

## Exterior Insulation and Finish Systems (EIFS): Problems, Causes and Solutions

### INTRODUCTION

Since about 1969, exterior insulation and finish systems (EIFS) have been a popular method of cladding lowrise and highrise buildings in North America. These systems consist mainly of plastic insulation board, reinforcing fibreglass mesh (or random fibres) and synthetic stucco.

EIFS became popular due to relatively low installation costs, low in-service weight compared to many traditional claddings and its thermal resistance. It also lends itself well to architectural detailing and wall surfaces may be finished in a wide range of textures and colours. EIFS has been used to reclad existing buildings both to improve the exterior appearance and to reduce heating and cooling expenses.

These systems generally are a single-element wall with an exterior face seal bearing the main impact of environmental conditions. In North America, EIFS commonly consists of expanded polystyrene foam insulation board adhered to exterior drywall sheathing substrate. After the foam board is mounted on the substrate, a base coat, which provides the primary water barrier, is applied to the outside surface of the board. A thinner, coloured finish coat of acrylic polymer and aggregate is applied over the base coat.

Although EIFS appears to be an economical cladding system, concerns emerged regarding its long-term durability. Research was undertaken to investigate problems thought to adversely affect EIFS performance and review potential solutions.

### RESEARCH PROJECT

The research looked at different types of EIFS construction and assessed their ability in general to control rain penetration and the flow of heat, air and water vapour. It also looked at fabrication, quality control measures, potential problems and possible solutions. A literature review and discussions with builders, subcontractors, suppliers and consultants formed the basis of the research.

### FINDINGS

The durability of EIFS appears to depend on the system's design, workmanship, quality control during the construction process and subsequent maintenance. Known EIFS failures have been attributed, almost without exception, to either faulty installation (the vast majority) or faulty detailing. At the time of the research, no national standards had been established for the correct application of EIFS.

## Research Highlight

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Moisture has been a major contributor to EIFS failures. These failures primarily consist of moisture Findings deposition on the substrate, with subsequent softening, delamination or warping of the substrate. Some drywall manufacturers are now producing moisture-resistant fibreglass-faced gypsum sheathing board and cementitious sheathing boards. Moisture in contact

with base and finish coats over prolonged periods of time can also cause softening due to reemulsification of the acrylic. Sills, parapet tops and so forth should be metal flashed, steeply sloped or given a special sealer for protection. Moisture may also accumulate at horizontal joints, causing reemulsification.

**Table 1** EIFS Problems and Examples of Potential Solutions

<b>Problem</b>	<b>Examples of Potential Solutions</b>
Water saturation of drywall during construction	Prefabricate EIFS wall panels, including drywall, under cover on site or at a factory. Substitute concrete backer.
Joint failures	Use two-stage sealing pressure to equalize the "rain screen joint". Double reinforcing mesh at all openings and terminations. Stagger foam board joints and interlock board ends at corners.
Saturation of the drywall after water penetration of EIFS	Protect drywall with building paper, spunbonded polyolefin, and mechanically fasten EIFS through drywall to framing. (Conventional mechanical fastening of EPS board is not recommended.) Form a drain screen system using a continuous air barrier and rigid fibreglass sheathing.
Moisture from indoor air moving into insulated cavities	Place a continuous rigid air barrier on the inside of the wall system.
Softening of base and finish coats	Use detailing that eliminates puddling on parapets, ledges, etc. Apply caulking to eliminate ledges where water can accumulate.
Curling of expanded polystyrene board	Allow EPS board to age according to EIFS manufacturer's recommendation.
Combustion of EPS board	Substitute mineral wool, fibreglass or foam glass board for EPS.
Failure of bond between substrate and EPS board	Test bond on-site under wet and dry conditions. Mechanically fasten EPS board with inset metal hat track.

Moisture-related deterioration may be exacerbated when claddings are installed over substrates that are sensitive to moisture. One of the most common substrates in North America is exterior gypsum board sheathing attached to steel studs with screws. (Alternatively, poured concrete, concrete blocks or existing concrete or brick walls may be used as substrate.) In most cases the EIFS cladding is adhered to the face of gypsum sheathing. This type of construction can result in the entire cladding system relying on the integrity of the gypsum core and/or the paper facing of the gypsum sheathing. In instances where no mechanical fasteners are used, as is often the case, any moisture-related softening of the gypsum board sheathing and/or corrosion of the screw attachments of the sheathing to the studs could result in significant loss of integrity of the cladding system.

Approximately 80 to 90 per cent of all systems in Europe use expanded polystyrene foam board, with the vast majority installed over masonry or poured concrete, not gypsum board. In France, failures of EIFS to provide suitable water and weather barriers resulted in the development of a national performance standard for EIFS, as well as training and certification of installers. This and other related steps eliminated most of the problems of poor workmanship experienced in France in the early years of using EIFS.

The table on the preceding page highlights a few methods presented in the research report for dealing with potential problems. The report presents a more detailed list of proposed solutions.

It may be concluded that EIFS claddings require high levels of workmanship and maintenance to provide reasonable serviceability, and to ensure the exterior surface and joints remain weathertight. The materials used in EIFS in general, and those used at the joints in particular, must meet very high performance requirements due to their exposure to wind, rain, thermal cycling and solar radiation over a prolonged period of time.

The extent and severity of moisture-related deterioration affecting EIFS claddings is unknown at this time and there is no consensus on the long-term serviceability of EIFS.

## RECOMMENDATIONS

The following steps are recommended:

1. Conduct field investigations of EIFS that have been in service for 1 to 20 years to determine the extent and severity of potential problems, if any.
2. Have the EIFS industry, building envelope specialists, designers and Canada Mortgage and Housing Corporation review field investigation results.
3. If warranted by the review, undertake more detailed field or laboratory research to establish the effects of condensation, wind, solar radiation, thermal cycling and rain on the performance of EIFS.
4. Investigate EIFS design and construction modifications to counter problems identified.
5. In cooperation with the EIFS industry, develop guidelines for manufacturers, installers and designers to enhance the performance of EIFS.

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**Project Manager:** Peter Russell

**CMHC Contact:** Luis de Miguel

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**Research Consultant:** Christopher Mattock,  
Habitat Design + Consulting Ltd.

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or contact:

Canada Mortgage and Housing Corporation  
700 Montreal Road  
Ottawa, Ontario  
K1A 0P7

Phone: 1-800-668-2642

Fax: 1-800-245-9274

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