3D Modelling and Simulation Methods in RCC Building using Bim Software

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Abstract: The building can be designed by using Autodesk Revit Software. Autodesk Revit is Building Information Modelling (BIM) software for, landscape architects, structural engineers, MEP engineers and contractors. The software allows users to design a building and its components in 3D annotate the model with 2D drafting elements and access building information from the building model's database. Our structure are G+14 Residential building and LIC Ludhiana projects. G+14 is the residential project in which there are 10 blocks with 2 basement, shops on ground and 1st floor, and typical floors from 3rd to 13th floor level which also consist of two refuges floor, the project has different AutoCAD plan of architectural and structural layout having sizes of Beam, column, slabs designed according to IS456:2000 and IS800:2007 LSM. In LIC Ludhiana project the work consist of Rebaring of slabs which includes the top and bottom rebar's of slab having different diameter or sizes of rebar's like 8mm, 10mm, 12mm etc. The schedule can be easily extract from this Revit models which will calculate the quantity of material required for the construction purposes. The extensions or plugins like Diroots, Dynamo run in Revit reduces the time of project and give more accuracy to provide id's to the elements.

Keywords: BIM, DIROOTS, DYNAMO RUN, LSM

I. INTRODUCTION

The Industrial Software AutoCAD is a commercial computer-aided design (CAD) and drafting software application. Developed and marketed by Autodesk, AutoCAD was first released in December 1982 as a desktop app running on micro computers with internal graphics controllers.

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Before AutoCAD was introduced, most commercial CAD programs ran on or minicomputers, with each CAD operator (user) working at a separate graphics terminal. AutoCAD is also available as mobile and web apps. AutoCAD is used in industry, by architects, project managers, engineers, graphic designers, city planners and other professionals. It was supported by 750 training centers worldwide in 1994. Whereas Charles River Software originally developed the software in 1997, renamed Revit Technology Corporation in 2000, and acquired by Autodesk in 2002.As shown in fig.1.Autodesk Revit is BIM software for Architects, Interior Designer, Landscape Architects, Structural Engineers, MEP Engineers, Contractors, and more. Revit can be used as a very powerful collaboration tool among different disciplines in the Architecture, Engineering, and Construction (AEC) industry. With the rapid adoption of BIM in the construction industry, and its gradual implementation in the design industry, careful considerations have to be taken when making the change over from the traditional method of creating construction documents towards a BIM approach. (M.Gopal Naik, 2019, [2])
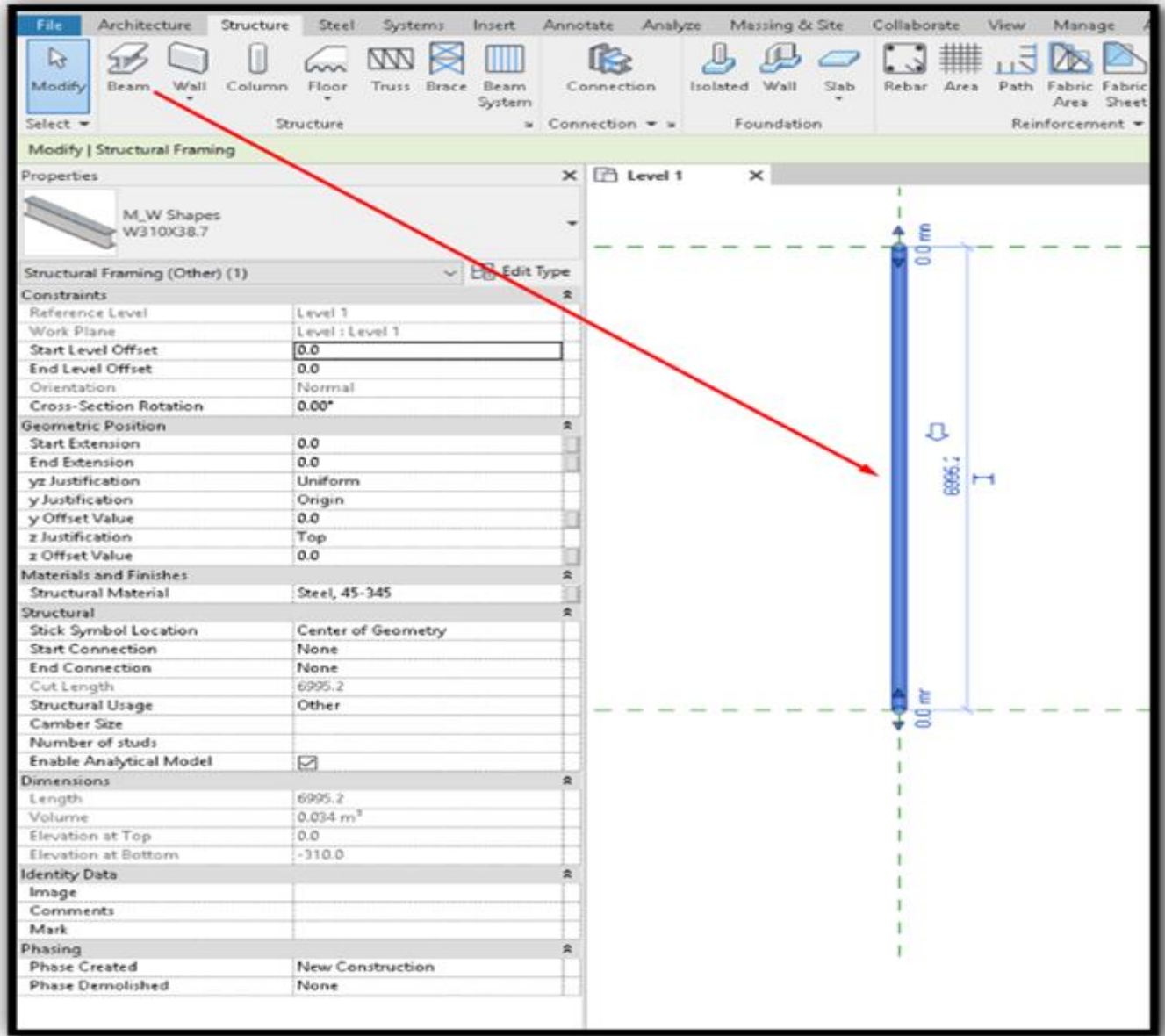
Fig. 1. Placing of beam

