Montana Department of Transportation
Research Programs
January 2017

EXPERIMENTAL PROJECT CONSTRUCTION REPORT AND FINAL EVALUATION

CONTECH RIBBED ALUMINUM BOX CULVERT (ABC)

Location:	Secondary 325 (C000325): Blaire County, Great Falls District
Project Name:	Jct. US 2 – North Belknap Crossing
Project Number:	STPS 325-1(3)0
Experimental Project No.	MT-12-01
Type of Project:	Ribbed Aluminum Box Culvert Installation
Principal Investigator:	Craig Abernathy: Experimental Project Manager (ExPM)
Date of Installation:	February/March 2012
Inspection Dates:	March 2013, February 2014, January 2016 & 2017

Objective

Document all phases of the installation practice of the ABC unit. Issues such as special backfill required, installation of reinforcing ribs, equipment required, and construction loading will supplement the report. Monitor and report on long-term performance of the culvert and roadbed.

Experimental Design

Placement of Contech Ribbed Aluminum Box Culvert (ABC). Approximately 46.0m (151 ft.) in length, span of 7.7m (25.2 ft.) and a rise of 2.36m (7.74 ft.). Type VI ribs at 9 inch spacing.

Documentation Procedures

Research will document the installation for best practice and any constructions concerns germane to the functioning of the ABC product. Annual inspections will report on culvert integrity and any other measurable outcomes. Additional site inspections may supplement the annual site visits based on need.

This report attempts to capture the pertinent elements of assembly to describe the installation events to give the reader an understanding on how this type of structure was constructed. This report also establishes a baseline of documentation for use in determining future performance of the ABC unit.

The following are images and descriptions of the ABC installation which took place in late February and early March of 2012 and images of the completed culvert under active use taken in August 2012; including the March 2013, February 2014, and January 2016/2017 site inspections.

Installation Notes

Other than noted in the supplemental portion of this report page seventeen (17), no issues on construction were noted that may affect the performance of the ABC unit.

The ABC took approximately two weeks to construct. The contractor staff had no prior experience of this type of installation. The vendor's representative was on site and acted as trainer and supervised the installation. The Rep stated an experience crew could have completed the culvert in a week.

This was a reconstruct and new highway realignment. The existing secondary was used as the detour.

Performance to Date

- March 2013: Inspection found no visual abnormalities of the interior or exterior of the culvert. The road bed displayed no visual distress as well. Refer to page nineteen (19).

- February 2014: Inspection found no visual abnormalities of the interior or exterior of the culvert. The road bed displayed no visual distress as well. Refer to page twenty-three (23).

- February 2015: Due to an early melt the 2015 inspection did not take place.

- January 2016: Inspection found no visual abnormalities of the interior or exterior of the culvert. The road bed displayed no visual distress as well. Refer to page twenty-five (25).

- January 2017: Same condition as reported in 2016 site inspection. Refer to page twenty-eight (28).

