CONCRETE REPAIR AND PROTECTION AT HIGH ALTITUDE

SKI AND RACQUET CLUB CONDOMINIUMS

BY CHRIS SAJBEL

Breckenridge, CO, has world-class skiing, gold-medal waters for fly fishing, and a beautiful Victorian downtown for shopping. However, because the town sits at 9600 ft (2925 m) above sea level, construction schedules tend to be very compressed over the summer months. Breckenridge typically sees over 300 in. (7.6 m) of snow per year, starting in October and ending in late April. The snow and cold limit most construction schedules to a 5- to 6-month window, typically starting in May and ending in mid- to late-October.

In 2008, the Owners' Board at Ski and Racquet Club condominiums (Fig. 1) determined that the 40-year old precast triple-tee beam concrete structure needed a new facelift. The Board contracted an architect in Breckenridge, CO, to review the structure and design a new building envelope system. Upon the initial investigation of the structure, the architect found several areas of concrete that looked suspect and determined that a structural engineer was needed to investigate potential concrete issues in the 40-year-old structure. Upon this review, it was determined that there was a significant amount of deteriorated concrete that needed to be repaired, including the front walkways (balconies) that had neutral or negative slope that allowed water to pond and flow into the condominium units. The design team developed a repair program that not only addressed the deteriorated concrete but also provided a new 1/4 in. (8 mm) per foot slope concrete topping, and an elastomeric traffic membrane to provide a decorative and waterproof finish, at the exterior walkways.

Fig. 1

Fig. 2

The design team delivered their design package to the Ski and Racquet Club Board of Directors for review and approval. In early 2008, the Board of Directors determined that the concrete repair needed to be reviewed by specialized concrete repair contractors. Several contractors reviewed the structure to help the Board determine a potential budget for the repairs. However, because of the available budget for the repair work along with the economic downturn, the project was put on hold. In January 2011, the Ski and Racquet Club Board of Directors decided to investigate the project once again.

In February 2011, the original structural engineer was brought in again to review the concrete repairs and determine the extent of the repair needs. Because of the harsh environmental conditions and the freezing-and-thawing cycles that the structure experiences on a daily basis, the concrete deterioration was considerably more than was observed in 2008. Deterioration to the triple-tee beams was observed at almost every tee beam end (T-end) (Fig. 2). Existing spalls in the concrete had grown substantially and new concrete deterioration was starting to show. Upon completion of this review, the Board of Directors at the Ski and Racquet Club determined that they needed to proceed with repairs to address the concrete deterioration at the building. The design team reduced the building envelope design scope of work and increased the concrete repair and protection design to stay within the budget established. On May 1, 2011, the repair contract was awarded to the construction team.

Late in May 2011, mobilization from the construction crews took place and the project began. The first step in the concrete repair program was to sound every T-end to determine the extent of the deterioration. The T-ends were sounded and marked for demolition. Once the deteriorated concrete was removed, the reinforcing steel and weld plates were prepared and coated to prevent future corrosion. When the steel preparation was completed, an overhead polymer-modified concrete repair material was installed.

A similar concrete review program took place on all walking surfaces. The contractor performed the review on the horizontal walkways, marked the areas that sounded hollow, and proceeded with the concrete demolition process (Fig. 3). The existing welded wire mesh was cleaned of corrosion, and in areas where it was significantly damaged, the mesh was replaced. Concrete deck spalls were also repaired using a polymer-modified concrete repair material. A form-and-pour method for the large spalls (Fig. 4) and a trowel-applied method for the smaller spalls were used to assist production.

During the initial review, the structural engineer determined that the exterior walkways exhibited neutral or negative slope. Accordingly, they developed a topping design that would allow for positive drainage from the building to the drip edge of the existing walkways. However, because of the new railing and hanger system at the walkway edge, along with the flush-mounted existing doors, this topping system installation took a lot of preplanning. The doors were the largest issue to overcome. The doors had to be removed, reframed, and cut to fit a new opening that was 2 in. (50 mm) smaller. Because the door thresholds had to be installed and waterproofed first, the contractor developed a system of blockout forms that would provide a curb for the thresholds to sit on. This allowed the door to be

Fig. 3

Fig. 4

removed and the curb to be placed. While the fast-setting polymer-modified sloping material was allowed to cure, the door was reframed and cut. Finally, an elastomeric waterproofing membrane was installed under the threshold. Once the doors were reinstalled, the deck sloping overlay installation began.

