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Manual and software-based design of RCC g+1 building and its comparison

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ABSTRACT

Civil Engineering is an ever changing industry. With advancement in technology, we have seen civil engineering fieldevolve from working solely with the concrete to now designing and building with the help of computer Technology. Theproject deals with different software used in civil engineering like AUTO CAD, REVIT, ETABS, STAAD PRO which are useful for project completion in various ways. Auto CAD helps for detailed drawings of 2D floor plans. After that for obtaining more details 3D model of building canbe made with help of Revit then design and analysis is done with STAAD PRO.

Keywords: *-AUTOCAD, REVIT, STAAD PRO, Manual, Design, Comparison*

1. INTRODUCTION

Construction is an ancient Human Activity. Human have been building homes and different structures for centuries. The construction in this 21st century is becoming challenging day by day. As in order to bring down these challenges and savetime, computer-based software programs are used by engineers. We use following software for completion of our project

1.1 AutoCAD

Some content related to your research work in running paragraphs. AUTOCAD is software tool that allows to designand plan in CAD system. It is very is to use, very comprehensive in it's ability to create 2D and some 3D drawings.

- Advantages of AUTOCAD

1. Easy and fast
2. Accurate and reduces errors
3. Save time and money
4. Easier import/export of files

1.2 Revit

Revit is a building information modeling software for architect, engineers, designers and contractors. This softwareallows users to design a building and structures and its components in 3D.

Advantages of AUTOCAD
1. Automation
2. Collaboration
3. Parametric modeling
4. The huge Library

1.3 STAAD Pro

STAAD is the abbreviation for structural analysis and design. STAAD PRO is one of the popular software that is used for analysis and design different structures. It can apply more than 90 international steel, concrete, timber andaluminum design codes.

Advantages of STAAD PRO
1. STAAD building planner
2. Steel Auto Drafter
3. Advanced concrete design
4. Advanced slab design

2. LITERATURE REVIEW

2.1 AUTOCAD

Runmei Zhang and YehuanGu (2017): They proposed research on Auto CAD Secondary Development and function expansion based on VBA technology. In this research the parametric drawing system based on the Auto CAD Secondary technology of VBA can solve the problem of repeatability and error in the mass production of industrial products.It also help for the defects of Auto CAD. Single drawing function. .On the basis; the enumeration of severalfunction of expansion. 3D Model, custom menu bar, dimension and so on, which also promote the future development of parametric Technology.

Azidah Abu Ziden, Fatariah Zakaria and Ahmad Nizam Otham (2012): "Effectiveness of Auto CAD 3D software as a learning support Tool". This research helps to increase performance of high and medium level student groups which gave a positive impact on a study. Effective use of this software proved to be helpful to students.

Thus, the expand use of this software is proposed to all the schools that teach ED to ease student to learn the subject as well as attract them to study. These indicate the software can help student visualization capability. The result shows excellent increases in student achievement after using this software.

2.2 Revit :

E.Rakesh Reddy, S.Kailashkumar (2019): They proposed research on "Design and Modelling of G+1 ResidentialBuilding by Autodesk Revit Architecture". The Revit Software will give the plan view,3D model with excellent elevation, detaining diagram, schedules for each structural elements. Using Revit architecture we can get the approximate estimation of building. Revit collects information about each structural elements material its visualization realistic in nature and its design such as thickness height and un schedule it will give number of datasuch as cost type of family, number of bricks, number of doors, number of windows etc., across all other representation of Project.

Prof.Sachin A. Ghadge, Mr. Mahesh G. Samal, Miss. Bhuvaran M. Madas, Miss Shravani B. Chintakindi, Miss. Ramadevi A. Ankam(2020): A case study on building Information modeling for residential Building. This project include Revit software. Revit BIM software is a building information 2odeling tool for structural engineeringconstruction design and Architectural design. It is one of the most popular software packages developed by the CADgiant Autodesk. Designed for MEP engineers, architects, designers, contractors and landscape architects, among others.

2.3 STAAD PRO:

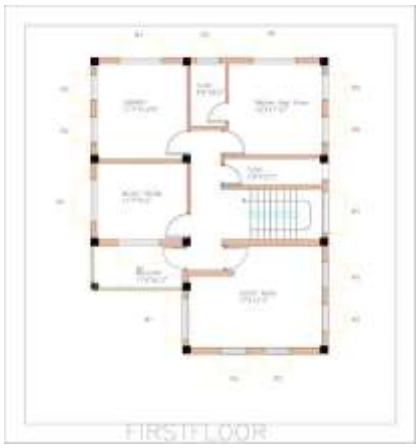
Deevi Krishna Chaitanya, et.al (January,2017): They proposed research on Analysis and design of a (G+6) Multi-storey Building Using STAAD PRO. They used the designing software STAAD PRO which reduced lot of time in designing, gives accuracy.

Mr.K.Prabin Kumar et.al (2018): They proposed a study on Design of Multi-storey Residential Building. They used STAAD PRO to analysis and designing all structure member and calculate quantity of reinforcement.

