Planning, Analysis and Designing of Multi Storied Building by using Finitie Element Analysis Software

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Abstract:- **As the walls don't take any load, they are also of thinner dimensions. So, the lighter structural components and walls reduce the self weight of the whole structure which necessitates a cheaper foundation. Also, the lighter walls which can be easily shifted provide flexibility in space utilisation. In addition to the above mentioned advantages the framed structure is more effective in resisting wind loads and earth quake loads.**

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1. INTRODUCTION

The population explosion and advent of industrial revolution led to the exodus of people from villages to urban areas. This urbanization led to a new problem – less space for housing, work and more people. Because of the demand for land, the land costs got sky rocketed. So, under the changed circumstances, the vertical growth of buildings i.e. constructions of multi-storey buildings has become inevitable both for residential and as well as office purposes. For multi-storied buildings, the conventional load bearing structures become uneconomical as they require larger sections to resist huge moments and loads

1.1Work done in this project:

A plot of 369.75 m^2 has been selected for the construction of a multi-storied office building. In the office building the functions will be different and it plays a major role because of different loads acts on different slabs. The frame analysis requires the dimensions of the members. For the analysis, 6 substitute frames taken in transverse direction and in longitudinal direction the net moment acting is zero, and this is due to symmetry city

1.1Analysis of structure:

Kani's method and substitute frame method is generally used to analyse a multistoried frame. The substitute frame method requires less computations and easier to carry out the analysis. Therefore, here substitute

frame method has been employed to carry out the frame analysis and method is discussed in the following paragraphs.

Theoretically, a load applied at any point of the structure cause reactions at all sections of the frame, but a close study of this aspect has shown that the moments in any

1.2 Design concept:

There are three design philosophies to design a reinforced concrete structures. They are:

1. Working stress method,
2. Ultimate load method and
3. Limit state method.

In the 'working stress' method it is seen that the permissible stresses for concrete and steel are not exceeded anywhere in the structure when it is subjected to the worst Combination of working loads. A linear variation of stress form zero at the neutral axis to the maximum stress at the extreme fibre is assumed finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

2.DESIGN

2.1 DESIGN OF SLABS

Typically we divided the slabs into two types:

i. Roof Slab and
ii. Floor Slab

In case of roof slab the live load obtained is less compared to the floor slab. Therefore we first design the roof slab and then floor slabs. We have two types of supports. They are:

1. Ultimate support and
2. Penultimate support

Ultimate support is the end support and the penultimate supports are the intermediate supports.
sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

Slab	Dimensions (M x M)
Roof S1	8.62 X 3.05
Roof S2	8.62 X 3.05
Roof S3	5.78 X 3.05
Roof S4	5.78 X 3.05

Roof S1 and Roof S2 are the slabs with same dimensions but with different end conditions.

Roof S3 and Roof S4 are also the slabs with the same conditions as mentioned above. But the point to be noted is that all the Slabs have same shorter span and in the design of one way slab shorter span is of more importance. Therefore we design any two slabs with different end conditions and the remaining two slabs also follow the same design.

Moment = 7.85 KN-m

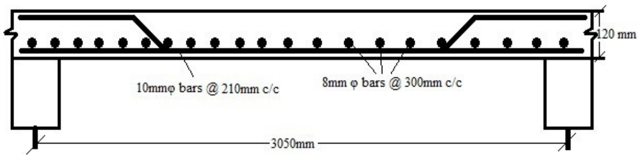
Total A_{st} (available) = 128.39 + 128.39 = 284.59 mm^2

Therefore A_{st} (available) = A_{st} (required)

DESIGN OF FLOOR SLAB (S1):

Calculation of Depth (D) by using modification factor. Assume the percentage of the tension reinforcement (P_t) provided is 0.4%

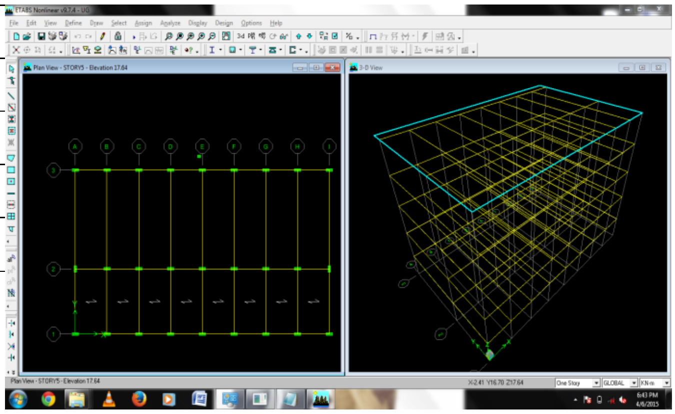
From IS456-2000, P38 Fig4, we get the modification factor (α) = 1.4



