"COIR FIBRE USED IN PAVING BLOCK"

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ABSTRACT

Interlocking Concrete Block has been presented in India in development, 10 years prior, for particular requirement to be specific footpaths and parking areas and so on. Presently Interlocking Concrete Block Pavement is being received broadly in various uses where the traditional development of pavement utilizing hot bituminous blend (for flexible pavement) or cement concrete (for rigid pavement) is not desirable or attractive. In this paper, strength properties of paver blocks comprising of waste aggregates is presented. Coconut fibers were added in proportions of 0.1%, 0.2%, 0.3%, 0.4% and 0.5% in volume of concrete. The compressive strength, flexural strength and water absorption were determined at the end of 7 and 28 days. Test results indicate that addition of coconut fiber by 0.3% paver block attains maximum compressive strength. Test results indicate that addition of coconut fiber gradually increases flexural strengths and water absorption at 7 and 28 days. In this investigation at 0.3% of coconut fiber content effect of top layer thickness on compressive strength and flexural strength is also determined. Results show that inclusion of fibers even up to 50% of top layer thickness compressive and flexural strengths are increasing. The paper also shows the cost comparison per each block.

Keyword : - *coir fibre,thermal and sound insulation,composites blocks*

1.INTRODUCTION

The individual cellular structure is narrow and hollow, with thick walls of cellulose. It is pale in colour at immature stage but with age becomes hardened and yellow with deposition of lignin layer. Each cell is about 1mm long with diameter 10-20 μm. Generally length of fibre is found between 10 to 30 cm. Coconut coir has about 48% of lignin which adds strength and elasticity to the cellulose based fibre walls. Since lignin resists bio-degradation, high lignin content also imparts longevity to outdoor applications. Coir fibre nearly takes more than 20 years to decompose.

1.1MATERIAL SPECIFICATION

Materials:

In paver block different types of material are used. In top layer cement, semi grit, dolomite powder and pigment are used and in bottom layer cement, fine aggregate, quarry dust is used. Also at different percentages coconut fiber are used. Ordinary Portland Cement (OPC) of grade 53 conforming to IS: 10262-2009 was used for the studies. Locally available fine aggregate with a maximum size of aggregate of 20mm was used. The size of the semi grit is less than 9.5mm were used. Quarry dust particles having size less than 4.75mm was used. Dolomite powder is one mineral

with specific gravity of 2.84 to 2.86 were used. The coconut fibers of 6 mm length and diameter of 0.01 mm which was produced from Lofgren are used in the present study.

1.2 STEP BY STEP PROCEDURE OF MIX DESIGN AS PER IS 10262 (2009)

1. DESIGN STIPULATIONS
   - a) Grade designation :M-35
   - b) Type of cement : OPC 53 grade conforming to IS
   - c) Maximum nominal size of aggregate : 12.5 mm
   - d) Minimum cement content : 240 kg/m^3 (Moderate)
   - e) Maximum water cement ratio :0.6 % - IS 456-2000
   - f) Workability : 13 mm
   - g) Exposure condition : Moderate (PCC)
   - h) Method of concrete placing : Manual
   - i) Degree of supervision : good
   - j) Type of aggregate : Recycled crushed aggregate
   - k) Maximum cement (OPC) Content :
   - l) Chemical admixture content : Hardener (Laqour)

2. TEST DATA FOR MATERIALS
   - a) Cement used : OPC 53 grade
   - b) Specific gravity of cement : 3.15
   - c) Specific gravity of :
     - I. Coarse aggregate : 2.12
     - II. Fine aggregate : 2.63
   - d) Water absorption
     - I. Coarse aggregate : 5.21 %
     - II. Fine aggregate
   - e) Free (surface) Moisture
     - I. Coarse aggregate : Nil
     - II. Fine aggregate : Nil
   - f) Sieve analysis
     - I. Coarse aggregate :
     - II. Fine aggregate :Conforming to grading Zone I of Table 4 IS 383

3. TARGET STRENGTH FOR MIX PROPORTIONING

$$f'_{ck} = f_{ck} + 1.65\ s$$

Where

f'_{ck} = Target average compressive strength at 28days

f_{ck} = Characteristics compressive strength at 28days

s = Standard deviation.

From table 1, Standard deviation, s = 5 N/mm^2

Therefore, target mean strength = 35 + 1.65 X 5 = 43.25 N/mm^2

4. SELECTION OF WATER CEMENT RATIO :

0.36<0.38…..OK

SELECTION OF WATER CONTENT :

From Table 2 of IS 10262 - 2009

Water content for 12.5 mm maximum size of aggregate = 202.5 kg

3% reduction for slump range 0-25. Therefore water content = 196.42 kg

As hardener is used in casting of paver blocks, water content was reduced by 20%.

Therefore, water content = 157.14 kg

5. CALCULATION OF CEMENT CONTENT

Cement content = water content / water to cement ratio

= 157.14 / 0.36

= 436.5 kg/m^3.

