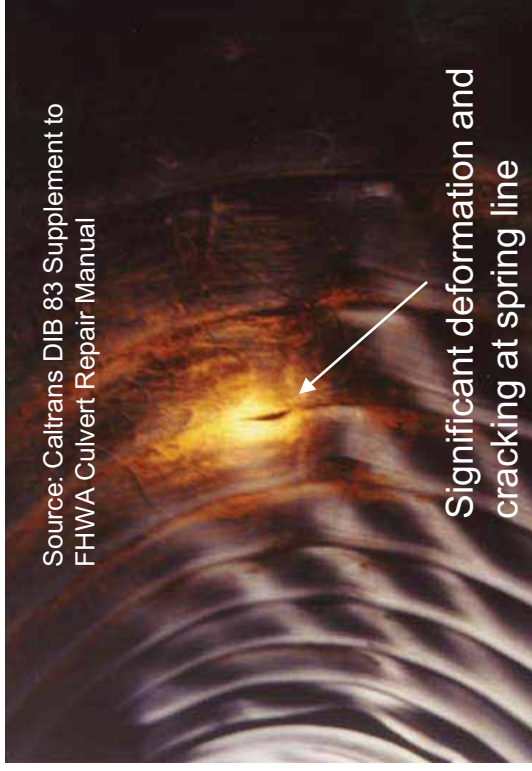
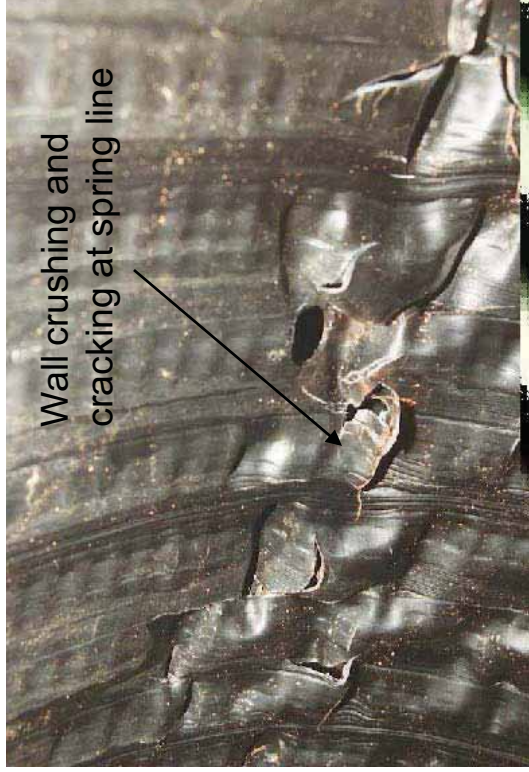
Plastic – Fair



Plastic – Fair

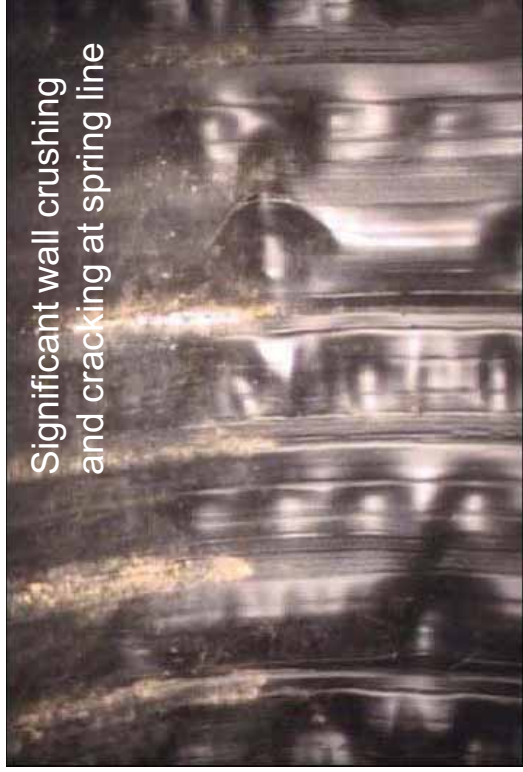
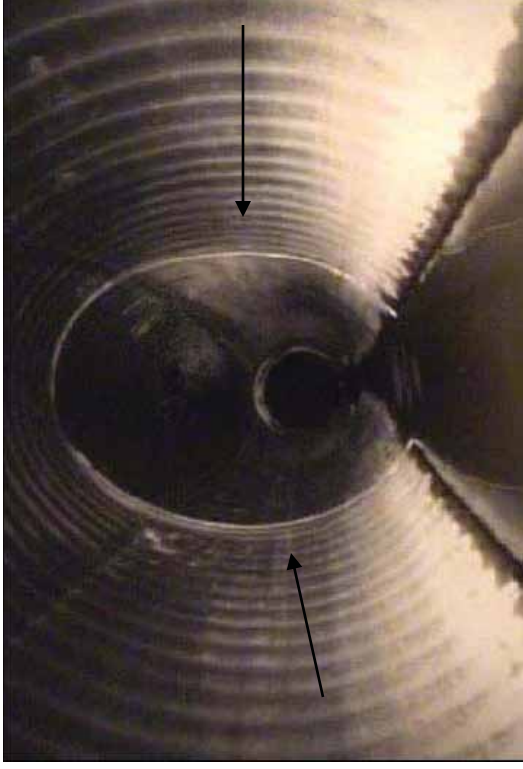