II. LIC LUDHIANA PROJECT

Plain concrete is weak in tension and strong in compression. Tensile property for concrete structures is obtained by incorporating steel reinforcement. The steel reinforcement is strong in both tension and compression. The tensile property provided by the steel reinforcement will prevent and minimize concrete cracks under tension loads. The coefficient of thermal expansion of steel reinforcement and concrete are similar in that they undergo similar expansions during temperature changes. This property will ensure that the concrete is subjected to minimal stress during temperature variations. The surface of the steel reinforcement bars is patterned to have a proper bond with the surrounding concrete material. The two main factors that provide strength to the concrete structures are steel and concrete. The design engineer will combine both the elements and design the structural element such a way that the steel resists the induced tensile and shear force, while the concrete takes up the compressive forces, by following guidelines given by the IS800:2007 about the steel design we have worked on rebaring work of slabs on different floors as shown in fig.2.
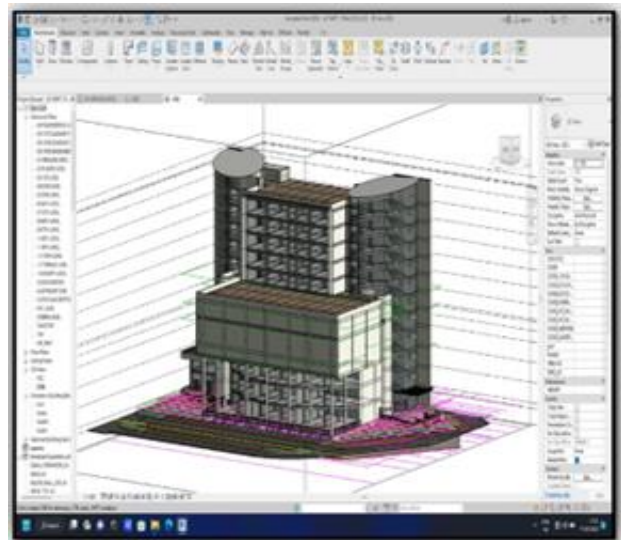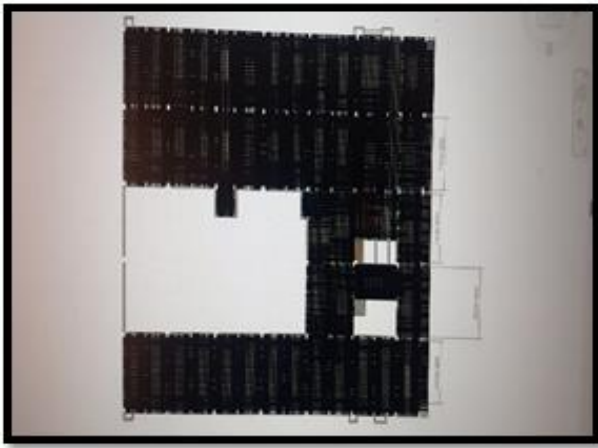

