ROYAL UNIVERSITY OF BHUTAN

COLLEGE OF SCIENCE AND TECHNOLOGY

STUDY ON THE EFFECT OF PET BOTTLE FIBRE IN CONCRETE

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OVERVIEW

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

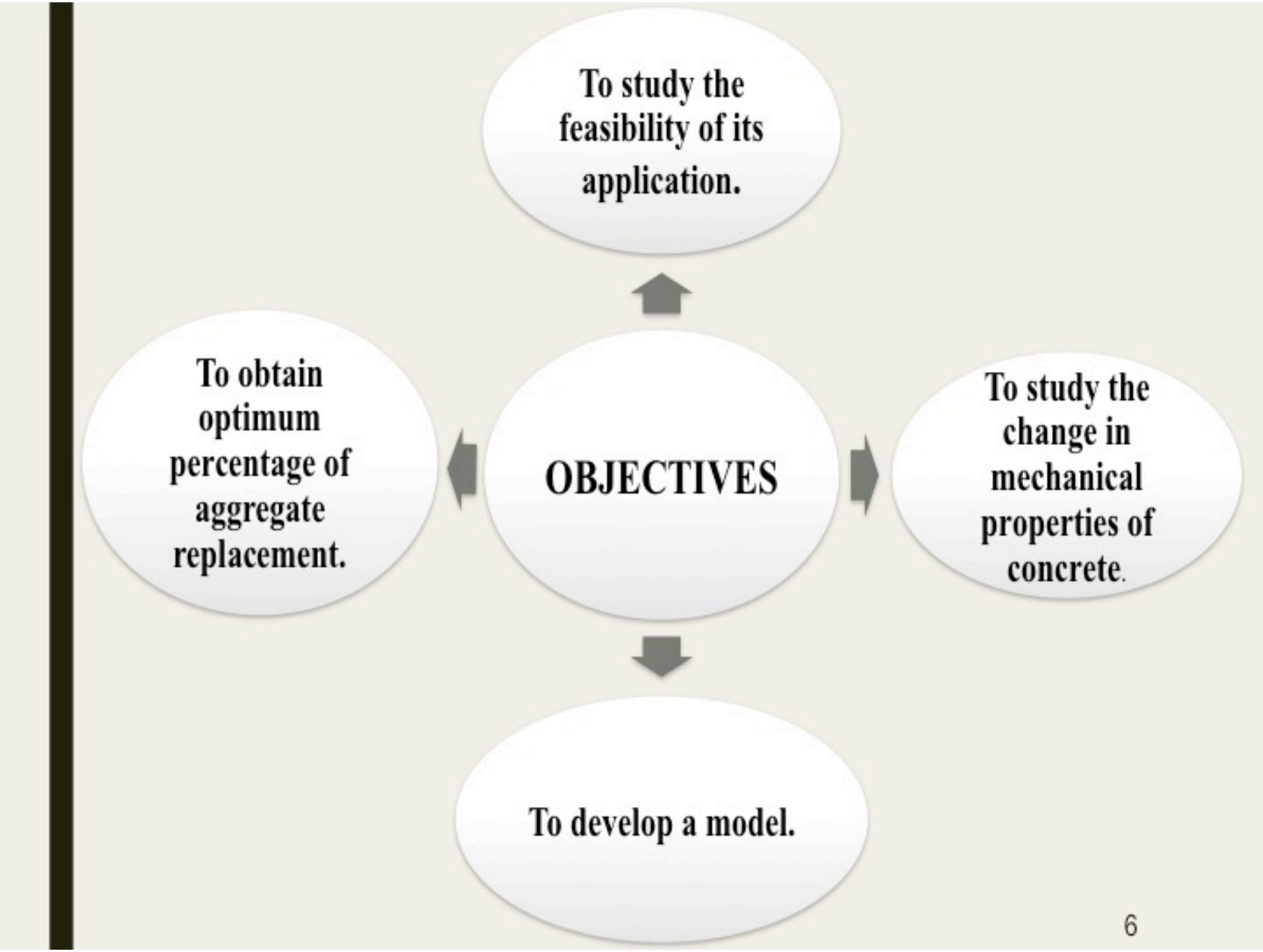
BACKGROUND

- 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.


To study the feasibility of its application.
To obtain optimum percentage of aggregate replacement.
OBJECTIVES
To study the change in mechanical properties of concrete.
To develop a model.

