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EXTERIOR INSULATION AND FINISHING SYSTEMS

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*Abstract:*Differential temperature in the cement structure causes cracks, spalling and eventually allows chlorides, sulphates & other ions to penetrate through the porous spaces causing the structural problems. These detrimental factors are limited if the cement has the ability to repel water. Here water repellency is achieved through internal &external surface application of water proofing compounds. Existing durable materials such as metals and ceramics are generally hydrophilic & require polymeric modifiers to render them hydrophobic properties. Plaster drain provides a cavity drainage system, suitable for remedial works, and is used to provide a key for plaster and render finishes. Water is an essential ingredient in cement structures, but uncontrolled excessive moisture can create whole host damage. The purpose of this research is to give an idea about insulation of building with the finishing systems like plastering and painting. Using good quality of materials and sustainable materials increases the durability of the structural component. It also gives knowledge about R value of individual component used, how to create a crack free finishing systems with eco-friendly materials.

IndexTerms **- EIFS, Insulation, R-value, Moisture, sustainability, durable structures.**

I. INTRODUCTION

Exterior Insulation and Finishing System's (EIFS) are a type of building material that is used as the exterior facing of a building's exterior wall. EIFS is composed of a number of layers. EIFS is a type of wall surfacing system and needs to be thought of as such a system.

EIFS is unique in that it is the only wall material that provides insulation, a finished exterior surface & weather proofing, in a single seamless product. This "single product does it all" attributes accounts for its popularity; EIFS is a good value.

EIFS looks like stucco (Portland Cement Plaster), Stucco is a "natural" product, composed of sand, Portland cement & other materials. EIFS is a synthetic product, unlike Stucco, EIFS can be made in large areas without any joints and also with a wide variety of shapes, colors and textures. EIFS is also called as synthetic stucco.

Here in this research incorporation of EIFS is directly done in the exterior finishing systems i.e. plastering by selecting few components of EIFS. So EXTERIOR INSULATION in FINISHING SYSTEM is a way of providing thermal insulation for the building. This system even concentrates on providing protection for building against moisture and also aims at crack proof finishing using sustainable green materials.

The expression deep energy retrofit lacks precision but broadly suggests a program of existing building improvement that has as one its goals a dramatic improvement in the level of energy efficiency while providing a healthier living environment and improving durability and safety. Adding insulation to exterior walls is often a key piece of a deep energy retrofit. However, this measure is often cost prohibitive and there are formidable challenges to altering the thermal envelope of existing, older structures.

II. OBJECTIVES

To provide the finishing system for external walls of the building with: -

1. Crack free surface:

Water plays a vital in the construction field. The surface exposed to external atmosphere is subjected to various kinds of attacks. Making the external surface to resist various sorts of attacks increases the durability of the structure. If the surface is crack free and having uniform temperature throughout makes the structure durable and sustainable.

2. Resistance to moisture attack:

Majority of the buildings in olden days was wood framed buildings, these buildings were facing water infiltration problems which leads to structural dampness and strength reduction in buildings. By incorporating EIFS system which includes drainage path to let water drain out behind the cladding system.

3. Good thermal insulating properties:

Insulation of building plays a vital role in energy conservation of the building. Thermal insulation is the reduction of heat transfer between the objects in thermal contact. Insulation helps in maintain comfort temperature by reducing leakages. So by using skeletal steel mesh and plastic mesh we can increase the insulation properties of building.

4. Retrofication of old buildings:

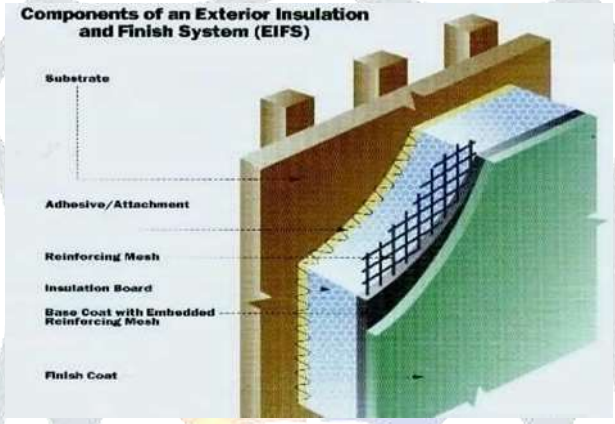
Retrofication is the process of modifying existing structure with additional or new component or members. By using EIFS concept we can retrofit the older buildings with central air means installing a condenser outside the home, a fan-and-coil system used inside the ducts to distribute the cooled air. In addition to this we can also increases the strength and durability of the old structures, instead of constructing a new structure.

III. METHDOLOGY:

To demonstrate the idea of insulation in External finishing systems incorporating the idea of EIFS, 4 specimens were prepared.
1. Plain mortared plastering with external application of water proofing
2. Plastering using skeletal steel mesh. 3. Plastering using plastic mesh.
4. Plastering using integral water proofing compound

MATERIALS USED FOR SPECIMENS: -

•Cement
•Fly ash
•Manufactured sand (m-sand) •Skeletal steel mesh
•Plastic mesh •Nails
•Water proofing agents



Estimation:-

Calculation of materials

1) 25mm Thick cement mortar 1:4 plastering for exterior brick wall

2.85m x 1.5m x 4 no's = 17.1sqm

- Volume of wet mortar =0.025 x 17.1 =0.43cum
- Adding extra 20% for filling the depressions, joints ,wastage ,etc.

