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STRUCTURAL ANALYSIS & DESIGN OF MULTILEVEL BUILDING

Er. Amit Kaushik, Er. Sandeep Singh

Department Of Civil Engineering
Matu Ram Institute Of Engineering and Management, Rohtak(Hr), India

Abstract: **This research work is done to embrace the project work on "Strucural Analysis & Design of Multistorey Building". The principle goal of the project work is to accomplish the degree of information and practical understanding required for analysis and design of High rise structures. This project research consolidates all the phases of structural analysis through the determination of loading parameters, preliminary and detailed design of structural members. Loads on the structure have been resolved utilizing particular IS Codes and they have been dispersed in like manner. Preliminary design comprises of evaluation of the dimensions of structural members , for example, beams, slabs, and columns. Preliminary measurements have been resolved utilizing essential structure measurements and arrangements in the IS Codes. Analysis of Structure deals with investigation of forces created internally in structural members due to various types of loading, for example, live loads, dead loads, quake loads, and other dynamically acting loads. Response spectrum analysis has been consolidated for examining the structure. Structural Design manages the estimation of internal forces in the different part of structures which are oppressed during their successful life expectancy. The Structural design has been checked in accordance to the enumerating necessities compulsory for seismic tremor resistance.**

Keywords: **Structural analysis , Response spectrum analysis.**

I. INTRODUCTION

The method of analysis and examination of any structure totally depends upon the sort of building, its multifaceted nature, the number of floors and so on . To begin with, the drawings of design of the structure are examined, structural framework is concluded, proportions of basic individuals are being choosed and the information is being brought on the concerned modeler. The method for structural plan include a few stages which depends upon the sort of building , its unpredictability and the time accessible for basic structure. Basically , the work is required to begin soon, so the means of configuration are to be masterminded in such a manner that the establishment drawings can be taken up close by inside a sensible timeframe.

Thus before beginning the structural plan, the accompanying data of information are required:

(i) Set of engineering drawings;

(ii) Soil Investigating Report (SIR)for soil information;

(iii) Location of the spot or kind of working so as to choose the loadings

(iv) Data for water tank limits on top, lift to be placed , extraordinary rooftop highlights or loadings, and so forth. Decision of a proper structural framework for the structure is essential for it to remain economical and for its wellbeing. There are two sort of building frameworks:-

(a) Load Bearing Masonary Structures.

(b) Framed Structures.

A. LOAD BEARING MASONARY STRUCTURES :

In Small buildings like house with small stretch of beams the slabs are generally constructed as load bearing brick walls with reinforced concrete slab beams . This framework is appropriate for working up to 4 or less floors . In such structures

crushing strength of bricks will be 100 kg/cm^2 minimum for 4 floors. This framework is adequate for vertical loads. It additionally serves to opposes horizontal loads likewind and earthquake by box activity. Further, to guarantee its action against earthquake, it is important to give RCC bands in vertical & horizontal reinforcement in brick wall according to IS: 4326-1967(Code of Practice for Earthquake Resistant Construction of Buildings). In some Structures, 115mm thick brick walls are given since these walls are unable to support vertical loads, beams must be given along their lengths to support abutting slab and the heaviness of 115mm thick brick wall of the upper storey. These beams are to lay on 230 mm thick brickwalls or RCC columns whenever required. The plan of Load Bearing Brick work Structures are done according to IS 1905-1980 (Code of Practice for Structural Safety of Buildings: Masonry Walls (Second Revision). Load bearing brick wall.

B. FRAMED STRUCTURES :

In these sorts of structures, RCC frames are given in both of the principal directions to resist vertical loads and these are transmitted to vertical frame system i.e, Foundations & Columns. This type of framework is powerful in opposing both horizontal & vertical loads. The brick walls are to be taken as non-load resisting walls only. The framework of this kind is appropriate for the multi-celebrated structure , that is additionally viable in opposing horizontal loads created due to earthquake.

In this type of system the floor slabs are generally 100mm to 150 mm in thickness having lengths which ranges between 3.0m & 7.0m. In some seismic prone regions, even singular or two storey structures are made for security reasons. Additionally single storey structures of huge storey statures (5.0 meter or plus) , like electric substation ,etc are made as brick walls of huge statures are slim and load conveying limit of such walls lessens because of slimness.

