Impact Resistance: EIF Systems Measure up for Today’s Construction

By Peter Harrison

As they are used today, exterior insulation and finish systems are available with a range of impact-resistive capabilities. Although a variety of methods have been used to enhance EIF system impact resistance, the method used the most is the incorporation of heavier glass fiber meshes to reinforce the system base coat. This method is exceptionally versatile and efficient. Impact resistances can be varied by design by utilizing an entire range of mesh weights, and the desired impact resistance can be installed just where it is needed.

To make systematic use of the impact resistive features of EIFS, methods were needed to measure their impact resistance. Before test methods were developed specifically for EIFS, their manufacturers adapted impact-resistance tests used for other types of building materials to the testing of EIFS. The methods used the most were a falling steel ball impact test, a lead shot or sand filled leather bag pendulum impact test, and a weighted half-inch diameter hemispherical indenter test. These methods had been designed respectively for testing wood-based panels, (ASTM D 1037), wall construction (ASTM E 695 and E 72) and organic coatings on metal (ASTM D 2794). All of them had to be modified with respect to the test specimen, test apparatus and pass/fail criteria. Without a standardized way of making the modifications, comparisons among products were not reliable. Also, because the shapes, sizes, masses, velocities and hardnesses of the objects striking the test specimens varied so much, comparisons among test methods were unreliable.

To address this state of affairs and provide a uniform method of impact resistance evaluation, the EIFS Industry Members Association, developed EIMA Test Method 10.86, Standard Test Method for Resistance of EIFS, Class PB to the Effects of Rapid Deformation (Impact). This method defines in detail the required test apparatus, specimens, procedures, interpretation of results, and reports, thus standardizing the testing.

It is useful to have in mind a basic description of the EIMA 101.86 method. A flat EIFS specimen 2 feet square with 1-inch thick insulation board is placed horizontally, coating side up, on a rigid flat surface, such as a concrete floor. A special indenter is dropped from a measured height down a vertical tube over the EIFS specimen and...
impacts upon it. The maximum drop height at which the indenter will not break the mesh in the EIFS specimen in more than four out of 10 drops is determined experimentally. This drop height is the “passing” height. The indenter is a four-pound steel cylinder with a half-inch diameter hemispherical head to contact the EIFS specimen. It is based on the Gardner Universal Impact Tester as referenced in ASTM D 2794 (see Photo 1, above). This shape of head produces more concentrated impact than the larger diameter steel balls or weighted bags adapted from other methods and produces a good compromise between puncturing and cracking action.

**Impact Classifications**

Testing by EIMA 101.86 results in the determination of a “passing” indenter drop height for an EIF system. In accordance with the EIMA method, the impact energy withstood by the specimen is computed as inch-pounds by multiplying the “passing” drop height, in inches, by the weight of the indenter, which is four pounds. For example, if an EIFS specimen withstands a drop height of 20 inches from the four-pound indenter, then the impact energy withstood is (20 inches) x (4 pounds) = 80 inch-pounds.

Although the impact energy from other shapes and weights impacting EIFS can also be expressed in inch-pounds, they are not necessarily comparable because the energy may be concentrated on a larger or smaller area of the test specimen, or may produce a different type of response in the specimen, such as crushing by using a slower moving but heavier weight.

In accordance with the ETMA method, after the impact energy withstood by passing test specimens is computed, the specimens are classified into one of four categories of impact resistance (Table 1, above).

It is possible to generalize some about fiberglass mesh weights and EIF system impact resistance classifications. Although not every EIF system or every mesh of a particular weight will achieve a particular impact classification, experience has shown that many EIF systems achieve a “standard” impact resistance classification with glass fiber mesh weighing approximately 4 1/2 ounces per square yard. Similarly, systems with meshes weighing about 10 ounces per square yard have typically achieved “medium” impact resistance classification. Heavier meshes are used in combination with lighter meshes. Typically, a mesh of about 4 ounces per square yard, combined with a mesh of 14 ounces per square yard, can give a “high” classification and, combined with a 20 ounce per square yard mesh, an “ultra-high” classification.

It must be stressed that any particular commercially available system may be different, and that the system manufacturer’s specifications must be strictly adhered to in order to produce the specified impact resistance classification. Intermixing base coats and meshes among different brands is never permitted because, although they may have the same nominal weight,
fiberglass meshes vary in construction and chemical make up. This affects not only impact resistance, but many other important properties of the system as well. EIFS are designed by their manufacturers as constructions of coordinated groups of proprietary components and must be respected as such.

Materials Comparisons

To give some practical feel to impacts produced by the EIMA method, it was applied to show the effect on a “passing” EIF system and the effects of various impact energies on other common building materials. Photo 2 on page 37 shows a typical EIFS construction with heavy and light fiberglass meshes com-
The small flat spot above the 6-inch mark on the ruler was formed by a 150 inch-pound impact from the EIMA test method. It is shown in close-up in Photo 3 (page 37). Impacts of 25, 50 or 90 inch-pound will produce similar effects on EIFS achieving “standard,” “medium” or “high” impact resistance classifications respectively.

For the purpose of comparison, several other building materials were tested at the impact energies of the EIMA classifications. They were all placed on 1-inch thick EPS in order to provide support equal to that which the EIFS receives from its 1-inch thick EPS.

Hardboard that is 1/8-inch thick is indented nearly through its thickness at only 18 inch-pounds (Photo 4, page 37), and punctured through at 50 inch-pounds. Impacts of 90 inch-pounds dent 1/4 plywood and metal roofing, shown in Photos 5 and 6 (page 40). Impacts of 150 inch-pounds break them (Photos 7 and 8, page 40). 150 inch-pounds impacts dent 7/16 plywood, in contrast to the slight flattening of texture of the EIFS with the ultra-high impact resistance classification.

Commercially available EIFS incorporating 20 plus 4.8 ounce per square yard mesh can even resist 200 inch-pound impacts with only slight indentation (Photo 9, page 40). This is contrasted with the distinct dent in 7/16-inch plywood shown in Photo 10 (page 40). EIFS can provide impact resistance superior to 7/16 inch plywood, which suggests that a new impact resistance classification level of 200 inch-pounds would be useful.

Designers and application contractors who advise builders and building owners about EIFS installation should consider recommending impact resistance classifications greater than “standard” for walls such as those next to areas exposed to pedestrian traffic: walkways, parking lots, decks and balconies. Bottoms of walls exposed to incidental contact with lawn-care equipment, walls around play yards, and gable ends over garage doors (for basketball nets) should be similarly considered. And a few locations, such as walls around loading docks subject to truck collisions, should be protected by structural guards to prevent those impacts.

Contract documents should indicate unambiguously where each impact-resistance classification shall be met by the EIFS installed. This can be done on the drawings or by specific description in the specification, such as, for example, “Install EIFS of High Impact Resistance Classification for a height of 4'-0" above all balcony decks. Impact resistance classification shall be in accordance with EIMA Test Method 101.86.”

EIF systems are unmatched for their design versatility, both in appearance and function, and they have gained recognition for this. The EIFS industry can benefit by the effort of all who work in it to convey the role that impact resistance classifications have in matching the system to the need. CD

About the Author
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