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DESIGN AND ANALYSIS OF BUILDING WITH LINEAR STATIC ANALYSIS BY USING STAAD.PRO

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ABSTRACT - *Structural designing involves structural analysis and earthquake or seismic analysis of any structure before it is constructed. Earthquake or seismic analysis is simply the calculation of the response of a structure to earthquake excitation. Different seismic data are required to conduct the seismic analysis of structures in this research: The structural response of structures is studied under earthquake excitation and expressed in terms of member forces, joint displacement, support reaction, and story drift. For g+9 building structures, the response is studied by using STAAD PRO designing software. We observed a reduction in the response of cases for ordinary moment resisting frame. In this case we have taken earthquake zone 2, response factor 3 for ordinary moment resisting frame and importance factor 1.*

Initially we begin with the designing of simple 2-dimensional frames and man checked the accuracy of the software with our results. Then based on the criteria specified to it, analyzes the structure and designs the members with reinforcement details for G+9 residential building RCC frames. The minimum requirements pertaining(Be appropriate) to the structural safety of buildings are being covered by way of laying down minimum design loads which have to be assumed for dead loads, imposed loads, and other external loads.

KEYWORDS: **Seismic analysis, Earthquake excitation, Ordinary moment resisting frame, Member forces, Joint displacement**

1.INTRODUCTION

The earthquake causes vibratory ground motions at the base of the structure, and the structure actively responds to these motions. There is an equivalent system for the structure responding to a moving base. The base is fixed and the structure is acted upon by forces that cause the same distributions that occur in the moving – base system. In design system it is conventional to take the structure as a rigid base system acted by inertia forces

1.1Behavior of the Structure:

The Building and other structure are composed of horizontal and vertical structural elements that resist lateral forces. The horizontal elements, diaphragms and horizontal bracings are used to distribute the lateral forces to vertical elements. The vertical elements that are used to transfer lateral forces to the ground are shear wall, braced frames and moment resisting frames. The design shall include complete lateral and vertical force resisting systems, that will have sufficient energy dissipation capacity to resist the design ground motions within the prescribed limits of deformation and strength demand.

1.2Objectives of project

Conducting a comprehensive design of the major structural features of a multi-storeyed building involving slabs, beams, columns, and footing . I obtained practical experience in engineering practice.

The structure should be so designed that dead, wind, and imposed loads can be transmitted in a direct manner to the foundations. The general arrangement should ensure a robust and stable structure that will not collapse progressively under the effects of misuse or accidental damage to any one element.

TABLE 1.1: Properties of HYSD bars (IS 1786-1985)

Property	Fe 415	Fe 500
0.2% Proof Stress, min N/mm2	415	500
Elongation %, min	14.5	12
Ultimate stress, min N/mm2	15% more than actual 0.2% proof stress	10% more than actual 0.2% proof stress

2.LITERATURE REVIEW

Chandurkar, Pajgade (2013) carried out study for response of 10 storey building with seismic shear wall under Staad Pro V8i It mainly focused on comparison of variation in response when location of shear wall is changed in the multi-storey building. Four models are studied- one bare frame structural system and rest three are dual type structural systems. Results were excellent for shear wall in short span at corners. Larger dimension of shear wall was found ineffective in 10 or below 10 stories. Shear wall is an effective and economical option for high-rise structures. Chances of changing positions of shear wall were found to attract forces, hence proper positioning of shear wall is vital. When the dimension is large, a major amount of horizontal forces was taken by shear wall. It was also observed that shear walls at substantial locations reduced displacements due to earthquake.

2.1SEISMIC DESIGN FORCE

Earthquake shaking is random and time variant. However, most design codes represent the earthquake-induced inertia forces as the net effect of such random shaking in the form of design equivalent static lateral force. The force so obtained is referred to as the Seismic Design Base Shear VB and is a quantity that stays primarily involved with force-based earthquake-resistant design of buildings. This force depends on the seismic hazard at the site of the building represented by the Seismic Zone Factor Z. Also, in keeping with the philosophy of increasing design forces to increase the elastic range of the building and thereby reduce damage in it, codes tend to adopt the Importance Factor I for effecting such decisions

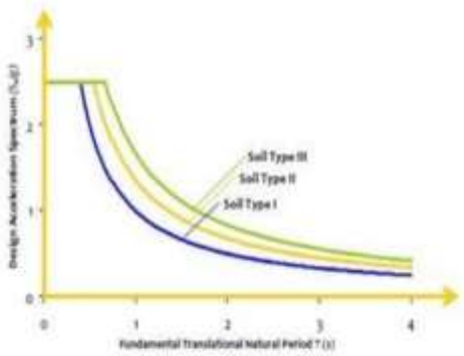

Figure 2.1 Design Acceleration Spectrum : This is based on fundamental transnational natural period T of the building ; this is defined as follows

2.2PARTS OF A BUILDING

A building can be divided into two parts:

a)Sub structure

b)Super structure

Sub structure:- That part of a building constructed beneath the ground level is known as sub structure.

Super Structure:- That portion of building constructed on the ground level, the super structure is a portion of the building. Super structure is the second step of a building. It will be constructed after completing making sub-structure. Super Structure of a building will involve flooring, wall and roof

3. ANALYSIS OF G+9 BUILDING

3.0.1. Dynamic Analysis:

Dynamic analysis is carried out to get the design seismic force, and its distribution to different levels along the height of the building and to the various lateral load resisting elements, for the following buildings:

a)Ordinary buildings- Those more than 40 m in height in zones IV and V, and those more than 90 m in height in zones II and III.

b)Irregular buildings-All framed structures more than 12 m in height in zones IV and V, and those more than 40 m in height in zones II and III.

