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The Finite Element Analysis of G+6 Steel Frame with and without Bracing Elements Performed using Staad

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ABSTRACT

Nowadays the objectives of civil engineering is to design a building's lateral resistance to wind and earthquake forces are to provide a system of shear walls, diaphragms, and interconnections to transfer lateral loads and overturning forces to the foundation, to prevent building collapse in extreme wind and seismic events and to provide adequate stiffness to the structure for service loads experienced in moderate wind and seismic events. In modern life styles people requirements also modern and different to fulfill and also scarcity of land to construct preferring high raised building with proper facilities.

The high raised multi-storey buildings having height is more than 30 meters. These using for different purposes like residential, educational institutes, commercial, healthcare and storage power generation etc. from the past few years the many structures are damaged and collapsed by earthquake, it shows that need of seismic adequacy for the existing building structures.

The behavior of high rise structural systems is dominated by lateral forces induced due to wind and earthquake actions. Hence the structural system consists of elements introduced mainly to resist lateral forces. In such cases stiffness rather than strength dominates the design of tall buildings. The steel braced frame is one of the structural systems used to resist lateral loads in $multi-storied buildings. Bracings ar usually provided to increases stability and stiffness of the structure under lateral loading. This also reduces lateral displacement significantly.

KEYWORDS: *structure, load, stiffness, Force, steel frame, braced element, foundation and building*

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INTRODUCTION

GENERAL

Light weight concrete is an important and versatile material in modern construction. It has many advantages of dead load reduction, high thermal insulation; increase the process of building and lowers haulage and handling cost. It also lowers power consumption for extreme climate condition due to possessing property of low thermal conductivity.

Nowadays lightweight concrete are commonly used in precast and prestressed components. Light weight concrete offers design flexibility and substantial cost savings by providing less dead load, improves seismic structural response, better fire rating, decreased storey height, smaller size structural members, lower foundation cost, and less reinforcing steel. The concrete made with light weight concrete exhibit lower thermal conductivity than of normal weight concrete. Therefore light weight concrete provide more efficient fire protection than dense aggregates as it is less liable to spalling and has a higher thermal insulation.

OBJECTIVE OF THE STUDY

Light weight concrete has many applications in concrete and construction industry now a days The fly ash and the thermocol used in concrete as a partial replacement of cement to reduce the dead load of the building and cost of construction. the mix design of concrete was done according to the Indian standard guidelines as per IS 10262-2009 and IS 456-2000 for M25 grade concrete. In the present investigation which is based on experimental study, where the quantity of cement is replaced with different percentages of fly ash such as 0%, 35%,are kept constant and the percentage of replacement of thermocol of 0.6% &0.9%. The compressive tests have to be conducted for 1, 14, & 28 days the split tensile tests have and relative costs of fly ash and thermocol were compared with the cement material.

- To understand the light weight concrete and level of application in construction industry.
- To reduce the effect of pollutant in the environment
- To compare the strength & density of LWC with normal concrete
- To study the influence of partial replacement of fly ash & thermocol in concrete
- To ascertain the proper mix at which LWC can have low density with good compressive strength
- To study the properties of LWC with the incorporation of EPS and SCM.

SCOPE OF THE STUDY

In this study an attempt has been made to compare the conventional concrete and light weight concrete using mix M25. Light weight concrete is made by partial replacement of cement and fine aggregates by fly ash and thermocol. In this fly ash which is waste material which is obtained by ash produced in small dreck flecks by the burning of powdered coal .and thermocol which is also a waste material which is a rigid clear thermoplastic polymer of styrene, From the literature review, replacing of cement by fly ash and thermocol will helps to reduce the dead load of the building, density of the building& the cost of construction.

CHARACTERISTICS OF MATERIALS

INTRODUCTION

The present section focuses on the study of characteristics properties of the basic materials used in concrete. The properties of the discussed materials includes chemical composition, specific gravity, water absorption, fineness, initial setting time, standard consistency and bulk density.

