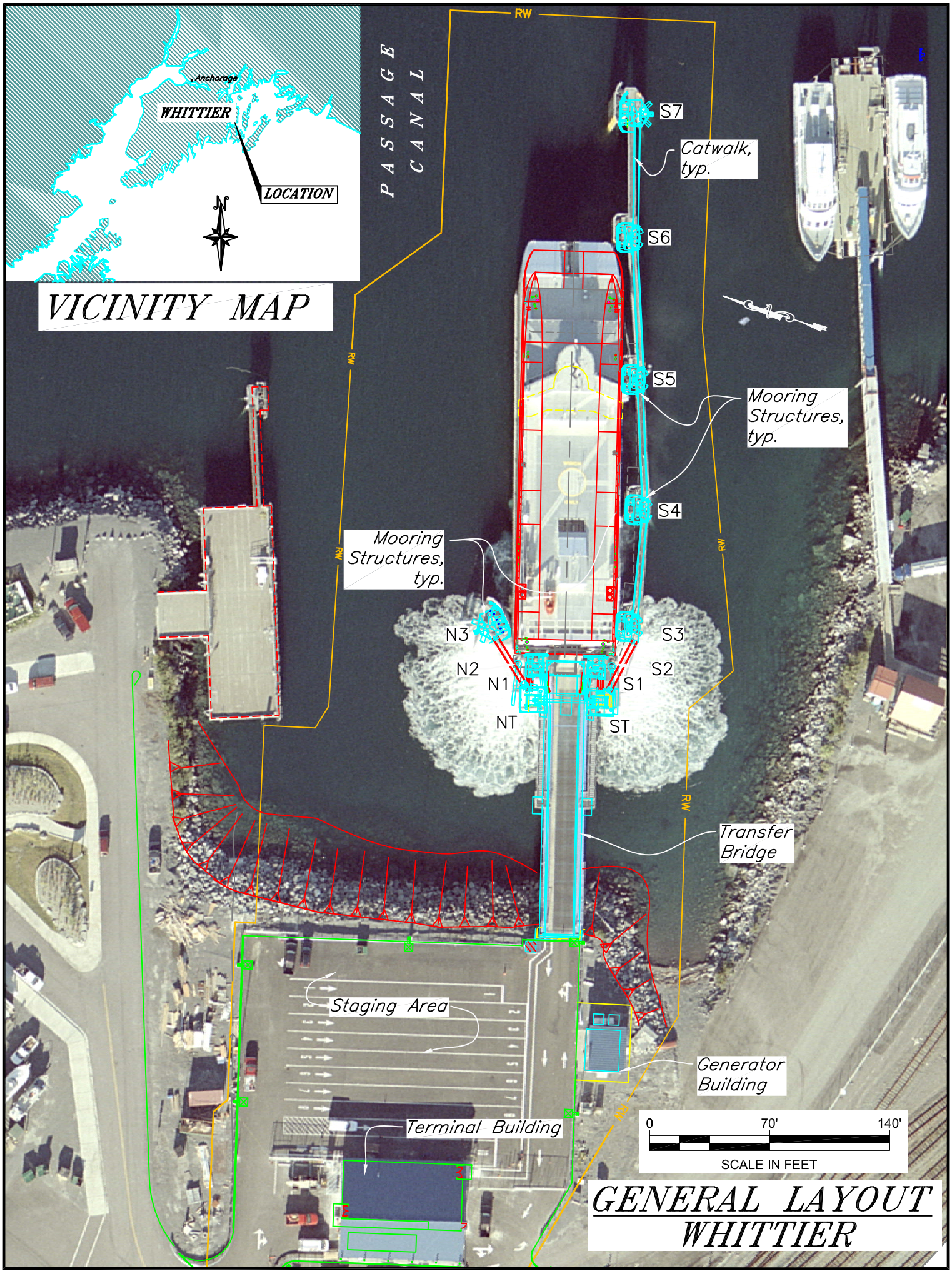

Anchorage
WHITTIER
LOCATION
VICINITY MAP
PASSAGE CANAL
RW
S7
Catwalk, typ.
S6
S5
Mooring Structures, typ.
S4
Mooring Structures, typ.
N3
N2
N1
NT
S3
S2
S1
ST
Transfer Bridge
Staging Area
Generator Building
Terminal Building
0
70'
140'
SCALE IN FEET
GENERAL LAYOUT
WHITTIER

