

APPENDIX G

***Yaquina* Impact and Mitigation Analysis**

Appendix G is a report prepared by Art Anderson Associates based on their analysis of the US Army Corps of Engineers hopper dredge *Yaquina*. That analysis describes the vessel, describes a potential plan for modifying the vessel to reduce its air draft requirements (so as to minimize and mitigate any impacts that occur from some of the mid-level bridge heights studied), and a work cost estimate.



MEMORANDUM

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Date: 31 July 2012
To: **Columbia River Crossing (CRC) Project Team**
ATTN: Jay Lyman; David Evans and Associates
From: Ben Anderson, Naval Architect, P.E.
Subject: Columbia River Crossing Vessel Impact Analysis
Attachment: Ship Visit: USACE Hopper Dredge YAQUINA

1. Background: As part of the study effort for the Columbia River Crossing project team, several ship visits are necessary to gain a clear understanding of ship specific modifications that may be required to meet the proposed new bridge air draft of 95 feet.
2. This analysis will include a brief ship explanation, ship visit report, recommended modification plan and work cost estimate. The modification plan described will be selected based on an effort to minimize the operational impact on the vessel/crew and minimize overall construction costs.
3. The attachment provides a report on USACE Hopper Dredge YAQUINA, visited 17JUL12. Art Anderson Associates primary point of contact for the ship visit coordination is Ben Anderson who can be reached at (360)479-5600, ext 2280 or by nanderson@artanderson.com.

Respectfully,

N. B. Anderson

General Ship Information

The YAQUINA was constructed by Norfolk Shipbuilding and Drydock Corporation in 1981 and delivered to the U.S. Corps of Engineering Portland District the same year. The vessel is primarily used to dredge the west coast entrance bars, rivers and harbors.



Figure 1: YAQUINA mooring in Newport, OR on 17JUL12.

General Characteristics:

Length: 200'

Beam: 58'

Draft: 8' light, 16' loaded

Displacement: 2,001 LT

The ship reported a minimum height clearance of 92 feet. Their website gives a minimum clearance of 90 feet. This is most likely due to mast antenna(s) installed post website update.

Ship Visit Notes

Preliminary review of YAQUINA's drawings, specifically *False Kingposts Masts Yards & Staffs*; Y-2232-38 Rev C (Ref 5), showed that the ship's main mast would be the primary focus of the ship visit due to its height above keel. The following Survey Data section supports this finding.

After meeting with the Captain(s) of the vessel, the Second Mate showed me around the ship and guided me through the safety procedures to climb the main mast. Relevant information passed to me with regards to the mast included information about a past failure at the 8"x3 1/2" reducer located just above the Crow's Nest. The cause of failure was reported to be due to excessive shaking caused by ship slamming. This failure was reported and repaired several years ago and there have been no problems since repairs.

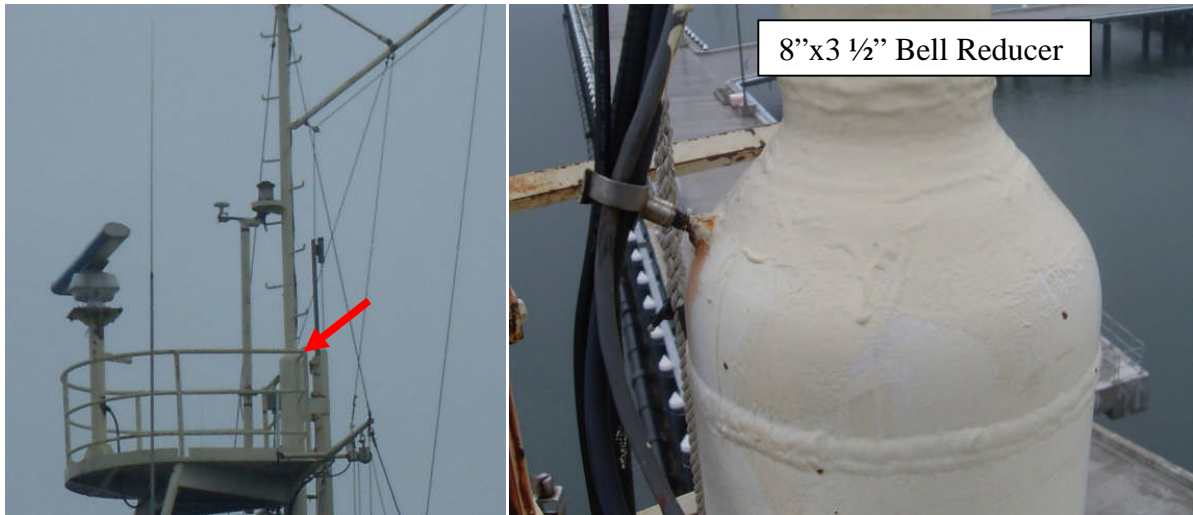


Figure 2: Point of past mast failure due to excessive vibrations.

