Technical Memorandum

October 3, 2022

To	Ryan Marquez, City of Pacifica	**Contact No.**	925 849 1019
Copy to	Paul Henderson	**Email**	satish.chilka@ghd.com
From	Satish Chilka PE	**Project No.**	11223688
Project Name	Pacifica Pier Handrail Repairs		
Subject	Condition Assessment of Pier Handrails - 2022		

1. Introduction

The Pacifica Municipal Pier, located at 2100 Beach Blvd. Pacifica, CA 94044, is an L-shaped concrete pier supported on concrete piles (Figure 1.1). The pier functioned to support an outfall extending from Beach Boulevard into the ocean. The pier deck are prestressed concrete box girders with cast-in-place concrete handrails.

GHD Inc. conducted a condition assessment of the concrete handrails in March 2021 and developed repair options for damaged handrails along the pier. The collapse of handrails along the pier extension had resulted in the portion of the pier remaining closed to the public. The findings of the assessment were documented in a technical memorandum (March 2021) and included as Attachment A.

The City of Pacifica is evaluating options to undertake priority-based repairs of the handrails with the available funds i.e., repair handrails with severe damage. A revised condition assessment was performed for the handrails in June 2022 to review the current condition and progress of deterioration, and update the quantities required to be repaired in the near-term. The revised assessment utilized the observations from the previous assessment in Year 2021 as baseline in providing the revised ratings and recommended timeline for undertaking repairs.

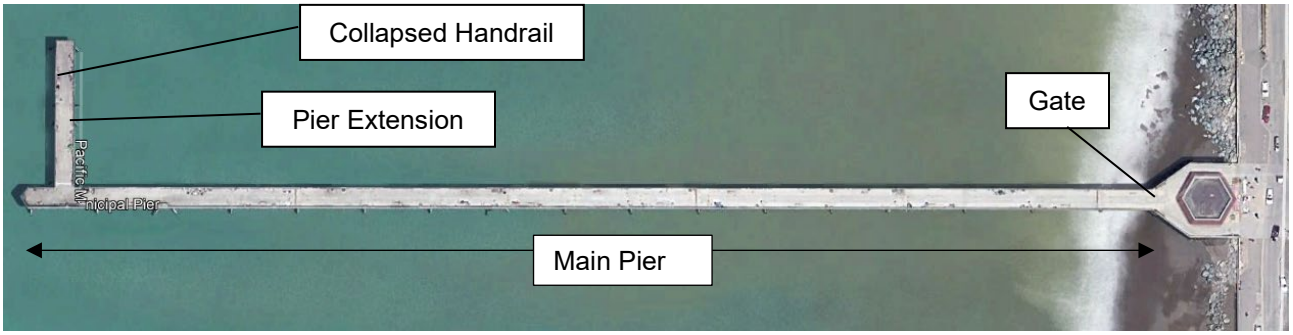

Figure 1.1 Pacifica Municipal Pier Layout

2. Methodology

The methodology was consistent with the condition assessment performed in Year 2021.

2.1 Observation methods

A visual observation of inside and outside faces of concrete handrails and deck surfaces was performed to assess current condition, identify areas of significant damage. At locations of observed damage, a 16-oz hammer was used to sound the concrete and determine extent of delamination and closed spall. Photographs and a handwritten record of observed damages were compiled. Results are tabulated with panels numbered starting at the Pier Abutment, with panel #1 being the first full panel starting beyond the gate.

The pier deck (box girder) was not accessible beyond visual observations in some locations, to evaluate the condition of the side walls that will affect the connection of the handrails.

2.2 Damage Ratings

The observed conditions of the guardrails are categorized in conformance with ASCE 130: Waterfront Facilities Inspection and Assessment. For reinforced concrete elements, damage can be described as either minor, moderate, major, or severe as described in Table 2.1.

Table 2.1: Damage Rating for Reinforced Concrete Elements - ASCE 130

Damage Rating	Existing Damage
Not Inspected	– Not inspected, inaccessible, or passed by
No Defects	– Good original hard surface, hard material, sound
Minor	– Mechanical abrasion or impact spalls up to 1-in in depth – Occasional corrosion stains or small pop-out – corrosion spalls – General cracks up to 1/16-in in width
Moderate	– Structural cracks up to 1/16-in in width – Corrosion cracks up to 1/4-in in width – Chemical deterioration: Random cracks up to 1/16-in in width; “Soft” concrete and/or rounding of corners up to 1-in deep – Mechanical abrasion or impact spalls greater than 1-in in depth
Major	– Structural cracks 1/16-in to 1/4-in in width and partial breakage (through section cracking with structural spalls) – Corrosion cracks wider than 1/4-in and open or closed corrosion spalls (excluding pop-outs) – Multiple cracks and disintegration of surface layer due to chemical deterioration – Mechanical abrasion or impact spalls exposing the reinforcing
Severe	– Structural cracks wider than 1/4-in or complete breakage – Complete loss of concrete cover due to corrosion of reinforcing steel with more than 30% of diameter loss for any main reinforcing bar – Loss of bearing and displacement at connections – Loss of concrete cover (exposed steel) due to – chemical deterioration

Damage Rating	Existing Damage
	– Loss of more than 30% of cross-section due to any cause

3. Condition Assessment

The existing handrails are cast-in-place concrete panels with reinforcement extending from the side walls of the pier deck (box girder) providing a connection between the deck and handrails.

The pier has continued experiences high wind in a harsh marine environment. There were no known instances of high surf (waves) reaching the pier deck or handrails since January 2021. Continuous exposure to seawater or marine spray with recurring wet and dry conditions are detrimental to the concrete structure. Cracks in concrete allow seawater to access the reinforcement, initiating corrosion. As corrosion expands around the circumference of the reinforcement, the bond between concrete and reinforcement weakens and results in delamination. The progressive delamination eventually leads to concrete breaking off from the reinforcement i.e., spalling.

3.1 Damaged Handrail

The pier experienced high surf and/or wind forces in January 2021. A 41-ft portion of the handrail on the west edge of pier extension (deck spanning north to south) collapsed inward onto the deck. The entire extension has remained closed to public access and the condition of handrails on this span were not assessed.

The collapsed panels were previously noted to have severely corroded reinforcement at the joint between the handrail panels and deck. The concrete panels did not show signs of exposed spall hence the weakened connection due to corroded reinforcement and potential delamination in the side walls of the pier deck were determined to be the main cause of failure. The pier deck was visibly damaged as the handrail reinforcement pulled out indicating spall in the pier deck.

