Precast Panels Provide Secure Historic Look for Philadelphia Federal Detention Center

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Designers for the Federal Metropolitan Detention Center in downtown Philadelphia, Pennsylvania had to balance the need for a highly secure appearance against the facility's location in a historic district. They also had a constrained site and budget requirements with which to work. These challenges were met with the use of precast concrete insulated panels with several finishes, including polished concrete at the base, a cut-stone appearance on the first two floors and varied sandblasting on the upper levels. A parking lane along the building's side served as a staging area for the crane, which was located inside the building's perimeter during erection. This article presents the architectural precast features of the structure as well as the erection highlights.

The new Federal Metropolitan Detention Center in Philadelphia, Pennsylvania provides a sober, dignified addition to a historic downtown area while supplying the specialized functions required to house detainees awaiting trail, sentencing or transfer to other facilities.

Interesting challenges were posed: how to achieve the functional and aesthetic goals of the project while working within the confines of an urban historic area. The use of architectural precast concrete panels for the exterior cladding allowed the creation of a distinctive design that could be erected on a tight site and at a cost that met the Federal Bureau of Prisons' (FBOP) budget requirements.

The facility consists of a 320,000 sq ft (29,700 m^2), eleven-story structure containing 628 cells and support functions for

short-term detainees (see Fig. 1). Programmatically, the basement and sub-basement include service and vehicular access as well as mechanical, storage, and maintenance shops.

Level 1 features the entry, reception, control, executive administration, financial management, and visiting areas. Level 2 houses administration and support systems such as inmate receiving and discharge, human resources, health services, associate wardens, staff assembly, food service, and laundry. The upper levels contain inmate housing, an administrative detention unit, and a disciplinary segregation unit on the top floor (see Figs. 2, 3 and 4).

Prior to the creation of this facility, the U.S. Marshals Service had used a variety of remote sites to house detainees, and the goal for the new structure was to bring all of them together near the federal courthouse. The downtown site consisted of a surface parking lot and a small, one-story office building which was easily cleared.

Nonetheless, the site had some important neighbors. Located just a few hundred feet from historic Independence Mall, the new facility sits near the Byrne-Green Federal Courthouse complex, the Federal Reserve Bank and the Gallery at Market East. The urban site was constrained by busy streets on two sides and small streets on two sides, but its location was ideal because the building could be connected to the courthouse by tunnel, eliminating the need for transporting prisoners by vehicle or removing them from a secure environment.

Officials at the FBOP requested that the architects produce three design schemes for the facility. The design criteria which led to the selected scheme were the functional advantages of symmetrical housing unit plans and the perceived appropriateness of exterior imagery.

The selected scheme features a cast-in-place reinforced concrete frame and 10 in. (254 mm) thick insulated precast concrete sandwich wall panels in a buff color with different finishes used on various parts. The design dictated organization of the program into a base, center and top. The main entry was placed on Arch Street – a major artery – with round precast columns identifying it.