Plastic – Poor



Plastic – Poor

(Excessive cross-sectional deformation and wall damage)



Wall crushing and cracking >6" long at spring line with significant deformation

Plastic – Poor



Plastic – Poor

(Fire damage and resultant severe deformations at ends)



Plastic – Critical



Timber – Good



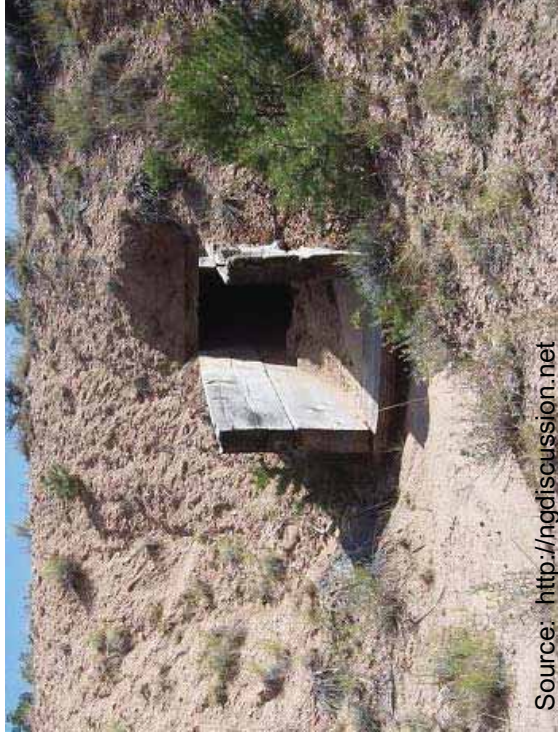
Source: Montana MDT



Source: USFWS Alpena NFWCO, MI



Source: National Park Service

