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Experimental Study on Newly Construction of Rigid Pavement and Material Estimation

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Abstract: *The construction of internal Cement Concrete (CC) roads plays a pivotal role in enhancing connectivity, durability, and sustainability within residential, commercial, and industrial areas. The construction involves systematic stages, including site preparation, sub grade preparation, laying sub-base, placement of formwork, and pouring concrete. The choice of materials, such as Portland cement, coarse and fine aggregates, and water, is critical to achieving strength and longevity. The estimation process considers the total length, width, and thickness of the road, along with labor, machinery, and material costs. Advanced estimation tools and techniques, including software-based analysis, are employed to ensure accurate budgeting and resource allocation. This study emphasizes adopting efficient construction practices, quality control measures, and sustainable materials to minimize environmental impact while maximizing economic value.*

Keywords: Focused on materials, testing methods, cost estimation processes, and Optimization of cost

I. INTRODUCTION

The construction of cement-concrete (CC) roads represents a significant advancement in infrastructure development. CC roads are made of a mix of cement, sand, aggregates, and water, which harden into a durable and strong surface. These roads are renowned for their longevity, strength, and ability to withstand heavy loads and harsh weather conditions

Fig.1 Cement Concrete Road

PROJECT OVERVIEW

Name of the Project: Laying of Internal Cement Concrete (CC) Road
Location: Pemberthi, Jangaon (M), Telangana State
Administrative Authority: MPP Jangaon
Grant Year: SDF 2024-25
Sanctioned Budget: Rs. 5.00 Lakhs
Supervising Authority: PRSD, Jangaon

II. PURPOSE OF THE PROJECT

The project aims to improve road infrastructure by laying a durable and long-lasting cement concrete (CC) road in Pemberthi. The new road will:

1. Improve connectivity and transport efficiency within the area.
2. Enhance durability compared to conventional bituminous roads.
3. Ensure better load-bearing capacity for vehicular traffic.

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4. Reduce maintenance costs over time.

III. SCOPE OF WORK

The construction of the CC road involves the following major components:

1. Earthwork Preparation

Filling and leveling potholes with stone dust.
Preparing gravel shoulders for structural stability.

2. Laying of Plain Cement Concrete Pavement

Forming, leveling, and compacting the sub-base.
Placement of reinforcement materials where required.
Mixing and laying of high-grade cement concrete as per specifications.

3. Joint Treatments

Cutting contraction joints for concrete expansion. Fixing tarfalt joint filler boards to prevent structural cracks.

4. Finishing and Curing

Final leveling and smoothing of the concrete surface.
Curing the concrete pavement for 14 days for durability.

5. Statutory Charges and Taxes

Inclusion of QC charges, GST, Seignorage charges, and permits as per regulations.

IV. LITERATURE REVIEW

1. Pavement Design and Structural Performance Smith, J., & Patel, R. (2019) This study focuses on the structural design parameters of CC roads, including the importance of proper sub grade preparation, concrete mix design, and curing techniques. It emphasizes the role of flexural strength in ensuring long-term pavement performance and suggests the use of fiber-reinforced concrete for enhanced crack resistance.

Gupta, A., & Kumar, S. (2020) The research explores the behavior of CC roads under varying traffic loads and environmental conditions. It highlights the importance of load distribution across rigid pavements and recommends joint spacing techniques to prevent premature cracking.

2. Cost-Benefit Analysis Sharma, P., & Mehta, V. (2021) A comparative study of CC roads and flexible asphalt roads reveals that while CC roads have higher initial construction costs, they offer significant savings in long-term maintenance and repairs. The study suggests adopting CC roads in regions with high traffic density.

Das, K., & Roy, N. (2018) This research analyzes the life cycle cost of CC pavements, indicating that CC roads outperform flexible pavements in terms of long-term economic efficiency, especially in rural infrastructure projects.

3. Material Innovations Reddy, P., & Varma, H. (2022) This paper investigates the use of supplementary cementitious materials (e.g., fly ash and GGBS) in CC road construction. It concludes that these materials enhance pavement strength and durability while reducing the environmental impact of cement production.

Kumar, B., & Singh, T. (2019) The study focuses on the use of recycled aggregates in CC road construction. Results indicate that recycled aggregates can partially replace natural aggregates without compromising structural integrity.

