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Comparison Between Cement Concrete Road and Concrete Paver Block

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Abstract: ***The use of proper pavement types has a great effect on expedience, sustainability, and economy of land transportations facilities. The study is aimed at comparing CC-Roads (Cement Concrete Roads) and CPB-Roads (Concrete Paver Block Roads) with respect to construction practices, constituent materials, structural performance, cost consideration, maintenance aspects, environmental issues and aesthetic appearance. Due to higher compressive strength and other properties, cement concrete roads in areas with heavy traffic loads, it is used, however, they also have longer construction period and initial cost. In contrast, roads constructed with concrete paver blocks made up of interlocking pre-cast units could be installed fast, is easier to maintain and it is more flexible to design and are more appropriate for use in urban or semi-urban areas with low to medium traffic. Furthermore, the drainage potential, recyclability and carbon footprint are taken into account providing a comprehensive comparison of both technologies. The results presented resulting useful for urban planners, civil engineers and decision -- makers to make informed choices in road construction projects, based on certain site conditions and performance parameters.***
In general, the cement concrete road is built beyond or within the village limit. But inside the village portion are the concrete paver blocks. It is observed that the cost of cement concrete road is very high compared to concrete paver. In the present study we are compared between cement concrete road and concrete paver blocks
Keywords: CementConcreteRoad,ConcretePaverRoadConstruction,CostComparison, Durability and Longevity, Climate Suitability.

I. INTRODUCTION

The use of alternative pavement materials is an important issue in the construction of modern roads, and greatly influences the durability, cost, and maintenance of road pavement. Cement concrete (CC) roads and concrete paver block (CPB) pavements are most popular type paving materials used for pedestrian and vehicular traffic movement in urban and semi urban areas, owing to its strength and performance.

Cement concrete pavements with rigid pavement design have advantages of high compressive strength, long-term performance, and ability to bear heavy loads of vehicles. They are massive highways constructed by pouring and setting concrete at the building site, and extensively reinforced. They are suitable for highways, urban roads, and industrial areas.

Concrete paver blocks as another case on the contrary are prefabricated units which are laid on well compacted sub- base and they provide the independence concerning durability, maintenance work as well as aesthetic value. Widely used in areas of low traffic such as residential streets, parking lots and footpaths, CPB pavements exhibit good drainage, can be repaired easily once in service and can be relaid without mechanical equipment. The goal of this paper is to compare these two types of pavements in detail with parameters focused around cost, construction, strength and durability, maintenance, environmental and application.

1) *Cement concrete road:-* A cement concrete roadis a rigid pavement that is built using a concrete mixture composed of cement, water, fine aggregate (sand), and coarse aggregate (gravelor crushed stone). It creates a tough, resilient surface that can endure heavy traffic and withstand various weather conditions.

Fig1.1:rawmaterial&ccroad

2) ConcretePaverBlock:- Highergrades mayexceed60MPaforindustrialuse. Complieswith standards likeASTM C936 or IS 15658. Flexural strength is generally between 3.5–5 MPa.

Goodresistanceto weathering,chemicals,oil,and UVradiationwhenproperlymanufactured. Enhanced byusing additives (e.g., silica fume, fly ash) and surface sealers.

Fig1.2 :concretepaverblock

II. LITERATURE REVIEW

According to the Indian Roads Congress (IRC: SP: 62-2004 and SP: 63-2004), cement concrete pavements are recommended for roads subjected to high traffic volumes and heavy loads due to their superior strength and rigidity. These documents also highlight that concrete roads, despite their high initial cost, prove to be cost-effective over their lifespan due to lower maintenance requirements and longer service life.[1]

1) Guptaetal.(2015):-Conductedalife-cyclecostanalysisofrigidpavementsandconcludedthat while the initial construction cost of CC roads is higher, their long-term maintenance costs are significantly lower compared to flexible pavements. They also noted that concrete pavements reduce fuel consumption due to reduced rolling resistance, contributing to sustainability.[2]