February/March 2012

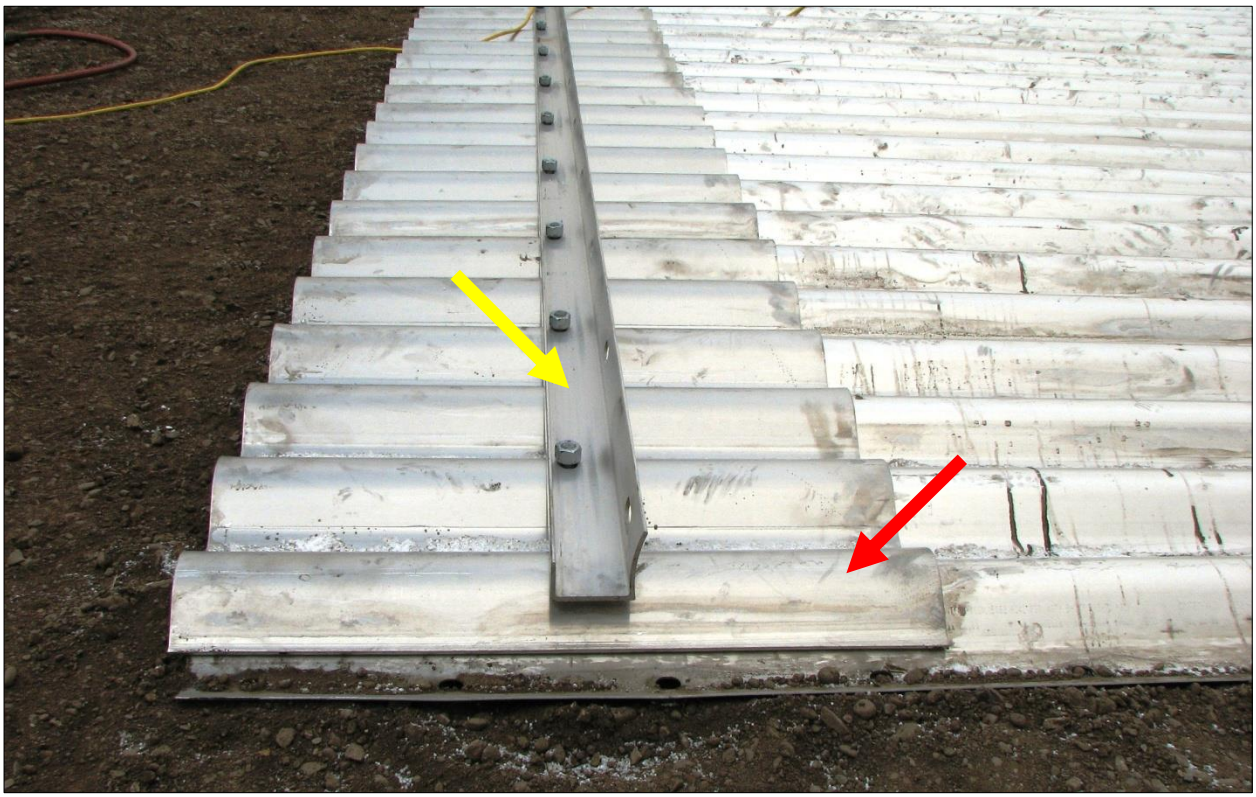
🡅🡇 Sample images of palletized Contech Plated Aluminum Box Culvert on-site.

🡅🡇 Top image shows the preparation of the foundation and bedding. Lower image shows completed bedding. Both views are looking west. Note that the ABC was phased as to begin installation from the center of the approximately 150' culvert at the 75' mark and proceed west (red line) to the inlet. The second phase of the installation would start at the culvert centerline and go east.

🡅🡇 Work begins with the connecting of the corrugated invert plates. The image below shows the almost completed culvert base.

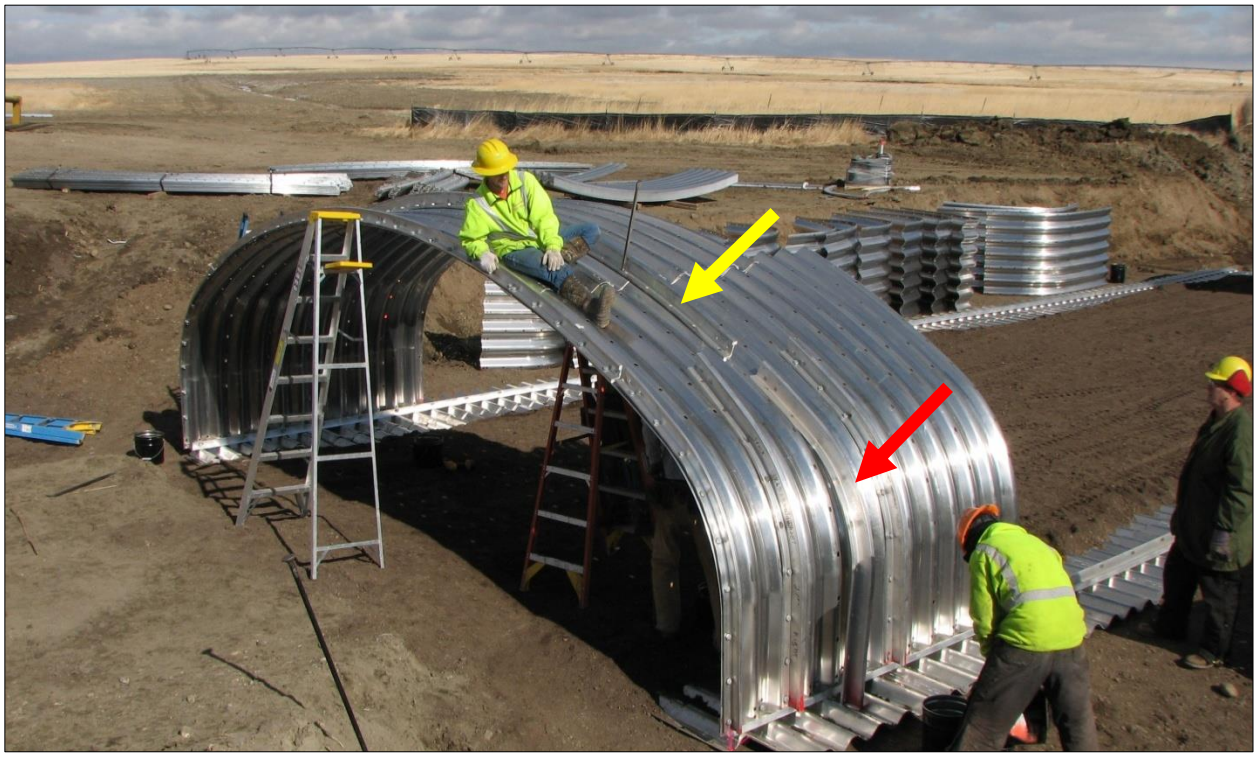
🡅 Completed corrugated invert plate base.

