RESTORATION OF THE MISSISSIPPI STATE PORT AT GULFPORT

by

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INTRODUCTION

On the morning of Monday, August 18, 1969, Port Officials inspected the catastrophic damage to the Mississippi State Port at Gulfport. The port facilities were in an almost unbelieveable state of destruction in the wake of Hurricane Camille, the worst storm of record ever to hit the United States Mainland. The Officials, representing the State Port Authority, responsible for Port Operations and the Mississippi Agricultural and Industrial Board, owners of the Port with overall responsibility for Port matters, faced a rebuilding program which ultimately cost nearly six million dollars.

Restoration and reconstruction were accomplished in three general phases; namely (1) immediate emergency clean-up, (2) emergency repairs to the banana terminal and (3) conventional contract procedures whereby plans and specifications were prepared by various firms and bids taken in the normal manner for construction and repair contracts.

This paper deals primarily with the third phase of work and more particularly within the limits of the West Pier. Other phases and areas are touched on briefly.

AFTERMATH OF HURRICANE CAMILLE

The Mississippi State Port at Gulfport is a manmade peninsula extending about 5,000 feet into the Gulf of Mexico. Two arms, the east and west piers protect a harbor basin which is approximately 1300 feet wide by 3400 feet long.

The mouth of the harbor faces generally in a SSE direction. From the way the debris was strewn on the Monday morning after, the 200 mph winds (estimated) and 20 feet tide struck the port heading in a generally WNW direction.

Two 500,000 gallon oil storage tanks (60' dia. x 25') located near the south end of the east pier were ripped from their foundations. One

ended up beside what was a filling station on Highway 90 about one-hal. mile west of the Port. The other was later found in the bottom of the harbor opposite Warehouse Section No. 2 off the west pier.

Near the central portion of the east pier, warehouses of steel frame with flat roofs and metal siding had contained about 8,000 tons of rolls of paper destined for Central America where they would be manufactured into banana boxes. These rolls weigh from 3200 to 4200 pounds each and were carried by the wind and water over a wide area of Gulfport and Long Beach. Some rolls were found as far as 4 miles west and 1 mile inland from the Port. The east pier warehouses were heavily damaged as the storm swept through them. The metal siding and roll-up steel doors were torn away by the storm or knocked down by the force of the heavy rolls of paper. The roofs, though heavily damaged, stood up better than one might have expected. The frames were racked as much as a foot out of plumb but remained standing with exception of the southern most bay.

At the north end of the east pier stands the Banana Terminal. The buildings, sheds and conveyor bridges are all of sheet metal covered light steel frames. The storm left these facilities a mass of tangled steel. The critical item of the banana handling complex is, of course, the four gantrys. Port Officials had enough warning so that they were able to lash down the gantrys with heavy cables and remove the electric motors. Because of these precautions, it was possible to initiate an around-the-clock emergency rebuilding program so that in three weeks, unloading of bananas resumed at the regular schedule of three ships per week. The record of this phase of the work is the subject of an accompanying paper.

Moving now to the south end of the west pier, located here was the newly completed Warehouse Section No. 13 (since renumbered No. 14). This building was a 128' clear span rigid steel frame by 720' long with tilt up concrete side walls and a conventional sheet metal roof. Stored in the building were over 24,000 bags of sugar and 15,000 bales of jute. The force of wind and water leveled all of the walls and swept the building clean of all stored cargo. The frames and roof, except for the south end bay, withstood the storm's fury.

South and west of the new warehouse was an asphalt paved open storage area. The area was protected on the east (harbor side) by a line of steel sheet pile cells and on the south and west by rip-rapped slopes. The area was approximately 250' x 550' before the storm, but afterwards the entire south slope was gone, as was approximately 50 per cent of the paved area and supporting sand fill. No damage was done to the sheet pile cell bulkhead.

Two elevated water storage tanks stand on the west pier. The older tank, erected in 1939, holds 100,000 gallons and is located near

the north limits of the harbor. The newer tank erected in 1969 holds 500,000 gallons is located about 2200 feet southward of the small tank and near the north end of Warehouse Section No. 14 (previously No. 13). The large tank, though battered by 200 mph winds, a 20 feet tide and flying debris, suffered only scarred paint. The small tank was only slightly more damaged. Flying or floating debris broke one lower diagonal brace rod on the east side and the two southward legs were found to have shifted about 3/4 inches.

Between the two tanks are located the bulk of the west pier facilities, eight wharfside warehouse sections (No. 1 through No. 8), four back-up warehouse sections (No. 9 through No. 12) together with maintenance shops, toilets, scales, and stevedore offices and shops.