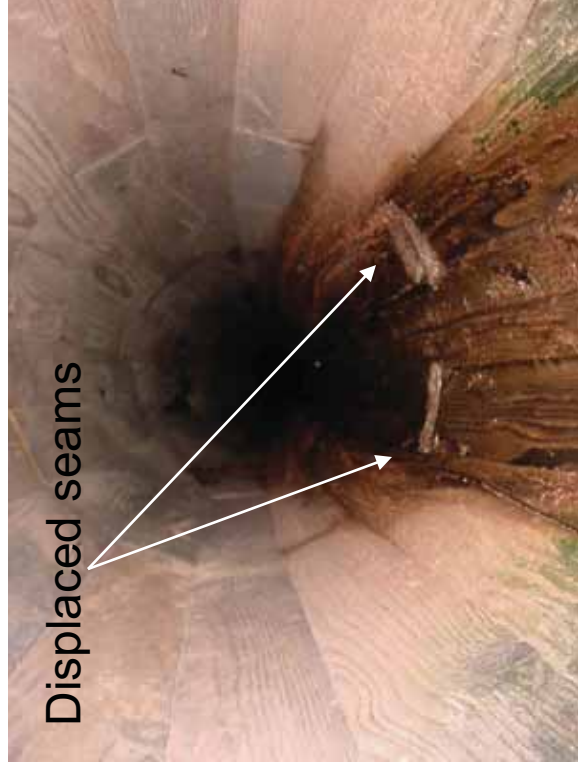


Source: <http://ngdiscussion.net>

Timber – Fair



Source: University of California Berkeley, ITS

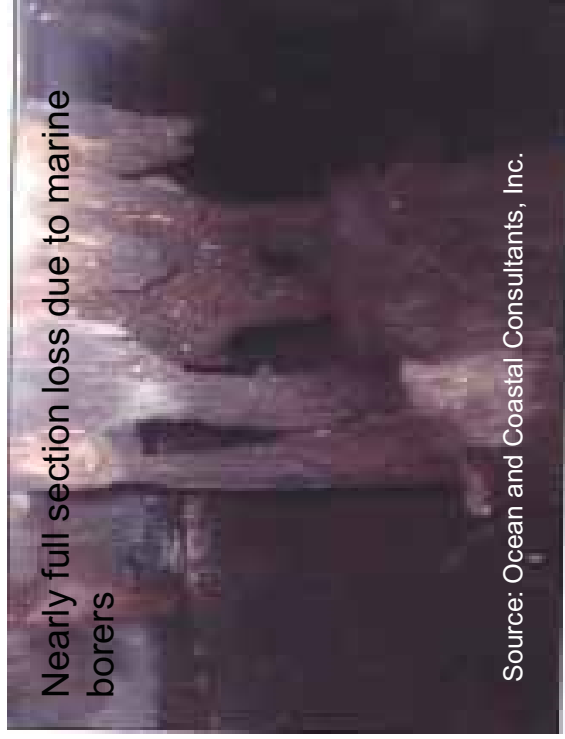


Source: www.fao.org

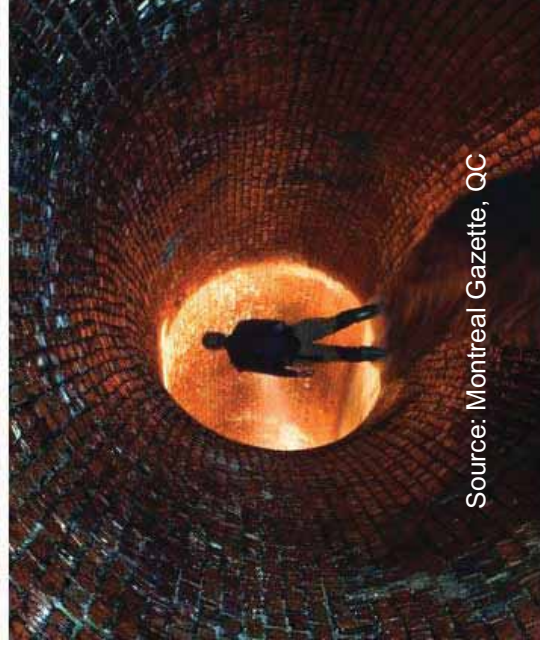
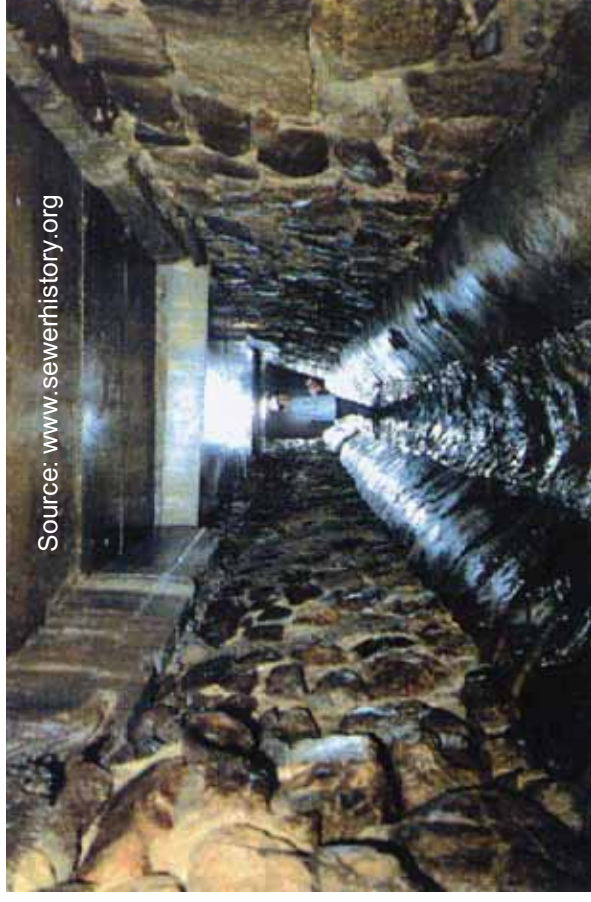
Timber – Poor



Timber – Critical

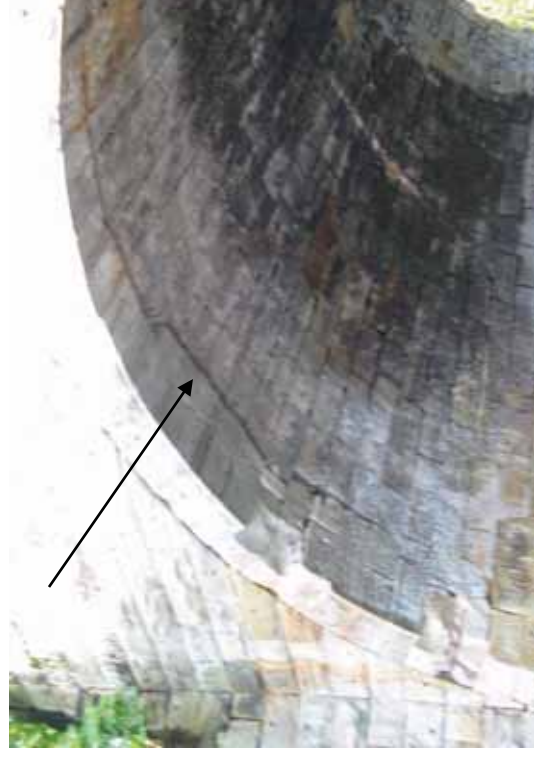
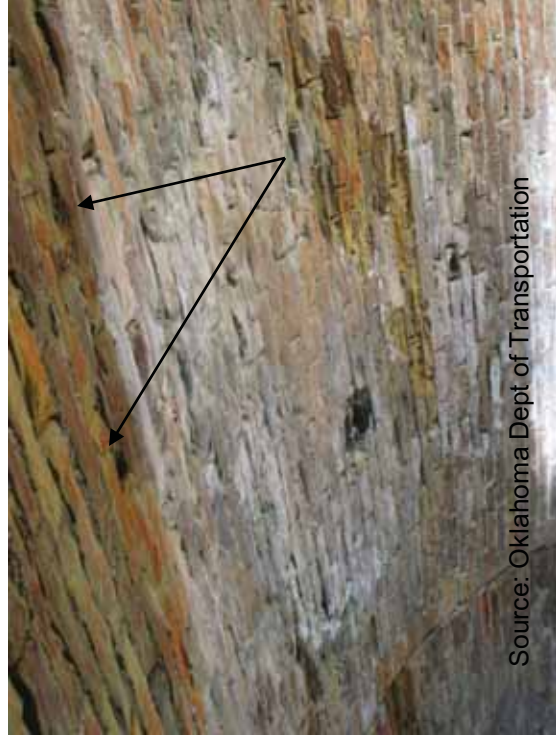