II. BASIC CODES FOR DESIGN

The plan ought to be conveyed in order to fit in with the accompanying Indian code for reinforced concrete design, published by the Bureau of Indian Standards, New Delhi: Motivation behind Codes - National construction standards have been defined in various nations to set down rules for the structure and development of the structure. The codes have developed from the aggregate insight of master structural engineers , increased throughout the years. These codes are intermittently reexamined to align them with ebb and flow look into, and regularly, current patterns. Initially, they guarantee sufficient structural security, by determining a specific fundamental least prerequisite for plan. Besides, they render the assignment of the engineer moderately basic; regularly, the consequence of sophisticate examinations is made accessible as a straightforward recipe or diagram. Thirdly, the codes guarantee a proportion of consistency among various engineers. At last, they have some legitimate legitimacy in that they shield the basic engineer from any risk because of basic disappointments that are brought about by insufficient supervision or potentially broken material and development.

(i) IS 456: 2000 – Plain and Reinforced Concrete – Code of Practice (Fourth Revision)

(ii) Loading Standards

These loads to be considered for structural design are determined in the accompanying loading measures:

IS 875 (Part 1-5): 1987 – Code of practice for design loads (other than quake) for buildings and structures (second modification)

Section 1: Dead loads

Section 2: Imposed (live) loads

Section 3: Wind loads

Section 4: Snow loads

Section 5: Special loads and load combinations"

"Design Handbooks

The Bureau of Indian Standards has likewise distributed the accompanying handbooks, which fill in as a helpful enhancement to the 1978 version of the codes. In spite of the fact that the handbooks should be refreshed to align them with the as of late reconsidered (2000 variant) of the Code, a large number of the arrangements keep on being substantial (particularly concerning basic plan arrangements).

SP 16: 1980 – Design Aids (for Reinforced Concrete) to IS 456: 1978

SP 24: 1983 – Explanatory handbook on IS 456: 1978

SP 34: 1987 – Handbooks on Concrete Reinforced and Detailing."

"General Design Consideration of IS: 456-2000.

The general design and construction of reinforced concrete structures will be administered by the arrangements of IS 456 – 2000

III. AIM

The aim behind analysis & designing is -

- The accomplishment of the satisfactory probability that structure which is to be planned will have appropriate degree of safety.
- To learn the concept of vertical & lateral loadings on the structure.
- Creating appropriate model of the building for structural analysis.
- Detailed structural analysis using suitable structural analysis program.
- Sectional design of structural components.

IV. METHOD OF DESIGNING

- Structural elements of the structure shall normally be designed by Limit State Method.
- Working Stress Method may be used where the Limit State Method cannot be adopted adequately.

V. LEAST GRADE OF CONCRETE

The least grade of concrete for reinforced & plain concrete shall be as per following table:

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 and 9.1.2)

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

Fig.(i) Least Grade Of Concrete

VI. GENERAL PRINCIPLES FOR THE DESIGN

On beginning at the outline of structural action, mechanism of damage and modes of failure structures, we can think of following contemplations:-

- Structures ought not be brittle or collapse suddenly Or maybe, they ought to be intense, ready to avoid or disfigure an impressive sum.
- Opposing components, for example, propping or shear walls, must be given equally all through the structure in both directions side to side, just as start to finish.
- All components, for example, walls and rooftop ought to be integrated to go about as a coordinated unit during seismic tremor shaking, transferring forces across connections and preventing separation.
- The building must be well connected to a good foundation and the earth.
- Wet, delicate soils ought to be maintained a strategic distance from and the establishment must be well integrated, just as attached to the divider, where delicate soils can't be stayed away from, uncommon reinforcing must be given.
- Care must be taken that all materials utilized are of acceptable quality, and are shielded from downpour, sun, bugs and other debilitating activities, with the goal that their quality endures.
- Unreinforced earth and brick work have no solid quality in strain and are fragile in pressure. By and large, they should be appropriately strengthened by steel or wood.
- Adherence to previously mentioned basic standards, a planner can give a structure that doesn't forestall all harm in moderate or huge seismic tremor, yet perilous breakdown can be forestalled and harm constrained to repairable extents.

VII. CONCLUSION

After the completion of the project on “Structural Analysis and Design of Multistory Building”", I have picked up inside and out information about the design of RCC structures. The reason for this task is absolutely academic arranged, yet I have made very efforts to make it achievable for genuine development. During my whole work, I utilized different codes for the seismic design and examination of composite loads, moments, deflections, nature of effects on every single member of the sectionthrough SAP Investigation. Right now due consideration is given to keep up the precision while examining the information in computer and planning the structural components. I have confronted numerous issues during the work. Be that as it may, difficult work, distinct fascination and dedication of my guides and their significant proposals made it conceivable to finish the undertaking inside the time span. After culmination of this task, my guides and I accept that I can exclusively plan comparative sorts of structure and structural components. I trust this project work will prove valuable to me in my carrier.

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