

Staples Center Los Angeles, California

Staples Center, completed in 1999, is the home of the LA Lakers, Clippers, and Kings. Bickerton Iron Works was the rigging contractor selected to assemble, erect, and rig the roof structure. Liftech Consultants was retained by Bickerton as the structural engineer.

The 435 foot diameter roof of the arena is supported in the middle by a 64 ft wide x 45 ft deep cigar-shaped truss called the Supertruss. At every Supertruss bay, secondary trusses span from the Supertruss to the arena walls. The Supertruss was assembled more than 100 feet in the air in five sections using shoring towers. Once each Supertruss section was lifted onto its shoring towers, the secondary trusses were put into place, then the roofing and mechanical systems were

installed. This method allowed all disciplines to work simultaneously. When the entire roof assembly was erected, the jacks on the Supertruss shoring towers were lowered until the Supertruss carried the weight of the roof. The Supertruss passed the test of carrying 80 tons of staging, in addition to the roof, for the Grammy Awards.

Reference:
Bickerton Iron Works
Torrance, California



Fatigue Investigation and Development of Structural Maintenance Program Antone Hydraulic Dredge, Dutra Dredging

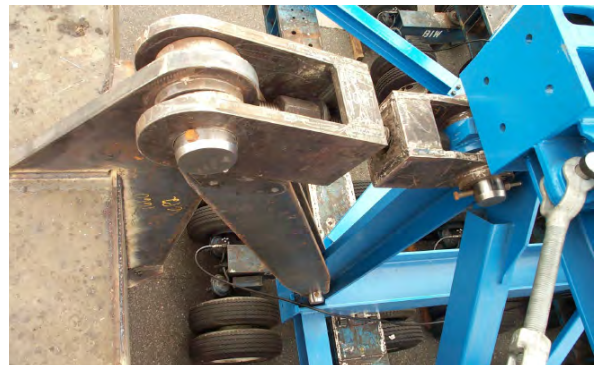
This barge-mounted Liebherr 998 hydraulic excavator experienced significant fatigue cracking during normal operations.

Liftech provided the following engineering services to mitigate the failure problem:

- 1) Reviewed the existing structural details and then monitored the manufacturer's modification of unacceptable fatigue details.
- 2) Developed a testing program to determine the magnitude of the problem.

3) Developed a structural maintenance program that included inspection and repair guidelines as well as a permanent monitoring system to track the fatigue damage occurring within the structure.

Reference:
The Dutra Group
San Rafael, California



Crane Move System

Liftech designed a crane move system for moving container cranes that was easy to ship and assemble.

Liftech designed a modular system with container sized components for shipping. The system can be assembled away from a crane, allowing the crane to continue working until it is moved. The container crane is secured to the system with four pins and lifted for transport.

The crane move system can move 50 ft to 100 ft gage cranes that weigh up to 1600 t on wharf decks that are designed for 1000 psf live loads.

Client:
Bickerton Iron Works
Torrance, California

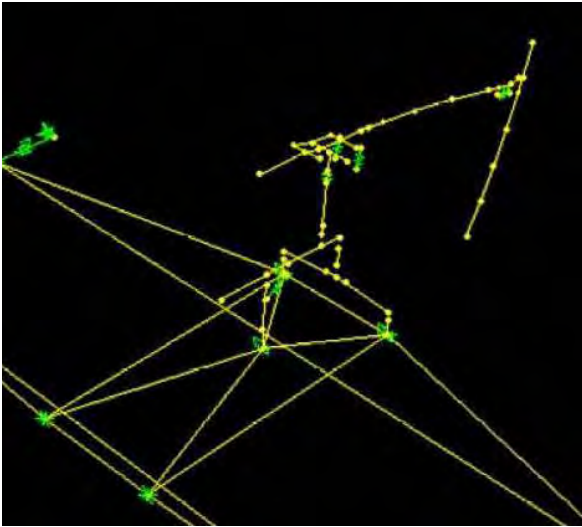


Jacking Frame for Raising Container Cranes Various Locations

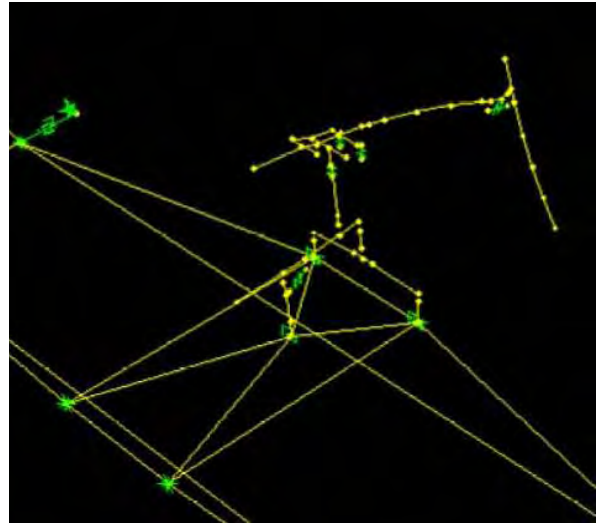
The existing jacking equipment for raising container cranes required a long time to set up and disassemble. Some equipment imposed unacceptable loads on the dock. Liftech designed a jacking frame that enables BIW to raise cranes in less than a week. The frame is capable of raising cranes 30 feet, can withstand up to 75 mph winds with the crane raised, and is supported on crane sill beams.