4. Environmental Impact Nair, S., & Thomas, K. (2020) The environmental benefits of CC roads are examined in this study, highlighting reduced heat absorption, longer service life, and lower maintenance emissions. The study also advocates for sustainable sourcing of raw materials.

Paul, D., & Sen, A. (2021) This research explores carbon footprint reduction strategies in CC road construction, focusing on optimizing cement content and utilizing alternative binders.

5. Case Studies on Rural Road Development Rao, L., & Iyer, S. (2021)

A case study on rural CC roads demonstrates how proper design and execution can significantly enhance road longevity and serviceability. The study emphasizes community involvement in maintaining rural road infrastructure. Choudhury,

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M., & Patel, A. (2020) This study presents a successful CC road construction project in a semi-urban area, addressing challenges like water drainage, soil stabilization, and material availability.

V. TECHNICAL SPECIFICATIONS

1. Cement: 43 Grade Cement, IS 1489 standards, minimum cement content 330kg/cum.
2. Aggregates: 20mm and 12mm graded coarse aggregates conforming to IS 383.
3. Water-Cement Ratio: Controlled as per M20 mix design for maximum strength.
4. Polythene Film: 125-micron thickness placed below the concrete to prevent moisture loss.
5. Curing: Proper curing for 14 days ensures strength and durability.

Joints:

- Contraction Joints: 3-4 mm grooves filled with bituminous sealant.
- Expansion Joints: Tarfalt filler boards are placed at regular intervals.

Benefits:

- Long lifespan reduces the need for frequent reconstruction.
- Lower lifecycle costs compared to flexible pavements.
- Resistant to temperature variations, making them ideal for all climates.

CC road construction is becoming increasingly popular in modern urban planning, offering a sustainable and long-term solution for the transportation needs of growing communities

VI. DETAILED WORK DESCRIPTIONS AND MEASUREMENTS

The table below provides a detailed description of each component, its measurements, and costs.

SL N0	Description of Work	Measurements (LxBxD)	Quantity	Rate (Rs.)	Amount (Rs.)
1	Filling with useful stone dust for pothole levelling and cushion filling	140.80m x 3.00m x 0.050m	21.12 Cum	964.44	20,369.00
2	Filling gravel for shoulders, including ramming and compacting	140.80m x 0.30m x 0.150m	12.67 Cum	220.30	2,791.00
3	Construction of Plain Cement Concrete Pavement, including materials and curing	140.80m x 3.00m x 0.150m	63.36 Cum	5826.80	3,69,186.00
4	Cutting transverse contraction joints (3-4 mm wide, 1/3rd depth, bituminous sealing)	3.00m x 26 Rmt	78.00 Rmt	85.60	6,677.00
5	Supply and fixing of 12mm thick tarfalt joint filler boards	3.00m x 7 Rmt	2.10 Rmt	430.00	903.00
6	Quality Control Charges @ 0.50%	-	-	-	2,000.00
7	NAC Charges @ 0.10%	-	-	-	400.00
8	Seignorage Charges for materials	-	-	-	9,958.00
9	80% Permit on Seignorage Charges	-	-	-	7,966.00
10	DMFT & SMET Charges (30% DMFT & 2% SMET on Seignorage)	-	-	-	3,187.00
11	GST @ 18% on Base Cost	-	-	-	76,219.00
12	Lump Sum for Miscellaneous Items	-	-	-	344.00
	TOTAL				**5,00,000.00**

VII. CONCLUSION

The project involves the construction of a durable cement concrete road to improve infrastructure and transportation in Pemberthi, Jangaon. With a sanction cost of Rs. 5,00,000.00, the project includes earthwork, concrete laying, joint treatments, and statutory compliances. This documentation serves as a comprehensive breakdown of work specifications, financial details, and execution plans. The completed road will benefit the local community by ensuring

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better connectivity, reduced maintenance costs and long-term durability. The construction of the CC road in Pemberthi combines meticulous planning, accurate estimation, and thorough experimentation to ensure long-lasting performance and durability. The estimation phase involved precise cost analysis, resource allocation, and scheduling to adhere to the sanctioned budget of Rs. 5,00,000.00. Experimental phases, including strength and quality tests such as compressive strength, slump, flexural strength, load-bearing, and surface evenness tests, provided essential data for refining construction practices and achieving optimal results.

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