2) Kadam and Patil (2018):- Emphasize the advantages ofConcrete Paver Blocks interms ofease of construction, low labor requirements, and reduced construction time. Their research also supportstheuseofpaver blocks in lowto mediumtrafficareas, especiallyinurbanenvironments where quick accessibility and minimal disruption are required.[3]

3) PatelandShah(2020):-SuggestthatCPBroadshavealowercarbonfootprintduringinstallation duetotheirprecast natureand minimalon-sitecuring.However,theyalso cautionthattheir long- termperformance heavily depends on proper subgrade preparation and interlocking efficiency.[4]

4) MohanandKumar(2017):-Whonotedtheeconomicandenvironmentalbenefitsofusingpaver blocks in areas where frequent underground utility access is required.[5]

5) Sathish &Kumar(2016):- The construction process involves subgrade preparation, laying of a bedding sand layer, placement of paver blocks, and joint filling. Proper compaction and edge restraints are crucial to maintain structural integrity. Studies emphasize that installation quality directly affects pavement longevity and performance.[6]

6) Bhattacharjee & Pandey (2015):- (IS:15658-2006) Concrete paver blocks are typically made using cement, aggregates, water, and sometimes additives. Their shape and size can vary, but standardization improves performance and load distribution. The interlocking mechanism contributes to stability and prevents lateral movement. Research highlights the importance of compressive strength, water absorption, and abrasion resistance for long-term durability.[7]

7) Rao & Prasad (2017):- Studies by ACI and IRC have emphasized the importance of optimal water-cement ratio, aggregate gradation, and the use of admixtures to enhance strength, workability, and durability. The incorporation of supplementary cementitious materials like fly ash, GGBS, and silica fume has shown promising results in improving the performance and sustainability of concrete roads.[8]

III. METHODOLOGY

A. ManufacturingConcretePaverBlocks

1) Materials Needed:-

- Cement:OrdinaryPortlandCement(OPC)orPortlandPozzolanaCement(PPC)
- Aggregates:Sand, crushedstoneorgravel
- Water:Cleanandpotablewater
- Admixtures:Optional,toimproveworkabilityor durability
- PaverBlockMolds:Variousshapesandsizes

2) Manufacturing Process

Step 1: Batching

- Material Quantities: Determine the quantities of cement, aggregate (crushed stone/sand/grave), and water.

Step 2: Mixing

- Method: Mix the ingredients either in a mixer or with hands- depending on the quantity and availability of equipment.
- Proportion: The mix proportion for the plain concrete was 1:3:6 or 1:4:8 design mix.

Step 3: Mold Preparation

- Selection of the Molds: Choose the paver block moulds according to the shape and size of the paving blocks.
- Mold Clearing: Clean the molds to keep clear the mould.

Step 4: Casting

- Pouring the Concrete: Pour the wet concrete into the molds you prepared.
- Filling: Fill the mould as needed, make the concrete be evenly distributed.

Step 5: Vibration

- Vibrating technique: Eliminate any air bubbles and get a polished finish with a vibrating table or a hand vibrator.

Step 6: Curing

- Curing: Paver blocks shall be cured in a controlled atmosphere or with a curing compound.
- Curing: Paver blocks shall be cured for a minimum of 24 hours or as specified in the design.

Step 7: Demolding

- Demolding: Unmould the paver block as per the curing time.
- Demoulding Care: do not handle the paver blocks with care to avoid damage or breakage

B. Manufacturingcementconcreteroad

1) MaterialsNeeded:-

- Cement:OrdinaryPortlandCement(OPC)orPortlandPozzolanaCement(PPC)
- Aggregates:Coarseaggregates(crushedstoneorgravel)andfineaggregates(sand)
- Water:Cleanandpotablewater
- Admixtures:Optional,toimproveworkabilityor durability

2) Manufacturing Process

Step 1: Site Preparation

- Clear and Grade: Remove all debris from the site and grade to grade.
- Press: Press down the soil to have a firm base.

Step 2: Subgrade Preparation

- Compaction of Subgrade: Achieve compaction of subgrade to the density specified.
- Leveling The Base: The base should be levelled and made smooth.

