SINGLE-WYTHE MASONRY DETAILED AS A VENEER SOLVES DESIGN AND CONSTRUCTION CHALLENGES

# FLASHED LOADBEARING WALLS

BY WILLIAM D. PALMER JR.

Every building has its own challenges. On buildings where the construction team is working together well, these challenges can usually be traced back to the needs of the owner and the constraints imposed by the site. Sometimes those constraints are more severe than others, such as on this project in upstate New York.

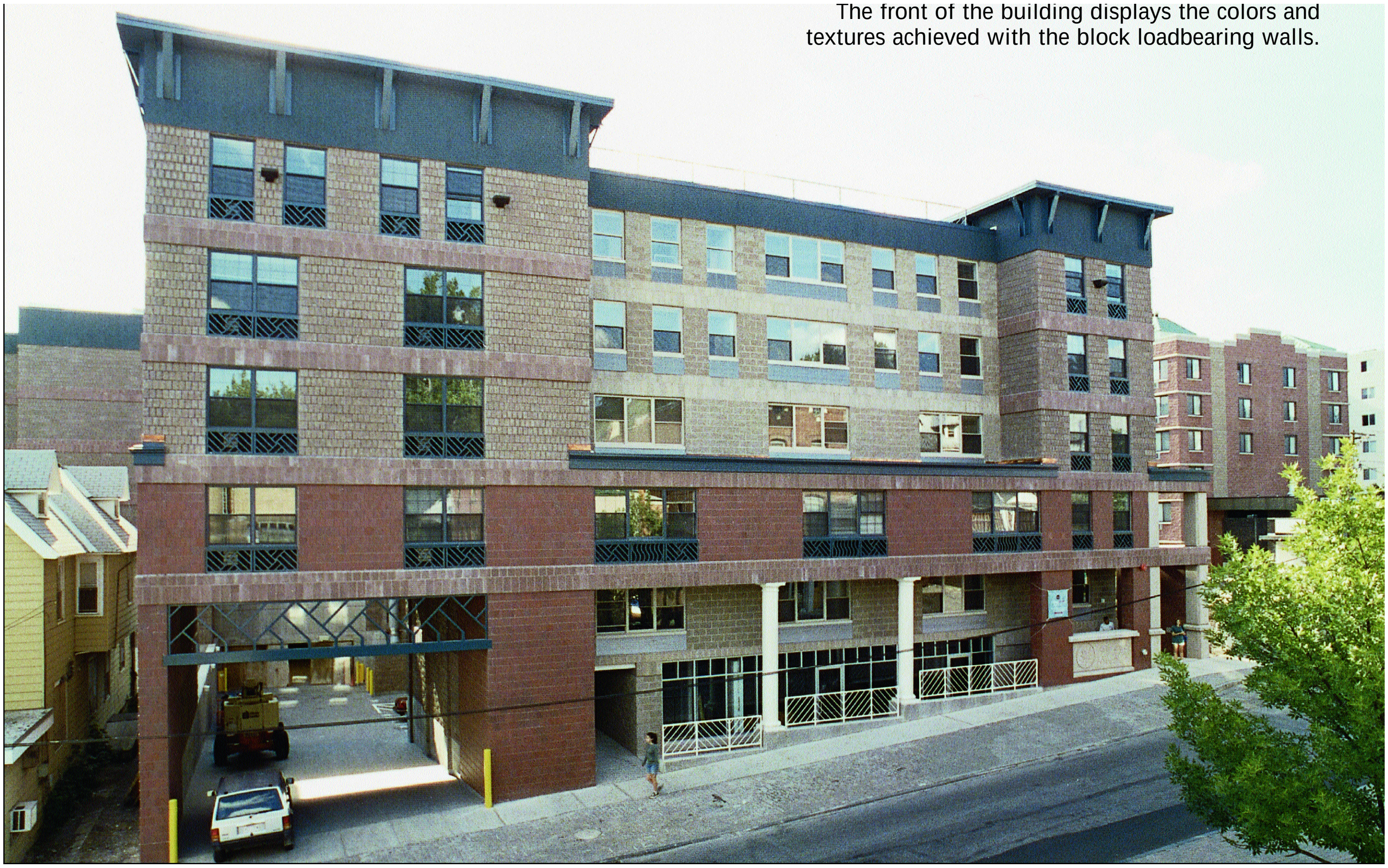
The designers were asked to create a building appealing in appearance and at a reasonable cost on a small, steeply sloped site that maximized the number of apartment units. In addition, they had to make absolutely certain that the project would be completed on schedule so that the tenants, university students, could move in when they arrived in the fall. From those initial conditions, the designers then created some challenges for the contractor: Construct a 6-story single-wythe masonry building with a drainage system, and do it through the middle of the winter without workers having access to the outside of the building.