Figure 3.1 Collapsed Handrail, Photo 2021

3.2 Typical Damage

The minor and moderate damages, characterized by cracks less than 1/16” in width and spalled concrete of less than 1” depth, are not expected to significantly impact the existing strength of the handrails. The primary cause for the collapsed handrail was due to weakened connection between the panel and deck. Hence, if

cracks, spalls, or rust stains were observed along the length of bottom connection to deck, those damages are categorized as major or severe damage.

More substantial cracks and spalls of concrete result in a significant loss of area in the structural concrete at supports, and generally leave existing reinforcement exposed to weather and subject to corrosion. In several instances, large spalls and reinforcement corrosion at handrails was accompanied by visible corrosion and spalling extending into the concrete below deck level.

Figure 3.2 through Figure 3.5 show the typical damage in handrail panels associated with the damage ratings.

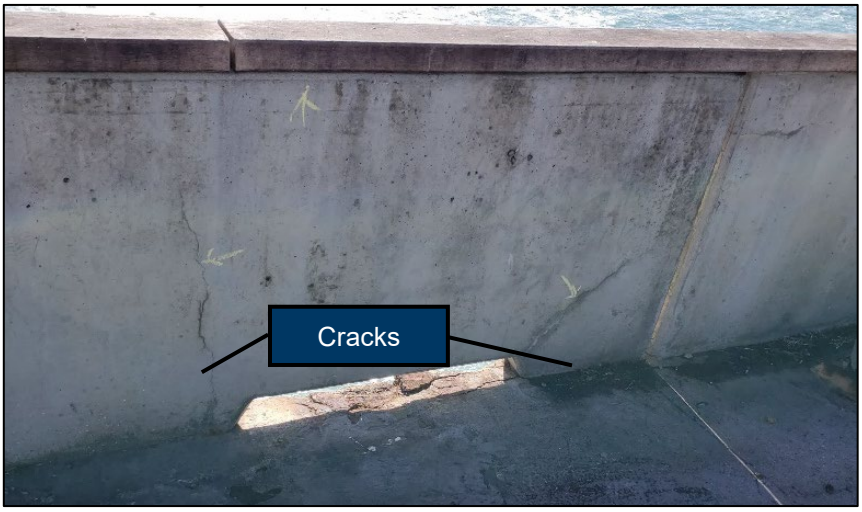

Figure 3.2: Typical Damage Rated Minor

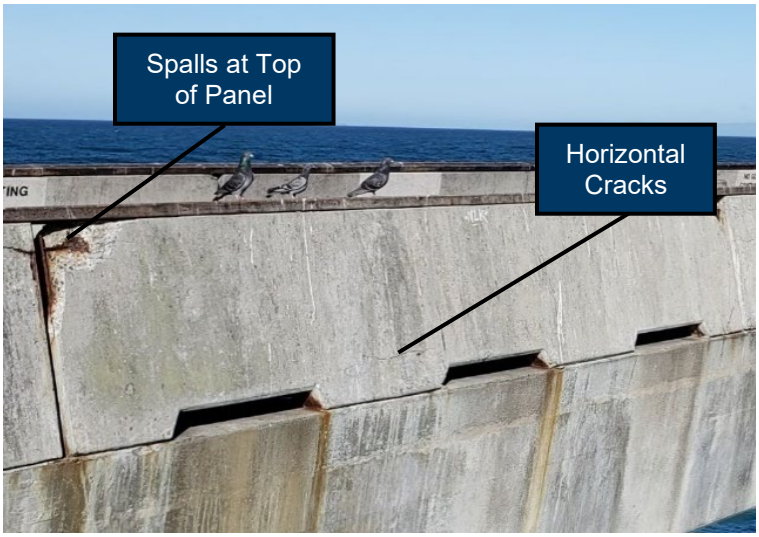

Figure 3.3: Typical Damage Rated Moderate

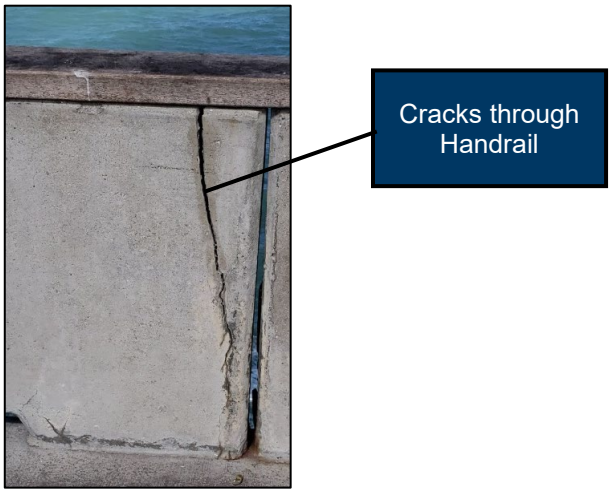

Figure 3.4: Typical Damage Rated Major

Figure 3.5: Typical Damage Rated Severe

A total of 164 panels were assessed on site and the corresponding damage rating for the panels have been summarized in Table 3.1, and include additional details in Attachment B. The condition of the panels and corresponding rating from Year 2021 was used a baseline for current assessment.

The panel ratings were revised accounting for the condition noted in the previous years' assessment and relative change in deterioration over the year. The reinforcement in the panels continues to corrode until mitigation actions, such as repairing spalled concrete, adding galvanic anodes etc., are undertaken. As a result, some panels previously rated to have "No Damage" or lower damage rating have been reassessed to the next level of damage. On the other hand, some ratings were lowered from "severe" to "major" as the panels did not have significantly different visual damage.

Table 3.1 Summary of Assessment – Damage Ratings

Assessment	Year 2022
No Damage	13
Minor Damage	29
Moderate Damage	29
Major Damage	56
Severe Damage	37

4. Conclusions and Recommendations

The extent of damage suggests that the corrosion and spalling is concentrated in areas of the pier farthest from shore, and panels closer to shore as well. In handrail panels without major or severe damage, the presence of corrosion staining, minor spalling, and cracking suggests that corrosion of reinforcement has already begun and will continue to progress in current exposure conditions. Field observations and categorization of observed damages have been recorded in detail for each panel, as summarized in the attached Attachment B.

