

## III-6. Case Study—Four (4) Inch Reinforced Brick Masonry Panels

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### ABSTRACT

*This paper is a case study on the Administration Building at Coppins State College, Baltimore, Maryland. The basic construction of the building is essentially of 4-inch prefabricated reinforced brick masonry panels attached to a reinforced concrete, flat-plate structural frame.*

*The paper examines, in detail, the 3-story, 8-sided structure in the following categories: (1) planning and development; (2) architectural design; (3) structural design; (4) construction; (5) quality control; (6) economics and (7) a listing of the names of the design team members. Graphics and photographs are included to illustrate architectural and structural design details and the construction process.*

*A data statement is included to summarize pertinent aspects of the project. Some of these are short descriptions of the walls, floor and roof construction, the quantity and size of brick units, type of mortar and grout, reinforcement in the panels, fire resistance, sound control classification, physical characteristics of the building, construction dates and the economics of the project.*

*The experience documented in this paper demonstrates that 4-inch reinforced brick panels, utilizing portland cement-lime mortar and grouts, are an efficient and economical mode of construction.*

### INTRODUCTION

This paper is a case study on a structure housing the administrative functions of Coppins State College. The project has distinguished itself and that of the masonry contractor. In 1978, the "Craftsmanship Award" from the Building Congress and Exchange Chapter of Baltimore, Maryland, was presented to the masonry contractor for outstanding quality of masonry panelization.

The basic design and construction of 4-inch thick reinforced brick panels are very similar to those of Academic Building #4 on the University of Maryland campus in Catonsville, Maryland.<sup>1</sup> The structural frame of the building consists of reinforced columns and flat plate roof and floor slabs.

### PLANNING AND DEVELOPMENT

#### Architectural Considerations

Architecturally, the architect conceived of a design that would make it appear that the structure was emerging from the landscape in "... a layered effect." The engineered brick panels made this layered effect possible.

#### Structural Considerations

Structural design of the brick panels was accomplished utilizing a rational design approach. A conventional port-

land cement-lime mortar and grout, in conjunction with reinforcement, was selected. Based on current technology, the mason contractor felt that the portland cement-lime mortar and grout would be a better, more predictable, and therefore dependable method of construction. Past experience with other methods had not always yielded satisfactory results.

#### Economics and Construction

A major requirement by the owner was occupancy of the building as soon as feasible. The brick panels were instrumental in making it possible to achieve faster construction. Another prime factor in the selection of the brick panel system was the competitive cost in association with architecturally finished precast concrete panels.

### PANEL DESIGN

The "C" shaped panels were designed with a vertical running bond pattern. This was achieved by turning the panels ninety (90) degrees from the position in which they were built.

The structural design, which included considerations for service loads, handling, transportation, erection, and connection details, is similar to that of Academic Building #4 at the University of Maryland.<sup>1</sup> The same holds true for the materials and specifications for the project, except that the size and the strength of the brick units are different.

## CONSTRUCTION, QUALITY CONTROL, TESTING AND INSPECTION

Prefabrication, testing, quality control and inspection are all very similar to that of the University of Maryland project. The average daily test results on mortar cubes and flexural prisms varied from those obtained from the University's project (see Table I). Fabrication of the panels proceeded during the same time period that the building frame was being constructed.

## ERECTION

The job site erection crew consisted of one crane operator and the remainder of bricklayers, including a bricklayer who was also a certified welder. The erection procedure was a one-step operation in handling the panels from the truck to the building frame. Special trucks, equipped to properly support the panels, were used to transport the panels to the job site. They were lifted directly from the trucks onto the structure with a steel "L" shaped cradle, equipped with lifting prongs similar to those on a fork-lift.

After a panel had been lifted into its proper location, the supporting clip angles of the panel were positioned and temporarily tack welded while another panel was moved into position adjacent to this panel. After the panels were all placed and permanently welded or anchored in place, plastic foam backer rope was placed between adjoining vertical edges of the panels. The joint was sealed with a two (2) part polysulfide elastic sealant.

