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Experimental study of polymer concrete Modulus of Elasticity and Poisson's ratio

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Abstract - ***Purpose of this paper is to find out effect of polymer Rheomix 141 which is styrene-butadiene co–polymer latex on different M 30 grads of cement with changing the percentages. To analyzes the result in static modulus of elasticity and passion ratio. The results are collected on both way according to ASTM 469 and Indian slandered method. From above got more strength of concrete due to use of polymer in concrete polymer have good property to achieve more strength than regular concrete. Modulus of elasticity is an important parameter used for the structural assessment and retrofitting of concrete structures Portland cement concrete has been successful in many applications. However, since the 1960s technological investigations concerning modification of concrete by polymer material have been conducted .the polymer concrete is reported to have better mechanical properties than its counterpart, Ordinary Portland cement concrete***.

Key Words: *Modulus of elasticity, Poisson ratio, compressive strength*,

1. INTRODUCTION

In 1999, an earth wake of magnitude of 7.4 on the Richter scale hit the Maramara region at the north-west of Turkey, killing more than 17000 people and damaging thousand of buildings. There are several reasons behind these losses and damage, but one of the reason was low construction quality of the structure [1]. Within 30 years, another major earthquake is expected in the Istanbul metropolitan area and studies indicate that retrofitting of many structures is urgently needed [2]. Currently school, hospitals, bridges and some public buildings are being retrofitted. Of the several factor, modulus of elasticity of concrete is one of the most important structural assessment and retrofitting of a structure it is used as an input parameter for the structural analyses [3]. Modulus of elasticity of concrete can be estimated using this expression given the code. For the existing structure. The main objective of the study was to provide more data on the modulus of elasticity of concrete. In the study, an excremental program was carried out

2. EXPERIMENTAL SETUP

The main purpose comparison between theoretical formula of Indian standard and experimental procedure of ASTM 469.Accourding to Indian standard method prepared several sample of cylindrical concrete mould in M 30 grad of concrete the size of sample diameter 75mm, 150mm height according to Indian slandered the proportion is follow ,

Table no- 1

Cement	Fine Aggregate	Course Aggregate	Water
383.2	546	1343.7	191.6
1	1.425	3.5	0.5

The properties of Rheomix 141 is styrene-butadiene co–polymer latex are follows

Table no-2

Property	Test result
Composition	Milky, white styrene butadiene copolymer latex specifically made for use with Portland cement.
Specific gravity	1.01
PH value	10.50
Mean particle size	0.17micron
Butadiene content	40% by wt of RHEOMIX 141

In the above proportion we added 3, 6 and 9 percentages of polymer by weight of cement every set of cylindrical concrete sample respectively.

2.1 APPARATUS

1. Testing machine- Use the compression testing machine (CTM/UTM) I has capacity range from 60 to 100 tones.

2. Compressometer – For the determining the modulus of elasticity use bonded or unbounded sensing devise. That measures to the nearest 5 millionths the average deformation of two diametrically opposite gages lines, each parallel of axis. And each centered about mid height of the specimen.

3. Extensometer- If the Poisson ratio is desired, the transverse strain shall be determined of unbounded extensometer capable in diameter of measuring to nearest 0.635µm the change in diameter at the mid height of the specimen.

3. PROCEDURE

The compressive test was performed using constant loading rate of 1.25 mm/min according to ASTM C 469-94. (11). In order to obtain Poisson's ratio, one specimen of each batch was also instrumented with two bolted strain gages mounted circumferentially at diametrical opposite point at the specimen mid-height. Longitudinal and circumferential strains were recorded continuously using a data logger with continuous acquisition system. Compressive strength, chord modulus elasticity in compression and Poisson's ratio were calculated using the following equations.

$$\sigma_c = \frac{F}{A}$$

where, σ_c is the compressive strength; P is the maximum load recorded; and A is the cross- section area of cylinder specimens

$$E = \frac{S2 - s1}{\varepsilon 2 - 0.00005}$$

Where E is the chord elasticity modulus; s2 is the stress corresponding to 40% of maximum load; s1 is the corresponding to a longitudinal strain of 50 millionths; and $\varepsilon 2$ is the longitudinal strain produced by s2.