The revised timeline for undertaking the handrail repairs based on the rate of deterioration observed in the handrails is provided in Table 4.1. Year 0 is referenced to the year of assessment (2022). The recommended timeline may be revised with subsequent condition assessment to accommodate the most current condition of the handrails. The repair or replacement of panels rated severe should be prioritized, followed by major and moderate over time.

Table 4.1 Recommended Timeline for Repairs

Damage Rating	Time (Years)
Severe	0 to 2
Major	0 to 5
Moderate	0 to 10
Minor	0 to 15

The collapsed handrail at the pier extension should be replaced or the extension should remain closed to the public.

At handrail panels with severe and major damage extending across two or more supports, as well as at the fully collapsed panels, full replacement of the panels is recommended.

The collapsed panels showed extensive loss of rebar at the connection to the pier deck and signs of concrete failure extending into the sides of the box girder. Thus, the condition of the reinforcement at the deck interface (between handrail panels and sides of the box girder) and the condition of the sides of the box girder is critical for the integrity of the panels. The panels with extensive damage along the interface and connection points are rated as severe or major. These panels are anticipated to have limited capacity to withstand the large loads from storm events (wind and wave loads), specifically those in combination with large swells.

At panels with minor to moderate damage, patching superficial cracks and spalled concrete would mitigate further damage. Providing additional supports at panels to supplement existing corroded reinforcement would extend the functional life of the panels and reduce the likelihood of future collapses.

The City of Pacifica should undertake annual condition assessment of the handrails and above deck components until the handrails are repaired, as necessary. The condition of the pier deck (box girder) and supporting piles should also evaluated to assess the integrity of the handrail connections to the pier deck.

The pier should be closed to public when high wind and wave conditions are anticipated in the area. The handrail panels, especially the ones parallel to shore, should be visually checked before opening the pier.

5. Limitations

This technical memorandum has been prepared by GHD for City of Pacifica. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose other than stated herein. It is not intended for circulation or incorporation into other documents in part. The matters discussed in this memorandum are limited to those specifically detailed in the memorandum and are subject to any limitations or assumptions specially set out.

Accessibility of documents

If this Technical Memorandum is required to be accessible in any other format this can be provided by GHD upon request and at an additional cost if necessary.

The opinions, conclusions and any recommendations in this memorandum are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this memorandum are constrained by the site conditions and location of the handrails limiting visual and physical access to all the handrail panels. As a result, not all relevant site features and conditions may have been identified in this memorandum.

Attachment A: Memorandum – Assessment of Pacifica Pier Above Deck Components, March 2021.

Attachment B: Field Notes – Condition Assessment July 2022.

ATTACHMENT A

Memorandum

03/29/2021

To:	Sam Bautista	Ref. No.:	11223688
From:	Patrick Brutzman, Satish Chilka	Tel:	(925) 849-1000
cc:	Paul Henderson, Craig Lewis		
Subject:	**Assessment of Pacifica Pier Above-Deck Components - FINAL**		

1. Introduction

The Pacifica Municipal Pier, located at 2100 Beach Blvd. Pacifica, CA 94044. The structure is an L-shaped concrete pier supported by concrete piles. GHD has been asked to provide a condition assessment and develop repair options for damaged existing handrails at the far end of the pier. The damage to handrails has resulted in the pier being currently closed to the public.

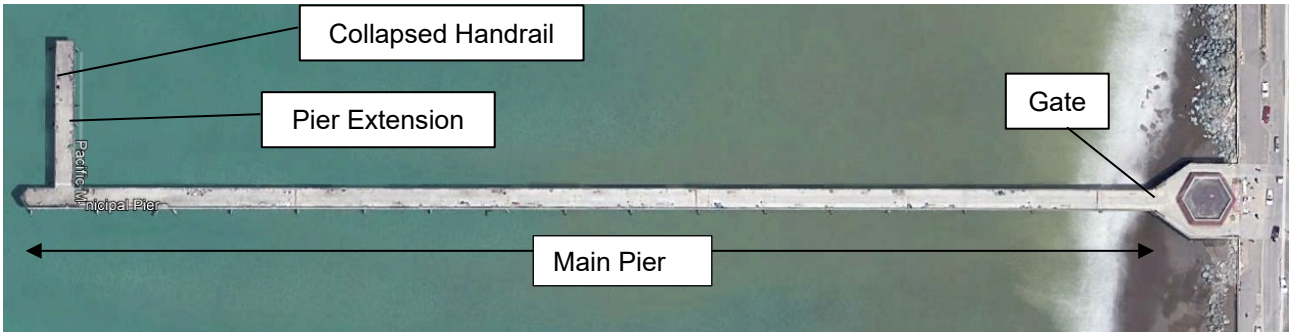

Figure 1: Pacifica Municipal Pier Layout

2. Background

Existing as-built drawings of the pier structure (dated 03/27/1972) are available as a reference for the original condition of the handrail. The handrail consists of cast-in-place concrete wall panels 6-1/2" thick and 42" tall, leaning inward over the deck. Panels are typically 18'-6" long, with shorter 4'-0" long panels occurring aligned with pile locations at 60'-0" on-center. The base of the typical panel has (3) 3'-0" openings with (2) 3'-0' supports between them, and the connection to the deck is reinforced with (2) #5 dowels at edge supports and (3) #5 dowels at interior supports. Refer to Figure 2 for a detail view of the existing handrail condition, and Figure 3 for an elevation view.

A condition assessment was performed by engineers from GHD on 2/12/2021 between 9:30 AM and 1:30 PM. Field observations were carried out to determine the current state of deterioration at all concrete

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guardrails and light post connections above the deck of the pier. At elements determined to be significantly damaged, measurements were taken in preparation for design of replacement and retrofit schemes.

