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IMPLEMENTING FACILITIES RISK MANAGEMENT WITHIN THE NAVAL FACILITIES ENGINEERING COMMAND

by

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Executive Summary

This report provides a summary of efforts by the Naval Facilities Engineering Service Center (NFESC) to apply Operational Risk Management (ORM) principles in the development of Risk Management in Facilities (RMF) tools for assessing Naval shore facilities.

The overall objectives of these efforts are to:

1. Determine how we can measure the level of risk to a mission if maintenance and repair projects are reprogrammed or deferred.

2. Determine how the ORM process can be used as a tool to validate the need to repair or replace operational facilities from a Navy-wide perspective.

3. Provide recommendations for deploying RMF.

ORM was developed as a means to integrate risk analysis into operations. However, ORM mainly focuses on the safety of personnel and equipment. The principle steps of ORM include identifying potential hazards, determining the associated degree of risk, and making a decision based on risk assessment.

RMF applies the ORM process by identifying the risks associated with deferring facilities maintenance, repair, or replacement. Once these risks are identified and an overall assessment developed, the appropriate decision-maker at the activity, region, claimant, or Office of Chief of Naval Operations (OPNAV) can review and determine risk acceptability and program projects in accordance with mission requirements. RMF provides the Navy with a decision support tool for assessing, managing, and validating risk in respect to the repair or replacement of operational facilities from a mission perspective.

Repairs to Pier Bravo, R1-98, a 4 million-dollar maintenance and repair (M&R) project was selected as the pilot project for determining how ORM applies to facilities. The application of the RMF process to Pier Bravo demonstrated that RMF can be used as a tool to measurably assess risk levels associated with waterfront maintenance and repair projects. Risk can be identified from both a mission and operational perspective. Controls or work arounds can be identified to decrease risk. The availability or lack of controls and their associated risks can be used to validate the need to maintain or replace an operational facility.

During the course of this study, it became evident that expanding the practice of risk management to encompass strategic oversight and on-going management of multi-project M&R programs can have a positive impact on the Navy's RPM program and on the readiness of shore activities. For example, the Navy could strengthen the credibility of its M&R backlog figures by basing individual "critical versus deferrable" decisions on objective and repeatable analyses rather than on the subjective opinions of tradesmen and engineers. Likewise, the Navy chain of command could improve the quality of resource allocation decisions by structuring those decisions to minimize risk to the mission rather than towards backlog reduction.

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The authors wish to acknowledge the assistance and guidance provided by Mr. Harry Singh, NAVFACHP PW. Without Mr. Singh's support and leadership, this effort could not have been accomplished.

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Section 1

REPORT SCOPE AND TASKING

This report provides a summary of efforts by the Naval Facilities Engineering Service Center (NFESC) to apply Operational Risk Management (ORM) principles in the development of Risk Management in Facilities (RMF) tools for assessing Naval shore facilities. This report was requested by the Director of the Facilities and Engineering Division, Chief of Naval Operations (N44) and NAVFAC Headquarters Public Works Office (NAVFACHQ PW).

The overall objectives of these efforts are to:

1. Determine how we can measure the level of risk to a mission if maintenance and repair projects are reprogrammed or deferred.

2. Determine how the ORM process can be used as a tool to validate the need to repair or replace operational facilities from a Navy-wide perspective.

3. Provide recommendations for deploying RMF.

Section 2

BACKGROUND

Operational Risk Management (ORM) is a proactive process to facilitate informed decision making for both day-to-day actions and long-range planning for Navy operations. Appendix A (CNO Washington DC msg 102317Z Aug 98) supports and directs inclusion of ORM as a core element in all Navy activities. Appendix B (OPNAVINST 3500.39) provides implementing guidance.

Navy resources must be prudently used. The Navy must have the tools to objectively judge one project against another. To do so, the decision-maker needs to be able to analyze both the fiscal and operational consequences of deferring a project. A system is needed that provides data to support decisions at multiple levels while focusing on both funding and capabilities.

ORM was developed as a means to integrate risk analysis into operations. However, ORM mainly focuses on the safety of personnel and equipment. The principle steps of ORM include:

- Identifying potential hazards
- Determining the associated degree of risk
- Making a decision based on risk assessment

By taking the principles of ORM and applying them to facilities, a process for Risk Management in Facilities (RMF) has been developed.

RMF applies the ORM process by identifying the risks associated with deferring facilities maintenance, repair, or replacement. Once these risks are identified and an overall assessment developed, the appropriate decision-maker at the activity, region, claimant, or OPNAV can review and determine risk acceptability and program projects in accordance with mission requirements. RMF provides the Navy with a decision support tool for assessing, managing, and validating risk in respect to the repair or replacement of operational facilities from a mission perspective.

Section 3

INTRODUCTION TO OPERATIONAL RISK MANAGEMENT

CONCEPT

ORM is a formalized process, which may be applied in dealing with risk. The ORM process is a decision making tool, which can be used to anticipate hazards and reduce the potential for loss, thereby increasing the probability of success. Applying the ORM process can reduce mishaps, lower costs, and provide for more efficient use of Navy resources.

ORM incorporates the following four principles:

(1) Accept risk when benefits outweigh the cost. The goal of ORM is not to eliminate risk, but to manage the risk so that the mission can be accomplished with the minimum amount of loss.
(2) Accept no unnecessary risk. Take only risks that are necessary to accomplish the mission.
(3) Anticipate and manage risk by planning. Risks are more easily controlled when identified early in the planning process.
(4) Make risks decisions at the right level. Risk management decisions should be made by the leader directly responsible for the operation.

PROCESS

ORM is a five-step process consisting of:

(1) ***Identify Hazards*** – Hazards are conditions that have the potential to cause personal injury or death, property damage, or mission degradation. ORM begins with an outline of the major steps in an operation (operational analysis). A list is developed of hazards associated with each operational step, along with possible causes for those hazards.
(2) ***Assess Hazards*** – The associated degree of risk is determined for each identified hazard. Risk is defined as an expression of possible loss in terms of severity and probability. Tables 1 and 2 are used to quantify hazard severity and probability

Table 1. Mishap Probability Assessment Table

Occurrence	Mishap Probability
A	Likely to occur immediately or within a short period of time. Expected to occur frequently to an individual item or person or continuously to a fleet inventory or group.
B	Probably will occur in time. Expected to occur several times to an individual item or person or frequently to a fleet inventory or group.
C	May occur in time. Can reasonably be expected to occur some time to an individual item or person or several times to a fleet inventory or group.
D	Unlikely to occur.

Table 2. Hazard Severity Assessment

Category	Loss of Mission Capacity
I	The hazard may cause death, loss of facility/asset, or result in grave damage to national interest.
II	The hazard may cause severe injury, illness, or property damage to national or service interests or degradation to efficient use of assets.
III	The hazard may cause minor injury, illness, property damage, damage to national service or command interest or degradation to efficient use of assets.
IV	The hazard presents a minimal threat to personnel safety or health, property, national service, or command interests or efficient use of assets.

The Risk Assessment Matrix shown in Table 3 is used to quantify and prioritize the risks associated with Naval Occupational Safety and Health assessments.

Table 3. Risk Assessment Matrix

		Probability of Occurrence			
		Likely	Probably	May	Unlikely
		A	B	C	D
SEVERITY	Cat I	1	1	2	3
	Cat II	1	2	3	4
	Cat III	2	3	4	5
	Cat IV	3	4	5	5
		Risk Levels			

Risk Assessment Code

1 = Critical
2 = Serious
3 = Moderate
4 = Minor
5 = Negligible

(3) ***Make Risk Decisions*** – Start with the most serious risk first (those with the lowest Risk Assessment Codes (RAC)). Select controls that will reduce the risks to a minimum, consistent with mission accomplishment. With selected controls in place, decide if the benefit of the operation outweighs the risks.

(4) ***Implement Controls*** – Implement controls to eliminate hazards or reduce the degree of risk. Controls can consist or engineering, administrative, or personnel actions that reduce the hazard to an acceptable level of risk.

(5) ***Supervise*** – Conduct follow-up evaluations of the controls to ensure they remain in place and have the desired effect.

Section 4

RISK MANAGEMENT IN FACILITIES PROCESS

RMF WORKSHOP/APPLICATION TEAM

A two-day, on-site RMF workshop was held on 26 and 27 July 2000 to assess the effectiveness of RMF applied to a specific waterfront facility, Pier Bravo at Naval Station San Diego. The workshop attendees consisted of 19 facilities experts with extensive knowledge in facilities management, port operations, explosive safety, construction management, waterfront structures, and fendering systems. On-scene knowledge was provided by representatives from North Island Weapons Department, Public Works (PW) Coronado, Public Works Center (PWC) San Diego, and Engineering Field Division, Southwest (EFDSW). Team members, current positions, and areas of expertise are:

Name		*Organization*	*Phone*	*Expertise*
Al	Antelman	NFESC/64	(805) 982-4975	Facilities Management
George	Baker	Unity Consultants	(619) 475-9769	Port Operations
Lyle	Beller	Naval Base Point Loma	(619) 524-3100	Facilities Management
Jim	Bradley	EFDSW	(619) 556-6510	Planning (DD1391)
Bill	Brandon	NAVSTA San Diego	(619) 556-6379	Explosive Safety
Don	Brunner	NFESC/63	(805) 982-1050	Waterfront Materials
Duane	Davis	NFESC/62	(805) 982-1248	Fendering Systems
Russ	Desjean	North Island Weapons	DSN 735-9397	Ordnance Operations
Jack	Feola	Unity Consultants	(856) 424-0325	Facilities Management
LT Eric	Haase	PW Coronado	(619)545-1207	AROICC
David	Hoy	NFESC/63	(805) 982-1062	Waterfront Materials
Chris	Inaba	NFESC/62	(805) 982-1261	Waterfront Structures
Curt	Kronberg	EFDSW	(619) 556-8871	ALNO
Alex	Miller	NFESC/54	(805) 982-1389	Ocean Engineering
Jim	Osborne	PWCSD LRMP	(619) 556-3139	Maintenance Planning
Mike	Petersen	Naval Base Coronado	(619) 545-4134	Public Works
Glenn	Rogers	Naval Base Coronado	(619) 545-2496	Public Works
Harry	Singh	HQNAVFAC	(202) 685-9249	Facilities Management

Additional support was provided by CDR Ken Branch and the Coronado Public Works Department staff. The team's in-depth knowledge of waterfront facilities and Navy Southwest Region mission requirements allowed the workshop to be completed in a relatively short period.

RMF WORKSHOP AGENDA

The first day of the workshop provided the attendees with an overview of the Operational Risk Management (ORM) process (see Appendix C). On day two, the team applied the ORM process to an existing, but unfunded, waterfront maintenance and repair project at Pier Bravo, San Diego.

July 26, 2000

0830	Introductions
0845	Background
0900	NAVFACHQ Overview
0915	ORM Process Overview
0945	Break
1000	Step 1 - Identify Hazards (exercise)
1100	Step 2 - Assess Hazards (exercise)
1200	Lunch
1330	Step 3 - Make Risk Decisions (exercise)
1430	Steps 4 & 5 - Implement Controls and Supervise
1515	Break
1530	Pier Bravo Site Visit
1630	End of First Day

July 27, 2000

	Option 1 - Defer Repairs to Pier Bravo
0830	Step 1 - Identify Hazards
0915	Step 2 - Assess Hazards
1000	Break
1015	Step 3 - Make Risk Decisions
1115	Step 4 - Control Implementation Discussion
1200	Lunch
	Option 2 - Repair Pier Bravo
1300	Step 1 - Identify Hazards
1345	Step 2 - Assess Hazards
1430	Break
1445	Step 3 - Make Risk Decisions
1530	Step 4 - Control Implementation Discussion
1600	Summary/Consensus
1630	End of Second Day

SELECTED FACILITIES PROJECT

Repair Bravo, R1-98 (see Appendix D) was selected as the pilot project for determining how ORM applies to facilities. Pier Bravo is located at North Island Naval Air Station, San Diego, CA. Pier Bravo provides a direct Military essential function without which serious degrading of war making ability would occur. Pier Bravo is used for off-loading and loading of ordnance at COMNAVREG San Diego. Pier Bravo is the only pier within San Diego Bay that can routinely handle the following classes of ordnance.

(1) *Explosive Class 1 Division 1*(maximum hazard): Damage is caused by concussion, blast, or by sympathetic detonation.
(2) *Explosive Class 1 Division 2* (fragmentation hazard): Damage is caused by fragment and blast, either individually or in combination, depending on storage configuration.
(3) *Explosive Class 1 Division 3* (mass fire hazard): Damage is caused by burning. The spread of fires may result from sprays of burning container materials, propellant, or other flaming debris. Toxic effects may occur from burning pyrotechnic items.
(4) *Explosive Class 1 Division 4* (minimum hazard): Damage is caused by moderate fire and no blast. Toxic effects may occur from burning pyrotechnic items.
(5) Flammable/combustible liquids and other hazardous materials normally found in explosive components may have toxic effects either from direct exposure or burning.

With the home porting of CVNs at North Island, the handling of ordnance away from berthing docks is critical because of the close proximity of the berthing areas to the City of Coronado. With the increased home porting of ships at North Island and Naval Station San Diego, Pier Bravo's requirement to provide the San Diego area with the capability to "arm, repair, provision, service, and support the U.S. Pacific Fleet and other operating forces" increases.

CURRENT SITUATION

Pier Bravo is a concrete pier with a wood pile fendering system and was constructed in 1979. The Pier's below deck and underwater structure appears to be in good condition with the exception of the top deck surface and curbing. Extensive delamination and spalls to the original concrete deck have occurred. Subsequent partial repairs to the north and south thirds of the pier deck have also failed. Corroding steel reinforcement bars are visible on the deck. Many of the curbs on the south walkways and mooring platforms are delaminating in long continuous pieces. The south end of the main pier has a number of curb spalls near the mooring fittings (cleats and bollards). The existing timber fender system has numerous missing and broken piles due to vessel impact and marine borer attack. The entire fender system has very few timber camels to distribute vessel loads to the fender piles. The existing corner protection system appears undersized for the anticipated loads and the upper steel wales are severely corroded.

The poor condition of the Pier's deck and fendering system increases the possibility of an accident occurring while handling ordnance. With home porting of CVNs at North Island, the use of the pier will increase, accelerating the Pier's already deteriorated state. The Shore Base Readiness Report (BASEREP) classifies Pier Bravo as only marginally meeting the demands of the mission category throughout the current reporting period, but with major difficulty (Condition C3). Pier bravo has a current facility replacement cost of $13,856,000. The estimated cost to repair Pier Bravo so that it can "fully" meet the demands of its mission category (Condition C1) is $3,948,000.

TEST APPLICATION OF THE RMF PROCESS

RMF focuses on the application of the first four steps of ORM. ***Step 1*** identifies the hazards. The RMF process focuses on hazards to the mission associated with Pier Bravo. ***Step 2*** is hazard assessment and is used to identify risk. The Workshop attendees agreed to adapt the standard ORM severity and probability categories used for Naval Occupational Safety and Health Assessments (see Tables 4 and 5) for application to hazards associated with Pier Bravo's "mission."

Table 4. Severity Categories (SC)

Category	Loss of Mission Capacity
I	The hazard may cause loss of the facility.
II	The hazard may cause degrade the efficient use of the facility
III	The hazard may cause minor degradation to efficient use of the facility
IV	The hazard presents a minimal threat

Table 5. Probability of Occurrence Categories (POC)

Occurrence	Mishap Probability
A	Likely to occur immediately or within a short period of time
B	Probably will occur in time.
C	May occur in time.
D	Unlikely to occur.

Similar to ORM, a risk assessment matrix (Table 3) was used to rank the risks. This is vital because risk control resources are always limited and should be directed at the most serious risk first to assure maximum effect for the resources expended.

Step 3, make risk decisions, includes identifying control options and determining the control effects. Control options for facility projects can include, but are not limited to:

(1) Deferring or canceling repairs
(2) Funding repairs
(3) Providing a temporary solution
(4) Restricting mission/operations
(5) Reassigning mission/operations to another location/facility
(6) Canceling the mission
(7) Providing additional personnel or other resources

Control effects can be evaluated in terms of increased or decreased:

(1) Readiness (ability to accomplish the mission)
(2) Cost (time/labor)
(3) Political Consequences/Impact to the Command
(4) Environmental Impacts (fines)
(5) Quality of Life
(6) Safety

Once control effects are determined, their impact on probability and severity must be recalculated using Table 3. The imposition of controls may increase or decrease risk. Some controls may impede each other, whereas other controls may reinforce each other. Control identification should be done with assistance of personnel that have on-scene knowledge. All resources required to mitigate risk should be identified. Risks should only be accepted when their benefits outweigh costs. ***Step 4*** implements controls. Priorities are established and a plan of action is developed.

RMF Workshop attendees explored two possible options in respect to Pier Bravo: (1) defer repairs and (2) make repairs.

Option 1 - Mission Impact if Repairs are Deferred

What is the task to be accomplished? Determine the effect of deferring maintenance and repairs.

Step 1. Identify Mission Hazards (Table 6). If no repairs are made to Pier Bravo, then what conditions have the potential to cause mission degradation.

Table 6. Mission Hazards (Option 1)

No.	Identify Hazards
1	Inability to provide training ordnance load-outs to the Fleet
2	Inability to provide ordnance load-outs to the San Clemente Island barge.
3	Inability to provide deployment ordnance load-outs to the Fleet.
4	Inability to receive ordnance by barge from NWS Seal Beach.

Step 2. Determine the Hazard Assessment (Table 7). The risk assessment matrix (Table 3) is used to rank the risks to the mission.

Table 7. Hazard Assessment (Option 1)

No.	Identify Hazards	POC	SC	RAC
1	Inability to provide training ordnance load-outs to the Fleet	B	II	2
2	Inability to provide ordnance load-outs to the San Clemente Island barge	A	I	1
3	Inability to provide deployment ordnance load-outs to the Fleet.	B	I	1
4	Inability to receive ordnance by barge from NWS Seal Beach.	B	III	3

Step 3. Make Risk Decision (Table 8). Hazards are ranked from high to low, since risk control resources are always limited and should be directed at the most serious hazards. Control options are identified for each hazard identified.

Table 8. Hazard Ranking/Risk Controls (Option 1)

No.	Identify Hazard	RAC	Identify Control Options
2	Inability to provide ordnance load-outs to the San Clemente Island barge.	1	Transport ordnance by aircraft to San Clemente Island or barge ordnance from NWS Seal Beach.
3	Inability to provide deployment ordnance load-outs to the Fleet.	1	Use Port Operations facilities at NWS Seal Beach
1	Inability to provide training ordnance load-outs to the Fleet.	2	Close Pier Bravo and relocate mission to Naval Station piers.
4	Inability to receive ordnance by barge from NWS Seal Beach.	3	Transport ordnance from NWS Seal Beach to NWS Fallbrook by truck to North Island.

Determine the Control Effects (Table 9). Six control effects (readiness, cost, political impacts, environmental impact, quality of life, and safety) were evaluated. Due to time constraints, control effect consequences were quantified in terms of probable impact to the mission. The impact values are totaled in order to determine overall effect. The controls with the highest values may offer the most benefits (least risk). Risks should only be accepted when their benefits outweigh costs.

Table 9. Risk Control Effects (Option 1)

No.	Identify Control Options	Determine Control Effects on Mission						
		Read.	Cost	Pol.	Envir.	Q/L	Safety	Sum
2	Transport ordnance by aircraft to San Clemente Island or barge ordnance from NWS Seal Beach	-1	-1	0	0	-1	-1	-4
3	Use Port Ops facilities at NWS Seal Beach	-1	-1	0	0	-1	0	-3
1	Close Pier Bravo and relocate mission to Naval Station piers.	-1	-1	-1	-1	-1	-1	-6
4	Transport ordnance from NWS Seal Beach or NWS Fallbrook by truck to North Island.	-1	-1	-1	0	-1	-1	-5

-1 = Adverse impact 0 = Little or not impact 1 = Positive impact

Recalculate Control Effects (Table 10). Once control effects are determined, their impact on probability and severity must be recalculated using Table 6, Risk Assessment Matrix.

Table 10. Recalculated Control Effects (Option 1)

No.	Identify Hazards	RAC	Identify Control Options	POC	SC	New RAC
2	Inability to provide ordnance load-outs to the San Clemente Island barge.	1	Transport ordnance by aircraft to San Clemente Island or barge ordnance from NWS Seal Beach.	C	II	3
3	Inability to provide deployment ordnance load-outs to the Fleet	1	Use Port Ops facilities at NWS Seal Beach	C	II	3
1	Inability to provide training ordnance load-outs to the Fleet	2	Close Pier Bravo and relocate mission to Naval Station piers.	C	II	3
4	Inability to receive ordnance by barge from NWS Seal Beach	3	Transport ordnance from NWS Seal Beach or NWS Fallbrook by truck to North Island	C	II	3

RAC = Risk Assessment Code; POC = Probability of Occurrence; and SC = Severity Occurrence

Step 4. Implement Controls. Available controls do provide reduction in risk to mission failure, as shown in Table 10. However, all of the controls, as shown in Table 9, have the potential for adverse impact on mission readiness and cost (time/labor). The controls also present adverse political, environmental, quality-of-life, and safety consequences. The operational cost of implementing any of the identified controls could be greater than the estimated cost of repairing

Pier Bravo. In addition, controls that attempt to avoid or defer maintenance and repair to Pier Bravo do not provide a long term affordable solution (due to time constraints, estimated cost controls were not calculated). If Real Property Maintenance (RPM) funding is not available this fiscal year and repairs must be deferred, than Steps 1 through 4 should be evaluated by decision makers as viable options.

Option 2 – Repair Pier Bravo

What is the task to be accomplished? Determine the effect of repairing Pier Bravo in terms of operational readiness.

Step 1. Identify Hazards to Current Operations (Table 11): What existing infrastructure conditions have the potential to adversely impact ordnance operations?

Table 11. Hazard Identification (Option 2)

No.	Identify Hazards
1	Cleat of bollard pulling loose from pier.
2	Berthing impact damage (pier/vessel
3	Weather/current related damage while vessel is berthed.
4	Crane outrigger or forklift punching through concrete deck.
5	Damage to ordnance. Dumping/spilling of weapon or ordnance load from forklift.
6	Fender pile beak away (hazard to navigation).
7	Trip and fall hazards to personnel.

Step 2. Hazard Assessment (Table 12). The risk assessment matrix (Table 5) is used to rank the risks.

Table 12. Hazard Assessment (Option 2)

No.	Identify Hazards	POC	SC	RAC
1	Cleat or bollard pulling loose from pier	B	II	2
2	Berthing impact damage (pier/vessel)	A	I	1
3	Weather/current related damage while vessel is berthed.	C	II	3
4	Crane outrigger or forklift punching through concrete deck.	B	I	1
5	Damage to ordnance. Dumping/spilling of weapons or ordnance load from forklift.	C	I	2
6	Fender pile break away (hazard to navigation).	A	III	2
7	Trip and fall hazards to personnel.	A	II	1

Step 3. Make Risk Decision (Table 13). Hazards are ranked from high to low, since risk control resources are always limited and should be directed at the most serious hazards. Control options are identified for each hazard.

Table 13. Hazard Ranking/Risk Controls (Option 2)

No.	Identify Hazards	POC	SC	RAC	Identify Control Options
2	Berthing impact damage (pier/vessel).	A	I	1	Implement "soft berthing" to minimize damage to the pier and ship
4	Crane outrigger or forklift punching through concrete deck.	B	I	1	Reduce lifting capability or position steel plate under outriggers.
7	Trip and fall hazards to personnel.	A	II	1	Provide structural repairs to the concrete deck, bollards, and cleats.
1	Cleat or bollard pulling loose from pier.	B	II	2	Increase number of tie points. Have tug stand by.
5	Damage to ordnance. Dumping/ spilling of weapon or ordnance load from forklift.	C	I	2	Reduce forklift speed and provide spotter.
6	Fender pile break away (hazard to navigation).	A	III	2	Replace fender wood piles with composite piles and provide foam-filled fenders.
3	Weather/current related changes while vessel is berthed.	C	II	3	Restrict use during adverse weather conditions. Perform "deadstick" move when required.

Determine the Control Effects. Similar to Option 1, six control effects (readiness, cost, political impacts, environmental impact, quality of life, and safety) were evaluated (see Table 14). Due to time constraints, control effect consequences were quantified in terms of probable impact to the mission. The impact values are totaled in order to determine overall effect. The controls with the highest values may offer the most benefits (least risk). Risks should only be accepted when their benefits outweigh costs.

Table 14. Risk Control Effects (Option 2)

No.	Identify Control Options	Determine Control Effects on Mission						
		Read.	Cost	Pol.	Envir.	Q/L	Safety	Sum
2	Implement "soft berthing" to minimize damage to the pier and ship.	-1	-1	0	0	-1	-1	-4
7	Provide structural repairs to the concrete deck, bollards, and cleats.	1	-1	0	0	1	1	2
1	Increase number of tie points. Have tug stand by.	-1	-1	0	0	-1	-1	-4
5	Reduce forklift speed and provide spotter	-1	-1	0	0	-1	1	-2
6	Replace fender wood piles with composite piles and provide foam-filled fenders.	1	-1	0	1	0	1	2
3	Restrict use during adverse weather conditions. Perform "deadstick" moves when required.	-1	-1	0	0	-1	-1	-4

-1 = Adverse impact 0 = Little or not impact 1 = Positive impact

Recalculate Control Effects (Table 15). Once control effects are determined, their impact on probability and severity must be recalculated using Table 3, Risk Assessment Matrix.

Table 15. Recalculated Control Effects (Option 2)

No.	Identify Hazards	RAC	Identify Control Options	POC	SC	New RAC
2	Berthing impact damage (pier/vessel)	1	Implement "soft berthing" to minimize damage to the pier and ship.	B	II	2
4	Crane outrigger or forklift punching through concrete block.	1	Reduce lifting capacity or position steel plate under outriggers.	C	II	3
7	Trip and fall hazards to personnel.	1	Provide structural repairs to the concrete deck, bollards, and cleats.	D	IV	5
1	Cleat or bollard pulling loose from pier.	2	Increase number of tie points. Have tug stand by.	C	II	3
5	Damage to ordnance. Dumping/spilling of weapon or ordnance load from forklift.	2	Reduce forklift speed and provide spotter.	D	I	3
6	Fender pile break away (hazard to navigation).	2	Replace fender wood piles with composite piles and provide foam-filled fenders.	D	IV	5
3	Weather/current related damage while vessel is berthed.	3	Restrict use during adverse weather conditions. Perform "deadstick" move when required.	C	III	4

RAC = Risk Assessment Code; POC = Probability of Occurrence; and SC = Severity Occurrence

Step 4. Implement Controls. Available controls will reduce operational risk, as shown in Table 15. The most significant reduction in operational risk will occur with the implementation of engineering controls for Hazards 6 and 7. The administrative controls for Hazards 1 through 5 are not advisable because their benefits will not likely outweigh their costs. Controls for Hazards 1 through 5, have the potential for adverse impact on operational readiness, cost (time/labor), quality of life, and safety. It is evident that controls that avoid or defer maintenance and repair to Pier Bravo's structural deck and fendering system do not provide a long term, low risk solution.

CONCLUSION

The application of the RMF process to Pier Bravo has demonstrated that RMF can be used as a tool to measure risk levels associated with a waterfront facility. Risks can be determined from both a mission and facility operations perspective. Administrative and engineering controls can be identified to decrease risk. Analyses of these administrative and engineering controls and their associated impacts can be used to validate maintenance and repair of operational facilities.

For Pier Bravo, we identified administrative options that could mitigate the risks posed by the marginal condition of Pier Bravo. The administrative controls included either full use of the pier or the use of optional facilities. It was found that the use of optional facilities entailed significant negative impacts on readiness, cost, political considerations, the environment, sailor quality of life, and safety. It is highly unlikely that these negative impacts would be acceptable to decision-makers. Administrative controls associated with continued use of Pier Bravo also entailed negative impacts for each of these factors. In contrast, engineering controls consisting of the repair and replacement of decking and fendering in addition to mitigating mission risks provided positive impacts to each of these related factors except for cost.

RECOMMENDATIONS

The formal RMF process used to evaluate Pier Bravo included the assistance of experienced technical experts with considerable on-scene knowledge. This level of assistance may not always be cost-effective but the exercise demonstrated that RMF can be a valuable tool for validating facilities maintenance and repair projects. In consideration of the potential cost of bringing together consulting expertise, it is recommended that three levels of RMF analyses be considered:

a. **High cost projects.** Use the deliberate formal process incorporating Steps 1 through 4. This process should be done with the assistance of NAVFAC technical experts to identify and assess hazards.

b. **Medium cost projects**. Application of the complete four-step RMF process. This approach uses available (local) experienced personnel and brainstorming to identify hazards and develops controls, and could be most effective when done in a group.

c. **Small cost projects**. An "on-the run" mental or oral review of the situation using Steps 1 through 3 without necessarily recording the information on paper. Should be employed by experienced, local personnel to consider risks while making decisions in a time-compressed situation.

Section 5

RECOMMENDATIONS FOR INTEGRATING RMF INTO NAVY FACILITIES MANAGEMENT PRACTICES

DEPLOYING RMF THROUGHOUT THE NAVY

During the course of this study, it has become evident that expanding the practice of risk management to encompass strategic oversight and on-going management of multi-project M&R programs would have positive impact on the Navy's RPM program and on the readiness of shore activities. For example, the Navy will strengthen the credibility of its backlog figures by basing individual "critical versus deferrable" decisions on objective and repeatable analyses rather than on the subjective opinion of tradesmen and engineers. Likewise, the Navy's Chain of Command will improve the quality of resource allocation decisions by structuring decisions to minimize risk to the mission rather than towards backlog reduction.

DEPLOYMENT OF RISK MANAGEMENT AT CLF

In response to a Naval Audit Service criticism concerning a "lack of standardization in applying the definition (determination) of a critical deficiency" during the Annual Inspection Summery (AIS) process. The Audit Service found that many inspectors interpreted the determination of critical verses deferred maintenance guidance differently depending on the situation they faced. In an effort to provide a more detailed decision-making process, CLF N464 has deployed a series of Risk Assessment Code (RAC) matrices for classifying facility deficiencies (Appendix L). Similar to the RAC Matrix shown in Table 3 and 4, the CLF critical deficiency matrices prioritize deficiencies by identifying probability of occurrence and severity. This year's AIS validation effort at PWC Norfolk's LRMP team has employed the CLF critical deficiency matrices. Due to this validation, many activities are realizing significant shifts of maintenance and repair work for critical to deferred.

MISSION CENTERED MAINTENANCE

The potential of applying risk management practices to multi-project M&R programs has led NAVFACHQ to use RMF as the framework in a recently undertaken top-to-bottom overhaul of its facilities management guidance. The overhaul combines RMF with three other modern practices: (1) engineering management systems, (2) mission dependency indexing, and (3) reliability centered maintenance.

(1) **Engineering Management Systems (EMS)**. Research and development at the U.S. Army Engineering Research and Development Center - Construction Engineering Research Laboratories (USAERDC-CERL) has led to the development of a very successful methodology for creating Engineering Management Systems (EMSs) to evaluate the condition of buildings (BUILDER) and facility components (ROOFER, PAVER, RAILER, and PIPER). These systems (Appendix E, F, G, H, and I) measure system/component health using a condition index rating scale of 0 to 100. USAERDC-CERL EMSs offer objective and repeatable analyses and are able to determine when, where, and how best to maintain facilities. These systems employ predictive

models that include facility condition indexing (Figure 1), system degradation (Figure 2) and penalty costs associated with deferring maintenance and repairs (Figure 3). No EMS now exists for waterfront facilities, although RAILER may be of assistance in accessing crane trackage.

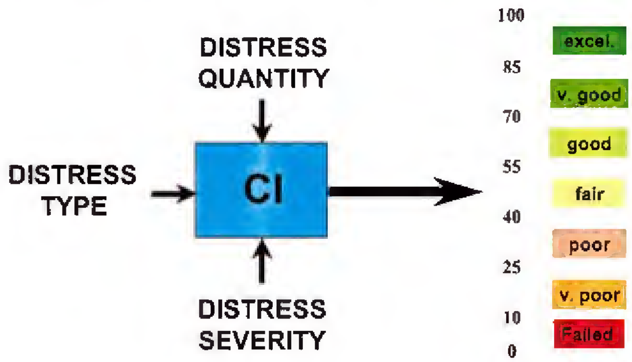

Figure 1. Condition index approach.

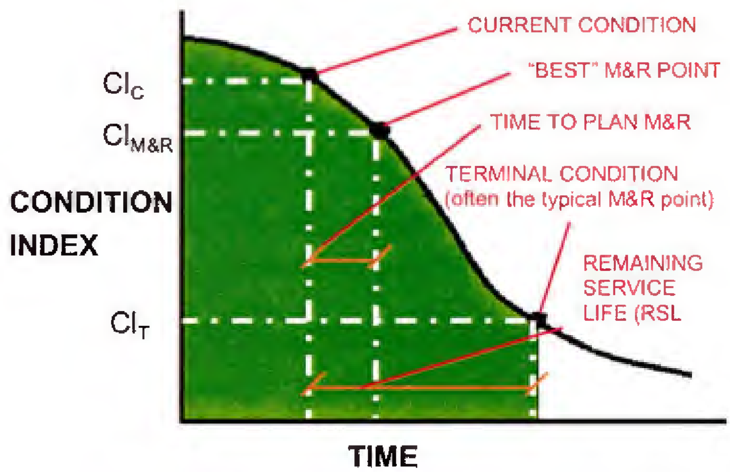

Figure 2. System degradation.

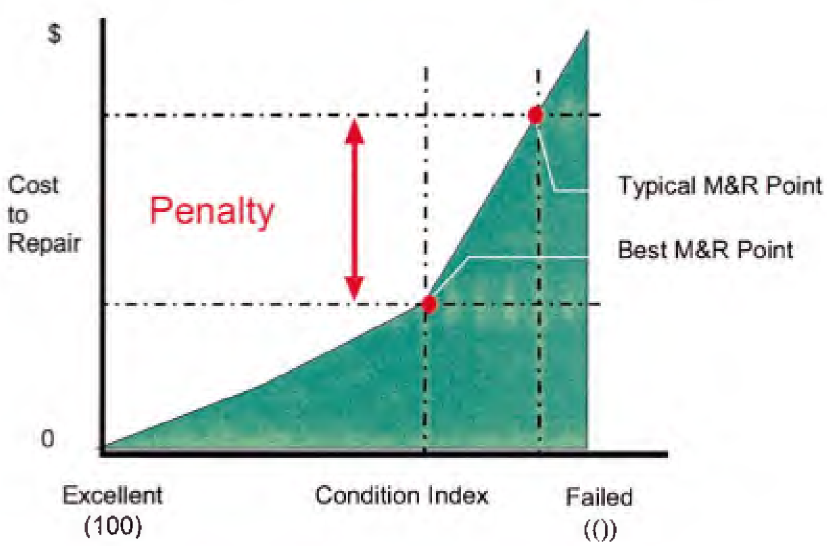

Figure 3. Penalty costs associated with deferring maintenance and repairs.

(2) **Mission Dependency Index (MDI).** At the request of EFDSW, NFESC developed a methodology for prioritizing M&R projects based on mission. Mission dependency is expressed in terms of interruptability and relocatability of explicit mission functions associated with specific facilities (Table 16).

Table 16. Mission Dependency Matrix

	Interruptability			
	None	Briefly	Short	Prolonged
	6	min.-hours	days-weeks	months
Relocatability	Impossible	5	4	3
	Difficult	4	3	2
	Possible	3	2	1

Mission Dependency Code

1 = Negligible
2 = Minor
3 = Moderate
4 =Seroius
5 = Critical
6 = Uninterruptable

The MDI value also includes other factors (modifiers) such as, environmental hazards, high cost equipment, high personnel occupancy, unique (one of a kind) facilities, emergency facilities, quality of life, safety, and historic preservation.

Modifiers could be set and controlled by the Regional Commander. The MDI value of a facility and the Condition Index (CI) value are combined to determine priority.

$$[(100-CI) \times (MDI + m)] = P$$

where:

CI	=	Condition Index Value ($0 \leq CI < 100$
MDI	=	Mission Dependency Index Value ($1 \leq MDI \leq 6$)
m	=	Sum of all appropriate modifiers ($0 \leq m \leq 1$)
P	=	Priority (Highest number has priority)

San Clemente Island was used as a "proof-of-concept" site for the development of MDI methodology (see Appendix J).

(3) **Reliability Centered Maintenance (RCM).** RCM is a process for determining maintenance strategies based on reliability techniques and applies well-known analysis methods such as failure mode effects and criticality analysis. The major consideration underlying RCM is how much the mission would be impacted (readiness) if failure were to occur. The RCM process identifies critical infrastructure and equipment failure modes to determine the optimum maintenance policy to avoid unplanned failures. Strategy alternative categories are: (1) Time-based preventive maintenance, (2) Predictive maintenance, and (3) run-to-failure. The effects of

redundancy, spares cost, maintenance crew costs, age of infrastructure, and repair times are also considered, along with many other parameters. PWC Norfolk is currently implementing a RCM prototype for test and evaluation.