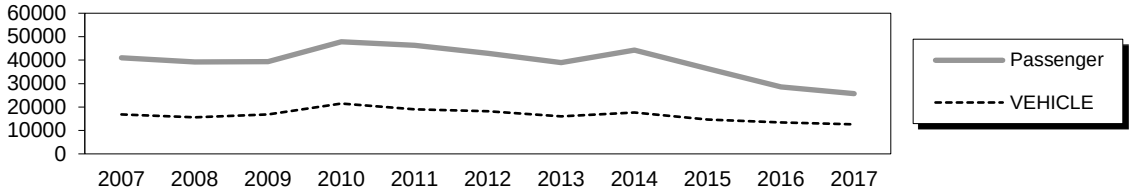
Whittier Ferry Terminal

¼ Mile Depot Road

Owner: State of Alaska

Terminal Manager: Stephanie Carlson, 907-472-2378

Terminal Description: Whittier is a stern-loading facility consisting of a transfer bridge, twin lift tower syncrolift, 10 steel pile dolphins and associated catwalks/gangways for line-handling access. The facility was upgraded from a timber tidal ramp to a lift and transfer bridge with steel mooring structures in 1988. Modifications were made in 2005 to accommodate the M/V AURORA, M/V KENNICOTT and the Fast Vehicle Ferry, MV CHENEGA. A single-lane highway tunnel and the Alaska Railroad provide access to Whittier from Anchorage and Portage. Like Valdez, this is a key connection point between Cordova and Anchorage. Tourism accounts for much of the summer traffic volume through this port. The facility went to year round service starting in 2005 with the reopening of the new modification project. The past 10 years of total passenger and vehicle traffic at Whittier is shown below.



The most recent above water survey inspection was completed on August 9, 2016. The underwater survey occurred on September 18, 2013. The most recent fracture critical inspection was on August 16, 2016.

Vessels	
Name	Berthing, Alignment
Aurora/Kennicott/FVF	Stern

Tidal Data (MLLW 0.0 feet)	
EHW	18.7
MHHW	12.3
MHW	11.3
ELW	-6.0

Terminal Building	
Year Built:	2005
Square Footage:	2200 s.f.
Heating System:	Furnace (Natural Gas)
Fuel Storage:	City Supply (Natural Gas)
Fire Protection:	Alarm Pyrotronics
Condition:	New

Generator & Building	
Building/Generator:	2005
Square Footage:	260 s.f.
Heating System:	Electric
Fuel Storage:	City Supply (Natural Gas)
Fire Protection:	Halon
Condition:	Good

Uplands	
Short-Term Parking:	3 cars
Long-Term Parking:	N/A
Staging Area:	1200 lineal feet; 125 lineal feet-buses/trucks
Paint Striping:	Yes
Driving Surface:	Asphalt

Vehicle Transfer Bridge - #1424	
Type:	16' x 140' twin box beam
Year Built:	1986
Shoreward support:	Concrete abutment
Seaward support:	Steel Lift Beam-Syncrolift
Coating:	Wasser Paint
Pedestrian Access:	Concrete 4' wide on bridge
Lighting:	None
Condition:	Good (see findings)
Load Posting Sign:	N/A
Original Design Load:	HS 20-44

Utilities		
	at Terminal	at Ramp
Electrical:	Yes, city & backup power	
Water:	Yes	No
Sewer:	Yes (Septic)	No
Telephone:	Yes	Yes
Cable TV:	No	No
Fuel:	No	No
Wireless Bridge:	Yes	-

Dolphins								
Dolphin	**Dolphin Piles**	**Fender Support**	**Fender Face**	**Anodes**	**Built**	**Cond.**	**Hawse Extensions**	**Notes**
N3	3B, 3V	Hanging	UHMW	Yes	2005	New	Yes	Red navlight
N2	1B, 1V	Floating	Rubber Fender	Yes	2005	New	Yes	
N1	2B,2V	Hanging	UHMW	Yes	2005	New	Yes	
ST	4V	-	-	Yes	1988	Good	-	
NT	4V	-	-	Yes	1988	Good	-	Light Pole
S1	2B,2V	Hanging	UHMW	Yes	2005	New	Yes	
S2	1B,1V	Floating	Rubber Fender	Yes	2005	New	Yes	
S3	2B,2V	Hanging	UHMW	Yes	2005	New	Yes	
S4	2B,2V	Hanging	UHMW	Yes	2005	New	Yes	
S5	2B,2V	Hanging	UHMW	Yes	2005	New	Yes	Light Pole
S6	2B,2V	Hanging	UHMW	Yes	2005	New	Yes	
S7	3B, 3V	Hanging	UHMW	Yes	2005	New	Yes	Red navlight & windsock

