International Journal of Scientific Research in Civil Engineering
© 2020 IJSRCE | Volume 4 | Issue 4 | ISSN : 2456-6667

Analytical investigation of a light weight tall structure considering lateral load resisting system using analytical tool ETABS

Amit Kumar[1], Rachana M Bajaj[2], Kapil Soni[3]
[1]P. G. Scholar, [2]Assistant Professor, [3]Assistant Professor & H.O.D
Department of Civil Engineering, RNTU, Bhopal, Madhya Pradesh, India

Article Info
Volume 4, Issue 4
Page Number: 85-90
Publication Issue :
July-August-2020

Article History
Accepted : 01 Aug 2020
Published : 15 Aug 2020

ABSTRACT

Strong structures are slanted to quake in view of mass of the structures. fundamental usage of assistant lightweight concrete (SLWC) is to diminish the dead pile of a strong structure, which empowers the essential fashioner to lessen the range of the fundamental people like column, fragment, and footings which brings about abatement of seismic quake powers on the structure. This assessment is an undertaking to envision the seismic response of a ten-celebrated invigorated strong packaging with the usage of lightweight concrete. A particularly arranged ten story point of reference is taken for study. The structure is exhibited with ETABS programming, and assessment is finished with average weight and lightweight concrete.

The basic justification of our examination is to apportion a light weight concrete in a tall structure, where we can check its positive and negative effect on the quality of the structure. In like manner to legitimize the assistant cost decline due to utilization of light weight material.

Keywords : ETABS, Structural analysis, forces, cost analysis, lateral forces, displacement.

I. INTRODUCTION

A tall structure is a multi-story structure in which most occupants depend upon lifts [lifts] to accomplish their objectives. By and by a days as a result of improvement of the people Housing has framed into an economy making industry. Given this intrigue, while raised structure structures have transformed into an answer in the metropolitan urban zones.

The usage of LWC (Lightweight concrete) has been a segment in the improvement business for a serious long time, yet like other material the wants for the execution have raised and now we are anticipating a consistent, strong material and obvious characteristics. Essential LWC has an inplace thickness (unit weight) on the solicitation of (1440 to 1940 kg/m^3) appeared differently in relation to standard weight concrete a thickness in the extent of 140 to 150 lb/ft^3 (2240 to 2400 kg/m^3).

Foam material is a versatile material which is contained bond, fly red hot remains and protein based foam. Basically it is another material which is starting at now using in India for walling reason. improved securing square structure for use in the advancement

of strong divider structures wherein the square structure is confined from expandable polystyrene material to give a lightweight, rigid, box-like structure having a few oppositely organized side dividers and end dividers which together portray a body pit to get concrete in that.

Foam material gives better strong assurance, warm insurance, intense, lightweight, uniform size and shape, decline vulnerability. It is non-load bearing fundamental part which has lower quality than standard concrete. Cell concrete is notable considering its light weight which decreases self-weight of structure.

In this assessment work light weight strong squares are tossed with 65% of Fly red hot remains and 35% of bond with preformed foam content 1.5% of complete weight and to fabricate its quality quarry dust is incorporated its plan up-to 30% in an interval of 5% in different shapes to check properties of these Foam Concrete (FC) squares test like compressive quality, thickness and water maintenance is done in the exploration office to make sense of which test is showing stable results to give its properties and grade to examination reason.

Figure 1 : Tall Structure

Response spectrum:

The seismic powers strikes the establishment of a structure will move with the ground movement. It shows that structure development is commonly more than the ground movement. The development of the structure when contrasted with the ground is declined as the dynamic enhancement. It relies upon the regular recurrence of vibration, damping, kind of establishment, technique for specifying of the structure. The reaction "plan speeding up range" which alludes as far as possible quickening called phantom increasing speed coefficient Sa/g, as an element of the structure for a predetermined damping proportion for seismic tremor excitation at the base for a solitary degree opportunity framework. The updated IS 1893-2002 utilizations the dynamic examination by reaction range. The major normal time of vibration of the structure (T in a flash), the damping properties of the structure, sort of establishment accommodated the structure.

II. LITERATURE REVIEW

T.Subramani et. al. (2017) The PC supported investigation is finished by utilizing E-TABS to discover the compelling sidelong burden framework during dynamic stacking in light weight solid structure. The exhibition of the structure is assessed as far as Lateral Displacement and Story Drifts. The examination found that Response range investigation decreased sidelong removal and story float because of dynamic burdens contrast with static examination for every single broke down model. RCC developments have more weight and bigger cross segments for basic individuals. In our examination about successful horizontal burden framework during dynamic stacking in light weight solid structure contrasting with RCC part. The investigation additionally discovered; horizontal removal, story float as for dynamic stacking in LWC area.

