

## 8.2 Whirley Crane Assessment



**SITE VISIT REPORT  
CONDITION ASSESSMENT OF WHIRLEY CRANE  
AT POINT POTRERO, RICHMOND, CA**

**FOR THE CITY OF RICHMOND  
PRIME CONSULTANT: MOFFATT & NICHOL**

**VISIT DATE: MARCH 27, 2025**

**Prepared by Liftech Consultants Inc.  
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**Project No. 2525**

*Quality Assurance Review  
for Liftech Consultants Inc.*

<i>Author:</i>	<i>Steven Martinez</i>	<i>Mechanical Engineer, M34675</i>	
<i>Editor:</i>	<i>Linda Weber</i>	<i>Technical Support</i>	
	<i>Sugi Loni</i>	<i>California Structural Engineer, S3041</i>	
<i>Principal:</i>	<i>Erik Soderberg</i>	<i>California Structural Engineer, S4426</i>	

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## BACKGROUND

The Richmond Museum Association owns a wheeled revolver crane, commonly known as the Whirley Crane. This crane is currently stored at the Port of Richmond's Point Potrero Marine Terminal (PPMT, Port), at Basin Number 5 near the SS *Red Oak Victory*. It is representative of the equipment used during World War II for ship construction at PPMT and has been inoperable for several decades.

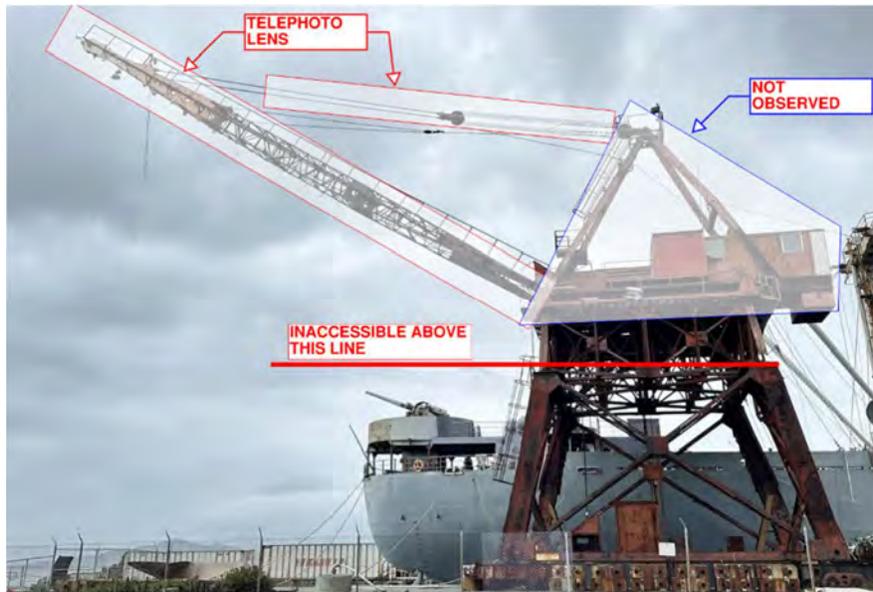
As part of the marine structures condition assessment, the Port requested that Liftech Consultants Inc. (Liftech), supporting Moffatt & Nichol (M&N), perform a preliminary condition assessment of the crane. The purpose of this investigation is to determine whether the crane poses a hazard to life or property and to provide recommendations for future action.

Liftech conducted a visual assessment of the crane in areas where access was feasible, using a tape measure and ultrasonic thickness gauge to evaluate conditions. Where access was restricted due to safety concerns, the team relied on Port-provided and telephoto images. The assessment did not include a review of original design calculations or a full structural analysis. Based on our observations, we offer conclusions and recommendations to support future decision making regarding the crane, including options for preserving it in place, dismantling and preserving it in whole or in part for museum display, or proceeding with demolition.

Steven Martinez, Liftech mechanical engineer, performed the visual assessment on March 27, 2025, with support from Sugi Loni, Liftech structural engineer, who was conducting wharf assessments.