Catwalks / Gangways								
#	**From Struc.**	**To Struc.**	**Length / Style / Main Members**	**Built**	**Safety Chains?**	**Cond.**	**Lighting**	**Notes**
C1	N3	NT	34' / Catwalk / W 12x26 Custom Girders	2005	No	Good	Tubuloid	
C2	NT	N1	9' / Catwalk / W 4x13 Bottom Chord	1988	No	Good	Tubuloid	
G1	ET	EBP	52' / Gangway / S 4x9.5 Bottom Chord	1988	Yes	Good	Tubuloid	
G2	WT	WBP	52' / Gangway / S 4x9.5 Bottom Chord	1988	Yes	Good	Tubuloid	
C3	ST	S1	9' / Catwalk / W 4x13 Bottom Chord	1988	No	Good	Tubuloid	
C4	S3	ST	33' / Catwalk / W 12x26 Custom Girders	2005	No	Good	Tubuloid	
C5	S4	S3	57' / Catwalk / W 18x40 Custom Girders	1988	Yes	Good	Tubuloid	
C6	S5	S4	65' / Catwalk / W 18x40 Custom Girders	2005	Yes	Good	Tubuloid	
C7	S6	S5	72' / Catwalk / W 18x40 Custom Girders	2005	Yes	Good	Tubuloid	
C8	S7	S6	61' / Catwalk / W 18x40 Custom Girders	1988	Yes	Good	Tubuloid	

LEGEND

ET = East Lift Tower
G1 = Gangway
V = Vertical Steel Pipe Piling
EBP = East Bridge Platform
B = Battered Steel Pipe Piling

Terminal Projects			
Year	**Project #**	**Project Name**	**Description**
1988	RS0830(1)	Whittier Ferry Terminal	Expanded uplands staging and parking area and constructed generator building. Dredged the mooring basin. Removed existing transfer structures and replaced with new steel transfer bridge and Syncrolift system. Removed existing timber mooring structures and replaced with steel mooring/fendering structures connected with steel access catwalks. Lighting and hydraulic lift control upgrades.
2005	67883 / NH-0496(007)	Whittier FT Improvements - Uplands & Terminal Building	Constructed uplands improvemnets, built new terminal and generator buildings and made utility upgrades.
2005	68335 / NH-0830(2)	Whittier FT Terminal Modifications	Removed existing mooring structures and replaced with ten new steel mooring/fendering structures.

Terminal Projects (cont'd.)			
Year	**Project #**	**Project Name**	**Description**
2008	73741	WIT Ferry Terminal Transfer Bridge Repairs	Harbor Welding repaired the FB-Girder weld cracks Dec 4th - 18th, 2008.
2008	69050 / SHAK - 0005(575)	Whittier - Ferry Dock Hoist Upgrade	Replaced the existing relay-based control panel for the transfer bridge lift system with a PLC-based control panel.
2011	N/A	WIT FT Building Repairs	Remove clerestory window & water-damaged wall frame.
2013	73125 (1)	WIT Staging Area Lighting Replacement	Remove & replace all exterior light fixtures in the staging area; replace conduit/wiring below the bridge, relocate to above the girder; other miscellaneous electrical
2013	N/A	Emergency Hoist Repairs	Repairs consisted of the complete replacement of all lift system components.
2016	N/A	WIT FT Bridge Strengthening	Installed a structural retrofit to the seaward end of the bridge to bring the load rating within standards for highway vehicles.

Observations

1. A repair project for the terminal building was designed & constructed in 2011.
2. Land area in Whittier is constrained. The ferry terminal property is substandard in size for the parking & staging needs of the Whittier terminal. Public parking near the terminal building may be insufficient. The staging area should be bigger to accommodate current & future traffic. The bridge transition plate is wearing into the pavement at the shore approach.
3. A project in 2013 replaced all the light poles with new high-wind rated poles.
4. The bridge is supported on the seaward end by a Syncrolift cable support system. The shore side end is supported by hinge bearings on a concrete abutment. In 2007, a frozen “normal up” limit switch on the left hoist of the Syncrolift led to one of the bridge girders being raised 4-feet higher than the other. Terminal personnel determined the cause of the problem, cleared the ice from the switch, and then the bridge operated normally. The problem has not reoccurred. Follow-up inspection revealed failed welded connections between the first floor beam and both girders. AMHS Shoreside Maintenance contracted the repair out to a certified-welder, Harbor Welding, and repairs were completed in December of 2008. On-site QC, including various methods of NDT, was performed by Mayes Testing Engineers.