The project was located within close proximity of the plant (approximately twelve (12) miles). Erection proceeded at a rapid pace, but would have been faster if more trucks had been available to provide panels when needed. The shortage of trucks slowed down the erection process. About two hundred (200) panels, eighteen thousand (18,000) square feet in area, were erected in only twelve (12) days. Erection occurred during the warm months of June and July of 1977.

## ECONOMICS AND PERFORMANCE

The actual unit cost of the panels, which was slightly over the bid cost, was approximately \$10.00 per square foot. The erection cost, not included in this unit price, was approximately \$2.00 per square foot.

Performance of the panels to date has been very satisfactory. They have resisted the weather, especially hard, wind-driven rains, and have not experienced leakage or moisture penetration problems.

## PROJECT DESIGN AND CONSTRUCTION TEAM

Architect: Mr. Leon Bridges, Baltimore, Maryland  
Structural Engineer: Ewell W. Finley and Associates

General Contractor: Roy Kirby and Son, Baltimore, Maryland

Masonry Contractor: Henry J. Knott, Inc., Baltimore, Maryland

Panel Engineer: Mr. George A. Evans, Jr., P.E., Inc., Baltimore, Maryland

Owner: State of Maryland

## DATA STATEMENT

Total Floor Area: 36,456 sq ft

Number of Stories: Three (3)

Construction: Four (4) inch reinforced brick masonry panels, reinforced concrete columns, flat plate floor and roof slabs.

Brick Panels: Quantity—200

Brick Units—Size:  $3\frac{5}{8} \times 3\frac{5}{8} \times 7\frac{5}{8}$  inches

Quantity: 80,000

Specifications: ASTM C 652

Grade SW, Type HBS

Minimum Compressive Strength: 5,000 psi

Mortar and Grout: Portland cement, hydrated lime and sand, Type S ( $1\frac{1}{2}:4\frac{1}{2}$ )

NOTE: Portland cement and lime were factory blended and packaged into a single bag unit. Grout consisted of the same mortar ingredients and proportions with extra water added to produce a pourable consistency.

Reinforcement: Reinforcement bars,  $\frac{1}{2}$  and  $\frac{5}{8}$  inch, ASTM A 615, Grade 40; Joint reinforcement, standard prefabricated ladder type, straight, corner and T-sections, ASTM A 82.