MATERIALS USED

Plastic fibres

Natural coarse aggregate

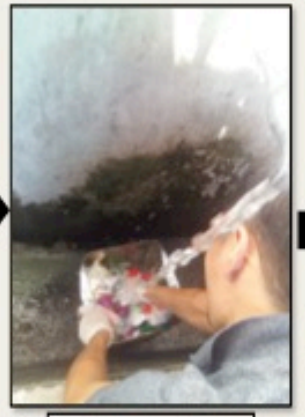
CONT.

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

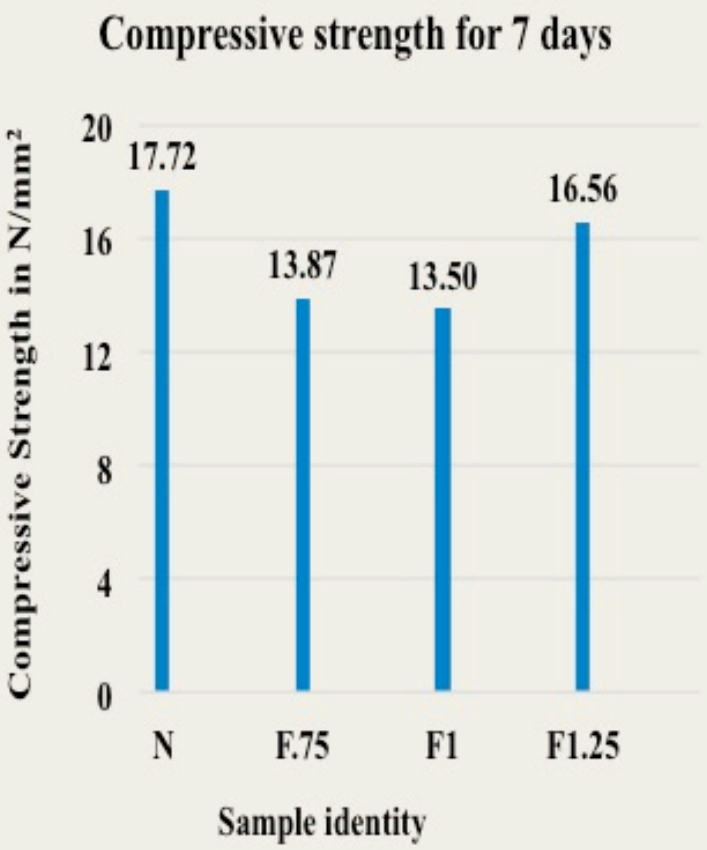
SAMPLE TESTING AND RESULTS

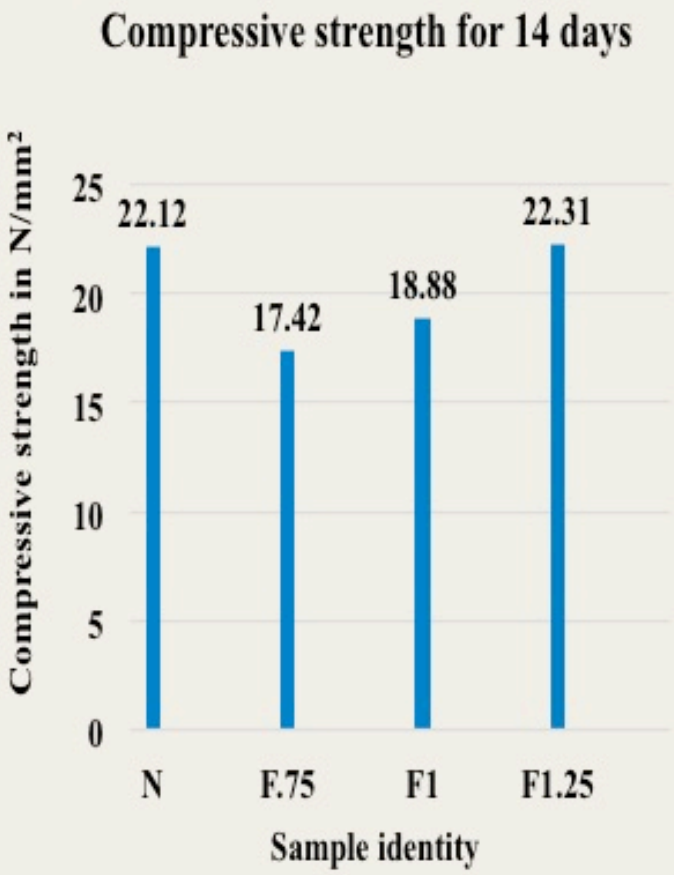
- Compression Test
- Tensile Test
- Flexural Test

