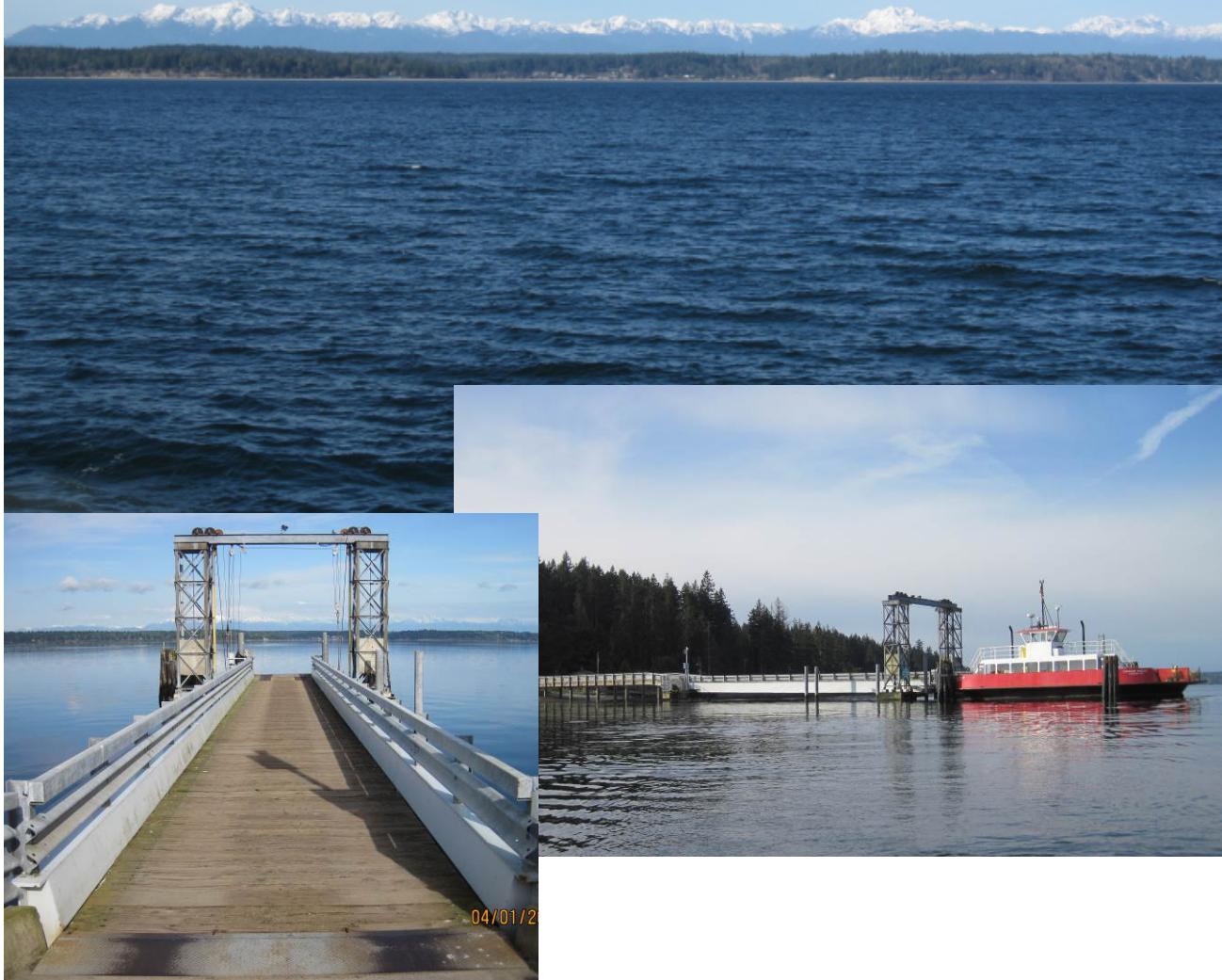


# *Herron Island Mainland and Island Ferry Terminal*

## *ROUTINE STRUCTURE INSPECTIONS – 2014*



For: HMC Management  
Inspection By: Sargent Engineers, Inc.  
A.L.Packard, P.E.  
C.A.Mallow, P.E.

