Engineering Matters

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***Falcon Engineering** is proud to introduce you to our new publication—**Engineering Matters**. We hope our clients and industry colleagues will benefit from our perspective and advice on a variety of site planning, construction, and maintenance issues affecting residential, commercial and educational buildings and properties. We welcome your feedback and suggestions for future issues and look forward to providing practical ideas and solutions of value to our readers.*

With best regards,

Andrew Amorosi, PE, RS
William J. Pyznar, PE
Principals, Falcon Engineering

Falcon Engineering
Consulting Engineers

HIGHER STANDARDS

PENNSYLVANIA • NEW JERSEY
NEW YORK • SOUTH CAROLINA

HEADQUARTERS
62 Grove Street, Somerville, NJ 08876
Phone: (908) 595-0050
Fax: (908) 595-0012
www.falconengineering.com
Email: info@falconengineering.com

Synthetic Stucco: Attractive Alternative or Potential Disaster?

By William J Pyznar, PE, Principal

What Community, property owner or property manager wouldn't welcome an exterior wall product that promised durability, energy efficiency, aesthetic appeal, design flexibility, competitive installation costs and lower overall maintenance expenses? These were the expectations created when Exterior Insulation and Finish Systems (EIFS) were introduced in the United States.

EIFS have become synonymous with synthetic stucco, due to their aesthetic and textural similarity to real stucco. When properly applied, moisture-controlled EIFS can work well as a weather barrier. However, when improperly applied, synthetic stucco can be a costly construction defect, and can result in large exterior maintenance, structural repair or replacement expenses.

Background

EIFS is a system of insulation board attached to a structural wall, covered with a thin, flexible mesh, then a thin base coat, followed by a thin textured, colored finish coat.

The entire thickness of the EIFS system is typically, approximately 1/8" to 1/4", plus the thickness of the insulation board, which will vary, based upon the desired insulation rating, commonly referred to as *R-value*. The insulation board allows for the additional *R-value* at the building exterior, to enhance energy efficiency. Moisture-controlled systems have a drainage plane behind the insulation board and weep system to allow water to escape from the wall.

Properly installed, EIFS provides an appearance and texture extremely similar to stucco, and the versatility of the product allows for a virtually limitless variety of architectural details and colors. The cost of an EIFS system ranges from approximately $5.00 to $8.00 or more per square foot, installed, depending upon the complexity of the work, which makes this product competitive to a conventional stucco system.

Under the Surface...

The EIFS system relies heavily on the adequacy of the initial installation. Improperly installed EIFS without moisture-control can lead to moisture trapped behind the EIFS, causing leaks, mold and structural damage. Improper detailing can also cause surface cracking.

There are a number of mistakes an untrained or careless applicator can make during EIFS installation, any of which can cause system deficiencies.

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Synthetic Stucco continued...

The most common of these installation problems relate to proper:

- Flashing building fenestration and interfaces with adjoining building materials
- Fastening of the insulation board to the building structure
- Application of the reinforcement mesh
- Thickness of material.

Handle with Care

In North Carolina, EIFS was extensively used for many years in residential construction. Improper detailing resulted in widespread deficiencies. In many cases, extensive rotting of the framing had taken place. In fact, in a much-publicized litigation, Senergy Inc., a subsidiary of Harris Specialty Chemicals Inc. of Jacksonville, Florida, agreed to contribute up to $20 million to repair homes clad with synthetic stucco that were damaged when moisture infiltrated behind the material.

Subsequently, a North Carolina superior court tentatively approved a partial settlement, (Ruff et al. v. Parex, et al. No. 96-CVS-0059) which extended the compensation to a much larger number of homeowners. Essentially, this ruling indicated that owners as of May 15, 1998, of one or two-family residential dwelling or townhouses anywhere in the United States, clad with the product manufactured by, Senergy or Thoro Products, Inc. could be awarded compensation. Although some of the defendants have settled this case and other issues remain pending, an in-depth discussion of this suit is not the purpose of this article. Our objective is to provide guidance related to EIFS' ability to function as a watertight weather barrier. In this regard, *Builder* Magazine published a 1996 study of more than 200 homes by the American Institute of Architects, which found "unacceptable moisture levels in 90% of homes it tested." Additionally, a November 1998 issue of *Nation's Building News* contained an article titled "Caution Advised in Using EIFS Systems." Collectively, this information emphasizes that EIFS-clad exteriors are potentially susceptible to moisture intrusion; care must therefore be taken to ensure that the EIFS functions as intended.