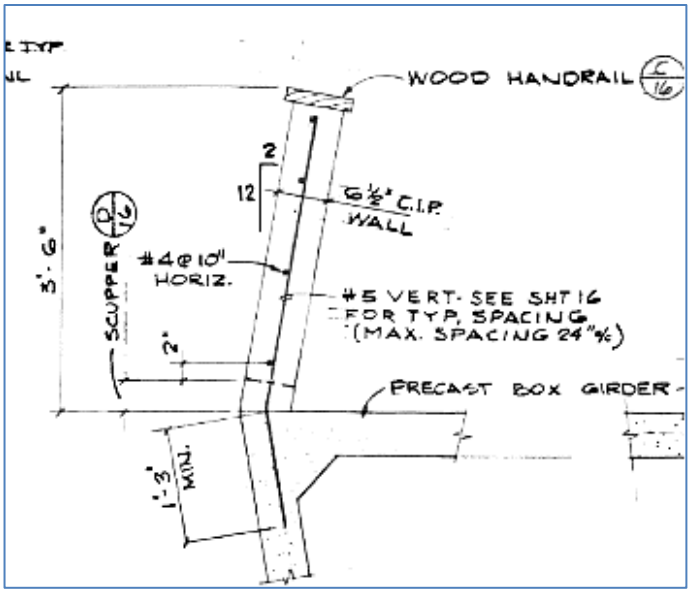

Figure 2: Existing Handrail Connection to Deck

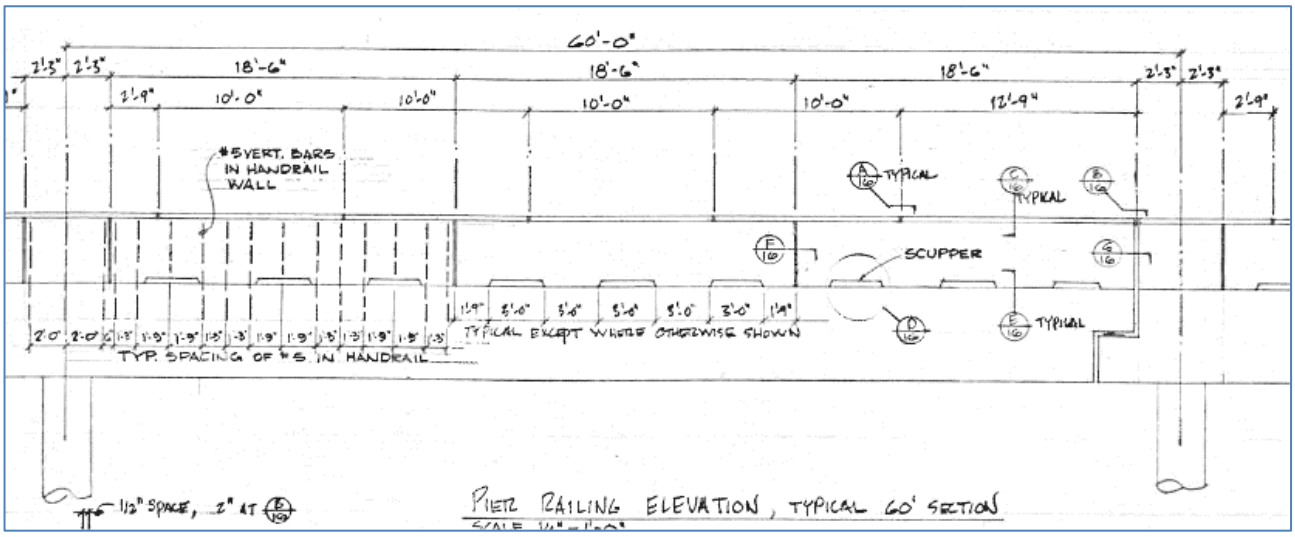

Figure 3: Existing Handrail Connection to Deck

3. Methodology

3.1 Observation methods

A visual observation of inside and outside faces of concrete handrails and deck surfaces was performed to assess current condition, identify areas of significant damage. At locations of observed damage, a 16-oz hammer was used to sound the concrete and determine extent of delamination and closed spall. Photographs and a handwritten record of observed damages were compiled. Results are tabulated with panels numbered starting at the Pier Abutment, with panel #1 being the first full panel starting beyond the gate.

3.2 Condition Assessment

The observed condition of the guardrails are categorized in conformance with ASCE 130: Waterfront Facilities Inspection and Assessment. For reinforced concrete elements, damage can be described as either minor, moderate, major, or severe as described in Table 3-1.

Table 3-1: Damage Rating for Reinforced Concrete Elements - ASCE 130

Damage Rating	Existing Damage
Not Inspected	• Not inspected, inaccessible, or passed by
No Defects	• Good original hard surface, hard material, sound
Minor	• Mechanical abrasion or impact spalls up to 1-in in depth • Occasional corrosion stains or small pop-out • corrosion spalls • General cracks up to 1/16-in in width
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Major	• Structural cracks 1/16-in to 1/4-in in width and partial breakage (through section cracking with structural spalls) • Corrosion cracks wider than 1/4-in and open or closed corrosion spalls (excluding pop-outs) • Multiple cracks and disintegration of surface layer due to chemical deterioration • Mechanical abrasion or impact spalls exposing the reinforcing
Severe	• Structural cracks wider than 1/4-in or complete breakage • Complete loss of concrete cover due to corrosion of reinforcing steel with more than 30% of diameter loss for any main reinforcing bar • Loss of bearing and displacement at connections • Loss of concrete cover (exposed steel) due to • chemical deterioration • Loss of more than 30% of cross-section due to any cause

4. Assessment Results

The pier experiences high wind and wave exposure in a harsh marine environment. Continuous exposure to seawater along with constant wet and dry conditions are detrimental to concrete structures. Cracks in concrete allow seawater access to the reinforcement, initiating corrosion. As corrosion expands the reinforcement, the bond between concrete and reinforcement weakens and causes spalling.

4.1 Damaged Handrail

At the pier extension, an approximately 41’ portion of west-facing handrail panels have collapsed inward onto the deck, probably resulting from high surf and/or wind forces sometime during January 2021. At the collapsed panels, the reinforcement is severely corroded at the joint between handrail panels and deck concrete, weakening the connection. Although the concrete panel itself did not show signs of spalls or delamination, the connections were the main cause of failure.

At the south end of the damaged panel, the reinforcement has pulled out of the concrete deck, indicating that there is a weakened bond within the deck concrete. The damage to handrails has also damaged the side wall of the deck. The underside of the deck was not accessible for further assessment during this inspection.

Figure 4: Photos of Collapsed Handrail

4.2 Typical Damage

A total of 164 panels were assessed on site and the corresponding damage rating for the panels have been summarized in Table 4-4-1, and include additional details in Appendix A.