### Site Visit Attendees

Firm	Person
Liftech	Steven Martinez, Senior Mechanical Engineer, PE
Liftech	Sugi Loni, Principal, Senior Structural Engineer, PE
<i>Lizeht Zepeda from the City of Richmond facilitated our time on-site. She was not part of the crane walkthrough itself.</i>	

**COMPONENTS OBSERVED**

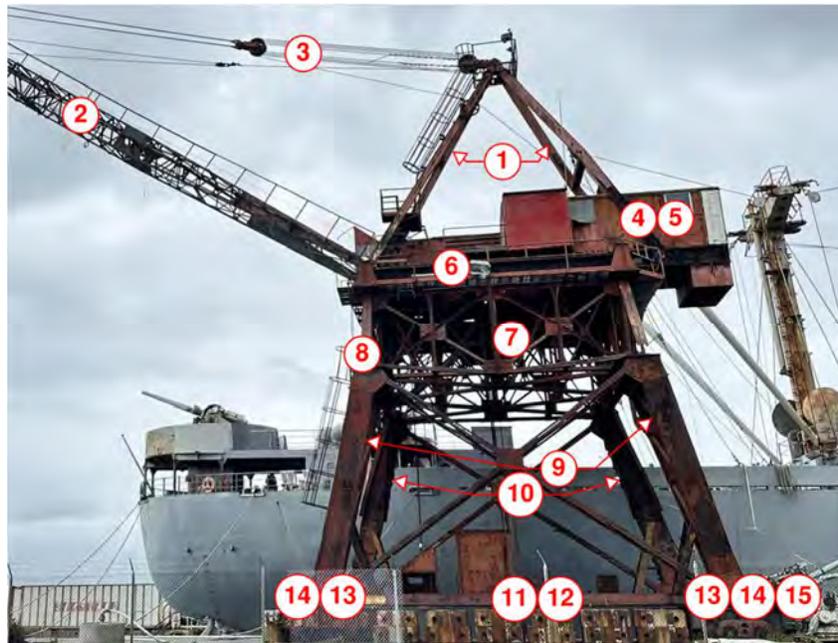
Photograph 1: Crane accessibility overview

Access was limited due to ladder damage. The second ladder to the machinery level was hazardous due to degraded and missing attachment welds. See Photograph 1. Inaccessible areas were photographed using a telephoto lens from different vantages, including the adjacent *Red Oak Victory* ship. No internal areas were observed, e.g., the machinery house.

Table 1 shows the components observed including comments on the extent of observation and condition. Review is for the exterior of components unless otherwise noted.

**Table 1: Observed Components**

#	Component	Observed	Comments
		✓ Yes A From afar, via telephoto lens N Not Observed	
1	A-frame Pylons	A	Limited vantage; no comment.
2	Boom	A	Minor corrosion damage.
3	Boom Reeving	A	Minor corrosion damage, remaining strength unknown.
4	M-House Interior	N	Not accessed.
5	M-House Exterior	A	Limited vantage. No major damage observed.
6	Slewing Mechanism	A	Limited vantage. Unknown condition.
7	Portal Truss Structure	✓	Minor corrosion damage.
8	Portal Accessways	✓	Major to severe corrosion damage. Unsafe.
9	Left Legs and Diagonals	✓	Minor corrosion with some local major corrosion damage.
10	Right Legs and Diagonals	✓	Minor corrosion with some local major corrosion damage.
11	Left Sill Beam	✓	Minor corrosion with some local major corrosion damage.
12	Right Sill Beam	✓	Minor corrosion with some local major corrosion damage.
13	Gantry Equalizers	✓	Minor corrosion damage.
14	Gantry Trucks	✓	Minor corrosion damage.
15	Gantry Machinery	✓	Corrosion damage, not serviceable.



