

A Study of Concrete Paver Block using Crumb Rubber in Interlocking

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ABSTRACT

Due to enormous need by the public, water has to be stored and supplied according to their needs. Water demand is not constant throughout the day. It fluctuates hour to hour. In order to supply constant amount of water, we need to store water. So to meet the public water demand, water tanks need to be constructed. They are grave elements in municipal water supply, firefighting systems and in many industrial amenities for storage of water. Intze type tank is commonly used overhead water tank in India. These tanks are designed as per IS: 3370 i.e. Code of practice for concrete structures for storage of liquids. Before taking up the design, the designer should first decide the most suitable type of staging of tanks and correct estimation of loads including statically equilibrium of structure particularly in regards to overturning of overhanging members shall be made. The design should be based on the worst possible combination of loads, moments and shears arising from vertical loads and horizontal loads acting in any direction. In this research by performing the analysis of Intze tank, what is deflection shape due to hydrostatic pressure then stresses, etc. which are analyzed.

KEYWORDS: water tanks, public, Environment, estimation, Fine Aggregate. Deflection, shape

I. INTRODUCTION

India is the world's largest producer of trash. Plastic makes up the largest portion of garbage produced. Rubber is the second-largest waste created, according to a recent research. 2.01 billion tonnes of municipal solid garbage are produced globally each year, of which 33% are not handled in an environmentally responsible way. Every year Urban India currently produces 62 million tonnes of municipal solid waste (MSW), and by 2030, that number is expected to rise to 165 million tonnes. Every year, 43 million tonnes of municipal solid trash are collected, yet only 11.9 million of those tonnes are cleaned before being placed in landfills. Due to the expansion of the automobile industry, excessive amounts of industrial waste are being produced, treated improperly, and released into the environment, where it has become extremely poisonous and harmful. The Government of India has taken numerous steps to address this trash, including raising money and establishing regional municipal organisations to collect the debris. Despite this precaution, garbage is nevertheless

deposited without being treated directly into a landfill. Today, the treatment of this garbage is a big concern. Natural resources are being depleted due to the rise in aggregate demand, but no action is being made. These wastes can be utilised in a variety of construction tasks to solve this issue. Due to the country's rapid population growth, trash-related issues have gotten worse over time, and the amount of garbage being processed is inadequate. As a result, health-related concerns have grown significantly. Therefore, appropriate steps should be made to treat this trash and maximise its utilisation.

The economics and infrastructure are crucial factors that must be taken into account for the country's success. For the expansion and improvement of our infrastructure, waste management must be dealt seriously. Waste that is recyclable and reusable has to be given more attention. The goal of the current study is to utilise industrial rubber waste in an experimental investigation of rubber paver blocks. The work being

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done intends to manufacture paver blocks that can support huge vehicular loads that are durable, eco-friendly, affordable, and low maintenance.

Objectives

The objectives of the present study are:

- To study the effect of utilization of crumbed rubber waste on paver blocks by partial replacement of fine sand.
- To experimentally validate the different concrete parameters such as water absorption, abrasion, tensile strength, and compressive strength as computed using interlocking paving blocks made of crumb rubber.
- To evaluate the difference in physical properties of concrete by using crumbed rubber waste.

LITERATURE STUDY

In their study **Darshan et al. (2021)** included experimental tests on rubber and aggregates used in the Paver Blocks. Nowadays in India useage of paver blocks has become important as it is durable, and if they are interlocked perfectly they can sustain the huge vehicular load for about 20-25 years. India is the largest generator of waste which includes both industrial waste and e-waste, where generation of plastic waste and rubber waste has become serious concern. The generation of rubber waste which is second largest waste generated in India and directly dumped into the landfill. The attempt has been done to utilize this rubber waste in the Paver Blocks. As the demand has increased for the use of natural aggregate, the natural resources have decreased. To overcome this problem main aim of the study is to make use of the industrial rubber waste as the partial replacement material with cement which is sustainable, durable, and environment friendly. The papers attempts to carry out the study on the use of industrial rubber waste at 5%, 10%, 15% and 20% in the production of concrete paver blocks. After preparing the specimen according to mix proportions of M40 mix, curing was done at 7 days. Then samples were taken out and their hardened properties such as

compressive strength check are carried out and strength was calculated. Results and conclusion are drawn from the test.