3.1 LOADS

The reinforced concrete structures are designed to resist the following types of loads.

1.Dead load

Dead loads are permanent or stationary loads which are transferred to the structure throughout their life span. Dead loads mainly cause due to self-weight of structural members, permanent partitions, fixed equipment's and fittings. These loads shall be calculated by estimating the quantity of each material and them multiplying it with the unit weight. The unit weights of various materials used in building construction are given in the code IS 875 (part -1) -1987

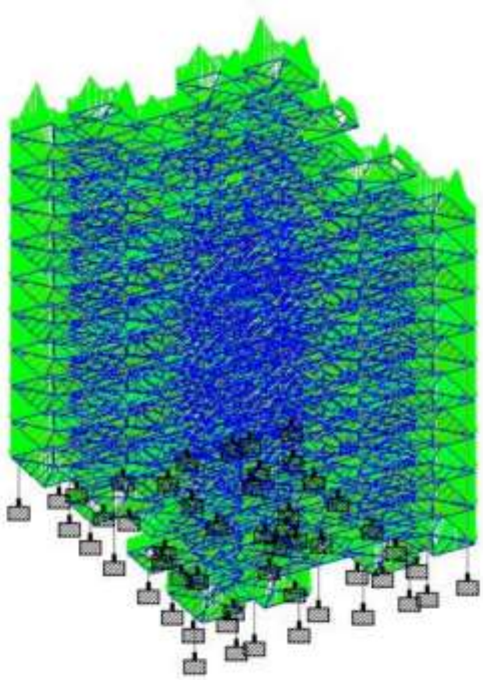

Figure 3.1. Dead Load of G+9 Building

2. Live loads (or) imposed loads:

These are the loads that changes with time. Live loads or imposed loads include loads due to the people occupying the floor, weight of movable partitions, weight of furniture and materials. The live loads to be taken in design of buildings have been given in IS: 875 (part-2) -1987. Some of the common live loads used in the design of buildings

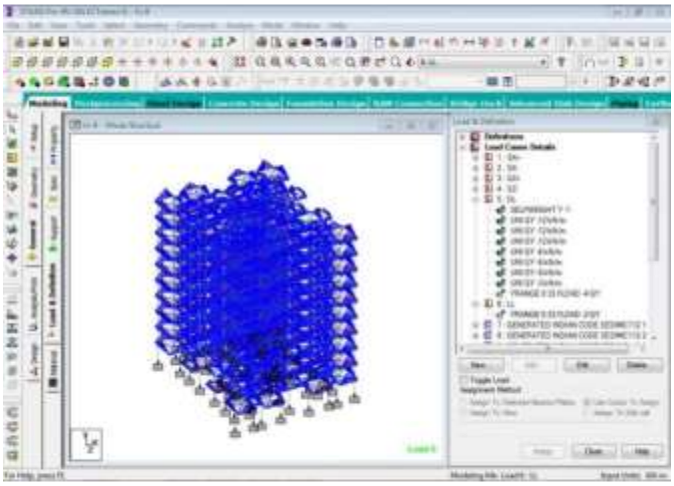

Figure.3.2. Live Load On G+9 Building

4. Wind loads:

Those which get on it laterally by wind are referred as wind loads. It relies up on the velocity of the wind and shape and size of the building. Completely the details of calculation about the wind loads on a structure are given in IS 875(part -3)-1987.

4. Earth quake forces:

Those due to earth quake are forced to move horizontally by it and shall be computed accordingly with IS 1893-1984.

4.SLAB DESIGN

4.1.Slab

Slabs are plain members whose thickness is low compared to its length and breadth. Slabs are frequently used as roof coverings and floors in various shapes such as square, rectangle, circular, triangular etc in buildings. Slabs primarily support transverse loads and pass them on to the supports by bending action in one or more directions. Beams or walls are the common supports for the slabs

4.2 General design requirements for slabs as per is: 456-2000

1. Effective span :- The effective span of a simply supported slab shall be taken as clear cover span plus effective depth of the slab or centre to centre distance between the supports whichever is less.

The effective span of the cantilever slab shall be accepted as its length to the face of the support plus half the effective depth except where it forms the end of a continuous slab where the length to the centre of support shall be taken.

2. Depth of slab :- The depth of slab relies on bending moment and deflection criterion.

Table 4.1 Types of Support (value)

Types of support	Fe 250	Fe 415
Simply supported	1/35	1/28
Continuous	1/40	1/32

CONCLUSION

In the earthquake resistant design of G+9 RC framed building, the steel quantity increased by 1.517% to the convention concrete design. The steel quantity increased in the structure ground floor to higher floor i.e G+9 level of the structure.

Seismic load dominates the wind load in G+9 building in case of seismic zone – II. The basic idea about wind pressure is high in the case of a high rise building based on the weather condition such as coastal areas, hilly stations. For the building, basically seismic forces create the main cause of damage to the structure.

Base Drift for considered G+9 Building The base drift condition gives that the base drifts = 0.0 at every storey It means that it safe structure under drift conditions so, shear walls or the braced columns aren't needed to be furnished So it's checked for a condition of storey drift under G+9.

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