REPAIR OF HISTORICAL CONCRETE STRUCTURES
MONTGOMERY WARDS CATALOG BUILDING

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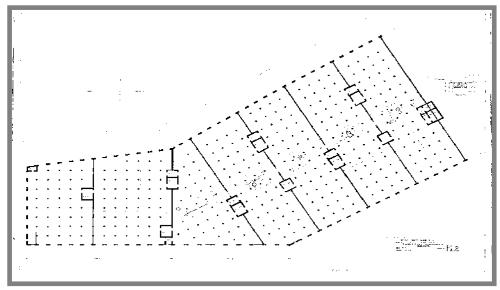
HISTORY

The Montgomery Wards Catalog Building has stood along the North Branch of the Chicago River for nearly a century. Designed and engineered by Richard Ernest Schmidt, Hugh Mackie Gorden Garden and Edgar D. Martin, the Catalog Building is considered one of the first (if not the first) reinforced concrete buildings in Chicago. When completed in 1908, the Catalog Building was one of the largest buildings in the world and the largest with a reinforced concrete frame.



The footprint of the eight-story building can be best described as a ‘bent-trapezoid’ with a total square footage of approximately 1.25 million square feet. The west elevation, which follows the bend of the Chicago River, measures 600 feet in length while the east elevation is 730 feet long. By contrast the south elevation is only 150 feet wide. Rather than try to hide the buildings immense length, the architect choose to accentuate it’s horizontality. This was achieved by continuous spandrels that extend the length of the building without interruption.

These spandrels were clad with red brick, which provided a welcome contrast to the natural gray color of the concrete frame and piers. Unfortunately, this contrast was lost when the decision was made in 1929 to paint the entire building an off-white color. Several layers of paint were added in subsequent years.

The two story projecting columns on the building’s lower floors (with recessed spandrels) were further accentuated with the application of elongated-shaped red terra cotta chevron motifs atop each pier. Additional ornamentation (red terra cotta) was used along the spandrel areas between the piers on the south and west elevations. Again, this detailing was lost when the building was painted.

The remaining six floors of the building were treated differently than the first two. Indicative of the ‘form follows function’ philosophy of many architects during that time the lack of ornamentation befits the function of the upper floor as purely storage space. On these floors the piers were set behind the spandrels and both were left relatively unadorned. The only ornamentation provided on the top six floors can be found atop each pier and consist of a thin band of terra cotta. A more ornate terra cotta rosette is used on top of the building along each pier.

Despite the building’s enormous size, expansion was necessary to accommodate the thriving mail-order catalog business and general growth of Montgomery Wards. In 1917 the northeast portion of the building was added – increasing the total dimension of the north elevation by an additional 480 feet. Although ornamentation of the eight-story addition was much simpler, it blended well with the original Catalog Building. Twenty-three years later (1940) a five-story addition was constructed along the Chicago River and then in 1970 an additional five stories were added to the 1940 addition. The additions to the Catalog Building (a.k.a. Catalog Building – North) increased the total square footage to approximately 2.2 million square feet (almost equivalent to the size of the Sears Tower laid on its side).

Of the structures that comprise the Catalog Building, only the original Catalog Building was designed by Schmidt, Garden and Martin. The additions were designed, in house, by the Montgomery Wards & Co. Department of Construction.

In 1978 the Original Catalog Building was designated a National Historical Landmark. With the decline of the Montgomery Wards, the Catalog Building was more or less abandoned in the mid-1990s. In July 1997 Montgomery Ward filed for bankruptcy and soon after, the Catalog and other buildings on the campus were sold.

INVESTIGATION

A month before Montgomery Wards filed for bankruptcy, Klein and Hoffman performed an investigation of the exterior facades of the Catalog Building. Both in 1999 and 2000 we performed follow-up investigation of the facades.

We noted, during our review of the facades, several areas of severely delaminated and/or cracked concrete and brick masonry. The location of these areas was documented and was eventually the basis of the wall rehabilitation program. Of particular interest during our examination was the presence of a significant and continuous vertical crack along the west elevation of the building.

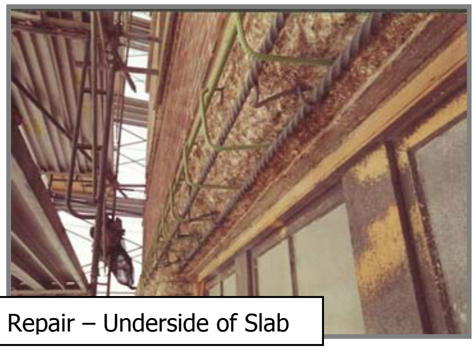
The exterior façade rehabilitation began in February 2000. The first task was to remove the layers of paint that were applied almost seventy years ago. Removal of the coating presented two problems.

