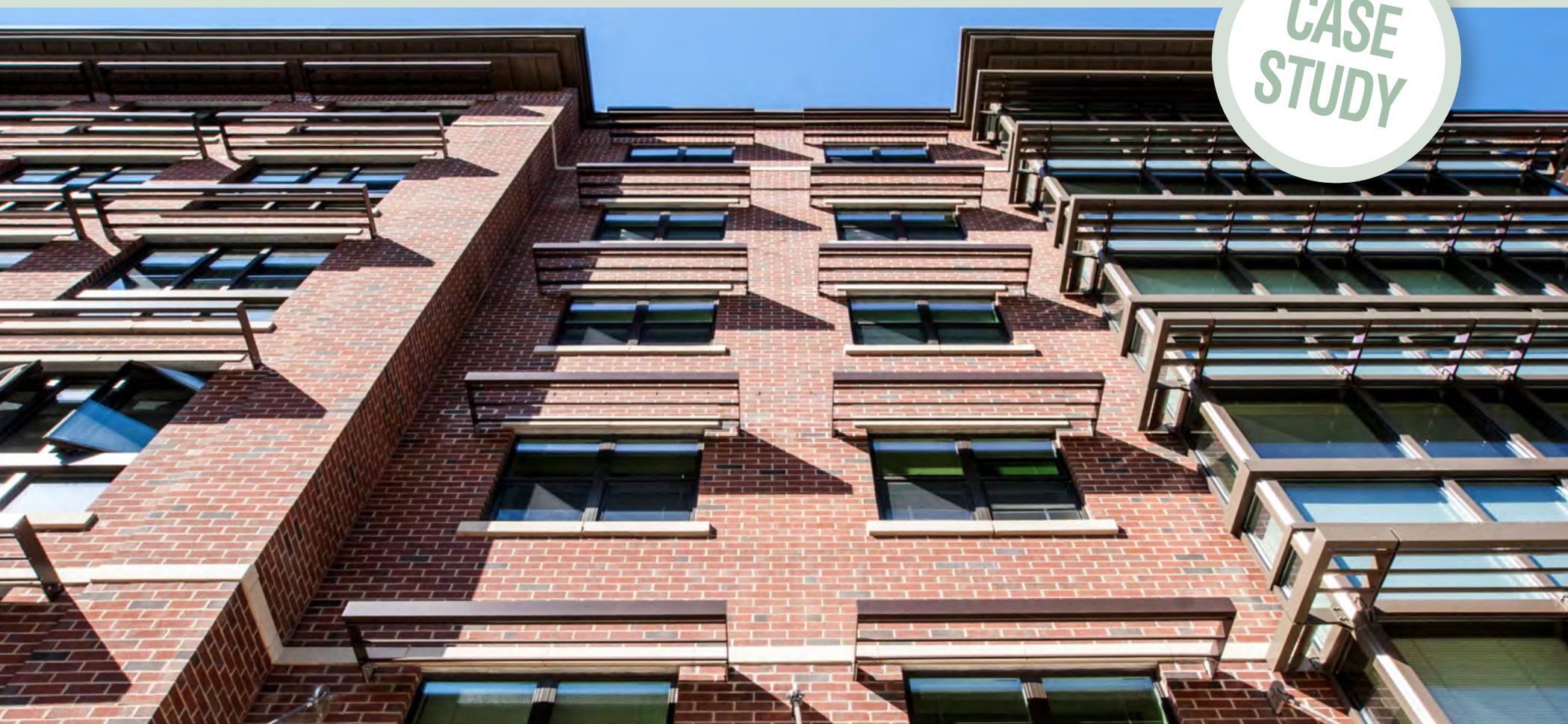


# WHY MASONRY?

CASE  
STUDY



**BRECKENRIDGE PLACE**  
ITHACA NEIGHBORHOOD HOUSING SERVICES – ITHACA, NY



**Supplier: Barnes & Cone Architectural Masonry**

**Architect: HOLT Architects**

**Owner: Ithaca Neighborhood Housing Services**

**General Contractor: Christa Construction**

**Mason: Dave Traver Masonry**

**Ryan Biggs | Clark Davis Engineering  
& Surveying.**

**Brick detailing is contemporary yet the tripartite elevation addresses surrounding historic masonry structures. Brick design features multiple reveal bands, soldier course banding, decorative brick banding, and cast stone accent bands, creating accents and shadow lines adding character to the exterior. Contemporary yet timeless composition.**

Located in the heart of downtown Ithaca NY, Breckenridge Place's architecture repairs the downtown urban fabric and pays respect to its historic context. Concrete masonry unit (CMU) walls support concrete plank floors and roof. An articulated brick façade was used to echo the styles and details of surrounding buildings. Masonry was a critical element both structurally and aesthetically. Value Engineering favors masonry, despite challenges.