🡇 Here the supplemental plate (red arrow) and receiving channel (yellow arrow) are attached to the culvert base.



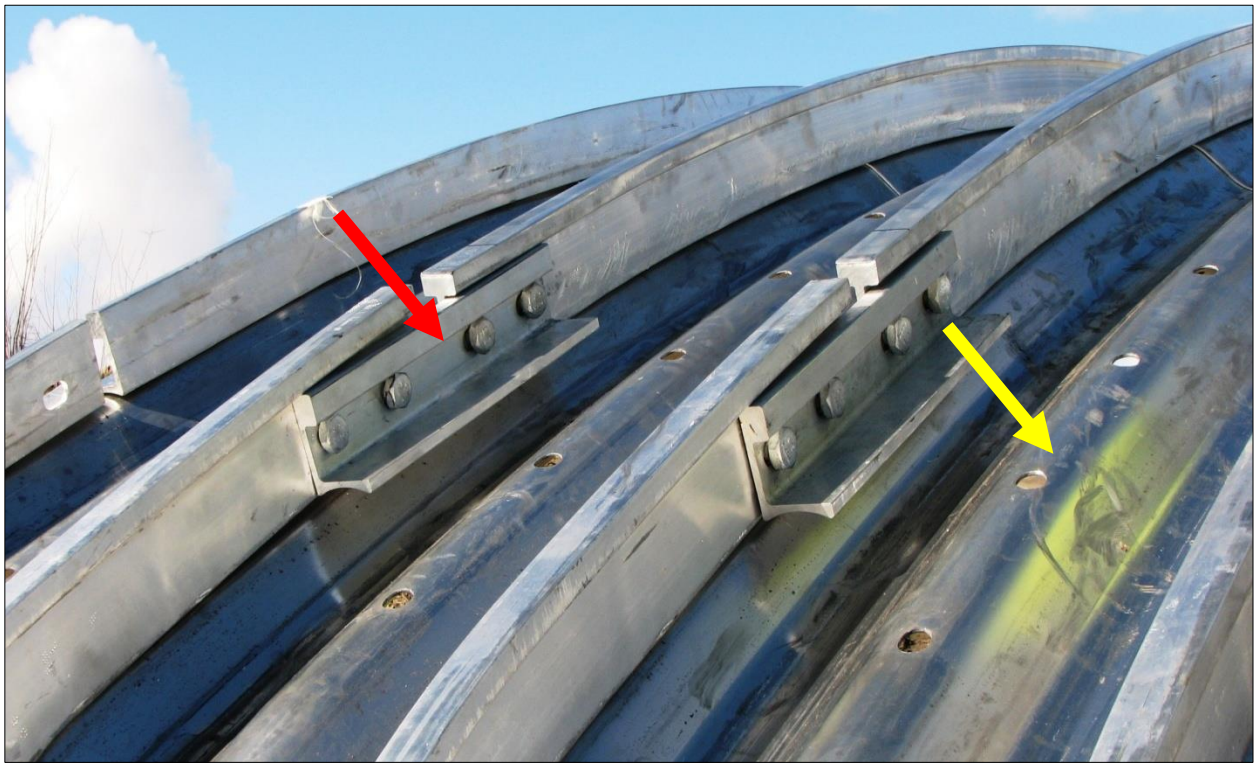
🡅 The first section of the corrugated shell plate is connected and ready for placement to the invert plate.