Because the original deck had a glued down outdoor carpet, surface preparation took on a significant role in the overlay process. ICRI concrete surface profile (CSP) chips were used to make sure that the contractor and the engineer could visually determine that the proper surface

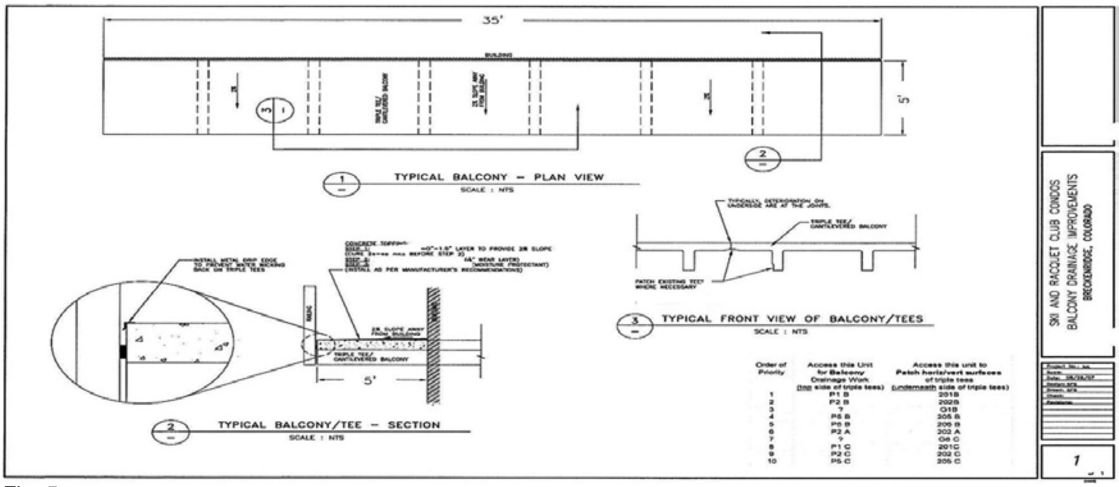


Fig. 5

Fig. 6

Fig. 7

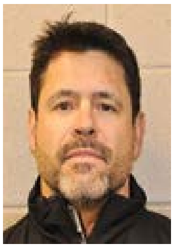
Fig. 8

Fig. 9

profile was achieved prior to placing the concrete overlay. The existing walkways (balconies) at the complex were typically at 262 x 5 ft (80 x 1.5 m), for over 12,000 ft^2 (1115 m^2) that needed to be resloped (Fig. 5). Once the carpet was removed, the concrete was ground to remove as much of the old glue as possible. The final step of the surface preparation was to use a concrete scabbler to achieve the desired concrete surface profile. As with all concrete repair applications, achieving the proper saturated surface-dry (SSD) condition of the prepared surface prior to concrete placement is critical. As such, the contractor sectioned off the deck into workable sections each day and allowed a soaker hose to keep the deck wet for several hours prior to installing the concrete topping. The second critical step in the overlay process was to make sure a scrub coat of the polymer-modified overlay material (Fig. 6) was used to ensure a good bond. Immediately after the scrub coat was applied, the polymer-modified sloping material was installed by pouring the mortar onto the deck and screeding the material into place between the forms. A light broom finish was applied to the new overlay and cured.

The next step was to apply a heavy-duty elastomeric deck coating system to the exterior walkways and balconies. The Owner's Board of Directors determined that because of the amount of snow that would need to be removed, the potential for ice that would need to be broken up, and because ski boots would be worn on this surface, it was important to use a heavy-duty coating. An elastomeric deck coating system was chosen because of its ease of being repaired and its ability to be recoated in a different color should the color scheme ever change. The polyurethane deck coating system (Fig. 7) was installed in a three-coat and sand-plus-primer installation. The base coat was applied 4 in. (100 mm) vertically at walls as a flashing and was applied on the sheet metal drip edge. The base coat was installed at a 30 mil dry film thickness (DFT). The intermediate coat was installed at a 15 mil DFT. A No. 16/No. 20 sieve size blended sand was broadcasted into the wet intermediate coat to provide skid resistance. Finally, a tan pigmented topcoat was installed, matching the color scheme of the Ski and Racquet Club (Fig. 8). The topcoat provided for an additional 15 mil DFT of protection. The elastomeric deck coating system has been inspected yearly since its installation in 2011 and is performing very well.

The Ski and Racquet Club construction started in late May 2011 and was completed in mid-October 2011 (Fig. 9). The project encompassed a general contractor and several specialty subcontractors to complete the concrete repairs and new building envelope installation. The project also included some energy-saving initiatives as part of the new building envelope. The insulation was upgraded to prevent heat loss in areas where insulation could be added. All windows and sliding glass doors were upgraded to low-E coated and thermal-rated window systems. These energy initiatives have proven to be a significant addition to the project, by providing a significant reduction in the average monthly energy cost to the ownership.



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Ski and Racquet Club Condominiums

OWNER
Ski & Racket Club Board of Directors and 71 Independent Owners
Breckenridge, CO

PROJECT ARCHITECT
BHH Architects
Breckenridge, CO

STRUCTURAL ENGINEER
Structural Consultants
Denver, CO

GENERAL CONTRACTOR
Devigne Developing
Breckenridge, CO

REPAIR CONTRACTOR
Western Waterproofing
Denver, CO

MATERIAL SUPPLIER
Pecora Corporation
Harleysville, PA