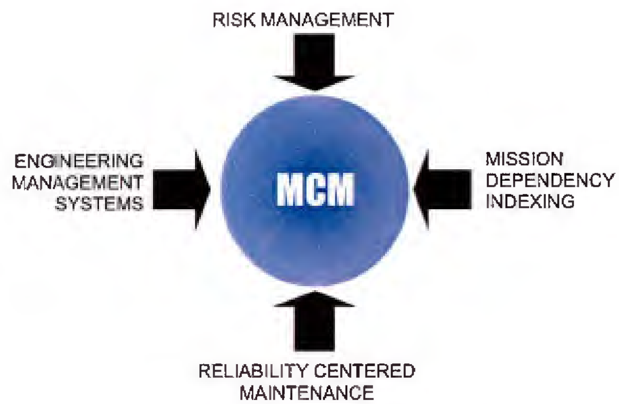

Figure 4. Integration of systems.

The new guidance will integrate RMF with RCM, MDI, and EMS into a Navy-wide business practice (see Figure 4). The practice will consistently and objectively budget and allocate Real Property Maintenance (RPM) dollars according to mission consequences, including project prioritization based on risk to mission and penalty cost of deferral. The concept is called "Mission-Centered Maintenance (MCM)."

Using new MCM guidance and tools each shore activity, Installation Major Claimants (IMC staff), and Navy headquarters could continuously, objectively, and in real time, assess and compare physical condition and M&R needs of facilities. They could also forecast the impact of various RPM funding alternatives and make resource requests and allocations based on true need as well as on the intentions of Headquarters, DOD, and Congress. Activities, IMCs, and Headquarters will also have the capability to appraise actual results of spending in terms of mission consequences.

The creation of such guidance and related IT tools will directly enhance communication between organizations and managers regarding facility condition and impact of funding decisions. Enhanced communications will result in better resource allocation decisions, and better decisions, in turn, will improve the physical condition of real property assets located at Navy shore activities.

NAVFACHQ has set up a steering group to create MCM guidance. Also under NAVFAC's sponsorship, the NFESC and USARDL-CERL are developing EMS tools, and several shore activities are running proof-of-concept tests.

The importance of this initiative to the Navy, as well as its complexity and urgency, is becoming increasingly clear. Both CLF and CPF have expressed interest in and support of MCM. Therefore, at this time, it would be beneficial for N4 to sanction and support the following:

RECOMMENDATIONS

1. Develop criteria and guidance for incorporating RMF into the project justification process.

Deliverables/Milestons/Cost *Work Units*	*FY01 (K)*	*FY02 (K)*	*FY03 (K)*	*Assigned*
1.1 Criteria Development & Documentation	$25	$10	$5	NFESC/Contract
1.2 RMF EFD Working Group	$10	$10	$10	EFD's
1.3 RMFManual	$15			Contract
Total	**$50**	**$20**	**$15**	

2. Develop severity and probability risk assessment matrices that are specific to the Navy's installation core business models similar to CPFs Readiness Condition Criteria as a basis for objectively assessing severity (see Appendix K).

Deliverables/Milestons/Cost *Work Units*	*FY01 (K)*	*FY02 (K)*	*FY03 (K)*	*Assigned*
2.1 Develop/Maintain RMF SeverityTables	$13	$5	$5	NFESC/EFDs/PWCs
2.2 Develop/Maintain RMF Probability Tables	$13	$5	$5	NFESC/EFDs
Total	**$26**	**$10**	**$10**	

3. Further development of tools needed to implement RMF and Mission-Centered Maintenance

Deliverables/Milestons/Cost *Work Units*	*FY01 (K)*	*FY02 (K)*	*FY03 (K)*	*Assigned*
3.1 CERL BUILDER Test & Eval	50	50	50	CERL/PWC/NFESC
3.2 CERL EMS Utilities Tool	100	100	100	CERL/NFESC/PWCs
3.3 Waterfront EMS (WHARFER)	355	430	305	NFESC/PWCs/CERL
3.4 Refine & Document MCM concept	75	75	75	Contractor/NFESC/PWCs
3.5 Continued Development and Refinement of MDI	75	50	35	NFESC/Contractor
3.6 MCM Tools	60	40	20	NFESC/Contractor
3.7 RCM Test and Evaluation	50	35	25	PWC Norfolk
Total	**765**	**780**	**610**	

4. Establish a RMF/MCM "Center of Expertise" at NFESC

Deliverables/Milestons/Cost *Work Units*	*FY01 (K)*	*FY02 (K)*	*FY03 (K)*	*Assigned*
4.1 Program Management	$50	$50	$50	NFESC
4.2 RMF Web-Based Training Site	$18	$12	$12	NFESC
4.3 RMF Web-Form (Hazards/Controls/Lessons Learned	$30	$15	$15	NFESC
Total	**$98**	**$77**	**$77**	

Appendix A

CNO Washington DC R 102317Z Aug 98 Message

ADMINISTRATIVE MESSAGE

ROUTINE

R 102317Z AUG 98 ZYB MIN PSN 936396I36

FM CNO WASHINGTON DC//N00//

TO NAVOP

UNCLAS //N05000//
NAVOP 006/98

MSGID/GENADMIN/CNO N00//

SUBJ/OPERATIONAL RISK MANAGEMENT//

REF/A/DOC/OPNAVINST 3500.39/-//

REF/B/NAVSAFECEN WEBSITE/-/-//

NARR/REF A IS OPERATIONAL RISK MANAGEMENT INSTRUCTION. REF B IS THE NAVAL SAFETY CENTER'S WEB SITE (WWW.NORFOLK.NAVY.MIL/SAFECEN).//

RMKS/1. ONE OF THE MOST CHALLENGING ASPECTS OF NAVAL OPERATIONS IS SUCCESSFULLY MANAGING RISK--IDENTIFYING AND ASSESSING HAZARDS, THEN EMPLOYING TOOLS TO MAKE SURE THOSE HAZARDS DON'T HARM OUR SHIPMATES AND DESTROY EQUIPMENT. OPERATIONAL RISK MANAGEMENT (ORM) IS SUCH A TOOL. IT'S A PROCESS FOR MAKING DISCIPLINED, INFORMED DECISIONS THAT ARE CRITICAL TO SAFETY IN BOTH PEACETIME AND WAR.

2. DURING OPERATIONAL PLANNING, ORM PROMOTES TWO-WAY COMMUNICATION IN THE CHAIN-OF-COMMAND, MAKES BETTER USE OF LESSONS LEARNED, AND EQUIPS US TO MINIMIZE HAZARDS WHICH ARE A BY-PRODUCT OF CHANGE. IT DOESN'T STIFLE CREATIVE APPROACHES TO PROBLEM-SOLVING. INSTEAD, ORM CLARIFIES THE BEST COURSE OF ACTION AVAILABLE VIA USE OF A CLEAR, LOGICAL PROCESS.

3. ORM APPLIES ACROSS THE ENTIRE SPECTRUM OF NAVAL ACTIVITIES, FROM JOINT OPERATIONS AND FLEET EXERCISES TO OUR DAILY ROUTINE. IT HAS ALREADY PRODUCED GREAT RESULTS IN NUMEROUS SQUADRONS AND SHIPS. BUT WE HAVE MUCH MORE TO DO! WE MUST ENCOURAGE TOP-DOWN INTEREST IN THE ORM PROCESS, FROM THE FLAG LEVEL ALL THE WAY TO THE DECKPLATES.

4. TO ACCOMPLISH THAT END, OUR FLEET CINCS ARE CONDUCTING A COMPLETE REVIEW OF THE INTER-DEPLOYMENT TRAINING CYCLE USING THE ORM PROCESS. THIS WILL HELP ALL LEVELS OF THE CHAIN-OF-COMMAND BETTER UNDERSTAND THE RISKS CONCURRENT WITH TASKING SUBORDINATE UNITS. ORM CLEARLY IDENTIFIES THE CONTROLS NECESSARY TO LIMIT SUCH RISKS AND ALERTS THE CHAIN-OF-COMMAND REGARDING WHEN IT'S NECESSARY TO MORE CAREFULLY EVALUATE THE "RISK VERSUS PAYOFF" INHERENT IN ALL OPERATIONAL DECISIONS.

5. DUE TO ITS IMPORTANCE, WE'RE NOW TEACHING ORM IN COMMAND LEADERSHIP COURSES AND WILL SOON EMBED IT THROUGHOUT OUR ENTIRE TRAINING CONTINUUM. BEYOND THE SCHOOLHOUSE, EACH COMMANDER IS RESPONSIBLE FOR IMPLEMENTING ORM WITHIN THEIR COMMAND, DRAWING UPON

GUIDANCE PROVIDED IN REF A. ADDITIONALLY, REF B CONTAINS VALUABLE RESOURCES AND OFFERS LINKS TO RELATED ARMY AND AIR FORCE SITES.

6. MISHAPS COST OUR NAVY 724 LIVES AND THREE BILLION DOLLARS OVER THE PAST FIVE YEARS. THAT IS A STAGGERING TOLL AND A TREND THAT MUST BE REVERSED. ORM IS A PROVEN PROCESS THAT PREVENTS THE LOSS OF PRECIOUS LIVES AND VALUABLE SYSTEMS. BUT IT CAN ONLY WORK IF ALL OF US INTEGRATE ORM INTO OUR DAILY ROUTINES. THIS REALLY IS ALL HANDS' BUSINESS AND I CHARGE EACH OF YOU WITH MAKING ORM A CORE ELEMENT OF NAVY LIFE. IT WILL MAKE A POSITIVE DIFFERENCE!

7. RELEASED BY ADM JAY L. JOHNSON, CNO.//

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Appendix B

OPNAVINST 3500.39 – OPERATIONAL RISK MANAGEMENT

OPNAVINST 3500.39
MCO 3500.27
N511
SD

OPNAV INSTRUCTION 3500.39
MARINE CORPS ORDER 3500.27

From: Chief of Naval Operations
Commandant of the Marine Corps

To: All Ships and Stations

Subj: OPERATIONAL RISK MANAGEMENT

Ref: (a) DODINST 6055.1

Encl: (1) Introduction to Operational Risk Management

1. Purpose. In accordance with change 2 to reference (a), establish Operational Risk Management as an integral part of Naval operations, training and planning at all levels in order to optimize operational capability and readiness.

2. Background

a. Uncertainty and risk are inherent in the nature of military action. The success of the Naval Services is based upon a willingness to balance risk with opportunity in taking the bold and decisive action necessary to triumph in battle. At the same time, Commanders have a fundamental responsibility to safeguard highly valued personnel and material resources, and to accept only the minimal level of risk necessary to accomplish an assigned mission.

b. Operational Risk Management is an effective tool for maintaining readiness in peacetime and success in combat without infringing upon the prerogatives of the Commander. Historically, the greater percentage of losses during combat operations were due to mishaps. Unnecessary losses either in battle or in training are detrimental to operational capability. Since 1991, Operational Risk Management, applied both in day-to-day operations and during crisis periods, has produced dramatic results in reducing these losses. This instruction is part of an initiative to integrate this effective technique throughout the Department of Defense. It provides a means to help define risk and control it where possible, thereby assisting the Commander in choosing the best course of action and seize opportunities which lead to victory.

3. Scope. This instruction applies to all Navy and Marine Corps activities, Commands and personnel. Addressees should not issue an implementing instruction to augment this policy except as needed to implement command-specific applications and requirements.

4. Discussion. NDP1, Naval Warfare Publication 1 states, "Risk Management is a formal, essential tool of operational planning. Sound decision making requires the use of this tool both in battle and in training." Operational Risk Management is described in enclosure (1). It is a method for identifying hazards, assessing risks and implementing controls to reduce the risk associated with any operation. Implementation of Operational Risk Management in the Department of the Navy will be accomplished as follows:

a. Operational Risk Management will be included in the orientation and training of all military personnel. Level of training will be commensurate with rank, experience and leadership position.

(1) Operational Risk Management training shall be incorporated into leadership courses, General Military Training and courses where safety or force protection is addressed (e.g., safety schools, initial warfare qualification schools, and tactical or operational level war fighting courses). This training should be incorporated into existing training periods on safety and operational planning/decision making whenever possible.

(2) The Operational Risk Management process and its specific application to pertinent subjects shall be integrated into fleet tactical training, Personnel Qualification Standards (PQS), Naval and Occupational Standards, Individual Training Standards and the Marine Corps Combat Readiness Evaluation System.

b. Operational Risk Management lessons learned will be submitted for inclusion in data bases of existing reporting systems.

c. The Operational Risk Management process should be integrated into all levels of a Command.

(1) Hazards should be identified, risks assessed, and controls developed and implemented during the earliest possible planning stages. Operations should be continuously monitored for effectiveness of controls and situational changes.

(2) Information available through existing safety, training and lessons learned data bases will be considered whenever practicable in making risk decisions.

5. Policy. All Navy and Marine Corps activities should apply the principles of Operational Risk Management in planning, operations and training. The Operational Risk Management process and other risk management techniques should be applied to optimize operational capability and readiness.

6. Responsibilities

a. Chief of Naval Operations (N511) and Commandant of the Marine Corps (SD) provide policy sponsorship and service approval of Navy and Marine Corps Operational Risk Management.

b. Chief of Naval Operations resource sponsors shall support integration of Operational Risk Management into existing training topics during review of courses under their cognizance.

c. Naval Doctrine Command shall address Operational Risk Management concepts and applications in appropriate doctrinal publications.

d. Systems Commands shall provide information, data and technical support for the resolution of hazards under their cognizance.

e. Chief of Naval Education and Training (CNET) shall:

(1) Develop curricula for and incorporate appropriate Operational Risk Management instructions at each level of formal leadership training, General Military Training (GMT) and all courses where safety or force protection is or should be appropriately addressed.

(2) Integrate specific applications of the Operational Risk Management process into PQS.

f. Commanding General, Marine Corps Combat Development Center shall:

(1) Develop curricula for and incorporate appropriate Operational Risk Management instructions at each level of formal

leadership training, GMT and all courses where safety or force protection is or should be appropriately addressed.

(2) Integrate specific applications of the Operational Risk Management process into Individual Training Standards and the Marine Corps Combat Readiness Evaluation System.

(3) Address Operational Risk Management concepts and applications in appropriate doctrinal publications.

g. Commander, Naval Safety Center shall serve as technical advisor on Operational Risk Management curricula, providing excerpts from past mishap and hazard reports and analysis of loss data.

h. Naval Manpower Analysis Center shall incorporate the Operational Risk Management process into Naval Standards and, where specific applications warrant additional requirements, Occupational Standards.

i. Fleet, Type and MEF Commanders should:

(1) Incorporate the Operational Risk Management process into operations, exercises and training.

(2) Address the Operational Risk Management process in post exercise/operation reports.

j. Unit Commanders should:

(1) Implement the Operational Risk Management process within their commands. Examples include, but are not limited to:

(a) providing training to Command personnel on enclosure (1);

(b) incorporating identified hazards, assessments and controls into briefs, notices and written plans;

(c) conducting a thorough risk assessment for all new or complex evolutions, defining acceptable risk and possible contingencies for the evolution.

(2) Address the Operational Risk Management process in safety, training and lessons learned reports. Reports should comment on hazards, risk assessments and effectiveness of controls implemented.

7. Review. Not later than 2 years following implementation,

CNO(N511) and CMC(SD) will complete fleet review of Operational Risk Management and this instruction. Requirement for further reviews shall be determined in conjunction with the first review.

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INTRODUCTION TO OPERATIONAL RISK MANAGEMENT

1. Background

a. NDP-1 (Naval Warfare) states, "By its nature, the uncertainty of war invariably involves the acceptance of risk...Because risk is often related to gain, leaders weigh risks against the benefits to be gained from an operation." We rely on the judgment of individual Commanders to balance the requirements of mission success with the inherent risks of military action. Naval leaders have always practiced risk management in their operational decision making. However, the approach to risk, and degree of success in dealing with it, have varied widely depending on the leader and his/her level of training and experience. The principles of Operational Risk Management can be taught and effectively applied throughout the Navy and Marine Corps to enhance the decision making capabilities of our personnel. Many Operational Risk Management techniques are currently incorporated into our operational planning and decision making processes. The evaluation and wargaming of different courses of action, the establishment of mission go/no-go criteria, the employment of maximum/minimum operating envelopes, and the use of mission/confirmation briefings are all examples of how Commanders and units evaluate and manage risk. In addition to continuing to utilize these techniques, the remainder of this enclosure outlines a formalized process which may be applied in dealing with risk.

2. Concept

a. The Operational Risk Management process:

(1) is a decision making tool used by people at all levels to increase operational effectiveness by anticipating hazards and reducing the potential for loss, thereby increasing the probability of a successful mission.

(2) increases our ability to make informed decisions by providing the best baseline of knowledge and experience available.

(3) minimizes risks to acceptable levels, commensurate with mission accomplishment. The amount of risk we will take in war is much greater than that we should be willing to take in peace, but the process is the same. Applying the Operational

Risk Management process will reduce mishaps, lower costs, and provide for more efficient use of resources.

3. Terms

a. Operational Risk Management Terms:

(1) Hazard - A condition with the potential to cause personal injury or death, property damage or mission degradation.

(2) Risk - An expression of possible loss in terms of severity and probability.

(3) Risk Assessment - The process of detecting hazards and assessing associated risks.

(4) Operational Risk Management (ORM) - The process of dealing with risk associated with military operations, which includes risk assessment, risk decision making and implementation of effective risk controls.

4. Process

a. Figure 1 shows the flow of the Operational Risk Management process. The five step process is:

(1) Identify Hazards - Begin with an outline or chart of the major steps in the operation (operational analysis). Next, conduct a Preliminary Hazard Analysis by listing all of the hazards associated with each step in the operational analysis along with possible causes for those hazards.

(2) Assess Hazards - For each hazard identified, determine the associated degree of risk in terms of probability and severity. Although not required, the use of a matrix may be helpful in assessing hazards (described further in paragraph D).

(3) Make Risk Decisions - First, develop risk control options. Start with the most serious risk first and select controls that will reduce the risk to a minimum consistent with mission accomplishment. With selected controls in place, decide if the benefit of the operation outweighs the risk. If risk outweighs benefit or if assistance is required to implement

controls, communicate with higher authority in the chain of command.

(4) Implement Controls - The following measures can be used to eliminate hazards or reduce the degree of risk. These are listed by order of preference:

(a) Engineering Controls - Controls that use engineering methods to reduce risks by design, material selection or substitution when technically or economically feasible.

(b) Administrative Controls - Controls that reduce risks through specific administrative actions, such as:

1. providing suitable warnings, markings, placards, signs, and notices.

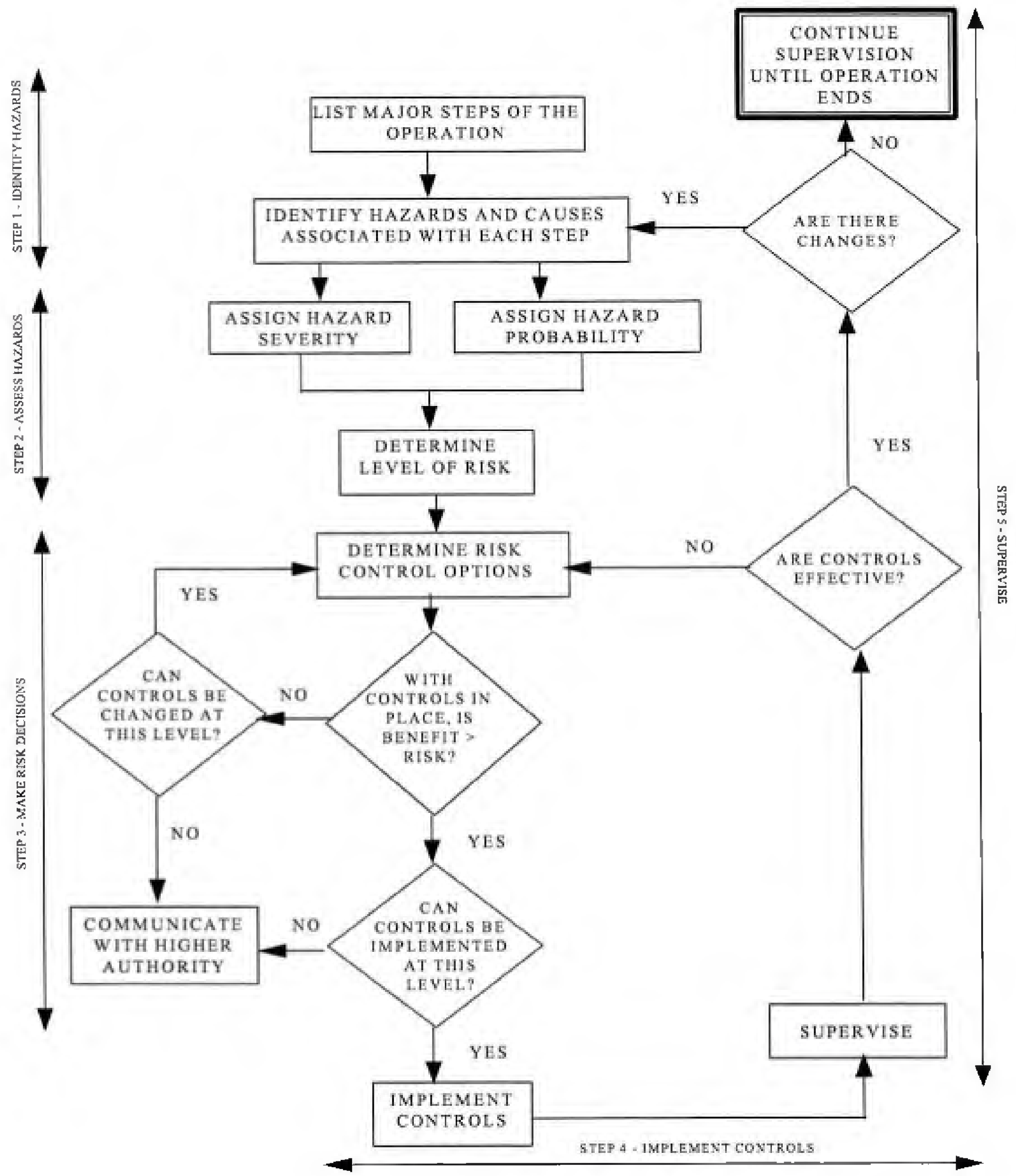
2. establishing written policies, programs, instructions and standard operating procedures (SOP).

3. training personnel to recognize hazards and take appropriate precautionary measures.

4. limiting the exposure to a hazard (either by reducing the number of personnel/assets or the length of time they are exposed).

(c) Personal protective equipment - Serves as a barrier between personnel and a hazard. It should be used when other controls do not reduce the hazard to an acceptable level.

(5) Supervise - Conduct follow-up evaluations of the controls to ensure they remain in place and have the desired effect. Monitor for changes which may require further Operational Risk Management. Take corrective action when necessary.



b. The Operational Risk Management process exists on three levels. The Commander selects which level based upon the mission, the situation, the time available, the proficiency level of personnel and the assets available. While it would be preferable to perform a deliberate or in-depth risk management process for all evolutions, the time and resources to do so will not always be available. One of the objectives of Operational Risk Management training is to develop sufficient proficiency in applying the process such that Operational Risk Management becomes an automatic or intuitive part of our decision making methodology. In the operational environment, leaders should be able to employ this time-critical process to make sound and timely decisions that generate tempo and facilitate decisive results. The three levels are as follows:

(1) Time-critical - An "on the run" mental or oral review of the situation using the five step process without recording the information on paper. The time critical level of Operational Risk Management is employed by experienced personnel to consider risk while making decisions in a time-compressed situation. It is the normal level of Operational Risk Management used during the execution phase of training or operations as well as in planning during crisis response scenarios. It is particularly helpful in choosing the appropriate course of action when an unplanned event occurs during the execution of a planned operation or daily routine.

(2) Deliberate - Application of the complete five step process as depicted in figure 1 in planning an operation or evaluating procedures. It uses primarily experience and brainstorming to identify hazards and develop controls, and is therefore most effective when done in a group. Examples of deliberate applications include planning of upcoming operations, review of standard operating, maintenance or training procedures and damage control/disaster response planning.

(3) In-Depth - Deliberate process with a more thorough risk assessment (first two of the five steps) involving research of available data, use of diagram and analysis tools, formal testing or long term tracking of the hazards associated with the operation (sometimes with assistance from technical experts) to identify and access the hazards. It is used to more thoroughly study the hazards and their associated risk in a complex operation or system, or one in which the hazards are not well understood. Examples of in-depth applications include long term planning of complex operations, introduction of new equipment, materials and missions, development of tactics and training curricula and major system overhaul or repair.

c. Operational Risk Management incorporates the following four principles:

(1) <u>Accept risk when benefits outweigh the cost</u>. FMFM 1 (Warfighting) states, "Risk is inherent in war and is involved in every mission. Risk is also related to gain; normally

greater potential gain requires greater risk." Our naval tradition is built upon principles of seizing the initiative and taking decisive action. The goal of Operational Risk Management is not to eliminate risk, but to manage the risk so that the mission can be accomplished with the minimum amount of loss.

(2) Accept no unnecessary risk. FMFM 1 also states, "We should clearly understand that the acceptance of risk does not equate to the imprudent willingness to gamble..." Take only risks which are necessary to accomplish the mission.

(3) Anticipate and manage risk by planning. Risks are more easily controlled when they are identified early in the planning process.

(4) Make risk decisions at the right level. Risk management decisions are made by the leader directly responsible for the operation. Prudence, experience, judgment, intuition and situational awareness of leaders directly involved in the planning and execution of the mission are the critical elements in making effective risk management decisions. When the leader responsible for executing the mission determines that the risk associated with that mission is too high or goes beyond the commander's stated intent, he should seek additional guidance.

d. Risk Assessment Matrix - A matrix can be used to accomplish the second step of the Operational Risk Management process. Using a matrix to quantify and prioritize the risk(s) does not lessen the inherently subjective nature of risk assessment. However, a matrix does provide a consistent framework for evaluating risk. Although different matrices may be used for various applications, any risk assessment tool should include the elements of hazard severity and mishap probability. The risk assessment code (RAC) defined by a matrix represents the degree of risk associated with a hazard considering these two elements. While the degree of risk is subjective in nature, the RAC does accurately reflect the relative amount of perceived risk between various hazards. The example matrix described below is used in Naval Occupational Safety and Health assessments. Using the matrix, the RAC is derived as follows:

(1) Hazard Severity - An assessment of the worst credible consequence which can occur as a result of a hazard. Severity is defined by potential degree of injury, illness, property damage, loss of assets (time, money, personnel) or

effect on mission. The combination of two or more hazards may increase the overall level of risk. Hazard severity categories are assigned as Roman numerals according to the following criteria:

(a) Category I - The hazard may cause death, loss of facility/asset or result in grave damage to national interests.

(b) Category II - The hazard may cause severe injury, illness, property damage, damage to national or service interests or degradation to efficient use of assets.

(c) Category III - The hazard may cause minor injury, illness, property damage, damage to national, service or command interests or degradation to efficient use of assets.

(d) Category IV - The hazard presents a minimal threat to personnel safety or health, property, national, service or command interests or efficient use of assets.

(2) Mishap Probability - The probability that a hazard will result in a mishap or loss, based on an assessment of such factors as location, exposure (cycles or hours of operation), affected populations, experience or previously established statistical information. Mishap probability will be assigned an English letter according to the following criteria:

(a) Sub-category A - Likely to occur immediately or within a short period of time. Expected to occur frequently to an individual item or person or continuously to a fleet, inventory or group.

(b) Sub-category B - Probably will occur in time. Expected to occur several times to an individual item or person or frequently to a fleet, inventory or group.

(c) Sub-category C - May occur in time. Can reasonably be expected to occur some time to an individual item or person or several times to a fleet, inventory or group.

(d) Sub-category D - Unlikely to occur.

(3) Risk Assessment Code - The RAC is an expression of risk which combines the elements of hazard severity and mishap probability. Using the matrix shown below, the RAC is expressed

as a single Arabic number that can be used to help determine hazard abatement priorities.

Hazard Severity	Mishap Probability A	B	C	D
I	1	1	2	3
II	1	2	3	4
III	2	3	4	5
IV	3	4	5	5

RAC Definition:

1 - Critical
2 - Serious
3 - Moderate

4 - Minor
5 - Negligible

Note that in some cases, the worst credible consequence of a hazard may not correspond to the highest RAC for that hazard. For example, one hazard may have two potential consequences. The severity of the worst consequence (I) may be unlikely (D), resulting in a RAC of 3. The severity of the lesser consequence (II) may be probable (B), resulting in a RAC of 2. Therefore, it is also important to consider less severe consequences of a hazard if they are more likely than the worst credible consequence, since this combination may actually present a greater overall risk.

e. The Operational Risk Management process provides an additional tool for commanders to use in reducing risks inherent in military operations. It is not a complete change in the way we approach the risk management problem, but rather provides a specific methodology for personnel to anticipate hazards and evaluate risk. Just as we have trained our personnel to focus on the mission, we can train our personnel to evaluate risk as part of their decision making process. As personnel are trained in and use the process, operational risk management will become intuitive, being applied automatically as a means to aid in quickly developing an effective course of action to accomplish the mission.

5. EXAMPLE

In preparation for an amphibious exercise, a deck officer might use Operational Risk Management to plan for launching small boats.

a. Step 1 - Identify Hazards.

(1) Operational Analysis:
Muster deck watch section
Brief
Man launch positions
Attach lines and Load boats
Move boats over water and lower
Detach lines and retrieve
Small boats move away from ship
Stow lines
Muster deck watch section

(2) Preliminary Hazard Analysis: For each step of the operational analysis, list any hazards which might result in personnel injury/death, property damage or mission degradation.

Hazards	Causes
Personnel slips/falls	Wet deck Gear adrift Rushing
Time/position requirements confused	Incomplete/Inaccurate brief
Boat overload	Inadequate training Crew complacency
Improperly attached lines	same as above
Lost control of boats (resulting in death, injury, damage of delay/abort of launch)	Material casualty (davit, crane or hardness failure High sea state Improper procedures (winch, davit operation) Improper positioning (boat crew and boat)
Man overboard	same as above

Lines tangled/knotted	same as above Improperly attached lines
Small boats unable to break away from ship	Small boat engine failure Suction effect from ship

b. Step 2 - Assess Hazards. Assess each hazard identified in terms of severity and probability of possible loss. For example, the deck officer might assess the hazard "Lost control of boats" using the Risk Assessment Matrix as follows:

(1) Consider possible consequences of hazard (severity).

(a) Death, boat knocks someone unconscious and overboard or crushes them between the ship and the boat (I)

(b) Severe injury, boat rolls, crewman slips and breaks bones (II)

(c) Severe small boat or ship damage (II)

(d) Boat launch(es) delayed or even aborted, resulting in diminished reconnaissance support for the amphibious landing and possibly delaying H-hour due to insufficient surf reports. (III for training environment, I for actual combat)

(2) Determine probability of loss from hazard based on past experience, available safety data, the weather forecast, information about the operations area, assigned personnel, the number of small boats and the assigned mission.

(a) With current procedures and personnel, the probability of a death during small boat operations is considered unlikely (D).

(b) Although small boat operations have not been a problem on this ship in the past few years, frequent small boat mishaps in the fleet and the number of potential causes lead the deck officer to conclude that a small boat mishap resulting in severe injury or damage and delayed boat launches probably will occur in time (B).

(3) Determine the RAC. Based on the following analysis, the hazard "Lost Control of Boats" would be assigned a RAC of 2, and prioritized with other hazards based on most serious RAC.

(a) Entering the matrix with severity I and probability D gives a RAC of 3 for personnel death during small boat launch.

(b) Entering the matrix with severity II and probability B gives a RAC of 2 for severe injury or damage.

(c) Entering the matrix with severity III and probability B gives a RAC of 3 for delayed launch or abort during training exercise.

c. Step 3 - Make Risk Decisions.

(1) Beginning with most serious risks first (lowest RAC), consider risk control options. For example, some controls for the hazard of lost control of boats might include thorough equipment checkout prior to the exercise, review of key procedures during brief, practice launch of empty boats prior to exercise, stationing supervisor/observer to monitor proper position and procedures and wearing helmets.

(2) Determine if benefit outweighs risk with selected controls in place. The deck officer decides the risk is acceptable with the above controls in place. However, he must coordinate with the captain to conduct the pre-exercise launch.

d. Step 4 - Implement Controls.

(1) The deck officer might draft a pre-exercise plan which establishes a requirement to check the equipment, delineates key procedures to be briefed, schedules the practice launch and assigns supervisor responsibility. Existing applicable SOPs should be referenced.

e. Step 5 - Supervise.

(1) Monitor the evolution for any changes which might present new hazards. Ensure appropriate supervisors enforce established procedures and follow through with selected controls.

(2) Adjust controls which are ineffective.

(3) After the evolution, determine which controls were effective and ensure they are implemented for future similar evolutions.

Appendix C

WORKSHOP ON RISK MANAGEMENT FOR FACILITIES (RMF)

San Diego
July 26-27 '00
"Pier Bravo"

SAN DIEGO
JULY26-27 ‘00
‘PIER BRAVO’

WORKSHOP ON RISK MANAGEMENT FOR FACILITIES (RMF)

Workshop Outline

- Background - Why we are here
- RMF Process Overview
- Applying the five-step process - “How To”
- Pier Bravo MCON Overview
- Pier Bravo Site Visit
- Applying the five-step process - Pier Bravo

WHO ARE YOU?

- What is your name?
- Where are you from?
- What do you do?

Background

- Apr 97: OPNAVINST/ MCO
- Aug 98: CNO releases ORM msg
- Nov 98: ORM billet at OPNAV N09K
  - Capt. Faherty
- Apr 00: CNO N44 RMF Tasking Letter > NAVFAC PWC (Singh)

Background

" ORM Applies across the entire spectrum of naval activities, from joint operations and fleet exercises to our daily routine. We must encourage top down interest in the ORM process, from the flag level all the way to the deckplates".

-ADM Jay Johnson, CNO

Background

" One of the most challenging aspects of naval operations is successfully managing risk--identifying and assessing hazards, then employing tools to make sure those hazards don't harm our shipmates and destroy equipment."

-ADM Jay Johnson, CNO

Background

Operational Risk Management (ORM) is Not Just Safety

It includes all aspects that put mission accomplishment at risk including training, safety, environmental, facilities or equipment.

Background

Risk Management for Facilities

dealing with facilities in terms of risks to military operations including hazard assessment, risk decision making, and implementation of effective risk controls.

Background

Risk Management for Facilities

- Determine the risks involved in terms of operational capabilities due to deferring maintenance, repair or construction projects.
- The operational readiness must be verifiable.
- The risks should be expressed as change in status over time

- Harry Singh

Background

NFESC Role in RMF

- Tasking from NAVFAC PWC - Harry Singh
- Long Term Objectives - Integrate RMF into Facilities Processes
  - Determine how risk management applies to facilities
  - Build it into policy, **training and procedures**
  - Develop/implement predictive tools
  - Develop Center of Expertise

Background

Workshop Objectives

- Understand the basic concepts and principles of RMF.
- Apply RMF to a Navy Facility - ‘Pier Bravo’

RMF Overview

RMF Terms

<u>RMF</u> - Operational Risk Management (ORM) Applied to Facilities

<u>Hazard</u> - A condition with the potential to cause personal injury or death, property damage or mission degradation.

<u>Risk</u> - An expression of possible loss in terms of severity & probability.

ORM Concepts

- All are responsible for using ORM.
- Risk is inherent in all operations.
- Risk can be controlled.

ORM Will:

- Increase probability of a successful mission.
- Significantly enhance overall decision making skills.
- Guide appropriate level decision making.
- Cut losses significantly.

Three ORM Levels

- Time Critical (Emergency)
- Deliberate (PMI)
- In-Depth (MCON)

Four ORM Principles

1. Accept risks when benefits outweigh costs.
2. Accept no unnecessary risk.
3. Anticipate and manage risk by planning.
4. Make risk decisions at the right level.

1. Accept Risk When Benefits Outweigh Costs

WHAT HAPPENS WHEN AN ORGANIZATION STOPS TAKING RISKS?

WEBSTER: "BUREAUCRACY: A system of administration characterized by lack of initiative and flexibility, by indifference to human needs or public opinion, and by a tendency to defer decisions to superiors or to impede action with red tape."

SUSTAINING A BOLD, RISK-TAKING ORGANIZATION IS ALWAYS A CHALLENGE IN PEACE & WAR. ORM HELPS.