## Designed to meet objectives

The size of the building site, multiplied by Ithaca's height restriction, defined the building's maximum volume, which dictated the number of apartments. But there were even more design requirements: The building had to be well-insulated and laid out so that there would be a window in every bedroom.

The solution was loadbearing masonry. This option was especially appealing since a single-wythe loadbearing masonry building had a shorter floor-to-floor height (only 8 feet 10 inches) than could have been achieved with a concrete or steel frame. This small advantage resulted in an entire additional floor being permissible under the Ithaca building height restriction. Masonry also allowed the construction to meet the schedule of completing the building in 10 months, with construction starting in July.

The building has loadbearing concrete masonry exterior walls with 10-inch precast concrete hollow-



The front of the building displays the colors and textures achieved with the block loadbearing walls.

core plank for the floors. Vertical reinforcing steel in fully grouted cells is placed at 16 inches on center for the first floor, with the amount of rebar gradually reduced to 32 inches on center for the top floor. Interior loadbearing block walls act as shear walls, and a small section of veneer across the front of the building is supported on the edge of the floor planks. For longer interior spans, there is some minimal structural steel. High bearing stresses can be generated where interior steel beams bear on masonry jambs, so these longer spans are supported on tubular steel columns.

Reinforced 16-inch-deep bond beam units create a reinforced band at the top of the wall for each floor level. This band serves as a beam to support the floor planks, which span up to 33 feet, and also serves as a lintel over window and door openings as wide as 10 feet. The 16-inch-deep bond beam is of a lighter-colored block than the walls. Above this, capping the end of the concrete planks, is a precast section formed to resemble a soldier course of masonry and color-matched to the bond beam units.

At each floor level, reinforcing steel crosses through the bond beam, tying together the floor planks and the walls above and below. At the building's ends, the walls parallel to the planks are tied to the planks with a clip angle. This was the best way to create a shear connection between the walls and the plank, given the large camber in the 33-foot planks. Trying to frame a 10-inch cambered plank into the masonry wall would have been a major construction problem but was simplified by the clips.

The engineer on the project, Ryan-Biggs Associates, Troy, N.Y., insisted that the entire wall system be detailed as if it were a cavity wall, with flashing and weeps at each floor. “This was costly but necessary,” says David Biggs. The “backing” for this 4-inch-wide cavity is a nonloadbearing insulated steel-stud wall. Attached to the back of the masonry wall is $1\frac{1}{2}$-inch rigid insulation board (Styrofoam Perimate from Dow Chemical) with grooved drainage channels cut directly into the face against the block. This is an unusual use of the board because Dow developed it for below-grade applications. The insulation is beveled across the bottom next to the block and weeps to create a clear drainage trough.

Tube weeps were installed at each floor line, as was through-wall flashing with stainless steel drip edges. Any water that penetrates the block will drain through the drainage grooves in the insulation panels, to the flashing, through weeps in the block head joints, over stainless steel drip edges, and onto the precast caps. This detail for the drip edges makes them nearly invisible on the face of the wall.

Besides the advantage of creating a drainage wall, this system has two layers of insulation, the rigid board layer against the back of the blocks and a fiberglass batt layer in the steel-stud wall. This combination provides a very high thermal rating for the wall, which is further improved by insulation in the cores at the ends of the precast floor planks.

Top: These third-floor walls show construction using 8-inch block built without scaffolding.

Bottom: Two floors of parking structure below grade were concrete frame, tied to the foundation of caissons and grade beams with rock bolts.