The design was partly inspired by

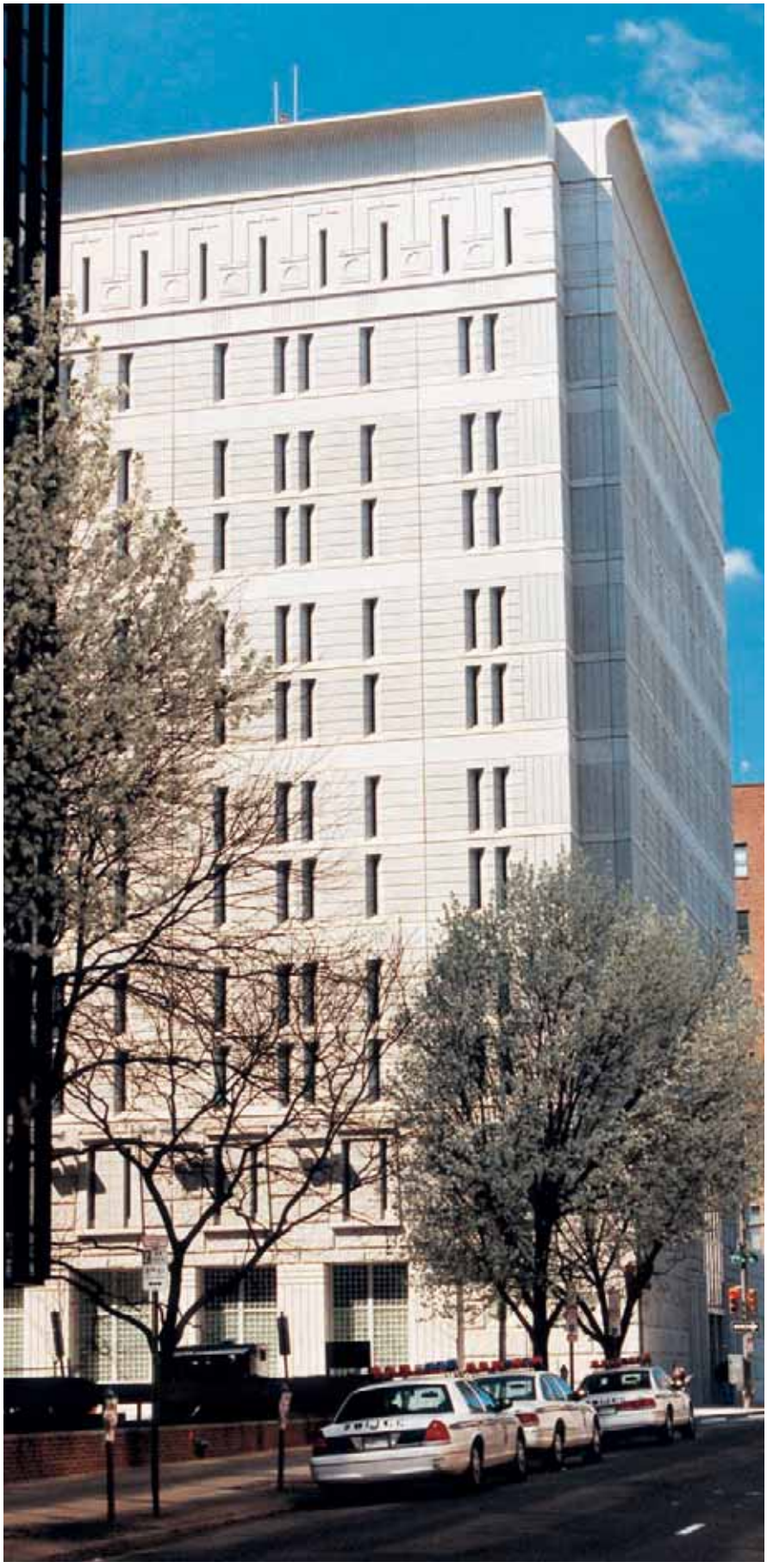

Fig. 1. The new Federal Metropolitan Detention Center in downtown Philadelphia with its cladding of architectural precast concrete panels. Photo courtesy: Robert Meier.

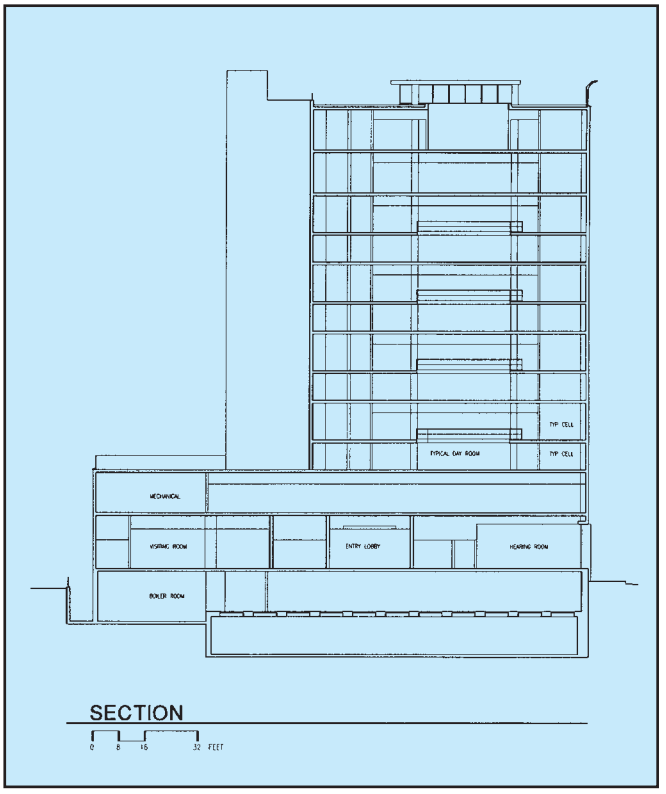

Fig. 2. Section plan shows below-grade floor, two service levels and upper inmate floors.