Salvi et al. (2021) A large number of plastic wastes have been collected from several places such as tourist and public places etc., High density polyethylene bags are collected, cleaned, and used as a replacement for cement in the manufacturing of Paver Blocks. Plastic waste is available in large quantity and hence the cost factor comes down. when we having waste plastic then we can use as reuse, recycle and reduce. Be mindful of what you do, pay attention to the items you buy, and always check yourself to see if you need it or if it comes in a package with less waste.

METHODOLOGY

A. DIMENTION OF SPECIMEN

For M30 grade concrete minimum thickness is 50mm so we use 60 mm thickness paver block with tolerance limit ± 3 mm [6-7]. Dimension of paver block is zigzag.

TABLE1: Dimension of specimen

| Length (mm) | Width (mm) | Thickness (mm) | Plane area mm ² | Aspect ratio |
|-------------|------------|----------------|----------------------------|--------------|
| 240 | 125 | 60 | 30868 | 4 |

B. CASTING OF CONTROL SPECIMEN

Generally rubber paver mould is used to cast paver block of concrete. This paver block is made in such a way that the specimen can be removed from the mould without any damage. The process we taken was by weight mix of the material hence we use design mix. after the weight mix of the ingredients is mixing in paver manufacturing. When mixed concrete placing in paver block following compaction is done. The compaction was completed manually or vibrating. A well done curing extend the strength of paver concrete. In mix proportion of concrete w/c ratio is (0.5).[8-9]

TABLE 2: Mix proportion of concrete in Kg

| | Cement | F.A. | C. A. | C.R. | Admixture |
|----------|--------|------|-------|------|-----------|
| 5% C.R. | 1 | 2.21 | 2.48 | 0.15 | 0.011 |
| 10% C.R. | 1 | 2.1 | 2.48 | 0.23 | 0.011 |
| 15% C.R. | 1 | 1.98 | 2.48 | 0.35 | 0.011 |
| 20% C.R. | 1 | 1.86 | 2.48 | 0.47 | 0.011 |
| 25% C.R. | 1 | 1.75 | 2.48 | 0.59 | 0.011 |
| 30% C.R. | 1 | 1.63 | 2.48 | 0.7 | 0.011 |
| 35% C.R. | 1 | 1.51 | 2.48 | 0.82 | 0.011 |
| 40% C.R. | 1 | 1.4 | 2.48 | 0.93 | 0.011 |

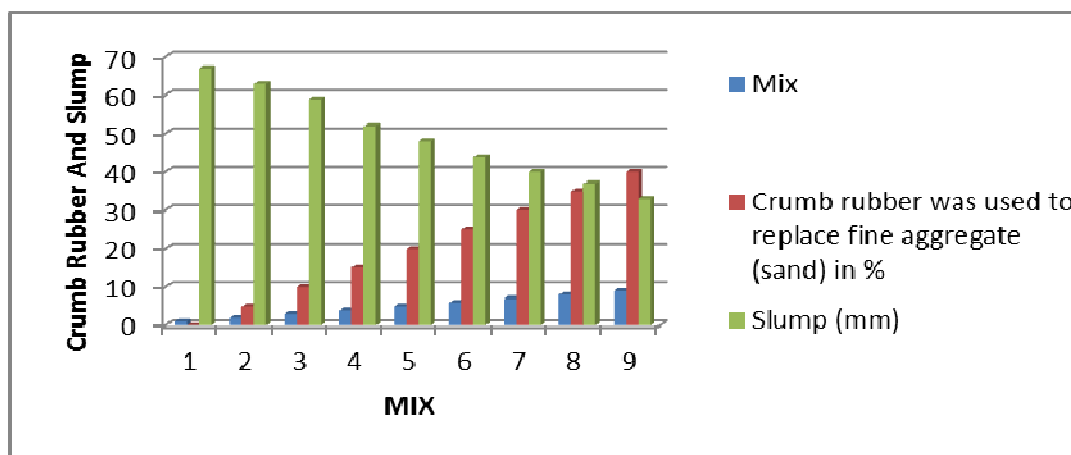
TEST AND RESULT

A. CONCRETE SLUMP TEST

The test is a type of empirical test, main ability of this test is measures the workability of a fresh concrete.

