



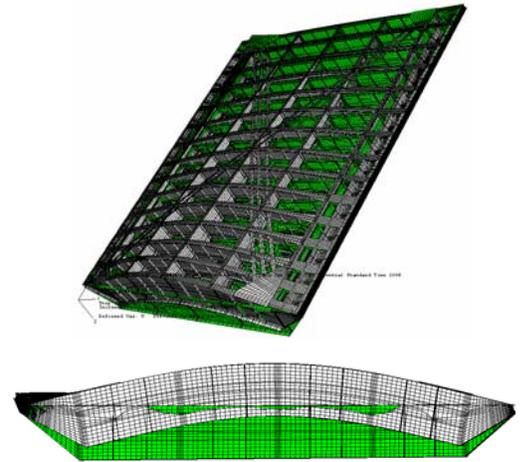
US Army Corps
of Engineers®

Engineer Research and
Development Center

Inspection and Condition Assessment of Steel Hydraulic Structures

Description

The research includes multiple thrusts. First is the development of criteria for performing fitness-for-service assessments of fatigue cracking and weld defects. This will provide a framework for performing an assessment of steel hydraulic structures containing defects (cracks, weld defects, etc.) including procedural guidance and appropriate factors of safety for continued safe operation. Analytical techniques for employing state-of-the-art capabilities for fracture mechanics analysis using finite element modeling are also being developed. This ongoing effort includes the use of commercially available nonlinear finite element programs incorporating J-integral analysis for fracture analysis. These analytical tools can produce much more accurate and detailed fracture assessments than the Corps currently has the capability to perform. An assessment of the connection details and design of miter gate diagonals is also being developed. This effort will include development of analytical models to assess the pre-stress requirements of diagonals and to develop improved details for diagonal/gate connections.



Issue

Cases of unsatisfactory performance of Corps' steel hydraulic structures have involved fatigue cracking due to low fatigue resistance, welded connections, and poor weld quality. The most severe cases have included at least one catastrophic failure of a bulkhead system, and complete replacement of lock gates has been required in at least two other cases. Maintenance and repair of fatigue and fracture failures represents a major O&M expenditure for the Corps of Engineers. Recently there have also been a number of failures of diagonals on miter gates. These appear to be fatigue-induced failures driven by the connection details at the diagonal ends, but some evidence also suggests that the current design guidance results in a much larger prestress in miter gate diagonals than may be required.

Users

The inspection and assessment tools are intended to aid district engineers

Products

Products include criteria for performing fitness-for-purpose assessment of steel hydraulic structures and procedures for state-of-the-art fatigue and fracture assessment.

Benefits

Avoidance of repairs and associated delays to navigation resulting in significant cost savings are a primary benefit. Avoiding deleterious effects of inadequate or flawed weld repairs performed in the field that could result in failure of a fracture critical member is also a potential benefit.

Corps Program

Navigation Systems Research Program, Mr. James Clausner, Program Manger.

Point of Contact Guillermo A. Riveros, US Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180; (601) 634-4476, email (Guillermo.A.Riveros@usace.army.mil), or Mr. James Clausner, (601) 634-2009, email (James.E.Clausner@usace.army.mil)

Partners Coastal and Hydraulics Laboratory and Information Technology Laboratory.