International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 10 | Oct -2017 www.irjet.net p-ISSN: 2395-0072

Cost Optimization of R.C Multistory Building

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Abstract - *In this paper we present the cost optimization of R.C building by considering various aspects of design. The structural optimization plays a vital role in today's highly competitive industry, where there is continuous increase in customer demand for superior quality, better safety and affordable Cost. The conventional ways of design development largely depend on excessive material Usage, very high design margins – hence, in turn ending up consuming more material into the Structures, buildings. Since last couple of decades, computational power is becoming more Efficient and affordable to everyone. This availability of high capacity computational power Gave of designer the opportunity for evaluating multiple options during the development phase itself, using finite element analysis methods. In addition, the efforts of the researchers helped our Field with many innovative and matured algorithms for optimizing the multiple design variables considering given constraints, scenarios at the same time. The combination of high power Computation with these algorithms is giving the designers limitless opportunities for managing the development more effectively and efficiently.*

India is a developing country, huge construction projects are yet to come, as undeveloped cities are needed to develop since so many years. In current century, many construction projects all Over the world are going through financial crises because of high financial budgets. Time delay Takes place, which in turn affects the growth of the construction of huge projects. In order to avoid time delay and thereby the growth, economic construction methodology should be adopted. To economize the structure structural optimization techniques should be used. For Large projects, it is necessary to go for structural optimization because it directly affects cost of Construction. Many Metropolitan cities are facing vast growth of infrastructure whether it may be in terms of horizontal development or vertical development

1. INTRODUCTION

To fulfill the task total 19 models of Reinforced concrete frames are analyzed. They are further divided into each model category. The supports assumed of columns are fixed supports. Further the calculations of dead load and live loads are done with IS 456:2000. All calculation work wind load is done in excel form work. Models are analyzed and designed in staad pro with the agenda of cost reduction without compromising the quality of material and safety of the whole structure. Each model is compared with the conventional model and accordingly quality of steel and concrete is compared. Also there will be not much cost difference with concrete quality so our main focus is on the quality of steel.

The following procedure was carried out in this research: -

- An existing model is analyzed in staad Pro by giving the dimension and all related specifications.
- By changing specifications other models are also analyzed.
- Analysis of different models is done using IS 456: 2000 code in staad pro.
- After designing all the components of R.C frame of all Models, they are checked for the safety. Only safe models are considered in the analysis.
- Quantity of steel and concrete per square meter area of whole R.C frame is calculated.
- After that quantity of all Trial models is compared by plotting graph.
- Finally result of whole the trial models are compared and economical as well as safe model is found.

1.1 Methodology

Here 19 different Models analyzed and designed with Seismic Coefficient Method. In General, Analysis the design results are presented in the form of required area of Reinforcement per square meter for optimization techniques for overall structure. After detailed analysis and design of structure, area of reinforcement per square meter is taken as a predominant parameter in order to identify the cost effectiveness and optimistic characteristic of structure and its behavior. Much focus is done on the quantity of steel, as it is the only material, which has high cost per unit area.

1.2 Traditional Building Model

The quantity of Steel and concrete required for the G+6 story building Having height 27.5, width 12 and length 16 meter per square meter area of the building is given below:-