Masonry – Good

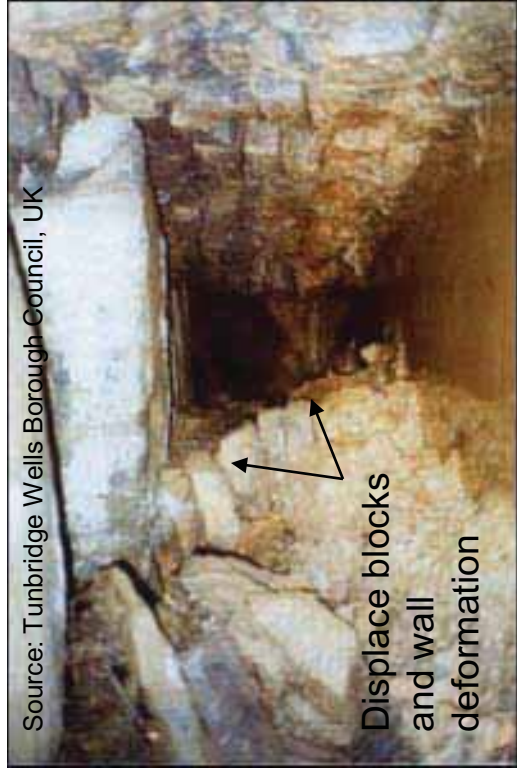
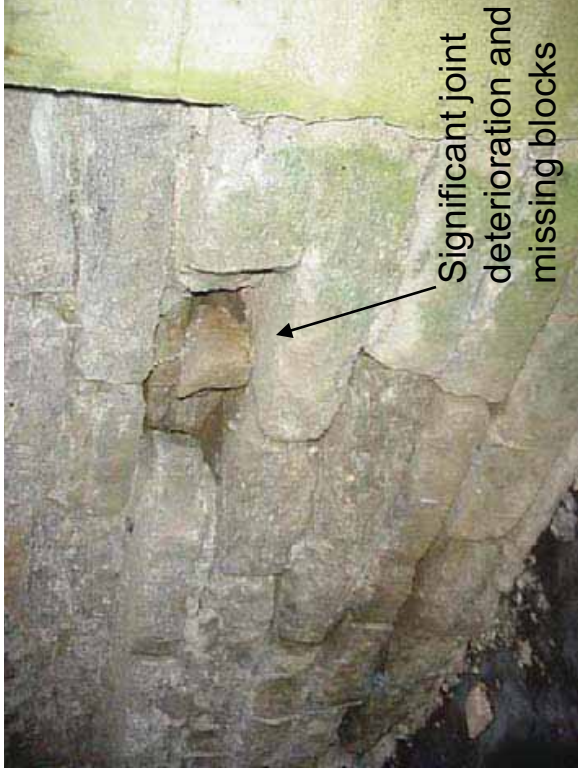


Masonry – Fair

(Minor cracks, mortar/section loss, loose blocks and infill)