At the time of the storm warehouse section No. 2 contained approximately 2000 tons of bulk fishmeal. As the storm tore through the wharfside warehouses, the fishmeal was flushed into the area behind the warehouse and in a matter of hours the wet fishmeal had spawned maggots to the extent the ground was covered an inch deep with them. Other wharfside warehouses stored 3000 tons of fertilizer and 10,000 bags of Magnesium Sulphate (Epsom Salts). These cargoes were also spread over the remainder of the west pier area so that even before the structural and physical damage could be assessed, it was necessary that the caotic mess be cleared.

The west pier wharf is in two sections, the north 1885' was constructed in 1935 and is a conventional poured-in-place reinforced concrete beam and slab system supported on precast concrete pile bents normal to the wharf side and at 20 feet on centers. The outer five feet was of cantilever construction. The south 1150 feet was completed in 1968 and consists of 18 steel sheet pile cells 64' in diameter acting as a bulkhead. At the time the storm hit, three ships were tied up to the west pier wharf. Two, the Silver Hawk and the Hulda were old WW II liberty ships. The third, the Alamo Victory was a military cargo vessel. The Hulda was laden with bagged palletized fertilizer destined for India. That was scheduled to be the old ship's last voyage as she was, upon its completion, intended for the salvage yards in Japan. The Silver Hawk was empty. The Alamo Victory was carrying military cargo of various types headed for Viet Nam. The ships, riding the 20 feet tide, were lifted above the wharf and pounded down on the wharf edge breaking off the cantilever portion over most of the old portions length. As the edge was broken off, the morrings were torn loose and after considerable crashing together, the ships ended up aground in the Northwest corner of the harbor basin.

In addition to the three ships which were tied up to the West Pier there was also a 26' x 175' std. hopper barge tied near the north end. The barge disappeared during the storm and was later located sunk in the center of the north end of the harbor.

IMMEDIATE CLEAN-UP AND RESTORATION

Within a matter of hours, action was taken to mobilize forces for clean-up work to eliminate health and safety hazards, and to make emergency repairs to the banana unloading facilities.

The clean-up work was in full swing by Wednesday, August 20, 1969, less than two days after the storm and was carried on during all day light hours for the next 13 days. Some vital work was carried on with assistance of portable light plants, around the clock. At the peak of activity some 430 men, 90 trucks and 54 pieces of other equipment were engaged in clean-up operations. On September 2, 1969, the emergency clean-up work was declared complete. The final cost of such clean-up operations amounted to $475,954.

Immediate emergency repairs to the banana unloading facilities cost $1,237,599. Thus, the cost of the first two phases of work totaled $1,713,553.

From this point restoration was accomplished by conventional bidding and contract procedures.

FINAL RESTORATION

Starting with completion of certain unfinished portions of emergency repairs to banana unloading facilities, consulting engineering firms were retained to evaluate the damages, determine appropriate repair methods and materials and to prepare plans and specifications for letting of bids. In all, five consulting firms were used to prepare thirteen separate construction contracts.

For the most part, repairs were made to match construction prior to the storm. Two notable exceptions to this procedure are (1) the use of reinforced concrete block masonry walls on top of 4 feet high poured-in-place concrete base walls in lieu of tilt-up concrete walls around the Warehouse Section No. 14; and (2) the reconstruction of the west pier wharf edge.

Because it was considered impracticable to attempt to anchor a cantilever section to the remaining wharf which would satisfactorily resist vertical loads as well as lateral forces of moored ships, a procedure was conceived which required a single new row of piles along the outer wharf edge. Another change in reconstruction of the wharf edge was change from a timber fender system that depended primarily on crushing action of the timber members to absorb docking forces to a springing timber system which used bending action of the timbers to absorb the ships inertia.

From the following sketch (Fig. 1) showing the details at the wharf edge, it can be seen that the outer row of prestressed piles are battered