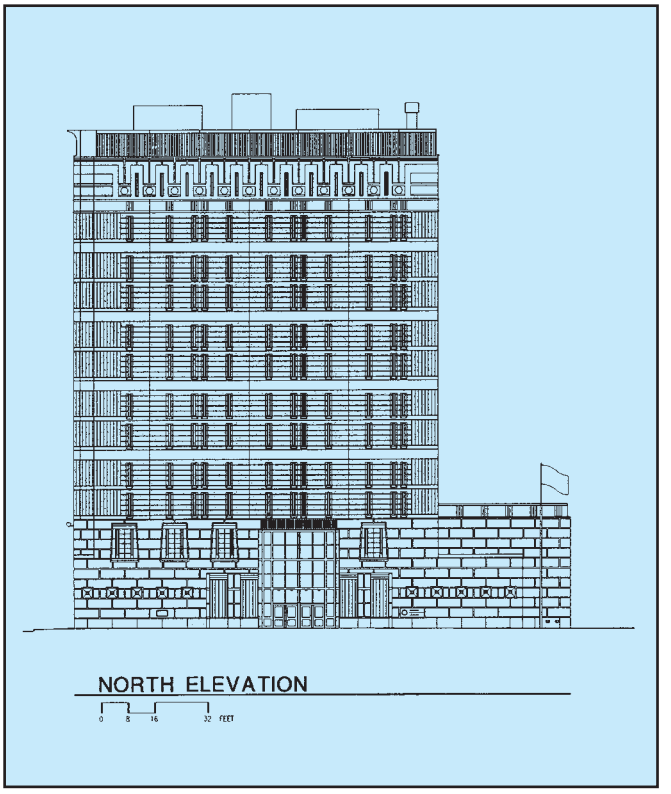

Fig. 3. North elevation of center shows variations in reveals and form liners.

