Carving New Theaters

By Ramon Gilzanz, P.E.

Structural challenges abounded in the conversion of a mixed-use office, retail and theater building into a nine-screen multiplex

Ever since the completion of the 800,000-sq.-ft. Landmark Square center in 1986, it has been the pre-eminent address in Stamford. The mixed-use complex, which took 14 years to complete, includes six buildings plus a 450,000-sq.-ft. parking garage. To maintain its dominant position, the project's owner recently embarked on a redevelopment effort—and an important component of the project is a renovation of the complex's movie theater.

The theater is housed in building number 5, a three-story, 65,000-sq.-ft. structure with a 90-ft.-by-300-ft. rectangular foot print. The building originally contained a three-story movie theater, retail stores and office space.

The building sits on top of a three-story parking garage, with the top floor of the garage at ground level. The plaza level for the building is at 33 ft., the second floor at 47 ft., the third at 59 ft. and the roof at an elevation of 72 ft. The parking garage and plaza level are of normal weight reinforced concrete joist and girder construction, while the building above consists of wide flange sections with 2½-in. concrete floor slabs supported on 3-in. metal deck. The foundation consists of footings on sand. Typical girder-to-column connections consisted of a stiffened seat angle, with a typical bay size of

19-ft.-by-30-ft. The steel beams had no shear studs.

In response to changing market conditions, the renovation of the building will eliminate most of the office and retail areas and convert the entire building into a nine-screen multiplex cinema with a total combined seating audience of 1,900. In addition to the design issues related to creating the larger—and more modern—theater space, the building also needed to be brought up to current seismic code. The design architect on the project was Richard Metsky from Beyer Blinder Belle, New York City, and the theater consultant was Valus and Carpenter.

As with any renovation project, there are always unpredictable details. On this project, an early problem was created after the removal of some architectural finishes when several deficient connections were found. As a result, a complete structural survey was necessary, which revealed missing bolts, loose bolts and missing welds. These were all repaired. Structural engineer was New York City-based Gilsanz Murray Staficek and the construction manager was Structure Tone, also of New York City.

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One of the major structural issues on the project was the creation of large open areas in what had previously been speculative office space. To make room for the open areas required by the theaters, an existing column needed to be removed. The loads were then transferred to new 50 ksi steel beams, which ranged in size from W8s to W27s.

In addition to the new beams, the existing beams were reinforced using a variety of methods. Some beams had new channels welded to the web, while others had a WT welded to the bottom flange, and in some cases composite action was created by adding shear studs to the top flange. Also, the columns that had no extra capacity for the new load were reinforced with plates welded to the tips of the flanges. Steel fabricator on the project was AISC active-member Burgess Steel Products.

Seismic Issues

While the peer review program and special inspection requirements of Connecticut's new State Building Code are a positive change from past practices, enforcing these new seismic provisions were one of the chief structural challenges on the project. In addition to the problem of the building sitting on a four-story concrete base and a foundation with limited excess capacity, the nature of theater design resulted in weak diaphragm action at the upper levels. The reduced floor diaphragm action is the result of the size and number of openings required for the new theaters, the stairs necessary to meet the stringent movie theater exiting requirements, the different theater floor elevations and slopes, and the necessity to meet American Disability Act requirements.

Fortunately, most of the seismic issues could be solved by adding bracing. Pipes were used for the bracing since the circular geometry provided the best slenderness ratio, which helped to allow the bracing to be enclosed in the theater's walls. The pipes were slotted at the gusset plates, making it easier to develop the full yield tension capacity of the

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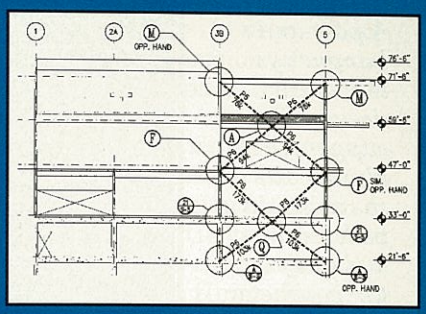
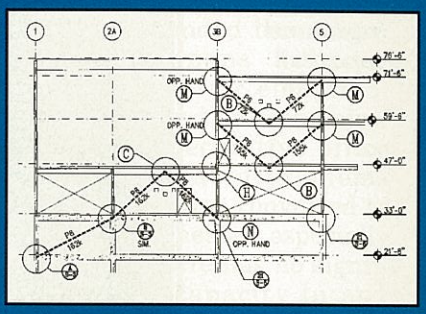
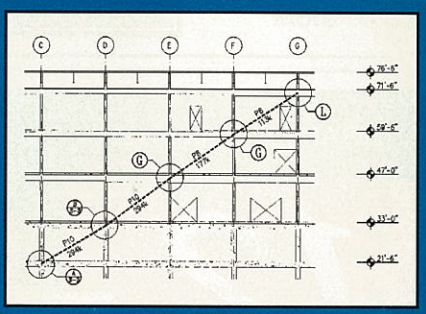
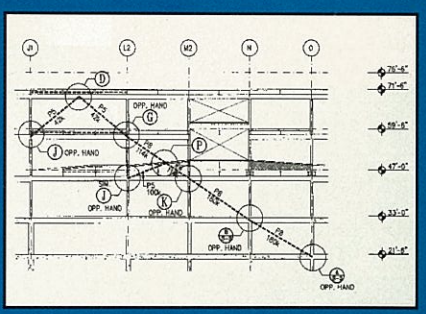
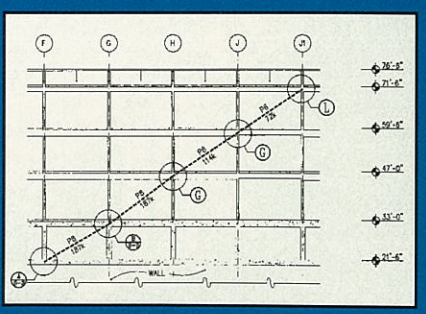
Elevation At Steel Bracing Along Column Lines 1-5



