CERTIFICATE

This is to certify that the report titled "INTEGRATION OF REVIT AND ETABS SOFTWARE TOOLS FOR ANALYSIS, DESIGN AND QUANTITY ESTIMATION OF AN EDUCATIONAL COMPLEX" Submitted by

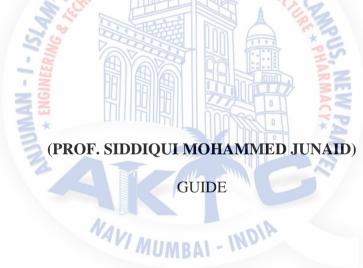
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In partial fulfilment of the requirements for the degree of Bachelor of Engineering in Civil Engineering, is a record of their work carried out in Department Of Civil Engineering of this institute.



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DECLARATION

I, Mr. ______ Civil engineering student of Anjuman Islam Kalsekar Technical Campus, hereby declare that I have completed the project titled ______ during the academic year 2013-2017. I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.



(Name of student and Roll No.)

Date

ACKNOWLEDGEMENT

We have taken effort in this project. However, it would not have been possible without the kind support and help of many individuals and organization. We would like extend our sincere thanks to all of them.

We thank our GOD for providing us everything that we required in completing this project.

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ABSTRACT

The following project deals with the planning, analysis, designing, modelling and Quantity Estimation of a 7-storey Hostel building using advance Civil Engineering softwares like AutoCAD, ETABS, Autodesk Revit and Microsoft Excel Spreadsheet. Project starts with planning of the building using AutoCAD. Then analysis of building is carried out using ETABS and Microsoft Excel Spreadsheet. Also detailing of reinforcement is done in ETABS. Then finally for Modelling and Estimation purpose, Autodesk Revit is used.



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CHAPTER 1

1.0 INTRODUCTION

AIKTC is a constituent college within the University of Mumbai (MU) due to good reputation, AIKTC experienced a tremendous growth over the period till now resulting in introduction of new faculties hence an increased intake. In view of this, there has been an increase in demand for accommodation on campus. AIKTC lacks accommodation facilities for its students. In an endeavor to maintain the increased number of intake, we introduced non-residential system whereby only few students are accommodated on campus. For instance, College of has a total of 4373 students of which 450 and 50 staff are accommodated on campus.

For planning purpose AutoCAD software is used and by referring bye-laws of hostel, planning is done. AutoCAD is a commercial software application for 2D and 3D computer-aided design (CAD) and drafting available since 1982 as a desktop application and since 2010 as a mobile, web- and cloud-based app marketed as AutoCAD 360. AutoCAD was derived from a program begun in 1977 and released in 1979 called <u>Interact CAD</u>, also referred to in early Autodesk documents as MicroCAD, which was written prior to Autodesk's (then Marinchip Software Partners) formation by Autodesk cofounder Mike Riddle

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For analysis purpose ETABS software is recommended. The innovative and revolutionary new ETABS is the ultimate integrated software package for the structural analysis and design of buildings. Incorporating 40 years of continuous research and development, this latest ETABS offers unmatched 3D object based modeling and visualization tools, blazingly fast linear and nonlinear analytical power, sophisticated and comprehensive design capabilities for a wide-range of materials, and insightful graphic displays, reports, and schematic drawings that allow users to quickly and easily decipher and understand analysis and design results. From the start of design conception through the production of schematic drawings, ETABS integrates every aspect

of the engineering design process. Creation of models has never been easier intuitive drawing commands allow for the rapid generation of floor and elevation framing. CAD drawings can be converted directly into ETABS models or used as templates onto which ETABS objects may be overlaid.

Design of steel and concrete frames (with automated optimization), composite beams, composite columns, steel joists, and concrete and masonry shear walls is included, as is the capacity check for steel connections and base plates. Models may be realistically rendered, and all results can be shown directly on the structure. Comprehensive and customizable reports are available for all analysis and design output, and schematic construction drawings of framing plans, schedules, details, and cross-sections may be generated for concrete and steel structures. ETABS provides an unequaled suite of tools for structural engineers designing buildings, whether they are working on one-story industrial structures or the tallest commercial high-rises. Immensely capable, yet easy-to-use, has been the hallmark of ETABS since its introduction decades ago, and this latest release continues that tradition by providing engineers with the technologically-advanced, yet intuitive, software they require to be their most productive.

Microsoft Excel is a <u>spreadsheet</u> developed by <u>Microsoft</u> for <u>Windows</u>, <u>macOS</u>, <u>Android</u> and <u>iOS</u>. It features calculation, graphing tools, <u>pivot tables</u>, and a <u>macro</u> programming language called <u>Visual Basic for Applications</u>. It has been a very widely applied spreadsheet for these platforms, especially since version 5 in 1993.

Microsoft Excel has the basic features of all spreadsheets, using a grid of cells arranged in numbered rows and letter-named columns to organize data manipulations like arithmetic operations. It has a battery of supplied functions to answer statistical, engineering and financial needs. In addition, it can display data as line graphs, histograms and charts, and with a very limited three-dimensional graphical display. It allows sectioning of data to view its dependencies on various factors for different perspectives .It has a programming aspect, Visual Basic for Applications, allowing the user to

employ a wide variety of numerical methods, It also has a variety of interactive features allowing user interfaces that can completely hide the spreadsheet from the user, so the spreadsheet presents itself as a so-called application, or decision support system (DSS), via a custom-designed user interface,. In a more elaborate realization, an Excel application can automatically poll external databases and measuring instruments using an update schedule, analyze the results, make a <u>Word</u> report or <u>PowerPoint</u> slide show, and e-mail these presentations on a regular basis to a list of participants

After analysis, Autodesk Revit software for modeling purpose is used. Autodesk Revit is building information modeling software for architects, structural engineers, MEP engineers, designers and contractors developed by Autodesk. It allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database. You can extract any data from it. Plan, elevations, sections, it's also easy to create color fill, 3D perspective, rendering, detailed drawing, and limited walkthrough animation.by creating building plan other data you can collect from your model is your building schedule. You can create a report wall length, number of doors and windows, and other schedule easily, you are actually creating it in 3D, visualization is easy to make. Just place your camera, tweak it a little bit, then you'll have a nice perspective! Revit is 4D BIM capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later demolition.

1.1 AIM AND OBJECTIVE

The aim is to create the best learning and training environment for students by improving their accommodation that has proved to be a contributing factor to quality education. The main object is to learn Autodesk (AutoCAD and Revit) and CSI (ETABS) softwares and other objectives are:

To improve Poor quality of accommodation.

Most of the off-campus accommodations do not meet the acceptable standards that a student requires. They consist of poor building structures, furniture and building services (electrical and plumbing fixings and fittings).

To provide Security.

There is low security especially for female students who run a higher risk of being robbed when traveling from school to hostels at night.

> To Absenteeism.

It is difficult to arrange for make-up classes since transport for off campus students is problematic. Where the make-up classes are inevitable, majority of off campus students do not attend.

Provide Hygienic food

Most of the students who reside off-campus have limited access to quality and safe food. Students buy food based on the availability and convenience and disregard the quality and safety hence putting their health at stake;

To provide better sanitation system

Generally, there is poor sanitation in most of the places that off-campus students reside.

Convenient studying places.

The College Library normally operates from 08:00am to 10:00pm; however, off campus students have a limited opportunity to fully utilize the same due to unavailability of transport to their respective hostels. The problem extends to the use of College Internet on campus as well as clinical-training experience conducted in hospital wards.

> To avoid disturbance

Off-campus students face many disturbance during festivals and other programs, hence we are providing smooth environment for study.

1.2 SCOPE

Based on the aim and objective mentioned in the preceding section, the scope of the present investigation is outlined as under:

By doing this project we will come to know some software of civil engineering related to planning, analysis and modeling of structures like AutoCAD, ETABS and Autodesk Revit.

The best learning and training environment for students by improving their accommodation that has proved to be a contributing factor to quality education.

CHAPTER 2

2. REVIEW OF LITERATURE

2.1 AutoCAD

Azidah Abu Ziden (2012), studied the effectiveness of AutoCAD software in learning of Engineering Drawing to enhance students understanding. It concludes that AutoCAD increase the performance of high and medium level students group gave a positive impact on the study. Effective use of this software proved to be helpful based on the dataobtained.

Asmaa G. Salih *et. al.* (2014), presents the significant revolution with computers usage in civil engineering business and construction process has been presented. AutoCAD software is an extremely powerful tool and can be adapted to specific needs in order to serve the intended purpose of any project. Civil engineering professionals use this software for variety of infrastructure projects, like: land development, transportation, water projects and road design..

Amol A. Metkari *et. al.* (2015), proposed Ladies Hostel building for Rajarambapu Institute of Technology College, Rajaramnagar. In that case study, building project, included real life examples of BIM and AutoCAD uses and benefits. Also in the case study, a prototype building project, examined the 2D, 3D, 4D and 5D model by using AutoCAD & BIM tools

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Prakash Chandar *et. al.* (2015), research on Integrating Building Information Modelling (BIM) and Construction Project Scheduling to Result in 4D Planning for a Construction Project, the conventional 2D drawings are prepared in AutoCAD 2010. The 2D drawings are converted into 3D model in Revit Architecture 2014 and the Time Scheduling is done in Microsoft Office project 2007.

Raiyan Mansoori *et. al.* (2016), studies the planning and design of Residential building (G+16) By Using AutoCAD & Revit Softwares taking 4th dimension as time. In this paper study is restricted to civil engineering construction planning

& scheduling by creating a 4D model, further other dimensions like cost, resources, materials etc. can be taken as nth dimensions.

2.2 ETABS

Abhay Guleria (2014) presents the analysis of the multistoried building using ETABS reflected that the storey overturning moment varies inversely with storey height. Moreover, L-shape, I-shape type buildings give almost similar response against the overturning moment. Storey drift displacement increased with storey height up to 6th storey reaching to maximum value and then started decreasing. From dynamic analysis, mode shapes are generated and it can be concluded that asymmetrical plans undergo more deformation than symmetrical plans. Asymmetrical plans should be adopted considering into gap.

Arpit A. Bhusar et. al. (2014) shows Building information models let structural engineers design, visualize, simulate, analyze, document and build projects more efficiently, accurately, and competitively. Among the most important benefits of BIM for structural engineer are productivity, coordination and consistency of data, and improved visualization and simulation of problems and situations. Structural engineers can easily spend more time coordinating a project than performing the structural analysis. With the use of BIM, the time spent in coordination is reduced, allowing structural engineers to focus all their efforts in solving problems, instead of having to constantly be checking for errors or coordinating changes made.

Sonia Longjam et. al. (2014), publishes the paper that presents the plan, model, analyze and design of a vertical irregular shopping mall structure of G+10 storey and investigate its performance under various lateral loading conditions. The main goal is to assess current Indian Standard design practice and to provide design guidelines using ETABS, presents the manual design calculation satisfying the necessary requirements as per BIS specification as well as various Indian standard code specifications.

D.Ramya et. al. (2015), principle objective of the project is comparative study on design and analysis of multistoried building (G+10) by STAAD Pro and ETABS software. STAAD Pro is one of the leading software for the design of structures. G+10 building is analyzed for finding the shear forces, bending moments, deflections & reinforcement details for the structural components of building (such as Beams, columns & slabs) to develop the economic design. ETABS is also a leading design software in present days used by many structural designers. Analyzed the same structure using ETABS software for the design. Finally an attempt to define the economical section of G+10 multistoried building using both STAAD Pro and ETABS comparatively. By the intensive study come to know that the "economical sections" was developed using ETABS software.

S. Vijaya Bhaskar Reddy et. al. (2015), published a paper which describes the salient features of ETABS and its various applications in civil engineering, using ETABS software the analysis of two multi storeyed buildings is carried out with different heights (15m and 10m). Thus it can be help the consulting engineers, construction experts, research scientists and students in the analysis of concrete structures. The essential features of ETABS is explained and the capability of the important concepts of effective memory management, plot options and user interface are described.

B. Anjaneyulu et. al. (2016), studies the analysis and design of Flat Slab By Using ETABS Software, concludes that flat plate/slab can be designed and built either by conventional reinforced concrete. or posttensioning. However, due to issues mentioned above with post- tensioning construction in India and its higher cost, conventional reinforced concrete design should be preferred choice for spans up to 10 meters.

2.3 REVIT

Ajla Aksamija et. al. (2011), Parametric design offers some advantages over traditional modeling methods, since it allows adaptation of an object through the use of rules and constraints or "parameters" to influence the object's properties. These processes as well as parametric computational tools, are relatively new in architectural design. They enable the adaptation of model geometry based on rules or data values, eliminating the need to recreate the model for every design change.

Cesar Augusto Hunt (2013), the benefits of using building information modeling are evident, especially when analyzing the way that this methodology enhances the structural design workflow. Engineers are realizing the power of BIM for more efficient and intelligent design, and most firms using BIM are reporting strong favor for this technology. Using the building information model not only enables the production of construction documents, but it also serves as a base to present the results from the structural analysis and design in an easy sharable way, keeping all the information regarding the analysis, design and documentation of a structural project in one place.