"Constructive" (and Inspection) Advice

Given the current base of experience with EIFS, prudence would dictate that Communities be aware of potential issues with EIFS installations, and exercise diligence in conducting regular, periodic EIFS inspections and testing.

Prior to inspecting the façade of the building, information should be collected regarding any ongoing, or past, water infiltration problems. After the inspection of the façade, suspect locations should be tested with a (preferably non-destructive) moisture meter. Locations in which the moisture content of the structure and sheathing behind the cladding exceeds 20% indicates a possible problem, and may require further investigative action and repair.

For Communities with installed synthetic stucco (or stucco of any type), a regimen of regular, routine inspections should be followed as an essential, and comparatively inexpensive, method of ensuring that EIFS provides an effective watertight weather barrier. However, our recent experience with EIFS on residential wood-framed buildings implies that maintenance of these systems is becoming increasingly cost-prohibitive, if not unrealistic.

Summary

While EIFS have only come into widespread use in residential construction in the United States in the past decade, they are still evolving and deficiencies continue to be discovered. Like traditional stucco systems, proper installation and the provision of a drainage plane is the key to maintaining the performance of the system. For Communities with EIFS installed, we recommend:

- A thorough investigation for any potential problem locations
- Inclusion of an annual inspection of the system as part of the preventive maintenance program and budget for the community.

Early detection of deficiencies is a cost-effective way to avoid more costly repairs in the future.

Should you have any questions or concerns about the issues addressed in this article, please feel free to contact Falcon Engineering. ■

Estimating Reserve Construction Costs: Coming Up Short?

Andrew Amorosi, PE, RS

...Our Association is embarking on a much-needed reconstruction project, however, we have found out that our reserve account has less then half of the monies we need for the project. How did this happen? What do we do now?

It seems this familiar scenario occurs within our industry far too frequently. As the hundreds of Communities constructed in the 1980's are aging, capital items are nearing the end of their originally intended useful lives. Generally, the answer to the question "What do we do now?" includes special assessments and bank loans. Unfortunately, this problem can also cause an Association to "fix" their replacement funding problem by reducing project costs through the use of inferior reconstruction materials, methods or contractors. The weak economy doesn't favor special assessments, and

not all Associations are able, or willing, to increase their debt obligations. Thus, underfunded reserve account balances can create a very difficult set of choices for a Community.

Since we are encountering many Communities that are, to varying degrees, experiencing Capital Reserve shortfalls, we believe it would be useful to review "the engineering basics" needed to plan effectively for Capital Replacement costs.

Background

The primary purpose of a Capital Reserve Funding Analysis is to offer recommendations to a single or multi-family development regarding the amount of monies the properties/Community should fund on a yearly basis for the future replacement of commonly owned elements. The analysis and recommendations are important tools for avoiding possible future special assessments of individual unit owners. The analysis should be in the best interest of the Community, period. The analysis should take into account the site specific existing conditions, the useful life of each common element, and the realistic replacement costs, which should be determined based upon actual material costs and the site-specific individual item's required method of reconstruction.

Whether reconstructing roadways, sidewalks, roofs, or other common elements of the Community, the Association Board must ensure that an adequate Capital Replacement plan is developed, based on the funding that has been recommended and established over the useful life of the item. Unfortunately, it seems that all too-often Associations who made these plans discover that their Capital Reserve Fund balances are underfunded at the worst possible time—at the inception of a replacement project.

One reason that this situation occurs is that Capital Replacement costs shown in the Funding Table of a prior Reserve Study were often derived from an estimating book or, worse, an outdated estimating book. Relying solely on this type of "armchair analysis" would not be considered the correct practice for calculating reserve requirements and accordingly, virtually ensures a Capital Reserve funding shortfall.

Suggestions for Avoiding Reserve Study Problems

The unit costs provided for the replacement of the Capital Reserve items in the Reserve Study's Funding Table should be based upon a number of sources, including published documentation on replacement costs; more importantly they should be based upon actual experience in site and building construction in New Jersey. The individual reconstruction or replacement of each item should be analyzed and the resulting unit costs should be adjusted accordingly. Individual (site-specific) characteristics affecting the elements' unit costs are different on every site and the replacement costs should be adjusted accordingly. Some of the many variables to be considered that affect the item's replacement costs include:

- Existing site conditions
- Size (scale) and scope of the future replacement project
- Job access locations
- Site restoration costs
- Presence of existing components.