🡇 The shell plate section is set onto the receiving channel and bolted in place.



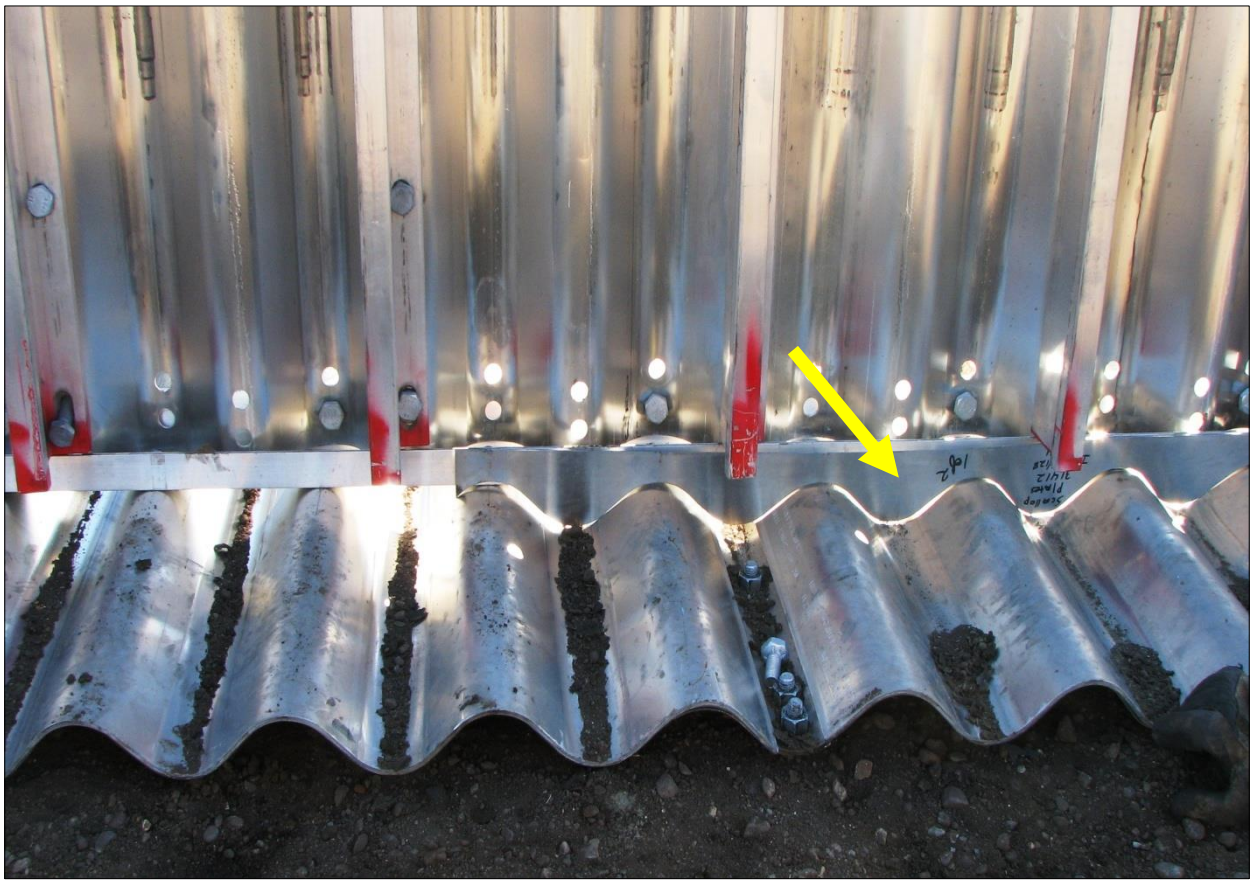
🡅 After several sections of the shell plate are attached, the shell reinforcing ribs (Type VI) are connected to the shell. The haunch rib (red arrow) is first to be placed then the crown rib (yellow arrow) is fixed to the shell.