Nisarg M. Mistry et. al. (2014) worked on Softwares for Building Information Modeling (BIM) for Project Management and Controlling. It can be concluded that Revit helps to provide immediate competitive advantage, better coordination and quality, and can contribute to higher profitability for architects and the rest of the building team. It can also be concluded that BIM is an efficient and reliable tool of project management. Project management can be done more effectively by using this type of tool.

Wei Peng (2014), the art of architecture refers to the law of beauty, and uses the unique architectural art language, so the building image has cultural value and aesthetic value, with symbolic and formal beauty, reflecting the national character and sense of the times. This paper takes the BIM building information modeling as integrated platform, through the Revit data interface, and uses 3Ds max software to design the art shape of building structure.

Shashank.R.Chandak (2016), presents the cost of optimization of construction projects using BIM Software Revit. The projects concludes that by using BIM method 80% reduction in time to generate estimates, 10% saving on construction cost through clash detection. 20% saving through construction cost simulation.

Based on the afore-mentioned literature review it is observe that AutoCAD, ETABS and Revit are user friendly softwares. Hence we have decided to do planning, analysis and quantity estimation of an educational complex by AutoCAD, ETABS and Revit.



CHAPTER 3

3. METHODOLOGY:

The project (An Educational complex-AIKTC) is software based, planning, analysis, designing and modelling will be done by using AutoCAD, ETABS and Autodesk Revit. This project consist of three main parts as follows:

3.1 Planning:

Planning of a hostel building has been done as per building Bye-Laws and IS Code requirement, keeping in mind the accommodation requirement for 450 students and 50 staff members, for this purpose, AutoCAD software is used. Hostel consist of 7 floors. Ground floor, 1st floor and 5th floor are master storeys.

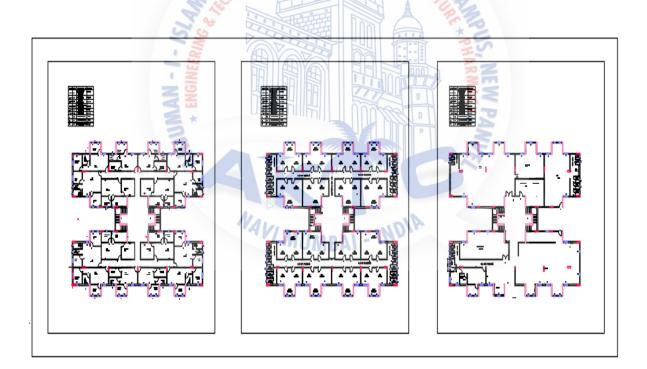


FIG.3.1 (I)

3.1.1 Ground Floor Plan (Refer Fig. 3.1.1 (I)):

- Ground floor consist of all fundamental amenities like Canteen, Indoor games, Gym, Library and Digital Library.
- Warden Office and Reception is also provided at Ground Floor itself in order to maintain discipline and better coordination for assistance to students.
- Server and Maintenance room is provided for systematic monitoring of electricity and computer servers.
- In order to avoid unnecessary chaos and disturbance, the door of Gym is provided outside the building and not from the lobby itself.
- Library and Digital Library is provided away from other distracting units like Canteen and Indoor games in order to maintain silence and better environment for studying.
- Opening for Canteen is wider for easy motion of students.

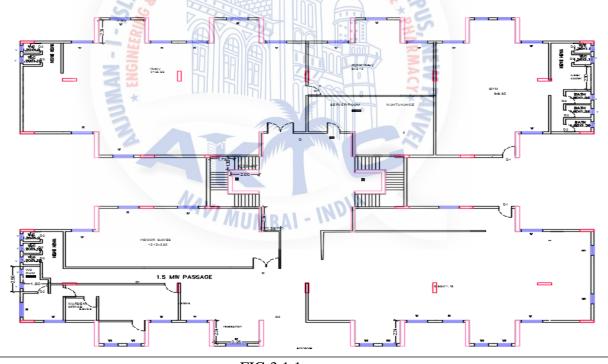


FIG.3.1.1

3.1.2 First Floor Plan (Refer Fig. 3.1.2 (I)):

- First Floor is the Master Floor for 2nd, 3rd & 4th floor, planned specifically 2-seaters and a common study room. Each room will be accommodating 8 for stud
- For every 4 rooms, 4 WC and 3 Bathrooms are provided at the corner of each floor.
- Passage way of 1.5m width is provided for easy movement.
- Open Well Staircase is provided throughout the building with Elevators on opposite sides.
- Each Floor consist of 16 Rooms, and each room consist of 4 beds of students.

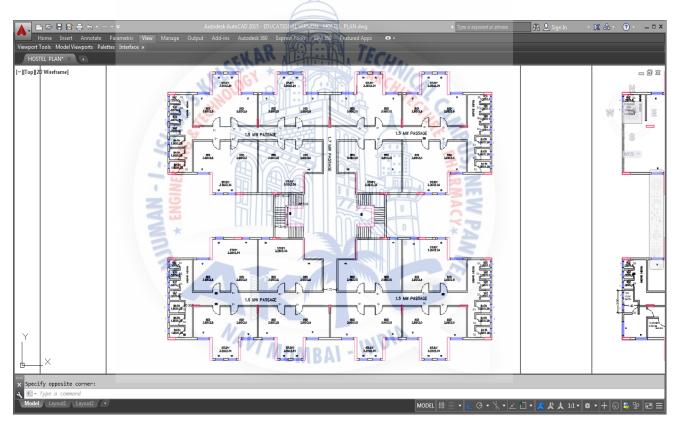


FIG.3.1.2

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

3.1.3 Fifth Floor Plan (Refer Fig. 3.1.3 (I)):

- Fifth Floor is the Master Floor for 6th & 7th Floors, planned specifically for Staff members.
- Each floor consist of 16 rooms. Each room is assigned to individual staff members and their family.
- Every room is equipped with attached W.C and Bath, and a modern furnished Kitchen and Bedroom.
- There are 4 rooms with 1RK and rest all rooms are 1BHK.

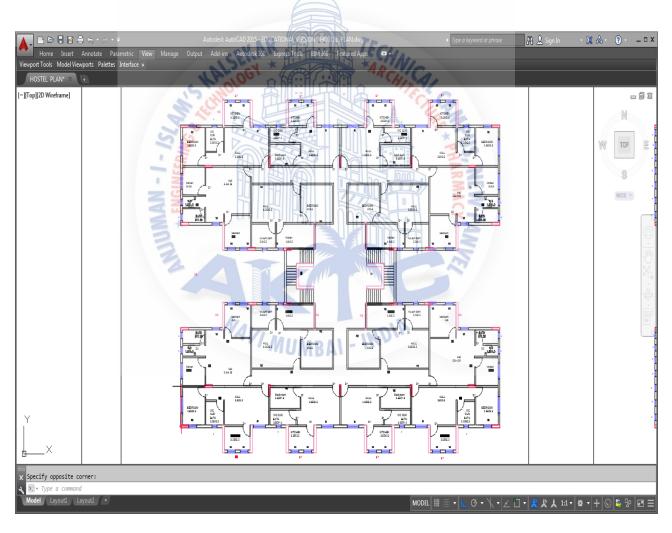


FIG.3.1.3

3.1.4 Obtaining Center-Line Plan (Refer Fig. 3.1.4 (I)) :

• After planning all the floors and its various unit, we extracted the Center-Line plan for importing the plans in ETABS for analysis purpose.

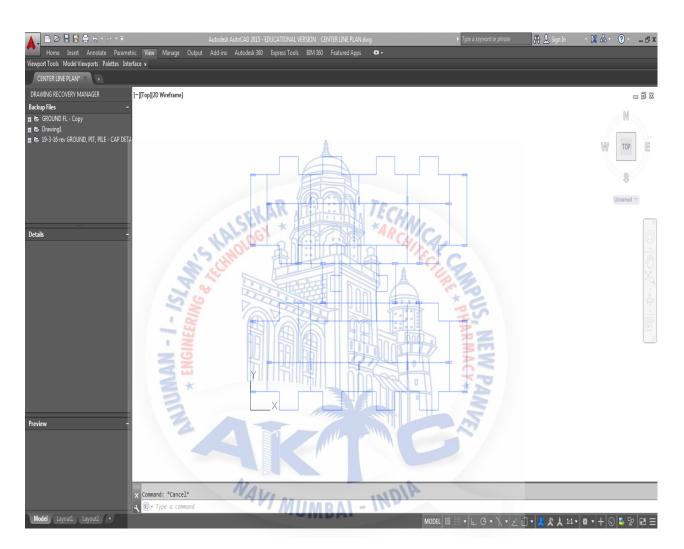
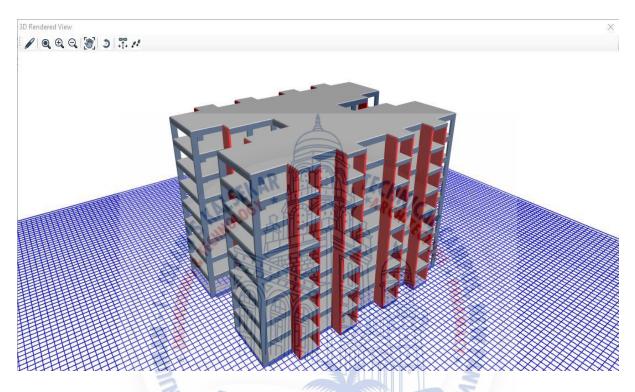


FIG.3.1.4

3.2 ANALYSIS

After completion of planning the project will move ahead by analyzing and designing process with the help of ETABS software. ETABS offers a single user interface to perform: Analysis, Design, Detailing, and Reporting. This software will analyze and design an educational complex with much ease. ETABS gives analysis and design for beams and columns only.



There is a step-by-step procedure followed by us for analyzing and designing the structure. The steps are explained in detail in proper sequence below:

- 1. Saving AutoCAD file as .DXF file. .
- 2. Opening .DXF file in ETABS and provide Unit in meters.

3. Define Material like M30, M35 etc. Grades of Concretes & Fe 415, Fe500, etc. Steel As per IS code provided in options.

4. Define Section Properties:

5. Frame section: In this section, Beams and Columns can be defined. Beams are as follows:

Beam B1 : (230X600)mm

Beam B2 : (300X600)mm

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ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

Beam B3: (300X500)mm, etc.

Column are as follows:

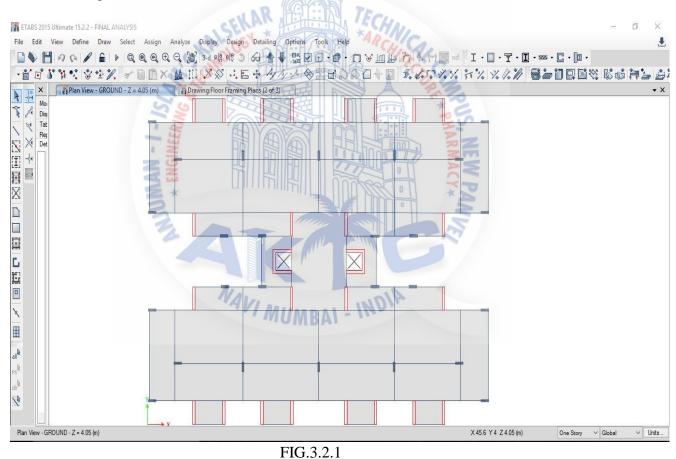
Column C1 : (300X1000)mm.

Slab section: From this section, thickness of slab in defined.

Wall section: From this section, thickness of shear wall is define

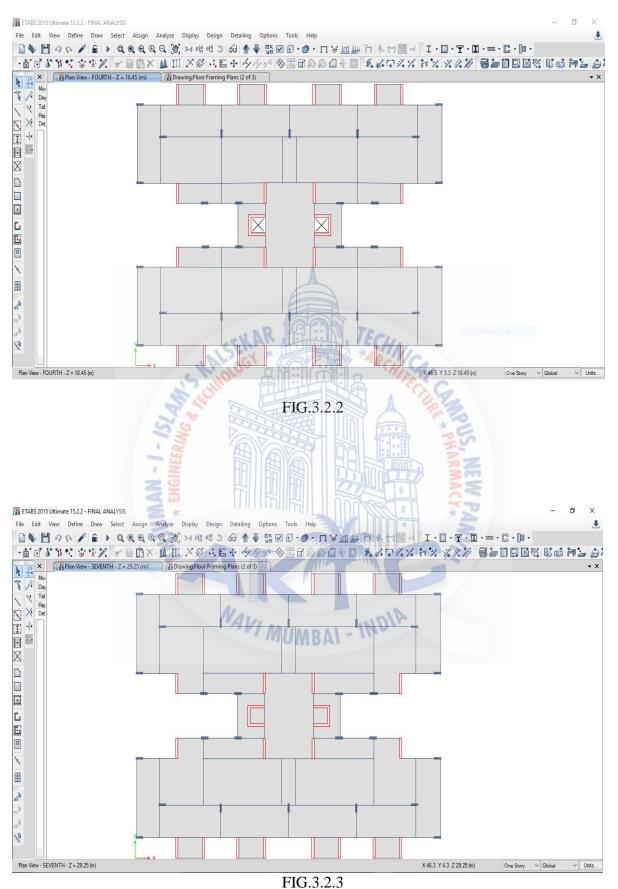
with suitable concrete grade.