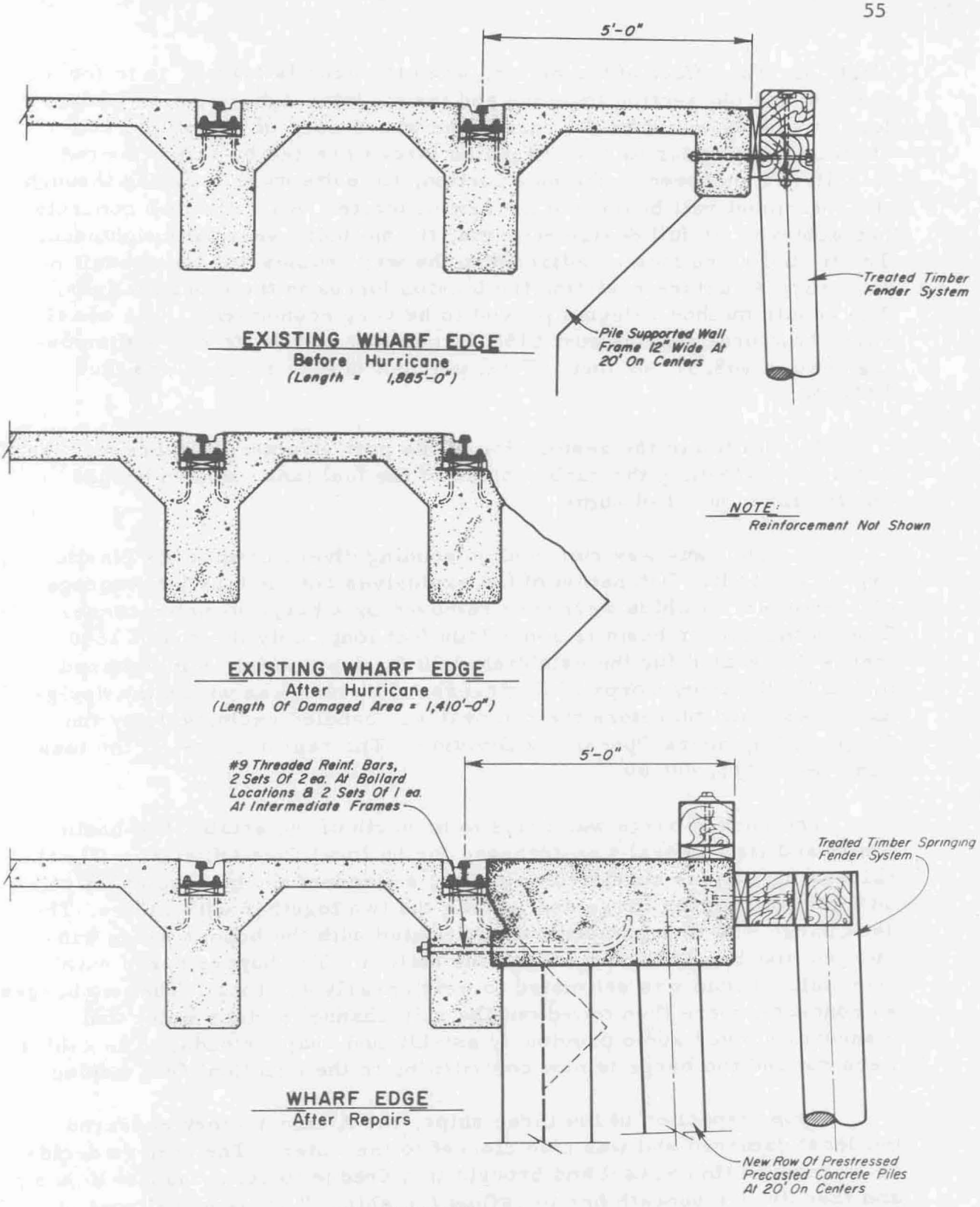

FIGURE 1

WHARF EDGE
MISSISSIPPI STATE PORT
GULFPORT, MISSISSIPPI
PREPARED BY
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slightly. The effect of the batter, when the deck is loaded, is to force the new and old section together and insure lateral distribution of the loads much as would be the case if the wharf were of monolithic construction. In order to resist tension forces created by ships moored to bollards anchored in the new portion, tie bolts were installed through the outermost rail beam into the new concrete. After the new concrete had achieved its full design strength, the tie bolts were fully tightened. The tie bolts are located adjacent to the wall frames and thus result in the entire structure resisting the tension forces in the mooring lines. The repair method selected proved to be very economical. The wharf edge structural repairs cost $153.11 per foot and the fender and mooring system $68.31 per foot. Total per foot cost of repairs was thus $221.42.

In addition to the restoration of the port structures, there was the problem of cleaning the harbor basin of the fuel tank, sunken barges and the three beached ships.

The fuel tank was removed by sending divers down to fix plastic explosives to it. Detonation of the explosives cut the tank into manageable size pieces which were then removed by a barge mounted crane. Though the harbor basin is some 3400 feet long, only the south 2640 feet is designated for the established 30 ft. depth which is maintained by the U. S. Army Corps of Engineers. The tank was within the designated basin and therefore the removal was handled exclusively by the Corps of Engineers Operations Division. The reported cost of the tank removal is $13,900.00.

