

# Bellaire Tower— The Jewel of Russian Hill

San Francisco, CA

Submitted by Sika Corporation

**B**ellaire Tower is a high-profile, historic building, standing 20 stories and 270 ft (82.3 m). The building footprint is 120 ft (36.6 m) east to west x 60 ft (18.3 m) north to south. The north and east elevations face the street and the west elevation is less than 20 ft (6.1 m) from its neighbor, whereas the south elevation shares a property line with its neighbor. The building houses 64 condominium units. The columns and beams are framed with structural steel, whereas the floor slabs and exterior walls are constructed of reinforced concrete. The ground floor exterior wall is 14 in. (356 mm) thick and the exterior walls are 6 to 12 in. (152 to 305 mm) thick. The exterior wall is 80,000 ft<sup>2</sup> (7432.2 m<sup>2</sup>) with 640 windows. The art deco exterior consists of a portland cement parge finish with ornate columns and arches.

## PROBLEMS THAT PROMPTED REPAIRS

The building had a long history of poor maintenance. The primary problem was water leakage in and around the windows. Residents haphazardly replaced their original steel windows with aluminum windows.

The building had been recoated several times, resulting in the accumulation of over 90 mils (2.3 mm) of nonbreathable coatings over the concrete. Dress beads of sealant were also applied in failed attempts to correct the leaks. Spalling of the

concrete resulted in both a safety hazard and an unsightly appearance.

## INSPECTION/EVALUATION METHODS

With a desire for a long-term, proper solution, the owner agreed to a large mockup to do a thorough inspection and complete the design ahead of proceeding with the project. The team selected the bottom four floors of the west elevation (about 4000 ft<sup>2</sup> [371.6 m<sup>2</sup>]) because it had many of the noted problems and was believed to be representative of the rest of the building. The sequence of steps consisted of:

- Erection of scaffolding and protection;
- Visual inspection and sounding of 100% of the area;
- Complete removal of the coatings, including abatement of the lead-based coating(s); and
- Visual inspection and sounding of the area using a Schmidt hammer for establishing substrate strength.

## OBSERVATIONS AND CAUSES OF DETERIORATION

- Sounding was conducted after the coatings were removed for accurate delamination mapping;
- Much of the spalled concrete was at the windows, where leakage had occurred;
- Spalling was due to corrosion of the steel window flanges embedded in the surrounding concrete;



*Mockup phase, coating removed, and delamination and cracks identified*



*Coating removal required several passes using different methods to complete*

EXCELLENCE

2011 Award of Excellence



*North façade with coating removed and crack and concrete repair in progress*

- Spalling in the walls was due to corrosion of the reinforcing steel;
- Joints and cracks within the exterior wall were a potential source for water infiltration;
- Ninety percent of prior repairs had failed; and
- Spalls tended to be deeper around the windows and shallower within the wall.

### **MOCKUP IMPLEMENTATION DESIGNED TO ADDRESS THE CAUSES OF DETERIORATION**

- Moving cracks were routed and sealed with a polyurethane sealant;
- Reinforcing steel was coated with an epoxy-cement coating;
- Spalls were either hand-applied or form and poured with polymer-modified repair mortars;
- Galvanic anodes were used to protect the steel window flanges and, in some cases, the reinforcing steel near the windows;
- The bottom four windows were removed and replaced;
- The exterior wall was power-washed; and
- An elastomeric, breathable, waterproof coating was applied to the exterior wall.

The mockup was completed in December 2004. As a result of the mockup, the team was able to get a good idea of the cost to remove the existing coatings and the magnitude and cost of the spall and crack repair and finalize a plan before awarding the project.

### **REPAIR SYSTEM SELECTED**

The system selected was based on the owner's objectives and the successful completion of the mockup. Because of the close proximity of the west and south elevations to the neighboring properties, strict fire code regulations would come into effect if

the steel windows were replaced. The owner decided to refurbish the windows, which meant leaving the window and steel flanges in place. The existing aluminum windows were not to be replaced or refurbished—only the perimeters were to be sealed. The existing steel windows would only be refurbished. The remaining steel flanges would be protected by drilled-in, galvanic anodes. Some of the decorative elements would also be rebuilt or replaced.