 Placement of beams and columns: Beams and columns are placed as indicated in Centre line plan. After placement of beams and columns, the view typical floors are as follows (Refer Fig.3.2.1, 3.2.2,and 3.2.3):



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ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX



10.0.2.

- 1. Load Define: Different type of load such as Live, Dead, Masonry, Seismic Loads, etc. are defined.
- 2. Assign of loads: loads are assign on beams, columns and slabs.
- 3. Load Cases: Different type of load cases are defined.
- 4. Load Combinations: Different combination of loads are embedded in ETABS as per IS code.
- Defining Functions: Functions for Seismic load for X & Y direction are defined under Response Spectrum.
- 6. Assigning Diaphragm: Rigid Diaphragm is provided.
- 7. Joints are restrained at plinth level.
- 8. Checking the model for assigned beams, columns and slabs (Refer Fig 3.2.4).

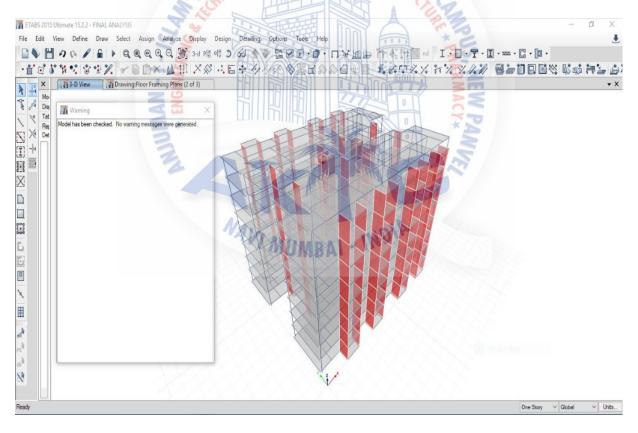
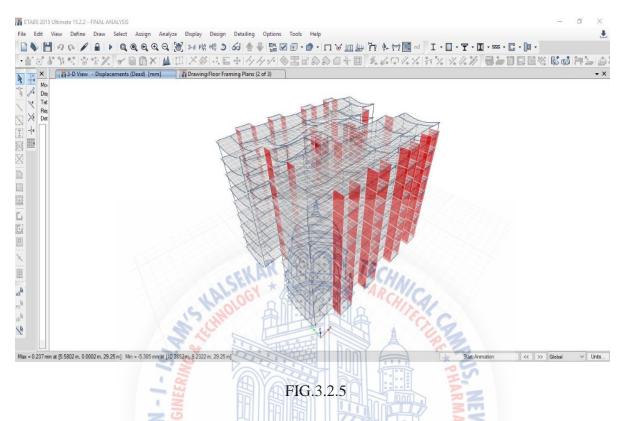
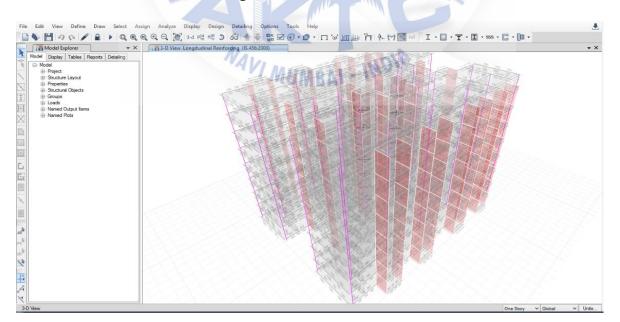


FIG.3.2.4

• After checking the model, analysis is run and the model is found to be safe (Refer Fig.3.2.5)



After analyzing the structure, we did the design check of frame section and obtained the required area of steel for each structural member. Also we get to know that none of the beam or column is Over-Stressed. (Refer Fig 3.2.6)



3.3 DESIGNING AND DETAILING:

After analyzing the structure, detailing of the structural members is done. Under this head, we can provide the number of main bars, number of distribution bars and spacing between the stirrups (tie bars) as per the area of steel obtained from the analysis of structure. Different structural members on different floors may or may not have same design and detailing schedule.

Some of the reinforced sections are shown below. It consist of longitudinal sections of column, beams and shear walls.

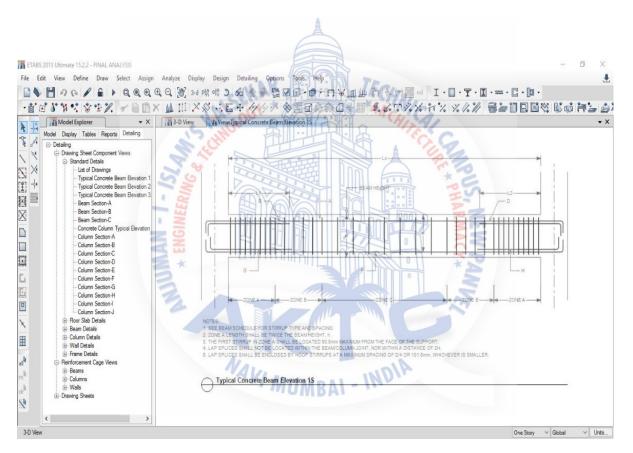


FIG.3.3.1

The above Figure shows the reinforcement details of Typical Beam (Elevation view) for single slab.

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Column Section-C Column Section-D Column Section-E	
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ii-Columns ii-Walls	
	A
	FIG.3.3.2
The above Figure sho	ows the longitudinal reinforced section for typical beams beneath the two
adjacent slabs.	
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Typical Concrete Beam Elevation 38	

FIG.3.3.3

The above Figure shows the longitudinal reinforced section for typical beams beneath three adjacent slabs.

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ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

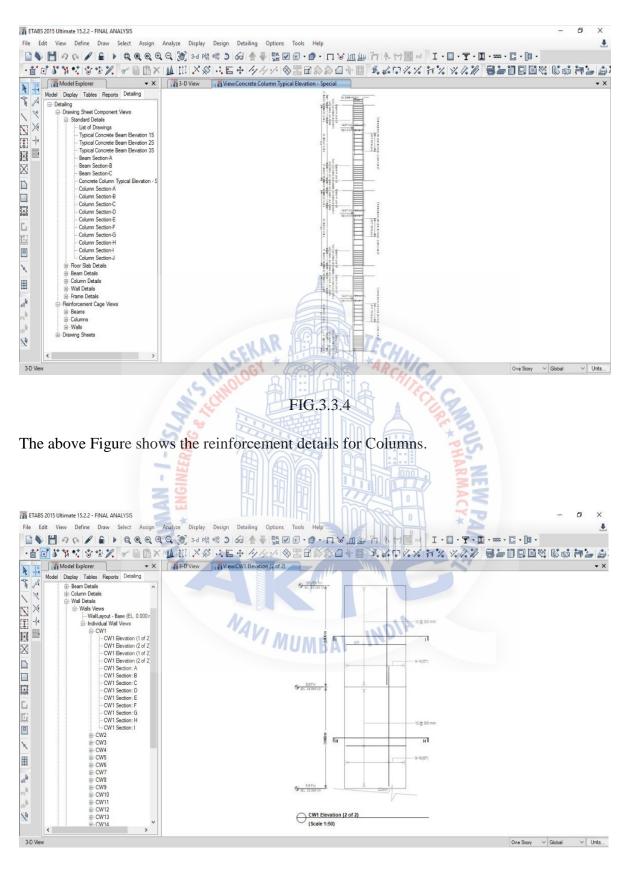


FIG.3.3.5

The above Figure shows the Spacing of main bars in Shear Walls.

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ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

TABS 2015 Ultimate 15.2.2 - FINAL ANALYSIS	- 0 ×
	Analyze Display Design Detailing Options Tools Help
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3-D View	Definition of the Story V Global V Litts.
	FIG.3.3.6
	FIG.3.3.0
The Figure indicates t	he Elevation view of shear wall with reinforcement details.
2	
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LI Y ⊡ Individual Wall Views ⊕-CW1	NAVI MUMBAL - THE
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- CW4	
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CW12	Operation and the second se
dr P-CW12	

FIG.3.3.7

The above Figure shows the reinforced section of Shear Wall.

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

TABS 2015 Ultimate 15.2.2 - FINAL ANALYSIS		- 0 ×
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	FIG.3.3.8	
The above Figure show	vs the Meshing in Shear Wall.	
	MAVI MUMBAL - INDIA	

3.4 DESIGNING OF SLAB AND FOOTING ON MICROSOFT EXCEL SPREADSHEET:

Since ETABS gives analysis and designing for beams and columns only, the analysis of slab and footing is done on Microsoft Excel Spreadsheet.

• DESIGN OF SLAB:

A. Design of slab S1:

	DESIGN OF	SLAB A	S PER IS	-456 2000				s1
Job No :-		• = = .			Date :-	4/30/2017		
Project :-					Slab ID	: s1		
				4				_
Thickness of	slab, D =	250	mm.	A		self load	625 kg/m ²	
Grade of con	crete $f_{ck} =$	25	N/mm ² .			live	300 kg/m ²	
Grade of Stee	$el f_y =$	415	N/mm ² .	66		floor finish	100 kg/m ²	
Clear cover	=	20	mm.	AR HIT	TE.	sunk load	0 kg/m ²	
sunk in slab	=	0	mm.	*		cobba	0 kg/m ²	
diameter of s	hort bar =	10	mm. 😡			TOTAL	1025 kg/m ²	
diameter of lo	ong bar =	10	mm.		RIA	TEC C		
Span & End	Conditions	for :	Cr.	LI MALL		1 119		
short bar	$L_x =$	3	m.	10		A Pri	D	_
long bar	$L_y =$	90	m. 🔀	10		*	≥L _y ↑,	
		. 2	A	VARIA			S I	
	$(L_y/L_x) =$	3.00					\uparrow	D
Aspect ratio	α _v =	0.01					Lx Lx	
	$\alpha_{\mathbf{x}} =$	0.99		- 1				
SHORT BAR	:	(To be pr	ovided along	g the shorter dir	- ection).	* 100	D	·
Mux =			t-m.			0	5	
K =		0.27	-	Section is sin	gly reinfor	ce.	2	
Pt =		0.12		Provide min	reinf. of 0.	12%. (cl.26.5.2.	1), IS-456: 2000).	
Ast =		300	mm ² .					
Deflection	ð =	0.33	mm.	Safe in deflee	ction.			
spacing requi	ire, s =	262	mm c\c.	< 3d, hence d	ok. (cl.26	6.3.3.b(1), IS-45	6:2000).	
			VAV	1	141	410		
	provide	10		neter bar @	-	c\c.		
LONG BAR:		. ,		g the longer dire	ection).			
Muy =			t-m.					
K = Pt =		0.03		Section is sin			1 10 150-0000	
		0.12	-	Provide min	reint. of U.	12%. (CI.26.5.2.	1, IS-456: 2000).	
Ast =	ስ =		mm ² .	On faile staffa	- (!			
Deflection	•		mm.	Safe in deflee				
spacing requi	ire, s =	262	mm c\c.	< 5d, Hence	ok. (cl.2	26.3.3.b(2), IS-4	56: 2000)	
	provide	10	mm dian	neter bar @	262	c\c.		
Summary		-	Quantity			VALID FOR	(tick appropriate	block).
	mm.	@					(/
Thickness.	250	Ŭ	6.75	cum.]	Tender.		
short bar.	10	262	66.55	kg.	1	Approval.		
long bar.	10	262	72.10	kg.]	Execution.		
sunk.	0		20.54	kg/cum.]			

