Overview of Prefabricated Ferrocement Components Probably Increase The Significant Engineering Properties of The Structures

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Abstract- *Ferrocement is united material of cement mortar matrix and steel wire mess having multiple layers. In modern age many construction companies use ferrocement technology to build their structures. The uses of prefabricated Ferrocement components most probably increase the significant engineering properties of the structure and as well as reduces the cost of overall construction and completion time. Ferrocement is used in precast and as well as composite precast slabs also. Because ferrocement is a versatile material so that it can be used to construct hallow wall, hallow slabs cavity wall and other type of structure. Ferrocement serve as innovative approaches in construction and low-cost construction material*

Keywords- Ferrocement, Cement, Wire mesh, Fine Aggregate,

I. INTRODUCTION

Italian architect and engineer P L Nervi invented ferrocement in 1940. Due to its characteristics including hardness, strength, watertightness, lightweight, ductility, and environmental balance, cement has seen a surge in uses. Ferrocement may be formed into any shape or structure that is needed. Ferrocement, a structural building material with distinct properties of strength and serviceability, may be tailored to a wide range of purposes or activities. Featuring tightly wound wire mesh steel reinforcing and thick cement mortar impregnation. Wire mesh, cement, and aggregate are all readily available. A thin shell made of densely reinforced mortar, referred to as ferrocement, has been described as having the behaviour of a composite material whose properties rely on the mix of steel and dense, high strength.Small diameter bars, or skeleton steel, and wire meshes serve as reinforcement. A thin, flexible, elastic, and very strong material called ferro cement is made of multiple layers of tiny steel mesh reinforced with a cement-rich mortar. Ferrocement, a type of wire mesh-reinforced mortar, has been employed for many years in project building. Although cement and concrete are used interchangeably, there are technical variances between the two, and the definition of cement has altered since the invention of ferrocement in the middle of the nineteenth century. Although the metal steel is commonly used in ferro-cement, ferro- denotes iron in this context. Prior to the nineteenth century, the term "cement" referred to mortar, which is composed of broken stone or tile combined with lime and water to create a sturdy mortar. [4] Portland cement is the most used kind of cement today. Concrete is the design mix of cement, sand, crushed stone aggregate, and water which is poured in formwork. Mortar is a paste made of a binder (often Portland cement), sand, and water (shuttering). The original term of reinforced concrete (also known as reinforced concrete), ferro-concrete, has been around at least since the 1890s. In 1903, it was properly detailed in the Society of Engineers Journal of London[6], but it is now frequently mistaken with ferrocement. It is made of cement and ferro (iron) (cement mortar). Ferrocement is a type of thin walled reinforced concrete structure in which Portland cement mortar is used in place of concrete and small-diameter wire meshes are employed uniformly across the cross section in place of discretely positioned reinforcing bars. Wire-meshes are filled with cement mortar in ferrocement. It is a composite made of densely woven wire mesh, tightly twisted steel skeletons, and rich cement mortar. All types of civil construction, including water and soil retaining structures, building components, large-scale space structures, bridges, domes, dams, boats, conduits, bunkers, silos, and sewage and water treatment facilities, use cement. They feature a high degree of inpermeability thin walls, and are lightweight, strong, and durable.

II. ADVANTAGE OF THIS STDUY

- Ferrocement can be considered as a environmentally sound technology, protect the environment, are less pollutions are used all resources in a more sustainable manner.
- Maintenance of ferrocement work is required less.
- Construction is very easy, low weight and long-life time durability.

- Ferrocement is cost effective.
- Better resistance against earthquake.
- Fabricated into any desired shape.
- Low labour skilled required.
- Recently ferro-cement are used in some residential building and industrial building also be used
- Raw material required for the construction areeasily available at low cost.

III. MATERIAL USE

A. CEMENT

A cement is a binder, a chemical substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. Setting and hardening result from hydration, which is a chemical combination of the cement compounds with water that yields sub microscopic crystals or a gel-like material with a high surface area.Use is made of Portland Pozzolana Cement (PPC) 43 grade in accordance with IS 1489 (Part 1)-1991. Fresh cement that is consistent in consistency, devoid of lumps and foreign objects, and of the appropriate type or grade for the job should be used. Throughout the project, ordinary Portland cement of the Ultratech brand created from a single batch will be utilized. It must be clean, have a consistent consistency, and be devoid of lumps and other objects. You can also use blended hydraulic cement that complies with ASTM C59585 Type 1 (PM), IS, 1 (SM), ISA, IP, or IPA..

Specific Gravity = 3.10, Standard Consistency =34%, Initial Setting Time = 37mins Compressive Strength = 52.10N/Mm2.