Minimum cement content for moderate condition = 240+30

= 270 kg/m^3

- From table no 6 of IS 456- 2006

6. PROPORTION OF VOLUME OF COARSE AND FINE AGGREGATE CONTENT

From table 3 of IS 10262 – 2009, volume of coarse aggregate corresponding to 12.5 mm size aggregate and fine aggregate (Zone I) for water-cement ratio of 0.36 = 0.48.

In present case water – cement ratio is 0.36. Therefore volume of coarse aggregate is requiring to be increased to decrease the fine aggregate content. As water cement ratio is lower by 0.10, the proportion of volume of coarse aggregate is increased by 0.02. Therefore, corrected proportion of volume of coarse aggregate for water-cement ratio of 0.36 = 0.51.

Volume of fine aggregate content = 1-0.51 = 0.49

7. MIX CALCULATIONS

The mix calculations per unit volume of concrete shall be as follows:

a) Volume of concrete = $1m^3$

b) Volume of cement = $\frac{\text{Mass of cement}}{\text{Specific gravity of cement}} \times \frac{1}{1000}$

$= \frac{436.5}{3.15} \times \frac{1}{1000}$

$= 0.138\ m^3$

c) Volume of water = $\frac{\text{Mass of water}}{\text{Specific gravity of water}} \times \frac{1}{1000}$

$= \frac{157.14}{1} \times \frac{1}{1000}$

$= 0.157\ m^3$

d) Volume of chemical admixture =

For bottom layer = $0.0002\ m^3$

For top layer = $0.00005\ m^3$

e) Volume all in aggregates = [a – (b + c + d)]

= 1 – (0.138 + 0.157 + 0.00025)

= $0.705\ m^3$

f) Mass of coarse aggregate = e x volume of coarse aggregate x specific gravity of coarse aggregate x 1000

= 0.705 x 0.51 x 2.12 x 1000

= 762. 246 kg

g) Mass of fine aggregate = e x volume of fine aggregate x specific gravity of fine aggregate x 1000

= 0.705 x 0.49 x 2.63 x 1000

= 908.533 kg

8. FINAL MIX PROPERTION

Cement	:	436.5 kg
Water	:	157.14 kg
Fine aggregate	:	908.533 kg
Coarse aggregate	:	762.246 kg

2. CASTING OF PAVER BLOCK

2.1 Casting of paver block

As per our concept of making paver blocks from debris we selected the suitable site for the collection of construction and demolition waste. After selecting particular site we collected the material and material was crushed as per our convenience and to suitable size as per IS specification. The crushed material was tested as per standard recommendation and the result were obtained as mentioned above. Further the required material was transported to the sponsored site which was going to provide us the further required material and also helped us to cast the blocks on their site with their equipment's. The steps of casting in detail are explained below.

1. Equipment:-
   a) Hammer
   b) Los Angeles Abrasion Testing Machine.
   c) IS sieves(12.2mm,10mm,4.75mm,2mm,600micron)
   d) Pans
   e) Trowel
   f) Weighing balance
   g) Rotating Drum Mixer
   h) Table Vibrator
   i) Rubber Moulds
   j) Other small Equipments.

2. Collection of material:-
   The material was selected from the site after visiting various sites. A suitable site was selected which will fulfil our material requirement. A site near Bibvewadi, Pune was selected which comprised of G+3 RCC structure and which was 10 years old. It was demolished for construction of new building. After then the material was transported for crushing purpose
3. Crushing Of Material:-
   The material from the site was transported and crushed. The crushing process of materials was carried out manually with help of hammer and mechanically with the help of Los Angeles abrasion Apparatus. It was tedious crushing process as the substantial amount of material was crushed by manual method by us, but the same can be made easily if we go with machine process. The material crushing was made was as per the required size for the blockS
4. Sieving Of Materials:-
   After crushing process material was obtained in various sizes. So as per the requirement of paver blocks we require three types of aggregates which are,
   1. Coarse aggregates (passing from 12mm IS sieve and retained on 6mm IS sieve)
   2. Fine aggregates :
      a) Grit (passing from 4.75mm IS sieve and retained on 2mm IS sieve)
      b) Crush sand (passing from 2mm IS)
5. The material was sieved for the above criteria and different materials were separated as per mix design proportion. The material where then taken to the site for further process. Crushing Of Material:- Casting Of Paver Blocks :-
   As this is sponsored project we received the materials from the site and we casted the paver blocks by compression moulds machine on the site itself with the help of their guidance and equipmrnt's .

3. CONCLUSIONS

The Compressive strength of cubes are increased by10% with addition coir fibre. As the fiber content is increased from 0.1% to 0.5% there is an increase in the water absorption from 0.95% to 6.01% compared to the concrete paver block at 28 days.

4. ACKNOWLEDGEMENT

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