Preliminary Engineering Assessment (PEA)

Pensacola Beach Gulf Pier

Escambia County, FL

April 5, 2021

Prepared For:

Escambia County Engineering Department

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Prepared By:

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Summary

This report documents the damage to the Pensacola Beach Gulf Pier, also known as the Casino Beach Fishing Pier, caused by Hurricane Sally on September 16th, 2020. Sally made landfall as a Category 2 Hurricane near Gulf Shores, Alabama. Storm surge reached a height of 5.6 feet in Pensacola which is the third-highest level on record. The Fishing Pier was subjected to high winds and wave impacts which caused extensive damage in several areas. The hydraulic forces from wave action dislodged multiple timber deck blowout panels, damaging the timber deck members and shifting the panels. High winds and wave loading destroyed the timber pedestrian railing along with the attached electrical, lighting and water utilities. In addition, concrete damage to piling, pile caps and beams occurred from water forces, debris impacts and the movement of the pier under lateral loads.

The repairs needed to restore the fishing pier to its pre-storm condition include:

1. Replace all pedestrian railing. The new railing should meet ADAAG guidelines.
2. Replace the missing signage, fishing line receptacles, and viewing telescope attached to railing.
3. Replace the electrical wiring and all pier lights with equivalent turtle friendly led fixtures.
4. Replace the water line.
5. Replace the damaged timber deck sections and adjust the blowout panel spacing to meet gap and dip limits of the ADA Section 303 guidelines.
6. Repair and attach the damaged benches.
7. Replace the flagpole.
8. Replace the entrance gate.
9. Repair concrete spall damage and seal concrete cracks in accordance with current FDOT Specifications for Road and Bridge Construction.

The opinion of probable cost for the repair project is $1.98 million.

This report has been digitally signed and sealed by:

Bart F Hendricks
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on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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Preliminary Engineering Assessment

On September 16th, 2020, Hurricane Sally made landfall as a Category 2 Hurricane near Gulf Shores, Alabama with sustained winds of 105 mph and gusts over 120 mph. The Hurricane caused extensive wind, flooding and storm surge damage in areas of Escambia County Florida. Sally was an extremely slow-moving storm which advanced at 2 mph and made landfall moving at 3 mph. Rainfall amounts in Escambia County from 7 am September 14th through 7am September 17th ranged from 12.74" to 24.88". Storm surge reached a height of 5.6 feet in Pensacola which is the third-highest level on record.

The Pensacola Beach Gulf Pier, also known as the Casino Beach Fishing Pier, was subjected to high winds and wave impacts which caused extensive damage in several areas. The hydraulic forces from wave action dislodged multiple timber deck blowout panels, damaging the timber deck members and shifting the panels. High winds and wave loading destroyed the timber pedestrian railing along with the attached electrical, lighting and water utilities. In addition, concrete damage to piling, pile caps and beams occurred from water forces, debris impacts and the movement of the pier under lateral loads. Mott MacDonald visited the pier on multiple occasions from 10/01/2020 to 12/18/2020 to assess the damage documented in this report. Observations were limited to visual identification above water and does not document damage that may have occurred to piling below the waterline. Plans and a previous comprehensive condition report are not available for the pier. Escambia County indicated that damage from previous storms had been repaired prior to Hurricane Sally. This report identifies damage that was likely caused by Hurricane Sally. Damage identified that was not likely caused by Hurricane Sally was not included in the opinion of probable costs for repairs.

Figure 1 – Pensacola Beach Gulf Pier, 09/14/20

Timber Deck Damage:

Hurricane Sally had a significant storm surge and the hydraulic forces from wave action dislodged multiple timber deck blowout panels. Panels are often subject to the highest uplift forces in locations where waves impact piles and pile caps. The hurricane wave action damaged the timber deck through direct impact, impact between items as panels were moved, and by shifting the panels that were not completely dislodged but allowed to move laterally after adjacent panels are blown out. The existing timber deck members also show signs of deterioration that are not related to the hurricane, but the opinion of probable repair costs does not include repairs for this deterioration. Figures 2 through 4 show the dislodged timber deck blowout panels adjacent to bents following the hurricane.

Without additional repairs, replacing blown out panels following a hurricane will not restore the deck to its pre-storm condition. Damaged or warped timbers result in a deck condition with gaps and dips that exceed the Americans with Disabilities Act Guidelines (ADA). ADA Section 302.3 limits the openings between deck members or timber gaps to 0.5” maximum. ADA Section 303.3 requires that changes in level between 0.25” and 0.5” high be beveled with a slope not steeper than 1:2. ADA Section 303.4 requires that changes in level greater than 0.5” high be ramped. Replacement of blown out panels requires replacement of any warped or damaged timbers, repairing concrete spalls, adjusting the spacing of all panels in the span and beveling edges to produce a deck surface that meets ADA Section 303 guidelines. Figures 5 and 6 show typical gaps and dips between blowout panels that exceed 0.5” and do not meet ADA guidelines.

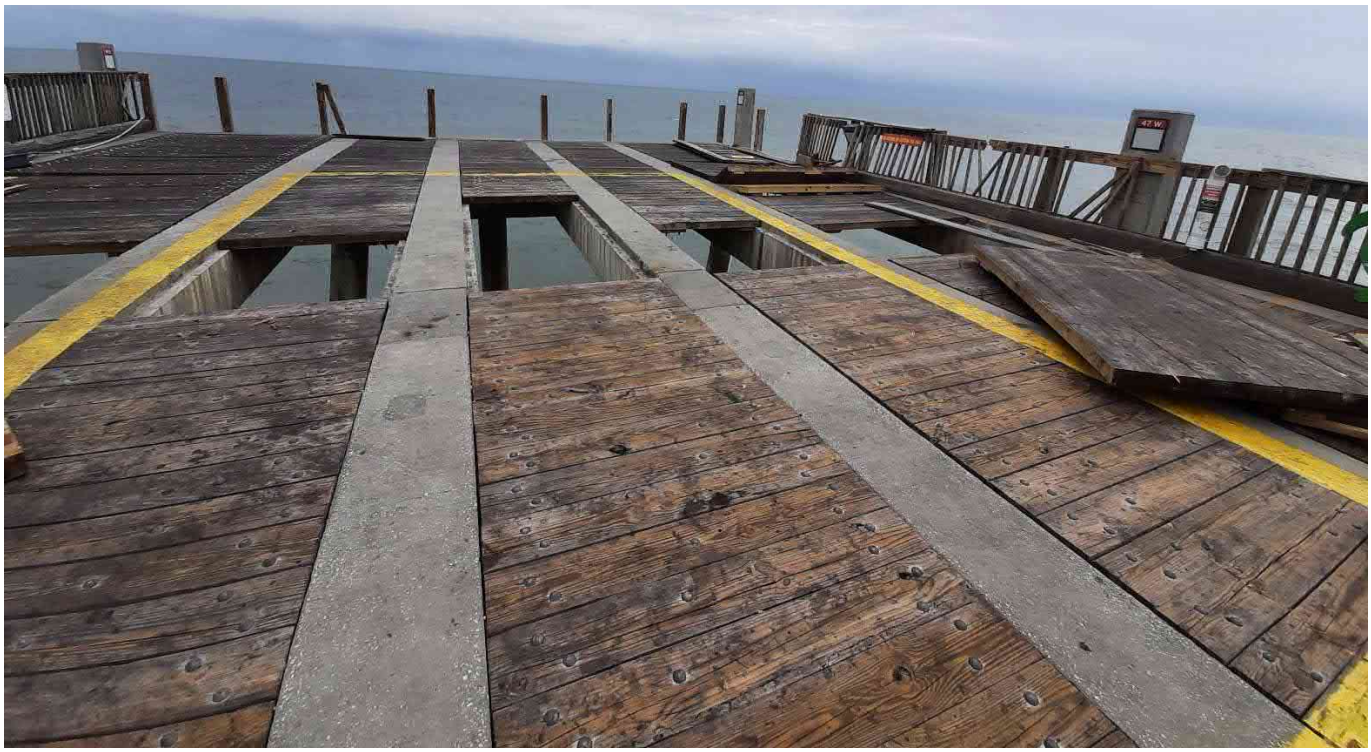

Figure 2 – Timber Deck Blowout Panels adjacent to Bent 47.

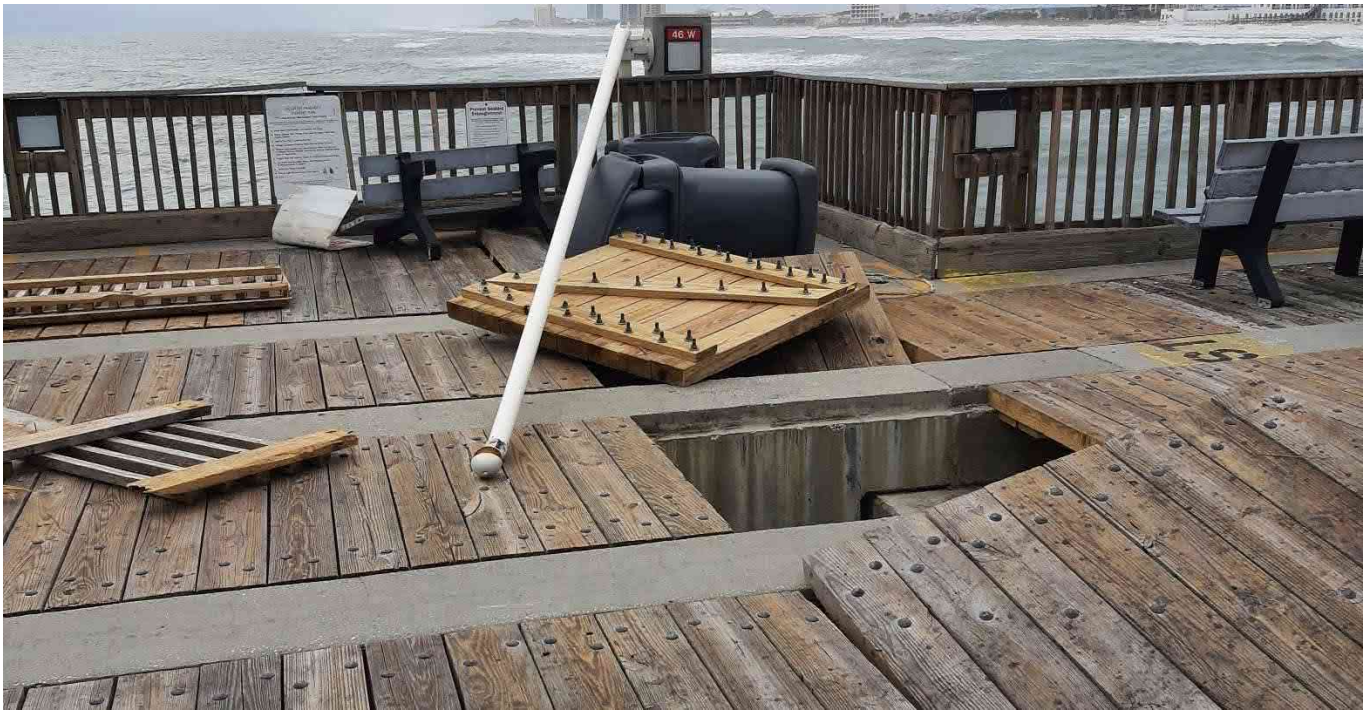

Figure 3 – Timber Deck Blowout Panels adjacent to Bent 46.

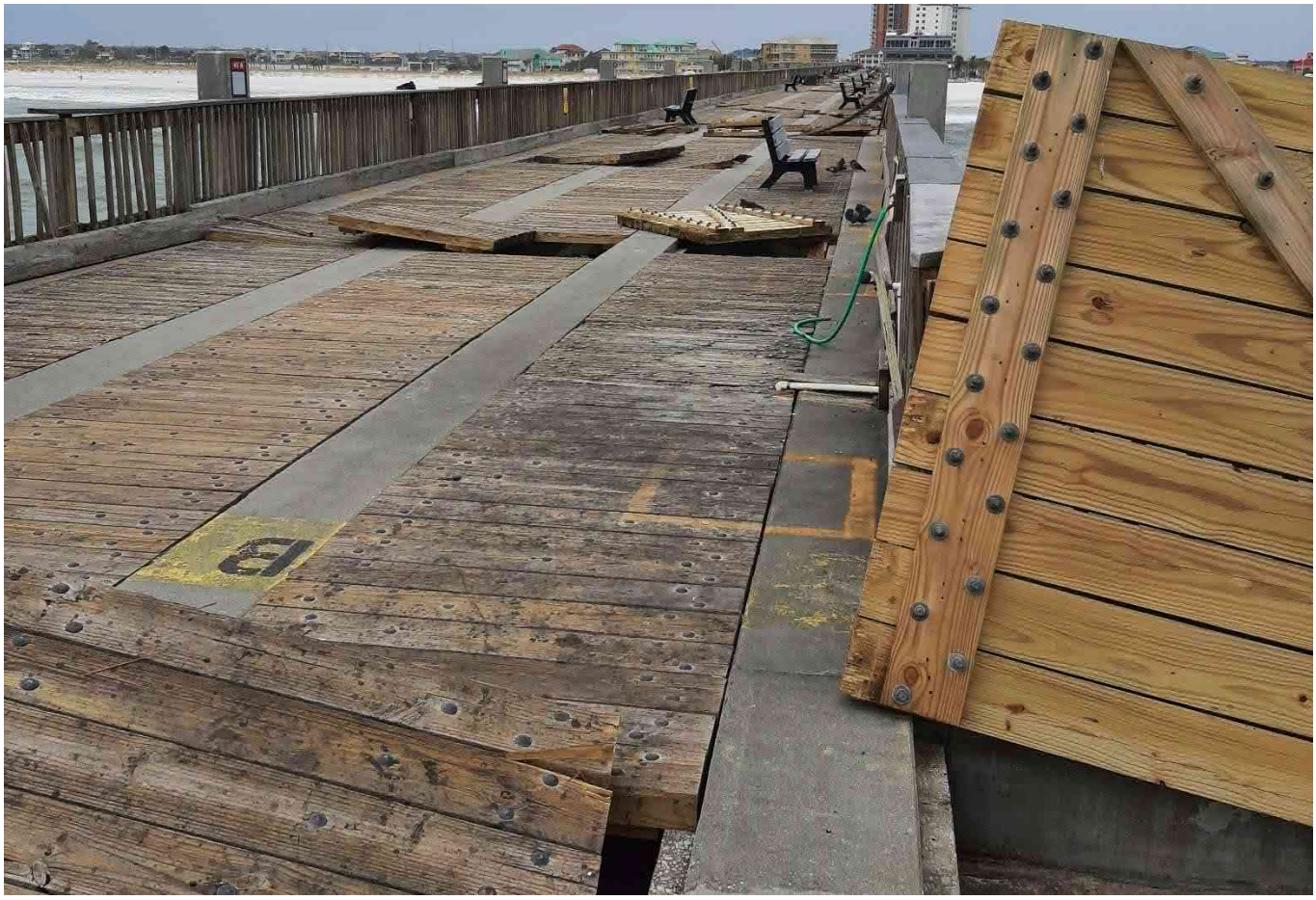

Figure 4 – Timber Deck Blowout Panels typical spans.

Figure 5 – Timber Deck Blowout Panel Dip > 0.5”

Figure 6 – Timber Deck Blowout Panel Gap > 0.5”

Assessing the extent of deck damage caused by the hurricane is difficult because there is considerable previous deck degradation. To quantify the hurricane deck damage, the number of panels blown-out was identified by photos and is listed in Table 1. Escambia County replaced the blown-out panels to provide a safer walking surface for inspections, but full replacement repairs as described above were not performed. In addition to the timber deck panel damage, two benches were damaged and will require repairs prior to placing into service. Note that timber deck damage can occur from lateral and uplift loads during a hurricane without dislodging the panels and all panels may have been shifted during Hurricane Sally. Refer to the Photo Log in Appendix A for documentation of the timber deck condition along the full length of the pier.

Table 1 Timber Blowout Panels Damaged

Location	L ft	W ft	Area SF	No. per span	Total Area SF
Bent 28	4.5	5	22.5	3	67.5
Bent 29	4.5	5	22.5	3	67.5
Bent 30	4.5	5	22.5	3	67.5
Bent 31	4.5	5	22.5	3	67.5
Bent 32	4.5	5	22.5	3	67.5
Bent 33	4.5	5	22.5	3	67.5
Bent 34	4.5	5	22.5	3	67.5
Bent 35	4.5	5	22.5	3	67.5
Bent 36	4.5	5	22.5	3	67.5
Bent 37	4.5	5	22.5	3	67.5
Bent 38	4.5	5	22.5	3	67.5
Bent 39	4.5	5	22.5	3	67.5
Bent 42	4.5	5	22.5	3	67.5
Bent 43	4.5	5	22.5	3	67.5
Bent 44	4.5	5	22.5	3	67.5
Bent 45	4.5	5	22.5	3	67.5
Bent 46	8.5	5	42.5	3	127.5
Bent 46	4.5	5	22.5	3	67.5
Bent 47	8.5	5	42.5	3	127.5
Bent 47	4.5	5	22.5	4	90

Pedestrian Railing Damage:

Wind and waves from Hurricane Sally severely damaged the pedestrian railing along the full length of the pier. Figure 7 shows a typical section of railing which has been completely blown out with only the posts remaining. Remaining posts have been loosened and the timber surface has been damaged where attachments have been ripped away. Also shown in Figure 7 is the damage to a water line and the pier lighting system which included railing lights at mid-span. Where sections of railing remain standing as shown in Figure 8, the railing is loose with timber members damaged and splitting. Typical damaged timber members are shown more closely in Figure 9 where the wood has split. These damaged members cannot be brought back to a condition that meets the building code strength requirements without using epoxy repairs which exceed the cost of the timber. Because it is not economically feasible to salvage the remaining pedestrian railing, the entire railing must be replaced to restore the structure to its pre-storm condition. Replacement of the railing will also require replacement of the attached utilities including electrical, lighting, and water as well as the signage located along the full length of the pier. A damaged viewing telescope was also attached to the railing. The flagpole located at Bent 46 was broken during the storm as shown in Figure 10. The storm also destroyed the entrance gate at Bent 7. Refer to the Photo Log in Appendix A for full documentation of the damage.

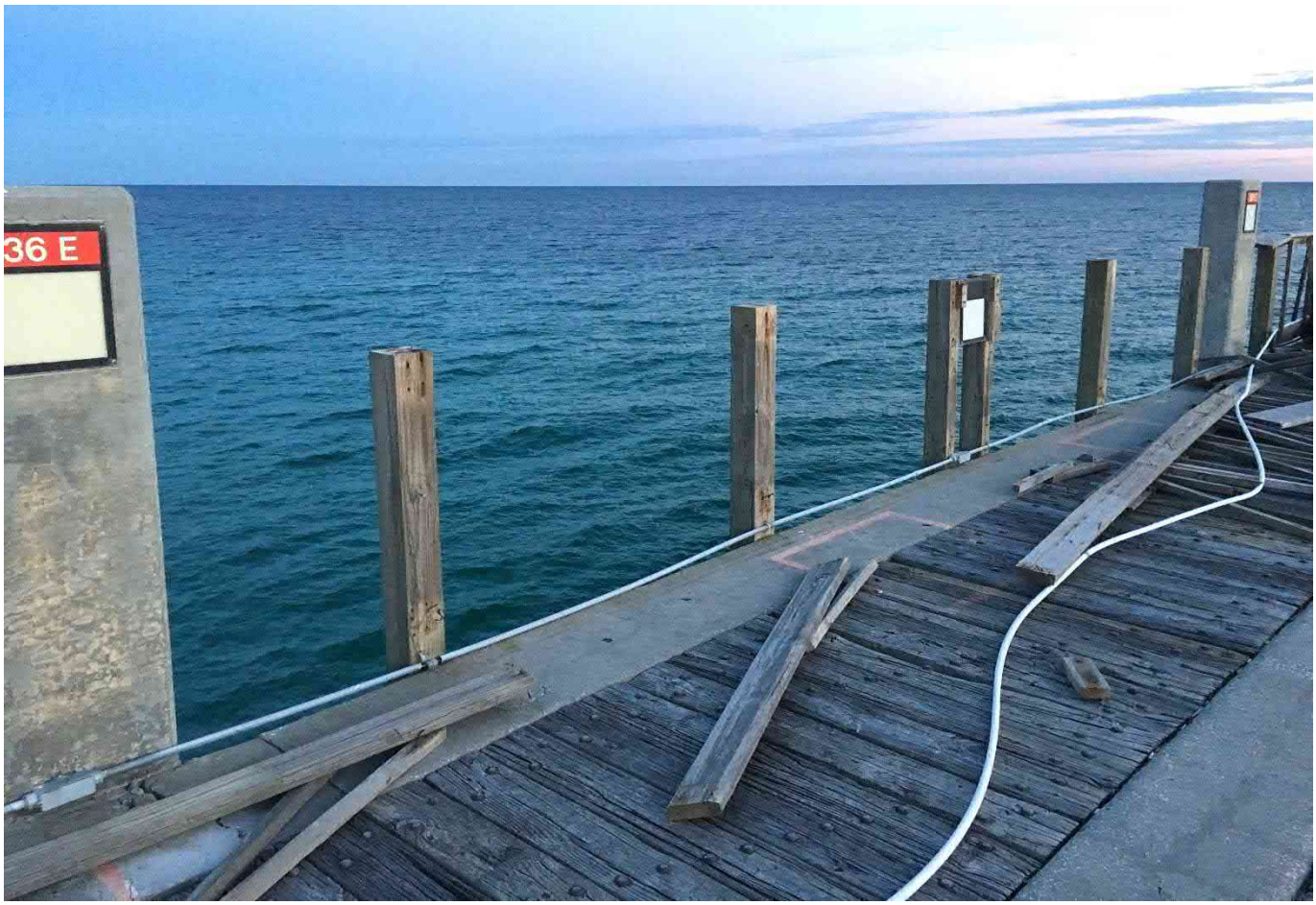

Figure 7 – Pedestrian Railing Destroyed Typical Spans

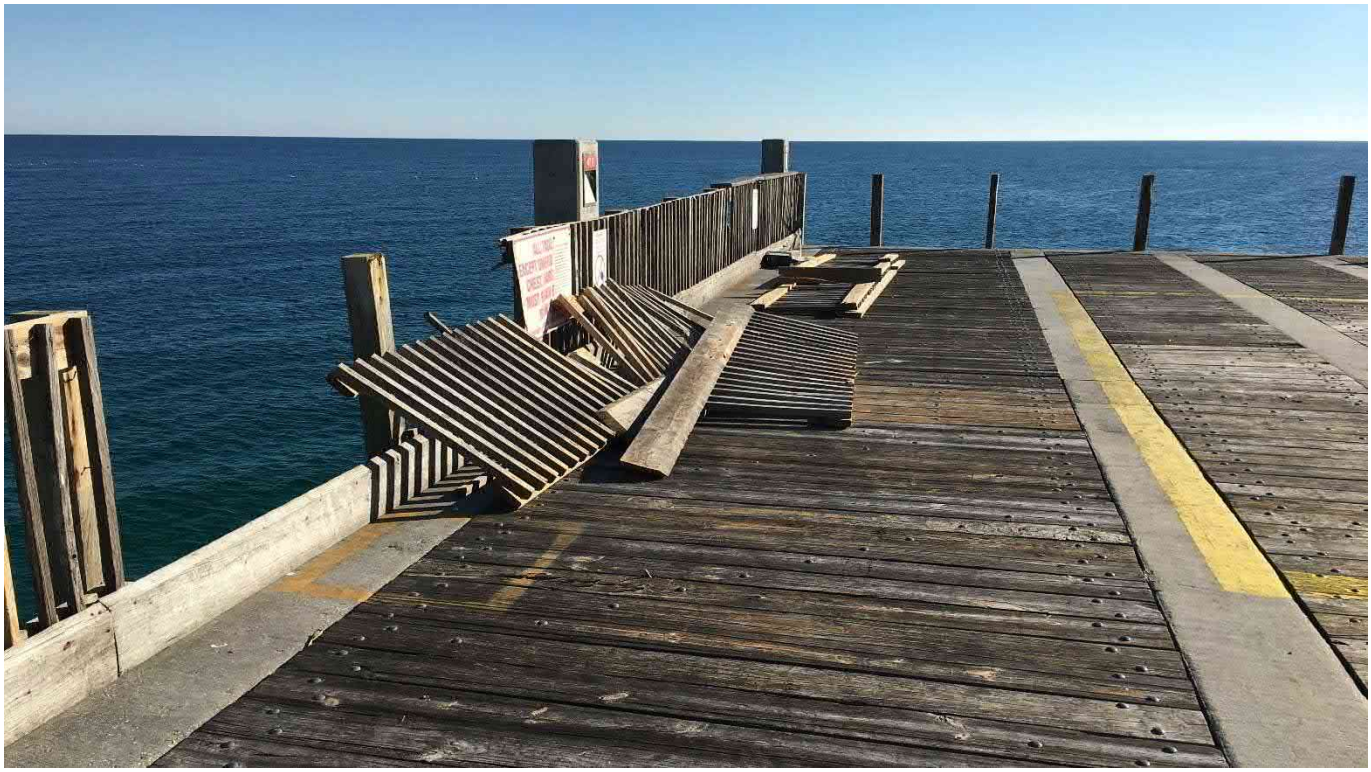

Figure 8 – Pedestrian Railing Destroyed End Spans

Figure 9 – Pedestrian Railing Loose and Split Timber Members

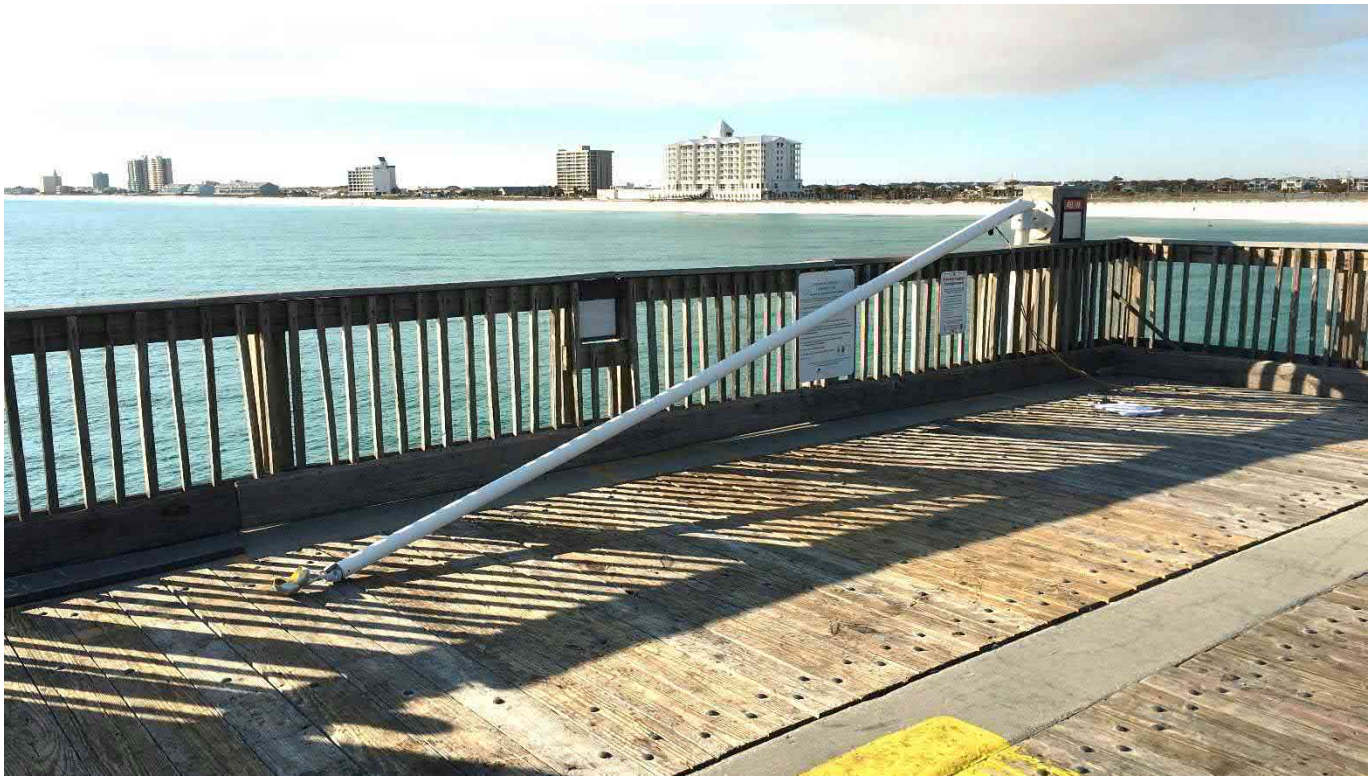

Figure 10 – Broken Flagpole

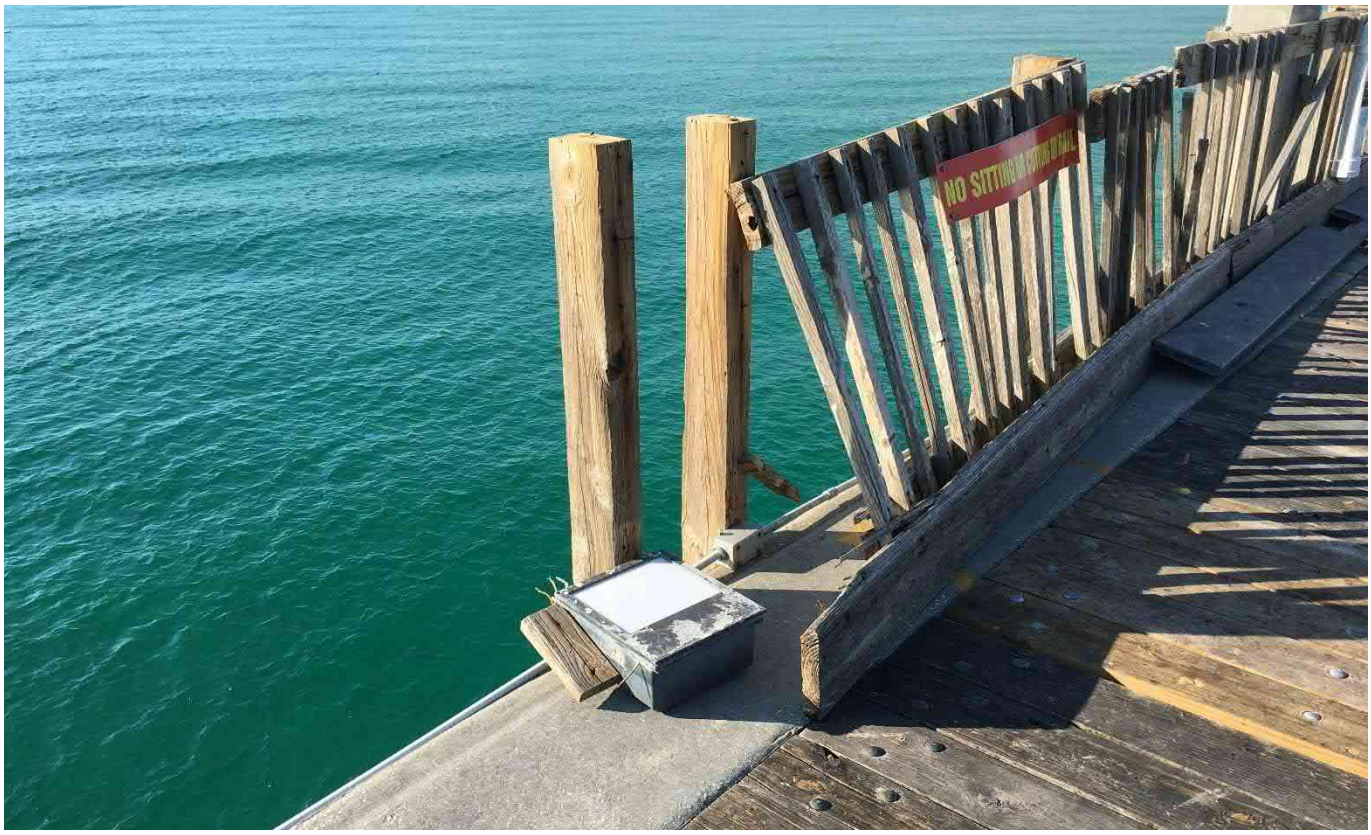

Figure 11 – Damaged Light Fixture

Concrete Damage:

Hurricane Sally likely damaged concrete members through direct water forces, debris impacts, and the movement of the pier under lateral loads. Lateral loading has cracked several light columns as shown in Figure 12 and the cracks must be sealed to prevent continued deterioration.

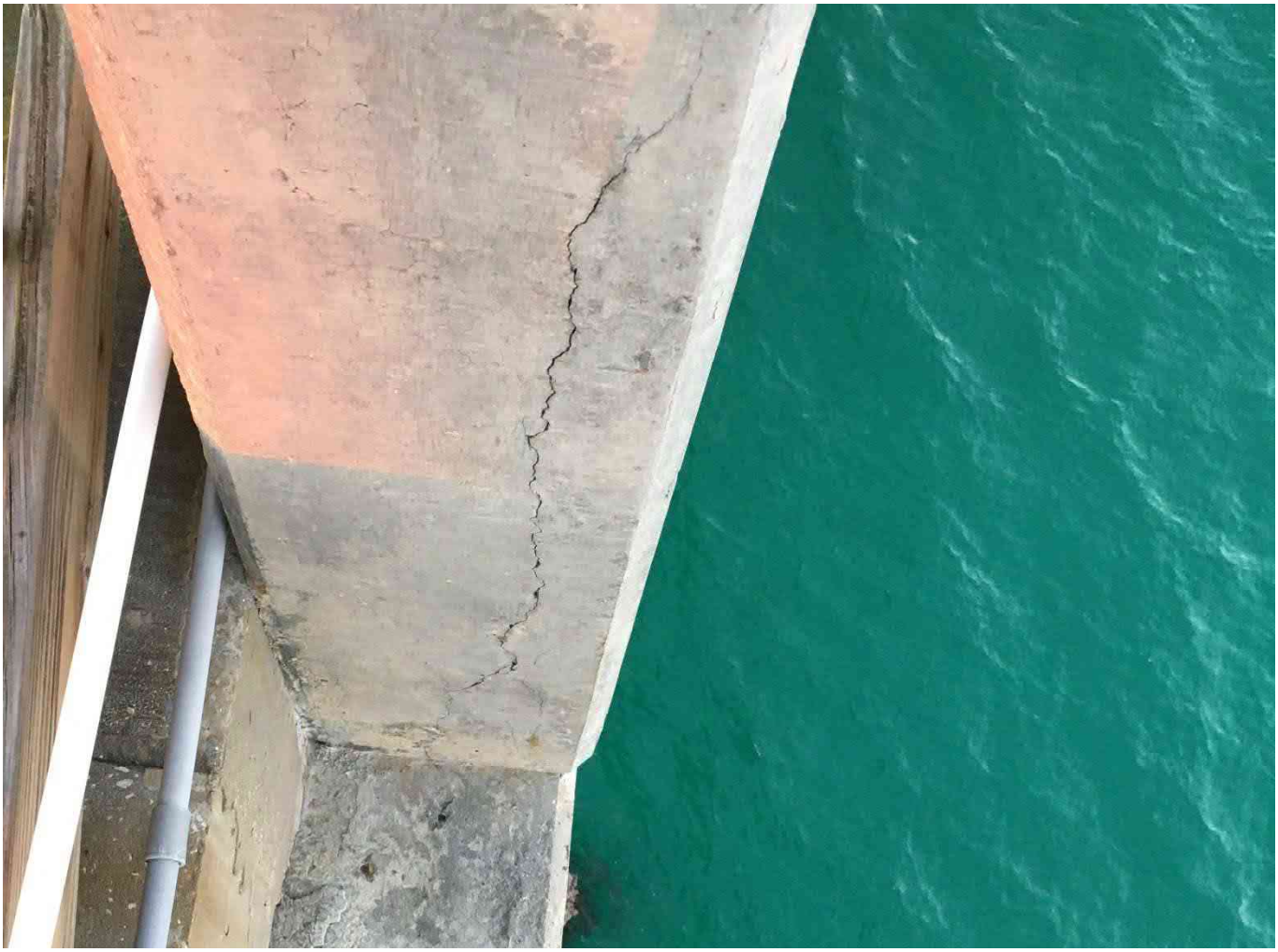

Figure 12 – Typical Light Column Cracking

Wave loading produced longitudinal loads which are transmitted along the full length of the pier. These longitudinal forces resulted in compression in the closure pours between beam ends which produced cracks and spalls in several locations. Cracks in closure pours between concrete sections which are still sound and not loose can be repaired by sealing. Large cracks with loose concrete should be treated and repaired as a concrete spall. The previously repaired closure pour shown in Figure 13 was likely cracked during the hurricane. This longitudinal loading has also caused cracking and spalls in the coped beam ends connected by the closure pours.

Figure 13 – Typical Closure Pour Cracks and Spalls

Figure 14 – Typical Beam End Cracking and Spall

The concrete beams have deterioration in the form of end cracking and spalls, longitudinal bottom flange cracking, and impact spalls along the top flange. Wave impact forces contributes to the beam end cracking and spalls as shown in Figure 14. Longitudinal cracking along the beam length of the beams was not greatly affected by the hurricane but is a problem that must be addressed to prevent future problems. The top flanges of several beams have spalls, as shown in Figure 15, likely from impacts with timber blowout panels during the storm event.

Figure 15 – Typical Beam Top Flange Spall

Hurricane Sally likely caused damage to the concrete pile caps in the form of spalls and cracking. Cracking could occur from the moments produced at the pile tops from wave action lateral loads. These moments can cause small cracks which extend along the pile cap face and spalls which occur at the bottom of the pile cap around the pile. Spalling around the piles due to lateral loading is shown in Figure 16. Pile caps may also be damaged by impact from floating debris during a storm event. These impacts can cause spalls such as that shown in Figure 17.

Figure 16 – Pile Cap Spalls around Piles from Lateral Loading

Figure 17 – Pile Cap Spall from Impact

The concrete piles have also been damaged from wave action and direct impact from floating debris. The longer piles have a series of filled holes which may be part of a splicing system. The holes are indicated as spalls in this report because they represent the same type of damage that spalls present. Previous repairs to fill these spalls have been damaged from wave forces which removed portion of the fill as shown in Figure 18. These spalls must be repaired again along with the repair of new spalls to provide proper protection against corrosion. Refer to the Photo Log in Appendix A for photos of all identified damage. A list of identified concrete spall damage for the pier elements is provided in Table 2 and cracking damage is shown in Table 3.

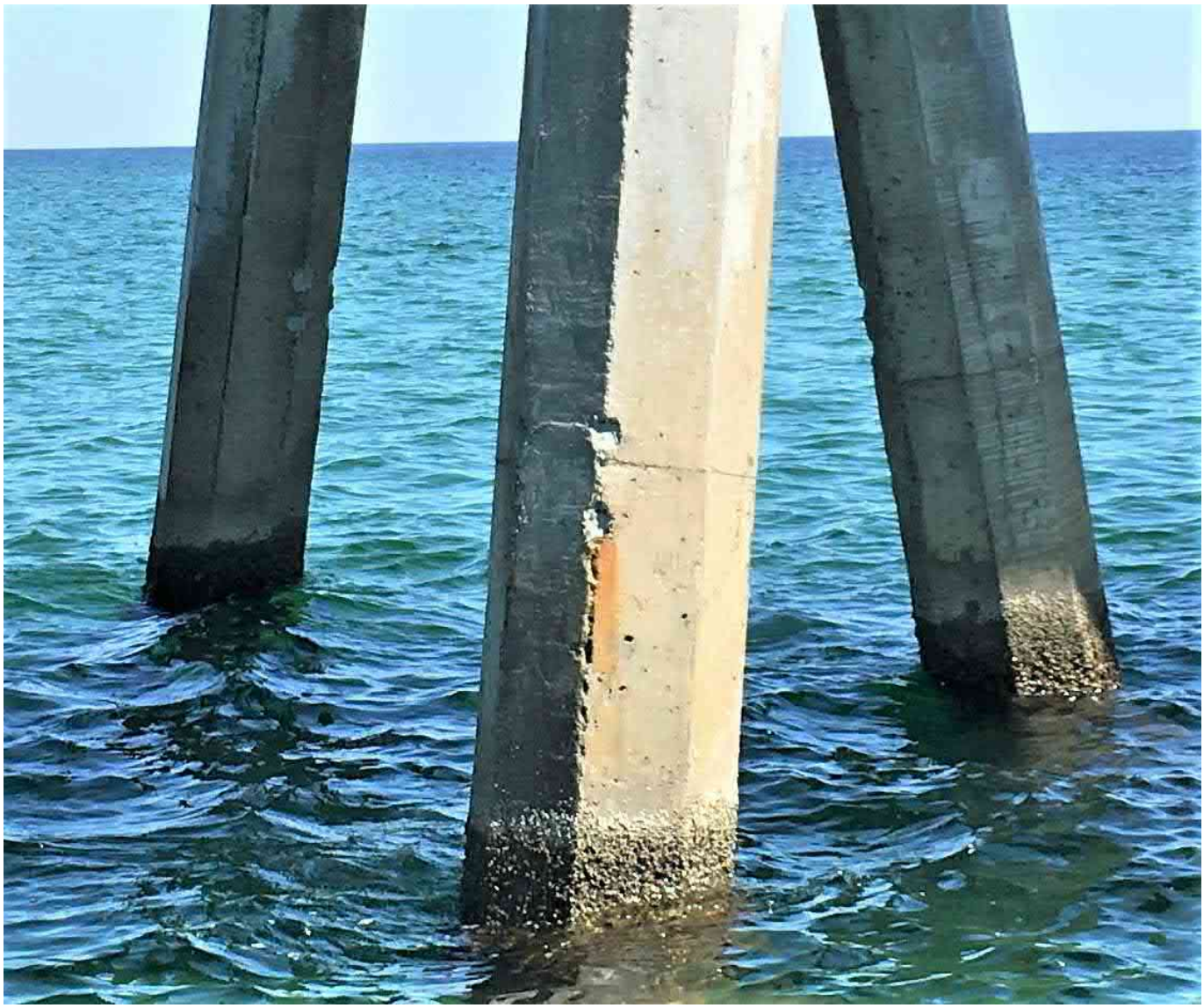

Figure 18 – Pile Spall Previous Repair Damage

Table 2 Concrete Spall Quantities

Location	Spall L in	Spall W in	Spall D in	No. Spalls	Total V CF	Removal SY	Sally Damage Y/N	Repair V CF	Removal Area SY
Bent 1	18	9	1	1	0.094	0.125	N	0.000	0.000
Bent 1E	18	18	1	1	0.188	0.250	N	0.000	0.000
Bent 4W	3	3	2	1	0.010	0.007	N	0.000	0.000
Bent 4E	6	4	1	1	0.014	0.019	N	0.000	0.000
Bent 4W	2	2	1	1	0.002	0.003	Y	0.002	0.003
Bent 5W	21	24	4	1	1.167	0.389	Y	1.167	0.389
Bent 5E	21	24	4	1	1.167	0.389	Y	1.167	0.389
Pile 5-1	12	3	1	1	0.021	0.028	Y	0.021	0.028
Beam 4-4 South	16	6	3	1	0.167	0.074	Y	0.167	0.074
Bent 5W Light Column	14	6	3	1	0.146	0.065	Y	0.146	0.065
Beam 5-1	24	12	6	1	1.000	0.222	Y	1.000	0.222
Beam 5-2	24	6	4	1	0.333	0.111	Y	0.333	0.111
Beam 5-2	16	8	1	2	0.148	0.198	Y	0.148	0.198
Beam 5-3	24	24	1	1	0.333	0.444	Y	0.333	0.444
Beam 6-3	4	4	1	1	0.009	0.012	Y	0.009	0.012
Beam 6-4	24	6	4	1	0.333	0.111	Y	0.333	0.111
Pile 6-2	7	4	1	1	0.016	0.022	Y	0.016	0.022
Bent 6	3	1	1	2	0.003	0.005	N	0.000	0.000
Pile 7-1	8	5	2	1	0.046	0.031	Y	0.046	0.031
Pile 7-3	22	3	2	1	0.076	0.051	Y	0.076	0.051
Pile 7-2	2	2	1	2	0.005	0.006	Y	0.005	0.006
Bent 7	8	4	2	1	0.037	0.025	Y	0.037	0.025
Beam 7-2	24	2	3	1	0.083	0.037	Y	0.083	0.037
Bent 8E	12	8	2	1	0.111	0.074	Y	0.111	0.074
Bent 8E Closure	12	6	4	1	0.167	0.056	Y	0.167	0.056
Beam 7-1	24	4	3	1	0.167	0.074	Y	0.167	0.074
Beam 8-1	24	12	1	1	0.167	0.222	Y	0.167	0.222
Beam 8-3	4	4	2	1	0.019	0.012	Y	0.019	0.012
Beam 8-4	8	4	3	1	0.056	0.025	Y	0.056	0.025
Beam 9-4	4	2	2	2	0.019	0.012	Y	0.019	0.012
Pile 9-1	12	10	1	1	0.069	0.093	Y	0.069	0.093
Beam 9-4	16	4	4	1	0.148	0.049	Y	0.148	0.049
Bent 10W Closure	14	4	4	1	0.130	0.043	Y	0.130	0.043
Beam 9-4	20	12	3	1	0.417	0.185	Y	0.417	0.185
Bent 10E	4	4	1	1	0.009	0.012	Y	0.009	0.012
Beam 9-3	24	12	4	1	0.667	0.222	Y	0.667	0.222
Pile 10-2	5	5	2	1	0.029	0.019	Y	0.029	0.019
Pile 10-2	12	5	2	1	0.069	0.046	Y	0.069	0.046
Beam 10-2	24	6	4	1	0.333	0.111	Y	0.333	0.111

Beam 10-3	24	6	4	1	0.333	0.111	Y	0.333	0.111
Beam 10-1	24	3	3	1	0.125	0.056	Y	0.125	0.056
Pile 11-2	7	5	2	1	0.041	0.027	Y	0.041	0.027
Beam 11-3	24	8	2	1	0.222	0.148	Y	0.222	0.148
Beam 11-4	8	4	3	1	0.056	0.025	Y	0.056	0.025
Pile 12-1	12	6	2	1	0.083	0.056	Y	0.083	0.056
Beam 11-3	48	12	2	1	0.667	0.444	Y	0.667	0.444
Beam 11-3	12	6	2	1	0.083	0.056	Y	0.083	0.056
Beam 11-4	12	8	2	1	0.111	0.074	Y	0.111	0.074
Beam 11-4	36	4	1	1	0.083	0.111	Y	0.083	0.111
Bent 12	5	5	1	1	0.014	0.019	Y	0.014	0.019
Beam 12-1	36	3	2	1	0.125	0.083	Y	0.125	0.083
Beam 12-3	36	24	2	1	1.000	0.667	Y	1.000	0.667
Beam 12-3	36	3	2	1	0.125	0.083	Y	0.125	0.083
Pile 13-3	20	14	2	1	0.324	0.216	Y	0.324	0.216
Beam 12-2	8	6	2	1	0.056	0.037	Y	0.056	0.037
Beam 13-3	24	4	2	1	0.111	0.074	Y	0.111	0.074
Beam 13-2	24	12	3	1	0.500	0.222	Y	0.500	0.222
Pile 13-2	10	5	2	1	0.058	0.039	Y	0.058	0.039
Beam 13-2	12	4	2	1	0.056	0.037	Y	0.056	0.037
Beam 13-3	36	4	2	1	0.167	0.111	Y	0.167	0.111
Beam 13-3	36	6	1	1	0.125	0.167	Y	0.125	0.167
Pile 14-1	6	4	1	1	0.014	0.019	N	0.000	0.000
Pile 14-2	6	6	2	1	0.042	0.028	Y	0.042	0.028
Pile 14-3	26	6	2	1	0.181	0.120	Y	0.181	0.120
Pile 14-3	20	6	2	1	0.139	0.093	Y	0.139	0.093
Pile 14-2	20	10	2	1	0.231	0.154	Y	0.231	0.154
Pile 14-2	16	5	2	1	0.093	0.062	Y	0.093	0.062
Bent 15	14	3	2	1	0.049	0.032	Y	0.049	0.032
Pile 15-1	5	3	2	1	0.017	0.012	Y	0.017	0.012
Pile 15-2	4	4	2	1	0.019	0.012	Y	0.019	0.012
Beam 16-2	30	8	3	1	0.417	0.185	Y	0.417	0.185
Pile 16-2	12	5	2	1	0.069	0.046	Y	0.069	0.046
Bent 17W Light Column	12	8	4	1	0.222	0.074	Y	0.222	0.074
Pile 19-1, 19-2	5	5	2	2	0.058	0.039	Y	0.058	0.039
Bent 20W Light Column	12	3	3	1	0.063	0.028	Y	0.063	0.028
Beam 21-3	24	24	4	1	1.333	0.444	Y	1.333	0.444
Pile 22-1	5	5	2	2	0.058	0.039	Y	0.058	0.039
Bent 23W Closure	18	6	4	1	0.250	0.083	Y	0.250	0.083
Bent 23W Light Column	16	6	4	1	0.222	0.074	Y	0.222	0.074
Beam 22-1	16	16	6	1	0.889	0.198	Y	0.889	0.198
Bent 23E	16	12	6	1	0.667	0.148	Y	0.667	0.148
Pile 23-2, 23-3	5	5	1	8	0.116	0.154	Y	0.116	0.154

Bent 23	6	3	2	1	0.021	0.014	Y	0.021	0.014
Beams 23-1, 23-3	24	3	2	2	0.167	0.111	Y	0.167	0.111
Pile 24-3	5	5	1	4	0.058	0.077	Y	0.058	0.077
Piles Bent 25	3	3	1	12	0.063	0.083	Y	0.063	0.083
Beam 25-3	36	2	1	1	0.042	0.056	Y	0.042	0.056
Beam 25-3	24	24	4	1	1.333	0.444	Y	1.333	0.444
Piles Bent 26	4	4	1	12	0.111	0.148	Y	0.111	0.148
Beam 26-2	24	20	3	1	0.833	0.370	Y	0.833	0.370
Piles Bent 27	4	4	1	12	0.111	0.148	Y	0.111	0.148
Pile 27-1	12	5	2	1	0.069	0.046	Y	0.069	0.046
Beam 28-4	24	6	4	1	0.333	0.111	Y	0.333	0.111
Pile 28-1	10	4	1	1	0.023	0.031	Y	0.023	0.031
Piles Bent 28	5	5	2	12	0.347	0.231	Y	0.347	0.231
Beam 29-3, 29-4	24	12	4	2	1.333	0.444	Y	1.333	0.444
Piles Bent 29	4	4	1	12	0.111	0.148	Y	0.111	0.148
Bent 30	24	8	3	1	0.333	0.148	Y	0.333	0.148
Pile 30-1	8	6	1	1	0.028	0.037	Y	0.028	0.037
Beam 30-1, 30-3	24	12	4	2	1.333	0.444	Y	1.333	0.444
Piles Bent 30	5	5	2	12	0.347	0.231	Y	0.347	0.231
Piles Bent 31	4	4	1	12	0.111	0.148	Y	0.111	0.148
Bent 31	4	4	2	2	0.037	0.025	Y	0.037	0.025
Pile 32-2	5	5	2	1	0.029	0.019	Y	0.029	0.019
Piles Bent 32	5	5	2	12	0.347	0.231	Y	0.347	0.231
Piles Bent 33	5	5	2	12	0.347	0.231	Y	0.347	0.231
Beam 34-4	24	6	3	1	0.250	0.111	Y	0.250	0.111
Bent 34	8	6	1	1	0.028	0.037	Y	0.028	0.037
Piles Bent 34	5	5	2	12	0.347	0.231	Y	0.347	0.231
Beam 34-4	24	4	3	1	0.167	0.074	Y	0.167	0.074
Bent 36E Closure	20	12	6	1	0.833	0.185	Y	0.833	0.185
Bent 36 Closure	20	10	6	1	0.694	0.154	Y	0.694	0.154
Piles Bent 36	4	4	2	12	0.222	0.148	Y	0.222	0.148
Pile 37-1	4	4	1	1	0.009	0.012	Y	0.009	0.012
Bent 37	3	3	2	1	0.010	0.007	Y	0.010	0.007
Pile 38-2	4	4	1	4	0.037	0.049	Y	0.037	0.049
Pile 39-1	8	5	1	1	0.023	0.031	Y	0.023	0.031
Piles Bent 39	4	4	1	12	0.111	0.148	Y	0.111	0.148
Pile 40-1	15	3	1	1	0.026	0.035	Y	0.026	0.035
Pile 40-1	8	8	2	1	0.074	0.049	Y	0.074	0.049
Piles 40-1, 40-2	4	4	1	8	0.074	0.099	Y	0.074	0.099
Pile 40-3	4	4	2	4	0.074	0.049	Y	0.074	0.049
Pile 41-1	8	3	1	1	0.014	0.019	Y	0.014	0.019
Beam 40-1	24	6	3	1	0.250	0.111	Y	0.250	0.111
Piles Bent 41	4	4	2	12	0.222	0.148	Y	0.222	0.148

Beam 41-1	16	12	4	1	0.444	0.148	Y	0.444	0.148
Bent 42	4	4	1	1	0.009	0.012	Y	0.009	0.012
Beam 42-1	24	12	4	1	0.667	0.222	Y	0.667	0.222
Beam 42-2	24	3	3	1	0.125	0.056	Y	0.125	0.056
Pile 42-1	6	6	1	1	0.021	0.028	Y	0.021	0.028
Piles Bent 42	4	4	2	12	0.222	0.148	Y	0.222	0.148
Bent 43	4	4	1	2	0.019	0.025	Y	0.019	0.025
Pile 43-1	4	4	1	1	0.009	0.012	Y	0.009	0.012
Beam 42-2	24	6	3	1	0.250	0.111	Y	0.250	0.111
Piles Bent 43	4	4	2	12	0.222	0.148	Y	0.222	0.148
Beam 44-2	24	6	2	1	0.167	0.111	Y	0.167	0.111
Pile 44-2	20	2	1	1	0.023	0.031	Y	0.023	0.031
Piles Bent 44	4	4	1	12	0.111	0.148	Y	0.111	0.148
Beam 45-1	24	6	3	1	0.250	0.111	Y	0.250	0.111
Beam 45-2	24	24	6	1	2.000	0.444	Y	2.000	0.444
Pile 45-3	10	8	1	1	0.046	0.062	Y	0.046	0.062
Beam 44-1	24	6	4	1	0.333	0.111	Y	0.333	0.111
Piles Bent 45	4	4	1	12	0.111	0.148	Y	0.111	0.148
Bent 46W	5	5	1	1	0.014	0.019	Y	0.014	0.019
Beam 45-4	3	3	2	2	0.021	0.014	N	0.000	0.000
Beam 45-1	3	3	2	2	0.021	0.014	N	0.000	0.000
Beam 45-1	12	3	2	1	0.042	0.028	Y	0.042	0.028
Bent 46	12	3	3	1	0.063	0.028	Y	0.063	0.028
Bent 46 Pile 46-2	30	20	10	1	3.472	0.463	Y	3.472	0.463
Pile 46-2	30	10	1	1	0.174	0.231	Y	0.174	0.231
Beam 46-5	24	12	2	1	0.333	0.222	Y	0.333	0.222
Bent 46	24	8	3	1	0.333	0.148	Y	0.333	0.148
Bent 46	24	24	2	1	0.667	0.444	Y	0.667	0.444
Pile 46-1	8	8	2	1	0.074	0.049	Y	0.074	0.049
Pile 46-2	6	6	1	1	0.021	0.028	Y	0.021	0.028
Piles Bent 46	4	4	1	20	0.185	0.247	Y	0.185	0.247
Beams 47-3, 47-4	24	12	4	2	1.333	0.444	Y	1.333	0.444
Piles Bent 47	4	4	1	20	0.185	0.247	Y	0.185	0.247
Beams 47-3, 4, 5, 6	24	12	3	4	2.000	0.889	Y	2.000	0.889
Bent 48	30	30	4	2	4.167	1.389	Y	4.167	1.389
Piles Bent 48	4	4	1	20	0.185	0.247	Y	0.185	0.247

Table 3 Concrete Crack Quantities

Location	Crack L ft	No. Cracks	Total L LF	By Sally Y/N	Crack L LF
Bent 1W	6	1	6	N	0
Bent 4 Closure	5.5	2	11	Y	11
Bent 5E Closure	5.67	1	5.67	Y	5.67
Bent 5W	20	1	20	Y	20
Bent 5E	15	1	15	Y	15
Bent 6 Closure	1.5	2	3	Y	3
Bent 6E	2	1	2	Y	2
Bent 6E Closure	2	1	2	Y	2
Bent 8 Closure	1.5	2	3	Y	3
Bent 9 Closure	1	2	2	Y	2
Bent 10W Closure	1.67	2	3.33	Y	3.33
Bent 12	30	1	30	Y	30
Bent 13	1.5	1	1.5	Y	1.5
Bent 15 Closure	2	1	2	Y	2
Bent 15	5	1	5	Y	5
Beam 20-2, 20-3	1.5	60	90	N	0
Bent 23E Closure	2	1	2	Y	2
Bent 23W Closure	2	1	2	Y	2
Bent 37W Closure	1.67	2	3.33	Y	3.33
Bent 37E Light Column	8	1	8	Y	8
Bent 40E Light Column	8	1	8	Y	8
Bent 41E Light Column	8	1	8	Y	8
Beam 42-1	1.33	1	1.33	Y	1.33
Bent 42E Light Column	5	1	5	Y	5
Bent 43 Closure	1.5	2	3	Y	3
Bent 44E Light Column	8	1	8	Y	8
Bent 48 Closure	1.5	5	7.5	Y	7.5

Pensacola Beach Gulf Pier Information and Details Review

The Pensacola Beach Gulf Pier, also known as the Casino Beach Fishing Pier, is located at 30.3313°N, 87.1428°W extending out from Santa Rosa Island into the Gulf of Mexico. The new pier constructed in 2001 replaced a wooden pier that was destroyed by Hurricane Opal in 1995.

