Instrumentation Options for Algiers Lock Gates

Response Summary:

For this response Leslie Campbell of MVN requested an engineer from ERDC conduct a site visit in regard to an ongoing issue with cracks forming in the ears of the sector gates at Algiers Lock. In the early 1990s and again in 2013, these cracks grew to a critical size and fractured the ear. During each dewatering, including the current dewatering efforts, small cracks were found in the flanges of the ears. Previous attempts were made to add welded stiffeners, but cracks continued to propagate. Currently, the welded stiffeners are being removed from the bottom and middle frame and replaced with a bolted strut arm.

ERDC's role in this effort was to provide insight into whether instrumentation would be useful in better understanding the transfer of load from the recess ear to the girders. During the operation of the gate, there are no valves and culverts for filling and emptying the chamber. The gates are opened partway to allow water to flow in/out to fill/empty the chamber. This process takes a couple of minutes and occurs every time the gates are operated. Possible instrumentation discussed was accelerometers to determine if the ear is experiencing flow induced vibrations during the filling/emptying of the chamber; strain potentiometers to measure the movement of the ear relative to the main girders; uniaxial strain gages to determine the loading experienced by the new strut arm configuration. The essential loading event to capture would be the swinging of the sector gates, particularly, the initial movement when the gates are open part way to let water in or out of the chamber.

Due to the timing of this response, no instrumentation has been installed yet. Eventually a dewatering of the upstream gates will be scheduled to occur for maintenance. When this is scheduled, a structural health monitoring system will be installed to monitor the aforementioned phenomena. In the meantime, a finite element model of a sector gate will be created in Abaqus once as-built drawings of the gate have been received from MVN in order to simulate certain loading events and create an instrumentation plan.

Period of Performance:

This response took place 07 November 2023.

Benefits of the Response to the USACE Dredging/Navigation Program:

The cracking of the ears is an ongoing issue for Algiers Lock. It has been demonstrated by past events that the cracks will continue to propagate until a fracture eventually occurs and causes the Lock to shut down for maintenance. The results of this response will provide insight to the civil engineers in MVN who can make design decisions based on a better understanding of the stress at this connection.

Deliverable:

A finite element model of the Algiers Lock sector gates will be created, an instrumentation plan detailing a structural health monitoring system for MVN will be generated, and a letter report detailing the results of this system will be written.

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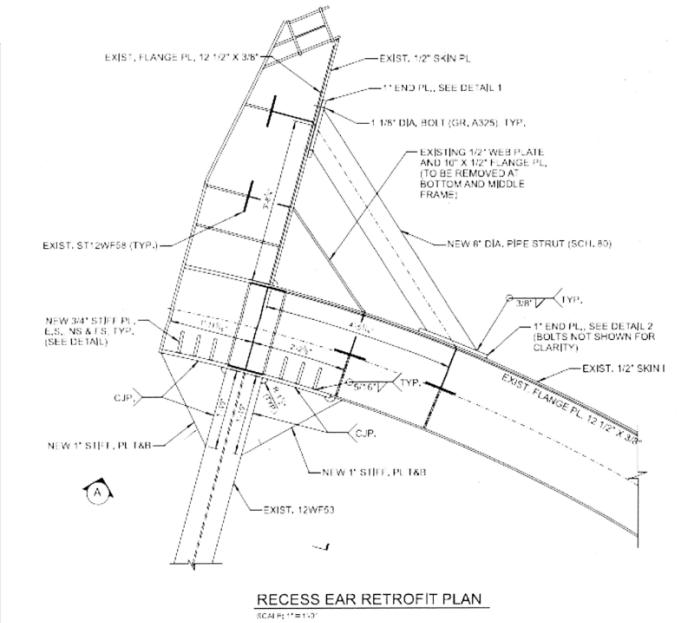
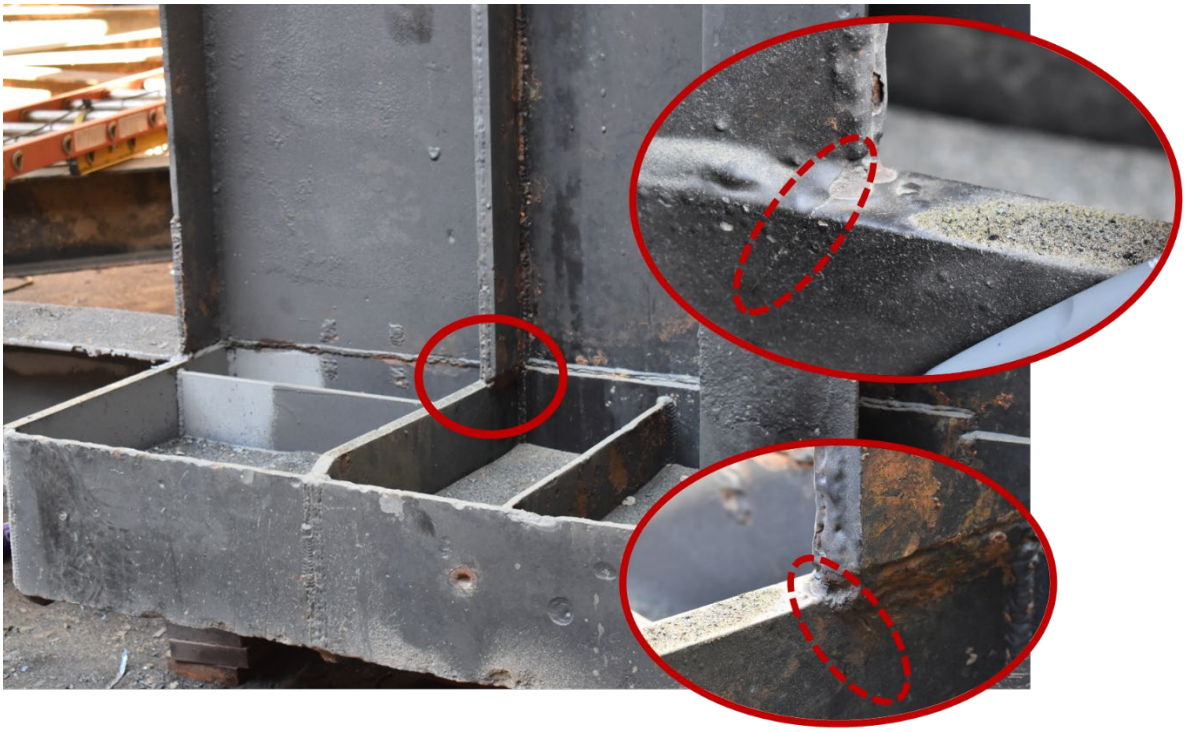


RECESS EAR RETROFIT PLAN



Providing environmental and engineering technical support to the U.S. Army Corps of Engineers Operations and Maintenance navigation and dredging missions

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