OLD meets NEW

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A series of three vintage masonry, cast iron and timber-framed buildings were combined to create contiguous retail spaces through the use of structural steel.

A major renovation had to be performed at a first class location on Boylston Street in Boston, an area comprised mainly with luxury retail stores and high-end restaurants. Most importantly, the Hynes Convention Center, which has been recently renovated, is located across the street and has had new additions added to it, helping the area business to flourish. The Boylston Street building could be the last renovated building to keep up with the revitalization of the area.

EXISTING BUILDING

The three story high building (with full basement) was formed of three separate but attached buildings and housed a large print shop and storage facility. The structural system of the first building was cast iron round columns with precast connection bracketed plates (at the interior bays), supporting steel and wood girders and wood floor joists, and brick bearing walls at the periphery of the building. The second and third buildings had a similar situation with steel columns at the lower level that changed to wood columns on the upper floors. Four rows of brick bearing walls separated the three buildings in the long direction. The two end walls acted as exterior walls, and the two interior walls acted as separation walls between the three buildings.

The three buildings were planned for use as a single facility and needed large openings in the interior bearing walls and floors to enable direct communication between the three buildings and create a view of the different levels from each floor. A new mechanical system was installed which required the installation of new rooftop units on low-rise dunnage frames in accordance with the guidelines of the City of Boston Building Department.

THE RENOVATION

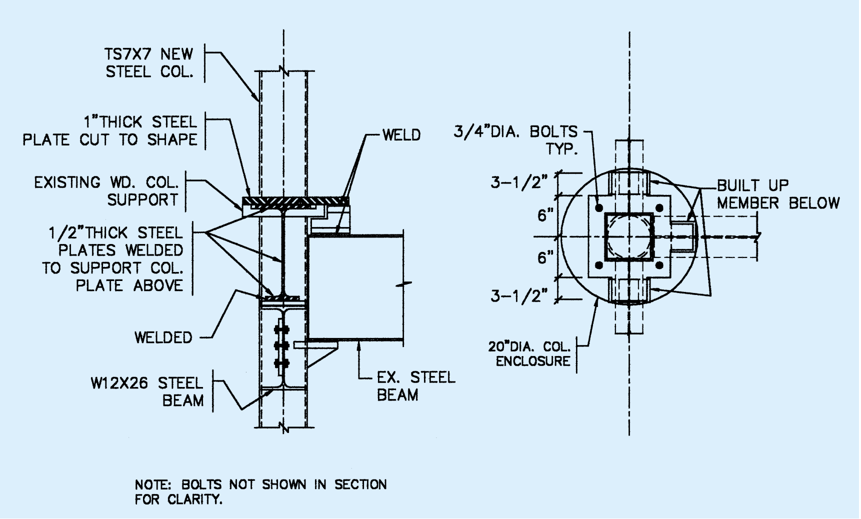
Steel lintels were used at large openings created in the 12″ brick bearing walls. Shallow but stiff steel girders were installed to help create the large floor openings with end support distribution steel plates. Escalators were designed by architects to be in the first and second buildings adjacent and running parallel to the party walls between the first and second buildings. Large span girders perpendicular to the brick walls were installed to carry the end loads of the escalator trusses. The immediate solution for the support of the escalator girders seemed to be the installation of new columns adjacent or inside the brick wall. The idea was abandoned due to space limitations and cost implications. Large load distribution steel plates were welded at the end support of girders to distribute the load of the escalator girders on the 12" brick wall and drop the stresses on the masonry to an allowable range. Existing steel columns were used to support the girders on the opposite side. To prevent lateral movement of the framing, steel members running parallel to the wood floor members were used to tie the columns together and to the exterior wall.

THE PROBLEM OF TORSION

An important issue was to overcome the torsion created in the girders from the eccentric connection configuration of the escalator trusses at the support girders. As the large supporting escalator girders were free to rotate at the ends, and minor torsional resistance was inherent in the wide flange girders, it was decided to brace the girders by welding horizontal beams to them with moment connections and extending and tying the beams to a distance beam installed parallel to the main girders. The torsion, which

Steel members were used to create large openings in the exisitng bearing walls. Note the timber column, upper left, reinforced with channels bolted to both sides. Existing timber beams are supported with special seats welded to the steel girders.

New escalator support beam (left). A "backup" beam, running parallel to the escalator support beam, helps resist torsion with a short, moment-connected filler beam.



Left and Above: Detail of connection of new HSS columns to existing cast-iron columns. The existing columns (below the base plate with tabs) have connection seats and web connection plates cast integrally with the column.

caused an uplift in the distance beam, was balanced by the vertical uplift reactions introduced in the distance beam. The same criteria were used for all escalator girders through all floors.

ATTACHING NEW TO OLD

Because the escalator was supported by beams resting on the existing brick masonry walls, as well as on interior existing steel columns, the steel columns had to be tied together with new beams and to the exterior brick bearing wall for lateral stability. It was a challenge for the steel erector to weld the new steel beams to the cast iron columns, a process that required special electrodes and preheating the weld area. After several trials, the welds failed to pass inspection, and the idea was abandoned. The necessity of using bolted connections became evident.

Also, where steel columns had to be installed at upper floors replacing existing closely spaced wood columns, attaching the new steel columns to the top of existing cast iron columns below became a problem. The cast iron columns had specially cast head plates with small dimensions for supporting upper floor wood columns.

Due to the small dimension of the cast iron column head plates, a larger size steel plate had to be welded to the new steel column bases. The steel plate was bolted to the existing cast-in-place cast iron plate and extended and welded to the lower floor beams. Because the cast iron plate was at a higher elevation than the floor level, the above procedure created a large size column base resulting in a larger finished size for the columns.

View of an existing cast-iron column-top connection. The existing columns have connection seats and web connection plates cast integrally with the column. The cast-iron cap plate has a cast “recess” to accept the column above.

OTHER CHALLENGES

The existing top floor columns were reinforced by installation of steel channels sandwiching the wood columns and extending up from the roof structure for the support of the new roof dunnage, sustaining the new mechanical units. The new elevator required cutting corners of the large granite pile caps to provide clearance for the 14’-deep elevator pit. Pressure grouting techniques were used to strengthen the soil, prevent and reduce excessive settlement and control seepage around the elevator pit area.

New plywood and floorboards were installed over the existing boards and tied to the periphery walls, both for architectural reasons and to create diaphragm action to transfer horizontal loads to the periphery brick walls.

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