1) Because sandblasting was not allowed, as it would damage the brick and terra cotta masonry, chemicals cleaners were used.

2) The lead content of the paint required the careful removal and capturing of the original coating. This proved to be an even bigger endeavor with the building's proximity to the Chicago River.

To solve this problem full-height scaffolding was erected and enclosed in tarpaulins to create a containment area. Both chemical (at terra cotta and brick masonry) and abrasive cleaning techniques were used. To further assist in the removal process, constant vacuuming was performed.

With the paint removed, the true condition of the facades was finally revealed. In some instances the paint was keeping the concrete together. Not surprisingly, the extent of the repairs that were necessary increased. Most of the required work occurred on the exposed concrete. Working with the repair contractor, we were able to identify the extent of the required repairs. As the contractor continued preparing the concrete, the size of many of the repair areas grew.



Repair – Underside of Slab

CONCRETE REPAIRS

Large sections of concrete along the sills and heads of the windows needed replacement. The concrete was easily removed and it appeared that a combination of poor concrete, exposure to the harsh Midwest climate and underlying corrosion of existing reinforcing steel contributed to the failures. Not surprisingly, areas with severely corroded reinforcing corresponded with areas with failed coating.

As the demolition continued, we noted two things: 1) the concrete was minimally reinforced; and 2) most of the reinforcing steel that was present had very little built-up corrosion considering the age of the structure. We suspect that the repeated application of coatings to the exterior surface, while helping preserve the reinforcing steel, also helped contribute to its demise.

As the coating failed, the adjacent concrete areas became susceptible to water infiltration. Water could easily get trapped behind areas of failed coating and lead to damage of the adjacent concrete and eventually the reinforcing. The multiple layers of coating inhibited breathing and kept the water within the slab wall materials resulting in considerable damage. We noted that on the brick masonry, most of the deterioration was caused by the effects of freeze thaw cycles.

During our investigation, we noted small pockets of replaced bricks on the bottom of the spandrel panels. Further investigation revealed that the location of these pockets corresponded to the top of slab. We learned that the openings in the spandrels were used as scuppers to remove water on the slab. As we understand, periodic cleanings of the interior slab involved water. This water was directed to the outside walls toward the openings in the spandrel. This information was relevant as it pertains to the underside of the slab.

For the most part, the interior slabs of the building were not coated with a membrane or similar protective coating. Without this protection, water could easily migrate through the slab. This in itself was not a problem. The problem occurred at locations where the undersides of the slabs were coated. Several layers of paint had been applied the undersides of the slabs along the exterior facade. The coating prohibited the breathing of the slabs rendering them more susceptible to the effects of freeze thaw cycles.

Existing Condition Slab Edges

Another situation that contributed to the condition of the concrete was inadequate coverage of the primary reinforcing and supplemental steel (ties). In these instances, the corrosion was visible along the surface of the concrete. Here again, the removal of the concrete was rather easy due to the poor condition of the material.

Repair – Slab Edge

Several concrete repairs were needed to address the varying conditions encountered. The most prevalent defect noted was delamination of the exposed slab edges. These slab edges also served as window heads for the existing wood frame windows that were set well into the space. Repair of the slab edge ranged from isolated repairs at the bottom corners of the slab to complete removal (for depths up to 6”) for the entire width of the widow openings.

Repairs to the underside of the slab (window head) were also necessary throughout. Original twisted bars were found with corrosion ranging from marginal to very significant. Other existing reinforcing steel was found with minimal concrete coverage.

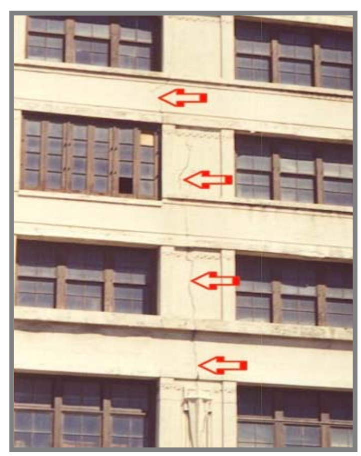
The last areas that were need of concrete repair were the faces of the existing piers and parapet walls. In addition to finding areas of failed concrete with corroded reinforcing steel, we also noted delaminated areas, which were most likely caused by exposure of trapped moisture to repeated freeze-thaw cycles.