Table No.1 Quantity of Steel and Concrete

S.NO	Type of Material Required	Volume
1	Concrete	772.80m³
2	Steel	448578N

1.3.1 Staad Pro Designed Model 2D-Image

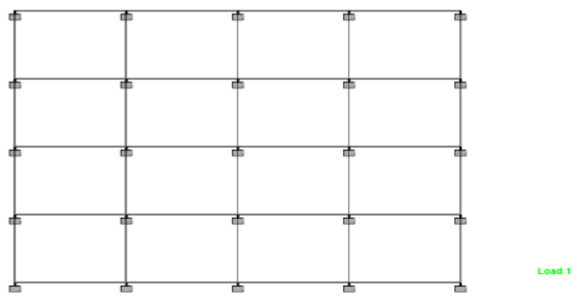

Figure 1 G+6 Story Building Plane

1.3.2 Staad Pro Designed Model 3D-Image

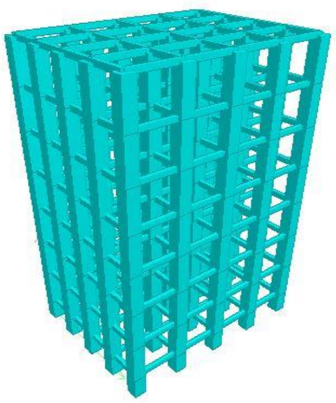

Figure 2 G+6 Story Building 3D Image

2. Different Models for the Cost Optimization

Different models are analyzed by changing the various types in the staad pro models. Each time steel and concrete quantity is calculated and also model is checked for the safety in the designing software. These models are given below in table :-

Table -2 Models with Descriptions

S.NO	Model	Description
1	Model No-1	Traditional Building
2	Model No-2	Grade Variation of Materials for structural Elements
3	Model No-3	Size variation of Columns and beams
4	Model No-4	Variation in the Thickness of Slab
5	Model No-5	Floor wise column Size reduction
6	Model No.6	Reduction in Dead Weight
7	Model No.7	Optimization with the change in Beam Spacing
8	Model No.8	OMRF and SMRF
9	Model No.9	Non Prismatic Beams

By the analysis of all these models, graphs are plotted for the different models and finally a combined graph is plotted which reflects the combined effect of all models. The graph shown below.

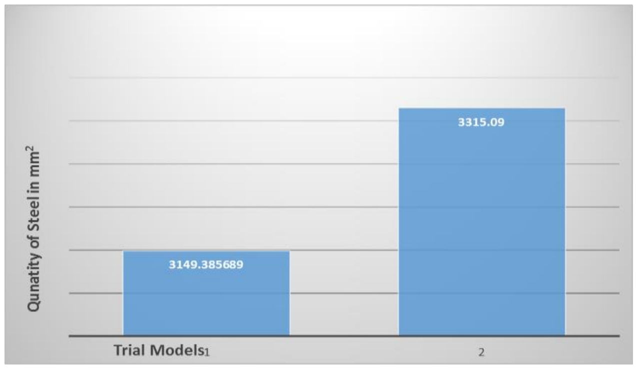

Chart -1: Quantity of Steel for Models

In this graph Model 1 is optimized model in which quantity of steel required is mentioned on the bar itself which is 3149.38mm², whereas the traditional model has quantity of steel which is quite more as compared to the optimized model.

3. CONCLUSIONS

1. If higher grade of concrete is used for columns than slab and beam with grade of steel Fe-500, then the structure is economical.
2. With the change in sizes of columns and beams, the structure is economical.
3. Like columns and beams if thickness of slab is changed as compared to the conventional model, the structure is economical.
4. Floor wise reduction of column sizes leads to economic structure.
5. Use of Siporex Bricks reduces dead weight of structure, which helps in reducing seismic forces. Hence, model with Siporex bricks is the optimum solution as compared with conventional bricks.
6. With the changes in beam spacing structure, become uneconomical, as reinforcement required per Square meter is more.
7. As per IS 1893:2002 (PART-I) for buildings located

in Seismic zone II, building should be designed with Ordinary moment resisting frame. However, study shows the special moment resisting frames is more economical even for seismic zone II.

REFERENCES

1. G. Dravid, "Structural optimization for Ramanujan IT city, Chennai", ISSE journal, Vol. 14-4, OCT 2012.
2. D. M. Frangopol and Moses, "Advances in design optimization", Reliability based structural optimization, Chapman and Hall, London, pp. 492
3. P. Agarwal & M. Shrikhande, "Earthquake Resistant Design of Structure." First edition, PHI learning publication.
4. Dr. V. Housur, "Earthquake-Resistant Design of Building Structures." First edition, Wiley publication.
5. M. Paz, "Structural Dynamics Theory and Computation" Second edition, CBS publication.
6. F. Cesar, A. R. Madia, "Modeling a reinforced concrete building frame with infill walls."
7. FEMA 273, NEHRP guidelines for the seismic rehabilitation of buildings, Federal Emergency Management Agency, Washington, D.C. 1997.
8. FEMA 356, Prestandard and Commentary for the seismic rehabilitation of buildings, Federal Emergency Management Agency, Washington.