Table 4-4-1: Damage Rating Summary

Damage Rating	No Damage	Minor	Moderate	Major	Severe
No. of Panels	25	29	30	36	44

The minor and moderate damage, characterized by cracks less than 1/16” in width and spalled concrete of less than 1” depth, is not expected to significantly impact the existing strength of the handrails. The primary cause for the collapsed handrail was due to weakened connection between the panel and deck. Hence, if cracks, spalls, or rust stains were observed along the length of bottom connection to deck, those damages are categorized as major or severe damage.

More substantial cracks and spalls of concrete result in a significant loss of area in the structural concrete at supports, and generally leave existing reinforcement exposed to weather and subject to corrosion. In several instances, large spalls and reinforcement corrosion at handrails was accompanied by visible corrosion and spalling extending into the concrete below deck level.

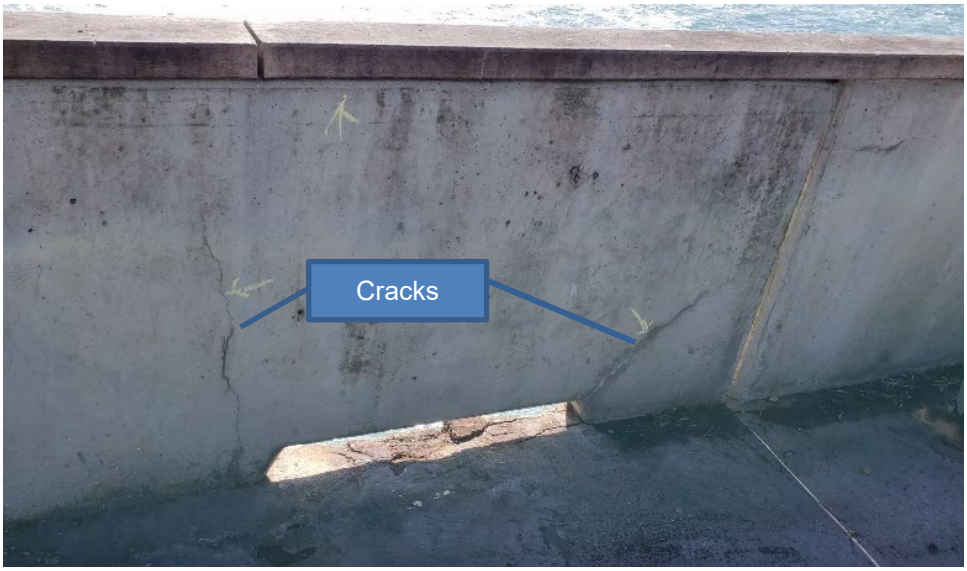


Figure 5: Typical Damage Rated Minor

Figure 6: Typical Damage Rated Moderate

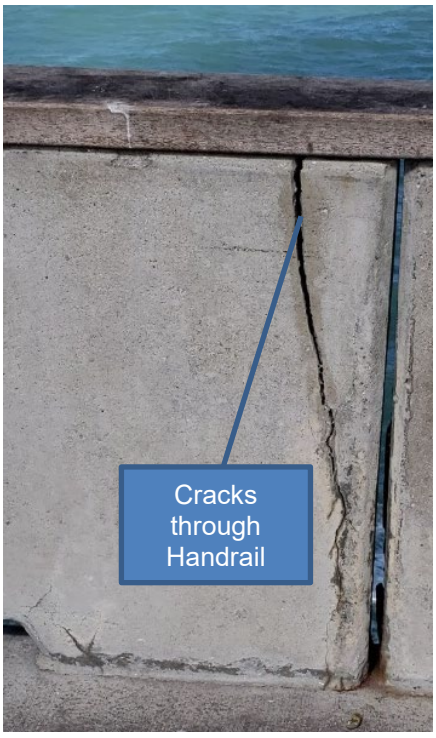


Figure 7: Typical Damage Rated Major

Figure 8: Typical Damage Rated Severe

4.3 Repaired Panel

One panel has been previously repaired. The exterior surface follows the profile of other panels, but the inside face is vertical, creating a wider base for stability. A galvanized steel angle section has been installed at the inside face, with anchors embedded into the panel and presumably into the deck to provide an improved connection.

Figure 10: Repaired Handrail Panel

4.4 Steel Brace Supports

Some panels have a 1/4” thick bent steel plate supports anchored at the inside face and at the deck to provide additional bracing. The anchors and hardware at these plate braces are significantly corroded, and at one location the plate has 100% section loss at mid-height.

Figure 11: Steel Brace at Handrail

4.5 Connections of Light Post

The light posts on the pier are connected to the pier deck using 4 bolts and steel base plate. The base plate and anchor bolts show signs of corrosion. The nuts seem to be stainless steel material, showed some discoloration but didn’t show significant corrosion. There was no visible damage to the connections or grout pad around the base plate indicating movement of the light post due to a weakened connection.

Figure 9: Typical Light Post Foundation

4.6 Fish Cleaning Stations

The fish cleaning stations are concrete structures connected to the deck. The stations showed signs of deterioration and spalls. These damages start from the bottom connections due to corrosion of reinforcement and align well with the observations of similar deterioration at handrails.

5. Conclusions and Recommendations

The current extent of damage suggests that the corrosion observed in collapsed railing panels is widespread at areas of the pier farthest from shore, and present in the abutment panels closer to shore as well. In railing panels without major or severe damage, the presence of corrosion staining, minor spalling, and cracking suggests that corrosion of reinforcement has already begun and will continue to progress in current exposure conditions. Field observations and categorization of observed damages have been recorded in detail for each panel, as summarized in the attached Appendix A.

At railing panels with severe and major damage extending across two or more supports, as well as at fully collapsed panels, full replacement of the panels is recommended. At panels with major or severe damage concentrated at supports, a retrofit consisting of repairing damaged concrete, repairing corroded reinforcement, and providing additional support mechanism may be a feasible alternative to full replacement.

At panels with minor to moderate damage, patching superficial cracks and spalled concrete would mitigate further damage. Providing additional supports at panels to supplement existing corroded rebar would extend the life of the panels and reduce the likelihood of future collapses.

The collapsed handrail at the extension pier should be replaced or the extension closed to the public. The recommended timeline for other panels is provided in Table 5-1, referenced to Year 2021 as baseline i.e., Year 0.

It is also recommended to close the pier when high wind and wave conditions are anticipated in the area. The panels, especially the ones parallel to shore, should be visually checked before opening the pier.

