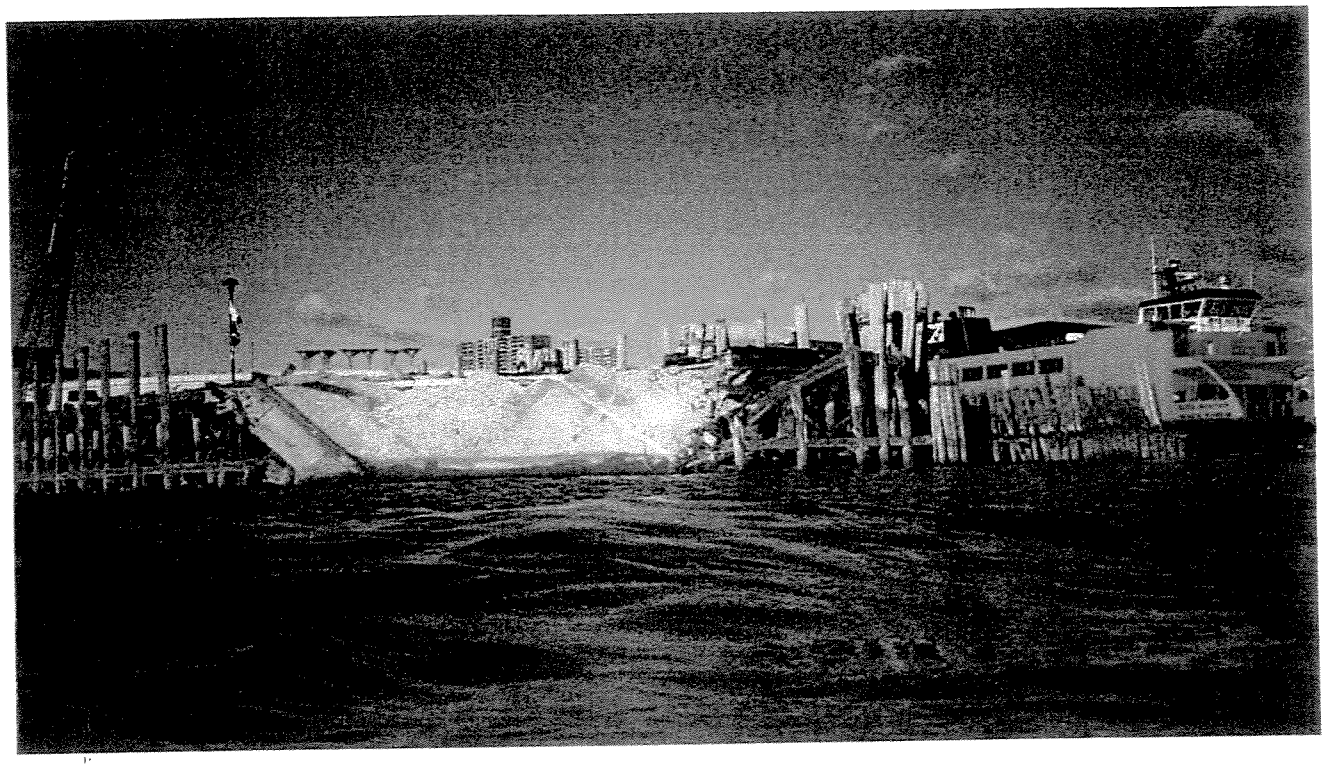
UNDERWATER INSPECTION AND EVALUATION REPORT

PIER 1-B
ST. GEORGE FERRY TERMINAL
MAINTENANCE FACILITY
STATEN ISLAND, NEW YORK

December 2003



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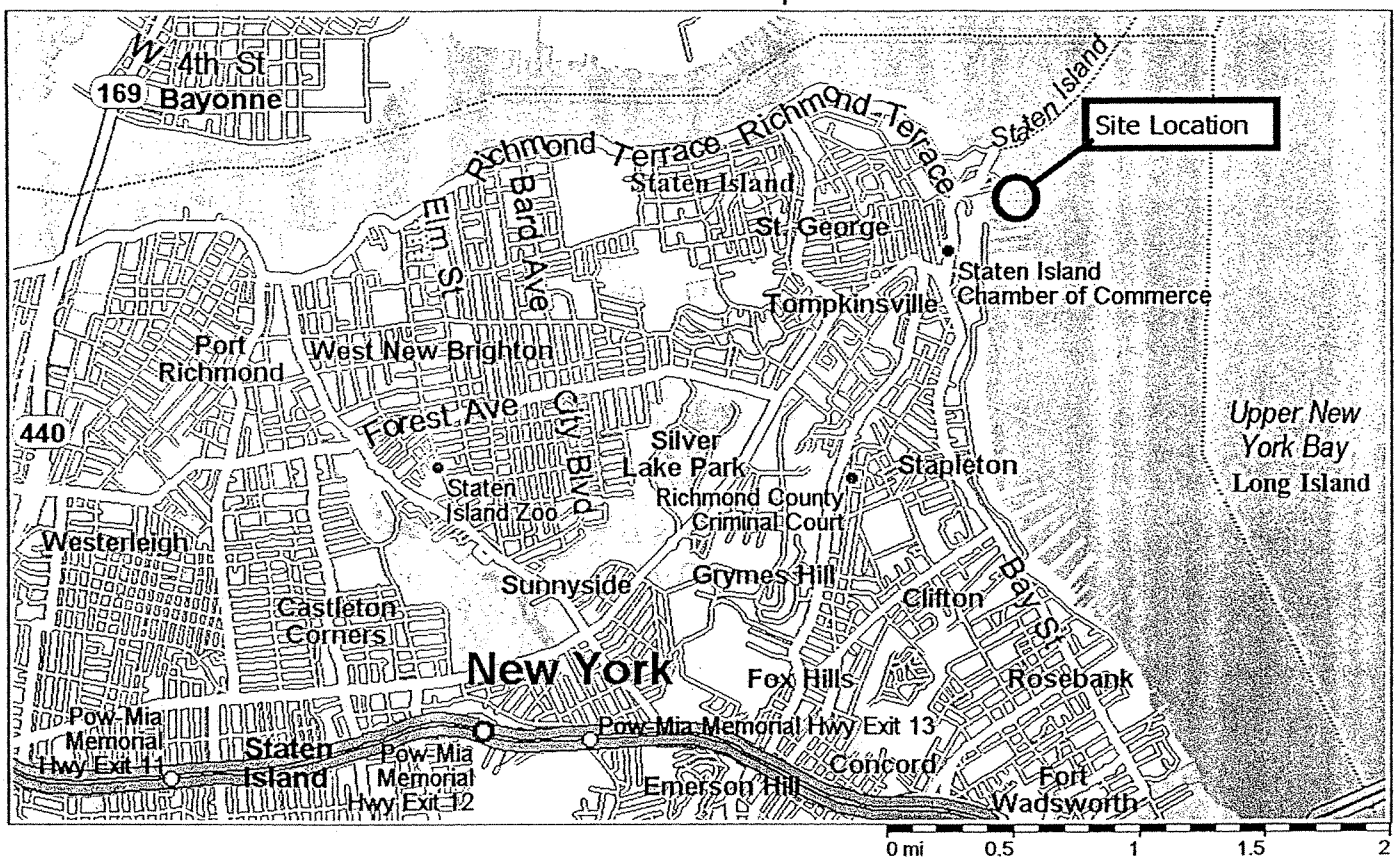
Location Map



INTRODUCTION

Atlantic Engineering, LLC, (AE) was contracted by Weidlinger Associates to perform an inspection of the damaged portion of Pier 1-B from the ferry impact on October 15, 2003 at the St. George Ferry Maintenance Facility, Staten Island NY. The pier is approximately 50' wide (North-South) and approximately 1000' long (East-West). The pier was recently impacted by a vessel causing collapse of the SE corner of the pier. The collapsed area is approximately 1500 SF. The inspection was limited to the impact damaged areas from below deck to the mudline only. This included inspection of pile bents 80 thru bent 75, and the surrounding fender piles. Some areas directly below the suspended crushed decking could not be safely inspected. Structural elements below this area can be considered broken beyond repair due to the extent of surrounding damage.

The pier is constructed of a cast in place concrete deck on timber cap beams supported by timber piles. Battered timber piles on the exterior, as well as a system of diagonal and horizontal timber bracing in the tidal zone, provide lateral support to the pier and piles. Timber fender piles and several dolphins (clusters of timber fender piles) provide a buffer against minor vessel impact.

The inspection was supervised by Bryan Juncosa, P.E./Diver. All elements where inspected from the underside of the reinforced concrete deck to the mudline. Inspection time was maximized during periods of low tide in order to improve efficiency of the inspection and the quality of the photography. Measurements and information was gathered in order to determine the condition of the structures and to make repair recommendations. No previous underwater inspection report was provided prior to the inspection.

This report includes a summary of findings and recommendations, a deficiency plan with soundings, deficiency tables, repair cost estimates, sketches of the structure, and 35 mm photos.

SUMMARY OF FINDINGS

GENERAL

The overall condition of the collapsed portion of the pier is poor with few elements of the structure considered to be salvageable. The collapse section is located at the southeast corner of the pier and measures 30'+/- along the east end, and 45'+/- along the south side. There is considerable timber, concrete and some vessel debris near the mudline at the SE corner. The remaining structural elements not subject to impact damage are fair with areas of rot and marine borer activity in the tidal zone.

The main structural support system for the reinforced concrete deck consist of a dual 6 x 12 timber cap beam. The tops of the 16" to 20" diameter timber piles are "notched" in order to accept the timber cap beam. Piles are driven in north-south rows (bents) at a 6' center to center spacing. Pile bents are spaced at 12' center to center. For the purposes of this inspection each bent is numbered and each pile is given a letter designation. The northern most pile in a bent is the "A" pile, the southern most is the "I" pile. In addition to these "plumb" piles, battered piles are observed at every other bent at the "A" and "I" position. Also, a system of 4 x 8 diagonal and horizontal bracing is constructed in the tidal zone between pairs of bents (see plans and sketches for configuration). Bent 80 is the eastern most bent. Bents 80 thru 75 were included in the inspection. Bents 80 and 79 are atypical as far as their construction. It appears these bents where constructed later then the others. A slightly different configuration was used including several battered piles and 12 x 12 timber caps.

FENDER SYSTEM

The fender system is constructed from timber piles driven along the perimeter of the pier at approximately a 6' to 8' center to center spacing. A 12 x 12 timber waler and 10 x 12 timber chock span between the piles at the deck elevation and at 8' below. Fender pile spacing at the corners of the pier is decreased to approximately 3' center to center. In addition to these fender piles, two (2) timber dolphins are observed along the north side of the pier. One (26) pile cluster located at the NE corner of the pier. The other (16) pile clusters located approximately 35' to the west. No dolphins existed along the south side of the pier. However, dock crews had reinforced the SE corner with 15 additional fender piles. A total of 11 fender piles were found to be broken and/or severely displaced due to impact. There were a total of 27 missing timber fender piles at the SE corner collapsed area. These piles are assumed to have been destroyed below the collapse and could not be safely identified. Note, approximately thirty (30) timber fender piles were observed lying on top of the pier, obviously pulled and placed by a crane.

DECK FRAMING AND PILES

The collapsed section of the pier is clearly defined by inspection of the "top side" of the reinforced concrete deck. A single large crack in the deck has allowed the SE corner of the concrete to collapse and remain "hanging" by the steel reinforcing bars, more or less "intact". Much of the timber substructure below this slab could not be safely inspected, but is clearly broken and displaced beyond repair. The timber cap beams, timber piles, and bracing lay under the collapsed deck in a heap of broken timber and concrete debris. This area is defined in detail on the deficiency plan and tables. Other timber structural elements on the edge of the collapse area are recognizable and could be safely inspected. These elements exhibit broken and/or severely displaced piles, broken cap beams, and
broken bracing with failed connections. It was noted that for all of the severely displaced timber piles inspected, no break was observed at or near the mudline. It is possible that these piles simply "tilted" over with impact due to the lack of soil stiffness, or the piles could be broken below the mudline.