Inspection Date: April 1<sup>st</sup> and 2<sup>nd</sup>, 2014

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April 8,2014

Ms. Claudia Ellsworth  
HMC Management  
P.O. Box 119  
Lakebay, WA 98349

**RE: Ferry Terminal Observation  
Project No.: A14111.00**

Dear Ms. Ellsworth:

## **INTRODUCTION**

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### **STRUCTURE DESCRIPTION**

The Herron Island Ferry terminals service a single ferry that is the only means for vehicular traffic to and from Herron Island and the mainland. The terminals carry a single lane of traffic that is controlled by signs, lights and ferry crew members. The approach spans leading to the draw span terminals consist of a cast in place reinforced concrete slab superstructure, supported by concrete abutments and reinforced concrete piles. The lift span superstructure consists of a timber plank deck, two painted steel girders, and a painted steel stringer and floor beam system. The lift span superstructure is supported by a concrete cap and concrete piles at one end and steel lift towers on battered concrete piling at the other end. The bridge is equipped with steel bridge rails with concrete and steel curbs. The bridge is not currently posted for vehicular loads, but the Heron Island Terminal Access Policy limits vehicle weight to 40,000 pounds. The length wise numbering orientation for both terminals is from the land end to the terminal end, and for side to side from left to right.

### **TIME AND SCOPE OF INSPECTION**

This inspection was performed on April 1<sup>st</sup> and 2<sup>nd</sup>, 2014. The inspection covered all of the structural elements of the mainland and island terminals that were above the water line at the time of the inspection. Areas inspected included the concrete approach spans, steel lift spans, and the steel counter-weight towers. The inspection also included a visual inspection of the mechanical elements of the lifting system for both terminals. The mechanical components inspected were the concrete counterweight towers, the lifting cables, cable anchors and connections, and sheaves.

## VISUAL INSPECTION

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### MAINLAND REINFORCED CONCRETE APPROACH SPANS

The reinforced concrete approach slabs are integral with the bent caps and piles:

Roadway Approach:

- Good condition, no deficiencies observed.

Reinforced Concrete Slab:

- Good condition, no deficiencies observed.

Reinforced Concrete Bent Caps:

- Good condition, no deficiencies observed.

Reinforced or Prestressed Concrete Piles:

- Good condition, small concrete patches in several columns, patches are in good condition.

Reinforced Concrete Abutment:

- Good condition, no deficiencies observed.



Image 1: Reinforced concrete approach spans.

## ISLAND REINFORCED CONCRETE APPROACH SPANS

The reinforced concrete approach slabs are integral with the bent caps and piles:

Roadway Approach:

- Some uneven settlement in the asphalt approaches at the bridge end. Settlement causes very little impact to the bridge because of low speed restrictions.