Structural systems originally considered and evaluated for a six-story 55,300 sf building with 50 one- and two-bedroom apartments on the upper five floors with community space and covered parking on the ground floor included:

- ▶ Structural steel framing supporting concrete plank \$1.04 M\*.
- ▶ Cold-formed metal stud bearing walls with cold-formed metal joists \$1.28 M.
- ▶ Structural steel framing with composite concrete slabs on metal deck. \$1.165 M.
- ▶ Not within budget.
- ▶ Christa Construction provided this approximate breakdown of structure costs.



## PERCEPTION

When initially vetting structural systems, masonry was not perceived to be an appropriate choice:

- ▶ Increased structure weight would add cost to the deep foundation system.
- ▶ Open multi-purpose and parking areas required long spans with little to no opportunity for bearing walls.
- ▶ Added weight [and reduced ductility] would increase seismic loads.
- ▶ Exterior bearing walls were riddled with large window openings.

Initially estimated by construction manager to be the most cost-effective solution for the site, a cold-formed metal stud bearing wall and joist system on a cast-in-place podium slab was selected to reduce the weight of the structure and the cost of the foundations, and to allow stick-built construction.

The design team proceeded developing the light-gauge structural system. A cast-in-place podium slab was designed to support the light-gauge bearing walls on the upper levels. The upper floor system was designed using 3/4" structural panel concrete subfloor. Concrete panels were supported on 8" light-gauge joists spaced 16" oc. Joists were supported on 6" light-gauge stud bearing walls that varied from 18 gauge to 14 gauge. Lateral system was designed using 6" light-gauge walls sheathed with 20 gauge steel sheet. Ends of shear walls were framed with multiple studs, and on the lowest level HSS 4x4 columns were used. Hold-down anchors were used to transfer loads through floor framing.

As the structural system was being developed, the architect was developing the design for fire-resistance, acoustics and air infiltration.

In order to meet the two-hour fire rating required for Type 1B construction, all interior bearing walls were required to have two layers of 5/8" gypsum board applied to each side. Exterior walls were required to have three layers of 1/2" gypsum applied to the inside face. In addition, floors were required to have two layers of 5/8" gypsum suspended from the bottom of joists.



**CM suggested we relook at a masonry bearing wall option. They noted the masonry solution was a ‘known system that gave peace of mind’.**

For acoustics, floors and walls were insulated with batt, and a layer of 1/2” plywood was added above cementitious board, separated with a layer of acoustic adhesive. Acoustic adhesive was also added between two layers of gypsum wallboard hung from floor joists.

Air infiltration from floor system into walls was also a concern. Special blocking and air sealing was required to prevent infiltration.

All penetrations through walls and floors had to be specially sealed to maintain fire separation and prevent air infiltration.

At the end of the Design Development Phase, the project was over budget. The construction manager noted that structure cost was \$1 million over what they had anticipated. This was largely due to the amount of gypsum wallboard required to achieve fire ratings and acoustics and the complexities of some of the light-gauge framing for shear walls. Around this time, drywall costs rose 20- 35%, adding unanticipated costs.

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The value of the raw grey simple unparalleled CMU wall system is that it saved more than \$1 million on this project. And contributed to LEED Platinum through the use of regional materials manufactured with recycled content, its thermal mass and insulated cavity wall system contributing to optimizing energy performance. Running bond CMU provides a robust structurally redundant wall system. Inherent in the block also are fire and acoustic ratings, seismic strength.



## A RELOOK AT MASONRY

The design team and construction manager worked hand-in-hand to find ways to reduce cost. After seeing all of the complexities associated with the light-gauge solution, the CM suggested that we relook at a masonry bearing wall option. They noted that the masonry solution was a 'known system that gave peace of mind'.

## REALITY PROVED TO BE MUCH DIFFERENT THAN PERCEPTION:

In reality, the added structure weight of the masonry and plank system had a relatively minor effect on the overall cost of the deep foundation system.

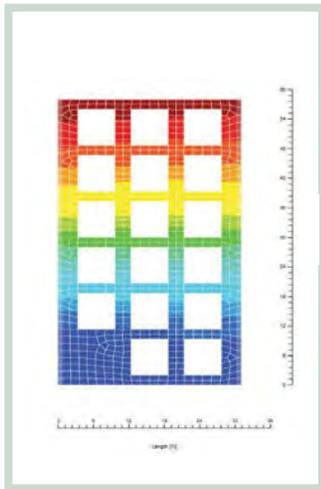
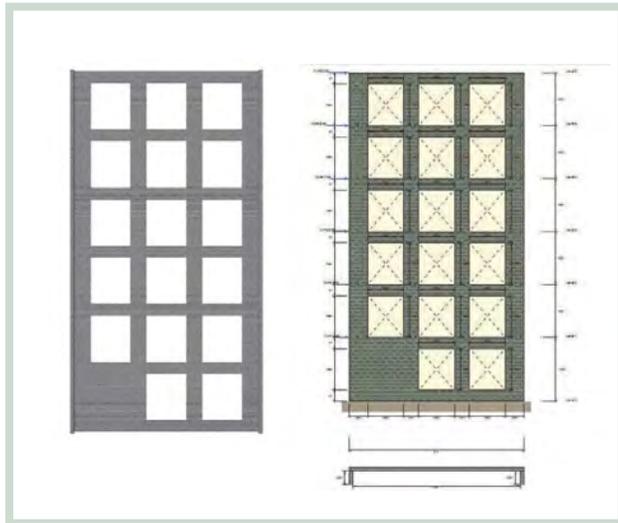
In reality, after making minor adjustments to ground-floor plan layout, major bearing and shear walls were able to extend full height of building, open parking area was still achievable by using steel frame and plank system over this area.