At each of the concrete repair areas, the delaminated concrete was carefully removed until ‘sound’ concrete was located. Fortunately, the deep inset of the windows did not require repairs that extended to the interior spaces. Where possible, existing reinforcing steel was reused after it was cleaned and coated with a zinc-rich primer. The contractor was careful not to apply the primer onto the existing concrete since it could act as a bond breaker.

Due to the minimal reinforcing in the exposed slab edges it was important to provide supplemental steel in the form of threaded rods to help anchor the new repairs. The threaded rods were embedded in the parent concrete to remain and secured with epoxy. Spacing of the threaded rods depended on the size and extent of the repairs. In some instances multiple rows of rods were provided.

Knowing that the effect of repairs on existing concrete to remain (halo effect) would be an issue, the repair details included the installation of sacrificial galvanic anodes. These anodes were meant to preserve the life of the existing reinforcing steel to remain by reducing anodic ion effect. Unfortunately, budgetary constraints did not allow for the anodes to be included with the repairs

When we completed an inspection of 100% of the exterior facade, we noted significant vertical cracks on the east and west elevation of the building. These areas were adjacent to the location of the original expansion joint. A new expansion joint detail was designed to replace the failed ones.



During our inspection of 100% of the exterior facades, we noted significant vertical cracks on the west elevation. A review of the available drawings revealed to us that the cracks observed corresponded to the original location of the expansion joint (west elevation). The original expansion joint, which consisted of steel plates, angles and bees wax had corroded and was ineffective. Consequently, nature created its own expansion joint with the crack observed.

Similar cracks (not as severe as was found on the west elevation – column line 7) were found at the location of the other expansion joints. At each of these locations, Klein and Hoffman designed new expansion joints to reestablish what was originally provided. The design that was developed involved ¾” bearing shoes (stainless steel) and two-ply neoprene pads (in place of the bees wax). The detail also involved additional concrete restoration at each of the spandrel sections. Our detail was found to be cost prohibitive and an alternative detail was developed. The revised detail involved grinding, pressure grouting and sealing the continuous vertical cracks. Half-inch diameter threaded rods (set in epoxy) were installed along each side of the cracks (which extended through the depth of the columns) at one-foot intervals (vertically) to ‘stitch’ the column together.

TERRA COTTA and COLOR SCHEME

One of the interesting outcomes of the removal of the existing coating was the revelation that areas above the piers that we suspected were decorative concrete were in fact terra cotta. Typically, terra cotta repairs can be difficult due to the underlying steel that is often implemented to secure the material. In the case of the Catalog Building, the terra cotta was cast with the concrete. For the most part, the terra cotta was in very good condition considering the age of the building. The terra cotta became an issue when it came to restoring its original color.

The Catalog Building is both a Chicago and National Landmark. Because of this, repair procedures had to be chosen to restore the original look of the building. All of the original wood windows were replaced with more thermally efficient aluminum models. Original window profiles and site lines (mutins, etc.) were maintained. Restoring the original color of the building required a bit more work.

Very little was documented as to the original color scheme of the building. It was generally agreed that the building was a combination of grey (concrete) and red (brick ad terra cotta) tones and the removal of the several layers of paint proved this. However, selecting the exact color scheme required several mock-ups to be completed. Fortunately, a scheme was selected and the repair program had the final piece of the puzzle.

STAGING

With the repair details in palace and the color scheme approved, the next step was to implement the program. However, another major obstacle had to be worked out. This involved staging the repairs. The solution was the building itself.

Because of the Chicago River to the west and limited street access around the remainder of the building, staging of the required repairs took place within the building. Because the building was primarily vacant, this solution was both the most economic and feasible. With the pipe scaffolding in place around entire elevations, repair materials were brought in through the structures at floor levels where they were needed. Construction debris was also removed on a daily basis through the building.

The building's relative vacancy also allowed the work to occur almost 'around the clock'. Several shifts worked on the building to complete the repairs within the specified schedule. Repairs began in February 2001 and were completed approximately one year later. Considering the size of the structure, completion of the repairs in such a short time frame was an accomplishment.

The exterior façade rehabilitation was soon followed by the development of the new River Walk along the west elevation. The first interior bay along the west elevation was removed but the shell of the façade remained. Aluminum framed windows were installed throughout to match the original sight lines of the building. The width of the concrete walkway (from the façade) remained the same but the depth increased with the removal of the exterior walls. The completed work recalls the original design of the building with the strong sense of horizontality re-established.

This project demonstrates that it is possible to save our older, historically significant buildings from demolition. In this case, through adaptive re-use, the beauty of the 20th Century has been captured, to blend with a high-tech, vital role forging it into the 21st.Century.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