

# Analysis and Design of Proposed Extension of Department Building

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**Abstract**—This article provides an analysis and design of a software-modelled reinforced concrete structure of our collage existing civil department building. The existing building was constructed as G+ 2 storey, so in this project an attempt is made to add one more floor for the purpose of necessary to required class rooms because of student intake will be increased. Nowadays Conventional method of manual design of high rise building is time consuming as well as possibility of human errors. So it is necessary to use some computer based software which gives more accurate results and reduce the time. In this study, CYPECAD, a software program from CYPE Ingenieros (<http://www.cype.com>), was used as a tool for calculating the analysis and design of the structure according to the standards codes from a selection of countries in India. Furthermore, it was demonstrated that CYPECAD serves as an effective and powerful tool in obtaining results for the analysis and design of structures.

**Key words:** Analysis, Design, CYPE CAD, extension building.

## I. INTRODUCTION

Nowadays the construction of building is major work of the social progress of the county. Daily new techniques are being developed for the construction of building economically, quickly and fulfilling the requirements of the community engineers and architects do the design work, planning and layout, etc., of the buildings. Draughtsman are responsible for doing the drawing works of building as for the direction of engineers and architects. The draughtsman must know his job and should be able to follow the instruction of the engineer and should be able to draw the required drawing of the building, site plans and layout plans etc., as for the requirements.

In every aspects of human civilization we needed structures to live in or to get what we need. But it is not only building structure but to build efficient structures so that it can fulfil the main purpose for what it was made for. Here comes the roll of civil of engineering and more precisely the roll of analysis of structure.

The design is made using software on structural analysis design (CYPE CAD). The building subjected to both the vertical loads as well as horizontal loads. The vertical load consists of dead load of structural components such as beams, columns, slabs etc. and live loads. The horizontal load consists of the wind forces thus building is designed for dead load, live load and wind load as per IS 875. The building is designed as two dimensional vertical frame and analyzed for the maximum and minimum bending moments and shear forces by trial and error methods as per IS 456-2000. The help is taken by software available in institute and the computations of loads, moments and shear forces and obtained from this software.

Few standard problems also have been solved to show how CYPE CAD can be used in different cases. These typical problems have been solved using basic concept of loading, analysis, condition as per IS code. These basic techniques may be found useful for further analysis of problems.

## II. OBJECTIVES

- Collection of data of existing building and evaluate its structural configuration.
- Proposing suitable design for new storey.
- Utilization of CYPECAD is for existing building by adding another storey.
- Analysis of current building and access its sustainability
- Study of design of various elements of building..
- Preparation of drawing and test its compatibility for the existing structure.
- Detailing of beams, columns, slabs with section proportioning and reinforcement.

## III. SOFTWARE DETAILS

### 1. CYPE CAD

This project involves analysis and design of multi-storeyed [G +2] Institutional building adding one more floor using a design software CYPECAD. We have chosen CYPECAD because of its following advantages:

- Program that carries out the analysis and design of reinforced concrete and steel structures, subject to horizontal and vertical loads, for homes, buildings and civil project works.
- Its use guarantees maximum analysis reliability and optimum drawing design.
- The geometry of the structure can be introduced automatically.

- The user can personalize the design and edit the elements that have been introduced, with the on-screen support provided such as, help options and error and warning texts.
- Provides very complete and precise construction drawings of the structure.
- CYPECAD is adapted to the latest national and international construction codes.
- From model generation, analysis and design to visualization and result verification, CYPECAD is the professional's choice for steel, concrete, timber, aluminium and cold-formed steel design of low and high-rise buildings, culverts, petrochemical plants, tunnels, bridges, piles and much more.

## 2. AutoCAD

- AutoCAD is powerful software licensed by auto desk. The word auto came from auto desk Company and CAD stands for computer aided design. AutoCAD is used for drawing different layouts, details, plans, elevations, sections and different sections can be shown in auto cad.
- The importance of this software makes every engineer a compulsion to learn this software's. We used AutoCAD for drawing the plan, elevation of a residential building.