Table 5-1: Recommended Timeline for Repairs

Damage Rating	Time (Years)
Severe	0 to 1
Major	0 to 2
Moderate	0 to 5
Minor	0 to 10

Appendix A

Field Observation Notes and Damage Rating Summary

ATTACHMENT A

PROJECT PACIFICA PIER HANDRAIL REPAIRS
CLIENT CITY OF PACIFICA
SUBJECT 2/12/2021 FIELD OBSERVATION REPORT - VISUAL AND SPALLING INSPECTION
ENGINEER PB **DATE** 2/15/2021
CHECKED SC **DATE** 2/18/2021

LEGEND

PANEL ID INFO

N/S/E/W	SIDE OF PIER (NORTH/SOUTH/EAST/WEST)
#	PANEL COUNT FROM ENTRANCE OF PIER (Negative # indicates panels shoreside of the gate)
S	SHORT PANEL
A	ABUTMENT WALL

REPORT ITEM

RAT	DAMAGE RATING
ND	No Damage
MN	Minor Damage
MJ	Major Damage
SV	Severe Damage

MC(##)	MINOR CRACK NOT EXCEEDING 1/16" (TOTAL LENGTH OF CRACK, INCHES)
MS(##x##)	MINOR SPALLING (APPROX. AREA, INCHES)
CR	CRACKING WITH LOSS OF EFFECTIVE CONCRETE AREA AT SUPPORT
SP	SPALLING WITH LOSS OF EFFECTIVE CONCRETE AREA AND REINFORCEMENT COVER
E	DAMAGE LOCATED AT EDGE OF PANEL
FW/FH	DAMAGE SPREAD ACROSS FULL WIDTH / HEIGHT
X#	NUMBER OF INSTANCES OF DAMAGE

MAIN PIER STRUCTURE

	Side S				Side N			
PANEL ID	**INSIDE S**	**OUTSIDE S**	**RAT S**	**REMARK S**	**INSIDE N**	**OUTSIDE N**	**RAT N**	**REMARK N**
-5A		SP	MN		CR(90)	FW-SP	SV	
-4A		SP	MD		CR	SP	MJ	
-3A	CR	SPX2	MD			SP	MJ	
-2A	CR(60)	SP(24X30)	MD		CR(48)	SP	SV	
-1A	E-SP	SP(3)	MJ		CR(30)	E-SPX2	MJ	
0A	MC, CR	FW-SP	SV	GATE OCCURS 4' FROM END	CR(60)	E-SP	MJ	GATE OCCURS 4' FROM END
1	MS(18X10)X2		MD				ND	STEEL BRACKET
2		E-MC	MN		MC(42)	CR	MN	
3			ND				ND	
4S			ND			SP	MD	
5			ND		MC(42)		MN	
6			ND				ND	
7	MS(12X4)		MN		MS		MN	
8S	MS		MN			MC	MN	
9	MC(90), MS	SP	MD			MS(12X18)X2	MD	
10		CR, SP	SV			MS(12X12)	MD	
11	CR	MS	SV		MS, MC(90)	MS	MD	
12S			ND			MS	MD	
13		MS(12X24)	MD	SPALLING	MC(42)	MC	MD	

ATTACHMENT A

PROJECT PACIFICA PIER HANDRAIL REPAIRS
CLIENT CITY OF PACIFICA
SUBJECT 2/12/2021 FIELD OBSERVATION REPORT - VISUAL AND SPALLING INSPECTION
ENGINEER PB **DATE** 2/15/2021
CHECKED SC **DATE** 2/18/2021

14			ND		SP	MC	SV	
15	MC(90)		MN		MS(18X6), MC		MJ	
16S			MN	CLEANING STA W/ SPALLING			ND	
17			ND		MS, MC(30)	SP	MJ	
18		MS(12X12)	MJ	CORRODED DECK	MC, SP	MS	MJ	
19		MS(6X12)X2	MD		SP(24X8)	MS	SV	
20S		MS	MD		MS		MN	
21		SP,MC(42)	MJ			MS	MN	
22	MS	MS,CR	SV			SP	MN	
23	MC(30)	MS	MD		CR, FW-MC	SP	MN	
24S		MS	MD				ND	
25		MS	MD		SP	SP	SV	
26		SP	MJ		SP	SP	MJ	
27		MC	MN				ND	
28S			ND				ND	
29			ND				ND	
30			MN	STEEL BRACKET LOST			ND	STEEL BRACKET
31		SP	MD		E-SP	MS,SP	SV	
32S		SP	MD			MC,MS	MJ	
33	MC	FH-SP	SV		E-SP	SP	SV	
34	E-SP,CR		SV		CR(300), SP	FH-CR	SV	
35	MC(30)		MN			FH-SP	MJ	
36S		MC(42)	MN			CR	MD	
37	MC(42), SP		MN		SP	MC	SV	
38	MC(42)		MN		SP	SP	SV	
39	MC(42)	MS	MJ			SP	MJ	
40S			ND				ND	
41	SP	SP	SV		SP(24X12)	E-SP,CR	SV	
42	E-SP, FW-SP		SV		E-SP		MJ	
43	MC(42)	SP	MJ		E-SP		MJ	
44S		E-SP	SV				MN	
45		E-SP	SV			E-SP	MJ	
46			ND		FW-SP	SP	SV	
47	MC		MN				ND	
48S			ND				ND	
49		E-SP	SV			E-SP	SV	
50	MS(12X24)X2	E-SP	SV			E-SP	SV	
51			MN			E-SP	MJ	
52S		SP	MJ			SP	MJ	
53	CR	SP	SV	CORRODED DECK	CR	MS	SV	
54			MN			E-MS	MJ	
55		SP	MJ	AT MID-PANEL		E-SP	MJ	

ATTACHMENT A

PROJECT PACIFICA PIER HANDRAIL REPAIRS
CLIENT CITY OF PACIFICA
SUBJECT 2/12/2021 FIELD OBSERVATION REPORT - VISUAL AND SPALLING INSPECTION
ENGINEER PB **DATE** 2/15/2021
CHECKED SC **DATE** 2/18/2021

56S		MS	MN		FW-CR	FW-CR	MD	
57		E-SP	SV			SP	MD	
58	CR	E-SP	SV			E-SP	MJ	
59	CR		MJ	STEEL BRACKET	CR	E-SP	SV	STEEL BRACKET
60S	CR		SV		CR	FW-CR	MD	
61	CR		SV		MC(42)	MS	MD	
62		MS	MD			CR,MS	MJ	AT MID-PANEL
63	MC(60)	MS	MD			SP	MD	
64S			MN				MN	
65		E-SP	SV		SP		SV	DAMAGE CONCENTRATED AT CORNER
66		FH-SP	SV				ND	OPEN BAY
67		E-SP	MJ		CR		MJ	AT CORNER
68	CR, SP	FW-SP	MJ	END WALL	CR, SP	FW-SP	SV	END WALL