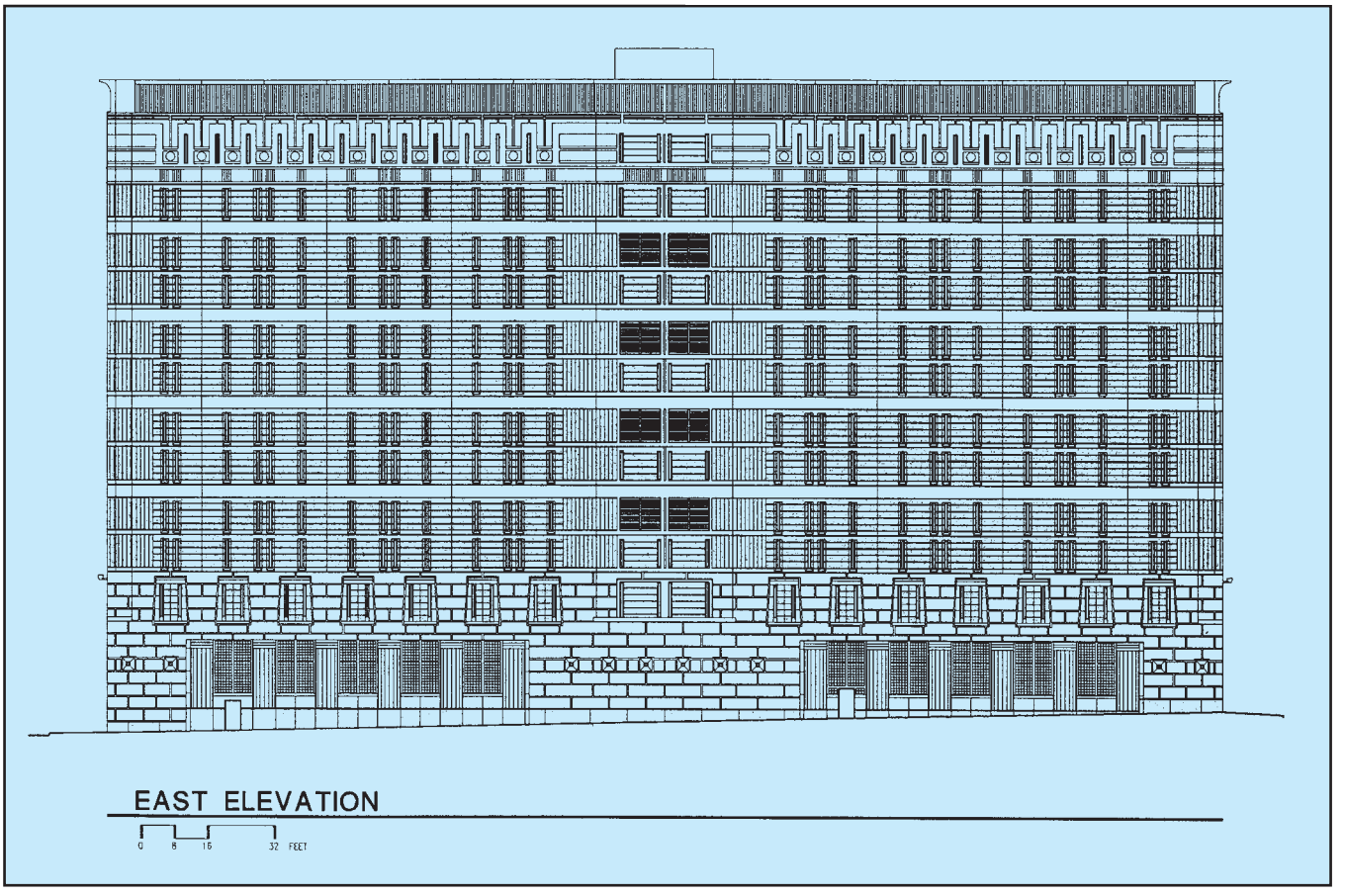

Fig. 4. East elevation shows the detailed architectural look that reduces the building's visual mass.

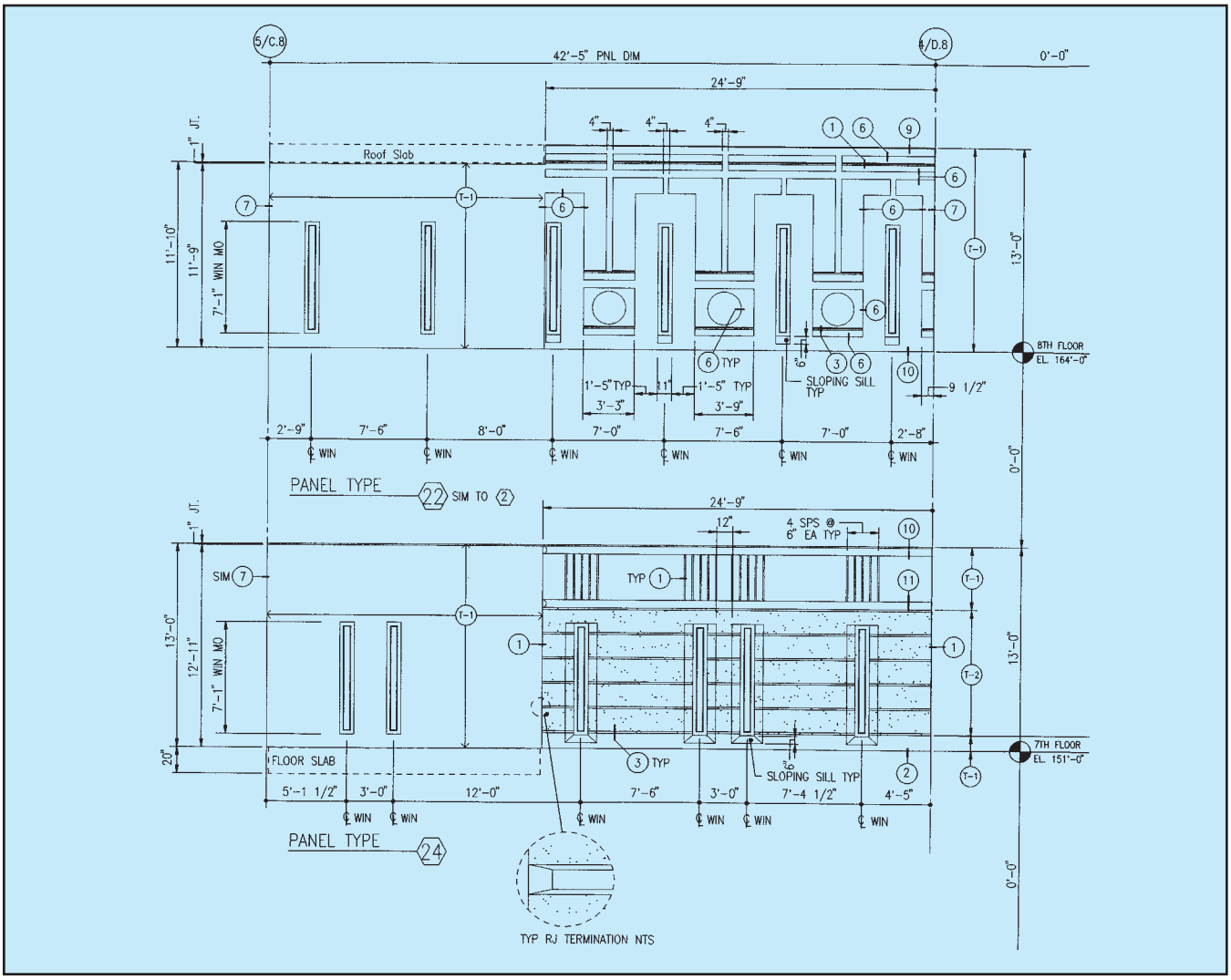

Fig. 5. Diagrams of two typical panels with fenestration show the detail required.

