INSIGHT

ISSUE NO. 18

A technical newsletter by Raths, Raths & Johnson, Inc. for the construction industry.

“Insight: to see into and understand; an item of knowledge gained by this power.”

INSIDE

Figure 1—Three-dimensional computer graphic rendering of the Hampden Green Condominium; produced to assist the owner in visualizing the finished project.

Project Profile

Hampden Green Condominium Façade Replacement

The Hampden Green Condominium is a 22-story building located in downtown Chicago with a direct view of the lakefront from the east elevation. The building was originally developed and constructed in the early 1970s as an apartment building and converted to 207 condominium units in the 1980s.

Figure 2— Construction phase showing new curtain wall system on bottom and original windows and spandrel panels on top.

RRJ was retained to evaluate the existing strip window and metal panel facade due to ongoing water infiltration problems and failure of a spandrel panel during a high wind event. RRJ performed interior and exterior exploratory openings to verify the construction and anchorage of the windows and spandrel panels. Additionally, RRJ conducted air infiltration and water penetration testing on representative existing windows to evaluate their current performance and deficiencies.

The building construction includes a cast-in-place concrete frame with projecting architectural "fins" framing strip window openings on the east and west elevations. The north and south walls have no fenestrations and act as shear walls for the structure. Concrete block knee walls were erected at the edge of the floor slabs and from column-to-column. The original windows were aluminum strip windows typically measuring 21-feet wide by 5 feet high, and anchored to the concrete knee wall below and the underside of the concrete slab above by use of discreet clip angles. Porcelain-coated spandrel panels measuring approximately 3 feet square were installed over the concrete block knee walls. The panels were supported by small custom clips attached to the concrete block.

RRJ's investigation revealed the window system exhibited multiple deficiencies including: leakage through glazing seals, open frame joints, worn and missing weatherstripping, and deteriorated sealants with multiple applications of sealants over the original materials. In addition, the porcelain-coated spandrel panel system installation resulted in poorly configured sealant joints and localized failures in the porcelain coating resulting in deterioration of the panel. RRJ also identified concerns related to the ability of the spandrel system to remain anchored during building code prescribed lateral wind loads. Due to the age and condition of the existing window and spandrel panel systems, retrofit of the existing units was ruled out.

RRJ prepared design documents for complete replacement of the strip windows and spandrel panels. A curtain wall system anchored to the concrete slab edge was selected as an alternate for replacement of both the windows and the metal spandrel panels due to strength deficiencies of the masonry knee walls resulting in the inability to meet current building code wind load requirements. The new curtain wall incorporated additional operable units in order to meet the current City of Chicago building code ventilation requirements.

Because the condominium units were all generally occupied, the replacement design needed to incorporate the ability to remove the existing window and spandrel panels of a given opening and install the new system the same day. To achieve this requirement, a flashing system located at the slab edge was incorporated in the design which not only provided temporary closure at the end of each day, but provided a back-up flashing system in the event of water infiltration through the perimeter systems at a later date.

The new aluminum framed curtain wall system selected incorporates high performance insulated vision glass units with a Low-E coating to address tenant heat gain concerns. Stacked project-out and project-in windows were located at each end of the window unit to provide the increased ventilation required by code. Opaque spandrel glass was used in lieu of metal panels to provide updated aesthetics for the facades. In addition, the exposed concrete was repaired and coated with a breathable elastomeric coating complimenting the new curtain wall installation. **The window replacement was completed in approximately 4 months.**

- Brian A. Faith, Senior Architect
- Kurt R. Hoigard, Principal

TechTip

More Bad News About Gypsum-Based Grouts

RRJ Insight Issue 13 provided three articles discussing various perils associated with the use of gypsum and gypsum/ Portland-cement-based grouts in moisture prone applications. **Recent RRJ investigations have continued to validate the findings and recommendations presented in Issue 13, and have identified additional corrosion-related problems associated with the use of gypsum-based grouts in exterior applications.** Because unprotected mild steel generally corrodes in the presence of water and oxygen, most steel construction products exposed to the weather are protected by either painting or galvanizing. Steel reinforcing bars encased in concrete receive corrosion protection from the concrete itself. The highly alkaline environment in concrete results in the formation of a tightly adhering film that protects the steel from corrosion. Similarly, Portland-cement based grout products provide passive protection to embedded items like railing posts.

Figure 4—Galvanized post showing deterioration of the portion within the gypsum-based grout.

Unlike Portland-cement-based grouts, gypsum-based grouts do not create a high-alkaline passive protection environment. Instead, as members of the chemical class called *salt*, they actually promote corrosion of embedded steel. RRJ investigations into concrete spall failures at hand and guard rail posts installed with gypsum-based grouts placed within sleeved and cored holes in concrete structural members have **identified accelerated corrosion of both painted and hot-dipped galvanized mild steel components.** In these cases, the post portions embedded in the gypsum-based grouts exhibited deterioration of the paint, consumption of the galvanizing, severe corrosion of the steel, and cracking and spalling of the adjacent concrete construction (refer to Figures 3 and 4). The portions of the posts not in contact with the grout, and fully exposed to the weather, showed no paint failures, reduction in galvanizing thickness, or corrosion.

Figure 3—Concrete cracking at a combination hand and guard rail post installed with gypsum-based grout.

The stark contrast in performance between post portions within the grout and those areas left exposed to the weather clearly **demonstrates the aggressive corrosive environment created by wet gypsum-based grout.** These findings further validate *RRJ Insight* Issue 13 which recommended avoiding the use of gypsum-based grouts in exterior and other moisture prone applications, even in conjunction with the traditional corrosion protection mechanisms of painting and galvanizing.

- Kurt R. Hoigard, P.E.

(A reprint of the article in RRJ Insight Issue 13 can be found on our website, www.rrj.com or call us to request a copy.)