SUBTOTAL	NO DAMAGE	12	
	MINOR	17	
	MODERATE	15	
	MAJOR	11	
	SEVERE	19	

SUBTOTAL	NO DAMAGE	13	
	MINOR	10	
	MODERATE	12	
	MAJOR	21	
	SEVERE	18	

PIER EXTENSION

	Side W				**Side E**			
PANEL ID	**INSIDE W**	**OUTSIDE W**	**RAT W**	**REMARK W**	**INSIDE E**	**OUTSIDE E**	**RAT E**	**REMARK E**
1S			MN	NEW PANEL	MC	CR	MD	
2	CR(42)	SP, E-SP	MJ		MC(42)	E-SP	SV	
3			MN			MC(30)	MD	
4S			SV	COLLAPSE	SP	SP	SV	
5			SV	COLLAPSE	CR	E-SP	SV	
6			SV	COLLAPSE		E-SP	MJ	
7	SP	FW-SP	SV			E-SP	MJ	
8		MS	MD	ENDPANEL		SP(24X12)X2	MJ	ENDPANEL

SUBTOTAL	NO DAMAGE	0	
	MINOR	2	
	MODERATE	1	
	MAJOR	1	
	SEVERE	4	

SUBTOTAL	NO DAMAGE	0	
	MINOR	0	
	MODERATE	2	
	MAJOR	3	
	SEVERE	3	

TOTAL	NO DAMAGE	25
	MINOR	29
	MODERATE	30
	MAJOR	36
	SEVERE	44

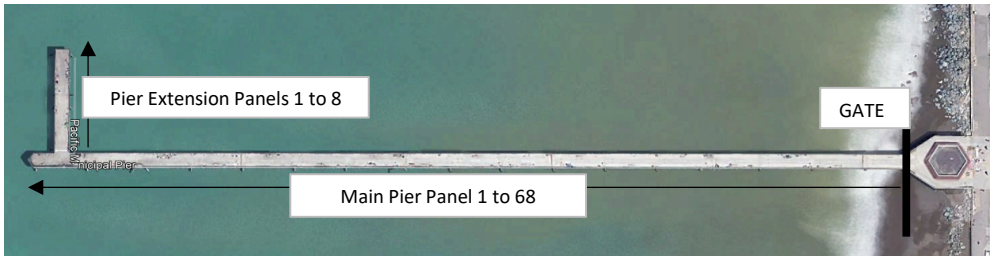
ATTACHMENT B

PROJECT	PACIFICA PIER HANDRAIL REPAIRS
CLIENT	CITY OF PACIFICA
SUBJECT	7/5/2022 FIELD OBSERVATION NOTES - VISUAL CONDITION ASSESSMENT
NOTES BY	Satish Chilka PE, Derek Linsley PE
COMPILED BY	Ishan Goel, EIT

LEGEND

PANEL ID INFO

N/S/E/W	SIDE OF PIER (NORTH/SOUTH/EAST/WEST)
#	PANEL COUNT FROM ENTRANCE OF PIER (Negative # indicates panels shoreside of the gate)
S	SHORT PANEL
A	ABUTMENT WALL



REPORT ITEM

RAT	DAMAGE RATING
ND	NO DAMAGE
MN	MINOR DAMAGE
MD	MODERATE DAMAGE
MJ	MAJOR DAMAGE
SV	SEVERE DAMAGE

MC(##)	MINOR CRACK NOT EXCEEDING 1/16" (TOTAL LENGTH OF CRACK, INCHES)
MS(##x##)	MINOR SPALLING (APPROX. AREA, INCHES)
CR	CRACKING WITH LOSS OF EFFECTIVE CONCRETE AREA AT SUPPORT
SP	SPALLING WITH LOSS OF EFFECTIVE CONCRETE AREA AND REINFORCEMENT COVER
B	BOTTOM CONNECTION DAMAGED
E	DAMAGE LOCATED AT EDGE OF PANEL
FW/FH	DAMAGE SPREAD ACROSS FULL WIDTH / HEIGHT
X#	NUMBER OF INSTANCES OF DAMAGE

MAIN PIER STRUCTURE - REVISED RATINGS

	PIER SIDE - S				PIER SIDE - N			
PANEL ID	**INSIDE**	**OUTSIDE**	**RAT**	**REMARK**	**INSIDE**	**OUTSIDE 2**	**RAT**	**REMARK**
-5A		SP	MN		CR(90)	FW-SP	SV	
-4A		SP	MD		CR	SP	MJ	B
-3A	CR	SPX2	MD			SP	MJ	B
-2A	CR(60)	SP(24X30)	MJ	B, 11'-2" (INSIDE)	CR(48)	SP	SV	11'-2" (INSIDE)
-1A	E-SP	SP(3)	MJ	B	CR(30)	E-SPX2	SV	MJ-SV
0A	MC, CR	FW-SP	SV	GATE OCCURS 4' FROM END	CR(60)	E-SP	MJ	GATE OCCURS 4' FROM END
1	MS(18X10)X2		MJ	MJ-MD, STEEL BRACKET (7'-11")			MN	STEEL BRACKET (8'-3")
2	42" CR	E-MC	MN		MC(42)	CR	MN	
3			ND				ND	
4S			ND			SP	MD	MD-MN
5			MN	DECK DAMAGED	MC(42)		MN	

PROJECT PACIFICA PIER HANDRAIL REPAIRS
CLIENT CITY OF PACIFICA
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COMPILED BY Ishan Goel, EIT

