Precast prestressed concrete piles saved both time and money in constructing this fast track ship repair facility in Portsmouth, Virginia.

Moon Ship Repair Facility

Moon Engineering Company of Portsmouth, Virginia, which operates a ship repair installation, found in late 1984 that they would need a new facility in working order by October 1985. Speed in both design and construction were the key elements for this fast track project, designed by MMM Design Group of Norfolk, Virginia.

The critical path for the construction of a ship repair facility is through the pier. The pier serves as a platform for the utilities, materials and labor to repair the ships berthed along the sides of the pier. Precast concrete was imperative to rapid construction, and prestressed concrete was essential for durability in a marine environment. One of the most important design elements for this pier was the detailing of the pockets in the precast pier caps which help support precast prestressed concrete piling.

Fig. 1. Aerial view of completed pier.

Fig. 2. Sea level view of pier.

Various stages of construction of the pier are shown in Figs. 1 through 5.

The platform has to sustain a 400 lb per sq ft (19.2 kPa) live load, have a capacity in two locations for a 90 ton (800 kN) mobile crane, resist lateral loads of 500 tons (4450 kN) from two ships up to 650 ft (198 m) in length and weighing up to 35,000 long tons

Fig. 3. End view of pier.

Fig. 4. Joint between precast planks over precast piers prior to placing of cast-in-place concrete.

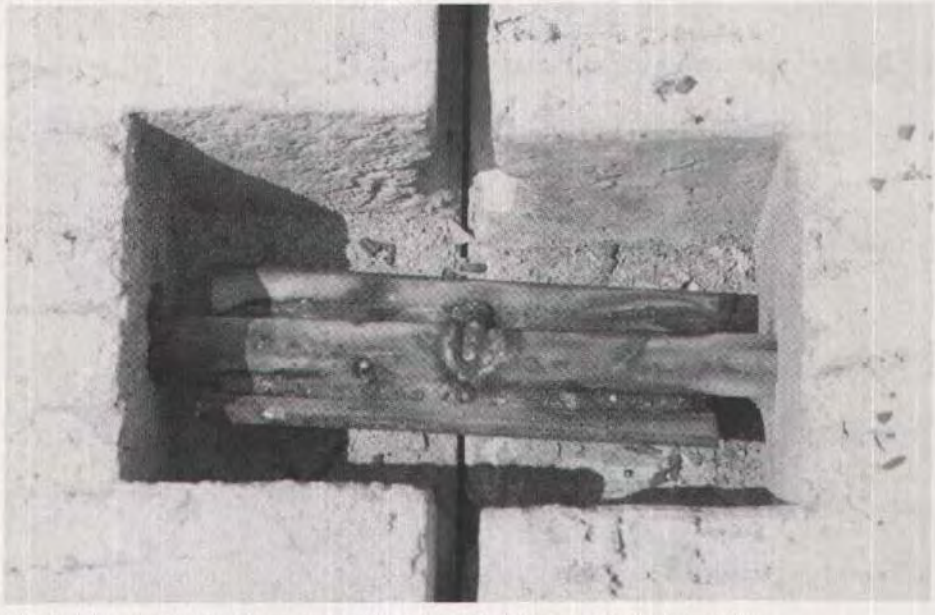

Fig. 5. Joint at midpoint of transverse through bolt holding precast plank together.

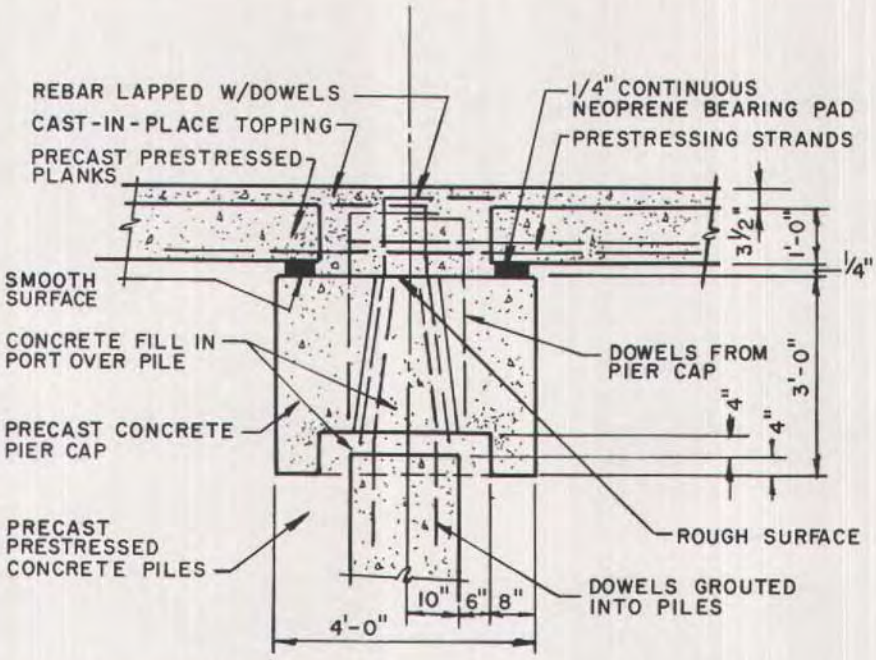

Fig. 6. Section through pier cap and pile.