Fig. 6. A column along the building's base shows the variety of detail achieved on a low budget. Photo courtesy: Robert Meier.

Egyptian Revival architecture used for 19th century prison facilities. Such structures as the Tombs in New York City by John Haviland and the Moya-Mensing Prison by Thomas U. Walter in Philadelphia, provided historical examples which made this architectural vocabulary seem appropriate to the FBOP. Furthermore, the proposed scheme conveyed an image of seriousness and a high level of security.

Precast concrete also met the tight budget criteria. Except for glass and glass block, no other material was used on the facade. The FBOP had recently completed justice facilities in Miami, Florida and Houston, Texas, using precast facades, so they were familiar with the quality of the material and precast construction methods. They liked the fact that the 10 in. (254 mm) thick precast concrete panels could provide both the exterior and interior facade wall on

Fig. 7. Form liners and polishing achieved these dramatically different panel textures. Photo courtesy: Robert Meier.

the prison levels, which left no gaps on the interior surface.

The panels featured 2 in. (51 mm) of insulation sandwiched between two 4 in. (102 mm) wythes of concrete. Typical panels measured 30 x 10 ft x 10 in. (9.14 x 3.05 m x 254 mm), although some panels on the lower floors have different dimensions and less regular shapes (see Fig. 5). The precaster's ability to cast panels off-site and deliver them as needed kept the project on schedule without tying up downtown traffic during construction.

The precaster was brought onto the project early in the design process to help ensure that all advantages were maximized. This included helping to devise the appropriate panel sizes and aiding with placement of reveals and connections, as well as evaluating the various finishes that were used. The designers had worked with precast concrete components in the past, but wanted to push the limits of the material in terms of variation of surface appearance.

The final design features polished concrete for several feet at the base of the building, replicating a granite appearance (see Fig. 6). This is topped by two stories of rusticated stone-appearing blocks, with upper floors employing both light and heavy sandblasted finishes (see Fig. 7).

Achieving the desired look with several of these finishes proved to be challenging. In particular, hand-polishing

Fig. 8. Several precast concrete columns had to be hand polished – a highly skillful procedure which made the columns look very elegant. Photo courtesy: Jeffrey Totaro.

Fig. 9. Column covers in precaster's yard prior to polishing.

Fig. 10. Panels were cast with 4 in. (102 mm) wide windows and beveled edges, then were completed with a steel window frame and glass that was glazed at the plant. Photo courtesy: Jeffrey Totaro.

Fig. 11. Finished window panel at precaster's yard.

Fig. 12. Finished wall panel for lower levels at precaster's yard.

Fig. 13. Typical cornice panel for placement at top of building.

the radiused columns at the entries was difficult and required careful attention (see Fig. 8). Fig. 9 shows unpolished column covers in precaster's yard prior to special treatment.

Selecting the appropriate coloration of the panels also took some evaluation, with the initial selection changed once mockups were cast. Initially, the designers and bureau officials decided on a slightly reddish cast for the precast concrete to complement the adjacent brick courthouse and the Federal Reserve Bank. But initial panel samples completed by the precaster showed that the desired hue could not be achieved consistently across all panels because of dusting from the aggregate. This would have caused significant consistency problems across the face of the building.

Instead, the design team decided on a white cement with a harder aggregate that created a buff color. This offered a limestone-like appearance and consistency. To ensure that all aspects of the panels in application were considered prior to casting, the precaster drove the mockup panels into both sunny and shady areas and hosed them down to show variations that would occur in rainy weather. The result of this attention to detail was a final mix that offered a uniform appearance across the entire building and furthermore suited the client's wish to fit in architecturally.

The windows comprise steel frames with factory-cast stud anchors embedded in the panels for maximum strength (see Figs. 10 and 11). The windows were glazed at the plant by the precaster, thus allowing the panels to be delivered to the site ready for installation. It also ensured one-piece construction for the windows, thus enhancing security.

Security was heightened further by the addition of reinforcing bars embedded in the precast panels at 8 in. (203 mm) on center in both directions. This reinforcement satisfied FBOP design guidelines for making the panels more secure and provided the required structural strength in the panels. In addition to window panels, other types of wall panels were used (see Fig. 12).