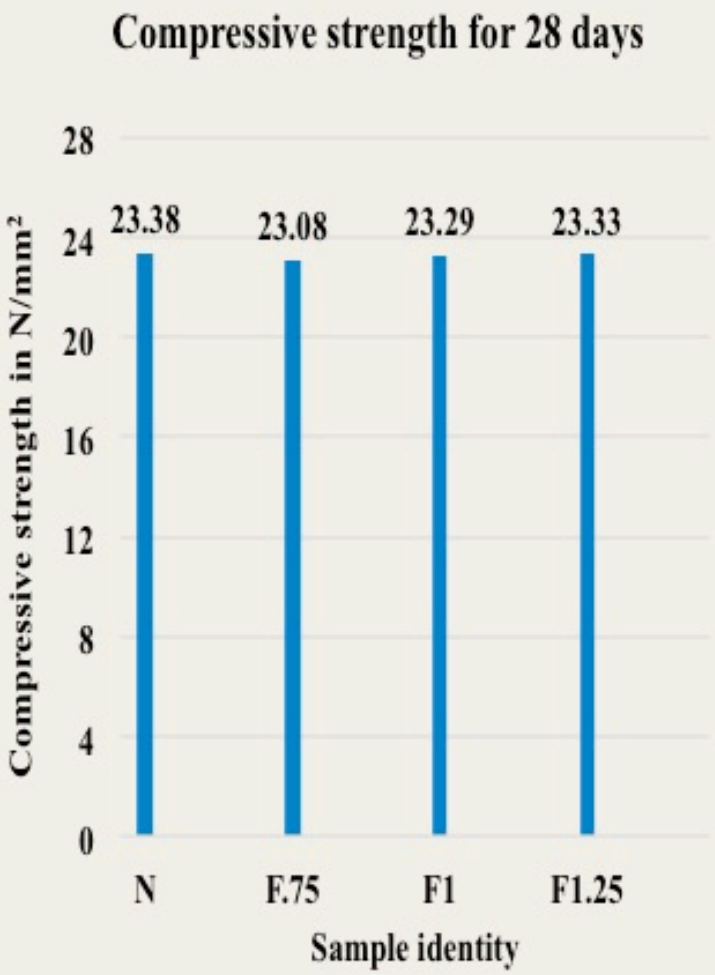
COMPRESSION TEST

- No. of cube samples casted 36

COMPRESSION TEST RESULTS



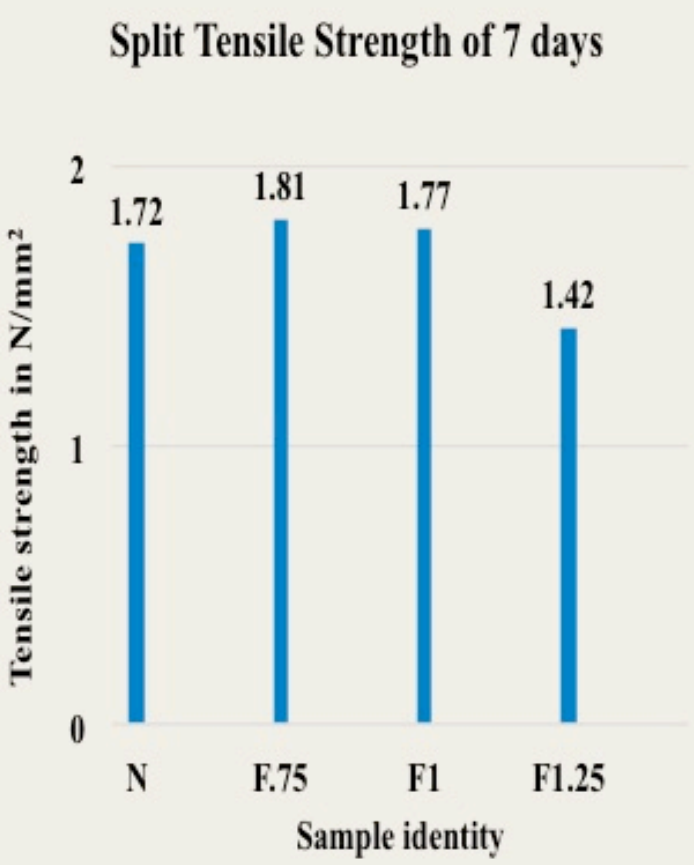