TABLE NO.3.4.1

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

- **DESIGN OF SLAB AS PER IS-456 2000** s2 Job No :-Date :-4/30/2017 Project :-Slab ID : s2 Thickness of slab, D = self load 500 kg/m² 200 mm. N/mm^2 . kg/m² Grade of concrete f_{ck} = 25 live 300 N/mm². kg/m² Grade of Steel f_v = 415 floor finish 100 20 Clear cover mm. sunk load 0 kg/m² = sunk in slab 0 mm. cobba 0 kg/m² = kg/m² diameter of short bar = 10 TOTAL 900 mm. diameter of long bar = 10 mm. Span & End Conditions for : short bar 10 $L_x =$ 3.7 D m. long bar $L_y =$ 8 10 m. $(L_v/L_x) =$ 2.16 D D 0.04 Aspect ratio α_v = 0.96 α**x** = SHORT BAR: (To be provided along the shorter direction). D Mux = 1.77 t-m. K = 0.58 Section is singly reinforce. Pt = 0.16 %. > 0.12%, Hence ok. (cl.26.5.2.1, IS-456: 2000). Ast = 287.7 mm². Deflection ð = 1.26 mm. Safe in deflection. spacing require, s = mm c\c. < 3d, hence ok. (cl.26.3.3.b(1), IS-456: 2000). 273 mm diameter bar @ provide 10 273 c\c. LONG BAR: (To be provided along the longer direction). 0.38 t-m. Muy = Section is singly reinforce. K = 0.14 Pt = Provide min reinf. of 0.12%. (cl.26.5.2.1, IS-456: 2000). 0.12 %. Ast = 240 mm². Deflection ð = 1.41 mm. Safe in deflection. spacing require, s = 328 mm c\c. < 5d, Hence ok. (cl.26.3.3.b(2), IS-456: 2000) 10 provide mm diameter bar @ 328 c\c. VALID FOR Summary Quantity (approx.) (tick appropriate block). mm. @ 200 Thickness. 5.92 cum. Tender. short bar. 10 273 70.68 kg. Approval. 10 328 64.09 long bar. kg. Execution. sunk. 0 22.76 kg/cum.
- B. Design of slab S2:

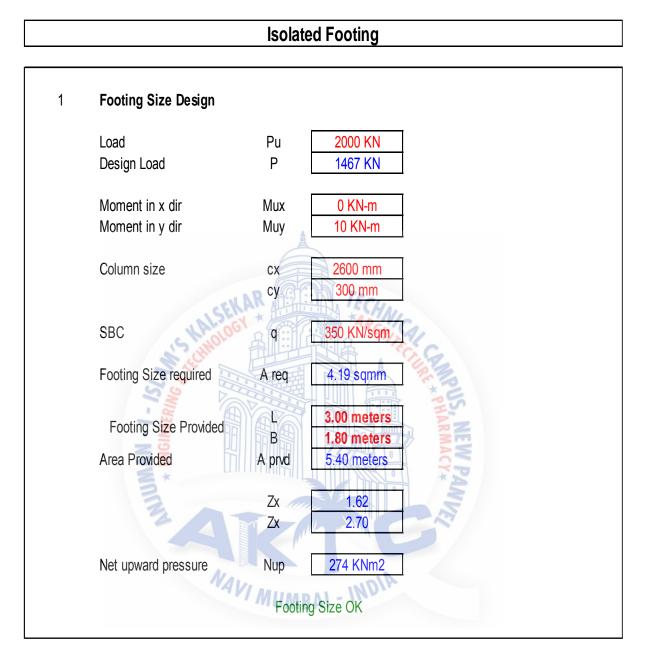
TABLE NO.3.4.2

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

- **DESIGN OF SLAB AS PER IS-456 2000** s3 Job No :-Date :-4/30/2017 Project :-Slab ID : s3 self load kg/m² Thickness of slab, D =200 500 mm. N/mm². kg/m² Grade of concrete f_{ck} = 25 live 300 N/mm². kg/m² Grade of Steel f_v = 415 floor finish 100 Clear cover = 20 mm. sunk load 0 kg/m² kg/m² sunk in slab 0 mm. cobba 0 = kg/m² diameter of short bar = 10 TOTAL 900 mm. diameter of long bar = 10 mm. Span & End Conditions for : short bar $L_x =$ 5.36 m. 10 D 8.15 long bar $L_v =$ m. 10 $(L_v/L_x) =$ 1.52 D Aspect ratio α_y = 0.16 0.84 α, = SHORT BAR: (To be provided along the shorter direction). D Mux = 3.27 t-m. K = 1.07 Section is singly reinforce. Pt = 0.31 %. > 0.12%, Hence ok. (cl.26.5.2.1, IS-456: 2000). Ast = 545.6 mm². Deflection ð = 4.89 mm. Safe in deflection. mm c\c. < 3d, hence ok. (cl.26.3.3.b(1), IS-456: 2000). spacing require, s = 144 provide 10 mm diameter bar @ c\c. 144 LONG BAR: (To be provided along the longer direction). Muy = 1.41 t-m. K = 0.52 Section is singly reinforce. Pt = > 0.12%, Hence ok. (cl.26.5.2.1, IS-456: 2000). 0.15 %. 243.29 mm². Ast = Deflection ð = 5.47 mm. Safe in deflection. spacing require, s = 323 mm c\c. < 5d, Hence ok. (cl.26.3.3.b(2), IS-456: 2000) provide 10 mm diameter bar @ 323 c\c. VALID FOR Summary Quantity (tick appropriate block). (approx.) mm. @ Thickness. 200 8.74 Tender. cum. short bar. 10 144 191.57 Approval. kg. 10 323 90.40 long bar. kg. Execution. 0 sunk. 32.27 kg/cum.
- C. Design of slab S3:

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

A. The following is the design calculation for isolated footing of shear wall.



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	Slab Design			,			
		lx	0.200				
		ly	0.750				
	Bending Moment in x dir	Mx	8 KN-m	1			
	Bending Moment in y dir	Му	116 KN-i				
	Concrete	fck	20 MPa				
	Steel	fy	415 MP				
	Minimum Depth Required	dmin	205				
		Gillin	200				
	Depth Provided	D	500 mm				
	Clear Cover	С	50 mm				
	Effective Cover	d'	💧 56 mm				
	Effective Depth	d'	444 mm	1			
	Area of Steel		bacing c/c in	n mm			
		12#	16#	ECH.	20#		
	533 sqmm	212 c/c	377 c/c		90 c/c		
	748 sqmm	151 c/c	269 c/c	4	20 c/c		
	Minimum Ast required act	ross x direcion			C C		
	7 4			A	RE		
	Ast across x direction	12 mm dia	@ 200 mm	c/c	565 sqm	m	
	Ast across y direction	12 mm dia	@ 150 mm	c/c	754 sqm	m	
	Ast across y direction	12 mm dia	@ 150 mm	c/c	754 sqm		
	Ast across y direction	12 mm dia	@ 150 mm	c/c	754 sqm		
	Ast across y direction	12 mm dia	@ 150 mm	c/c	2 2 2		
	idth 1000 mm	12 mm dia		c/c	2 2 2		
м	idth 1000 mm ulim/bd ² Mulim	12 mm dia	Wi	idth ulim/bd ²	1000 mm Mulim		
м	idth 1000 mm	12 mm dia	Wi	idth •	1000 mm		
M 2.	idth 1000 mm Iulim/bd ² Mulim 76 544 KN-m	12 mm dia	Wi	idth ulim/bd ²	1000 mm Mulim		
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma	x Section Che	wi M 2. Ck	idth Iulim/bd ² 76 xumax/d	1000 mm Mulim 544 KN-m	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma	x Section Che	wi M 2. Ck	idth Iulim/bd ² 76 xumax/d 0.48	1000 mm Mulim 544 KN-m		
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma	x Section Che	wi M 2. Ck	idth lulim/bd ² 76 <u>xumax/d</u> 0.48 SRB	1000 mm Mulim 544 KN-m xumax 213	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma	x Section Che	wi M 2. Ck	idth idth iulim/bd ² 76 <u>xumax/d</u> 0.48 <u>SRB</u> a	1000 mm Mulim 544 KN-m xumax 213 0.7529	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105	× Section Che	wi M 2. Ck	idth idth idim/bd ² 76 <u>xumax/d</u> 0.48 <u>SRB</u> a b	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417	x Section Che	wi M 2. Ck	idth lulim/bd ² 76 xumax/d 0.48 SRB a b c	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105 0.5865	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105	x Section Che	wi M 2. Ck	idth idth idim/bd ² 76 <u>xumax/d</u> 0.48 <u>SRB</u> a b	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51	x Section Che	ck MBA1-	idth Iulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116	x Section Che	ck MBA1-	idth lulim/bd ² 76 xumax/d 0.48 SRB a b c -p	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684	Rumax	
M 2.	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205	x Section Che	ck MBA1-	idth Iulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast Min steel %	1000 mm Mulim 544 KN-m xumax 213 0.7529 -3.6105 0.5865 0.1684 748 0.205	Rumax	
M 2. Mi	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205 Ast 51 Vin Steel 533	x Section Che	ck MBAN-H	idth ulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast Min Steel % Ast	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748 0.205 748 533	Rumax	
M 2. Mi	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205 Ast 51	x Section Che		idth lulim/bd ² 76 <u>xumax/d</u> 0.48 <u>SRB</u> a b c -p Ast fin steel % Ast	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748 0.205 748	Rumax	
M 2. Mi	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205 Ast 51 Vin Steel 533	x Section Che		idth ulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast Min Steel % Ast	1000 mm Mulim 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748 0.205 748 533	Rumax	
M 2. 	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205 Ast 51 Viin Steel 533 Vax Steel 17760	x Section Che		idth ulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast Min Steel % Ast Min Steel Max Steel	1000 mm Mulim 544 KN-m 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748 0.205 748 533 17760	Rumax	
M 2. 	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205 Ast 51 Viin Steel 533 Vax Steel 17760 Ast 533	x Section Che		idth ulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast Min Steel % Ast Min Steel Max Steel Ast	1000 mm Mulim 544 KN-m 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748 0.205 748 533 17760 748	Rumax	
M 2. 	idth 1000 mm ulim/bd ² Mulim 76 544 KN-m xumax/d xumax Ruma 0.48 213 0.138 SRB a 0.7529 b -3.6105 c 0.0417 -p 0.0116 Ast 51 in steel % 0.205 Ast 51 Viin Steel 533 Vax Steel 17760 Ast 533 t provided 0.1200	x Section Che		idth ulim/bd ² 76 xumax/d 0.48 SRB a b c -p Ast Min Steel % Ast Min Steel Max Steel Max Steel Ast	1000 mm Mulim 544 KN-m 544 KN-m 213 0.7529 -3.6105 0.5865 0.1684 748 0.205 748 533 17760 748 0.1684	Rumax	Section 7.

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

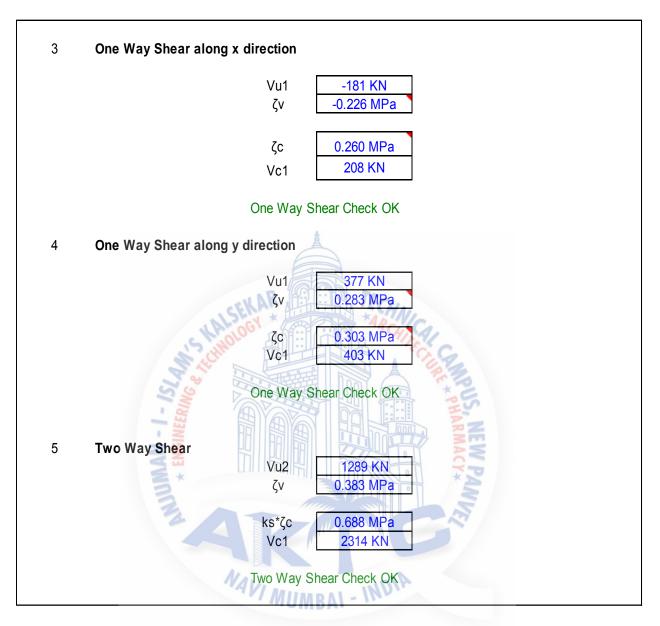
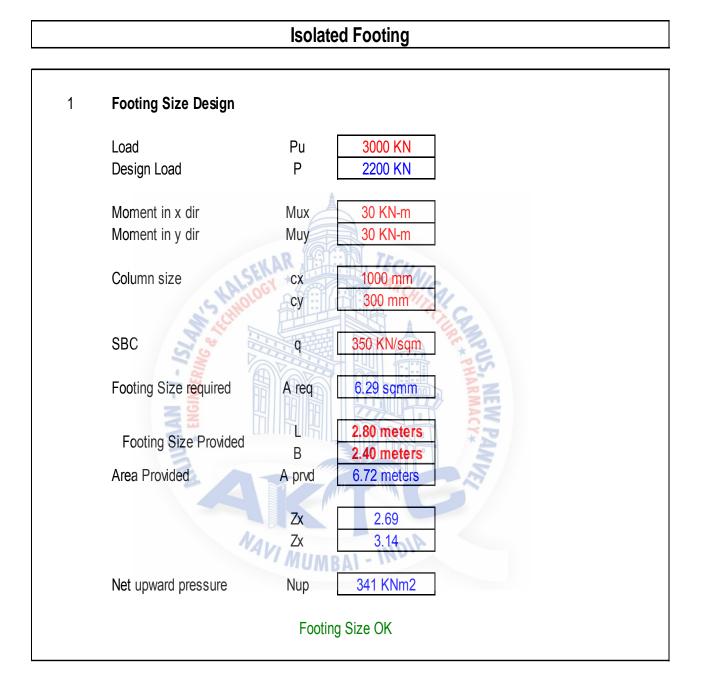


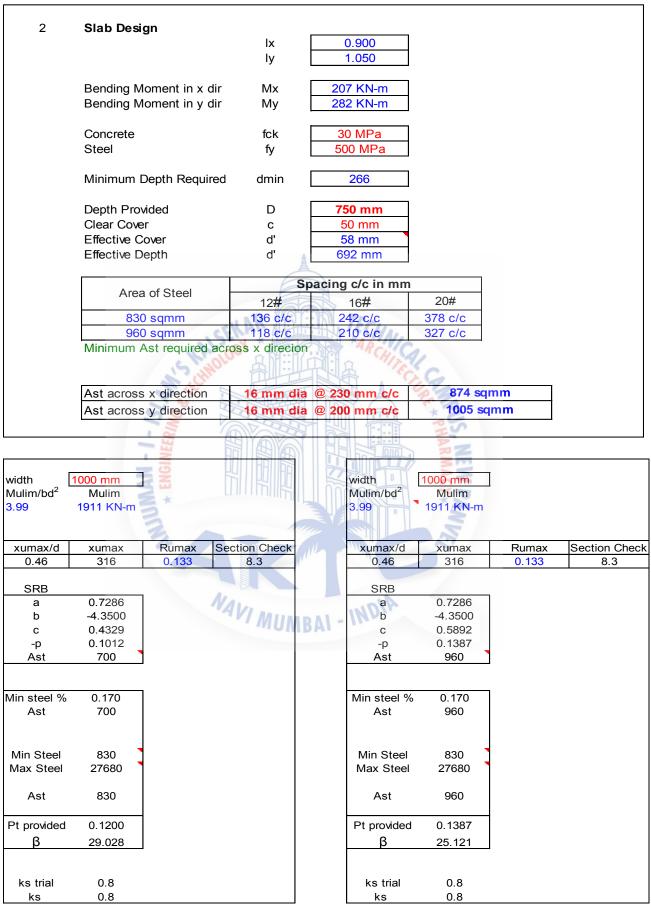
TABLE NO.3.4.4

B. There are 3 types of columns dealing with different loadings i.e. 3000KN, 4000KN and 5000KN (approximately). So we have designed 3 different columns individually. The calculations are shown below.