Photograph 2: Indexing of observed areas

**Photographs**

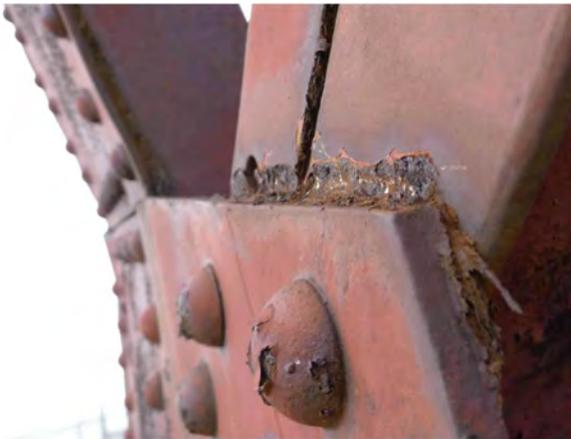
The following photographs represent the observed condition of the crane. The City of Richmond (City) also provided reference photographs to Liftech, taken in 2024. Since some areas of the crane, such as the machinery house, were not accessible during Liftech’s site visit, select photographs (as noted in the captions) were used to support the assessment.



Photograph 3: Leg 4 – typical leg and sill beam.



Photograph 4: Corrosion jacking; rivets appear unbroken.



Photograph 5: Example of section loss near connection plate joints.



Photograph 6: Kingpin to gantry equalizers; corrosion and section loss.



Photograph 7: Longitudinal sill beams with minor corrosion damage.



Photograph 8: Sill beam structural reinforcing is detached.



Photograph 9: Walkway grating has significant corrosion and is unreliable.



Photograph 10: Wire rope, no signs of broken wires or significant corrosion; condition of core (internal) unknown.



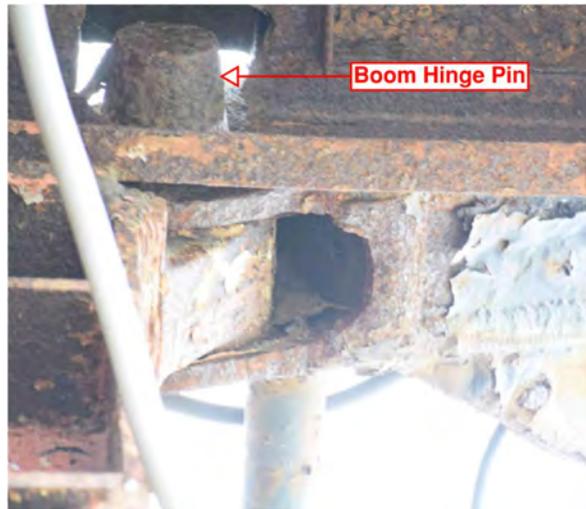
Photograph 11: Boom reeving is not redundant; it is supported by one rope (photograph courtesy of the City's 2024 walkthrough).



Photograph 12: Hoist and boom machinery in the machinery house (photograph courtesy of City's 2024 walkthrough).



Photograph 13: Slewing arrangement (photograph courtesy of City's 2024 walkthrough).



Photograph 14: Boom hinge pin with significant corrosion, but with significant thickness remaining.



Photograph 15: Typical truss structural joint with limited corrosion damage to members. Rivets appear unbroken.



Photograph 16: Thickness measurement of structural lap plate. Fifty percent thickness loss measured near the corroded drain hole.

## FINDINGS

### Failed Painting System and General Corrosion

The crane's painting system has mostly failed; most the crane's steel is exposed. All areas observed have corrosion damage. The crane's structure will continue to corrode and deteriorate.

### Primary Structure

#### *Frame*

All structural components of the primary structure have general corrosion damage and some locations also have localized corrosion damage; however, no signs were observed of significant distress, which would raise concerns about global stability.

There is significant corrosion jacking at most riveted connection plates. Corrosion jacking is caused by the expansion of rust between plates, resulting in local plastic deformation of the connection plates. No broken rivets were observed. We could not observe the inner surfaces of rivets between the connection plates and members.

The kingpin joints of the equalizer assemblies have major corrosion damage and have lost significant material and strength.

All joint connections to the gantry system that collect water have major to severe local corrosion.

The upper structure appears to have only minor corrosion damage based on observation from a distance.

#### *Boom and Reeving*

The boom structure including reeving appears adequate for its non-operating condition.

