



**DEFENCE CONSTRUCTION  
CANADA**

**Inspection Report for:**  
**D Jetty Fender System**  
**CFB Esquimalt**

**96272**  
**October 1996**



***Westmar Consultants Inc.***



# Westmar Consultants Inc.

Maritime, Structural, Civil & Materials Handling Engineers

Rec'd  
4 Nov 96

October 31, 1996

Department of National Defence  
Base Construction Engineering Office  
CFB Esquimalt  
FMO Victoria, BC  
V0S 1B0

Project No. 96272

Attention: Ross Gibbs, P.Eng.

Reference: Inspection Report for D Jetty Fender System

Dear Sir:

With reference to the above, please find enclosed one (1) copy of the D Jetty Fender System Inspection Report.

We trust the report meets your approval. Please do not hesitate to contact us if you have any questions regarding our inspection findings, or if you require assistance in implementing the recommended repair program.

Yours truly,

**WESTMAR CONSULTANTS INC.**

Alden J. Evans, P.Eng.  
Project Engineer

AJE/mr  
Encl.

# DEFENCE CONSTRUCTION CANADA

Inspection Report for:

D Jetty Fender System - CFB Esquimalt

96272  
October 1996

Prepared by: Alden J. Evans, P.Eng.

Approved by: Peter Acton, P.Eng.



**DEFENCE CONSTRUCTION CANADA**  
**D Jetty Fender Pile Inspection**

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- Timber Chocks 152 mm x 355 mm; and,
- Rubber Fenders 254 mm x 254 mm.

### **3 Inspection Results**

The detailed inspection observations and related reference material are presented in the Appendices as described below:

- *Appendix A* presents site photographs;
- *Appendix B* presents the inspection notes; and,
- *Appendix B* presents the reference drawing.

The results are based on visual above and underwater observations of each member.

The general condition of the various elements of the fender system are described below. Tables itemizing members with damage and/or deterioration, and the recommended repair options are referenced in and follow, the general descriptions.

#### **3.1 Fender System**

##### **3.1.1 Fender Logs**

The fender logs are generally in good condition. The fender log spanning between Bents 47A and 55A is missing.

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### 3.1.2 Rubbing Poles

The rubbing piles are generally in good condition. Specific piles requiring remedial work are presented in *Table 3.1.2*:

**TABLE 3.1.2: Damage to Rubbing Piles**

Bent	Observation	Recommendation
1A	Pile is missing.	Replace pile
5A	Lower connection bolt is missing.	Install lower connection bolts.
9A	Top 1.2 m of pile is crushed.	Replace pile
19A	Lower connection bolts are missing and pile is loose (Photograph No.1).	Replace upper and lower connection bolts.
25A	10% marine borer cavity (MBC) at lower bolt connection; bolt is missing and pile is loose.	Plug existing bolt holes and install replacement lower connection bolts at different elevation.
39A	25% MBC at lower bolt connection; pile is loose.	Remove existing bolts and plug hole; install replacement bolts at different elevation.
43A	Lower connection bolt is missing, and pile is loose causing abrasion damage in the intertidal zone.	Install lower connection bolts.
A	Rubbing Pole No.5 has 50% cross-section loss (CSL) at lower bolt connection; bolt is missing and pile is loose.	Replace pile
B	One bolt is loose due to an elongated bolt hole, and the other bolt is missing at lower connection.	Install new connection bolts at different elevation.
D	50% CSL in intertidal zone due to abrasion (Photograph No.2).	Replace pile

13A  
Replace  
HAT.  
is it easy to  
replace?

plug or wrap old connection

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Bent	Observation	Recommendation
F	20% CSL in intertidal zone due to abrasion. Pile is loose at bottom due to elongated lower connection bolt hole.	Install new lower connection bolts at different elevation. <i>easy to install new fendering pile?</i>
2	Lower connection is loose.	Install new lower connection bolts. <i>plus wrap old connection</i>
5	50% MBC at lower bolt connection; bolt is loose. 25% CSL in intertidal zone due to abrasion.	Replace pile
7	Lower bolt connections are loose. 30% CSL in intertidal zone due to abrasion.	Replace pile
8	15% CSL in intertidal zone due to abrasion. Pile is loose at bottom due to elongated lower connection bolt holes, and a missing bolt.	Install new lower connection bolts at different elevation.
17	Lower connection bolt is loose.	Replace lower connection bolts.
31	Lower connection bolt is loose.	Replace lower connection bolts.
32	Only one lower connection bolt exists, and it is loose.	Install additional cross-bolt.



