STUDY ON THE EFFECT OF PET BOTTLE FIBRE IN CONCRETE

MEMBERS
LHAKPA WANGMO THINGH TAMANG
KARMA TSHERING DARJAY
KARMA SANGAY PHUNTSHO
TSHERING WANGMO
UGYEN WANGCHUK
PHUNTSHO NAMGYAL
OVERVIEW

- Background
- Aim
- Objectives
- Materials Used
- Preparation of Fibre
- Sample Casting and Curing
- Sample Testing and Results
- Result Analysis
- Application
- References
BACKGROUND

- Plastics being durable, light, easily mouldable and adaptable to different user requirements have become an essential material.
- However, excessive use and generation of plastic waste have become serious threat to the environment and the human health.
- Plastic wastes deteriorates aesthetic value of a place and the fertility of useful land.
Contd..

- Extraction of natural aggregates which comprise of 60-75% of the concrete volume causes heavy environmental impacts (Soloago, 2014).

- Excessive extraction of fine aggregate has major impact on rivers, deltas and aquatic ecosystem.

- Incorporating plastic waste in concrete is one of the solutions to problems faced in disposal of plastic garbage and also the extraction of natural aggregates.
To incorporate plastic waste as concrete aggregate and to minimize the generation of waste from PET bottles.
OBJECTIVES

To study the feasibility of its application.

To obtain optimum percentage of aggregate replacement.

To develop a model.

To study the change in mechanical properties of concrete.
MATERIALS USED

Plastic fibres

Natural coarse aggregate
CONT.

Cement

Natural fine aggregate
PREPARATION OF PLASTIC FIBRE

Collection of raw material → Rinsing → Drying → Shredding
SAMPLE CASTING

Sample

Plastic fibre partially substituting fine aggregate.
(0%, 0.75%, 1% & 1.25%)

1. Cubes (150x150x150mm)
2. Beam (500x100x100mm)
3. Cylinder (D=75mm,
H=150mm)

Curing age = 7, 14, 28 days

Total samples = 108 samples
PREPARATION OF SAMPLES

Casted samples
CONT.

Curing
SAMPLE TESTING AND RESULTS

- Compression Test
- Tensile Test
- Flexural Test
COMPRESSİON TEST

✧ No. of cube samples casted 36
COMPRESSION TEST RESULTS

Compressive strength for 7 days

- N: 17.72 N/mm²
- F.75: 13.87 N/mm²
- F1: 13.50 N/mm²
- F1.25: 16.56 N/mm²

Compressive strength for 14 days

- N: 22.12 N/mm²
- F.75: 17.42 N/mm²
- F1: 18.88 N/mm²
- F1.25: 22.31 N/mm²

Sample identity

Compressive Strength in N/mm²
Compressive strength for 28 days

![Bar chart showing compressive strength in N/mm² for samples N, F.75, F1, and F1.25. The values are 23.38, 23.08, 23.29, and 23.33 respectively.](image-url)
TENSILE TEST

- No. of cylinder samples casted 36
TENSILE TEST RESULTS

Split Tensile Strength of 7 days

Tensile strength in N/mm²

Sample identity

0 1 2

N 1.72 F.75 1.81 F1 1.77 F1.25 1.42

Tensile strength for 14 days

Tensile strength (N/mm²)

Sample identity

0 1 2

N 2.29 F.75 1.73 F1 1.91 F1.25 1.79
FLEXURAL TEST

- No. of beam samples casted 36
FLEXURAL TEST RESULTS

Flexural strength for 7 days

<table>
<thead>
<tr>
<th>Sample identity</th>
<th>Flexural strength in N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>2.73</td>
</tr>
<tr>
<td>F.75</td>
<td>1.78</td>
</tr>
<tr>
<td>F1</td>
<td>3.74</td>
</tr>
<tr>
<td>F1.25</td>
<td>2.82</td>
</tr>
</tbody>
</table>

Flexural strength for 14 days

<table>
<thead>
<tr>
<th>Sample identity</th>
<th>Flexural strength in N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>2.74</td>
</tr>
<tr>
<td>F.75</td>
<td>3.44</td>
</tr>
<tr>
<td>F1</td>
<td>3.93</td>
</tr>
<tr>
<td>F1.25</td>
<td>4.66</td>
</tr>
</tbody>
</table>
Flexural strength for 28 days

Sample identity

Flexural strength in N/mm²

N  4.02
E.75  3.44
F1  3.56
F1.25  4.67
WEIGHT COMPARISON

Nominal and PET fibre replaced concrete cubes

<table>
<thead>
<tr>
<th>Sample identity</th>
<th>weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>8.5</td>
</tr>
<tr>
<td>F.75</td>
<td>8.44</td>
</tr>
<tr>
<td>F1</td>
<td>8.38</td>
</tr>
<tr>
<td>F1.25</td>
<td>8.38</td>
</tr>
</tbody>
</table>
REDUCTION IN WEIGHT

- F.75 → 0.71%
- F1 → 1.41%
- F1.25 → 1.41%
RESULT ANALYSIS
Optimum Replacement Percentage

- **Compressive strength**: maximum for 1.25% replacement of fine aggregate.

- **Split tensile strength**: 0.75% is found to be the maximum percentage of aggregate replacement but 32% reduction in the strength was observed at 28 days.

- **Flexural strength**: 1.25% replacement of was found reasonable for flexural strength of concrete.

- Therefore, it is observed that 1.25% is the optimum percentage of fine aggregate replacement.
Changes in Mechanical Properties of Concrete

- Partial replacement of natural aggregate with plastics reduces the weight of concrete.
- Spalling was observed in conventional concrete during failure while bulging in transverse direction was observed in fibre replaced concrete.
- Incorporating plastic fibre in concrete reduces brittle failure of concrete.
- Incorporating plastic waste in concrete leads to sustainable use of plastic waste.

- For 1 m³ of concrete, 4.08 kg of PET fibres was used as partial replacement for fine aggregate which is a substantial reduction of plastics waste.
APPLICATIONS

- Pavement slab for rigid pavement
- Drain cover
- Concrete pipes
- Concrete blocks
IMPLEMENTATION

Drain cover
REFERENCES


IS: 10262-2009, Concrete Mix Proportioning-Guidelines, Bureau of Indian Standards, New Delhi, 2009
😊 Thank you😊