Step 3: Prep the Base Course

- Base Course Material: Place a layer of a comparable aggregate (crushed stone or gravel) as base course material.
- Compaction: Compact the base course to one of density.

Step 4: Concrete Mixing

- Mixing of Concrete: Find Out the Mix Design of Concrete as Per the Required Properties (eg. M20, M25 etc.).
- Measurement of Materials: Measure the Proper amounts of Cement, Quantities of Aggregates, Quantities of water.
- Blending: Blend the ingredients in a pug mill or batch plant.

Step 5: Concrete Placement

- Pouring Ready Mix Concrete: Spread the poured ready-mix on the install paver base.
- Spread: Use a screed board or paver to level the concrete.

Step 6: Finishing

- Finish Surfaces: Finish surfaces with texture or broom finish.
- Curing: Cure with a curing compound or sample with wet cure methods to prevent loss of moisture.

Step 7: Quality Control

- Inspect the Material: Make sure the materials are by-spec.

Step 8: Final Checking and Testing

- Final Inspection Upon completion, examine the surface of the road for any defects or blemishes.
- Testing: Perform tests, including surface roughness and coring, to verify that the road meets the specified standards.

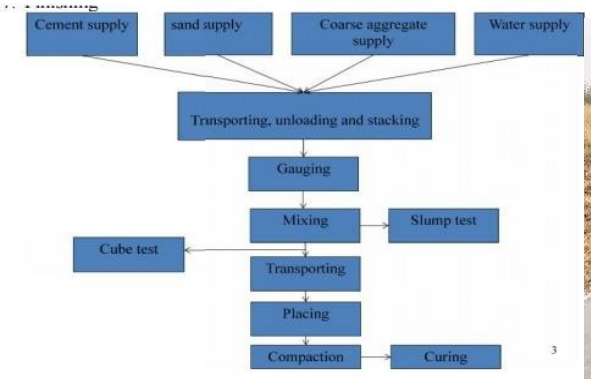

Fig.3.1.2Methodologysteps

Fig.3.2 layingcementconcrete road

IV. RESULTANDDISCUSSION

ComparativeResult studyBetween cementconcreteroadandconcretepaverblock

Table -1 (IS Code)

Sr.No.	Test	I.S.Code		Range	
		Concrete paverblock	Cement concrete road	ncrete paver block	Cement concrete road
1.	CompressiveStrength	IS:15658:2006	IRC:15-2017orIS:456-2000	20–40MPa	M30or higher
2.	Waterabsorption	IS:15658:2021	IS2386-3 (1963)	notexceed 7%	greaterthan 2%
3.	Impactvalueofaggregate	IS 2386 (Part IV)– 1963	IS 2386 (Part IV)- 1963	notexceed 20%	20%-30%

Table-2 (Test)

SrNo	Test	CementConcreteRoad	ConcretePaverBlock
1.	Compressive strength	36.7N/mm^2	29N/mm^2
2.	Waterabsorption	5.05%	3.6%
3.	Impactvalueofaggregate	26%	12.5 %
4.	Costestimation(1sq mt)	1550₹	950₹

The Compressive strength of the Cement Concrete Road was 36.7 N/mm², which was marginally more than the 29 N/mm² of Concrete Paver Blocks. Water resistance Water absorption was found to be lower in case of Concrete Paver Blocks (3.6%) when compared to Cement concrete roads (5.05%). Aggregates for CPBs showed far higher impact resistance, 12.5% of impact value, than that of the 26% for CCR. Economical perspective Concrete Paver blocks(₹950/SqM) are economicalthan Cement Concrete Roads (₹1550/SqM).

V. CONCLUSION

Both concrete paver blocks and cement concrete roads come with their own set of benefits and drawbacks, and the decision between the two relies on the specific needs of a project. Concrete paver blocks are well-suited for locations that require easier upkeep, enhanced appearance, and faster installation,suchaswalkways,parkingareas,andzoneswithlowtraffic.Conversely,cement concreteroadsprovideexceptionalstrength,longevity,andload-bearingcapabilities,makingthem more appropriate for highways, main thoroughfares, and areas with heavy traffic. While paver blocks offer greater flexibility and easier repair options, cement concrete roads deliver a long- lasting, stable solution with less frequent maintenance needed. Thus, the choice should consider factors such as traffic intensity, budget constraints, maintenance abilities, and intended use.