A decorative element was added at the cornice level, where panels with a 3 ft (0.914 m) radius curve out over the side of the cornice (see Fig. 13). This gives the building a top, especially at night

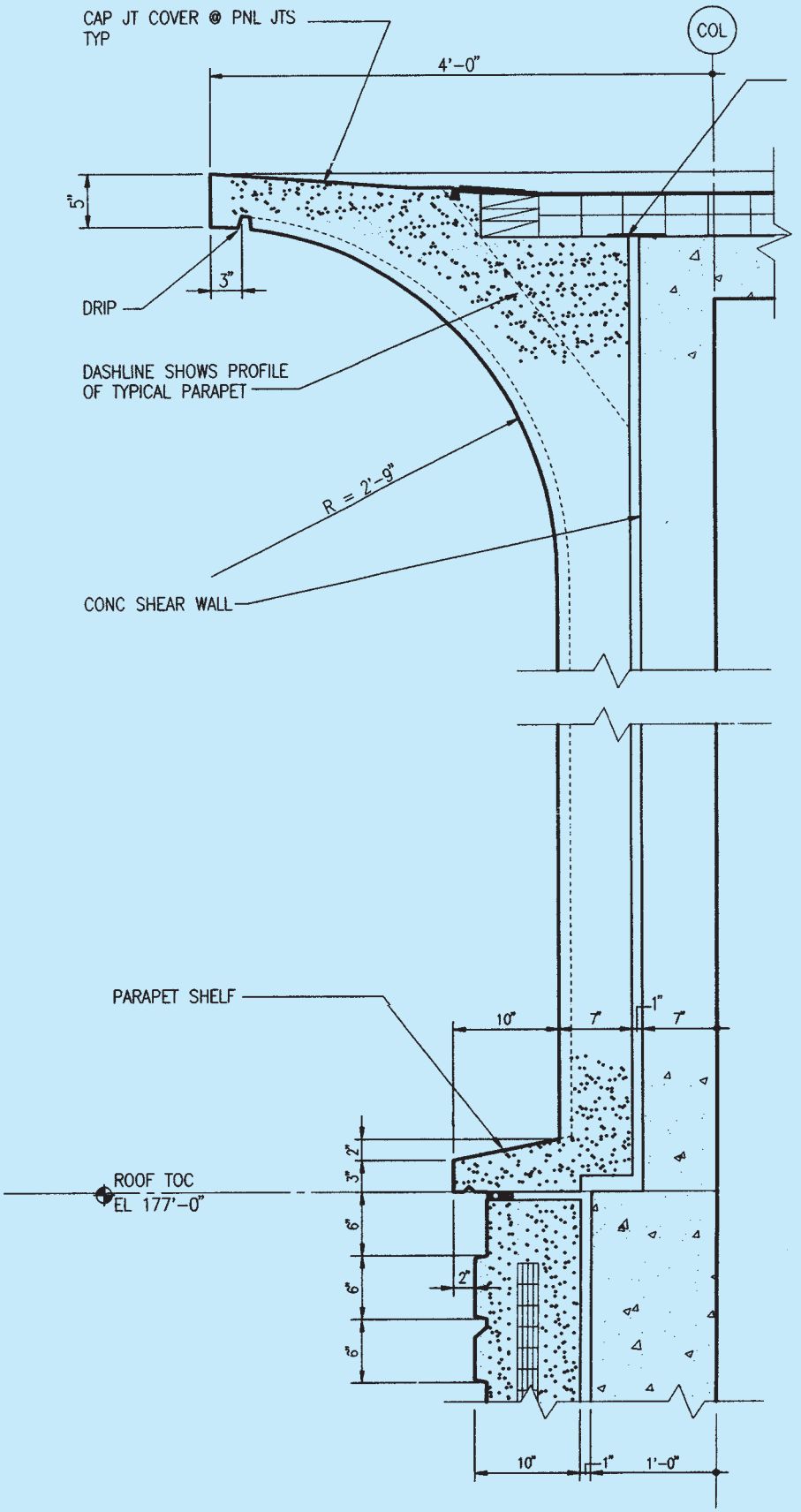

Fig. 14. Elevation detail of precast concrete cornice.