The pier is 1,471' long including the concrete ramp at the base of the pier. The typical width is 20'-0" between the railing and 22'-0" out to out of the concrete light columns. An enlarged section that is 66'-0" long x 42'-0" wide out to out is located at the pier end. At the end the pier deck is 26' +/- above the water and the water depth is 20' +/-. The pier has 47 spans of 30' using prestressed concrete beams supported by concrete pile caps and prestressed concrete piles. The beams are designed as simple span. The deck is composed of timber blowout panels spanning between the concrete beam top flanges.

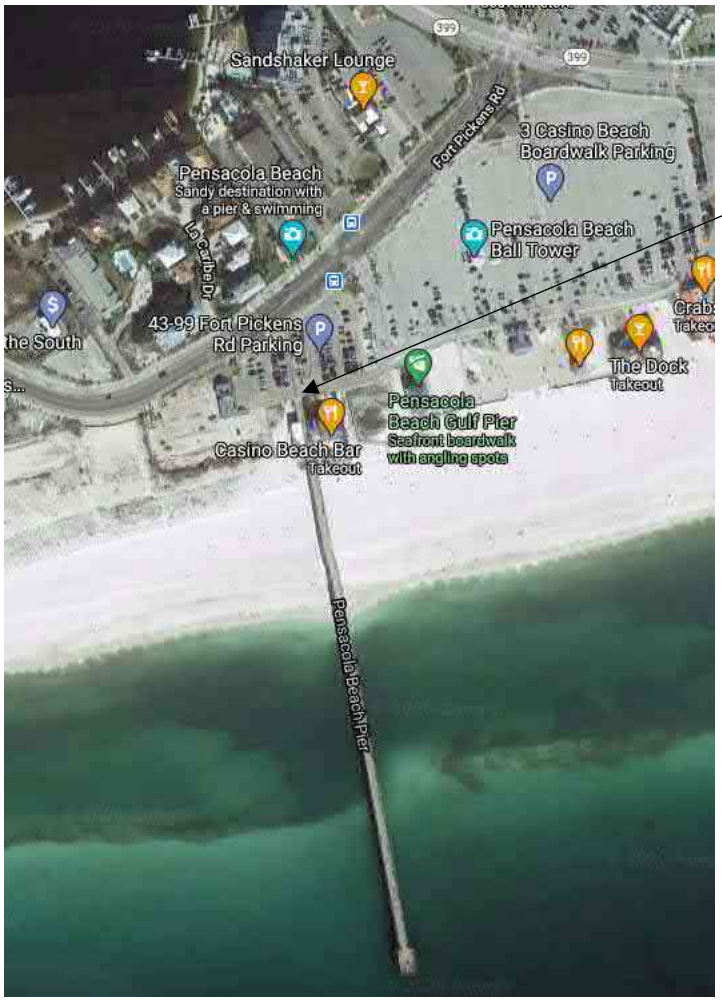

Figure 19 – Pensacola Beach Gulf Pier Location

Pier plans were not made available to Mott MacDonald for this report. The pier performed as designed during the storm with timber panels blowing out to reduce hydraulic forces on the structure. The pier appears to meet current Escambia County standards and desired details with the following exceptions:

1. The pier railing is a constant 42” height which meets the requirements of the current International Building Code (IBC). Escambia County now follows the Americans with Disabilities Act Accessibility Guidelines (ADAAG) which requires that at least 25 percent of the rails be 34” or less in height and that these lower rail sections be positioned in a variety of places on the pier. Note that the ADAAG does not require lower rail sections if the rail is designed to meet all the requirements of the IBC and the local building code requires compliance with the IBC.
2. Timber has proved to require frequent maintenance for both the railing and the decking. In addition, the timber deck blowout panels are difficult to keep in compliance with ADA requirements. Alternate composite materials are desired to replace timber if costs are within required budgets.
3. If timber is used for the railing, revise the design to replace the 2”x2” pickets with a different type of rail panel.
4. Investigate increasing reinforcement in the closure pours with repairs to enable them to transfer higher longitudinal forces without cracks or spalls.
5. The prestressed beams show signs of longitudinal cracking along with end cracking and spalls. Repair and maintenance of these beams may require the addition of cathodic protection to prevent future premature loss of structural capacity through delamination and spalling along the length of the strands. Beam end repairs must eliminate future corrosion and be able to withstand wave impact forces.

Figure 20 – Pensacola Beach Gulf Pier Aerial Photo
(photo from visitpensacolabeach.com)

Recommendations

Rapid repair of the pier damage from Hurricane Sally is recommended to prevent further chloride contamination through cracks and spalls. The repairs needed to restore the Pensacola Beach Gulf Pier to its pre-storm condition include:

1. Replace all pedestrian railing. The new railing should meet ADAAG guidelines.
2. Replace the missing signage, fishing line receptacles, and viewing telescope attached to railing.
3. Replace the electrical wiring and all pier lights with equivalent turtle friendly led fixtures.
4. Replace the water line.
5. Replace the damaged timber deck sections and adjust the blowout panel spacing to meet gap and dip limits of the ADA Section 303 guidelines.
6. Repair and attach the damaged benches.
7. Replace the flagpole.
8. Replace the entrance gate.
9. Repair concrete spall damage and seal concrete cracks in accordance with current FDOT Specifications for Road and Bridge Construction.

In addition to the repairs to damage caused by Hurricane Sally, it is recommended that all prestressed beams be rehabilitated to address end cracking, delamination, and longitudinal cracking which is prevalent throughout the structure. The addition of an active cathodic protection system to arrest active corrosion is recommended for all beams.

Opinion of Probable Construction Cost

The opinion of probable construction cost for the repair of the damage caused by Hurricane Sally is $1.98 million (see Table 4). The item unit costs were derived from several sources as detailed in the notes to Table 4. The inspection performed to identify and quantify the damage was limited in scope and it is anticipated that additional damage will be discovered during the repair project. The construction cost shown includes a 10% contingency for additional damage that will be found during the repair project. The Opinion of Probable Cost considers a standard design – bid – build delivery method. Engineering fees were determined from FEMA's Public Assistance Cost Estimating Tool for Engineering and Design Services. Fees for CEI are based on recent history of similar projects. Mott MacDonald does not guarantee that proposals, bids, or actual costs will not vary from the opinion of probable costs shown. Mott MacDonald does not control the cost of labor, materials, equipment, or services furnished by others, methods of determining prices, or competitive bidding or market conditions. Therefore, any opinions rendered as to costs, including but not limited to opinions as to the costs of construction and materials, have been based on Mott MacDonald's experience and represent the judgment of experienced and qualified professionals, familiar with the industry. In addition, some work included in the opinion of probable costs and schedule may include material or products from areas impacted by

the coronavirus, COVID-19 virus or other disasters. In addition, actions by Governments or Local Authorities resulting in labor disruptions to reduce the effects of a pandemic may occur while this project is under construction. The opinion of probable costs and schedule do not account for and specifically excludes any cost increases, disruptions or delays to the procurement or supply of such materials, or work disruptions caused by the current coronavirus or COVID-19 outbreak or other future disaster events.

Table 4 Opinion of Probable Repair Construction Cost

Item No.	Item Description	Quantity	Unit	Unit Price	Total
101-1	Mobilization (10%)	1	LS	$ 132,259.45	$ 132,259.45
110-82 (2)	Remove & Dispose of Damaged Railing	23.5	MB	$ 2,178.52	$ 51,195.22
110-4-10 (3)	Removal of Existing Concrete (repair prep)	21	SY	$ 200.00	$ 4,200.00
401-70-4 (3)	Restore Spalled Areas, Portland Cement Grout	46.9	CF	$ 460.00	$ 21,574.00
(5)	Snooper Truck/Trailer with Operator	3	MO	$ 40,000.00	$ 120,000.00
470-1 (2)	Temporary Timber Mats (outrigger supports)	2.7	MB	$ 4,462.98	$ 12,050.05
(4)	Timber Pedestrian Railing	2753	LF	$ 219.70	$ 604,834.10
(7)	Timber Blow-out Panels	1493	SF	$ 40.00	$ 59,720.00
411-1 (2)	Epoxy Material for Crack Injection - Structures Rehab	5	GA	$ 334.19	$ 1,670.95
411-2 (2)	Cracks Inject & Seal - Structures Rehab	162	LF	$ 94.15	$ 15,252.30
550-60225 (1)	Fence Gate, Type B, Double, 24' Opening	1	EA	$ 1,875.00	$ 1,875.00
630-2-15 (2)	Conduit, Furnish & Install	6841	LF	$ 20.35	$ 139,214.35
635-3-12 (1)	Junction Box, Furnish & Install, Mounted	24	EA	$ 375.00	$ 9,000.00
10.14.53.20.1200 (6)	Signage	88	EA	$ 105.00	$ 9,240.00
10.75.23.10.0300 (6)	Flagpole	1	EA	$ 3,100.00	$ 3,100.00
26.56.23.55.0410 (6)	Light Fixtures	183	EA	$ 600.00	$ 109,800.00
715-1-12 (1)	Lighting Conductors, F&I, Insulated, No. 6	20667	LF	$ 3.83	$ 79,154.61
715-1-60 (1)	Lighting Conductors, Remove & Dispose	20667	LF	$ 1.24	$ 25,627.08
1050 31202 (2)	PVC Waterline	1322	LF	$ 12.53	$ 16,564.66
	Sub-Total				$ 1,416,331.76
	3% increase for construction over open water				$ 38,522.17
	Contingency (10%)				$ 145,485.39
	Total Net Construction Cost				$ 1,600,339.33
	Engineering, FEMA Curve B at 10.7%	1	LS	$ 170,666.81	$ 170,666.81
	CEI at 15%	1	LS	$ 212,449.76	$ 212,449.76
	Total Project Cost				$ 1,983,455.90

Item Unit Price Source:

(1) FDOT Item Average Unit Cost, Area 1, 11/30/2020

(2) FDOT Item Average Unit Cost, Statewide, 11/30/2020

(3) Bid Results Bob Sikes Bridge Rehab, 9/5/2019, Southern Road & Bridge

(4) Bid Results, Quietwater Beach Ferry Landing, 11/30/2017, HG Harders, adjusted for material / LF

(5) Historical costs, Bob Sikes Bridge Inspection 2016, Anderson Crane & Bridge Technologies

(6) R.S. Means Building Construction Costs, 77th Edition

(7) Historical costs, Infrastructure Specialty Services, 2019

Preliminary Engineering Assessment (PEA)

Pensacola Beach Gulf Pier

Escambia County, FL

April 5, 2021

APPENDIX A – DAMAGE PHOTO LOG

Prepared For:

Escambia County Engineering Department

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Prepared By:

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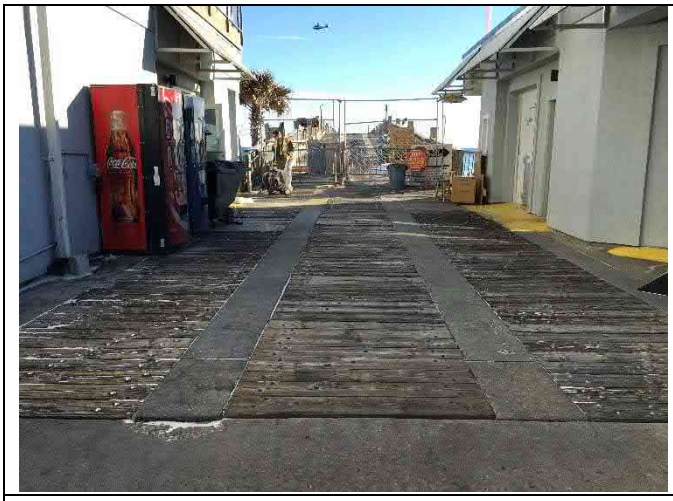
Damage Photo Log:



Bent 1 / Span 1 Looking South – Slab spall 18”x9”x1” (previous)

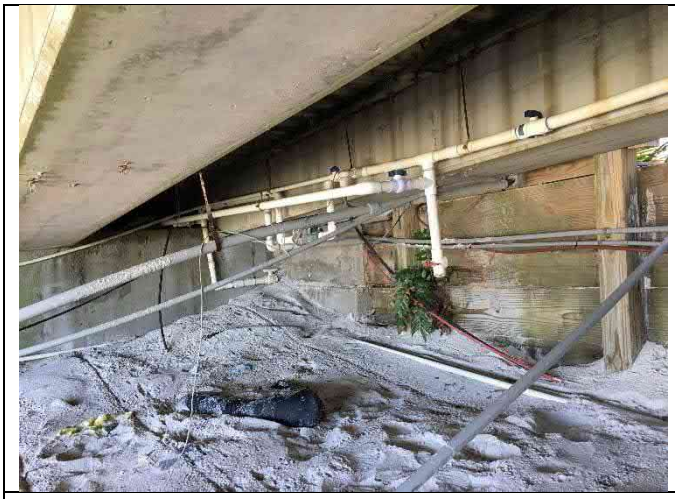
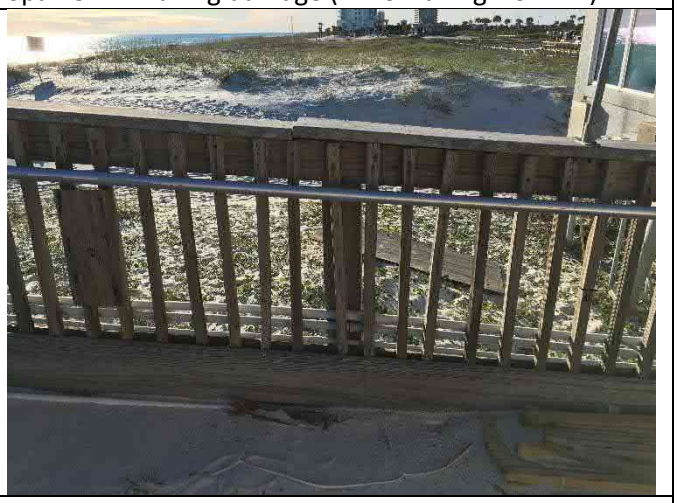
Bent 1E – Closure pour spall 18”x18”x1” (previous)

Bent 1W – Closure pour cracking (previous)

Bent 3E

Span 3 - Temporary Fence between B3 and B4

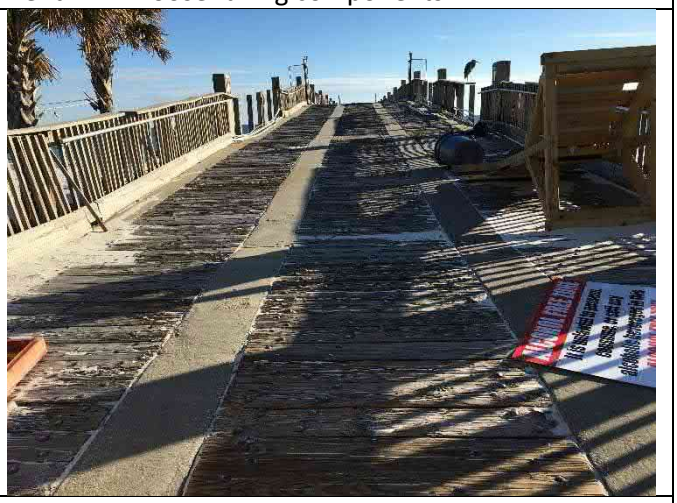
Span 3E – Railing damage (25’ of railing from B4)

	
Bent 3E – Water and electrical conduit damage	Bent 3W
	
Span 3 – Deck panels have been submerged	Span 3W – Railing damage (21’ of railing from B4)
	
Span 3 Center – Looking north	Span 3W – Loose and damaged railing components

Bent 4E – Railing damage

Bent 4W – Loose railing components

Span 4E Deck



Span 4 – Rough deck and damaged railing. Signs detached and missing.

Span 4 – Rough deck surface with changes in elevation between 0.25” and 0.5” without bevel and greater than 0.5” exceeding ADA 4.5.2 limits.

Span 4 – Deck opening greater than 0.5” exceeding ADA 4.5.4 limits.

Span 4E – Railing damage and loose components

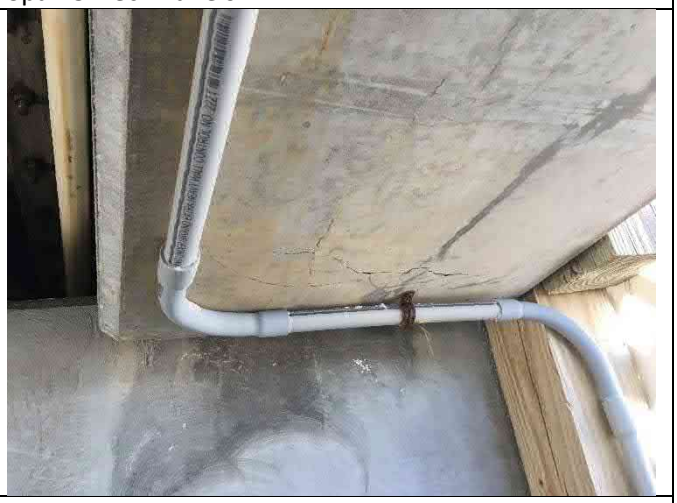
Bent 4W – Pile cap spall and closure cracking, loose railing components

Bent 4W – Pile cap spall 3”x3”x2”

Bent 4E – Pile spall 6”x4”x1”

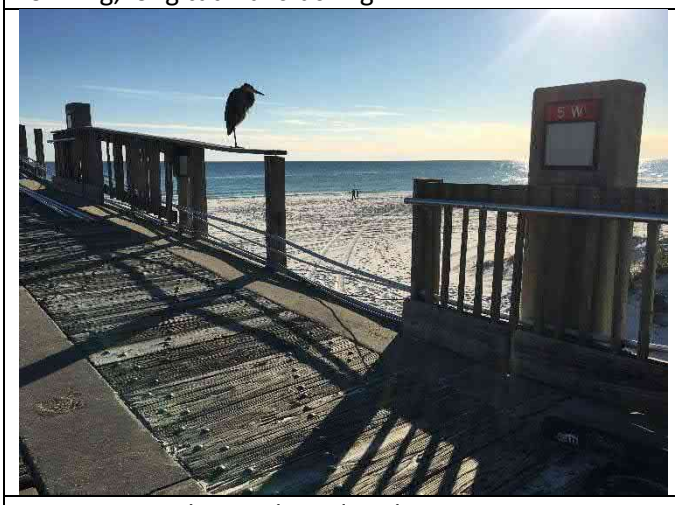
Bent 4 Center – Closure cracking, loose bolts

Bent 4W – Closure cracking, loose bolts

	
Bent 4 Center – Closure cracking	Span 5 Deck Panels
	
Bent 4W South – Cap spall 2”x2”x1”	Beam 4-1 North – Bottom flange cracking and spall forming, longitudinal bottom flange cracking
	
Beam 4-2 North – Bottom flange cracking, spall forming, longitudinal cracking	Beam 4-3 North – Bottom flange cracking, spall forming, longitudinal cracking

Beam 4-4 North – Bottom flange cracking, spall forming, longitudinal cracking

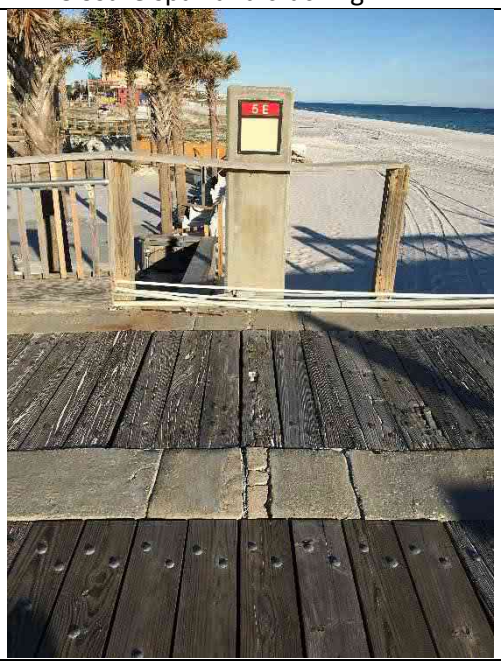
Bent 5E – Railing and conduit damage



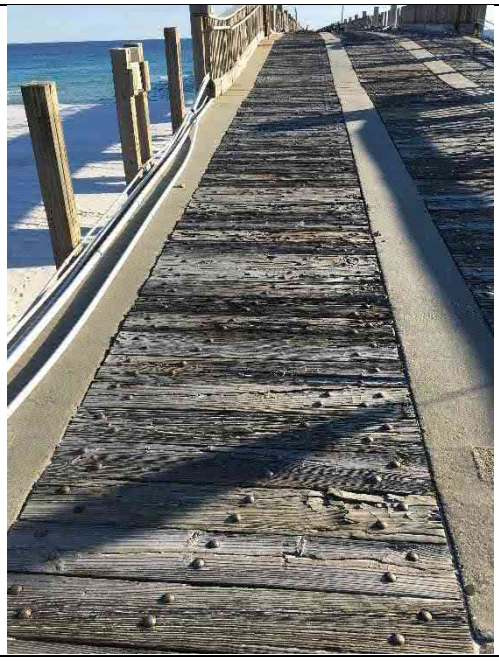
Bent 5W – Railing and conduit damage

Bent 5W – Closure spall and cracking

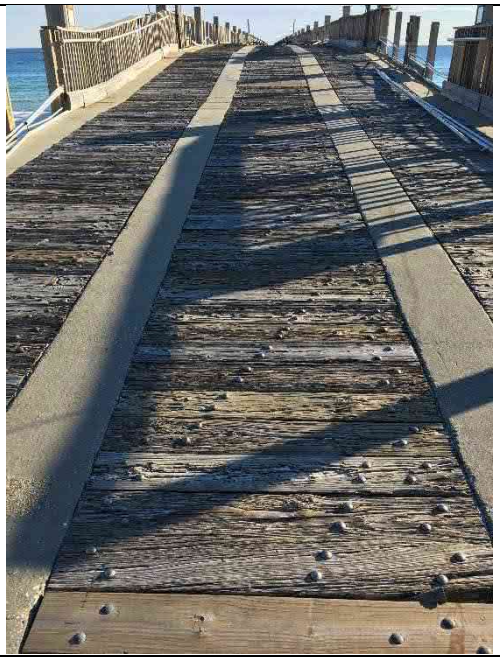
Bent 5W



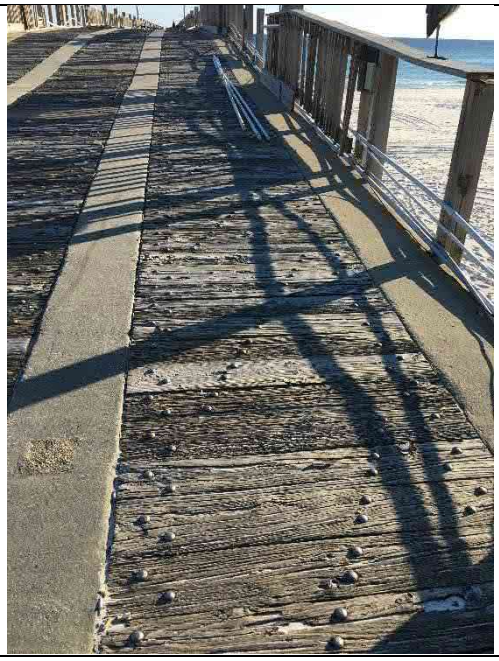
Bent 5E – Closure cracking, missing railing, loose posts



Span 5E Deck



Span 5 Center Deck



Span 5W deck

Span 5E – Missing railing (guardrail and handrail)

Span 5W – Missing and damaged railing

Span 5 - Damaged deck

Span 5 Deck – Tripping hazard

Beam 4-1 South – Bottom flange cracking, end delamination and spall forming, longitudinal cracking

Beam 4-3 South – Bottom flange cracking, end spall and spall forming, longitudinal cracking

Bent 5W – Cracking (20’ +/-)

Pile 5-2 – Repair in good condition

Pile 5-1 – Spall 12”x3”x1” from impact

Bent 5E – Cracking (15’ +/-), missing railing, utility damage

Beam 5-2 North – End spalls, longitudinal cracking (common condition)

Beam 4-4 South – Spall 16”x6”x3”, Closure pour spall 14”x8”x6”, light column spall 14”x6”x3”, previous repairs damaged

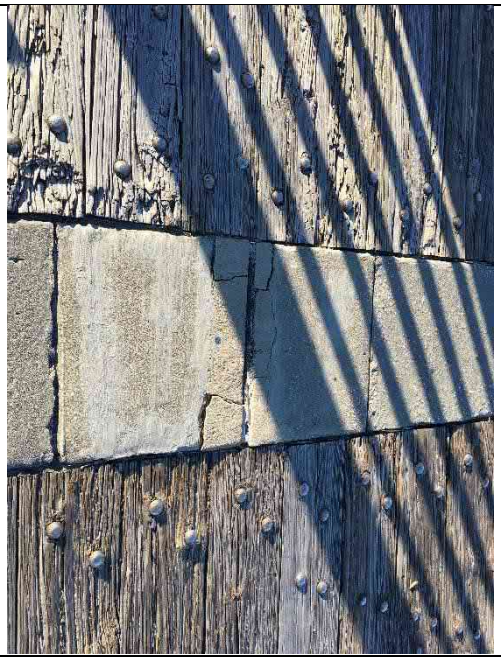
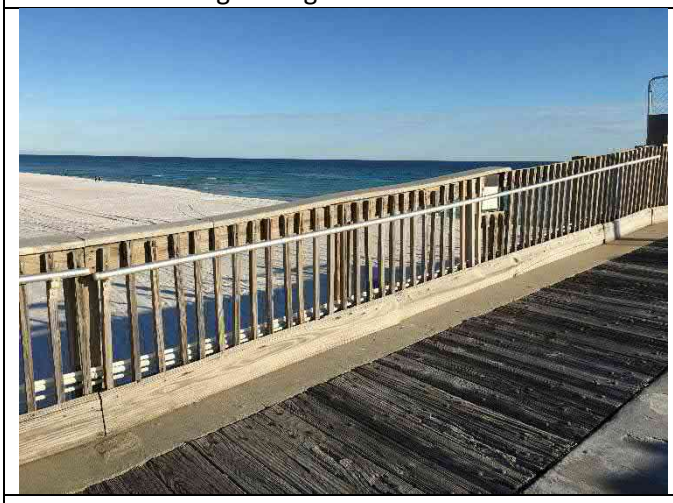
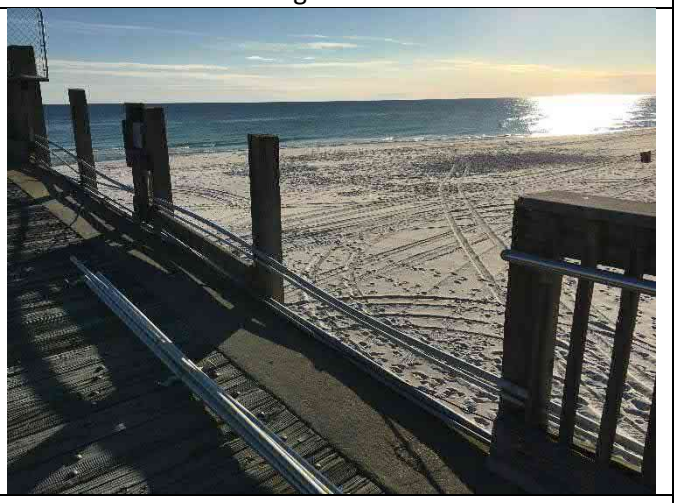
Beam 5-1 North – Cracking and spall 24”x12”x6”, longitudinal cracking, pile cap cracking

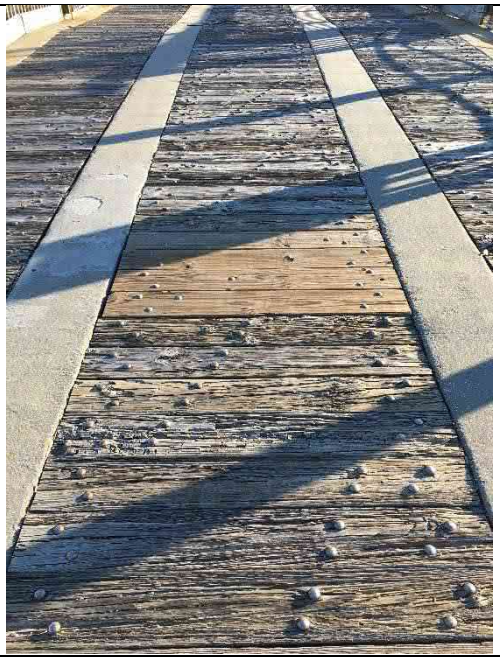
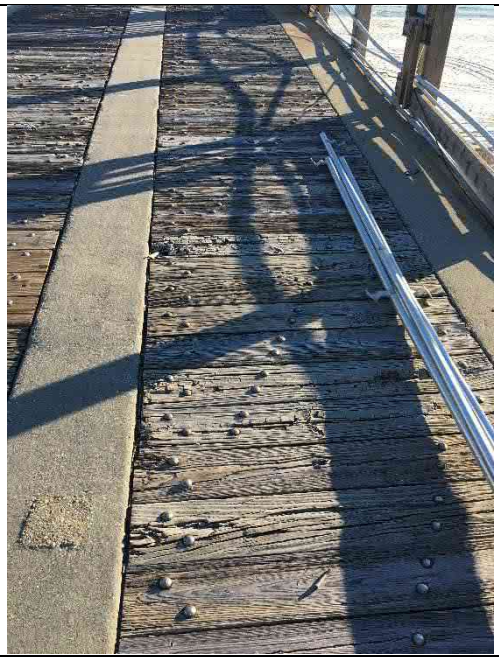
Beam 5-2 North – Cracking and spall 24”x6”x4” bottom flange, longitudinal cracking, spalls on dapped end 16”x8”x1” each side

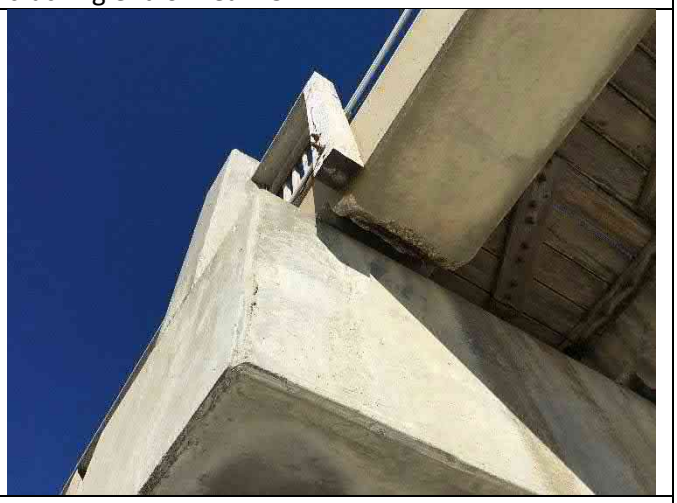
Beam 5-3 North – End cracking, delamination and spall 24”x24”x1”, longitudinal cracking

Beam 5-4 North – End cracking and delamination 24”x12”

Bent 6E – Railing damage

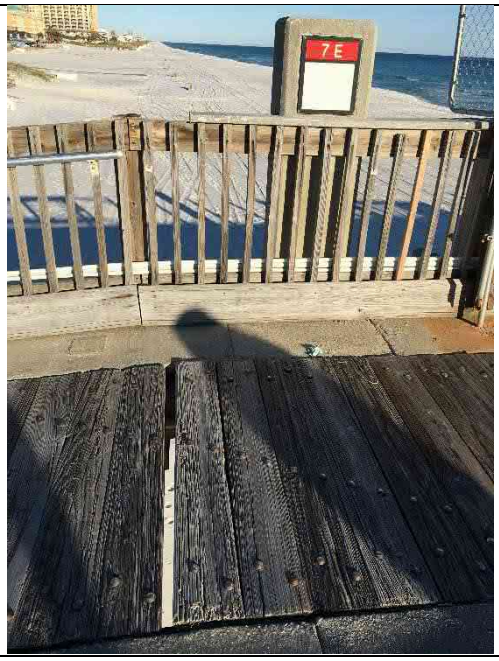
	
Bent 6W – Railing damage	Bent 6 – Closure cracking
	
Span 6E – Railing damage, deck plank damage	Span 6W – Railing missing and damaged, utility damage

	
Span 6E Deck	Span 6 Center Deck
	
Span 6W Deck	Span 6 Deck – 1.75” Opening > 0.5”

	
Span 5E	Bent 6E – Minor pile cap cracking (2’ +/-), closure cracking end of Beam 5-1
	
Bent 6W – Split railing post (common condition)	Beam 6-4 North – End spall 24”x6”x4”
	
Beam 6-3 North – Small end spall, end cracking and delamination 24”x12”, longitudinal cracking	Beams 6-2 and 6-2 North – End cracking and delamination, longitudinal cracking

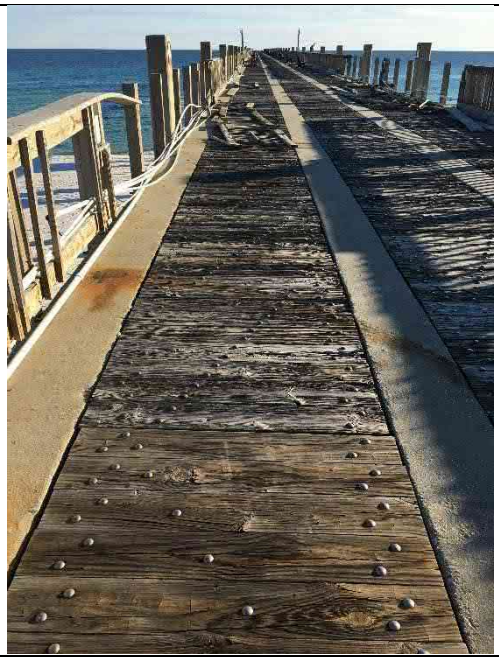
Pile 6-2 – Spall 7”x4”x1”

Bent 6 – Pile cap minor spalls and rust from exposed reinforcement or chairs

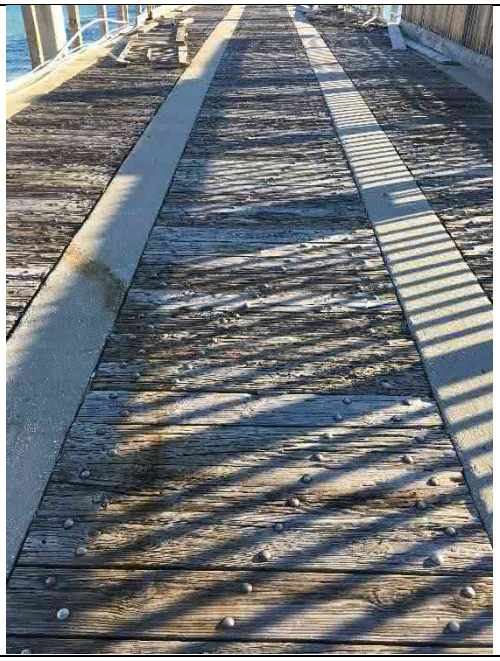


Bent 7E

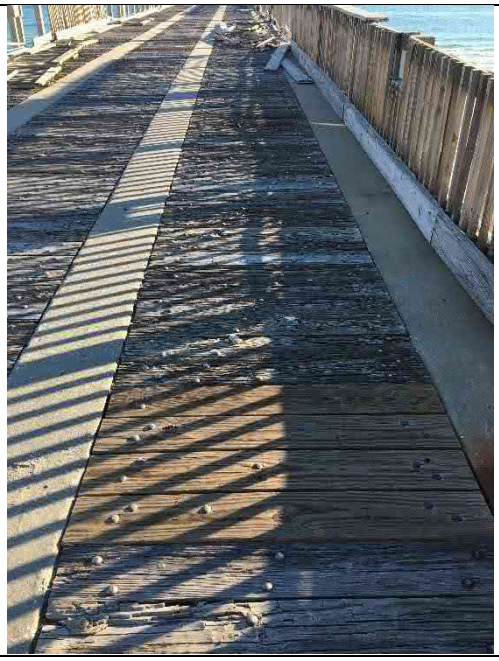
Bent 7W



Span 7E Deck

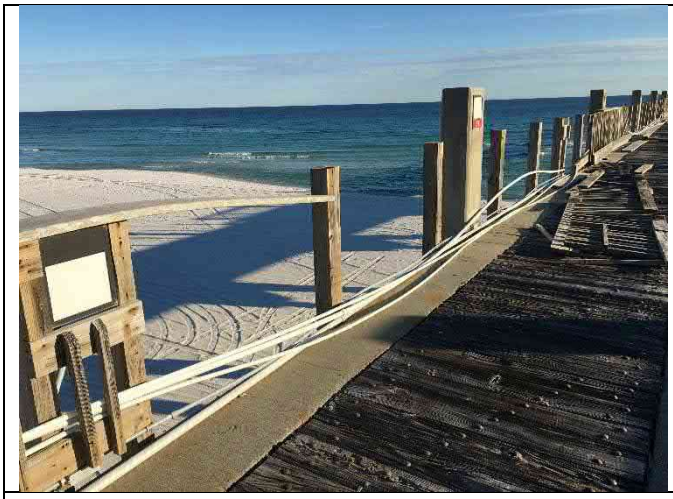


Span 7 Center Deck

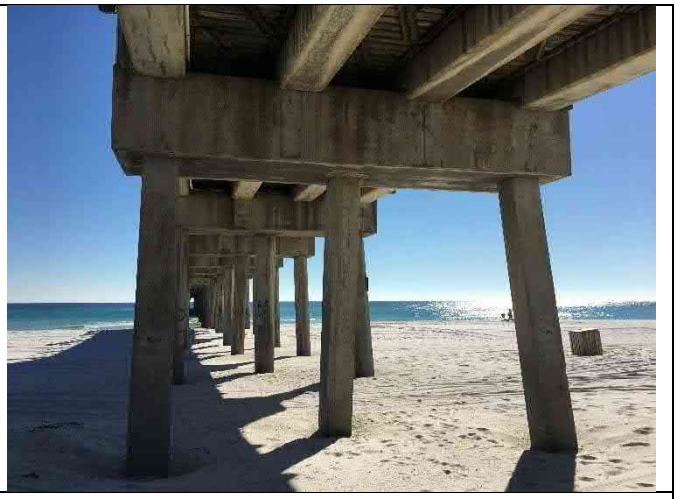


Span 7W Deck

Bent 7 – Missing gate



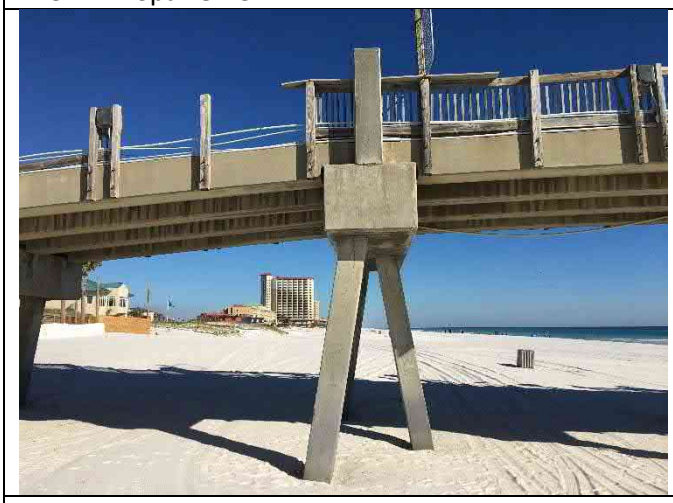
Span 7E – Damaged and missing railing



Bent 7 North Face – Spalls piles 7-1 and 7-3,

Pile 7-1 – Spall 8”x5”x2”

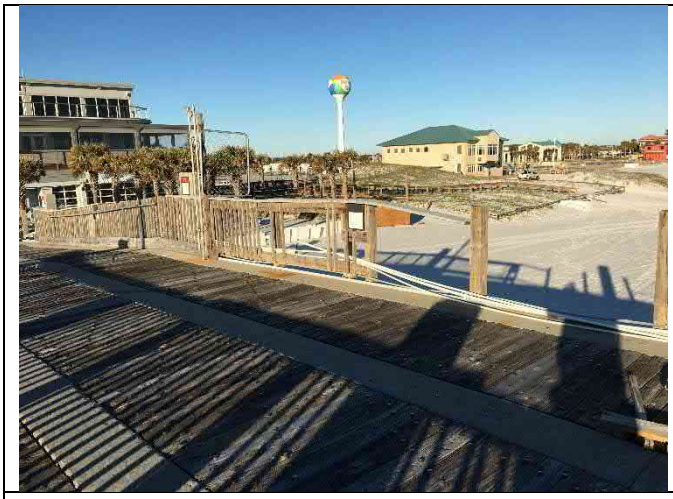
Pile 7-3 – Multiple spalls, 22”x3”x2”

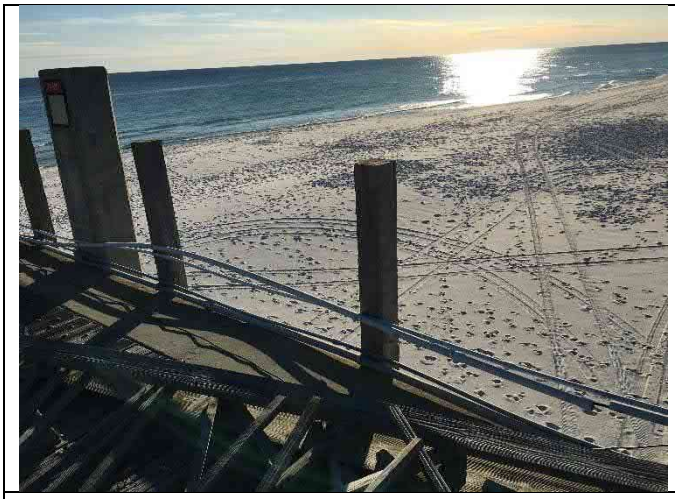


Bent 7W

Bent 7E

	
Beam 6-1 South – End cracking and delamination	Beam 6-4 South – End cracking and delamination
	
Pile 7-2 – Two spalls 2”x2”x1”	Bent 7 South Face – Spall 8”x4”x2”
	
Beam 7-1 North – End cracking and delamination, longitudinal cracking	Beam 7-2 North – End cracking and delamination, spall 24”x2”x3”

	
Span 7E – Railing damage	Span 7W – Railing damage – Standing railing loose with multiple wood splitting (common condition)
	
Bent 8E – Railing damage, closure cracking	Bent 8E – Light column spall 12”x8”x2”, closure spall 12”x6”x4”
	
Bent 8W – Previous light column repair good	Bent 8W – Railing damage

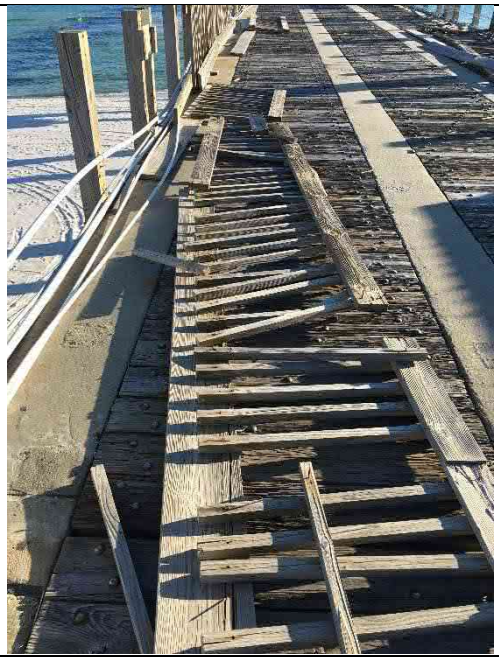
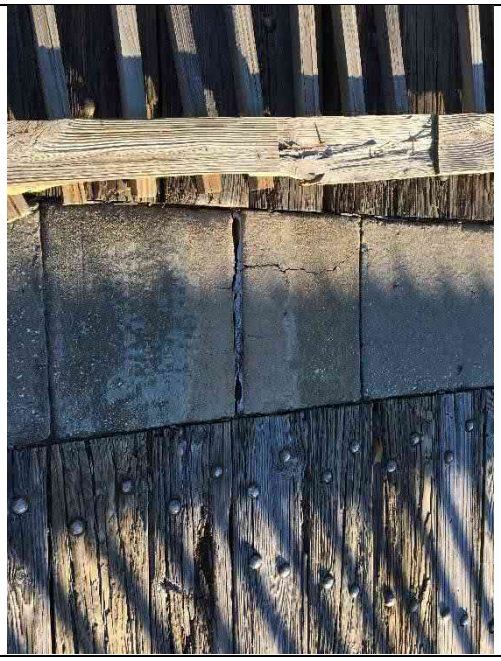
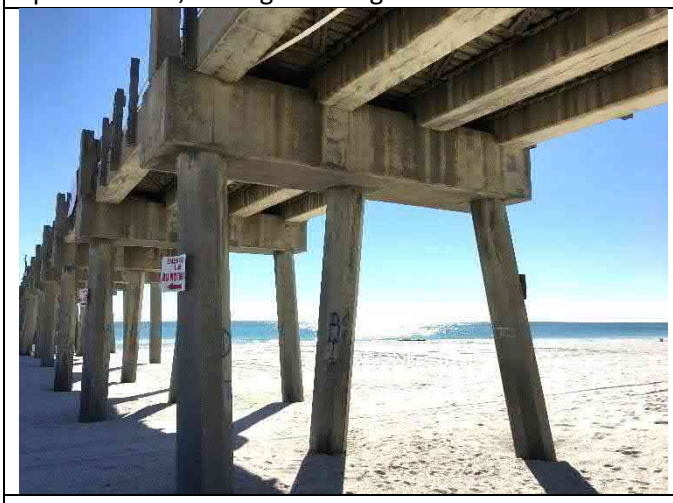
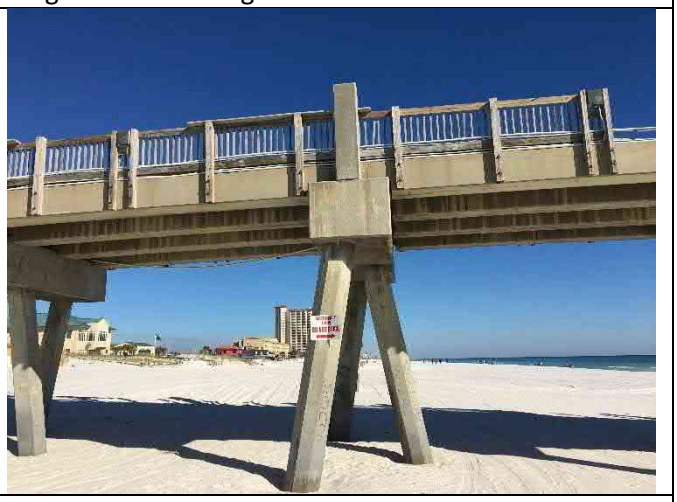


Span 8W – Railing and utility damage

Span 8 – Closure cracking, deck deterioration

Span 8W Deck

Span 8 Center Deck

	
Span 8E Deck, damaged railing and utilities	Bent 8 Beam 2 – Closure cracking
	
Bent 8 North Face	Beam 7-1 South – End cracking and spall 24”x4”x3”, longitudinal cracking
	
