1. Project Name: Nawiliwili Deep Draft Harbor

2. Date of Inspection: May 7, 2003

3. Inspection Personnel:

	Name	Agency/Office	Telephone No.
a.	Dan Meyers	COE	438-8875

4. General:
No new dolo breaks were identified, however there may be expansion joint movement and rib cap movement at Sta. 14+53. There may be new damage in the area of Sta. 10+00 - Sta. 11+00. It was noted on this inspection that there were several voids extending down to the waterline in this high-energy area. Due to the nature of thiis area (overtopping) in-depth inspections are limited.

5. Discussion:
Note: In 1999, engraved white ceramic paving buttons were installed at the following locations:

0+00 (approximate location, offset harbor side)
5+00
10+00
12+00 (Begin Rib Cap)
15+00
18+00 (First Bend)
19+20
20+45

There are also white painted crosses for air survey use at Sta.4+00 and at other locations. At Sta. 4+55 there is a brass US Army Corps of Engineers survey disk and white painted cross.

a. Sta. 0+00 - Approximate location.

b. COE Sign on Root of Breakwater.

c. Overview of Breakwater, OS, approx. Sta. 1+00.

d. Sta. 4+55, COE Survey Marker

e. Sta. 4+60, Overview of HS.

f. Sta. 5+00, OS, Overview & begin Armor stone placement.

g. Sta. 5+50, OS, dislodged armor stone @ toe, UL exposed.

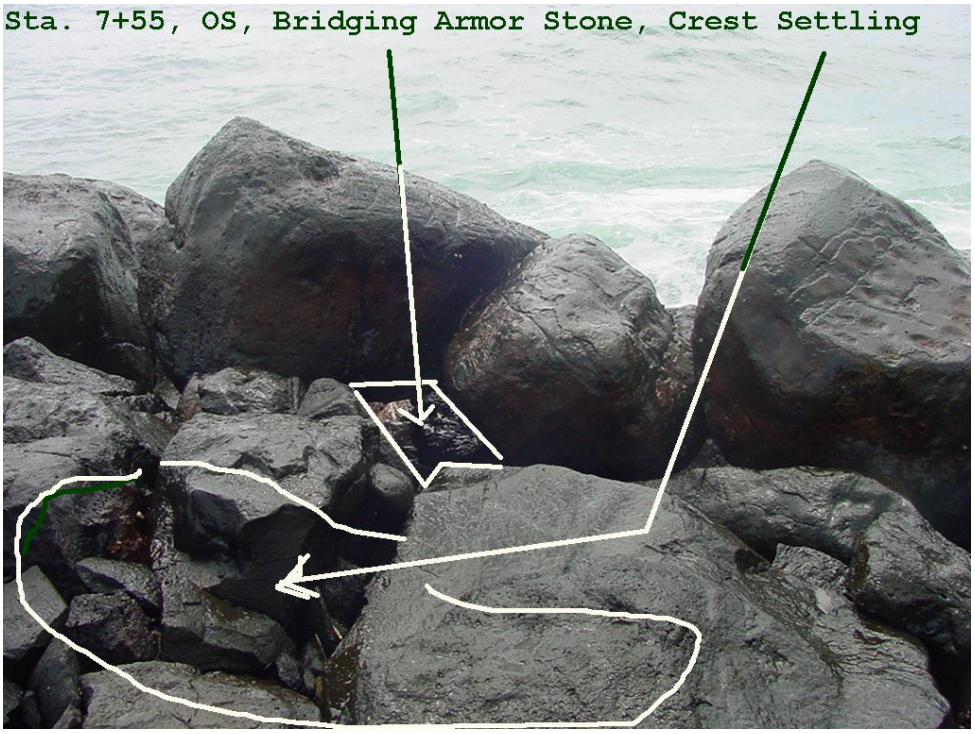
h. Station 5+80: 1 ea. armor stone (2nd row from the bottom) detached.

i. Station 6+15: 1 ea. armor stone (2nd row from the bottom) detached.

j. Station 6+60: 1 ea. armor stone dislodged from toe.

k. Station 6+90: 1 ea. armor stone dislodged from toe.