SUMMARY OF FINDINGS Continued

Beyond this "buffer" zone little damage due to impact was observed. In general the timber piles and bracing appear to have a moderate marine borer infestation problem. Bolt holes in the tidal zone have allowed the organism to access untreated areas of the timber. A "hollowing" trend is observed on several of the timber piles in the area of mean low water. This concealed tunneling is of particular concern. Piles my appear to be satisfactory when viewed from the outside, while inside excessive loss in cross-sectional area is occurring. Evidence of both the Limnoria and Teredo species of marine borer is observed.

SE CORNER DEBRIS

The southeast corner of the pier was inspected for debris. The investigation was limited to areas that could be safely inspected. Debris was considerable, including broken timber piles, bracing, concrete, a bollard, and parts of the ferry vessel. The debris may pose navigational hazards. The extent of debris can only be estimated from the quantity and type of material known to have been in place before the impact. Much of the debris will have to be removed to allow construction. Subsequent dive inspections may be necessary upon removal of debris.

RECOMMENDATIONS and Deficiency Tables

The poor conditions observed at the collapsed portion of the pier leave little option other than complete replacement. Additional removal of the reinforced concrete deck will be necessary for the driving of new piles and to restore continuity to the deck slab. Piles and bracing found to be in poor condition due to rot and/or marine borer activity should also be repaired by pile posting and replacement.

Based on the findings of this inspection the following items should be addressed:

Deficiency/Recommendation Table

Structural Element/ Location	Description	Recommendation
SE corner of pier deck, Pile bent 80 to 76, (see plan for limits)	Reinforced concrete deck failed, collapsed. Deck to be removed for driving of new timber piles.	Remove and replace reinforced concrete deck restoring continuity by lap or mechanical splicing of reinforcing.
Timber Fender Piles and horizontal walers on perimeter from Bent 79.5 north side 76 south side. Total 40 piles total.	Timber fender piles are broken or missing.	Locate, remove, and replace timber fender system. Design system specifically for the needs of the vessels of the facility.
Timber Piles 80F, 80G, 80H, 80I, 80E-bat, 80G-bat, 80I-batW, 80I-batN 79F, 79G, 79H, 79I, 78G, 78H, 78I	Timber piles are missing and assumed destroyed below the collapsed concrete deck.	Locate, remove, and replace timber piles.
Timber Piles 80A, 80B, 80C, 80D, 80E, 80A-batS, 80A-batW, 80C-bat, 80D-bat, 79D, 79E, 78D 78E, 78F, 77G, 77H, 77I, 76I, 76I-bat, 78I-bat	Timber piles are broken and/or exhibit excessive displacement due to impact damage.	Remove and replace piles.
Timber Piles 78A, 78A-bat, 77A, 76A, 76D, 76F	Timber piles exhibit excessive loss of cross-sectional area due to rot and/or marine borer activity.	Replace poor section of pile with 12 x 12 timber post repair.
12 x12 Timber Cap Beam Bent 80	12 x 12 Timber cap beam is broken or split due to impact damage.	Remove and replace timber cap.
12 x12 Timber Cap Beam Bent 79, "D" pile to "I" pile	12 x 12 Timber cap beam is broken or split due to impact damage.	Remove and replace timber cap. Splice to good 12 x12 cap at "C" pile.

RECOMMENDATIONS and Deficiency Tables Continued

Deficiency/Recommendation Table

Structural Element/ Location	Description	Recommendation
Dual 6 x 12 Timber Cap Beam Bent 78, "D" pile to "I" pile	(2) 6 x 12 Timber cap beam is broken or split due to impact damage.	Remove and replace timber cap utilizing existing splice at "D" pile.
Dual 6 x 12 Timber Cap Beam Bent 77, "D" pile to "I" pile	(2) 6 x 12 Timber cap beam is broken or split due to impact damage.	Remove and replace timber cap. Splice to good 6x 12 cap at "G" pile.
Dual 6 x 12 Timber Cap Beam Bent 76, 3 LF at "I" pile	(2) 6 x 12 Timber cap beam is broken or split due to impact damage.	Remove and replace timber cap. Splice to good 6x 12 cap at "H" pile.
4 x 8 Diagonal timber bracing, see "Diagonal Bracing Deficiency Plan" for locations	4 x 8 Diagonal bracing is missing and assumed destroyed below the collapsed concrete deck.	Locate, remove, and replace 4 x 8 diagonal timber bracing.
4 x 8 Diagonal timber bracing, see "Diagonal Bracing Deficiency Plan" for locations	4 x 8 Diagonal bracing is broken due to impact damage.	Remove, and replace 4 x 8 diagonal timber bracing.
4 x 8 Horizontal lower timber bracing, see "Lower Bracing Deficiency Plan" for locations	4 x 8 Horizontal bracing is missing and assumed destroyed below the collapsed concrete deck.	Locate, remove, and replace 4 x 8 horizontal timber bracing.
4 x 8 Horizontal lower timber bracing, see "Lower Bracing Deficiency Plan" for locations	4 x 8 Horizontal bracing is broken due to impact damage.	Remove, and replace 4 x 8 horizontal timber bracing.
4 x 8 Diagonal timber bracing, see "Diagonal Bracing Deficiency Plan" for locations	4 x 8 Diagonal bracing is broken, not due to impact damage.	Remove, and replace 4 x 8 diagonal timber bracing.
4 x 8 Horizontal lower timber bracing, see "Lower Bracing Deficiency Plan" for locations	4 x 8 Horizontal bracing is broken, not due to impact damage.	Remove, and replace 4 x 8 horizontal timber bracing.

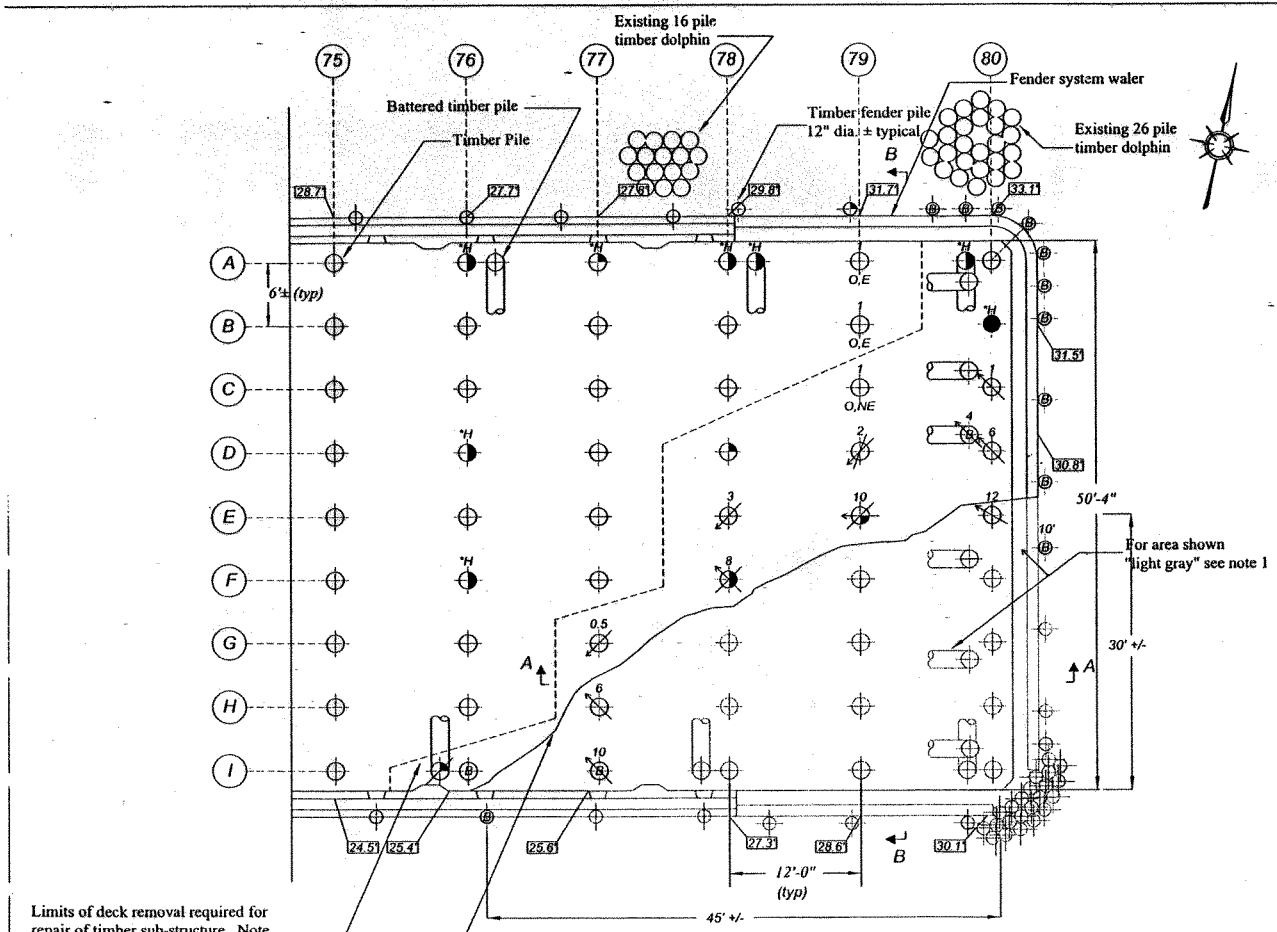
ENGINEER'S COST ESTIMATE

REPAIRS TO PIER 1-B (BENTS 80 to 75 only)
ST. GEORGE FERRY TERMINAL MAINTENANCE FACILITY
STATEN ISLAND, NEW YORK

Item	Description	Unit	Quantity	Unit Cost	Cost
1	Reinforced concrete deck replace, 12" thick SIP Form	SF	1500	$50	$75,000
2	Timber system fender replacement	LF	120	$50	$6,000
3	Timber fender pile replacement	EA	40	$2,500	$100,000
6	Timber pile replacement	EA	35	$2,500	$87,500
7	Timber pile posting (6 posts)	LF	60	$200	$12,000
8	12 x 12 Timber cap beam replacement	LF	85	$200	$17,000
9	(2) 6 x 12 Timber cap beam replacement	LF	50	$200	$10,000
10	4 x 8 diagonal timber brace replacement	LF	650	$40	$26,000
11	4 x 8 horizontal timber brace replacement	LF	160	$40	$6,400
12	Concrete, timber piles, cap, braces,& ship parts removal	LS	1	$75,000	$75,000

Sub Total	$414,900
15% Contingency	$62,235
Grand Total	$477,135

SKETCHES



PILE/DECK DEFICIENCY PLAN
Scale 1"=10'