Pile 8-3 – Minor local scour	Bent 8W

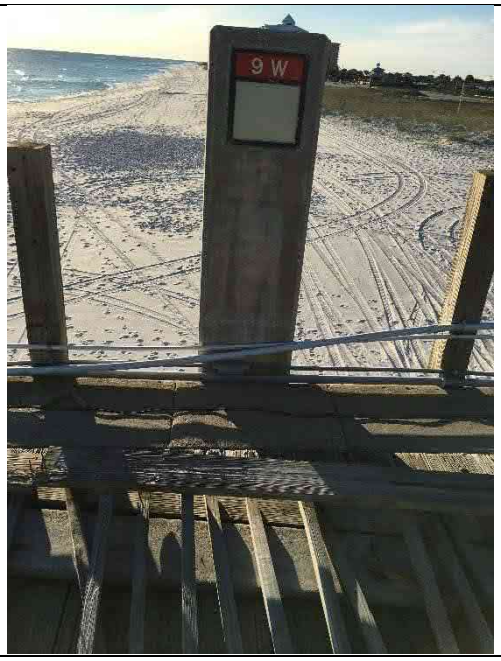
Bent 8 South Face

Beam 8-1 North – End cracking and delamination and spall 24”x12”, longitudinal cracking

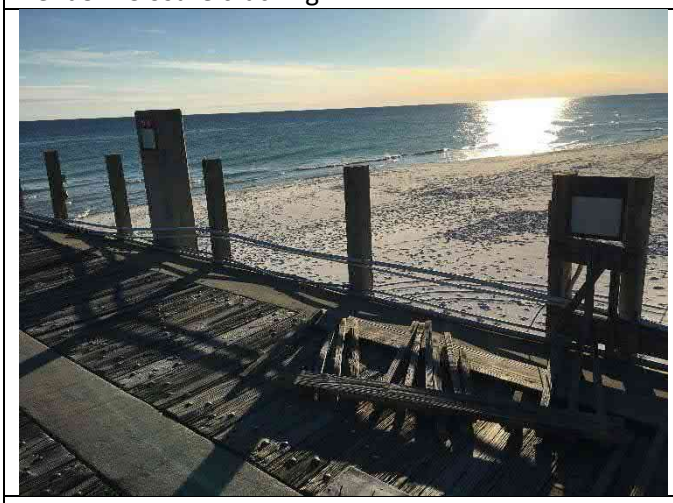
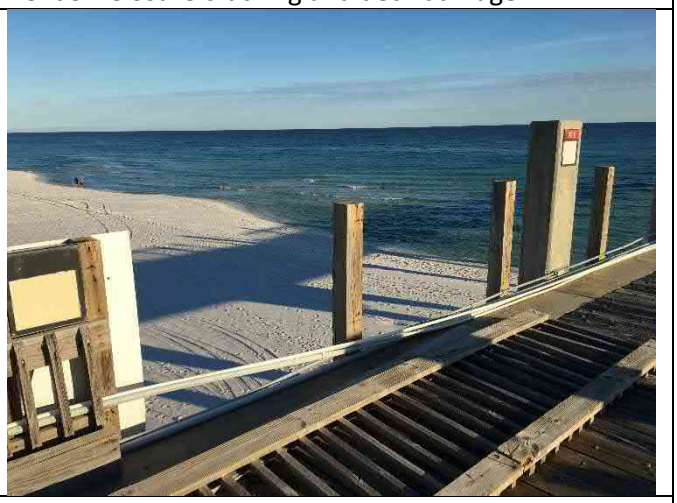
Beam 8-2 North – End cracking and delamination

Bent 8E

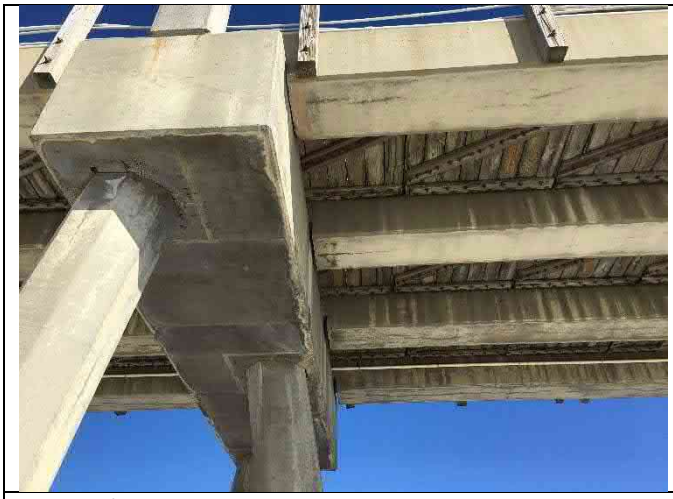
Bent 9E – Loose and damaged railing



Bent 9W – Damaged railing and utilities

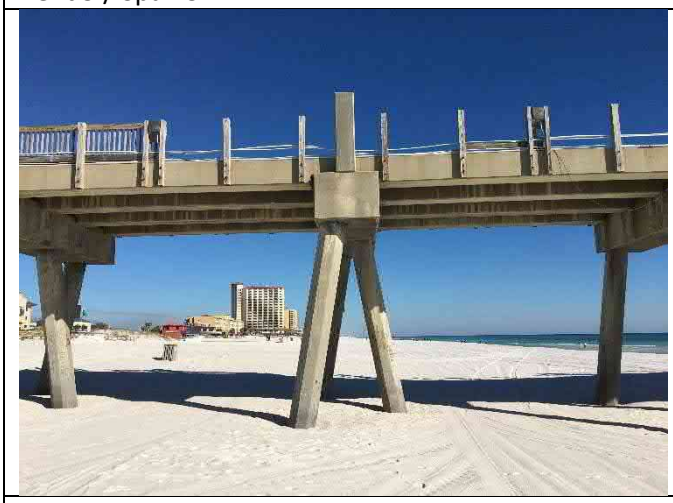
	
Bent 9 – Closure cracking	Bent 9 - Closure cracking and deck damage
	
Span 9W – Railing damage	Span 9E – Railing damage
	
Span 9E Deck	Span 9 Center Deck

	
Span 9W Deck	Span 9 – Deck damage with gaps and openings exceeding 0.5”
	
Bent 9 North Face	Beam 8-4 South – End spall 8”x4”x3”, longitudinal cracking
	
Beam 8-3 South – End spall 4”x4”x2”, longitudinal cracking	Beam 9-4 North – End spalls 8”x2”x2” combined, beam has moved north with gap closed



Bent 9 / Span 9

Beam 9-3 North – End cracking

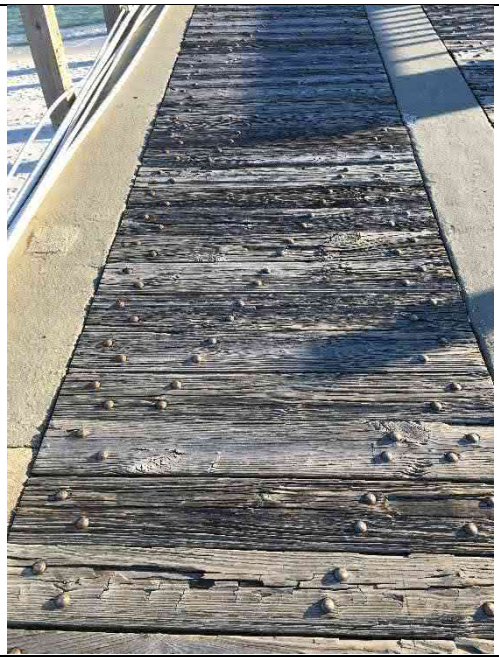
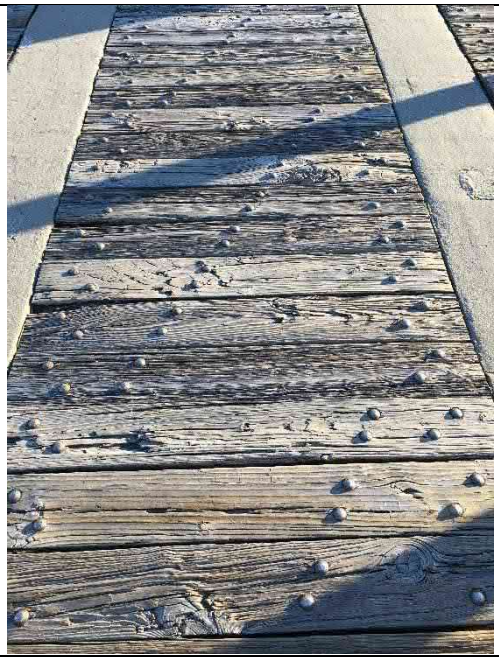


Bent 9W

Bent 9E – Spall Pile 9-1 top 10”x12”x1”

Bent 10E

Bent 10E

	
Span 10E Deck	Bent 10 Closure
	
Span 10 Center Deck	Span 10W Deck – Gaps exceed 0.5”

	
Bent 10W – Closure cracking	Beam 9-4 South – Spall 16”x4”x4”, closure spall 14”x4”x4”
	
Bent 10 North Face	Beam 9-4 South – Spall 20”x12”x3” from deck impact
	
Bent 10E – Spall 4”x4”x1”, Beam 9-1 South cracking	Beam 9-3 South – End cracking and delamination 24”x12”x4”, longitudinal cracking

Bent 10W

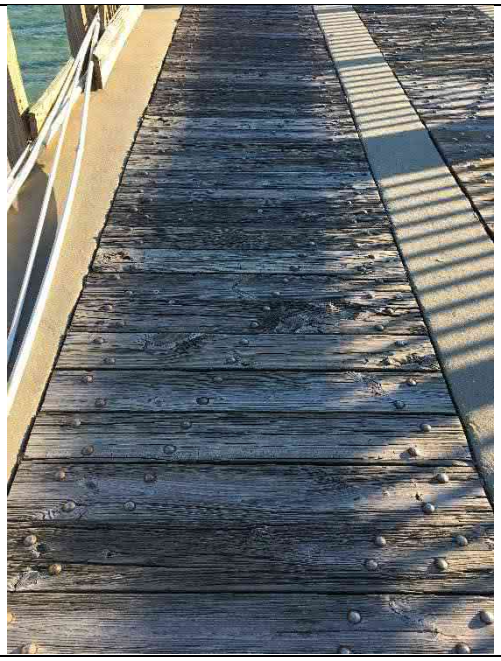
Bent 10 South Face

Pile 10-2 – Spalls 5”x5”x2”, 12”x5”x2”

Beam 10-3 North – End cracking and spalls 24”x6”x4”, longitudinal cracking

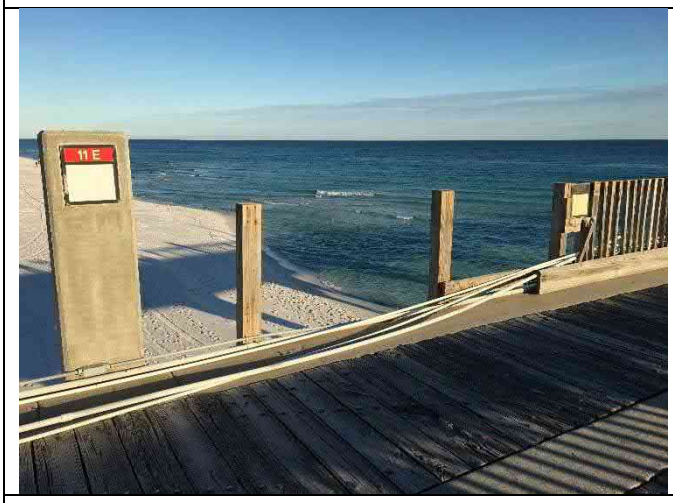
Beam 10-2 North - End cracking and spalls 24”x6”x4”, longitudinal cracking

Bent 10E

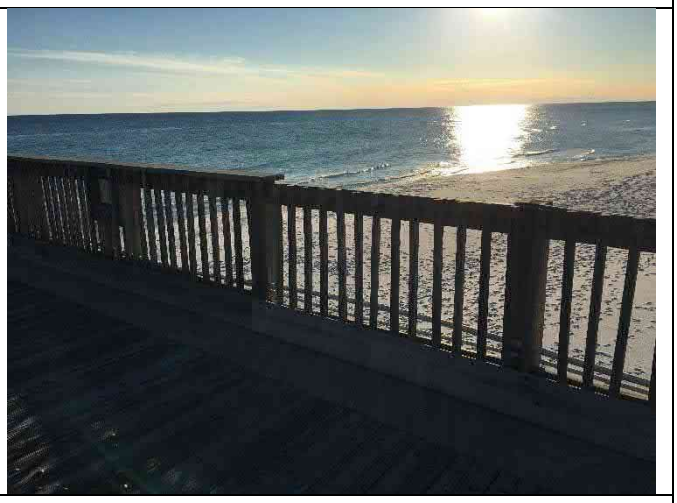
	
Bent 11E	Span 11E Deck
	
Bent 11 - Closure pours	Bent 11 - Closure pours

Bent 11 Center Deck

Bent 11W Deck



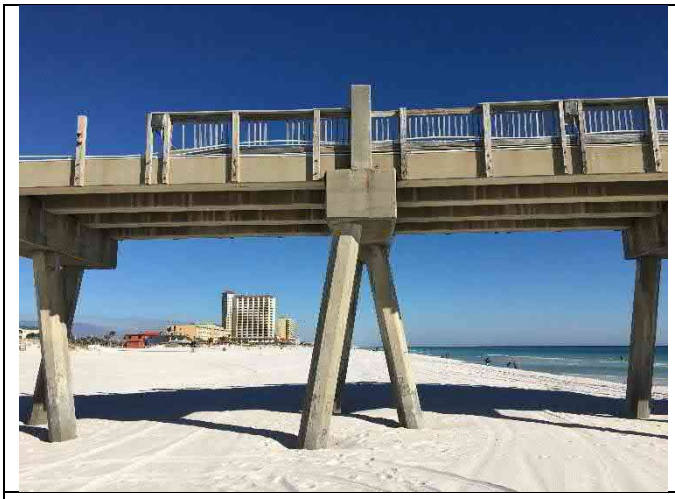
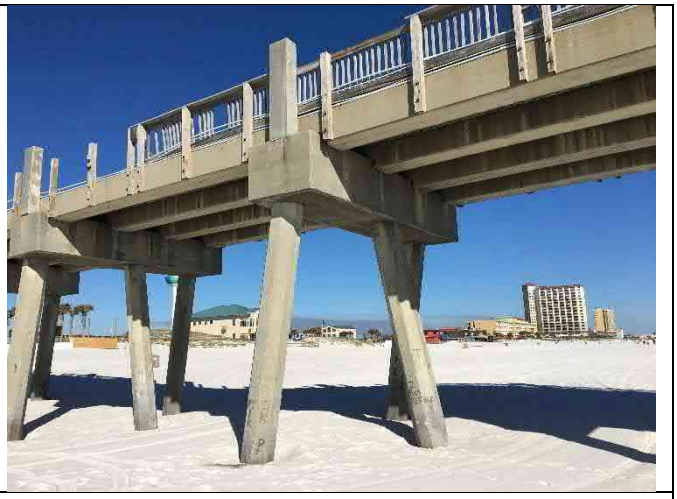
Span 11E – Railing damage



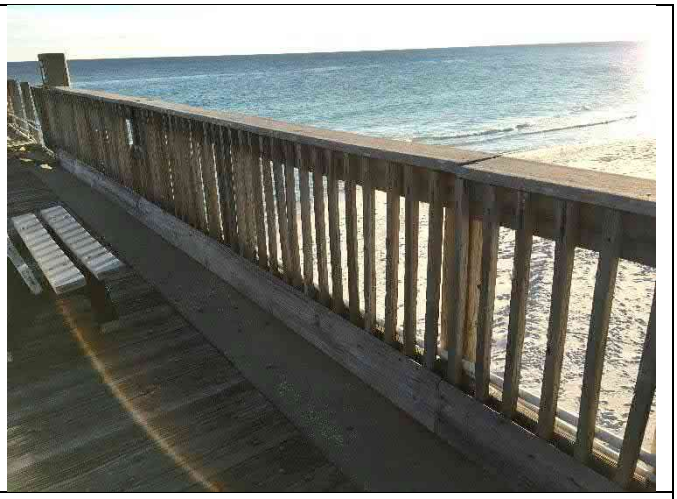
Span 11W – Railing loose and damaged, wood split

Bent 11 North Face

Beam 10-1 South – End spall 24”x3”x3”, pile cap hairline crack

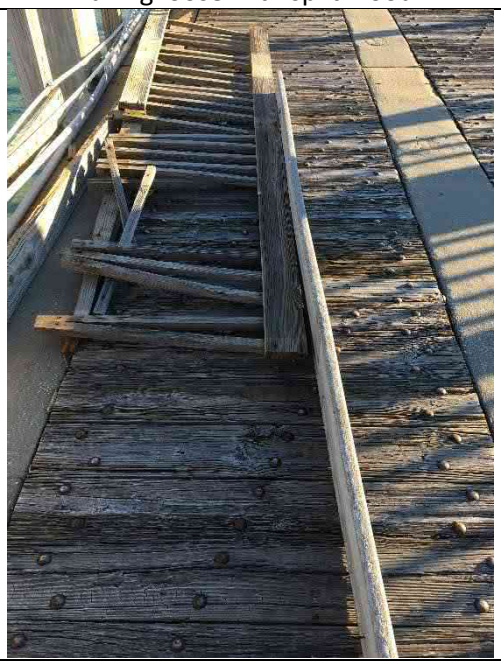
	
Bent 11W – Rust staining below light column	Bent 11 South Face
	
Pile 11-2 – Spall 5”x7”x2”	Span 11
	
Beam 11-3 North – Top flange spalls 24”x8”x2” total, beam end cracking	Beam 11-4 North – Spall 8”x4”x3”, longitudinal cracking

Bent 11E

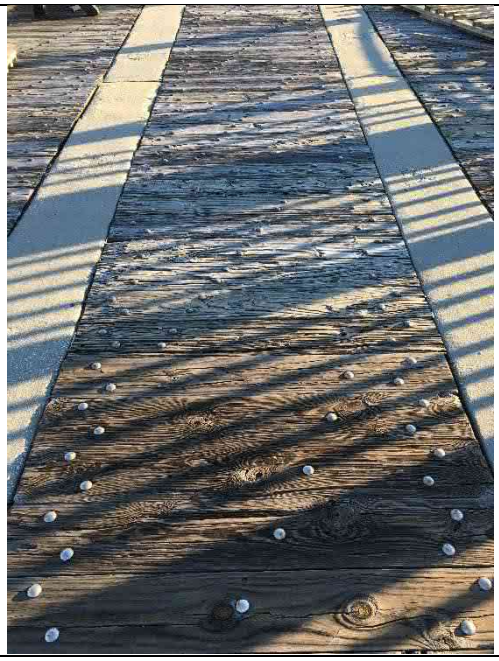


Span 12W – Railing loose with split wood

Bent 12E



Span 12E Deck

	
Span 12 Center Deck	Span 12W Deck
	
Bent 12W	Bent 12 Closure

Span 12E Railing

Bent 12 North Face

Pile 12-1 – Spall 12”x6”x2”

Beam 11-3 South – Top flange spalls 48”x12”x2”, beam end cracking, longitudinal cracking

Beam 11-3 – Top flange spalls 12”x6”x2”

Beam 11-4 – Top flange spall 12”x8”x2”, longitudinal cracking

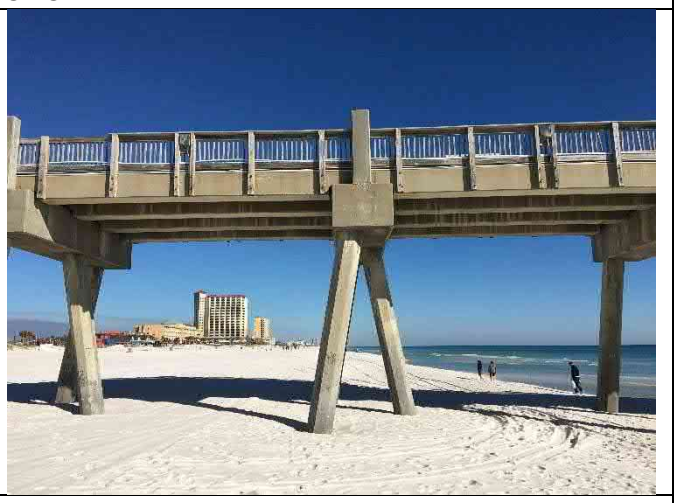
Beam 11-4 – Top flange spalls 36”x4”x1”, longitudinal and horizontal cracking

Beam 11-1 South – End cracking and delamination

Beam 11-3 South – End cracking and delamination, pile cap cracks

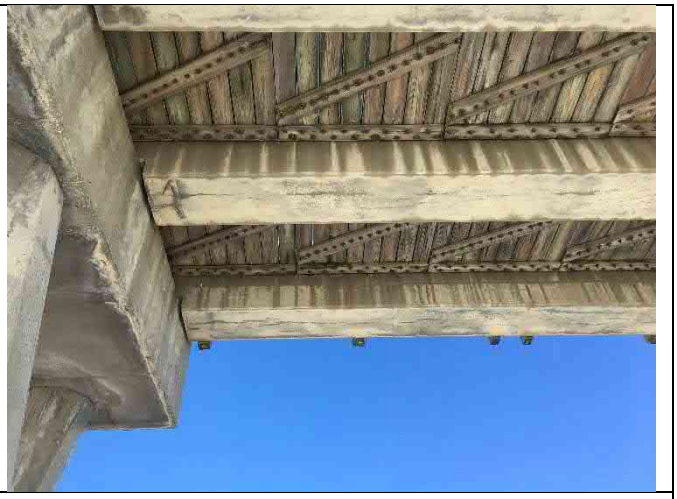
Bent 12 North Face – Pile cap cracks (30’ +/-), spall 5”x5”x1”

Bent 12E



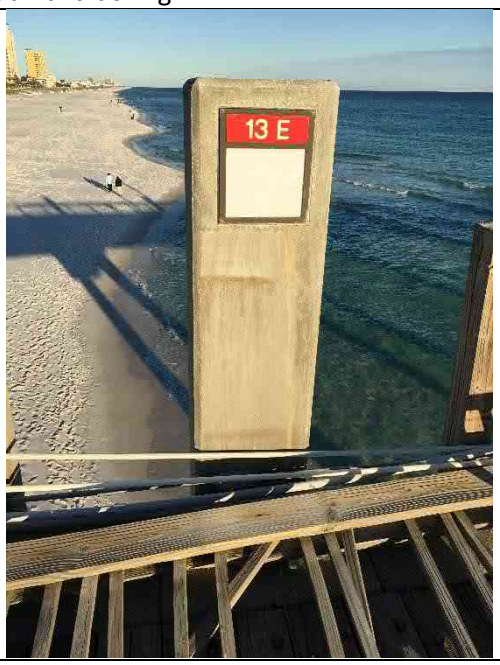
Bent 12W – Rust staining below light column

Bent 12 South Face -

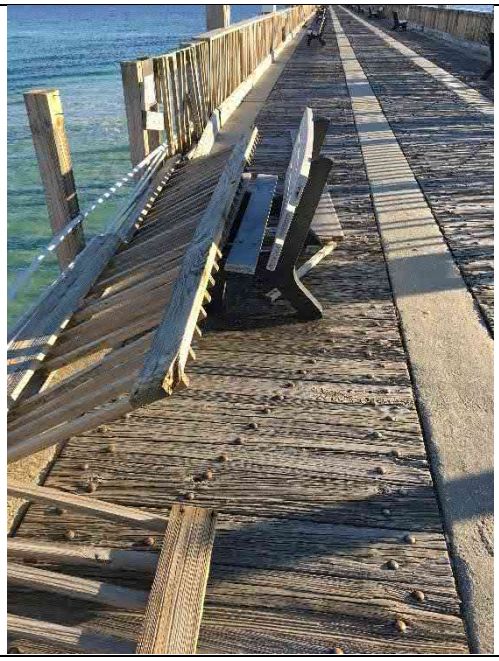
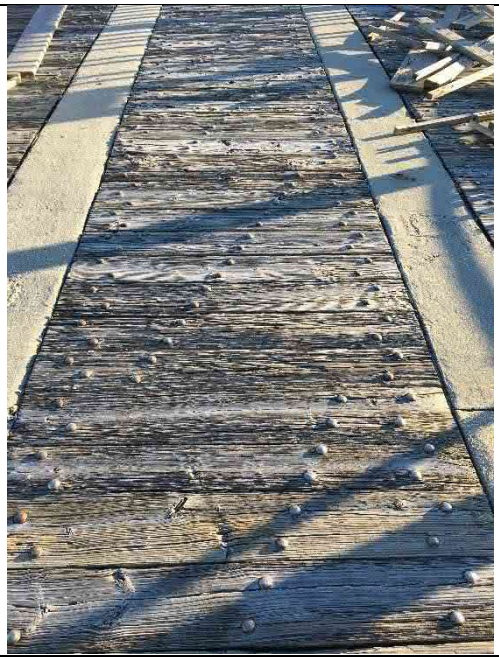


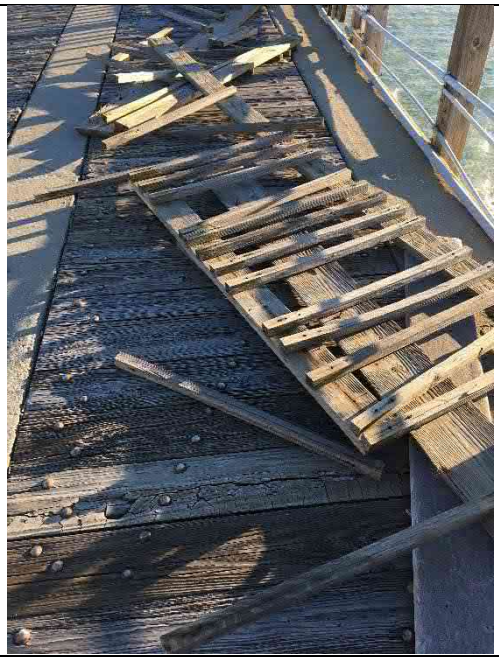
Beam 12-2 North – End cracking and delamination, longitudinal cracking

Beam 12-1 – Top flange spalls 36”x3”x2”



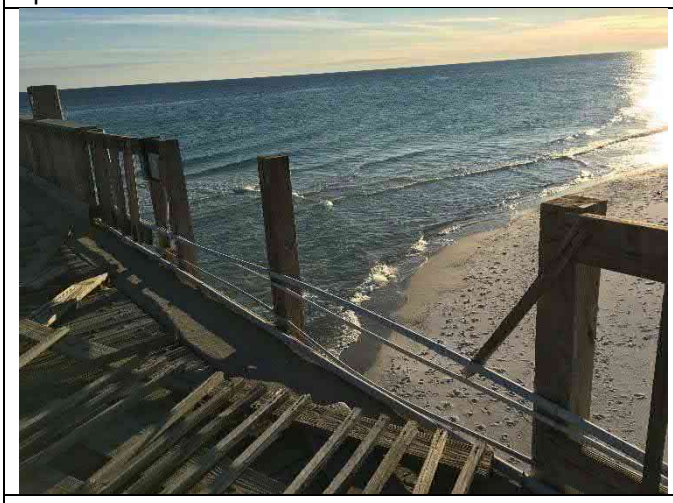
Bent 13E

	
Span 13E Deck	Bent 13 Closure Cracking
	
Span 13 Center Deck	Bent 13 Closure



Span 13W Deck

Bent 13W

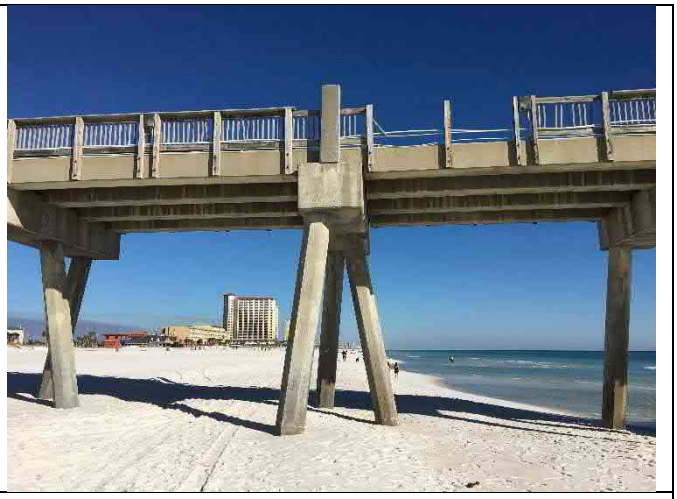
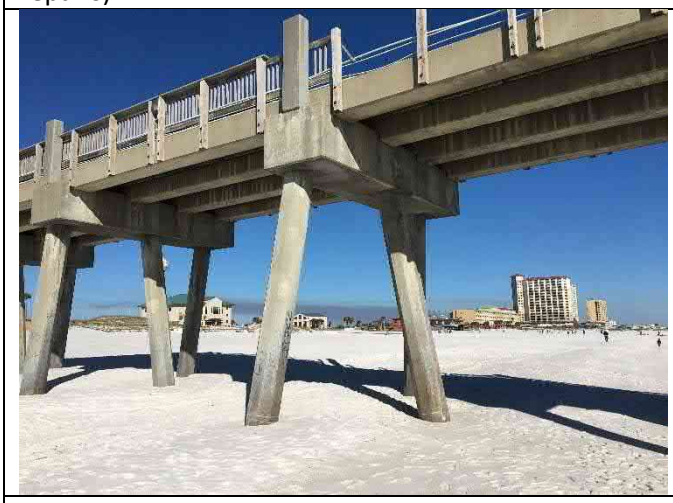
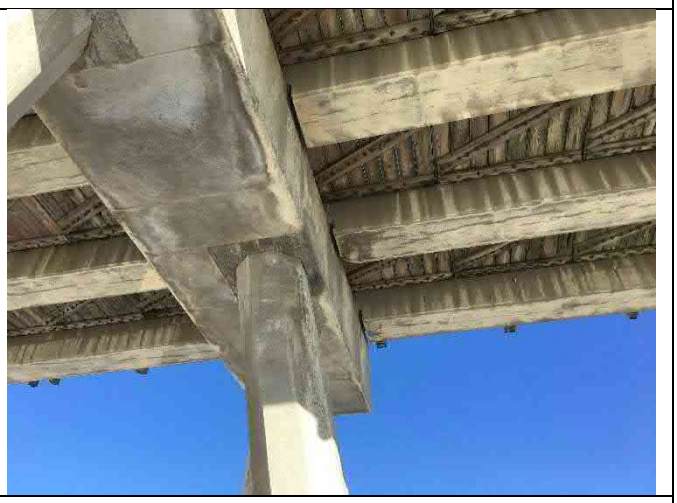


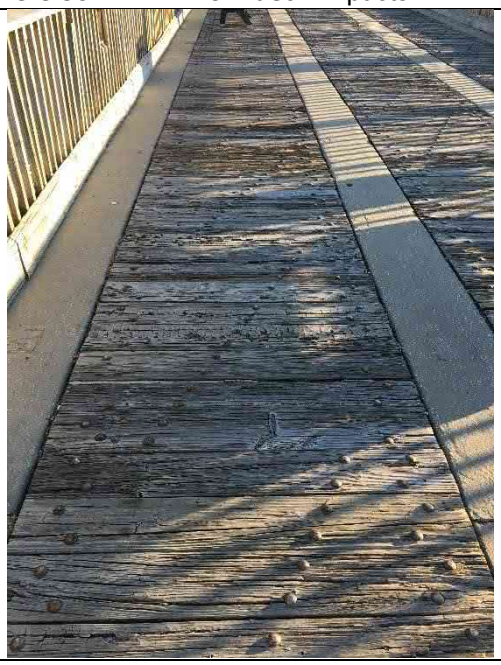
Span 13W – Railing and utility damage

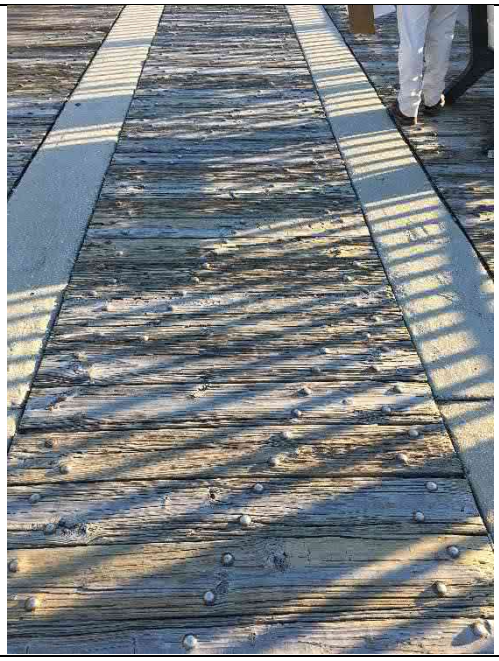
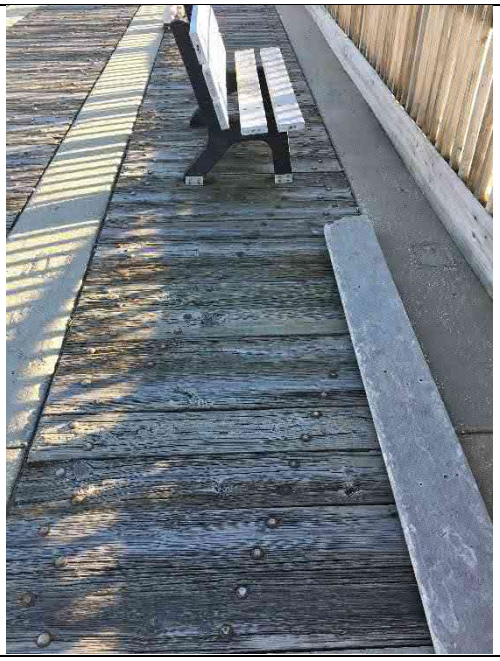
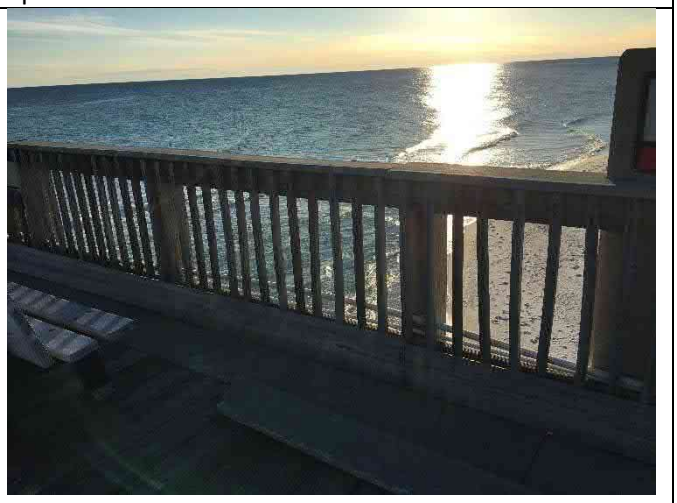
Bent 13 North Face

Span 12 South Beams

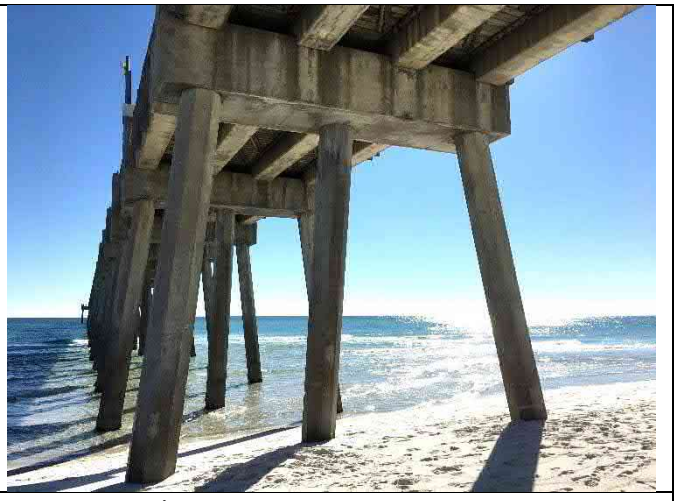
Beam 12-3 South – End cracking and spall 36”x24”x2”, top flange spalls 36”x3”x2”, longitudinal cracking

	
Pile 13-3 – Spalls 20”x14”x2” (damage to previous repairs)	Bent 13W
	
Bent 13 South Face	Bent 13 – Top flange spall Beam 12-2 8”x6”x2”, top flange spalls Beam 13-3 24”x4”x2”, beam end cracking, longitudinal cracking
	
Pile 13-2 - Spall 10”x5”x2”	Beam 13-2 North – End cracking, delamination and spall 24”x12”x3”

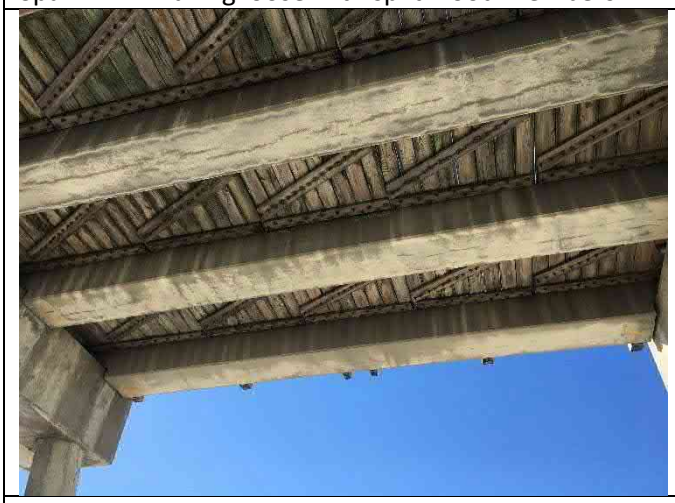
	
Bent 13E	Span 13 – Top flange spalls Beam 13-2 12”x4”x2”, Beam 13-3 36”x4”x2” from deck impacts
	
Bent 14E	Span 14E Deck

	
Span 14 Center Deck	Span 14W Deck
	
Bent 14W	Span 14W – Railing loose with split wood members

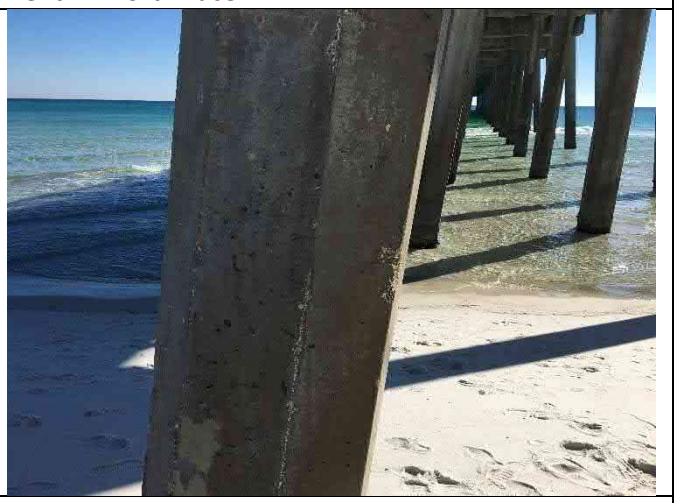
Span 14E – Railing loose with split wood members



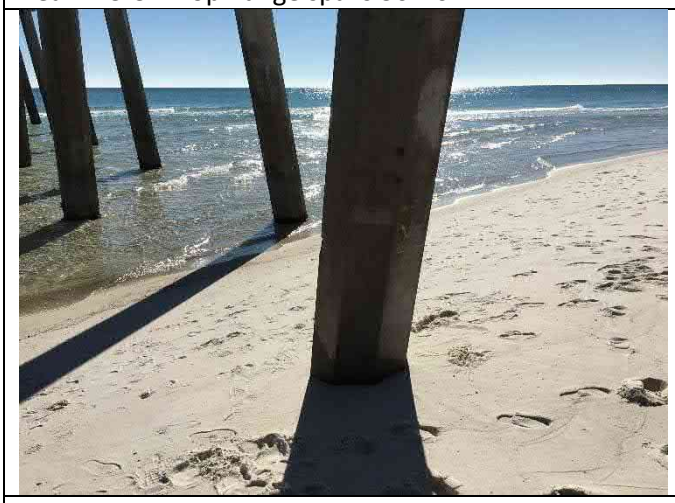
Bent 14 North Face



Beam 13-3 – Top flange spalls 36”x6”x1”

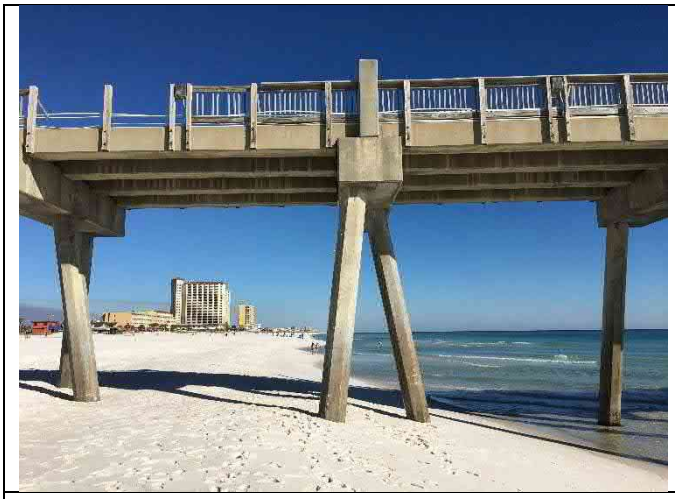


Pile 14-1 – Spall 6”x4”x1”

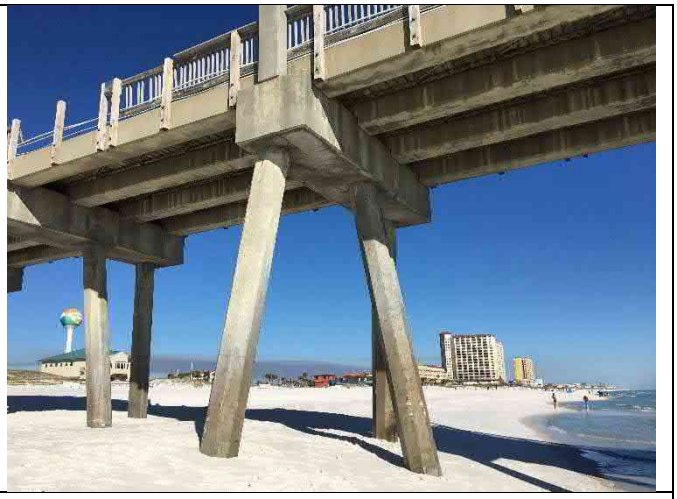


Pile 14-2 – Spall 6”x6”x2”

Pile 14-3 – Spall 26”x6”x2”, 20”x6”x2”



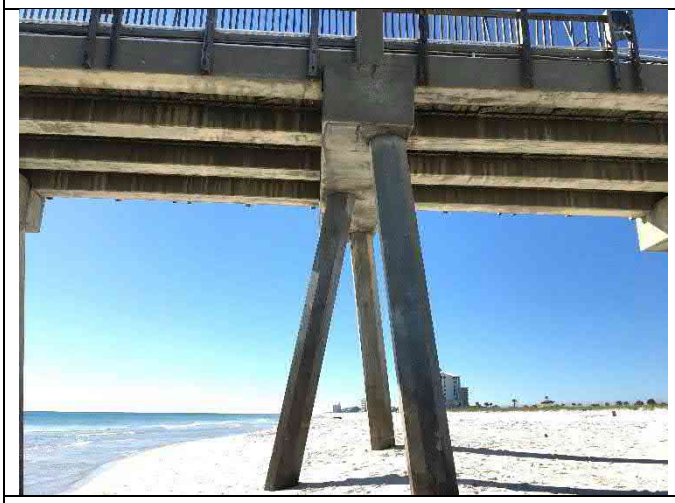
Bent 14W



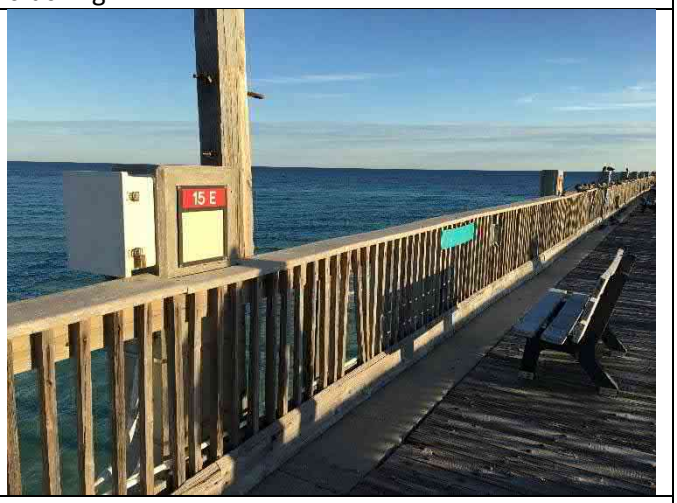
Bent 14 South Face

Pile 14-2 – Spalls 20”x10”x2”, 16”x5”x2”

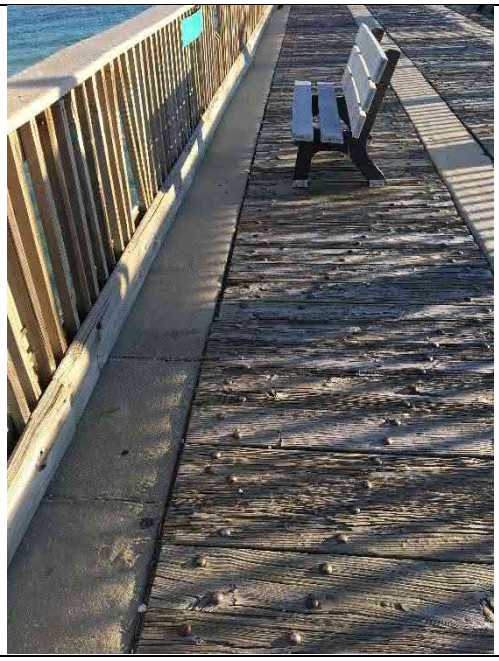
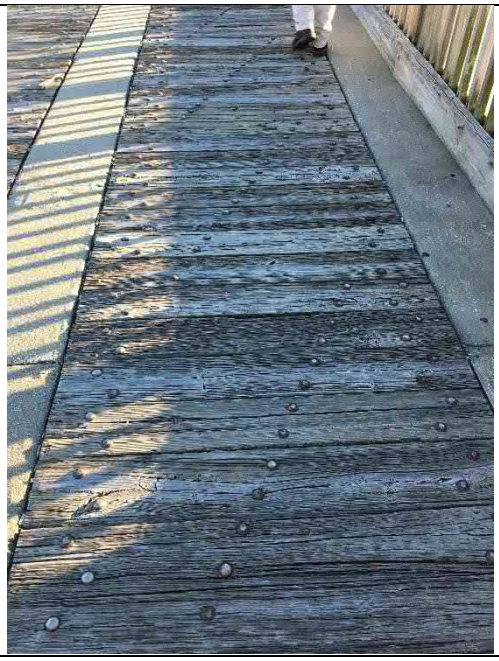
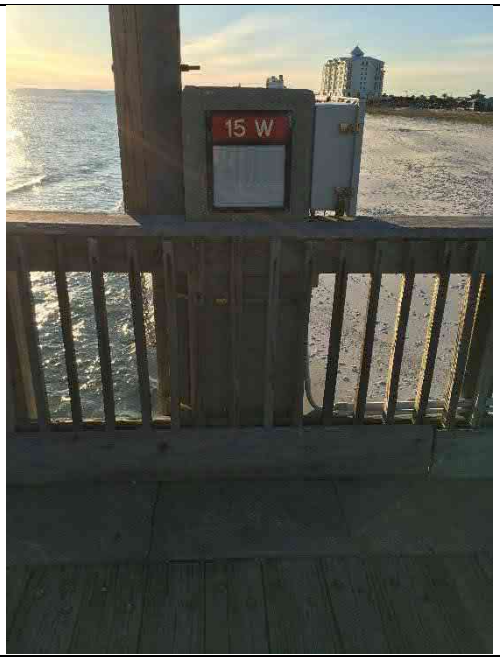
Span 14 North – Beams shifted north, end beam cracking

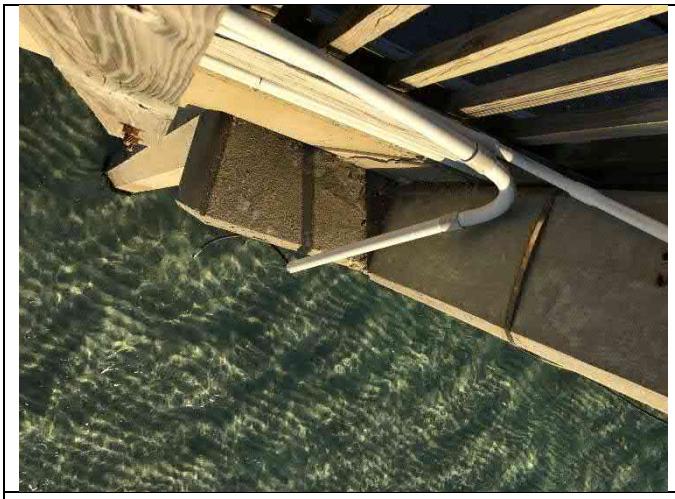
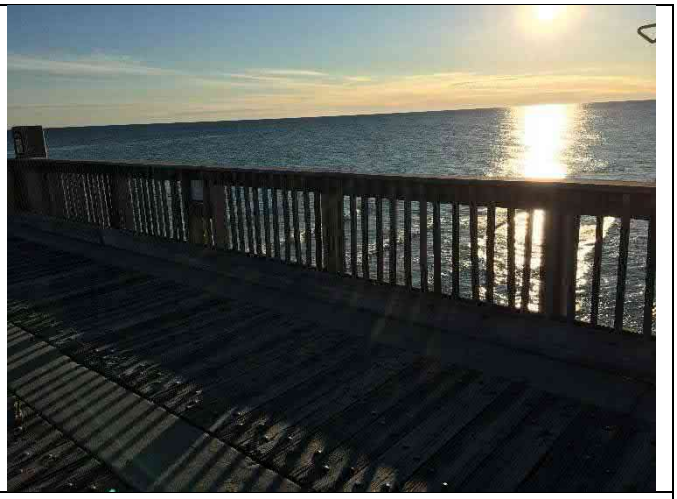
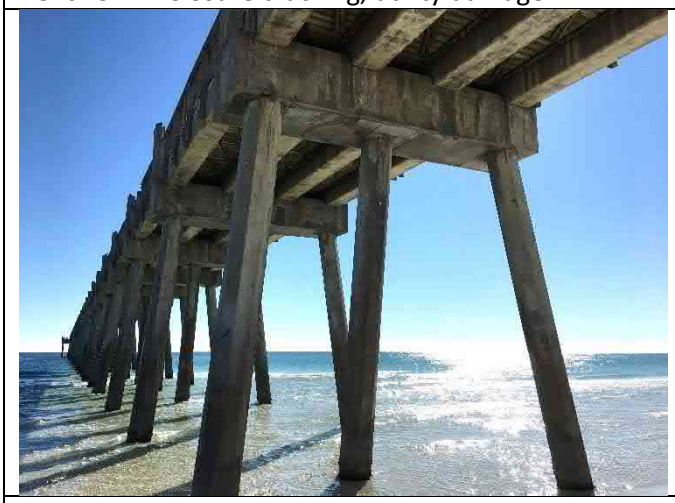


Bent 14E

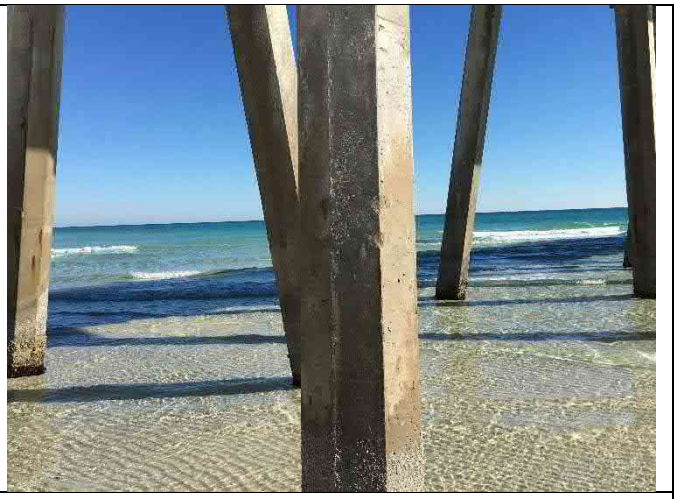


Bent 15E – Rail and utility damage

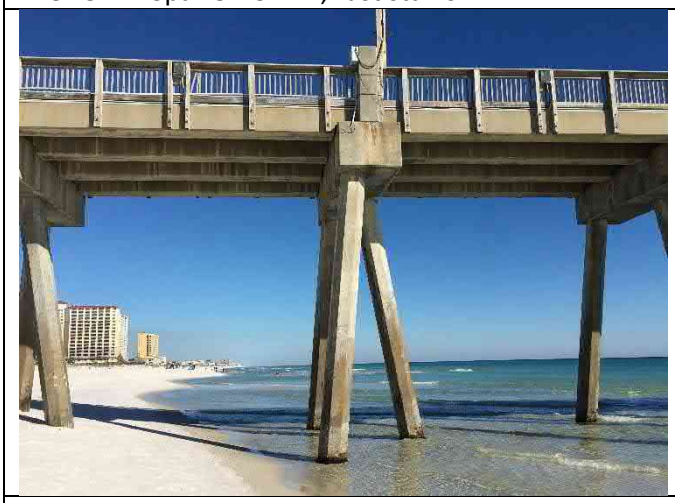
	
Span 15E	Span 15 Center
	
Span 15W	Bent 15W

	
Bent 15W – Closure cracking, utility damage	Span 15W – Railing loose with split wood members
	