a) FOR 3000KN LOAD:



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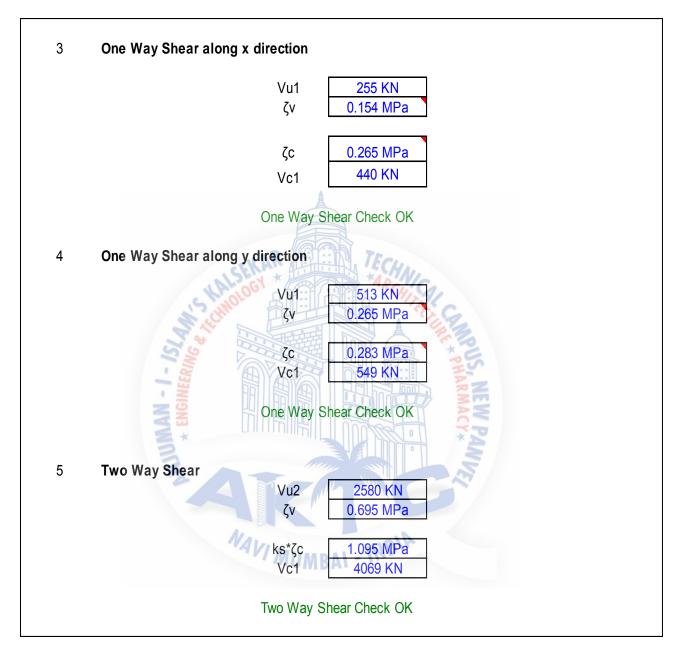


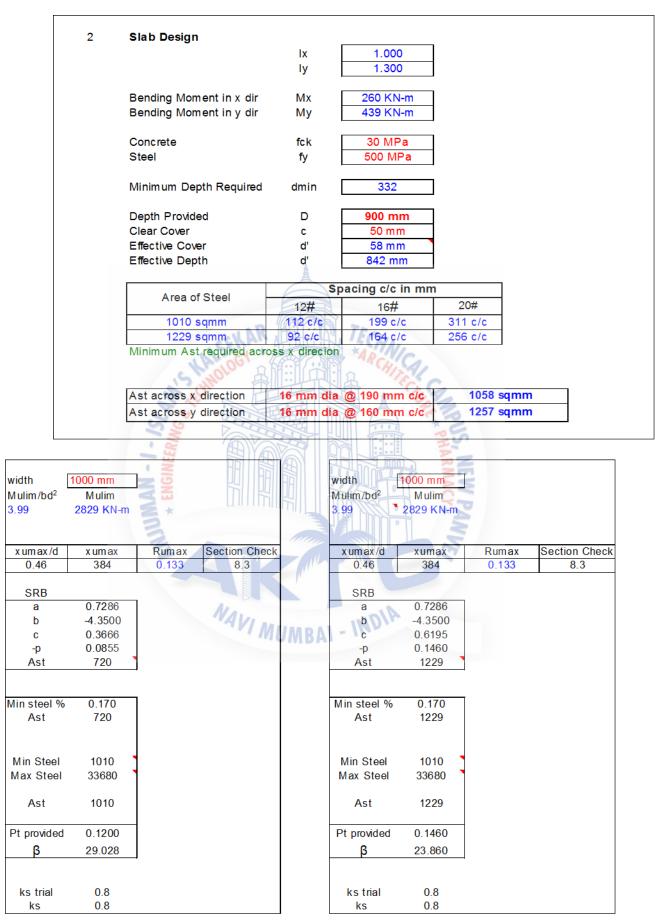
TABLE NO.3.4.5

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

b) FOR 4000KN LOAD:

		lsolat	ed Footing
1	Footing Size Design		
	Load	Pu	4000 KN
	Design Load	Р	2933 KN
	Moment in x dir	Mux	30 KN-m
	Moment in y dir	Muy	30 KN-m
	Column size	cx cy	1000 mm 300 mm
	SBC	g	350 KN/sqm
	Footing Size required	A req	8.38 sqmm
	Footing Size Provided	B	3.00 meters 2.90 meters
	Area Provided	A prvd	8.70 meters
	NAVIN	UMBAN	4.21
		Zx	4.35
	Net upward pressure	Nup	347 KNm2
		Footir	ng Size OK

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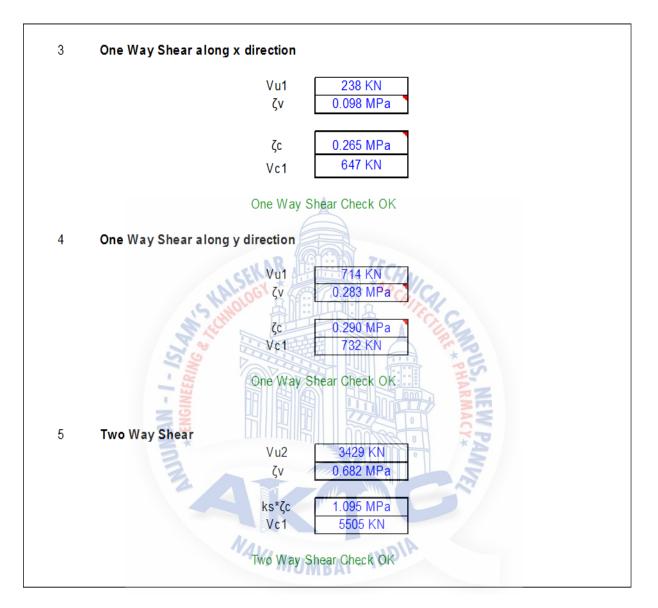
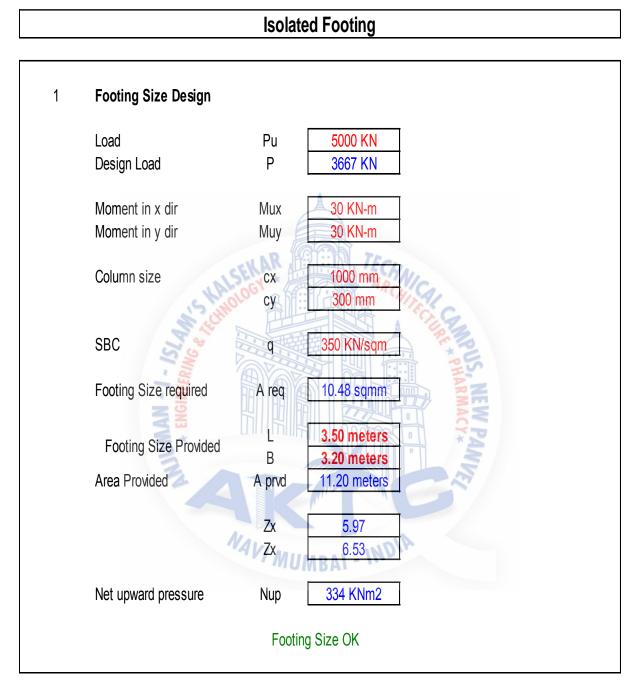


TABLE NO.3.4.6.

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

c) FOR 5000KN LOAD:



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1						
2	Slab Design		·	l		
		lx	1.250			
		ly	1.450			
	Bending Moment in x dir	Mx	391 KN-m			
	Bending Moment in y dir	My	526 KN-m			
		,				
	Concrete	fck	30 MPa			
	Steel	fy	500 MPa			
	Minimum Depth Required	dmin	364			
		Girini	001			
	Depth Provided	D	1000 mm			
	Clear Cover	C	50 mm			
	Effective Cover Effective Depth	d' d'	58 mm			
	Ellective Depth	u	942 11111			
	Aron of Stool	S	pacing c/c in mm	1		
	Area of Steel	12#	16#	20#		
	1130 sqmm	100 c/c	178 c/c	278 c/c		
	1315 sqmm	86 c/c	153 c/c	239 c/c		
	Minimum Ast required acro	oss x aireción		417AL		
	S. CHIP	THE.		SC Co		
	Ast across x direction	16 mm dia	@ 170 mm c/c	1183 sq	mm	
	Ast across y direction	16 mm dia	@ 150 mm c/c	1340 sq	mm	
	BI I			1		
width	1000 mm 📃 💆	4 - 1	width	1000 mm 🦐	S	
Mulim/bd ²	Mulim See		Mulim/bd ²	Mulim 📿	0	
3.99	3541 KN-m		3.99	3541 KN-m		
	2 .		and some			
xumax/d						
		tion Check	xumax/d	xumax	Rumax	
0.46	xumax Rumax Sec 430 0.133	tion Check 8.3	xumax/d 0.46	xumax 430	Rumax 0.133	8.3
	430 0.133	8.3	0.46	430		
0.46 SRB a	430 0.133	8.3	0.46	430 0.7286		
0.46 SRB	430 0.133	8.3	0.46	430 0.7286 -4.3500		
0.46 SRB a b c -p	430 0.133 0.7286 -4.3500 0.4408 0.1031		0.46 SRB a b - c -p	430 0.7286 -4.3500 0.5932 0.1396		
0.46 SRB a b c	430 0.133	8.3	0.46	430 0.7286 -4.3500 0.5932		
0.46 SRB a b c -p	430 0.133 0.7286 -4.3500 0.4408 0.1031	8.3	0.46 SRB a b - c -p	430 0.7286 -4.3500 0.5932 0.1396		
0.46 SRB a b c -p Ast Min steel %	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170	8.3	0.46 SRB a b c -p Ast Min steel %	430 0.7286 -4.3500 0.5932 0.1396 1315		
0.46 SRB a b c -p Ast	430 0.133 0.7286 -4.3500 0.4408 0.1031 971	8.3	0.46 SRB a b c -p Ast	430 0.7286 -4.3500 0.5932 0.1396 1315		
0.46 SRB a b c -p Ast Min steel %	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170	8.3	0.46 SRB a b c -p Ast Min steel %	430 0.7286 -4.3500 0.5932 0.1396 1315		
0.46 SRB a b c -p Ast Min steel % Ast Min Steel	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170 971 1130	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130		
0.46 SRB a b c -p Ast Min steel % Ast	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170 971	8.3	0.46 SRB a b c -p Ast Min steel % Ast	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315		
0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170 971 1130 37680	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130 37680		
0.46 SRB a b c -p Ast Min steel % Ast Min Steel	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170 971 1130	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130		
0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast Pt provided	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 1130 37680 1130 0.1200	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast Pt provided	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130 37680 1315 0.1396		Section Check 8.3
0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 0.170 971 1130 37680 1130	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130 37680 1315		
0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast Pt provided	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 1130 37680 1130 0.1200	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast Pt provided	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130 37680 1315 0.1396		
0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast Pt provided	430 0.133 0.7286 -4.3500 0.4408 0.1031 971 1130 37680 1130 0.1200	8.3	0.46 SRB a b c -p Ast Min steel % Ast Min Steel Max Steel Ast Pt provided	430 0.7286 -4.3500 0.5932 0.1396 1315 0.170 1315 1130 37680 1315 0.1396		

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

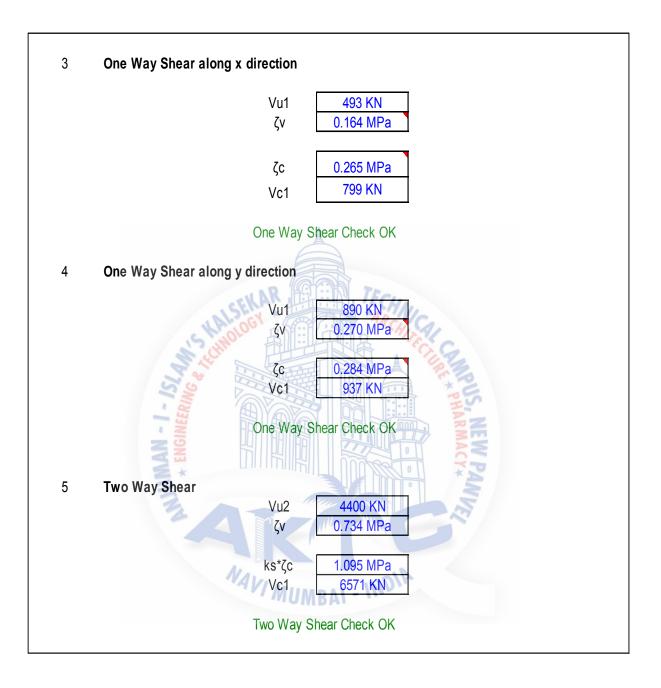


TABLE NO.3.4.7.