🡇 The haunch and crown reinforcing ribs are coupled together by the rib splice (red arrow). Towards the end of the installation additional crown ribs are attached to the shell (yellow arrow).



🡅 Sample image of continued installation of shell and rib components.

🡇 To compensate for the gap between the supplemental plate and receiving channel, a scallop plate (yellow arrow) is wedged between these two components.

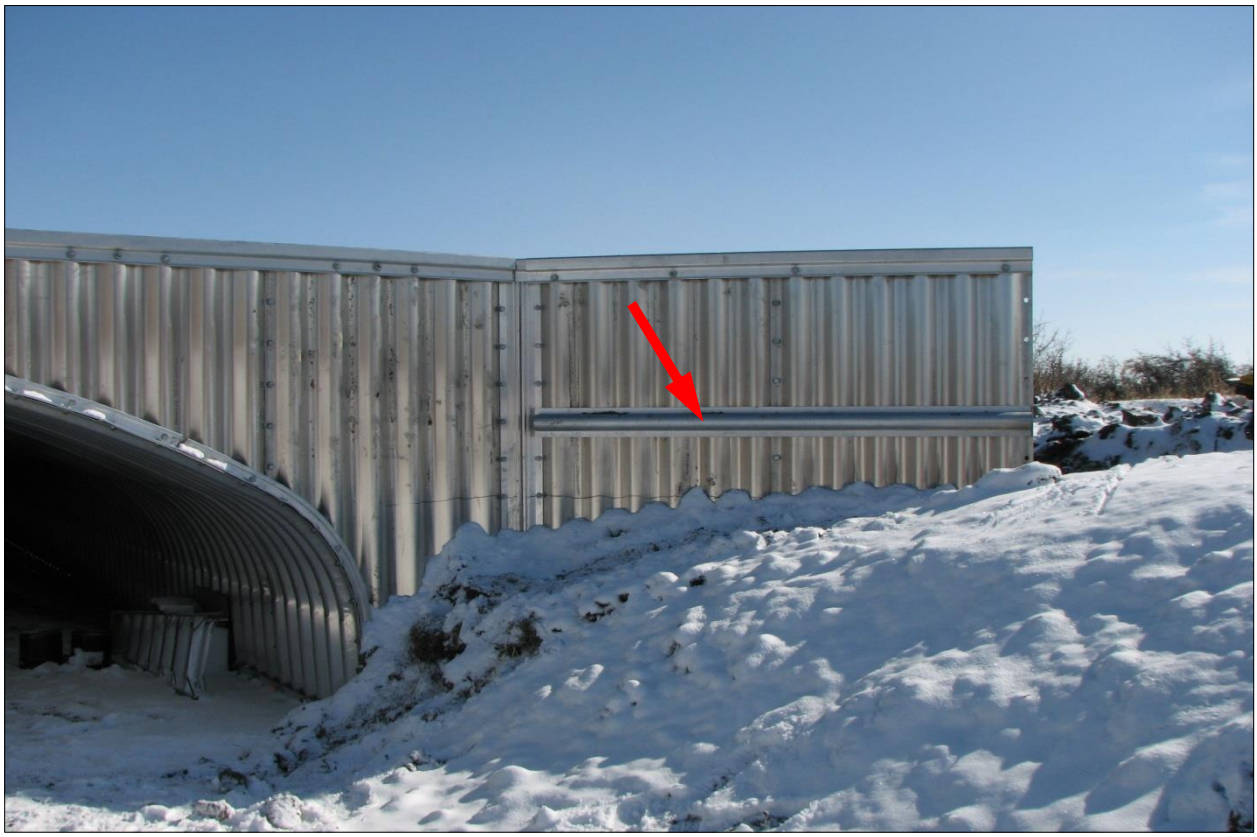


🡅 The scallop plate is secured with a compression clip; although the clip can receive a bolt it is not required.

🡇 A geotextile (red arrow) is place at the base of the receiving channel overlapping the plate and shell then secured with bedding material.

🡅 Overview of completed inlet headwall and wingwalls.

🡇 Close-up of wingwall with wale beam (red arrow).



🡅 North side of rear inlet wingwall showing three placed deadman anchors.

🡇 South side of rear inlet wing wall with two attached deadman anchors. The anchor rods (red arrow) have a special attachment to the wingwall wale beam.