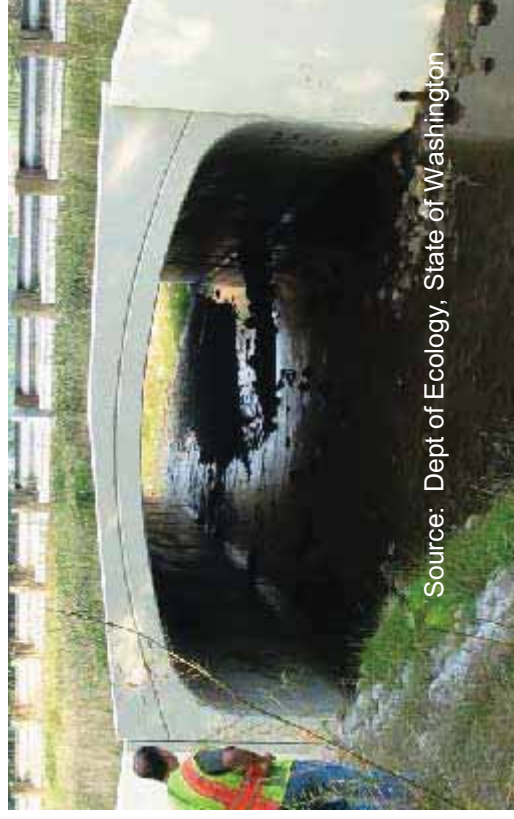
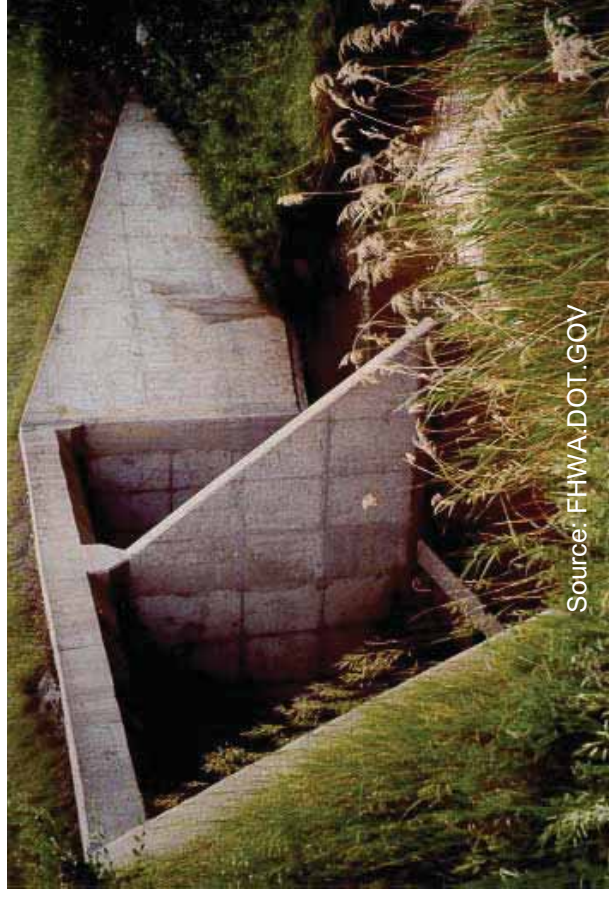
Masonry – Poor



Masonry – Critical



Appurtenances - Good



Appurtenances - Good



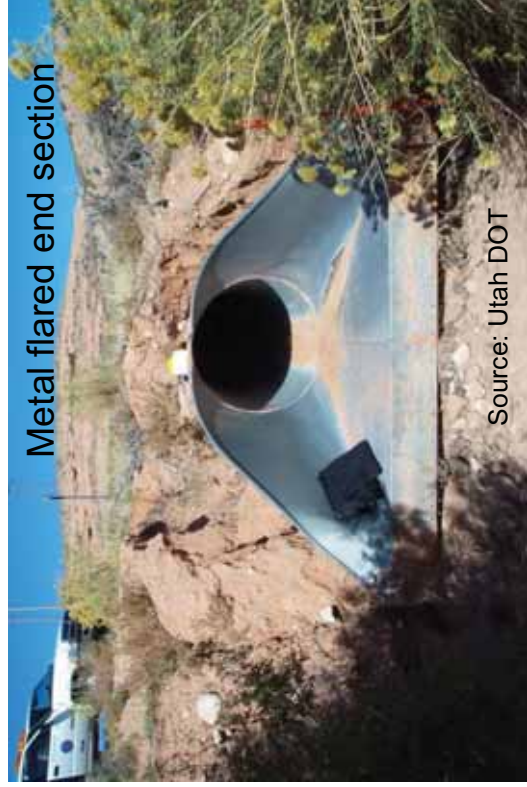
Source: California State Parks



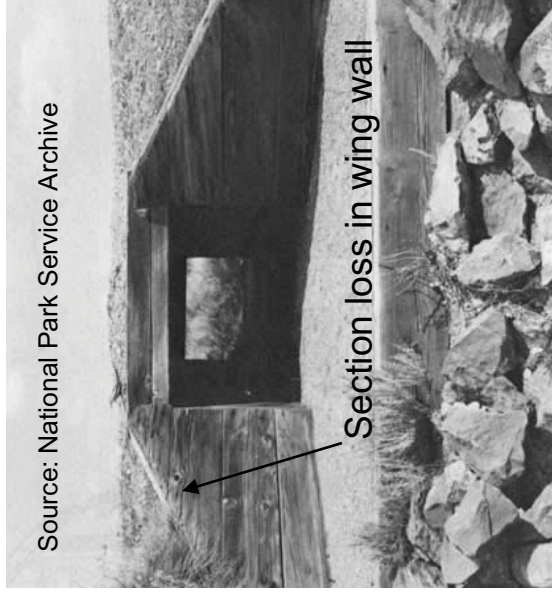
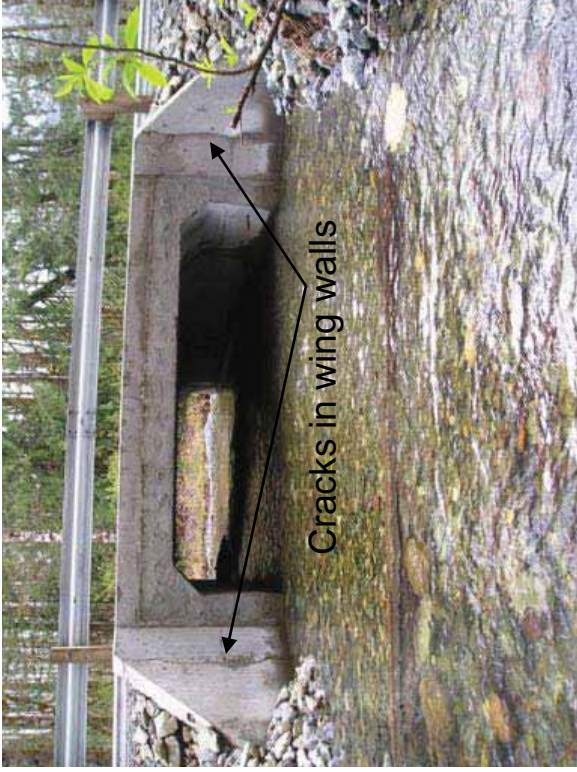
Appurtenances - Good