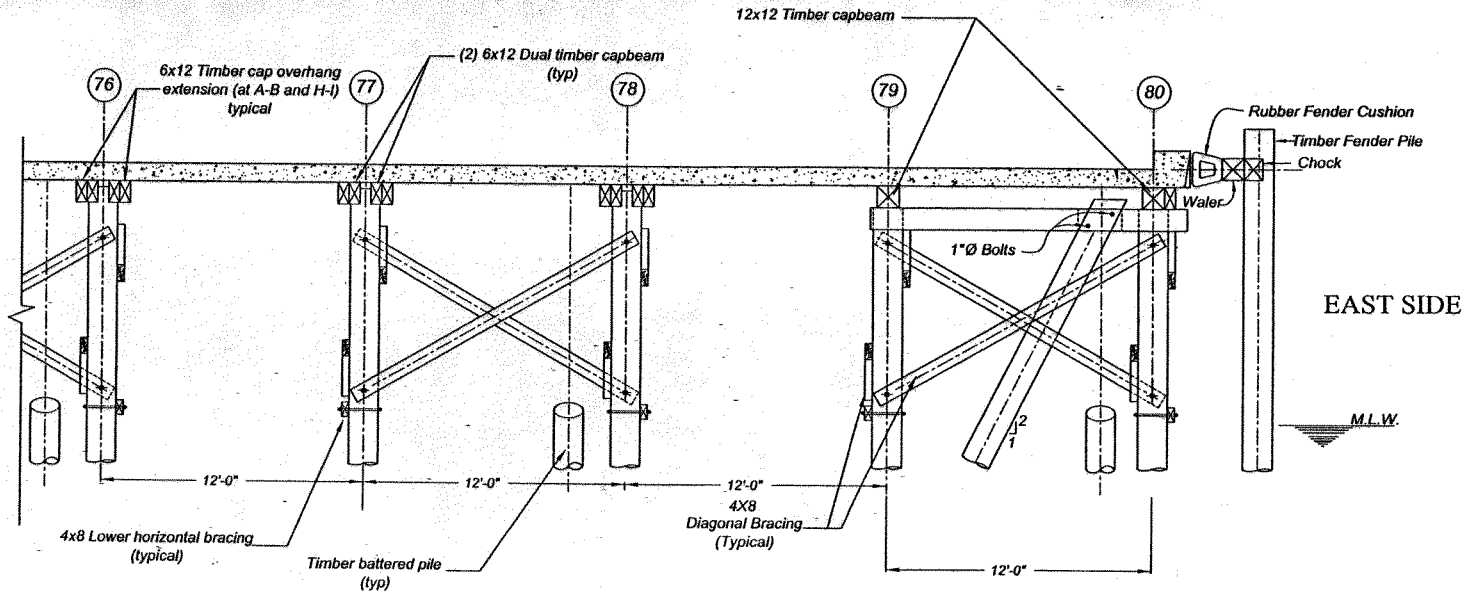
LEGEND

- Timber pile
- 1 O,SW — Timber pile is offset 1' to the SW of the timber pile cap beam. Misalignment does not appear to be the result of impact damage.
- (B) Broken timber pile
- (M) Missing timber pile
- Split timber pile
- Loss in cross-section diameter (Loss 25% of diameter)
- Loss in cross-section diameter (25% < Loss 50% of diameter)
- Loss in cross-section diameter (50% < Loss 75% of diameter)
- Loss in cross-section diameter (75% < Loss 100% of diameter)
- 6 — Timber pile displaced 6' at top toward
- *M Timber pile with minor marine borer activity
- *MOD Timber pile with moderate marine borer activity
- *H Timber pile with heavy marine borer activity
- 29.8 Indicates mudline sounding from top of deck elevation

NOTES

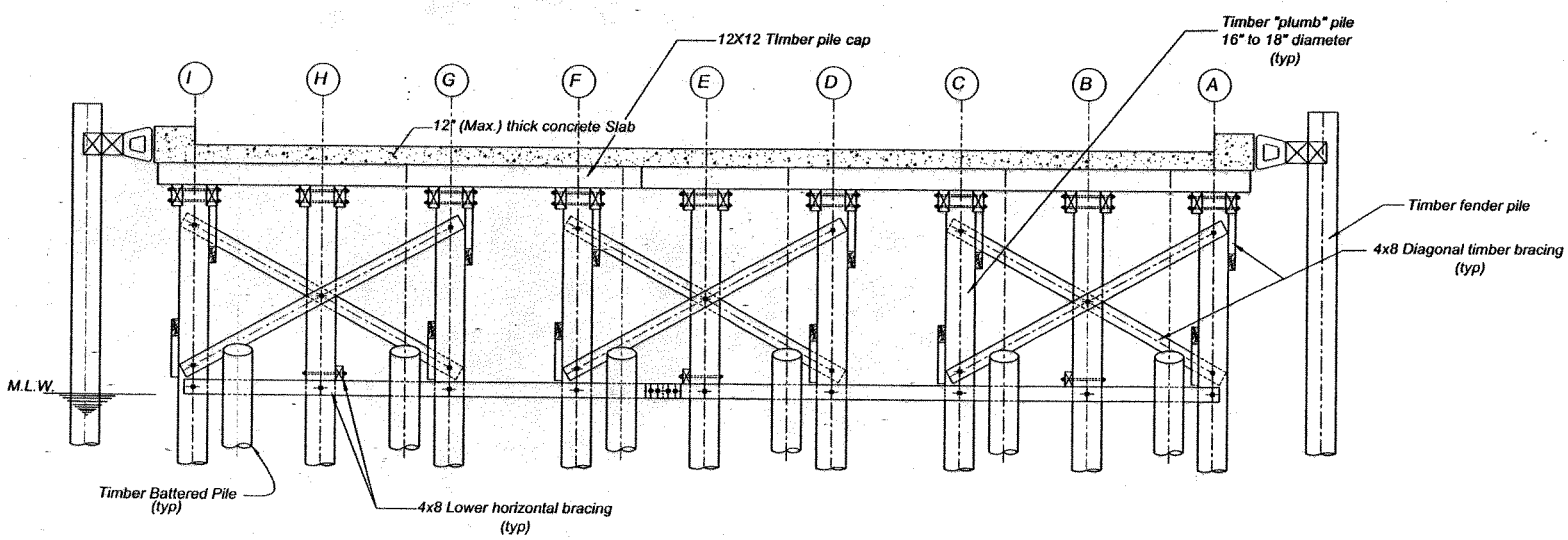
1. Some of the destroyed timber caps, piles, and bracing could not be safely inspected due to remnants of concrete deck above. Large concrete slab is "hanging" by deck reinforcing. Demolition and removal poses local stability issues. All elements are considered to be broken. Timber, concrete and pieces of vessel present.

U/W Inspection and Evaluation
St George Ferry Terminal
Pier 1-B
1" = 10'
December 2003
Atlantic Engineering, LLC
Suite 21, Kinnelon Rd.
Kinnelon, New Jersey 07405



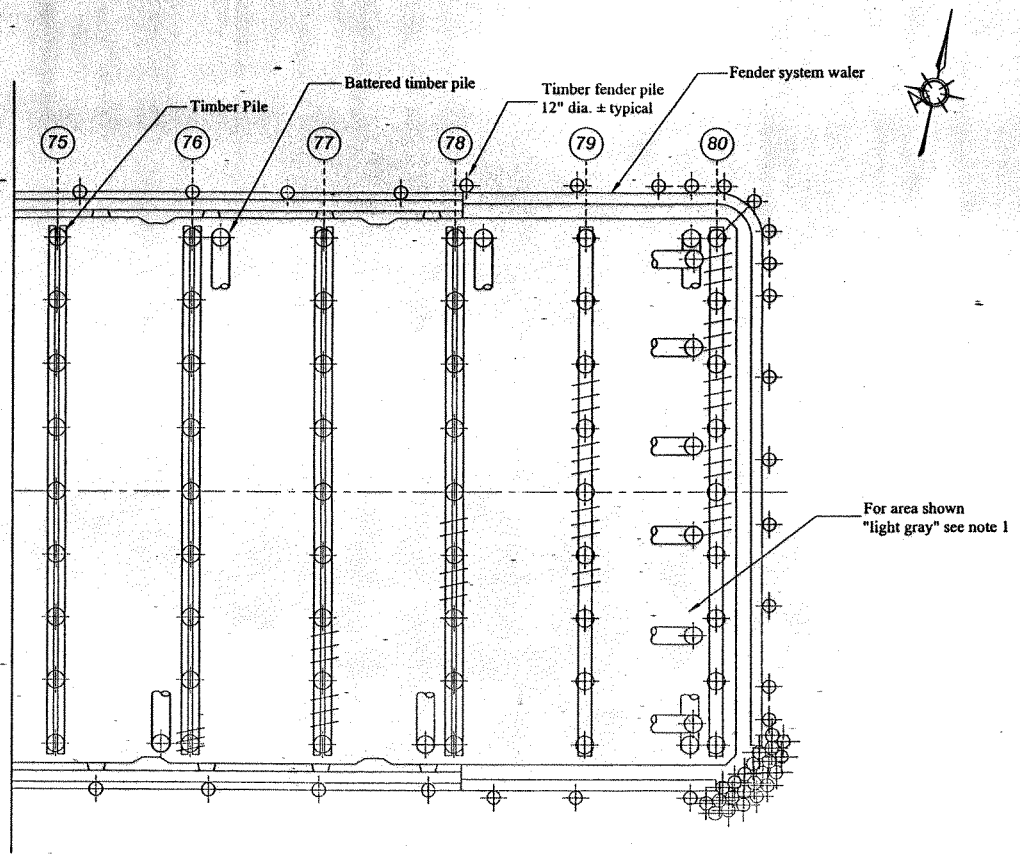
SECTION A-A
Scale 1"=5"

U/W Inspection and Evaluation
St George Ferry Terminal
Pier 1-B
1" = 5'
December 2003
Atlantic Engineering, LLC
Suite 21, Kinnelon Rd.
Kinnelon, New Jersey 07405



SECTION B-B
Scale 1"=5"

U/W Inspection and Evaluation
St George Ferry Terminal
Pier 1-B
1" = 5'
December 2003
Atlantic Engineering, LLC
Suite 21, Kinnelon Rd.
Kinnelon, New Jersey 07405



LEGEND

- 12x12 timber pile cap beam
- (2) 6x12 dual timber pile cap beam
- 12x12 timber pile cap beam broken or split
- (2) 6x12 dual timber pile cap beam broken or split

NOTES

1. Some of the destroyed timber caps, piles, and bracing could not be safely inspected due to remnants of concrete deck above. Large concrete slab is "hanging" by deck reinforcing. Demolition and removal poses local stability issues. All elements broken.

TIMBER PILE CAP DEFICIENCY PLAN

Scale 1"=10'

U/W Inspection and Evaluation
St George Ferry Terminal
Pier 1-B
1" = 10'
December 2003
Atlantic Engineering, LLC
Suite 21, Kinnelon Rd.
Kinnelon, New Jersey 07405

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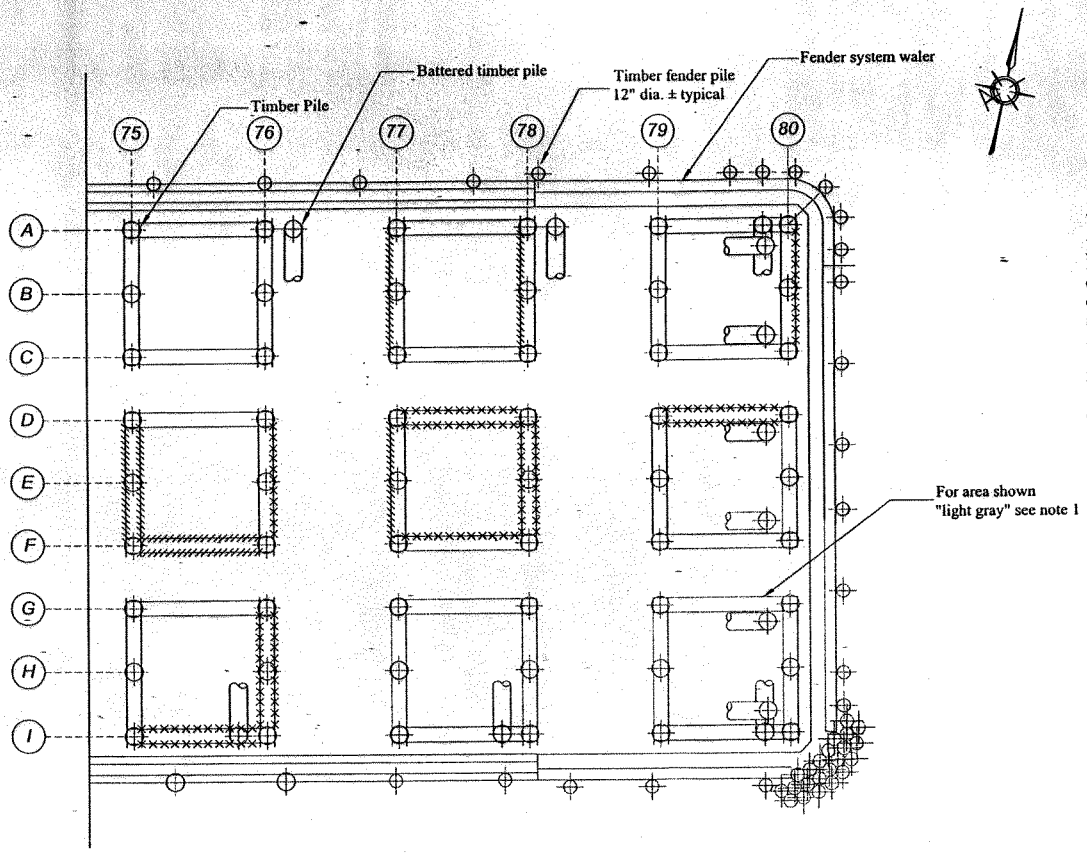
NTSB 02120



Diagonal Bracing Deficiency Plan
Scale 1"=10'

LEGEND

~~XXX~~ Impact damaged, "crushed timber bracing"

////// Deteriorated timber brace (rotted)

NOTES

1. Some of the destroyed timber caps, piles, and bracing could not be safely inspected due to remnants of concrete deck above. Large concrete slab is "hanging" by deck reinforcing. Demolition and removal poses local stability issues. All elements below are considered to be broken.

