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EXPERIMENTAL INVESTIGATION OF SLAB BY TESTING ON STATIC LOADING AND DYNAMIC LOADING

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INTRODUCTION :

1.1 GENERAL

Past three decades, The researches gave much attention to seismicity and the usage of composite materials as the replacement of constituent materials in concrete. The most Common types of composites are Polymer matrix composites, Metal matrix composites, Ceramic matrix composites.

2. METHODOLOGY

2.1 GENERAL

In this chapter, the brief description of the methodology and the sequence of the works to be carried out in this complete duration of project are presented.

2.2. CEMENT

Cement is a material that has cohesive and adhesive properties in the presence of water. These consist primarily of silicates and aluminates of lime obtained from limestone and clay.

The chemical composition and fineness of cement can influence the age -strength relation of concrete quite significantly. The early strengths of cement are generally attributed to higher content of tri-calcium silicate (C_3S) than di-calcium silicate (C_2s).

Table 1 Chemical Composition of Portland Cement

Chemical Ingredients	Content in Percentage
CaO (Lime)	60 – 67
SiO_2 (Silica)	17 – 25
Al_2O_3 (Alumina) & $CaSO_4$ (Calcium Sulphate)	3- 8

Fe_2O_3 (Iron Oxide)	0.5 – 6
MgO (Magnesia)	0.1 – 4
Alkalies	0.4 - 1.3
Sulphur	1 – 3

2.3. AGGREGATES

Processed coarse aggregates are obtained by quarrying solid rock and then crushing it to a suitable size and grading. Aggregate properties greatly influence the behavior of concrete, since they occupy about 75% of the total volume of concrete.

2.3.1. FINE AGGREGATE

Sand is the granular form of silica (SiO_2). The grains vary in size and shape and they may be rounded or angular. Good is that whose mineralogical composition approaches to pure quartz. Natural sands are weathered off and worn out particles of stone and rock. In India, river sand is used as a fine aggregate.

2.3.2. COARSE AGGREGATE

Coarse aggregate for structures consist of materials within the range of 5mm to 150 mm size. Rocks having water absorption value greater than 3% or specific gravity of less than 2.5 are not considered suitable for mass concrete.

2.4. WATER

Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required has to be looked into very carefully.

Table 2. Comparison of Properties of Various Types of Thermosetting Resins

PROPERTY	EPOXY	ACRYLIC	POLYESTER	POLYURETHANE
Weatherability	Poor	Excellent	Excellent	Good
Corrosion Resistance	Excellent	Good	Very Good	Very Good
Chemical Resistance	Excellent	Very Good	Good	Very Good
Heat Resistance	Very Good	Good	Good	Very Good
Impact Resistance	Excellent	Good-Fair	Good	Very Good
Flexibility	Excellent	Good-Fair	Very Good	Very Good
Adhesion	Excellent	Good-Fair	Excellent	Very Good

Polyurethane foam structural core can be combined with glass-reinforced or graphite-reinforced composite laminates to produce a lightweight, strong, sandwich structure. The properties of polyurethane are high strength, high modulus of elasticity,

2.5. TWARON-REINFORCEMENT PHASE

Aramid fibers are a class of heat-resistant and strong synthetic fibers. They are used in aerospace and military applications, for ballistic-rated body armor fabric and ballistic composites, in bicycle tires, and as an asbestos substitute. The name is a portmanteau of "aromatic polyamide".

They are fibers in which the chain molecules are highly oriented along the fiber axis, so the strength of the chemical bond can be exploited. In general the properties of aramid are good resistance to abrasion, good resistance to organic solvents, nonconductive, no melting point,degradation starts from 500 °C, low flammability, high Young's modulus, high tenacity, low creep.

Table 3. Comparison of Properties of Various Types of Glass

PROPERTY	E-GLASS	CARBON	ARAMID
Strength(Mpa)	2350-4600	2600-3600	2800-4100
Elasticity modulus(Gpa)	73-88	200-400	70-190
Strain at failure (%)	2.5-4.5	0.6-1.5	2.0-4.0
Density(g/ cm^3)	2.6	1.7-1.9	1.4

3. TESTING OF MATERIALS

3.1 COMPRESSIVE STRENGTH OF CEMENT

The compressive strength of hardened cement is the most important of all the properties. Therefore, the cement has to be tested for its strength at the laboratory before it is used in important works.