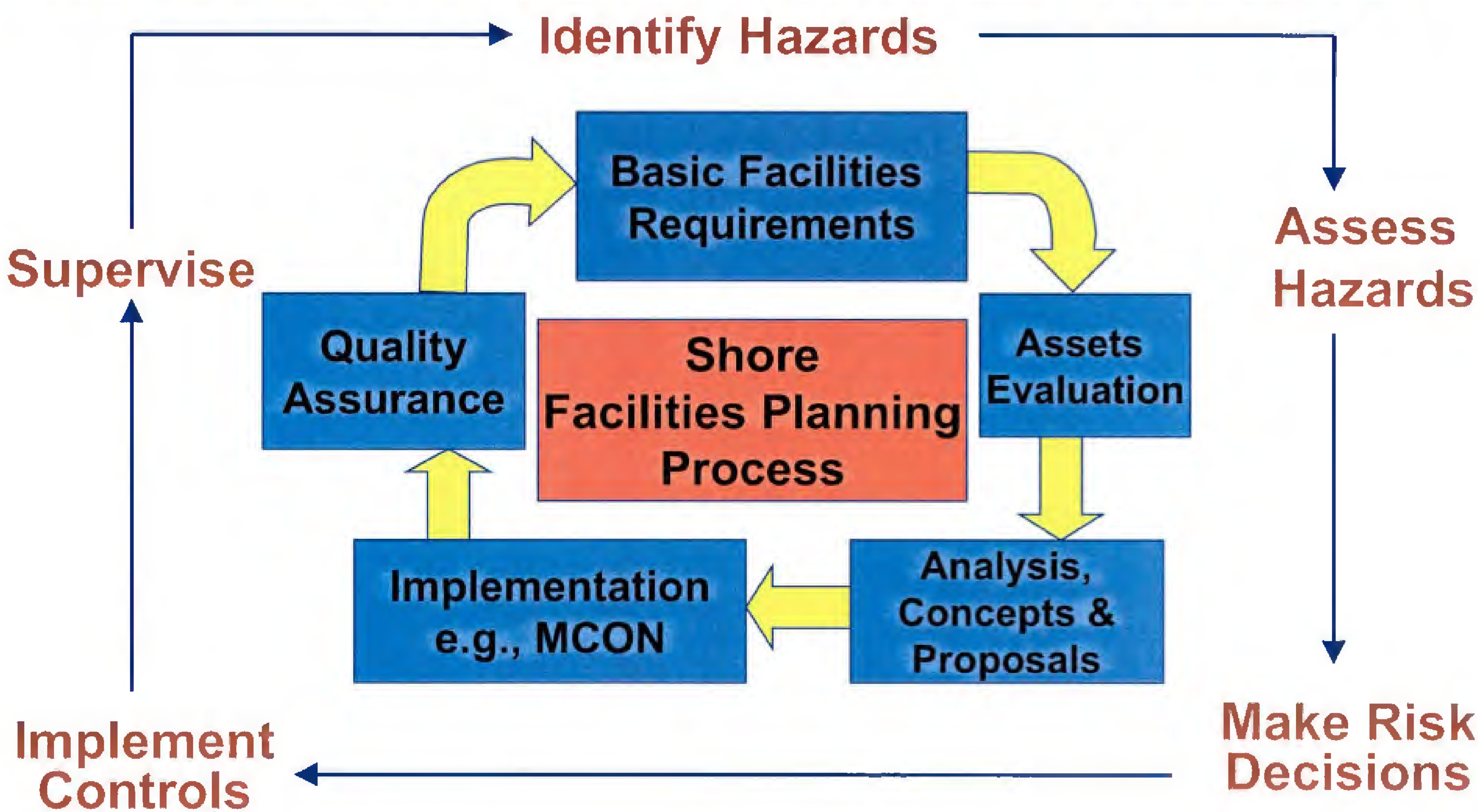
2. Accept No Unnecessary Risks

BUT.... WHO TAKES "UNNECESSARY" RISKS?

*If **all** detectable hazards have not been detected, then unnecessary risks are being accepted.*

3. *Anticipate and Manage Risk by Planning*

RMF CAN BE INTEGRATED INTO CURRENT PROCESSES



4. *Make Risk Decisions at the Appropriate Level*

Factors below are a decision-making guide

- Who has the maturity and experience to make decisions?
- Who has on-scene knowledge?
- Who has the resources to mitigate the risk?
- Who must make this decision in an emergency?
- Who will answer in the event of a mishap?

ORM Overview

Questions?

Step 1 - Identify Hazards

Hazard: A condition with the potential to cause personal injury or death, property damage or mission degradation.

Identify Hazards

1. Identify Hazards

- Define the Mission - Operational Terms
- Define Facilities Requirements
- List Alternative Facilities Solutions
- Do a Task Analysis
- **List Hazards associated with each Task**

Define the Mission

- Ask operators
- Focus on Navy operational mission requirements
  - facilities are required only as needed to meet mission requirements
- Decide between competing projects based on operational priorities

Define the Mission

1. Identify Hazards

National Defense

Maintain Fleet Readiness

<u>Provide Fleet Berthing</u>

Build Pier

Define Facility Requirements

1. Identify Hazards

- Ask operators
- Focus on key requirements

Adequate Size

Support Services

List Alternative Facility Solutions

1. Identify Hazards

- Focus on key requirements/costs
- Look at past solutions
- Ask experts

Build a Pier

Use Existing Pier

Build Mooring

Do Task Analysis

1. Identify Hazards

- List events in sequence
- Prioritize significant events

Build a Pier

1. Env. Permit	3. Demo Old Pier
2. Design Pier	4. Select A&E

List Hazards for Each Task

- Most Important Part of ORM
- Use Preliminary Hazard Analysis
- Use 'What If' Tool

Task 4. Foundation Hazards

- poor quality concrete
- uneven ground
- fall in wet concrete

Step 1-
Identify Hazards

Questions?

Next Presentation

BACKUP SLIDES

Navy ORM Mission

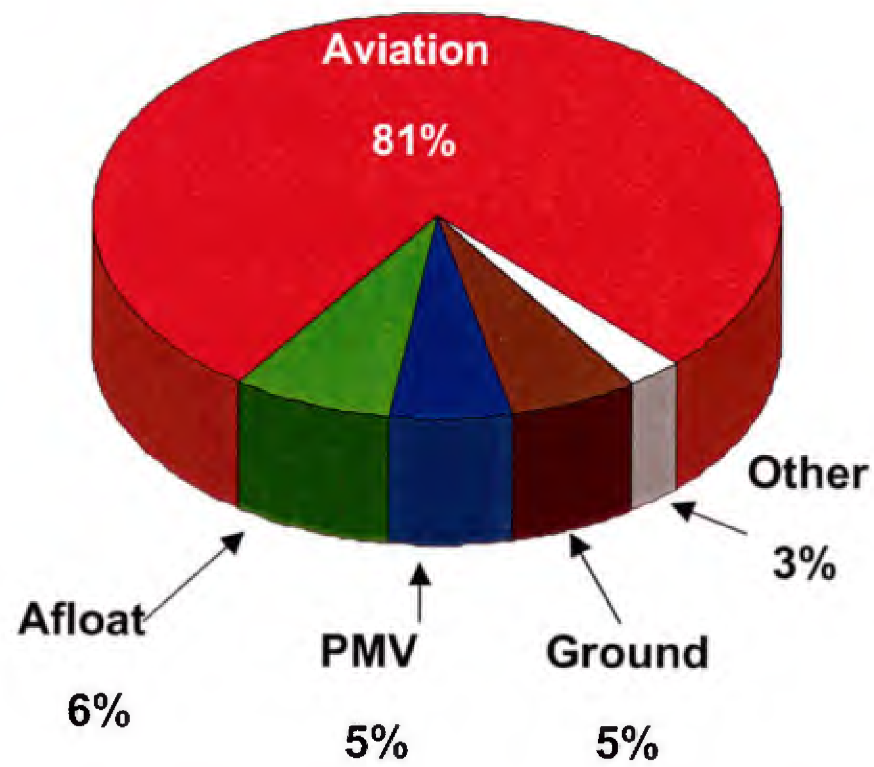
“Enhance operational capability at all levels while minimizing risk”

"Avoid the distractions of debates on political correctness and focus on the soldiers' mission, one that remains fixed, determined, inviolable. It is to win our wars."

-General Douglas MacArthur
April, 1962

Navy & Marine Corps

Cost of Mishaps



FY92-99 mishaps cost $6.5B

Navy/Marine FY99 Fatalities

1. 121 MOTOR VEHICLE
2. 42 SUICIDE
3. 40 NATURAL CAUSES
4. 25 RECREATION
5. 16 VIOLENT CRIME
6. 13 AVIATION
7. 3 FALLS
8. 2 FIREARMS
9. 1 ALCOHOL

" *Unit level failures can have serious corporate consequences* "

- CAPT Denis Faherty

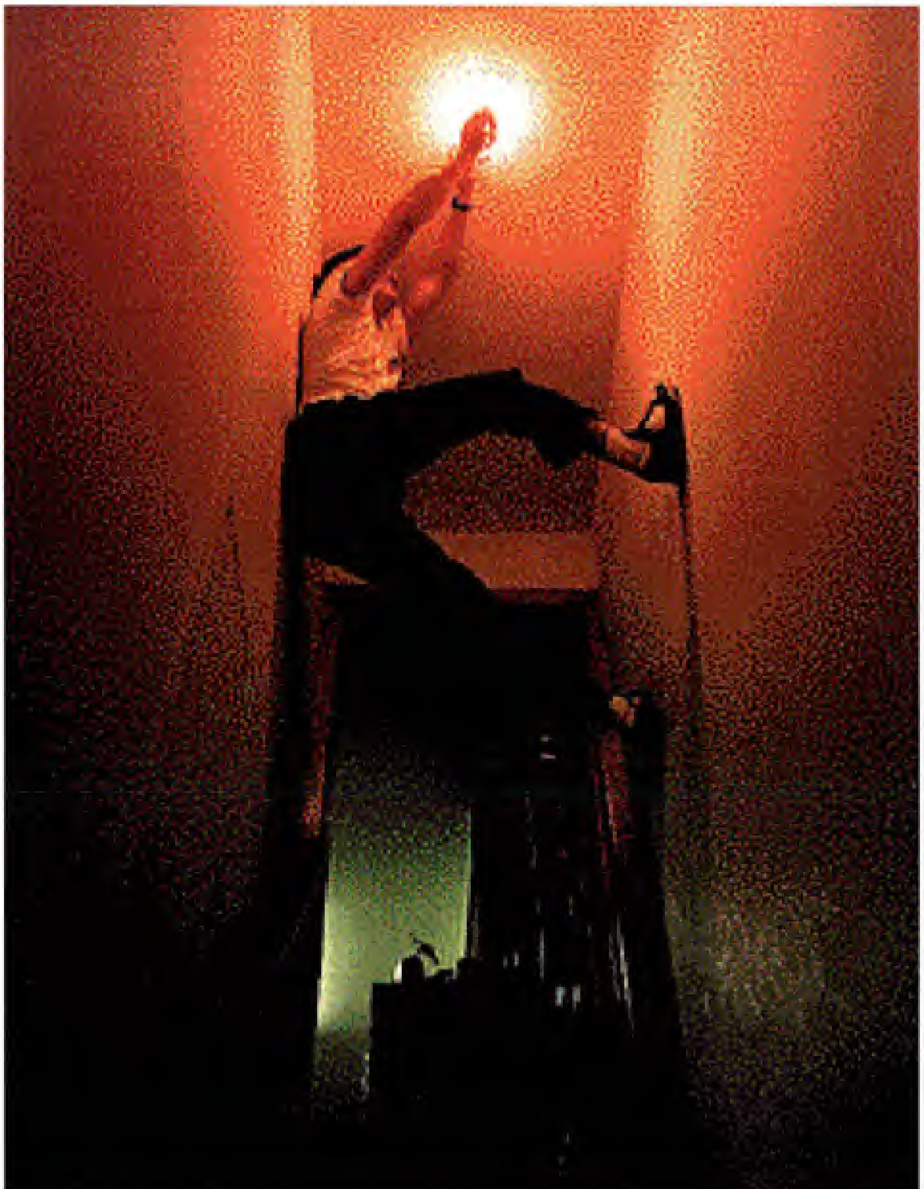
Causes of Risk

* Two Important Causes of Risk
    * Resource Constraints
        * New Technology

" I charge each of you with making ORM a core element of Navy life. It will make a positive difference!"

-ADM Jay Johnson, CNO

Where's the Hazard Assessment?



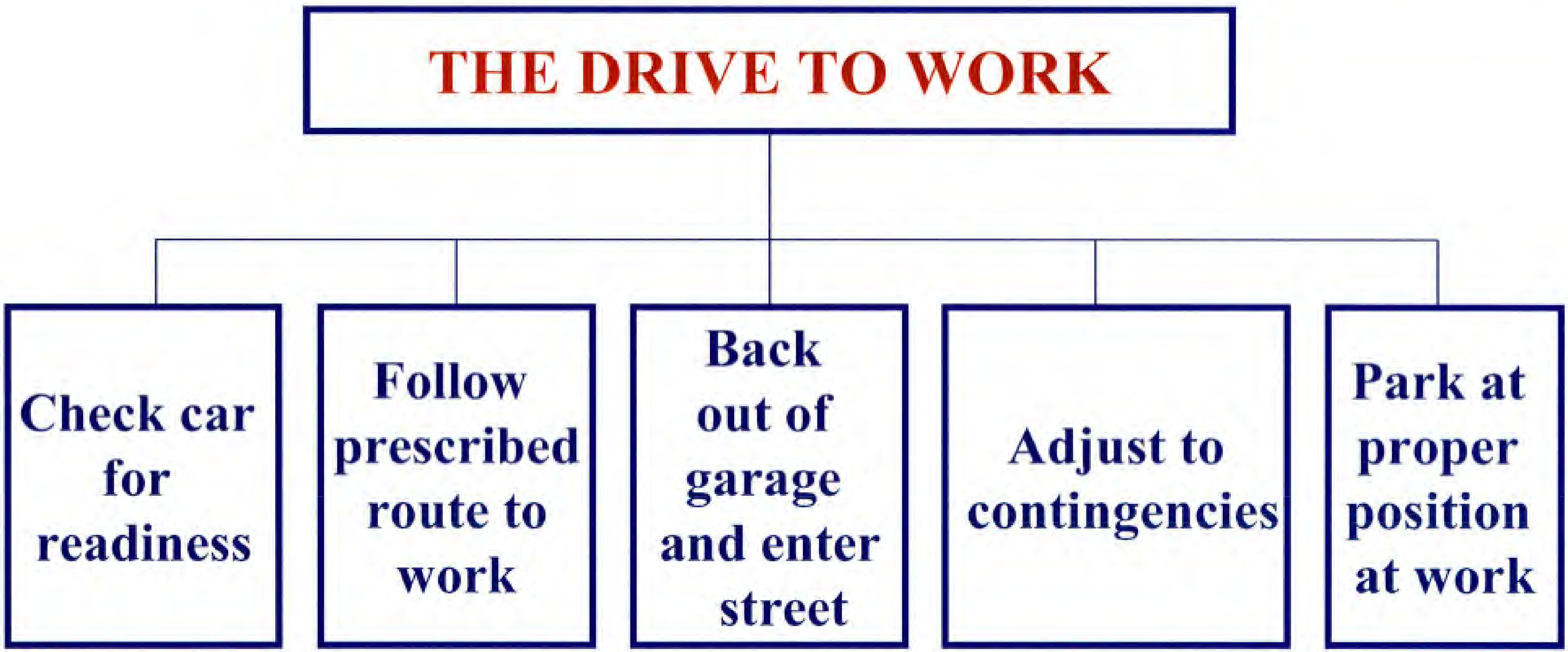
When individual sailors apply Risk Management away from work, Risk Management will be a success.

Operational Analysis

1. Identify Hazards

- List events in sequence
- Prioritize significant events

Operational Analysis

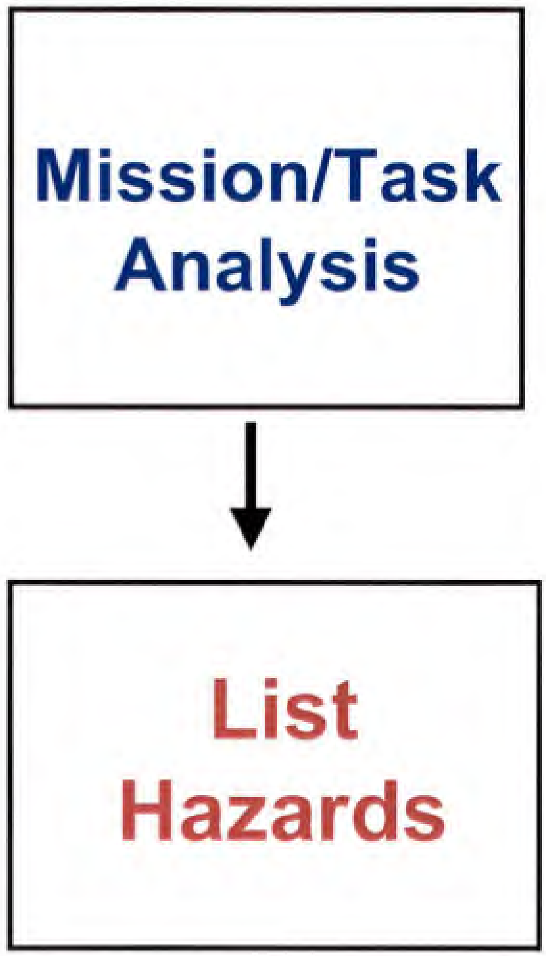


1. Identify Hazards

EXERCISE A

Operational Analysis

List Hazards



Basic Sources

1. Identify Hazards

There are three basic sources:

- Experts and References - Instructions
- Traditional Techniques - (Inspections, Mishap Reports, Interviews, Audits)
- Hazard Identification Tools

Sources at Your Unit

1. Identify Hazards

- Unit personnel.
- A lessons learned database or file.
- An industrial hygiene survey.
- A safety and/or fire inspection hazard inventory.
- An inventory of hazardous materials with locations.
- A mishap/incident report database or file.

Hazard ID - Guidelines

- About 30-40% of total ORM time and resources should go to Hazard ID.
- Assure one or more Hazard ID tools are targeted at your “what's at risk” issues.
- Use personnel from the operational area to assist in Hazard ID. Tailor the tools used to compliment their capabilities.
- Be flexible.

Hazard Identification Tools

1. Identify Hazards

- Preliminary Hazard Analysis (PHA)
- "What If" Tool
- Change Analysis

Brainstorming

- Useful technique throughout all ORM
- “Free” input (disciplined)
- Round-robin technique

Root Cause

1. Identify Hazards

- Target <u>root cause</u> versus symptom
- Keep asking why until root cause is determined

Preliminary Hazard Analysis

1. Identify Hazards

- Start with Operational Analysis
- Brainstorm hazards for each step

PHA

The Drive To Work

1. Identify Hazards

Follow prescribed route to work	Adjust to contingencies	Park at proper position at work

Follow prescribed route to work

- Routine traffic hazards

Adjust to contingencies

- Route blocked
- Car failure
- Criminal activity

Park at proper position at work

- Position filled
- Lack of clearance

Exercise B

Preliminary Hazard Analysis (PHA)

"What If" Tool

- Natural evolution from PHA
- Easy to do

"What If" Tool

THE DRIVE TO WORK

- "What if" the car catches fire?
- "What if" a carjack is attempted?
- "What if" I have to take an unknown detour?
- "What if" I run out of gas?
- "What if" another car rear ends me?

EXERCISE C

1. Identify Hazards

"What If"

Change Analysis

1. Identify Hazards

- Focus on what is different
- Planned and unplanned events
- Great labor saver

Change Analysis

THE DRIVE TO WORK

1. Identify Hazards

Driving a medium truck, not your car

- Objects (truck, car, bigger)
- Protective Devices (no air bag, air bag, less protection)
- Procedures (numerous change procedures, standard car procedures, new-more complex task
- Schedule (probably will take longer, standard time, longer task)
- Control chain (company truck, personal car, liability changes)

EXERCISE D

Change Analysis

Appendix D

REPAIR PIER BRAVO
(Project No. R1-98)

Form DD 1391

1. COMPONENT	FY 2001 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
NAVY		Mar. 2000

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
NAVAL AIR STATION, NORTH ISLAND, SAN DIEGO, CALIFORNIA, 92135	REPAIR PIER BRAVO

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
O & M,N	151-10	R1-98	$4,477

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
REPAIRS TO PIER BRAVO				
CONCRETE DECK REPAIR	LS	1	1,050	1,050
UNDERDECK CONCRETE REPAIR	LS	1	79	79
FENDER SYSTEM REPAIR	LS	1	2,819	2,819
(Note: See attached cost estimate for detailed breakdown)				
SUBTOTAL				3,948
CONTINGENCY (5%)				197
SUBTOTAL WITH CONTINGENCY				4,145
SUPERVISION, INSPECTION, AND OVERHEAD (8%)				332
TOTAL FUNDED COST				
TOTAL REPAIR				4,477
TOTAL CONSTRUCTION				0
TOTAL EQUIPMENT INSTALLATION				0
TOTAL MAINTENANCE				0
TOTAL REQUEST				4,477
PLANNING AND DESIGN COSTS (8%)				358
EQUIPMENT PROVIDED FROM OTHER APPROPRIATIONS				0

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Pier Bravo is for the loading and unloading of ordinance. The pier is constructed with a concrete deck and supported by wooden piles. The repairs are required to correct the deteriorated state due to age and exposure to saltwater. Repairs consist of resurfacing the deck, repairing the walers and fenders, replace wooden piles and dolphins with plastic piles, and add rip rap to the shore line on the inboard side of the pier.

11. REQUIREMENT: 8,300 SY ADEQUATE: 0 SY SUBSTANDARD: 0 SY

PROJECT:

This project will repair the concrete deck that has delaminated so severely that the main top decking has structural re-bar exposed and is deteriorating due to the corrosive atmosphere. The deteriorated and damaged wooden piles and dolphins will be replaced with plastic piles, the damaged fenders will be replaced, and additional riprap will be added to the shoreline along the inboard side of the pier.

(Continued on sheet 2)

1. COMPONENT NAVY	FY 1999 MILITARY CONSTRUCTION PROJECT DATA	2. DATE Mar. 2000
3. INSTALLATION AND LOCATION NAVAL AIR STATION, NORTH ISLAND, SAN DIEGO, CALIFORNIA 92135		
4. PROGRAM ELEMENT O & M,N		5. PROJECT NUMBER R1-98

(CONTINUED)

11. REQUIREMENT:

Pier Bravo is essential in the loading and unloading of ordinance from ships. Pier Bravo is the only pier in San Diego with ordinance loading capabilities. With the home porting of CVN's at North Island, the handling of ordinance away from the berthing docks is very critical because of the close proximity of the berthing areas to the City of Coronado. With the increased home porting of ships at North Island, Pier Bravo's requirement to provide the San Diego area with the capability to "arm, repair, provision, service, and support the U.S. Pacific Fleet and other operating forces" increases.

CURRENT SITUATION:

Pier Bravo's concrete deck has delaminated so severely that the main top decking has structural re-bar exposed and is deteriorating due to the corrosive atmosphere. The pier supports and fenders are broken and borer-infested. The poor condition of the pier increases the possibility of an accident occurring while handling ordinance. With Home Porting of CVN's at North Island the use of the pier will increase, accelerating the piers already deteriorated state.

AIS........M
BASEREP....C3
The facility was constructed in 1979
Study by Russell-Veteto Engineering, Inc. (attached)

IMPACT IF NOT PROVIDED:

Without repairs Pier Bravo's deterioration will continue. The deterioration will increase the possibility of an accident happening and eventually close Pier Bravo. Failure to provide this project will result in the inability to support the Navy's loading and unloading of ordinance in the San Diego area.

ADDITIONAL DATA:

A. Facility Number:...............1335
B. Property Record Number:........201278
C. Facility Replacement Cost:.....$13,856,000
D. Hazardous Material.............The piles are creosote treated.
E. Status of Design:...Design has not started.
F.

(Continued on sheet 3)

Form DD 1391c

1. COMPONENT NAVY	FY 1999 MILITARY CONSTRUCTION PROJECT DATA	2. DATE Mar. 2000

3. INSTALLATION AND LOCATION
NAVAL AIR STATION, NORTH ISLAND,
SAN DIEGO, CALIFORNIA 92135

4. PROGRAM ELEMENT	5. PROJECT NUMBER
O & M, N	R1-98

(CONTINUED)

11. REQUIREMENT:

ATTACHMENTS:

A. Site plan and vicinity map.
B. Engineering cost estimate.
C. Categorical exclusion.
D. Photographs.

12. SIGNATURE:

_______________ TITLE _______________ DATE

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL AIR STATION, NORTH ISLAND		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

(Continued)

Photo 1. Pier Bravo. Overview of the south half of the main pier and the southern extension.

Photo 2. Pier Bravo. Overview of the north end of the main pier and the northern extension.

DD FORM 1391c
1 DEC 76

1. Component **NAVY**	**FY 2001 MILITARY CONSTRUCTION PROGRAM**	2. Date **15 Mar 00**
3. Installation And Location/UIC: **N00246** **NAVAL AIR STATION, NORTH ISLAND**		
4. Project Title **REPAIRS TO PIER BRAVO**		7. Project Number **R1-98**

(Continued)

Photo 3. Pier Bravo. Existing treated timber fender fender system on the outboard side of the main pier.

Photo 4. Pier Bravo. Existing treated timber system on the inboard side of the main pier.

DD FORM 1391c
1 DEC 76

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL AIR STATION, NORTH ISLAND		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

(Continued)

Photo 5. Pier Bravo. The existing concrete deck surface has extensive delamination at nearly 100% of the previous partial repair areas. Delamination of the deck quickly leads to open surface spalls which impede forklift traffic on the pier.

Photo 6. Pier Bravo. Delamination and surface spalls are caused by corrosion of steel reinforcing bars in the concrete deck. The past use of seawater to clean the deck is most likely responsible for the rapid decay of this deck.

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00

3. Installation And Location/UIC: **N00246**

NAVAL AIR STATION, NORTH ISLAND

4. Project Title **REPAIRS TO PIER BRAVO**	7. Project Number **R1-98**

(Continued)

Photo 7. Pier Bravo. Concrete curb spall at a mooring bollard on the main pier.

Photo 8. Pier Bravo. Concrete delamination at the side of a mooring cleat on the main pier.

DD FORM 1391c
1 DEC 76

CATEGORICAL EXCLUSION STATEMENT
REPAIRS TO PIER BRAVO
NAVAL AIR STATION, NORTH ISLAND, CALIFORNIA

---

1. PROJECT DESCRIPTION:

This project will provide necessary repairs to the deteriorated concrete pier deck and replacement of a timber fender system at Pier Bravo, NASNI (Enclosure 1). The existing deck will be repaired by removing the top three and one-half inches of concrete and replacing it. The existing timber fender system on the outer side will be removed and replaced by several types of fender systems, dependent on the type of loading. A primary fender system, consisting of six foam-filled fender stations, will be constructed along the outboard side of the main pier. Each station includes an eight-foot diameter foam-filled fender, eight concrete reaction piles and a steel wale. This primary system will accommodate the full range of naval surface vessels. Between the foam-filled fender stations, a secondary system of concrete fender piles will be constructed to accommodate large and small barges. This system includes the concrete piles and recycled plastic log camels to distribute the berthing energy to the piles. Corner protection systems, consisting of plastic piles, rubber buckling fenders, and steel wales, will be constructed at the outboard corners of the main pier and extreme north and south corners of the mooring platforms. At the four horseshoe shaped pockets between the mooring platforms, a system of concrete-filled fiberglass fender piles, plastic piles, and plastic camels will be constructed to accommodate small barges. No repairs will be made to the fender system at the inboard side, since sediment has reduced the water depth to a point that no further use is anticipated. Ladders, utilities, and other appurtenances will be removed and replaced as required.

2. NEPA REQUIREMENTS:

The proposed project meets requirements for a Categorical Exclusion, as outlined in OPNAVINST 5090.1B, Chapter 2, paragraph 2-4.1. items a to e. Specifically, repairs to Pier Bravo will not, individually or cumulatively:

a. Affect public health or safety;

b. Involve an action that is determined, in coordination with the appropriate resource agency, to have the potential for significant environmental effects on wetlands, endangered or threatened species, historical or archeological resources, or hazardous waste sites;

c. Involve effects on the human environment that are highly uncertain, involve unique or unknown risks, or that are scientifically controversial;

d. Establish precedents or make decisions in principle for future actions with significant effects; or

e. Threaten a violation of Federal, state or local law or requirements imposed for protection of the environment.

Prepared by:
Mike Petersen, SWDIV
619-556-8923

The proposed project does not meet the description for actions that normally require an Environmental Assessment (OPNAVINST 5090.1B, Chapter 2, paragraph 2-4.3.2) nor does it meet the requirements for an Environmental Impact Statement (OPNAVINST 5090.1B, Chapter 2, paragraph 2-4.4.3).

3. CATEGORICAL EXCLUSIONS:

OPNAVINST 5090.1B of 1 November 1994, Chapter 2, paragraph 2-4.2 provides a list of 33 actions that are normally categorically excluded from further documentation requirements of NEPA. Actions that are categorically excluded do not individually or cumulatively have a significant effect on the human environment and therefore, neither an Environmental Assessment nor an Environmental Impact Statement is required. This project is considered to meet the definition of action [6]:

> "Routine repair and maintenance of facilities and equipment to maintain existing operations and activities."

4. AGENCY CONCURRENCE:

In August 1998 the Navy received a General Consistency Determination for repair and maintenance activities in Naval Bases in San Diego Bay Area from the California Coastal Commission (CD-070-98). Also in August 1998 the Navy received a general waiver from the Regional Water Quality Control Board for waterfront repairs regarding Section 401 water quality certification (98C-127). These two waivers allow for general maintenance and repair of piers. To ensure the California least tern will not be impacted by the repair activity any work to be completed between April 1 and September 15 the US Fish and Wildlife Service should approve. Outside the stipulations above repairs to Pier Bravo would have no direct or indirect impacts to environmental resources. As such, no regulatory agencies were consulted in determining that the action will have no adverse effect on resources listed in OPNAVINST 5090.1B, Chapter 2, Paragraph 2-4.1.b.

5. DETERMINATION:

Southwest Division, Naval Facilities Engineering Command has determined that the proposed action, in compliance with the stipulations described above, does not individually or cumulatively have a significant effect on the environment and, therefore, neither an Environmental Assessment nor an Environmental Impact Statement is required.

6. CONCURRENCE:

Naval Air Station North Island:

M. A. GIORGIONE (signature) — 3/3/99
By direction — Date

Concur ✓ — Do not Concur ____

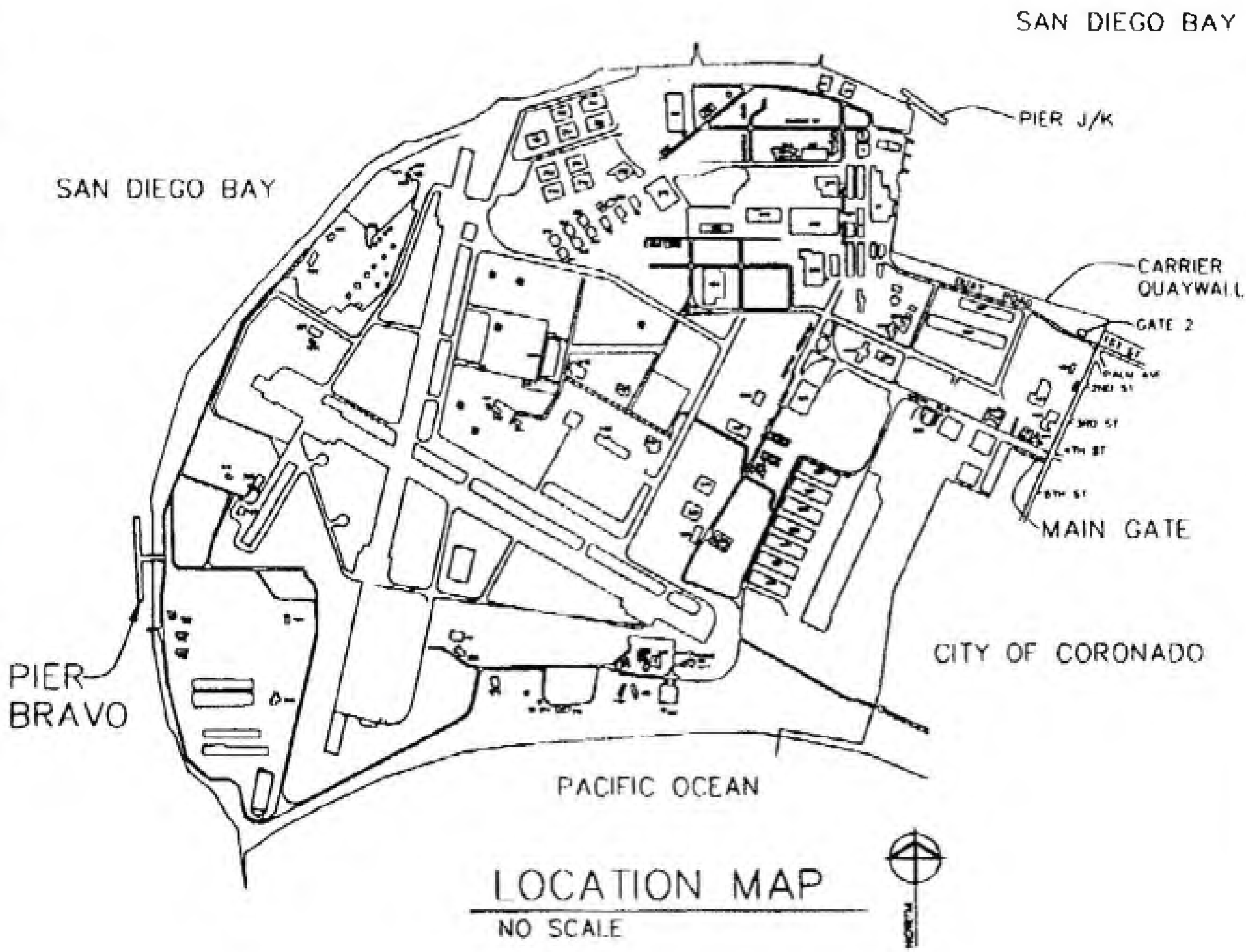
Prepared by:
Mike Petersen, SWDIV
619-556-8923
CE_24

1. Component		2. Date
NAVY	FY 1999 MILITARY CONSTRUCTION PROGRAM	4 Dec 98

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



LOCATION MAP

NO SCALE

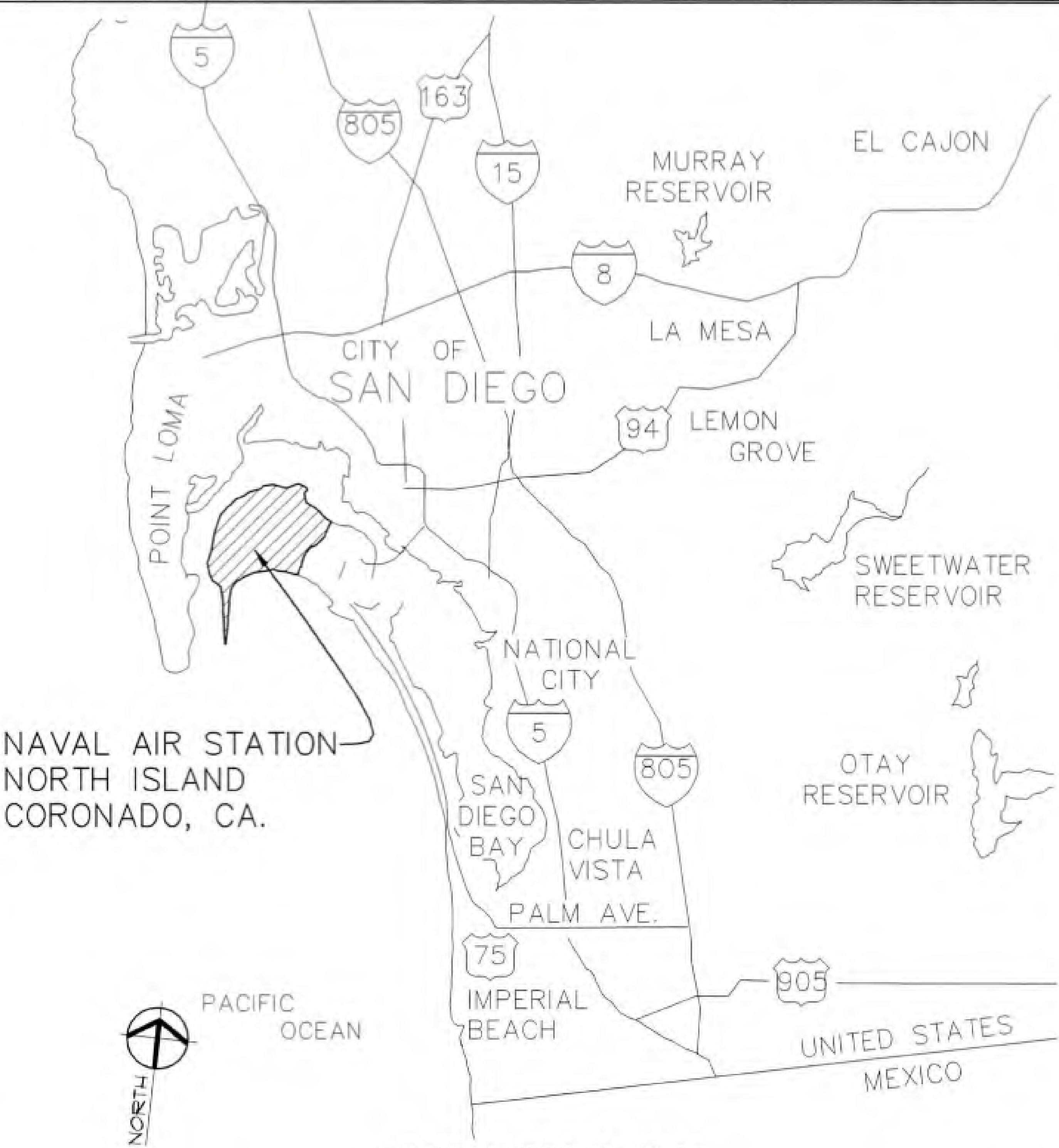
FIG. NO.2

1. Component	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date
NAVY		15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



VICINITY MAP

NO SCALE

FIG. NO.1

1. Component	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date
NAVY		15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