Vandanapu and Krishnamurthy (2018) Studied that Concrete structures are inclined to seismic tremor because of mass of the structures. ,e essential utilization of auxiliary lightweight cement (SLWC) is to decrease the dead heap of a solid structure, which

permits the basic planner to diminish the size of the basic individuals like pillar, section, and footings which brings about decrease of seismic tremor powers on the structure. This paper endeavors to anticipate the seismic reaction of a six-celebrated strengthened solid casing with the utilization of lightweight cement. A very much structured sixstorey model is taken for study. The structure is displayed with standard programming, and investigation is completed with typical weight and lightweight cement. Bowing minutes and shear powers are considered for both NWC and LWC, and it is seen that bowing minutes and shear powers are diminished to 15 and 20 percent, separately, in LWC. ,e thickness contrast watched was 28% lower when contrasted NWC with LWC. Accepting that the segment and fortifications are not amended because of utilization of LWC, one can expect huge edge far beyond MCE (most extreme thought about tremor; IS 1893-2016), which is an attractive seismic obstruction highlight in significant structures.

Grethel (2015) Potential market to utilize auxiliary lightweight cement is expanding in Mexico because of elevated structure development, tilt-up and precast industry. Auxiliary Lightweight Concrete can be intended to get comparable execution to ordinary weight concrete and to offer a weight-quality proportion more proficient in basic components. The greater part of the cases, the minimal expense of lightweight cement is remunerated by size decrease of auxiliary components, diminishing of strengthened steel, lessen dead heap of structures, which implies worldwide costs decrease of the undertaking. There are no few wellsprings of lightweight totals in Mexico to plan this kind of auxiliary cements. This report approves various kinds of ordinary totals of five districts of (Mexico City, Tijuana, Guadalajara, Monterrey and Cancun) utilizing lightweight engineered particles to plan lightweight cement with auxiliary execution including new solid properties (droop, siphoning, harmony and dry thickness) and solidified solid properties (compressive quality, versatility modulus and warm conductivity). Basic lightweight cements are approved in three degrees of harmony thickness: 1500 kg/m3 , 1700 kg/m3 and 1900 kg/m3 with various doses of lightweight manufactured particles.

Vanissorn et. al. (2012) In basic plan, a perfect circumstance in material sparing is to lessen the heaviness of the structure without settling on its quality and workableness. Another lightweight sandwich strengthened solid area has been created with a novel utilization of lightweight concrete as infill material. The area, to be specific LSRC segment, is appropriate for use as pillar or section individuals. Exploratory examinations concerning the quality of shafts with LSRC area shows promising outcomes under both flexural and shear tests. In light of the test outcomes, the flexural limit of LSRC pillars was seen as practically indistinguishable from the limit of the identical strong bar. The shear limit of the LSRC bars was expectedly decreased because of the low compressive quality of the lightweight cement infill material. ANSYS 12.1 was utilized to create three dimensional nonlinear limited component models of LSRC bars and was confirmed against the trial results.

Zulkarnain et al.(2013) examined that compressive quality of frothed concrete is basically an element of dry thickness and is just marginally influenced by the level of concrete supplanted by silica smolder. Huge extent of silica rage didn't essentially influence the drawn out compressive quality. The compressive quality of froth concrete with silica smolder is higher than the froth concrete without silica rage and the distinction of solidarity between froth concrete with silica and control tests is roughly same for all age.

Siram (2015) on her examination he reasoned that Foams framed from protein based surfactants have littler air pocket size, are more steady and have a more grounded shut air pocket structure contrasted

with the froth created utilizing engineered surfactants. Thus, they are high quality froth cements. The thickness of froth concrete is the capacity of volume of froth that is added to the concrete glue. The compressive quality of frothed concrete is a converse capacity of the thickness of the material.

Aim of the study :

a) To diminish the expense of development
b) To decline oneself load of the structure and furthermore give a superior material for divider framing which can withstand to all the more likely stable protection, warm protection, solid, lightweight, uniform size and shape, diminish penetrability.
c) To break down the usage of light weight concrete in tall structure utilizing ETABS"17.
d) To decide the variety in solidness of the structure under parallel powers considering light weight concrete.

Scope of study:

The principle thought process of this exploration is to examine the impact of Foam Concrete squares on a tall structure. light weight cell solid squares are casted with 40% of Fly debris and 40% of concrete with froth content 1.5% of absolute weight and to build its quality quarry dust is included its arrangement upto 35% expanding 5% for each situation. Auxiliary execution of light weight Material on elevated structure utilizing ETABS programming.
By developing the cutting edge Light weight solid structure with all offices and it is valuable the people groups including efficient, bought to everything in single spot, and furthermore vitality sparing.