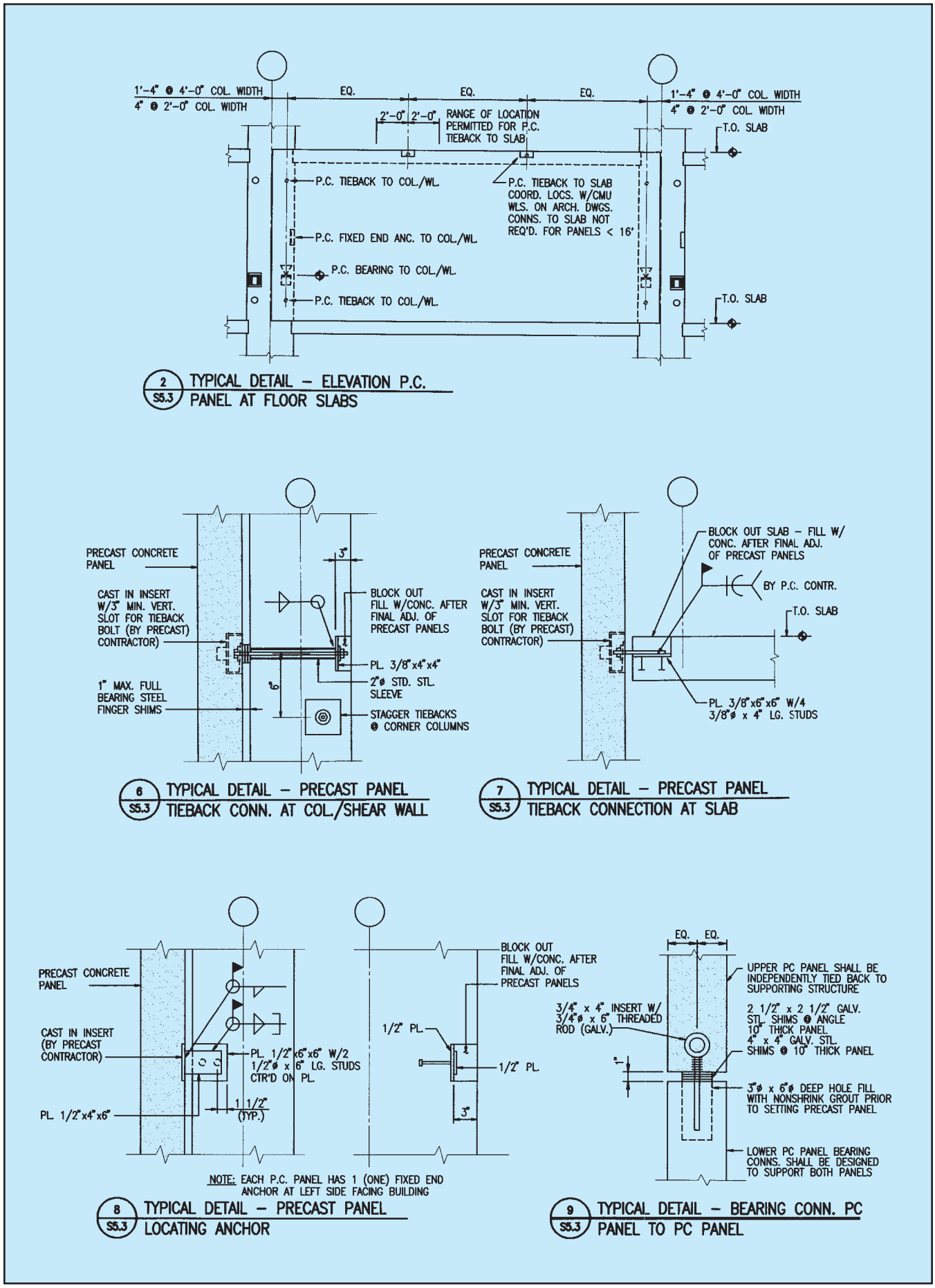

Fig. 15. Elevation and typical connection details of panels.

Fig. 16. With a downtown urban site and a building filling the available footprint, precast panels remained on the trucks until they could be erected that night. Photo courtesy: Jeffrey Totaro.

when the spotlights shine on it. The panels also hide mechanical equipment and air wells for outdoor exercise areas located on the roof.

Fig. 14 shows the elevation detail of the cornice. Typical connection details of the panels are shown in Fig. 15.

The building was sited to pull it forward to the wider streets and push it away from the narrower streets along the sides. This ensured that occupants in nearby buildings would have less visual access to prison cells and added some measure of privacy.

Unfortunately, the site offered no space for staging areas. Access to the city center was limited for large construction deliveries requiring close communication between the precaster and the site crew. This presented a new challenge, namely, how to ensure the arrival of appropriate precast components when needed.

ERECTION HIGHLIGHTS

Because no parking is allowed in front of federal buildings (in response to the Oklahoma City bombing tragedy), the precaster had the parking lane available for delivery and staging of panels (see Fig. 16).

Most deliveries had to be made at night, but some permit loads had to be delivered during the afternoon, before and after rush-hour traffic (resulting in several trucks lined up around the building in the parking access lane) (see Fig. 17). However, once the staging system was settled in, the deliveries went smoothly.