Fig. 2. LIC building 3d model

Fig. 3. Rebaring of slab's

Main Bars and Distribution Bars

Normally Main bars are provided at the bottom of distribution bar in slabs. But distribution bars are provided on the top of the main bar. Main bars are provided in the shorter span of the slabs. But distribution bars are provided in the longer span of the slabs. Higher dimension bar is used as main reinforcement bar. Lower dimension bar is used as distribution bars. Main reinforcement was provided to counter the bending moment, tensile stresses and superimposed load. But Distribution bars are used to distribute the load equally, resist the shrinkage stress (Temperature variation) or hold the mesh in his desire position, as shown in fig 3&4 Main reinforcement bar is used to transfer the bending moment to beams. Distribution bars are used to resist the shear stress, and cracks developed at the top of the slab. Main bars in the slab won't be less than 8mm if you are using (HYSD) or 10mm if you are using (Plain bars) and the Distribution bars is also not less than 8mm diameter and the bar won't be more than 1/8 of the thickness of the slab.
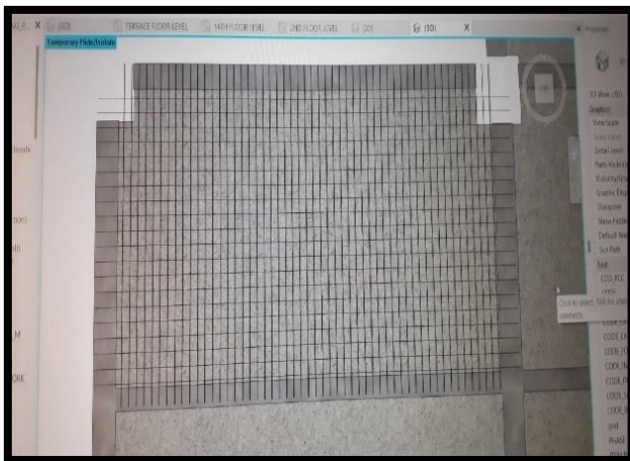

Fig. 4. Bottom bars

III. TRINE SHILP RESIDENCY PROJECT AT GOTA

The Trine Shilp modelling project is the project of Trine infra group, which consist of 10 blocks. Each and every block have their architectural plans and structural plans. This phase of planning is very important we need to read the drawings properly and identify the similar work so that we can I have the mirror work already prepared with us and can save time. The project is of G+14 with having levels starting from 2nd

basement to terrace and there are different plans of basements, plinth floor, ground floor, 1st floor, 2nd floor, and 3rd floor is the typical floor working plan and 6 and 8th floor is the refuge floor, and last we have the terrace floor.
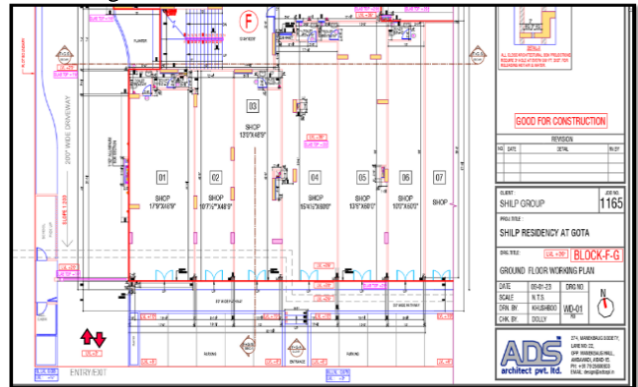