🡅 The culvert shell anchor rods (bracing assembly) are attached to the headwall cap (yellow arrow).

🡇 The anchor rod attachment piece is field drilled and bolted to the crown rib.

🡅 Image of nearly completed outlet head and wingwall, view looking west.

🡇 Interior image of completed ABC unit, view looking west.

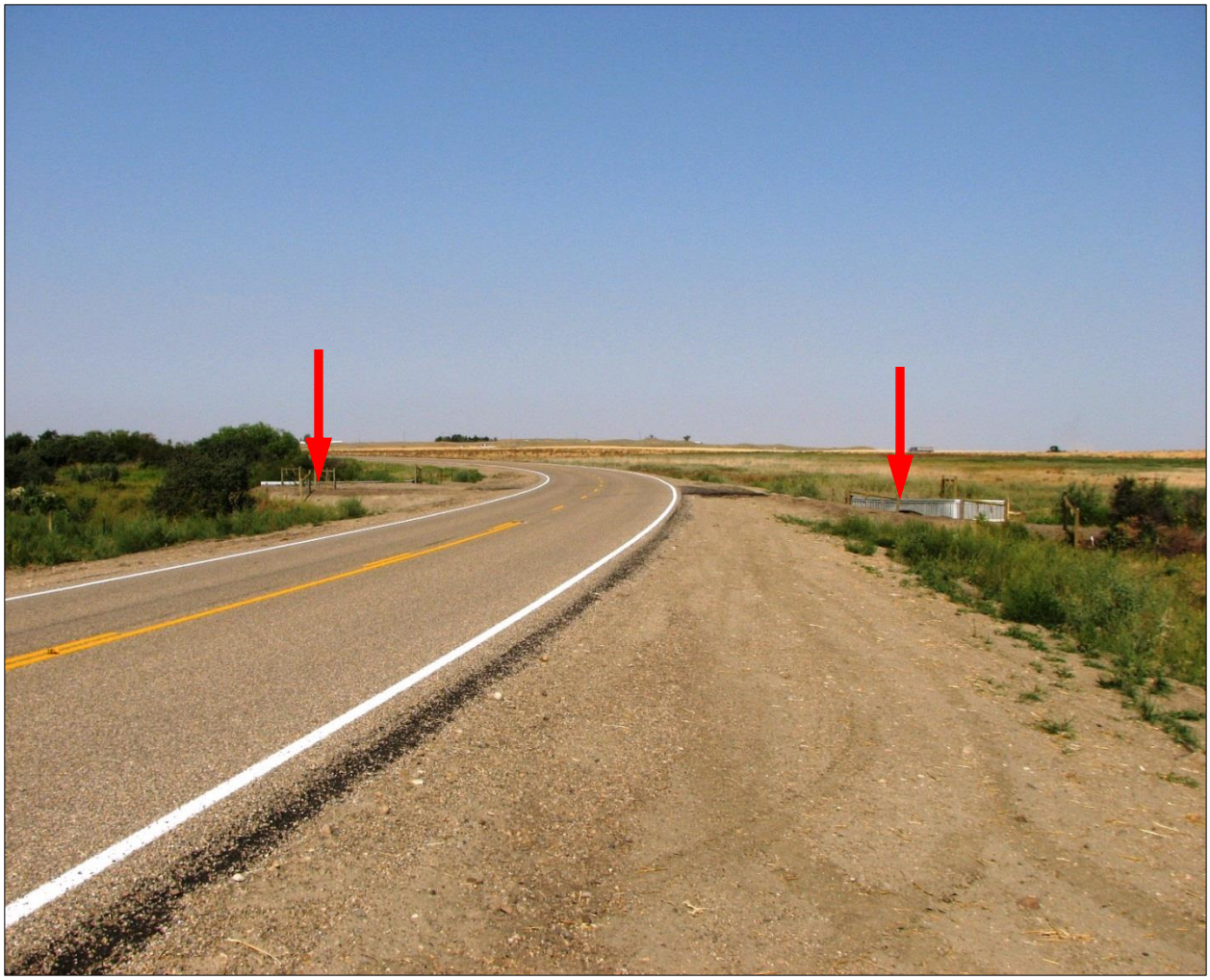
🡅🡇 Images of completed and covered ABC unit. Above image is the inlet, below image the outlet.