The assembly is used for projects in the United States and overseas.

Reference:
Bickerton Iron Works
Torrance, California



Calculated Unloader Deformations



Unloader Seismic Study Sacramento, California

Liftech performed a seismic response study of a ship unloader on a stiff wharf structure and a flexible wharf structure.

The study included a finite element time history analysis and a pushover analysis for three design Operating Level Earthquakes and three Contingency Level Earthquakes used for design by a port on the West Coast of the United States.

The study provided an understanding of the seismic response of the structure including displacements, dynamic characteristics, stability, and forces and moments within the structure. Time history results included maximum forces and moments and their concurrent forces and moments at key locations on the structure.

Liftech also provided recommendations to improve the structure's seismic performance.



**Alumar IMPSA Unloader
Structural Design Review
Sao Luis, Maranhao, Brazil**

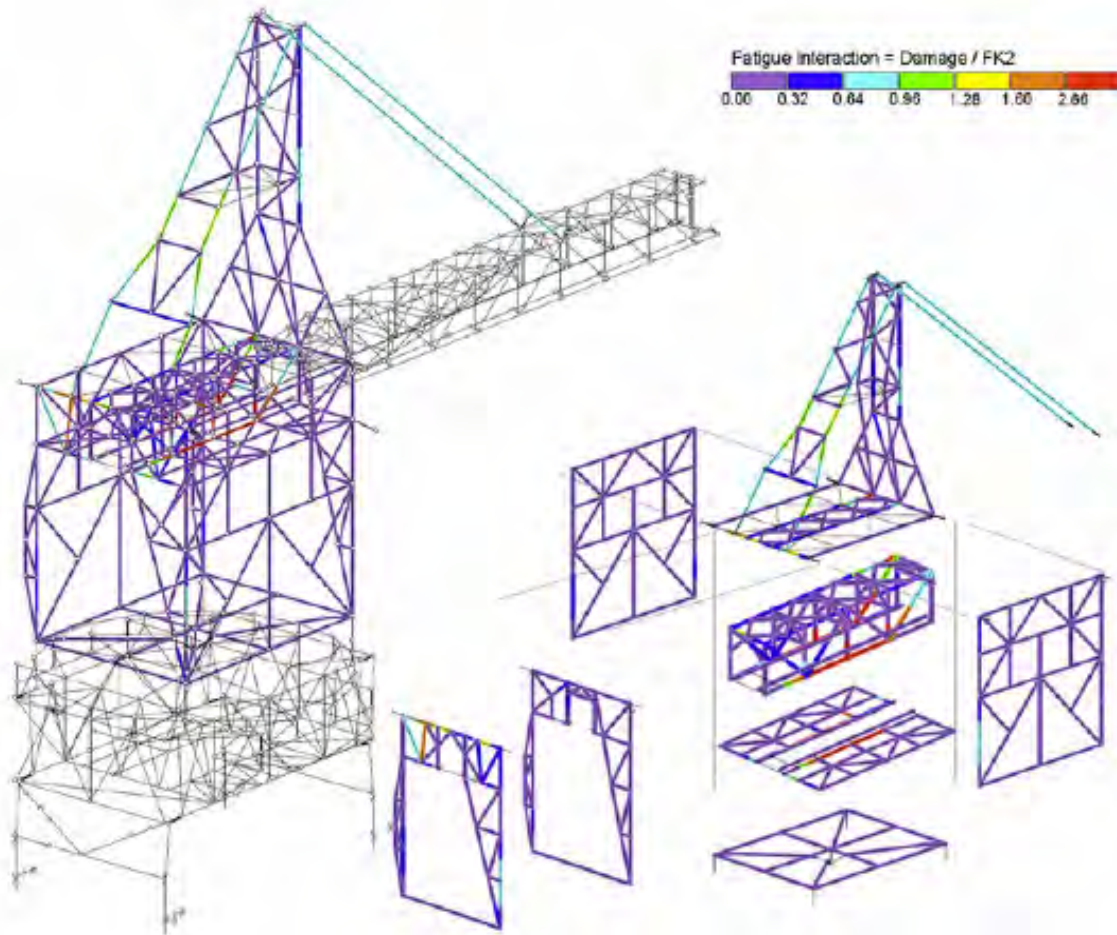
Liftech provided structural design review of an IMPSA unloader at the Alumar facility in Sao Luis, Brazil.