Bent 15 North Face	Bent 15 – Pile cap spall 14”x3”x2”, hairline crack
	
Span 14 South Beams	Beam 14-2 South – End beam cracking and delamination

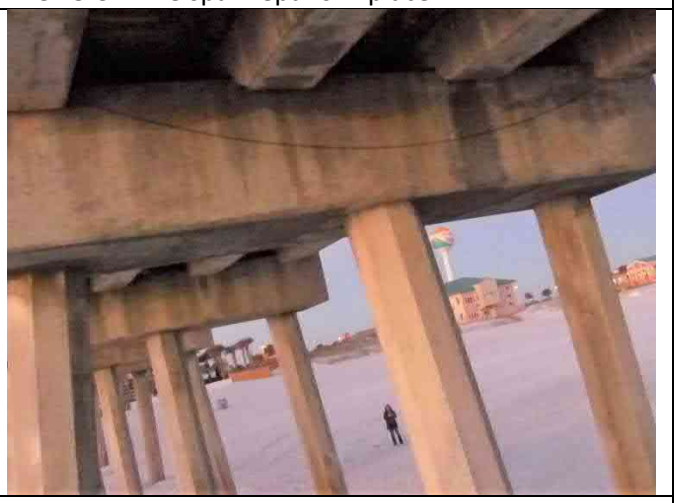
Pile 15-1 – Spall 5”x3”x2”, rust stains



Pile 15-3 – Pile spall repairs in place

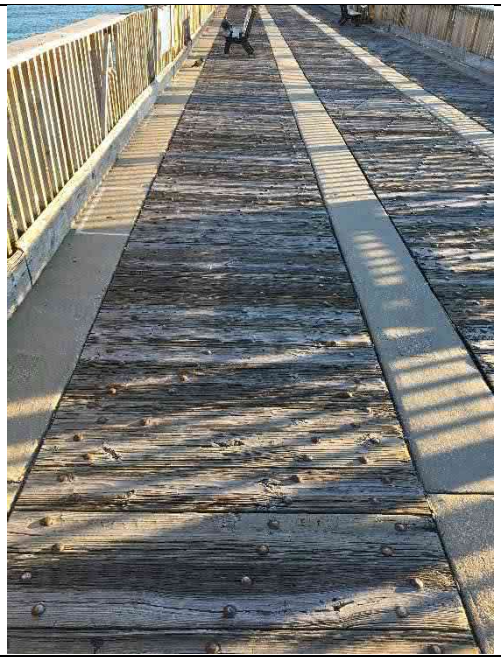


Bent 15W – Rust staining below light column, Pile 15-2 spall 4”x4”x2”

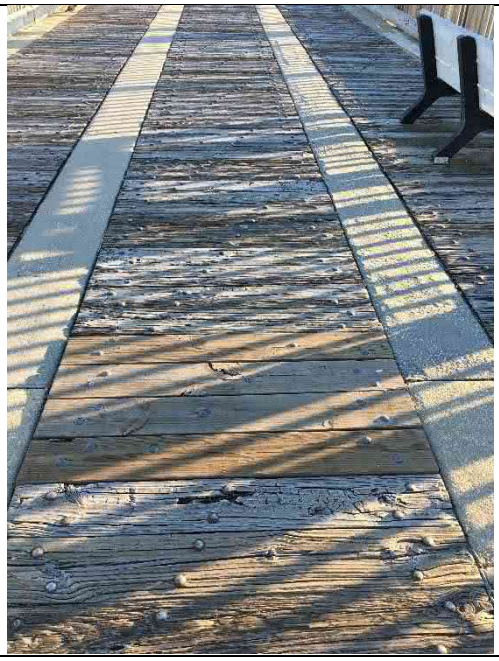
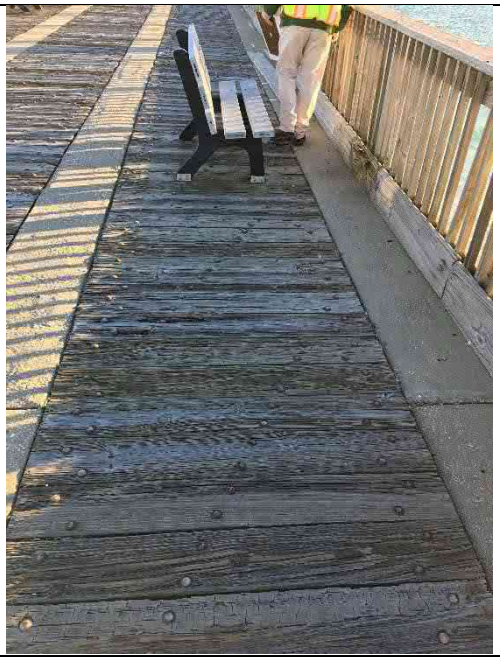
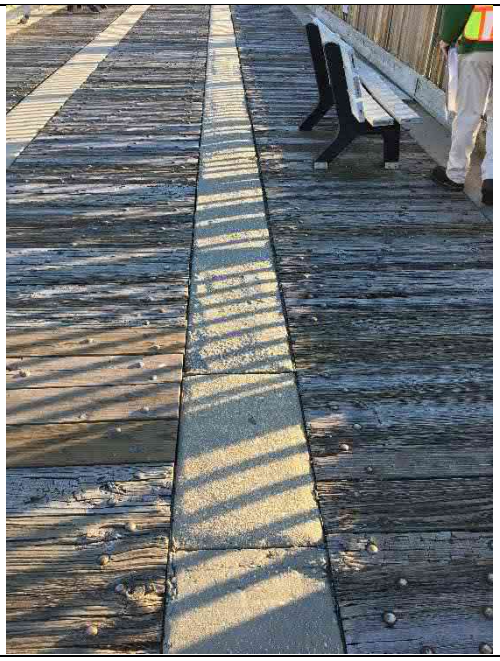


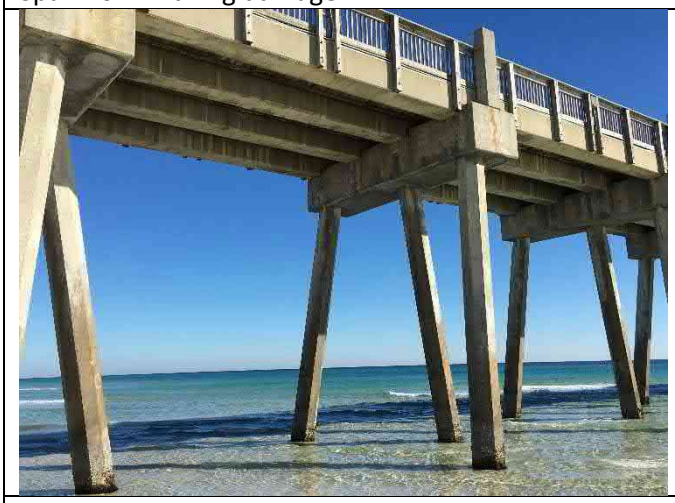
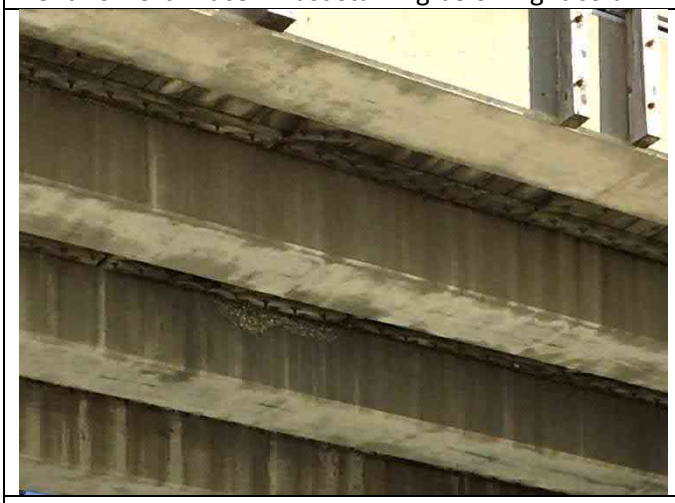
Bent 15 South Face – Beam 15-3 North end cracking and delamination

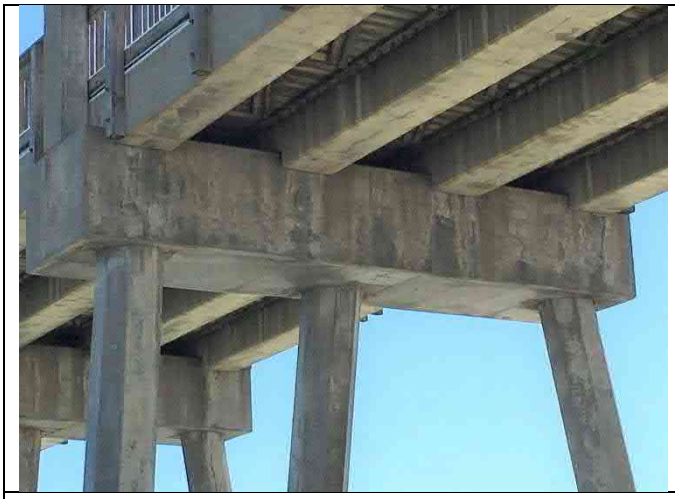
Bent 16E



Span 16E

	
Span 16 Center Deck	Span 16W Deck
	
Bent 16W	Bent 16 Closure pour and Deck

	
Span 16E – Railing damage	Span 16 – Deck damage with dips and gaps > 0.5”
	
Bent 16 North Face – Rust staining below light column	Span 16
	
Beam 16-2 – Top flange spall 30”x8”x3”	Pile 16-2 – Spall 12”x5”x2”

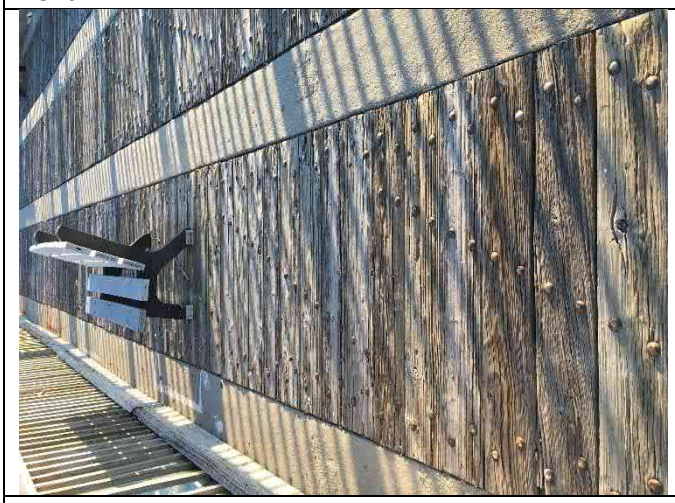


Bent 16 North Face

Bent 16 South Face

Bent 17E

Span 17E



Span 17W

Span 17 Center

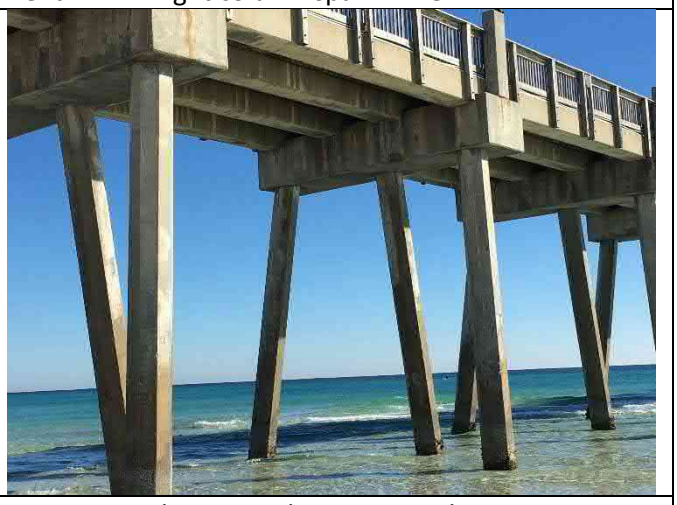
Span 17W

Beam 17-3 – Top flange spalls

Bent 17W

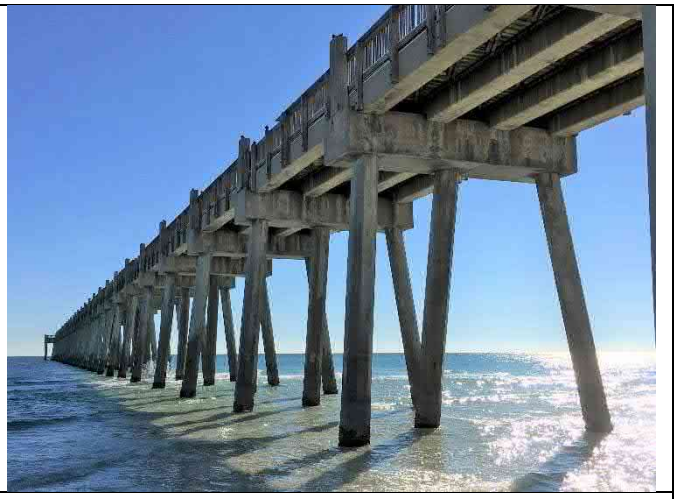
Bent 17W – Light column spall 12”x8”x4”

Span 17W – Railing loose with split wood members



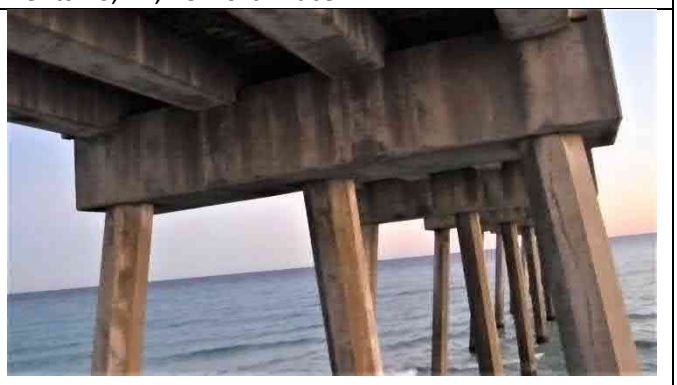
Bent 17 North Face – Pile repairs in place

Span 17 – Beams South



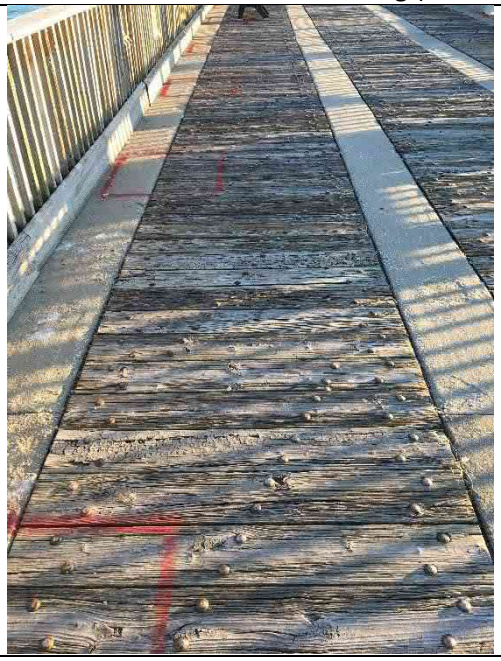
Bents 16, 17, 18 North Face

Bent 17 North Face

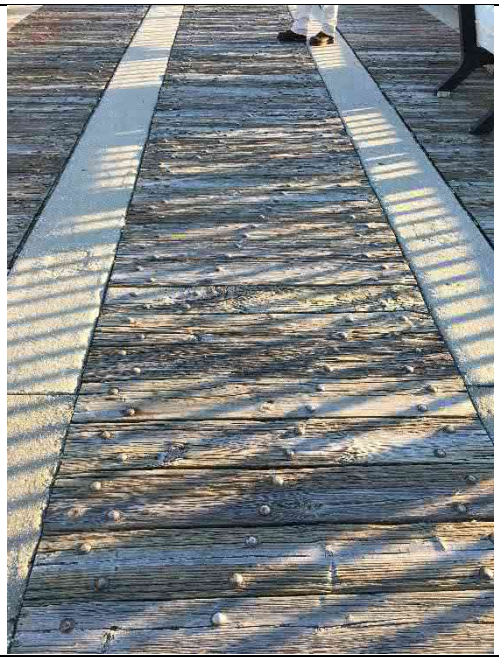
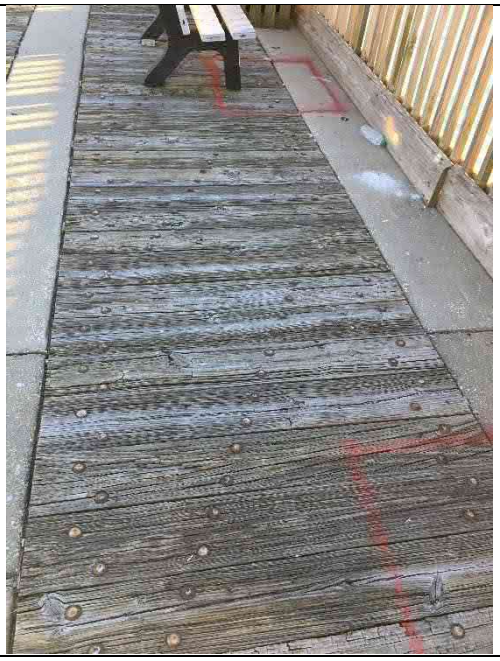
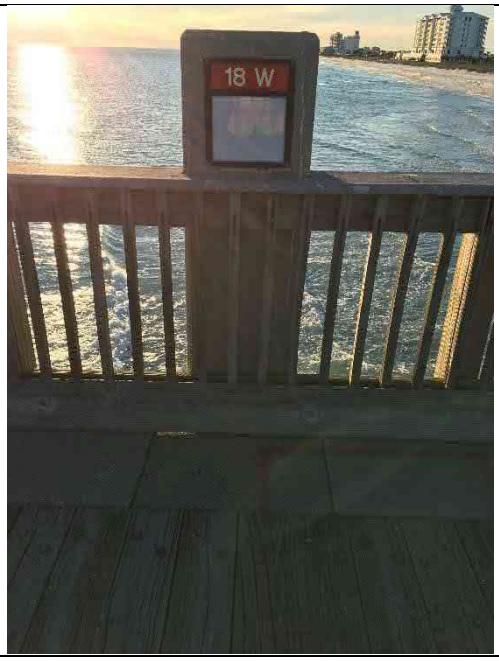
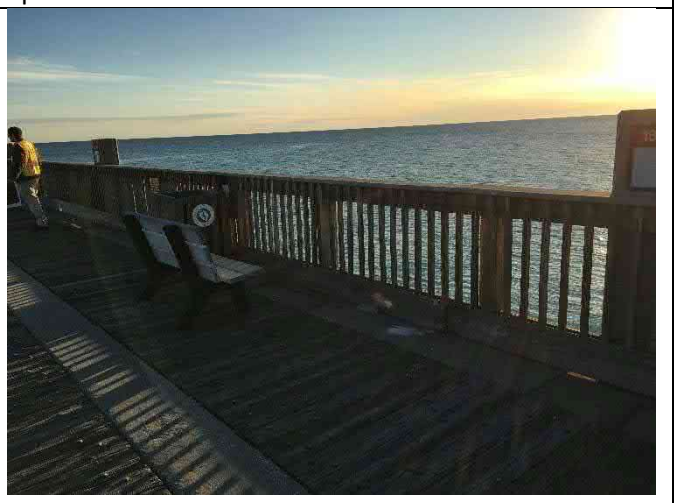


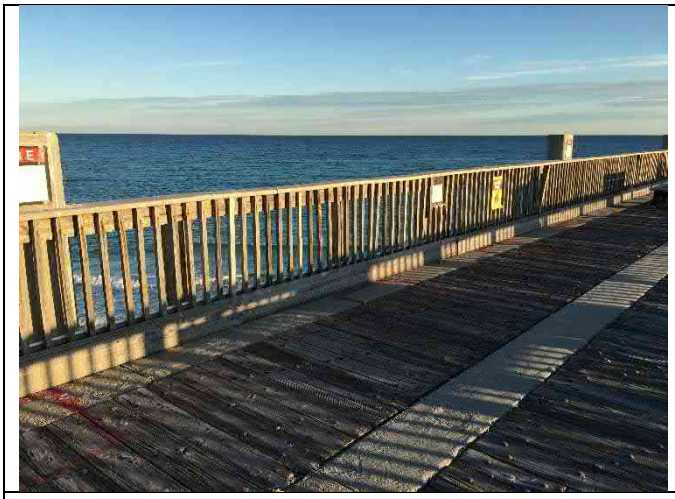
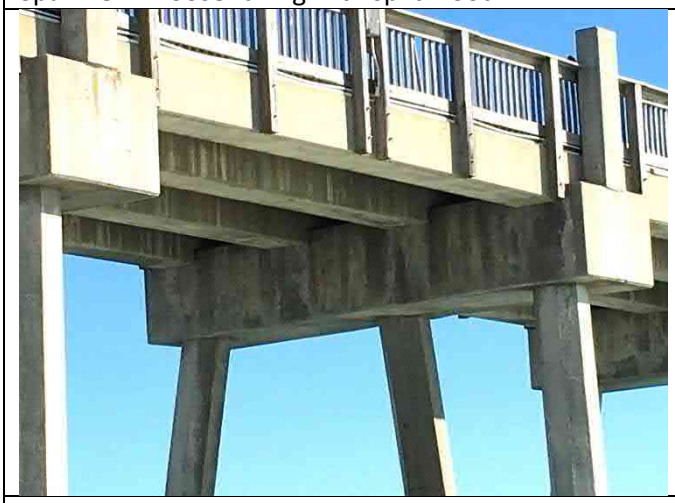
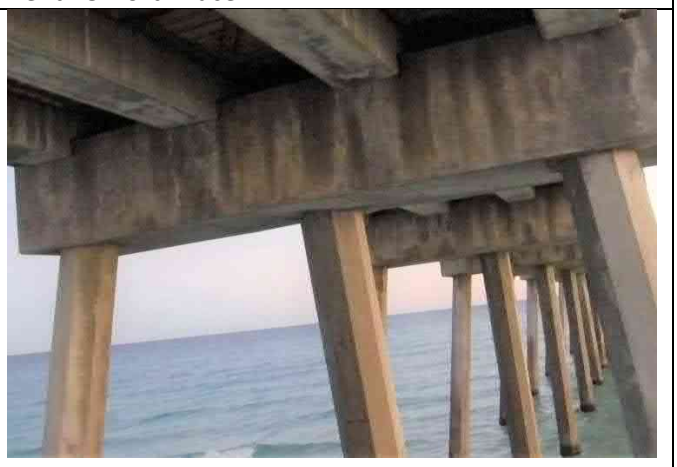
Bent 17 North Face – Beam end cracking (common)

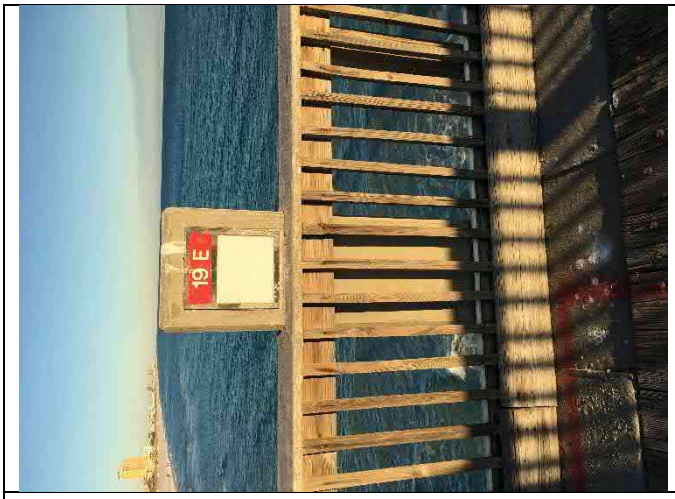
Bent 18E



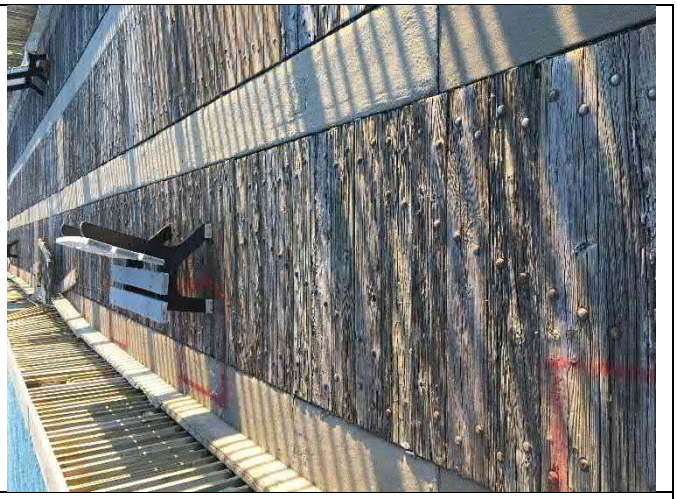
Span 18E

	
Span 18 Center	Span 18W
	
Bent 18W	Span 18W – Railing loose with split wood

	
Span 18E – Loose railing with split wood	Bent 18 North Face
	
Span 18 – Bottom flange end cracking (common)	Beam 17-3 South – End cracking and delamination
	
Bent 18 South Face	Bent 18 South Face



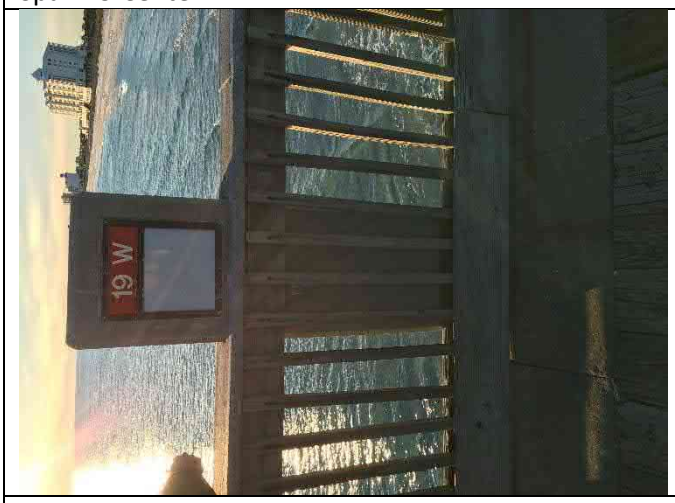
Bent 19E



Span 19E

Span 19 Center

Span 19W



Bent 19W

Span 19E – Railing loose with split wood

Span 19W – Loose rail with split wood members

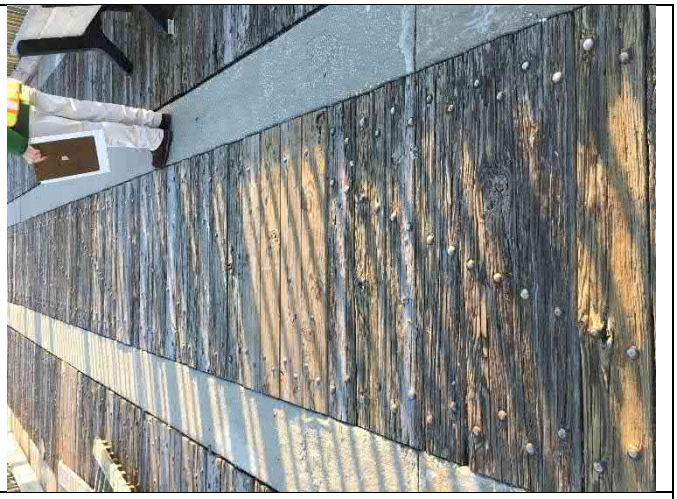
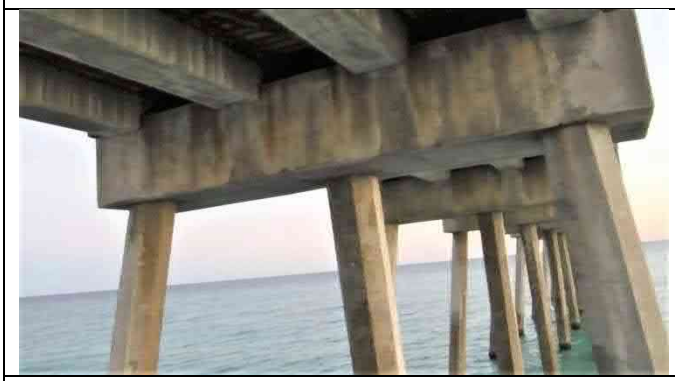
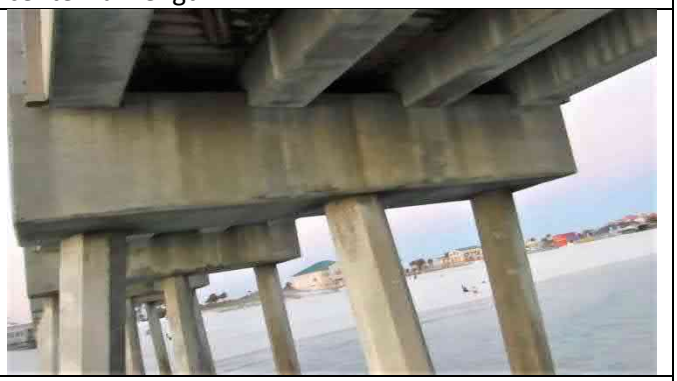
Span 19E – Loose rail with split wood members

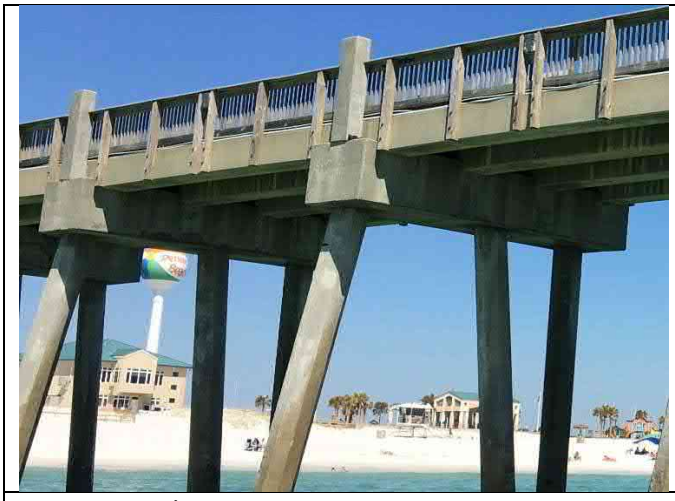
Bent 19 North Face

Piles 19-1 and 19-2 – Spalls 2~5”x5”x2” each

Bent 19 South Face – Beam end cracking (common)

Bent 20E

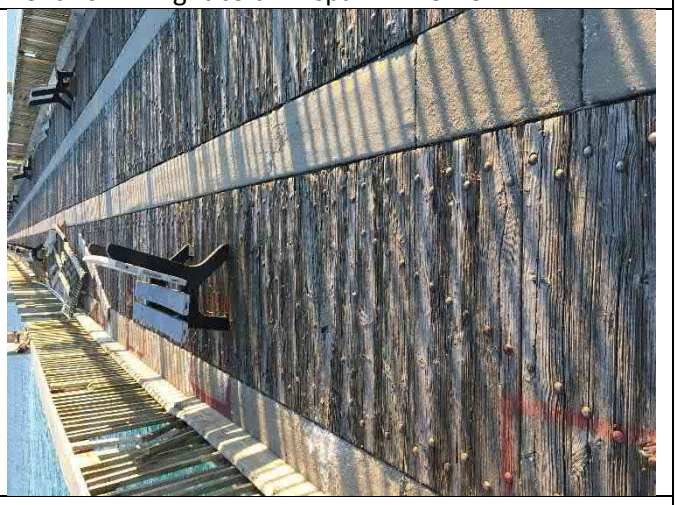
	
Span 20E	Span 20 Center
	
Span 20W	Beam 20-2 and 20-3 – Top flange cracking 12”+/- on center full length
	
Bent 20 North Face	Bent 20 South Face



Bent 20 South Face

Bent 20W – Light column spall 12”x3”x3”

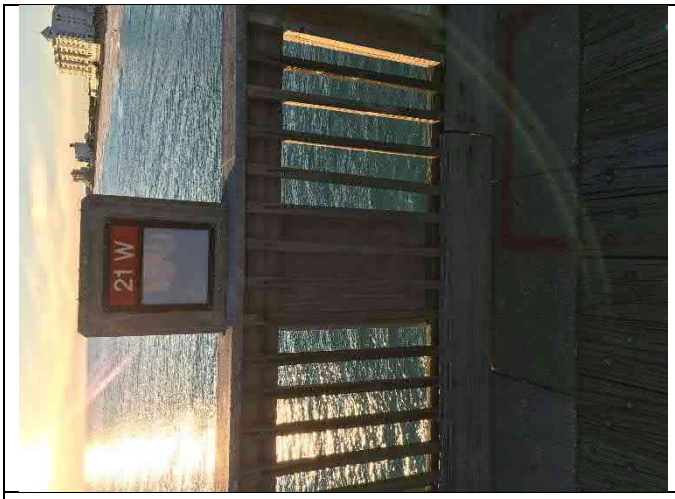
Bent 21E



Span 21E

Span 21 Center

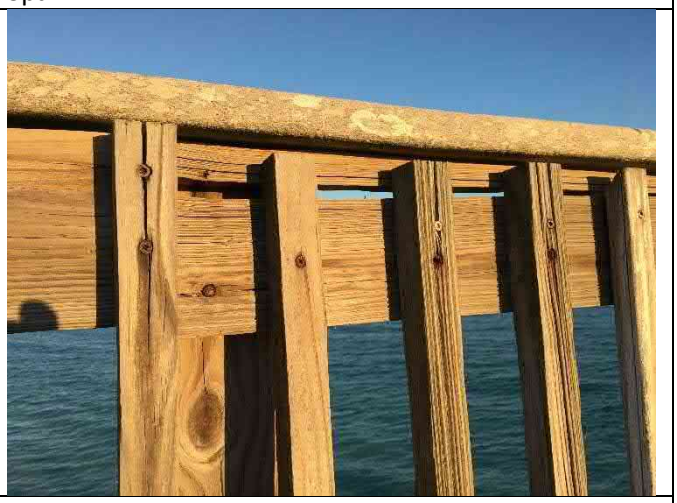
Span 21W



Bent 21W

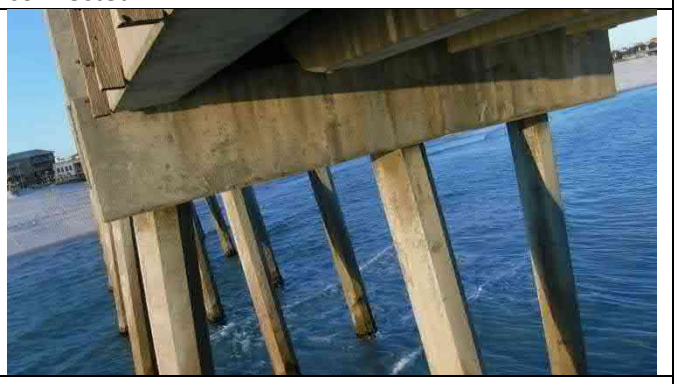
Span 21E

Span 21W

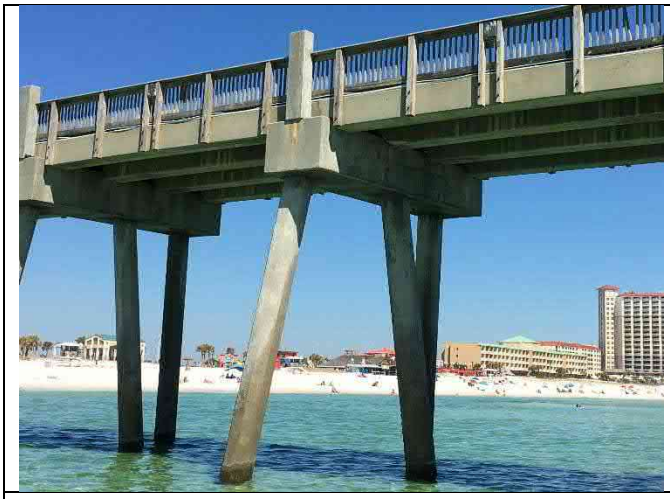


Span 21E – Typical railing split wood for section still connected

Bent 21 North Face – Beam end cracking

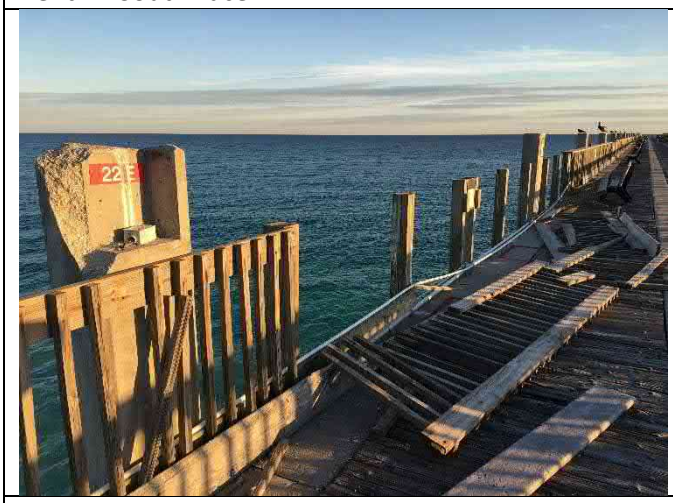


Bent 21 South Face – Beam 21-3 North end cracking and spall 24”x24”x4”

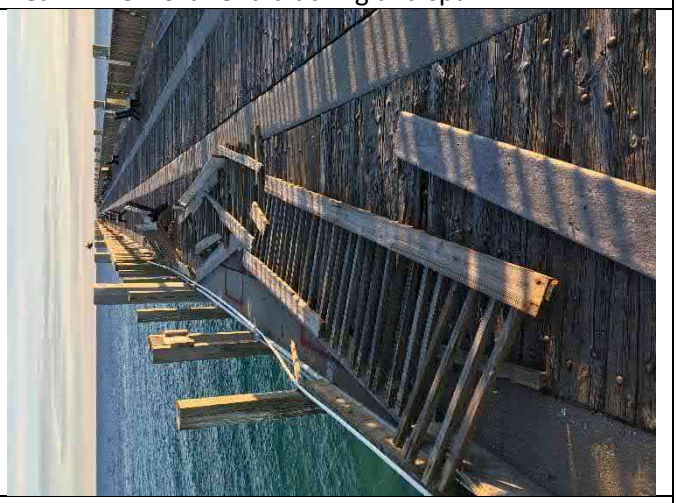


Bent 21 South Face

Beam 21-3 North end cracking and spall 24”x24”x4”



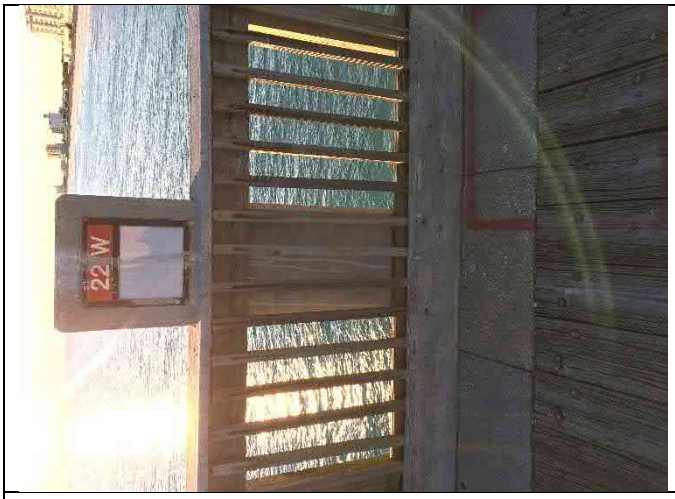
Bent 22E – Damaged light column (existing pre-storm)



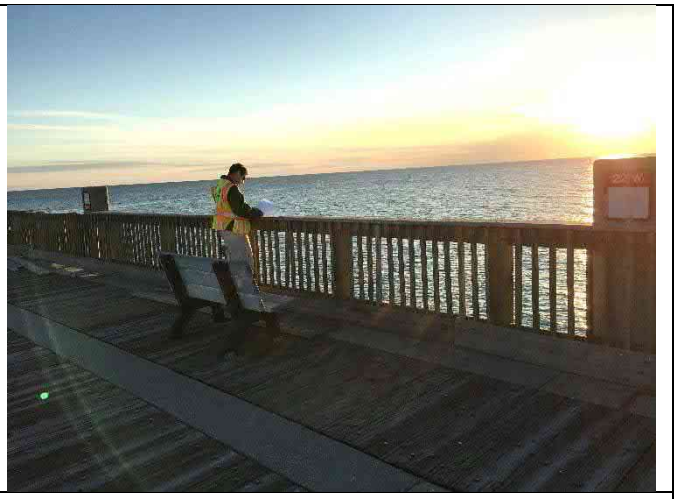
Span 22E

Span 22 Center

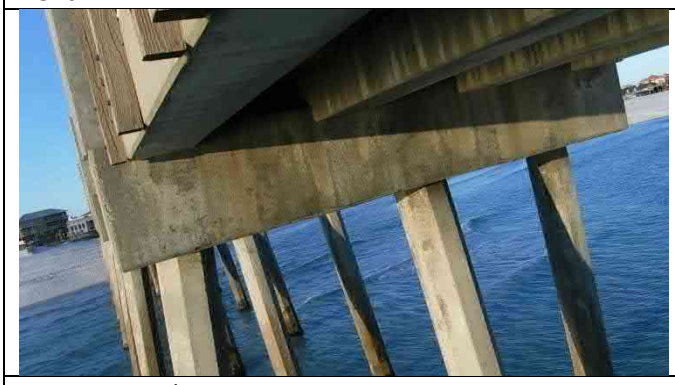
Span 22W



Bent 22W



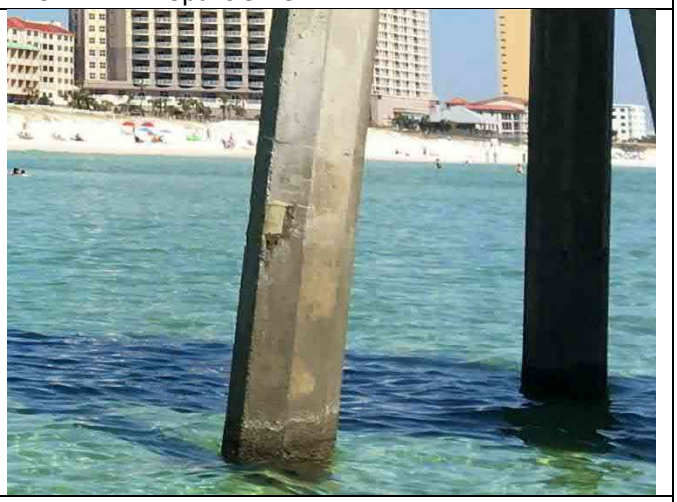
Span 22W



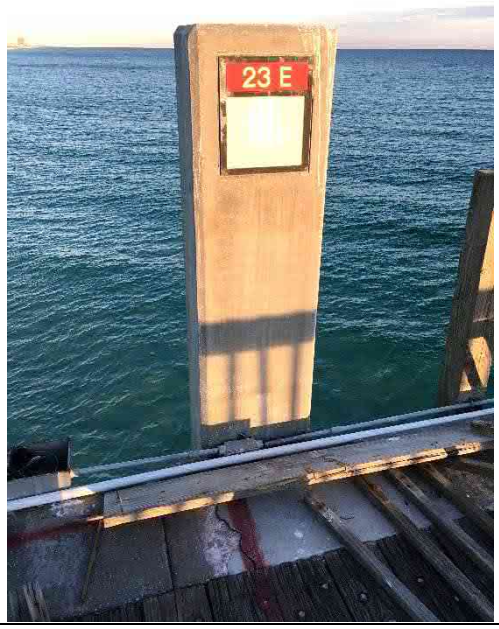
Bent 22 South Face

Pile 22-1 – 2~Spalls 5”x5”x2”

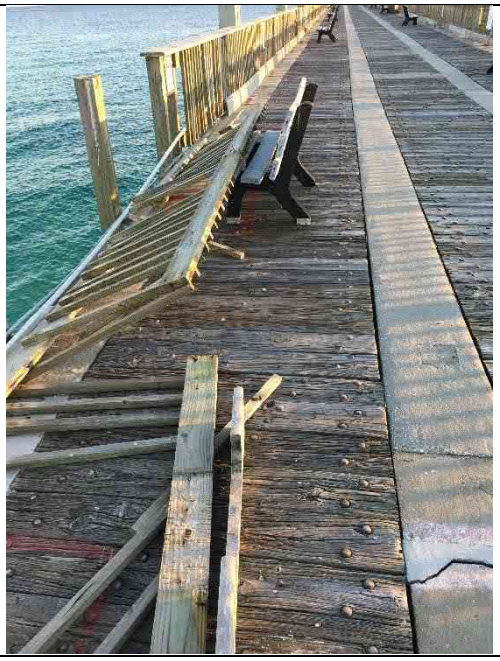
Bent 22W, Span 21W



Pile 22-3 – Repaired spall



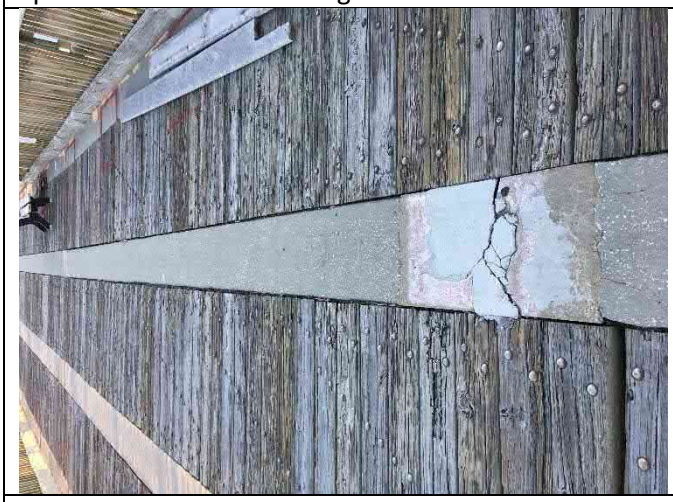
Bent 23W – Missing railing, closure cracking and spalls, utility damage, beam spalls



Span 23E – Railing damage, closure cracking

Span 23E – Closure cracking

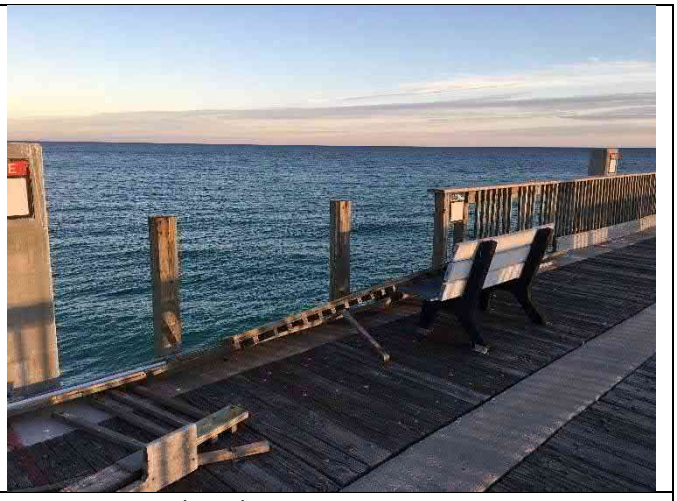
Span 23 Center



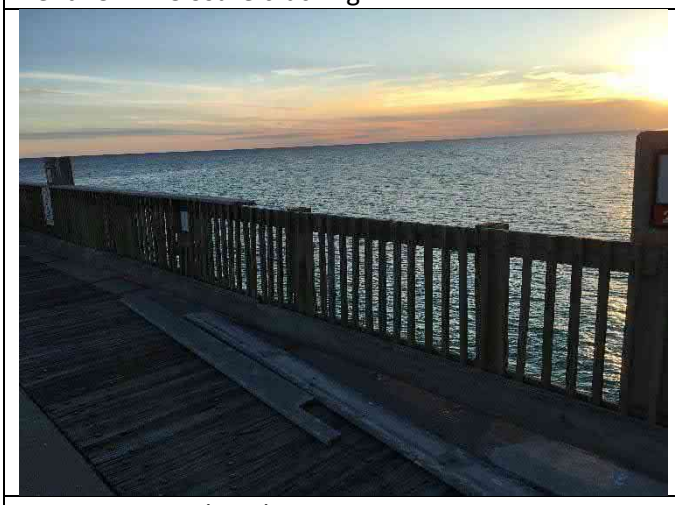
Span 23W – Closure cracking

Span 23W

Bent 23W – Closure cracking



Span 23E – Railing damage



Span 23W – Railing damage

Bent 23W – Closure cracking

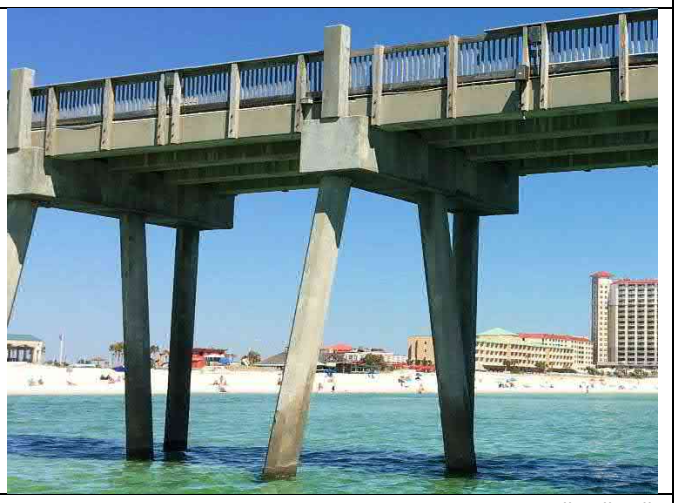
Bent 23W – Light column spall 14”x6”x4”

Beam 22-1 South – Spall 16”x16”x6”, closure spall 16”x12”x6”

Bent 23E – Beam 22-1 end spall, closure pour cracking and spall

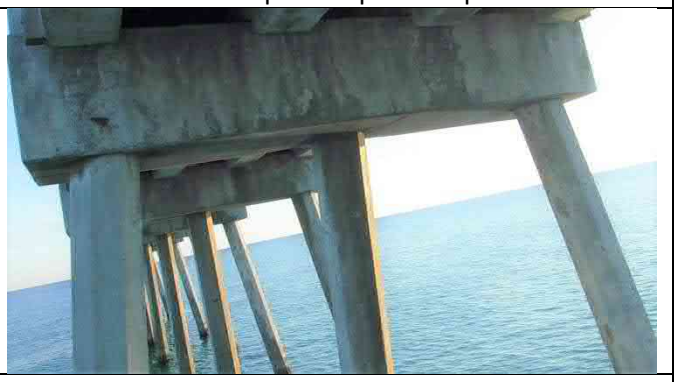
Bent 23E – Closure cracking

Bent 23E, Spans 22 and 23



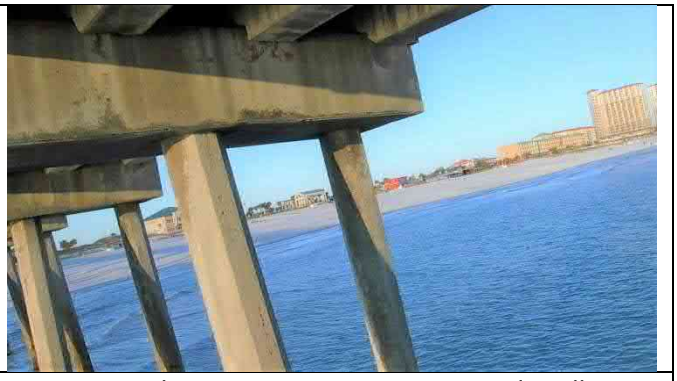
Bent 23W – Pile 23-3 partial spall at repair 4~6”x6”x1”