🡅 View north. The contractor is beginning to set the base for the roadbed. Red arrows show the location of the culvert inlet/outlet.

August 2012: Completed Project

🡅 View of culvert inlet.

🡇 View of culvert outlet.



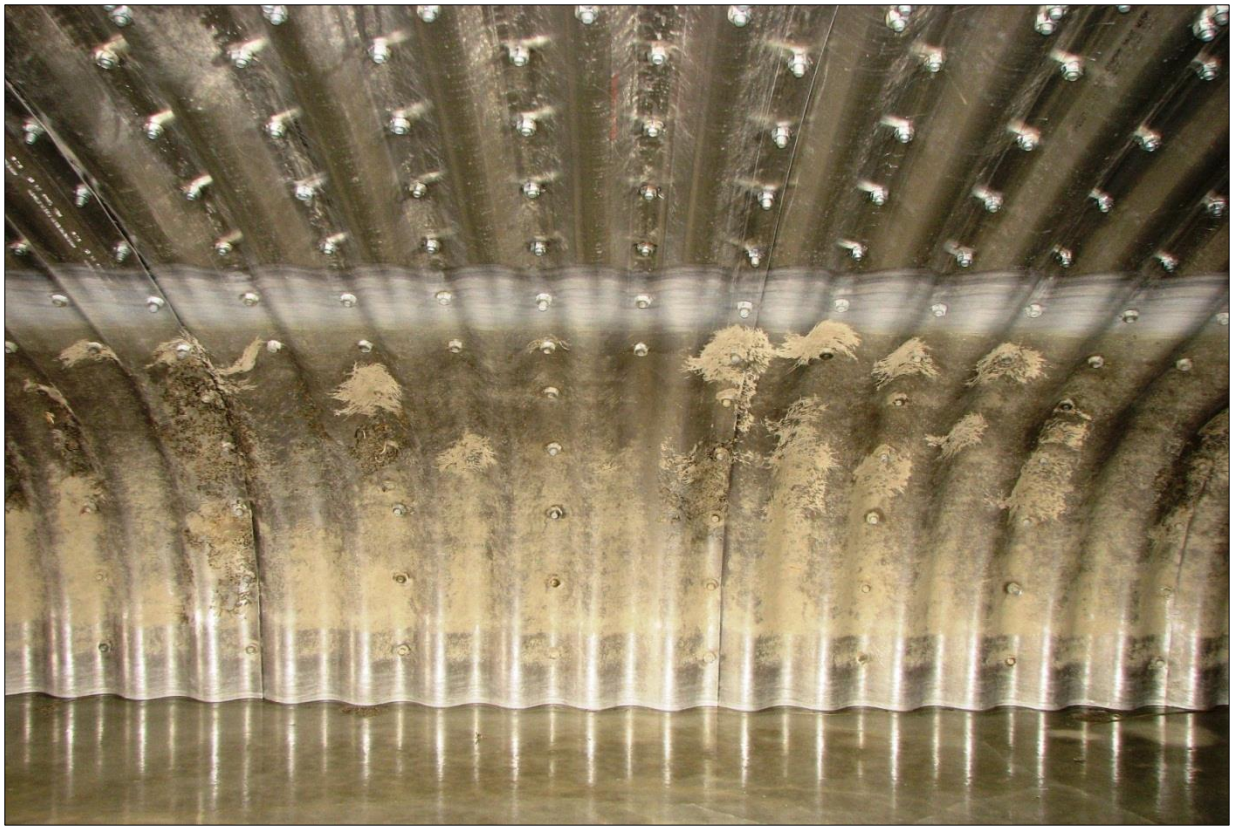
🡅 Competed roadbed. Red arrows show location of culvert inlet and outlet, view north.

🡇 Arial view of completed roadbed and culvert.

March 2013: Site Inspection

🡅 Interior view of the culvert on west end looking east.

🡇 View of interior side wall. Water level stain is clearly seen near top of culvert.



🡅🡇 Side angle images of sidewalls; views east.

🡅🡇 Upper image of culvert inlet, lower image of culvert outlet.

🡅 View of completed road bed and culvert as of March 2013; view north.

February 2014: Site Inspection

🡅 View inlet; west side of culvert.