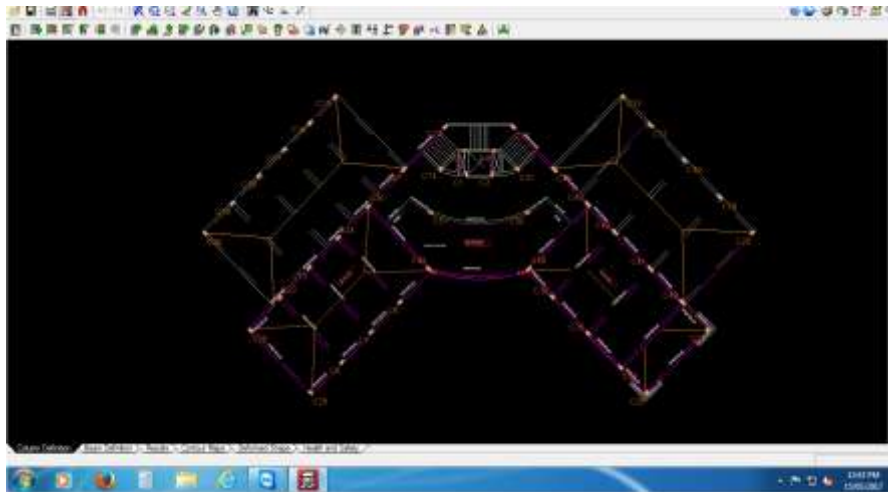
## IV. LITERATURE REVIEW

CYPE-CAD <sup>[1]</sup> is a "Software for Architecture, Engineering and Construction" ISO 9001:2008 – 2015. It is a software package which assists in carrying out the analysis and design of reinforced concrete and steel structures, subject to horizontal and vertical loads, for homes, buildings and civil work projects. Its use guarantees maximum analysis reliability and optimum drawing design.

M.C.G Pastor and C.F Fernandez <sup>[2]</sup>, Department of research and development CYPE Ingenious, Alicante, Spain on "Structural Analysis with Different International Standards of Buildings Subjected to Seismic Loads".

In this research paper, have done an analytical investigation with different international standards of buildings subjected to seismic loads. This paper concludes that the structural reinforcement not only depends on the forces produced by the action to which the structure is subjected, but also depends on seismic requirement for reinforcement specified by the standards codes.

## V. STATEMENT OF OUR PROJECT



**Figure 1: structural plan of existing building**

### 1.SALIENT FEATURES

1. Utility of building : institutional building
2. No of stories : G+3
3. Shape of the building : Radial
4. No of staircases : 1
5. Type of construction : R.C.C framed structure
6. Type of walls : cement block wall
7. Foundation type : combined and rectangular footing
  - Concrete grade : M25 –column

: M20- slab

: M20- footing

- All steel grades : Fe415 grade
- SBC of soil : 250 KN/ m<sup>2</sup>

Loads on floor:

- Live load = 3KN/ m<sup>2</sup>
- Dead load = 1.5 KN/ m<sup>2</sup>
- Wall load for 0.23m wall = 14 49KN/m (18\*0.23\*3.5)
- Depth of foundation = 1.8mtrs

**TABLE 1 : GEOMETRIC DETAILIES**

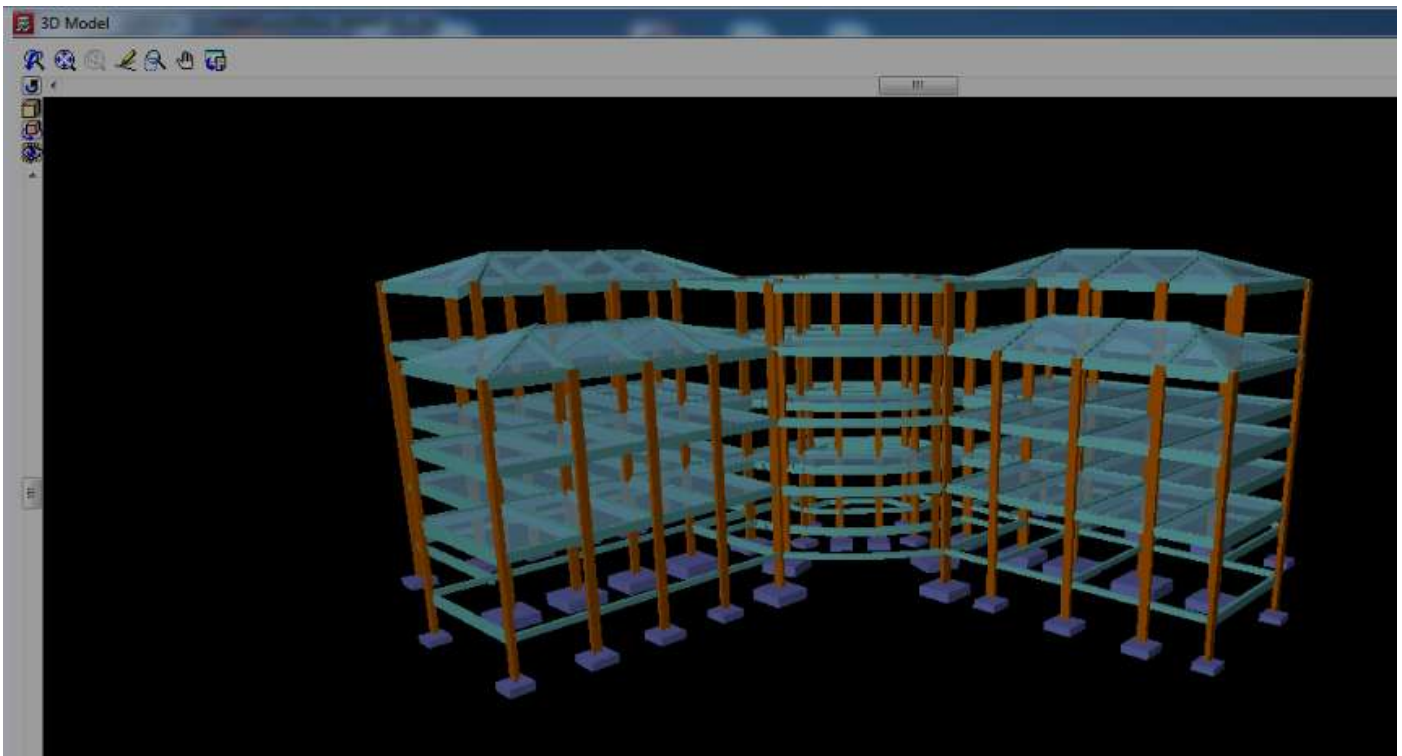
FLOOR NAME	HEIGHT (m)	ELEVATION (m)
3 <sup>rd</sup> Floor	3	13.8
2 <sup>nd</sup> Floor	3.5	10.8
1 <sup>st</sup> Floor	3.5	7.3
Ground Floor	3.5	3.8
Foundation	1.8	0.30
Basement	0	-1.50