Construction Year: 1977

Panel Cost (approximate): Material and labor—\$10.00 per sq ft

Erection—\$2.00 per sq ft

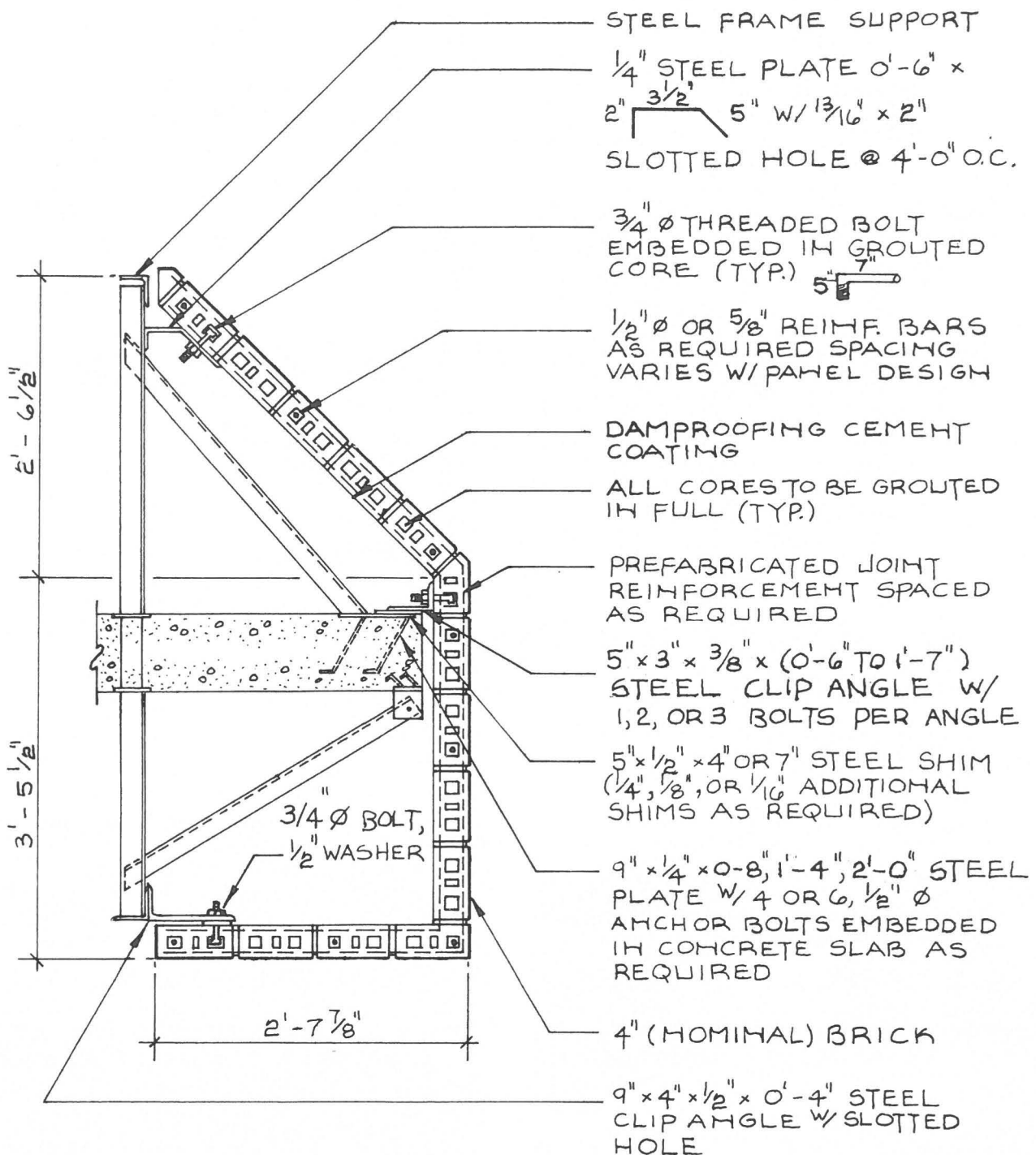
## REFERENCES

1. Design, Construction and Quality Control Experience of Prefabricated Four (4) Inch Reinforced Brick Panels—Academic Building #4, University of Maryland, Catonsville, Baltimore County, Maryland, D. Cammer, D. Patterson, A. Yorkdale, W. Ruth, and J. Thomas, 1979.

TABLE I—Average Daily Test Results

Mortar Cubes		Flexural Prisms	
7 days	28 days	7 days	28 days
1150 psi	1800 psi	138 psi	167 psi

# TYPICAL "C" SHAPED PREFABRICATED BRICK PANEL (SECTION X-X)



SECTION X-X

Figure 1.