2. Lower bracing and lower end of diagonal bracing typically exhibits minor deterioration with rot, marine borer activity and moderate corrosion of the hardware.

U/W Inspection and Evaluation
St George Ferry Terminal
Pier 1-B
1" = 10'
December 2003
Atlantic Engineering, LLC
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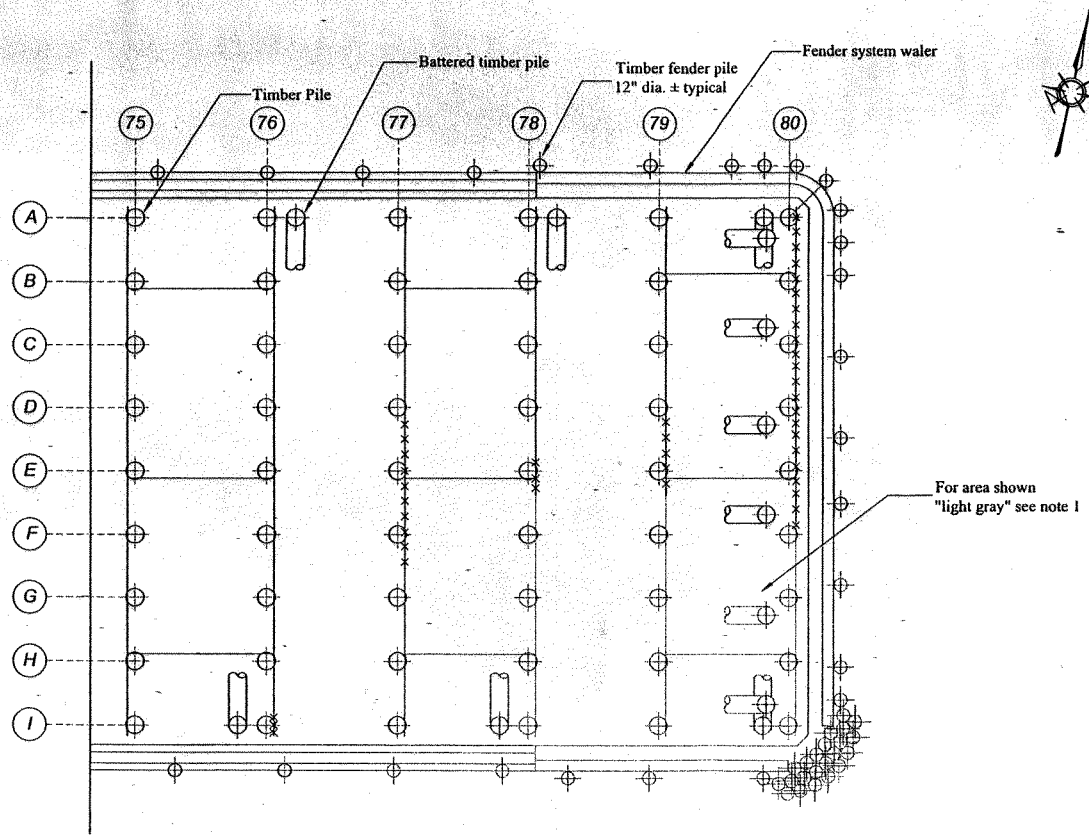
Kinnelon, New Jersey 07405



LOWER BRACING DEFICIENCY PLAN
Scale 1"=10'

LEGEND

~~XXX~~ Impact damaged, "crushed timber bracing"

////// Deteriorated timber brace (rotted)

NOTES

1. Some of the destroyed timber caps, piles, and bracing could not be safely inspected due to remnants of concrete deck above. Large concrete slab is "hanging" by deck reinforcing. Demolition and removal poses local stability issues. All elements below are considered to be broken.

2. Lower bracing and lower end of diagonal bracing typically exhibits minor deterioration with rot, marine borer activity and moderate corrosion of the hardware.

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Pier 1-B
1" = 10'
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PHOTOGRAPHS

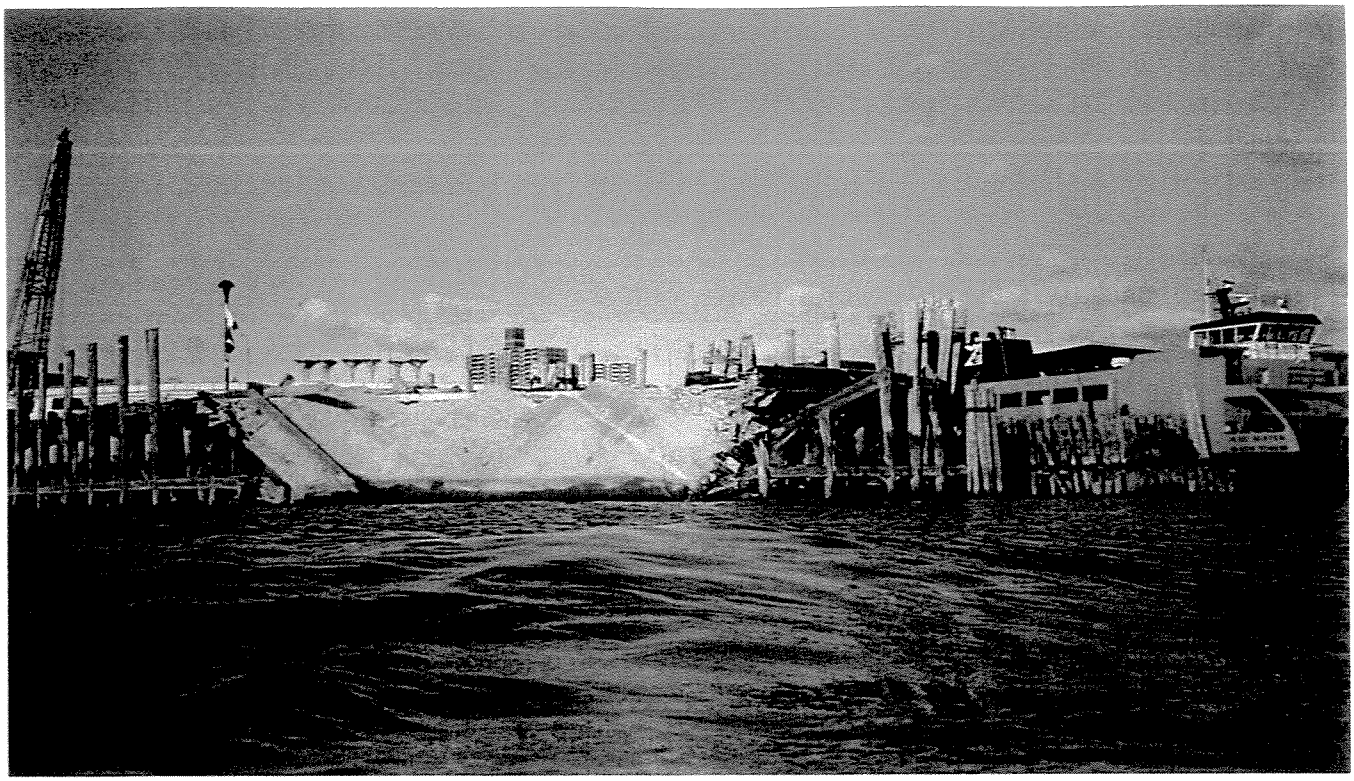

PHOTO 1 - General view of pier with collapsed SE corner, looking NW.

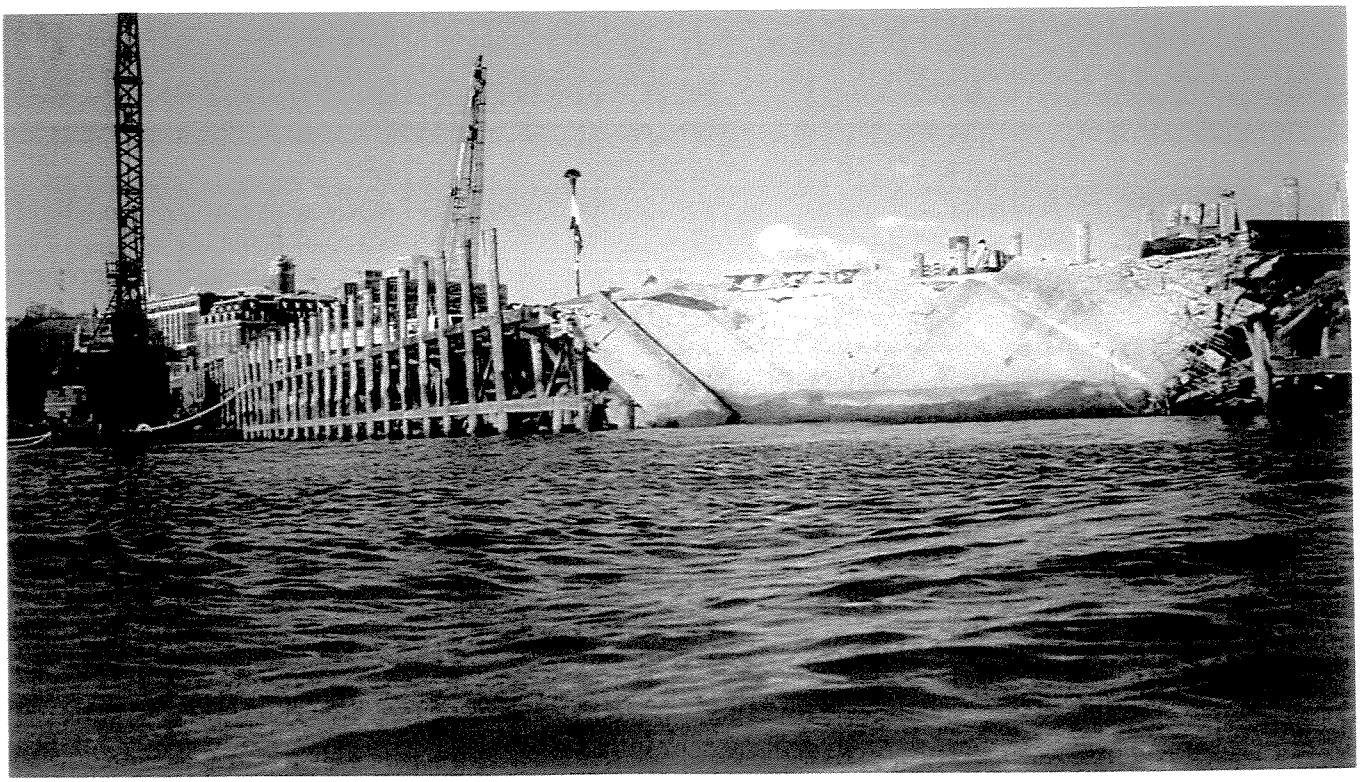

PHOTO 2 – General view of pier with collapsed SE corner, looking west.

PHOTO 3 - East end of pier, approximately 20' along the east face remains erect at north end.

PHOTO 4 – East end of pier close-up view collapsed/erect interface, 20' south of the NE corner , looking NW.

