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STRUCTURAL ANALYSIS AND DESIGN OF G+6 OFFICE BUILDING WITH PROVISION OF CASTELLATED BEAM.

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Abstract – *The Project is on design and analysis of G+6 office building framed structural with the provision of castellated beam. The entire process of structural planning and design have been completed using STAAD Pro V8i. Software. The planning is performed using the Green Building Rules. All the drafting and detailing was done by using Auto CAD and RCDC Software. RCC Beams are replaced with Castellated Beam to avoid the core cutting of RCC Beam. In this project, the seismic Analysis is done according to IS:1893-1 (2002) and the entire structure is design using IS: 456-2000 code book. Castellated beam is used due to increase depth of section without any addition of weight, low maintenance and also the opening provided in beam for the passing of service pipe. Stiffeners are provided in Beam to prevent failure. Static analysis of the structure is performed; base shear is calculated for different earthquake zone.*

Keywords—castellated beam, static analysis, Base shear, earthquake zone.

1. INTRODUCTION:

Today many multi-storeyed buildings in India have Castellated Beam as an unavoidable feature. This is being adopted- a) to provide opening in beam b) to decrease the load of structure and for economic design.

The Determination of general shape, specific dimension and size is known as structure analysis so that it will perform the function for it create and will safely withstand the influences which will act on throughout its useful life.

In this project, an effort made on planning, analysis and design of office building. For analysis and design of building, the plan draft by AUTO-CAD software which plan import in STAAD Pro.

The office building is designed for Zone II using static analysis method

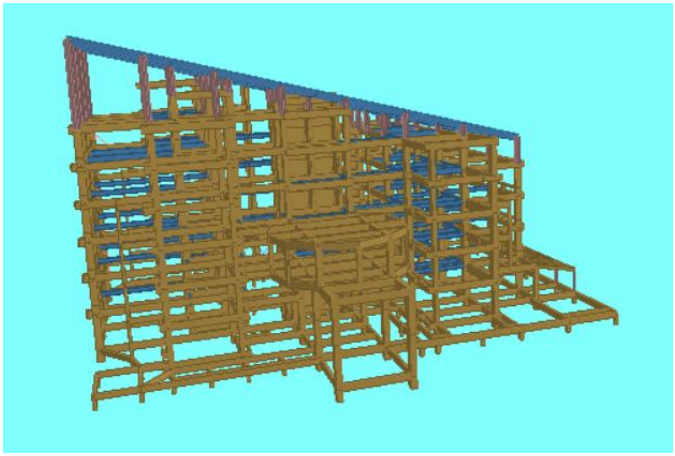


Fig :1 Elevation

Fig :2 Elevation

I. OBJECTIVES

The primary objectives of the study are as under –

1. To study the behavior of multi-storied buildings with Castellated Beam under earthquake excitations.
2. To carry out Static and conventional gravity analyses for different cases by varying the location of Castellated Beam floor wise and within the floor.
3. To model the building using software STAAD PRO V8i for analysis and design purpose.
4. To study the structural response of the building models with respect to following aspects –

1.Shear force and Bending Moment
2. Base shear.
3. Storey Displacement.
4.Story Drift

II. MODEL STUDIES

A 42m x 33m multi-storied building (G+5), with special moment resisting frame was selected for study. It was considered to be located in Zone II on Type III(medium) soil. The loads and member sizes are summarized in Table I. In this study first a slab with castellated beam is modeled whose floor elevations are shown in figure 2. For the model three different Zones are studied Displacement and Bending Moment.

Building Data:

Member dimension	
Slab	0.150 m
Beam	0.23 x 0.6 m
Column	0.3 x 0.6 m,0.45 x 0.6 m
Loads	
Unit weight of concrete	25 KN/m^3
Floor	Dead load	5.375 KN/m^2
	Live load including finish	3.5 KN/m^2