Fig. 5. Ground floor working plan of Block F&G

The center line plan for column position in the modelling with having different sizes on different floors. The each and every column have different id and sizes. fig 5. Shows the typical floor level plan of 3rd floor in which there are two blocks showing the G block whereas fig.6 basement columns showing the F block with detail plan.
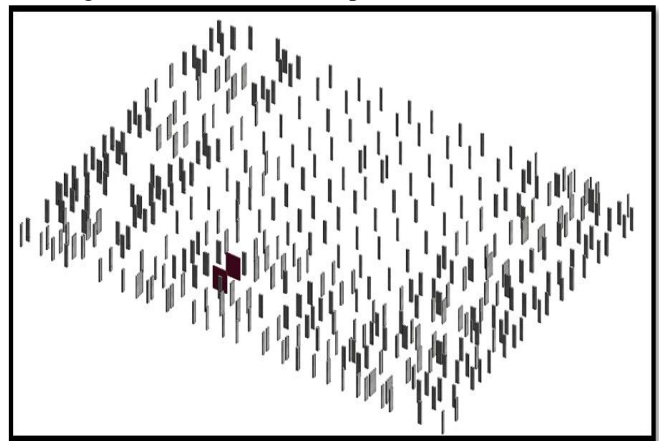

Fig. 6. 3D Modelling of columns of Block F&G

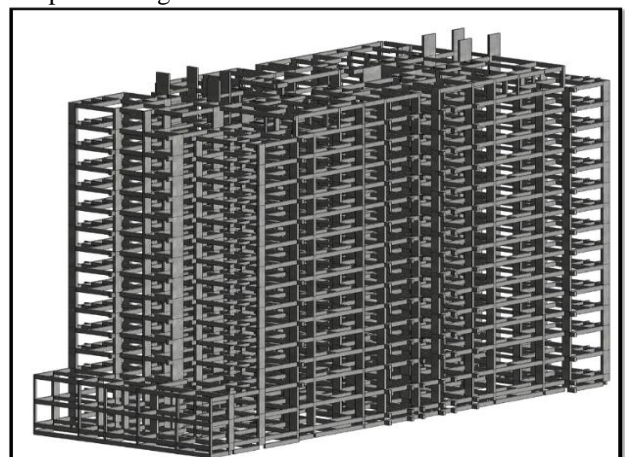The fig. 6 shows the modelling work of basement column at their particular grid with different sizes.

Fig. 7. 3D Modelling of Beams of Block F&G

The above fig.7 is the combination of both beam and column which is the second step in the modelling work, while doing this work we need to make sure the beam should not merge inside the column so joint it properly , Modelling of Slab of Block F&G Below fig.8 is the placing of slab with having different sizes like somewhere it is of 5" and sometimes it is of 6" and also the sunk slab which is placed over the toilet is 3" having base offset. And the slabs are always drawled in a rectangular way it will give the accurate schedule quantity of material of slab.
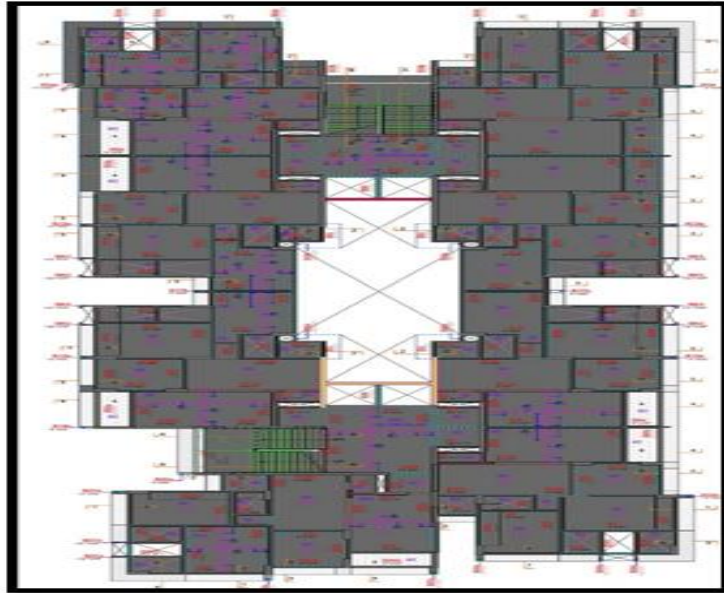
Fig. 8. 3D Modelling of Slabs

Fig. 9. 3D Modelling of wall of Block F&G

The below fig.9 show the placing of wall which consist of Internal plaster, internal paint , external plaster, external paint and the wall , which having different sizes like 4.5" , 9", 1' etc. To give the id's to the wall we use the extension called Diroots which will directly identify the positon of wall in the whole project and automatically give the Id's to the wall. While doing wall work sometimes the wall get merged into each and another there we need to disallow the wall join and when wall are merging in beam or column we need to go with unjoin element it will reduce the volume or amount of material. Building Information Modelling (BIM) is the digital data flow surrounding the lifecycle of an asset or element of the built environment, instigated to provide better information management to aid with decision making. (C. Thomson, 2015, [1])