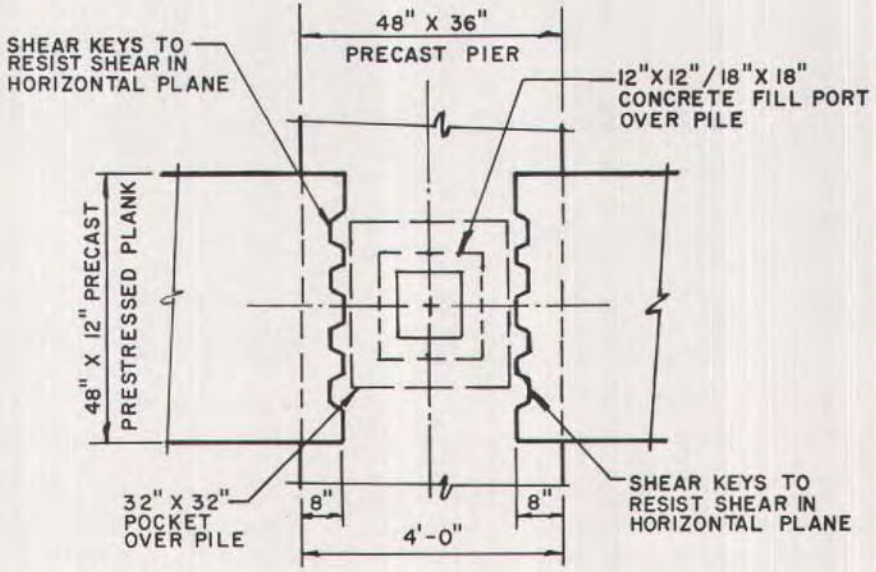

Fig. 7. Plan detail at plank shear keys.

Fig. 8. Stage One: Construction after 40 days.

Fig. 9. Stage Two: Construction after 80 days.

(350 MN) each. It was determined that prestressed piling 20 in. (508 mm) square with a capacity of 100 tons (990 kN) each was required. Furthermore, in order to reach soil that would sustain these loads, the piling had to be up to 94 ft (28.7 m) in length. This combination of large, long, battered piles fitting into a precast cap presented a unique design and construction problem.

After consulting with an experienced marine contractor, it was determined that a 4

Fig. 10. Stage Three: Construction after 126 days.

in. (102 mm) driving tolerance for a compound, battered pile was possible. This tolerance plus the stated 20 in. (508 mm) battered pile dimensions required a 32 in. (1219 mm) wide pier cap (see Fig. 6).

The pier caps were detailed with a splice in the middle of the cap. This splice was thought to be necessary because a full length cap would weigh 58 tons (516 kN) and be 53 ft (16.15 m) in length. However, since the precaster and the manufacturing facility are located on the water, it was decided to fabricate the caps in one piece and transport them to the site on barges.

Distribution of the lateral loads to several pile bents was necessary since one pier and pile group was not capable of sustaining the ship berthing loads. This was accomplished by using the deck as a diaphragm and transferring the loads through shear keys in the ends of the planks (see Fig. 7).

The project was completed on time and in 126 days after the award of the contract. Total cost for the new ship repair facility was $1,297,461.00, or $39.16 sq ft ($131.10 m^2). Construction moved quickly (see Figs. 8, 9 and 10) because environmental permits had already been obtained and a dredging contract had been awarded in November 1984. Simultaneous with the dredging, the design was completed, advertised, awarded and notice to proceed was given to the contractor on April 1, 1985. The pier was completed in early August 1985.

Precast concrete, fast track design and the experience of the precaster and general contractor were essential to the construction speed of this job.

Credits

Owner: Moon Engineering Co., Portsmouth, Virginia.

Engineer: Lewis H. Bridges, Jr., P.E., MMM Design Group, Norfolk, Virginia.

General Contractor: Tidewater Construction Corp., Norfolk, Virginia.

Precast Prestressed Concrete Manufacturer: Bayshore Concrete Products Corp., Cape Charles, Virginia.