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**3.1.3 Fender Piles**

The fender piles, and connections, are generally in good condition. Specific areas requiring remedial action are presented in *Table 3.1.3*:

**TABLE 3.1.3: Damage to Timber Fender Piles**

Bent	File No.	Observation	Recommendation
1A	1	75% MBC in 1.8m of water; top of pile is crushed.	Replace pile
	2	Vertical fracture at top bolted connection front and back of pile.	Replace pile
18A	-	Fender pile cluster attached to jetty at one location only, with excessive movement.	Install additional eyebolts and restraint chains.
19A	1	100% MBC in 1.8m of water.	Replace pile
	2	100% MBC in 1.8m of water.	Replace pile
A	-	Connection/restraint chain between concrete pilecap and timber fender piles is loose; 4-pile cluster at corner does not appear to be connected to the jetty (Photograph No.3)	Tighten up restraint chain Install additional eyebolts and restraint chains.
B	-	Connection/shear chain between concrete pilecap and timber fender piles is broken.	Replace restraint chain
	2	Bolt hole is elongated at lower connection.	New bolts to be installed recommended in <i>Table 3.1.2</i>
17	2	OBH 300mm above mudline.	Install treated dowell
36	2	Pile stops short of mudline by 450mm.	Replace pile

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**3.1.4 Top Rubbing Strip**

The top rubbing strip is generally in good condition. The rubbing strips spanning between Bents 39A and 41A is fractured, and between Bents 11 and 14 is split. Replacement is recommended at both locations.

**3.1.5 Timber Chocks**

The timber chocks are in good condition.

**3.1.6 Fender Wale**

The fender wale is in good condition.

**3.1.7 Rubber Fenders**

The rubber fenders are in good condition. The eye-bolt at Bent 30 has sheared off and will require replacement.

**4 Residual Life Estimates**

An estimate of the residual life of each structural element is an essential part of the long term planning and maintenance process. The estimates presented below are based on the following assumptions:

- where creosote or salt-treated timber has been examined for the presence of decay and is found to be sound, an estimated life in excess of 8 to 10 years is deemed appropriate;
- where some evidence of decay has been found, but very limited in extent, the element can be assumed to have a residual life in the order of 3 to 7 years; and,

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- where an element has a weakened cross-section due to decay, the residual life should be taken as negligible, and the element should be considered unreliable for structural loads.

It is important to note that these are approximate estimates. Fungal decay (rot) and marine borer attack will spread quickly once established in the structure and where conditions are favourable.

**D Jetty Fender System:**

• Fender Logs	8 to 10 years
• Rubbing Piles	3 to 7 years, except as noted
• Fender Piles	3 to 7 years, except as noted
• Timber Chocks	8 to 10 years
• Top Rubbing Strip	8 to 10 years, except as noted
• Rubber Fenders	8 to 10 years

## **5 Recommendations**

The fender system at D Jetty is generally in good condition. The scope of repair work and associated costs are presented below:

**Mobilization:**

1.	Mobilization/demobilization	1996/1997	\$5,000
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**Fender System Repairs:**

1.	Replace one fender log	1996/1997	\$1,000
2.	Replace six rubbing poles	1996/1997	\$3,000
3.	Replace five fender piles	1996/1997	\$15,000

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4.	Re-bolt fender piles at 13 locations and plug open bolt holes	1996/1997	\$3,500
5.	Replace two top rubbing strips	1996/1997	\$1,500
6.	Replace one damaged eyebolt	1996/1997	\$500
7.	Miscellaneous connection repairs/maintenance	1996/1997	\$2,000
<b>Total Without Mobilization</b>			<b>\$26,500</b>

The estimated cost for engineering services and field supervision is in the order of \$1,500.