In reality, added weight and reduced ductility of the masonry system DID significantly increase seismic loads. In fact, seismic base shear increased from 150 K with the light-gauge system, to 485 K with the masonry system. However, masonry shear walls have significantly more strength than the light-gauge counterpart and were easily able to resist these higher loads with fewer masonry shear walls than with the light gauge solution!

In reality, exterior walls with openings were designed using bond beam lintels, which also served as coupling beams to permit walls to act as coupled shear walls for lateral system.

## MASONRY WALL

Strategic changes were made to the ground-floor layout to allow one of the interior corridor bearing walls to extend down through the ground-floor level. The parking area still required large open space at the ground floor. The design was changed to a masonry bearing wall structure with 8" precast plank floors with a 2" topping. 8" CMU walls were used at all upper levels, 12"



CMU was used only at the lower level. At the parking area, a steel frame and plank transfer structure was utilized.

All of the complexities for fire rating, acoustics and air transfer were eliminated. Block inherently provide superior performance with no special detailing required. Gypsum requirement was reduced to 1/2" sheathing on wall furring.

CMU was locally produced with 30% ground, granulated blast furnace slag, a preconsumer recycled material contributing to the goal for LEED Platinum. Results show both cost and time savings. Masonry bearing wall and plank structure resulted in more than \$1 million savings over the lightgauge solution, and this included an extra \$150,000 for winter protection for the masonry.

The construction manager noted that the masonry was a better overall solution. The Owner ended up with a robust structural system, with superior fire resistance and acoustical performance with fewer materials required, saving money and improving construction schedule.

Other systems had to add fire protection, acoustic fill and adhesive, air sealing and seismic connections and collector elements. In the simple unparalleled CMU wall system, it's all there. It's all inherent in the block. Most efficient. That simple little fact cut the enclosure cost in half and won the job!

The architect, engineer, and contractors worked together on the utilization of material and sustainability, achieving a LEED Platinum Certification from the USGBC for the project. Making use of regional and recycled materials was important to achieving this goal.

**All complexities for fire rating, acoustics and air transfer were eliminated. Block inherently provide superior performance with no special detailing required.**



**Jamie Davis, PE,  
LEED AP, Principal,  
Ryan Biggs | Clark  
Davis, Engineering  
and Surveying.**

**Skaneateles Falls NY My passions lie in the past and future of masonry construction; masonry restoration and preservation, and advancement of masonry modeling tools for BIM (Building Information Modeling)—and yoga and chocolate.**

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Energy optimization through the use of the masonry cavity wall insulated with regionally produced foil-faced polyisocyanurate rigid panels and CMU thermal mass was also instrumental as was inherent noise abatement for separation between rooms which helped achieve those goals. This building was also designed to meet the Enterprise Green Criteria, NYS Division of Housing and Community Renewal Green Criteria, and New York State Energy Research and Development Authority multi-family energy standards.

This project was a success story for the economic use of masonry for mid-rise housing in an urban setting.

## **THE R AND THE OMEGA**

One of the perceived benefits of using a light-gauge system is the ability to use a higher R value. In structural engineering, R value is a seismic response modification factor – a measure of the ductility of the lateral force resisting system, not thermal resistance. As the R value is increased, the lower the design seismic force.

The light-gauge shear wall system originally designed had an R value of 6.5. However, designers must also design for an Omega factor of 3. This factor is used to increase seismic forces for connections and collector elements. This has a significant impact on the design of light-gauge shear walls.

When designing masonry shear walls, we always design them as Intermediate Reinforced Shear walls. The only difference between an Ordinary Reinforced Shear wall and an Intermediate Reinforced wall is the requirement to have minimum vertical reinforcing of a # 4 bar at 4'oc versus 10'oc. The effect on the R value is significant increasing from 2 for Ordinary, to 3.5 for Intermediate. That is a 44% reduction in design seismic forces. Well worth the few extra vertical bars.

Designer should be using intermediate reinforced shear walls instead of ordinary to obtain a 44% reduction in seismic forces.

**Photo Credits: HOLT Architects**