3. METHDOLOGY

Line Plan	• Rough Plan
2D Plan	• With the help of AutoCAD
3D View	• With the help of Revit
Manual Design	• With the help of IS-456
Software Design	• With the help of ETABS AND STAAD PRO
Comparitive study	• Comparision of manual and software design
Conclusion	

2D PLAN DESIGNED IN AUTOCAD



3D MODEL MADE IN REVIT

Table1: Details of plan

Sr.No	Particulars	Number	Sizes (sq.ft)
1.	Living Room 1.Door(D) 2.Window(W1) 3.Window(W2)	1 1 1 4	226.1 3'X7' 6'X5' 4'X5'
2.	Kitchen 1.Door(D) 2.Window(W1)	1 1 1	117 3'X7' 6'X5'
3.	Master Bedroom with attach Toilet 1.Door(D) 2.Window(W1) 3.Window(W2) Toilet 1.Door(D1) 2.Ventilation(V)	1 1 1 2 1 1	169.92 3'X7' 6'X5' 4'X5' 2.5'X7' 2.5'X2.5'
3	Bedroom 1.Door(D) 2.Window(W1) 3.Window(W2)	1 1 1 2	147.42 3'X7' 6'X5' 4'X5'
4.	Common Toilet 1. Door (D1) 2.Ventilation(V)	1 1 1	44.28 2.5'X7' 2.5'X2.5'
5.	Verandah	3	60.42

Comparison of Manual And Software Design

Table 2:Results obtained after design of slab

		MANUAL DESIGN		SOFTWARE DESIGN	
ELEMENT NAME	DIMENSIONS	SHORTER DIRECTION	LONGER DIRECTION	SHORTER DIRECTION	LONGER DIRECTION
S1	5.35 x 3.85	10Ø - 260mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S2	3.58 x 3.85	10Ø - 300mmc/c	8Ø - 300mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S3	3.58 x 3.28	10Ø - 300mmc/c	8Ø - 300mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S4	5.35 x 4.25	10Ø - 300mmc/c	8Ø - 280mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S5	1.49 x 3.28	10Ø - 300mmc/c	8Ø - 300mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S6	3.35 x 1.76	10Ø - 180mmc/c	8Ø - 150mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S7	1.62 x 4.80	10Ø - 300mmc/c	8Ø - 250mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c
S8	3.84 x 3.28	10Ø - 300mmc/c	8Ø - 280mmc/c	8Ø - 200mmc/c	8Ø - 200mmc/c

Table 3: Results obtained after design of beam

	MANUAL DESIGN		SOFTWARE DESIGN	
ELEMEN T NAME	MAIN REINFORCEMENT	SHEAR REINFORCEMENT	MAIN REINFORCEMENT	SHEAR REINFORCEMENT
B1	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B2	25Ø - 3 bottom12Ø - 2 top	8Ø - 200mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B3	25Ø - 3 bottom12Ø - 2 top	8Ø - 200mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B4	25Ø - 3 bottom12Ø - 2 top	8Ø - 200mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B5	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B6	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B7	25Ø - 3 bottom12Ø - 2 top	8Ø - 200mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B8	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B9	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B10	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B11	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B12	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 150mm c/c

B13	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 130mm c/c
B14	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B15	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	10Ø - 2 bottom10Ø - 2 top	8Ø - 110mm c/c
B16	25Ø - 3 bottom8Ø - 2 top	8Ø - 300mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B17	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B18	25Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B19	25Ø - 3 bottom12Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 150mm c/c
B20	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B21	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B22	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B23	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c
B24	20Ø - 3 bottom8Ø - 2 top	8Ø - 250mm c/c	12Ø - 2 bottom12Ø - 2 top	12Ø - 110mm c/c

Table 4: Results obtained after design of column

	MANUAL DESIGN		SOFTWARE DESIGN	
ELEMENT NAME	MAIN REINFORCEMEN T	SECONDARY REINFORCEMENT	MAIN REINFORCEMENT	SECONDARY REINFORCEMENT
C1	12Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C2	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C3	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C4	12Ø - 6	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C5	12Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C6	12Ø - 6	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C7	12Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C8	12Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C9	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C10	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C11	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C12	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C13	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C14	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C15	12Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C16	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c
C17	16Ø - 4	6Ø - 190mm c/c	12Ø - 8	12Ø - 190mm c/c

Table 5: Results obtained after design of footing

	MANUAL DESIGN		SOFTWARE DESIGN	
ELEMENT NAME	LONGER DIRECTION	SHORTER DIRECTION	LONGER DIRECTION	SHORTER DIRECTION
F1	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F2	18Ø - 75mm c/c	16Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F3	22Ø - 75mm c/c	22Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F4	18Ø - 75mm c/c	16Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F5	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F6	18Ø - 75mm c/c	16Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F7	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F8	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F9	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F10	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F11	18Ø - 75mm c/c	16Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F12	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F13	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F14	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F15	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F16	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c
F17	12Ø - 75mm c/c	12Ø - 75mm c/c	6Ø - 70mm c/c	6Ø - 70mm c/c

4. CONCLUSIONS

1. Design of Multi storey building has completed quickly and easily by using software than the manual Calculation.
2. By observing final comparison it concludes that design of software is more at safer side, on other hand design by manual process is more at economical side. Beside the differences, both design are at acceptable safer side.
3. During application of the software as well as manual result while construction, both of them can be applied according tothe situation, where we want economical or safer design.
4. The diameter of the bars which are given by STAAD PRO varied from the bar diameter given by manual design.
5. The design of beam, slab, column, footing and stair case are safe in deflection, bending, shear and other aspect.

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