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Assessment of Construction Time and Cost Savings Using Ferro-cement Technology

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Abstract: ***The construction industry continuously seeks economical, sustainable, and efficient construction techniques to reduce project cost, construction duration, and material consumption. Conventional Reinforced Cement Concrete (RCC) construction involves high material usage, increased labor requirements, longer execution periods, and considerable construction waste. Ferro-cement technology has emerged as a lightweight and cost-effective alternative for selected structural applications such as wall panels, roofing systems, prefabricated components, and low-cost housing. The present study focuses on the comparative assessment of construction time and cost savings achieved using Ferro-cement technology in comparison with conventional RCC construction. A comparative analysis of RCC and Ferro-cement wall panels was carried out based on quantity estimation, cost analysis, and construction duration evaluation. The study considered material consumption, reinforcement requirement, labor involvement, curing duration, and formwork requirements for both construction techniques.***

The results obtained from the analysis indicated that Ferro-cement construction achieved approximately 56.48% reduction in construction cost and 36.36% reduction in construction duration compared to RCC construction. Significant reduction in cement consumption, reinforcement usage, and formwork requirement was also observed due to the lightweight and thin structural sections of Ferro-cement. The study demonstrates that Ferro-cement construction improves material efficiency, reduces overall project expenditure, and enhances construction speed. Therefore, Ferro-cement technology can serve as an economical and sustainable alternative to RCC construction for low-cost housing and selected structural applications.

Keywords: Ferro-cement, RCC, Cost Analysis, Time Analysis, Sustainable Construction, Lightweight Construction, Construction Management, Material Efficiency.

I. INTRODUCTION

The construction industry is one of the largest consumers of natural resources and construction materials worldwide. Conventional Reinforced Cement Concrete (RCC) construction methods involve significant consumption of cement, aggregate, steel reinforcement, formwork materials, and labor. Increasing construction cost, shortage of skilled labor, project delays, and environmental concerns have encouraged researchers and engineers to investigate alternative construction technologies that are economical, lightweight, and sustainable.

Ferro-cement is a thin composite construction material consisting of closely spaced wire mesh reinforcement embedded in rich cement mortar. Unlike conventional RCC construction, Ferro-cement uses wire mesh reinforcement distributed uniformly throughout the section, resulting in improved crack resistance, ductility, and lightweight structural behavior. Ferro-cement structures require thinner sections and smaller quantities of materials while maintaining satisfactory structural performance.

Due to these advantages, Ferro-cement technology has gained importance in applications such as:

- Low-cost housing
- Prefabricated wall panels
- Roofing systems
- Water tanks
- Repair and rehabilitation works
- Lightweight structural elements

The present study focuses on evaluating the construction time and cost savings achieved using Ferro-cement technology compared to RCC construction systems. The study mainly emphasizes construction economy, faster execution, and reduction in material usage.

The study aims to provide useful information regarding the feasibility of adopting Ferro-cement technology in modern construction practices, particularly for affordable and sustainable housing applications.

II. LITERATURE REVIEW

Several researchers have investigated the applications and performance of Ferro-cement construction technology in comparison with conventional RCC construction systems.

Kavita V. Desai and Dr. Deepa A. Joshi (2015) studied Ferro-cement as an effective alternative construction material and concluded that Ferro-cement structures provide advantages such as lightweight construction, crack resistance, durability, and reduced material consumption. The study emphasized the environmental benefits associated with reduced cement and steel usage.

Lakhan Murari and Elson John (2016) investigated prefabricated Ferro-cement wall panels and concluded that Ferro-cement elements are economical and suitable for low-rise construction. The study highlighted the reduction in dead load and overall project cost.

Ganesh A. Choughule and N. N. Morey (2016) carried out cost analysis of Ferro-cement panels for affordable housing and observed that Ferro-cement construction cost was nearly half compared to conventional construction methods.

Naaman (2000) discussed the mechanical and economic advantages of Ferro-cement structures and stated that reduced thickness and lightweight sections significantly improve construction efficiency and economy.

Shah and Kumar (2018) emphasized the sustainability aspects of Ferro-cement construction and observed that reduced material consumption and lower construction waste contribute to sustainable construction practices.

The literature review indicates that Ferro-cement technology has strong potential for reducing construction cost, project duration, and material consumption while improving construction efficiency.

III. OBJECTIVES OF STUDY

The objectives of the present study are:

1) To compare construction cost between RCC and Ferro-cement wall panels.
2) To evaluate construction time savings achieved using Ferro-cement technology.
3) To analyze material consumption and construction efficiency.
4) To assess the feasibility of Ferro-cement for economical construction applications.