$$V = \frac{\varepsilon t2 - \varepsilon t1}{\varepsilon 2 - 0.00005}$$

Where V is the Poisson's ratio and $\varepsilon t2$ and $\varepsilon t1$ are the transverse strains at mid height of the specimen produced strain at mid height of the specimen produced respectively by s2 and s1. The Indian standard theoretical formula for calculated the modulus of elasticity are follow,

$$E = 5000\sqrt{fck}$$

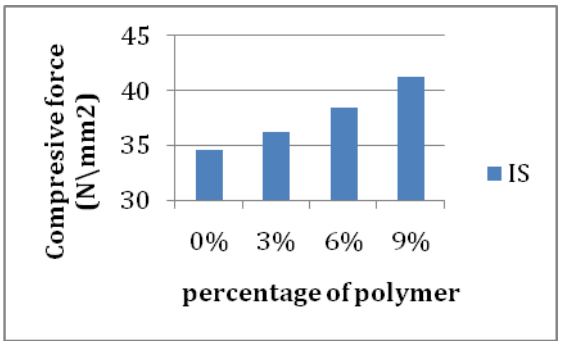
Where fck is the compressive strength of concrete this result in N/mm^2 . This value is 20 percent less or more according to the Indian stranded

Fig no 1 - polymer and concrete mixture.

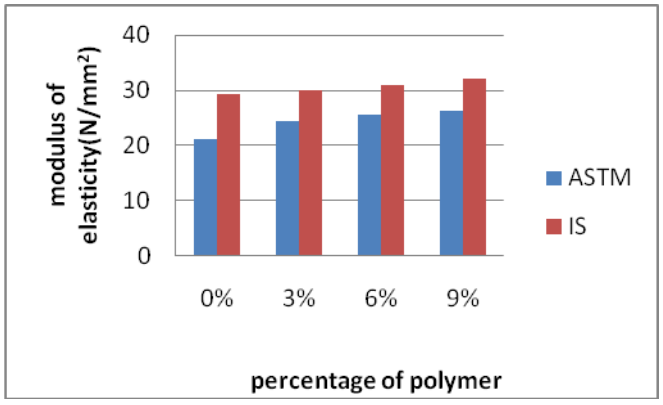
fig no 2- Experiment set up of the with stain indicator

4. RESULT AND CONCLUSION

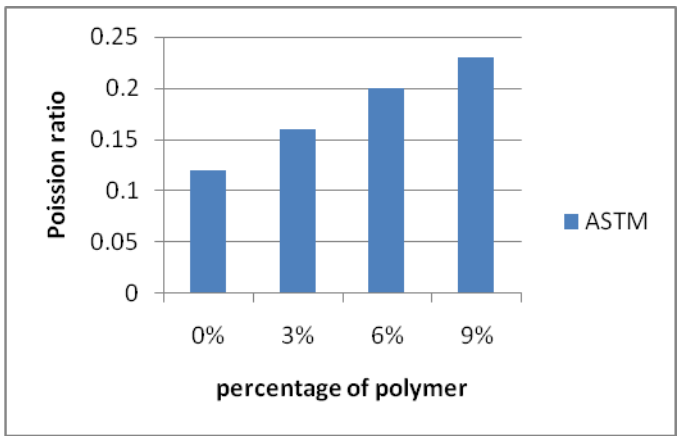
The all specimen are tested with proper mixing , compaction is done and all sample are proper curried at 28 days under water as method of Indian standard codes. The result are follow



In that sample the mix three level of percentage of polymer by weight of cement and its gives the modulus of elasticity in theoretical IS method and ASTM experimental procedure



According to procedure the use of extensometer the longitudinal and lateral strain are calculated. This strain helps to calculate the passion ratio are follows



5. CONCLUSIONS

The following conclusion can be drowning from the experimental result of this study:

(1) Compressing fresh concrete remarkable increases the compressive stress and modulus of elasticity of the concrete.
(2) The increases in the compressive strength of concrete. Then it increases the value of modulus of elasticity. Fig shows that the 9 percent polymer is add in the concrete the modulus of elasticity value is more.
(3) Comparison of ASTM and IS that the, Indian standard code shows the high value of modulus of elasticity as well as Poisson ratio. but the experimental work are gives the accurate result.
(4) When the increases the polymer content in the concrete mixture the its affect the workability and strength of concrete.

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