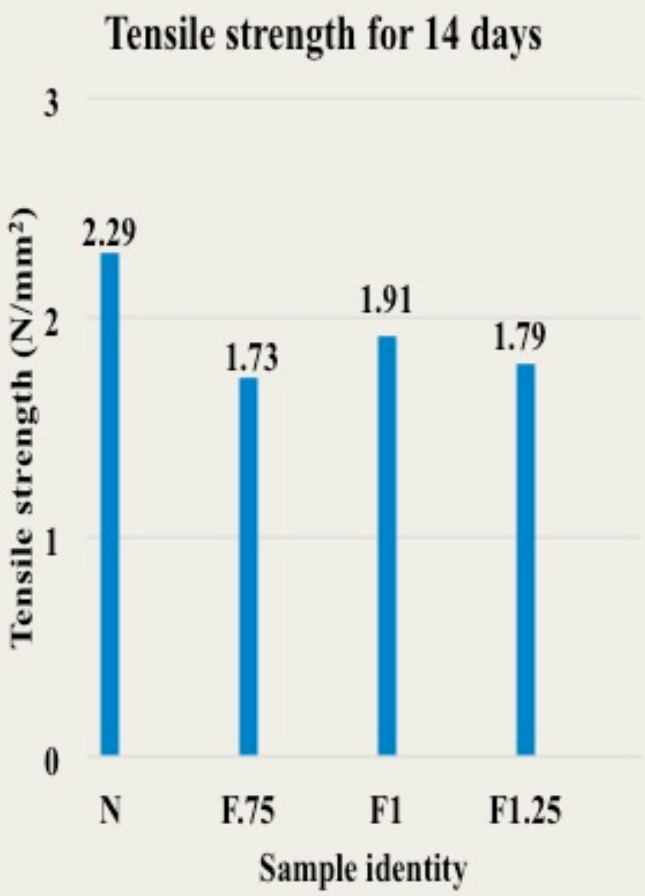

Compressive strength for 28 days
Compressive strength in N/mm²
28
24
20
16
12
8
4
0
23.38
23.08
23.29
23.33
N
F.75
F1
F1.25
Sample identity