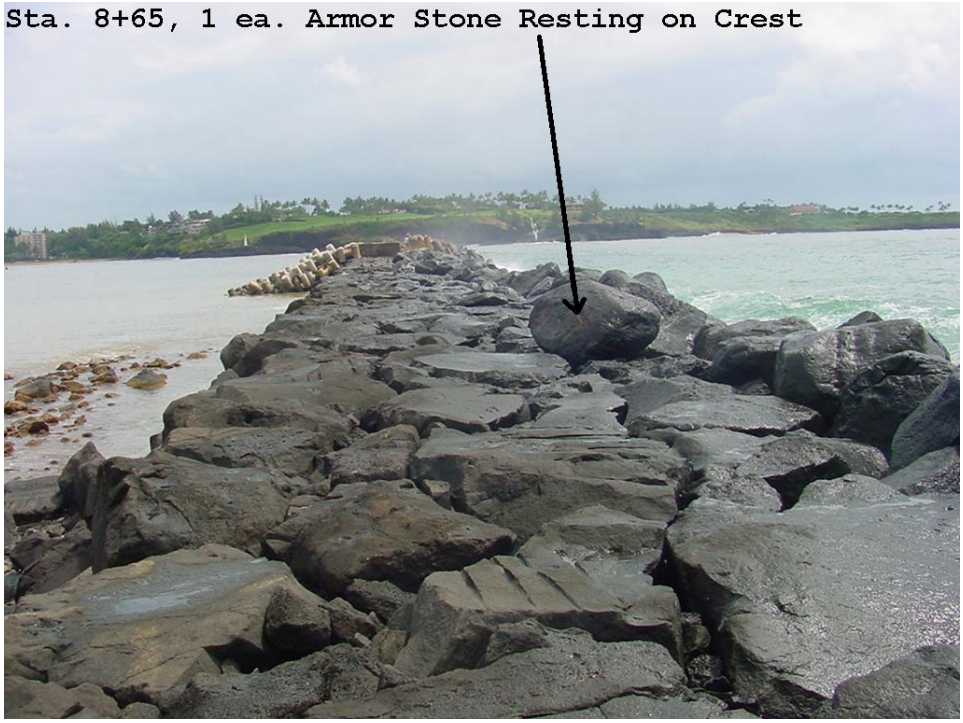
l. Sta. 7+15, Crest, note displaced armor stones from OS sideslope perched on crest.



m. Sta. 7+55, OS, Slight settling of crest, bridging armor stones.

n. Station 7+65: 1 ea. armor stone dislodged from toe.

o. Station 8+40: 1 ea. armor stone dislodged from toe.



p. Station 8+65, OS: Perched armor stone on crest apparently from side slope.

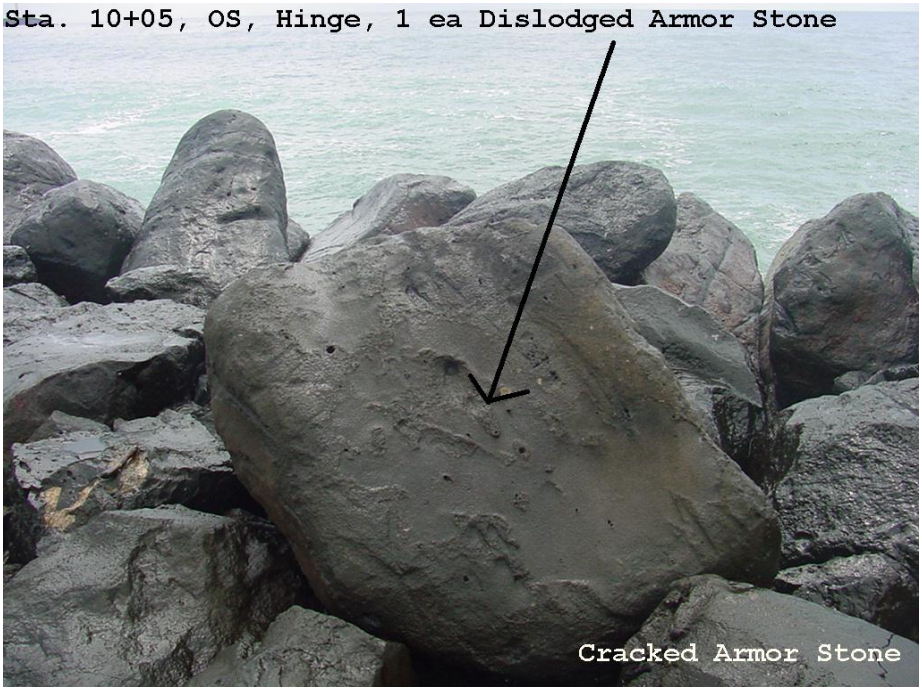
q. Station 8+70: 1 ea. armor stone dislodged from toe.

