

# Multiple Facility Complex (M.S.I. #6) Greensville County, Virginia

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*A precast prestressed concrete modular system was successfully adopted to build this \$100 million prison complex in Virginia.*

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**T**his facility is the largest prison in Virginia history and one of the largest prison construction projects in the United States to date. Ten housing buildings with a total of 1700 cells and eight versa space support buildings occupy the 1000 acre

(405 ha) site. The overall project cost is nearly \$100 million.

Three general housing buildings and a program support building comprise a unit to support 500 medium security prisoners. The pod living area concept is utilized to minimize the re-



quired supervision. This second order generation prison enables officers in a control room at one corner of the day-room area to supervise inmates in individual units on two levels.

A precast concrete balcony system cantilevered from the cells allows pedestrian traffic around the perimeter of the upper tier. The cells are stacked four high with a precast double tee floor and beam-column interior frame to provide the dayroom for the top two levels of cells. There are three units and a separate two-story segregated housing building for 200 maximum security prisoners. They will share certain support facilities and services.

Of the more than 7000 precast concrete components in the job, 888 are dual cell precast modules. Each module is monolithically cast and consists of two 70+ sq ft (6.5 m<sup>2</sup>) cells and a common mechanical chase. Cells are fully contained, as the 4 in. (102 mm) cap slab of each module serves as the floor for the module stacked on top. Grouting is minimized since the horizontal joint between the cells is the only joint exposed.

Insulation extruded around 8 gage wire trusses was cast into the outside 8 in. (203 mm) thick wall. The side walls, chase walls and common wall are nominally 4 in. (102 mm) thick with a single layer of grade 60 bars tied together outside the form as a cage for reinforcement. Electrical conduit and boxes, furniture embeds, window and door embeds, and mechanical and plumbing openings into the chase wall were cast in as required by other trades.

The support buildings were designed utilizing insulated, loadbearing double tee wall panels which also serve as shear walls in resisting lateral loads. To minimize potential cracking, each panel was designed as a non-composite section with the outer wythe isolated by means of a bond breaker at the interface with the insulation. The overall section was 20 in. (508 mm). Double tees [28 in. (711 mm) deep] were used for the roof members of the support buildings. Some were clear span between the exterior walls, whereas certain buildings had interior prestressed concrete beam and column supports integrated with

the wall line. Maximum clear span was 80 ft (24.4 m), supporting typical roof dead and live loads. Heavy equipment loading was accommodated by decreasing the support width of the member.

The housing buildings were nominally 130 ft x 130 ft (39.6 x 39.6 m) with an interior of 100 ft x 100 ft (30.5 x 30.5 m) as the cell modules formed an open square around the perimeter. Each vertical stack of four modules picked up a proportionate share of the lateral loads. The modules were tied

Table 1. Products supplied for the Greenville Correctional Center.

10 Housing Units	1760	Cells
3 Program Support	85,125	sq ft (each)
Kitchen/Laundry	14,400	sq ft
Maintenance/Warehouse	78,350	sq ft
Power Plant	14,370	sq ft
Reception Center	1218	sq ft
Administration Center	17,630	sq ft
Medical Services	31,861	sq ft
6 Guard Towers		