Due to the thinness of the ice a walk-in interior inspection was not possible. However the researcher was able to gain bank access (inlet and outlet) to see within the culvert to ascertain if any distress (bending or buckling of the shell plate) was noticeable.

No issues were detected in this inspection, all components were visually intact.

🡅 View north. No issues with the roadbed were observed.

January 2016: Site Inspection

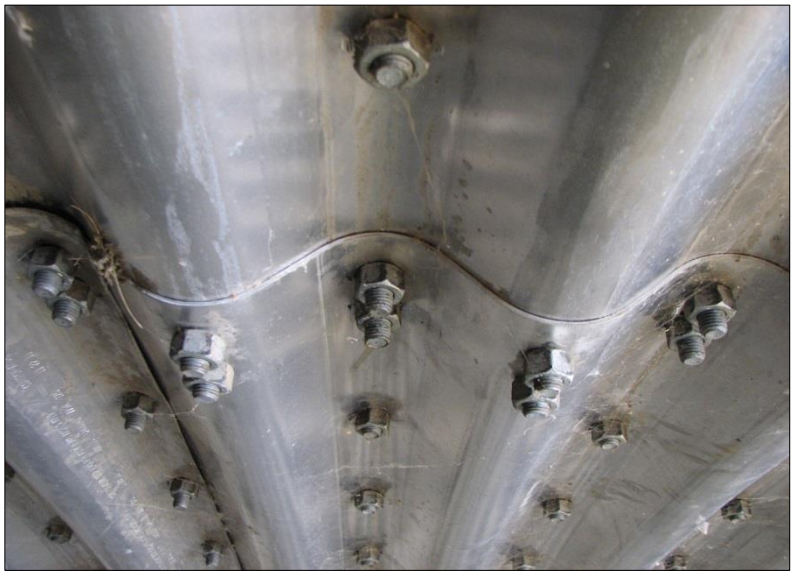
🡅 View of inlet; west end Contech Plated Aluminum Box Culvert.

🡇 View of outlet; east end Contech Plated Aluminum Box Culvert.

🡐 Interior view of culvert at inlet.

The light colored material at the side wall of the culvert is accumulated sediment.

🡐 View of interior sidewall.



🡐 Close up of plate/rib connections.

🡅 View north. No issues with the roadbed were observed.

January 2017: Site Inspection

🡸🡻 As stated earlier in the report, the ABC unit is in the same condition as reported in 2016. No performance issues to convey.

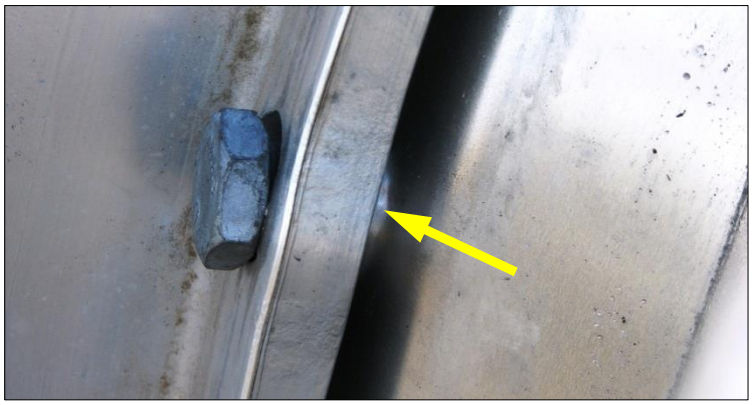
These images represent the general condition of the culvert.

The roadway over the culvert had no visible distress.

Supplemental – Over Torque of Nut and Bolt during Installation

🡐 Image of properly torqued nut and bolt (interior view).

🡐 Over torqueing the nut has punched through the soft skin of aluminum shell plate.



🡐 Here you can see the aluminum skin extruding due the excess torque of the nut (exterior view of shell plate to rib attachment).

🡐 Those nuts which did pierce or deform the skin were fitted with washers.

Note that this condition was very minor in occurrence. Once the Contractor and crew were aware of the over-torqueing problem, they quickly rectified the situation by applying the correct torque application.

Supplemental – Placement of Bedding Material on Invert Plate (Culvert Base)

🡅🡇 The contractor elected to cover the base of the invert plate with a 4-5" layer of bedding. This was done to provide a safer work surface for the installers than walking on the deep corrugation of the plate, and (as a minor point) to add weight for a more stable base for installation.

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