FIG. NO.2

DD FORM 1391c
1 DEC 76

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

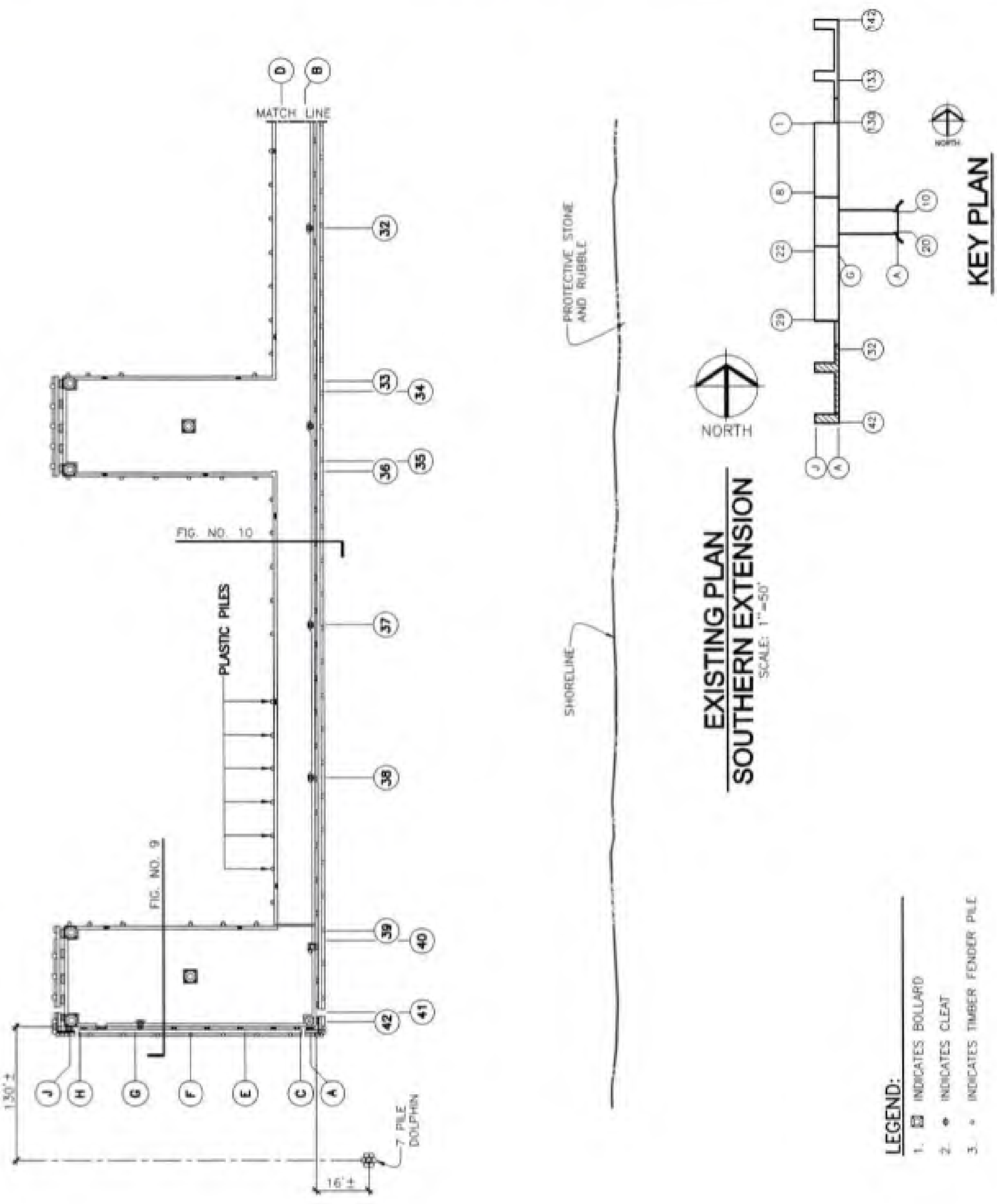


FIG. NO.3

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

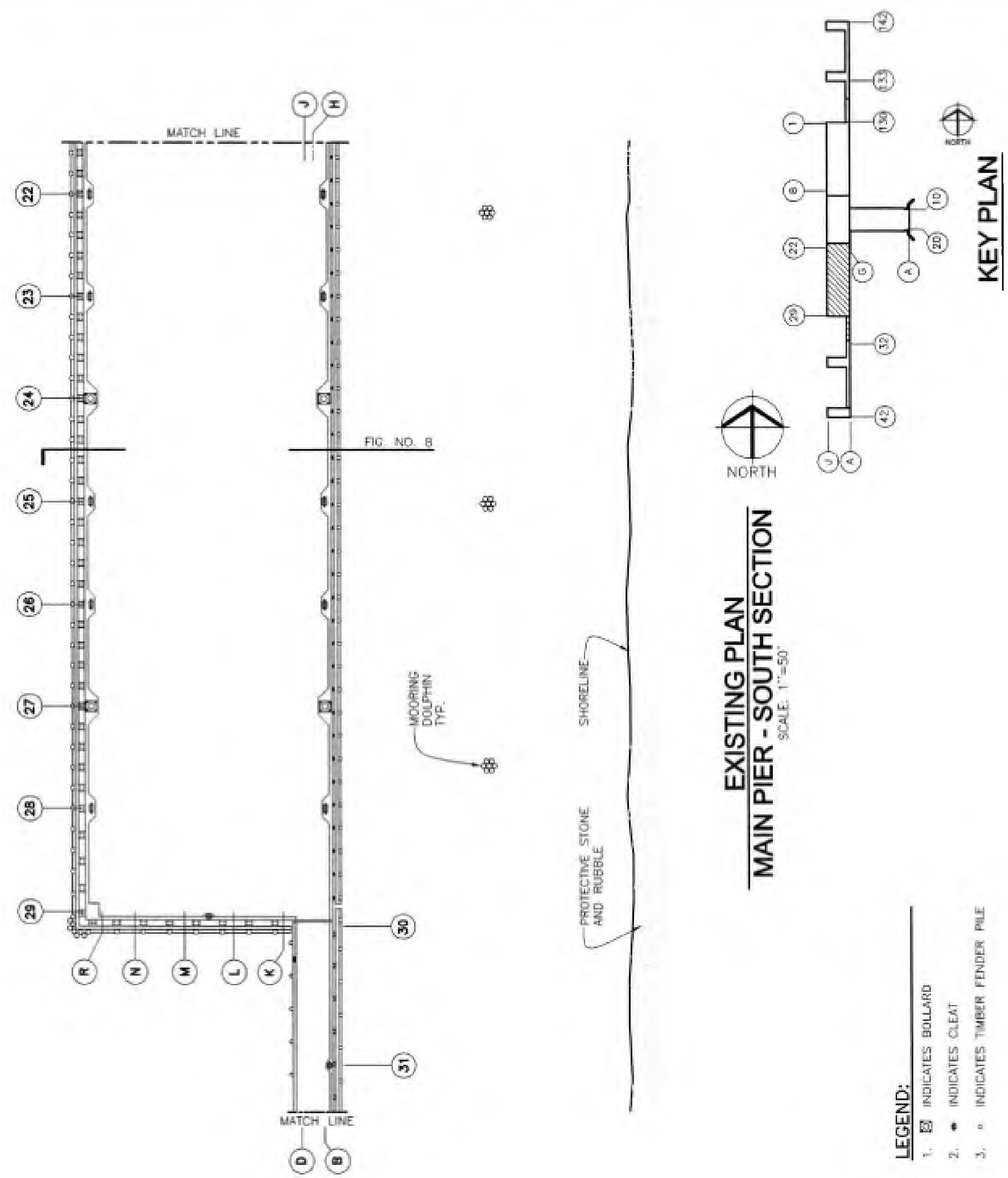
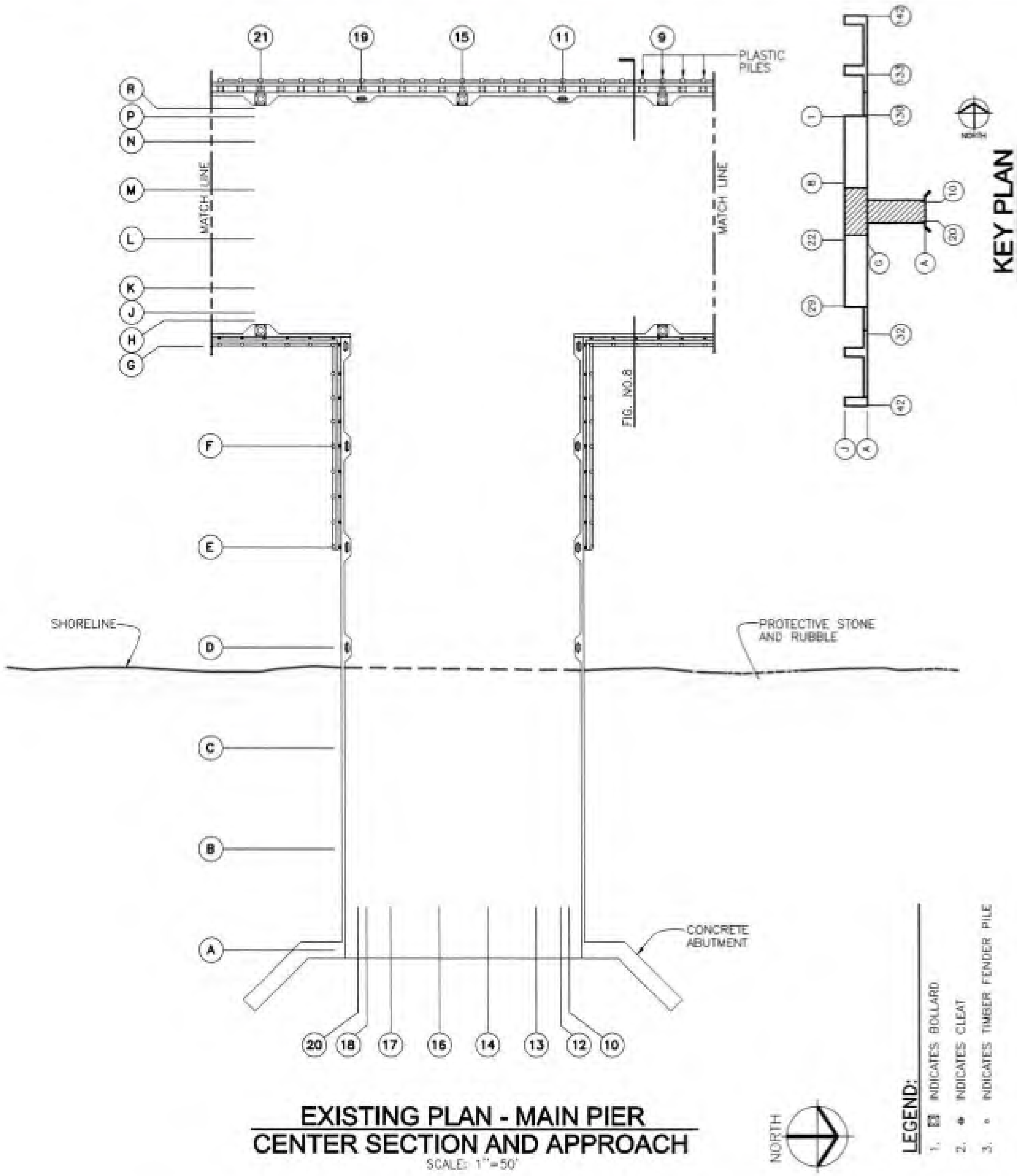


FIG. NO.4

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98



EXISTING PLAN - MAIN PIER
CENTER SECTION AND APPROACH
SCALE: 1"=50'

FIG. NO.5

DD FORM 1391c
1 DEC 76

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

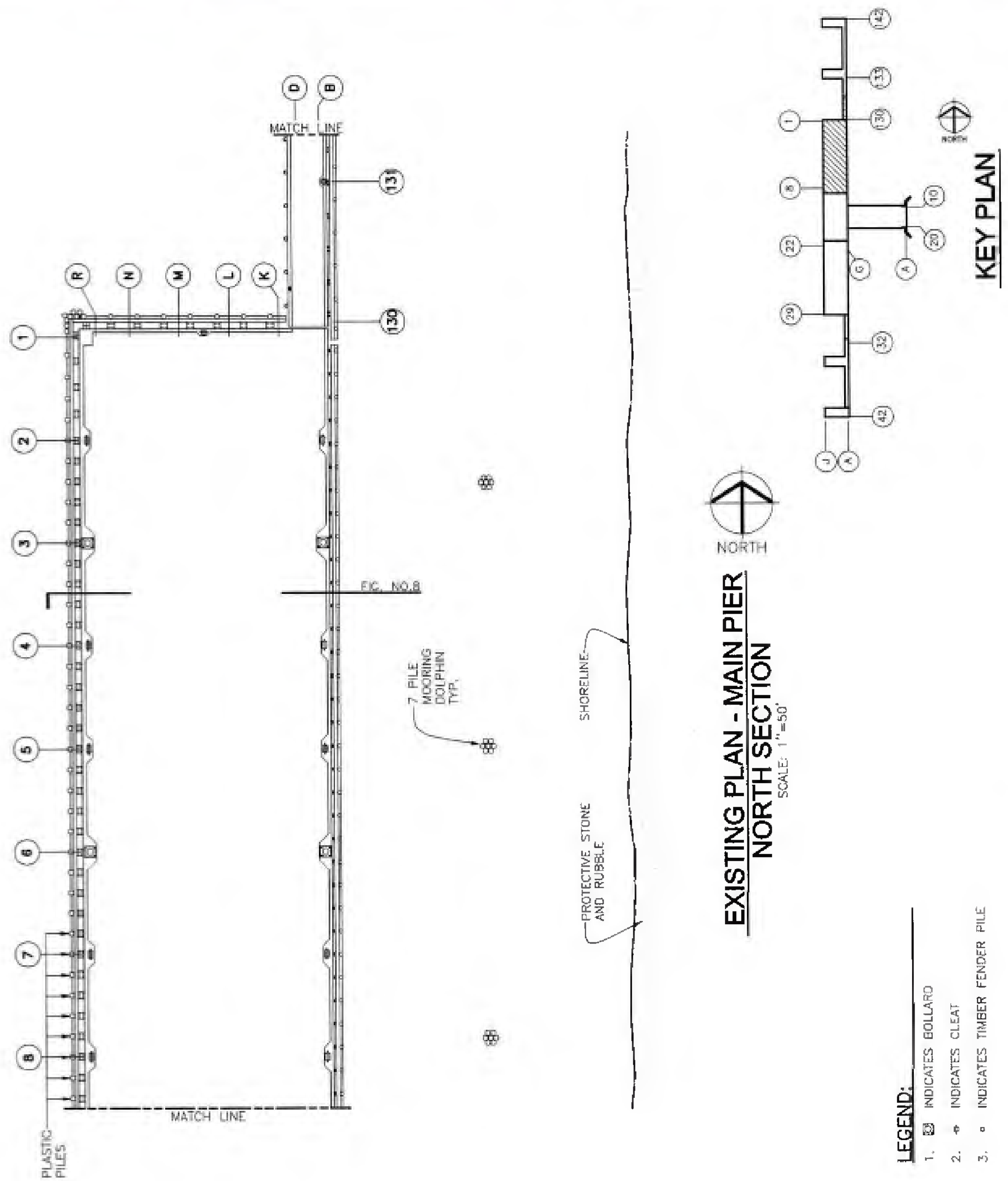


FIG. NO.6

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL AIR STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

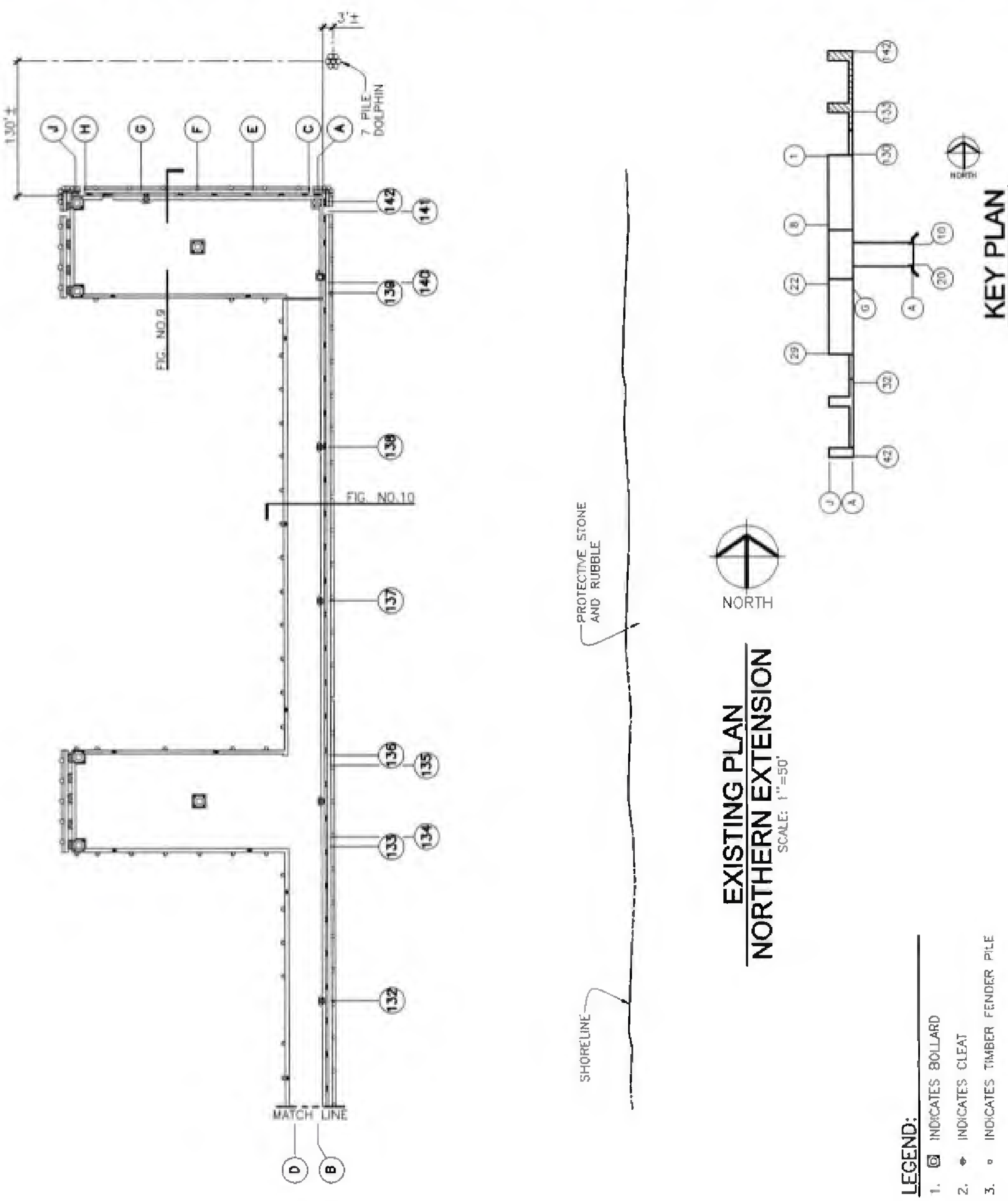


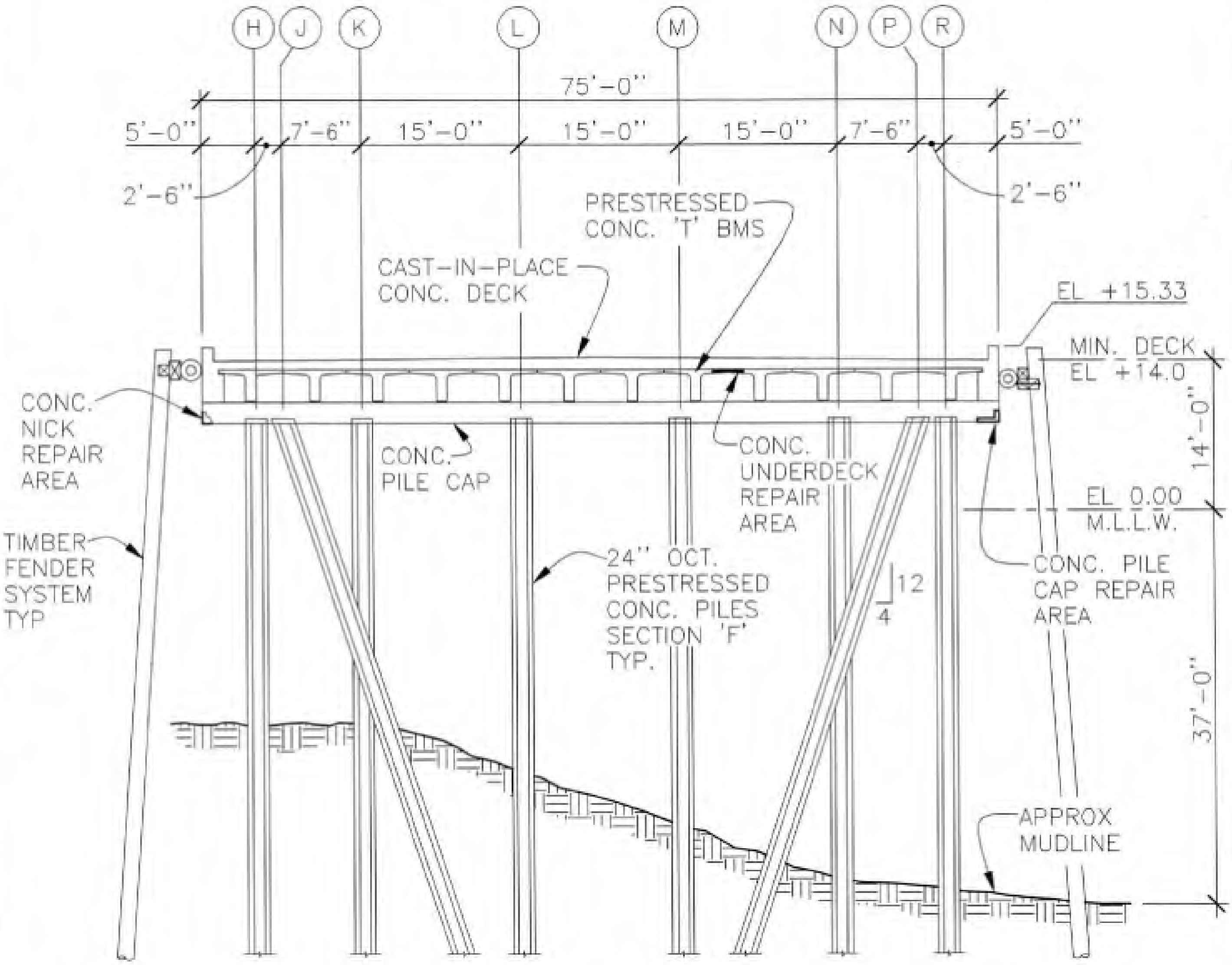
FIG. NO.7

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title REPAIRS TO PIER BRAVO	7. Project Number R1-98



EXISTING TYPICAL BENT – SECTION 'A'

SCALE: 1/16"=1'-0"

FIG NO.8

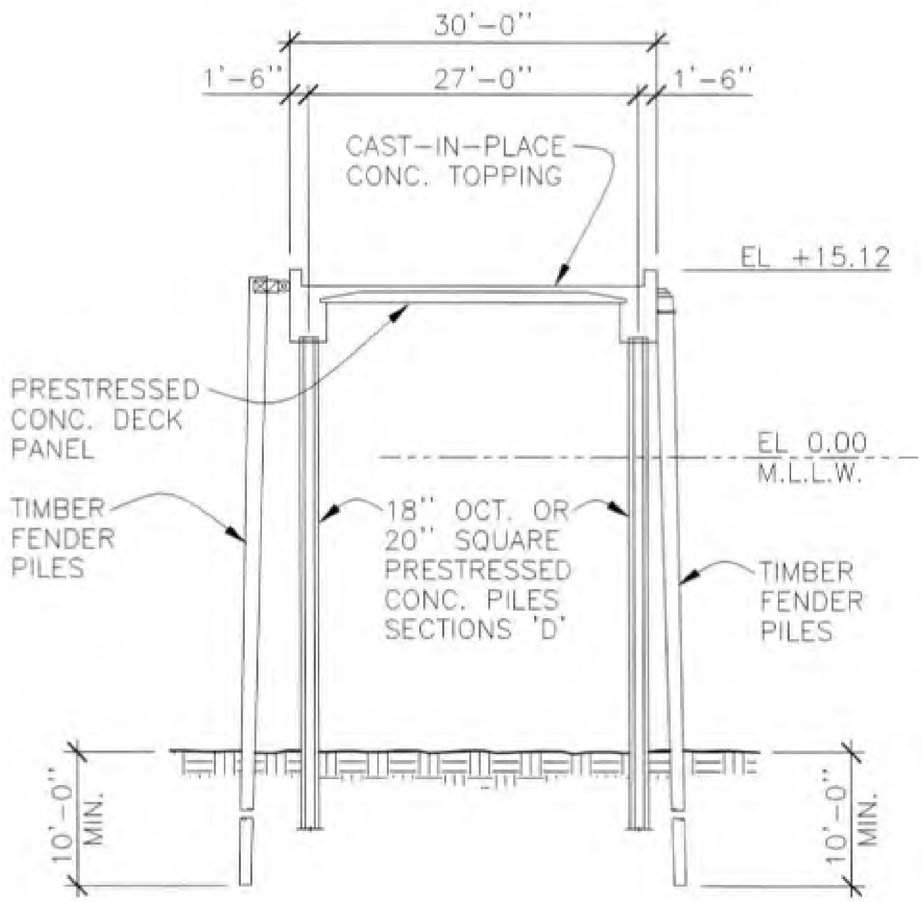
DD FORM 1391c
1 DEC 76

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



EXISTING MOORING PLATFORM – SECTION 'B'

SCALE: 1/16"=1'-0"

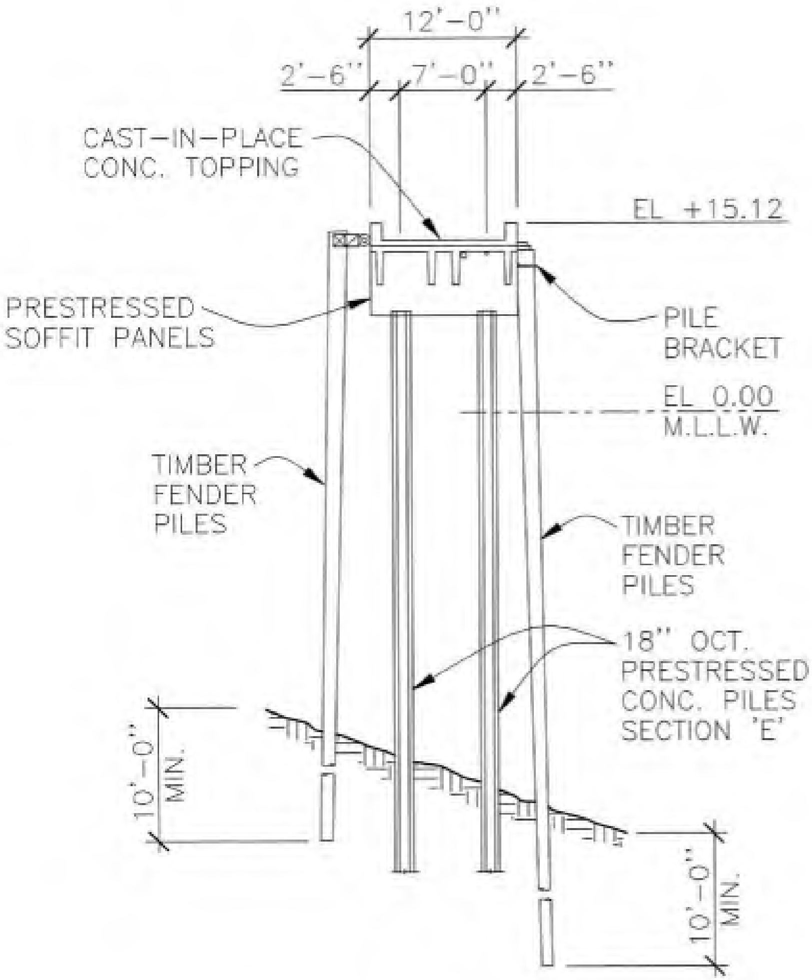
FIG NO.9

1. Component	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date
NAVY		15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



EXISTING WALKWAY – SECTION 'C'

SCALE: 1/16"=1'-0"

FIG NO.10

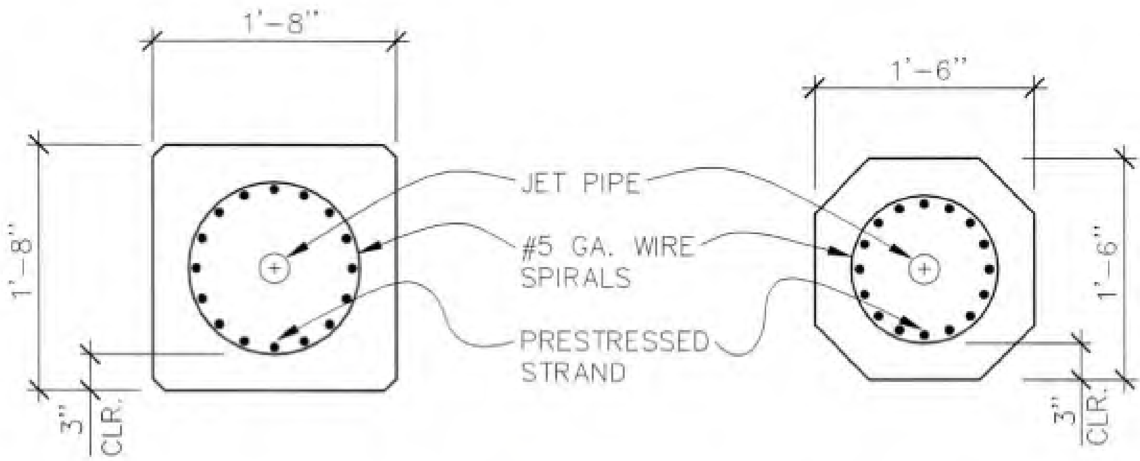
DD FORM 1391c
1 DEC 76

1. Component	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date
NAVY		15 Mar 00

3. Installation And Location/UIC: N00246

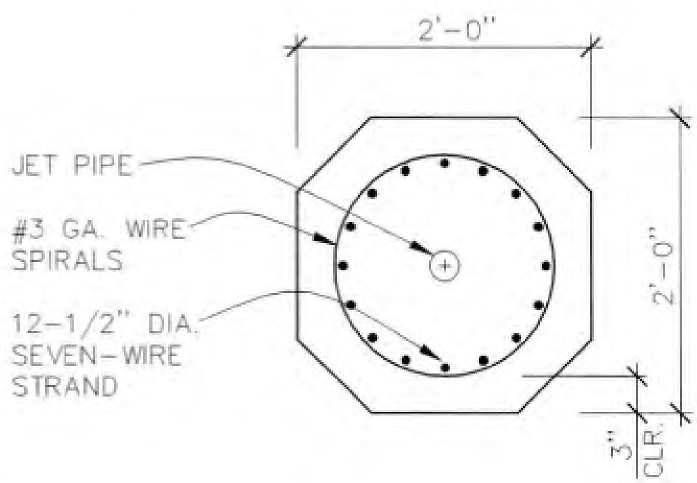
NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



EXIST. PILE-SECTION 'D'
3/4"=1'-0"

EXIST. PILE-SECTION 'E'
3/4"=1'-0"



EXIST. PILE-SECTION 'F'
3/4"=1'-0"

FIG NO.11

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

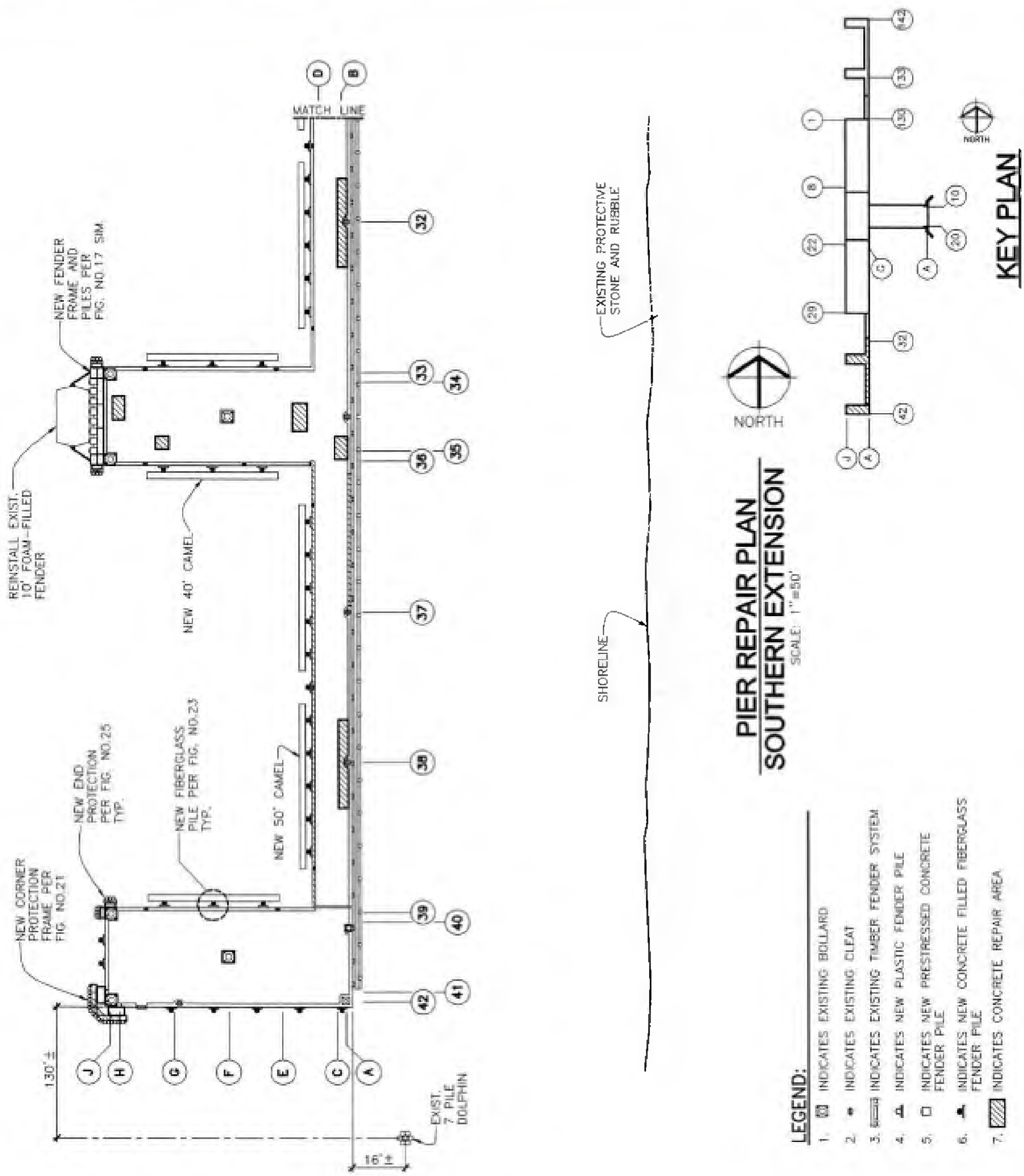


FIG. NO. 12

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246
NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