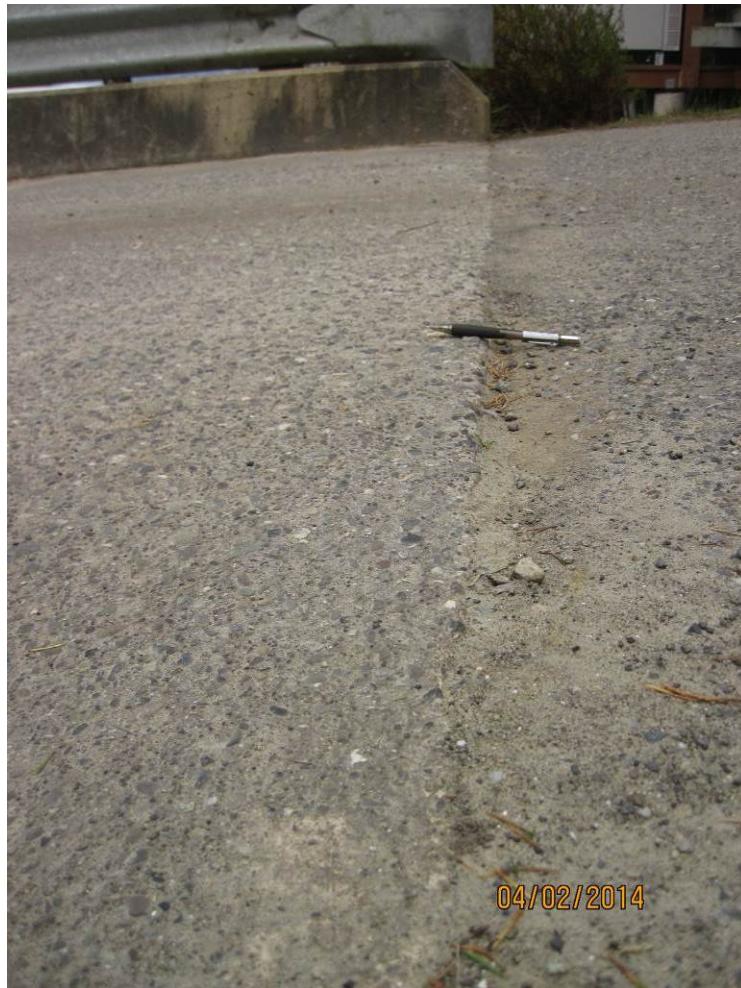


Image 2: Approach end. One inch or less of settlement.

Reinforced Concrete Slab:

- Some minor transverse and longitudinal cracking in the deck surface of span 1. Several transverse seal patches are in place. The concrete deck wearing surface is worn to small aggregate.

### Reinforced Concrete Bent Caps

- No deficiencies observed.

### Reinforced or Pre-stressed Concrete Piles:

- Minor hairline cracking near tops of several piles. (1) Minor spall with a short length exposed rusting rebar. Small concrete patches in several columns, patches are in good condition.



Image 3: Typical of patches. Short length of exposed rebar visible near the top.

Timber Abutment: Timber back wall supported by timber piles.

- All timber sounded, no significant decay was observed. Some settlement in rip rap bulk head protection.

## MAINLAND BUILT-UP WELDED STEEL LIFT SPAN

Rail and Curb System:

- Good condition, minor scrapes with surface corrosion.

Timber Deck:

- The surface of the planks is wearing and rutting in the traffic wheel lines and there are checks and splits in the top side of many of the planks. The bottom surface of the planks is in better condition with little or no checking or splitting. Very little rot or decay was observed in the planks. It appears most all deterioration is from vehicle traffic and exposure. Though the deck planks are becoming worn and are in the later stages of their service life, it is likely have several years of service life remaining. Counting from the mainland end, planks 1, 2, 17, 21, and 29 were found to have advanced splitting and wear and should be replaced. The remaining planks should be monitored and replaced when significant splitting is noticed. The clips attaching the timber decking to the stringer tops are appear secure and in good condition.



Image 4: Mainland transfer span timber decking.



**Image 5:** General condition of mainland transfer span timber decking.

**Painted Steel Stringers:**

- Generally, the paint on the steel members on the land side of the counterweight towers is in better condition than the paint on the steel members beyond the towers. The transfer span area beyond the towers must get more exposure and have more contact with salts. The primary areas with deficiencies are along the stringer top flanges and the stringer to floor beam connections. Along the stringer top flanges, there are rust stains washing down from the interface between the stringers and the deck. Vehicle traffic is most likely causing the deck planks to wear against the tops of the stringers, causing the paint to wear. At the stringer connection to the floor beam, paint is deteriorated along the welded connection and along the bottom edge of the stringer. This is a typical location for accelerated paint breakdown and corrosion. No significant loss of section from corrosion was observed. No cracking in the members was observed.



Image 6: General paint condition of steel members inland of counter weight towers.



Image 7: General paint condition of steel members located beyond counter weight towers.



**Image 8:** Typical of rust stains along the stringer top flange, from wear at the interface with the timber plank decking.



**Image 9:** Stringer to floor beam connection area.

Painted Steel Floor Beams:

- The paint condition of the floor beams varies with location similar to the stringers, with the poorest conditions being beyond the towers. The floor beam connections to the main girders are welded. The welds of the girder gusset plates and the floor beams intersect. When welds like these intersect, they cause a stress concentration. This area can be susceptible to cracking from fatigue. No cracking was observed at the time of this inspection. The area surrounding this connection is convoluted with intersecting members, creating pockets that hold moisture and salts. This typical condition accelerates the breakdown of paint and corrosion of exposed steel. The paint in these areas continues to deteriorate, and the amount of area with exposed steel and corrosion is increasing. No significant loss of section from corrosion was observed. No cracking in the members was observed.



Image 10: Location of intersecting welds.