Figure 1: Cement

B. FINE AGGREGATE

When the aggregate is sieved through a 4.75 mm sieve, the aggregate passed through it called as fine aggregate They are also used in the foundation of a road or even on the roof of a building. But, there are some crucial differences between fine aggregates and coarse aggregates.let us talk about them further Sand is selected. It belongs to Zone II and complies with IS 383 1970. Clean, sturdy, and devoid of organic contaminants and harmful chemicals, normal weight fine aggregate is also comparatively free of silt and clay. The aggregate is made up of fine aggregate that has been graded thoroughly and passes a 4.75 mm screen (also known as sand from Shahpur). The sand is chosen from nearby riverbeds that are devoid of biological materials and other harmful elements. When determining how much water is needed, the aggregate's moisture content should be taken into account. The most popular type of aggregate used in cement should adhere to ASTM C33 and ACI 549.1R-93 standards for fine aggregate. Sand that conforms to IS 383-1970 requirements is the typical aggregate utilized. To maintain the high strength of mortar we use optimum water cement ratio and we have to make sure that mortar should be penetrated through the steel wire mesh effectively.

Specific Gravity = 2.50, Density compacted = 1790 kg/m³, Water absorption = 1.50%, Fines = 6%.

Figure 2: Fine Aggregate

C. WATER

The usage of portable tap water that has a pH of 7.0 and complies with IS456-2000 standards is made. Potable water is suitable for use as cement curing and mixing water. Potable water refers that it is free from undesirable ingredients and matter which can be uses as a drinking water. There should be little to no organic particles, silt, oil, sugar, chloride, or acidic substances in the water. In order to reduce the pH decline of the mortar slurry, it must have a pH of at least 7. Chlorinated drinking water is suitable in place of salt water.

Figure 3: PH Value of Water

C. WIRE MESH

According to the ACI 549-IR-7, the wire mesh is made of mild steel by galvanized welding . The diameter of wire mesh may be 1mm to 13mm and the of mesh may be square grid or square mesh. Steel meshes for ferrocement include hexagonal chicken wire mesh, square woven or square welded mesh, and expanded metal mesh. Galvanized mesh filaments are available. Mesh size, ductility, production, and treatment are likely to have an impact on the final ferrocement product's properties. The most important criterion is that it must be readily handled and, if required, flexible enough to be twisted over sharp corners. There are many different types of wire meshes available practically everywhere; they typically consist of tiny wires, either woven into the mesh or welded into it. Different varieties of wire mesh are available in the market. For example, some varieties like as hexagonal chicken mesh, square mesh, welded mesh, and woven mesh. Samples are cast using hexagonal chicken mesh and square steel welded mesh, and test results are compared.

Figure 4: Wire-mesh

IV. EXPERIMENTAL WORK

Compression tests on 150x150x150 mm cubes were performed. Tests were conducted in accordance with Bureau of Indian Standards' guidelines. We perform the test of this cube after curing at 7^{th} day and 28^{th} day respectively. The most recent study demonstrates that reinforcing for ferro cement under compression results in a minimal increase in ultimate strength [24]. For which its unique distribution and relative size of the reinforcement alters its structural behaviorferrocement may be seen as reinforced concrete.

Table 1:COMPAIRE WITH REINFORCEMENT CEMENT CCONCRET

Sr. No.	Feature	RCC	Ferrocement
1	Matrix Material	Concrete cement	Rich cement motor
2	Reinforcement	Steel bars	Wire Mesh
3	Thickness	75mm minimum	25 to 50 mm
4	Casting process	Required formwork shuttering in casting	Wire mesh act as supporting motor casting
5	Composition	Heterogeneous	Nearly Homogeneous
6	Strength	Weak in tension, bond & shear	High tensile strength, superior bond & shear

V. CONCLUSION

According to the study, ferro cement wire mesh outperforms RCC in terms of load bearing capacity and deformation under load. Regardless of the kind of welded steel mesh used in rehabilitation, ferrocement plates lead to an improvement in ductile ratio and energy absorption, which raises ultimate load and also results in a nice cracking pattern without the usual spalling of concrete cover. Because of their increased stiffness and greater modulus, welded meshes exhibit lower fracture widths in the early stages of the load-deformation curve. The examined specimen becomes stiffer as a result. Because it is less Ferro-cement is a good material. Further modification in ferrocement can make it best materials in structure as compared to RCC or other type of material and also ferrocement is economical in nature and having a good

performance against lateral load. Maintenance cost of ferrocement structures is almost negligible. Considering its unique features, no doubt ferrocement will be one of the most important structural alternatives for RCC and a repair material in the future expensive, casting is simpler, and it is a lightweight material, using ferro cement concrete for repairs is beneficial. Due to the ferrocement's flexibility, thin, strong, and first crack load-rich panels may be designed, which shortens the building process. Openings for windows and doors have a greater impact on strength since they weaken the structure and cause more deflection, thus more care must be taken while designing around them. The member's ability to carry more weight improves with each additional layer of wire mesh, which would result in an increase in the deflection.

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