Volume of wet mortar = 0.43 + (20/100) x 0.43 = 0.516 ≈ 0.52cum

- For dry mix adding 1/3 rd extra, therefore volume of dry mortar

= 0.52+(1/3)x0.52 = 0.693 ≈ 0.7cum

- Cement = (0.7)÷(1+4) = 0.14cum
- Cement is replaced by 40 % of fly ash = 0.056cum
- Sand = 0.14 x 4 = 0.56cum (1.33tonne)
  - i. 1 Tonne = 0.42cum

X = 0.56cum

Therefore X = 1.33tonne

- 60% of cement = 0.084cum = 3.15 bags
- 40% of Fly ash = 0.056cum = 0.13 tonne

IV RESULTS AND DISCUSSION:

1. Plain mortared plastering.
2. Plain plastering with integral water proofing agent
3. Plastering using skeletal steel mesh.
4. Plastering using plastic mesh.
5. Plastering using water proofing agent.

4.1. Plain mortared plastering

After observation of 1 week from the day of specimen preparation, small air cracks started forming. As the specimen was kept under observation for 3 months it was observed that the air cracks were expanding. When it was tested for water tightness test it developed damp patches.

4.2. Plain plastering with integral water proofing agent

The surface developed vertical air cracks. Since the water proofing compound was mixed during the specimen preparation itself, the structure was not allowed to breath. For a durable structure, the cement should breath, there should be exchange of gases between atmosphere.

Still the specimen is tight against moisture attack.

4.3. Plastering using skeletal steel mesh

The specimen gave better results when compared to all other specimens. After a observation of 3 months, not even a single crack is developed. It gave good results for water tightness test.

4.4. Plastering using plastic mesh

The surface developed air cracks which increased on time. Cracks develop mainly when different materials come in contact.

4.5. Plastering using water proofing agent

The specimen developed air cracks which was sealed after the application of water proofing compound. After the observation it was noticed that the surface developed air cracks

Coming to the point of insulation, iron fibers are good insulators because of the air trapped between the fibers. Iron itself is a good conductor, but thin fibers change this property.

In many homes insulation is the most practical and cost effective way to make a house more energy efficient, keeping it cooler in summer and warmer in winter and saving upto 40% in heating and cooling bills. In addition insulation may reduce condensation in the home.

The finishing of the surface of all specimens were made with paints and primers having insulating properties.

Using steel mesh instead of carbon fibres which have proven results of insulating properties is because of the health hazards of carbon fibres when it is exposed to atmosphere.

R values are additive in nature,

Table X: R-Value of materials

Sl.no	Materials	Thickness	R (F^o.sq.ft HR/BTU)
1	Common brick	4”	0.80
2	Resin	0.5” insulation	1.80
3	Cement mortar	¾”	0.15
4	Acrylic compounds		1.78
5	PVC		1.80

Source: ASHRAR Handbook of Fundementals

Table XI:R-value reality check

Sl.no	R value	Amount of heat flow reduction (%)
1	R -8	90
2	R-12	93
3	R-16	95
4	R-20	96
5	R-30	97

Source: ASTM

R value of the specimen =6.33

Higher R value results in good thermal insulation.

The r value of 6.33 reduces the amount of flow of heat by 71.21%.

V. CONCLUSION

1. Insulating a house has several benefits such as energy savings, cost savings and increased comfort. By insulating a house, one can reduce the heat loss in buildings. Here by adopting insulation within the finishing system saves extra money required for installing the insulation system.
2. By insulation of building not only helps lower monthly energy bills, but also adds to the overall comfort. Insulation helps maintain comfort, temperature by reducing leakages.
3. Replacing 40% of cement with fly ash provides much more benefits like decreased permeability, increased durability, reduced heat of hydration and much many.
4. Using M SAND instead of river sand promotes the saving of natural materials. Thus, a sustainable building is obtained.
5. Making the finishing systems exposed to external atmosphere safer with regarding to moisture attacks and other chemical attacks increases the durability of the entire structure and also decreases the maintenance cost.
6. The specimen prepared with skeletal steel mesh gave better results when compared to all other specimens. After a observation of 3 months, not even a single crack was developed. It gave good results for water tightness test. After application of insulating primer and paint good thermal insulation was observed.
7. Higher R value results in good thermal insulation. The r value of 6.33 reduces the amount of flow of heat by 71.21%.
8. We can also incorporate the above whole system in retrofication of old buildings.
9. Fosroc Brush Bond powder which is a water proofing agent, and it also protects the structure from extreme weather conditions.
10. Making the external surface to resist various sorts of attacks increases the durability of the structure. If the surface is crack free and having uniform temperature throughout makes the structure durable and sustainable.
11. We can retrofit the structures by using the above all process of plastering, In addition to this we can also increases the strength and durability of the old structures, instead of constructing a new structure.

Construction field stands in second position for the environmental pollution. Approximately manufacturing of 1 tone cement liberates 1 tone corbon di oxide, so it is advised to replace cement with pozzolanic materials where ever possible.

Plastering of a structure hardly requires 9mpa compressive strength, so replacing the cement here is not a problem for structural behaviour.

Insulation of a building is playing a vital role in the present century there are many methods available for insulating a building with environmental cause like filler slab techniques, using cera boards, installation of Mangalore tiles etc.. one such method is EIFS.Adoption of EIFS in any structure leads to improvement in its energy.

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