r. Sta. 8+75, HS, 2 ea. Dislodged armor stones from sideslope resting at toe.

s. Sta. 8+90, OS, 1 ea. Dislodged armor stone and void at hinge.

t. Station 9+20, HS: 1 ea. split armor at hinge.

u. Station 9+90: 1 ea. armor stone dislodged from toe.



v. Sta. 10+05, OS Hinge, 1 ea. Dislodged armor stone, 1 ea. Cracked armor stone.

w. Sta. 10+10, OS Hinge, 1ea. Cracked armor stone.

x. Station 10+35 (2), OS: Perched armor stone on crest (apparently from side slope), new void and adjacent armor stone with "T" crack.

y. Sta. 10+60, OS, Void and poor contact at hinge.

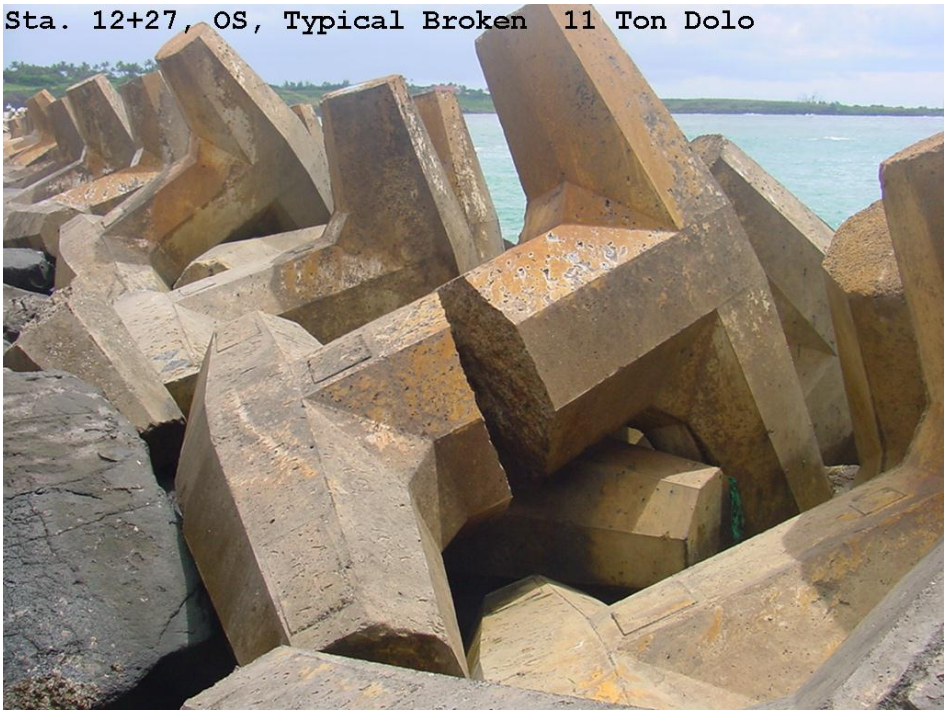
z. Station 11+65, OS, Perched armor stone on crest apparently from side slope.

aa. Station 11+65, OS, Perched armor stone w/void to waterline.

bb. There is a large void at Sta. 11+84 near the top of the side slope. This is an area of frequent overtopping and increased wave energy.