IV. RESEARCH METHODOLOGY

The methodology adopted for the present study includes:

1) Literature review
2) Selection of comparative case study
3) Quantity estimation
4) Cost analysis
5) Time analysis
6) Comparative evaluation

The study compares RCC wall panel construction with Ferro-cement wall panel construction of similar dimensions and functional requirements.

A. Comparative Parameters

The following parameters were analyzed:

- Material consumption
- Construction cost
- Construction duration
- Reinforcement requirement
- Formwork requirement

B. Comparative Specifications

Parameter	RCC Wall Panel	Ferro-cement Wall Panel
Panel Size	1 m × 1 m	1 m × 1 m

Thickness	100 mm	25 mm
Reinforcement	Steel Bars	Wire Mesh
Concrete/Mortar	M20 Concrete	1:3 Mortar
Curing Period	28 Days	28 Days

V. QUANTITY ESTIMATION

A. *RCC Wall Panel*

Volume of RCC Panel

$$1 * 1 * 0.10 = 0.10 \text{ m}^3$$

Material Quantities

- Sand = 0.042 m³
- Aggregate = 0.084 m³
- Steel Reinforcement = 7.85 kg

B. *Ferro-cement Wall Panel*

Volume of Ferro-cement Panel

$$1 * 1 * 0.025 = 0.025 \text{ m}^3$$

Material Quantities

- Cement = 11.88 kg
- Sand = 0.0247 m³
- Wire Mesh = 2.5 kg

C. *Comparative Quantity Analysis*

Material	RCC Panel	Ferro-cement Panel
Concrete/Mortar Volume	0.10 m³	0.025 m³
Cement	40.32 kg	11.88 kg
Sand	0.042 m³	0.0247 m³
Aggregate	0.084 m³	Nil
Reinforcement	7.85 kg	2.5 kg

VI. COST ANALYSIS

A. *RCC Wall Panel Cost*

Item	Amount (₹)
Cement	365
Sand	76
Aggregate	134
Steel	550
Formwork	250
Labor	500
Total	1875

B. Ferro-cement Wall Panel Cost

Item	Amount (₹)
Cement	108
Sand	45
Wire Mesh	213
Formwork	100
Labour	350
Total	816

C. Comparative Cost Analysis

Parameter	RCC	Ferro-cement
Total Cost	₹1875	₹816
Cost Reduction	—	56.48%

The analysis clearly indicates that Ferro-cement construction significantly reduces construction cost due to lower material consumption, minimal formwork, and reduced labor requirement.

VII. TIME ANALYSIS

A. RCC Construction Duration

Activity	Duration
Formwork Preparation	1 Day
Reinforcement Work	1 Day
Concrete Casting	1 Day
Curing	7 Days
Finishing	1 Day
Total Duration	11 Days

B. Ferro-cement Construction Duration

Activity	Duration
Mesh Preparation	0.5 Day
Mortar Application	1 Day
Surface Finishing	0.5 Day
Curing	5 Days
Total Duration	7 Days

C. Comparative Time Analysis

Parameter	RCC	Ferro-cement
Total Construction Duration	11 Days	7 Days
Time Reduction	—	36.36%

The reduction in construction time is mainly due to:

- Reduced formwork operations
- Faster mortar application
- Lightweight material handling
- Simplified construction process

VIII. DISCUSSION OF RESULTS

The study demonstrates that Ferro-cement technology provides substantial advantages in terms of construction economy and execution speed.

The reduced thickness of Ferro-cement wall panels significantly lowered cement, reinforcement, and aggregate consumption. Since coarse aggregate is not used in Ferro-cement construction, material handling becomes easier and construction becomes faster.

The use of wire mesh instead of conventional steel reinforcement also reduced reinforcement quantity and labor requirement. Minimal formwork and simplified casting procedures contributed to faster construction completion.

The study also observed that Ferro-cement construction is highly suitable for:

1) Low-cost housing
2) Prefabricated structures
3) Lightweight wall panels
4) Sustainable construction applications

The findings confirm that Ferro-cement can effectively improve construction productivity while reducing overall project expenditure.