METHODOLOGY

- In the present study, we have used concrete cube moulds of size (150*150*150) mm for the compression test & cylindrical moulds of size 150*300 mm for split tensile strength.
- The specimens are casted for M25 grade concrete where cement is partially replaced by fly ash (35%) and thermocol (0.6% to 0.9%).
- Hand mixing is use for concrete mixing.
- After casting required specimens, the specimens will be cured by the normal water at the room temperature.
- After curing the cubes are subjected to compression test for 7, 14, and 28 days & cylinders are subjected to split tensile strength test for 28 days by using compression testing machine at the rate of loading of 140 Kg/cm^2 or 14 N/mm^2/min as per IS 516-1959.

RESULTS AND DISCUSSIONS

COMPRESSIVE STRENGTH OF CONCRETE

Normally the compressive strength of the concrete is a measure of quality of concrete for a particular mix. The results of the compressive strength of cubes are tabulated in table 6.1.

Table 6.1 Compressive Strength of the concrete cubes at 7, 14, & 28 days

PERCENTAGE OF REPLACEMENT		COMPRESSIVE STRENGTH (Mpa)		
FLY ASH	THERMOCOL	7 DAYS	14 DAYS	28 DAYS
0%	0%	20.44	21.55	22.66
30%	0.6%	17.33	18.22	19.11
30%	0.9%	14.22	14.66	15.55

DESCRIPTION OF THE MATERIALS USED

This section presents the description of the various materials used in this experimental investigation. The material used in the present study are cement, fine aggregate, coarse aggregate, fly ash, thermocol and water.

CEMENT

Cement is a well known binding material which has occupied an indispensable place in the construction works. Cement is a finally powdered material which by itself is not a binder, it develops the binding property as a result of hydration. Cement is called a hydraulic product, the hydraulic products are stable in aqueous environment (water resistance)

FINE AGGREGATE

Normally concrete is prepared by using the mix design. In this study altogether different combination of materials are used in the preparation of concrete. Concrete which has reported in this study is prepared with the different combination of the selected ingredients to suit the requirement has a concrete. The sand is one of the main ingredients use in the preparation of concrete. Fine aggregates are basically the sand that has been obtained from the land or marine environment. The fine aggregate generally consist of the natural sand or crushed stone.

COARSE AGGREGATE

The coarse aggregate is defined as an aggregate most of which is retained on 4.75 mm IS sieve. The coarse aggregate are formed by the natural disintegration of rocks. The coarse aggregate can also be obtained by the artificial crushing of the rock and gravel thus the coarse aggregates derive many of their properties from their rocks. The properties of coarse of coarse aggregates includes chemical composition, mineral composition, specific gravity, hardness, strength and pore structure. Some of the other properties of the coarse aggregates, which is not possessed by the parent are particle size, particle shape, surface texture and absorption characteristics. All these properties may have a considerable effect on the quality of the concrete in the fresh state or hardened state. The mostly commonly used coarse aggregates in the construction work are crushed stone and gravel which are easily available.

WATER

Water is a very important ingredient in the preparation of concrete, as it actively participates in the chemical reaction with the cement during the mixing of concrete. In general the water fit for drinking is suitable for mixing concrete. Impurities in water may affect the initial and final setting time, strength and shrinkage of concrete. It may also have its effect in promoting the corrosion of the reinforcement. It has been estimated that or an average water by the weight of cement is required for the chemical reaction in cement compounds. Portable water free from the impurity salts was used for mixing and curing of concrete blocks.

A proper yard stick to the suitability of water for mixing concrete is that, if the water is fit for drinking then it is fit for mixing concrete. This does not appear as a true statement for all the conditions. Some water containing sugar would be suitable for drinking but it is not suitable fore mixing the concrete and conversely water suitable for making concrete may not be necessarily fit for drinking.

FLY ASH

Fly ash which is a waste material used as a partial replacement for cement.fly ash is a ash produced in small drake flecks by the burning of powdered coal and it is also known pulverized fuel ash, flyash is generally captured by electrostatic precipitators before the fuel gases reach the chimneys.