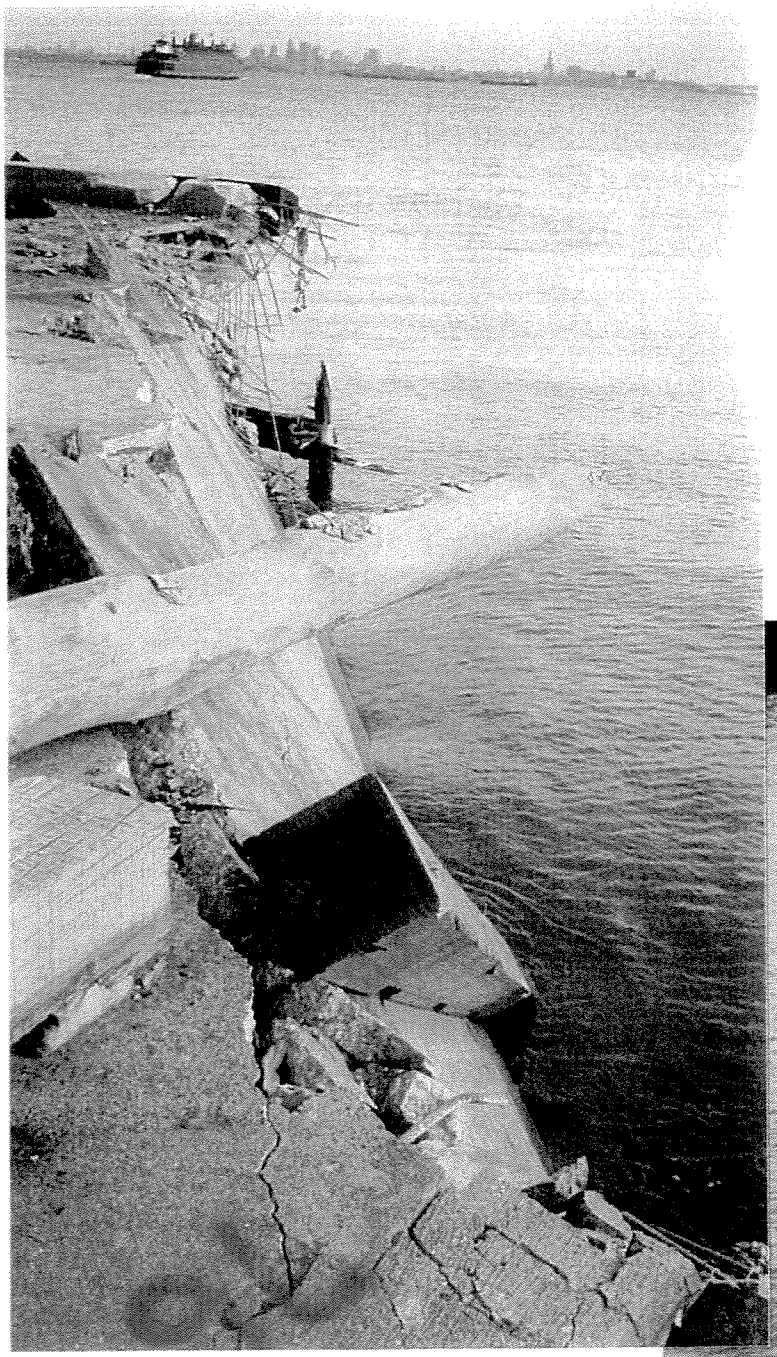

PHOTO 5 - Top side view of collapsed SE corner of the pier looking NE.

PHOTO 6 – Top side view of collapsed SE corner of the pier looking SW.

PHOTO 7 - Top side view with pulled fender system piles on top of the pier, looking east.

PHOTO 8 – Bent 80, piles "C" and "D" with "C-batter" and "D-batter" showing general configuration and construction. Note, top horizontal 6 x 12 bracing provides connection of battered piles to bent 80 and 79 vertical pile, looking SE.

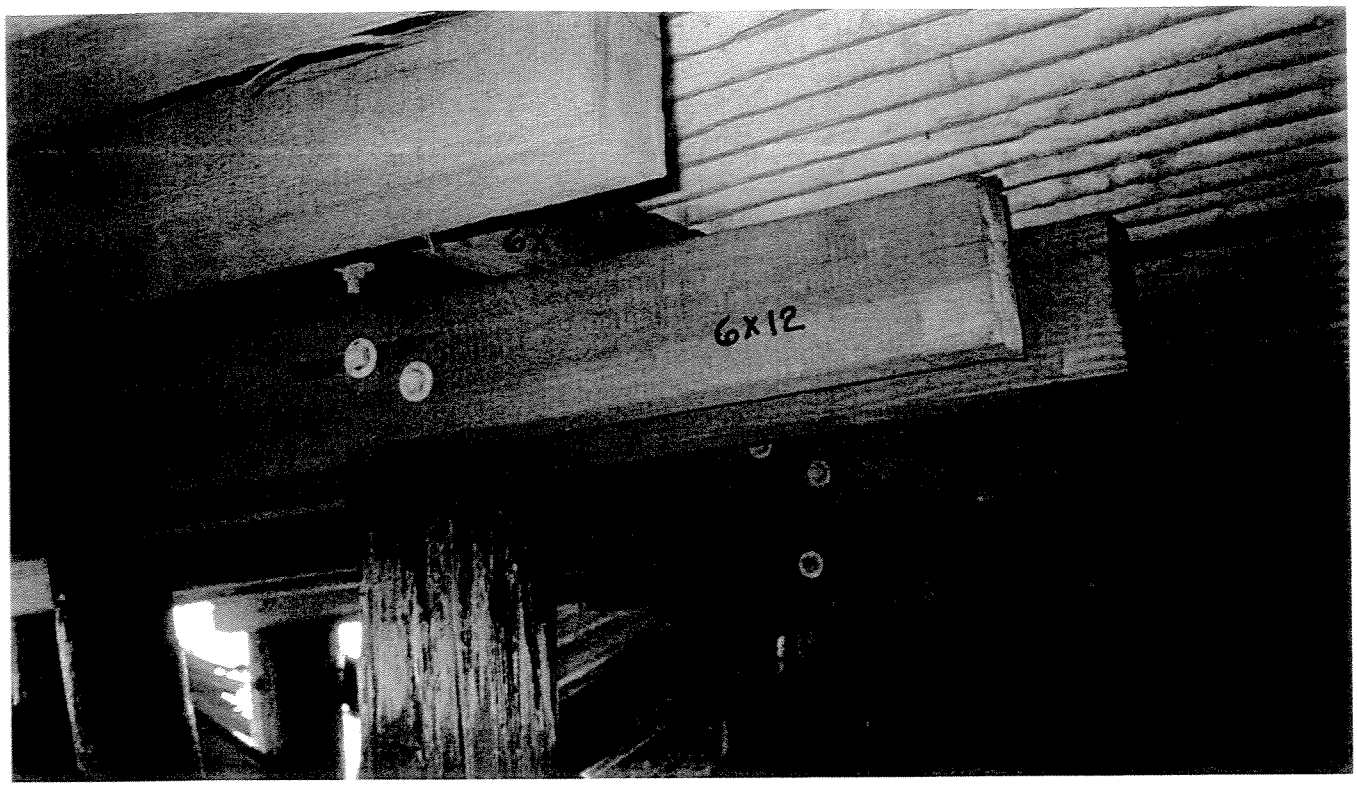

PHOTO 9 - Pile bent 79, pile "B" showing general configuration and construction. Note 6x 10 timber "sistered" to 12 x 12 cap acting as a ledger to support the corrugated steel deck form. Transverse 6 x 12 horizontal timbers serve as bracing and provide connection of battered piles at bent 80 (see photo 8) , looking SE.

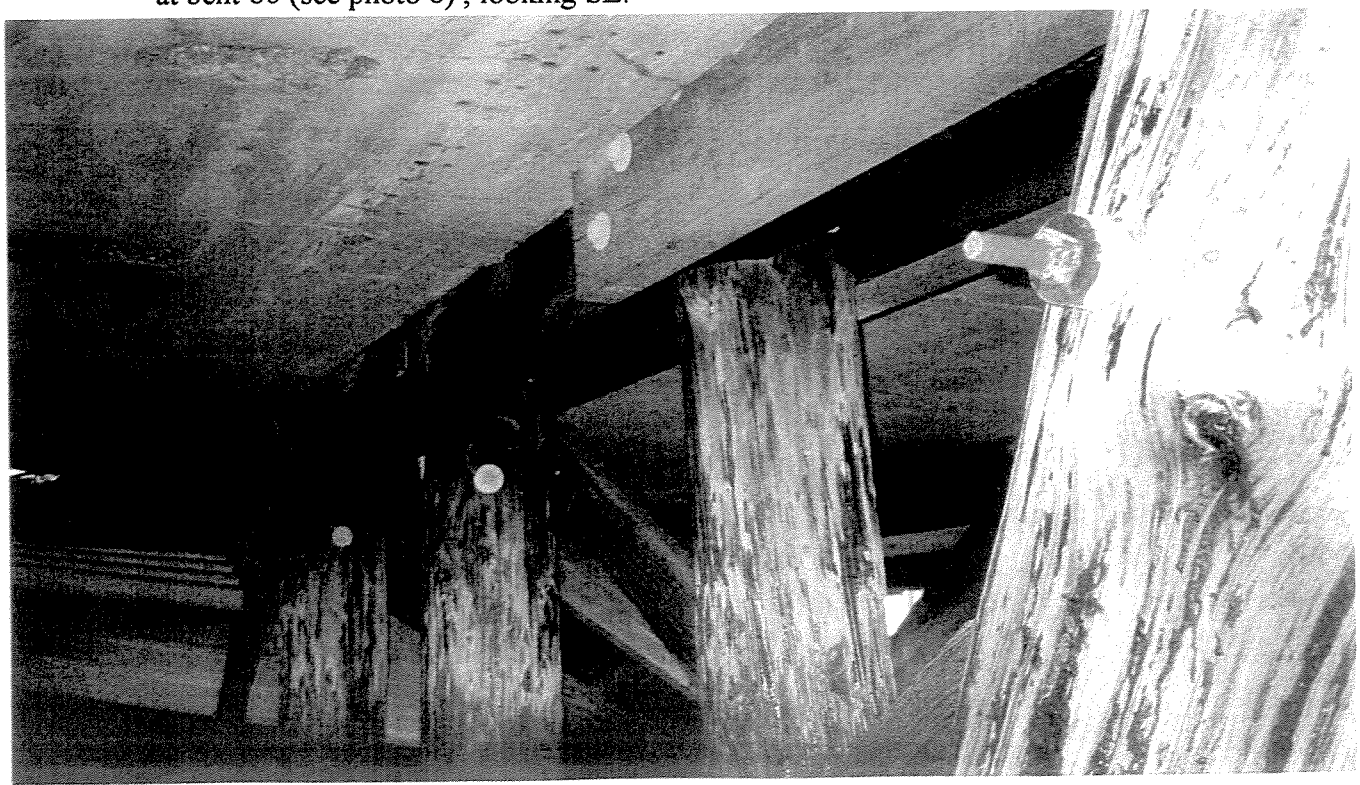

PHOTO 10 – Bent 78, piles "A-batter," to "D." Bent numbers 78 and lower have a dual 6 x 12 timber cap with a "sistered" 6 x12 from piles "B" to "A" and "H" to "I" providing a 2' long cantilever on the outside perimeter of the pier for support of the concrete deck above, looking SW. Refer to section.