Erecting the panels in this constrained space took some logistical maneuvering. The crane was positioned in a portion of the building where a two-story building section of the structure was to be built, and then it was used to erect first the cast-in-place reinforced concrete column and floor slab followed by the precast panels (see Fig. 18). The hydraulic crane erected several stories of cast-in-place concrete, and after curing over several days, the precast concrete erection began to follow it up the building.

Fig. 17. Because of a lack of staging area, trucks sometimes backed up along a parking lane in front of the correction center. Photo courtesy: Jeffrey Totaro.

Fig. 18. Shear walls with blockouts were included for connection to precast panels. Photo courtesy: Jeffrey Totaro.

The crane was put into use day and night, with both operations underway simultaneously. This proved to be beneficial for the precast concrete, as it could follow the frame up the building sides almost immediately. The precast panels had to be picked and lifted by the crane operator while he was not in visual contact with the panels, but this was a typical operation for the precast erector and did not pose any unusual difficulties.

Panel connections were designed so all of them are concealed by the block walls that separate the individual cells. In some locations, these demising walls were cast-in-place shear walls which required a special connection process for the panels (see Fig. 19).

The shear walls were cast to include one sq ft (0.093 m^2) access holes, through which the connections were welded (see Fig. 20). The holes were then filled in with concrete and grouted to form a smooth, monolithic interior surface, which was painted. Aligning these cast-in-place access holes with the precast concrete panels took considerable maneuvering, but the procedure was accomplished without incident to eliminate any interior seams.

CONSTRUCTION SCHEDULE

Site impact studies began in 1992. The location finally was decided in early 1995, at which time design and documentation began. This process continued through 1996, when an archeological site investigation was conducted which turned up various artifacts from commercial enterprises from the 18th and 19th centuries on the site (primarily pottery and glass shards).

Construction began in 1997 with precast erection commencing in August 1998 and continuing through the early winter. The project was finished in January 1999 except for one bay, which was left open to provide space for the construction elevator and other access requirements. That bay was

Fig. 19. One bay of precast panels was left open to allow for construction access after the rest was finished. Photo courtesy: Jeffrey Totaro.

Fig. 20. Erection was performed with the crane located within the perimeter of the building due to the constrained downtown site. Photo courtesy: Robert Meier.

closed in August 1999.

Construction was completed in March 2000 and inmates began to be accepted in June 2000. In all, the $4 million precast concrete contract required 492 pieces: 381 insulated wall panels, 70 non-insulated panels, 23 special cornice pieces, 14 column covers, and four round column covers.

The precast concrete panels were produced by High Concrete Structures at their plant in Denver, Pennsylvania. High Concrete was also responsible for the transportation and erection of the precast panels. The panels were shipped to the project site by truck-trailer — a distance of about 60 miles (97 km).

Figs. 21 and 22 show completed views of the Federal Detention Center. It is apparent that the design-construction team achieved their purpose of creating a functional, secure and yet aesthetic looking building.

CONCLUSION

The resulting project creates a dramatic presence in downtown Philadelphia that belies its highly functional and serious nature. The façade projects a solid but attractive look that provides visual interest without elaborate decoration or cost.

Best of all, nearby residents are pleased with the structure, including some who were skeptical and fearful of having this facility constructed near their place of business. It has been well received in the neighborhood, having been featured by the architecture critic of the local newspaper.

The building also has been recognized by design peers, winning the award for Best High-Rise Correctional Facility in the 2000 Design Awards Program sponsored by the Precast/Prestressed Concrete Institute.

In presenting the award, the judges said, "This building does a marvelous job of dealing with a security institution while still providing interest, especially in the transition from the ground to the roof line. Even the lighting helps to break down the scale. The structure could have been more of a bunker than it is, and it deals with these challenges in a very elegant way. It uses the efficiency and affordability of precast concrete to give texture and vitality to the façade for the

Fig. 21. The elegantly detailed cornice features a 3 ft (0.914 m) radius that adds interest and hides mechanical equipment on the roof. Photo courtesy: Jeffrey Totaro.

Fig. 22. Finished view of building at dusk uplighting the variety of textures achieved on precast panels. Photo courtesy: Jeffrey Totaro.

sake of the city around it."

In retrospect, the Federal Bureau of Prisons, as well as the design-construction team are pleased with the quality and appearance of the architectural precast concrete façade on this building. Indeed, the new Detention Center has become a major downtown Philadelphia landmark!

CREDITS

Owner: United States Department of Justice Federal Bureau of Prisons, Washington, District of Columbia.

Architect / Engineer: Ewing Cole Cherry Brott Inc., Philadelphia, Pennsylvania.

General Contractor: Keating Building Corp., Bala Cynwyd, Pennsylvania.

Precast/Prestressed Concrete Manufacturer: High Concrete Structures Inc., Denver, Pennsylvania.