The boom structure has minor corrosion damage. The boom hinge has major to severe corrosion but still has substantial diameter remaining.

The wire ropes supporting the boom appear to have only minor corrosion with no signs of external wire breaks. Since the boom is at a stowage position with no live load, the rope load is small compared to its design operating load. However, it cannot be assumed the rope is uncompromised. Given the exposure of the ropes to weather and the potential for internal water entrapment, there is a risk of hidden corrosion that cannot be assessed visually. An internally compromised rope can have a significant reduction in strength. In addition, the boom reeving is not redundant, meaning that the boom is supported by only one rope. Any failure along its entire length would release the boom.

### **Secondary Structure**

Many of the thinner secondary structural components, including handrails, walkways, and ladder systems, have major and severe corrosion damage and are not suitable for safe access. Many expanded metal walkways appear unsuitable for supporting people. Several handrails are detached and several failed ladder welds were observed.

***There is a significant risk that these deteriorated components could detach and fall from the crane. Access beneath and on the crane should be restricted until the conditions are addressed.***

### **Machinery**

#### *Gantry*

The gantry machinery is no longer operational and restoration for service is not feasible.

#### *Machinery House and Machinery*

These areas were not observed during the site visit. Comments are based on a review of 2024 photographs provided by the City.

Overall, the indoor environment has contributed to better preservation of the machinery house relative to the crane structure. Corrosion is evident on thinner sheet metal, particularly at joints, but the machinery deck structure, enclosure, and plate flooring appear to remain structurally sound.

The hoist machinery is unloaded, with ropes spooled onto the drums. Motors are absent; only the drums remain. The design is outdated and lacks functional utility.

As noted in the Boom and Reeving section, the boom drum is currently supporting the boom load. A pawl and band brake system provides redundancy for load holding; however, given the system's age, it should not be considered reliable for long-term load support.

Other observed components include the operator's cabin and a rack of resistor banks, which offer limited remaining value.

In general, the machinery house and associated components may hold some historical or aesthetic interest if appropriately refurbished for display.

### **Crane Motion Restraints**

The crane is currently restrained from movement by two passive measures. At the elevated rotating (whirling) level, chocking wedges are placed between the steel wheels and rails to inhibit rotation. At the gantry level, where the crane can roll along the wharf, the steel wheels are partially buried in gravel to discourage translational movement. While these measures provide some resistance, they are informal and not engineered to reliably prevent displacement under environmental or seismic loads.

There is a risk of unintended crane movement, either rotating or translating, if these passive restraints become dislodged, deteriorate, or are otherwise compromised over time. Uncontrolled crane motion could pose a hazard to nearby structures or people.

We recommend installing positive, engineered restraints to ensure the crane remains securely fixed in place. Options include pinning or welding the wheel assemblies to the rails, installing structural stops or brackets, or fabricating custom cradle supports to secure both the gantry and slewing bases. These measures should be designed by a structural engineer and verified in the field to ensure long-term stability and safety.

## COMMENTS AND RECOMMENDATIONS

### Immediate Risk Mitigation

We recommend some immediate actions to reduce risks to the public.

1. Access:
  - a. **Do not allow people access on or under any part the crane.**
  - b. Before ladders and walkways are used, repair or replace areas with major corrosion. Some engineering input will be required during the design, and to review the completed repairs.
2. Falling objects: Related to item 1a above, confirm that areas below secondary components with major corrosion damage are blocked off. Repair, or if not needed, remove compromised components with significant corrosion damage that may fall, e.g., compromised ladders, railings, and gratings. Have an engineer design and review completed repairs, determine what to remove, or both.

### Near-Term Risk Mitigation

We recommend several actions be implemented soon to evaluate and mitigate risks.