Table No.: 1

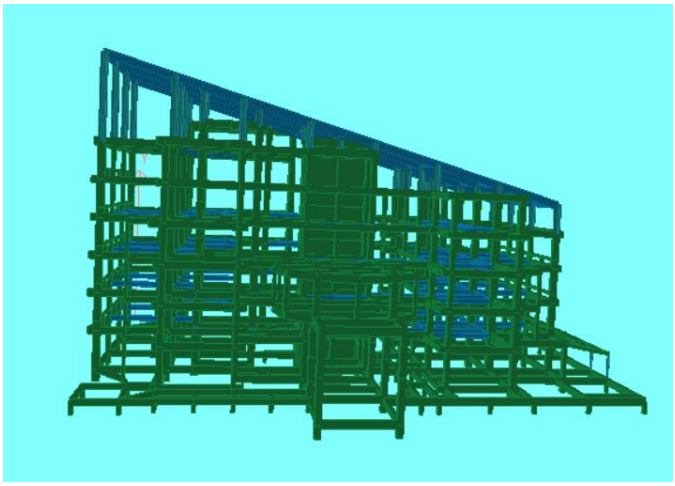


Fig. 3

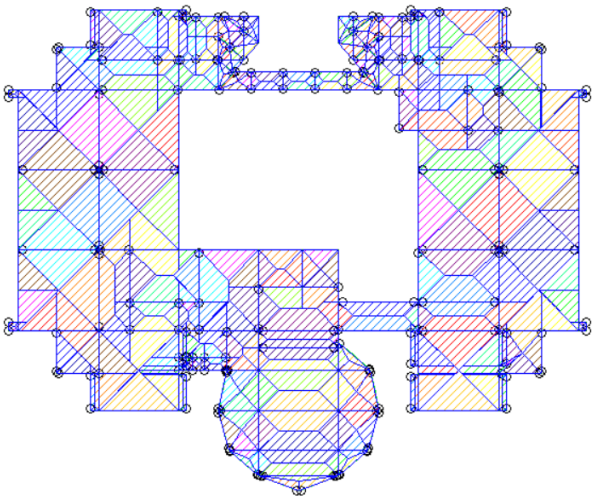


Fig 4 Plan with slab Load distribution

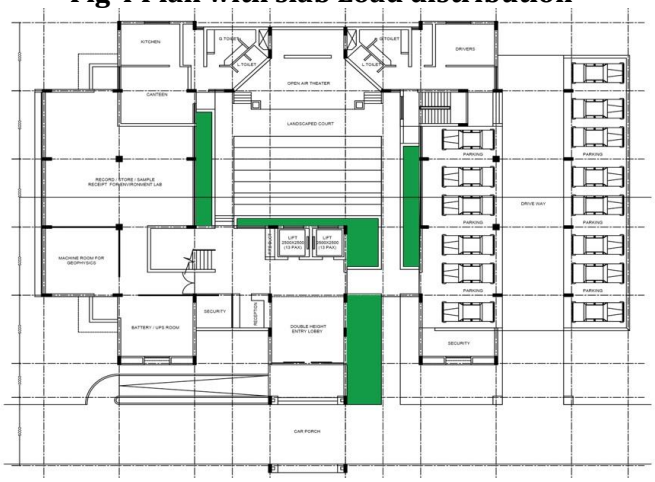


Fig 5 Ground Floor Plan

III. STAAD PRO CALCULATION

The total seismic weight of the structure is calculated by using IS-1893 2000.The Model with Castellated Beam is analyses on Staad pro.

Given Data,
Zone :- II (Nagpur)
Type of soil :- Hard
Importance Factor (I) :- 1.5
Response Reduction Factor(R) :- 3
Fundamental time period :- $0.075h^{0.75}$

LOAD COMBINATIONS CONSIDERED FOR THE BUILDING ANALYSIS

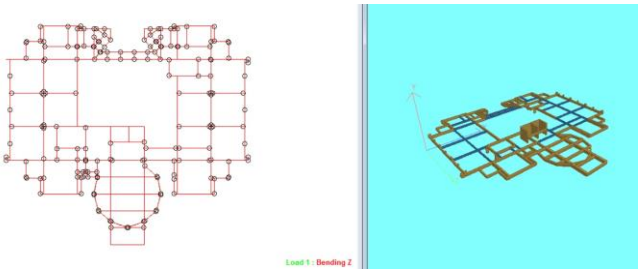
The shown load combinations are adopted for the design and analysis of the structure according to the code IS 1893 (part I) : 2002

Table: - Load combinations as per IS 1893(Part1):2002

SR NO.	Load Combination	Load Factors
	Gravity analysis	1.5(DL+LL)
2.	Equivalent static analysis	a)1.2(DL+LL±EQX) b)1.2(DL+LL±EQY) c) 1.5 (DL ± EQX) d) 1.5 (DL± EQY) e) 0.9 (DL ± EQX) f) 0.9 (DL± EQY)

TABLE No.: 02 (LOAD COMBINATION)

Where,
DL= Dead load LL = Live load.
EQX, EQY= Earthquake load in the X and Y directions, respectively.



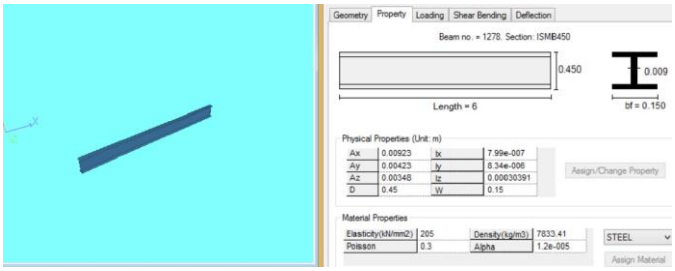


Fig :6 Member Property

IV. RESULT

B E A M N O. 1410 D E S I G N R E S U L T S

M30 Fe500 (Main) Fe500 (Sec.)

LENGTH: 3000.0 mm SIZE: 450.0 mm X 750.0 mm COVER: 25.0 mm

SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	750.0 mm	1500.0 mm	2250.0 mm	3000.0 mm
TOP REINF.	0.00 (Sq. mm)	0.00 (Sq. mm)	0.00 (Sq. mm)	550.80 (Sq. mm)	1095.10 (Sq. mm)
BOTTOM REINF.	2454.20 (Sq. mm)	1834.93 (Sq. mm)	1195.67 (Sq. mm)	607.50 (Sq. mm)	0.00 (Sq. mm)

SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	750.0 mm	1500.0 mm	2250.0 mm	3000.0 mm
TOP REINF.	8-10í 1 layer(s)	8-10í 1 layer(s)	8-10í 1 layer(s)	8-10í 1 layer(s)	14-10í 2 layer(s)
BOTTOM REINF.	32-10í 3 layer(s)	24-10í 2 layer(s)	16-10í 2 layer(s)	8-10í 1 layer(s)	8-10í 1 layer(s)
SHEAR REINF.	2 legged 12í @ 240 mm c/c	2 legged 12í @ 155 mm c/c	2 legged 12í @ 175 mm c/c	2 legged 12í @ 85 mm c/c	2 legged 12í @ 240 mm c/c

In the present work, the structural displacement of column in RC building on with respect to base shear and displacement using equivalent static analysis.
The result is listed in the Figure

V. CONCLUSIONS

1. It was observed that castellated beam behaves satisfactorily as compared to its parent I beam in respect of deflection and strength requirement
2. The strength of the beam with opening may be governd by the plastic deformation that occur due to both moment and shear at the opening.
3. Castellated beam with hexagonal openings is proved to be better than other opening in respect of load carrying capacity.

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BIOGRAPHIES

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