Bent 23 – Piles 23-2 and 23-3 spalls 2x4~5”x5”x1”



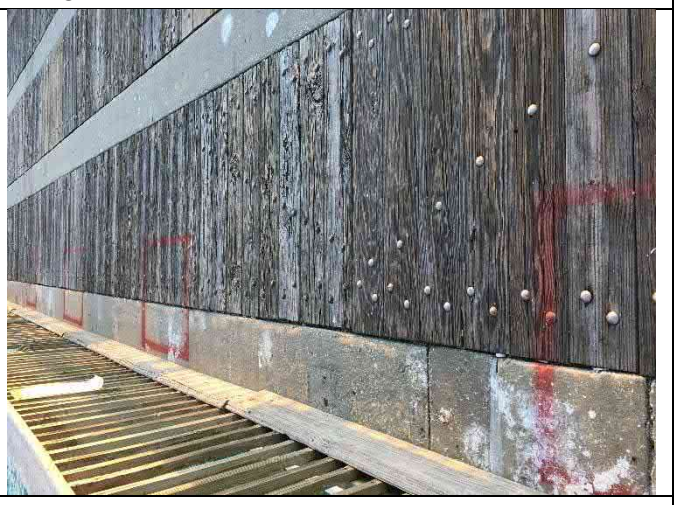
Bent 23 North Face – Pile cap spall 6”x3”x2”, beam end cracking

Bent 23W – Electrical damage

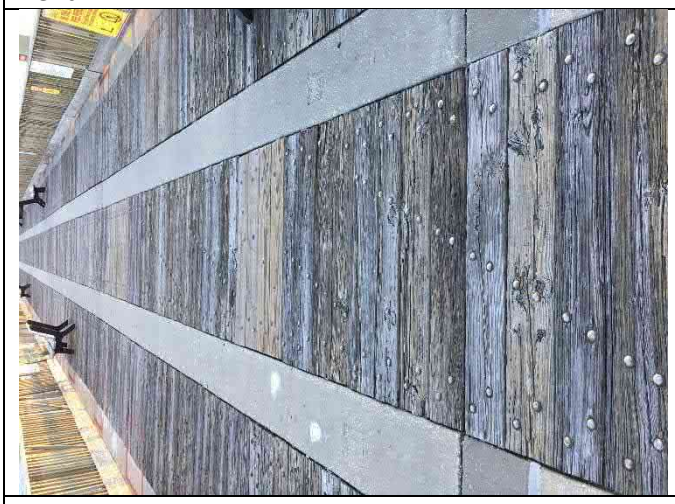


Bent 23 South Face – Beams 23-1, 23-3 end spalls 24”x3”x2”

Bent 24E



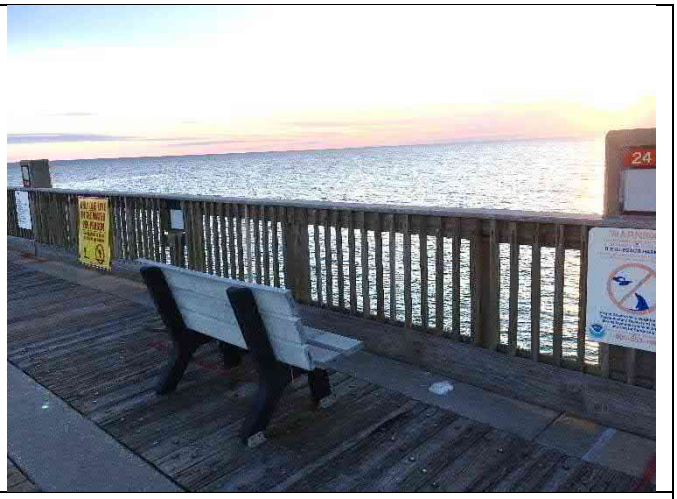
Span 24E



Span 24 Center

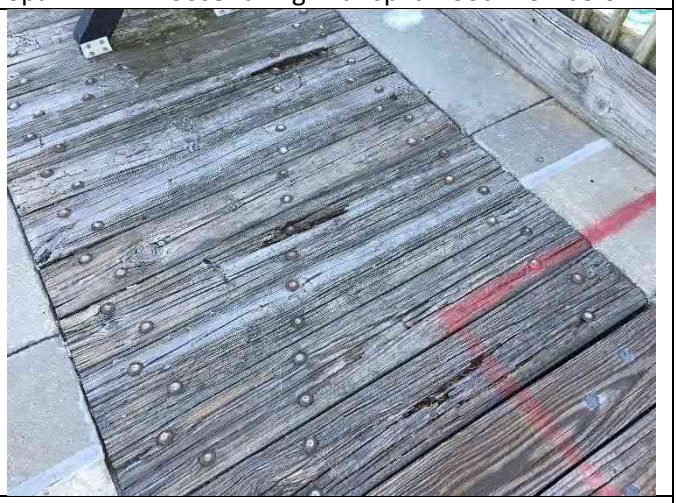
Span 24W

Bent 24W



Span 24W – Loose railing with split wood members

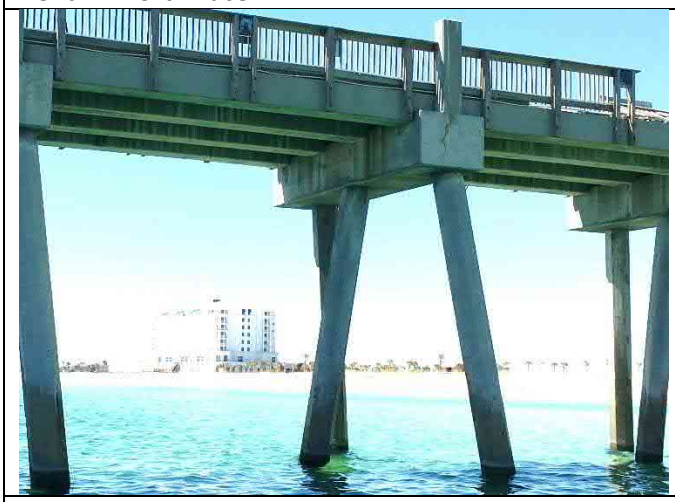
Span 24 – Deck damage



Span 24 – Deck damage

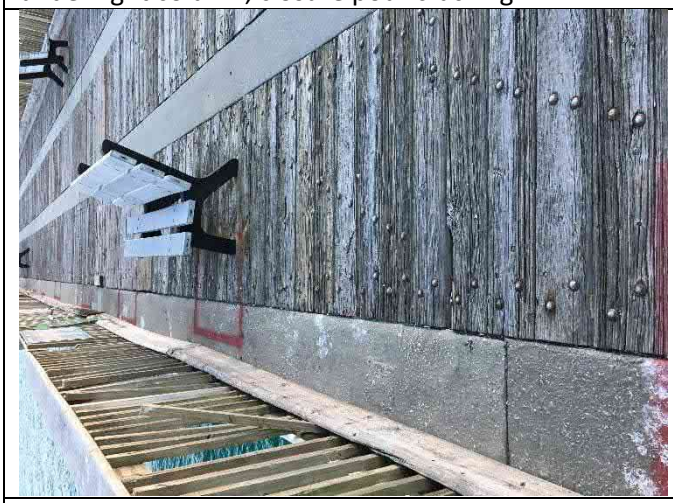
Span 24 – Deck decay

Bent 24 North Face

	
Bent 24W	Pile 24-3 – Pile repair partially damaged 4~5”x5”x1”
	
Bent 24 North Face	Bent 24 South Face
	
Bent 24E	Bent 24W – Pile 24-3 repair partial damage 4~5”x5”x1”

Bent 24W – Span 24 beams shifted north, rust staining under light column, closure pour cracking

Bent 25E

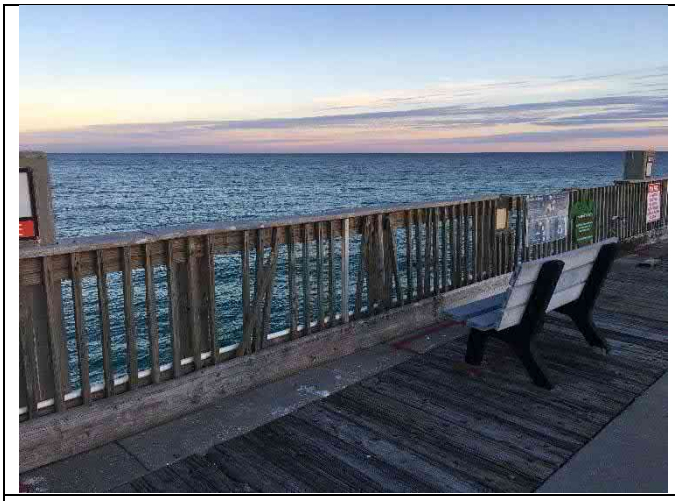


Span 25E

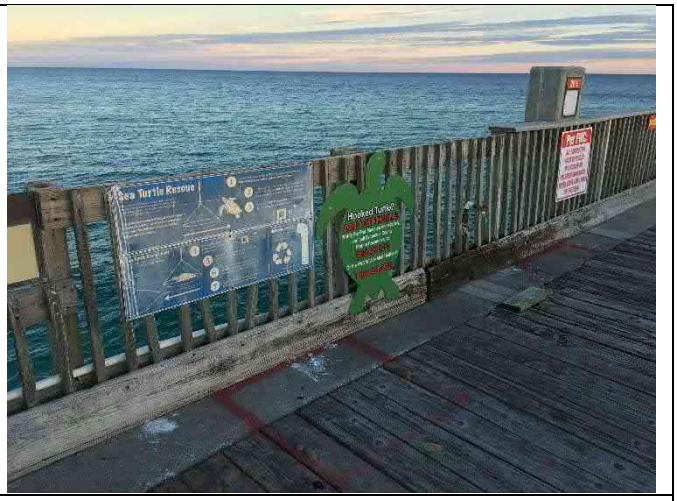
Span 25 Center – Deck damage > 0.5”

Span 25W

Bent 25W



Span 25E – Railing damage

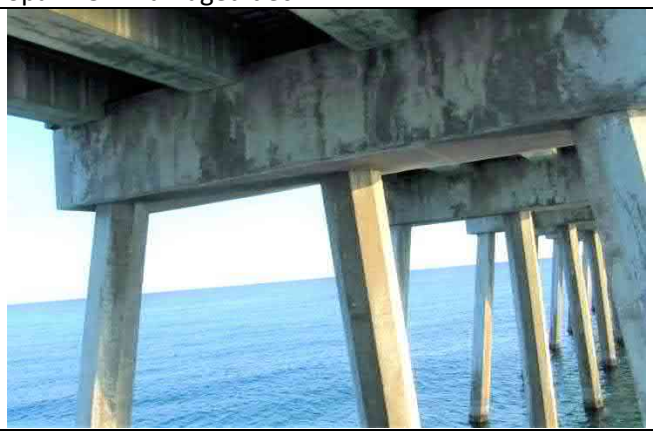


Span 25E – Signs and water, railing damage

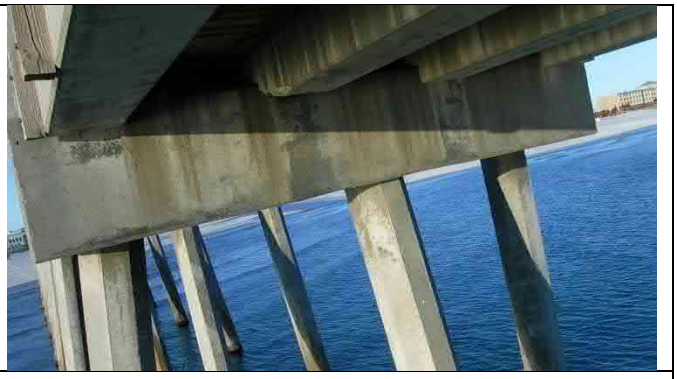
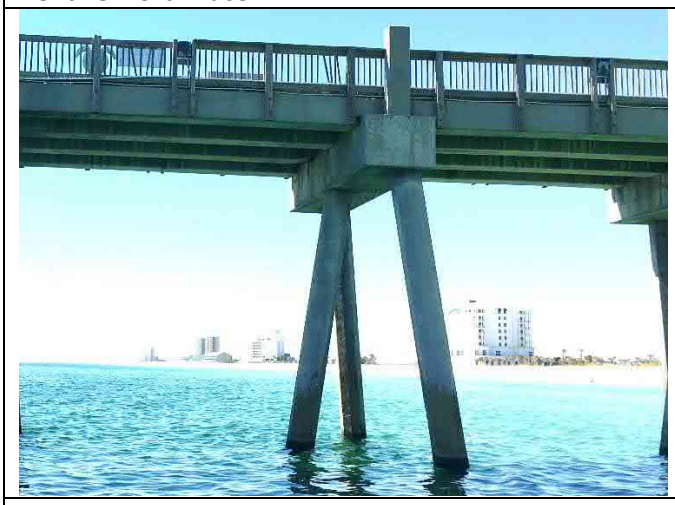
Span 25W – Loose railing with split wood members

Span 25 – Damaged deck

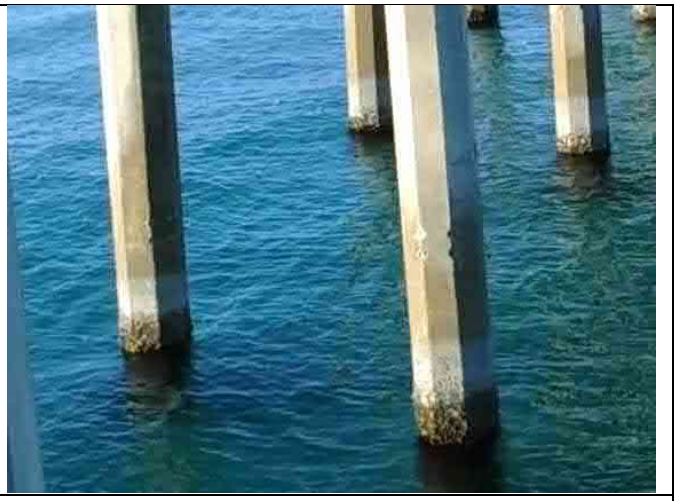
Span 25 – Damaged deck



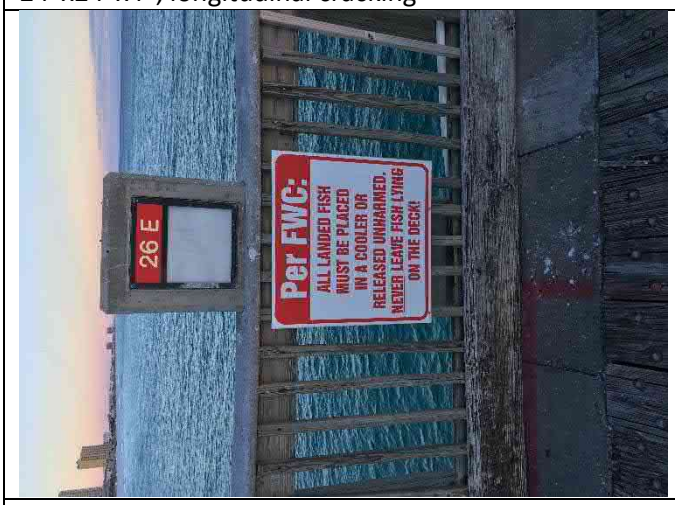
Bent 25 North Face

	
Bent 25 North Face	Bent 25 South Face
	
Bent 25E – Previous pile spall repairs partially damaged 12~3”x3”x1”	Bent 25 North Face
	
Bent 25 South Face – Span 25 beams shifted north, Beam 25-3 top flange spalls 36”x2”x1”	Beam 25-3 North – End cracking, delamination and spall 24”x24”x4”

Beam 25-3 North – Cracking, delamination and spall 24”x24”x4”, longitudinal cracking



Bent 25 – Pile spall repair damage

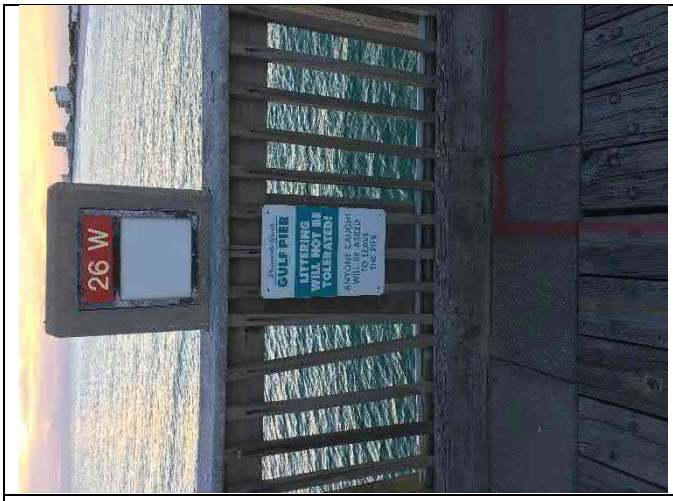


Bent 26E

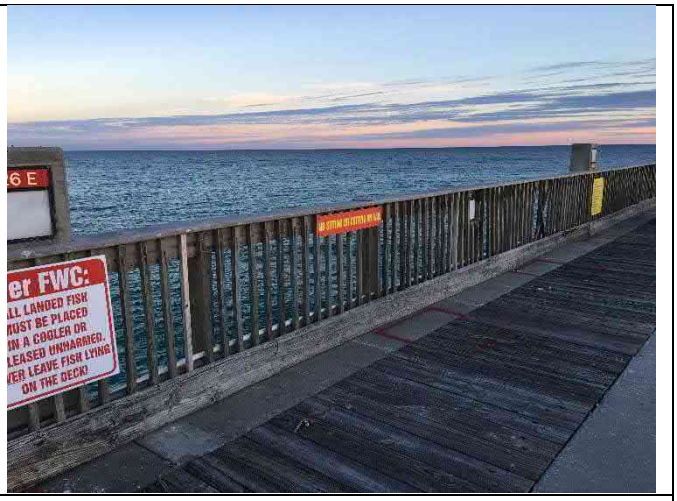
Span 26E

Span 26 Center

Span 26W



Bent 26W



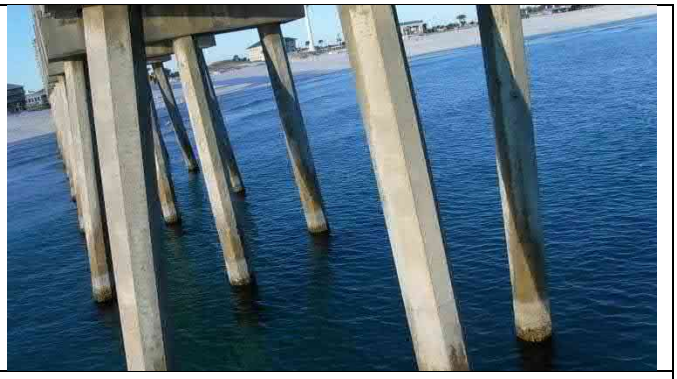
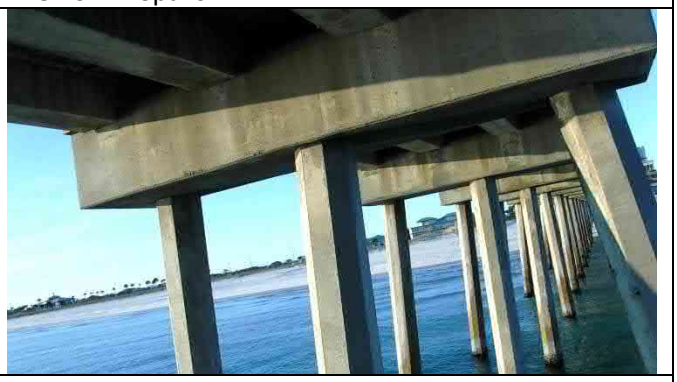
Span 26E – Railing loosed with split wood members

Span 26W – Railing loose with split wood members

Span 26 – Damaged deck with gaps and dips > 0.5”

Span 26 – Damaged deck with gaps and dips > 0.5”

Span 26 – Damaged deck with gaps and dips > 0.5”

	
Bent 26 North Face	Pile 26-1 – Spalls 4~4”x4”x1”
	
Bent 26 South Face – Pile 26-1 spalls, waterline damage	Bent 26 South Face
	
Pile 26-2 and 26-3 – Spalls 2x4~4”x4”x1”	Bent 26E

Bent 26W

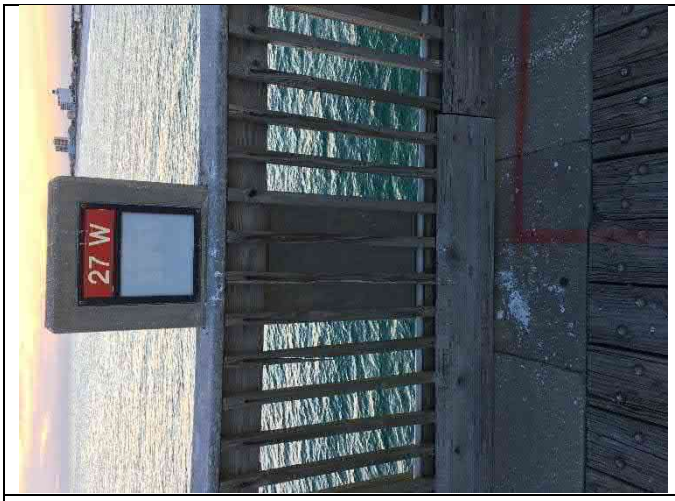
Beam 26-2 North – Spall 24”x20”x3”

Bent 27E

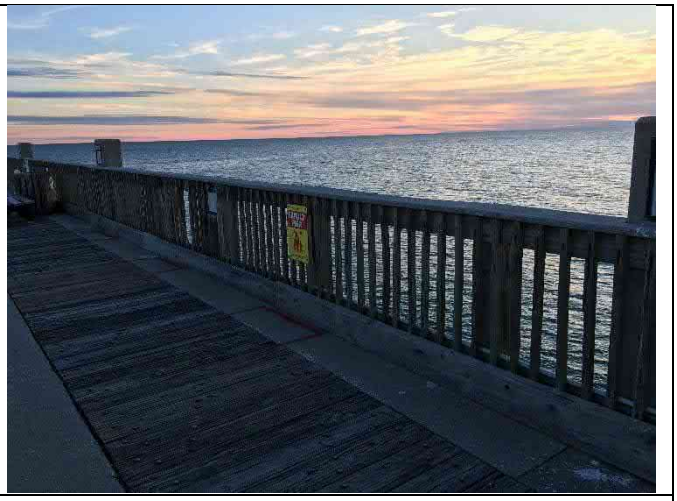
Span 27E

Span 27 Center

Span 27W



Bent 27W



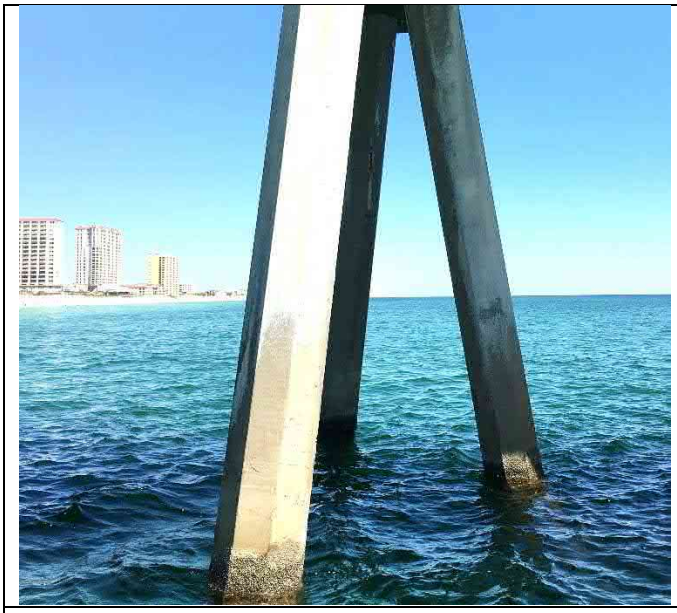
Span 27W – Railing loose with split wood members

Span 27E – Railing loose with split wood members

Bent 27 North Face

Bent 27E – Spall repairs damaged all piles 3x4~4”x4”x1”

Pile 27-1 – Spall 12”x5”x2”



Bent 27W - Spall repairs damaged 3x4~4”x4”x1”, Pile 27-1 spall 12”x5”x2”

Bent 27 North Face, Span 26

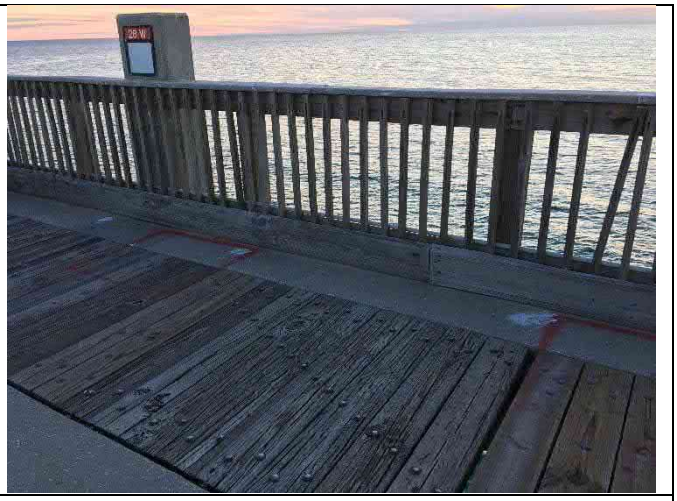
Bent 28E

Span 28E

Span 28 Center

Span 28W

Bent 28W

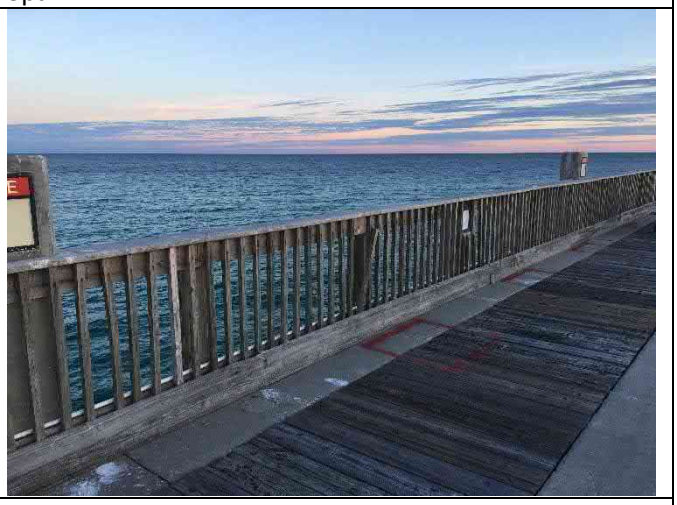


Span 27W – Railing damage and large deck gap

Span 27W

Span 27W

Span 28W – Railing loose with split wood members

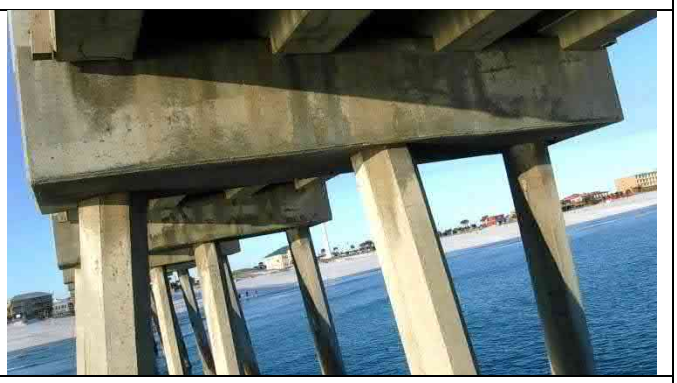


Span 28E – Railing loose with split wood members

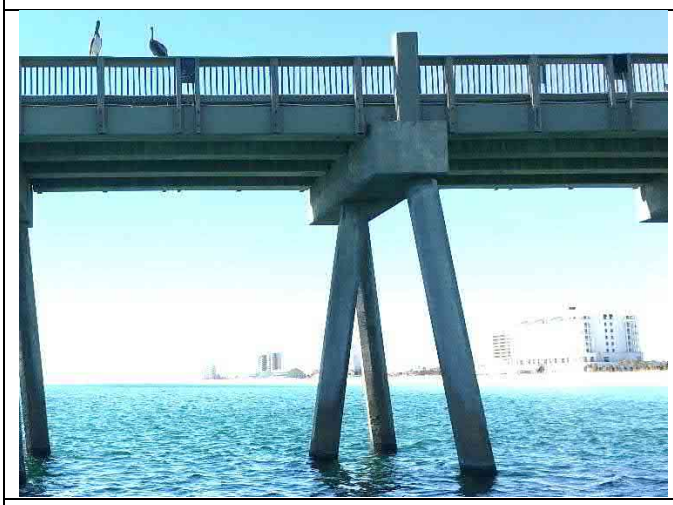
Span 28W at Bent 29W – Fishing line receptacle damage

Span 28 – Timber deck deterioration

Bent 28 North Face

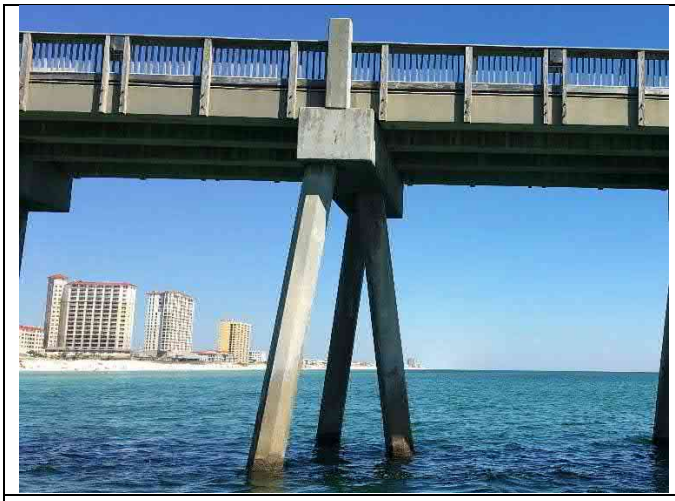


Bent 28 South Face – Beam 28-4 North end cracking, delamination and spall 24”x6”x4”, Pile 28-1 top spall 10”x4”x1”

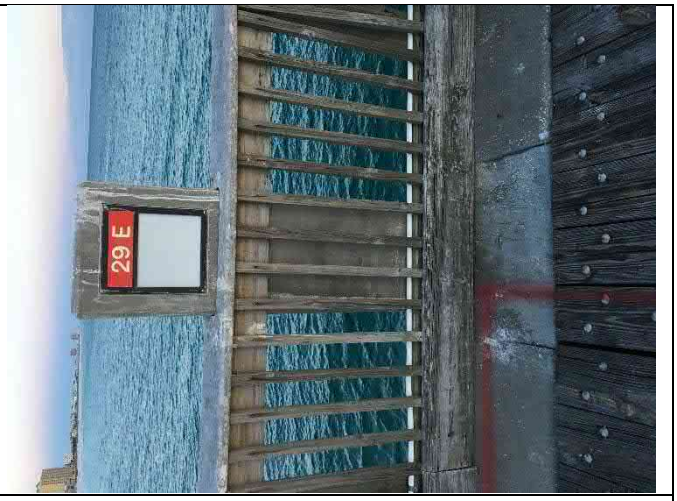


Bent 28E – Piles 28-1, 28-2, 28-3 previous spall repair damage 3x4~5”x5”x2”

Pile 28-3 – Spall repair damage 4~5”x5”x2”



Bent 28W -Beams shifted north

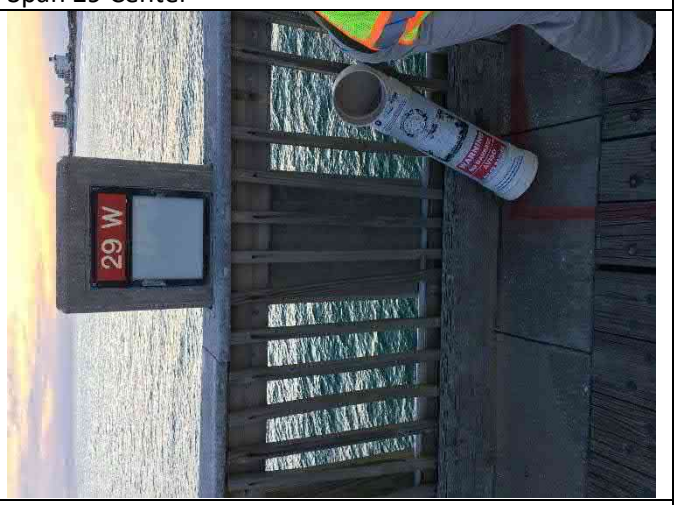


Bent 29E

Span 29E

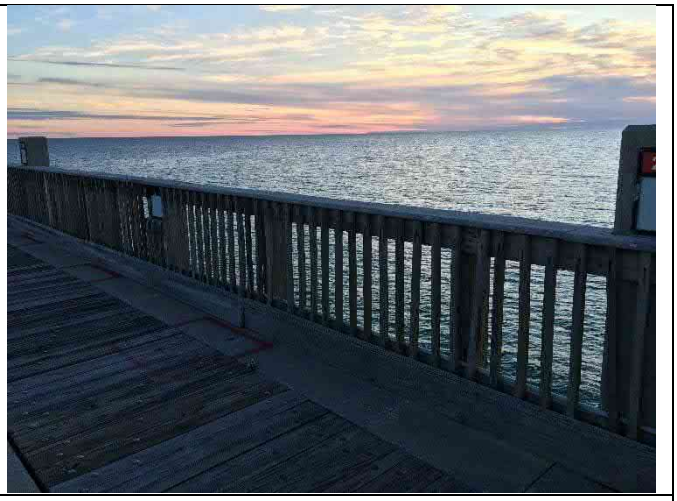
Span 29 Center

Span 29W



Bent 29W

Span 29E – Railing loose with split wood members

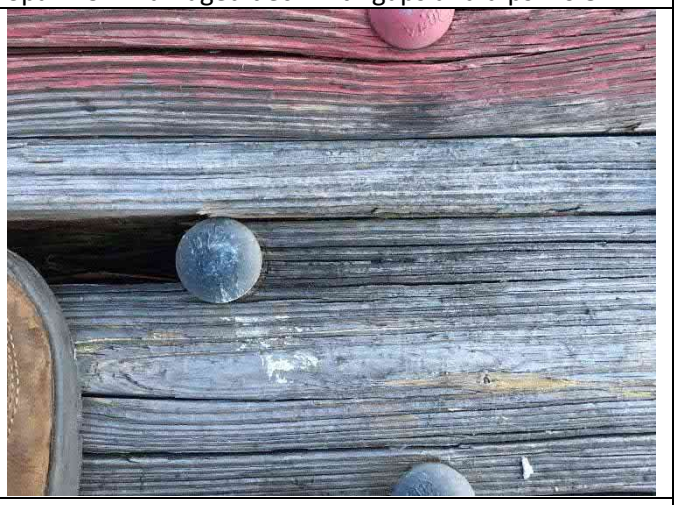


Span 29W – Railing loosed with split wood members

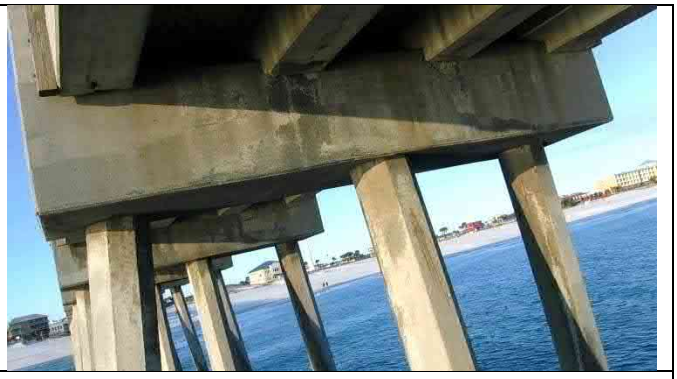
Span 29 – Damaged deck with gaps and dips > 0.5”

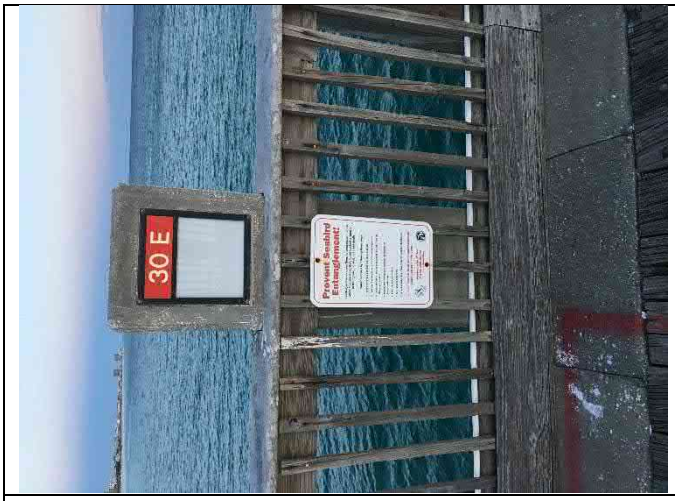
Span 29 – Damaged deck with gaps and dips > 0.5”

Span 29 – Damaged deck with gaps and dips > 0.5”



Span 29 – Damaged deck with gaps and dips > 0.5”

	
Bent 29 North Face	Bent 29 South Face – Beam end cracking, delamination and spalls Beam 29-3 and 29-4 2x24”x12”x4”
	
Bent 29E – Pile spall repair damage 3x4~4”x4”x1”	Bent 29W – Beams shifted north
	
Bent 29 South Face	Bent 29 – Beam 29-3 and 29-4 damage



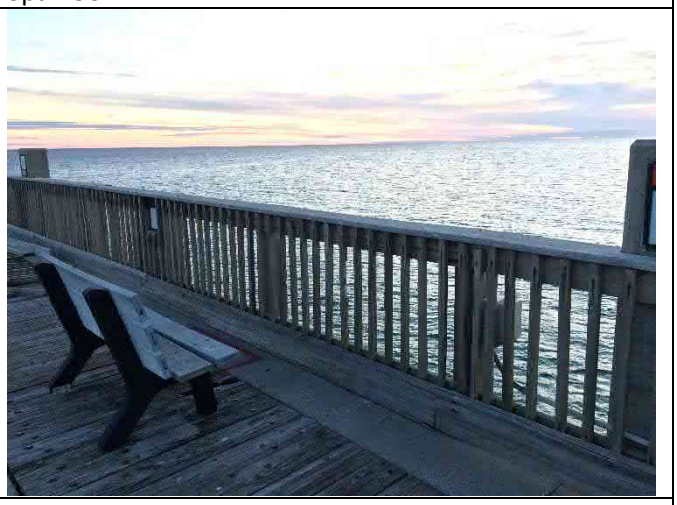
Bent 30E

Span 30E

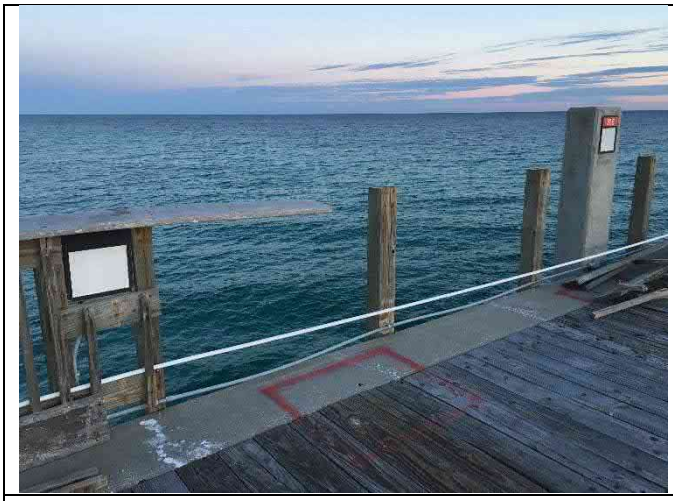
Span 30 Center

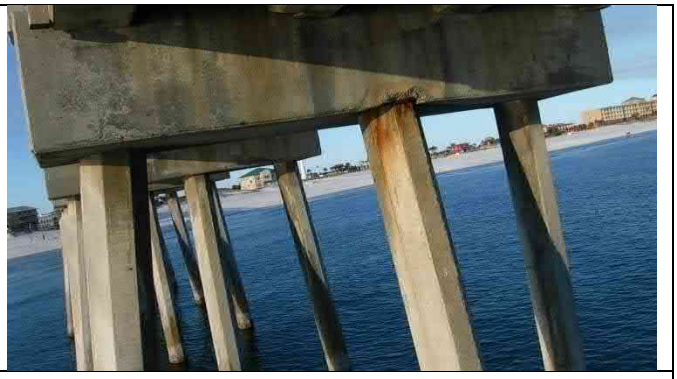
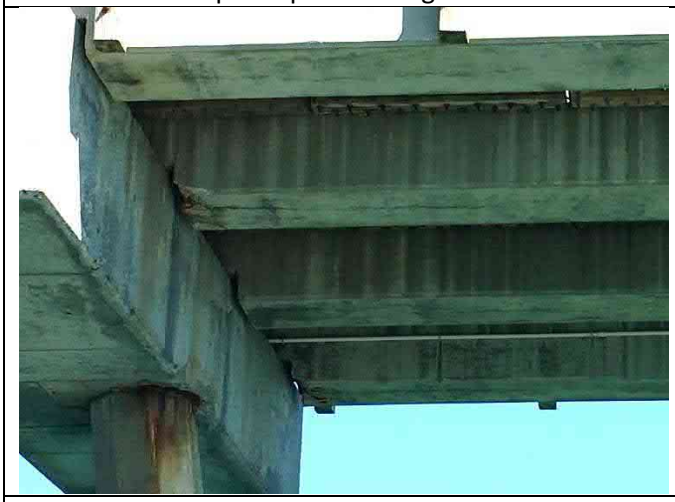
Span 30W

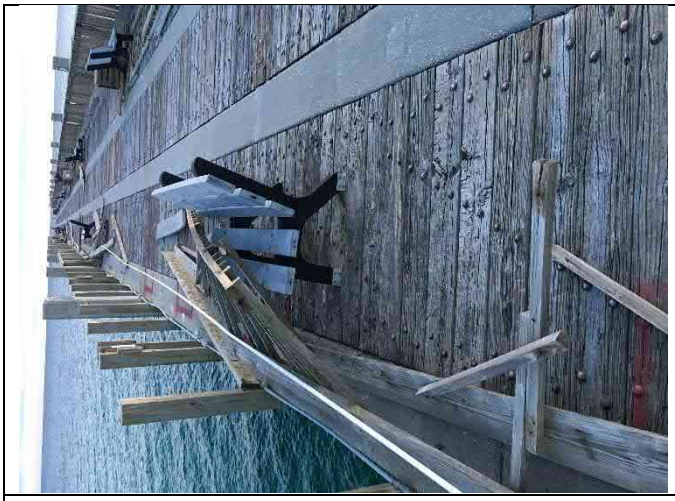
Bent 30W



Span 30W – Railing loose with split wood members

	
Span 30E – Railing destroyed	Span 30 – Damaged deck with gaps and dips > 0.5”
	
Span 30 – Damaged deck with gaps and dips > 0.5”	Span 30 – Damaged deck with gaps and dips > 0.5”
	
Span 30 – Damaged deck with gaps and dips > 0.5”	Span 30 – Damaged deck with gaps and dips > 0.5”

	
Bent 30 North Face	Bent 30 South Face – Beam 30-1 and 30-3 end cracking, delamination and spalls 24”x12”x4”, Pile cap spall over Pile 30-2 24”x8”x3” with rust stains, Pile 30-1 top spall 8”x6”x1”
	
Bent 30E – Pile spall repairs damaged 3x4~5”x5”x2”	Bent 30W
	
Bent 30 – Beams 30-1, 30-3 north end cracking, delamination and spalls 24”x12”x4”, pile cap spall over Pile 30-2	Bent 31E

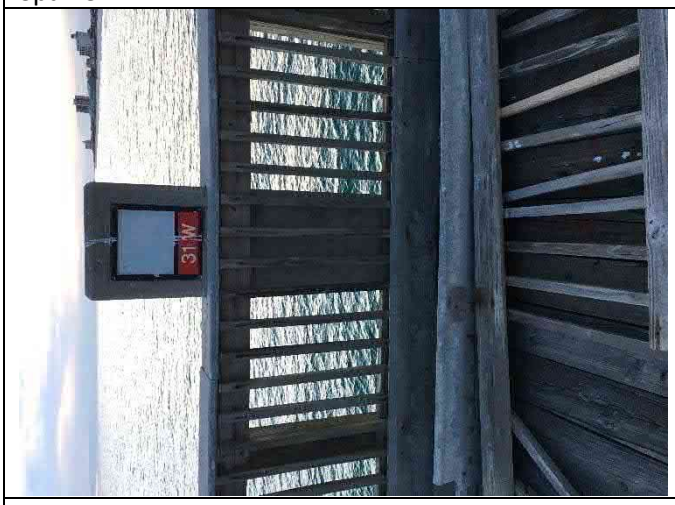


Span 31E

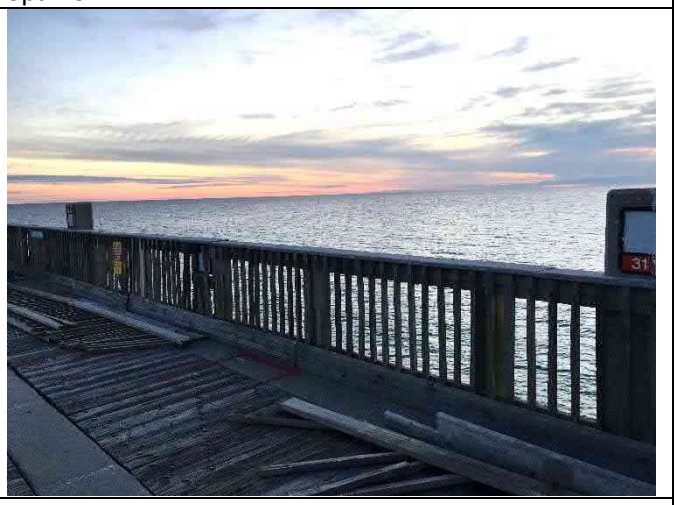
Span 31E

Span 31W

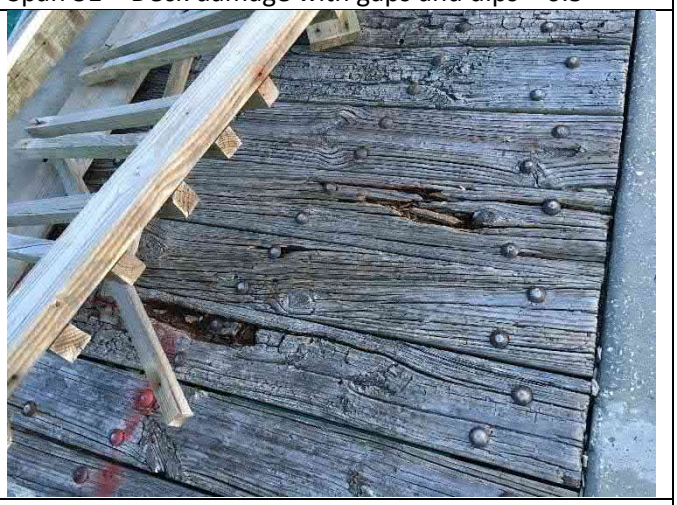
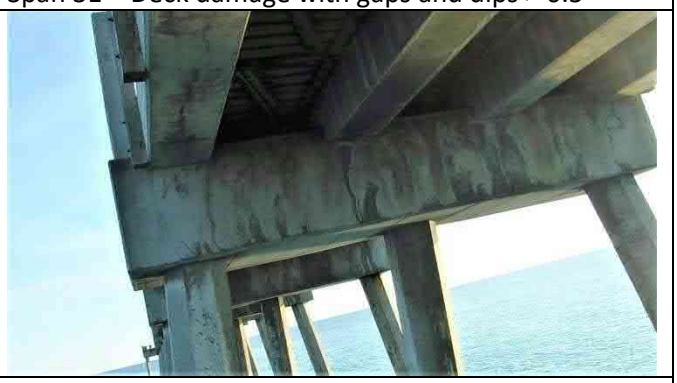
Span 31W

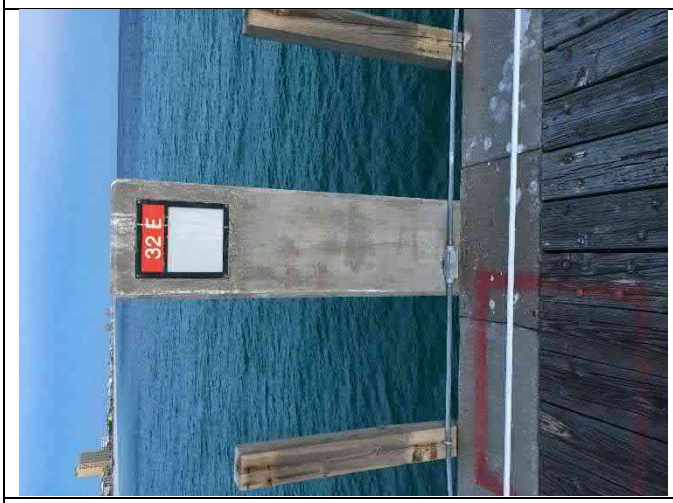


Bent 31W



Span 31W – Railing loose with split wood members

	
Span 31E – Railing destroyed	Span 31 – Deck damage with gaps and dips > 0.5”
	
Span 31 – Deck damage with gaps and dips > 0.5”	Span 31 – Deck damage with gaps and dips > 0.5”
	
Span 31 – Deck damage with gaps and dips > 0.5”	Bent 31 North Face

	
Bent 31 South Face	Bent 31 South Face
	
Bent 31E – Pile spall repairs damaged 3x4~4”x4”x1”	Bent 31W North Face – Pile cap spalls 2~4”x4”x2”, minor rust stain under light column
	