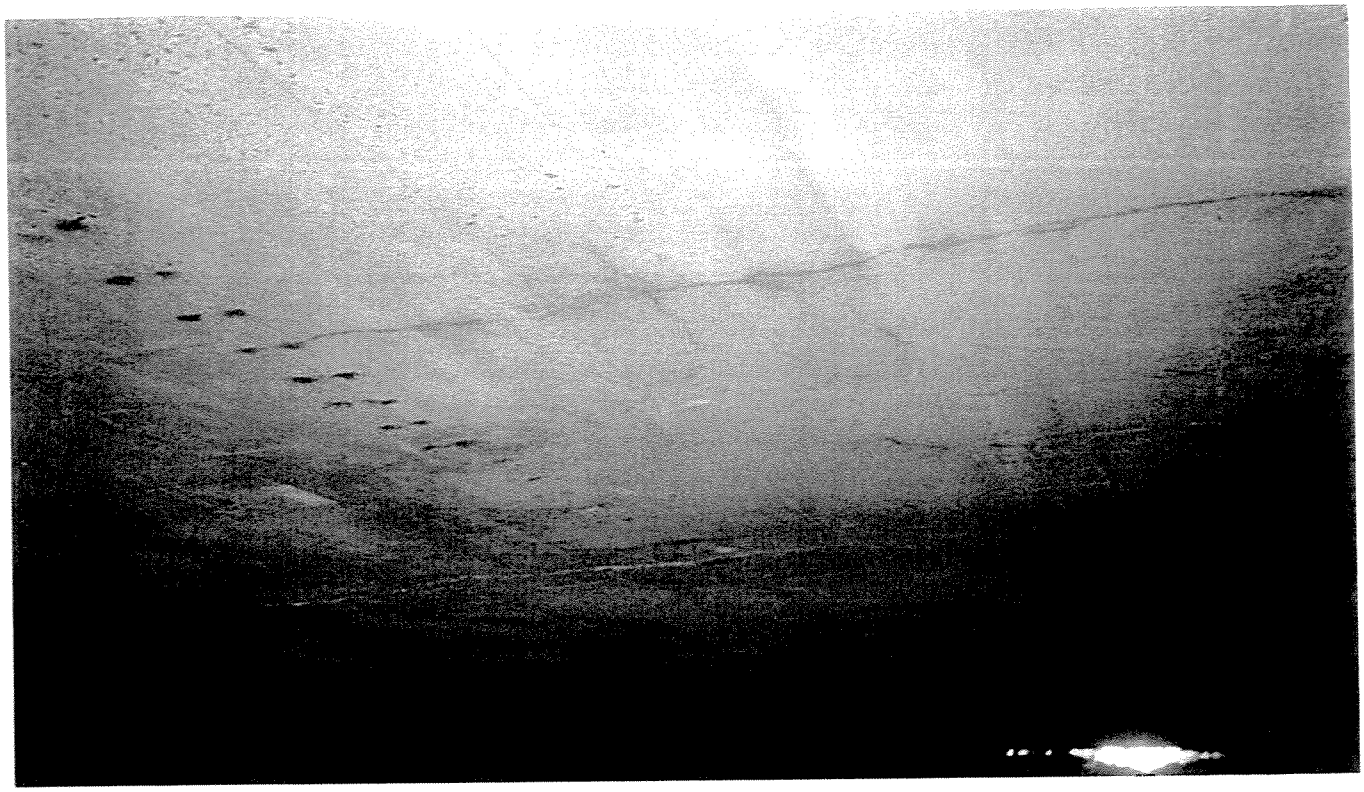

PHOTO 11 - Between pile bents 78 and 77 at north side of pier. General view of typical underside of concrete deck in satisfactory condition with several longitudinal cracks, looking SE.

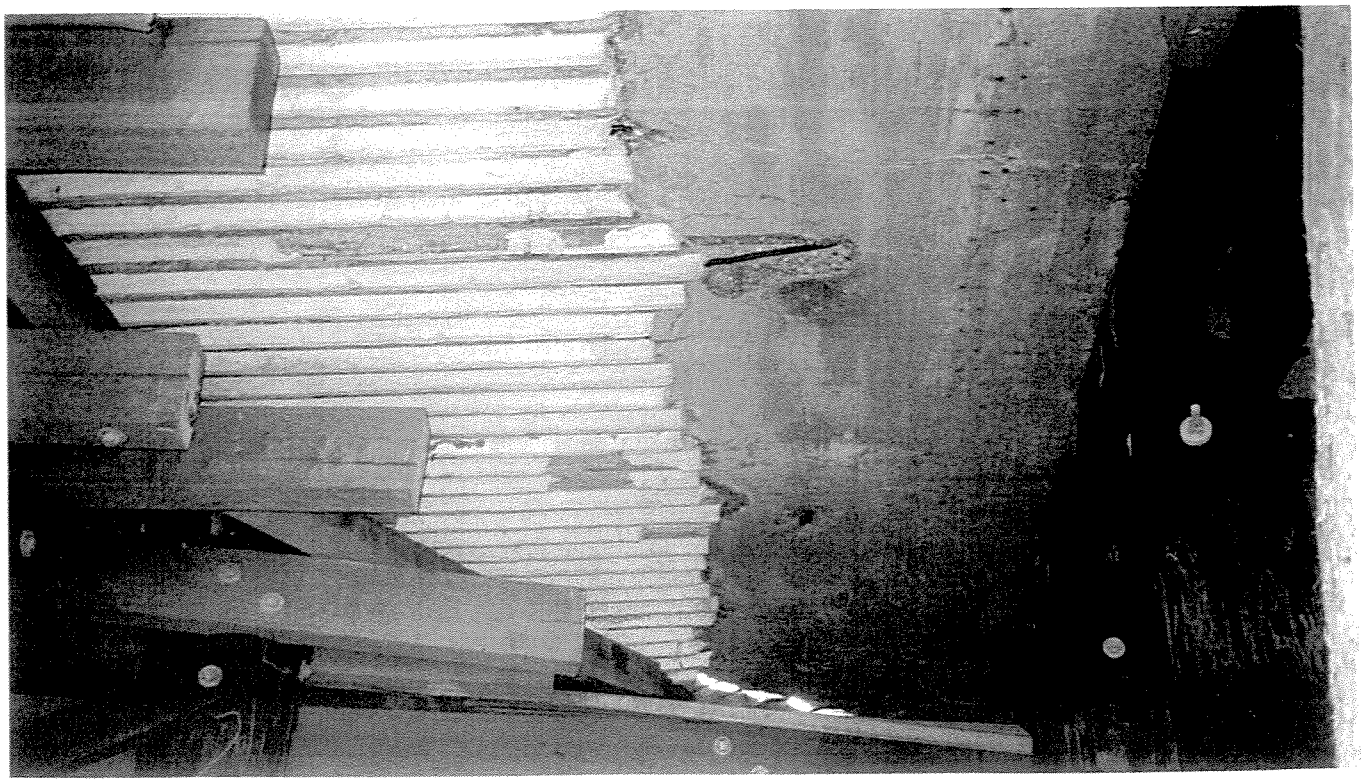

PHOTO 12 – Between pile bents 79 & 78, north side of pier. East side (left) formed with steel corrugated metal decking (gone). Note, deck flutes were packed with a foam filler still in place. West side (right) typical cast in place concrete deck with a few small spalls with exposed steel reinforcing, looking south.

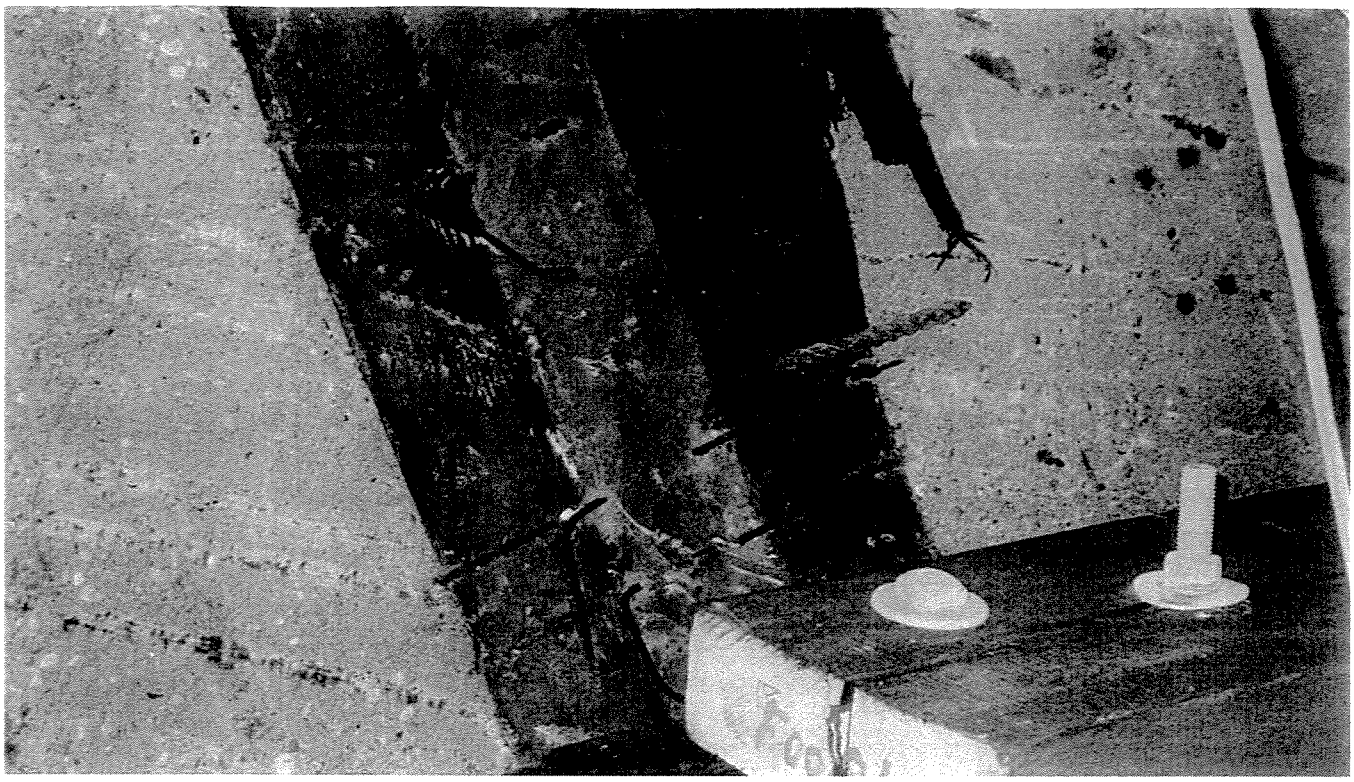

PHOTO 13 - Pile bent 78, close-up of collapsed deck showing 1/4" diameter steel "ties," sets of four (4) at 12" spacing. Steel ties assumed to have provided connection between concrete deck and timber pile cap, looking south.

PHOTO 14 – Pile bent 77, general view of impact damaged, collapsed underside of pier. Piles "D" thru "I," timber cap beam broken south of "G" pile with severe displacement of "H" and "I" piles, looking SE.

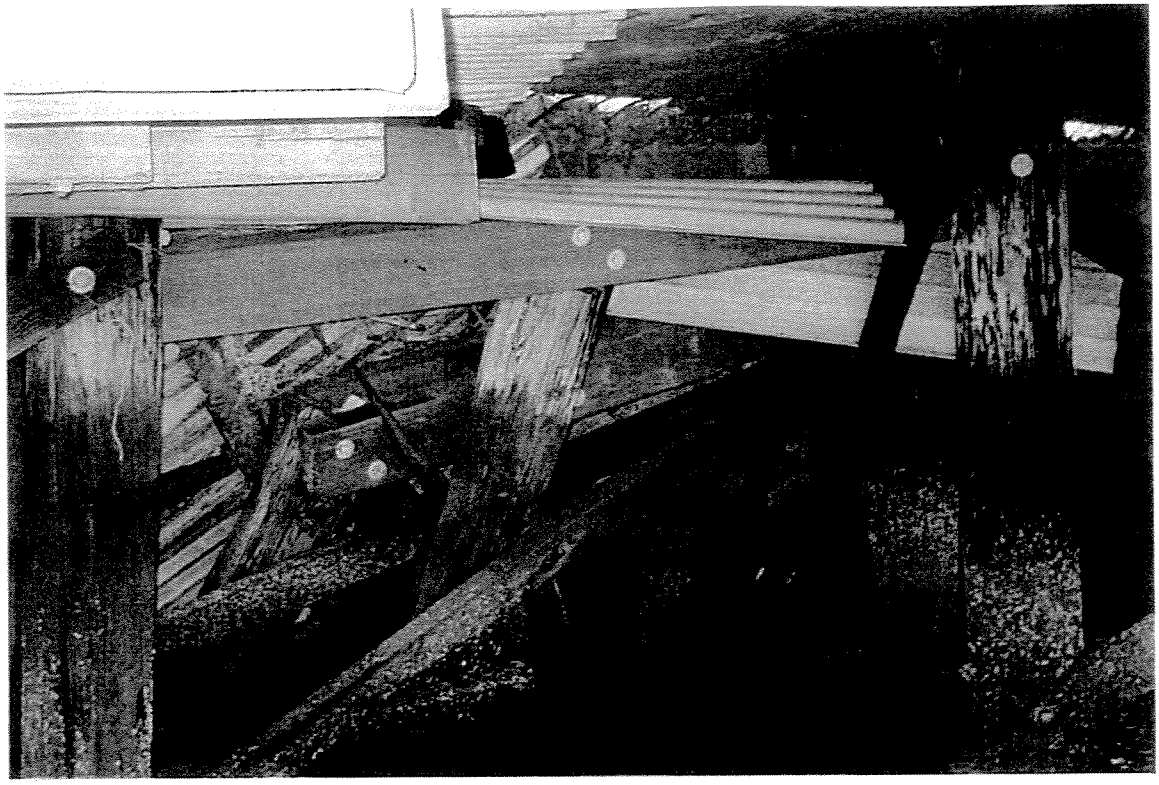

PHOTO 15 - Between pile bents 79 and 78 at the north side of pier. General view of collapsed area with severely displaced piles, looking south.