Table 1 5/03
Broken Armor Unit Inventory Data

Armor Unit No.	Station No.	Type of Armor Unit	Offset from Centerline m (ft) Seaside	Harborside	Type of Break, Comments
1	12+10	9,980-kg (11-ton) Dolos	9.45 (31)		Straight shank-fluke break



2	12+27	9,980-kg (11-ton) Dolos	4.57(15)		Straight mid-shank break
3	12+73	9,980-kg (11-ton) Dolos	9.45 (31)		Straight shank-fluke break
4	12+88	5,900-kg (6.5-ton) Tribar	3.56 (12)		Leg broken oft through center of unit
5	13+40	9,980-kg (11-ton) Dolos	10.36(34)		Angled fluke-shank break
6	13+49	9,980-kg (11-ton) Dolos	10.36 (34)		Straight mid-shank break
7	13+60	9,980-kg (11-ton) Dolos	7.62 (25)		Straight fluke-shank break
8	13+87	5,900-kg (&5-ton)Tribar	3.66(12)		Leg broken off—placed as two-leg unit
9	13+98	5,900-kg (6.5-ton) Tribar	3.66 (12)		Leg broken off—placed as two-leg unit
10	14+02	9.980-kg (11-ton) Dolos	6.10 (20)		Angled mid-shank break
11	14+04	9,980-kg (11-ton) Dolos	7.62 (25)		Straight mid-shank break

12 14+34 **RIB 34** 9.980-kg (11-ton) Dolos 8.53 (28) Straight shank-fluke break

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13 14+53 **RIB 41** 9,980-kg (11-ton) Dolos 8.23(27) Angled mid-shank break

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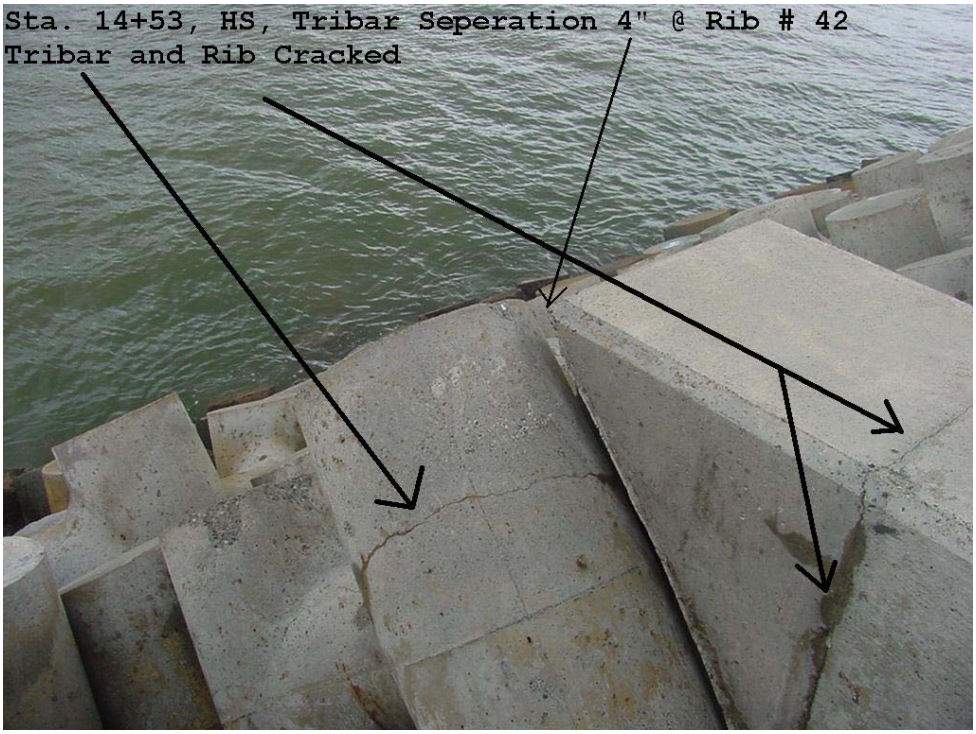


13A 14+53, **RIB 41,** Tribar separating from rib cap approx. 4", tribar cracked. (HS)