The sunken barge was found to be north of the established basin limits and its removal was arranged for by local Port Officials. The salvage operations consisted of sinking a standard deck barge exactly on top of the hopper barge and lashing the two together with cables. The deck barge was then pumped out and floated with the hopper barge submerged just beneath it but free of the bottom. The hopper barge with accumulated mud was estimated to weigh nearly 400 tons. The two barges so connected were then towed out the ship channel to deep water and maneuvered over some previously established snapper beds. The cables were cut and the barge is now contributing to the excellent Gulf fishing.

Upon inspection of the three ships, the Alamo Victory appeared the least damaged and was also closest to the water. The owners decided to recover this vessel and brought in a dredge to cut a channel to her and then dredge beneath her to refloat the ship. The reported cost of the successful recovery effort was $284,000. The Alamo Victory was then taken to Beaumont, Texas, where after a detailed inspection, the damage was found to be much greater than previously believed and the decision was made to junk the vessel.

Estimates of the cost of recovery and repairs of the remaining two

ships far exceeded their value. If the owners had abandoned the ships where they lay, it would have resulted in a possible liability to the State. Accordingly, action was taken through legal channels to hold the cargo of the Hulda and to prevent cannibalizing of the ships. That is, removing all the valuable machinery and parts and leaving the hulks on the hands of the Port. The State thus extracted guarantees that it would suffer no liabilities before releasing the ships and cargo. The owners and insurers of the cargo and of the ships were then permitted to make the best deals they could in disposing of them. The reported salvage price obtained by receipt of bids was $105,000.

SUMMARY OF PORT RECONSTRUCTION

Following is a summary of the various projects which includes a brief description of the work included and ultimate cost.

1. Emergency Clean-Up: Removal of all health and safety hazards together with 95% of storm created debris. $ 475,954

2. Emergency Repairs to Banana Terminal: Repairs to gantry booms; repair and replacement of conveyors, conveyor bridges and conveyor sheds; repairs to loading sheds; repairs and replacement of electrical and mechanical systems; and repairs of north half of east pier warehouse. $1,237,599

3. Completion of Emergency Repairs to Banana Buildings: Finished siding of warehouse, finished covering of conveyor bridges, finished covering loading sheds, finished lighting work. $ 47,276

4. Complete Emergency Repairs to Banana Terminal Machinery: $ 35,581

5. West Pier Restoration - Electrical: Replaced electrical service entrance structure, switches and conduit. $ 19,586

6. Removal of Sunken Tank: $ 13,900

7. Banana Terminal Fence: Replaced existing fence. $ 9,400

8. West Pier Restoration - Streets, Utilities and Warehouse Sections 5 - 8: Cleaned storm and sanitary sewers; reworked two well pumps, surge pumps, elevated tanks and sewer lift stations; electrical power wiring, lighting and motor controls;

	removed and replaced damaged street and driveway pavement; straightened and replaced steel framing; new metal siding; repaired roofs and gutters; restored roll-up doors; and restored sprinkler systems.	$ 517,535
9.	West Pier Wharf Repairs: Demolished damaged wharf structure back to sound construction, replaced outside wharf edge, fender system and mooring facilities.	$ 448,526
10.	Clean-out of North Harbor: Removed sunken barge and other major debris from harbor basin.	$ 24,350
11. *	West Pier Restoration - Warehouse Sections 1 through 4 and 9 through 12: Restored electrical power wiring and lighting; straightened or replaced steel framing; replaced metal siding; repaired roofs and gutters; restored roll-up doors; repaired firewalls.	$ 663,000
12. *	West Pier Restoration - Open Wharf Area and Warehouse Section No. 14: Replaced lost land fill and rip-rap; replaced warehouse walls; repaired roof; restored electrical system and sprinkler system.	$ 901,000
13. *	Restoration of Banana Terminal Facilities:	$ 464,000
14. *	Repairs to Small Craft Harbor Drainage, Streets, Railroads Fences and North End Bulkhead:	$ 244,000
15. *	East Pier Warehouse and Toilet:	$ 196,500
16. *	Port Office Replacement:	$ 153,300
17. *	Truck Marshalling Area:	$ 45,100
	TOTAL RESTORATION COST -	$5,449,331

*Indicates projects incomplete - Cost not exact.

Note: Above costs includes engineering, testing and inspection where applicable.