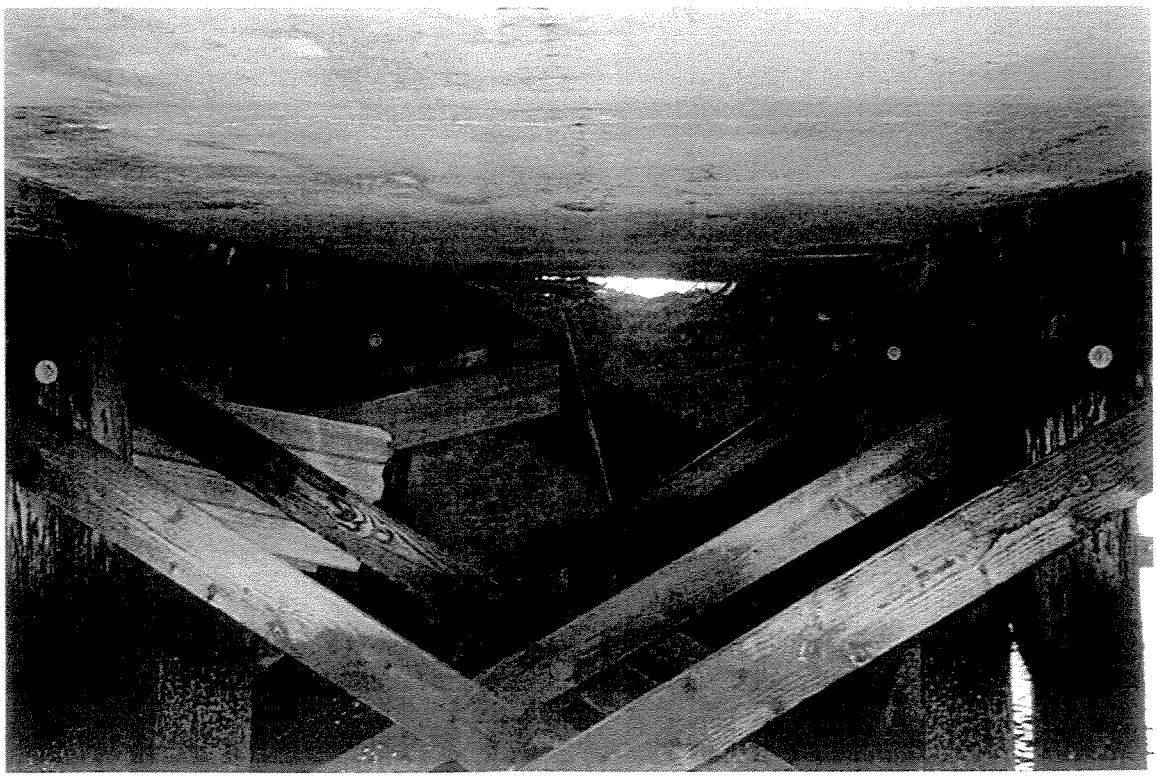

PHOTO 16 – Between pile bents 78 and 77 at the north side of the pier. General view of collapsed area with severely displaced piles and broken timber caps, looking south.

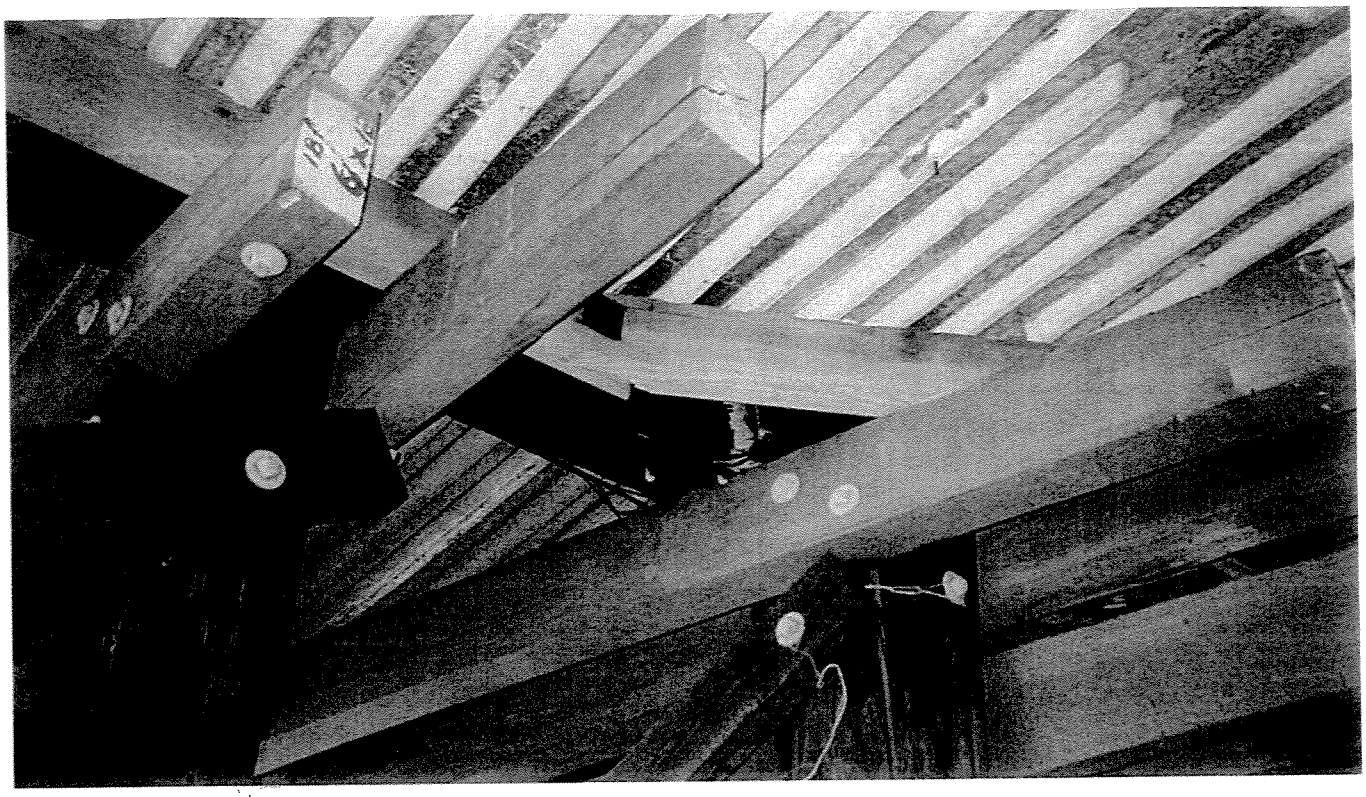

PHOTO 17 - Bent 79, pile "C" and "D." Note break in timber cap at "D" with split pile and rotation of 6 x 12 horizontal timber bracing, looking SE.

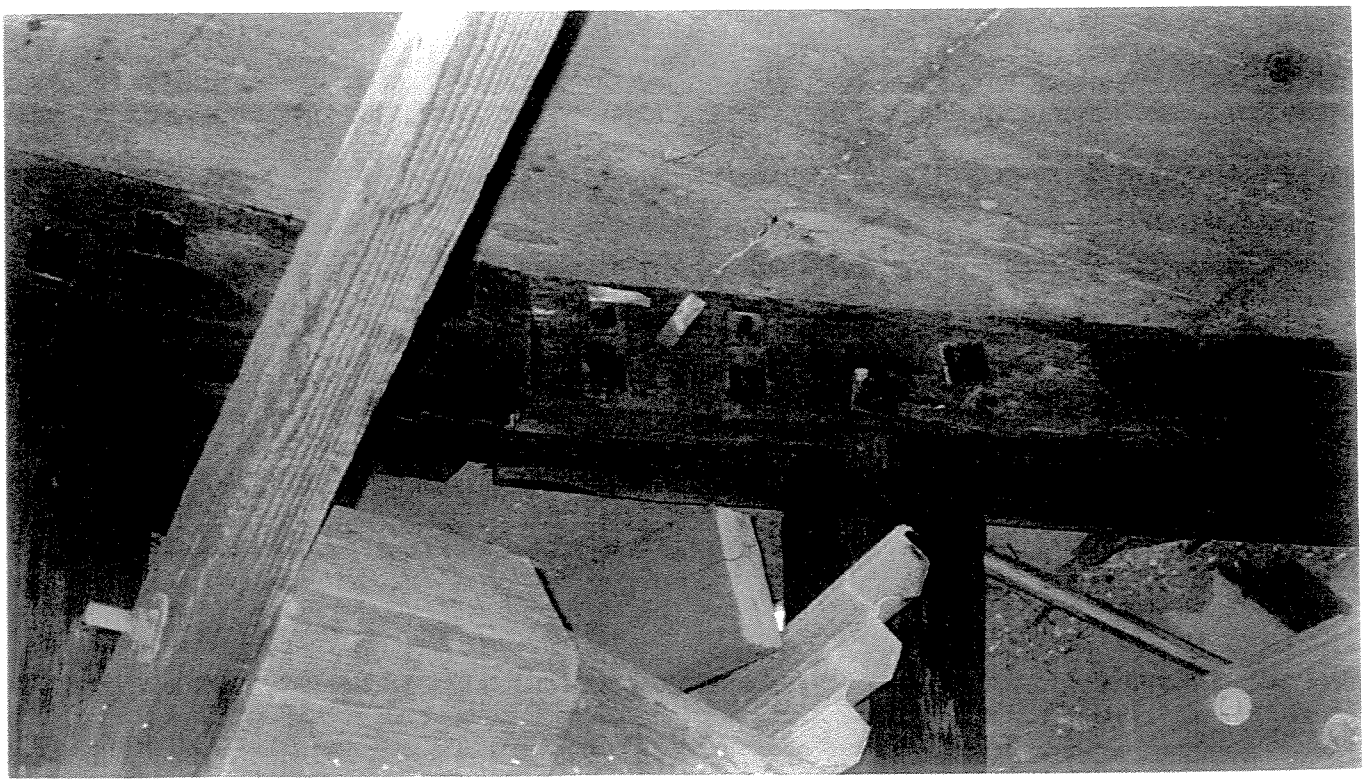

PHOTO 18 – Bent 78 piles "D" and "E," splice in timber pile cap beam with displaced "E"pile and broken cap. Timber cap to the north of the splice is satisfactory, looking SE.

PHOTO 19 - Bent 76, "E" pile, diagonal 4 x 8 timber brace broken. Deficiency does not appear to be the result of impact damage.