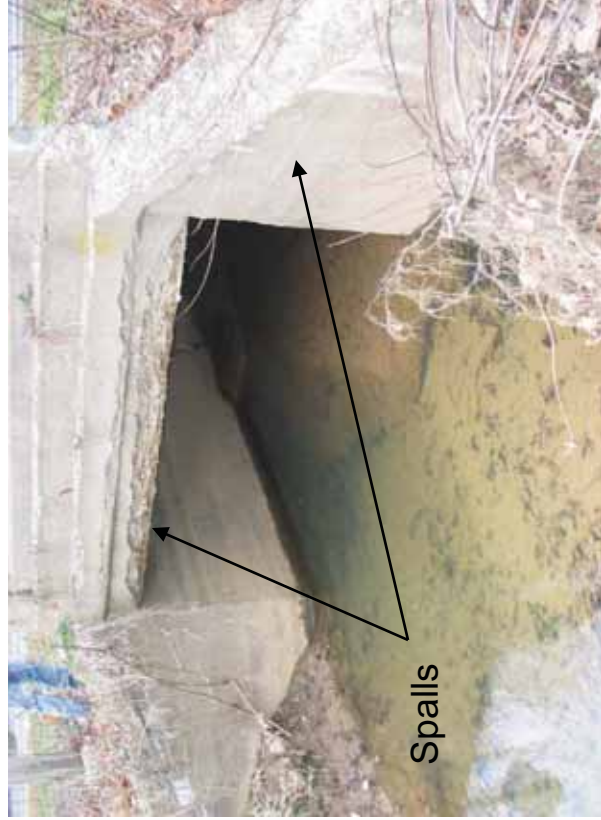
Appurtenances - Good



Appurtenances - Fair



Appurtenances – Fair



Appurtenances - Poor



Appurtenances - Critical



Performance – Perched Outlet



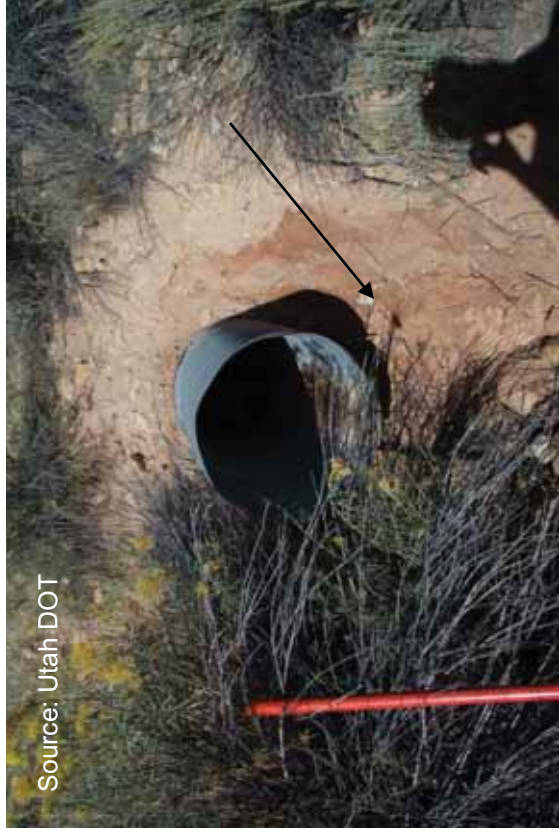
Source: Caltrans DIB
83 Supplement to
FHWA Culvert Repair
Manual