The components of fly ash includes substantial amounts of silicon dioxide (sio2),aluminum oxide(al2o3)and calcium

oxide (cao).the minor constituents of fly ash depend upon the specific coal bed composition such as arsenic, beryllium, boron, cadmium, chromium, cobalt, lead, mercury& manganese.

Fly ash has very small particles which makes the concrete highly dense and reduces the permeability of concrete. it can also add greater strength to the building. the concrete mixture generates a very low heat of hydration which prevents when it is used in concrete mixes, fly ash improves the strength and segregation of the concrete and makes it easier to pump. Fly ash is known to reduce shrinkage in certain situations. reduced heat of hydration. Replacing cement with the partial amount of fly ash can reduce the heat of hydration of concrete. The main advantage of using fly ash to reduce the environmental pollution, it is highly economical and it is environmental friendly as the waste materials from industries are effectively being used to create quality building materials

THERMOCOL

Thermocol is also known as expanded polystyrene and rigid clear thermoplastic polymer of styrene. It can be molded into objects or made into foam and it is used as a thermal insulation. Thermocol is manufactured through a simple process; thermo plastic granules are expanded through application of steam and air.

The use of expanded polystyrene in construction of walls, slab, that is used for non structural elements which imparts less weight, economic, faster construction, act as insulator and by which results in a sustainable future as the resources can be saved to some extent.

Thermocol acts as a good resistant to cold and heat. Thermocol with water is nonreactive process and it is highly elastic and softens when heated. The mechanical properties of polystyrene include its strength, elongation, modulus, impact strength and toughness. Crystal forms of polymer polystyrene have low impact strength. Thermocol is a light weight material which is not surprising considering it is comprised of 19%air and it is moisture resistance, thermal efficiency, shock absorption, versatility and easy to used.

PROPERTIES OF CONCRETE

The performance requirements of hardened concrete are more or less well with respect to shape, finish, strength, durability, shrinkage and creep. The strength of concrete assume a greater significance because its strength relates to the hardened cement paste and gives an overall picture of the quality of the concrete. The strength is assumed to depend mainly on water/cement ratio and degree of compaction for concrete of a given age under specific curing conditions.

To achieve these objectives economically, the fresh concrete in addition to admixtures and aggregates should satisfy a number of requirements from the mixing stage till it is placed in form work and compacted. Compressive strength plays an important role to improve the durability of concrete and workability also affects the durability of the concrete.

WORKABILITY

Workability is defined as the property of freshly mixed concrete or mortar which determines the ease and homogeneity with which it can be mixed, placed, compacted and finished. Workability of fresh concrete is a complex system of two critical parameters, consistency and homogeneity.

Consistency is the relative mobility or ability of a freshly mixed concrete to flow and is usually measured in terms of slump for concrete. Major factors affecting consistency are:

- Water content
- Cement content
- Cement characteristics
- Air content
- Temperature
- Mixing conditions
- Admixtures

CONCLUSION

Based on the experimental investigations concerning the compressive strength and split tensile strength of concrete, the observations and the following conclusions are drawn from the present study

1. The compressive strength of concrete was higher than the conventional concrete for 30% fly ash and 0.6%&0.9% thermocol replacement by the weight of cement at 7, 14, & 28 days of curing ages. However further increase in replacement percentages lowers the compressive strength of concrete.
2. The split tensile strength of concrete in which cement was replaced by 30% FA & 0.6%&0.9% TC was higher than conventional concrete. However further increase in replacement percentages lowers the split tensile strength of concrete.
3. FLY ASH AND THERMOCOL can be used as partial replacement for cement in concrete which helps in reduction of construction cost.
4. The optimum replacement of cement by FLY ASH & THERMOCOL is 30% and 0.6%&0.9%, further increase in the replacement percentages results in reduction of concrete strength.

SCOPE FOR FUTURE WORK

1. Effect on different curing periods on concrete.
2. Effect on the strength of concrete by using different water cement ratio for the design mix concrete.
3. The logistics of implementing the use of fly ash and thermocol concrete in developing country construction to ensure that this low cost construction
4. To investigate the behavior of reinforced fly ash and thermocol concrete under flexure, shear, torsion and compression.

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