In reviewing the estimated costs, it is important to note the following:

- the estimate is based on in-house experience with similar projects and on budget price quotations from local contractors and suppliers;
- the estimate is based on mid-1996 cost levels and does not allow for escalation;
- the estimates do not include GST (if applicable);
- the estimate is based on the repair work being completed in conjunction with other pile driving activity in Esquimalt Harbour; and,
- it is recommended that a contingency allowance of 25% of the total estimated cost is included to cover undefined items. This contingency is not a reflection of the accuracy of the estimate, but covers items of work that will have to be performed, and elements of cost that will be incurred, but which are not explicitly detailed or described due to the level of engineering and estimating that has been completed to date. The total estimated amount is considered accurate to be a nominal Class C level, i.e.  $\pm 25\%$  accuracy.

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**APPENDIX A**

**Inspection Photographs**

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**APPENDIX A**



**Photograph No. 1:** Bent 19A, Rubbing Pole - Lower connection bolts are missing and Pile is loose.



**Photograph No. 2:** Bent D, Rubbing Pole - 50% CSL in intertidal zone due to abrasion.



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**APPENDIX A**



**Photograph No. 3:** Four Pile Cluster - Piles do not appear to be connected to the jetty.

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**APPENDIX B**

**Field Notes**



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**APPENDIX B****General Inspection Notes**

Bent	Pile No.	Observation
1A	1	75% MBC in 1.8 m of water. Top of Pile is crushed, has no hat, and appears rotten.
	2	Vertical fracture at top bolted connection, both front and back. Pile has no hat.
	3	Pile is missing.
5A	3	Lower connection bolt is missing.
7A	3	10% CSL in the intertidal zone due to abrasion. - MONITOR
9A	3	Top 1.2 m of Pile is crushed.
13A	3	75% of hat is missing.
15A	3	15% CSL in the intertidal zone due to abrasion.
18A	-	Connection of fender Pile group to Jetty is loose.
19A	1	100% MBC in 1.8 m of water.
	2	100% MBC in 1.8 m of water.
	3	Lower connection bolt is missing and Pile is loose.
	4	10% CSL due to abrasion from camel log.
	7	Top of Pile is rotten. ? quantify recommended.
25A	1	10% CSL due to abrasion from loose fender Pile 3.
	3	10% MBC at lower bolt connection; bolt is missing and Pile is loose.
33A	1	10% CSL on bottom 1.2 m due to abrasion from camel log.
39A	3	25% MBC at lower bolt connection. Pile is loose.
39A - 41A	-	Top rubbing strip is broken.
43A	3	Lower connection bolt is missing, and Pile is loose causing CSL in intertidal zone due to abrasion.
47A	3	25% CSL in intertidal zone due to abrasion.

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**APPENDIX B**

Bent	Pile No.	Observation
47A - 55A	-	Fender log is missing.
A	-	Chain connection between concrete pilecap and timber fender Piles is too loose.
	-	4 Pile cluster on corner, adjacent to Bent A, does not appear to be connected to the jetty.
	5	50% CSL at lower bolt connection; bolt is missing and Pile is loose. 50% of hat is missing.
B	-	Chain connection between concrete pilecap and timber fender Piles is broken.
	2	Bolt hole is elongated at lower connection.
	3	One bolt is loose due to an elongated bolt hole and the other bolt is missing, at the lower connection.
D	3	50% CSL in intertidal zone due to abrasion.
F	3	20% CSL in intertidal zone due to abrasion. Pile is loose at bottom due to elongated lower connection bolt hole.
2	3	Lower connection is loose.
4	3	10% CSL in intertidal zone due to abrasion.
5	3	50% MBC at lower bolt connection; bolt is loose. 25% CSL in intertidal zone due to abrasion.
7	3	Lower bolt connections are loose. 30% CSL in intertidal zone due to abrasion.
8	3	15% CSL in intertidal zone due to abrasion. Pile is loose at bottom due to elongated lower connection bolt holes, and a missing bolt.
11 - 14	-	Top rubbing strip is split.
16	3	15% CSL in intertidal zone due to abrasion. Minor borer activity near mudline.
17	2	OBH 300 mm above mudline.
	3	Lower connection bolt is loose.

