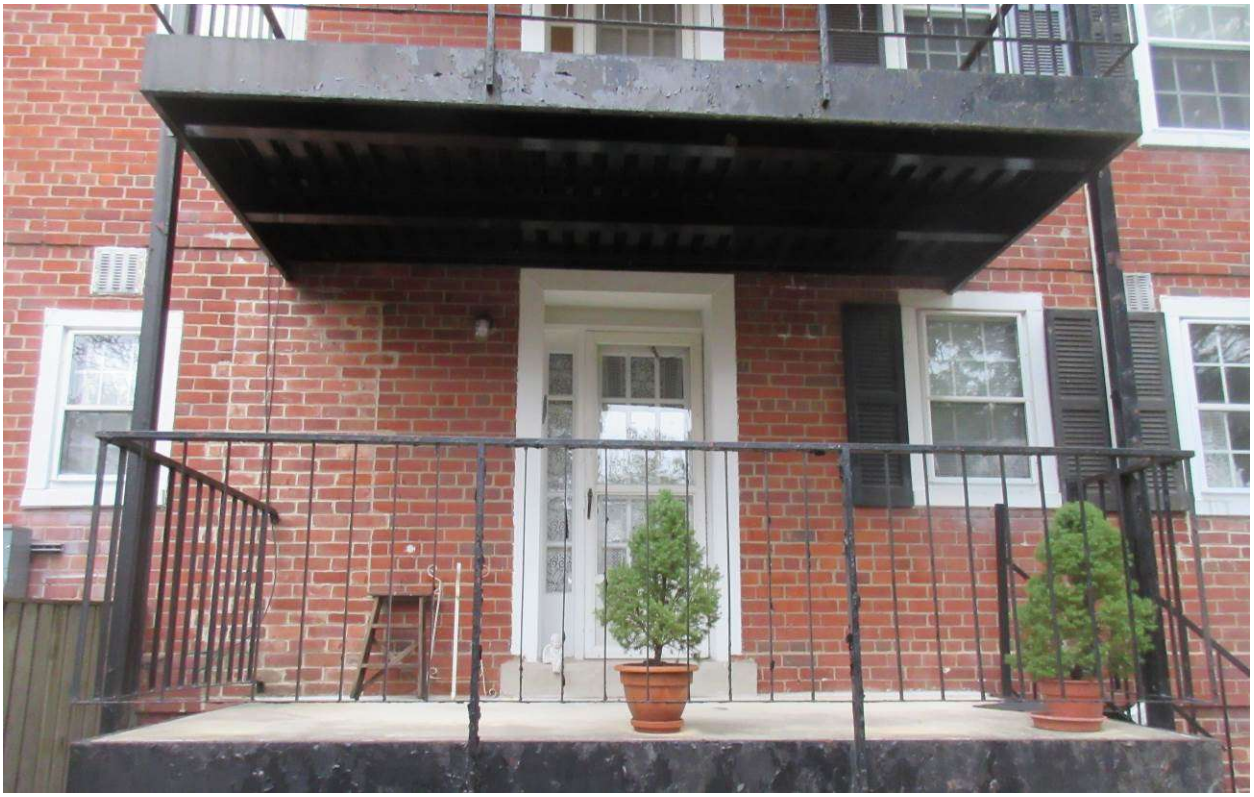
BALCONY REPAIR AND REPLACEMENT CASE STUDY

Project Introduction

Tiered steel framed with concrete deck balconies of a condominium complex constructed in the 1940's with balconies constructed in 1975 in Virginia were observed to be deteriorated due to corrosion and freeze-thaw effects. TCE was contracted to document the extent of deterioration, perform a structural analysis of the present conditions to determine adequacy, develop a program outlining several repair options for the Homeowners Association, assist in the project bidding process, and provide quality assurance and construction administration services during construction. A cost-benefit analysis determined full replacement of the existing balconies with new, coated aluminum prefabricated balconies would be the best option for the complex.