6			ND				ND	
7	MS(12X4)		MN		MS		MD	MD-MN
8S	MS		MJ	MD-MJ		MC	MN	
9	MC(90), MS	SP	MJ	MD-MJ, LARGE OPENING		MS(12X18)X2	MJ	MD-MJ, B
10		CR, SP	MJ	MD-MJ, ENDS		MS(12X12)	MD	
11	CR	MS	MJ	MD-MJ, TOP	MS, MC(90)	MS	MD	MD-MN
12S			ND			MS	MD	MD-MN
13		MS(12X24)	MD	SPALLING	MC(42)	MC	MD	MD-MN
14			MN		SP	MC	SV	SV-MJ, ENDS
15	MC(90)		MN		MS(18X6), MC		MJ	MJ-MD
16S			ND				ND	CLEANING STA W/ SPALLING
17			MD	CORRODED DECK	MS, MC(30)	SP	MJ	
18		MS(12X12)	MD		MC, SP	MS	MJ	MJ-MD
19		MS(6X12)X2	MD		SP(24X8)	MS	SV	SV-MJ
20S		MS	MN		MS		MN	MN-ND
21		SP,MC(42)	MJ	MJ-MD		MS	MD	MN-MD, B
22	MS	MS,CR	MJ	MD-MJ, ENDS		SP	MJ	MD-MJ
23	MC(30)	MS	MJ	MD-MJ	CR, FW-MC	SP	SV	SV-MJ
24S		MS	MD	DECK DAMAGE			MJ	MJ-MD
25		MS	MN		SP	SP	SV	
26		SP	MJ	MJ-MD	SP	SP	MJ	MJ-MD
27		MC	MD		MC		MN	ND-MN
28S			MN	MN-ND,NO JOINT GAP			ND	NO JOINT GAP
29			ND	STEEL BRACKET LOST			MN	ND-MN, CORRODED STEEL BRACKET
30			MD	MN-MD		END LAND - SPALL	MJ	MD-MJ
31		SP	MN		E-SP	MS,SP	MJ	MD-MJ
32S		SP	MD			MC,MS	MJ	MJ-MD
33	MC	FH-SP	MJ	MJ-MD	E-SP	SP	SV	SV-MJ, ENDS
34	E-SP,CR		SV		CR(300), SP	FH-CR	SV	
35	MC(30)		MN	DECK CRACK		FH-SP	MJ	
36S		MC(42)	MN			CR	MD	WATERSIDE BASE DAMAGED
37	MC(42), SP		MD	MN-MD	SP	MC	SV	
38	MC(42)		MJ	MD-MJ	SP	SP	SV	
39	MC(42)	MS	MJ			SP	MJ	
40S			MN	ND-MN			ND	
41	SP	SP	SV	DECK DAMAGE	SP(24X12)	E-SP,CR	SV	SV-MJ, DECK DAMAGE - MD
42	E-SP, FW-SP		SV		E-SP		SV	MJ-SV, ENDS

ATTACHMENT B

PROJECT PACIFICA PIER HANDRAIL REPAIRS
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43	MC(42)	SP	MJ	MJ-MD	E-SP		MJ	MJ-MD
44S		E-SP	SV	SV-MJ			MN	
45		E-SP	MJ	MD-MJ		E-SP	MJ	
46			ND		FW-SP	SP	SV	
47	MC		MD	MN-MD			SV	SV-MJ
48S			MN				MN	ND-MN
49		E-SP	MJ	MD-MJ		E-SP	SV	SV-MJ, ENDS
50	MS(12X24)X2	E-SP	MJ	MD-MJ		E-SP	SV	SV-MJ
51			MD	MN-MD		E-SP	MJ	MD-MJ
52S		SP	MJ	MD-MJ		SP	MJ	MD-MJ
53	CR	SP	MJ	CORRODED DECK	CR	MS	SV	SV-MJ, MD - DECK DAMAGE
54			MD	MN-MD		E-MS	MJ	MJ-MD
55		SP	MJ	MD-MJ, AT MID-PANEL		E-SP	MJ	MJ-MD
56S		MS	MN		FW-CR	FW-CR	MD	
57		E-SP	SV	SV-MJ		SP	MJ	MD-MJ
58	CR	E-SP	SV	SV-MJ		E-SP	MJ	
59	CR		MD	MN-MD, STEEL BRACKET MISSING	CR	E-SP	SV	MJ-SV, STEEL BRACKET
60S	CR		MN		CR	FW-CR	MJ	MD-MJ
61	CR		MJ	MD-MJ, DECK DAMAGE	MC(42)	MS	MJ	MD-MJ
62		MS	MJ	MD-MJ		CR,MS	MJ	AT MID-PANEL
63	MC(60)	MS	MJ	MD-MJ		SP	MJ	MD-MJ
64S			MN				MN	MN-ND
65, L-SHAPE @ N		E-SP	SV	SV-MJ	SP		SV	DAMAGE CONCENTRATED AT CORNER
66		FH-SP	MJ	MJ-MD			ND	OPEN BAY, DECK DAMAGE
67		E-SP	MD		CR		MD	AT CORNER
68	CR, SP	FW-SP	SV	SV-MJ, END WALL	CR, SP	FW-SP	SV	END WALL

SUBTOTAL	NO DAMAGE	7	
	MINOR	17	
	MODERATE	16	
	MAJOR	25	
	SEVERE	9	

SUBTOTAL	NO DAMAGE	6
	MINOR	10
	MODERATE	10
	MAJOR	27
	SEVERE	21

ATTACHMENT B

PROJECT PACIFICA PIER HANDRAIL REPAIRS
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PIER N/S EXTENSION - CLOSED NO ACCESS - RATINGS NOT REVISED

	PIER SIDE - W				PIER SIDE - E			
PANEL ID	**INSIDE**	**OUTSIDE**	**RAT**	**REMARK**	**INSIDE**	**OUTSIDE 2**	**RAT**	**REMARK**
1S			MN	NEW PANEL	MC	CR	MD	
2	CR(42)	SP, E-SP	MJ		MC(42)	E-SP	SV	
3			MN			MC(30)	MD	
4S			SV	COLLAPSE	SP	SP	SV	
5			SV	COLLAPSE	CR	E-SP	SV	
6			SV	COLLAPSE		E-SP	MJ	
7	SP	FW-SP	SV			E-SP	MJ	
8		MS	MD	ENDPANEL		SP(24X12)X2	MJ	ENDPANEL

SUBTOTAL	NO DAMAGE	0	
	MINOR	2	
	MODERATE	1	
	MAJOR	1	
	SEVERE	4	

SUBTOTAL	NO DAMAGE	0	
	MINOR	0	
	MODERATE	2	
	MAJOR	3	
	SEVERE	3	

SUMMARY

TOTAL	NO DAMAGE	13
	MINOR	29
	MODERATE	29
	MAJOR	56
	SEVERE	37