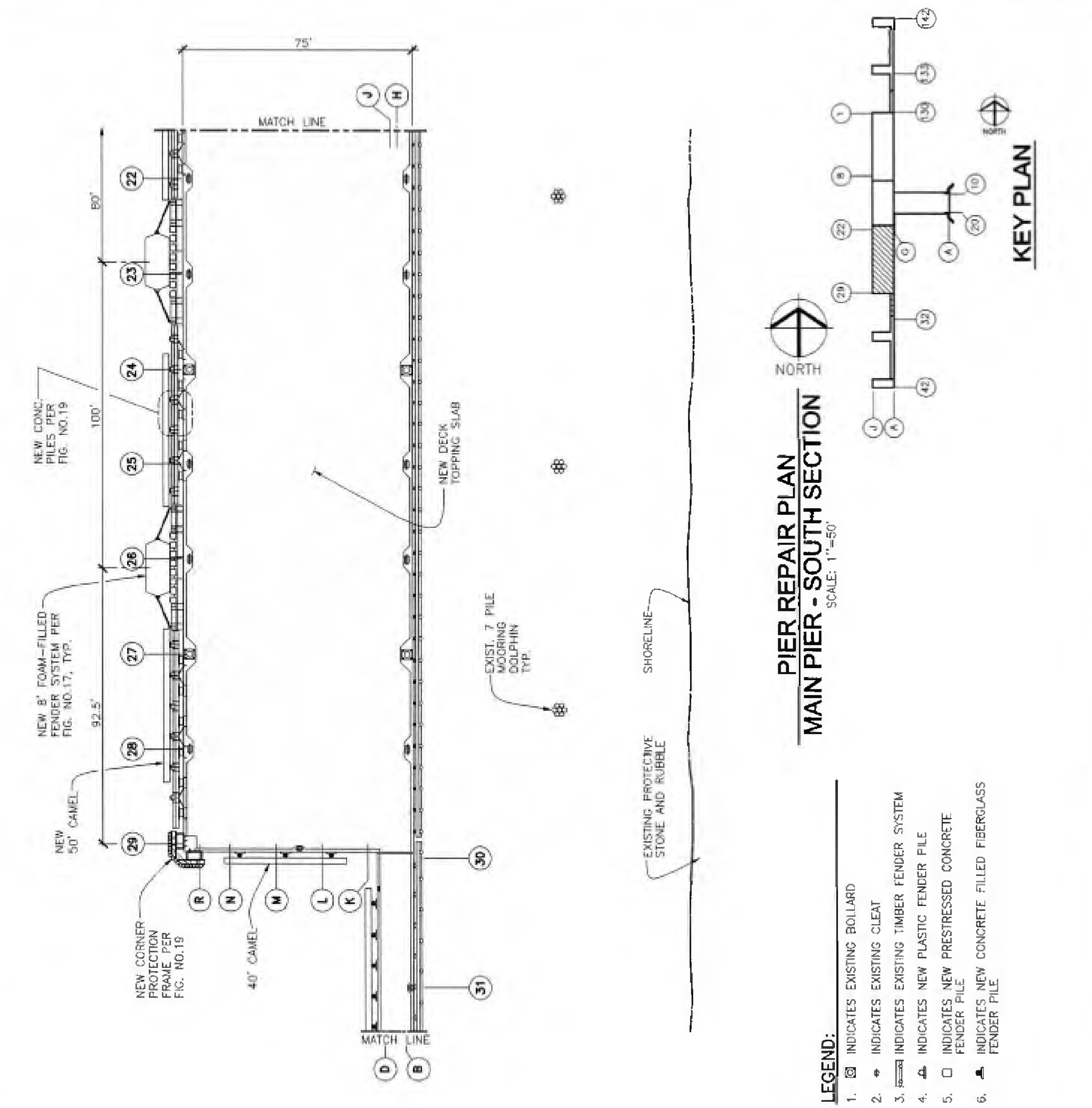


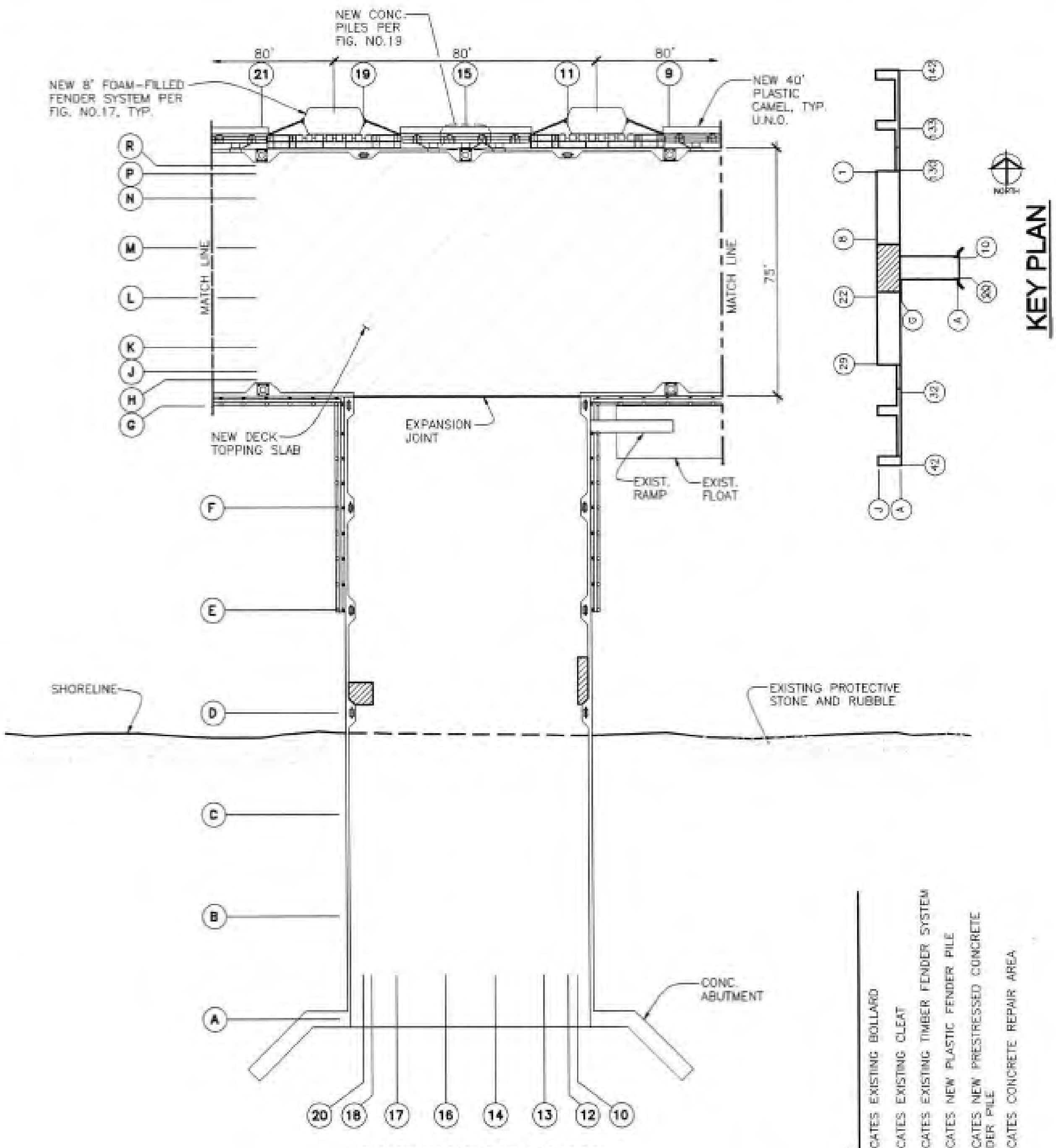
FIG NO.13

1. Component	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date
NAVY		15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



PIER REPAIR PLAN
MAIN PIER - CENTER SECTION AND APPROACH
SCALE: 1"=50'

FIG NO.14

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98

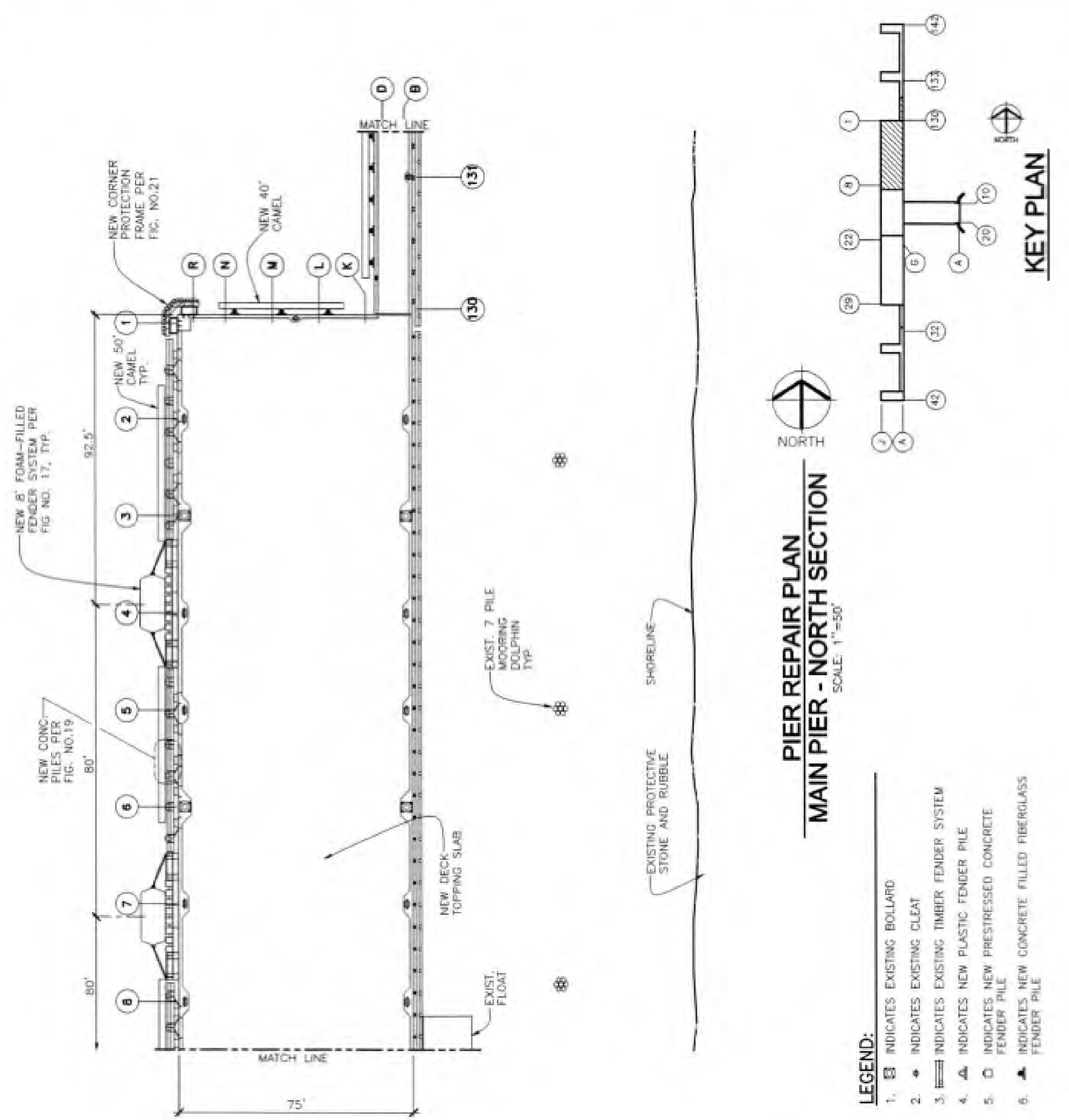


FIG NO.15

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

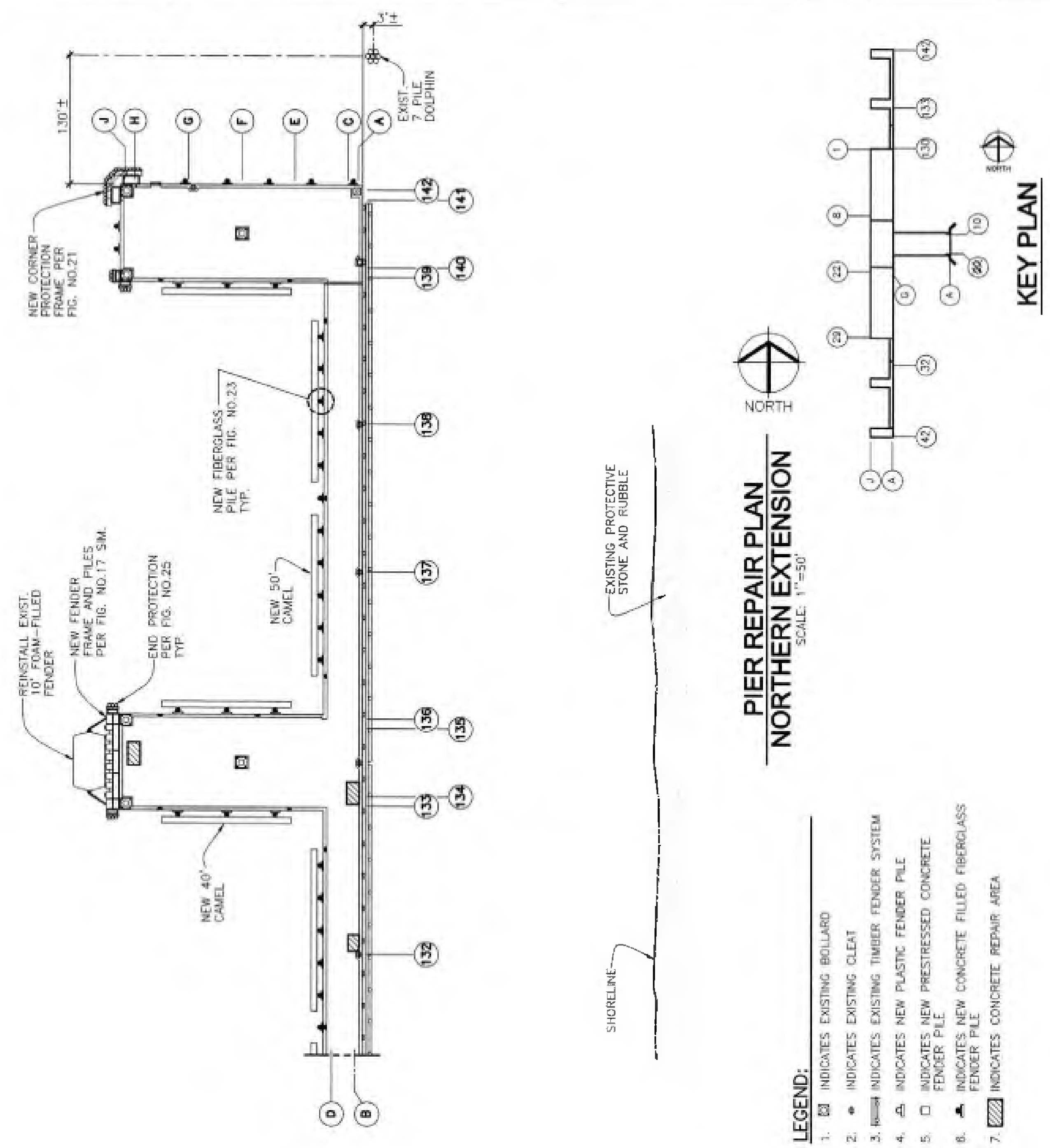


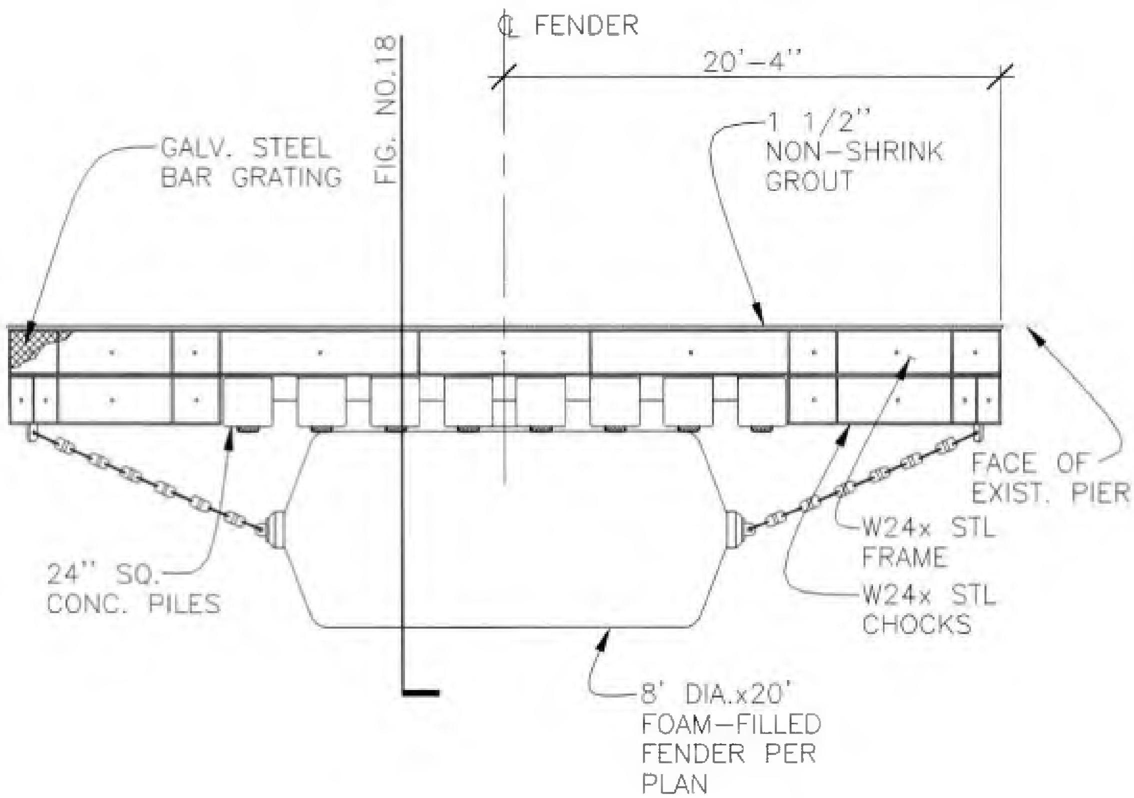
FIG NO.16

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title REPAIRS TO PIER BRAVO	7. Project Number R1-98

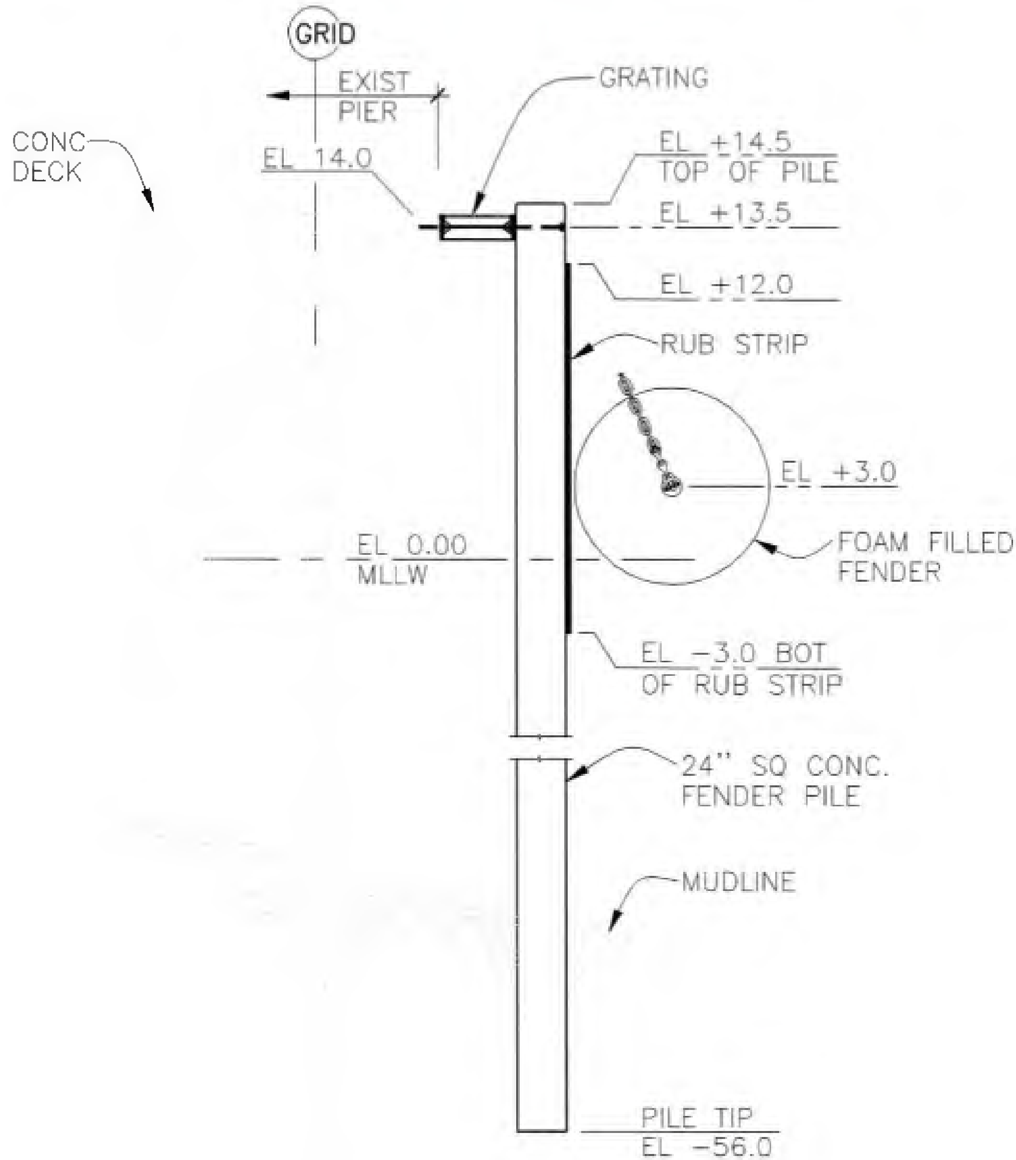


NEW FOAM FILLED FENDER – PLAN

SCALE: 1/8"=1'-0"

FIG NO.17

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

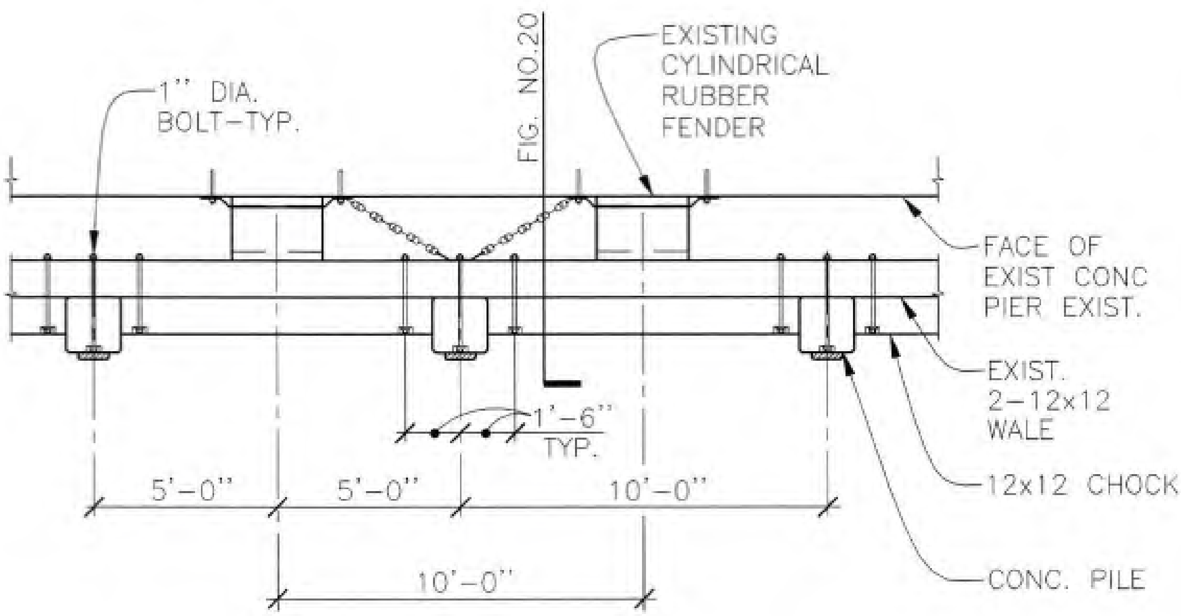


NEW FOAM FILLED FENDER SYSTEM – SECTION

SCALE: 1/8"=1'-0"

FIG NO.18

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

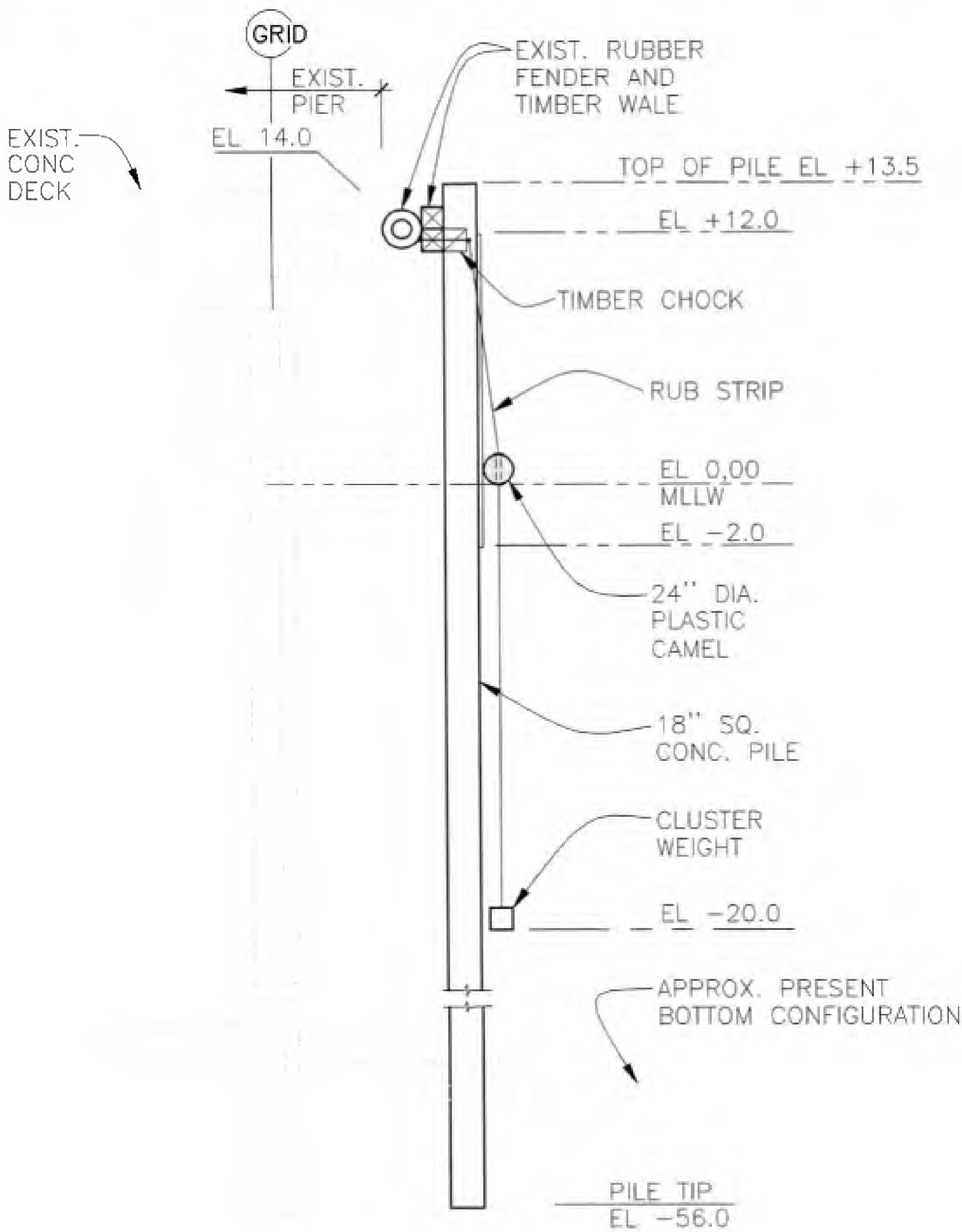


NEW CONCRETE FENDER SYSTEM - PLAN

SCALE: 3/16"=1'-0"

FIG NO.19

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

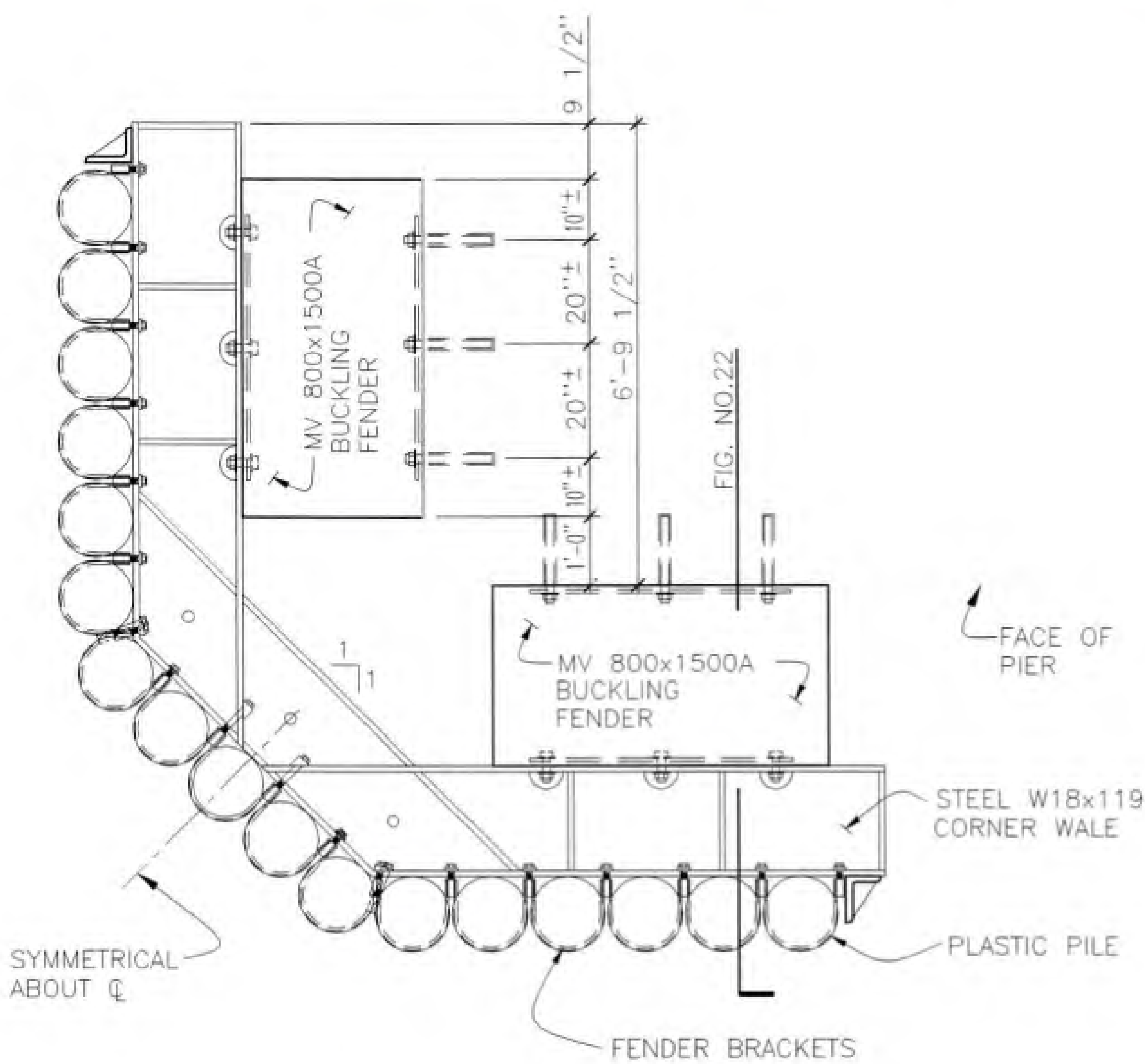


NEW CONCRETE FENDER PILE SYSTEM – SECTION

SCALE: 1/8"=1'-0"

FIG NO.20

1. Component		2. Date
NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98



NEW CORNER FENDER SYSTEM – PLAN

SCALE: 3/8"=1'-0"

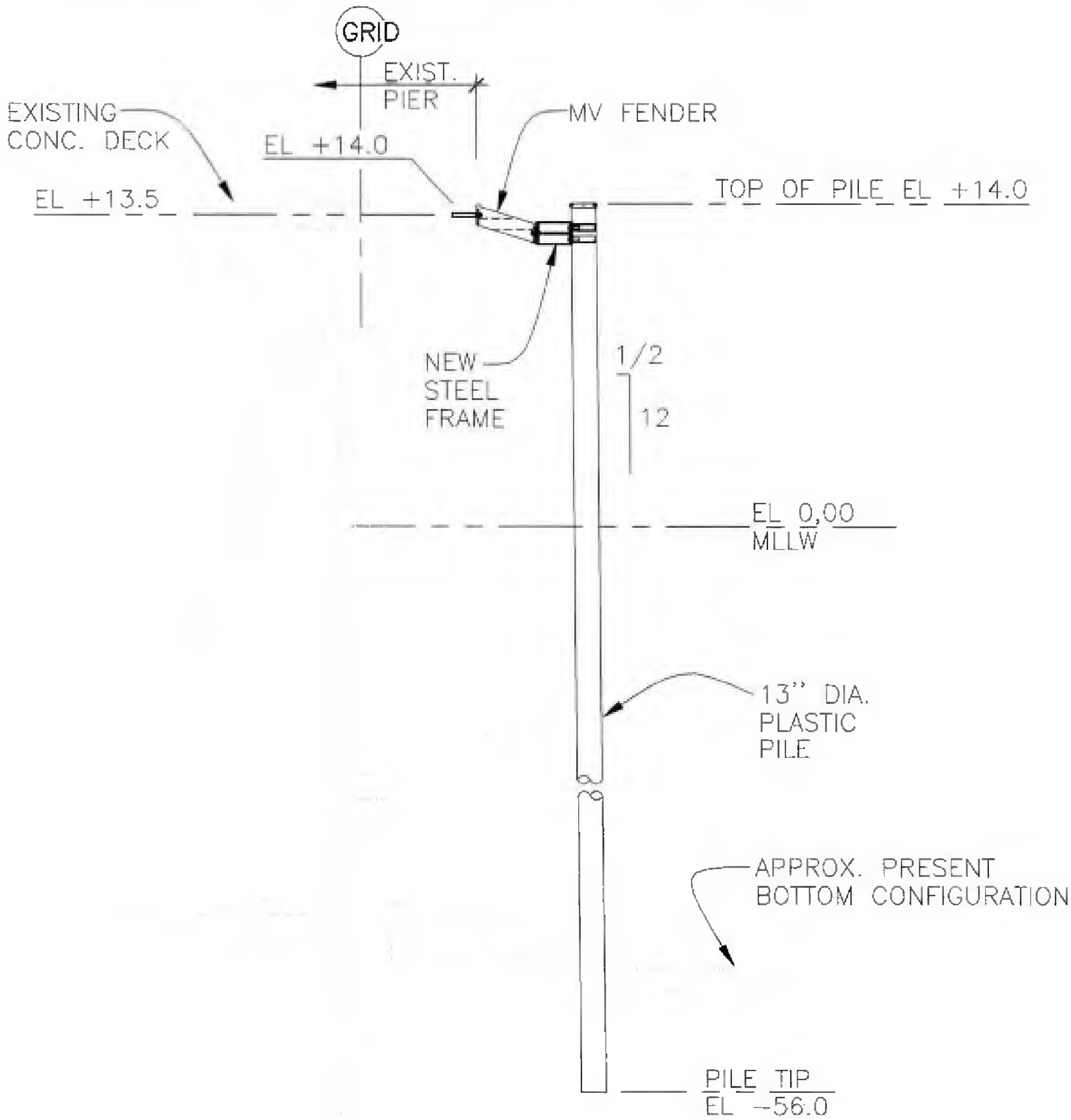
FIG NO.21

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title REPAIRS TO PIER BRAVO	7. Project Number R1-98

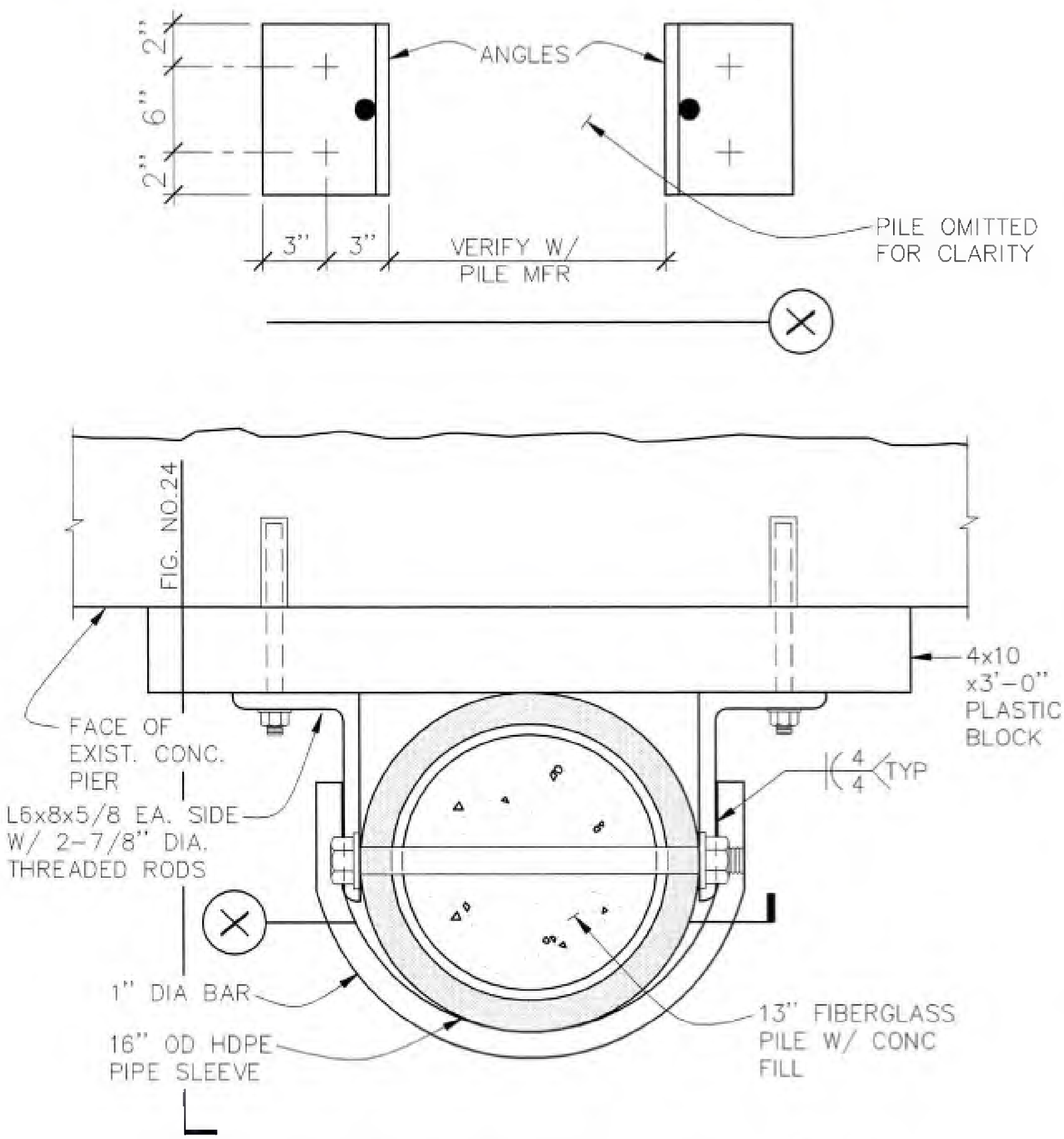


NEW CORNER FENDER SYSTEM – SECTION

SCALE: 1/8"=1'-0"

