Analysis and Design of G+2 Multistoried Building with Quantity Comparison

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Abstract – *Structural Analysis is that the revelation of the consequences of effects of loads on physical structures and their components and Structural design is that the process of arrangement of the structure to securely prevent the applied loads and effects of loads within the most resources in proper manner. The most aim of structural analysis and style is to take care of a structure which is capable of resisting all applied loads with none failure of structure. In Project, structure is analyzed for earthquake resistance for various grades of concrete then the comparison of quantity and then the comparison of quantity of steel and concrete for interior panel with different plan for a same building i.e. slabs & beams are compared and therefore the results are obtained. Our results depend upon the Seismic analysis of multistoried building (G+2) for seismic zone-III with the assistance of software STAAD PRO. IS 1893-2002 (Part 1) mentions that structure will normally experience more sever ground motion, than that given within the code for design purpose, It had been said that "The designed as an Earthquake resistance has increase the value of construction." The statement is faithful to some extent.*

***Key Words*: Residential Building, STAAD-pro, AutoCAD, Structural Designing, Analysis, Earthquake**

1.1 INTRODUCTION

In an earthquake, seismic waves arises from sudden movements during a rupture zone (active fault) within the earth's crust. Waves of different types and velocities travel different paths before reaching a building site and subjecting the local ground to various motions. Earthquake damage depends upon many parameters including magnitude, intensity, duration and frequency content of ground motion, geologic and soil conditions, quality of constructions etc. "An earthquake is that the vibrations, sometimes violent, of earth's surface that follows a release of energy in Earth's crust." Earthquake are one among the foremost devasting forces in nature. Vibrations of earth's surface, caused by seismic waves coming from a source of disturbance inside the world are referred to as Earthquake.

1.2 Methodology

As our analysis deals with the Engineering College Building, The functional drawing were given thus we only selected the size of columns and beams as per design requirements.

With the reference to the plan of the building, position were fixed and various sizes were adopted as per IS: 13920 for the design and analysis.

To get our ideas more clear, first we tried some small problems and then jumped towards our original task of analysis. STAAD-pro deals with advance analysis of structure subjected to horizontal forces i.e. EQ- earthquake forces as the calculations of horizontal forces manually it is a cumbersome job hence STAAD-pro software helps us to make our job easier.

Salient features of Building Properties:

Utility of building: Engineering College Building
No of stories: G+2
Length of Building= 50.6 c/c.
No. of bays = 11 bays (along the length)
Width of building = 11.84 m
No. of Bays= 2 (along the width)
Height of building = 13.5 m
Ground floor to first floor = 4 m
First floor to third floor = 4 m
Second floor to third floor = 4 m
Parapet wall = 1.0 m
Sizes of the Members:
Column sizes-
C1 – 0.45 m x 0.6 m (Corridor)
C2 – 0.45 m x 0.6 m (main)
Beam Sizes –
B1- 0.23 m x 0.9 m
Wall thickness = 0.23 m

According to sizes, a 3-D model has been generated in STAAD pro. After assigning the various properties and loads, the structure is analysed for earthquake resistant for various load cases.

Loads Considered:

Dead Load (D.L.)
Live Load (L.L.)
Seismic Loads (EQX, -EQX, EQZ, - EQZ)
Member Load and Floor Load

Load combinations:

1.5 D.L. + 1.5L.L + 1.5 R.L.L.
1.5 D.L. + 1.5 R.L.L.
1.5 D.L. + 1.5 EQX
1.5 D.L. – 1.5 EQX
1.5 D.L. + 1.5 EQZ

1.5 D.L. - 1.5 EQZ
1.2 D.L + 0.6 L.L. + 1.2 EQX
1.2 D.L + 0.6 L.L. - 1.2 EQX
1.2 D.L + 0.6 L.L. + 1.2 EQZ
1.2 D.L + 0.6 L.L. - 1.2 EQZ
0.9 D.L. + 1.5 EQX
0.9 D.L - 1.5 EQX
0.9 D.L + 1.5 EQZ
0.9 D.L - 1.5 EQZ