   On the following inspection cycle in 2010, rust staining was discovered along the bottom of the first floor beam-to-girder connections. QA Services, out of Anchorage, removed the paint and verified the extents of the weld cracks with NDT methods. The most recent inspection found the following weld cracks:

   <u>Girder 2 (RT) – FB 0 Exterior</u>:

   - 1-1/2” crack between the top flange of FB and the Girder web.
   - A crack wraps around the top shoreward corner that is 1-1/2” along the top flange and 6-1/2” along the shoreward web of the FB.

   <u>Girder 1 (LT) – FB 0 Exterior</u>:

   - 1-1/8” long crack between the top flange of FB and the girder web.
   - A crack wraps around the top shoreward corner that is 7-1/2” along the top flange and 4” along the shoreward web.
   - There is a 3-3/4” long crack between the girder end plate and girder web
   - A crack along the entire lower flange of the FB and wraps around both corners and up the web of the FB on both sides 3”

   <u>Girder 2 (RT) – FB 0 Interior</u>:

   - 1-3/4” crack reflecting through the web from the exterior, near the first bearing stiffener
   - 5” crack reflecting through the web from the exterior, near the girder end plate

Girder 1 (LT) – FB 0 Interior:

- 3" crack reflecting through the web from the exterior, near the first bearing stiffener
- 4" crack reflecting through the web from the exterior, near the girder end plate

These weld cracks have continued to propagate, albeit at a slow annual rate, along the web weld between the FB and Girder. This weld is the primary path for load transfer of vehicle loads.

5. The 2006 inspection of the transfer bridge discovered that the pin of the right shoreside hinge is rotating relative to the base. The keeper bars, that restrict movement of the outboard nut, have been forced aside, permitting the nut to rotate as the bridge is raised and lowered. Shore personnel have been alerted to monitor the position of the pin. The most recent inspection found the gap between the nut and the bearing assembly hasn't changed in several years.

   The seaward hinge bearings, on the lift beam, do not appear to rotate as the bridge is raised or lowered. Most likely the bearing surfaces seized due to inadequate lubricating grease. The platform on the lift beam for maintenance access is too narrow to use, so greasing can only be done from skiff.

6. An AMHS Maintenance project replaced the 2005 PLC controls with a new PLC automated control system in 2008. The bridge controls have stabilized, but if faults occur, they can be monitored on the internet. The elevation of both girders is gauged, and the software was written to stop operations and reset levels when an elevation variation greater than 2" occurs.

7. Heavy condensation exists on the interior of girder 1 and 2 and all associated components. These moist conditions have resulted in heavy laminating corrosion on top of the bottom flange plate, with up to 1/16-inch section loss.

8. The Whittier facility is unique in that the apron rotates to a vertical, down position for use by the MV Aurora. The bridge apron is lowered out of the way to permit the Aurora to place its stern apron directly on the bridge. In the down position (only when the Aurora is in port), approximately half of the apron is submerged and the apron is subjected to wave forces. Wave motion causes the apron to pound against the stops and purportedly deflects the lift arm support some 4 inches in severe weather.

   Typically the bridge is lifted all the way up to the tower, in order to reset the syncrolift winches. But if the apron is left in the water, the force of the waves may cause damage to the apron hinges, lift arm, or its supports. The simple solution is to keep the apron out of the ocean environment as much as possible. Perforating the apron will reduce the induced wave forces. In addition, the apron may be braced by supports at a lower elevation to reduce the loads resisted by the arm support.

9. In August, 2013 an electrical contractor was employed to relocate conduits and conductors from under the bridge to the top flange of both box girders. A level bench of riprap extends several feet in front of the abutment creating a shelf for snow to accumulate under the bridge. Electrical conduits suspended from the floor framing are repeatedly crushed against the snow mound when lowering the bridge at low tides. This work remedied the problem by moving the conduits to the top of the box girders where they are no longer at risk for damage. When replacing the conductors the electrical contractor mistakenly reversed the power feed to the Syncrolift hoist motors. When the hoist was activated after the wiring modifications, the brake pawls did not retract as the bridge was lowered. The winch drum was driven against the pawl, completely failing the winch drum pillow blocks on both hoists. Replacement parts required a 6 month lead time; therefore, the hoists were replaced in their entirety with used units and the terminal was reopened in November, 2013.