CALCULATION

Compressive strength = Load/Area

= 134 x 1000 /4.98

= 27MPa

3.2. STANDARD CONSISTENCY TEST ON CEMENT

For finding out initial setting time, final setting time and strength, a parameter known as standard consistency has to be found.

3.3 pH TEST OF WATER

In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. Pure water has a pH very close to 7.

pH value of sample taken = 7.6

3.4 SIEVE ANALYSIS

Sieve analysis is an operation of dividing a sample of aggregate into various fractions each consisting of particles of the same size.

4. PROCEDURE

i. In assembling the mould for use, the joints between the sections of the mould are thinly coated with mould oil and a similar coating of mould oil is applied between the contact surface of the bottom of the mould and the base plate in order to ensure that no water escapes during the filling.

ii. The interior surfaces of the assembled mould is also required to be thinly coated with mould oil to prevent adhesion of concrete.

iii. A steel bar 16 mm in diameter, 0.6 m long and bullet pointed at the lower end serves as a tamping bar.

iv. The test cube specimens are made as soon as practicable after mixing and in such a way as to produce full compaction of the concrete with neither segregation nor excessive laitance.

v. The concrete is filled into the mould in layers approximately 5 cm deep.

vi. The standard tamping bar is used for hand compaction and the strokes of the bar are distributed in a uniform manner over the cross-section of the mould. The number of strokes per layer required to produce the specified conditions vary according to the type of concrete.

vii. After the top layer has been compacted the surface of the concrete is brought to the finished level with the top of the mould, using a trowel. The top is covered with a glass or metal plate to prevent evaporation.

viii. The test specimens are stored in place free from vibration, in moist air of at least 90% relative humidity.

ix. The specimen centrally placed on the location marks of the compression testing machine and load is applied continuously, uniformly and without shock.

x. The type of failure and appearance cracks are noted and that load is taken as collapse load.

Fig 1 : Compression Test on Concrete

Calculation

7 Days Compression Strength

Cube Weight = 8120 Kg

Load Applied (Normal) = 252 KN

Load Taken On Synthetic Fibre = 281 KN

Cube Size = 150x150mm^2
Area Of Cube = 22500 mm^2

Compression Strength = load / Area

Normal Concrete =252 / 22500

= 11.11 N/mm^2

Polyurethane = 281 / 22500

= 12.48 N/mm^2

14 Days Compression Strength

Cube Weight = 8180 Kg

Load Applied (Normal) = 416 KN

Load Taken On Polyurethane = 464 KN

Cube Size = 150x150mm^2
Area Of Cube = 22500 mm^2
Compression Strength = load / Area