BEFORE



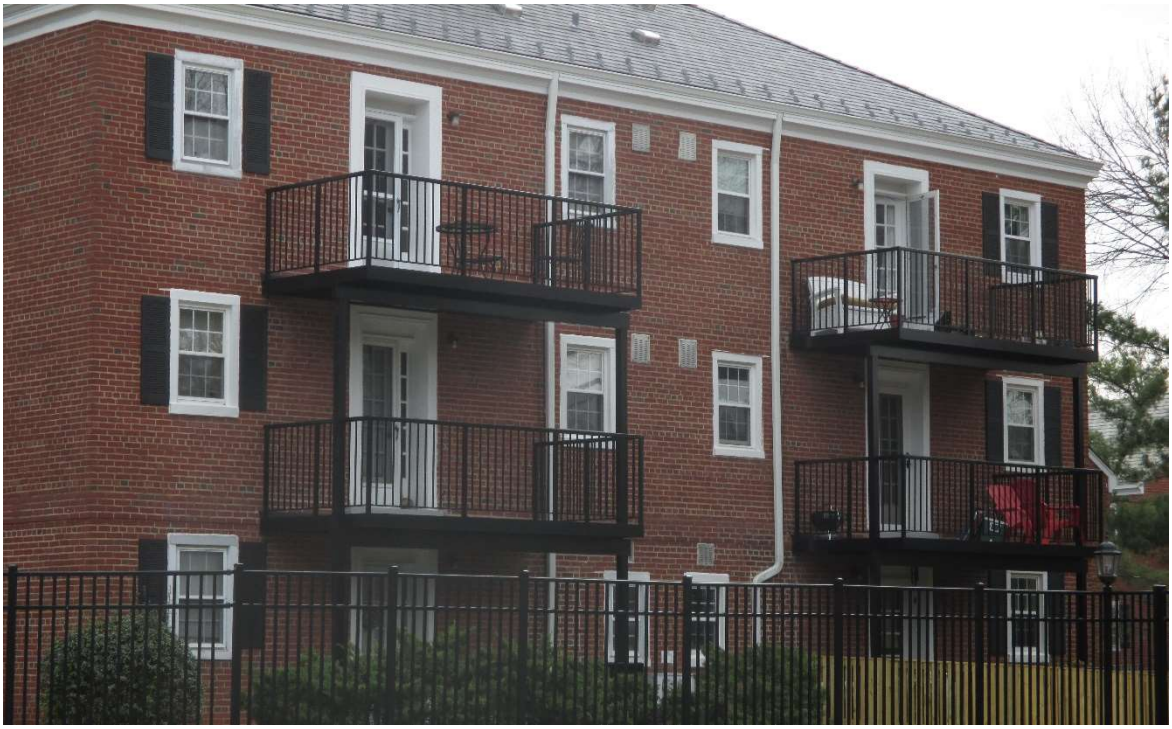
BEFORE

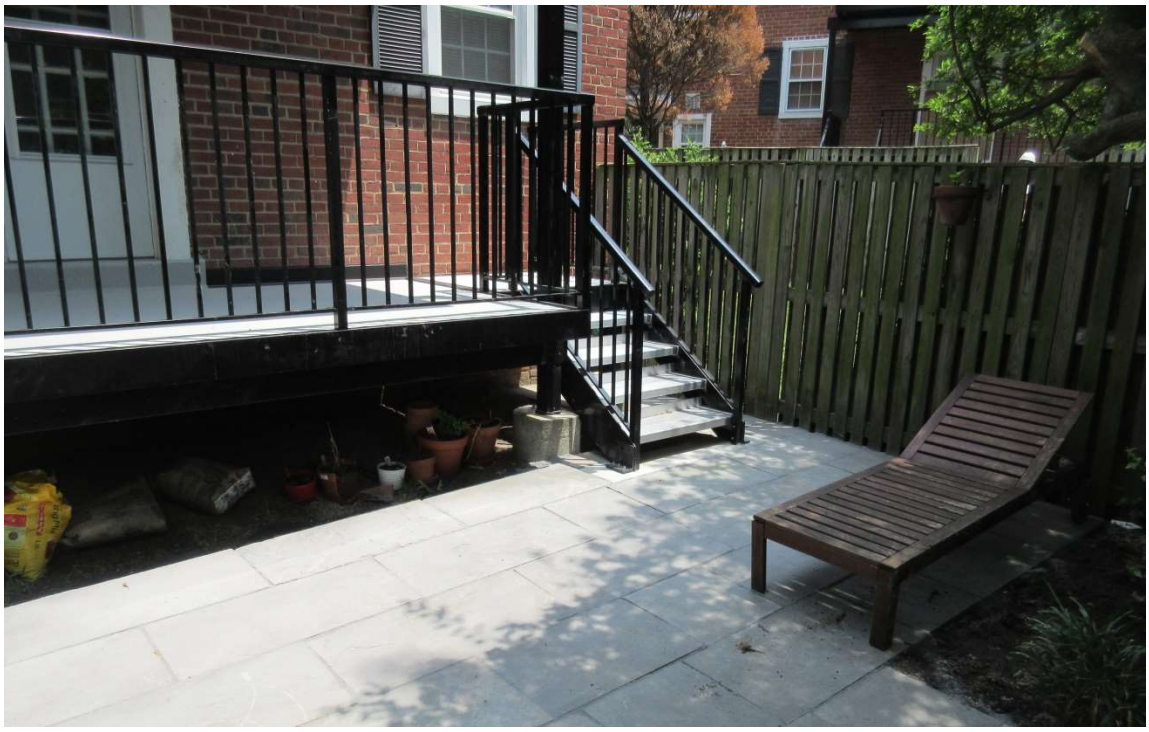
Overall view of steel framed balconies

Corrosion of steel post base

Corrosion of steel post base

AFTER





Project Description

- Issues Observed
    - Building Management noted visual distress at many of the balconies throughout the complex. TCE was contacted by Management to perform a structural review of the balconies.

- Investigation Performed
    - TCE performed a visual examination of the balconies, which documented the extent of deterioration of the structural steel members and the supporting elements, including concrete piers and footers and brick façade. Observations included splitting, bulging and corrosion of the structural steel elements, out-of-plumb steel members from original construction, and heaving of the existing concrete footers.
    - Existing balcony columns were constructed of steel hollow structural sections (HSS) commonly referred to as tube steel. Measurement of the extent of corrosion at a particular point could not be performed due to the tube shape. Ultra-sonic testing (UT) was implemented to provide an accurate measurement of the in-situ thickness of the steel. UT involves sending sound waves into the steel. The sound wave is sent in at the (front) surface of the steel, travels to the back surface where it is reflected and travels back to the front surface. If flaws are present, such as rust on the back side of the steel surface, which reduces the thickness of the metal, the reflected sound wave returns sooner. The instrument used is calibrated for steel and the thickness range in question, measures the different rates of return of the reflected sound waves and produces a reading in inches of actual solid steel thickness.
    - As-built conditions were measured and a structural analysis was performed to determine both the original design capacity and the capacity with various levels of deterioration.

- Temporary Procedures
    - With the findings that some balconies were structurally inadequate to carry the designed loading due to excessive deterioration, temporary shoring was installed to avoid any failure. The temporary shoring remained in place until repairs were performed. Temporary shoring was designed in a manner to allow continued use of the balcony.

- Repair Options & Cost-Benefit Analysis
    - Several repair options were presented to the Homeowners Association along with estimated costs and expected service lives of each repair. Options included structural steel strengthening, replacement of selective structural members, replacement of selective balconies and complete replacement with new field fabricated and prefabricated balconies.

- Final Product

- Following review of the options with TCE, the Homeowners Association decided to replace all balconies at the building complex. The replacement would be phased per the allocated budget over a span of six (6) years.
- The prefabricated option was chosen in order to limit costs, shorten the replacement time for each balcony, and provide a lasting installation. Minimizing disruption to the owners and tenants was a priority for the Homeowners Association.
- Several prefabricated options from different manufacturers were reviewed. A coated aluminum support and deck system was ultimately chosen for its longevity, minimal maintenance and overall aesthetics. The manufacturer was able to provide a 50-year warranty for the full system.