## VI. MODELING IN CYPE CAD

Modeling in CYPECAD involves following steps:

- Automatic job introduction
- Specifying structure details.
- Importing of architectural drawings.
- Specifying loads on the structure.
- Defining Structure geometry.
- Defining special loads on the structure.

Using CYPECAD's Automatic job introduction, the user has two options which allow for a structure to be generated automatically either by means of importing a file in IFC format, generated by the main CAD/BIM programs ( Archicad, Revit Architecture); or by using a file in DXF or DWG format. For the current project we imported plan of the building in DWG format. Specifying Structure details involves entering of details such as numbers of floors, height of the floors etc. The architectural drawings that are to be imported should be edited such that it fulfils the software requirements. Editing of drawing involves creating layers which indicates the positioning of columns and its dimensions. These different floor drawings which are edited are imported to the software for further modelling after importing the architectural drawings the floor loads which are calculated earlier are feed to the software. The dead loads and live loads are entered separately. The software allows usage of different load cases. After giving all the data the layout of Column, Beam&Slab is done and we get the 3D view of the structure i.e. The Modeled Structure.



**Figure 2: CYPE CAD 3D Modelled structure**

After Modelling we perform the analysis part without foundation and the analysis is done by a method known as Stiffness matrix method. Once the structure is modeled we select the appropriate foundation for the structure based on trial and error method, for our project we found that isolated footing is safe with bearing capacity of soil assumed as 250KN/m<sup>2</sup>. A vast amount of analysis and reinforcement options are available to be able to take into account those aspects that are deemed most adequate. Additionally, for each structural element and each reinforcement position, personalized reinforcement tables may be defined. For all design elements, their geometry and reinforcement can be edited and modified, with multiple tools to carry out the task. Drawings can be personalized according to the user's needs, as the program allows configuring all the drawing layers and elements and generating them via DXF, DWG, printer and plotter.

**RESULT AND ANALYSIS**

**Design Reports**

**Table 2: The code check for roof column no.2**

Column data	
	Geometry
	Dimensions : 45x23 cm
	Span : 10.800/13.800 m
	Free height : 2.46 m
	Geometric cover : 4.0 cm
	Maximum aggregate size : 20 mm
	Materials
Concrete : M 25	ZX plane : 2.46 m
Steel : Fe 415	ZY plane : 2.46 m
Longitudinal reinf.	Stirrups
Corner : 4Ø12	Perimeter : 1sØ8
X Face : 4Ø12	Y Direction : 2cØ8
Steel area : 0.87 %	Spacing : 15 cm