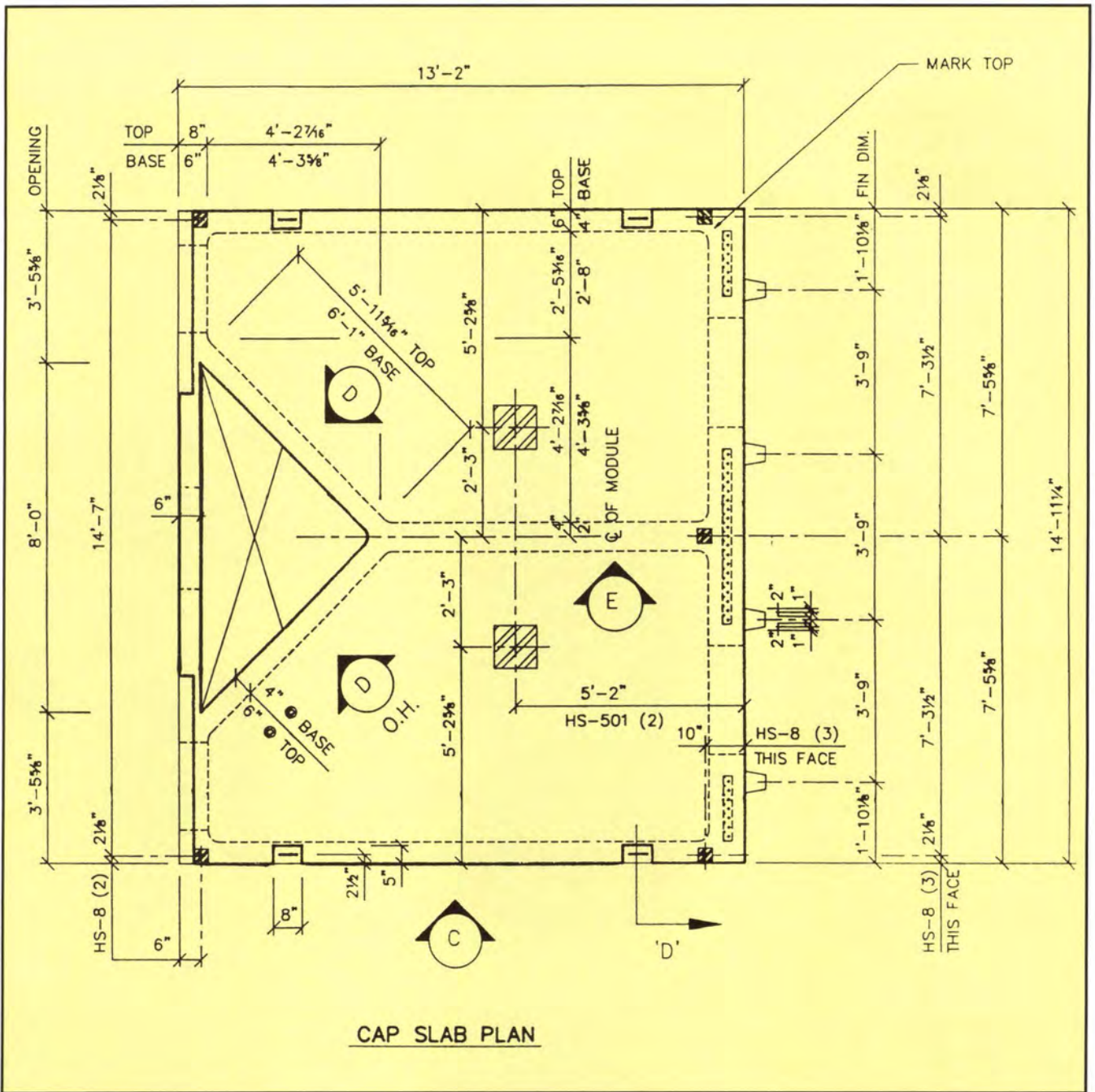
Metric (SI) conversion factor: 1 sq ft = 0.093 m<sup>2</sup>.



Cell units in yard awaiting erection.



Precast module (weighing 27 tons) being lifted into place. Each 176-cell four-story housing building was erected in less than 30 working days.



At left is the unfinished dayroom interior. At right is the finished dayroom interior. Long span prestressed double tees allowed for open dayrooms which facilitate observation by control room guards.

together vertically by means of splice sleeves, but not horizontally. The second floor dayroom and roof were made with 28 in. (711 mm) deep double tees, with a 3 in. (76 mm) field topping applied to the dayroom floor.

The design span was 49 ft (14.9 m), with one end of the tee supported by the module and the other by a 40 ft (12.2 m) long prestressed beam supported on prestressed columns. The inverted tee beam was 36 in. (914 mm) deep and 36 in. (914 mm) wide at the base with nearly 1000 kips (4448 kN) of prestress required at the dayroom floor.

So as not to infringe on the 5 ft (1.52 m) wide balcony below and above, end columns required an outrigger on the side opposite the beam support to pick up the last double tee stem. A secondary pour was made at the plant to cast this approximately 3 ft (0.91 m) long section. Reinforcing bar couplings were used to provide the reinforcement continuity.

The buildings were designed for Seismic Zone 1 and for wind loads of 80 miles per hour (129 km/hr). Due to the size and configuration of the build-

ings, connections between the stacked units were dictated by the minimum requirements of the ACI Code. The interior and exterior walls of the modules were designed as loadbearing, while the side and common walls were designed as horizontal elements spanning between the outer walls.

The project was started in 1989 and erection of the precast concrete components took less than a year. The first

phase (unit) has been operating efficiently for the past 8 months, with subsequent phases to be turned over to the State at 6 month intervals.

The total cost of the housing units was \$25,800.00 per cell. Total facility cost was just over \$50,000.00 per cell.

This project shows that the low cost, short erection time, and structural strength of precast concrete make this material ideal for prison construction.



Housing unit building.



Aerial view showing three housing buildings. Note that three 176-cell housing buildings and program support building comprise one prison unit.



Aerial view of medical building (in foreground).



Elevation of housing with security fence.



## Credits

Architect and Engineer: DMJM/VVCR Partnership, Alexandria, Virginia.

Construction Manager: Morrison-Knudsen Company, Inc., New York, New York.

Owner: Commonwealth of Virginia, Department of Corrections, Richmond, Virginia.

Precast/Prestressed Concrete Manufacturer: Tindall Concrete Virginia, Inc., Petersburg, Virginia.

Precast Engineers: Tindall Concrete Virginia, Inc., Petersburg, Virginia, and  
The Consulting Engineers Group, Inc., Glenview, Illinois.