3.5 MODELLING

This project demonstrates how to create and manage more complex projects and draw model using Autodesk Revit software as the base layer. The group focuses on the modeling of civil and building engineering structures, both linear and non-linear. In modeling the quantity of material will be estimated and the 3-Dimensional view will be displayed. Revit is a single software application that supports a BIM (Building Information Modelling) work flow from concept to construction. Use Revit to model designs with precision, optimize performance and collaborate more effectively.

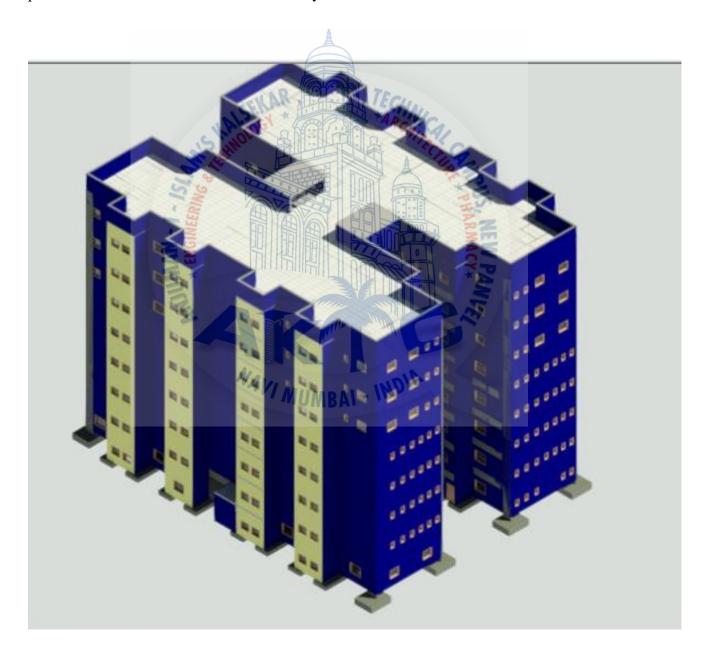


FIG.3.5

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

The step by step procedure for modelling in Autodesk Revit is mentioned below:

- 1. Importing the AutoCAD plans for ground, 1st & 5th floor.
- 2. Defining levels: Levels are defined from plinth level to 7th floor.
- 3. Editing walls beams and columns: dimensions for different walls beams and columns are duplicated as per schedule obtained from ETABS analysis.
- 4. Modelling of ground floor: Beams, columns and walls which are required on ground floor as per the AutoCAD drawing is placed.(Refer Fig.3.3.1 and 3.3.2)
 - In Canteen, dining tables & cooking utensils are provided for students and canteen staff respectively.
 - Indoor games room consist of all modern gaming facilities including snooker, carrom board, chess, table tennis, etc.
 - Gymnasium is equipped with all advance and reputed workout equipment.
 - Library & Digital Library are loaded with all the required study materials.
 - Warden Office and Reception is provided at necessary location.

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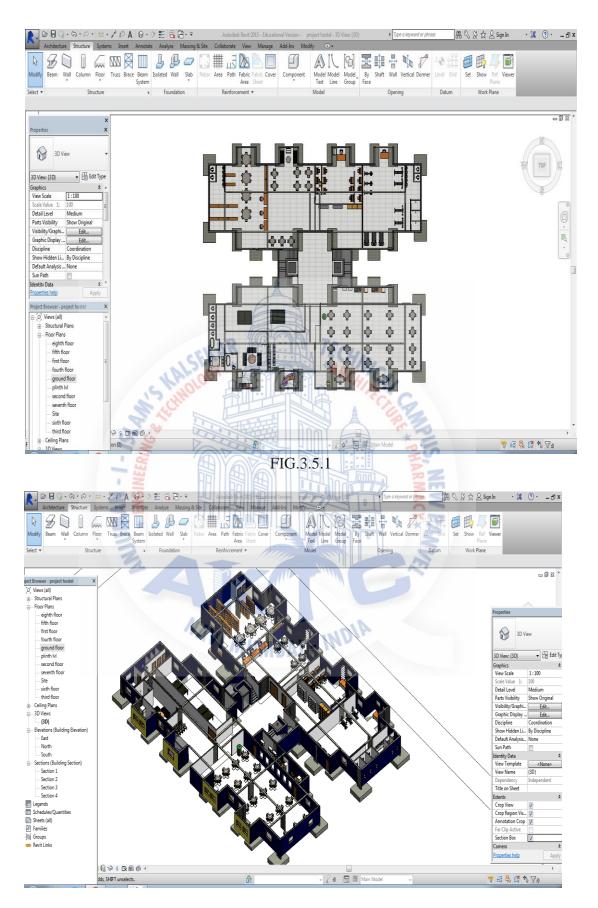


FIG.3.5.2 43

- Modelling of 1st floor: This floor is being modelled as per the comfort of the students. Floors 2nd, 3rd & 4th are replica of 1st Floor. (Refer Fig 3.3.3 and 3.3.4)
 - Each room consist of 4 Double-Bed for 8 students.
 - A common study is provided with chairs and tables.
 - Book Shelves, Cupboards and Study table is provided in each room.

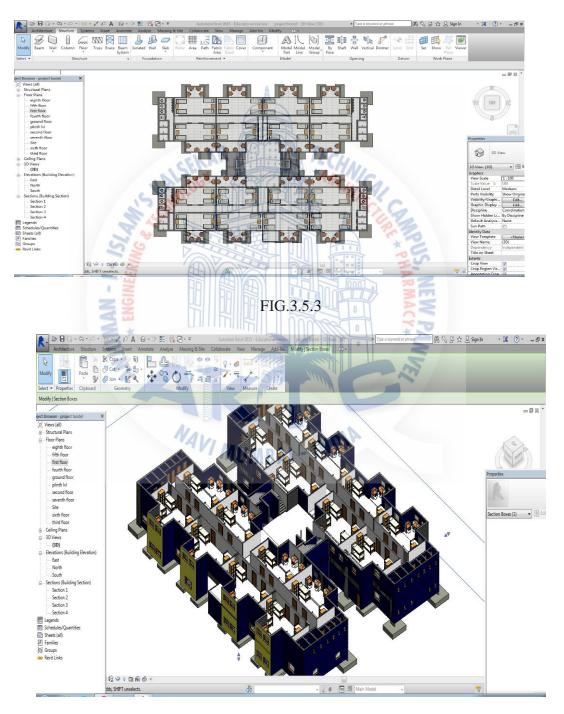


FIG.3.5.4 44

- 6. Modelling of 5th floor: This floor is modelled for staff members of college. 6th and 7th floors are replica of 5th floor. (Refer Fig 3.3.5 and 3.3.6)
 - The rooms on this floor are modelled for staff teachers to be residing with their families.
 - There are 8 rooms on each floor with 6 1BHK rooms and 2 1RK rooms.
 - Each Living Room is equipped with 2 Sofas and a center table.
 - Kitchen is provided in each room with latest amenities

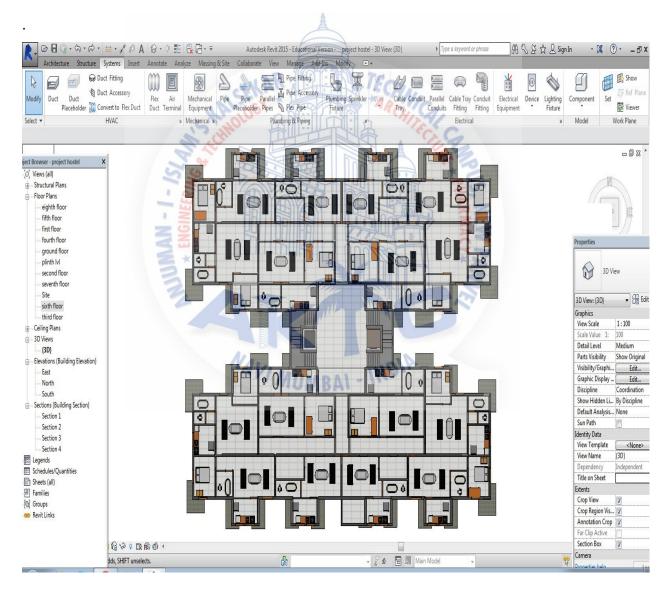
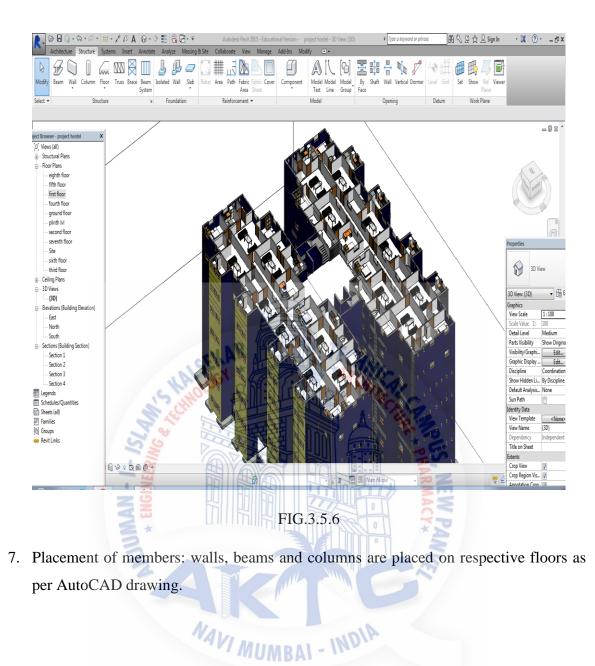


FIG.3.5.5



3.6 QUANTITY ESTIMATION

Estimation of the quantities of materials is generated using Autodesk Revit software

Estimation is generated automatically in this software. We have estimated the quantity of steel and concrete in structural beams, columns and footing for the whole structure.

This is done by selecting "View" option. Then go in "Scheduling" on the "Task Bar".

Then we sort the table columns by Family Type, Count, Volume and Estimated Rebar Volume as shown in Figure below. (Refer Fig.3.4.1)

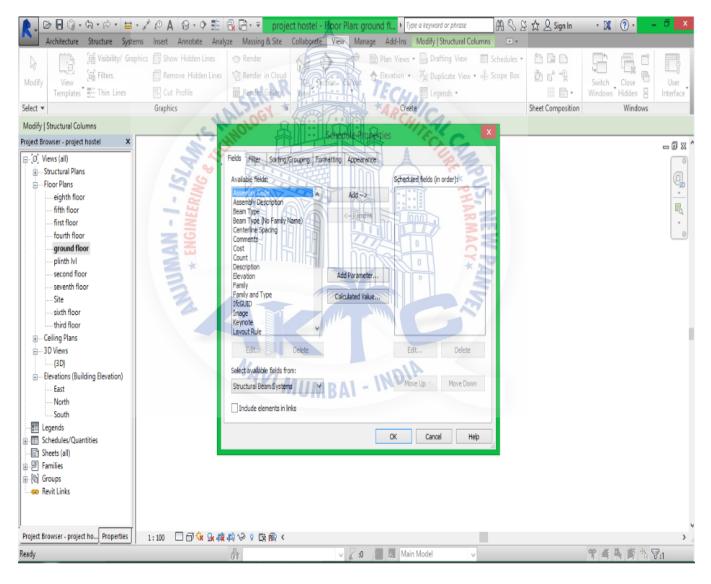


FIG.3.6.1

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

CHAPTER 4

4.0 RESULT AND DISCUSSION:

4.1. ETABS:

After the detailed analysis of structure, the following results is obtained which shows the area of steel required in respective structural members (beams, columns, shear walls). Along with the steel area, the bending moment details, shear force details and deflections in each beam is also obtained in a systematic manner. All these details are obtained in an auto-generated ".docx" file which is generated automatically by ETABS software while we work on the structure. Necessary snapshots are provided below.