**Image 11:** Corrosion in areas of intersecting members at the floor beam to girder connection.

**Painted Steel Girders:**

- Two girders support the floor beams and stringers along the transfer span. These girders are considered fracture critical because they have no load path redundancy. I.E., if one girder were to fail the entire span would fail. Like the floor beams, there are several girder strengthening details with intersecting welds. Like the stringers and floor beams, the girder lengths beyond the towers have more paint deterioration than those on the land side of the towers. The majority of that paint deterioration is along the bottom edge of the girders and at connections with intersecting members. The amount of corrosion has increased slightly since the last inspection. No areas with a drastic increase in corrosion were observed. No cracking in the girders or welds were observed.
- The paint condition of the steel outriggers, which connect the girders to the lifting cables, is generally in fair condition. There is failed paint along the edges and along the underside. No cracking in the outriggers or welds were observed.



Image 12: Typical of corrosion along the bottom girder edge.



Image 13: 2012 - Interior face of a steel girder: Typical of the corrosion around the connections areas.



**Image 14:** 2014 – Photograph of same location as above, some increase in the amount of surface area with corrosion since 2012.



**Image 15:** 2014 – Painted steel outrigger.

Painted Steel Bearings:

- The bearings are in fair condition. The movable painted steel bearing at bent 9 appears to be free and in good service condition. There is some paint deterioration and corrosion along the edges of the bearing.



Image 16: Typical of the corrosion around the girder bearing.

## ISLAND BUILT-UP WELDED STEEL LIFT SPAN

Rail and Curb System:

- Good condition, Minor scrapes with surface corrosion.

Timber Deck:

- Generally, the island deck planks are in the same condition as the mainland planks and have the same remaining service life expectancy. The planks should be monitored and replaced when significant splitting is noticed. The clips attaching the timber decking to the stringer tops are appear secure and in good condition.



Image 17: Island transfer span timber decking.



**Image 18:** Underside of plank decking is in fair condition.

Painted Steel Stringers:

- Like the mainland stringers, the paint on the steel members on the land side of the counterweight towers is in better condition than the paint on the steel members beyond the towers. The locations of paint deterioration are the same as the mainland, though overall the degree of corrosion is less. This is attributed to the fact that the island terminal is somewhat sheltered by the island from the southwest winds, where the mainland terminal

is exposed to them. No significant loss of section from corrosion was observed. No cracking in the members was observed.



**Image 19:** General paint condition of steel members located inland of counter weight towers.



**Image 20:** General paint condition of steel members located beyond counter weight towers.

Painted Steel Floor beams:

- Like the mainland floor beams, the paint on the steel members on the land side of the counterweight towers is in better condition than the paint on the steel members beyond the towers. The locations of paint deterioration are the same as the mainland, though overall the degree of corrosion is less, and again is attributed to shelter from the winds. No significant loss of section from corrosion was observed. No cracking in the members was observed.



Image 21: Corrosion in areas of intersecting members at the floor beam to girder connection.

Painted Steel Girders:

- The girders are fracture critical. Like the stringers and floor beams, the girder lengths beyond the towers have more paint deterioration than those on the land side of the towers. The majority of that paint deterioration is along the bottom edge of the girders and at connections with intersecting members. The amount of corrosion has increased slightly since the last inspection. No areas with a drastic increase in corrosion were observed. No cracking in the girders or welds were observed.
- The paint condition of the steel outriggers is generally in fair condition. There is some failed paint along their edges and along the underside. No cracking in the outriggers or welds were observed.



Image 22: Typical of corrosion along the bottom edge.



**Image 23:** 2014 – Painted steel outrigger. Also note the paint deterioration in the winch cable platform.

**Painted Steel Bearings:**

- The bearings are in fair condition. The movable painted steel bearings appear to be free and in good service condition. There is minor paint deterioration and corrosion along the edges of the bearings.



**Image 24:** Typical of the corrosion around the girder bearing.

## MAINLAND AND ISLAND STEEL LIFTING TOWERS

- Generally in very good condition. The galvanizing protection system is also in good condition. The steel tower base plates are corroding. No cracking or section loss from corrosion was observed.
- Steel lug weights that are embedded in the concrete counterweight are corroding. Most significantly at the bottom face of the counterweight. Eventually the corrosion could cause spalling and delamination in the counterweight.