We reviewed the workmanship of the primary structure, performed finite element analyses, reviewed design drawings, and provided wheel load and stability calculations.

Liftech provided a report of the significant findings of our review and recommendations for improvements. We also provided a comprehensive structural maintenance program based on cumulative fatigue damage analysis.

Client:
McKay International Engineers
Benicia, California

Owner:
Consortio de Alumínio do Maranhão (Alumar)
Sao Luis, Maranhao, Brazil



Future Fatigue in Rotor Structure

Bauxite Unloader Study

Two bauxite unloaders of identical design have been operating for over 50 years. The operator wished to continue operations for another 15 years.

Liftech analyzed the crane structure to assess the fatigue life for continued operations. The study showed that the crane structure can perform reliably for another 15 years with repair and strengthening of some members and implementation of a structural maintenance program.

Reference:
Hoist & Crane Service Group
Charlotte, North Carolina



**Alumar Torque Unloader
Structural Condition Survey
Sao Luis, Maranhao, Brazil**

Alumar has been operating a Paceco Torque unloader, DM-11, at their bauxite refinery facility in Sao Luis, Brazil, since it was built in 1983.

Liftech performed a structural condition survey of the unloader structure and presented significant findings and recommendations in the structural assessment report.

Liftech identified cracks in the boom and other critical members during the observations and assisted Alumar with emergency repairs of the boom so the unloader could resume operation.

Client:
McKay International Engineers
Benicia, California

Owner:
Consortio de Aluminio do Maranhao (Alumar)
Sao Luis, Maranhao, Brazil



Coal Loader Crane Assembly and Transportation Los Angeles, California

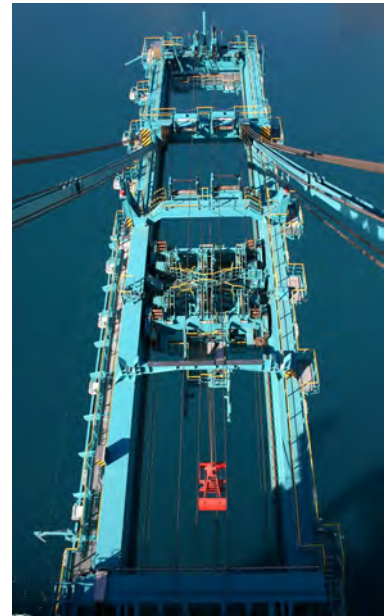
The crane was designed by Krupp, built in Malaysia, and shipped in pieces to Los Angeles. Bickerton Iron Works was responsible for assembling the crane and transporting it from the assembly site to the LAXT terminal.

Liftech provided engineering assistance for the assembly of the crane and devised a scheme to connect two barges and roll the crane onto them.

The crane was supported on beams and dollies and rolled onto two 242 x 60 x 16 ft barges. The barges were connected with two hinged spacer beams and

two hinged braces. The flexible connection allowed the barges to move relative to each other in the vertical direction while minimizing the load transfer between them.

Reference:
Bickerton Iron Works
Torrance, California



Esperance Port Authority Hybrid Crane Review Esperance, Australia

Esperance Port Authority purchased a hybrid crane from ZPMC to handle containers and bulk material. Robert Reid & Associates and Liftech Consultants Inc. provided procurement services.

Liftech reviewed the structure design, helped resolve design issues, and audited the structural fabrication in China. Liftech also reviewed the crane wheel loads and helped coordinate the crane interface issues with Esperance Port Authority.

Reference:
Robert Reid & Associates
Port Melbourne
Victoria, Australia



**Water Emergency Transportation Authority (WETA)
South San Francisco Ferry Terminal
Float and Gangway
Oyster Point Marina
South San Francisco, California**

As part of a Manson Construction Company design-build team, Liftech designed a 103 ft long steel truss gangway, 45 ft wide by 115 ft long post-tensioned concrete float, and mooring dolphins. The float is used to berth ferry boats.

Reference:
Manson Construction Company
Richmond, California

The design includes gangway supports that permit large lateral displacements between the pier and float during seismic events.

The ferry terminal is designed to be operational after a large earthquake.



**Water Emergency Transportation Authority (WETA)
Pier 9 Ferry Layover Berths
San Francisco, California**

Liftech designed two 80 ft by 15 ft by 5 ft steel floats as layover berths for Water Emergency Transportation Authority ferry vessels.

Client:
Manson Construction Company
Richmond, California

Each float is moored with three steel pipe piles. The pile collars are removable and their locations can be adjusted several inches to accommodate float placement at other locations.

An aluminum gangway, walkway, and hinged ramp are provided to access the vessel. Utilities are provided to each float.