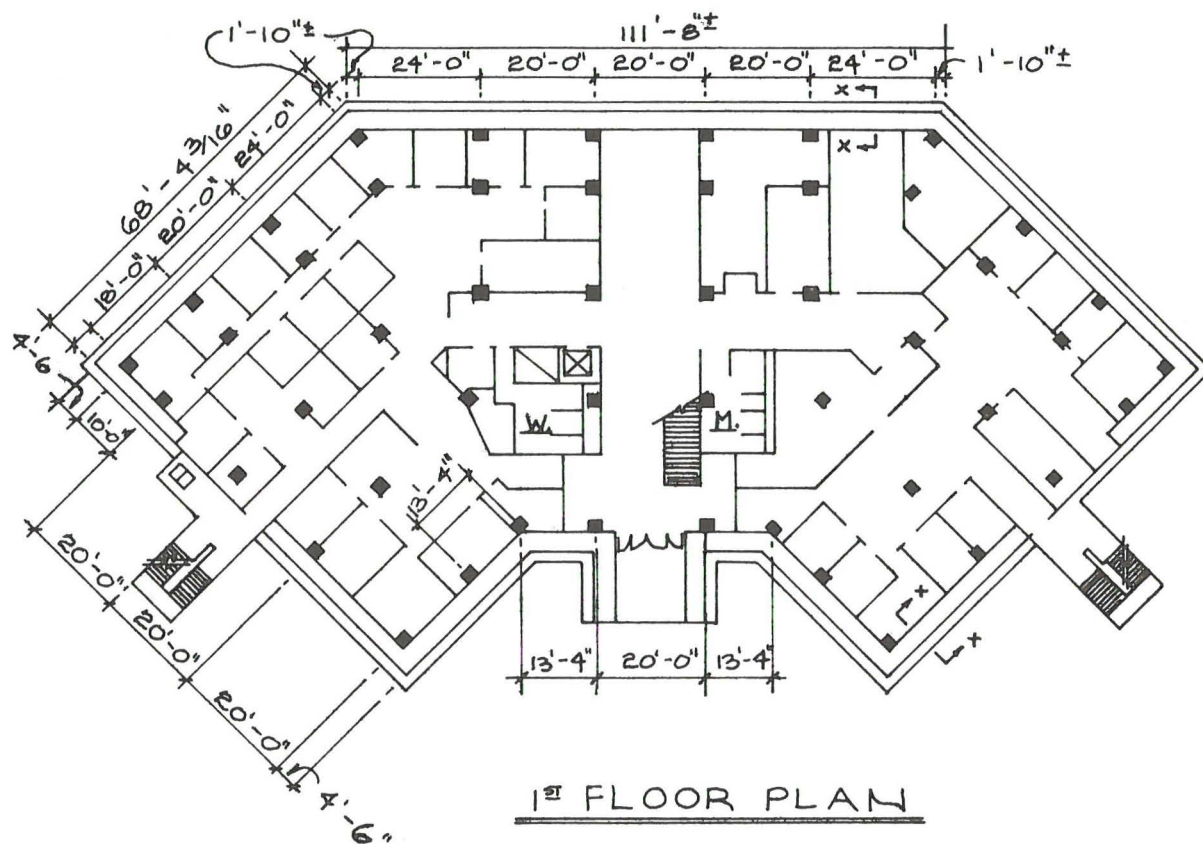


Figure 2.



Figure 3. Front-Side View Coppins Administration Building



Figure 4. "C" Shape Panel

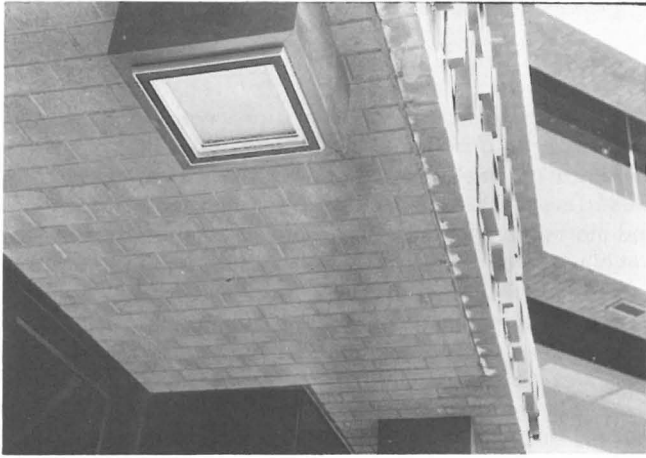


Figure 5. Soffit of "C" Panel at Entranceway



Figure 6. Soffit at Corners of "C" Panels