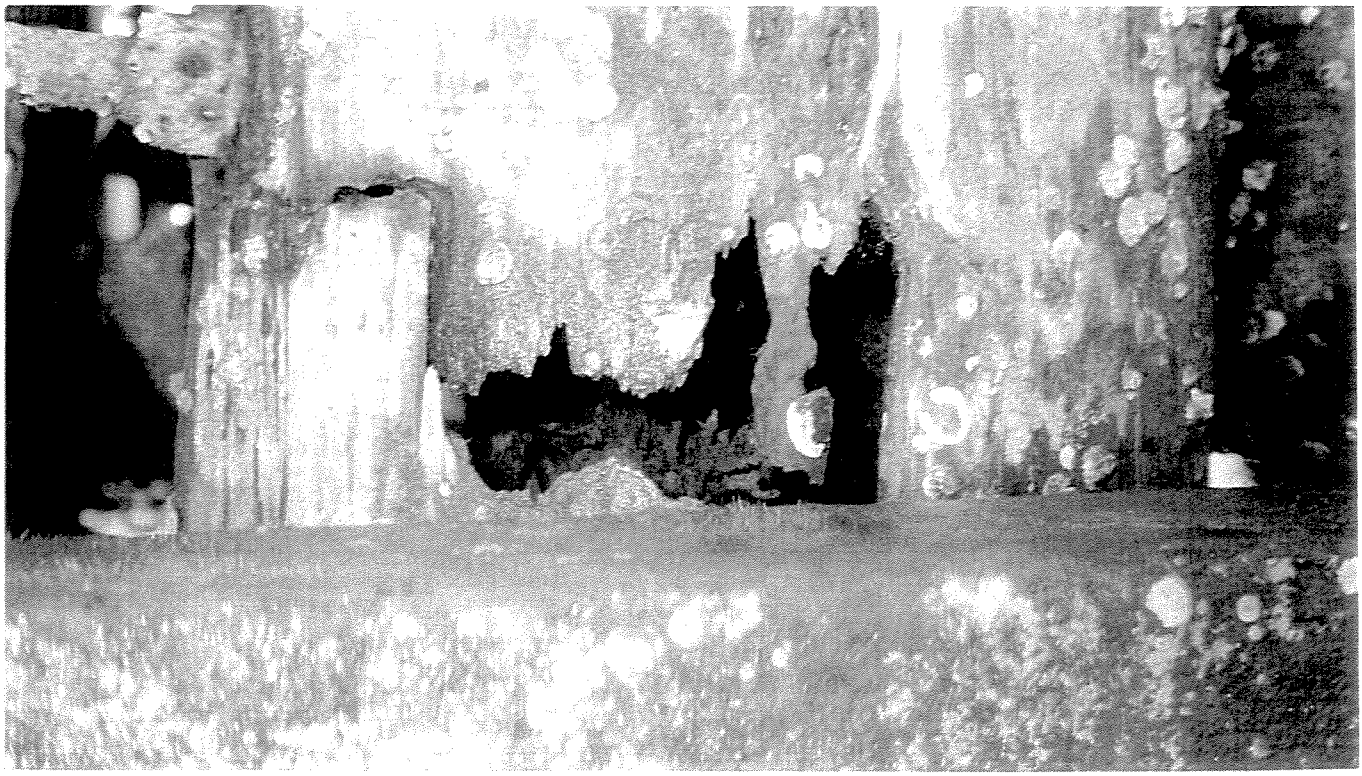

PHOTO 20 – Bent 80, "B" pile, close-up view of hole in pile, 2" above the lower horizontal brace. Note, pile exhibits hollowing with 95% loss of cross-sectional area and heavy marine borer activity.

PHOTO 21 - Bent 76, "E" pile with typical splice of lower timber bracing between piles "E" and "F," looking NW.

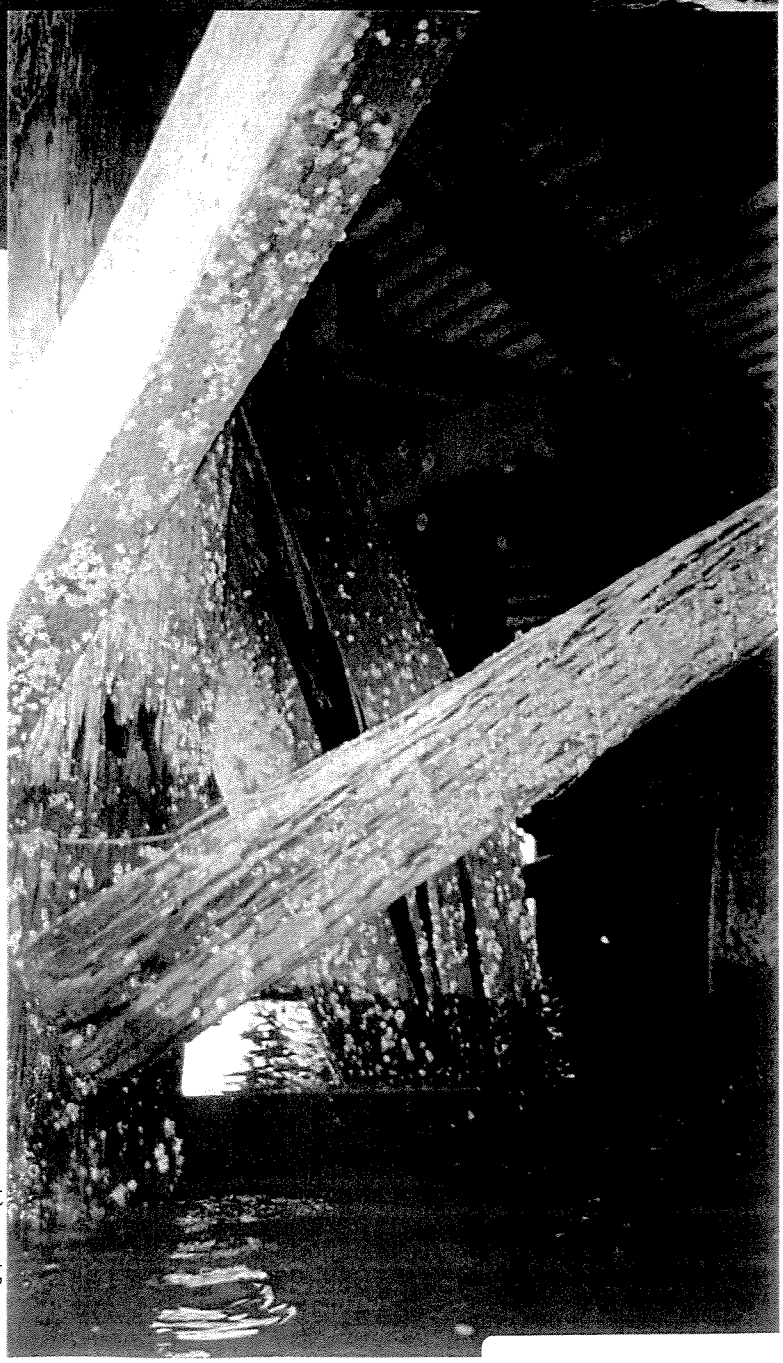

PHOTO 22 – Bent 78, "A" pile with "A-batter" beyond. Both piles exhibit 25% to 50% loss of cross-sectional area due to rot in the tidal zone with heavy marine borer activity, looking SE.

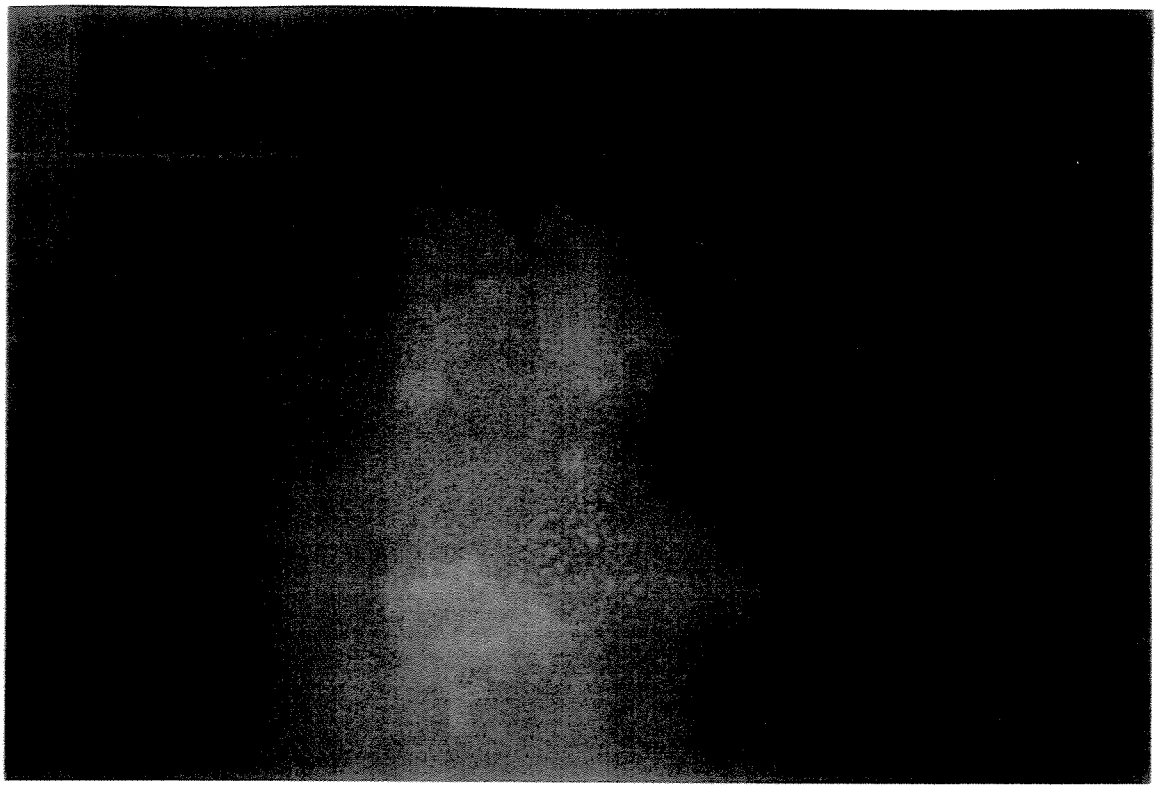

PHOTO 23 - Pile 76 "B," at the mudline. Typical pile with light marine growth in good condition, looking east.

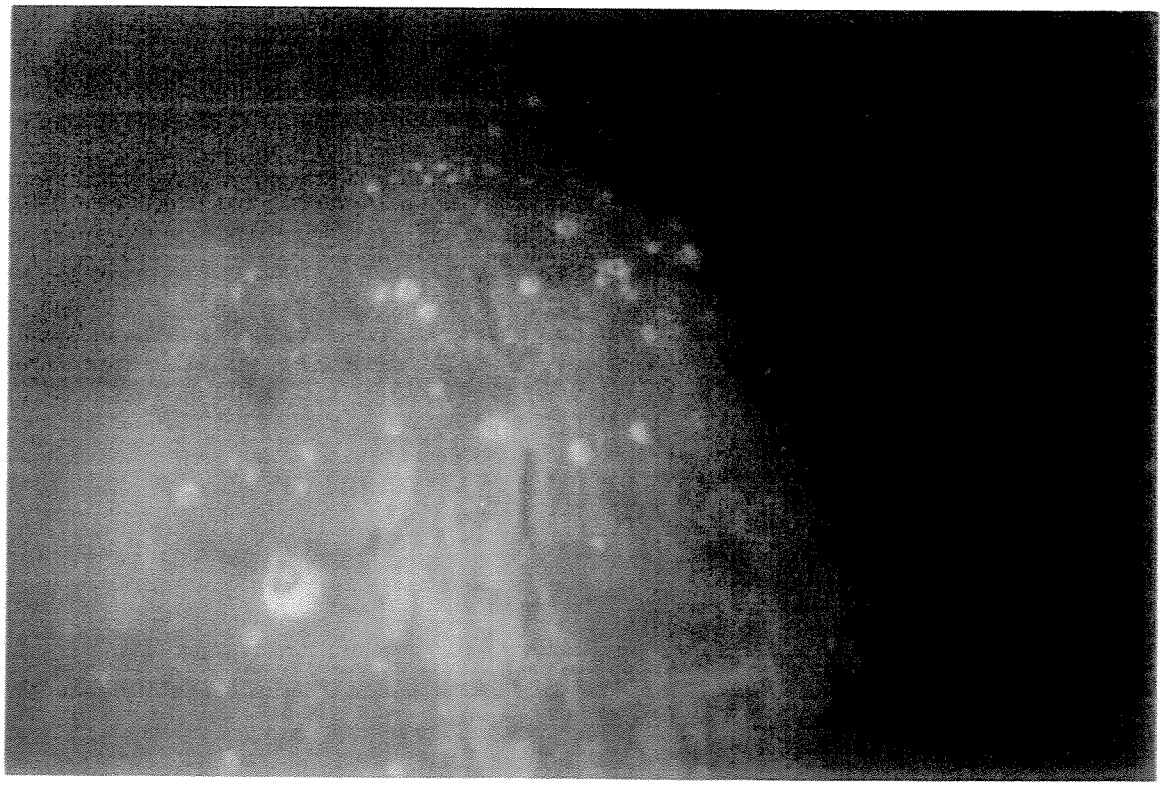

PHOTO 24 – Pile 75 "B," 5' above the mudline. Typical pile with minor marine borer activity. Note the vertical 1/4" diameter "tracks" indicative of the Teredo marine borer, looking NE.