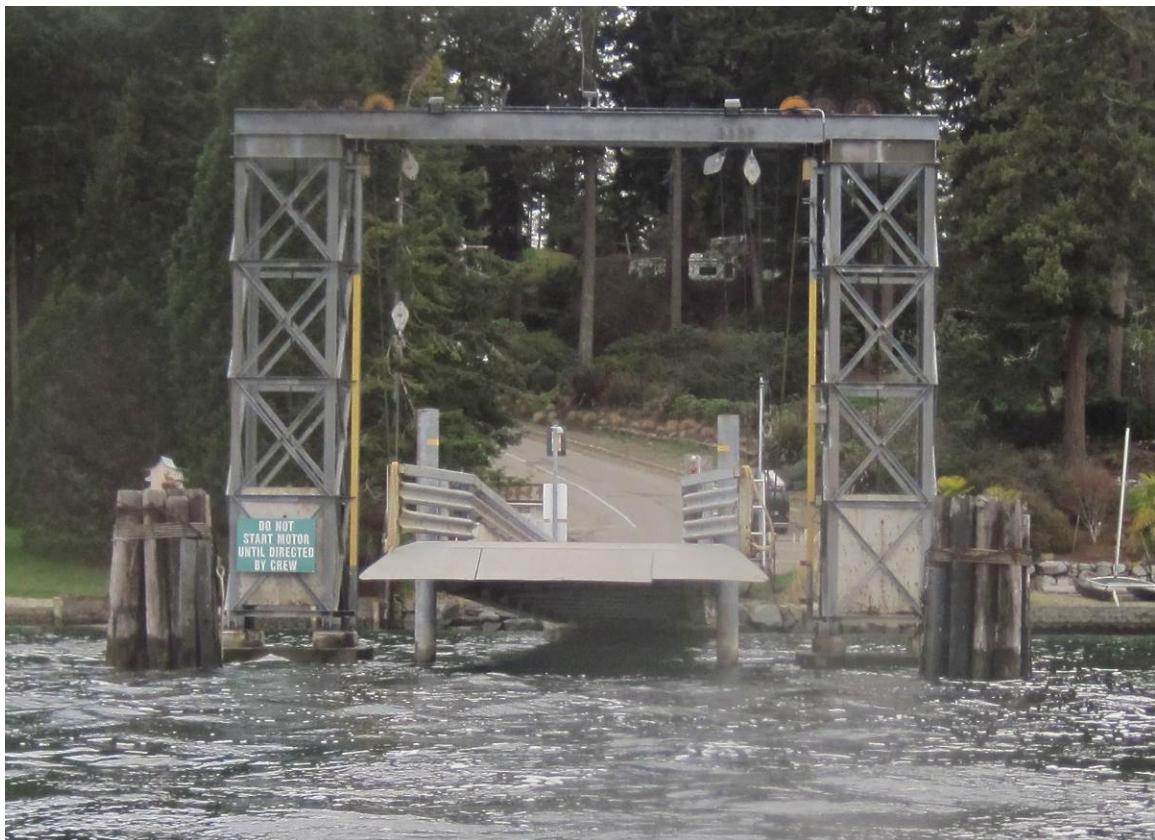


Image 25: Typical of the steel lifting towers.



Image 26: Typical corrosion of steel lugs on the bottom face of the tower concrete counter weights.