FIG NO.22

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98

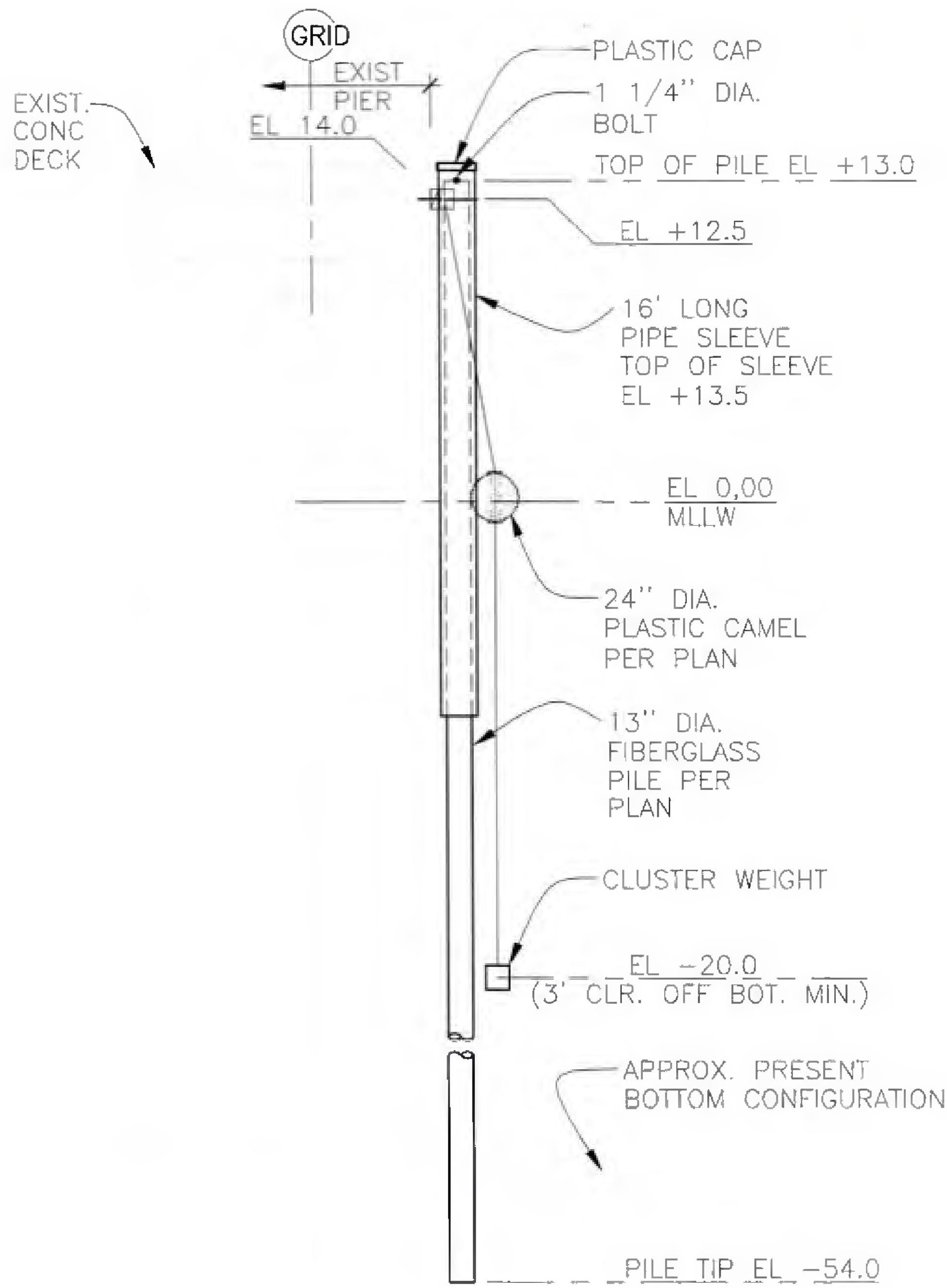


NEW FIBERGLASS PILE BRACKET – PLAN

SCALE: 1 1/2"=1'-0"

FIG NO.23

1. Component NAVY	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date 15 Mar 00
3. Installation And Location/UIC: N00246 NAVAL STATION, NORTH ISLAND, CORONADO, CA		
4. Project Title REPAIRS TO PIER BRAVO		7. Project Number R1-98



NEW FIBERGLASS PILE FENDER SYSTEM – SECTION
SCALE: 1/8"=1'-0"

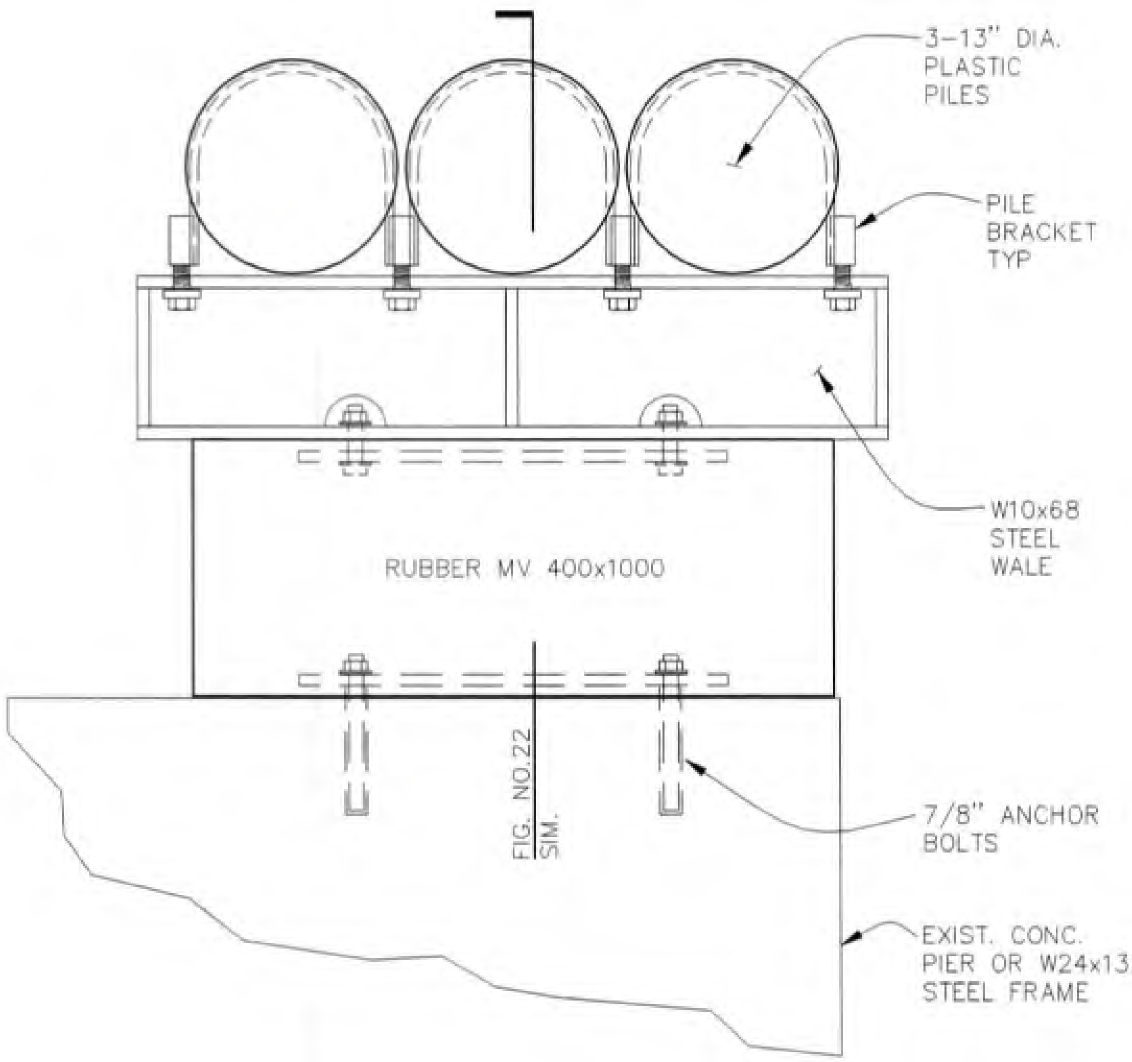
FIG NO.24

1. Component	FY 2001 MILITARY CONSTRUCTION PROGRAM	2. Date
NAVY		15 Mar 00

3. Installation And Location/UIC: N00246

NAVAL STATION, NORTH ISLAND, CORONADO, CA

4. Project Title	7. Project Number
REPAIRS TO PIER BRAVO	R1-98



PIER END PROTECTION SYSTEM

SCALE: 1"=1'–0"

FIG NO.25

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED	15-Mar-00
SHEET	1
ACTIVITY AND LOCATION	**Naval Air Station, North Island Coronado, CA**
CONSTRUCTION CONTRACT NO.	
IDENTIFICATION NUMBER	R1-98
ESTIMATED BY	**Southwest Division Code 5SCN.CD**
CATEGORY CODE NUMBER	151-10
PROJECT TITLE	**Repairs to Pier Bravo**
STATUS OF DESIGN	[X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ______
JOB ORDER NUMBER	

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
GENERAL SUMMARY									
CONCRETE DECK REPAIR				251,085		799,187		1,050,271	
UNDERDECK CONCRETE REPAIR				30,211		48,501		78,711	
FENDER SYSTEM REPAIR				2,146,749		671,821		2,818,570	
TOTAL								3,947,552	
TOTAL REPAIR COST									

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 2

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

PROJECT TITLE: **Repairs to Pier Bravo**

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ______

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
CONCRETE DECK REPAIR									
Hydroblast top 3.5" of Main Pier deck	45260	SF			10.15	459,389	10.15	459,389	R
Demolish concrete curbing	253	CF			30.00	7,590	30.00	7,590	R
Hydroblast 3.5" for partial deck repairs	1600	SF			10.15	16,240	10.15	16,240	R
Sawcut deck	2000	LF			4.00	8,000	4.00	8,000	R
Sawcut curbs	150	LF			20.00	3,000	20.00	3,000	R
PVC Deck Drains and Grate	22	EA	50.00	1,100	75.00	1,650	125.00	2,750	R
Core drill holes for drains	22	EA			100.00	2,200	100.00	2,200	R
Top deck partial repairs:									
Place supplemental reinforcing	200	LB	1.00	200	7.00	1,400	8.00	1,600	R
Place anti-corrosive coating	1600	SF	2.00	3,200	2.00	3,200	4.00	6,400	R
Place polymer concrete	400	CF	120.00	48,000	10.00	4,000	130.00	52,000	R
Top deck replacement at Main Pier:									
Place supplemental reinforcing	40000	LB	1.00	40,000	0.30	12,000	1.30	52,000	R
Place cast-in-place concrete	489	CY	75.00	36,675	60.00	29,340	135.00	66,015	R
Place interface bond coating	45260	SF	1.00	45,260	0.30	13,578	1.30	58,838	R
Curing Compound	45260	SF	0.26	11,768	0.43	19,462	0.69	31,229	R
Curb repairs:									
Sandblast concrete and reinforcing	506	SF	1.50	759	8.00	4,048	9.50	4,807	R
Place supplemental reinforcing	400	LB	1.00	400	7.00	2,800	8.00	3,200	R
Place anti-corrosive coating	506	SF	2.00	1,012	2.00	1,012	4.00	2,024	R
Place forms	506	SF	3.00	1,518	33.60	17,002	36.60	18,520	R
Place cast-in-place concrete	253	CF	5.00	1,265	10.00	2,530	15.00	3,795	R
SUBTOTAL				191,157		608,441		799,597	R
General Requirements, OH & Profit	31.35%			59,928		190,746		250,674	R
TOTAL CONCRETE DECK REPAIR				251,085		799,187		1,050,271	R

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00

SHEET: 3

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

PROJECT TITLE: **Repairs to Pier Bravo**

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ____

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
UNDERDECK CONCRETE REPAIR									
Demolish concrete underdeck	175	CF			150.00	26,250	150.00	26,250	R
Underdeck repairs:									
Sandblast concrete and reinforcing	450	SF	2.00	900	8.50	3,825	10.50	4,725	R
Place supplemental reinforcing	200	LB	1.00	200	10.00	2,000	11.00	2,200	R
Place anti-corrosive coating	450	SF	2.00	900	3.00	1,350	5.00	2,250	R
Place polymer concrete	175	CF	120.00	21,000	20.00	3,500	140.00	24,500	R
SUBTOTAL				23,000		36,925		59,925	R
General Requirements, OH & Profit	31.35%			7,211		11,576		18,786	R
TOTAL UNDERDECK CONCRETE REPAIR				30,211		48,501		78,711	R

* U.S. Government Printing Office: 1982-505-106/6608 2-1

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED	SHEET
15-Mar-00	4

ACTIVITY AND LOCATION
Naval Air Station, North Island
Coronado, CA

PROJECT TITLE
Repairs to Pier Bravo

CONSTRUCTION CONTRACT NO.

ESTIMATED BY
Southwest Division Code 5SCN.CD

STATUS OF DESIGN
[X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify)

IDENTIFICATION NUMBER
R1-98

CATEGORY CODE NUMBER
151-10

JOB ORDER NUMBER

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
FENDER SYSTEM REPAIR									
Remove exist corner frame systems	4	EA			200.00	800	200.00	800	R
Remove existing fender piles	228	EA			250.00	57,000	250.00	57,000	R
Remove pile stubs	100	EA			300.00	30,000	300.00	30,000	R
Remove broken piles and stubs	25	EA			350.00	8,750	350.00	8,750	R
Remove existing chocks and wales	2650	LF			15.00	39,750	15.00	39,750	R
Remove misc. bottom debris	50	EA			70.00	3,500	70.00	3,500	R
Remove and store ladders	2	EA			50.00	100	50.00	100	R
Remove and reinstall utilities	1	LS			25,000	25,000	25,000	25,000	R
Barge w/ crane	8	WKS	3,750.00	30,000			3,750.00	30,000	R
Foam-filled fenders 8'x 20' long	6	EA	45,000	270,000	500.00	3,000	45,500	273,000	R
1 3/4" galvanized stud link chain	192	LF	25.00	4,800			25.00	4,800	R
Shackles	32	EA	125.00	4,000			125.00	4,000	R
Corner Buckling Fender MV800x1500	8	EA	2,000.00	16,000	200.00	1,600	2,200.00	17,600	R
Corner Buckling Fender MV400x1000	8	EA	750.00	6,000	150.00	1,200	900.00	7,200	R
Prestressed Concrete Piles - 24" sq x 70.5'	64	EA	3,948.00	252,672	990.00	63,360	4,938.00	316,032	R
Prestressed Concrete Piles - 18" sq x 69.5'	36	EA	3,336.00	120,096	930.00	33,480	4,266.00	153,576	R
UHMWPE Face Panels	260	CF	213.00	55,380			213.00	55,380	R
3/4" and 1" dia bolts (stainless steel)	1200	EA	6.00	7,200	1.50	1,800	7.50	9,000	R
Finish concrete pile tops	100	EA	26.00	2,600	30.00	3,000	56.00	5,600	R
Core drill and grout pile bolts	100	EA	62.00	6,200	100.00	10,000	162.00	16,200	R
Epoxy Grout	42	CF	100.00	4,200	15.00	630	115.00	4,830	R
Barge w/ crane	3	WKS	3,750.00	11,250			3,750.00	11,250	R
Plastic piles 13" x 70'	92	EA	3,570.00	328,440	600.00	55,200	4,170.00	383,640	R
Attach piles and finish tops	92	EA	60.00	5,520	100.00	9,200	160.00	14,720	R
Barge w/ crane	3	WKS	3,750.00	11,250			3,750.00	11,250	R

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 5

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

PROJECT TITLE: **Repairs to Pier Bravo**

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
Fiberglass piles 12.75" dia x 67'	82	EA	1,876.00	153,832	600.00	49,200	2,476.00	203,032	R
Attach piles and finish tops	82	EA	50.00	4,100	50.00	4,100	100.00	8,200	R
Concrete fill	160	CY	75.00	12,000	75.00	12,000	150.00	24,000	R
HDPE pipe sleeve 16" dia x 16'	1312	LF	30.00	39,360	5.00	6,560	35.00	45,920	R
1 1/4 " dia bolts x 20 " long	82	EA	35.00	2,870	2.00	164	37.00	3,034	R
Barge w/ crane	3	WKS	3,750.00	11,250			3,750.00	11,250	R
12"x12" Timber Chocks at 18" Conc Piles	250	LF	30.00	7,500	10.00	2,500	40.00	10,000	R
1"dia Nut, Bolt & Ogee Washers at Chocks	72	EA	13.00	936	15.00	1,080	28.00	2,016	R
Plastic Blocks (12 x 12)	60	LF	30.00	1,800		0	30.00	1,800	R
Plastic Blocks (4 x 10)	246	LF	16.00	3,936		0	16.00	3,936	R
Plastic Log Camels	1030	LF	155.00	159,650	5.00	5,150	160.00	164,800	R
Cluster Weight Hardware:									
3/4" dia Dowels, eye bolt end	46	EA	8.00	368	40.00	1,840	48.00	2,208	R
5/8" Chain w/ Shackles	1518	LF	4.00	6,072	0.29	440	4.29	6,512	R
Concrete Deadman	46	EA	6.00	276	15.00	690	21.00	966	R
Steel WF Wale:									
Wide Flange Section	54496	LB	0.75	40,872	0.50	27,248	1.25	68,120	R
Bar Stock	11545	LB	1.00	11,545	0.50	5,773	1.50	17,318	R
Bar Grate	832	SF	4.75	3,952	1.50	1,248	6.25	5,200	R
Weldment (Fillet Weld or Equiv)	2048	LF	0.46	942	6.35	13,005	6.81	13,947	R
Dowels for Wale (1.00 dia.)	120	EA	11.00	1,320	40.00	4,800	51.00	6,120	R
Neoprene Pads	80	SF	41.00	3,280	21.00	1,680	62.00	4,960	R
Epoxy Grout behind wale	50	CF	120.00	6,000	20.00	1,000	140.00	7,000	R

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 6

ACTIVITY AND LOCATION
Naval Air Station, North Island
Coronado, CA

CONSTRUCTION CONTRACT NO.

IDENTIFICATION NUMBER: R1-98

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

PROJECT TITLE
Repairs to Pier Bravo

STATUS OF DESIGN
[X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ______

JOB ORDER NUMBER

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
Corner Protection Frames (68 Piles):									
Wide Flange Sections	9400	LB	1.00	9,400	0.50	4,700	1.50	14,100	R
Weldment (Fillet Weld or Equiv)	804	LF	0.46	370	6.35	5,105	6.81	5,475	R
Bar Stock	3048	LB	1.00	3,048	0.50	1,524	1.50	4,572	R
Pile Brackets & Bolts	68	EA	100.00	6,800	100.00	6,800	200.00	13,600	R
Dowels for MV800's (1.375 dia.)	24	EA	15.00	360	75.00	1,800	90.00	2,160	R
End Protection Frames (24 Piles):									
Wide Flange Wales	2594	LB	0.75	1,946	0.50	1,297	1.25	3,243	R
Pile Brackets & Bolts	24	EA	100.00	2,400	100.00	2,400	200.00	4,800	R
Dowels for MV400's (.875 dia.)	8	EA	10.00	80	50.00	400	60.00	480	R
Ladder Re-installation	2	EA	50.00	100	200.00	400	250.00	500	R
Steel Landing & Fiberglass Ladder	4	EA	600.00	2,400	300.00	1,200	900.00	3,600	R
SUBTOTAL				1,634,373		511,474		2,145,847	R
General Requirements, OH & Profit	31.35%			512,376		160,347		672,723	R
TOTAL FENDER SYSTEM REPAIR				2,146,749		671,821		2,818,570	R

DATE GENERATED: 16 Mar 2000
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VERSION: ECONPACK for Windows 1.02

Pier Bravo Deck Repair
ECONOMIC ANALYSIS

EXECUTIVE SUMMARY REPORT

PROJECT TITLE : Repair Pier Bravo, NAS North Island
DISCOUNT RATE : 4.2%
PERIOD OF ANALYSIS : 30 Years
START YEAR : 2001
BASE YEAR : 2001
REPORT OUTPUT : Constant Dollars

PROJECT OBJECTIVE : To repair the deteriorated concrete deck.

ALTERNATIVES CONSIDERED FOR THIS ANALYSIS:

This economic analysis looks at two methods of concrete repair at the pier deck of Pier Bravo, Naval Air Station North Island, Coronado, California. The pier was constructed in two phases, with different configurations. The main pier is "T" shaped, consisting of a 75-foot wide access pier and a 625-foot long by 75-foot wide main pier. The second phase of construction added four 30-foot by 75-foot mooring platforms, two on either end of the main pier. These extensions are linked to the main pier by 12-foot wide by 130-foot long walkways.

The top deck surface and curbing at the main pier is deteriorated and spalling. There is extensive(approximately 50% of the total deck area)delamination and spalls of the original deck and subsequent partial repairs.

The top deck surface of the approach and extensions have moderate areas (5% to 25% of the total area) of delamination and spalling.

There are basically two methods of concrete repairs in this type of situation: removal of the entire top surface of the pier deck replacing with new concrete, and sawcutting and removal of deteriorated areas replacing with polymer-modified concrete. Because of the minor nature of deterioration in the extensions and access portions, partial repairs are minimal and the most effective method. Because of the significant amount of deterioration in the main pier, both methods were analyzed to determine which were most cost effective.

<u>Alternative 1: Replace Top Deck at Main Pier</u>

This alternative includes removing the top 3.5" of surface of the main pier, placing additional reinforcing steel as necessary, and placing a new deck surface of cast-in-place concrete. Because of the extent of removal, deck drains will need to be removed and new drains installed.

This alternative also includes partial repairs to the concrete deck in the extensions and access portions of the pier, and repairs to the concrete curb at various locations over the entire pier. Partial repairs include sawcutting and removal of concrete where delaminated, replacement of reinforcing steel as necessary, anti-corrosive coating, and patching with polymer-modified concrete (typical for small repair areas).

This alternative assumes that the new deck surface will last for 30 years, but will require partial repairs over 10% of the surface in 20 years.

Alternative 2: Partial Repairs at Main Pier

This alternative includes partial repairs to the concrete deck over the entire pier, and repairs to the concrete curb. Partial repairs include sawcutting and removal of concrete where delaminated, replacement of reinforcing steel as necessary, anti-corrosive coating, and patching with polymer-modified concrete (typical for small repair areas).

For estimating purposes, the analysis assumes 50% of the main deck area will need to be repaired, and assumes that the average size of patch will be a four foot by four foot section. The patch dimensions are needed to determine the amount of sawcutting required, and are conservative (a square has less perimeter length than a rectangle of the same area).

This alternative also assumes that about half of the patches will deteriorate and require repair within 10 years. This is based on the life-span of the previous deck repairs, which were performed less than 10 years ago.

ASSUMPTIONS OF THE ANALYSIS:

1. Funding will be available for construction in FY 01.
2. Other assumptions as listed in the Discussion of Alternatives.

ECONOMIC INDICATORS: **($ in thousands)**

ALTERNATIVE NAME	NPV
1 Renovation	$1,153
2 Partial Repairs at Main Deck and Ex	$2,768

RESULTS AND RECOMMENDATIONS:

The results of the economic analysis indicate that the best value will be achieved by replacing the top 3.5" of the pier deck at the main pier, and performing partial repairs at the pier extensions and access portion. Partial repairs of the top deck previously performed have proven to provide only a temporary relief from deck damage.

Other advantages to this alternative are a reduced construction time, minimizing impact to operations. Hand demolition and replacement necessary for partial repairs is labor intensive and time consuming. The full deck repair can also be phased to minimize disruption without impact on total cost or schedule. This will be determined during design.

ACTION OFFICER: C. Davis
ORGANIZATION : SWDIV NAVFACENGCOM

LIFE CYCLE COST REPORT

1 Renovation **($ in thousands)**

YEAR	Replace Top Deck (1)	Maintenance and Repair (2)	TOTAL ANNUAL OUTLAYS	END OF YEAR DISCOUNT FACTORS	PRESENT VALUE
2001	$1,050	$0	$1,050	0.960	$1,008
2002	$0	$0	$0	0.921	$0
2003	$0	$0	$0	0.884	$0
2004	$0	$0	$0	0.848	$0
2005	$0	$0	$0	0.814	$0
2006	$0	$0	$0	0.781	$0
2007	$0	$0	$0	0.750	$0
2008	$0	$0	$0	0.720	$0
2009	$0	$0	$0	0.691	$0
2010	$0	$0	$0	0.663	$0
2011	$0	$0	$0	0.636	$0
2012	$0	$0	$0	0.610	$0
2013	$0	$0	$0	0.586	$0
2014	$0	$0	$0	0.562	$0
2015	$0	$0	$0	0.539	$0
2016	$0	$0	$0	0.518	$0
2017	$0	$0	$0	0.497	$0
2018	$0	$0	$0	0.477	$0
2019	$0	$0	$0	0.458	$0
2020	$0	$0	$0	0.439	$0
2021	$0	$344	$344	0.421	$145
2022	$0	$0	$0	0.404	$0
2023	$0	$0	$0	0.388	$0
2024	$0	$0	$0	0.373	$0
2025	$0	$0	$0	0.358	$0
2026	$0	$0	$0	0.343	$0
2027	$0	$0	$0	0.329	$0
2028	$0	$0	$0	0.316	$0
2029	$0	$0	$0	0.303	$0
2030	$0	$0	$0	0.291	$0
%NPV	87.42	12.58			
	$1,008	$145			
DISCOUNTING CONVENTION	E-O-Y	E-O-Y			
INFLATION INDEX	No Inflation	No Inflation			

LIFE CYCLE COST REPORT

1 Renovation **($ in thousands)**

YEAR	CUMULATIVE NET PRESENT VALUE
2001	$1,008
2002	$1,008
2003	$1,008
2004	$1,008
2005	$1,008
2006	$1,008
2007	$1,008
2008	$1,008
2009	$1,008
2010	$1,008
2011	$1,008
2012	$1,008
2013	$1,008
2014	$1,008
2015	$1,008
2016	$1,008
2017	$1,008
2018	$1,008
2019	$1,008
2020	$1,008
2021	$1,153
2022	$1,153
2023	$1,153
2024	$1,153
2025	$1,153
2026	$1,153
2027	$1,153
2028	$1,153
2029	$1,153
2030	$1,153

4.2% DISCOUNT RATE, 30 YEARS

LIFE CYCLE COST REPORT

2 Partial Repairs at Main Deck and Extensions **($ in thousands)**

YEAR	Initial Construction (1)	Maintenance and Repair (2)	TOTAL ANNUAL OUTLAYS	END OF YEAR DISCOUNT FACTORS	PRESENT VALUE
2001	$1,893	$0	$1,893	0.960	$1,817
2002	$0	$0	$0	0.921	$0
2003	$0	$0	$0	0.884	$0
2004	$0	$0	$0	0.848	$0
2005	$0	$0	$0	0.814	$0
2006	$0	$0	$0	0.781	$0
2007	$0	$0	$0	0.750	$0
2008	$0	$0	$0	0.720	$0
2009	$0	$0	$0	0.691	$0
2010	$0	$0	$0	0.663	$0
2011	$0	$900	$900	0.636	$572
2012	$0	$0	$0	0.610	$0
2013	$0	$0	$0	0.586	$0
2014	$0	$0	$0	0.562	$0
2015	$0	$0	$0	0.539	$0
2016	$0	$0	$0	0.518	$0
2017	$0	$0	$0	0.497	$0
2018	$0	$0	$0	0.477	$0
2019	$0	$0	$0	0.458	$0
2020	$0	$0	$0	0.439	$0
2021	$0	$900	$900	0.421	$379
2022	$0	$0	$0	0.404	$0
2023	$0	$0	$0	0.388	$0
2024	$0	$0	$0	0.373	$0
2025	$0	$0	$0	0.358	$0
2026	$0	$0	$0	0.343	$0
2027	$0	$0	$0	0.329	$0
2028	$0	$0	$0	0.316	$0
2029	$0	$0	$0	0.303	$0
2030	$0	$0	$0	0.291	$0
%NPV	65.62	34.38			
	$1,817	$952			
DISCOUNTING CONVENTION	E-O-Y	E-O-Y			
INFLATION INDEX	No Inflation	No Inflation			

LIFE CYCLE COST REPORT

2 Partial Repairs at Main Deck and Extensions **($ in thousands)**

YEAR	CUMULATIVE NET PRESENT VALUE
2001	$1,817
2002	$1,817
2003	$1,817
2004	$1,817
2005	$1,817
2006	$1,817
2007	$1,817
2008	$1,817
2009	$1,817
2010	$1,817
2011	$2,389
2012	$2,389
2013	$2,389
2014	$2,389
2015	$2,389
2016	$2,389
2017	$2,389
2018	$2,389
2019	$2,389
2020	$2,389
2021	$2,768
2022	$2,768
2023	$2,768
2024	$2,768
2025	$2,768
2026	$2,768
2027	$2,768
2028	$2,768
2029	$2,768
2030	$2,768

4.2% DISCOUNT RATE, 30 YEARS

LIFE CYCLE COST REPORT

SOURCE AND DERIVATION OF COSTS AND BENEFITS:

Unit costs were taken from an investigation performed by Blaylock Engineering Group in October 1998. The investigation determined the existing condition of Pier Bravo (pier structure and fendering system), and made recommendations for repairs.

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 1

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

PROJECT TITLE: **Repairs to Pier Bravo**
Concrete Deck Repair - Replace Top Deck at Main Pier

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ____

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
CONCRETE DECK REPAIR									
Hydroblast top 3.5" of Main Pier deck	45260	SF			10.15	459,389	10.15	459,389	R
Demolish concrete curbing	253	CF			30.00	7,590	30.00	7,590	R
Hydroblast 3.5" for partial deck repairs	1600	SF			10.15	16,240	10.15	16,240	R
Sawcut deck	2000	LF			4.00	8,000	4.00	8,000	R
Sawcut curbs	150	LF			20.00	3,000	20.00	3,000	R
PVC Deck Drains and Grate	22	EA	50.00	1,100	75.00	1,650	125.00	2,750	R
Core drill holes for drains	22	EA			100.00	2,200	100.00	2,200	R
Top deck partial repairs:									
Place supplemental reinforcing	200	LB	1.00	200	7.00	1,400	8.00	1,600	R
Place anti-corrosive coating	1600	SF	2.00	3,200	2.00	3,200	4.00	6,400	R
Place polymer concrete	400	CF	120.00	48,000	10.00	4,000	130.00	52,000	R
Top deck replacement at Main Pier:									
Place supplemental reinforcing	40000	LB	1.00	40,000	0.30	12,000	1.30	52,000	R
Place cast-in-place concrete	489	CY	75.00	36,675	60.00	29,340	135.00	66,015	R
Place interface bond coating	45260	SF	1.00	45,260	0.30	13,578	1.30	58,838	R
Curing Compound	45260	SF	0.26	11,768	0.43	19,462	0.69	31,229	R
Curb repairs:									
Sandblast concrete and reinforcing	506	SF	1.50	759	8.00	4,048	9.50	4,807	R
Place supplemental reinforcing	400	LB	1.00	400	7.00	2,800	8.00	3,200	R
Place anti-corrosive coating	506	SF	2.00	1,012	2.00	1,012	4.00	2,024	R
Place forms	506	SF	3.00	1,518	33.60	17,002	36.60	18,520	R
Place cast-in-place concrete	253	CF	5.00	1,265	10.00	2,530	15.00	3,795	R
SUBTOTAL				191,157		608,441		799,597	R
General Requirements, OH & Profit	31.35%			59,928		190,746		250,674	R
TOTAL CONCRETE DECK REPAIR				251,085		799,187		1,050,271	R

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00

SHEET: 2

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

PROJECT TITLE: **Repairs to Pier Bravo Future Maintenance Costs**

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ____

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
CONCRETE DECK REPAIR - FUTURE MAINTENANCE									
Sawcut for partial deck repairs at Main Pier	4480	LF			4.00	17,920	4.00	17,920	R
Hydroblast 3.5" for partial deck repairs at Main Pier	4526	SF			10.15	45,939	10.15	45,939	R
Top deck partial repairs at Main Pier:									
Place supplemental reinforcing	660	LB	1.00	660	7.00	4,620	8.00	5,280	R
Place anti-corrosive coating	5280	SF	2.00	10,560	2.00	10,560	4.00	21,120	R
Place polymer concrete	1320	CF	120.00	158,400	10.00	13,200	130.00	171,600	R
SUBTOTAL				169,620		92,239		261,859	R
General Requirements, OH & Profit	31.35%			53,176		28,917		82,093	R
FUTURE REPAIR COST - 20 YEARS				222,796		121,156		343,952	R

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 1

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.

IDENTIFICATION NUMBER: R1-98

PROJECT TITLE: **Repairs to Pier Bravo — Concrete Deck Repair - Partial Repairs to Deck**

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ____

JOB ORDER NUMBER

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
CONCRETE DECK REPAIR									
Sawcut for partial deck repairs at Main Pier	22400	LF			4.00	89,600	4.00	89,600	R
Sawcut for partial deck repairs at Extensions	2000	LF			4.00	8,000	4.00	8,000	R
Hydroblast 3.5" for partial deck repairs at Main Pier	22630	SF			10.15	229,695	10.15	229,695	R
Hydroblast 3.5" for partial deck repairs at Extensions	1600	SF			10.15	16,240	10.15	16,240	R
Demolish concrete curbing at Main Pier	253	CF			30.00	7,590	30.00	7,590	R
Sawcut curbs at Extensions	150	LF			20.00	3,000	20.00	3,000	R
PVC Deck Drains and Grate	22	EA	50.00	1,100	75.00	1,650	125.00	2,750	R
Core drill holes for drains	22	EA			100.00	2,200	100.00	2,200	R
Top deck partial repairs at Main Pier:									
Place supplemental reinforcing	3300	LB	1.00	3,300	7.00	23,100	8.00	26,400	R
Place anti-corrosive coating	26400	SF	2.00	52,800	2.00	52,800	4.00	105,600	R
Place polymer concrete	6600	CF	120.00	792,000	10.00	66,000	130.00	858,000	R
Top deck partial repairs at Extensions:									
Place supplemental reinforcing	200	LB	1.00	200	7.00	1,400	8.00	1,600	R
Place anti-corrosive coating	1600	SF	2.00	3,200	2.00	3,200	4.00	6,400	R
Place polymer concrete	400	CF	120.00	48,000	10.00	4,000	130.00	52,000	R
Curb repairs:									
Sandblast concrete and reinforcing	506	SF	1.50	759	8.00	4,048	9.50	4,807	R
Place supplemental reinforcing	400	LB	1.00	400	7.00	2,800	8.00	3,200	R
Place anti-corrosive coating	506	SF	2.00	1,012	2.00	1,012	4.00	2,024	R
Place forms	506	SF	3.00	1,518	33.60	17,002	36.60	18,520	R
Place cast-in-place concrete	253	CF	5.00	1,265	10.00	2,530	15.00	3,795	R
SUBTOTAL				905,554		535,867		1,441,421	R
General Requirements, OH & Profit	31.35%			283,891		167,994		451,885	R
TOTAL CONCRETE DECK REPAIR				1,189,445		703,861		1,893,306	R

DATE GENERATED: 16 Mar 2000
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VERSION: ECONPACK for Windows 1.02

Pier Bravo Fender System Repair
ECONOMIC ANALYSIS

EXECUTIVE SUMMARY REPORT

PROJECT TITLE	:	Repair Pier Bravo, NAS North Island
DISCOUNT RATE	:	4.2%
PERIOD OF ANALYSIS	:	30 Years
START YEAR	:	2001
BASE YEAR	:	2001
REPORT OUTPUT	:	Constant Dollars

PROJECT OBJECTIVE : To repair the deteriorated fender system.

ALTERNATIVES CONSIDERED FOR THIS ANALYSIS:

This economic analysis looks at two methods for repairing the existing timber fender system at Pier Bravo. The existing system is a combination of treated and untreated fender piles and treated timber camels, with a few experimental plastic piles installed for research. The fender system should be able to accommodate the full range of Naval surface ships expected to use this facility.

Alternative fendering systems included in this analysis are:

1. A combination system which uses foam-filled fenders, concrete fender piles, concrete-filled fiberglass piles, and plastic piles.
2. Untreated timber piles with log camels

Chemical preservative treated timber piles and camel logs were not considered for any alternative in this analysis. Treated timber leaches polycyclic aromatic hydrocarbons (PAH) into the water. Due to growing environmental sensitivity, the placement of treated timber in San Diego Bay is no longer permitted by the Navy.