III. METHODS AND MATERIAL

Method following in this project:

1. Casting light weight material.

For this examination, a pre framed strategy was received to give polyurethane frothed concrete. The readymade froth was added to the base blend through the spout of the froth can as indicated by the determined sum by preliminary and mistake. The thickness of the frothed concrete created was then checked against the objective thickness.

Test on material:
Water ingestion tried

Thickness and pressure quality.

Table 1 : Test results

COMPRESSIVE STRENGTH IN MPa		
S.NO	% of Quarry dust	M-20
1	0%	17.4
2	5%	17.52
3	10%	17.67
4	15%	18.43
5	20%	20.13
6	25%	19.23
7	30%	18.98

As per compressive testing machine results 20% quarry dust sample will be studied

For further implementation in software:

For this research work following steps should be followed:

Step-1 Review of literature overview done in past identified with our .
Step-2 To decide the properties of light weight material to be use in this investigation.
Step-3 To Analyze the structure utilizing light weight material properties utilizing examination apparatus.
Step-4 To Define sectional subtleties and end conditions.
Step-5 To perform dynamic stacking according to Standard criterias.

Step-6 To decide the examination results

Step-7 To perform near investigation utilizing M.S. Exceed expectations.

Step-8 To gauge the expense of material according to Schedule of rates.