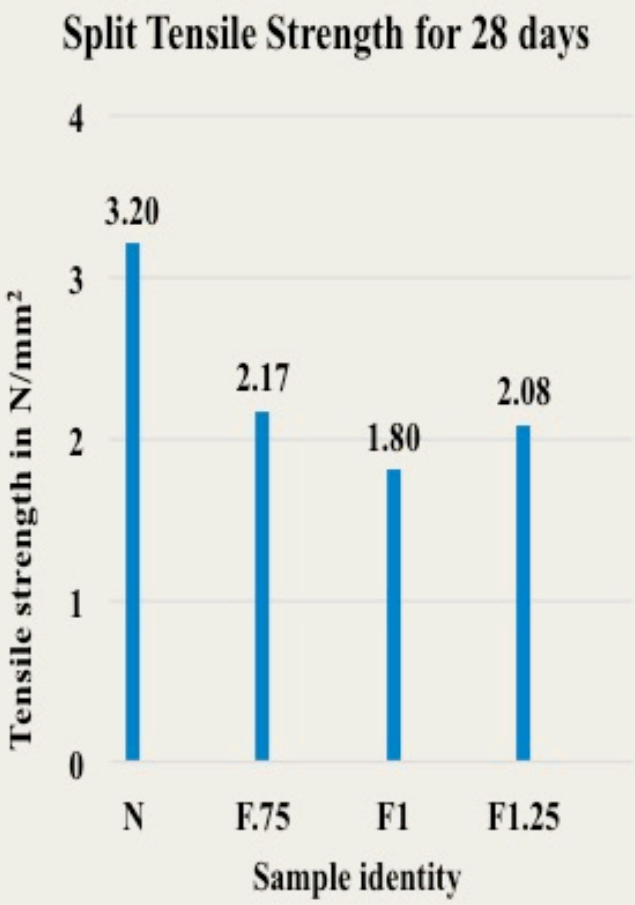
TENSILE TEST

- No. of cylinder samples casted 36

TENSILE TEST RESULTS



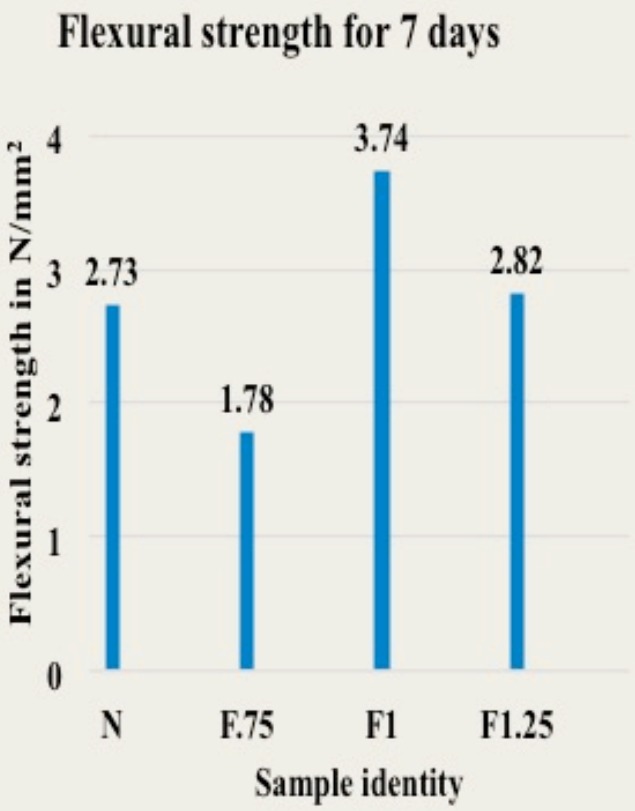


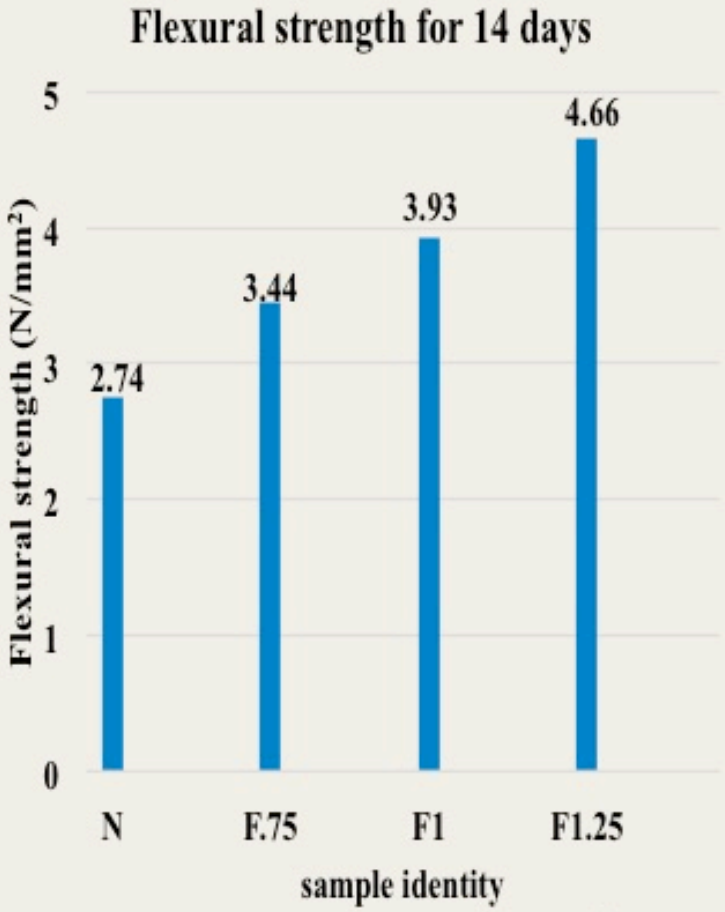

Split Tensile Strength for 28 days
4
3
2
1
0
3.20
2.17
1.80
2.08
Tensile strength in N/mm²
N
F.75
F1
F1.25
Sample identity