Following are some of the cross-sections and longitudinal sections from the structure along with the reinforcement details:

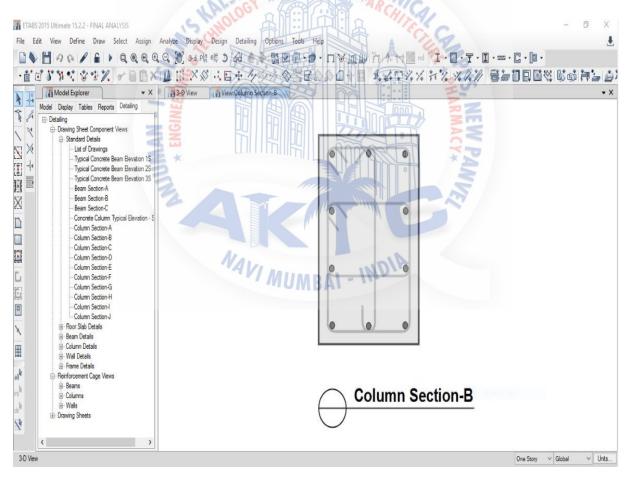


FIG.4.1.1

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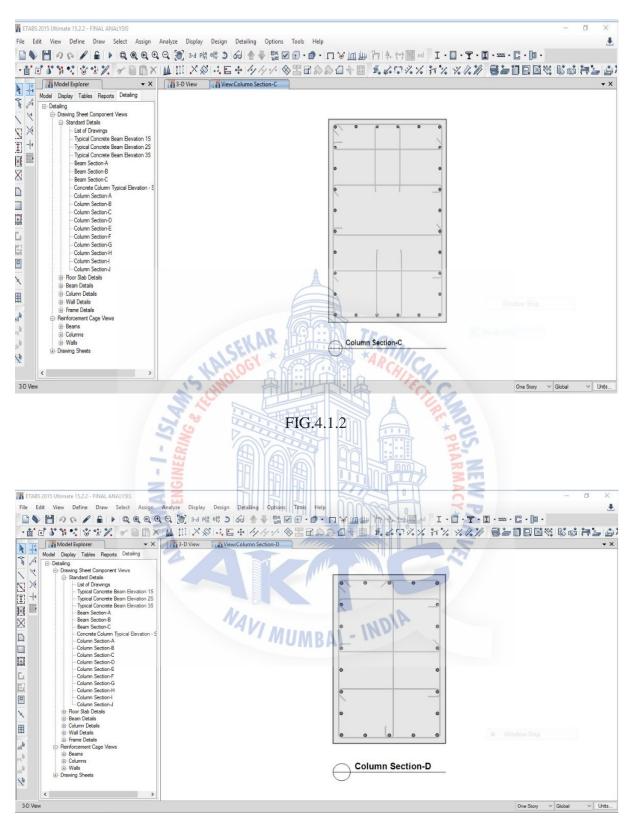


FIG.4.1.3

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TABS 2015 Ultimate 15.2.2 - FINAL ANALYSIS	- 0 >
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Beam Section-B Beam Section-C	
- Concrete Column Typical Elevation - S - Column Section-A	0 0
- Column Section-B - Column Section-C	
Column Section-D Column Section-E	0 0
Column Section-F Column Section-G	
Column Section-H Column Section-I	0 0
Column Section-J ()- Floor Slab Details	
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⊕ - Wall Details ⊕ - Frame Details	Window Ship
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	Column Section-A
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	FIG.4.1.4
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Model Display Tables Reports Detailing	13-D View 18 View.Column Section-€ 0 •
o ^{d4} ⊡ Detailing	
Typical Concrete Beam Elevation 1S Typical Concrete Beam Elevation 2S	
- Typical Concrete Beam Elevation 3S	
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- Beam Section-C - Concrete Column Typical Elevation - S	
Column Section-A	
- Column Section-C - Column Section-D	0 0
Column Section-G Column Section-H	
- Column Section-I	
⊕ Floor Slab Details ⊛ Beam Details	
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Reinforcement Cage Views Beams Coheman	
⊕-Beams ⊕-Columns ⊕-Walls	Column Section-F
⊞-Beams ⊛-Columns	Column Section-F
⊕-Beams ⊕-Columns ⊕-Walls	Column Section-F

FIG.4.1.5

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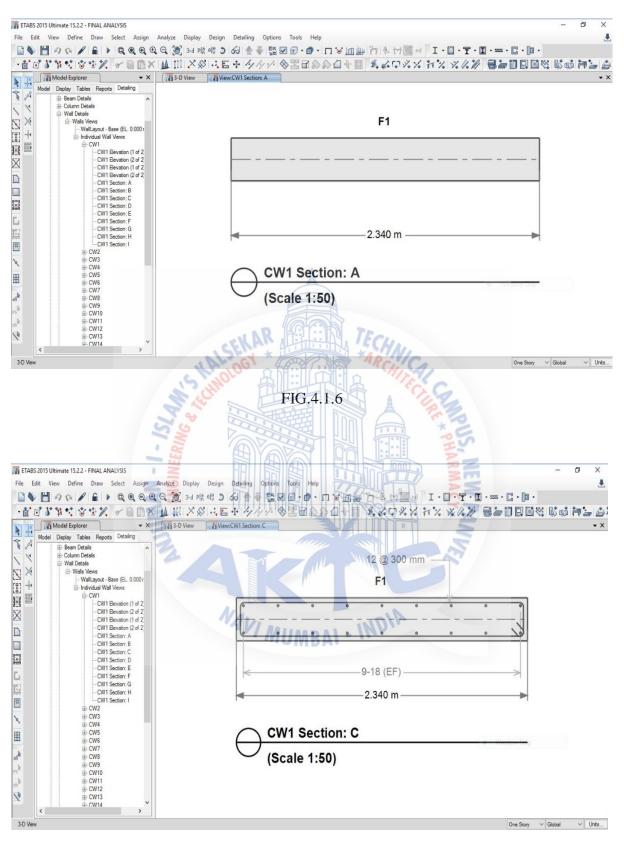


FIG.4.1.7

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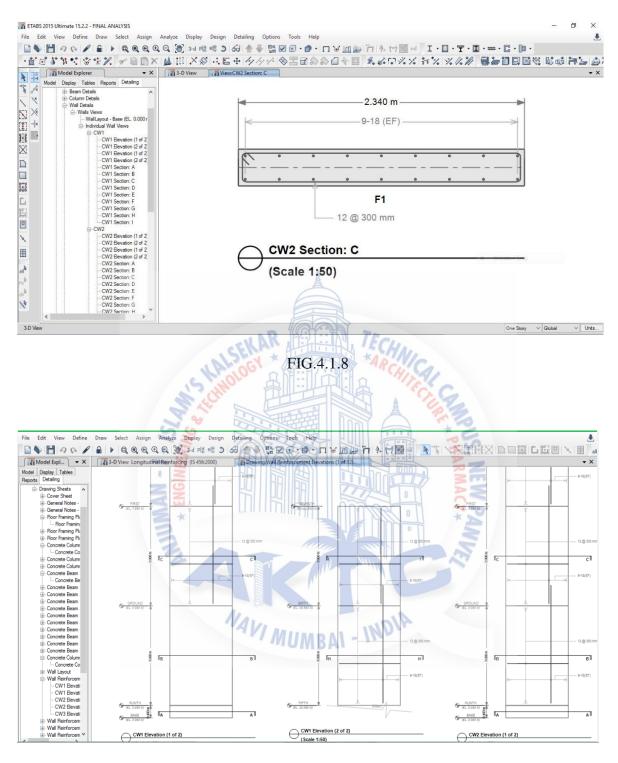


FIG.4.1.9

181 2-1	D View Longitudinal Rei		ng (i	CC			E.A.	Jrawii	ng:Co	norete C CC		1 Sche	dule	(1 of :	»)	C	:3					C	:4					СС	:5					C	6	_	
		COLUMN SIZE	SECTION	REINFORCING	TIES ZONE-A	TIES ZONE-B	TIES ZONE-C	COLUMN SIZE	SECTION	REINFORCING	TIES ZONE-A	TIES ZONE-B	TIES ZONE-C	COLUMN SIZE	SECTION	REINFORCING	TIES ZONE-A	TIES ZONE-B	TIES ZONE-C	COLUMN SIZE	SECTION	REINFORCING	TIES ZONE-A	TIES ZONE-B	TIES ZONE-C	COLUMN SIZE	SECTION	REINFORCING	TIES ZONE-A	TIES ZONE-B	TIES ZONE-C	COLUMN SIZE	SECTION	REINFORCING	TIES ZONE-A	TIES ZONE-B	
	SEVENTH	4	Ŷ			4	4	4			4	4	Ŷ	4	4			4	4	4			Ŷ	4	4	Ŷ	Ŷ	1	4	4			4		÷		+
	SIXTH			10-18 (2,400.00)						16-16 (2,400.00)						16-16 (2,400.00)						16-16 (2,679.05)						16-16 (2,400.00)						16-16 (2,400.00)			
	FIFTH			16-16 (2,400.00)						16-16 (2,400.00)					ł	16-16 (2,400.00)		A				16-16 (2,679.05)						16-16 (2,400.00)						16-16 (2,400.00)			
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ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

5		View Longi									smic) (1 of		LE (1 OF	11)					
			SPAN	SECTION	ON SIZE				GITUDINAL					,		STIRRUPS		TYPICAL	٦
•	BEAM ID	SPAN NO.	LENGTH (LC)	WIDTH	DEPTH	A	В	С	D	F	G	н	и	L2	ZONE A	ZONE B	ZONE C	ELEVATIONS	
8	10081	1	2.958 M	300 MM	500 MM	2-18 (434)		1-20 (434)	1-20	4-12 (434)				0.740 M	3-8 @ 225 MM TYPE A (0.3)		9-8 @ 225 MM TYPE A (0.3)	ELEVATION 15	1
ľ	10082	1	9.060 M	300 MM	800 MM	2-20 (760)	1-20	2-20 (760)	1-20	3-20 (884)			2.265 M	2.265 M	3-8 @ 275 MM TYPE A		25-8 @ 275 MM TYPE A	ELEVATION 1S	1
ľ		1	1.533 M	300 MM	800 MM	2-20 (845)	1-20	-		3-20 (750)			0.383 M		6-12 @ 125 MM TYPE A (1.4)		8 @ 275 MM TYPE A	ELEVATION 25	1
	10083	2	3.067 M	300 MM	800 MM	2-20 (852)	1-20	2-20 (760)	1-20	3-20 (760)			0.767 M	0.767 M	6-12 @ 125 MM TYPEA (1.4)	8-10 @ 125 MM TYPE A (0.9)	3-8 @ 275 MM TYPEA (0.3)	ELEVATION 25	1
	10054	1	6.450 M	300 MM	800 MM	2-20 (1.020)	2-20	2-20 (1.035)	2-20	3-20 (760)			1.613 M	1.613 M	6-12 @ 125 MM TYPE A (1.5)	11-10 @ 125 MM TYPE A (0.9)	12-8 @ 275 MM TYPE A (0.3)	ELEVATION 1S	
		1	1.528 M	300 MM	800 MM	2-20 (881)	1-20	-		3-20 (750)			0.382 M		6-12 @ 125 MM TYPE A (1.4)		8 @ 275 MM TYPE A (0.0)	ELEVATION 2S	1
	10085	2	3.072 M	300 MM	800 MM	2-20 (835)	1-20	2-20 (760)	1-20	3-20 (750)			0.768 M	0.768 M	6-12 @ 125 MM TYPE A (1.3)	8-10 @ 125 MM TYPE A (0.9)	3-8 @ 275 MM TYPEA (0.3)	ELEVATION 25	1
		1	1.582 M	300 MM	BOD MM	2-20 (760)	1-20			3-20 (760)			0.396 M		3-8 @ 275 MM TYPE A (0.3)		8 @ 275 MM TYPE A (0.0)	ELEVATION 3S	1
		2	1.528 M	300 MM	800 MM			2-20 (760)	1-20	3-20 (760)				0.382 M	4-8 @ 225 MM TYPE A (0.4)		2-8 @ 275 MM TYPE A (0.0)	ELEVATION 3S	1
	10086	3	3.565 M	300 MM	800 MM			2-20 (760)	1-20	3-20 (760)			•	0.891 M	6-10 @ 125 MM TYPE A (1.0)	10-8 @ 100 MM TYPE A (0.7)	8-8 @ 275 MM TYPE A (0.3)	ELEVATION 35	1
		4	2.965 M	300 MM	800 MM	2-20 (760)	1-20	2-20 (777)	1-20	3-20 (760)			0.746 M	0.746 M	4-8 @ 225 MM TYPE A (0.4)		7-8 @ 275 MM TYPE A (0.3)	ELEVATION 35	1
	10057	1	5.070 M	300 MM	800 MM	2-20 (760)	1-20	2-20 (760)	1-20	4-12 (190)	1-20 (760)	1-20 (760)	1.268 M	1.258 M	3-8 @ 275 MM TYPE A (0.3)		12-8 @ 275 MM TYPE A (0.3)	ELEVATION 1S	1
ľ		1	3.230 M	300 MM	800 MM	2-20 (760)	1-20			3-20 (760)			0.807 M		4-8 @ 200 MM TYPE A (0.4)		10-8 @ 200 MM TYPE A (0.4)	ELEVATION 3S	1
	10088	2	3.445 M	300 MM	800 MM			2-20 (760)	1-20	3-20 (760)	a	1-20 (970)	7· _	0.861 M	7-10 @ 100 MM TYPE A (1.1)	10-8 @ 100 MM TYPE A (0.8)	0-0 @ 275 MM TYPE A (0.3)	ELEVATION 35	1
		3	2.985 M	300 MM	800 MM	2-20 (760)	1-20	2-20 (771)	1-20	3-20 (760)	Ĩ.		0.746 M	0.746 M	3-8 @ 275 MM TYPE A (0.3)		7-8 @ 275 MM TYPE A (0.3)	ELEVATION 3S	1
ľ	10089	1	3.550 M	230 MM	600 MM	2-20 (665)	1-20	2-20 (679)	1-20	4-12 (399)			0.887 M	0.887 M	5-8 @ 125 MM TYPE A (0.7)	10-8 @ 150 MM TYPE A (0.5)	2-8 @ 275 MM TYPE A (0.3)	ELEVATION 1S	1
	100810	1	3.910 M	300 MM	800 MM	2-20 (760)	1-20	2-20 (1.023)	2-20	5-20 (1,281)	FI	11	M 876.0	M 876.0	7-12 @ 100 MM TYPE A (1.6)	8-12 @ 125 MM TYPE A (1.5)	11-10 @ 125 MM TYPE A (1.0)	ELEVATION 1S	1
		1	2.985 M	300 MM	BOD MM	2+20 (780)	1-20	84	• =	3-20 (760)		H	= 0.745.M		3-8 @ 275 MM TYPE A (0.3)	2	7-8 @ 275 MM TYPE A (0.3)	ELEVATION 3S	1
	100811	2	3.540 M	300 MM	800 MM	9	8	2-20 (783)	1-20	3-20 (760)	. 0	7.5	S	0.885 M	7-10 @ 100 MM TYPEA (1.1)		10-8 @ 275 MM TYPE A (0.3)	ELEVATION 3S	1
		3	3.135 M	300 MM	800 MM	2-20 (760)	1-20	2-20 (760)	0 1-20	3-20 (750)	田田	1-20 (994)	0.78411	0.784.M	4-5 @ 200 MM TYPE A (0.4)	20	10-8 @ 200 MM TYPE A (0.4)	ELEVATION 3S	
w					S	S	1	7	A	112				-	AR A TRAIN TYPE A	26	One Story	✓ Global	v
					1	GINEER			E	F	IG.4	.1.1				ARMA			