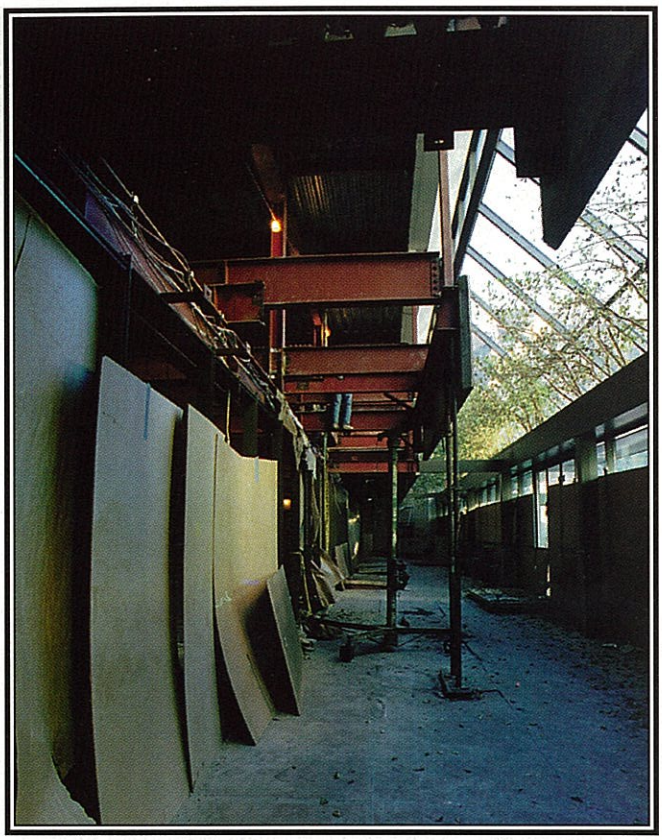








A post-and-hangar system was designed to support the glass walls of the enclosed pedestrian walkway on the perimeter of the project (right and opposite).



braces. To distribute the upward and downward forces due to seismic overturning, we spread the braces over the maximum number of columns. However, in some areas we removed the concrete fill over the parking garage to ensure that the foundation would not be overstressed.

For structural efficiency, the geometry of the braces, columns and beams have coincident working points and the braces induce no bending moments in the columns or beams. As could be expected, the many access doors for the theaters and stairs made coordination of the braces with the openings difficult.

Gussets at the base of the building are embedded in the concrete to insure the forces are transferred into the concrete floor and the bracing extended into the first parking garage level to insure the transfer of the seismic shears at ground level. Between the ground level and

TRANS WORLD DOME, St.Louis, Missouri

12 acre roof

the plaza level the interaction of the new braces and all the existing concrete columns was considered. The effect of the interaction is to partially reduce the force in the braces. From there it goes through the concrete floor to the basement walls that deliver it to the soil. As a result of our study, we produced composite steel-concrete details that connect the new steel bracing pipes to the existing concrete frame and we added one additional story of braces instead of reinforcing the levels with weak diaphragms.

Public Walkway

One of the most notable features of the project is an existing glass-enclosed public walkway situated along the buildings at the plaza level. The curtain wall facade of the buildings along the walkway cantilever over to the center of the walkway, which creates an impression of a very open and airy space. This walkway is the main artery for pedestrian traffic and extends into the Stamford Town Mall. The project's original structural engineer created this cantilever condition without moment connections and extended the floor framing beyond the column line and supported the extended beam on a girder that spans between columns at a lower elevation. While this created an economical design for a speculative office building, it created problems when the space was converted to a multi-screen theater, especially since the structure has no significant reserve capacity in any

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structural elements, including the foundation.

The conversion required the removal of the back spans of the multiple cantilever beams that support the glass wall facade in order to create the additional ceiling height required in a theater. The solution was to design a post-and-hangars system to support the glass walls. Posts connect the tip of the cantilevers to the new or reinforced beams at elevation 47. At some areas, we hung the cantilevers from the roof; however, this required the addition of new beams at the roof level. At the building corner, both facades are cantilevered and beams are provided in two directions. All the new steel and reinforcing steel was installed prior to removal of any metal deck or steel beams to reduce the shoring required.

Prior to demolition of the existing slabs, the contractor used them as working platforms to install some finishes—sheetrock walls, mechanical ducts, etc. The final removal of steel happened only after the new concrete floor was in place. The added weight to the backspan then produced a vertical movement of the new cantilever tips that unloaded the existing cantilevers. The innovative concept of using the existing slabs as platforms came from Structure Tone's Thomas Bentzen. Anthony Nicoletti from Valus and Carpenter was responsible for coordinating all of the trades on the project.

The multiple elevations required for the theater are obtained using a concrete slab on top of a polystyrene fill. This was considered more economical and it weighs less than concrete masonry units and concrete on metal deck. Originally, a foam glass from Corning was specified, but it was replaced with polystyrene for value engineering reasons. To reduce its exposure to fire, the polystyrene fill was encased.

Different theaters and ramps are next to each other and share the same steel framing beams. To achieve all the necessary elevations, in some areas with new slabs a layer of polystyrene and another slab is required.

The difficulties encountered on this project are actually typical of any renovation work. Fortunately, good cooperation between the building team members helped the project succeed. The project's owner is the Metropolitan Life Insurance Co., with GRM Management Inc. acting as owner's representative. And Thomas Becker, the tenant's representative from Galbreath Company, did a great job of creating a very positive work atmosphere.

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