*done #3 extend to mudline?*

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**D Jetty Fender Pile Inspection****APPENDIX B**

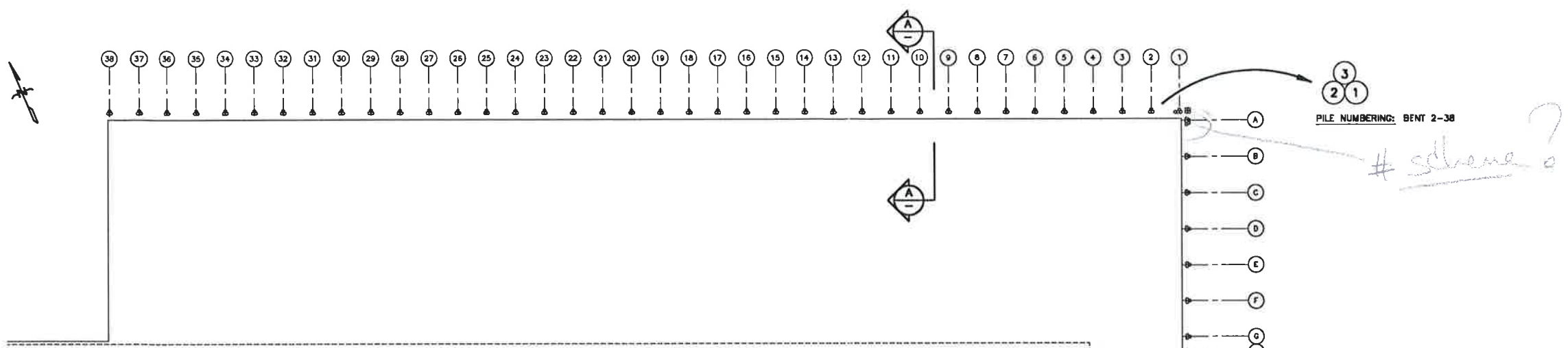
Bent	Pile No.	Observation
28	3	15% CSL in intertidal zone due to abrasion.
29	3	15% CSL in intertidal zone due to abrasion.
30	-	Eye-bolt has sheared from concrete pile cap, and therefore chain is no longer attached.
31	3	Lower connection bolt is loose.
32	3	Only one lower connection bolt, and it is loose.
36	2	Pile stops short of mudline by 450 mm.

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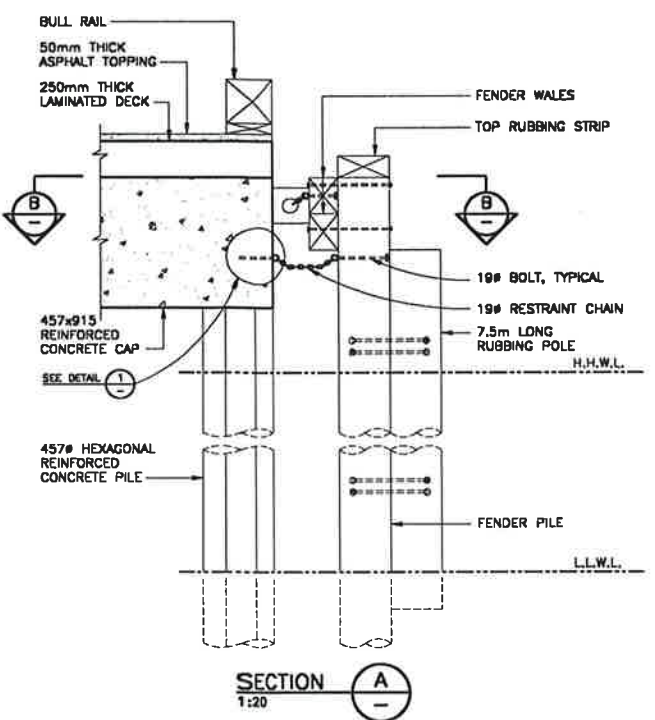
**APPENDIX C**

Reference Drawing

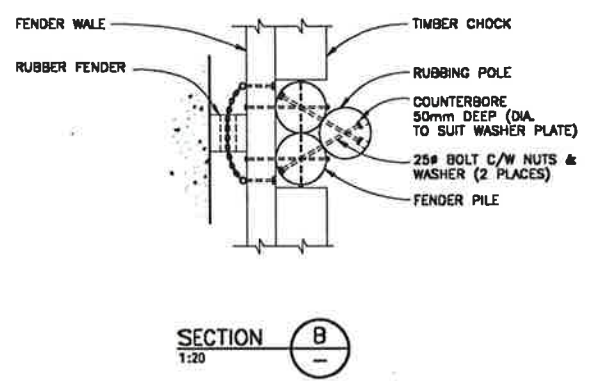




FENDER PILE PLAN  
1:250



SECTION A  
1:20



SECTION B  
1:20

TABLE 1: FENDER PILES TO BE REPLACED (TOTAL NO. : 5)