Alternative 1, Combination Fender System:

This alternative would consist of several types of fender systems, designed for loading requirements at the various portions of the pier. A primary system of six foam-filled fender stations on the outboard side of the main pier will accommodate the hull sweep of DDG-51 class destroyers. Two existing foam-filled fenders will be relocated to the first mooring platform north and south of the main pier, and will be used as pier protection during berthing of large ships such as amphibious assault ships. The foam-filled fender stations include concrete backing piles and a steel wale at each location.

A secondary fender system of concrete fender piles between the foam-filled fender stations will accommodate small and large barges. 24" diameter plastic camels will distribute the barge loads to the concrete piles.

Corner protection systems, consisting of plastic piles, rubber buckling fenders, and a steel wale, will protect the outboard corners of the main pier and the extreme north and south corners of the mooring platforms.

The four horseshoe shaped pockets between the mooring platforms will be protected by a system of concrete-filled fiberglass fender piles and plastic fender piles. The fiberglass piles will accommodate a small barge, and the plastic piles will accommodate other small craft.

The selection of these various systems was based on the berthing loads required at the different locations, and the cost of the systems.

Alternative 2, Untreated Timber Piles with Log Camels:

This alternative would be a direct replacement of the existing timber fender system as required to repair existing damage. New fender piles would be untreated and the new log camels would be made of recycled plastic material. For purposes of analysis, it was estimated that approximately 25% of the existing fender piles are missing or damaged, and need immediate replacement. Due to the aggressive marine borer environment in the bay,it is also assumed that half of the existing system will need repairs within 2 years, and untreated timber piles will require replacement on a two-year cycle.

ASSUMPTIONS OF THE ANALYSIS:

1. Funding will be available for construction in FY 00
2. The functional life of the fender system is 30 years

ECONOMIC INDICATORS: **($ in thousands)**

ALTERNATIVE NAME	NPV
1 Combination System	$2,705
2 Untreated Timber Fender System	$10,558

RESULTS AND RECOMMENDATIONS:

The results of the economic analysis indicate that the best value will be achieved by replacing the timber fender system with a combination of engineered fender systems.

In addition to economic benefit, the recommended systems are engineered to withstand the berthing energies from naval surface ships, and provide more protection for the ship as well as the pier. Timber fender systems are generally not designed, but are installed based on empirical and historical data.

ACTION OFFICER: C. Davis
ORGANIZATION : SWDIV NAVFACENGCOM

LIFE CYCLE COST REPORT

1 Combination System **($ in thousands)**

YEAR	Initial Construction (1)	TOTAL ANNUAL OUTLAYS	END OF YEAR DISCOUNT FACTORS	PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
2001	$2,819	$2,819	0.960	$2,705	$2,705
2002	$0	$0	0.921	$0	$2,705
2003	$0	$0	0.884	$0	$2,705
2004	$0	$0	0.848	$0	$2,705
2005	$0	$0	0.814	$0	$2,705
2006	$0	$0	0.781	$0	$2,705
2007	$0	$0	0.750	$0	$2,705
2008	$0	$0	0.720	$0	$2,705
2009	$0	$0	0.691	$0	$2,705
2010	$0	$0	0.663	$0	$2,705
2011	$0	$0	0.636	$0	$2,705
2012	$0	$0	0.610	$0	$2,705
2013	$0	$0	0.586	$0	$2,705
2014	$0	$0	0.562	$0	$2,705
2015	$0	$0	0.539	$0	$2,705
2016	$0	$0	0.518	$0	$2,705
2017	$0	$0	0.497	$0	$2,705
2018	$0	$0	0.477	$0	$2,705
2019	$0	$0	0.458	$0	$2,705
2020	$0	$0	0.439	$0	$2,705
2021	$0	$0	0.421	$0	$2,705
2022	$0	$0	0.404	$0	$2,705
2023	$0	$0	0.388	$0	$2,705
2024	$0	$0	0.373	$0	$2,705
2025	$0	$0	0.358	$0	$2,705
2026	$0	$0	0.343	$0	$2,705
2027	$0	$0	0.329	$0	$2,705
2028	$0	$0	0.316	$0	$2,705
2029	$0	$0	0.303	$0	$2,705
2030	$0	$0	0.291	$0	$2,705
%NPV	100.00				
	$2,705				
DISCOUNTING CONVENTION	E-O-Y				
INFLATION INDEX	No Inflation				

4.2% DISCOUNT RATE, 30 YEARS

LIFE CYCLE COST REPORT

2 Untreated Timber Fender System **($ in thousands)**

YEAR	Initial Construction (1)	Maintenance and Repair (2)	TOTAL ANNUAL OUTLAYS	END OF YEAR DISCOUNT FACTORS	PRESENT VALUE
2001	$881	$0	$881	0.960	$845
2002	$0	$0	$0	0.921	$0
2003	$0	$1,269	$1,269	0.884	$1,122
2004	$0	$0	$0	0.848	$0
2005	$0	$1,269	$1,269	0.814	$1,033
2006	$0	$0	$0	0.781	$0
2007	$0	$1,269	$1,269	0.750	$951
2008	$0	$0	$0	0.720	$0
2009	$0	$1,269	$1,269	0.691	$876
2010	$0	$0	$0	0.663	$0
2011	$0	$1,269	$1,269	0.636	$807
2012	$0	$0	$0	0.610	$0
2013	$0	$1,269	$1,269	0.586	$743
2014	$0	$0	$0	0.562	$0
2015	$0	$1,269	$1,269	0.539	$685
2016	$0	$0	$0	0.518	$0
2017	$0	$1,269	$1,269	0.497	$631
2018	$0	$0	$0	0.477	$0
2019	$0	$1,269	$1,269	0.458	$581
2020	$0	$0	$0	0.439	$0
2021	$0	$1,269	$1,269	0.421	$535
2022	$0	$0	$0	0.404	$0
2023	$0	$1,269	$1,269	0.388	$493
2024	$0	$0	$0	0.373	$0
2025	$0	$1,269	$1,269	0.358	$454
2026	$0	$0	$0	0.343	$0
2027	$0	$1,269	$1,269	0.329	$418
2028	$0	$0	$0	0.316	$0
2029	$0	$1,269	$1,269	0.303	$385
2030	$0	$0	$0	0.291	$0
%NPV	8.01	91.99			
	$845	$9,713			
DISCOUNTING CONVENTION	E-O-Y	E-O-Y			
INFLATION INDEX	No Inflation	No Inflation			

LIFE CYCLE COST REPORT

2 Untreated Timber Fender System **($ in thousands)**

YEAR	CUMULATIVE NET PRESENT VALUE
2001	$845
2002	$845
2003	$1,967
2004	$1,967
2005	$3,000
2006	$3,000
2007	$3,952
2008	$3,952
2009	$4,828
2010	$4,828
2011	$5,635
2012	$5,635
2013	$6,378
2014	$6,378
2015	$7,063
2016	$7,063
2017	$7,694
2018	$7,694
2019	$8,274
2020	$8,274
2021	$8,809
2022	$8,809
2023	$9,302
2024	$9,302
2025	$9,755
2026	$9,755
2027	$10,173
2028	$10,173
2029	$10,558
2030	$10,558

4.2% DISCOUNT RATE, 30 YEARS

LIFE CYCLE COST REPORT

SOURCE AND DERIVATION OF COSTS AND BENEFITS:

Unit costs were taken from an investigation performed by Blaylock Engineering Group, and are based on their cost database.

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00

SHEET: 1

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

PROJECT TITLE: **Repairs to Pier Bravo Fender System Repair - Conc, FFF, Composites, and Plastic**

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ______

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
FENDER SYSTEM REPAIR									
Remove exist corner frame systems	4	EA			200.00	800	200.00	800	R
Remove existing fender piles	228	EA			250.00	57,000	250.00	57,000	R
Remove pile stubs	100	EA			300.00	30,000	300.00	30,000	R
Remove broken piles and stubs	25	EA			350.00	8,750	350.00	8,750	R
Remove existing chocks and wales	2650	LF			15.00	39,750	15.00	39,750	R
Remove misc. bottom debris	50	EA			70.00	3,500	70.00	3,500	R
Remove and store ladders	2	EA			50.00	100	50.00	100	R
Remove and reinstall utilities	1	LS			25,000	25,000	25,000	25,000	R
Barge w/ crane	8	WKS	3,750.00	30,000			3,750.00	30,000	R
Foam-filled fenders 8'x 20' long	6	EA	45,000	270,000	500.00	3,000	45,500	273,000	R
1 3/4" galvanized stud link chain	192	LF	25.00	4,800			25.00	4,800	R
Shackles	32	EA	125.00	4,000			125.00	4,000	R
Corner Buckling Fender MV800x1500	8	EA	2,000.00	16,000	200.00	1,600	2,200.00	17,600	R
Corner Buckling Fender MV400x1000	8	EA	750.00	6,000	150.00	1,200	900.00	7,200	R
Prestressed Concrete Piles - 24" sq x 70.5'	64	EA	3,948.00	252,672	990.00	63,360	4,938.00	316,032	R
Prestressed Concrete Piles - 18" sq x 69.5'	36	EA	3,336.00	120,096	930.00	33,480	4,266.00	153,576	R
UHMWPE Face Panels	260	CF	213.00	55,380			213.00	55,380	R
3/4" and 1" dia bolts (stainless steel)	1200	EA	6.00	7,200	1.50	1,800	7.50	9,000	R
Finish concrete pile tops	100	EA	26.00	2,600	30.00	3,000	56.00	5,600	R
Core drill and grout pile bolts	100	EA	62.00	6,200	100.00	10,000	162.00	16,200	R
Epoxy Grout	42	CF	100.00	4,200	15.00	630	115.00	4,830	R
Barge w/ crane	3	WKS	3,750.00	11,250			3,750.00	11,250	R
Plastic piles 13" x 70'	92	EA	3,570.00	328,440	600.00	55,200	4,170.00	383,640	R
Attach piles and finish tops	92	EA	60.00	5,520	100.00	9,200	160.00	14,720	R
Barge w/ crane	3	WKS	3,750.00	11,250			3,750.00	11,250	R

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00 | SHEET: 2

ACTIVITY AND LOCATION
Naval Air Station, North Island
Coronado, CA

CONSTRUCTION CONTRACT NO.

IDENTIFICATION NUMBER: R1-98

ESTIMATED BY
Southwest Division Code 5SCN.CD

CATEGORY CODE NUMBER: 151-10

PROJECT TITLE
Repairs to Pier Bravo
Fender System Repair - Conc, FFF, Composites, and Plastic

STATUS OF DESIGN
[X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ___

JOB ORDER NUMBER

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
Fiberglass piles 12.75" dia x 67'	82	EA	1,876.00	153,832	600.00	49,200	2,476.00	203,032	R
Attach piles and finish tops	82	EA	50.00	4,100	50.00	4,100	100.00	8,200	R
Concrete fill	160	CY	75.00	12,000	75.00	12,000	150.00	24,000	R
HDPE pipe sleeve 16" dia x 16'	1312	LF	30.00	39,360	5.00	6,560	35.00	45,920	R
1 1/4 " dia bolts x 20 " long	82	EA	35.00	2,870	2.00	164	37.00	3,034	R
Barge w/ crane	3	WKS	3,750.00	11,250			3,750.00	11,250	R
12"x12" Timber Chocks at 18" Conc Piles	250	LF	30.00	7,500	10.00	2,500	40.00	10,000	R
1"dia Nut, Bolt & Ogee Washers at Chocks	72	EA	13.00	936	15.00	1,080	28.00	2,016	R
Plastic Blocks (12 x 12)	60	LF	30.00	1,800		0	30.00	1,800	R
Plastic Blocks (4 x 10)	246	LF	16.00	3,936		0	16.00	3,936	R
Plastic Log Camels	1030	LF	155.00	159,650	5.00	5,150	160.00	164,800	R
Cluster Weight Hardware:									
3/4" dia Dowels, eye bolt end	46	EA	8.00	368	40.00	1,840	48.00	2,208	R
5/8" Chain w/ Shackles	1518	LF	4.00	6,072	0.29	440	4.29	6,512	R
Concrete Deadman	46	EA	6.00	276	15.00	690	21.00	966	R
Steel WF Wale:									
Wide Flange Section	54496	LB	0.75	40,872	0.50	27,248	1.25	68,120	R
Bar Stock	11545	LB	1.00	11,545	0.50	5,773	1.50	17,318	R
Bar Grate	832	SF	4.75	3,952	1.50	1,248	6.25	5,200	R
Weldment (Fillet Weld or Equiv)	2048	LF	0.46	942	6.35	13,005	6.81	13,947	R
Dowels for Wale (1.00 dia.)	120	EA	11.00	1,320	40.00	4,800	51.00	6,120	R
Neoprene Pads	80	SF	41.00	3,280	21.00	1,680	62.00	4,960	R
Epoxy Grout behind wale	50	CF	120.00	6,000	20.00	1,000	140.00	7,000	R

* U.S. Government Printing Office: 1982-505-106/6608 2-1

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00

SHEET: 3

ACTIVITY AND LOCATION: **Naval Air Station, North Island Coronado, CA**

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER: R1-98

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

PROJECT TITLE: **Repairs to Pier Bravo**
Fender System Repair - Conc, FFF, Composites, and Plastic

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify) ______

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL	TYPE
Corner Protection Frames (68 Piles):									
Wide Flange Sections	9400	LB	1.00	9,400	0.50	4,700	1.50	14,100	R
Weldment (Fillet Weld or Equiv)	804	LF	0.46	370	6.35	5,105	6.81	5,475	R
Bar Stock	3048	LB	1.00	3,048	0.50	1,524	1.50	4,572	R
Pile Brackets & Bolts	68	EA	100.00	6,800	100.00	6,800	200.00	13,600	R
Dowels for MV800's (1.375 dia.)	24	EA	15.00	360	75.00	1,800	90.00	2,160	R
End Protection Frames (24 Piles):									
Wide Flange Wales	2594	LB	0.75	1,946	0.50	1,297	1.25	3,243	R
Pile Brackets & Bolts	24	EA	100.00	2,400	100.00	2,400	200.00	4,800	R
Dowels for MV400's (.875 dia.)	8	EA	10.00	80	50.00	400	60.00	480	R
Ladder Re-installation	2	EA	50.00	100	200.00	400	250.00	500	R
Steel Landing & Fiberglass Ladder	4	EA	600.00	2,400	300.00	1,200	900.00	3,600	R
SUBTOTAL				1,634,373		511,474		2,145,847	R
General Requirements, OH & Profit	31.35%			512,376		160,347		672,723	R
TOTAL FENDER SYSTEM REPAIR				2,146,749		671,821		2,818,570	R

* U.S. Government Printing Office: 1982-505-106/6608 2-1

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 1

ACTIVITY AND LOCATION
Naval Air Station, North Island
Coronado, CA

CONSTRUCTION CONTRACT NO.

IDENTIFICATION NUMBER: R1-98

PROJECT TITLE
Repairs to Pier Bravo
Fender System Repair - Untreated Timber Piles

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

STATUS OF DESIGN: [X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify)

JOB ORDER NUMBER

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
TIMBER FENDER SYSTEM REPAIRS									
Remove pile stubs	100	EA			300.00	30,000	300.00	30,000	R
Remove broken and deteriorated piles	65	EA			350.00	22,750	350.00	22,750	R
Remove existing chocks and wales	675	LF			15.00	10,125	15.00	10,125	R
Remove misc. bottom debris	25	EA			70.00	1,750	70.00	1,750	R
Barge w/ crane	2	WKS	3,750.00	7,500			3,750.00	7,500	R
Piles - 16" dia untreated timber	65	EA	1,150	74,750	500.00	32,500	1,650.00	107,250	R
Attach piles	65	EA	30.00	1,950	70.00	4,550	100.00	6,500	R
Barge w/ crane	2	WKS	3,750.00	7,500			3,750.00	7,500	R
Wale (12"x12")	8100	BF	4.50	36,450	2.50	20,250	7.00	56,700	R
Chocks (10"x12")	6750	BF	4.50	30,375	2.50	16,875	7.00	47,250	R
Camels	2120	LF	165.00	349,800	11.00	23,320	176.00	373,120	R
SUBTOTAL FOR INITIAL REPAIR				508,325		162,120		670,445	
General Requirements, OH & Profit	31.35%			159,360		50,825		210,185	R
TOTAL INITIAL FENDER SYSTEM REPAIR				667,685		212,945		880,630	R

S/N 0105-LF-010-1335

* U.S. Government Printing Office: 1982-505-106/6608 2-1

NAVFAC 11013/7 (1-78)
Supercedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 15-Mar-00
SHEET: 2

ACTIVITY AND LOCATION
Naval Air Station, North Island
Coronado, CA

CONSTRUCTION CONTRACT NO.

IDENTIFICATION NUMBER: R1-98

ESTIMATED BY: **Southwest Division Code 5SCN.CD**

CATEGORY CODE NUMBER: 151-10

PROJECT TITLE
Repairs to Pier Bravo
Fender System Repair - Untreated Timber Piles

STATUS OF DESIGN
[X] Prelim [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify)

JOB ORDER NUMBER

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE		TYPE
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	
TIMBER PILE REPLACEMENT COST - EVERY 2 YEARS									
Remove pile stubs	200	EA			300.00	60,000	300.00	60,000	R
Remove broken and deteriorated piles	130	EA			350.00	45,500	350.00	45,500	R
Remove existing chocks and wales	1350	LF			15.00	20,250	15.00	20,250	R
Remove misc. bottom debris	25	EA			70.00	1,750	70.00	1,750	R
Barge w/ crane	4	WKS	3,750.00	15,000			3,750.00	15,000	R
Piles - 16" dia untreated timber	130	EA	1,150	149,500	500.00	65,000	1,650.00	214,500	R
Attach piles	130	EA	30.00	3,900	70.00	9,100	100.00	13,000	R
Barge w/ crane	4	WKS	3,750.00	15,000			3,750.00	15,000	R
Wale (12"x12")	16200	BF	4.50	72,900	2.50	40,500	7.00	113,400	R
Chocks (10"x12")	13500	BF	4.50	60,750	2.50	33,750	7.00	94,500	R
Camels	2120	LF	165.00	349,800	11.00	23,320	176.00	373,120	R
SUBTOTAL				666,850		299,170		966,020	
General Requirements, OH & Profit	31.35%			209,057		93,790		302,847	R
TOTAL FUTURE REPAIRS				875,907		392,960		1,268,867	R

Appendix E

BUILDER Engineered Management System

by

U. S. Army Corps of Engineers
Construction Engineering Research Laboratory

Welcome to the US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory

BUILDER Engineered Management System

An Engineered Management System (EMS) is a decision-support tool that helps the user decide when, where, and how to best maintain facilities and their key components. BUILDER is a Windows®-based software application EMS for buildings.

Related On-Line Materials: http://owww.cecer.army.mil/facts/sheets/cf-25.pdf.

CERL ID Number: CF-25

Research Theme: Facilities – Enduring Buildings Installations – O&M Technology

Problem:

The Army spends about 55 percent of its installation real property maintenance funds on maintenance and repair (M&R) of buildings. It is difficult to allocate these funds optimally because no structured, objective condition-rating system for work identification exists, and there is no procedure for quickly developing short- and long-range work plans based on a sound investment strategy. Consequently, key components may not be inspected adequately and deficiencies are often overlooked; the result is that work cannot be planned, programmed, and budgeted efficiently. The large number of buildings on installations increases the difficulty of budgeting effectively and allocating funds to areas that most urgently need attention. In addition, it is difficult to establish effective preventive maintenance programs, or to even set work priorities. Without objectivity in work planning, cost-effective M&R programs cannot be sustained. Mission-support capabilities, quality of life, and past investment in facilities are jeopardized.

Technology:

BUILDER is a Windows®-based software application EMS for buildings that is being developed into a network-based multi-user system. BUILDER technologies and methods include an inventory of building major components; video imaging; checklist-style, pen-based inspections; work history, condition indexes, condition prediction capabilities; prioritized long-range work-planning procedures, presentation graphics, and an interface to a geographical information system (GIS).

BUILDER allows users to manage buildings individually or in groups. Historic, housing, health/environment, and safety/code issues can be effectively managed. Projects can be BUILDER-generated or initiated externally from customer requests.

Technology:

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BUILDER allows users to manage buildings individually or in groups. Historic, housing, health/environment, and safety/code issues can be effectively managed. Projects can be BUILDER-generated or initiated externally from customer requests.

Benefits:

BUILDER consolidates a variety of building-related management issues into a single decision-support package. The system will give functional managers and decision-makers instant access to data about their building inventory, the current condition of individual buildings, a fact-based prediction of future condition, current and potential regulatory compliance issues, and so on. Users will be able to develop multi-year M&R strategies and plans based on site-specific information and imposed budget constraints. M&R costs will be saved, mission capabilities will be sustained, and quality of life will be enhanced for building occupants. BUILDER will enhance the role of the facility manager by providing new, sophisticated analysis procedures that were not previously possible.

Status:

BUILDER version 1.0 was released in mid-FY98. The technologies to be included are complete, and computer programming is under development. Field testing is in progress for completed software modules.

Related Information:

- Geographic Information System (GIS) Module for the ROOFER Engineered Management System

For Additional Information:

Dr. Donald R Uzarski, Civil Engineer, CERL, P.O. Box 9005, Champaign, IL, 61826-9005. Phone: 217-373-4464, Fax: 217-737-7222, EMail: d-uzarski@cecer.army.mil

Appendix F

ROOFER - Engineered Management System

by

U. S. Army Corps of Engineers
Construction Engineering Research Laboratory

Welcome to the US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory

ROOFER – Engineered Management System

CERL has developed a Roofing Engineered Management System (EMS) -- ROOFER. Military installations, as well as other governmental agencies and private building owners, can use the ROOFER procedures and MicroROOFER software to manage their roofing assets.

CERL ID Number: CF-09

Research Theme: Facilities – General Installation Operations - O&M Technology
Facilities - Enduring Buildings

Problem:

Military installations, like many federal, state, and local governmental agencies, have large inventories of buildings with low-slope membrane and steep roofing systems. A major portion of their infrastructure maintenance dollars is being spent to repair and replace these roofs. The facility managers need systematic procedures to evaluate the roofs, select repair strategies, determine priorities, and identify long-range program requirements that will ensure maximum return-on-investments.

Technology:

Military installations, as well as other governmental agencies and private building owners, can use this practical decision-making tool to help identify cost-effective strategies for repair and replacement of their low-slope roofs. ROOFER includes procedures for collecting inventory and inspection information, evaluating roof condition, identifying repair/replacement strategies, prioritizing projects, and developing work plans. Micro ROOFER, a microcomputer application that runs in Windows 3.11, Windows NT, or Windows 95 environment, provides data storage and analysis and generates management reports. ROOFER uses a standard condition index, the Roof Condition Index (RCI), which is derived from indexes for the membrane (MCI), flashing (FCI), and insulation (ICI) components of a roofing system. A roof's condition is determined by observed distresses through visual inspection and nondestructive moisture surveys for insulated roofs. The indexes provide an objective, consistent measure of roof condition, repairs needed, and waterproof integrity.

Benefits:

ROOFER enables building managers to rate their present roof condition, prioritize projects, and optimally allocate the budget. At the project level, ROOFER can help select repair and replacement strategies and identify work requirements. In the long term, this technology results in maximized roof conditions using available funds. ROOFER's benefits include: (1) inventory of roofing assets, (2) development of detailed roof plan drawings, (3) detection of roof defects using visual inspection to identify membrane and flashing problems and aerial infrared scans to locate areas of wet roof insulation, (4) development of condition indexes for flashings, membrane, insulation, and overall roof condition, (5) network analysis reports to summarize the findings and development of a 10-year budget program, (6) project analysis evaluation to determine if it is more cost-effective to do repair or replace, and (7) work requests to document the recommended action.

Status:

CERL developed the ROOFER system for bituminous built-up membrane and single-ply membrane roofs. The MicroROOFER software has undergone continual enhancements. These include a pen-based "electronic clipboard" application which eliminates the need for paper inspection worksheets and provides direct downloading of data into MicroROOFER databases.

CERL is currently developing a ROOFER condition evaluation procedure for asphalt shingle roofing systems. An Asphalt Shingle Inspection and Distress Manual and updated version of the MicroROOFER software will be released in the summer of 2000.

Micro ROOFER and associated technical reports are available through the ROOFER Technical Assistance Center at the University of Illinois at Urbana-Champaign, Conferences and Institutes. The Center has established fees for program distribution and technical support. ROOFER Technicial Assistance Center POC is Lynn Brownfield, COMM 217-333-5414; Conferences and Institutes, Suite 202, University Inn, 302 East John Street, Champaign, IL 61820-5612.

In addition, CERL can assist military users in training personnel to use ROOFER and in developing the installation data base and summary reports.

Related Information:

- Geographic Information System (GIS) Module for the ROOFER Engineered Management System

Additional Details:

- Geographic Information System (GIS) Module for the ROOFER Engineered Management System

For Additional Information:

Mr. David M Bailey, Civil Engineer, CERL, P.O. Box 9005, Champaign, IL, 61826-9005. Phone: 217-352-6511 (ext. 7480), Fax: 217-373-7222, EMail: d-bailey@cecer.army.mil

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Appendix G

Micro PAVER Pavement Management System

by

U. S. Army Corps of Engineers
Construction Engineering Research Laboratory

Welcome to the US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory

Micro PAVER Pavement Management System

The Construction Engineering Research Laboratory (CERL) developed the Micro PAVER Pavement Management System to optimize the use of pavement repair funds.

CERL ID Number: CF-32

Research Theme: Installation Operations - O&M Technology

Problem:

Reduced funding for pavement maintenance and repair (M&R) requires that existing funds be used more effectively. A pavement management system is needed to assist military and civilian organizations in optimizing the use of funds available for pavement repair.

Technology:

CERL developed the Micro PAVER Pavement Management System to optimize the use of pavement repair funds. The system, which uses state-of-the-art engineering techniques, was developed through funding from the U.S. Army, U.S. Air Force, U.S. Navy, Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), and the American Public Works Association (APWA). Micro PAVER was developed for use on IBM-compatible personal computers.

An important factor in optimizing the use of pavement repair funds is the pavement condition, which is determined by using the Pavement Condition Index (PCI). The PCI is an objective and repeatable rating of pavement condition based on observable distress. PCI procedures for roads, parking lots, and airfield pavements have been developed. The PCI for airfields has become an American Society for Testing and Materials (ASTM) Standard Test Method (ASTM designation: D 5340-93).

The pavement condition prediction is performed using the CERL-developed family analysis modeling technique. With this technique, pavements having similar characteristics are first grouped into families. Then, a different deterioration curve is developed for each family. Condition prediction for each pavement section is based on the family to which it is assigned.

Benefits:

Network-level management tools help personnel develop rational budget requests and allocate optimal budget assignments. An important output at the network level is the consequence of various budget scenarios on the PCI. This technology results in maximized pavement conditions using available funds.

Status:

Micro PAVER subscribers include cities, universities, consultants, airports, and others. The support centers located at the University of Illinois at Urbana-Champaign (UIUC) and with the APWA sell the Micro PAVER program and provide strategic support (i.e., phone consulting and training) to its users. CERL provides APWA and UIUC with updated versions of the program. These two centers have established fees for distribution and support of the program.

Micro PAVER version 4.2 was released in August 1999 and sets the stage for the next generation of Public Works management tools.

Another improvement is an interface to a Geographic Information System (GIS). When GIS technology is used to view information in the Micro PAVER database, the user gets a visual map that shows the different properties of the pavement. New versions of Micro PAVER, which include Version 5.0, will have a built-in GIS capability. The Beta version of 5.0 is due to be released in August 2000.

For information about roads and parking lots, CERL Technical Report TR M-90/05 and Army Technical Manual TM 5-623 are available from the National Technical Information Service, 1-800-553-6847. For information about airfield pavements, see FAA Advisory Circulars AC 150/5380-6 and AC 150/5380-8, Air Force Regulation 93-5, and ASTM D 5340-93. The UIUC Support Center can be reached at 217-333-2882; or UIUC, Conferences and Institutes, 3028 East John Street, Suite 202, Champaign, IL 61820.

The APWA Support Center can be reached at 814-472-6100, ext. 591; or APWA, 106 West 11th Street, Suite 1800, Kansas City, MO 64105-1806.

For Additional Information:

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Appendix H

RAILER® Engineered Management System

by

U. S. Army Corps of Engineers
Construction Engineering Research Laboratory

Welcome to the US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory

RAILER® Engineered Management System

Since the Army relies heavily on rail transportation for mobilization purposes, inadequate railroad track maintenance can jeopardize readiness. The RAILER® EMS can help managers optimize inspection procedures and maintenance programs.

CERL ID Number: CF-44

Research Theme: Installation Operations - O&M Technology

Problem:

The Army owns and maintains about 2500 miles of railroad track, much of which is strategically important for movement of troops and materiel. Much of this track is several decades old and has not been adequately maintained or repaired over the years. Due to budget constraints much of the Army's railroad network is deteriorating faster than maintenance and repair (M&R) funds become available. Inadequate track maintenance jeopardizes the Army's ability to mobilize, so economical, effective track management procedures are needed to ensure continued military readiness.

Technology:

The RAILER® Engineered Management System (EMS), developed by the Construction Engineering Research Laboratory (CERL), helps civil engineers, technicians, and managers evaluate track and plan effective, economical M&R programs. RAILER® provides track managers with a computerized database for storing data on railroad track inventory, inspection results, track conditions, M&R costs and policies, work history, and other essential items.
Periodic track inspections form the basis for the track management process. Sampling procedures may be used to speed the inspection process and reduce inspection costs.

Three methods are employed for condition assessment: condition indexes, track standards, and the Army's Installation Status Report (ISR). A Track Structure Condition

Index (TSCI) based on the Rail and Joints Condition Index (RJCI), Tie Condition Index (TCI), and Ballast and Subgrade Condition Index (BSCI) has also been developed. (A Grade Crossing Condition Index (GCCI) is under development.) These indexes measure track segment and component "health" on a 0 - 100 rating scale. The indexes reflect the ability of a track segment to support routine traffic, and they indicate the maintenance actions necessary to restore or sustain acceptable track condition. The indexes are also used to determine track deterioration rates and to provide input to the Army ISR. Track standards (Technical Manual 5-628 and others) match operating restrictions to specific track defects.

RAILER® can be used for both network-level and project-level management. *Network-level* management activities include assessing current overall track network condition and trends, developing M&R strategies, budgeting, developing short- and long-range M&R plans, and justifying budgets and M&R projects. These tasks involve the use of track standards and the TSCI. *Project-level* management activities include the detailed analysis of specific track segments that may be needed for problem diagnosis. Linkage to the CERL-developed TRACK program (see fact sheet CF-51) enhances this analysis.

Inspections are characterized either as "safety" or "detailed," based on applicable track standards. *Safety inspection* findings are used only for comparison with applicable track standards. *Detailed inspection* procedures may too be used to compare current conditions to applicable standards, but they also provide the basis for calculating the TSCI, RJCI, TCI, and BSCI.

The RAILER® system can incorporate the results of commercially available internal rail flaw detection and automated track geometry surveys. Also, the efficiency of data logging and transcription can be improved further using the RAILER RED add-on software application for pen-based electronic clipboards (see Fact Sheet CF-01). RAILER data and analysis results can also be viewed in the ArcView geographic information system (GIS) using the optional RAILER GIS program.

Benefits:

Once identified and analyzed through RAILER®, the best M&R strategy can be budgeted and executed in a prioritized and timely manner, making the best feasible use of available resources.

RAILER® enables managers to plan M&R work for specific track areas before unacceptable deterioration occurs. This practice ensures that track is maintained at a level consistent with operating needs and sufficient to prevent catastrophic failures and accidents. RAILER® also provides a systematic, documented engineering basis for determining short- and long-term needs and priorities. These benefits translate to (1) protecting the defense mobilization or revenue generating ability, (2) avoiding costs for restricted operations, major repairs due to neglected M&R, and damaged cargo and equipment, and (3) improved life safety.

Twenty-fold M&R cost savings have been documented.

Status:

RAILER® version 5.0 is available for immediate implementation on Windows 98 and NT systems. It incorporates inventory, safety inspection, detailed inspection, cost estimation, condition indexes, condition comparison against different track standards, manual track geometry features, and presentation graphics reports. RAILER® 5.0 supports the development of multi-year work plans for track networks.

Software is available through a RAILER® Support Center at the University of Illinois at Urbana-Champaign. The Support Center POC is Lynn Brownfield, 217-333-5414, Department of Continuing Education, University of Illinois, 302 E. John Street, Suite 202, Champaign, IL 61820.

For Additional Information:

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Appendix I

Water PIPER (W-PIPER)
Engineered Management System

by

U. S. Army Corps of Engineers
Construction Engineering Research Laboratory

Welcome to the US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory

Water PIPER (W-PIPER) Engineered Management System

CERL's W-PIPER EMS can help water distribution system managers plan and prioritize maintenance and repair (M&R)activities to make better use of M&R resources while protecting water system carrying capacity.

Related On-Line Materials: http://www.cecer.army.mil/usmt/wpiper/wpiper.htm.

CERL ID Number: CF-04

Research Theme: Facilities - General Installation Operations - General Installation Operations - O&M Technology

Problem:

Deterioration of underground water distribution systems, particularly those made of unlined metallic pipe, is a serious and costly problem on military installations as well as in the private sector. Modern construction techniques, such as lining metallic pipes with cement mortar or plastic, have greatly reduced the problem, but millions of miles of unlined pipe are still in operation. One of the most severe deterioration processes occurring in unlined metallic pipe is the loss of carrying capacity, which means the system fails to meet fire flow and daily demand requirements. Pipe corrosion, leading to the formation of tubercles, or calcium carbonate scale build-up on the pipe's interior surfaces causes diminished carrying capacity.

Several repair options are possible. Pressure cleaning, replacement, installation of parallel mains, installation of additional pumps, and installation of additional elevated storage are some alternatives. Making maintenance and repair decisions for a water distribution system is a complex process with many variables. The duration and effectiveness of repair alternatives are frequently unknown. Researchers recognized that a tool to determine these unknowns would be extremely valuable in making cost-effective maintenance and repair decisions.

Technology:

CERL developed Water PIPER (W-PIPER) to help installation Directorates of Public Works (DPWs) make cost-effective M&R decisions for underground water distribution systems, particularly in cases where loss of carrying capacity in metallic pipes is the chief failure mode. W-PIPER includes a pipe network inventory, a hydraulic model, data analysis reports, and a *Hazen-Williams C-factor* prediction model. The C-factor is related to the roughness of the pipe's interior surface, which can affect the pipe's carrying capacity. The Water Distribution System Analysis and Optimization (WADISO) program, developed by the U.S. Army Engineer Waterways Experiment Station, provides the hydraulic modeling capabilities for W-PIPER.

The C-factor model predicts the degradation of the C-factor in each pipe based on water chemistry or field measurements as a function of time. Using the C-factor model in conjunction with the hydraulic model, managers can determine when the piping system, or specific sections of it, will fall below fire flow and/or daily demand requirements. This prediction is used to determine the effective life of a particular maintenance alternative. Based on this information, a cost-effective maintenance decision can be made.

Prediction models for other failure modes are planned.

Benefits:

W-PIPER is a valuable tool for water distribution system design and scenario-building. Knowledge of future Hazen-Williams C-factors and the life of repair alternatives will enable DPW personnel to make cost-effective M&R decisions about underground water distribution systems. W-PIPER can also serve as a valuable tool in the design of new water distribution systems.

Status:

A users' manual and software are available for W-PIPER. The POC at Headquarters, U.S. Army Corps of Engineers is Nelson Labbe, CEMP-EC, 202-761-1494, 20 Massachusetts Avenue NW, Washington, DC 20314-1000.

For Additional Information:

Ms. Vicki L Van Blaricum, General Engineer, CERL, P.O. Box 9005, Champaign, IL, 61826-9005. Phone: 217-373-6771, Fax: 217-373-6732, EMail: v-vanblaricum@cecer.army.mil

Appendix J

MISSION DEPENDENCY METHODOLOGY

by

Al Antelman/ESC64


MISSION
DEPENDENCY METHODOLOGY
San Clemente Island
MDI Proof of Concept
6 Sept 00
Al Antelman/ESC64
(805) 982-4975
NAVAL FACILITIES ENGINEERING SERVICE CENTER

MISSION DEPENDENCY INDEX

Objectives

Develop a simple (easy to use), yet meaningful methodology for:

- Determining the operational relationships between infrastructure and mission.
- Prioritizing maintenance and repair projects.

MISSION DEPENDENCY INDEX

Solution

M&R prioritization can be determined by integrating of condition assessment data with mission assessment data

MISSION DEPENDENCY INDEX

Concept Development - Definition

$$MD = f\,(I,R)$$

MD	Mission Dependency
I	Interruptabilty of function
R	Relocatability of function

MISSION DEPENDENCY INDEX

Concept Development - Questions

Infrastructure Owner/Controller

Q1: How long could the “functions” supported by the infrastructure be stopped without impact on the mission?

- *100% Operational (N)*
- *Brief: Minutes, Hours (B)*
- *Short: Days, Weeks (S)*
- *Prolonged: Months (P)*

Infrastructure Owner/Controller

Q2: If the infrastructure was completely destroyed, or not working, could you continue performing your mission by occupying or using another existing facility, or by setting up temporary facilities?