1. Boom rope inspection and secondary support: Have a qualified rope inspector inspect the rope, e.g., for internal corrosion, broken wires, and loss of cross-sectional area, and advise if replacement is necessary and feasible. If the ropes are found to be significantly compromised, install a new rope, or install a redundant support in addition to the existing to provide redundant support. Replacing the existing rope may not be feasible if the reeving system is compromised, e.g., seized bearings or excessive corrosion.
2. Crane restraints: Install engineered restraints to prevent movement of the crane and slewing of its upper works. Options may include pinning or welding the wheels to the rails, installing structural stops or brackets, or fabricating custom cradles to secure the crane in place.

### Crane Functionality

The crane has been inoperable for decades and parts are no longer available. From an economic perspective, the crane is obsolete and has negative value. It would not make economic sense to restore the crane for any use.

### Long-Term Preservation for Historic Reasons

If the crane needs to be preserved, the crane should be retrofitted so it is safe for public viewing, access, or both as desired. If public access on the crane is desired, significant effort and cost will be

required to retrofit the crane to bring it to the standards required by today's regulatory agencies such as Cal/OSHA, ADA, etc.

### *Structural Analyses*

Perform an engineering assessment to determine the adequacy of the structure. The assessment should consider modern wind and earthquake loading criteria and the crane's current condition, and determine what repairs and modifications are required. If the public will not be on or under the crane, this will lessen the required analyses, repairs, and modifications.

### *Modifications*

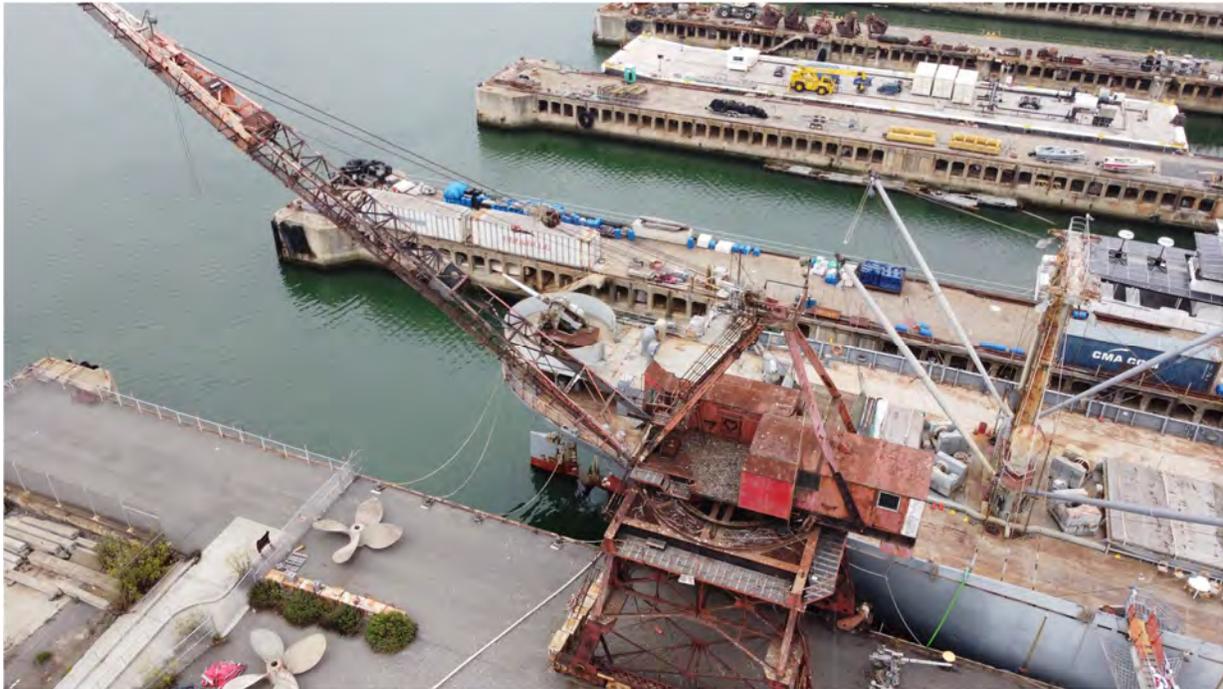
Based on structural analyses and this condition assessment, a scope of modifications for long-term preservation can be determined. Examples include corrosion repairs (removal or replacement of damaged secondary components), coating repairs (new coating), and strengthening of select portions of the crane structure. Other non-structural improvements will be required.