If all of these factors are not properly considered and weighed accordingly, a frequent result is that the unit replacement costs shown in these studies barely cover the materials costs for the item.

This is an unacceptable error, and is by far the most glaring and unexplainable reason for underfunded Reserves.

Estimating 101 (Short and Simple)

Situation 1, below, and **Situation 2**, on the following page, provide two examples which contrast an unrealistic approach to estimating methodology, with a more realistic approach. An unrealistic approach can become the basis for erroneous data in an Association's reserve funding tables:

Situation 1: Driveway Reconstruction
Assumptions

Unrealistic Estimate

- Asphalt overlays are listed in a 1999 estimating book at $4.51 per square yard
- There are 4114 square yards
- The replacement cost is 4114 x 4.51 or **$18,554**.

Realistic Estimate

- The driveways have significant failures
- They are individually small in size they are very flat and in some cases back pitched towards the garage the pavement surface is flush with the garage aprons, sidewalks and curbs
- Since the driveways are failing, flat and small, it appears that the driveways have a deficient section thickness of asphalt
- Based on the above, a complete removal and replacement will be required.

Realistic estimate using 2002 costs and actual site variables:

Remove existing asphalt:	$1.58/s.y.
Excavate for desired section:	$2.22/s.y.
Prepare sub grade:	$0.27/s.y.
Install base material (slow hand work required, not like a roadway):	$6.78
Install surface material (slow hand work required, not like a roadway):	$5.94
Topsoil and seed edges:	$0.26/s.y
Total:	**$17.05/s.y.** →

Therefore, the replacement cost is 4,114 x $17.05 or **$70,144.**

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Situation 2: Wood Siding Repair
Assumptions

Unrealistic Estimate
- Wood siding is listed in a 1999 estimating book at $3.55 per square foot
- There are 195,500 square feet
- The replacement cost is 195,500 x $3.55 or **$694,025.**

Realistic Estimate
- The siding is a high-end cedar product
- The buildings have a history of leaks
- The buildings are intricate with various small sections
- The buildings have an extensive trim pattern.

Realistic estimate using 2002 costs and actual site variables:

Remove siding and underlayment:	$0.70/s.f
Disposal of siding	$1.28/s.f.
Replace random framing/sheathing	$0.50/s.f.
Install new underlayment:	$0.23/s.f.
Replace trim:	$0.21/s.f.
Replace corner ports	$0.17/s.f.
Install flashing	$0.11/s.f.
Install new 5/8" beveled cedar siding:	$4.89/s.f
Total:	**$8.09/s.f.**

Therefore, the replacement cost is 195,500 x $8.09 or **$1,581,595.**

As these examples illustrate, the differences between the calculations are enormous and funding these shortfalls has the potential to have serious negative impacts on the Association's financial position. The greater the scale of the project, the greater the potential magnitude of error.

Conclusion

Continuing periodic Reserve updates using actual site conditions and realistic replacement dates and costs is the most effective (if not the only) way to ensure that an Association's Capital Replacement needs will be properly funded. CAI Reserve Specialists (RSs) and Professional Engineers (PEs) should do everything possible to ensure the accuracy and detail required by these Reserve Funding estimates. Some Communities with older common elements in need of replacement are only now beginning to feel the effects of these underestimated funding studies. This is an especially difficult situation for the Community given current economic conditions. Experience would indicate that more Associations have the problem of underestimated reserve funding needs than are likely aware of their potential dilemma.

Associations which have not had their reserve studies updated in three years should consider reviewing and possibly updating their studies to ensure that they have adequate Capital Replacement Plans to guide them in ensuring funding adequacy as Capital Replacement projects occur.

The professional certifying the Reserve report or estimate should always do a site inspection and check the accuracy of his/her staff's work, as well as validate the pricing methods used in preparing the study. "Plug and chug" methods, and unqualified evaluations don't work for sophisticated situations like reserve studies; they never have-and never will.

Please feel free to contact Falcon Engineering if you have any questions about this article, or any of your engineering needs. ■

What's New?

Lyle Hoffman has earned his *Certified Playground Safety Inspector* certificate. Mr. Hoffman will be providing Falcon Engineering clients with in-depth studies to ensure that playground facilities are meeting the new stringent safety standards, and to help clients limit playground-related liabilities. ■

John Lacopo completed a training program to become certified in the area of *Mold Remediation.* Mr. Lacopo's training in engineering and experience in the construction industry allows him to provide sampling, reporting and remediation programs that are in depth and effective. ■