

Precast prestressed concrete components, in addition to being durable, economical and saving erection time, provided a functional and safe wall system at this generating station.

Replacement of Coal Storage Retaining Walls

Two precast prestressed concrete retaining walls at Indianapolis Power & Light Company's generating station in Petersburg, Indiana replaced two 15-year-old steel sheet piling walls which had lost their load carrying ability due to corrosion and abuse by mobile coal handling equipment.

Three alternative methods of replacing the retaining walls were considered during the bid evaluation process. These alternatives were precast prestressed concrete, structural steel, and cast-in-place concrete. All alternatives were evaluated on the basis that the coal stockout boom would be out of service for a maximum of 12 days.

Competitive bids were received from several contractors with the most cost effective alternative being precast prestressed wall panels and columns. With this system the stockout boom would be out of service for only ten days.

Retaining Wall A, located adjacent to the coal stockout boom, is 40 ft (12 m) tall and is constructed using precast prestressed concrete structural members with cast-in-place horizontal struts and column foundations. The precast prestressed



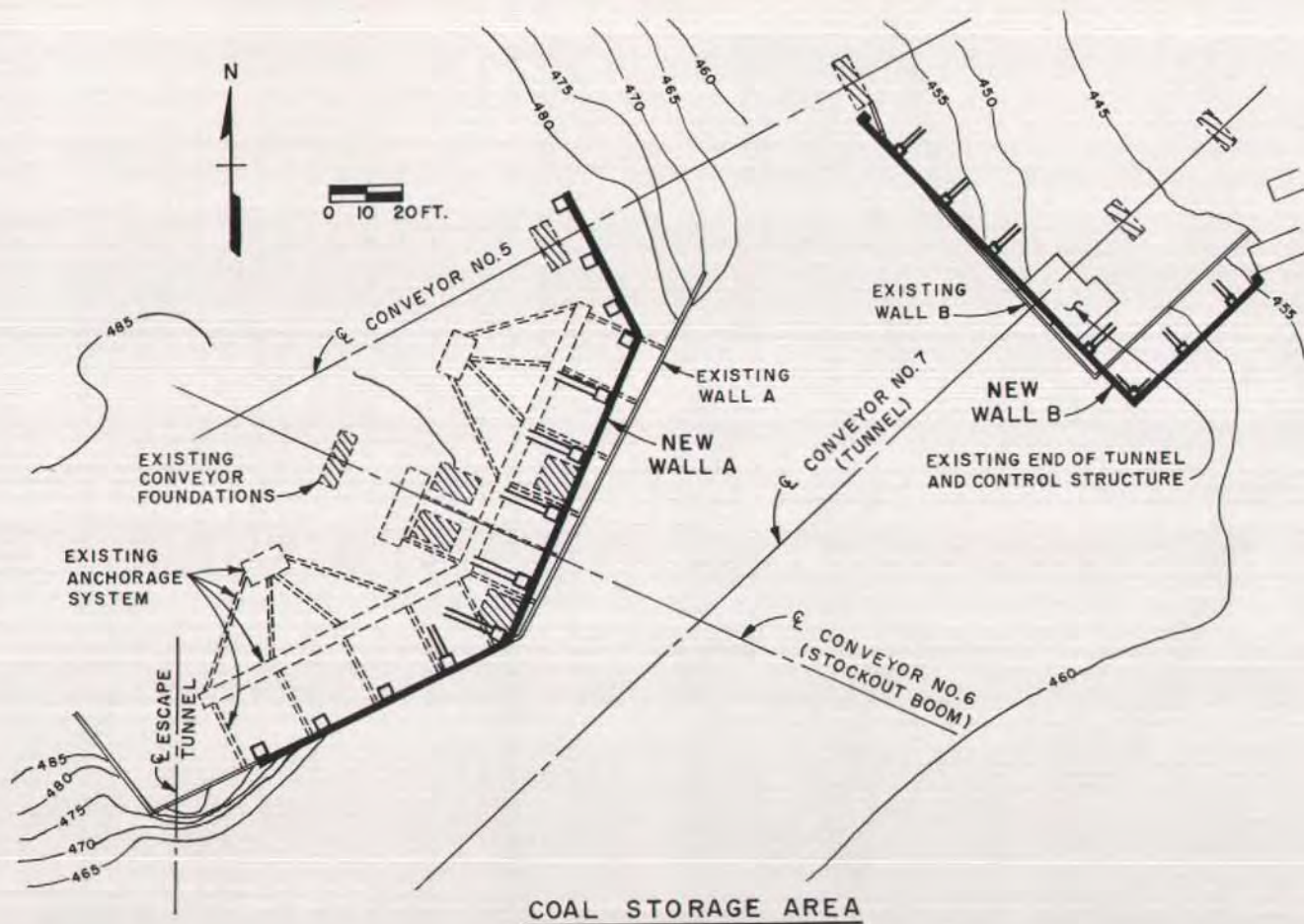


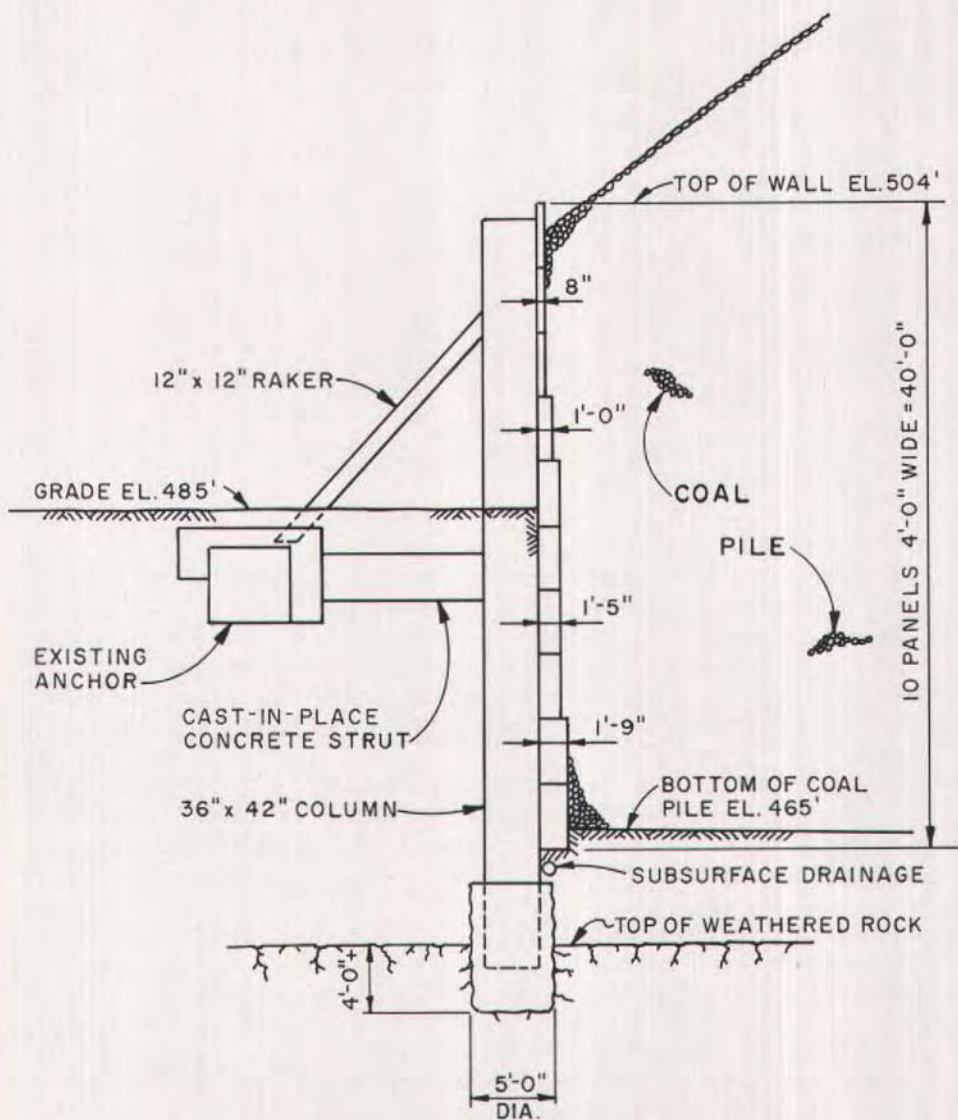
members consist of 13 columns — 36 x 42 in. (914 x 1067 mm); 6 rakers — 12 x 12 in. (305 x 305 mm); and 51 panels — 4 ft (1.2 m) wide. The column lengths varied from 27 ft 6 in. to 46 ft 6 in. (8.4 to 14.2 m). The thickness of the panels varied from 8 to 21 in. (203 to 533 mm) with the length varying from 9 ft 4 in. to 37 ft 6 in. (2.8 to 11.4 m). The total surface area of Wall A is 6057 sq ft (563 m²).

Retaining Wall B, located adjacent to the coal reclaim tunnel, is 16 ft (5 m) tall and was also constructed using precast prestressed concrete structural members with cast-in-place foundations. The structural members consisted of 9 columns — 24 x 24 in. (610 x 610 mm); 8 rakers — 12 x 12 in. (305 x 305 mm); and 21 panels — 4 ft (1.2 m) wide. The column lengths varied from 14 to 24 ft (4.3 to 7.3 m). Panel thicknesses varied from 8 to 17 in. (203 to 432 mm) and their length varied from 12 ft 2 in. to 38 ft (3.7 to 11.6 m). The total surface area of Wall B is 2351 sq ft (218 m²).