For this report, it will be assumed that affected equipment includes everything above the Crow's Nest. Included, but not limited to, on this list are the following:

- Radio antennas
- Aft Mast light
- Maneuvering light
- Furuno Radar
- Flag halyards
- Wind bird and GPS

The mast structure is composed of steel members while the superstructure and pilothouse top is of aluminum. Datacouplers join the two structures together at the three mast base points.

It was noted from the ship Captain(s) that the ship has limited ballasting ability to “draft down” to reduce the overall ship air draft height. The vessel arrived at normal operational drafts. For this report it will be assumed that the vessel will not alter drafts (from normal) in order to pass under the bridge.

Survey Data

The survey collected Height Above water data (Ref 3), using an average draft of 12-12.5 feet forward and 11-11.5 feet aft, is shown in Table 1. For the survey, the water elevation column refers to the tidal level in the Newport harbor. The table factors in the CRC Vessel Analysis criteria of a 10 foot air gap (distance between lowest part of the bridge and highest part of the vessel) as well as assuming the river level to be at 16 feet. River level is based off a river's gauge reading, which has a reference level of gauge zero. This equates to a vessel needing an air draft of approximately 69 feet (95' bridge clearance at normal river level (gauge zero), minus 10' air gap, minus 16' river level increase).

Table 1: Survey data collected on 17JUL12.

Vessel Name	Antenna	Mast	Crow's Nest	Light Bar	Water Elev (ft)	Height Above Water (ft)
	Elev (ft)	Elev (ft)	Elev (ft)	Elev (ft)		
YAQUINA	91.3				1.3	90
		87.9			1.3	87
			70.7		3.0	68
				69.7	1.3	68

The crane boom was surveyed but not considered due to its ability to be cradled at a low height above water. From the above table and below figure it is assumed for this report everything located above the Crow's Nest will either have to be permanently relocated or temporarily moved during passing under the proposed new I-5 Bridge.