Image 27: Typical of corrosion at the tower leg base plates

## MAINLAND MECHANICAL LIFTING SYSTEM

### Steel Wire Cables

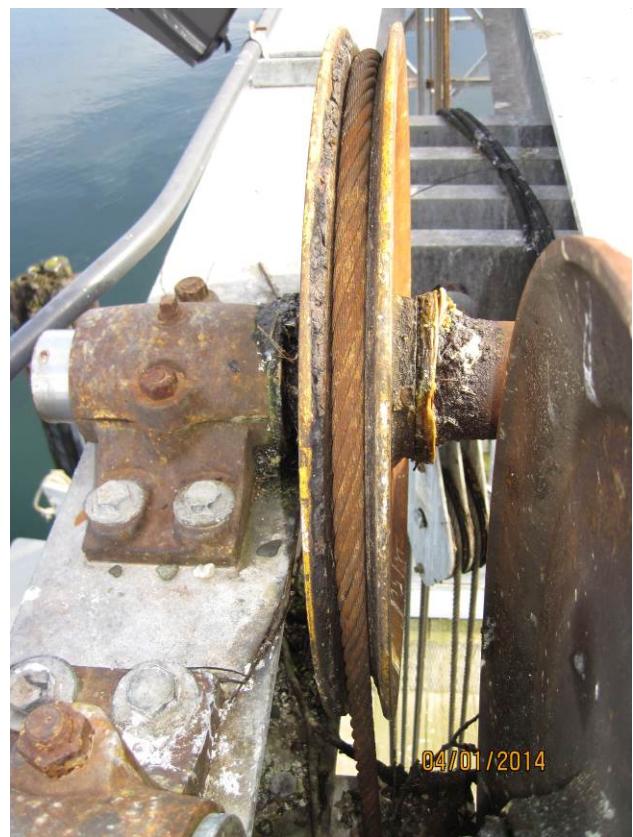
- The mainland terminal has more exposure to the winds, salts, and birds than the island terminal. The added exposure causes the mainland greases to wear and dissipate faster. The lifting cables are in fair condition. At the time of this inspection, both cables were dry along the lengths that do not reach the winch spool. The left hand cable is not galvanized and has some surface rusting. Both cables appear to be spooling correctly.
- The concrete counterweight cables are in fair condition. At the time of this inspection they were dry.



Image 28: Mechanical cable lifting system.



**Image 29:** Correctly spooled lifting cables.  
Well-greased at the spool.



**Image 30:** Dry lifting cable above at the tower sheave. Some surface rusting.

Cable Anchors:

- The counter weight cable anchors are in satisfactory condition. There is some minor surface rusting. The grease at the point where the cable enters the spelter socket is breaking down at the connections to the counterweight and at the winch platform. Grease here prevents water for penetrating inside of the connection. The no section loss or cracking was observed.
- The lifting cable anchors are in satisfactory condition. There is some minor surface rusting. The grease at the point where the cable enters the spelter socket is breaking down. The no section loss or cracking was observed.



Image 31: Typical counter weight cable anchor. Note grease at the spelter socket breaking down..



**Image 32:** Typical lifting cable anchor. Note grease at the spelter socket breaking down.



**Image 33:** Typical dry counter weight cable.

Pulleys and Clevis Connections:

- The pulleys and block pulleys within the cable lifting system are in good condition.
- The clevis connections in the counterweight and lifting system are in good condition. There are several clevis connections without cotter pins. There is no indication that any of the bolts in the clevises are loose or that the lack of a cotter pin is a problem.