Bent 32E	Span 32E

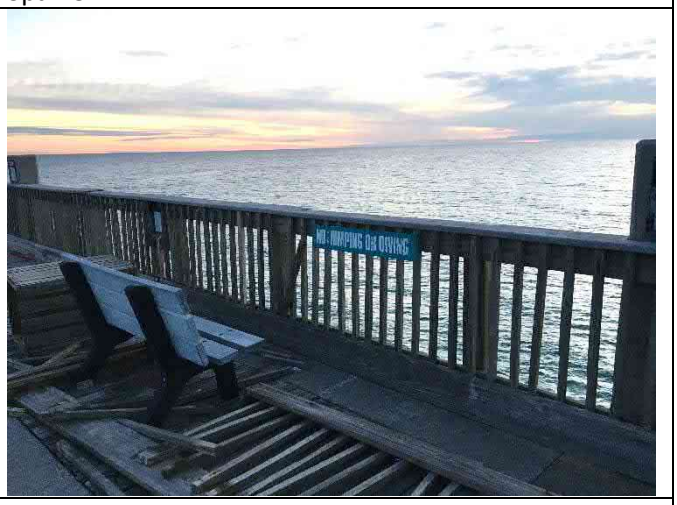
Span 32E

Span 32 Center

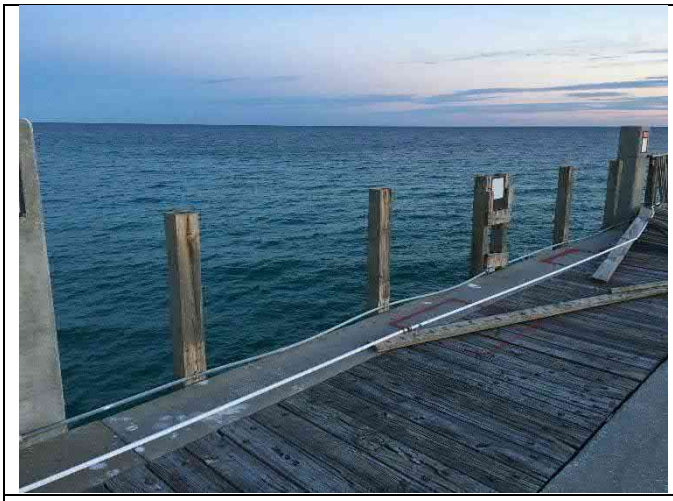
Span 32W

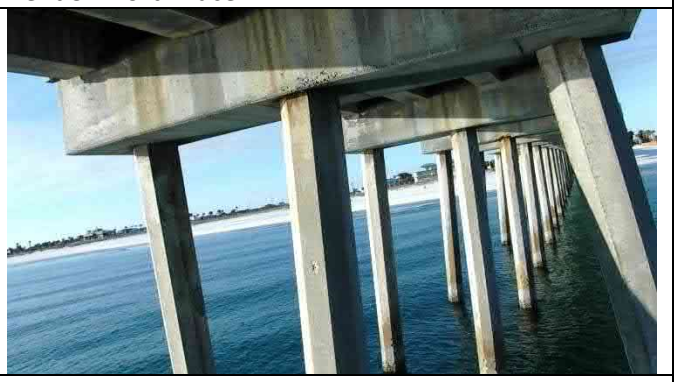
Span 32W

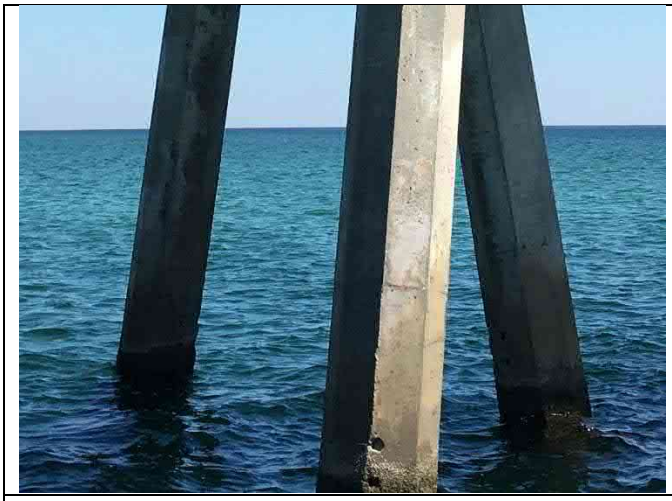
Bent 32W



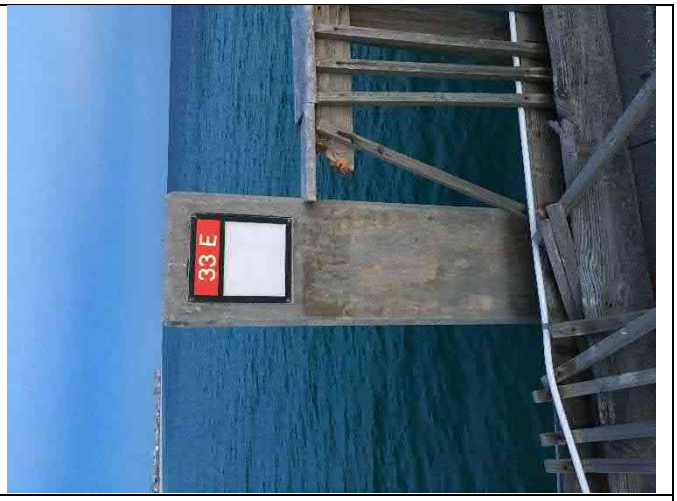
Span 32W – Railing loose with split wood members

	
Span 32E – Railing destroyed	Span 32 – Decking damaged with gaps and dips >0.5”
	
Span 32 – Decking damaged with gaps and dips >0.5”	Span 32 – Decking damaged with gaps and dips >0.5”
	
Span 32 – Decking damaged with gaps and dips >0.5”	Span 32 – Decking damaged with gaps and dips >0.5”

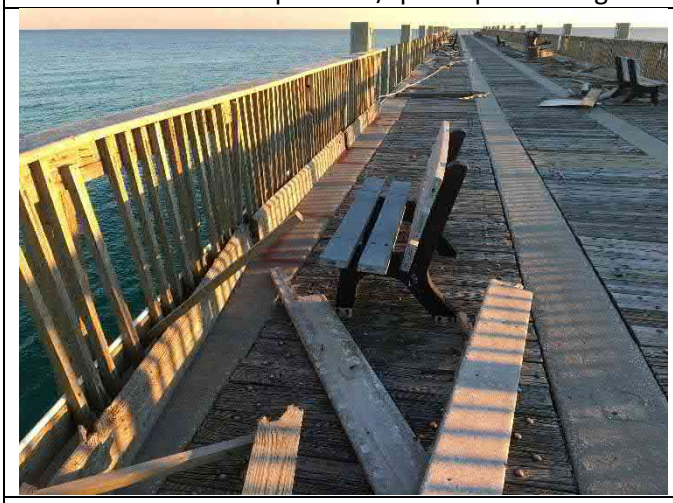
	
Bent 32 North Face – Rust staining top of Pile 32-3	Bent 32 North Face
	
Bent 32 South Face	Bent 32 South Face – Pile 32-2 upper spall 5”x5”x2”, Beams 32-3 and 32-4 north end ,rust staining top of Piles 32-2 and 32-3
	
Bent 32E – Pile spall repairs damages 3x4~5”x5”x2”	Bent 32W – Rust stains top of Pile 32-2 and 32-3



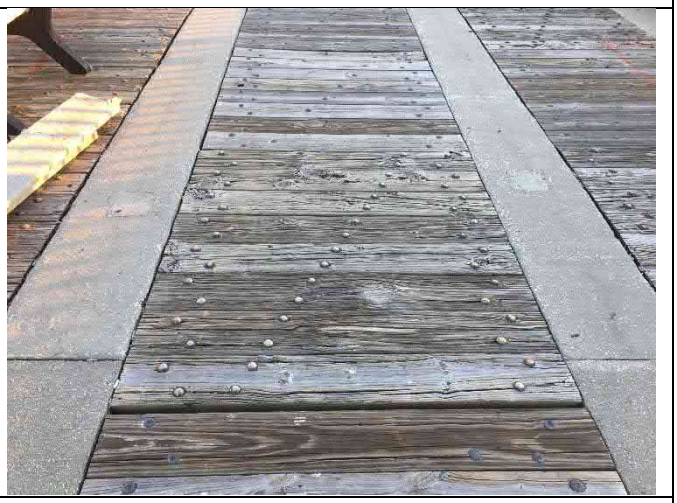
Bent 32W – Previous pile hole/spall repair damaged



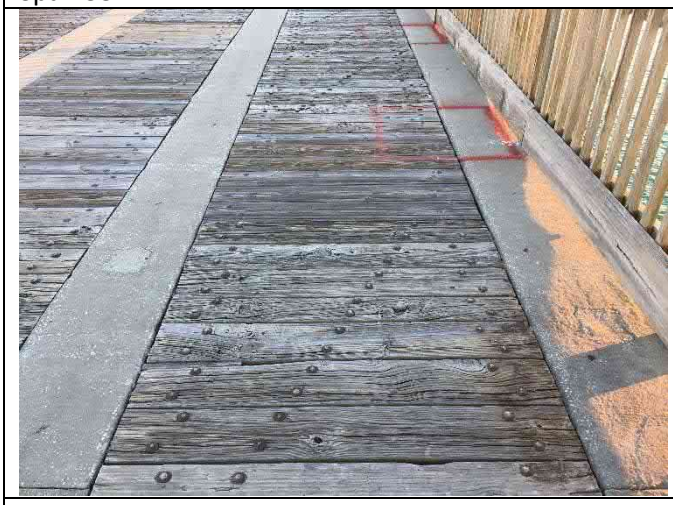
Bent 33E



Span 33E

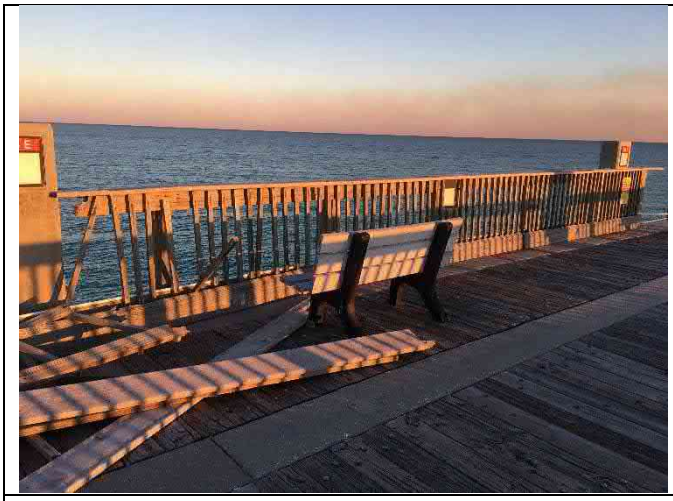
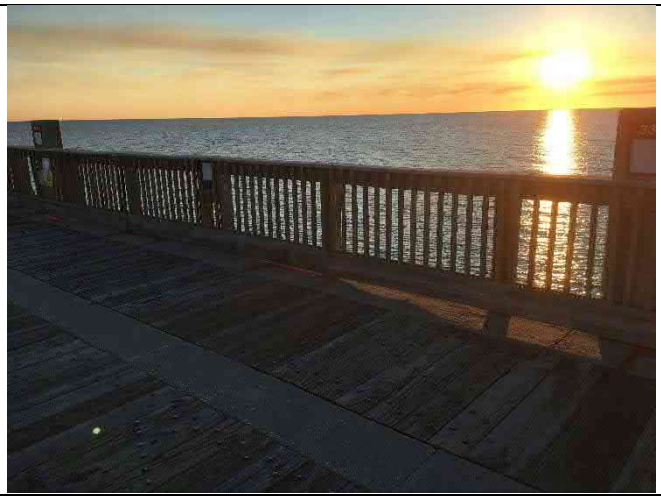
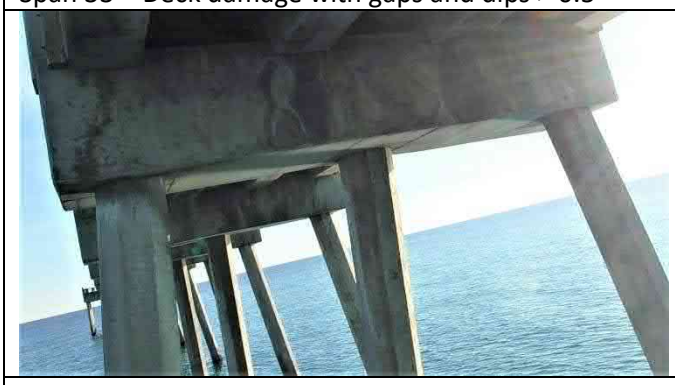
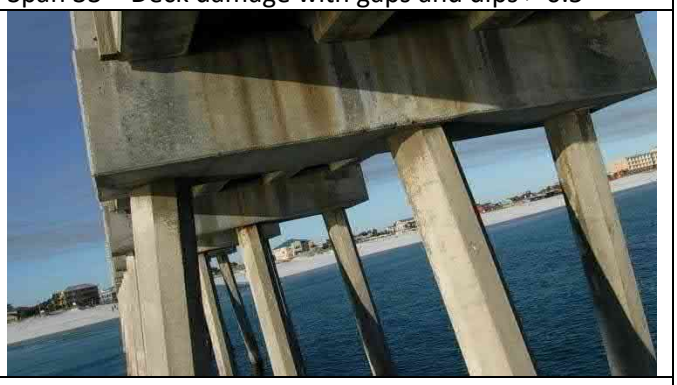


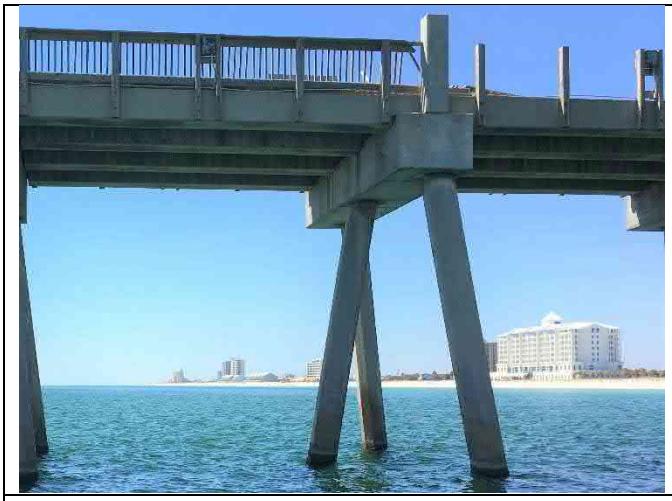
Span 33 Center



Span 33W

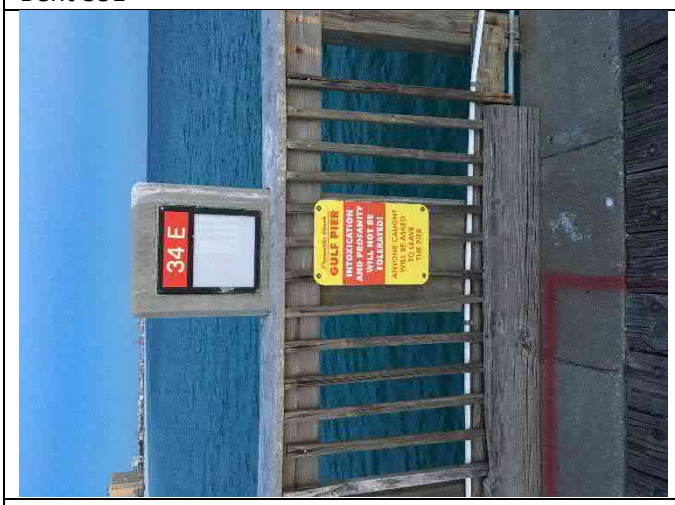
Bent 33W

	
Span 33E – Railing damaged	Span 33W – Railing loose with split wood members
	
Span 33 – Deck damage with gaps and dips > 0.5”	Span 33 – Deck damage with gaps and dips > 0.5”
	
Bent 33 North Face	Bent 33 South Face

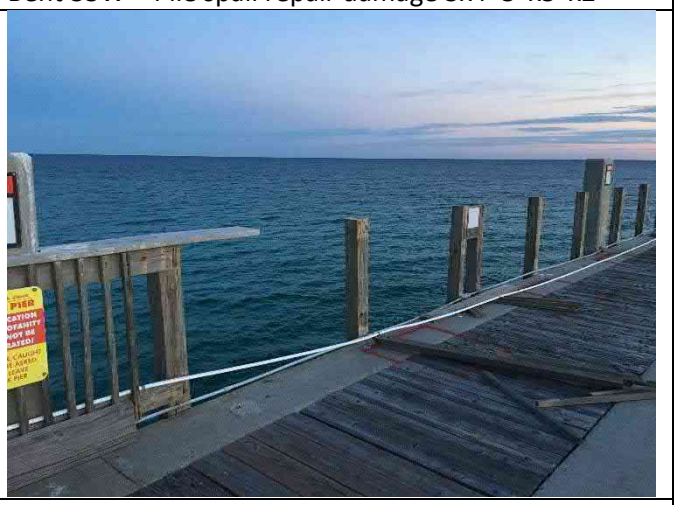


Bent 33E

Bent 33W – Pile spall repair damage 3x4~5”x5”x2”

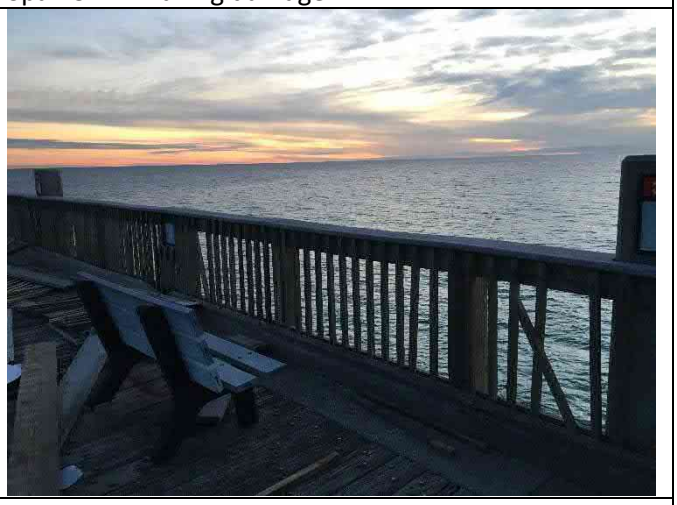


Bent 34E

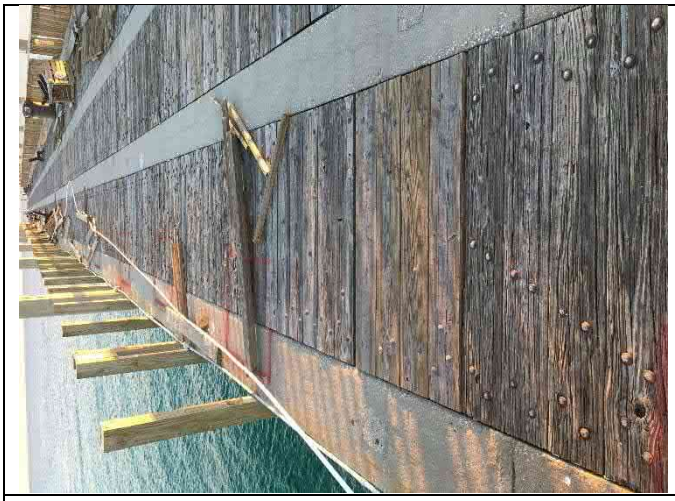


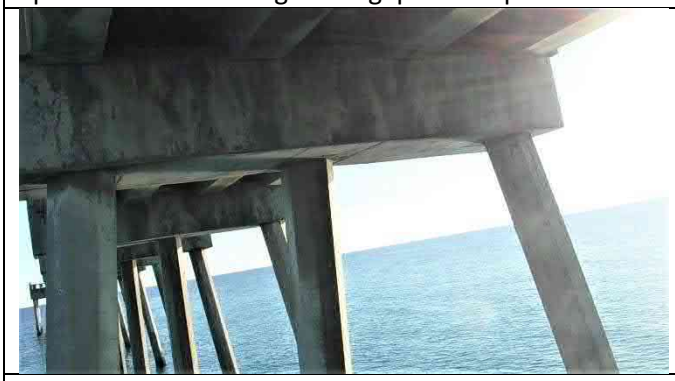
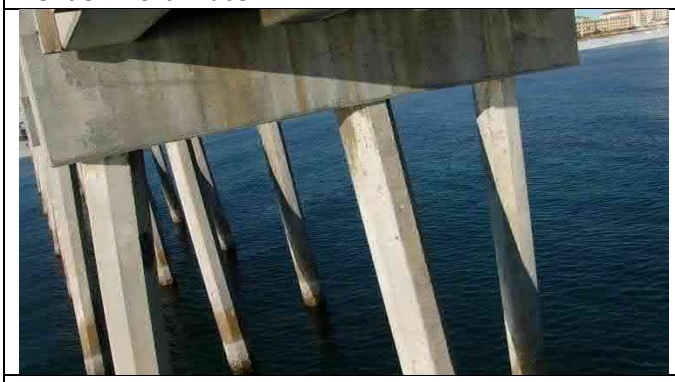
Span 34E – Railing damage

Bent 34W



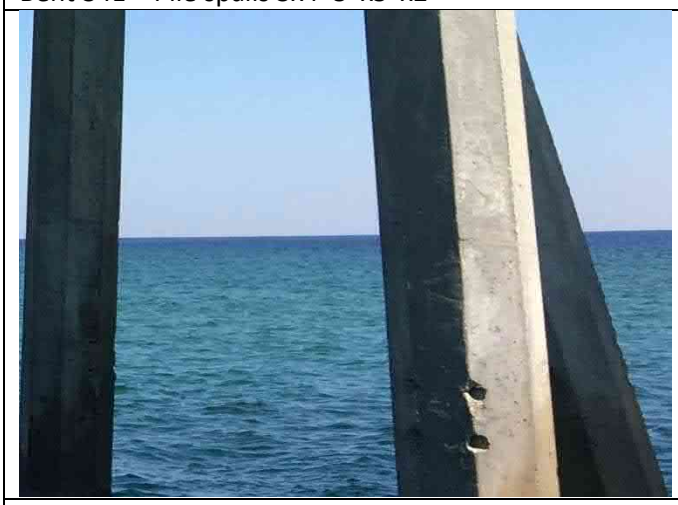
Span 34W – Railing damage

	
Span 34E	Span 34 Center
	
Span 34W	Span 34 – Deck gaps > 0.5”
	
Span 34 – Deck damage with gaps and dips > 0.5”	Span 34 – Deck damage with gaps and dips > 0.5”

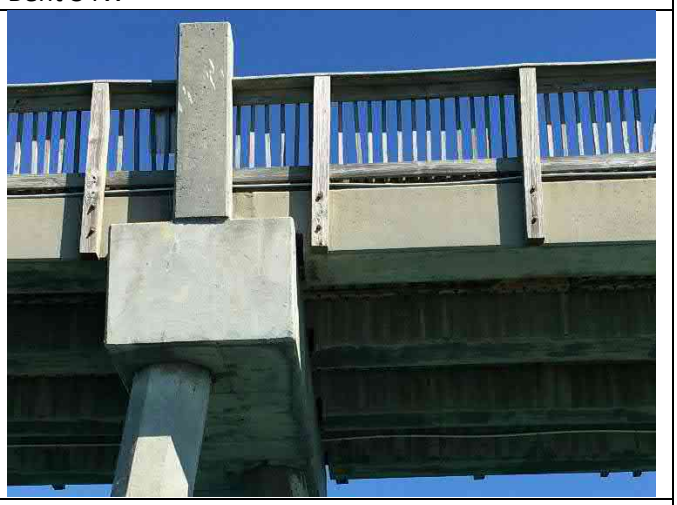
	
Span 34 – Deck damage with gaps and dips > 0.5”	Span 34 – Signage damage
	
Bent 34 North Face	Bent 34 North Face
	
Bent 34 South Face – Beam 34-4 North end cracking and delamination 24”x6”x3”	Bent 34 South Face – Pile cap top spall 8”x6”x1”

Bent 34E – Pile spalls 3x4~5”x5”x2”

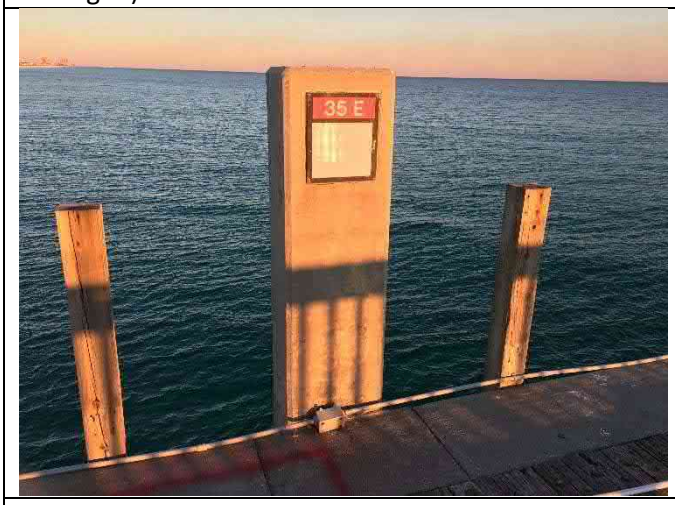
Bent 34W



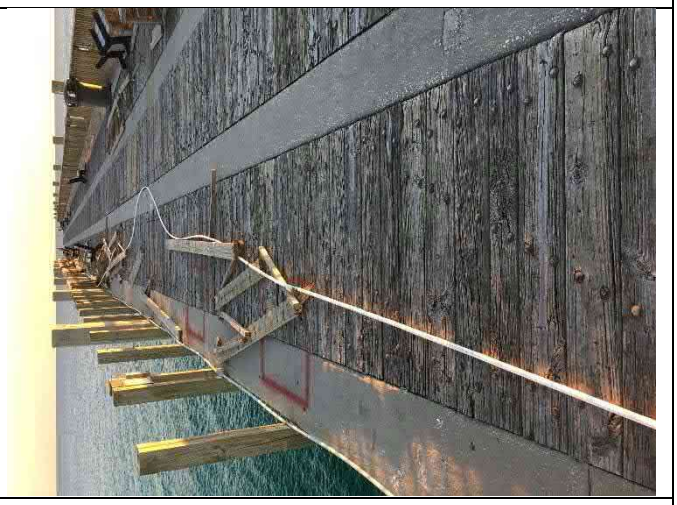
Pile 34-3 – 4~5”x5”x2” spalls (previous repair damaged)



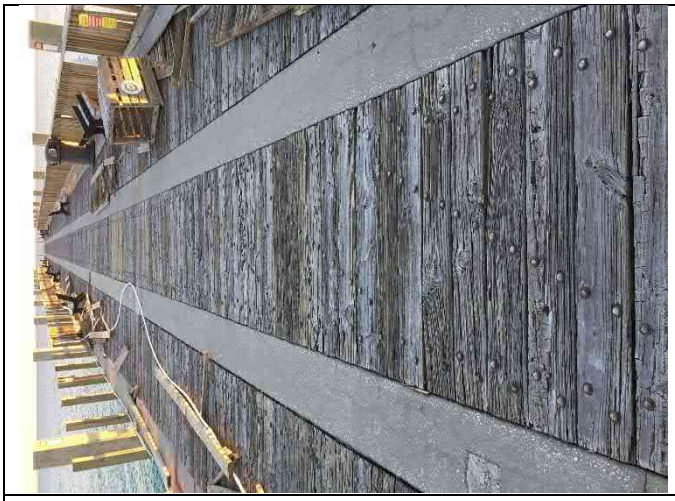
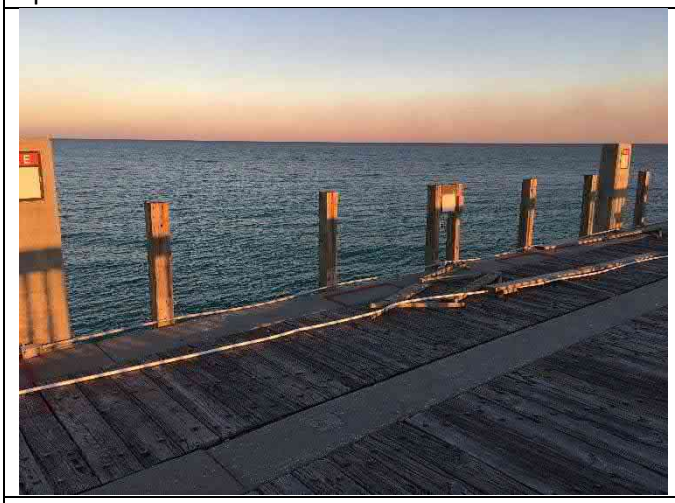
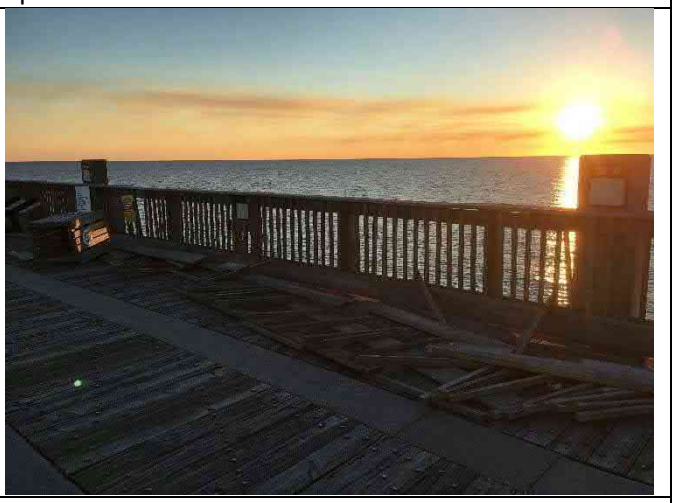
Bent 34W – Beam 34-3 end cracking and delamination

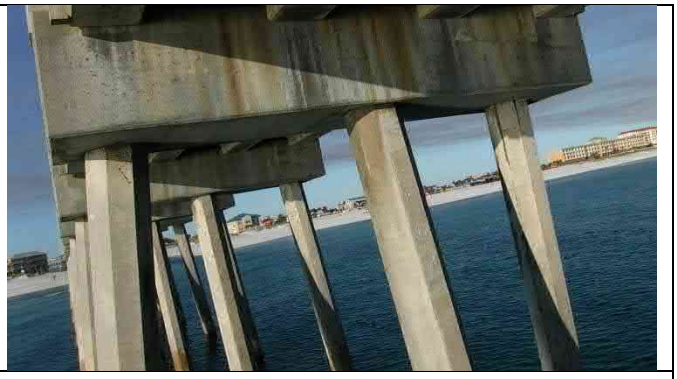
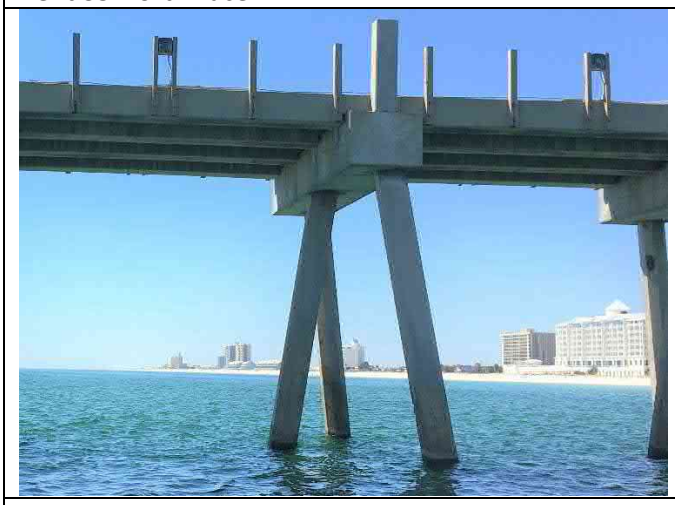
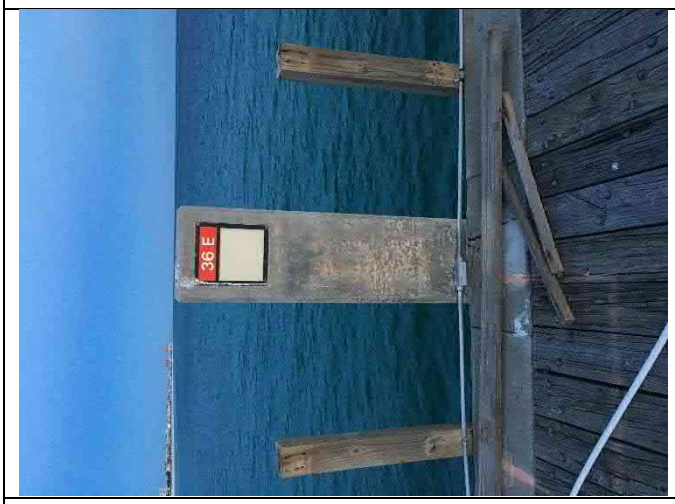


Bent 35E



Span 35E – Railing and utility damage

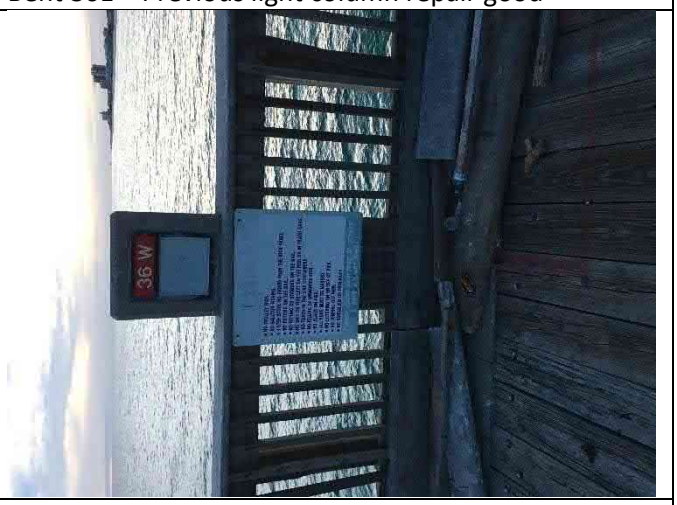
	
Span 35 Center	Span 35W
	
Span 35E – Railing and utility damage	Span 35W – Railing damage, loose railing
	
Span 35 – Deck damage with gaps and dips > 0.5”	Span 35 – Deck damage with gaps and dips > 0.5”

	
Bent 35 North Face	Bent 35 South Face
	
Bent 35E	Bent 35W – Beam 34-4 South end cracking, delamination and spall 24”x4”x3”
	
Bent 36E	Bent 36E – Closure pour cracking and spalls

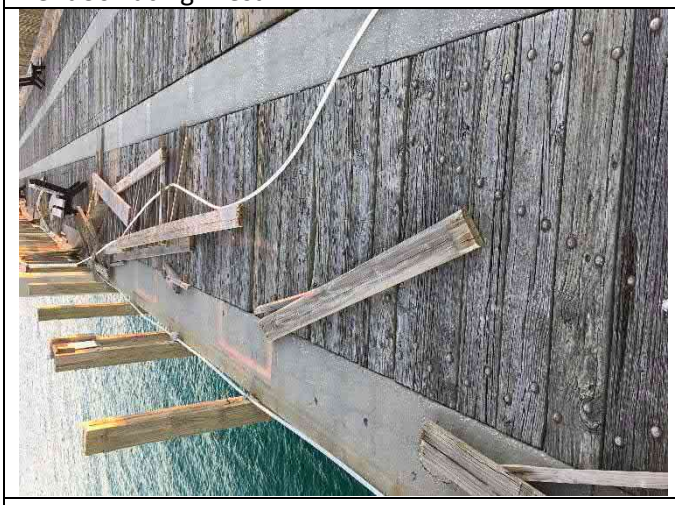
Bent 36E – Closure pour cracking and spalls

Bent 36E – Previous light column repair good

Bent 36 Facing West



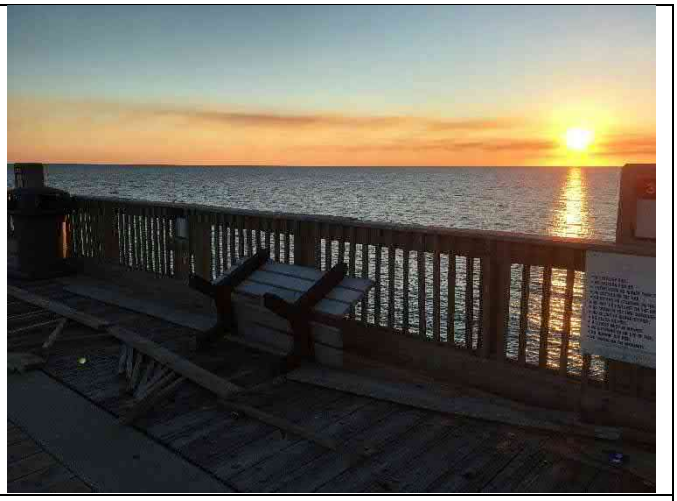
Bent 36W



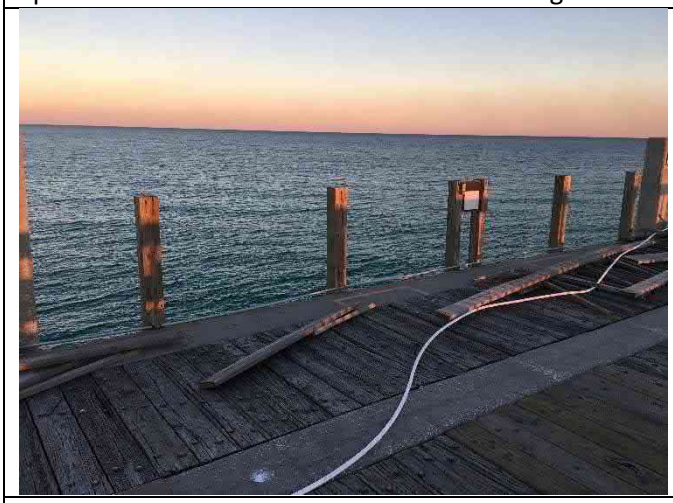
Span 36E

Span 36 Center

Span 36W – Bench to deck connection damage



Span 36W – Railing loose with split wood members

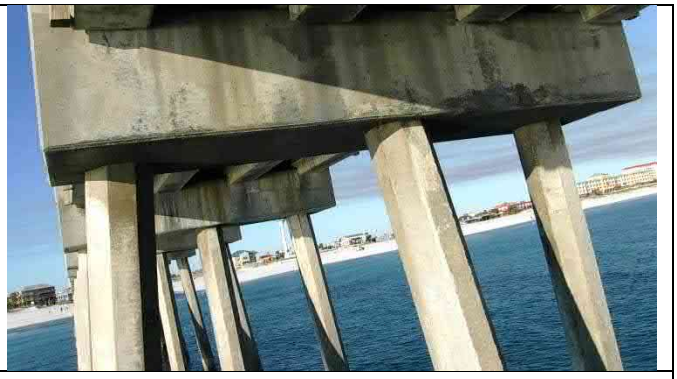
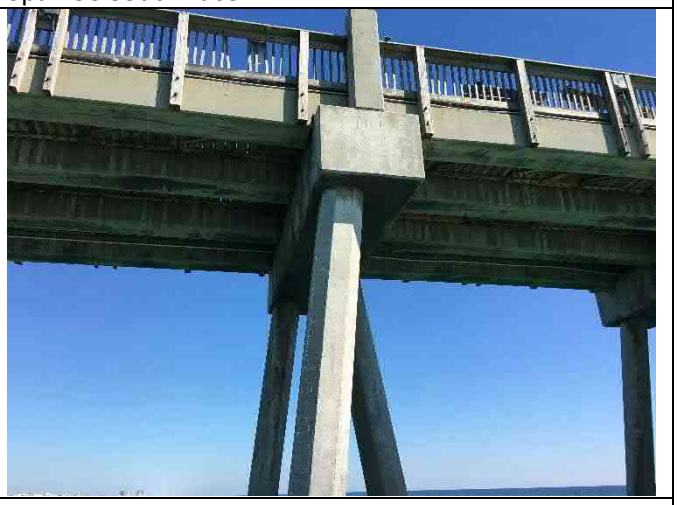
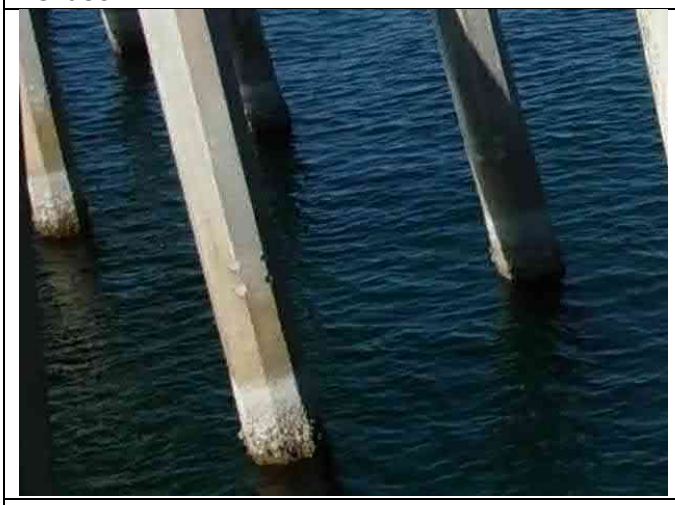


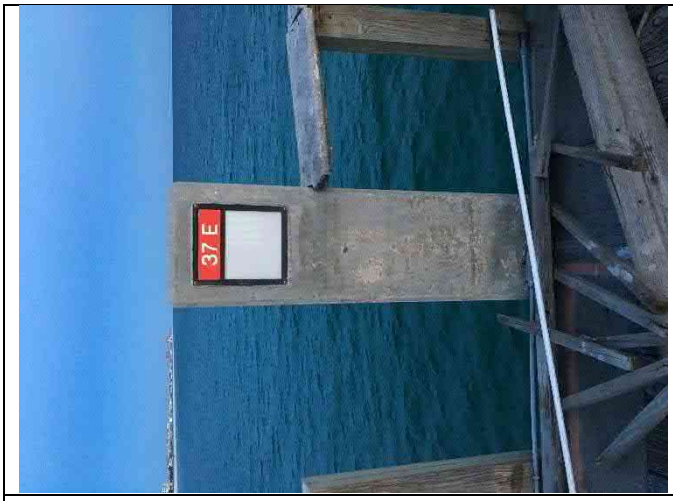
Span 36E – Railing destroyed, utility damage

Span 36 – Deck damage with gaps and dips > 0.5”

Span 36 – Deck damage with gaps and dips > 0.5”

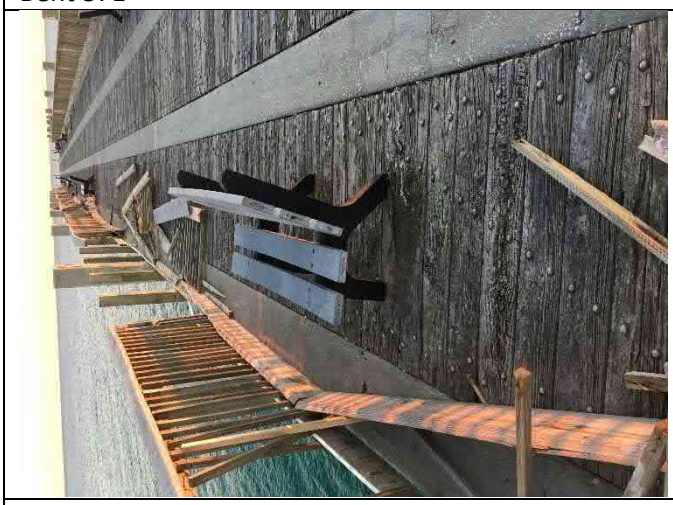
Span 36 – Deck damage with gaps and dips > 0.5”

	
Span 36 North Face	Span 36 South Face
	
Bent 36E	Bent 36W
	
Bent 36 Piles previous spall repairs damaged 3x4~4”x4”x2”	Bent 36W, Span 36



Bent 37E

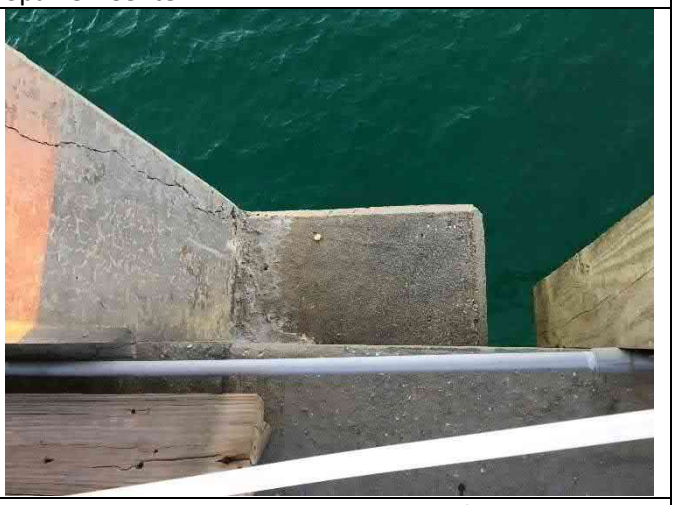
Bent 37W – Closure cracking



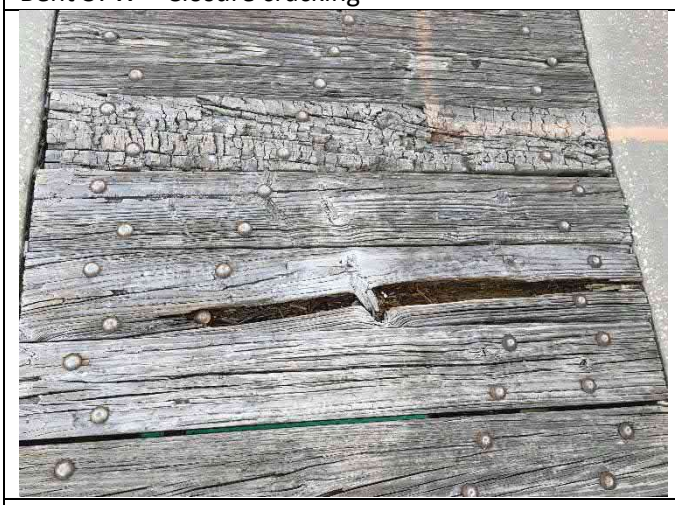
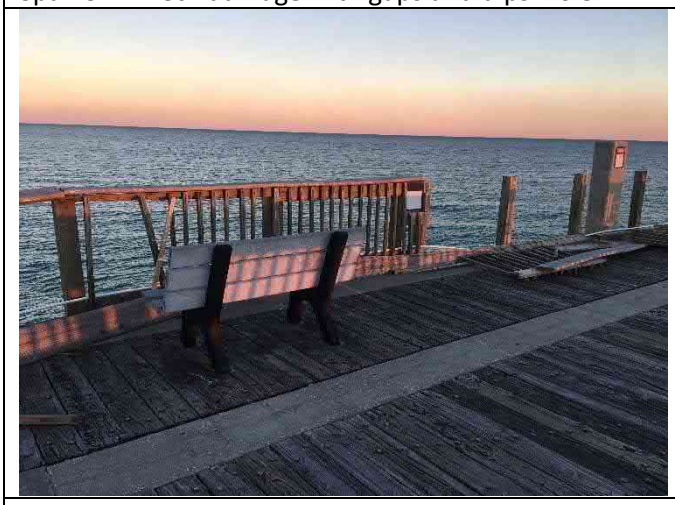
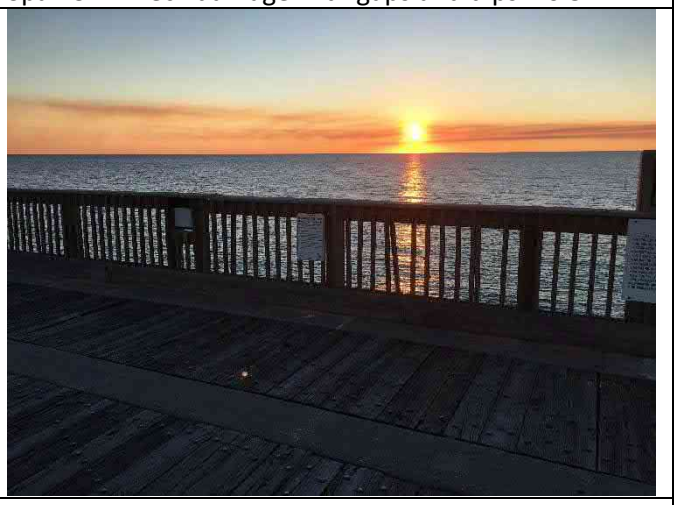
Span 37E

Span 37 Center

Span 37W

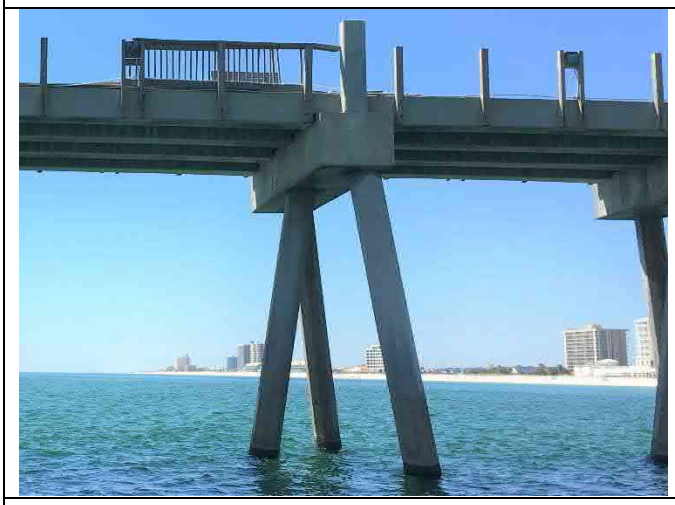


Bent 37E – Light column cracking (8’ +/-)

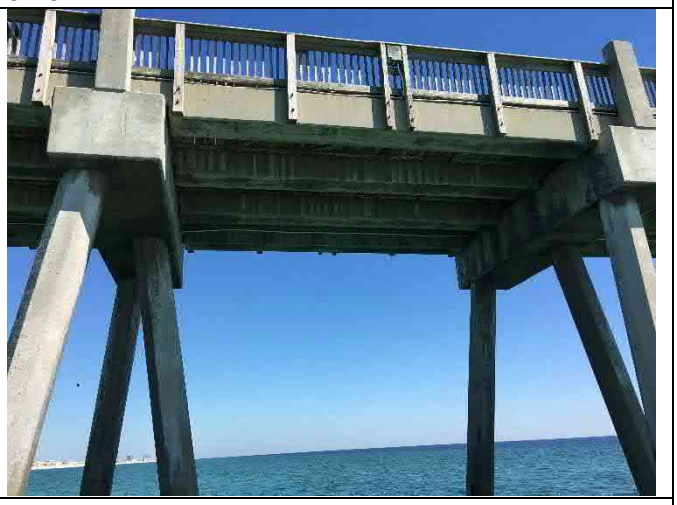
	
Bent 37W – Closure cracking	Span 37 – Deck damage with gaps and dips > 0.5”
	
Span 37 – Deck damage with gaps and dips > 0.5”	Span 37 – Deck damage with gaps and dips > 0.5”
	
Span 37E – Railing damage	Span 37W – Railing damage

Bent 37 North Face – Pile 37-1 top spall 4”x4”x1”

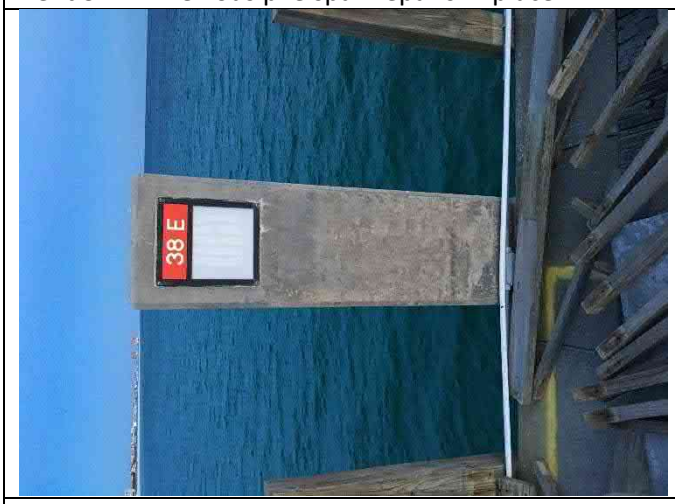
Bent 37 South Face – Pile cap spall with rust staining 3”x3”x2”



Bent 37E – Previous pile spall repairs in place

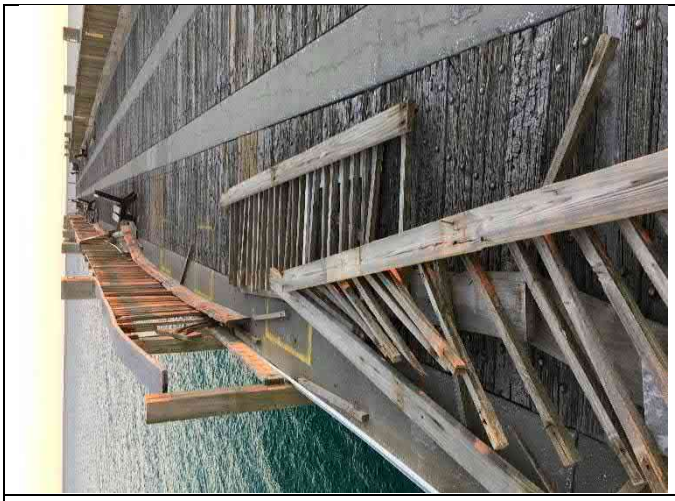


Bent 37W, Span 37



Bent 38E

Bent 38W



Span 38E

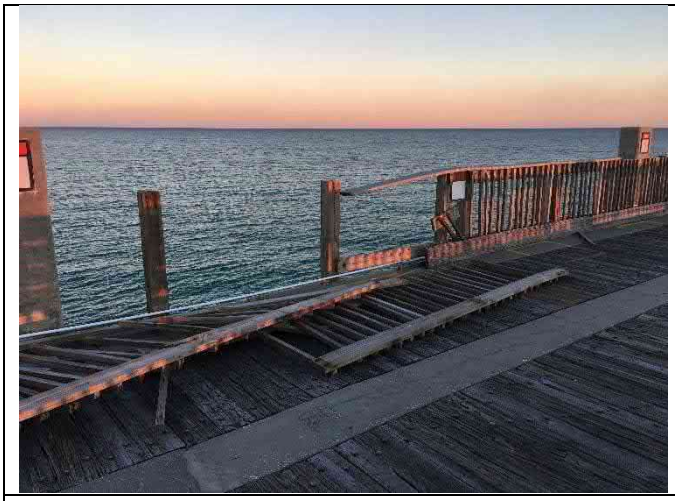
Span 38 Center

Span 38W

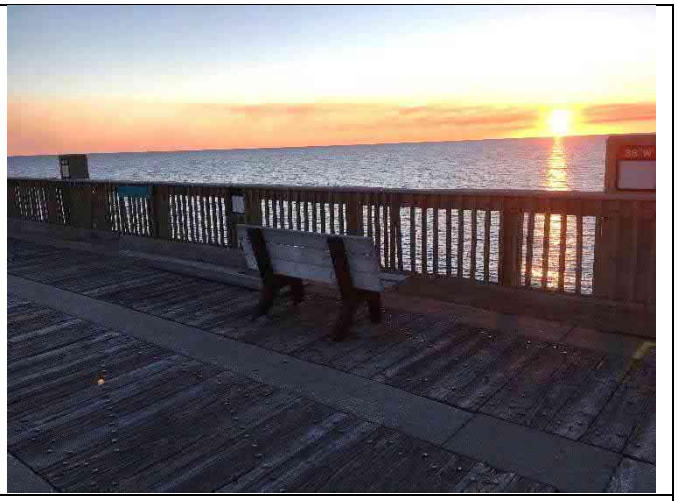
Span 38 – Deck damage with gaps and dips > 0.5”