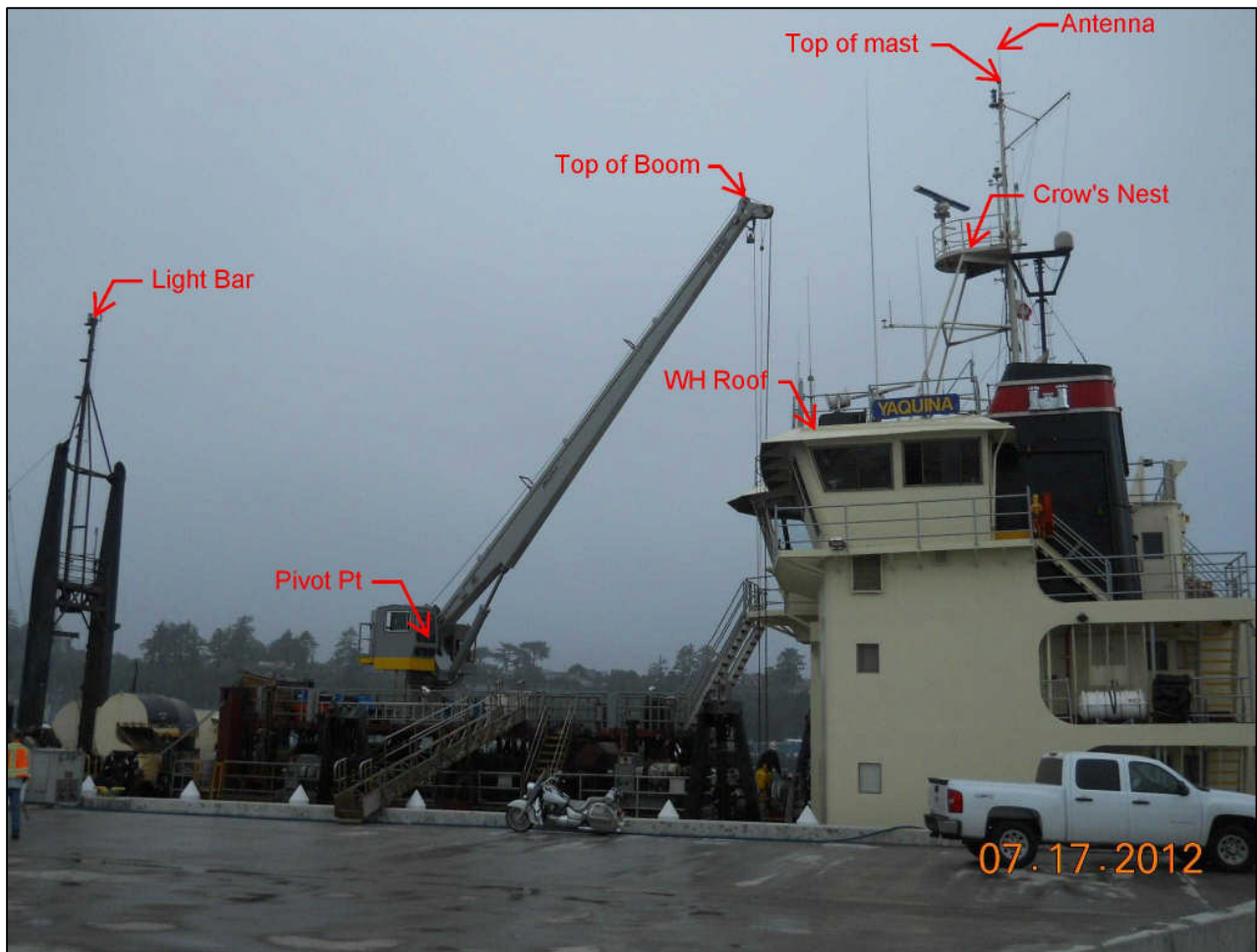


Figure 3: Survey points on YAQUINA.

Vessel Required Air Draft

In order for YAQUINA to pass under the new I-5 Bridge at high river level, with a 10' air gap, the mast would need to be no greater than 69' above water (at a given draft of 12.5' fwd, 12' mid, and 11.5' aft; assumed operating drafts for transit).

Recommended Modification

Assuming normal operating drafts, everything one foot higher than the existing Crow's Nest platform would need to be removable, hinged, or removed/repositioned all together. The recommended modifications are listed below:

Removals:

- Remove radar and foundation down to 6" off Crow's Nest platform.
- Remove Flag halyard and gaff pipe.
- Remove electronics
- Detach cabling from mast on structure higher than the Crow's Nest platform.
- Remove masthead and maneuvering lights.
- Remove handrails down to Crow's Nest deck
- Cut and remove Mast down to 6" above Crow's Nest platform.
- Adjust height of vertical ladder and associated safety cable to 6" above Crow's Nest platform. Ladder will need to be moved off center to starboard to allow for modified mast.

Installations:

- Install removed radar directly to Crow's Nest platform.
- Install wind bird and GPS on yard arm.
- Install safety clip railing around Crow's Nest Platform to allow for safe maintenance on radar.
- Install locking mechanism near Crow's Nest Platform for new mast while in vertical position.
- Install pinned connection on existing 8" mast structure. Install pulley, cable, and winch.
- Fabricate and install new lightweight mast (no longer needs to be climbed). Max height will be three feet less than previous mast head height (still meeting USCG light arrangement requirements).
- Install antennas, lighting foundations and lights on pinned mast.
- Reinstall cabling to all electronics, adjust cable lengths as needed.

With the removal of the ladder rungs, approx. 3.5' of mast height, and new light weight light foundations, the new mast will be much lighter than original shown in Figure 5. Stays may not be necessary depending on the pinned mast weight distribution and strength calculations. Electrical cable lengths need to be adjustable based on new equipment position and pinned mast.



Figure 4: Electronic cabling coming from YAQUINA bridge.



Figure 5: Top of existing mast.