Normal Concrete = 416 /22500

= 18.48 N/mm^2

Polyurethane = 464 / 22500

= 20.62 N/mm^2

28 Days Compression Strength

Cube Weight = 8210 Kg

Load Applied (Normal) = 540 KN

Load Taken On Synthetic Fibre = 596 KN

Cube Size = 150x150mm^2

Area of Cube = 22500 mm^2

Compression Strength = load / Area

Normal Concrete = 540 / 22500

= 24.1 N/mm^2

Polyurethane = 596 / 22500

= 26.4 N/mm^2

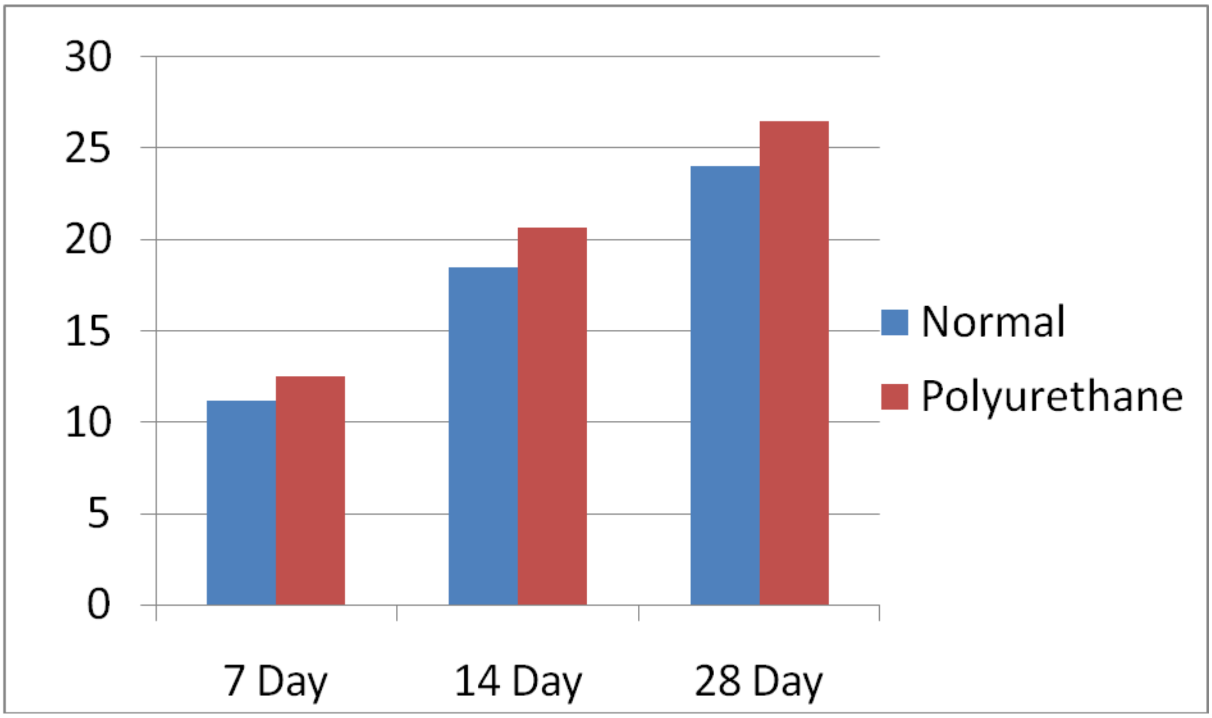

Figure 2. Comparison of Compressive Strength

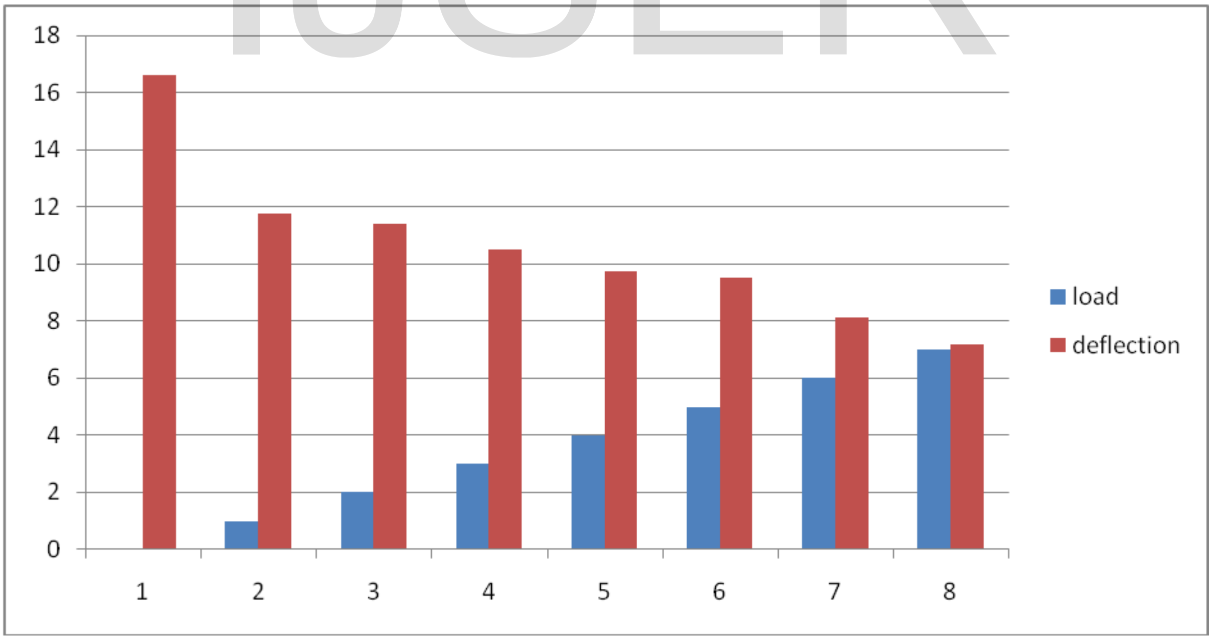

Figure 3. Load & Deflection Chart

5. Static load test

SI.NO	LOAD (TONNE)	DEFLECTION (MM)
1	0	16.6
2	1	11.74
3	2	11.4
4	3	10.5
5	4	9.74
6	5	9.5
7	6	8.12
8	7	7.2

Table 1. Load & Deflection

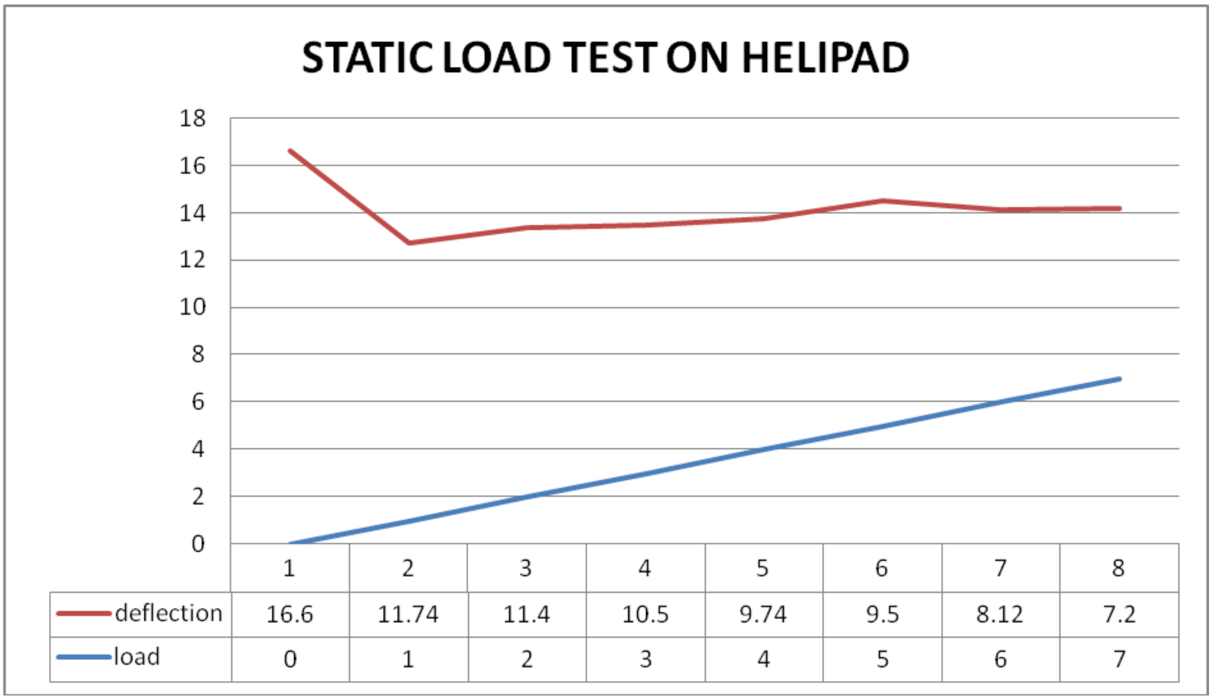

Figure 4. Static Load Test on Helipad

6. CONCLUSION

1. The experimental study shows that the addition of Polyurethane in concrete shows various properties of concrete in terms of compressive strength, split tensile strength, flexural strength.
2. Polyurethane replacing concrete can be used in light weight concrete as it decreases the density of the concrete.
3. Compressive strength of the concrete decreases as increase in replacement of Polyurethane.
4. From the literature review and experimental studies it is concluded that despite of decrease in strength of concrete there is a very high demand of concrete so it can be used as a partial replacement.
5. Light weight Polyurethane concrete can be used for the architectural use.

7. REFERENCES

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