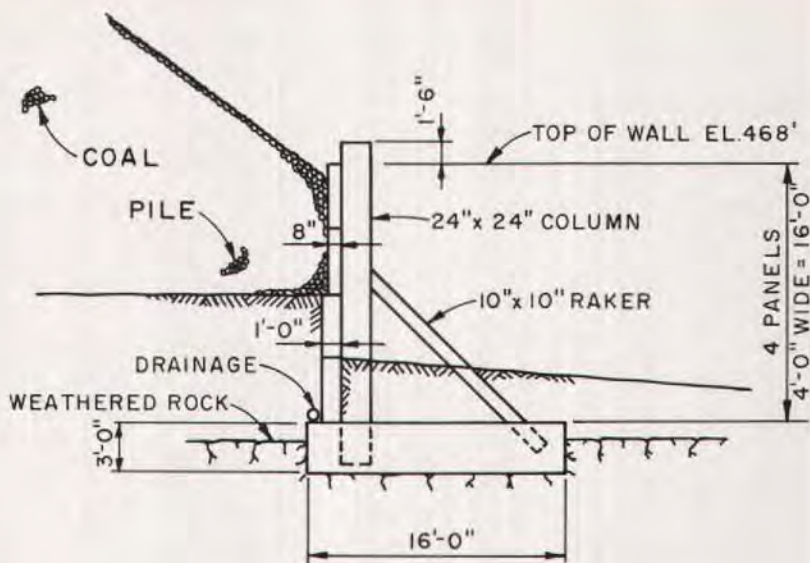
The specified minimum 28-day compressive strength for the precast prestressed concrete members was 5000 and 6500 psi (35 and 45 MPa), depending on the required design strength. The minimum concrete strength at the time of prestressing was 4000 psi (28 MPa). The prestressing strand used was ½-in. (13 mm) seven-wire low relaxation strand having a yield strength of 270,000 psi (1863 MPa). The specified minimum 28-day compressive strength for the cast-in-place concrete was 3500 psi (24 MPa).

During the first 30 days of construction, 15 5-ft (1.5 m) diameter holes were augered through medium to stiff clays and 5 ft (1.5 m) into weathered rock. As each hole was drilled, the columns were set and the bottom 4 ft (1.2 m) of the columns was encased with cast-in-place concrete. Concurrently, the foundations for Wall B were installed





WALL "A" TYPICAL SECTION



WALL "B" TYPICAL SECTION

as well as horizontal cast-in-place concrete struts and precast rakers for Wall A. The horizontal struts were attached to an existing concrete anchor wall.

All precast prestressed concrete columns and panels were shipped on an as-needed basis to minimize double handling. The columns and panels were manufactured at a plant approximately 50 miles (80 km) from the job site. The heaviest column weighed 66,000 lb (294 kN) and was 46 ft 6 in. (14 m) long. The largest panel was 38 ft (11.6 m) long and 21 in. (533 mm) thick.

After the columns were installed, the coal was removed and the existing piling wall was demolished. The new wall panels were then attached to the columns. On Wall A, the bottom 20 ft (6 m) was attached to the columns with 1 in. (25.4 mm) diameter coil bolts. These five bottom panels were designed to resist horizontal pressure from both the earth and the coal.

The pressure from the earth was based on a unit weight of 125 lb/ft³ (200 kg/m³) and a pressure coefficient of 0.7. The pressure for the coal was based on a unit weight of 65 lb/ft³ (104 kg/m³) and a pressure coefficient of 0.67 with an angle of repose of 37 deg. The 20 ft (6 m) portion of wall above ground was designed for coal loading only and was attached to the columns with steel clip angles.

Wall B was designed for earth pressure on the bottom 8 ft (2.5 m) plus a surcharge of 8 ft (2.5 m) of coal. The unit weights and pressure coefficients for the coal and earth were the same as those used for the design of Wall A. Because the loading was applied in only one direction on Wall B, all the panels were attached to the columns with clip angles.

The coil bolts used in Wall A were countersunk into the panels and covered with epoxy grout. This feature provided a smooth face on the wall and corrosion protection for the coil bolts themselves. A preformed rigid drainage membrane was placed on the earth side of the panels to allow subsurface water to be drained from the retaining walls.



The use of precast prestressed concrete components allowed this project to be completed in less than 4 months and within budget. Maintenance and operating costs are also expected to be reduced to almost zero because of the product's ability to resist leachates from the coal which attack exposed steel. In addition, the smooth face of the panels allows the coal to compact and minimizes the number of voids in the coal pile. These voids are a source of spontaneous combustion.

The total cost of the project was \$690,000 with the precast prestressed concrete amounting to \$250,000.

The retaining walls (A and B) were installed between August and November, 1984.

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Credits

Owner/Engineer: Indianapolis Power & Light Company, Indianapolis, Indiana.

Geotechnical Engineer: ATEC Associates, Inc., Indianapolis, Indiana.

Drilling Contractor: Kentucky Foundation Drilling Co., Louisville, Kentucky.

Erection Contractor: Gust K. Newberg Construction, Chicago, Illinois.

Precast Concrete Manufacturer: Construction Products Corporation, Henderson, Kentucky.