3. ANALYSIS OF FRAMES

We have many number frames from the plan and the need to be analysed. We have two different types of frames:

1. Longitudinal direction frame
2. Transverse direction frame



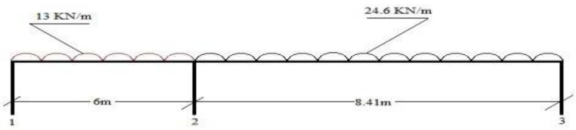
3.1Transverse frame:

The frames are chosen in such a way that the loads vary from one frame to the other and we have 6 transverse frames.

In every frame we need to analyse the three types of loading cases and each frame consists of roof and floor analysis. Here we assumed the cross sections of beams and columns in advance and with the help of the assumed dimensions, we calculate the stiffness of the members and there by the distribution factors for the members especially at the joints. To analyse the frame we use the substitute frame method and there by applying the moment distribution method to know the moments carried by the member at the joints.

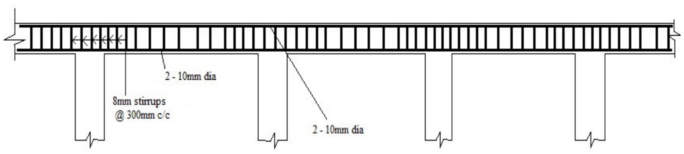
We take each floor span and we assume the top and bottom storeys are fixed by the substitute frame principle.

Therefore, maximum moment = 40.35 KN-m



4. DESIGN OF BEAMS

Bending moment diagram for entire building:



I.

USING THE TEMPLATE

From IS456-2000(Clause 40.4, P72)

When exceeds, shear reinforcement shall be provided

Shear reinforcement shal be provided to carry a shear equal to V_u - $\tau_c$bd. The strength of shear reinforcement V_{us} shall be calculated as follows. From IS456-2000(Clause 40.4, P72)

When $_v$ exceeds $_c$, shear reinforcement shall be provided Shear reinforcement shall be provided to carry a shear equal to V_u - $_c$bd. The strength of shear reinforcement V_{us} shall be calculated as vertical stirrups where d is the effective depth of the section under

5. DESIGN OF COLUMNS

Since the loads and moments in the three columns in a frame are different. Each of the Column is required to be designed separately. However, when entire building is to be designed, there will be a number of other columns along with each of the above columns to form group.

Since exact values of P_u and M_u are known for all storeys for all columns, the column section will be designed using exact method using charts and tables. Charts are useful for any column. It is advisable to have curves plotted of P_u-M_u for standard sections normally used in building design to avoid calculations.

All the columns are subjected to axial load sand uni-axial bending. They will be designed to resist P_u and M_u for bending about x- x axis which is the major axis.

For frame 19-10-01:

Columns are C19 at left end, C10 at middle and C01 at right end of the frame.The moments and axial forces are calculated in analysis of frames and design of beams. We have transverse frames and in these frames the plinth level transverse beams are absent and longitudinal beams are present at the plinth level.

In each level the types of loads are:

1. Max shear from transverse beams
2. Shear from longitudinal beams
3. Self weight of columns.

But in plinth level shear from transverse beams is absent. We have only two values at the plinth level Section: 230mm x 600mm

6. DESIGN OF FOOTINGS

In the design of footing, the loads are known from the column analysis. The working load is used for the footing design. Footing is a member through which the load of the superstructure is transferred to the sub soil. Therefore the safe bearing capacity is the main factor in design

soil is 250 KN/m^2.

Therefore the footing is isolated rectangular sloped footing. The slope is provided to decrease the amount of concrete in the construction which results into an economic construction.

From the analysis of frames and columns, considered 6 frames and each frame consists of 3 footings so totally 18 footings are to be designed.

7. DESIGN OF STAIR CASE

Stairs consist of steps arranged in a series for purpose of giving access to different floors of a building. Since a stair is often the only means of communication between the various floors of a building, the location of the stair requires good and careful consideration

A residential house, the staircase may be provided near the main entrance. In a public building, the stairsnmust be from the main entrance itself and located centrally

8. REFERENCE

[1] Design of Reinforced Concrete Structures by A. K. Jain
[2] Illustrated design of reinforced concrete buildings by Dr.V.L. Shah & Dr.S.R.Karve
[3] Basic principle and analysis and design Framed Structures by Prof. H. R. Surya Prakash S. Krishna Murthy