Mt. Zion’s

Long wait ends

Switch from Steel to Loadbearing Masonry Allows Church to Realize Dream

— by Don Root, AIA

Pastor Loren Covarrubias watched as people filed into the new Mt. Zion Church and thought, “God’s will has been done. Our dream is realized.” The new worship space opened to the public on Sunday, March 22, to a rousing, standing-room-only congregation of 3400 parishioners. Serving a growing Southeast Michigan community for more than 30 years, Mt. Zion Church sought to expand its existing sanctuary that accommodates 1300 people. Four Sunday services and one on Wednesday evenings became cumbersome for one pastor to handle alone and Pastor Loren longed to return to a single Sunday service while retaining the Wednesday evening service.

Abounding Obstacles

In December 2001, the journey began with the commission of Integrated Design Solutions, LLC (IDS) to design a new sanctuary. Clarkston’s site plan approval review discovered that previously promised changes to an existing wetland had not been completed. The Church was waiting to see how design of the new space for worship would affect the site plan. Negotiations with the township and the Michigan Department of Environmental Quality (DEQ) on what would be required to fulfill the wetland mitigations took a year and a half and changed the location of the sanctuary, adding a long, connecting corridor between the existing building and the

The gentle curve of this 44’ tall, 12” single wythe CMU wall provides the strength needed to support the 156’ long trusses.
new sanctuary. The resulting corridor gave the Church six new nurseries for the increasing infant and toddler population, new offices for additional staff members, a 400-seat Praise Room providing worship space for students from first to sixth grade. The Praise Room also provides a theater where first- and second-run religious movies can be shown. The new design was completed and ready for bids by September 2005.

**Loadbearing CMU Saves $1.25 Million**

Original design was 90% metal stud back-up with masonry in-fill structural system and masonry veneer. Most of the interior walls were planned to be light-gauge steel stud with gypsum board. At the time the project went out to bid, the cost of steel was at an all-time high because of construction in China and the Pacific Rim countries. Bids came in higher than budgeted. Again, the project was on hold. Pastor Loren still had hope and with input from his staff, mason contractor Muirhead Construction and IDS, it was agreed the building would be redesigned one more time. Dave Muirhead offered suggestions and solutions to save $1.25 million by using loadbearing masonry. He created 3D models of how the wall would be changed. The original design had approximately 15,000 units. It now has 235,000 concrete masonry units (CMU). He knew how to make it work and brought in Scott Walkowicz, PE, then structural engineer and head designer from Ledy Design Group, for his creative thinking and to take out as much steel as possible. Walkowicz, now owner of Walkowicz Consulting Engineers, LLC and engineering consultant to the Michigan Masonry Coalition, was quick to understand the concepts of what we wanted to achieve. Only the roof structure remained steel. In August 2007, a new contract was signed and the new design began.

**Loadbearing Characteristics**

The building had all characteristics to support a loadbearing masonry design. To paraphrase the article by Walkowicz in the July/August 2004 StoryPole, the building met all requirements to be masonry-bearing wall construction. Ledy Design Group was commissioned as the structural engineer to ensure sound, functional design. Primary design elements are itemized:

- The main worship space has masonry walls in all four directions to stabilize each other. The worship space and the Praise Room are large open areas easily spanned with long-span trusses.
- The township zoning ordinance limits building height to an average of 35'. This means the highest wall facing I-75 is approximately 44' and the shortest wall is 34'8" with the roof sloping from 38'8" to 33'8" above the finished first floor level.
- Intermediate supports reinforce walls of the large spaces. Main corridors and classrooms surrounding the sanctuary and Praise Rooms are lower spaces with sloped roofs. This provides bracing at two points of the walls: about halfway up the wall and about three quarters of the way from the top.
- Window design had always been punched small openings for budgetary purposes, but it is also the right design for masonry-bearing walls. Smaller openings allow the entire wall to act as one wall rather than separate sections.
- The roof was first thought to only have parapets on the tall side, but to help make the roof work better as a diaphragm to transfer the walls' reactionary loads, short parapets were added to all four sides.
- The entire roof load was able to be transferred into the walls, thus reducing the flexural tension in the wall.
- Tall walls are designed with 12" CMUs, the shorter walls are designed with
8” concrete masonry units, providing enough cell space in the block to allow for required reinforcing.