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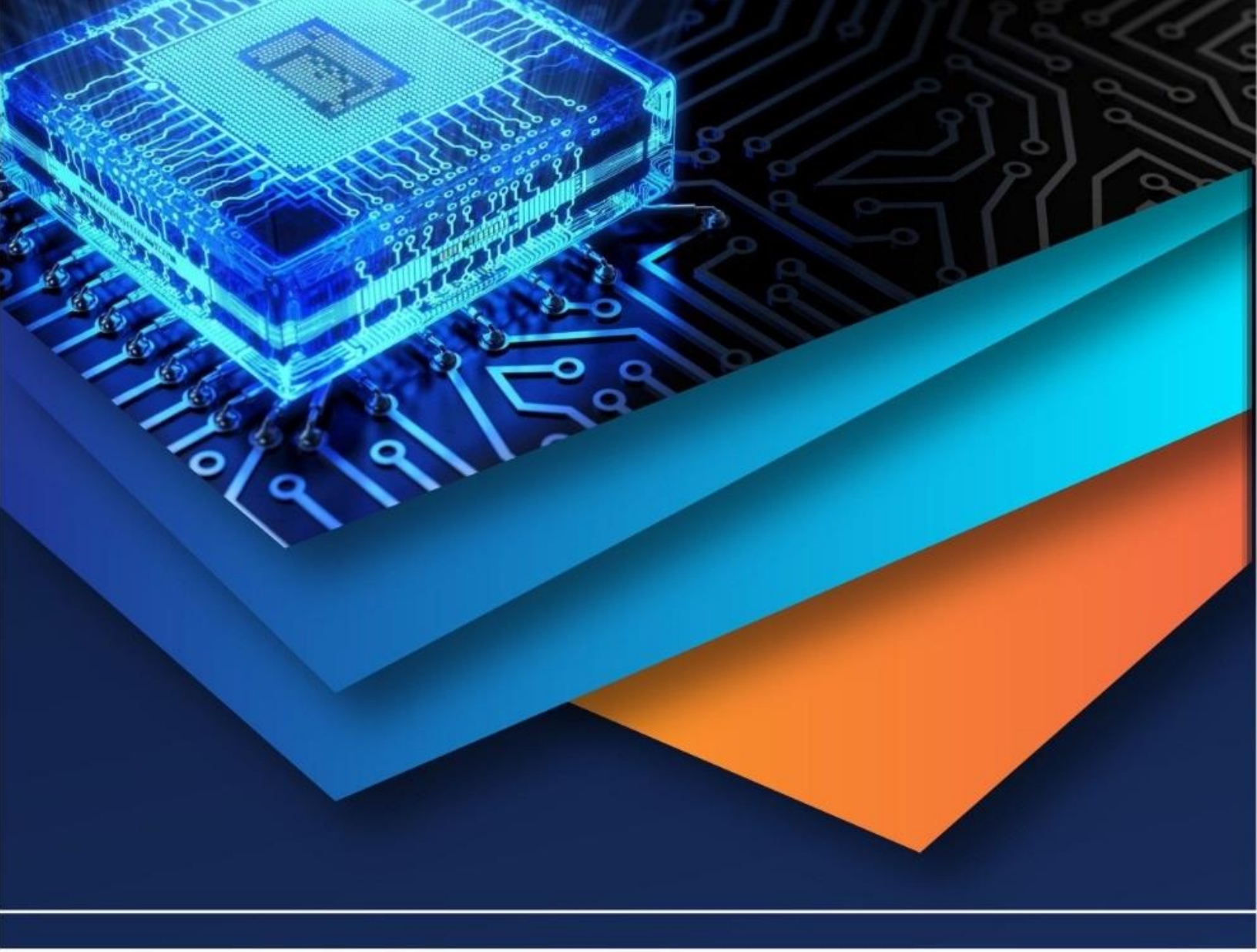

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