

MOCK-UPS: CONSTRUCTION'S CRASH TEST DUMMY PART 2 - TYPES OF MOCK-UPS

by Brian Stroik, Performance Excellence & Quality Consultant, American Contractors Insurance Group

The first part of this series reviewed WHY mock-ups are critical for properly constructing our building enclosures. So, what exactly is a mock-up? Mock-ups, to some, means a massive structure built in a lab that undergoes numerous tests. To others, it is a visual comparison of materials, or perhaps it is the first run study of in-place material. All these beliefs are correct. The building enclosure contains a myriad of exponential possibilities from size, types of materials used, installer's experience (some trained, some?), the geographical location of the building, and budgets (including over-budget concerns). How can anyone possibly account for all these situations and ensure their building will perform as intended – performance mock-ups are a good start. Let's look at the four most common types of mock-ups used in construction today:

- Visual inspection
- First-run study of the actual install
- Independent site built
- Large-scale laboratory

Each of these mock-up types has its own sets of benefits and drawbacks. Would you rather drive a car that had been through all the safety testing versus having one built in your backyard and you being the crash test dummy?

Visual Inspection (Photo 1): This is the least expensive mock-up and provides the least knowledge regarding **system performance**. It is still better (only slightly) than reading a spec datasheet, crossing your fingers, and hoping the product(s) will work. A visual mock-up is where the construction team builds a wall using the materials to be installed on-site. The owner/architect mainly uses it to validate color selection and appearance. These mock-ups do not run any tests on the primary barrier or connections of different materials (**what a waste of money if you go this far – test it already!**). Another version is to have a contractor install two or three similar materials from different manufacturers for an owner/architect and consultant to review before providing a product recommendation. This type of mock-up can be used to validate material installation sequencing – and how the installation process could affect the schedule. Again, this is better than nothing, but not by much.



Photo 1 – Visual Mock-up - Cost = low

First in-place study of actual install (Photo 2): This mock-up has the construction manager scheduling and utilizing an area on the actual building where different materials come together (typically a window to the wall and perhaps including the below-grade to above-grade transition) and performs a battery of tests. This type of mock-up **needs to be scheduled early**. It is constructed with the primary barriers and connecting materials before actual full-blown installation on the project occurs. This is the critical time for testing the compatibility, adhesion, and constructability of different primary barriers, especially if you have various facades (EFIS, metal panel, brick, etc.), each with its own primary air vapor retarder. Why should this be done separately or early from the bulk of the building? What happens if the corners on the metal panels you thought were welded come out and are not, or the windows do not pass at the intended design pressures? The construction team now has a chance to analyze the situation, locate alternate material, order a sample, install it, and redo the testing without losing much time in the overall production schedule. If you wait and test this type of mock-up during full-blown construction – and something fails.... you will have a scheduling nightmare which could result in a schedule push. The benefit to this mock-up – when everything passes – all materials stay in place, and construction moves on using these materials as actual project materials.

Photo 2: First Run / In Place Mock-up

Cost = Low, if materials first used are accepted – increases if new materials are required and could affect end schedule.

Independent site built: This mock-up is being used regularly around the country. Typically, as footings are being poured, a mud slab near the job site trailers is also poured out. On it, the architect designs a structure using the exact details from the project. This is usually a three-sided structure with a roof, and the fourth side is a simple closure area (typically plywood) with a gasket door (to ensure air testing can occur). Best practices include foundation-to-wall transitions, air barrier material(s), window (if using curtain wall, storefront, flanged, etc. – a sample of each) to-wall transitions, typical penetration types (brick ties, Z-girts, support angles, clip and rail anchors, etc.) and roof to wall transitions (scuppers are an excellent idea to include here) within this structure. Each trade partner is responsible for their work to be installed per details, shop drawings, and the manufacturer's application instructions. Then the



structure is run through a battery of tests to validate **system performance**. After getting the mock-up to pass (always test with the cladding/rainscreen not yet installed), the project can add the various cladding so the architect and owner can validate their color/material schemes.



Photo 3: On-site Mock-up

Cost varies depending on size, number, and types of tests run, failures and root cause analysis, and retests till pass.

Large laboratory structures (Photo 4): The Grand Daddy of mock-ups. These are typically larger-scale structures (two stories on average) constructed and tested at independent facilities. As with the independent site-built mock-ups, architects use the building details to combine as many various and different intersecting materials as possible. These mock-ups generally see the most rigorous set of tests performed (see part 3 of the series – mock-up testing) and provide the most information on proper installation, validation of the design/details, and confirmation of the materials' performance. There are numerous certified testing laboratories located around the country that can perform these services.



Photo 4: Large Laboratory Mock-up

Cost varies upon the size of structure and scope of testing.

Enclosure failures and their subsequent rework, waste of original materials, and potential litigation **cost the United States billions of dollars annually**. Although a mock-up is not a 100% guarantee for a successful project, it does allow for validation of selected materials, design, and constructability sequencing. Some mock-ups also provide **system performance assurance** and can assist installers with the opportunity to learn the tips and tricks for the project's unique assembly before the actual final project installation.

There are different types of mock-ups with different goals and information found in each, but please don't be a dummy whenever possible – **TEST** your enclosure mock-up!

The author, Brian Stroik, is currently a Performance Excellence & Quality Consultant for American Contractors Insurance Group, Past Chair & Fellow for the Air Barrier Association of America, Past Chair of the National Building Enclosure Council, voting member of ASTM E06 – Building Performance, Board of Directors for the Building Enclosure Technology and Environmental Council, a Union Trained Carpenter and former Quality Assurance Manager for Billion Construction Manager.

This is the second of a four-part series on performance mock-ups. Stay tuned for more information.

- **Part 1** - Mock-ups Constructions Test Crash Dummy
- **Part 3** - Testing of Performance Mock-ups
- **Part 4** - Transferring Knowledge from the Performance Mock-up