14	14+69	5,900-kg (6.5-ton) Tribar 3.66 (12)	Leg broken off — placed as two-leg unit
15	14+84	9,980-kg (11-ton) Dolos 10.06 (33)	Straight mid-shank break
16	14+88	9,980-kg (11-ton) Dolos 11.28 (37)	Straight shank-fluke break
17	14+89	9.980-kg (11-ton) Dolos 10.06 (33)	Straight mid-shank break
18	14+93	9,980-kg (11-ton) Dolos 10.06 (33)	Angled fluke-shank break
19	15+02	16,150-kg (17.8-ton) Tribar 6.10(20)	Leg broken off, crack through center
20	15+15	16,150-kg (17.8-ton) Tribar 13.72 (45)	Broken through center
21	15+16	9,980-kg (11-ton) Dolos 16.15 (53)	Straight fluke-shank break
22	15+25	9,980-kg (11-ton) Dolos 16.15 (53)	Straight shank-fluke break
23	15+29	9,980-kg (11-ton) Dolos 12.19(40)	Straight mid-shank break
24	15+42	9,980-kg (11-ton) Dolos 13.72 (45)	Straight mid-shank break
25	15+60	9,980-kg (il-ton) Dolos 14.63(48)	Straight fluke-shank break

26	15+62, **RIB 60**	16150-kg (17.8-ton) Tribar 6.10 (20)	Three legs separated through center
27	15+96	9,980-kg (11-ton) Dolos 15.54(51)	Straight mid-shank break
28	15+96	9,980-kg (11-ton) Dolos 15.54 (51)	Angled shank-fluke break
29	15+98	9,980-kg (11-ton) Dolos 11.28 (37)	Straight shank-fluke break
30	16+02	9,980-kg (11-ton) Dolos 11.28 (37)	Straight mid-shank break
31	16+10	9,980-kg (Il-ton) Dolos 8.53 (28)	Angled mid-shank break
32	16+18	16,150-kg (17.8-ton) Tribar 6.40 (21)	Portion of one leg broken off
33	16+23	9,980-kg (11-ton) Dolos 10.36(34)	Straight fluke-shank break
34	16+31	9,980-kg (11-ton) Dolos 13.11 (43)	Straight fluke-shank break
35	16+50	16150-kg (17.8-ton) Tribar 579 (19)	Leg broken off
36	16+57	9,980-kg (11-ton) Dolos 10.36(34)	Straight mid-shank break
37	16+70	9.980-kg (11-ton) Dolos 10.67 (35)	Straight shank-fluke break
38	16+76	16,150-kg (17.8-ton) Tribar 6.40 (21)	Leg cracked near center of unit
39	16+83	9,980-kg (11-ton) Dolos 13.41 (44)	Straight mid-shank break
40	16+90	9,980-kg (11-ton) Dolos 16.46(54)	Straight shank-fluke break
41	17+21	9.980-kg (11-ton) Dolos 15.24(50)	Straight fluke-shank break
42	17+46	9,980-kg (11-ton) Dolos 17.07 (56)	Angled shank-fluke break

43	17+58	9,980-kg (11-ton) Dolos 15.85 (52)	Straight mid-shank break
44	17+59	9,980-kg (11-ton) Dolos 16.76 (55)	Angled shank-fluke break
45	17+62	9,980-kg (11-ton) Dolos 13.12 (45)	Straight mid-shank break
46	17+92	9,980-kg (11-ton) Dolos 9.45 (31)	Straight fluke-shank break
47	18+10	9,980-kg (11-ton) Dolos 15.24 (50)	Straight fluke-shank break
48	18+10	16,150-kg (17.8-ton) Tribar 7.92 (26)	Broken through center
49	18+10	9,980-kg (11-ton) Dolos 17.68 (58)	Angled fluke-shank break