BENT	PILE NO.	BENT	PILE NO.
1A	1	19A	1
	2	38	2

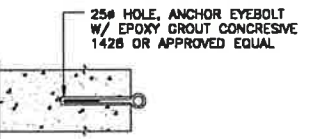
TABLE 2: RUBBING POLES TO BE REPLACED (TOTAL NO. : 6)

BENT	PILE NO.	BENT	PILE NO.
1A	3	D	3
9A	3	5	3
A	5	7	3

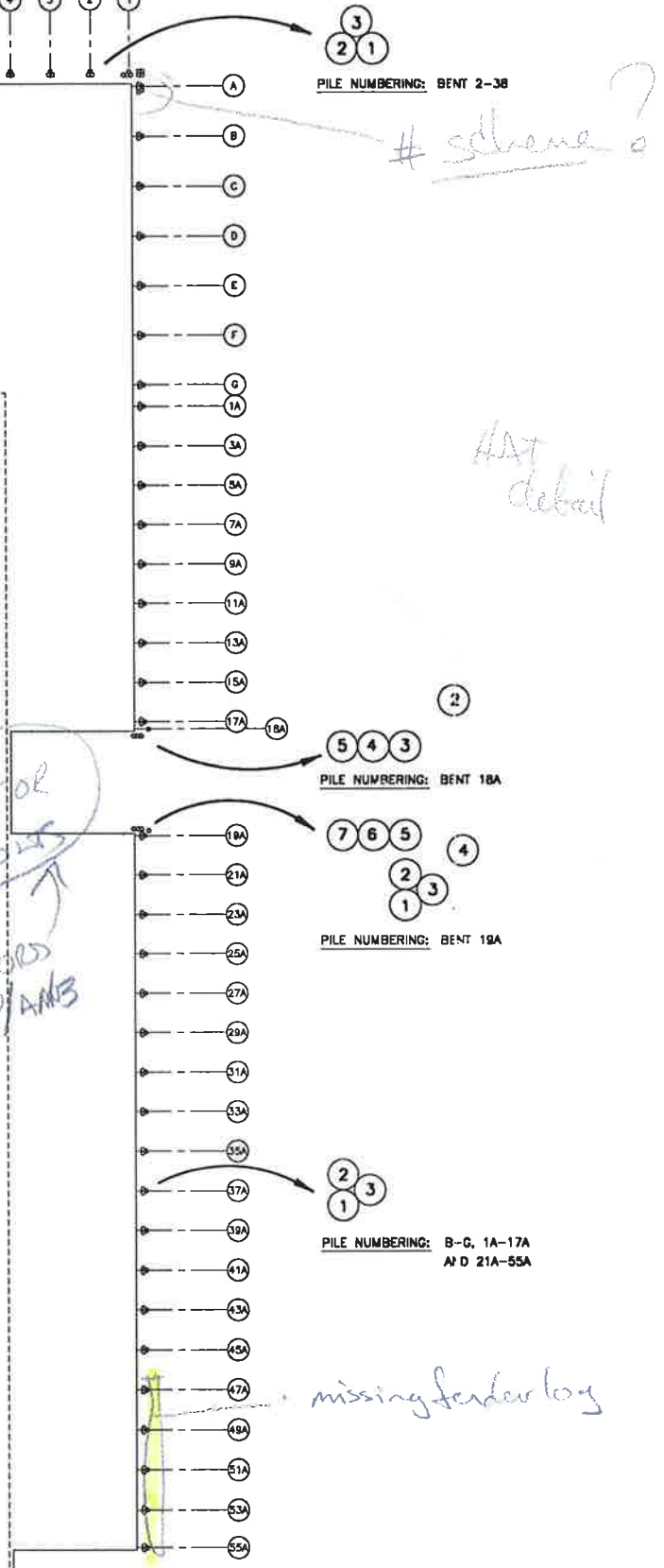
TABLE 3: MISCELLANEOUS REPAIRS

BENT	PILE NO.	RECOMMENDATION
5A	3	INSTALL LOWER CONNECTION BOLTS
18A	-	INSTALL ADDITIONAL EYEBOLTS AND RESTRAINT CHAINS
19A	3	REPLACE UPPER AND LOWER CONNECTION BOLTS
25A	3	INSTALL REPLACEMENT LOWER CONNECTION BOLTS AT DIFFERENT ELEVATION
39A-41A	-	REPLACE TOP RUBBING STRIP
39A	3	REMOVE EXISTING BOLTS; INSTALL REPLACEMENT BOLTS AT DIFFERENT ELEVATION
43A	3	INSTALL LOWER CONNECTION BOLTS
47A-55A	-	REPLACE FENDER LOG
*A	-	TIGHTENED UP RESTRAINT CHAIN
	-	REPLACE RESTRAINT CHAIN
B	2	INSTALL NEW CONNECTION BOLTS AT DIFFERENT ELEVATION
	3	
F	3	INSTALL NEW LOWER CONNECTION BOLTS AT DIFFERENT ELEVATION
2	3	INSTALL NEW LOWER CONNECTION BOLTS
8	3	INSTALL NEW LOWER CONNECTION BOLTS AT DIFFERENT ELEVATION
11-14	-	REPLACE TOP RUBBING STRIP
17	2	INSTALL TREATED DOWEL
	3	REPLACE LOWER CONNECTION BOLTS
30	-	REPLACE EYEBOLT
31	3	REPLACE LOWER CONNECTION BOLTS
32	3	INSTALL ADDITIONAL CROSS BOLT

\* INSTALL ADDITIONAL EYEBOLTS AND RESTRAINT CHAINS TO SECURE THE 4 PILE CLUSTER AT THE CORNER OF THE JETTY



DETAIL 1  
1:10  
REPLACEMENT EYEBOLT DETAIL  
- BENT 30



PRELIMINARY  