Reinforcement Details for Columns and Beams:

For M25, Fe415:

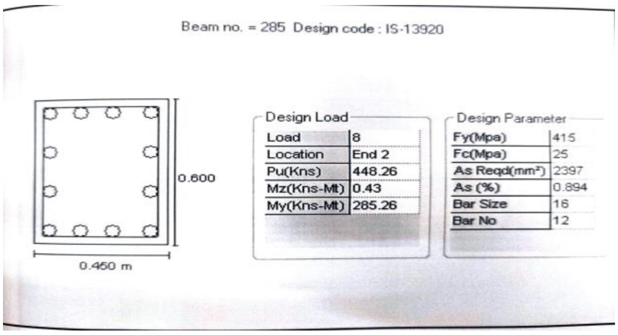

Fig.1 : **Beam No. 285 as per IS – 13920 from STAAD-pro**

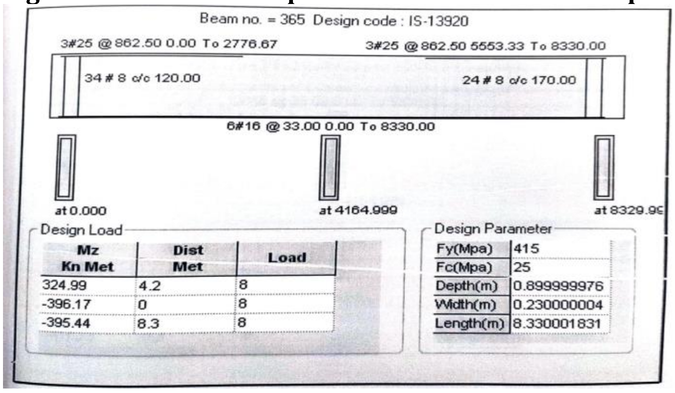

Fig.2: **Beam No. 365 as per IS – 13920 from STAAD-pro**

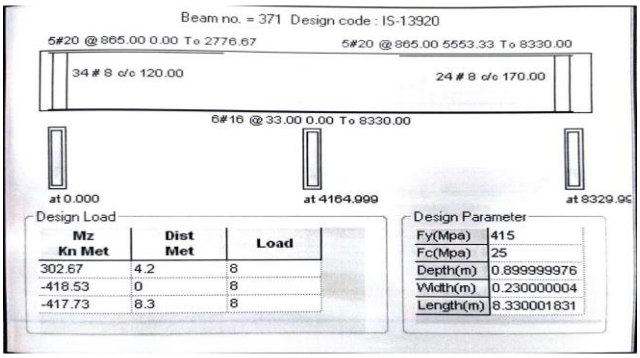

Fig.3: **Beam No. 371 as per IS – 13920 from STAAD-pro**

2. RESULTS

Table -1: Quantity comparisons for various Grades of Concrete

Sr. No.	Grade	Vol. of Concrete (m³)	Quantity of steel for beams (Kg.)	Remarks	Quantity of steel for Columns (Kg.)	Remarks
1	M20	14.19	695.1	--------	830.95	--------
2	M25	14.19	695.94	Near about same	793.0	Decrease by 4.56%
3	M30	14.19	727.56	Increase by 4.34%	806.25	Decrease by 2.97%
4	M35	14.19	705.73	Decrease by 3.09	961.86	Increase by 13.61%

1 .It is observed that the quantity of steel in case of beams for all Grades doesn't vary considerably except M30.

2. Whereas in case of columns, the quantity of steel decreases in M25 and M30 Grades as compared to M20 grade, it is also increase in M35 Grade as compare to earlier grades.

3. For this building, the M25 grade of concrete will be more economical for given sizes of columns and beams.

3. CONCLUSIONS

From all the results, it is concluded that with the use of higher grade of concrete, the overall cost of construction goes on decreasing. The most important thing is hat, the sizes adopted for the structure is safe while analyzing for earthquake forces.

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