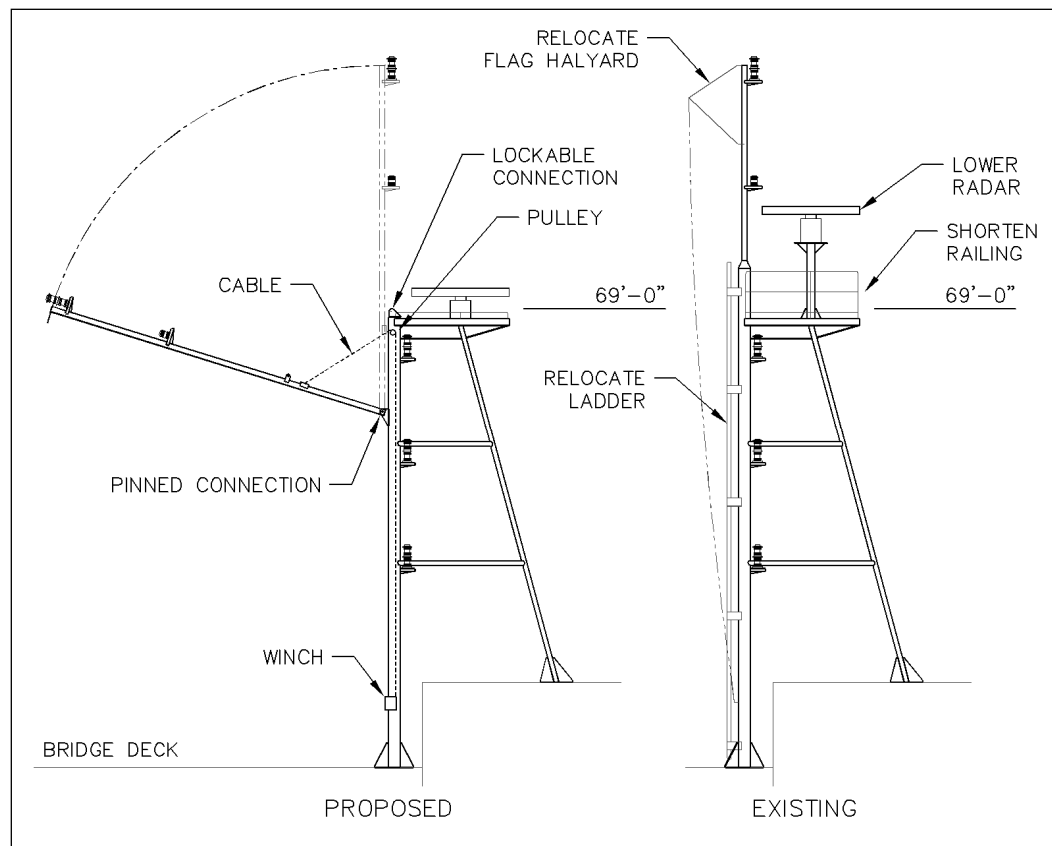


Figure 6: Sketch of proposed YAQUINA modification.

Maintenance Item General Description

The proposed modification above enables the ship owner to lower and raise the upper portion of the mast by means of a manual (or electric) winch located on the Pilothouse upper deck. The height of the mast, when winched in the upright position, could be approximately 3.5' lower than existing while meeting USCG navigational requirements. This will help reduce the weight of the pinned mast. The upper mast weight can also be decreased due to the reduced strength requirement since it no longer needs to be climbable. Before, the mast had ladder rungs for crew to climb up for maintenance/installation needs. The new pinned mast can now be lowered for all maintenance/installation needs. The locking connection at the Crow's Nest platform level can be dampened to help mitigate vibration effects. Adjustable mast stays can also be installed as determined by calculations.

The radar was left on the Crow's Nest platform due to operational needs. It will be approximately 1' above the required air draft of 69', making the bridge clearance at high river level 9' rather than 10'. Moving the radar to a lower position on a new pedestal is feasible, but the cons include a decreased radar visibility (mast, stacks, and Pilothouse) and a higher frequency of shutting down the radar due to crew members going aloft.

The ladder and safety cable will be moved off center to the starboard side. This will allow the mast to lie firmly against the existing 8" mast base. The flag halyard and gaff pipe will need a new foundation coming off of the 8" mast, with its highest point near the Crow's Nest platform. Lights and associated foundations shall be positioned to meet USCG guidelines. Wind bird and GPS

antenna can be positioned on the yard arm. Electric cables will need to be adjusted to account for the pinned connection. It is possible to contact the USCG to ask for permission to deviate from the USCG navigation light position requirements. If this is pursued, several additional options could be explored. However, all would entail cutting the existing mast and modifying the radar height.

It is recommended that while the ship is in dry-dock the height above keel for both the forward mast light (light bar in survey) and Crow's Nest be verified and documented.


Cost Estimate

During the ship visit it was found that the YAQUINA goes into dry-dock on an annual basis due to its rigorous/continuous operations. A work package is completed for each availability. This work package is modified based on the needs of the ship and the USACE's budget.

For this report it will be assumed that modifications made to the ship will take place within one of the scheduled annual availabilities. This will eliminate contract mobilization costs, reduce overall man hours, and allow for early scheduling to minimize contract changes. Cost estimates are assuming work will be completed in the Pacific Northwest Region. Labor rates include shipyard overhead fees. Material costs include a 20% mark up. See Figure 7 below for a preliminary cost estimate breakdown.