TABLE 3: Average Slump tests results for all mixes

| Mix | Crumb rubber was used to replace fine aggregate (sand) in % | Slump (mm) |
|-----|---|------------|
| 1 | 0 | 67 |
| 2 | 5 | 63 |
| 3 | 10 | 59 |
| 4 | 15 | 52 |
| 5 | 20 | 48 |
| 6 | 25 | 44 |
| 7 | 30 | 40 |
| 8 | 35 | 37 |
| 9 | 40 | 33 |

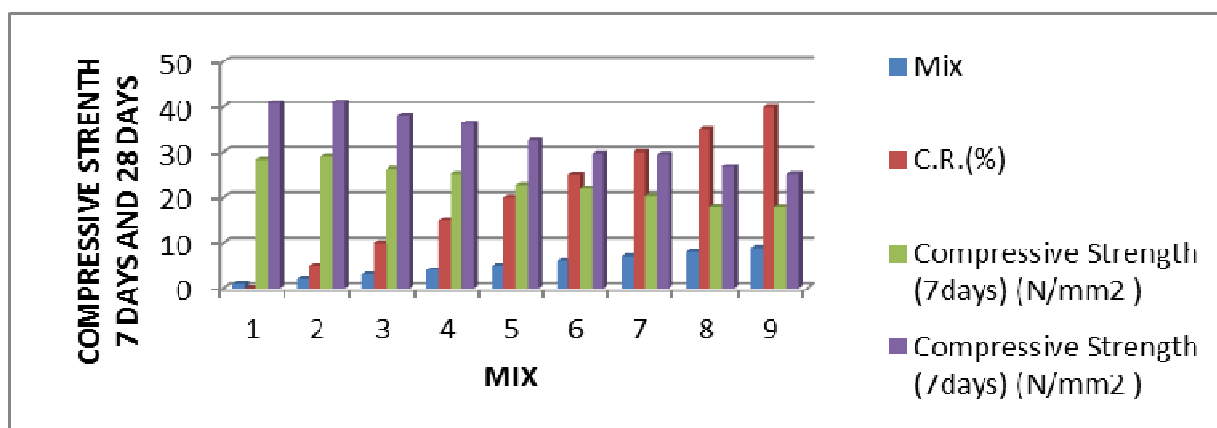


B. COMPRESSIVE STRENGTH

The test method performs to determination compressive strength to find out strength of experimental paver block specimen. According to IS:15658 (2006), number of Specimens taken for this test 3 to determine strength of paver block. The upper face of the paver block specimens shall be cover by 4 mm thick wooden plywood sheets of size larger than the test paver specimens. For this plywood 5mm Margin should be taken from all edges of the paver specimen. Load applies by UTM machine shall be without shock and continuously increasing load at a rate of 15 + 3 N/mm2/minutes. A correction factors apply according to table 5 IS: 15658.

TABLE 4: Average compressive strength at 7 days and 28 day

| Mix | C.R.(%) | Compressive Strength (7days) (N/mm ²) | Compressive Strength (28days) (N/mm ²) |
|-----|---------|---|--|
| 1 | 0 | 28.44 | 40.85 |
| 2 | 5 | 29.08 | 41.02 |
| 3 | 10 | 26.21 | 38.13 |
| 4 | 15 | 25.2 | 36.45 |
| 5 | 20 | 22.9 | 32.8 |
| 6 | 25 | 21.93 | 29.7 |
| 7 | 30 | 20.3 | 29.5 |
| 8 | 35 | 18.08 | 26.83 |
| 9 | 40 | 18.05 | 25.16 |



CONCLUSION

Based on experimental observations, the following conclusions are drawn:

- Crumb rubber in paver block given good result in the abrasion resistance in this performed test wearing depth not exceed 3.5mm for general purpose.
- The tensile strength was almost similar when the crumb rubber used up to 20%.
- Up to the Replacing 20% crumb rubber to sand interlocking paver block meet all characteristic requirement for construction work in light traffic region such paver blocks would be very useful for small street where heavy load vehicle are not allowed.
- This type of paver block is environment friendly, maintenance quickly and helps to increase ground water table. Its maintenance are also quick.

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