- *No, It's impossible (**I**)*
- *Yes, but with great difficulty (D)*
- *Yes, with little or no difficulty (p)*

Table - 1

	Q1: Interruptability of Function			
	None	Briefly	Short	Prolonged
	6	min.-hours	days-weeks	Months
Q2: Relocatability	Impossible	5	4	3
	Difficult	4	3	2
	Possible	3	2	1
		Risk Level		

Mission/Infrastructure RAC	
5	Critical
4	Serious
3	Moderate
2	Minor
1	Negligible

MISSION DEPENDENCY INDEX

Modifiers

Modifier	Description	Value
E	Environmental Hazards	0.10
$	High Cost Equipment	0.10
#	High Personnel Occupancy	0.10
U	Unique (one of a kind)	0.15
e	Emergency Equipment/Response	0.15
QL	Quality of Life	0.20
S	Safety	0.10
h	Historic Preservation	0.10
	Modifier Sum $\leq$ 1.0	1.000

Mission Dependency Index Form

FACILITY NUMBER	CONTROL/OWN FUNCTION	MISSION	RAC	MOD	MDI	INTERRUPTABLITY (N) (B) (S) (P)	RELOCATABILITY (I) (D) (P)	MODIFIERS (S) (QL) (E) (#) ($) (U) (e) (h)
60072	Small Arms Range	SPECWAR	5.00	0.15	5.15	B	I	U
60068	Galley	SPECWAR	4.00	0.55	4.55	B	D	QL $ # U
60070	Emergency Generator	SPECWAR	4.00	0.30	4.30	B	D	e U
60071	Armory	SPECWAR	4.00	0.25	4.25	B	D	U $
60069	Boat Storage	SPECWAR	3.00	0.35	3.35	S	D	E $ U
60061	Small Arms Cleaning	SPECWAR	3.00	0.30	3.30	S	D	U E
60063	Laundry/Heads	SPECWAR	3.00	0.30	3.30	S	D	QL $
60065	Class room	SPECWAR	3.00	0.25	3.25	S	D	$ U
60074	Ready Service Locker	SPECWAR	3.00	0.25	3.25	B	P	S U
60075	Ready Service Locker	SPECWAR	3.00	0.25	3.25	B	P	S U
60076	Ready Service Locker	SPECWAR	3.00	0.25	3.25	B	P	S U
60077	Ready Service Locker	SPECWAR	3.00	0.25	3.25	B	P	S U
60040	Maintenance/Storage	SPECWAR	3.00	0.10	3.10	S	D	$
60041	Gym	SPECWAR	3.00	0.10	3.10	S	D	$
60073	Range Tower	SPECWAR	2.00	0.25	2.25	S	P	S U
60042	Transient Berthing	SPECWAR	2.00	0.20	2.20	S	P	QL
60066	Enlisted Staff Berthing	SPECWAR	2.00	0.20	2.20	S	P	QL
60067	Berthing Officer Staff	SPECWAR	2.00	0.20	2.20	S	P	QL
60062	Dive Gear Storage	SPECWAR	2.00	0.15	2.15	S	P	U
60079	Target Repair bldg.	SPECWAR	2.00	0.15	2.15	S	P	U
60059	Bulk Storage	SPECWAR	2.00	0.10	2.10	S	P	$
60078	CEOs Storage	SPECWAR	2.00	0.10	2.10	S	P	$
60037	Staff Briefing	SPECWAR	2.00	0.00	2.00	S	P	
60060	Quarterdeck/Admin	SPECWAR	2.00	0.00	2.00	S	P	
60064	Student Berthing	SPECWAR	2.00	0.00	2.00	S	P	
60084	Range Training Bldg.	SPECWAR	2.00	0.00	2.00	S	P	

No.	Sub-System	RAC	Modifier	SS-MDI
1.0	Exterior Closure	5.00	0.40	5.40
9.0	Fire SupPression	4.00	0.40	4.40
5.0	Electrical	4.00	0.25	4.25
8.0	Roof	4.00	0.15	4.15
2.0	Structure	4.00	0.10	4.10
12.0	Exterior Circulation	3.00	0.25	3.25
4.0	Plumbing	3.00	0.00	3.00
7.0	Site	2.00	0.40	2.40
3.0	Interior Construction	2.00	0.10	2.10
6.0	HVAC	2.00	0.00	2.00
11.0	Specialities	1.00	0.00	1.00
10.0	Conveying	0.00	0.00	0.00

MDI Sub-System Prioritization Modifiers BLDG 60143 Fire Station

Exterior closure projects would have the highest priority (I.e. overhead doors) and conveying systems (non-existing system) would have the lowest priority for M&R funding.

MDI Sub-System (MDI-SS) would be incorporated into the MDI algorithm to determine a project's "overall priority". This process is still under development.

MISSION DEPENDENCY INDEX

Concept Development -Questions

Not Owned or Controlled by Interviewee

Q3: What other facilities not under your control or ownership support your mission? If stopped, how long could your personnel and/or equipment continue performing their mission?

- *100% Operational (N)*
- *Brief: Minutes, Hours (B)*
- *Short: Days, Weeks (S)*
- *Prolonged: Months (P)*

MISSION DEPENDENCY INDEX

Concept Development - Questions

Not Owned or Controlled by Interviewee

Q4: If the infrastructure was completely destroyed, or not working, could you continue performing your mission?

- *No, It's impossible (**I**)*
- *Yes, but with great difficulty (D)*
- *Yes, with little or no difficulty (p)*

Table - 2

Q4: Ability to Perform Mission	Q3: InterRuptability of Function			
	None	Briefly	Short	Prolonged
	6	min.-hours	days-weeks	Months
	Impossible	5	4	3
	Difficult	4	3	2
	Possible	3	2	1
		Risk Level		

Mission/Infrastructure RAC	
5	Critical
4	Serious
3	Moderate
2	Minor
1	Negligible

FUNCTION	MISSION/CORE BUSINESS	INTERrUPTABLITY(B) (S) (P)	ABILITY TO PREFORM MISSION (I) (D) (P)	RAC	N0	Ave
Barge Landing	Seaport Support/SPECWAR	S	D	3.00	2	**3.00**
Wilson cove pier	Seaport Support/SPECWAR	S	D	3.00		
Fire Station	PUBLIC SAFETY/SPECWAR	S	D	3.00	3	**3.33**
Security	PUBLIC SAFETY/SPECWAR	S	D	3.00		
Medical Clinic	PUBLIC SAFETY/SPECWAR	B	D	4.00		
Hazmat Storage	Facility Management/SPECWAR	P	I	3.00	10	**3.70**
Carpenter shop	Facility Management/SPECWAR	S	D	3.00		
Diesel fuel	Facility Management/SPECWAR	S	D	3.00		
Gas Depot	Facility Management/SPECWAR	S	D	3.00		
PWC Maintenance	Facility Management/SPECWAR	S	D	3.00		
PWC Transportation	Facility Management/SPECWAR	S	D	3.00		
Water Plant	Facility Management/SPECWAR	B	I	5.00		
Water Storage Tank	Facility Management/SPECWAR	B	I	5.00		
Water Treatment Plant	Facility Management/SPECWAR	B	I	5.00		
Water Treatment Plant	Facility Management/SPECWAR	B	D	4.00		
Fuel Farm	Command Support/SPECWAR	S	I	4.00	5	**3.60**
Magazine	Command Support/SPECWAR	S	I	4.00		
Telephone Switching	Command Support/SPECWAR	B	I	5.00		
Servemart	Command Support/SPECWAR	S	D	3.00		
Ship Store	Command Support/SPECWAR	S	P	2.00		
Airfield	Airfield Support/SPECWAR	S	I	4.00	2	**3.50**
Passenger Terminal	Airfield Support/SPECWAR	B	P	3.00		

MISSION DEPENDENCY INDEX

Algorithm

$$[(100 - CI) \times (MDI + m)] = P$$

CI: Condition Index
100 = Best Condition … 0 = Worst Condition

MDI: Mission Dependency Index (Value)
6 = Highest MDI value … 1 = Lowest value

m: Sum of all appropriate modifiers
$0 \leq 1\ m \leq 0$

P: Priority Number (High number has priority)

MISSION DEPENDENCY INDEX
Algorithm

Example:

CI	MDI	m (sum)	P	Comment
99.99	5	0.500	0.055	Excellent Condition/High MDI
80	5	0.500	110	
60	5	0.500	220	
40	5	0.500	330	
20	5	0.500	440	
1	5	0.500	544.5	Poor Condition/High MDI

$$[(100 - CI) \times (MDI + m)] = P$$

CI	MDI	m (sum)	P	Comment
99.99	1	0.000	0.01	Excellent Condition/Low MDI
80	1	0.000	20	
60	1	0.000	40	
40	1	0.000	60	
20	1	0.000	80	
1	1	0.000	99	Poor Condition and Low MDI

Appendix K

CPF READINESS CONDITION CRITERIA

by

Commander in Chief
United States Pacific Fleet

RPM OVERALL FACILITIES
Readiness Condition Criteria

C1

- FULLY MISSION CAPABLE
- **Major Repairs/Preventive Maintenance/ Emergency Service Optimized**
  - Major Repairs accomplished before system failure
- **"War Fighting" and "Non-War Fighting" Mision Areas Balanced**
  - Near-Term Must Fund/Long Term Investment M&R Demands Balanced
- **Reduce/Hold BMAR to 1% CPV Over 10 Years**
  - Just Enough Cyclic/Preventive Maintenance
  - Breakdown Maintenance Eliminated
- **Adequate Investment Funding**
  - Facilities Optimized to Meet Operational Requirements
  - Strong Life-Cycle Maintenance Program
  - Maximize Technology
  - Outstanding QOL/Work Life
  - Shed Infrastructure/Reduce Future Requirements quickly
- **Lowest Cost to Maintain Long-Term Readiness**

C2

- SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY
- **Major Repairs (Inspection Driven) Performed with Minimal Work-Arounds/Mission Impact**
- **"War Fighting" and "Non-War Fighting" Funding More in Balance**
  - Near-Term Must Fund + War Fighting + Limited Non-War Fighting Mission Areas
- **BMAR (Slow Growth)**
  - Minimize Breakdown Maintenance
- **Marginal Investment Funding**
  - High Return Re-Engineering Initiatives only
  - High Return Life-Cycle Maintenance Initiatives only
  - Critical QOL Enhancements only
  - Limited Consolidation of Functions/Demolition
- **Short-Term and Marginal Long-Term Readiness Achieved**

C3

- MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY
- **Major Repairs Performed Just Prior to Failure (Design/Repair Lag)**
  - Work Arounds Common Place
- **"War Fighting" Mission Areas, Utilities, & Roofs Receive Vast Majority of Funding**
  - "Non-War Fighting" Mission areas deteriorate rapidly
  - Focused on Near-Term Must Fund + War Fighting Mission Areas + Life-Safety
- **BMAR (Rapid Growth)**
  - Breakdown Maintenance Primary Execution Method
  - Temporary Fixes
- **Inadequate Investment Funding**
  - Unable to Consolidate Functions/Eliminate Redundancy/Shed Excess Infrastructure
  - Cannot execute Re-Engineering and Life-Cycle Initiatives
  - No QOL Enhancements
- **Short-Term Readiness Only**
  - Least Short-Term RPM Costs
  - Creates Unaffordable (RPM-OBOS-MCON) Bow-wave

AIR OPERATIONAL FACS
Readiness Condition Criteria

C1

- **AIRPORTS FULLY MISSION CAPABLE**
- Pavement Condition
  - PCI (Pavement Condition Index) >85
  - Load Carrying Capacity Ratio <0.90
  - Surface Friction of Runway i > 0.50
- Air operations restricted/curtailed due to condition of runway, taxiway, arresting gear, and aprons <5% of days/year.
- Air operations restricted/curtails due to runway lighting <5% of days/year.
- Preventive Maintenance/Emergency Service Optimized
  - Routine maint/repair & joint/crack sealing accomplished.
  - Full slab replacement, full depth repair, and partial depth spall repair performed.
  - Minimal work arounds.

C2

- **SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY**
- Pavement Condition
  - PCI (Pavement Condition Index) 71-85
  - Load Carrying Capacity Ratio 0.9-1.1
  - Surface Friction of Runway i = 0.42-0.50
- Air operations restricted/curtailed due to condition of runway, taxiway, arresting gear, and aprons 5-10% of days/year.
- Air operations restricted/curtails due to runway lighting 5-10% of days/year.
- Constrained Preventive Maintenance/Emergency Service
  - Routine maint/repair-joint/crack sealing deferred until first impact realized.
  - Sections of slab replaced and partial depth/spall repair.
  - Repairs range from band-aid/temporary fixes to select major repairs.

C3

- **MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY**
- Pavement Condition
  - PCI (Pavement Condition Index) 56-70
  - Load Carrying Capacity Ratio 1.2-1.3
  - Surface Friction of Runway i = 0.25-0.41
- Air operations restricted/curtailed due to condition of runway, taxiway, arresting gear, and aprons 11-20% of days/year.
- Air operations restricted/curtails due to runway lighting 11-20% of days/year.
- Minimal Preventive Maintenance/ Emergency Service
  - Joint/crack sealing and sub-sealing corrected after mission impact.
  - Slab replacement & spall repairs deferred.
  - Temporary fixes and work arounds common place.

NON-WAR FIGHTING FACILITIES

Readiness Condition Criteria

These criteria provide guidelines for assessing the overall condition rating of Non-War Fighting Facilities. For purposes of assessing the condition of your hangar, use them as a guide. In general, C1 means operations are impacted less than 5% of the time; C2 means operations are impacted 5-10% of the time; C3 means operations are impacted 11-20% of the time; and C4 means operations are impacted greater than 20% of the time.

C1

- **FACILITIES ARE FULLY MISSION CAPABLE**

- Roof replacement based on inspection system and prior to leaks.
  - Roof drains cleaned out prior to build-up.
- Facilities painted on cyclical basis prior to structural deterioration.
- Alterations funded when dictated by mission (i.e., electric outlets, new doors, security reqmt's, walls moved, etc.).
- Life/Safety deficiencies corrected immediately (e.g., fire sprinklers/alarms, etc.).
  - Full support of Americans with Disabilities Act (ADA) code requirements.

C2

- **FACILITIES SUBSTANTIALLY MEET MISSION DEMANDS WITH MINOR DIFFICULTY**

- Roof replacement when deterioration is readily apparent but prior to leaks.
  - Clean drains when built-up with debris.
- Only the most mission critical alterations funded. Deferred projects impact mission and result in work arounds.
- Life/Safety deficiencies corrections delayed by funding, employees adversely impacted.
  - Unable to fully support Americans with Disabilities Act (ADA) requirements.

C3

- **FACILITIES MARGINALLY MEET MISSION DEMANDS WITH MAJOR DIFFICULTY**

- Roof leaks experienced. Temporary fixes followed by replacement.
  - Results in roof structural damage and additional maintenance costs
- Essentially no alterations/minor construction funded.
  - Mission adversely impacted.
- Life/Safety deficiencies exist. Employees' welfare and safety at risk.
  - Correction of Americans with Disabilities Act (ADA) code deficiencies deferred. Employees' productivity, efficiencies, effectiveness adversely impacted.
  - 11-20% of training days lost due to facility condition.

Enclosure (4)

SEAPORT OPERATNL FACS
Readiness Condition Criteria

C1

- **PORT OPERATIONS FULLY MISSION CAPABLE.**
- Waterfront Fully Operational
  - <5% increase in evolution time for loading/off-loading/maintenance due to reduced capacity of pier/wharf.
  - Cold iron support, weapons system testing, and degausing/deperming operations impacted <5% of ship berthing days.
- Maintenance Dredging performed per cyclic schedule to ensure unhindered operations.
  - Depth at berth causes no risk of fouling or non-availability of berths to designated ships due to shoaling or accumulated sediment.
- Structural, Safety, and Environmental Hazards corrected with no impact to mission.

C2

- **PORT OPERATIONS SUBSTANTIALLY MEET MISSION DEMANDS WITH MINOR DIFFICULTY**
- Waterfront Substantially Operational
  - 5-10% increase in evolution time for loading/off-loading/maintenance due to reduced capacity of pier/wharf.
  - Cold iron support, weapons system testing, and degausing/deperming operations impacted 5-10% of ship berthing days.
- Maintenance Dredging is inspection driven and funded when requirement is identified.
  - Operations are hindered due to maintenance dredging.
  - Depth at berth is 1-2 feet less than designed depth which causes some risk of fouling or non-availability of berths to designated ships due to shoaling or accumulated sediment.
  - Structural, Safety, and Environmental Hazards funded with some impact to mission.

C3

- **PORT OPERATIONS MARGINALLY MEET MISSION DEMANDS WITH MAJOR DIFFICULTY**
- Waterfront Marginally Operational
  - 11-20% increase in evolution time for loading/off-loading/maintenance due to reduced capacity of pier/wharf.
  - Cold iron support, weapons system testing, and degausing/deperming operations impacted 11-20% of ship berthing days.
- Just-in-Time Maintenance Dredging
  - Operations hindered by work arounds.
  - Depth at berth is 3-4 feet less than designed depth which causes risk of fouling or non-availability of berths to designated ships due to shoaling or accumulated sediment.
  - Structural, Safety, and Environmental Hazards pose serious risk and impact to mission.

INDUSTRIAL MAINT FACS
Readiness Condition Criteria

C1	C2	C3
• FULLY MISSION CAPABLE	• SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY	• MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY
• Organizational/intermediate/depot level maintenance impeded by facility condition <5% of days/year.	• Organizational/intermediate/depot level maintenance impeded by facility condition 5-10% of days/year.	• Organizational/intermediate/depot level maintenance impeded by facility condition 11-20% of days/year.
• <5% of the reduced capacity to perform depot-level maintenance in Airframes, Engines, Components, Avionics, GSE, or Composites caused by facility condition.	• 5-10% of the reduced capacity to perform depot-level maintenance in Airframes, Engines, Components, Avionics, GSE, or Composites caused by facility condition.	• 11-20% of the reduced capacity to perform depot-level maintenance in Airframes, Engines, Components, Avionics, GSE, or Composites caused by facility condition.
• <5% of time reduced capability to perform intermediate maintenance in any one of the major ship repair categories (hull, machinery, electrical, electronics, combat systems, weapons) caused by facility condition.	• 5-10% of time reduced capability to perform intermediate maintenance in any one of the major ship repair categories (hull, machinery, electrical, electronics, combat systems, weapons) caused by facility condition.	• 11-20% of time reduced capability to perform intermediate maintenance in any one of the major ship repair categories (hull, machinery, electrical, electronics, combat systems, weapons) caused by facility condition.
• <5% of time that maintenance/repair completion dates were delayed was due to facility condition.	• 5-10% of time that maintenance/repair completion dates were delayed was due to facility condition.	• 11-20% of time that maintenance/repair completion dates were delayed was due to facility condition.

LOGISTICS STORAGE FACS
Readiness Condition Criteria

C1

- **FULLY MISSION CAPABLE**

- <5% reduction of capacity to receive/store POL or distribution restricted due to facility condition
- <5% reduction of Ammunition Basic Stock Level Allowance (ABSLA) capacity to store ordnance due to facility condition
- <5% of supply levels unable to be maintained under prescribed storage procedures due to facility condition.
- <1% of annual inventory damaged due to facility condition (i.e., loads dropped from forklift traveling over deteriorated pavement/floors, rain damage from leaky roofs, IDS inoperable).
- 1 or less downtime incidences per year for cold storage due to facility condition (i.e., refrigeration equipment down).
- <1% of average inventory of hazardous flammable material damaged due to facility condition.

C2

- **SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY**

- 5-10% reduction of capacity to receive/store POL or distribution restricted due to facility condition
- 5-10% reduction of ABSLA capacity to store ordnance due to facility condition
- 5-10% of supply levels unable to be maintained under prescribed storage procedures due to facility condition.
- 1-5% of annual inventory damaged due to facility condition (i.e., loads dropped from forklift traveling over deteriorated pavement/floors, rain damage from leaky roofs, IDS inoperable).
- 2-3 downtime incidences per year for cold storage due to facility condition (i.e., refrigeration equipment down).
- 1-5% of average inventory of hazardous flammable material damaged due to facility condition.

C3

- **MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY**

- 11-20% reduction of capacity to receive/store POL or distribution restricted due to facility condition
- 11-20% reduction of ABSLA capacity to store ordnance due to facility condition
- 11-15% of supply levels unable to be maintained under prescribed storage procedures due to facility condition.
- 6-10% of annual inventory damaged due to facility condition (i.e., loads dropped from forklift traveling over deteriorated pavement/floors, rain damage from leaky roofs, IDS inoperable).
- 4-5 downtime incidences per year for cold storage due to facility condition (i.e., refrigeration equipment down).
- 6-10% of average inventory of hazardous flammable material damaged due to facility condition.

RDT&E FACILITIES
Readiness Condition Criteria

C1

- FULLY MISSION CAPABLE

- <5% of research and development activities impeded due to facility condition.
- <5% of experimentation and testing delayed, postponed, rescheduled or otherwise impeded due to facility condition.

C2

- SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY

- 5-10% of research and development activities impeded due to facility condition.
- 5-10% of experimentation and testing delayed, postponed, rescheduled or otherwise impeded due to facility condition.

C3

- MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY

- 11-20% of research and development activities impeded due to facility condition.
- 11-20% of experimentation and testing delayed, postponed, rescheduled or otherwise impeded due to facility condition.

TRAINING FACILITIES
Readiness Condition Criteria

C1

- **FULLY MISSION CAPABLE**

- <5% of classroom or unit training mandays lost or degraded due to facility condition.
- <5% of simulator sorties/operations adversely affected by facility condition.
- <5% of time training rescheduled to other facilities due to condition of facility (i.e., roof leaks jeopardize equipment, HVAC system down, etc.).
- <5% of student complaints/comments address classroom facility condition.

C2

- **SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY**

- 5-10% of classroom or unit training mandays lost or degraded due to facility condition.
- 5-10% of simulator sorties/operations adversely affected by facility condition.
- 5-10% of time training rescheduled to other facilities due to condition of facility (i.e., roof leaks jeopardize equipment, HVAC system down, etc.).
- 5-10% of student complaints/comments address classroom facility condition.

C3

- **MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY**

- 11-20% of classroom or unit training mandays lost or degraded due to facility condition.
- 11-20% of simulator sorties/operations adversely affected by facility condition.
- 11-20% of time training rescheduled to other facilities due to condition of facility (i.e., roof leaks jeopardize equipment, HVAC system down, etc.).
- 11-20% of student complaints/comments address classroom facility condition.

COMMUNICATIONS FACS
Readiness Condition Criteria

C1	C2	C3
• FULLY MISSION CAPABLE	• SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY	• MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY
• <5% of increased costs to communications equipment incurred due to facility condition (i.e., leaky roofs, power surges, HVAC breakdowns, etc.).	• 5-10% of increased costs to communications equipment incurred due to facility condition (i.e., leaky roofs, power surges, HVAC breakdowns, etc.).	• 11-20% of increased costs to communications equipment incurred due to facility condition (i.e., leaky roofs, power surges, HVAC breakdowns, etc.).
• <5% of voice/data communications degraded due to facility condition.	• 5-10% of voice/data communications degraded due to facility condition.	• 11-20% of voice/data communications degraded due to facility condition.

BACHELOR HSG FACS
Readiness Condition Criteria

C1

- FULLY MISSION CAPABLE
- <5% of current bachelor housing requirement (stationed and transient personnel) not met in adequate facilities due to condition of BQ facilities.
- <5% of inventory does not meet current 1+1 criteria due to non-conformance with safety or building codes.

C2

- SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY
- 5-10% of current bachelor housing requirement (stationed and transient personnel) not met in adequate facilities due to condition of BQ facilities.
- 5-10% of inventory does not meet current 1+1 criteria due to non-conformance with safety or building codes.

C3

- MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY
- 11-20% of current bachelor housing requirement (stationed and transient personnel) not met in adequate facilities due to condition of BQ facilities.
- 11-20% of inventory does not meet current 1+1 criteria due to non-conformance with safety or building codes.

SUPPORT FACILITIES
Readiness Condition Criteria

C1

- **FULLY MISSION CAPABLE**

- <5% of time required recreational services unavailable due to facility condition (i.e., bowling alleys, courts, fields, etc.).
- <5% of time other personal services (e.g., family service, religious, laundry, library) and administrative services unavailable due to facility condition.
- <5% of events require rescheduling or relocation due to non-availability of facility due to condition.
- No complaints addressing facility condition.

C2

- **SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY**

- 5-10% of time required recreational services unavailable due to facility condition (i.e., bowling alleys, courts, fields, etc.).
- 5-10% of time other personal services (e.g., family service, religious, laundry, library) and administrative services unavailable due to facility condition.
- 5-10% of events require rescheduling or relocation due to non-availability of facility due to condition.
- 0-10% of complaints address facility condition.

C3

- **MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY**

- 11-20% of time required recreational services unavailable due to facility condition (i.e., bowling alleys, courts, fields, etc.).
- 11-20% of time other personal services (e.g., family service, religious, laundry, library) and administrative services unavailable due to facility condition.
- 11-20% of events require rescheduling or relocation due to non-availability of facility due to condition.
- 11-20% of complaints address facility condition.

UTILITIES
Readiness Condition Criteria

C1

- **FULLY MISSION CAPABLE**
- Utility Supply and Distribution Facilities meet requirements with high reliability. Redundant capability for mission essential facilities.
- Activity missions impeded or jeopardized <5% of time due to utility distribution system.
  - Cold iron support provided.
  - 100% reliability. Power outages only when scheduled.
  - Perform annual system tests and repair defects prior to impact.
- Preventive Maintenance programs ensure utilities services are not degraded due to structural, safety, or environmental hazards.
- Investment in new technology: Short (1-3 yrs), Medium (4-5 yrs), and Long-Range (6-10 yrs) energy savings projects.
- Systems properly looped for redundancy.
- Regulatory violations unlikely.

C2

- **SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY**
- Utility Systems Capable of meeting most facilities requirements.
- Activity missions impeded or jeopardized 5-10% of time due to condition of utility distribution system.
  - Cold iron support occasionally impacted.
  - Power outages infrequent. Water/steam systems leak infrequently.
- Some risk that future utilities services will be degraded due to documented structural, safety, or environmental hazards.
- Investment limited to High (1-3 yrs) and Medium payback (4-5 yrs) energy savings projects.
- Possible regulatory violations.

C3

- **MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY**
- Utility Systems minimally meet capacity requirements with reduced reliability.
- Activity missions impeded or jeopardized 11-20% of time due to condition of utility distribution facilities .
  - Limited cold iron support.
  - Occasional brown-outs jeopardize/limit air ops. Periodic steam/water leaks, water breaks, pressure low and disrupts critical ops and fire fighting capability. HVAC systems experience outages/failure impacting operations and employees. Power surges damage test/calibration equipment. Generators required to ensure power to vital areas. Sewage system leaks pose potential health risk and environmental fines.
  - Risk that future utilities services will be degraded due to documented structural, safety, or environmental hazards.
- Investment in projects with payback less than one year only.
- Probable regulatory violations.

ROADS & GROUNDS
Readiness Condition Criteria

C1

- **FULLY MISSION CAPABLE**

- <5% increase in maintenance of base vehicles due to condition of roads.
- PCI (Pavement Condition Index) > 70

Following are proposed indicators that need to be reviewed by the cognizant NAVFAC expert.

- Bridge Structural Adequacy and Safety Rating > 50 (55 max).
- Railroad trackage assigned full certification level iaw NAVFACINST 11230.1D (no restricted or non-certified trackage).

C2

- **SUBSTANTIALLY MEETS MISSION DEMANDS WITH MINOR DIFFICULTY**

- 5-10% increase in maintenance of base vehicles due to condition of roads
- PCI (Pavement Condition Index) 56-70

Following are proposed indicators that need to be reviewed by the cognizant NAVFAC expert.

- Bridge Structural Adequacy and Safety Rating of 46-50.
- Railroad trackage assigned certification level of 75% full certification and 25% restricted certification iaw NAVFACINST 11230.1D (no non-certified trackage).

C3

- **MARGINALLY MEETS MISSION DEMANDS WITH MAJOR DIFFICULTY**

- 11-20% increase in maintenance of base vehicles due to condition of roads
- PCI (Pavement Condition Index) 41-55

Following are proposed indicators that need to be reviewed by the cognizant NAVFAC expert.

- Bridge Structural Adequacy and Safety Rating of 41-45.
- Railroad trackage assigned certification level of 25% full certification and 75% restricted certification iaw NAVFACINST 11230.1D (no non-certified trackage).

NON-WAR FIGHTING FACS
Readiness Condition Criteria

C1

- FACILITIES ARE FULLY MISSION CAPABLE

- Roof replacement based on inspection system and prior to leaks.
  - Roof drains cleaned out prior to build-up.
- Facilities painted on cyclical basis prior to structural deterioration.
- Alterations funded when dictated by mission (i.e., electric outlets, new doors, security reqmt's, walls moved, etc.).
- Life/Safety deficiencies corrected immediately (e.g., fire sprinklers/alarms, etc.).
  - Full support of Americans with Disabilities Act (ADA) code requirements.
- <5% of training days lost due to facility condition.
- <5% reduction of capacity to receive/store POL or distribution restricted due to facility condition.
- <5% reduction of ABSLA capacity to store ordnance due to facility condition.
- <5% increase in maintenance of base vehicles due to condition of roads.

C2

- FACILITIES SUBSTANTIALLY MEET MISSION DEMANDS WITH MINOR DIFFICULTY

- Roof replacement when deterioration is readily apparent but prior to leaks.
  - Clean drains when built-up with debris.
- Only the most mission critical alterations funded. Deferred projects impact mission and result in work arounds.
- Life/Safety deficiencies corrections delayed by funding, employees adversely impacted.
  - Unable to fully support Americans with Disabilities Act (ADA) requirements.
- 5-10% of training days lost due to facility condition.
- 5-10% reduction of capacity to receive/store POL or distribution restricted due to facility condition.
- 5-10% reduction of ABSLA capacity to store ordnance due to facility condition.
- 5-10% increase in maintenance of base vehicles due to condition of roads.

C3

- FACILITIES MARGINALLY MEET MISSION DEMANDS WITH MAJOR DIFFICULTY

- Roof leaks experienced. Temporary fixes followed by replacement.
  - Results in roof structural damage and additional maintenance costs
- Essentially no alterations/minor construction funded.
  - Mission adversely impacted.
- Life/Safety deficiencies exist. Employees' welfare and safety at risk.
  - Correction of Americans with Disabilities Act (ADA) code deficiencies deferred. Employees' productivity, efficiencies, effectiveness adversely impacted.
  - 11-20% of training days lost due to facility condition.
- 11-20% reduction of capacity to receive/store POL or distribution restricted due to facility condition.
- 11-20% reduction of ABSLA capacity to store ordnance due to facility condition.
- 11-20% increase in maintenance of base vehicles due to condition of roads.

Appendix L

RISK ASSESSMENT CODE (RAC) MATRICES FOR CLASSYING FACILITY DEFICIENCIES

ENVIRONMENTAL Matrix for Classifying Deficiencies

Environmental Impact

<u>Examples (Category I Mishap Probability A):</u>
1. Deteriorated sprayed-on Asbestos inside a facility
2. Deteriorating Chlorine gas cylinders/systems servicing a swimming pool or refrigeration plant
3. Surface fuel spill greater than 25 gallons.

<u>Examples (Category II Mishap Probability A):</u>
1. Peeling interior lead paint.
2. Friable asbestos
3. Fuel spill less than 25 gallons

<u>Examples I(Category III Mishap Probability A):</u>
1. Leaking Drain, Waste and Vent piping system
2. Improperly vented sewage return

Deficiency Severity	Mishap Probability	A **Subcategory A** System is in a state of failure	B **Subcategory B** Failure is predicted within a year after the inspection	C **Subcategory C** Failure is likely to occur before next scheduled inspection (3yrs)	D **Subcategory D** System is near the end of its "Life Cycle". Failure may occur prior to next scheduled inspection
Category I-Catastrophic The deficiency will cause immediate toxic pollution or result in a violation of statutory or regulatory requirements	I	1	1	3	4
Category II-Critical The deficiency may cause major property damage or result in severe local environmental degradation	II	1	2	3	4
Category III-Marginal May cause minor property damage and result in minor local environmental degradation	III	2	3	4	5
Category IV-Negligible Probably would not affect any environmental aspect, but is nevertheless, in violation of a BOCA, ASN (I&E), CNO or Claimant goals	IV	3	4	5	5

E1-CRITICAL
E2-SERIOUS

Critical

Deferrable

E3-MODERATE
E4-MINOR
E5-NEGLIGIBLE

MISSION Matrix for Classifying Deficiencies

Facility Operations Impact

Examples I(Category I Failure Probability A):

1. Roof severely damaged and leaking over 50% of its surface
2. Electrical Main distribution panel with overloaded circuits, major violations of the National Electrical Code and Infra-red survey and load readings project an overloaded and overheating condition

Examples (Category II Failure Probability A):

1. Roof is leaking on one section less than 50% of its total area
2. One of three packaged Glycol HVAC systems used for equipment cooling is inoperative

Examples (Category III Failure Probability A):

1. One of several circulating pumps used for equipment cooling chilled water distribution system has failed

Deficiency Severity	Failure Probability	**Subcategory A** System is in a state of failure	**Subcategory B** Failure is predicted within a year after the inspection	**Subcategory C** Failure is likely to occur before next scheduled inspection (3yrs)	**Subcategory D** System is near the end of its "Life Cycle". Failure may occur prior to next scheduled inspection
		A	B	C	D
Category I-Catastrophic The deficiency will result in the loss of 50% or more of the facility operations	I	1	1	3	4
Category II-Critical The deficiency will result in partial loss of facility operations (<50%)	II	1	2	3	4
Category III-Marginal Will cause continued deterioration and property damage	III	2	3	4	5
Category IV-Negligible Probably will not affect any mission aspect, but is nevertheless, in violation of a BOCA, NEC, or other National Standards	IV	3	4	5	5

M1-CRITICAL
M2-SERIOUS

Critical

Deferrable

M3-MODERATE
M4-MINOR
M5-NEGLIGIBLE

QUALITY OF LIFE Matrix for Classifying Deficiencies

Quality of Life Impact

<u>Examples (Category I Failure Probability A):</u>

1. The HVAC system servicing a facility in ICN 15/16 has failed, or the condition of the equipment is in such a deteriorated state that failure is predicted within 12 months

<u>Examples (Category II Failure Probability A):</u>

1. The steam piping system servicing a messing facility is deteriorated and leaking resulting in the loss of operation of the steam cooking kettles
2. Deteriorated windows and exterior surfaces are damaged to the extent that moisture infiltration, to interior surfaces is causing mold, peeling paint etc, in several areas of a BQ or workplace

<u>Examples (Category III Failure Probability A):</u>

1. A HVAC fan coil unit servicing a single room in a BQ is inoperative.

	Failure Probability	**Subcategory A** System is in a state of failure	**Subcategory B** Failure is predicted within a year after the inspection	**Subcategory C** Failure is likely to occur before next scheduled inspection (3yrs)	**Subcategory D** System is near the end of its "Life Cycle". Failure may occur prior to next scheduled inspection
Deficiency Severity		**A**	**B**	**C**	**D**
Category I-Catastrophic The deficiency will result in the loss of facility operations and/or result in severe degradation of habitability of IC15 or IC16	I	1	1	3	4
Category II-Critical The deficiency will result in partial loss of facility or in significant degradation of habitability of IC15 or IC16. Additionally, the deficiency represents a severe degradation of habitablity in the workspace	II	1	2	3	4
Category III-Marginal Will cause continued deterioration and property damage or results in minor degradation of habitability	III	2	3	4	5
Category IV-Negligible Appearance Only: does not adversely affect habitability of living/working spaces	IV	3	4	5	5

Q1-CRITICAL
Q2-SERIOUS

Critical

Deferrable

Q3-MODERATE
Q4-MINOR
Q5-NEGLIGIBLE

SAFETY Matrix for Classifying Deficiencies

Hazard Severity

Examples (Category I Mishap Probability A):

1. The fire protection sprinkler heads are painted over throughout the facility
2. The fire escape is severely rusted and deteriorated depicting loss of structural integrity and metal fatigue

Examples (Category II Mishap Probability A):

1. The stair treads servicing a facility are damaged or loose presenting the possibility of a trip hazard.
2. The vent stack servicing a boiler is improperly sized or vented, presenting the possibility of carbon monoxide build up within a facility

Examples (Category III Mishap Probability A):

1. The floor covering in a workspace or BQ is deteriorated, torn or loose and buckled presenting the possibility of a trip hazard

	Mishap Probability	Subcategory A Likely to occur immediately	Subcategory B Probably will occur in te next 12 months	Subcategory C May occur before the next inspection time (3yrs)	Subcategory D Unlikely to occur
Deficiency Severity		A	B	C	D
Category I-Catastrophic The hazard or deficiency may cause death or loss of facility	I	1	1	2	3
Category II-Critical The deficiency may cause minor injury, severe occupational illness, or major property damage	II	1	2	3	4
Category III-Marginal May cause minor injury, minor occupational illness, or minor property damage	III	2	3	4	5
Category IV-Negligible Probably will not affect personal safety of health, but is nevertheless in violation of a NAVOSH Standard	IV	3	4	5	5

S1-CRITICAL
S2-SERIOUS
S3-MODERATE

Critical

Deferrable

S4-MINOR
S5-NEGLIGIBLE