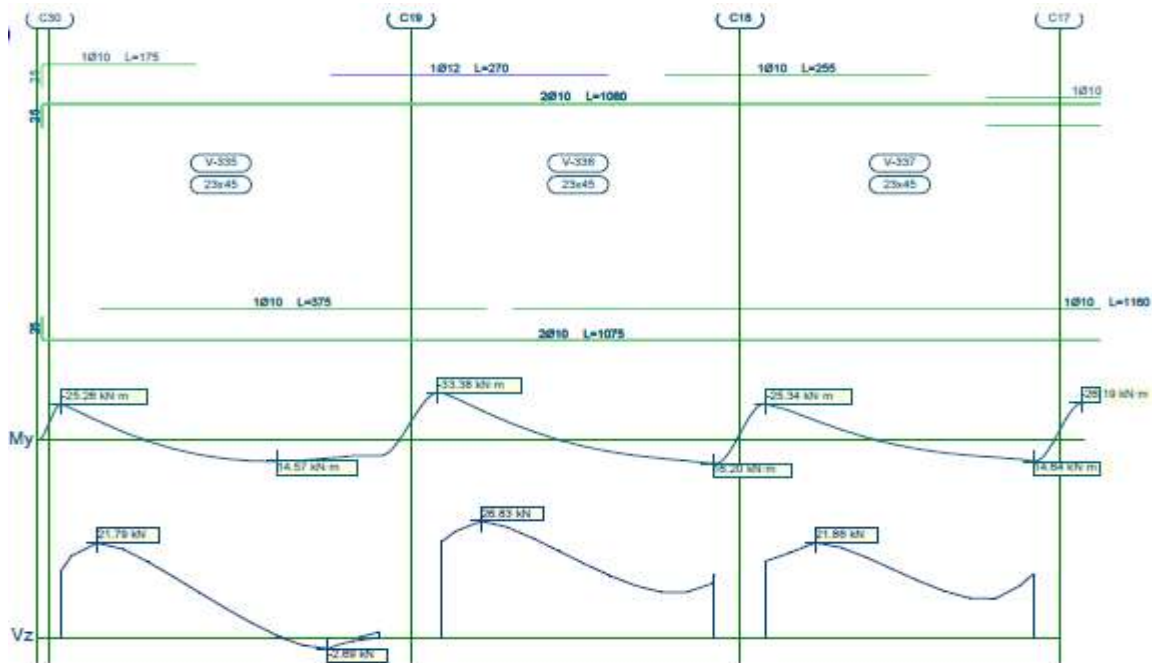


Figure 3: Beam reinforcement report of frame 20

Table 3: Foundation reinforcement report of Column 1,2,3,4,13

References	Material	Geometry	Reinforcement
C1, C2		Eccentric rectangular footing Initial width X: 62.5 cm Initial width Y: 72.5 cm Final width X: 62.5 cm Final width Y: 72.5 cm Footing width X: 125.0 cm Footing width Y: 145.0 cm Depth: 35.0 cm	X: 9Ø10@16 Y: 8Ø10@16
C3, C4, C13		Eccentric rectangular footing Initial width X: 47.5 cm Initial width Y: 37.5 cm Final width X: 47.5 cm Final width Y: 37.5 cm Footing width X: 95.0 cm Footing width Y: 75.0 cm Depth: 35.0 cm	X: 4Ø10@18 Y: 5Ø10@18

➤ CONCLUSION

- The existing building structural components like column, beam, foundation, is sufficient to carry the another roof load
- .Designing using Software's like CYPE CAD reduces lot of time in design work.
- .Details of each and every member can be obtained and also estimation, job report, concrete quantity, quantity of steel, bending schedule obtained using CYPE CAD software.
- All the List of failed beams can be obtained and also Better Section is given by the software.
- Accuracy is improved by using software.
- TheCYPECAD enables to check the safety of design and modification in individual structural element.

REFERENCES

[1] Dr.V.L.Shah & Dr.S.R.Karve, "Illustrated design of reinforced concrete building", Structure publications, 5th edition, Feb.2014.  
 [2] S.S.Bhavikatti, "Advanced R.C.C. Design", New Age International Publishers, 2nd edition, 2009.

- [3] CYPE Ingenieors, Cypecad – user’s manual, 2009.
- [4] Mr.Shivam Sharda, Mr.Abhishek Sharma, “Design and Analysis of Multi-Storey Reinforced Concrete Tower”, project report, 2013, pg 12-53.
- [5] Nawari O, Ph.D., P.E., M.ASCE, “BIM-Model Checking in Building Design”, 2013, pg 3- 29.

#### **IS CODES**

1. IS 456-2000 ( Design of RCC structural elements )
2. IS 875-Part 1 ( Dead Load )
3. IS 875-Part 2 ( Live Load )
4. SP-16 ( Depth and Percentage of Reinforcement)