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A comparitive analysis of exterior insulation and finishing system according to indian climatic condition

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Abstract: **"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 project 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.**

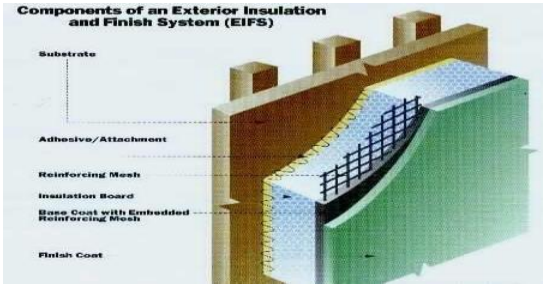
Keywords: Fly Ash (FA), P Sand, Poly Urethane Foam(PUF), R Value, U Factor.

I. INTRODUCTION

Since about 1969, exterior insulation and finish systems (EIFS) have been a popular method of cladding low-rise and high-rise buildings in North America. These systems consist mainly of plastic insulation board, reinforcing fiberglass mesh (or random fibers) 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 colors. EIFS has been used to recall 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, Colored finish coat of acrylic polymer

and aggregate is applied over the base coat. Exterior Insulation Finishing Systems (EIFS) assemblies are lightweight synthetic wall claddings used to create architectural detail and provide insulation properties to exterior building surfaces. EIFS moldings can be created in a wide variety of styles and finishes, including various colors and textures, to simulate stucco, stone or even brick**.**

"**Exterior insulation and finishing system is a general class of non-load bearing building cladding systems that provides exterior walls with an insulated, water-resistant, finished surface in an integrated composite material system"**



COMPONENTS OF EIFS

II. OBJECTIVES

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

1. **Crack free surface**
2. **Resistance to moisture attack**
3. **Good thermal insulating properties**

III. . MATERIAL DESCRIPTION

A. Cement

Cement shall be Ordinary Portland confirming to IS. And the requirements must satisfy as per IS 8112:2013. Approved blended cement shall be used for internal plaster, plumbing and flooring works etc. It shall be received in bags of 50kg's (or in bulk carriers in case of storage in silos) of one brand and grade with consistency certificate of the manufacturer. Each batch shall be accompanied with a test certificate of the factory. Also it shall be tested before use to ascertain its strength, setting time, etc. "In our project we used Ordinary Portland cement of 43- grade ZUARI cement".

B. Fine Aggregate

PLASTERING MANUFACTURED SAND :-

Plastering manufactured sand is a substitute of river sand for construction purposes sand produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand (P-Sand) is less than 4.75mm. Requirements of P-sand must satisfy according to IS 1542:1977. Due to fast growing construction industry, the demand for sand has increased tremendously, causing deficiency of suitable river sand in most part of the word. Due to the depletion of good quality river sand for the use of construction, the use of manufactured sand has been increased. Another reason for use of P-Sand is its availability and transportation cost. Since this sand can be crushed from hard granite rocks, it can be readily available at the nearby place, reducing the cost of transportation from far-off river sand bed.

C. Skeletal Steel Mesh

As reinforcing material, plaster mesh is used for building internal and external decoration, especially in plastering work. It protects the plaster layer surface from cracking and increases the mechanical strength of the plaster layer. Meanwhile plastering mesh provides a better grip with plaster wall and forms the skeleton layers of the wall plaster and putty, thereby significantly strengthening the plaster layer and significantly extending its service life. Due to its strength and durability, plaster mesh is also successfully used as reinforcing material in strengthening the foundations of buildings, restoration and reinforcement of existing plaster, brickwork, installation of thermal insulation and roofing tile ties, and road laying pavement construction.

D. Plastic mesh

Plastic mesh is recommended for plastering both internal and external. Perform the function of reinforcing mesh and protect against the formation of surface cracks and crevices, as well as increase its mechanical strength and prevent deformation. However, its scope is not limited Plastering. **Plastic plaster mesh** is also successfully used in plastering and painting works by pouring floors, for heat and sound insulation

wall surfaces, for the reinforcement of door and window frames, to protect the facades. Specially recommended for plaster using fast-drying dry mixes, plastic mesh with large mesh is an alternative to metal plaster mesh. "In our project we used plastic mesh of size 1mm diameter and 2.85m x 1.5m size".

E. Nails

In our project we used sterilized nails of size 1inch length and which is free from corrosion for nailing the skeletal steel mesh and plastic plastering meshes respectively, before plastering.

F. Water Proofing Agent

These water proofing agents are used in order to protect the structures from extreme weather conditions. And by using water proofing agents we can modify the properties of cement while constructing new building or while doing any restoration works

In our project we used two types of water proofing agents;

1) Poly Urethane Foam(PUF)
2) Fosroc brush bond powder

G. Fly ash

Fly ash is obtained from a product of coal. Fly ash containing low calcium having colour of whitish grey, specific gravity of 2.16, was used.