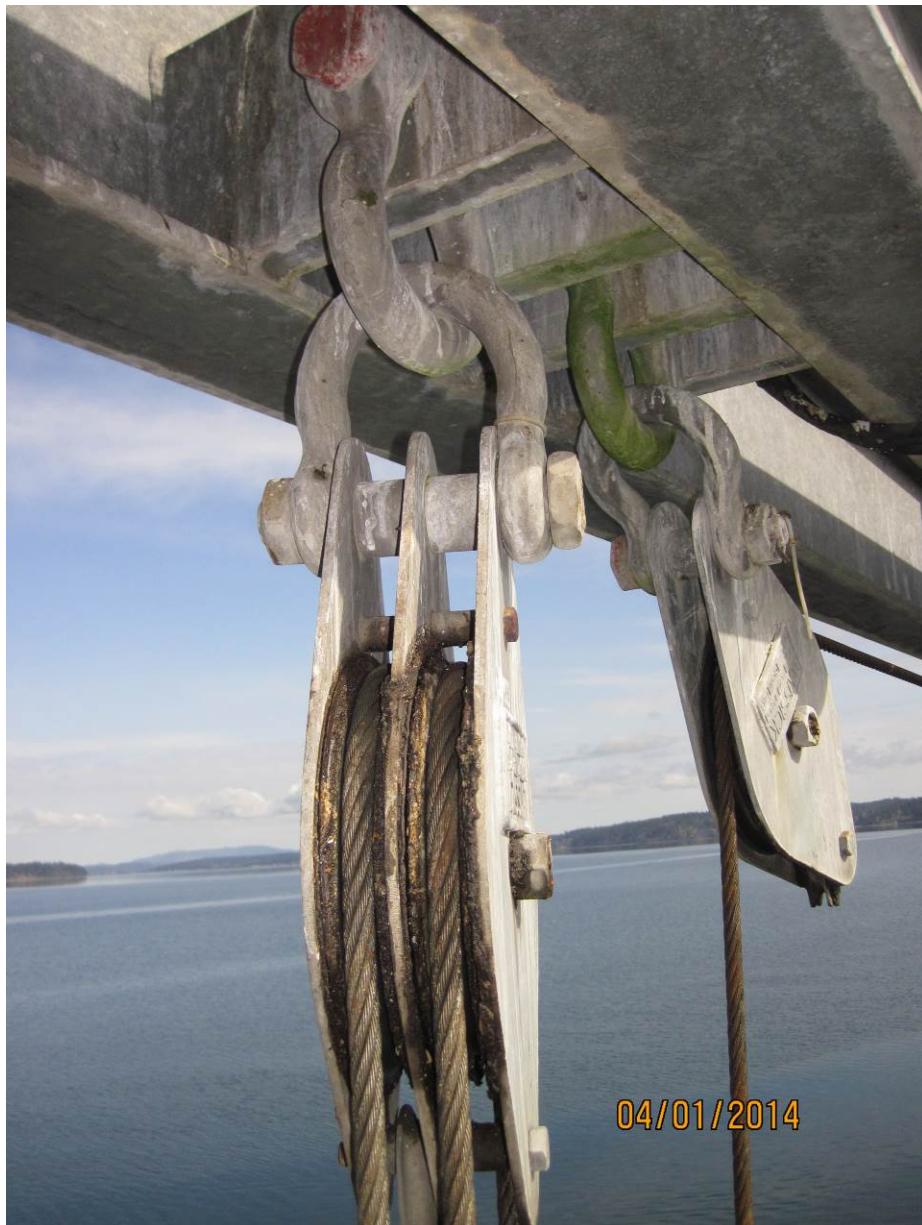


Image 34: Typical clevis connecting a lifting cable to a pulley block. Note the lack of a cotter pin in the clevis bolt.

Sheaves:

- The 20 inch diameter sheaves in the lifting cable system and the 24 inch diameter sheaves in the counterweight system are in good condition. All of the sheaves are well greased and appear to be running smoothly. The bearing oilers were at least half full.



Image 35: Typical of well-greased counterweight sheave. Note dry cables.

Winch and Platform:

- The winch chain is stretched or loose.
- The paint system for the winch platform is failed and corroding.

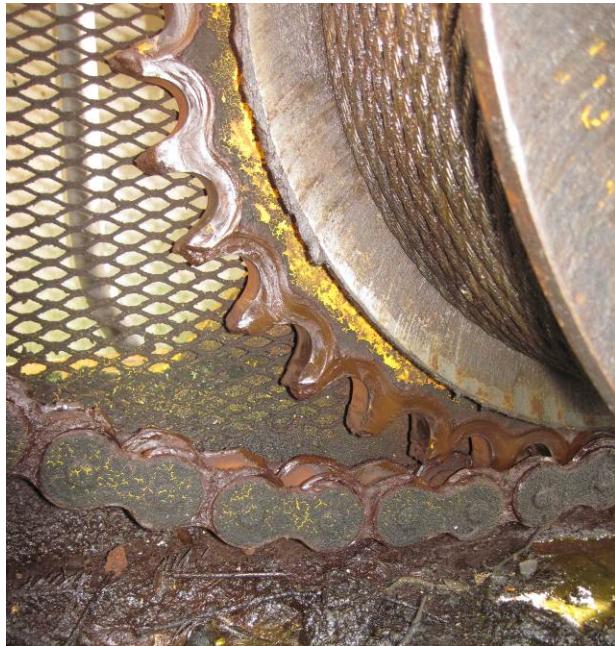


Image 36: Chain at bottom of drive sprocket.

Image 37: Failed paint and corrosion of winch platform.



## ISLAND MECHANICAL LIFTING SYSTEM

Steel Wire Cables:

- The lifting cables are in good condition. The left cable is ungreased near the upper sheave, the remaining lengths of cable are well coated. Both cables appear to be winding correctly
- The counterweight cable grease is breaking down but is providing satisfactory protection. There is some minor wear in the strands along the bottom side of the length of cable that passes over the two larger 24 inch diameter sheaves at the top of the lifting tower.