- Punched openings are designed so masonry lintels could be used. This helped the wall act as a single unit, allowing the wall to have vertical continuity of vertical reinforcing. It shortened the schedule and ensures the lintels will last as long as the wall, rather than rusting prematurely.

Original design for the low connector wing also had punched openings with a steel frame and steel bar joists providing for the sloped roof. The wings were easily converted to masonry-bearing walls with light gauge metal truss framing for the sloped roofs, eliminating more costly steel. Changing interior walls from metal stud and gypsum board to masonry helped expedite construction. The mason began work at the existing building and constructed all of the walls working toward the sanctuary. As a section was finished, the roof framing would follow and then the windows, enclosing the space so the building progressed in a lineal direction. It flowed from the existing building, along the wing until they reached the sanctuary. This allowed portions of the building to be occupied while construction continued at the other end.

**Varied Masonry Palette**

Administration limited the masonry palette. Fendt Builders’ Supply provided four colors of standard CMU in up to three textures: ground face or burnished, sand blasted and split faced. Standard grey block was used where it was not part of the final finish of the room. In most locations the structural wall became the finished wall. There were several locations where the wall had a CMU veneer added to the interior face as well as the exterior face. The same side of the wall would switch from interior to exterior. All exterior bearing walls are cavity wall construction. A 4” face CMU is separated from the bearing wall with a 4” cavity consisting of a 2” air space and 2” of rigid insulation.

At many locations where tall bearing walls are braced by low roofs, the face veneer and cavity were supported on shelf angles just below the connection of the low roof, eliminating the veneer from the ground up.

**Mt. Zion**

**Masonry-bearing walls help spread structural loads.**

On the exterior, two colors were used to accentuate punched openings and entrances. A lighter accent color emphasizes windows and entrances. A darker red in a ground face and split face texture provide relief of the expansive masonry walls.

Interior colors were just the opposite. The unit used for the main wall color, throughout the offices and classrooms, was light colored with a sand blasted finish to make the spaces brighter and more cheerful.

A darker ground face unit was used as the base so in most rooms a finish base was not required. Also, the same dark unit was used as an accent band at the top of the wall separating the wall color from the ceiling. Inside the sanctuary, the darker color became the predominant finish so the parishioners’ view would focus on the platform area and the service. The platform will eventually be treated with a stone veneer. Three textures of the same color were used, providing interest to the large expanses of the side walls in the sanctuary and helping break up the surface for better acoustics. Masonry interior partitions provided walls that will need little maintenance for the life of the building.

Color change at the entrances helps first-time attendees find their way in. Notice how the control joints strengthen the corners.
Masonry Meets Environmental and Budgetary Goals

Masonry-bearing walls also help spread structural loads more evenly over the very wet soils. The water table on the property is within 4’ of the surface. There are three wetlands on the property surrounding the new addition. By using masonry-bearing, the weight of the building was more evenly distributed with no point loads, requiring only minimum width continuous footings reducing footing costs. Other aspects of the building were also redesigned as part of the cost reduction efforts. Mechanical systems were redesigned, lighting and electronics were simplified, ceilings were removed, landscaping and site features reduced. These changes reduced project costs so Pastor Loren’s dream could be realized.

The Church chose to be its own construction manager to save money, requiring its staff, especially its business manager and facilities manager, to take on additional responsibilities. Although data about cost savings is held by the owner, we know that switching to masonry-bearing construction was a major factor in keeping the project within budget.

On March 24, just two days after the Grand Opening, the Masonry Institute of Michigan honored this project with the President’s Award for masonry-bearing wall construction. It is a fitting honor.

A CMU palette of four colors and three finishes was used for the entire addition, inside and out, to provide continuity, but also enhanced aesthetics. Here, dark units provide relief in the large masonry expanse of the high walls.

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