10. In 2015 a bridge load rating performed by Burgess & Niple, Inc. consulting engineers indicated deficiencies in floor beam 14 and some of the cantilevered stringers at the seaward end of the bridge. An independent rating by ADOT&PF Marine confirmed a component LFR of 0.36 for the floor beam and similarly low values for the stringers. On November, 2015 the Marine Design section conducted a special inspection of the overloaded members but found no indication of distress or excessive deflection.

    In May 2016 a bridge strengthening project added two floor beams to the underside of the bridge's seaward floor framing to remedy the deficient floor beam and stringers. The rating factors of all elements at the seaward end increased above 1.0 but the overall bridge rating factor is 0.82, limited by the capacity of floor beam 11. ADOT&PF policy does not require posting of this bridge as the LFR rating exceeds 0.75.

Observations (continued)

11. The tube shaped light fixtures, mounted on bridge, catwalk & dolphin handrails, have failed due to infiltration of rain water. There are several loose connections in the liquid-tight plastic conduit beneath the transfer bridge. Several bridge grating clamps are broken. The 2006 inspection noted that the catwalks still sway/rotate under pedestrian loads, even after the addition of cross bracing. The non-skid coating is cracking along the edges of the dolphin caps, but is in serviceable condition. The stern all-tide mooring floats (single vertical pile and batter pile) sway sideways approximately 1 foot during high wave conditions. This could be minimized by installing a strut to the stern mooring structure batter pile.
12. The UHMW face was detached from the fender panel of dolphin N1. Thermal expansion of the plastic causes the panels to expand, and shear off the metal studs. Lower fender panels on dolphin N3 were pried off, bolts were missing and numerous scrapes were observed on the UHMW. AMHS Maintenance repaired both the N1 and N3 fender panels in April of 2013. Depth to mudline elevations, taken with leadline readings at each mooring dolphin along the fender face in 2016, range from -41 to -43 MLLW.
13. The northwest edge of the north bridge girder has rubbed against the batter pile from dolphin N1 during low tides. Investigations of this matter to date are inconclusive. The vent cap on the seaward end of the RT girder has been removed, and the girder is open to seaspray and the elements.

Inspection Summary		
Structure	Priority	Recommendations
Category I - Safety Repairs		
Transfer Bridge - Shoreward bearings	1	Program a project to repair the cracks in the connection between Floorbeam 0 and both Girder webs. Analyze what the potential causes of the cracks stem from (seaward end of bridge contacting piles of stern dolphins, bearing on packed snow/ice at abutment, cyclical fatigue from movement at Syncrolift, etc). Remove the stop bars on the south bridge hinge pin, and tighten the nut down.
Category II - Rehabilitation Work		
Bridge Lifting Beam Access	2	Program a project to install an access ladder on the lift tower and a wider platform on the seaward bridge lift beam, similar to the design in Valdez.
Bridge Apron	3	Shoreside personnel need to monitor the apron hinges and stops for damage.
Transfer Bridge	4	Repair the paint coating to the interior girders, stringers, and bridge curb during the floor beam weld repair project. Replace broken open-deck grating hold down rods and plates.
Hawse Rails	5	Program a project to cut back the hawse rail extensions and replace them with welded padeyes on hawse rail ends and catwalk railing with heavy rope in-between.
Hand Rails	6	Program a project to drill holes at the bottom of vertical chords in the hand rails. Straighten bent handrails where damage is observed when funding is available.
Dolphins	7	Monitor donut bracket plates at S5 and N1 dolphins and monitor the deck surface corrosion on dolphin S6.
Miscellaneous	8	Remove gouged pavement and install a concrete pad beneath the shoreward bridge transition plate. Also replace the tubaloid light fixtures with 'jelly jar' fixtures. Replace broken bridge grating clamps in kind. Install a strut between the all-tide mooring dolphins and the stern mooring dolphins. Install safety cables on catwalks. Repair field-applied weld coatings where they're failing. Install a vent cap on the seaward end of the RT girder.
Category III - Upgrades Needed		
Lift Tower	9	When funding is available, program a project to design/construct a full enclosure for the lift towers (similar to Valdez).
Structure Removal	10	Schedule to remove a structure in front of the ferry terminal to improve traffic flow and parking.
Terminal Parking	11	Program a project to increase the parking capacity at the ferry terminal.