H. Water

Ordinary portable water was used in this investigation both for mixing and curing.

R-VALUE

The **R-value** is a measure of thermal resistance or ability of heat to transfer from hot to cold, through materials and assemblies of materials (such as walls and floors). The higher the R-value, the more a material prevents heat transfer. R-value depends on material's resistance to heat conduction, as well as the thickness and (for loose or porous material) any heat losses due to convection and radioactive heat transfer. However it does not account for the radioactive or convective properties of the material's surface, which may be an important factor for some applications.

U Factor

The U-factor or U-value is the overall heat transfer coefficient that describes how well a building element conducts heat or the rate of transfer of heat (in watts) through one square meter of a structure divided by the difference in temperature across the structure. The elements are commonly assemblies of many layers of components such as those that make up walls/floors/roofs etc. It measures the rate of heat transfer through a building element over a given area under standardized conditions

Poly Urethane Foam

Builders, Architects and Service Consultants alike are constantly looking for ways to enhance energy-efficiency in buildings. Optimum level of building insulation not only helps lower monthly energy bills, but also adds to the overall comfort. Insulation helps maintain comfort temperature by reducing leakages. With the advent of green technologies and practices, today the potential to save energy by design can be as high as 40-50 %.Insulation in buildings is assuming tremendous importance and

has a potential to reduce energy consumption to an extent of 5-8 %.

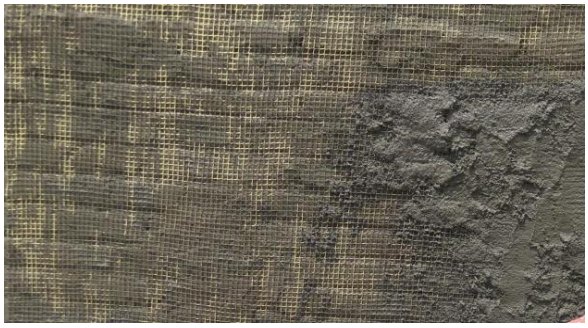
The PUF with greater R values are good insulators

IV. EXPERIMENTAL PROCEDURE

1.Plain mortared plastering

2.Plastering using Skeletal Steel Mesh

3.Plastering using plastic Mesh



4.Plastering using Water Proofing Agent(PUF)

Dimensions:-

Dimensions of the plastering area are 2.85m x 1.5m.

Proportioning and mixing:-

The proportioning of mortar shall be maintained by one part of cement and four parts of M-sand (CM 1:4).

RATE ANALYSIS OF MATERIAL:-

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

2.85m*1.5m*4nos=17.1sq.m

- Volume of wet mortar= 0.025*17.1=0.43cum
- Adding extra 20% for filling the depressing ,joined wastage volume of wet mortar =0.43 + (20/100)*0.43=0.516cum
- 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
  i. Sand = 0.14 x 4 = 0.56cum (1.33tonne)
  000000000000000001 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

Estimation of materials

TABLE 1 ESTIMATION OF MATERIAL

SNO	PARTICULARS	Qty	UNITS	RATE (₹)	AMOUNT (₹)
	MATERIALS				
1	CEMENT	3.15	BAGS	350	1100
2	M-SAND	1.33	TONNES	850	1150
3	FLYASH	0.13	TONNES	1500	195
4	MESH				

5	STEEL MESH	2.85	M	90	256
6	GEOTEXTILE MESH	2.85	M	70	200
7	NAILS	350	Gm	_	70
8	WATER PROOFING AGENTS				
9	PUF	200	Ml	_	250
10	FOSROC BRUSHBOND POWDER	6	Kg	_	402
	TRANSPORTATION				
1	CEMENT	_		_	40
2	M-SAND	_		_	1200
3	FLYASH	_		_	150
	LABOURS				
1	MASON	2		650	1300
				TOTAL=	**6300**
				PROFIT & OVERHEAD @10% OF TOTAL=	449.4
				NET TOTAL=	**6800**
				GRAND TOTAL =	**6800 Rs**

EXPERIMENTAL RESULT

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

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 patch.

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.

Plastering using plastic mesh

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

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.

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. Replacing 40% of cement with fly ash provides much more benefits like decreased permeability, increased durability, reduced heat of hydration and much many.
3. Using P SAND instead of river sand promotes the saving of natural materials. Thus a sustainable building is obtained.
4. Making the finishing systems exposed to external atmosphere more safe with regarding to moisture attacks and other chemical attacks increases the durability of the entire structure and also decreases the maintenance cost.

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