Vessel: Columbia River Crossing Vessel Analysis AAA Project #: CEDEA001 SHT: 1 OF 1
 System: USACE Yaquina Estimator: N. Anderson DATE: 27-Jul-12

ITEM	MAJOR ASSUMPTIONS AND DESCR. OF WORK	MANHOURLY ESTIMATE												LABOR TOTAL	LABOR COST	MAT'L COST	TOTAL COST		
		L	S/F	B/W	P/F	E/E	S/C	S/M	IN	P	R	I	M						
1	Material: ABS steel, winch, cable, foundations																	\$ 3,500	\$ 3,500
2	Remove Existing Mast above Crow's Nest																		
2.1	Set Up and Clean Up	24									16						40	\$ 2,800	\$ 2,800
2.2	Remove electronics (crane)	8				16							8				32	\$ 2,240	\$ 2,240
2.3	Remove radar pedestal and mast (crane)	16	4	16									8				44	\$ 3,080	\$ 3,080
2.4	Remove top of existing mast (crane)	8		4									8				20	\$ 1,400	\$ 1,400
3	Install New Mast and Foundations																		
3.1	Install pinned connection (crane)	8	8	8									4			8	36	\$ 2,520	\$ 2,520
3.2	Install safety railings	8	8	8									4				28	\$ 1,960	\$ 1,960
3.3	Install foundations, halyards (crane)	24	16	16									16				72	\$ 5,040	\$ 5,040
3.4	Fabricate and install new mast	24	12	24									4				64	\$ 4,480	\$ 4,480
4	Prep and Paint -Set Up Containment																		
4.1	Prep and new and old metal	24															24	\$ 1,680	\$ 1,680
4.2	Paint - Material																	\$ 200	\$ 200
4.3	Paint (200 sqft)	8											24	8			40	\$ 2,800	\$ 2,800
5	Restore Electronics (crane)	16				32											48	\$ 3,360	\$ 3,860
6	Operations Test	16															16	\$ 1,120	\$ 1,120
7	Crane usage																	\$ 3,000	\$ 3,000
8	Temp Services, Design and Meetings	20															20	\$ 1,400	\$ 2,000
Totals:		204	48	76	0	48	0	0	0	0	24	76	0	8		484	\$ 36,880	\$ 7,440	\$ 43,080



Standard Labor Rate: \$70.00

S/F = SHIPFITTER P/F = PIPEFITTER S/C = STAGEBUILDER/CARPENTER
 B/W = BURNER/WELDER E/E = ELECTRICAL/ELECTRONICS S/M = SHEETMETAL
 M = MACHINIST R = RIGGER P = PAINTER L = LABORER IN = Insulator I = Inspector

Figure 7: Preliminary Shipyard cost estimate for maintenance item included in a larger availability package.

Additional costs associated with the shipyard work include design, review, and construction oversight. It is estimate that the engineering and design efforts for this specific task could take up to 6 man weeks (2 to 3 people for two weeks). An estimated cost for this work would be \$15,000 to \$25,000. The modifications drawings will also need to be reviewed and approved by regulatory bodies, such as American Bureau of Shipping (ABS). Based on our work with similar projects, a reasonable estimate for the ABS fee for a project of this size is \$2,500. Any costs associated with reviews by the U.S. Coast Guard and oversight by USACE personnel has not been included in this estimate.

It is anticipated that recurring (maintenance) costs for this project will be minimal and have not been included. However, it is likely, just as any other piece of equipment on the vessel, that the winch, cable, and other mechanical devices will wear over time and need to be replaced. Operational costs such as fuel (power/lighting) and man hours have been excluded from this estimate as the owner of the vessel should not be required to expend any *additional* of either one in an effort to raise and lower the new mast.

Therefore, based on estimated material, shipyard labor, and engineering and design costs as well as estimated review fees, total cost estimate for the suggested modifications to YAQUINA should range from **\$60,000 to \$75,000**.

References

1. USACE Website, Portland District Vessels
<http://137.161.203.100/navigation/vessels.asp>
2. 33 Code of Federal Regulations, Parts 1 to 124, July 1, 2009
International and Inland Navigational Rules
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3. Survey Data collected on 17 July 2012 for YAQUINA
NOAA Marine Operations Center-Pacific, Newport, OR
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4. NAVSEA Design Data Sheet 170-0
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5. Dredge YAQUINA, Ship's Drawings
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