Span 38 – Deck damage with gaps and dips > 0.5”

Span 38 – Deck damage with gaps and dips > 0.5”



Span 38E – Railing damage



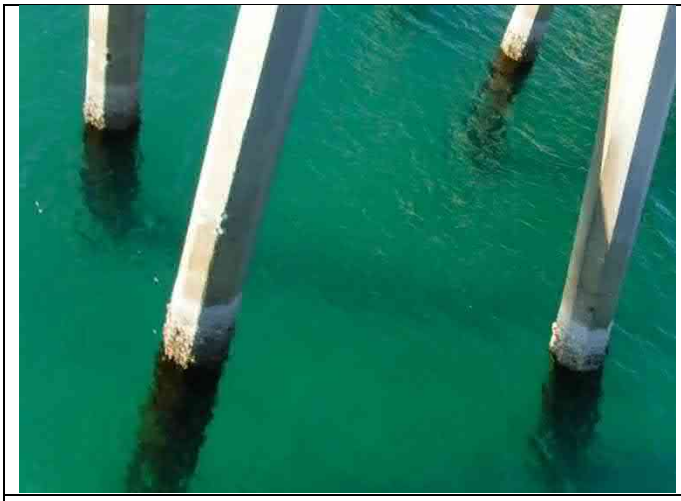
Span 38W – Railing loose with split wood members

Bent 38 North Face

Bent 38 South Face

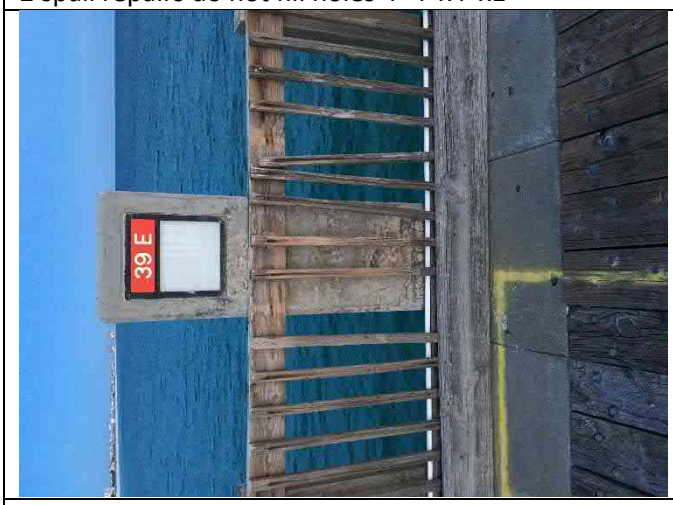
Bent 38E

Bent 38W North Face

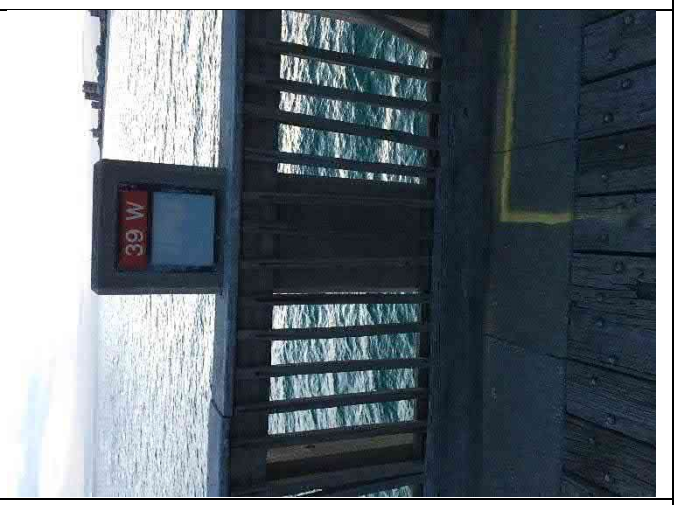


Bent 38E – Previous pile spall repairs in place, Pile 38-2 spall repairs do not fill holes 4~4”x4”x1”

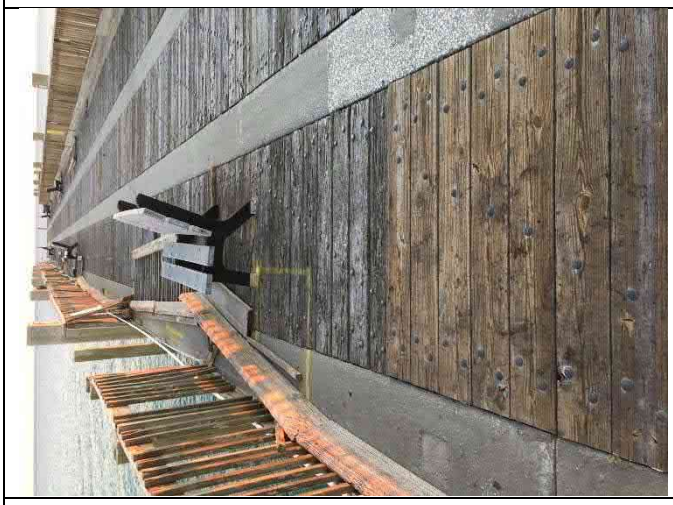
Bent 38W South Face



Bent 39E



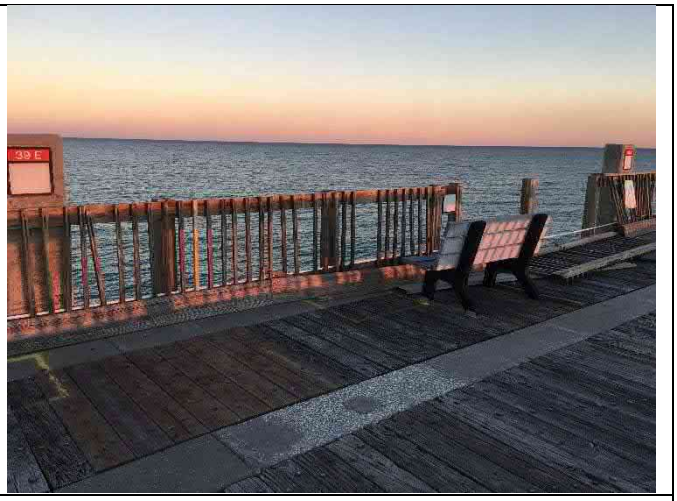
Bent 39W



Span 39E

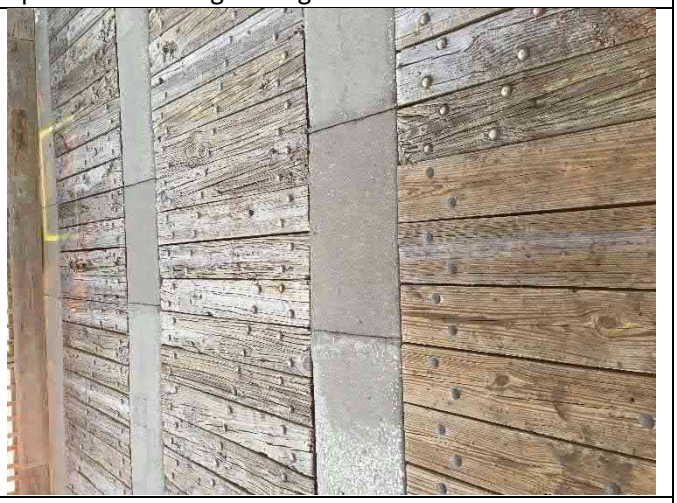
Span 39 Center

Span 39W



Span 39E – Railing damage

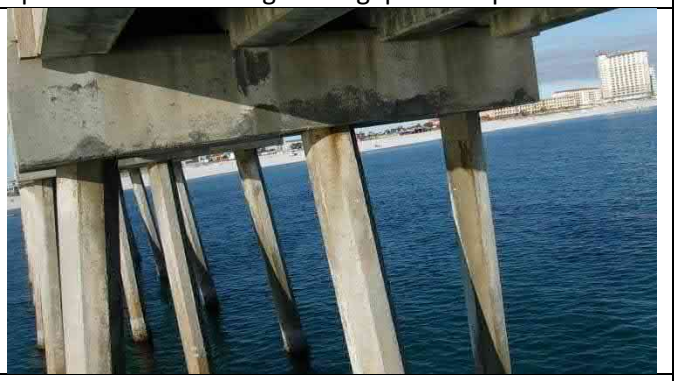
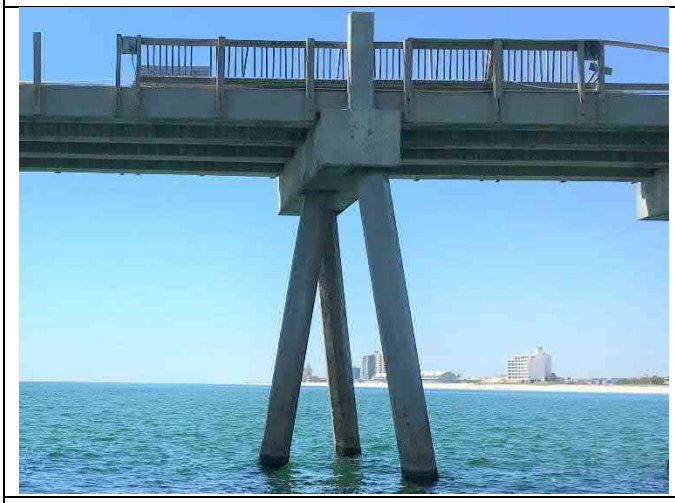
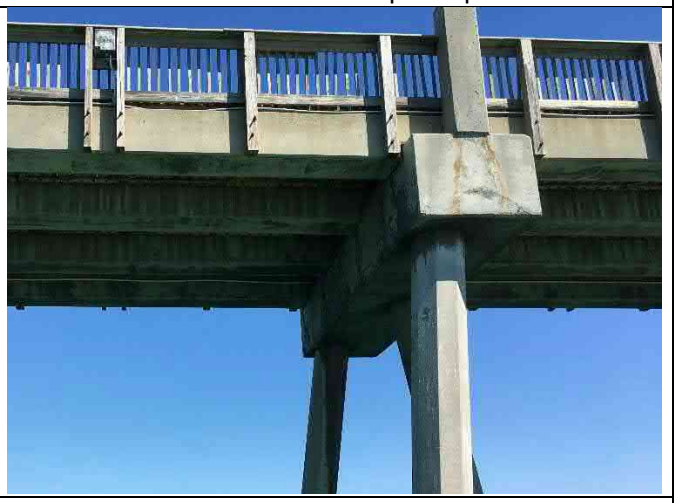
Span 39W – Railing damage



Span 39 – Closure pours

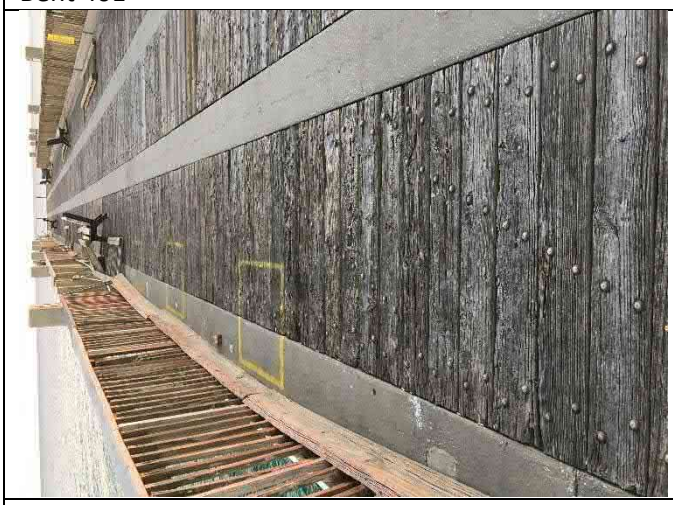
Span 39 – Deck damage with gaps and dips > 0.5”

Span 39 – Broken deck below bench

	
Span 39 – Deck damage with gaps and dips > 0.5”	Span 39 – Deck damage with gaps and dips > 0.5”
	
Bent 39 North Face	Bent 39 South Face – Pile 39-1 Spall top 8”x5”x1”
	
Bent 39E – Pile spall repairs in place but not filling holes 3x4~4”x4”x1”	Bent 39W

Bent 40E

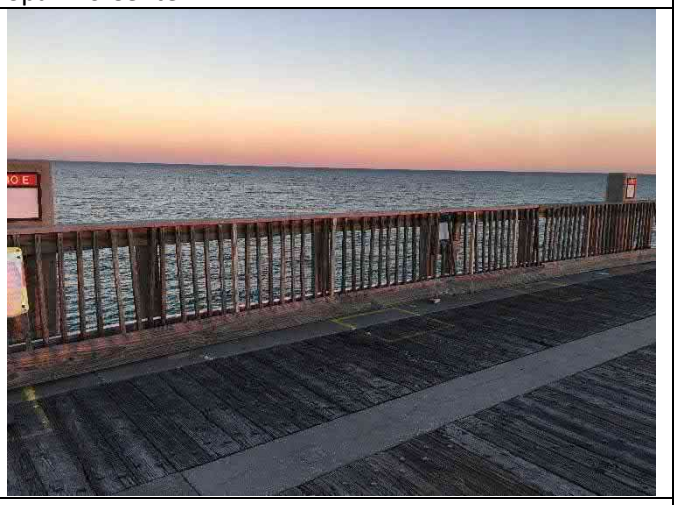
Bent 40W



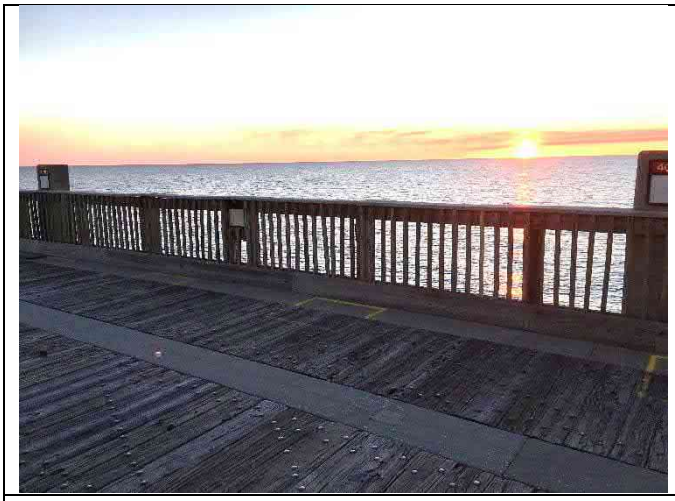
Span 40E

Span 40 Center

Span 40W

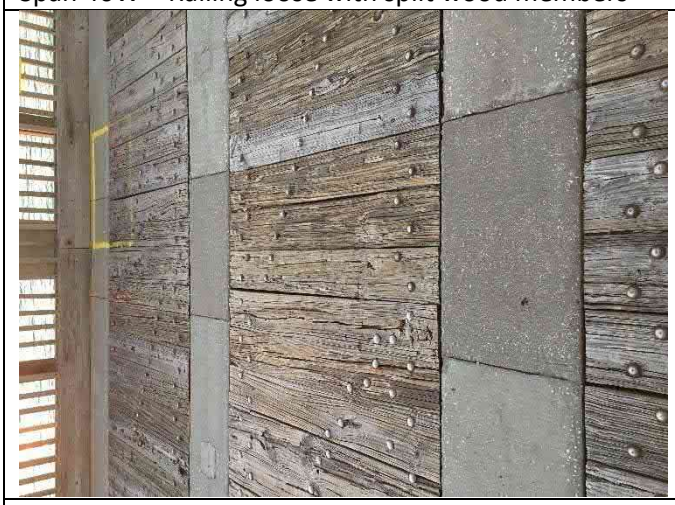


Span 40E – Railing loose with split wood members



Span 40W – Railing loose with split wood members

Bent 40E – Light column cracking (8’ +/-)

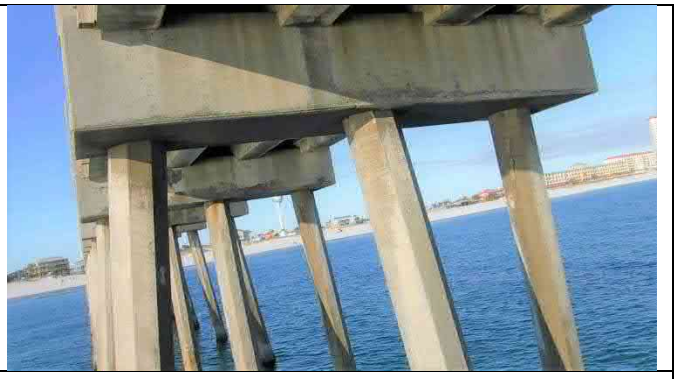
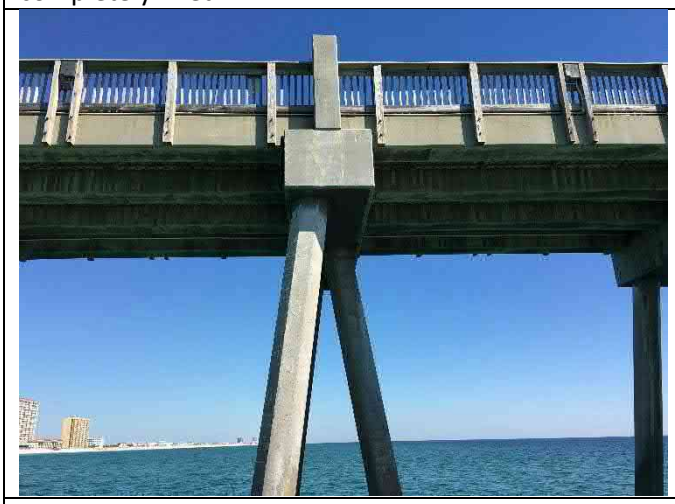


Span 40 Closure

Span 40 – Deck damage with gaps and dips > 0.5”

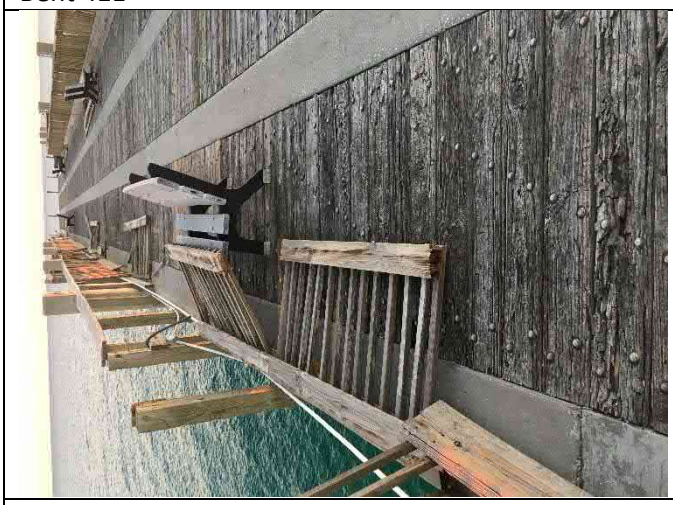
Span 40 – Deck damage with gaps and dips > 0.5”

Span 40 – Deck damage with gaps and dips > 0.5”

	
Bent 40 North Face	Bent 40 South Face – Pile 40-1 top spalls 15”x3”x1”, 8”x8”x2”
	
Bent 40E – Piles 40-1, 40-2 spall repairs not completely filled 2x4~4”x4”x1”	Bent 39W, 40W – Pile 40-1 top spalls, Pile 40-3 spall repairs damaged 4~4”x4”x2”
	
Bent 40W	Bent 40W, 41W

Bent 41E

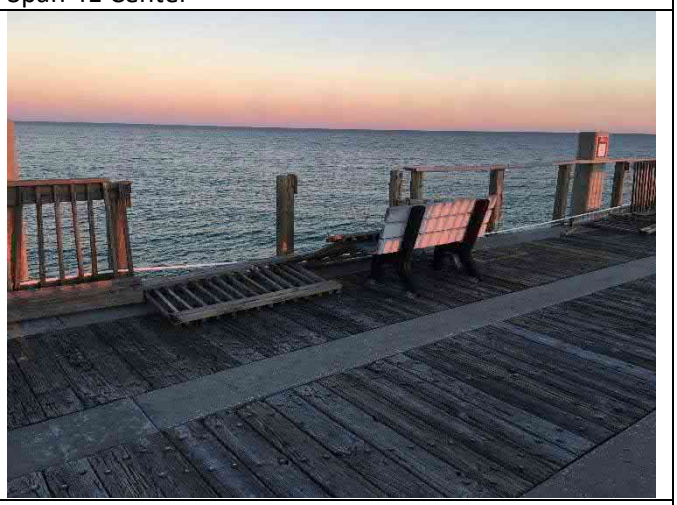
Bent 41W



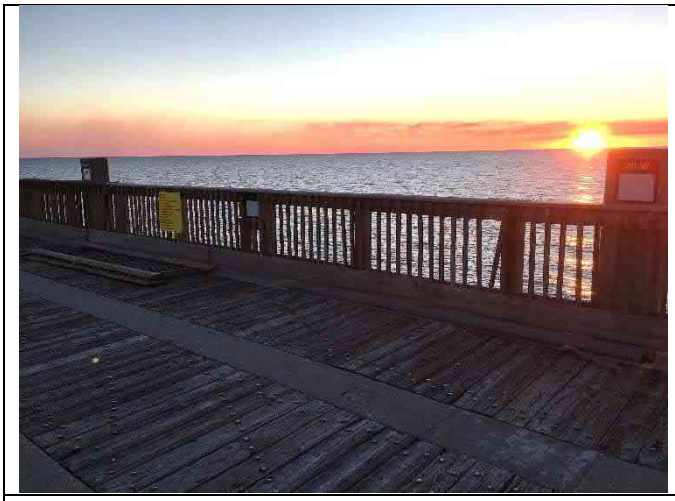
Span 41E

Span 41 Center

Span 41W

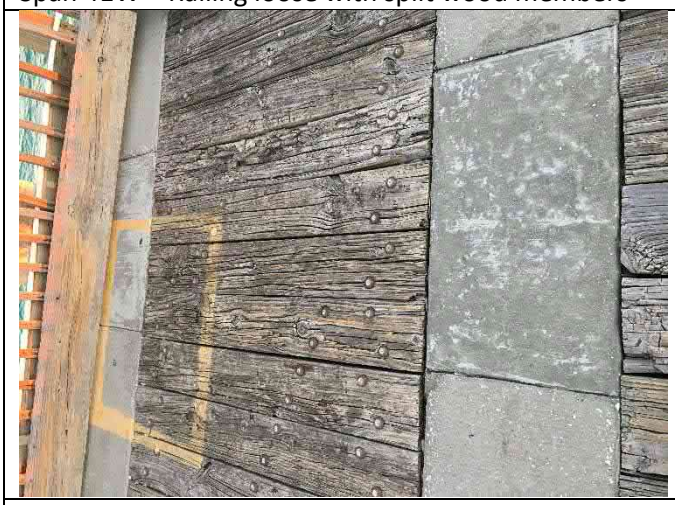


Span 41E – Railing damage



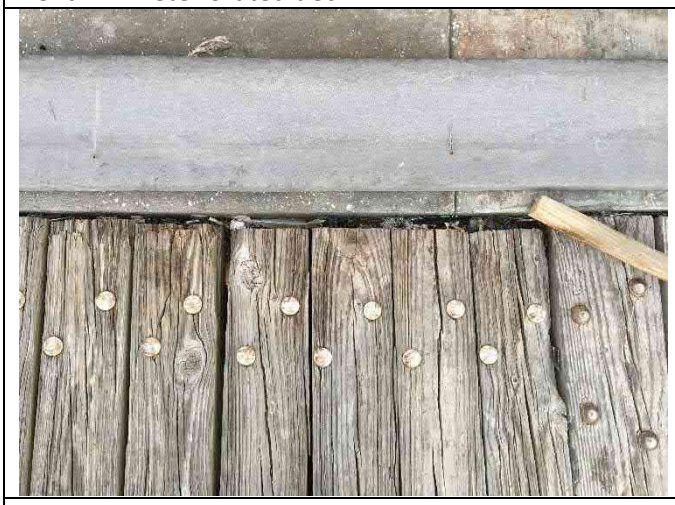
Span 41W – Railing loose with split wood members

Bent 41E – Light column cracking (8’ +/-)

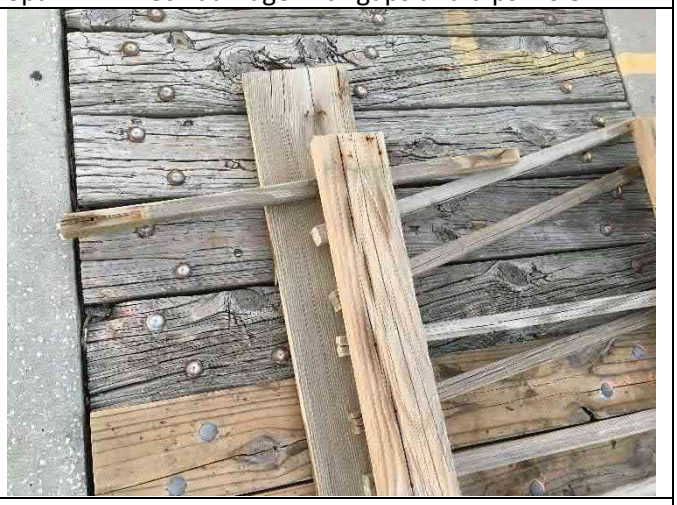


Bent 41 - Deteriorated deck

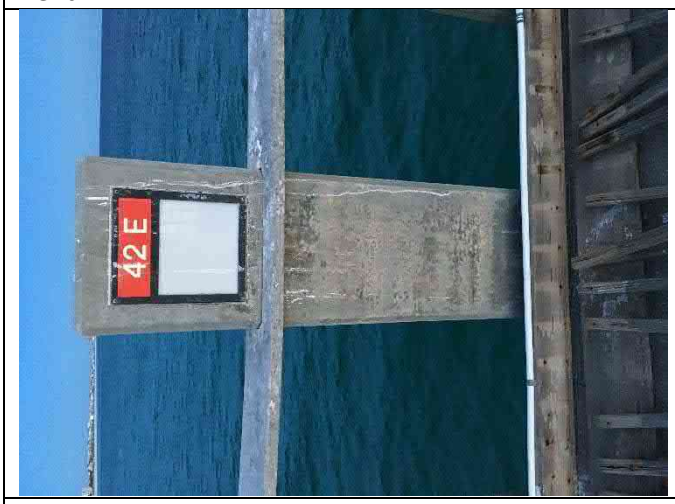
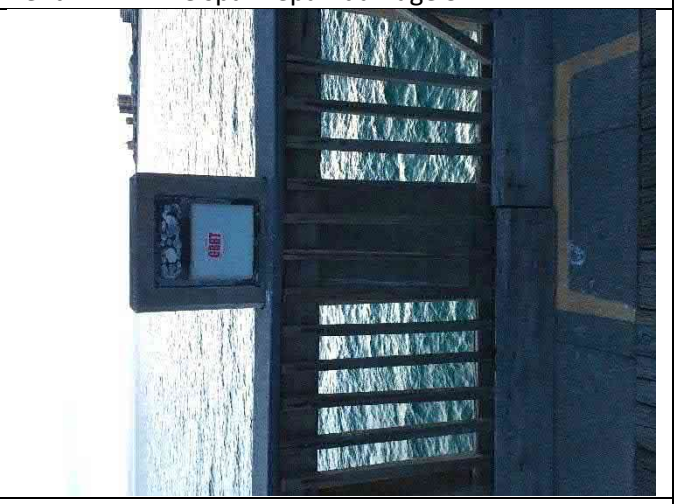
Span 41 – Deck damage with gaps and dips > 0.5”

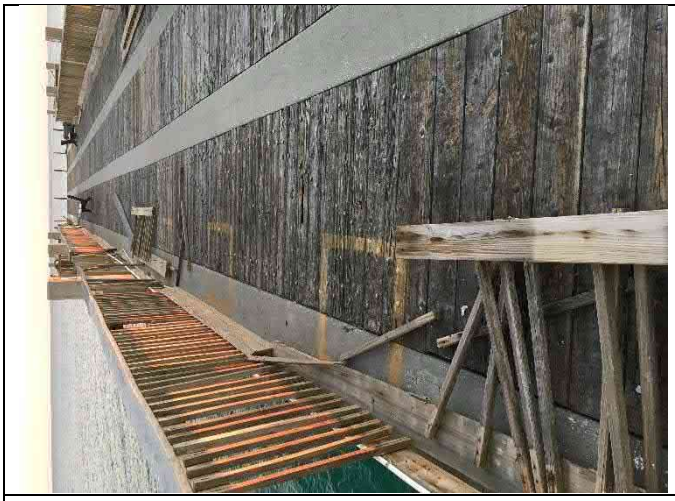


Span 41 – Deck damage with gaps and dips > 0.5”

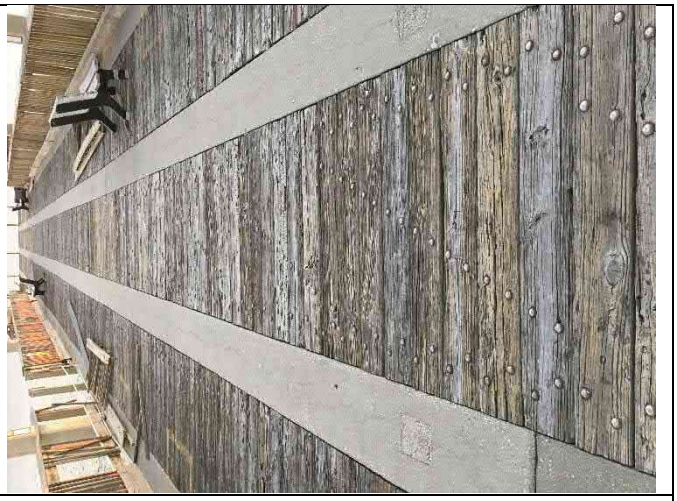


Span 41 – Deck damage with gaps and dips > 0.5”

	
Bent 41 North Face	Bent 41 North Face – Pile 41-1 top spall 8”x3”x1”, Beam 40-1 South end cracking and delamination 24”x6”x3”
	
Bent 41E	Bent 41W – Pile spall repair damage 3x4~4”x4”x2”
	
Bent 42E	Bent 42W – Bent number signage missing

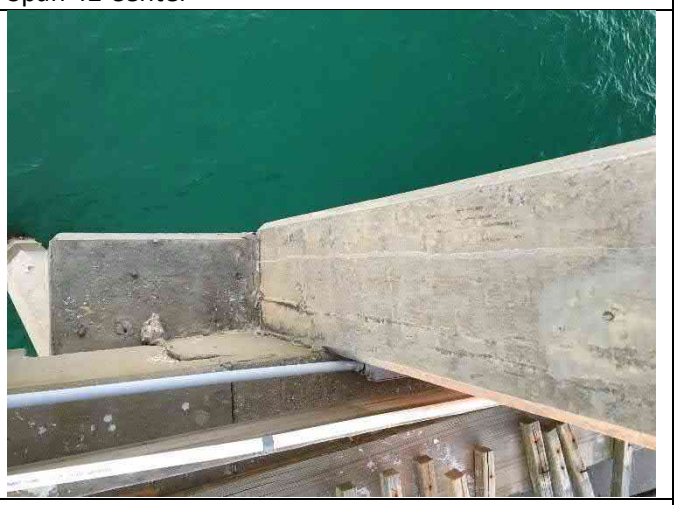


Span 42E



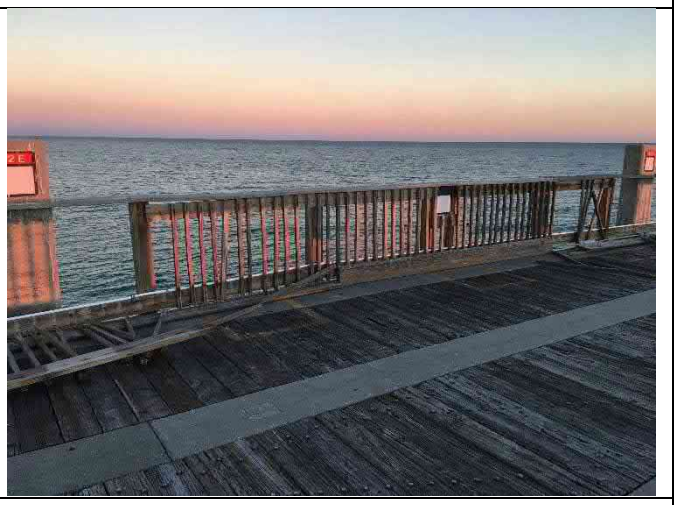
Span 42 Center

Span 42W

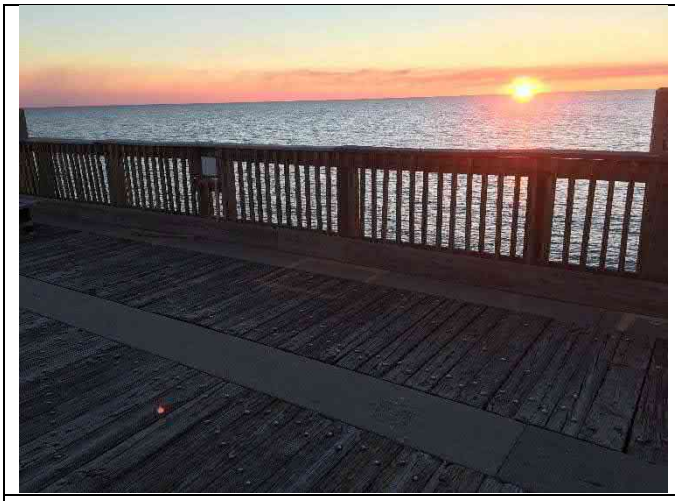
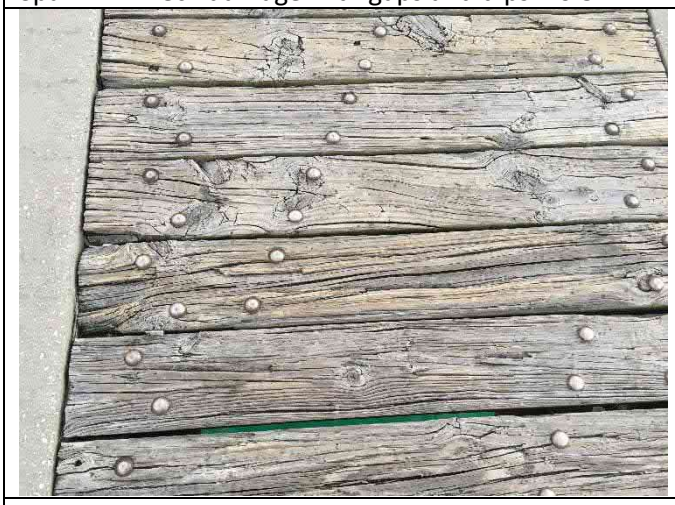


Bent 42E – Beam 41-1 end spall and closure cracking 16”x12”x4”

Bent 42E – Beam 42-1 closure cracking (16” +/-), light column cracking (5’ +/-)



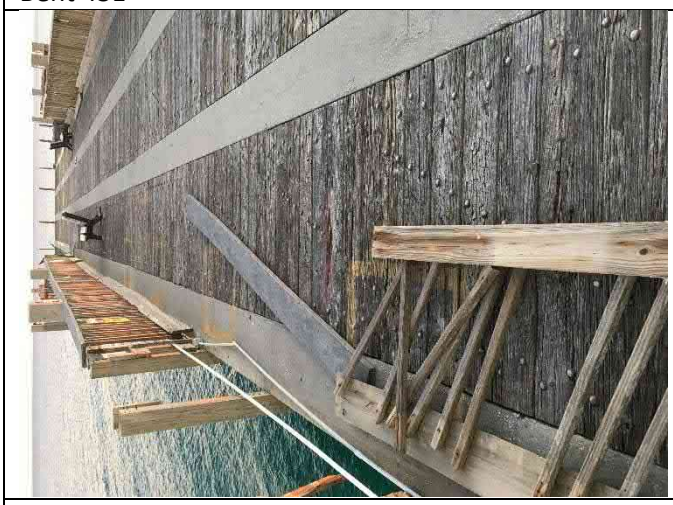
Span 42E – Railing damage

	
Span 42W – Railing loose with split wood members	Span 42 – Deck damage with gaps and dips > 0.5”
	
Span 42 – Deck damage with gaps and dips > 0.5”	Span 42 – Deck damage with gaps and dips > 0.5”
	
Span 42 – Deck damage with gaps and dips > 0.5”	Span 42 – Deck damage with gaps and dips > 0.5”

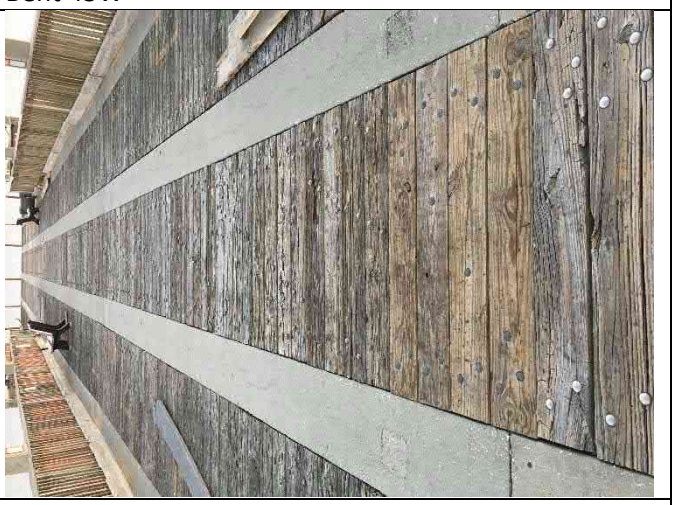
	
Bent 42 North Face	Bent 42 North Face
	
Bent 42 South Face – Pile cap top spall 4”x4”x1”, Beam 42-1 and 42-2 end cracking, delamination and spalls	Beam 42-1 north end cracking, delamination and spall 24”x12”x4”, Beam 42-2 north end spall 24”x3”x3”
	
Bent 42E – Pile 42-1 top spall 6”x6”x1”	Bent 42W - Pile spall repair damage 3x4~4”x4”x2”

Bent 43E

Bent 43W



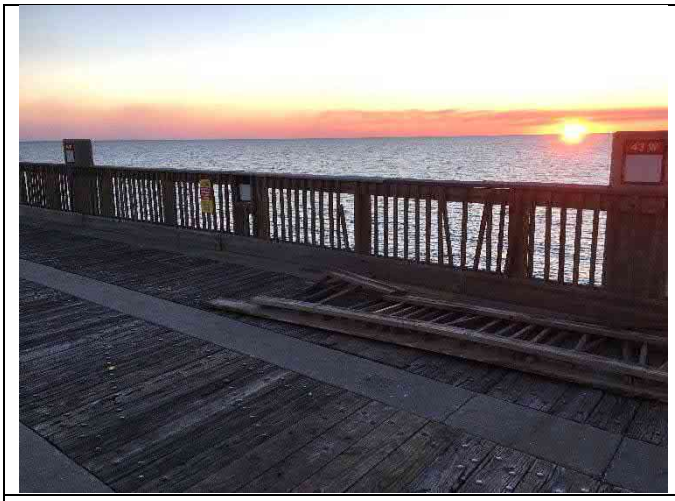
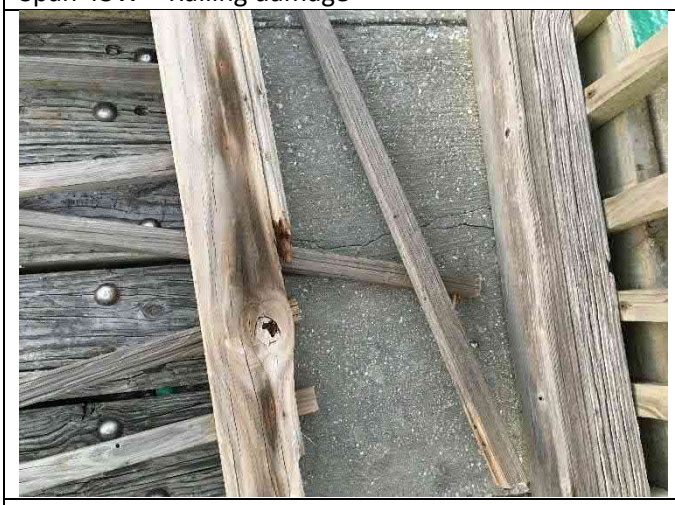
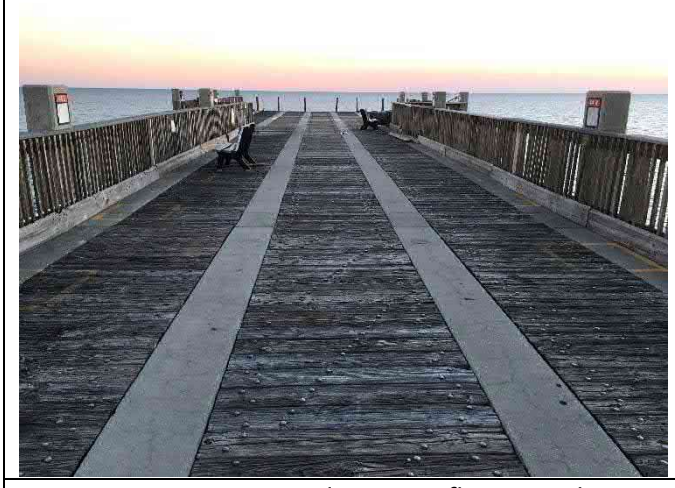
Span 43E



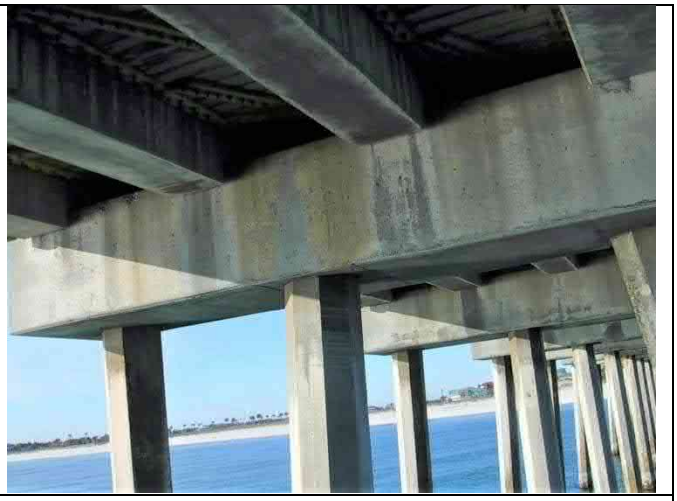
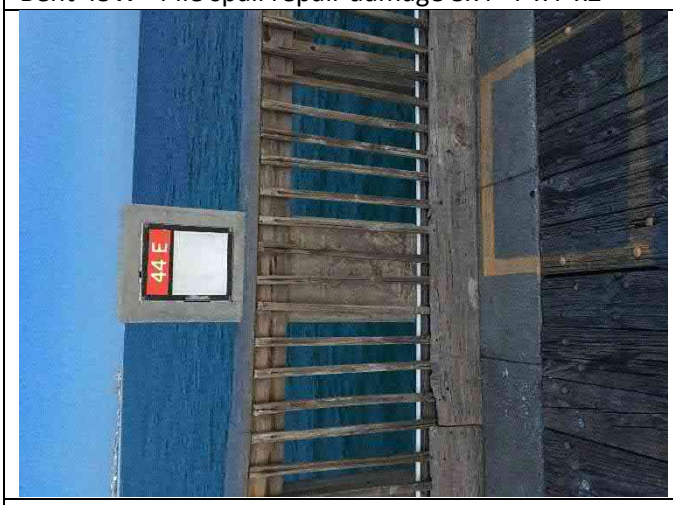
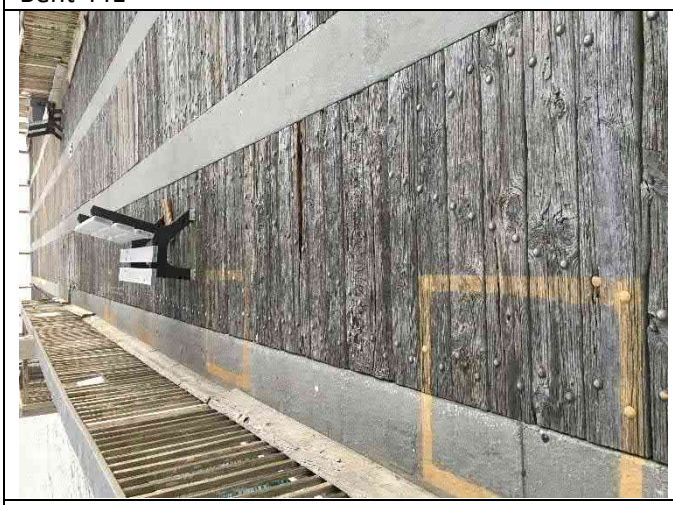
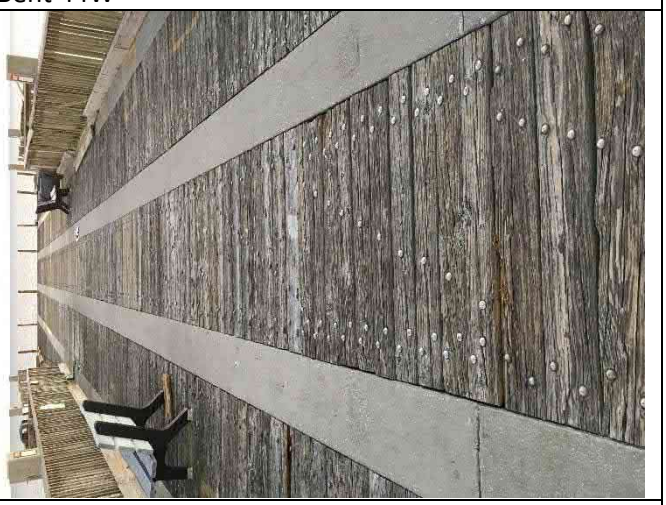
Span 43 Center

Span 43W

Span 43E – Railing damage

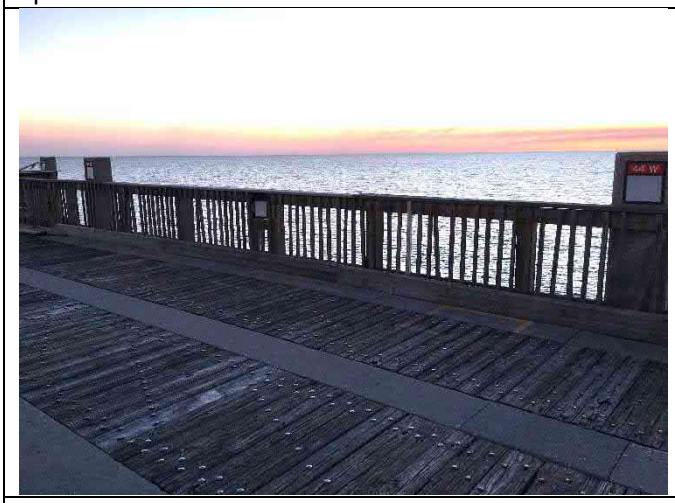
	
Span 43W – Railing damage	Bent 43 – Closure cracking
	
Bent 43 – Closure cracking	Span 43 – Deck damage with gaps and dips > 0.5”
	
Span 43 – Beams 43-2 and 43-3 top flange cracking (12” O.C. +/-)	Span 42 – Beams 42-2 and 42-3 top flange cracking (12” O.C. +/-)

	
Span 43 – Deck damage with gaps and dips > 0.5”	Span 43 – Deck damage with gaps and dips > 0.5”
	
Bent 43 North Face	Bent 43 South Face – Pile cap spalls 2~4”x4”x1”, Pile 43-1 top spall 4”x4”x1”
	
Bent 43E	Beam 42-2 South – End cracking, delamination and spall 24”x6”x3”

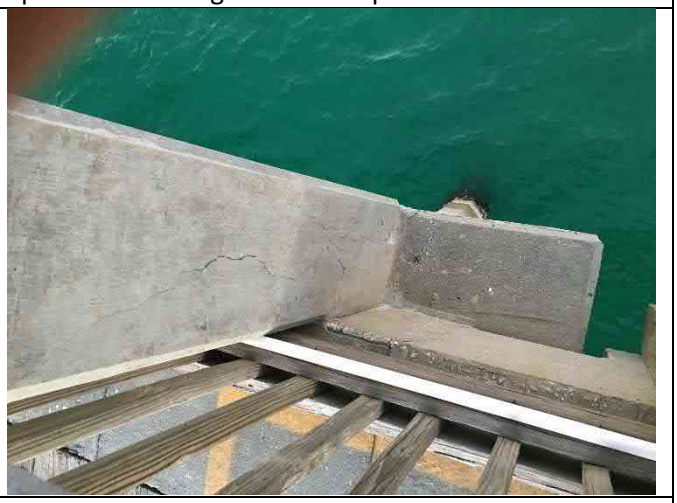
	
Bent 43W - Pile spall repair damage 3x4~4”x4”x2”	Bent 43 South Face
	
Bent 44E	Bent 44W
	
Span 44E	Span 44 Center

Span 44W

Span 44E – Railing loose with split wood members



Span 44W – Railing loose with split wood members

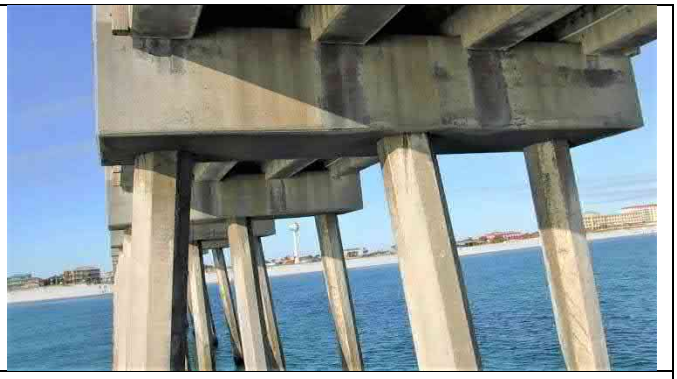


Bent 44E – Light column cracking (8’ +/-)

Span 44 – Deck damage with gaps and dips > 0.5”

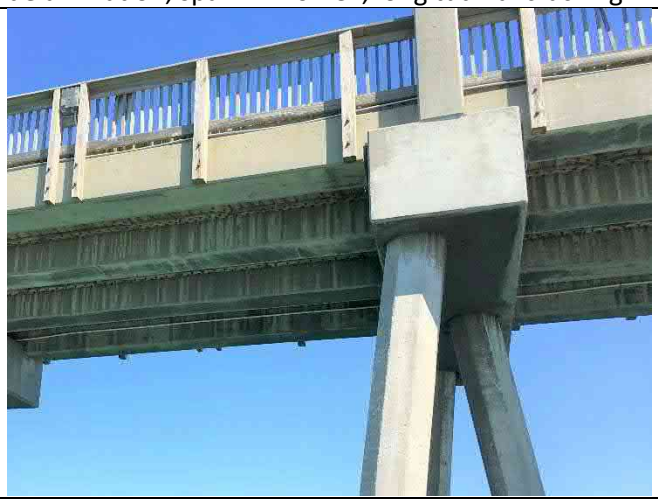
Span 44 – Deck damage with gaps and dips > 0.5”

Bent 44 North Face

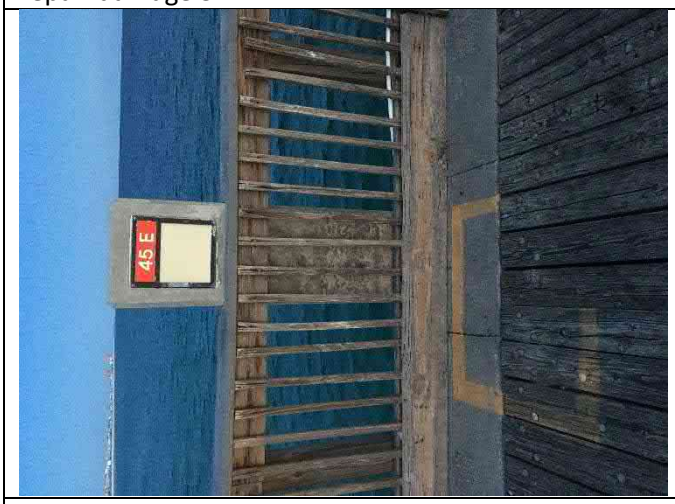


Bent 44 South Face – Beam 44-2 north end cracking, delamination, spall 24”x6”x3”, longitudinal cracking

