RESEARCH in Progress

Forest Products Laboratory

Durable Solutions for Balconies and Decks in Midrise Buildings

Wood-frame construction has become the technology of choice for midrise multifamily and mixed-use buildings containing apartments and condominiums. It is typical for these types of occupancies to feature balconies and decks in all or most dwelling units, both for their functionality and architectural qualities. As configurations of multifamily building continue to evolve and challenge stereotypes, a wide range of balcony and deck designs are used across the country. These balconies and decks represent one of the most vulnerable elements in the building from the durability standpoint. Unless adequately designed and constructed, the balcony can act as a water entry point into the enclosure causing risk of long-term damage to the enclosure materials, the balcony connections, and the balcony components. The complexity of the design can be exacerbated by the use of finishes such as a concrete topping and other elements that limit drying and can be the source of moisture load. Water-absorptive claddings such as exterior insulation and finish system (EIFS), stucco, or brick can present further challenges for integrating balconies with the rest of the structure. It is also noted that exterior assemblies in midrise buildings are subject to fire requirements that trigger the use of assemblies and materials that are different from conventional low-rise single-family buildings.

Construction in Charlotte, North Carolina. (Photo credit: Home Innovation Research Labs)

Background

Several high-profile balcony and deck failures have raised concerns about the safety of many older structures and call into question whether designs adequately address moisture issues and if critical design features are understood and implemented. (Such failures include the Berkeley balcony collapse on June 16, 2015, which killed 6 people; and the Chicago balcony collapse on June 29, 2003, which killed 13.) In many cases, the forensics investigations have discovered construction defects that have led to moisture-driven rot or corrosion issues. After the Berkeley balcony collapse, the state of California's Contractors State Licensing Board conducted an investigation that led to a comprehensive report indicating that contractors willfully departed from or disregarded design specifications (https://www.cslb.ca.gov/Resources/Reports/Investigative/cslb_berkeley_balcony_materials_packet.pdf).

Dr. Frank Woeste and Bruce A. Barker compiled an extensive list of 239 balcony and deck collapses between 2001 and 2016 throughout the United States. Material selection and construction details are often cited as critical elements in the construction of balconies and decks. Given the potential safety risk when balconies and decks are not designed or constructed correctly, we believe this project will

have utility in the construction industry and provide technical guidance for establishing and promulgating best design and construction practices.

A recent code change proposal for the 2018 IBC introduced new requirements for ventilation of balconies as a measure to improve the overall durability of the system. The effectiveness of the new requirements has not been validated.

Objective

The proposed study will evaluate the moisture performance of balconies and decks in midrise multifamily and mixed-use wood-frame buildings with various types of exterior cladding materials.

Approach

The project is organized along the following tasks:

1. Develop an inventory of balcony and deck configurations used in midrise wood-frame buildings. Home Innovation will source this information from their two certification programs of multifamily buildings: National Green Building Standard program and Energy Star Multifamily program. Follow-up interviews with architectural design or building inspection firms will be conducted to finalize the inventory.

2. Review available details for construction of balconies in buildings with various claddings and finishes. Based on the review, we will identify and expand best practices and identify key configurations that will benefit from additional evaluations and improvements.

3. Develop a test method for evaluation of moisture performance of balcony–wall interface. The test method will be developed with direct involvement of and review by the advisory group that will include key industry and product manufacturer representatives.

4. Select several representative balcony designs (two to four) for testing.

5. Construct the designs in the laboratory or as part of test huts, including key integration features with the primary enclosure, and conduct laboratory testing.

6. Based on the results of the evaluation, recommend best practices for balcony and deck construction in midrise wood-frame buildings.

An advisory group with broad representation of various stakeholders will be formed to assist with the development of the research plan and test methods and with review of the results and recommendations.

Expected Outcomes

The study will culminate in recommended best practices for balcony and deck construction in midrise wood-frame buildings, with the focus on water management and integration with the primary building enclosure systems. A broad range of finishes and balcony configurations will be evaluated for applications across various construction markets and climatic conditions. The outcome will include a set of specific details and solutions for durable wood-frame deck and balconies with focus on the interface with the exterior wall systems.

Timeline

The inventory of balcony configurations used in wood-frame buildings was completed in October 2019. An advisory group will be formed in January 2020. Laboratory testing and performance evaluation of representative balcony designs will be completed in March 2021. A final report will be prepared and submitted by September 2021.

Cooperators

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