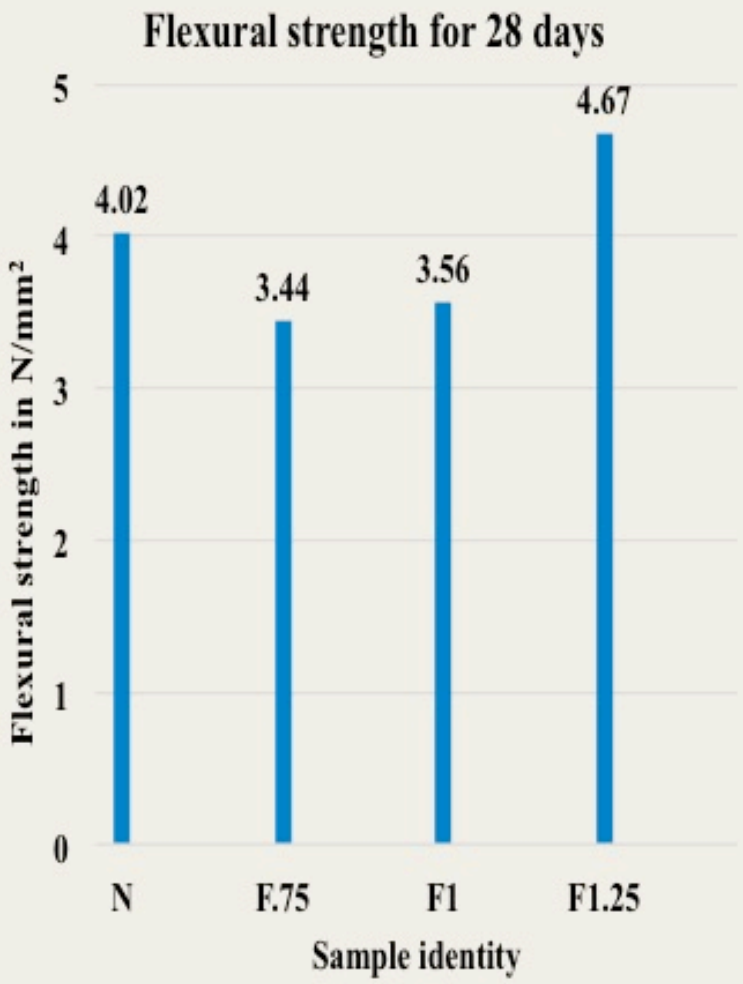
FLEXURAL TEST

- No. of beam samples casted 36

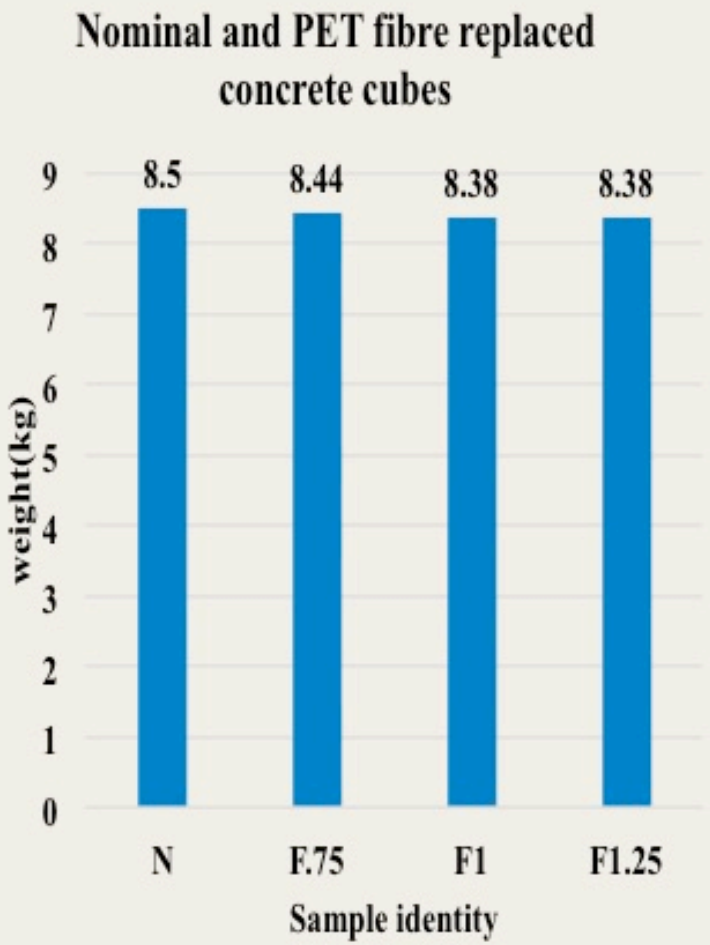
FLEXURAL TEST RESULTS






Flexural strength for 28 days
Flexural strength in N/mm²
5
4
3
2
1
0
4.02
3.44
3.56
4.67
N
F.75
F1
F1.25
Sample identity

WEIGHT COMPARISON



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 m^3 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: 383-1970, *Specification for coarse and fine aggregate*, Bureau of Indian Standards, New Delhi, 1970.

IS: 516-1959, *Methods of test for strength of concrete,* Bureau of Indian Standards, New Delhi, 1959.

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

CONT.

Soloaga, I. S. (2014). The use of recycled plastic in concrete. An alternative to reduce ecological footprint. *Journal of Construction, 13*(3), 19-26.

☺ Thank you ☺