49A 18+20, **RIB 102,** crack in rib cap OS

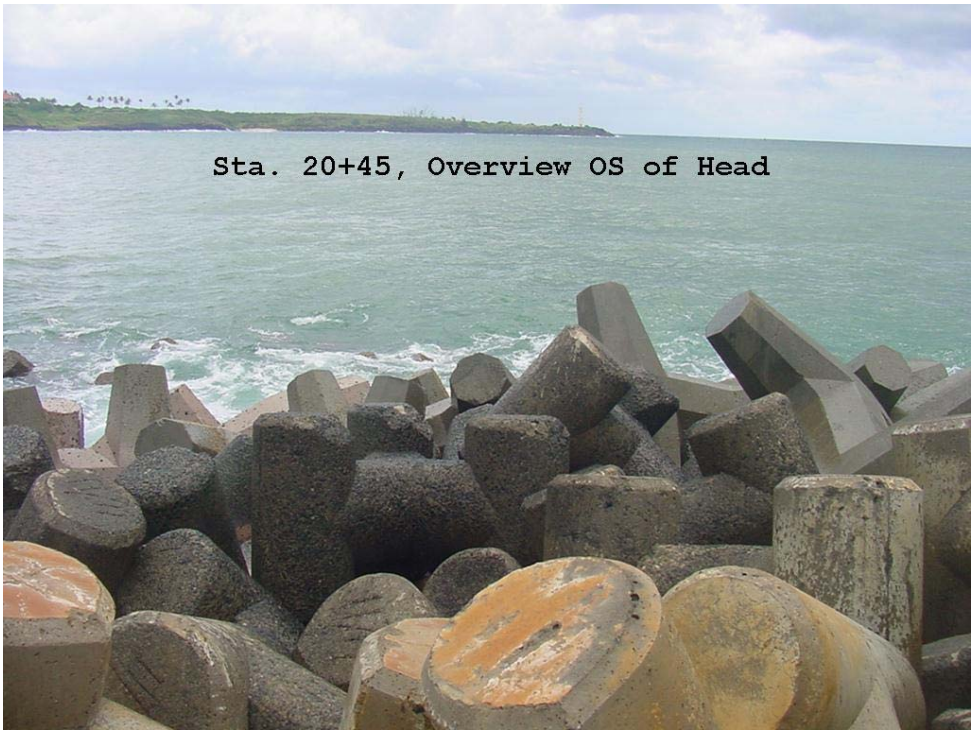
50	18+30	9,980-kg (11-ton) Dolos 9.14 (30)	Straight fluke-shank break
51	18+35	9,980-kg (11-ton) Dolos 12.50 (41)	Straight shank-fluke break
52	18+59	9.980-kg (11-ton) Dolos 15.85 (52)	Straight mid-shank break
53	18+65	9.980-kg (11-ton) Dolos 12.19 (40)	Straight mid-shank / straight fluke-shank/breaks
54	18+77	16.150-kg (17.8-ton) Tribar 8.23(27)	Leg broken off unit
55	18+78	16,150-kg (17.8-ton) Tribar 4.88 (16)	Leg broken off unit
56	18+85	16,150-kg (17.8-ton) Tribar 5.49 (18)	Leg broken off unit
57	19+10	9,980kg (11-ton) Dolos 8.23 (27)	Straight shank-fluke break
58	19+15	9,980-kg (11-ton) Dolos 8.84 (29)	Straight shank-fluke break

59	19+20 **RIB 120**	16,150-kg (17.8-ton) Tribar 4.27 (14)	Broken through center, all legs separated
60	19+32	16,150-kg (17.8-ton) Tribar 4.57 (15)	Leg broken off unit
61	19+34	16,150-kg (17.8-ton) Tribar 8.53 (28)	Leg broken off unit
62	19+50	20,865-kg (23-ton) Dolos 6.10 (20)	Straight mid-shank break
63	19+52	16.150-kg (17.8-ton) Tribar 8.53 (28)	Cracked through center of unit
64	19+56	20,865-kg (23-ton) Dolos12.80 (42)	Angled mid-shank break
65	19+57	20,865-kg (23-ton) Dolos12.50 (41)	Straight fluke-shank break