Image 38: Note condition of counter weight grease and lack of lifting cable grease.

Cable Anchors:

- The counterweight cable anchors are in good condition. Grease is present but breaking down at the top of the spelter socket. The cable anchor plate paint is wearing thin and the plates have some surface corrosion
- The lifting cable anchors are in good condition.



**Image 39:** Counter weight cable spelter socket connection, at the counter weight.



**Image 40:** Counter weight spelter socket connection at the lifting platform.

Pulleys and Clevis Connections:

- The pulleys and block pulleys within the lifting cable system are in good condition. The swage that ties off the thimbled loop for the wire rope connecting the winch platform to the lower lifting pulley block has surface corrosion. There is no visible indication of a loss of strength. Swage will be replaced during the upcoming scheduled cable replacement.
- The clevis connections in the counterweight and lifting system are in good condition. There are several clevis connections without cotter pins. There is no indication that any of the bolts in the clevises are loose or that the lack of a cotter pin is a problem.



Image 41: Upper lifting pulley block and clevis connection.



Image 42: Lower pulley block. Note surface corrosion on swage.

## Sheaves

- The 20 inch diameter sheaves in the lifting cable system and the 24 inch diameter sheaves in the counterweight system are in good condition. All of the sheaves are well greased and appear to be running smoothly. At the time of this inspection one bearing auto oiler was empty.



Image 43: Lifting cable and counter weight sheaves.

Winch and Platform:

- The winch chain appears in good condition.
- The paint system for the winch platform is failed and corroding.



Image 44: Winch drive chain.

Image 45: Note failing yellow paint of winch base.



## SUMMARY

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The concrete approach spans appear to be in good structural condition with no significant deficiencies noted. The timber deck planks are in the later stages of their service life. It should be expected that the planks will continue to split and require replacement over the next few years. The mainland terminal has more exposure to the elements than does the island terminal. As a result the protective systems, paint and cable greases wear more quickly on the mainland terminal. The mainland paint system has more failed areas than does the island terminal. The terminals should undergo spot paint repairs or be fully repainted sometime within the next two of years. The amount of surface area with deteriorated paint on the Island terminal is less than the mainland terminal. It would be best to paint both terminals at the same time, but if necessary, paint repairs to the island terminal could be put off for an additional year. With the exception of a lack of protective grease on some of the cables, the steel cables, sheaves, and connections appear to be in satisfactory condition. The mainland cable systems should be greased more frequently than currently scheduled. The current cable replacement schedule is satisfactory. It would be prudent to replace the recently replaced un-galvanized lifting cable at the mainland terminal with a galvanized one at the same time the others are replaced. This would remove an unprotected cable from the system as well as get them all back on the same replacement schedule.

## RECOMMENDED MAINTENANCE AND REPAIRS

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The following are maintenance and minor repair recommendations that should be performed to keep the bridge elements functioning properly and extend the life of the bridge.

1. Blast clean and spot paint or fully re-paint the steel members of the mainland terminal within the next two years
2. Blast clean and spot paint or fully re-paint the steel members of the island terminal within the next two to three years.
3. Blast clean and paint the bottom one foot of the mainland and island terminal tower legs.
4. Blast clean and paint the counter weight cable anchor plates. Located in weight cavity
5. Monitor intersecting welds on the floor beams and main girders during subsequent inspections.
6. Replace the deck planks noted for replacement in the report, monitor and replace remaining planks as necessary.
7. Continue to periodically clean out the cavity on the top side of the reinforced concrete counter weights.
8. Continue cable and grease maintenance schedule. Increase frequency of greasing on the mainland terminal. Include greasing top of spelter sockets.
9. Refill upper sheave bearing oilers.
10. Continue current cable replacement schedule, consider replacing the newly replaced un-galvanized cable at the mainland terminal.
11. Consider replacing the existing clevis bolts without cotter pins, for longer ones with cotter pins.

12. Monitor slack in the mainland winch drive chain. Tension or replace as necessary.

If you should have any questions, please call.

Respectfully,  
**Sargent Engineers, Inc.**



Andrew L. Packard  
Project Engineer



ALP

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## APPENDIX

### PHOTOGRAPHS



Image 46: Typical of approach span construction.



Image 47: Typical of lift span construction.