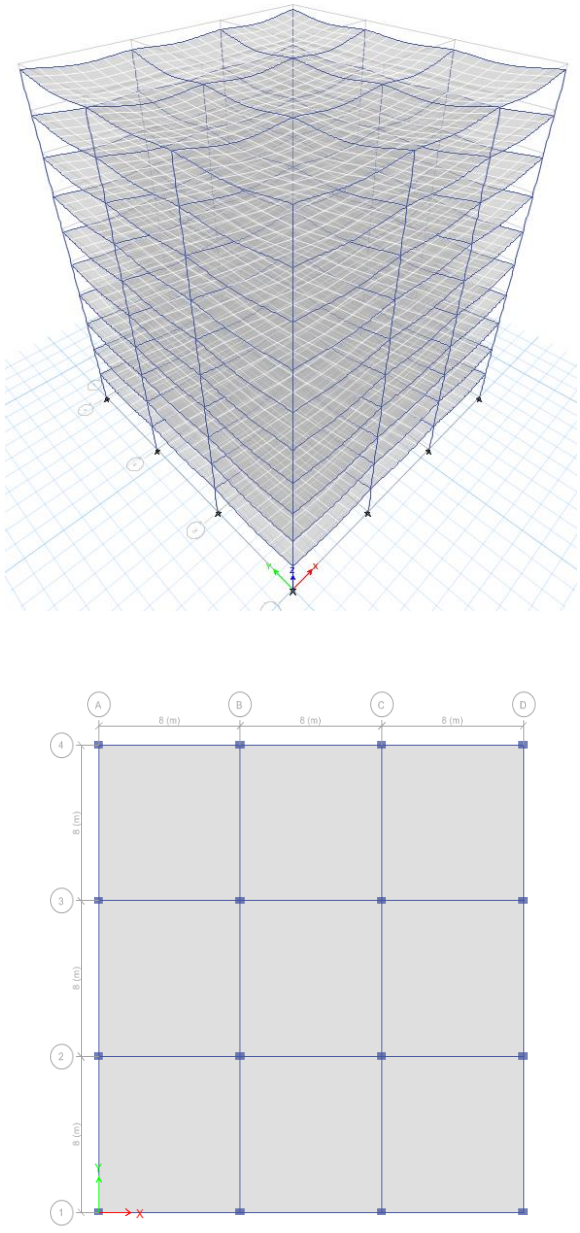

Figure 2: plan & 3-d of selected building frame

IV. Analysis & Results

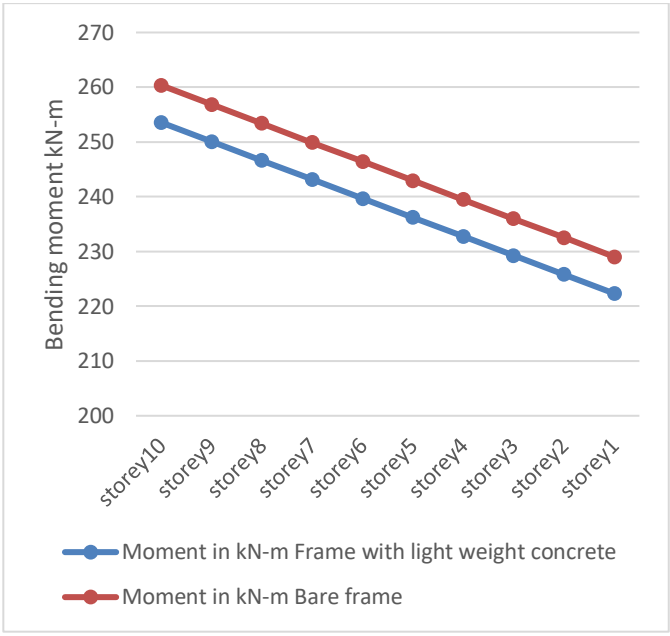

Figure 3: Moment in typical storeys

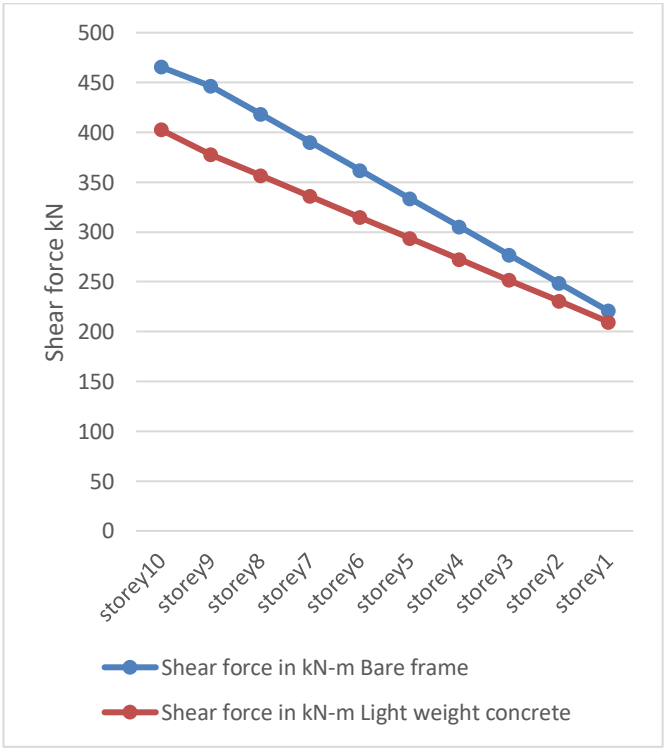

Figure 4: Shear force

Cost Analysis:

Table 2: cost analysis

S.No.	Frame type	Concrete cu.m	Rate of concrete (m^3) as per S.O.R.	Cost of concrete in INR (Rupees)
1	Bare frame	110.98	5757	6,38,911.86
2	Frame with light weight concrete	96.98	5757	5,58,313.86

S.No.	Frame type	Reinforcement in kg	Rate of Rebar kg as per S.O.R.	Cost of Rebar in INR (Rupees)
1	Bare frame	9454.23	72.75	6,87,795.23
2	Frame with light weight concrete	9252.87	72.75	6,73,146.30

V. CONCLUSION

1. It tends to be inferred that structure with light weight concrete as infill can be steady as results shows less bowing second which brings about efficient structure as well.
2. Execution of structure utilizing light weight material (froth) a decrease in the danger of seismic tremor harm and expanded warm protection and imperviousness to fire utilizing ETABS .
3. The structure brings about less parallel uprooting because of horizontal powers as saw in results.
4. Structure is more efficient as far as material expense according to S.o.R.
5. Equipped for opposing sidelong powers in serious seismic districts

VI. REFERENCES

[1]. A. Kılıç, C. D. Atis¸, E. Yas¸ar, and F. Ozcan, "High strength ¨ lightweight concrete made with scoria aggregate containing mineral admixtures," Cement and Concrete Research, vol. 33, no. 3, pp. 1595–1599, 2003.

[2]. ACI 211.2-98, "Standard practice for selecting proportions for structural lightweight concrete," 1998.

[3]. A. Kan and R. Demirboga, "A novel material for lightweight concrete production," Cement and Concrete Composites, vol. 31, no. 7, pp. 489–495, 2009.

[4]. Available Design Codes in STAAD Pro, pp. 1–14, Bentley Communities publisher, 2015.

[5]. ACI 318–14, Building Code Requirements for Reinforced Concrete, vol. 552, American Concrete Institute, IHS, 2014.

[6]. H. J. Shah, Design Example of a Six Storey Building. A Report by IIT Kharagpur—A Case Study.

[7]. ASTM C 567, "Standard test method for determining density of structural lightweight concrete," 2014.

[8]. ACI Committe-213, Guide for Structural LightweightAggregate Concrete, pp. 1–38, American Concrete Institute, Farmington Hills, MI, USA, 2003

Cite this article as :

Amit Kumar, Rachana M Bajaj, Kapil Soni, "Analytical investigation of a light weight tall structure considering lateral load resisting system using analytical tool ETABS", International Journal of Scientific Research in Civil Engineering (IJSRCE), ISSN : 2456-6667, Volume 4 Issue 4, pp. 85-90, July-August 2020.

URL : http://ijsrce.com/IJSRCE204414