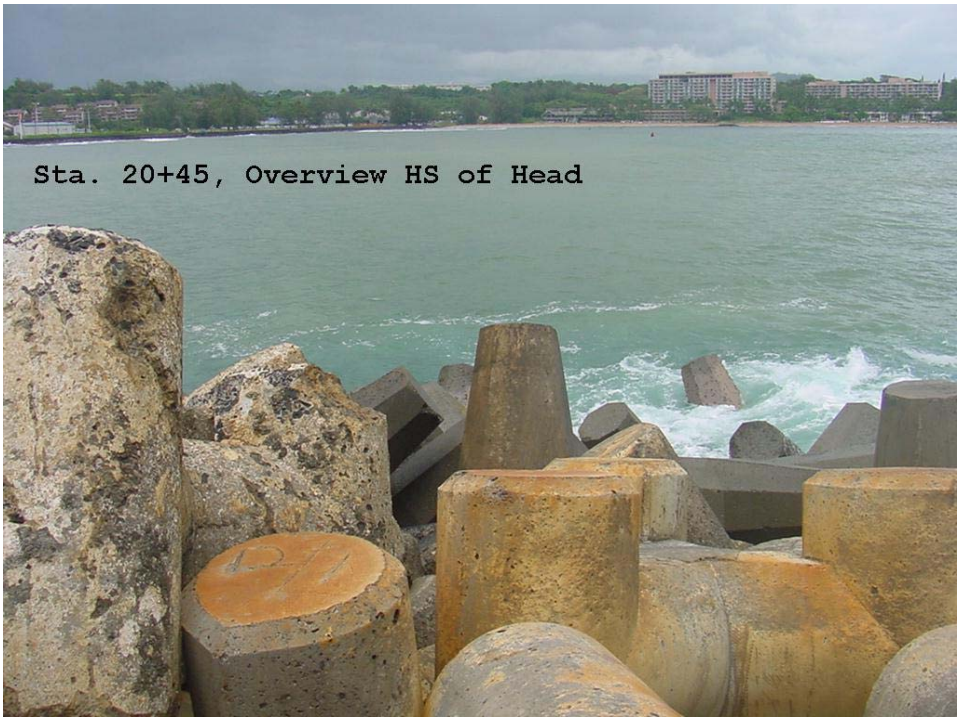
65A 19+60, OS, Broken rib cap tip, tribar settling

66	19+74	16,150-kg (17.8-ton) Tribars 4.27 (14)		Leg broken off unit
67	19+79	20,865-kg (23-ton) Dolos 8.53 (28)		Angled mid-shank break
68	19+82	20,865-kg (23-ton) Dolos12.50 (41)		Straight shank-fluke break
69	20+03	16,150-kg (17.8-ton) Tribar 4.57 (15)		Two legs broken off unit
70	20+11	16,150-kg (17.8-ton) Tribar 7.32 (24)		Leg broken off unit
72	20+13	20,865-kg (23-ton) Dolos 13.11 (43)		Angled mid-shank break
73	20+13	16,150-kg (17.8 ton) Tribar 5.79 (19)		Leg broken off unit
74	20+16	16,150-kg (17.8 ton) Tribar 7.01 (23)		Leg broken off unit
75	20+34	16,150-kg (17.8-ton) Tribar 8.23 (27)		Leg cracked
76	20+67	20.865-kg (23-ton) Dolos 18.59 (61)		Angled shank-fluke break
77	20+90	20,865-kg (23-ton) Doios	0.30 (1)	Straight shank-fluke crack off head

cc. Sta. 19+25, HS, Overview.



dd. Sta. 20+45, OS, Overview of head.



ee. Sta. 20+45, HS, Overview of head.

ff. Sta. 19+20, OS, OS, Broken Tribar # 52 (ref: Technical Report).

6. Findings/Conclusions:

The breakwater structure is in relatively good condition for a structure built in increments starting in 1921. It is possible that some of the areas of dislodged armor units noted occurred during construction; however, it is more likely a result of tsunami and storm damage. Particular attention should be given to monitoring the area in the vicinity of Sta. 11+65, OS where a large void exists and water is visible through the crest. Additional changes were noted in this area this inspection.

Signed: _____
Dan Meyers, CEPOH-EC-T

Signed: _____
Jim Pennaz P.E., Ch, CEPOH-EC-T

Project Index Map