The procedure which makes the work flow easier and faster is as follows in the initial stage read all the plans carefully and try to identify the similar work and the start your work by importing AutoCAD plan in Revit on each and every floor. Then start the structural modelling of column, beam, slabs after completing the above work initiate with the wall work along with the wall external and internal paint and plaster. Then by looking into sectional drawing draw the skirting and toilet dado and then complete the window and door work, while doing this work also work on planters and balcony simultaneously it will reduces the time of 3d modelling.

IV. RESULTS

A. Lic Ludhiyana Project

Table 1. Scheduling of Slab work

LEVEL	ID	L	B	H	QUANTITY	CODE	PHASE
9th Level	S2	3.54	7.6	0.15	4.035	RMC_9F_FLYASH_M25_CW	RA-13
	S2	3.55	7.6	0.15	4.047		
	S2	3.54	7.6	0.15	4.035		
	S2	3.45	7.6	0.15	3.933		
	S2	3.44	7.6	0.15	3.921		
	S2	3.55	7.6	0.15	4.047		

Table 2. Scheduling of rebaring work

Level	ID	Location	Type mark	Spacing	Bar Diameter	Bar Length	Quantity	Total Bar Length
9th Level	S4	F-G/4-5	Top Extra	200	8	8824	3	26473
9th Level	S4	F-G/4-5	Top Extra	200	8	4346	6	26079
9th Level	S4	F-G/4-5	Top Extra	200	8	1954	19	37126
9th Level	S4	F-G/4-5	Top Extra	100	8	2850	80	227991
9th Level	S4	F-G/4-5	Bottom Main	150	10	4384	53	232349
9th Level	S4	F-G/4-5	Bottom Dist.	200	8	8440	19	160360

B. Tine Shilp Residency Project At Gotta

Table 3. Scheduling of Slab work

LEVEL	ID	L	B	H	QUANTITY	CODE	PHASE
GROUND FLOOR LEVEL	S13	2.019	1.333	0.127	0.342	M30_RCC_SLAB_VSI_CW	RA-3
	S7	3.545	1.524	0.127	0.68		
	S4	2.854	3.277	0.127	1.934		
	S8	3.45	4.6	0.127	2.296		
	S1	3.85	2.6	0.127	1.189		
	S2	3.55	7.6	0.127	4.047		

Table 4. Scheduling of Column work

LEVEL	ID	L	B	H	QUANTITY	CODE	PHASE
FIRST FLOOR LEVEL	C121	9”	36”	11'	0.175	M30_RCC_COLOUMN_VSI_CW	RA-5
	C122	12”	36”	11'	0.934		
	C126	12”	36”	11'	0.934		
	C127	36”	12”	11'	0.934		
	C129	36”	12”	11'	0.934		
	C131	36”	12”	11'	0.934		

Table 5. Scheduling of Beam w

LEVEL	ID	L	B	H	QUANTITY	CODE	PHASE
THIRD TYPICAL FLOOR LEVEL	B1a	7.48	0.229	0.584	0.999	M30_RCC_BEAM_VSI_CW	RA-7
	B60	5.601	0.229	0.584	0.784		
	B52	4.61	0.229	0.584	0.616		
	B2	4.458	0.229	0.584	0.595		
	B57	2.019	0.114	0.584	0.135		
	BK1	2.019	0.114	0.584	0.135		

V. CONCLUSION

1 Revit Software is the BIM (Building Information Modelling) software which can be used for preparing the Schedule work and Modelling work.

2 Extension which are developing day by day for egg. Dynamo Run, Di roots makes the work easy and save the time.

3 Before completing the graduation we are getting the Industrial Knowledge.

4 Working with the industrial ongoing project teach us about the Dead line of the Work and develop the discipline quality and the Time management skills in the person.

5 BIM software's gives us the Realistic View of the project which are going to develop in the future.

6 Revit software has 3 parts Architecture, structural, MEP (mechanical, electrical)

DECLARATION

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Ethical Approval and Consent to Participate	No, the article does not require ethical approval and consent to participate with evidence.
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Authors Contributions	All authors have equal participation in this article.

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