Performance – Outlet Scour or Degradation



Source: Utah DOT



Source: Utah DOT

Performance – Embankment Erosion



Source: Montana MDT



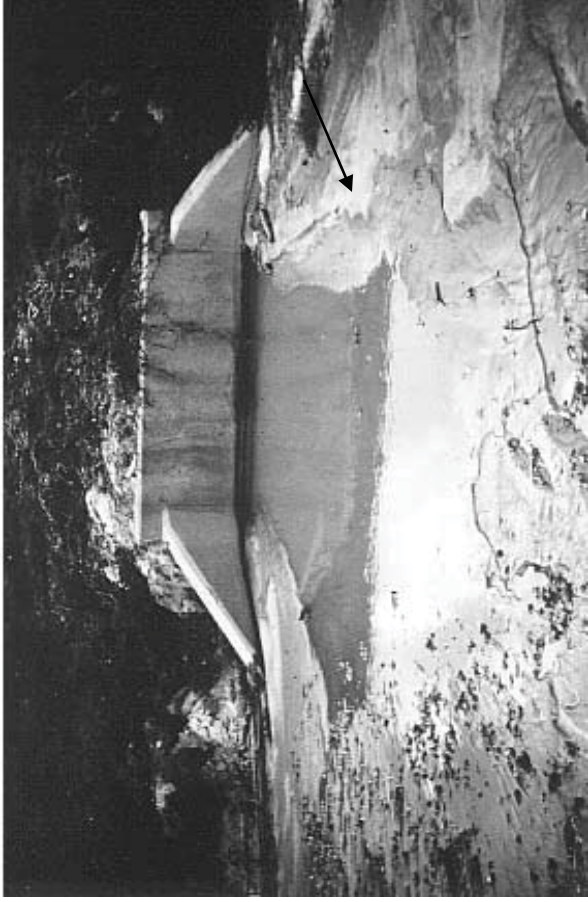
Source: Federal Lands Highway



Performance – Embankment Erosion



Performance – Chronic Sediment



Source: Utah DOT



Source: Utah DOT



Source: Utah DOT

Performance – Debris and Vegetation



Source: US Forest Service

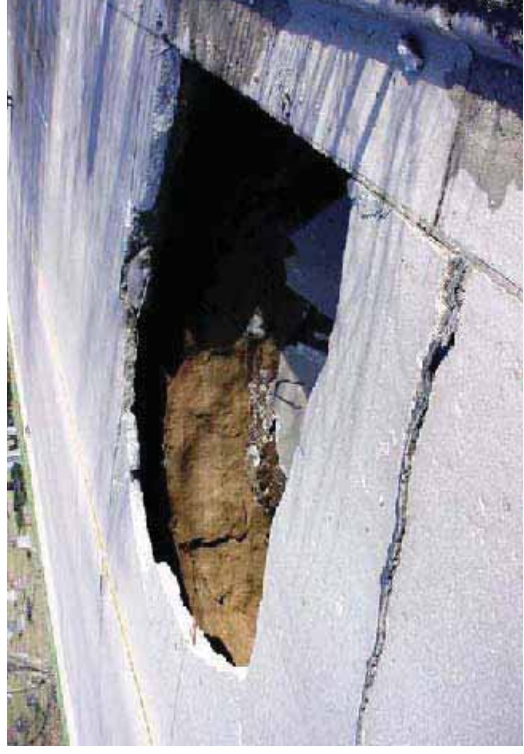


Source: Utah DOT

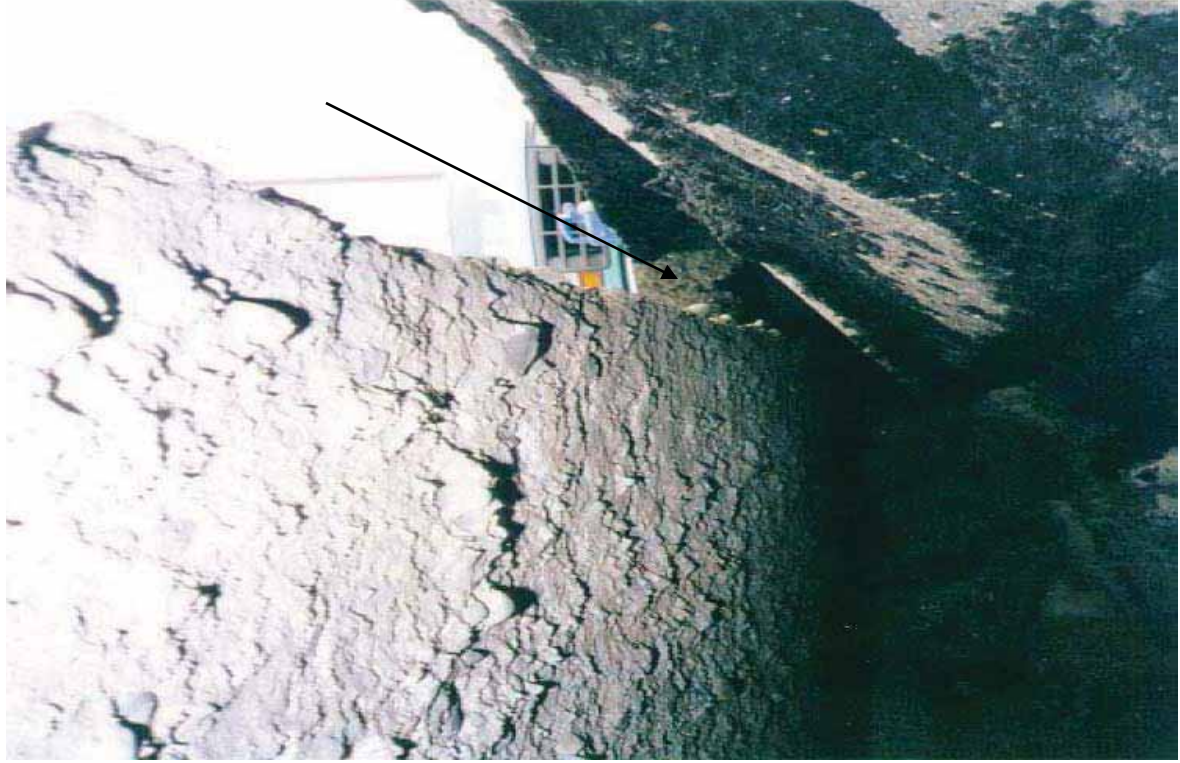


Source: Utah DOT

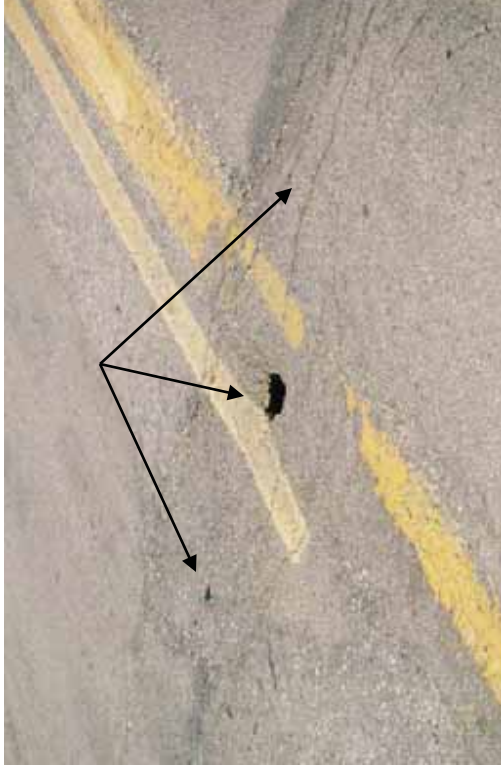
Performance – Piping/Settlement/Holes



Performance – Piping/Settlement/Holes



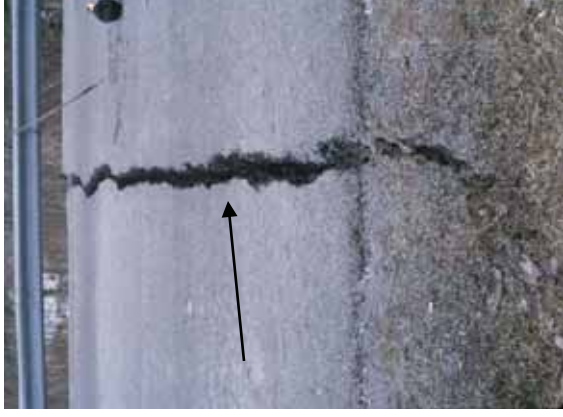
Performance – Piping/Settlement/Holes



Performance – Piping/Settlement/Holes



Performance – Piping/Settlement/Holes



Source: Muskegon Chronicle, MI



Performance – Piping/Invert Buckling