IX. CONCLUSION

Based on the comparative analysis carried out in the study, the following conclusions are drawn:

1) Ferro-cement construction is more economical than conventional RCC construction due to reduced material consumption and lower labor requirement.
2) Ferro-cement technology achieved approximately 56.48% reduction in construction cost compared to RCC wall panel construction.
3) Construction duration was reduced by approximately 36.36% due to simplified construction operations and reduced formwork requirement.
4) Ferro-cement construction significantly improves material efficiency and reduces structural dead load.
5) The technology is highly suitable for low-cost housing, lightweight structures, and prefabricated construction systems.
6) Ferro-cement can serve as an effective alternative to RCC construction for selected structural applications where economy and faster execution are important considerations.

X. FUTURE SCOPE

Further research may be carried out on:

1) Structural strength analysis
2) Durability studies
3) Seismic behavior
4) Large-scale Ferro-cement applications
5) Prefabricated modular construction systems
6) Carbon emission reduction analysis

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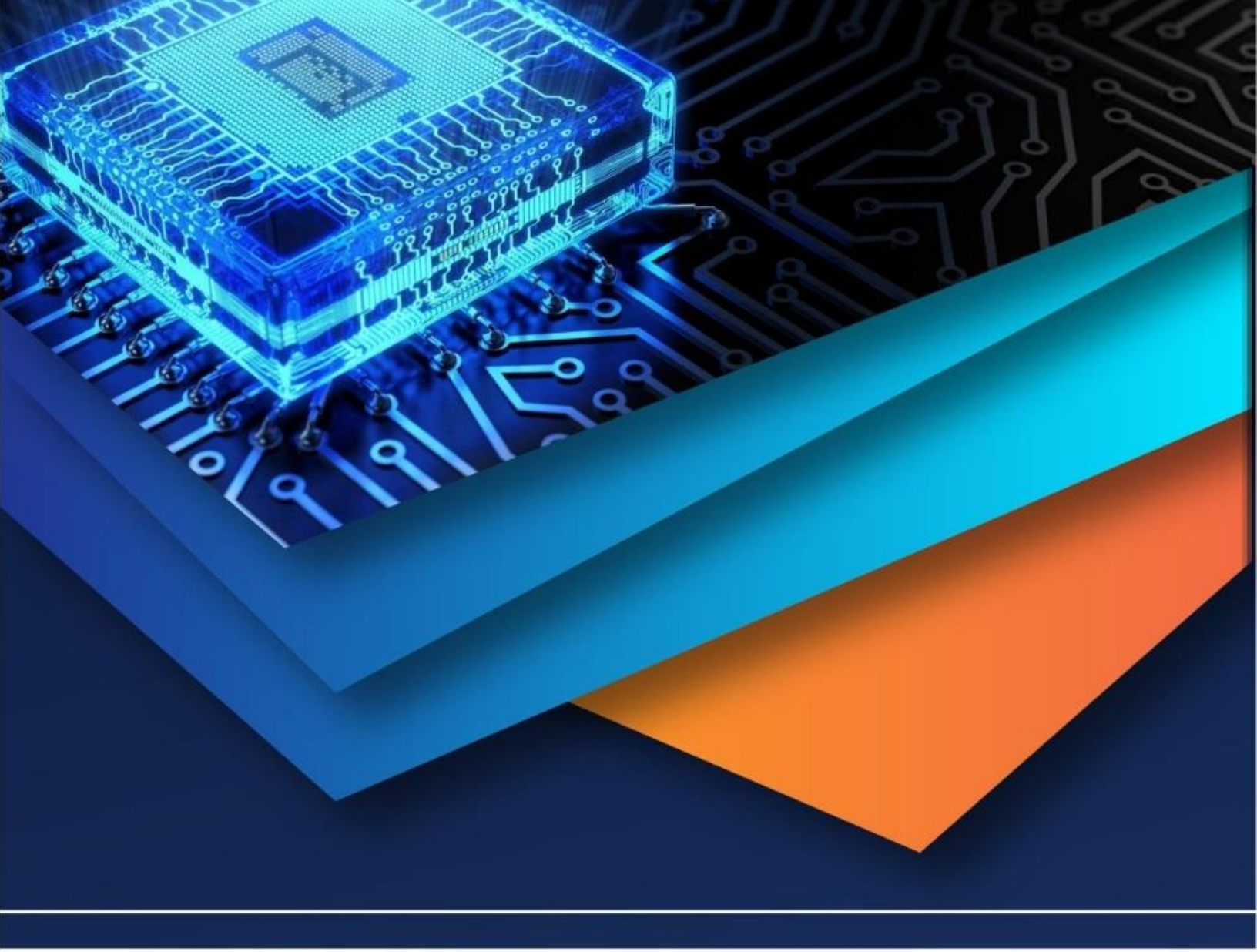

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