### *Corrosion and Coating Repair*

Corrosion and coating repair/replacement will require surface preparation including removal of the remainder of the existing coating system. Given the age of the structure, lead-based paint probably exists, requiring special protocols. Surface preparation and installation of a new coating will require permits and oversight related to stormwater runoff, air quality, and hazardous materials.

### **Demolition**

Demolition will require significantly less cost than preservation. Similar to preservation, demolition will probably require lead paint abatement. To limit costs, it may be favorable to dismantle the crane into large sections and truck them to a recycler, such as SIMS or Snitzer Steel, who can handle most of the paint abatement at their facility. Although less probable, if the crane can be moved close to the south edge of the wharf, it may be practical for a marine contractor, such as Manson Construction Company or Power Engineering Construction Company, to lift the entire crane with one of their floating cranes, set it on their barge deck, and then offload the entire crane at a local metal recycler such as SIMS or Schnitzer. See photograph 17.



Photograph 17: Whirley crane position near the edge of the wharf.

**COST ESTIMATES**

For reference, Liftech developed high-level cost estimates for the above recommendations. This is based on Liftech’s experience with limited input from contractors. We recommend including a minimum 20% contingency to these estimates for budgeting.

**Table 2: Cost Estimates in 2025 Dollars**

#	Recommendation	Cost Estimate	Comments
1	Immediate and Near-Term Risk Mitigation	\$ 200,000	Falling object hazards; boom rope inspection, redundancy design, installation; crane restraint against motion.
2	Preservation On-Site with Wind and Seismic Reinforcing	\$ 2,500,000	Seismic & wind analyses; corrosion abatement including permitting, rust removal, painting; allowance for unknowns. Included in cost is \$1M structural reinforcing required for seismic and wind adequacy.
3	Museum Preservation Off-Site of Select Components	\$ 1,400,000	Partial demolition & rigging design; site dismantling; scrap majority; abate & preserve some components; transport to museum; allowance for unknowns.
4	Demolition	\$ 700,000	Demolition design & permitting; contractor dismantles using cranes; transit via barge and scrap.

**CONCLUSION**

The Point Potrero Whirley Crane has extensive coating system failure and corrosion damage. Corrosion is mostly minor with some localized areas with major corrosion or other damage. Some secondary structures, such as ladders, railings, and gratings, have major or severe corrosion damage and are a hazard for access and for falling. These hazards should be addressed if access must be maintained or if the areas below are not restricted.

The crane does not appear to be at significant risk of collapse from the observed corrosion damage. The boom support rope has minor external corrosion, but a rope inspector should evaluate it to confirm the rope is not significantly compromised by significant internal damage, e.g., corrosion. If needed, the rope can be replaced, or a new redundant rope or chain system can be installed.

If the crane coating system is not repaired, corrosion and deterioration will continue.

The crane is obsolete, has negative value not considering historic value, and is not practical to restore for operation. Preserving the crane for historic reasons will require significant effort and cost to bring the crane to meet today's safety standard, including a structural evaluation to develop repair designs and possible strengthening modifications, repair of the coating system by removing the remaining coating system and corrosion, and installing a new coating system and, if public access is required, other safety improvements for safety and regulatory compliance like OSHA.

Demolishing the crane will require much less cost than preservation. This will probably require lead abatement, which we expect can be handled mostly at a recycling facility already set up to handle it, e.g., SIMS Steel in Richmond or Schnitzer Steel in Oakland.

### **NEXT STEPS WITH STAKEHOLDERS AND TIMELINE**

We suggest developing a plan through a working session with M&N and the Port to align priorities and determine next steps. We recommend the following schedule:

**Table 3: Recommended Schedule**

<b>Timeline</b>	<b>Item</b>
Immediate	Restrict access on or under the crane to qualified personnel.
Near Term, Within 6 Months	Complete near-term risk mitigation steps.
Within 1 Year	Develop long-term preservation or demolition approach.

This concludes our report.