Source: Utah DOT

Performance – Channel Degradation



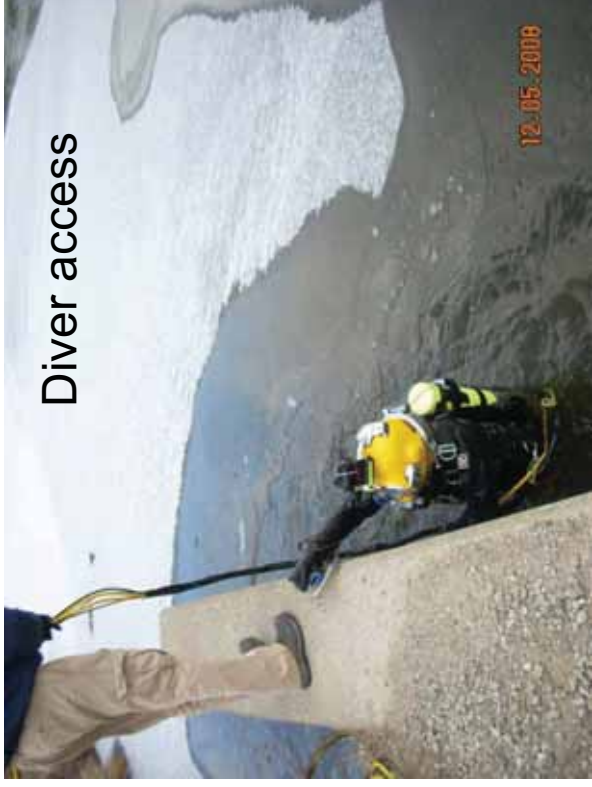
Performance – Approaching Headcut



Level 2 – No Access or Specialized Equipment Necessary



Swift water conditions



Diver access



Rope access and confined space



ROV/robotic crawler access

Sources

- AASHTO Culvert Inspection, Material Selection, and Rehabilitation Guideline (Chapter 14); 2007.
- Caltrans Supplement to FHWA Culvert Repair Practices Manual; 2003.
- FHWA FLH Field Photo Archives.
- FHWA HDS5 Hydraulic Design of Highway Culverts; Rev 2005.
- MnDOT HYDINFRA website <http://www.dot.state.mn.us/bridge/Hydraulics/HydInfra.html>
- Ohio/ORITE Risk Assessment and Update of Inspection Procedures for Culverts; 2005.
- USDA Forest Service Summary of Trenchless Technology for Use With USDA Forest Service Culverts; 2005.
- Otherwise noted on the individual photograph.