A full survey of the exterior wall was conducted to document and quantify the amount of spalls and cracks. Cracks and spalls were quantified. The thorough documentation allowed for competitive bidding for the entire scope of the project. Five ICRI/SWRI contractors bid on the project.

### **PROJECT INSTALLATION**

Due to the size and complexity of the project, it was divided into four phases. The following sequence was completed for each elevation:

- Installation of scaffolding, swing stages, and interior protection;
- Removal and abatement of wall and window coatings;
- Consultant examination for spalls and cracks;
- Concrete demolition and surface preparation;
- Installation of anodes and steel coatings;
- Spall and crack repair;
- Window refurbishment:
  - Grinding of the steel and sash;
  - Removal of the glass and existing putty;
  - Installation of new flashing at the sill;
  - Repainting;
  - New glass set in a bead of silicone sealant; and
  - Installation of new hinges and handles
- Perimeter seal of windows;
- Power wash;
- Consultant inspection and approval of repairs; and
- Application of coating.

### **SITE PREPARATION**

A combination of 20-story frame scaffolding and swing stages was used to access the entire exterior wall. The scaffolding and swing stages required suitable enclosures to contain all construction debris, dust, and lead-based coating abatement. Enclosures with windows were built in each unit during window refurbishment.

### **DEMOLITION METHODS**

The removal and abatement of all existing coatings on the concrete used a labor-intensive “tomahawk” method, which entailed delicately chopping away at the coating with small axes. Grinders were used to remove the coating on the steel windows.

Once all the coatings were removed, the consultant re-sounded the wall to mark all delaminated and spalled concrete. The edges of the spalls were

saw cut with angle grinders while removal of the concrete was accomplished with lightweight chipping hammers. The existing sealants were completely removed using utility knives.

Cracks and window header drip edges were chased with angle grinders.

## SURFACE PREPARATION

The steel flanges and reinforcing steel were grinded to clean metal. Special coring equipment was used to core the holes necessary for the galvanic anodes. Areas to be repaired were cleaned and rinsed. Joints were wiped clean for the new sealant. Ahead of applying the coating, the exterior wall was power-washed.

## APPLICATION METHODS

Three different forms of anodes were used to protect the steel. Thirty-five hundred anodes were placed and grouted into cored holes and connected to the steel window flanges. Other anodes were tied directly to the reinforcing steel. In some of the tighter areas, a zinc-coated sheet was applied to the steel flange. Steel coatings were brushed onto the exposed reinforcing steel and steel window flanges. Window perimeter concrete repair was formed on two sides and poured into place. Other concrete repairs were hand-applied.

Window refurbishment proceeded as originally planned for the south and west walls. Because the fire code restrictions did not apply to the north and east elevations, the team had greater flexibility on how to treat those windows. It was decided that if the refurbishment cost exceeded 50% of the remove and replace cost, the window would be replaced. Approximately 25% of the steel windows were replaced. All metal-metal and metal-glass in the aluminum windows received a new wet seal of silicone. Eighty steel windows were replaced and another 360 were refurbished, while about 100 aluminum windows received new wet seals throughout and another 100 received a new wet seal around the perimeter.

Finally, some of the ornamental concrete elements were replaced with glass fiber-reinforced concrete. Polyurethane sealants were gunned into the concrete-window joints and other moving cracks. A breathable, waterproof coating was rolled onto the entire exterior wall.

It was over 6 years from the time the consultant got involved until the last elevation was completed. The owner, consultant, contractor, contractor's site personnel, and material supplier worked together as a team. In fact, the Board was so pleased at the conclusion of the project that the President was heard to say, "The building is sound, waterproofed, and looking great. The Jewel of Russian Hill is reborn and looking better than ever."



*Twenty-story scaffolding erected on the west wall, fully enclosed*



*Restoration complete*

## Bellaire Tower

### OWNER

**The Bellaire Homeowners Association**  
San Francisco, CA

### PROJECT ENGINEER/DESIGNER

**JFM Enterprises, Inc. (Consultant)**  
San Francisco, CA

### REPAIR CONTRACTOR

**Everest Waterproofing & Restoration, Inc.**  
San Francisco, CA

### MATERIAL SUPPLIERS/MANUFACTURERS

**Sika Corporation**  
Lyndhurst, NJ

**Wiss, Janney, Elstner Associates, Inc.**  
(Consultant)  
Emeryville, CA