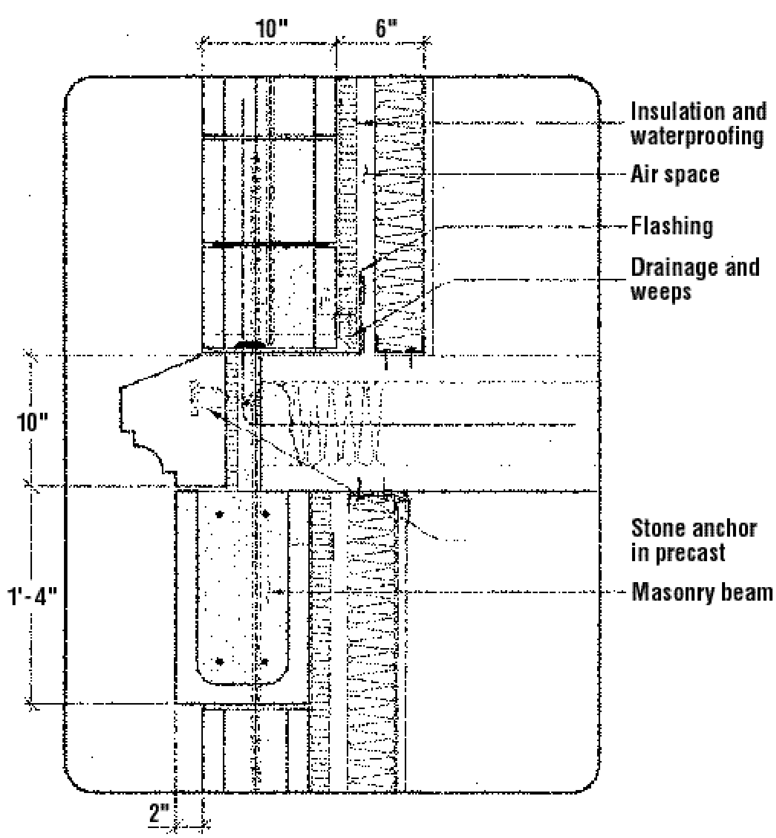
### Scaffold-free winter construction

To take full advantage of the site, designers placed the building with near-zero setbacks from the property lines. But the contractor could not work from the outside of the building without encroaching onto adjacent properties. Materials were therefore delivered on an as-needed basis and loaded onto the floor under construction. “Luckily we had use of the tower crane, although coordination was sometimes difficult since everyone was using it,” says Mike Casler of Casler Masonry, Auburn, N.Y. With no exterior access or scaffolding, all masonry had to be laid overhand from atop the floor planks. At each floor, after the planks were laid, the masons laid the walls and finished them by leaning over the top of the walls to tool the joints on the outside face. Prior to being selected, the masonry contractor had to build a sample panel to prove that the firm could provide acceptable joints working from over the top of the wall.

The deep masonry bond beams were built as the last course at the top of each floor’s walls. After they were grouted, the beams were shored for one week over openings. The precast floor planks were then positioned by crane, and the precast concrete end cap was positioned using a stone anchor (cast in the concrete) that was hooked to a horizontal piece of reinforcing steel, then grouted. A latex topping was placed on the floor planks, and the intersecting keyway between planks was grouted full. A bent reinforcing bar was embedded in the grout and projected straight up at the plank ends to tie into the masonry wall above. Vertical reinforcing bars also came up from the wall below through the grout between the precast cap and the floor planks and into the masonry above. The first course of each masonry wall was then grouted solid to tie everything together and to provide a solid foundation for the wall above.

Before the masonry wall was built, workers installed the through-wall flashing at each floor level: rubberized asphalt with the sticky side down to adhere to the stainless steel drip edge and to the top of the wall below. During construction of the masonry wall and installation of the insulation, the release sheet was left on the portion of the flashing that came past the edge of the wall. Workers then mechanically attached the highly moisture-resistant insulation board, since gluing would have plugged the drainage channels between the block wall and the boards. After the insulation was in place, the release sheet was removed from the flashing, and a second piece of rubberized asphalt flashing was added, 8 inches wide, this time with the sticky side up. This flashing assembly was then folded up, adhered to the cavity side of the insulation board, and firmly attached with termination bars. Finally, the interior insulated steel stud wall was placed, leaving a 2-inch open cavity. With the flashing system in place, exterior moisture should never reach the interior wall.

To meet the construction schedule, it was necessary to do much of the masonry work during the coldest part of the winter atop a hill in upstate New York. Cold weather procedures followed the MSJC Specification’s requirements. “Wind was a big prob-




Top: Note the insulation within the plank cores and the reinforcement extending from the walls below.

Middle: This small area provided the staging for delivery to the masons of mortar and grout.

Bottom: The exterior bearing wall and the floor system are tied together at each floor level.

lem, but we enclosed and heated all the walls after construction," says Casler.

The apartments at 312 College Avenue opened in August 1999, in time for Cornell University students to take up residence in September. The building's parapet may mimic those on nearby older buildings, but the structure is modern, warm, and quiet, perfect for study and all the other activities a group of college students can come up with.

## PROJECT PARTICIPANTS

Developer: 312 College Avenue Association, Ithaca, N.Y.
Concept architect: Allan McLane Chambliss Jr., Brooktondale, N.Y.
Project architect: Gregory J. Seleman, PC, Albany, N.Y.
Structural engineer: Ryan-Biggs Associates, PC, Troy, N.Y.
General contractor: Northland Associates, Syracuse, N.Y.
Masonry contractor: Casler Masonry Inc., Auburn, N.Y.
Masonry supplier: Auburn Cement Products, Auburn, N.Y.

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