Bent 44E – Pile 44-2 top spall 20”x2”x1”, Pile spall repair damage 3x4~4”x4”x1”

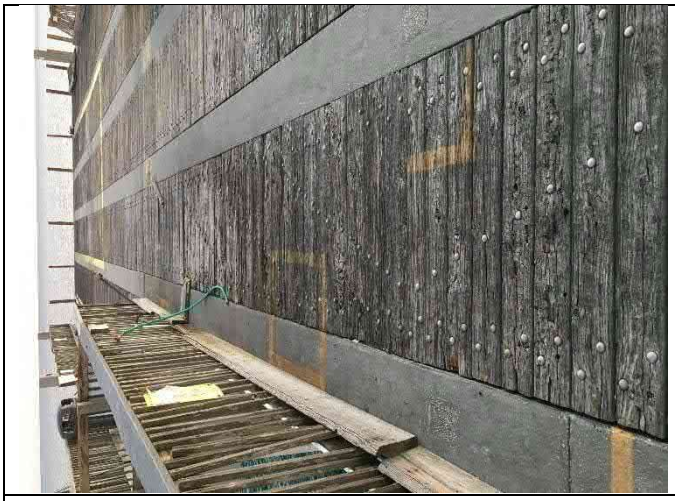


Bent 44W

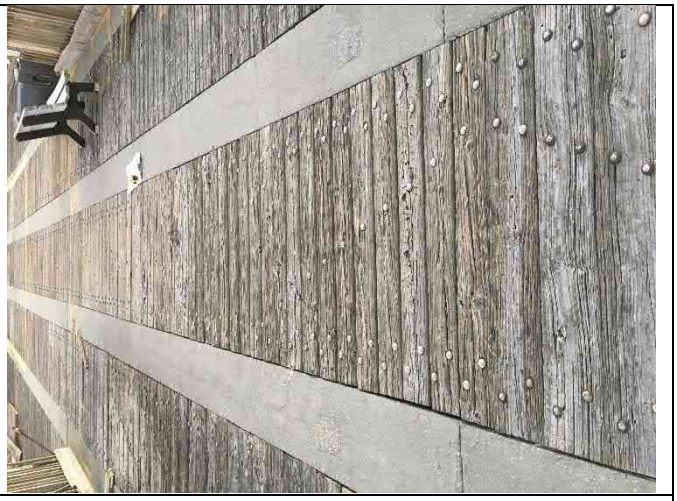


Bent 45E

Bent 45W

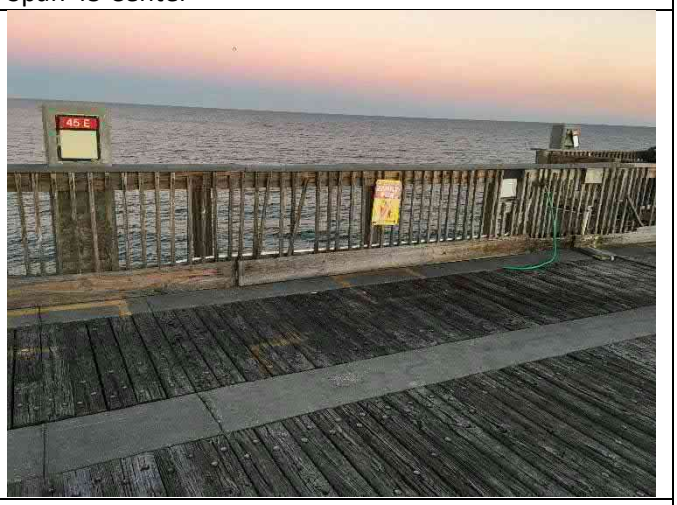


Span 45E

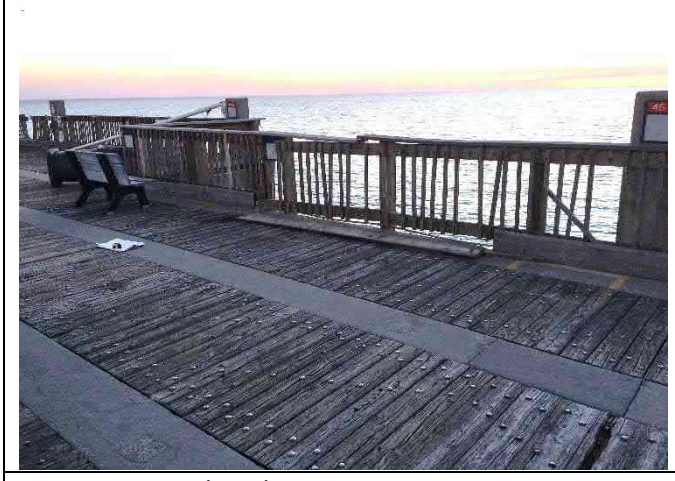


Span 45 Center

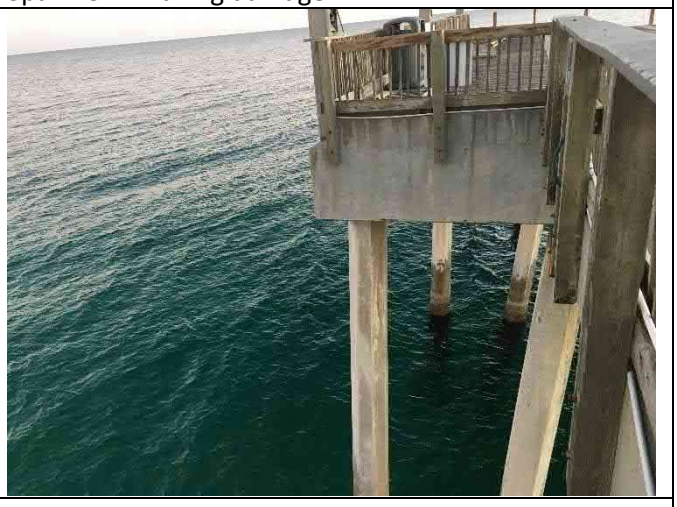
Span 45W



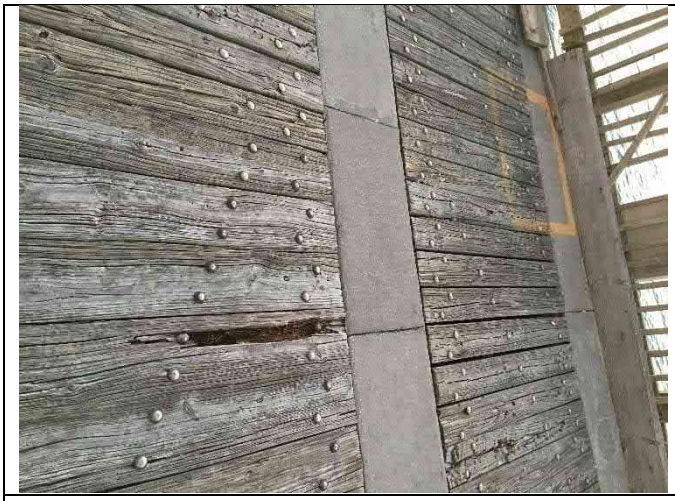
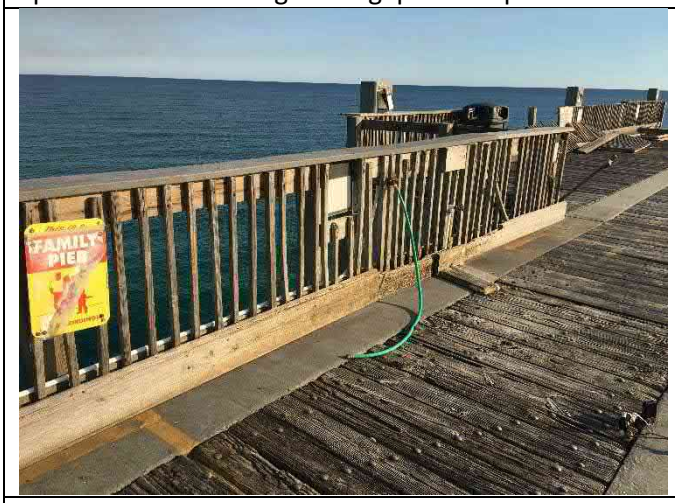
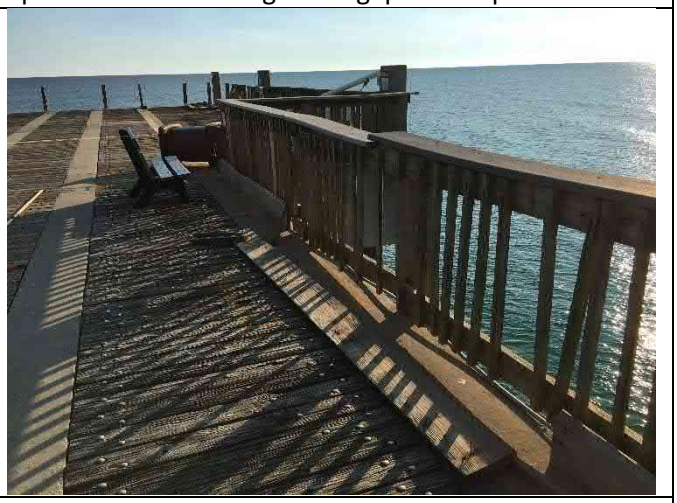
Span 45E – Railing damage

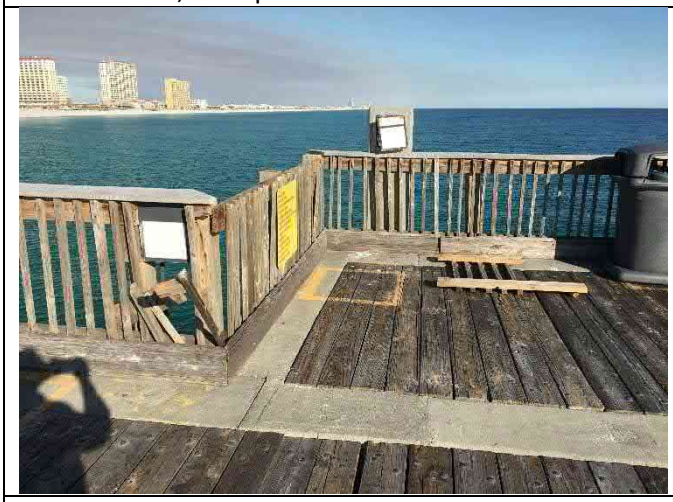
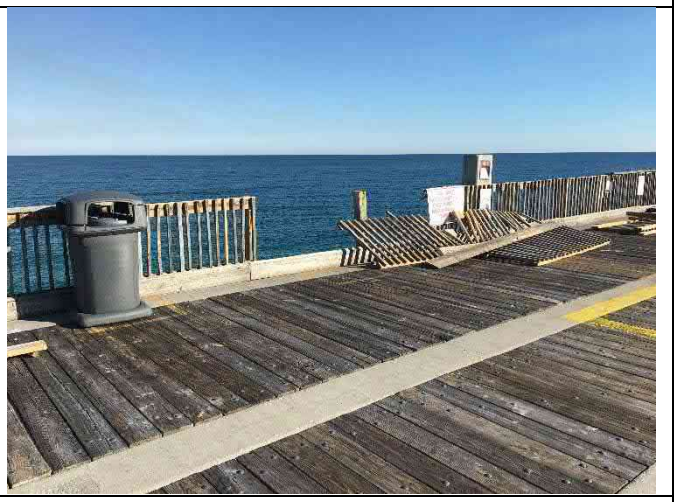


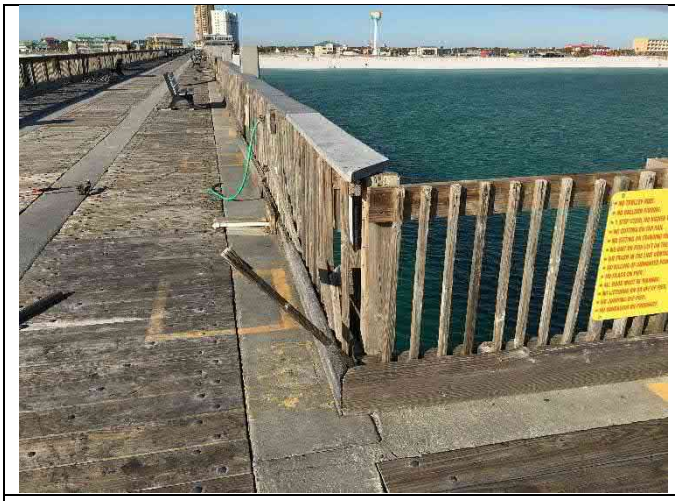
Span 45W – Railing damage



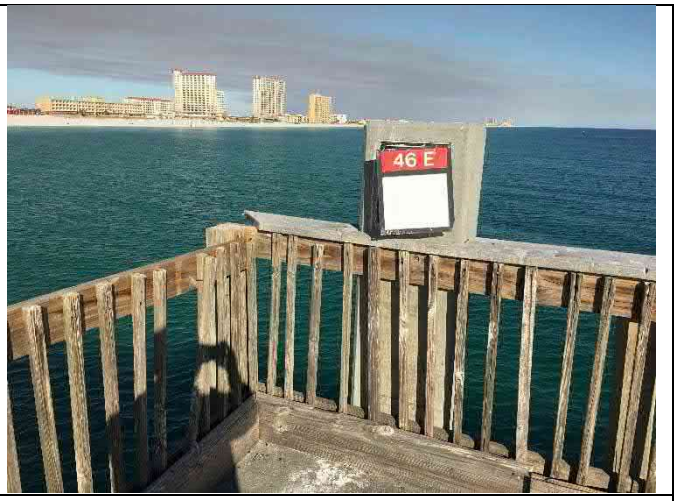
Bent 46E

	
Span 45 – Deck damage with gaps and dips > 0.5”	Span 45 – Deck damage with gaps and dips > 0.5”
	
Span 45E – Railing, deck and utility damage	Span 45W – Railing damage
	
Bent 45 North Face	Bent 45 South Face – Beam 45-1 north end cracking and spall 24”x6”x3”

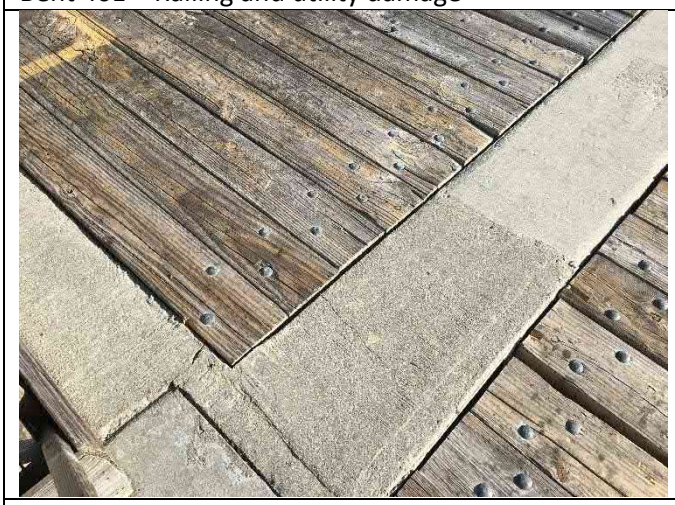
	
Bent 45 South Face – Beam 45-2 north end cracking, delamination and spall 24”x24”x6”, Pile 45-3 spall 10”x8”x1”	Bent 45E
	
Bent 45W – Beam 44-1 south end cracking, delamination, and spall 24”x6”x4”	Pile 45-3 – Pile spall repairs damaged all piles 3x4~4”x4”x1”
	
Bent 46E – Railing, deck and sign damage	Span 46E – Railing damage



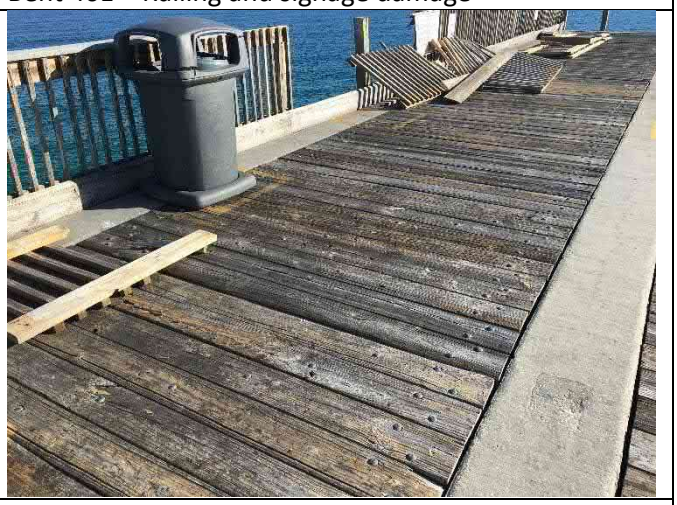
Bent 46E – Railing and utility damage



Bent 46E – Railing and signage damage

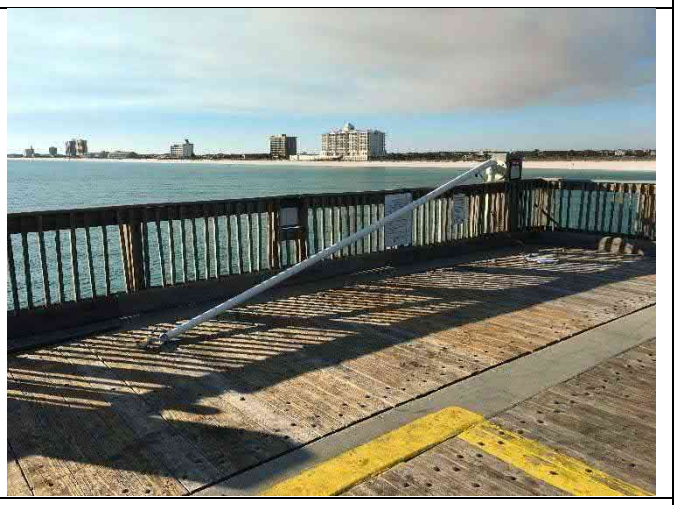


Beam 46-2 – Top flange cracking, timber decking damage with gaps and dips > 0.5”

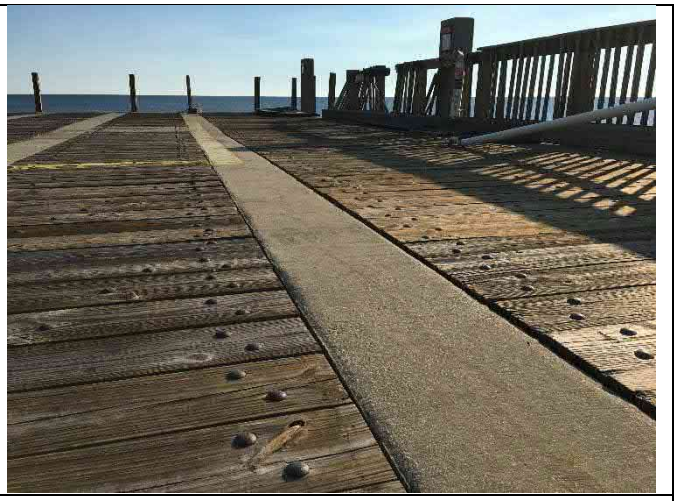
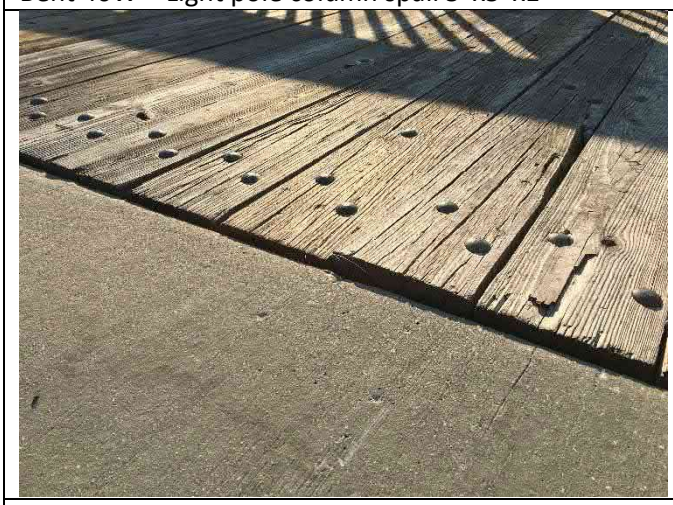
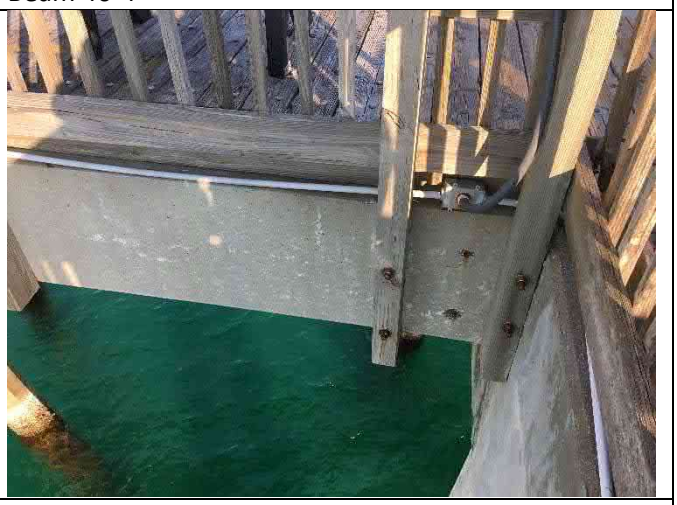
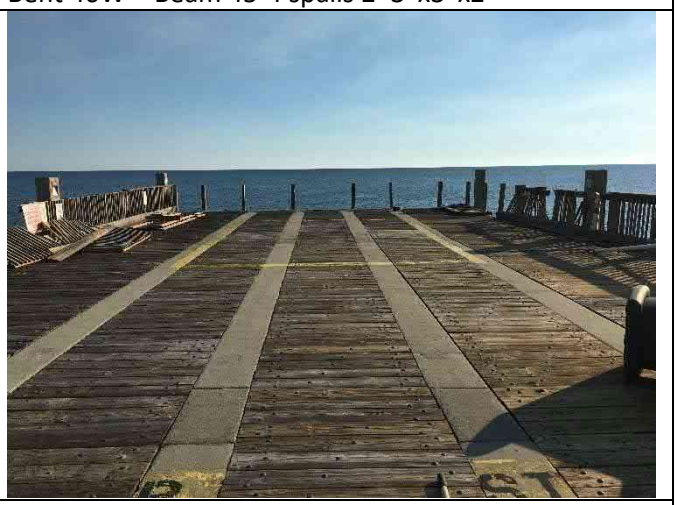


Span 46E – Deck gaps and dips > 0.5”, railing damage

Bent 46W – Broken flagpole, railing damage

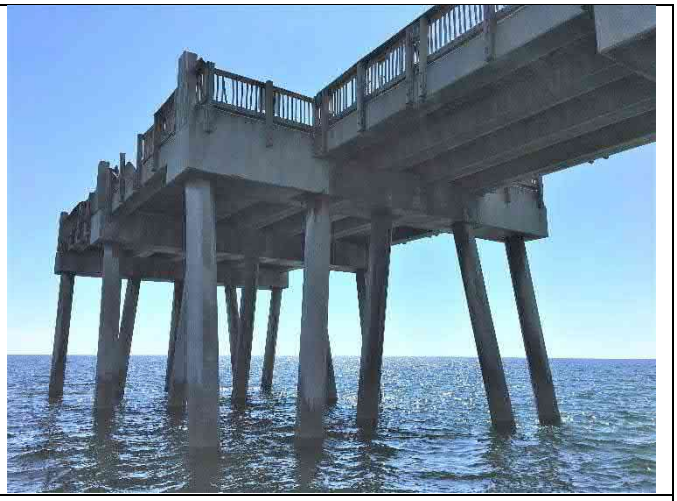


Span 46W – Railing loose with split wood members, broken flagpole (4.5” diameter x 27’ +/- fiberglass)

	
Bent 46W – Light pole column spall 5”x5”x1”	Beam 46-4
	
Span 46 and 47 - Deck plank tripping hazard	Bent 46W – Beam 45-4 spalls 2~3”x3”x2”
	
Bent 46E – Beam 45-1 spalls 2~3”x3”x2”, spall 12”x3”x2” top flange	Span 46 – 4~short and 4~long damaged deck sections with gaps and dips > 0.5”

	
Bent 46 North Face	Bent 46 North Face
	
Bent 46 North Face – Pile cap impact spall Pile 46-1 12”x3”x3”	Pile 46-2 – Previous pile cap cracking and spall repair damaged 30”x20”x10”
	
Bent 46 South Face – Pile 46-2 top spall 30”x10”x1”	Bent 46 South Face - Beam 46-5 north end cracking, delamination and spall 24”x12”x2”
	
Bent 46 South Face – Pile cap spall between Pile 46-3 and 46-4 24”x8”x3”	Bent 46 South Face – Pile cap spall over Pile 46-1 24”x24”x2”

Pile 46-1 – Spall 8”x8”x2”



Bent 46E North Face – Pile 46-2 top spall 6”x6”x1”

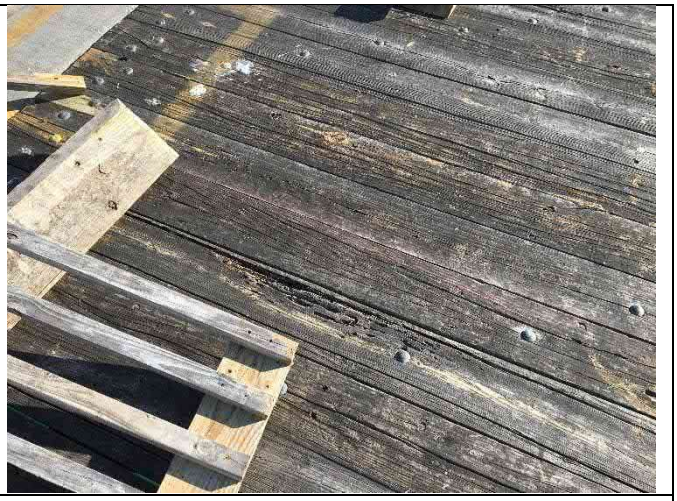
Bent 46E South Face – Pile spall repairs damaged 5x4~4”x4”x1”

Bent 46W North Face

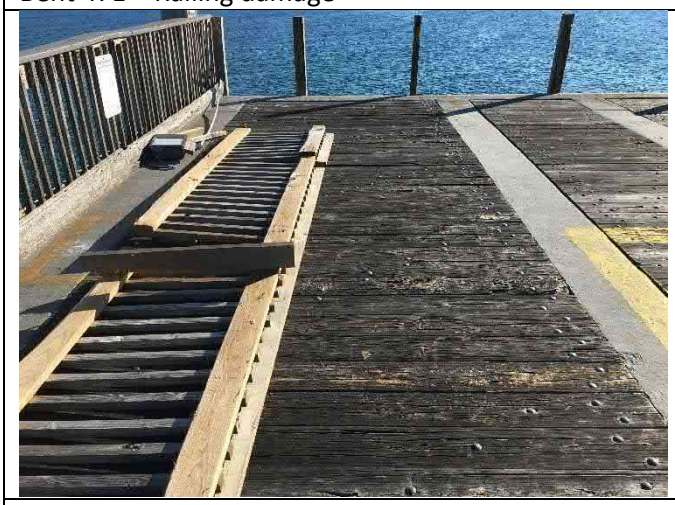
Bent 46W South Face

Bent 46W – Flagpole broke during storm

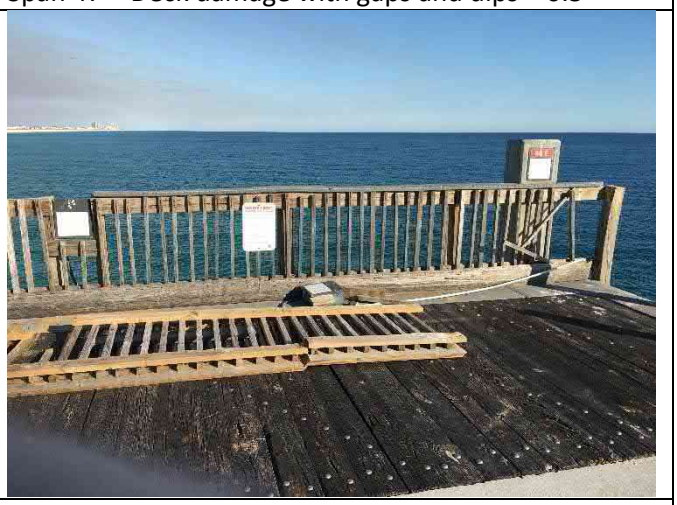
Bent 47E – Railing damage



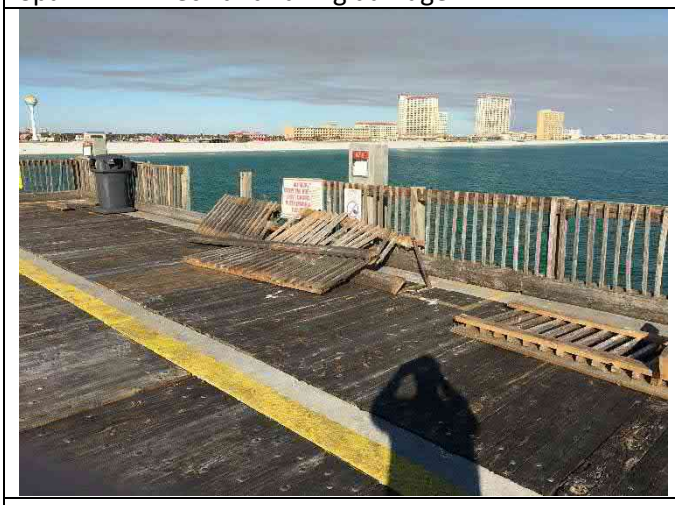
Span 47 – Deck damage with gaps and dips > 0.5”



Span 47E – Deck and railing damage

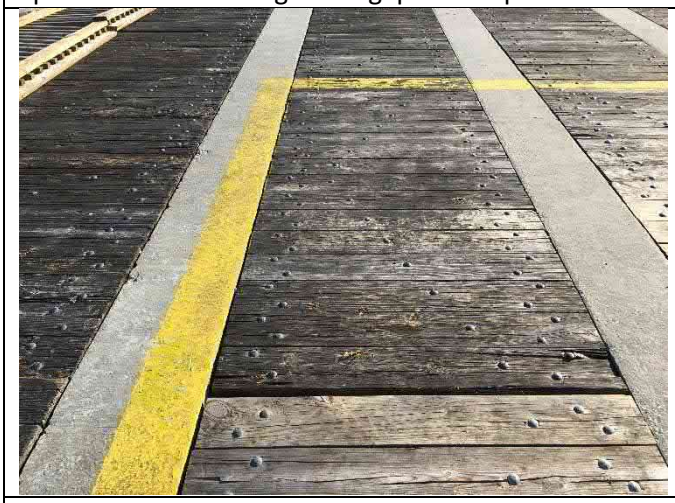
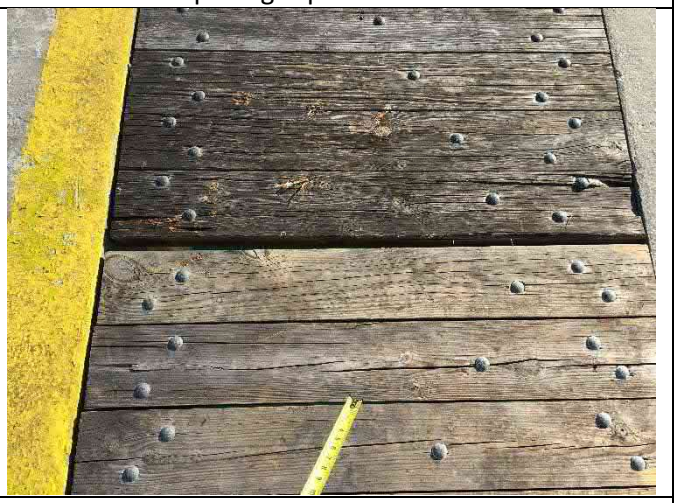
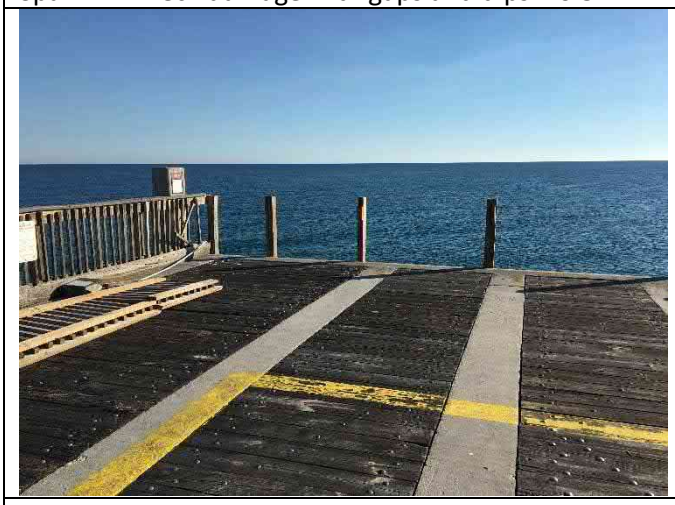


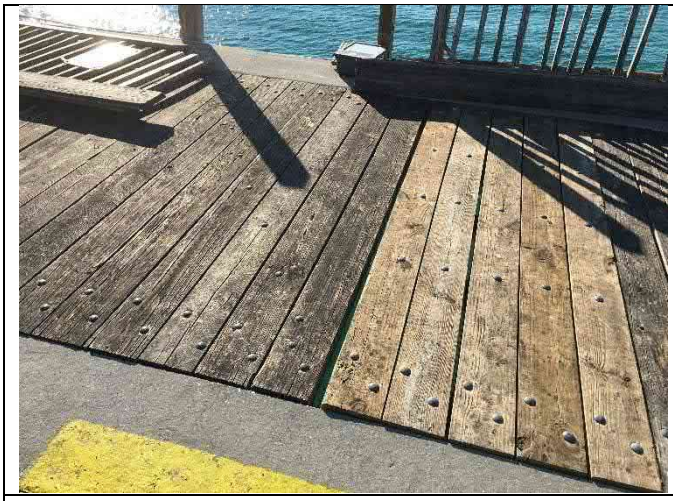
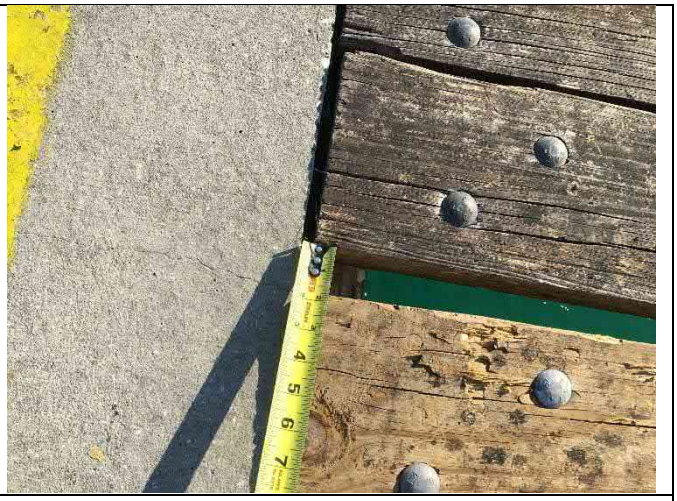
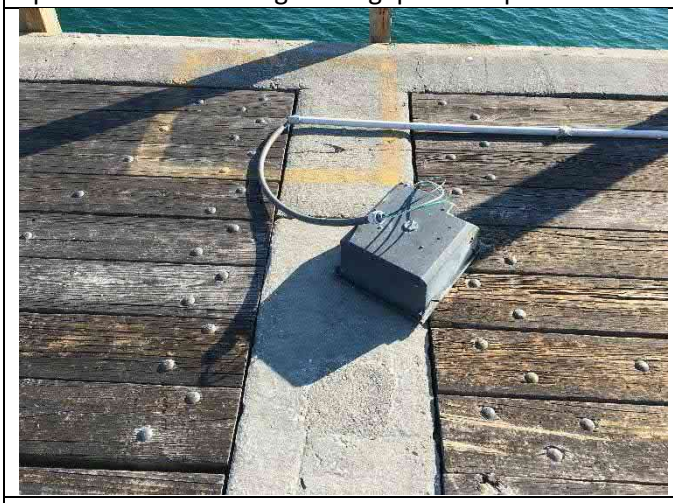
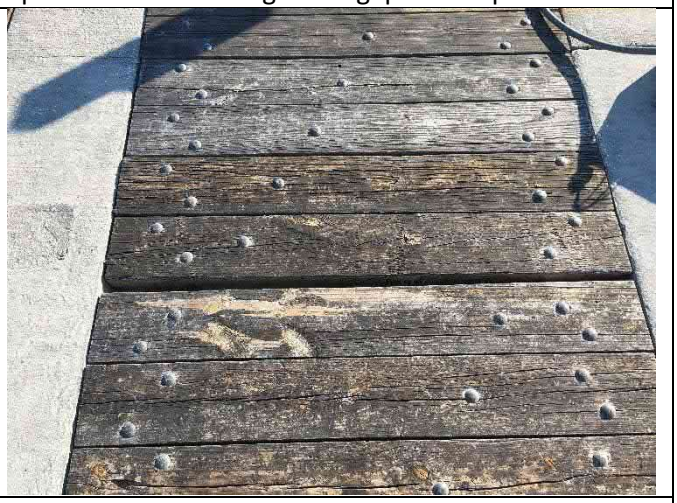
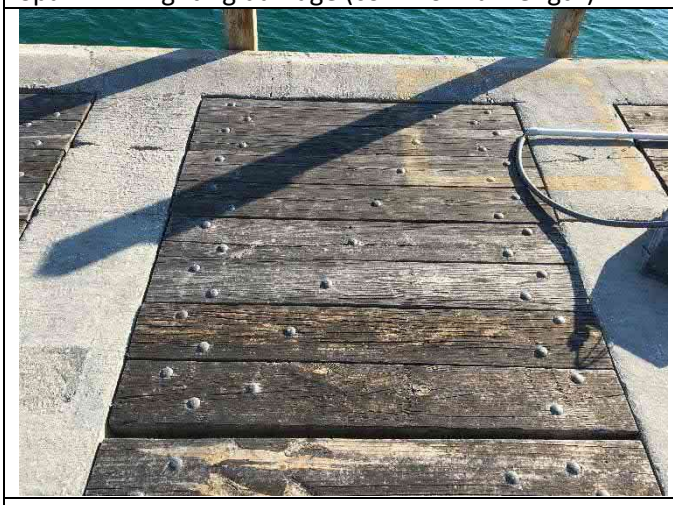
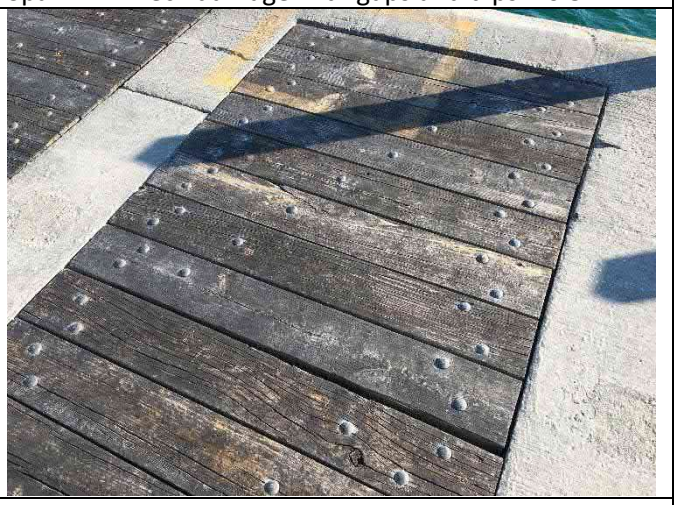
Span 47E - Deck and railing damage

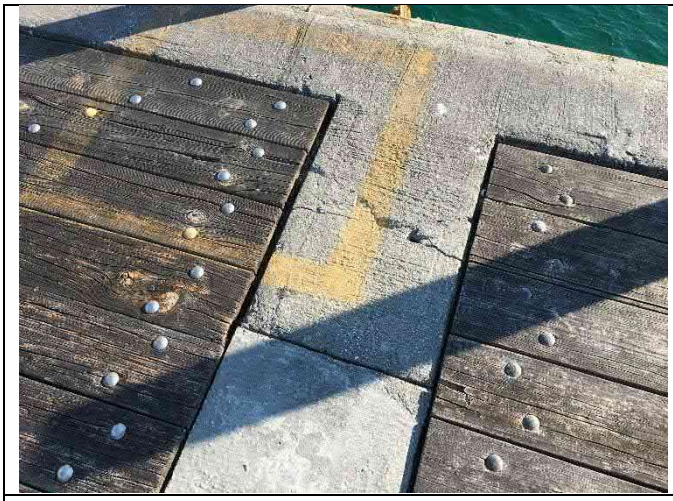
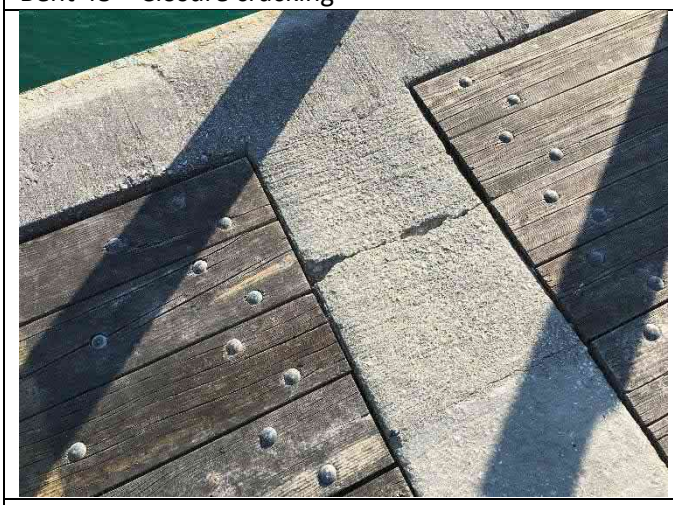
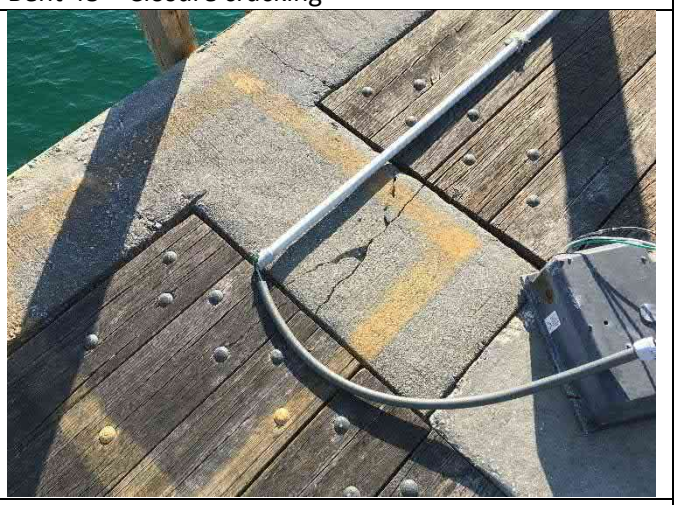
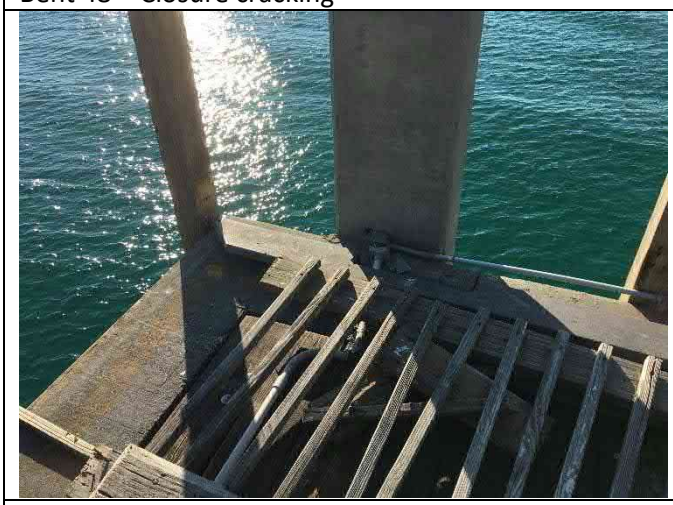
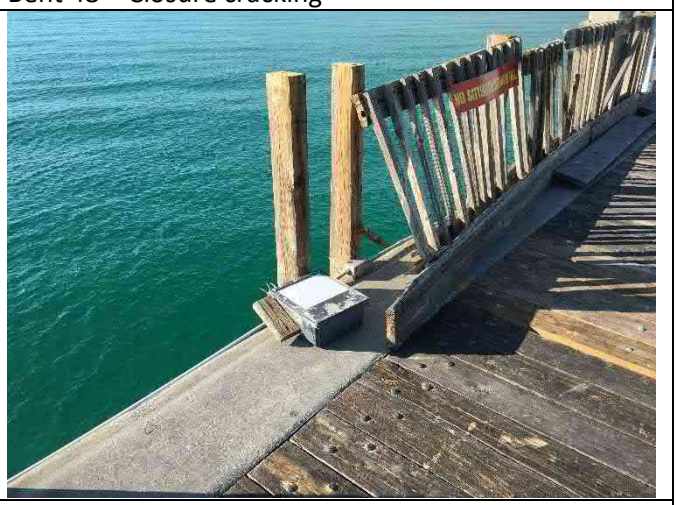


Span 46E, 47E - Deck and railing damage

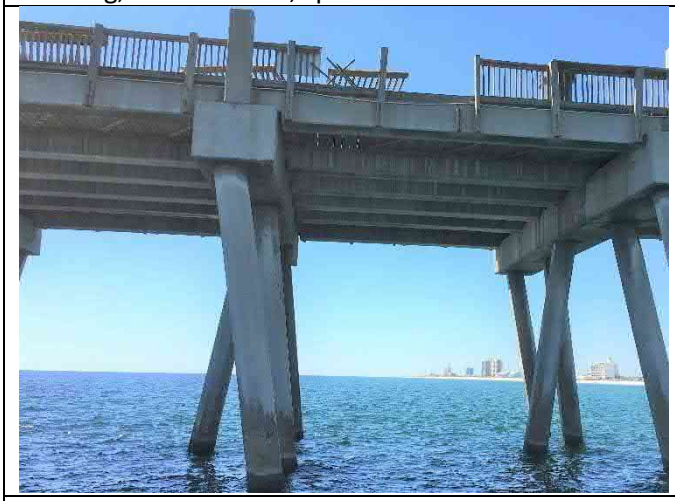
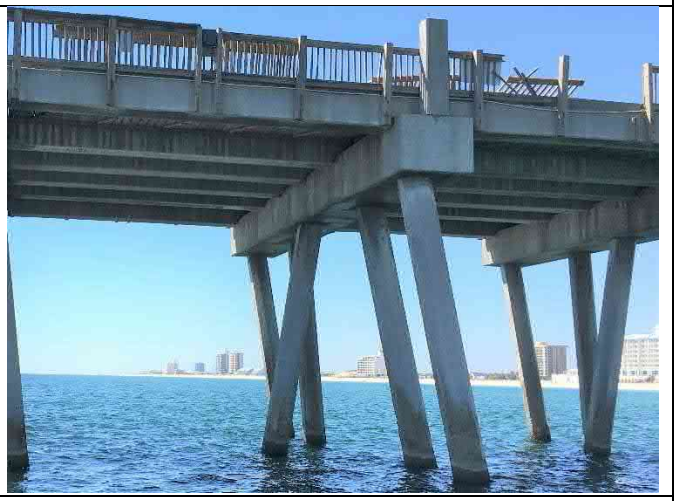
Span 47 – Deck damage with gaps and dips > 0.5”

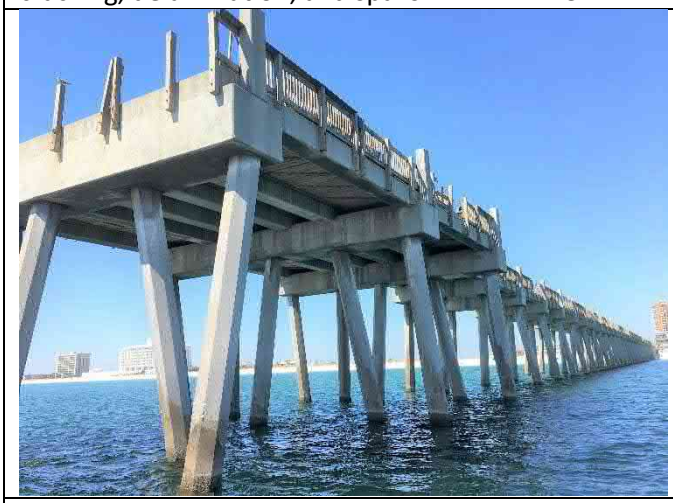
	
Span 47 – Deck damage with gaps and dips > 0.5”	Beam 74-2 – Top flange spall 4”x2”x1”
	
Span 47 – Deck damage with gaps and dips > 0.5”	Span 47 – Deck damage with gaps and dips > 0.5”
	
Span 47 – Deck and railing damage	Span 47 - 8~short and 5~long damaged deck sections with gaps and dips > 0.5”, railing damage

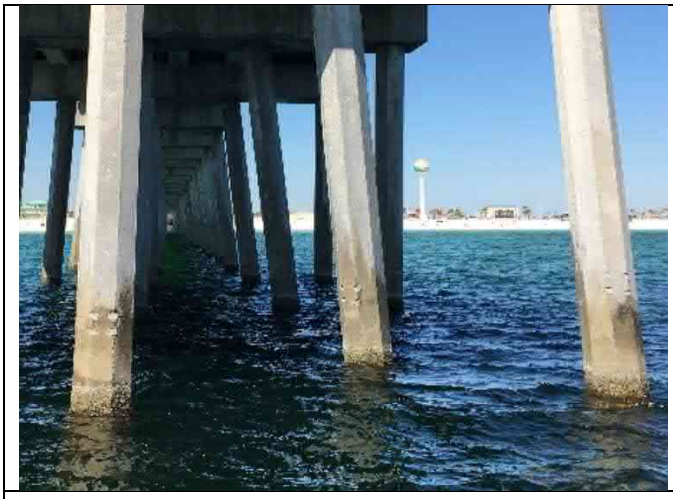
	
Span 47 – Deck damage with gaps and dips > 0.5”	Span 47 – Deck damage with gaps and dips > 0.5”
	
Span 47 – Lighting damage (common full length)	Span 47 – Deck damage with gaps and dips > 0.5”
	
Span 47 – Deck damage with gaps and dips > 0.5”	Span 47 – Deck damage with gaps and dips > 0.5”

	
Bent 48 – Closure cracking	Bent 48 – Closure cracking
	
Bent 48 – Closure cracking	Bent 48 – Closure cracking
	
Bent 48W – Railing and lighting damage	Span 47W – Railing and lighting damage

	
Span 47 – Deck damage with gaps and dips > 0.5”	Span 47 – Deck damage with gaps and dips > 0.5”
	
Bent 47W – Railing damage	Bent 48E
	
Bent 49W – Railing damage	Bent 47 North Face

	
Bent 47E North Face	Bent 47W North Face
	
Bent 47 North Face	Bent 47 North Face
	
Bent 47 South Face – Beams 47-3, 47-4 north end cracking, delamination, spalls 2x24”x12”x4”	Bent 47 South Face
	
Bent 47E	Bent 47E – Pile spall repairs damaged 5x4~4”x4”x1”

	
Bent 47W North Face	Bent 47W South Face – Beams shifted north
	
Bent 48 – Beams 47-3, 47-4, 47-5, 47-6 south end cracking, delamination, and spalls 4x24”x12”x3”	Bent 48 - Pile cap cracking around Piles 48-2 and 48-4 2x30”x30”x4”
	
Bent 48E South Face	Bent 48 South Face

	
Bent 48 – Pile spall repairs damaged 5x4~4”x4”x1”	Bent 48W – Beams 48-3, 48-4, 48-5, 48-6 south end cracking, delamination, and spalls 4x24”x12”x3”, Pile cap spall around Pile 48-5 30”x30”x4”
	
Bent 48W South Face	Bent 48W