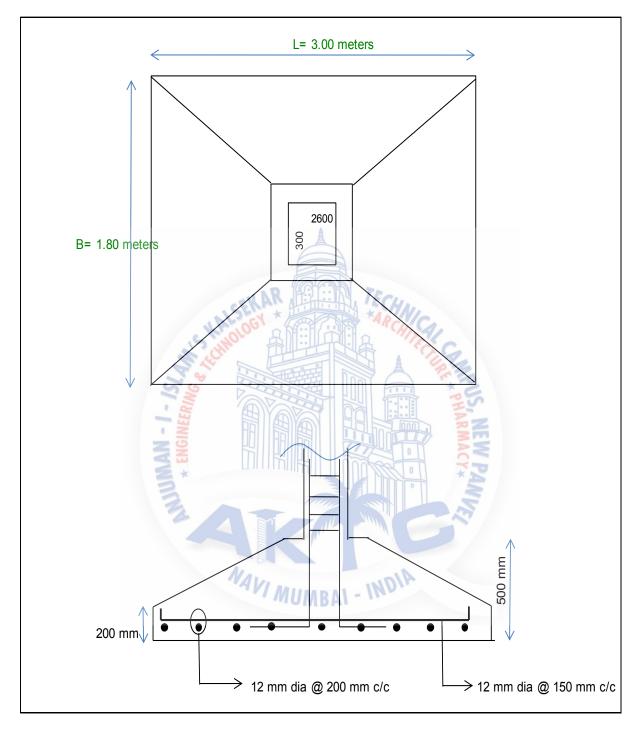
4.2. MICROSOFT EXCEL SPREADSHEET:

As beams, columns and shear walls are designed in detailed manner in ETABS, the design of slabs and footing are done in Microsoft Excel Spreadsheets. Also calculation of beams and columns are done on excel sheet for cross checking. The details of designs can be seen in the following Figure.

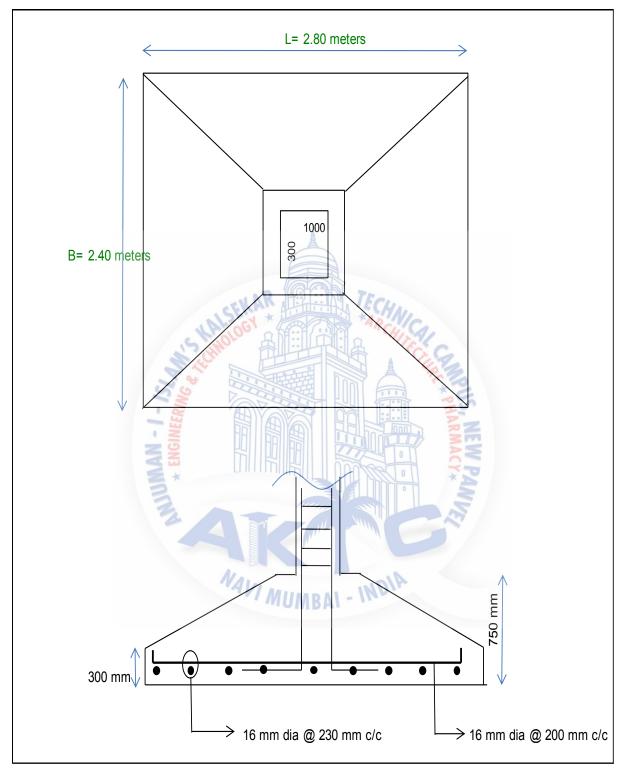
• SCHEDULE FOR SLABS :

59.38	1912.05	Total Quantity	Total										
11.19	386.68	320	120		10	240	9 609.49	9	415	25	200	12	9 S9
6.27	182.31	230	210	4	10	331.84 DN	9 373.49	9	415	25	200	12	8 S8
12.73	612.74	210	100		10	375.18	9 823.18	14	415	25	200	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	7 S J
1.98	43.64	320	300		10	240	9240	SEL	415	25	200	10	6 S6
1.67	37.07	320	300	ľ	10	240	9 240	A × COG	415	25	200	64	5 S5
5.48	118.25	320	300		10	240	9 240	9	415	25	200	32	4 S4
8.74	281.97	BA 320	140	, UL	10	243.29	9 545.6	9	415	25	200	40	3 S3
5.92	134.77	320	270		10	240	9 287.7	9	415	25	200	64	2 S2
5.4	114.62	320	300		0	240	9 240	ARCA 9	415	25	200	32	1 S1
			A	C	0			NIC					
aum	(Kg)	(Y-direction)		(X-direction)	(mm)	Y (1	Xexe	(Kn/m)			(mm)		
Total Quantity of steel Total Quantity of concrete	Total Quantity of steel		Spacing	Spacing	Diameter of bar Spacing	N	Area of steel		Grade of steel	Thickness Grade of concrete Grade of steel Total Load	Thickness	Count	Sr.NO Mark
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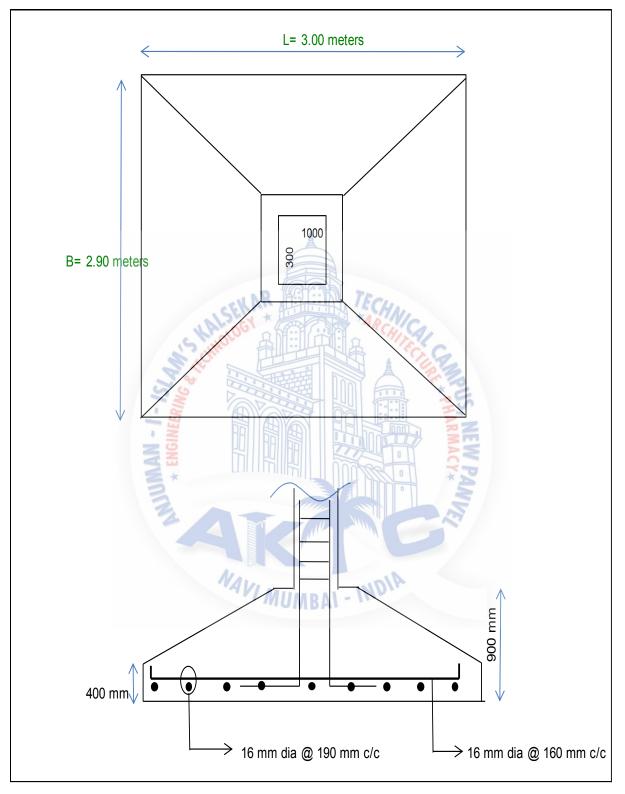
1. FOOTING FOR SHEAR WALL:



1. FOOTING FOR COLUMN WITH 3000KN LOAD:



2. FOOTING FOR COLUMN WITH 4000KN LOAD:



3. FOOTING FOR COLUMN WITH 5000KN LOAD:

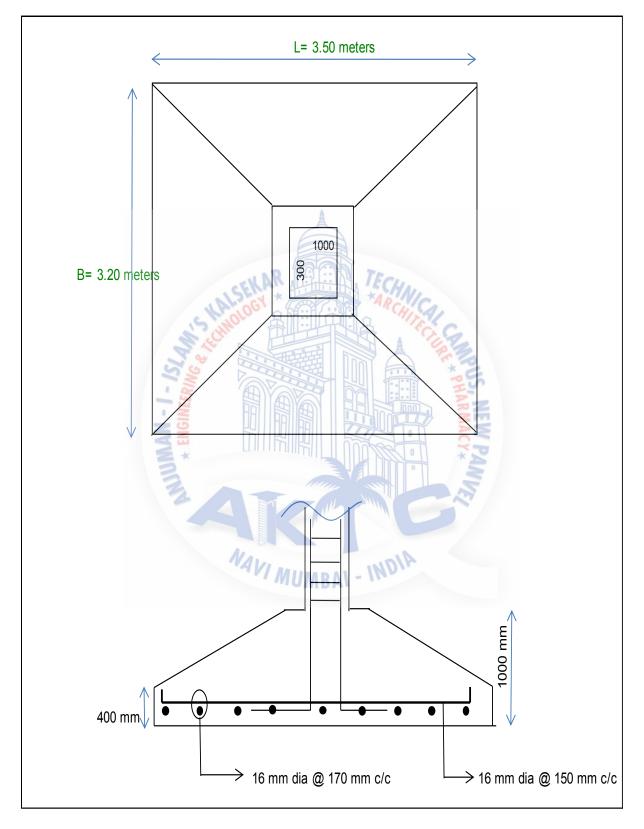


TABLE NO.4.2.5

ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

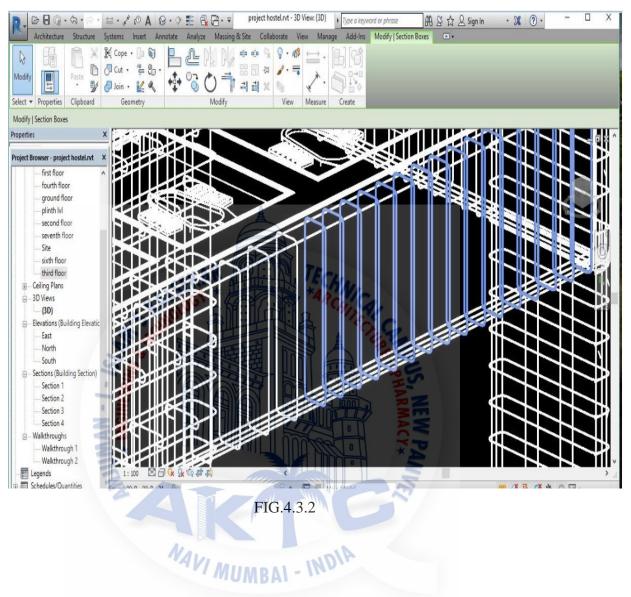
4.3. AUTODESK REVIT:

After obtaining the detailed design reports and necessary AutoCAD plans, the 3D modelling of the structure is carried out in Autodesk Revit. We have also done the Rebar Modelling on Revit which shows the reinforcement details in particular structural members as per the design. The following are some of the screenshots of reinforced structural members obtained after Rebar Modelling.

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- I. Reinforcement details in Column and Footing:

FIG.4.3.1

II. Reinforcement details in Beams:



ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

QUANTITY ESTIMATION:

After completing the modelling part, we have done the quantity estimation from Autodesk Revit software. Quantity of Concrete and Steel is obtained successfully for all structural members. Following are the snaps showing the total quantity of steel and concrete for individual structural members.

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i. QUANTITY ESTIMATION FOR COLUMNS:

FIG.4.3.3

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ANALYSIS, DESIGNING AND MODELLING OF AN EDUCATIONAL COMPLEX

ii. QUANTITY ESTIMATION FOR FOOTING:

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						Quantity Estimation
	Beam	Column	Footing	Wall	Slab	Total Quantities
Concrete (cum)	538.81	174.5	206.95	3230.98	60	4211.24
Steel (Kg)	8615.43	6348.199	1766.53	19903.82	1912.05	38546.0292

TABLE NO.4.3.6

This is the final table concluding the total quantity of construction materials required in execution of all the units in the whole structure.

After overviewing the above three softwares, discussion can be done that AutoCAD is one of the most efficient and user-friendly software for planning purpose. ETABS give the user a wide possibilities for designing almost any kind of structure in any region and under various conditions. Autodesk Revit is the most comfortable and user friendly software for 3D modelling as it is very easy to understand the commands as well as to execute them. It also provide a wide range of libraries for massing as well as for interior designing purpose.



CHAPTER 5

• CONCLUSION

After the completion of project, we end up with the conclusion that all the softwares used by us for completing this project is of great significance and unique of its kind.

AutoCAD is an advanced software which is very user-friendly and efficient for planning any kind of structure.

Analysis and designing part can be done most efficiently and quickly with the help of ETABS.

Designing of Slabs and Footings is done very easily and in detailed manner using Microsoft Excel Spreadsheet.

Autodesk Revit is a very efficient and beneficial software for Modelling and Quantity Estimation of any structure.

In all, we can conclude that we have successfully gained enough basic knowledge about the above mentioned softwares and it will be beneficial for us in our near future.

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