DO NOT USE FOR CONSTRUCTION

**NATIONAL DEFENCE**  
**DÉFENSE NATIONALE**

Headquarters  
 Quartier général

LOCATION

**NOTES:**  
 1. THE CONTRACTOR IS TO VERIFY THE SCOPE OF WORK AND ALL DIMENSIONS PRIOR TO COMMENCING WORK.  
 2. ALL WORK SHALL CONFORM TO THE BC BUILDING CODE 1990 AND WCB INDUSTRIAL HEALTH AND SAFETY REGULATIONS.  
 3. SUBMIT DETAILS OF PROPOSED WORK METHODS TO THE OWNER FOR APPROVAL PRIOR TO PROCEEDING WITH THE WORK. OBTAIN APPROVAL FROM THE OWNER PRIOR TO CUTTING, DEMOLISHING, OR REMOVAL OF ANY MATERIAL FROM THE SITE.  
 4. TIMBER FENDER PILES AND RUBBING POLES SHALL BE SIZE 356mm (#14) COAST DOUGLAS FIR IN ACCORDANCE WITH CSA STANDARD 086. PILES SHALL BE GIVEN FULL CELL CREOSOTE OIL TREATMENT TO A NET RETENTION OF 225 KG PER CUBIC METRE (14pcf) IN ACCORDANCE WITH CSA 086.

0 .25 .5 .75 1m  
 1:10  
 0 .5 1m  
 1:20  
 0 5 10 15 20m  
 1:250

PI	OCT31/98	ISSUED FOR CLIENT REVIEW	
NO	DATE	REVISION	APPROVED

Consulting Engineers - North Vancouver, B.C., Canada Tel: (604) 985-6468

SCALE - ÉCHELLE  
 AS NOTED

PROJECT - PROJET  
 CFB ESQUIMALT DOCKYARD B.C.

'D' JETTY FENDER UPGRADE

TRADE - MÉTIER	STRUCTURAL	DATE	98.10.28
SUBJECT - SUJET	PILE PLAN AND REPAIR DETAILS		

DESIGNED ÉLABORÉ	CONCURRED - APPRÉHÉ	
DRAWN DRESSÉ		B.F.C.
CHECKED VÉRIFIÉ		C.V.D.
COORDINATION	APPROVED BY - APPROUVÉ PAR	D.B.A.

DWG. - DESCH. NO.  
 98272-00-001