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# DESIGN AND ANALYSIS OF G+5 RESIDENTIAL BUILDING USING ETABS

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***Abstract*** **:** 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. In the present work a G+5 Residential building is analyzed in Etabs considering both gravity loads as well as lateral loads as it is a high rise building. The various IS codes considered are IS 875 Part 1 for Dead loads, IS 875 Part 2 for Live loads , IS 1893-2002 for Earthquake, IS 456-2000 for Design of RCC members and SP -16 Curves for the design of columns. The grade of concrete considered is M20 and Grade of steel considered is Fe500. The design results will be extracted from Etabs, while manual calculations will also be carried out to get complete knowledge on manual design of RCC structures.

## INTRODUCTION

Reinforced concrete is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength and/or ductility. The reinforcement is usually, though not necessarily, steel reinforcing bars (rebar) and is usually embedded passively in the concrete before the concrete sets. Reinforcing schemes are generally designed to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure. Modern reinforced concrete can contain varied reinforcing materials made of steel, polymers or alternate composite material in conjunction with rebar or not. Reinforced concrete may also be permanently stressed (in compression), so as to improve the behavior of the final structure under working loads. In the United States, the most common methods of doing this are known as pre-tensioning and post-tensioning.

For a strong, ductile and durable construction the reinforcement needs to have the following Properties at least:

a. High relative strength
b. High toleration of tensile strain
c. Good bond to the concrete, irrespective of pH, moisture, and similar factors
d. Thermal compatibility, not causing unacceptable stresses in response to changing temperatures.
e. Durability in the concrete environment, irrespective of corrosion or sustained stress for example

Reinforced concrete is widely used for construction on a large scale due to its desirable mechanical properties. Types of steel and non-steel concrete reinforcement are described. Corrosion has an adverse effect on the embedded steel if structures are not properly designed and constructed.

## PERFORMANCE OF REINFORCED CONCRETE

Concrete consists of a cement and stone aggregate mixture that forms a rigid structure with the addition of water. When steel that has a high tensile strength is embedded in concrete, the composite material withstands compression, bending, and tensile stresses. Such a material can be used for making any size and shape, for utilization in the construction.

The main quality of reinforced concrete is similarity of its coefficient of thermal expansion with that of steel, due to which the internal stresses initiated due to variation in thermal expansion or contraction are eliminated.

Secondly, on the hardening of the cement paste inside the concrete, it corresponds to the surface features of the steel, allowing the stresses to be efficiently transmitted between the two materials. The cohesive characteristics between the steel and concrete are enhanced by the roughening of steel bars.

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## OBJECTIVES

For every RCC structures the following listed objectives are required

a. Reinforcement Cement Concrete
b. Reinforced cement concrete cover is provided and where it is.
c. The behavior of RMC in concrete used in large scale.
d. Precautionary measures in placing reinforced cement concrete.
e. Form work for construction of reinforced cement concrete structure.
f. Removing of form work used in reinforced cement concrete structure.

## CALCULATION OF LOADS

Actual loadings in a building are typically either concentrated or uniformly distributed over an area. The former need no further consideration other than as necessary to characterise them as a force vector. In the latter, however, some modelling is needed when the area considered is actually made up of an assembly of one-way line and surface elements. These elements would pick up different portions of the total load acting over the surface, depending on their arrangement.

Consider the simple structural assembly shown in Figure 1 (a). Eight pre-cast concrete elements are supported by three beams Both external beams have to carry the weight of a half concrete element The

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middle beam carries the weight of one element (½ of the left and right element as illustrated in Figure 1 (b)). The reactions from all the elements supported by a beam then become loads acting on the beam. Note that these loads form a continuous line load on the beam. Loads of this type are expressed in terms of a load or force per unit length (i.e. N/m) and are commonly encountered in the structural analysis process.Another way of looking at this same loading is to think in terms of contributory areas. Each of the beams can be considered as supporting an area of the extent indicated in Figure 2 (a) and (b). The width of each area is often called the load strip. The load acting over the width of the load strip is transferred to the support beams. If the uniformly distributed load is constant and the load strip is of a constant width, the amount of load carried per unit length by the support beam is simply the load per unit area multiplied by the width of the load strip. This process is illustrated in Figure 2. The result is again a continuous line load describable in terms of a load per unit length. This process is valid for equal uniformly distributed loads only. The loading considered should, of course, include both live- and dead-load components. The exact value of the latter can be found by calculating the volume contributory area ´ the thickness of the material and multiply it by the unit weights for that material. Determining these values can be tedious. An alternative is to use a unit weight, e.g. the wei-ght for one square metre, typically expressed as a force per unit area, to represent the weight expressed as N/m$^2$,. Since live loads are also expressed in terms of a force per unit area, the calculation process is facilitated, since both loads can be considered simultaneously. Some

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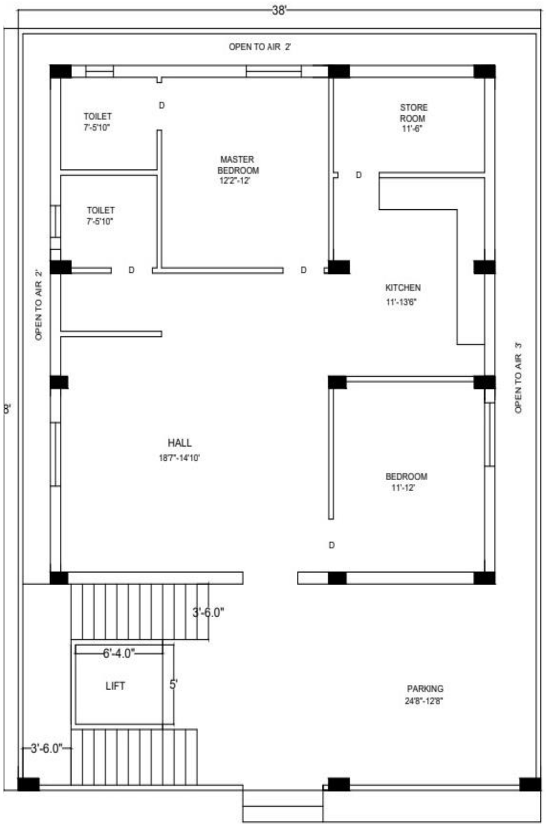
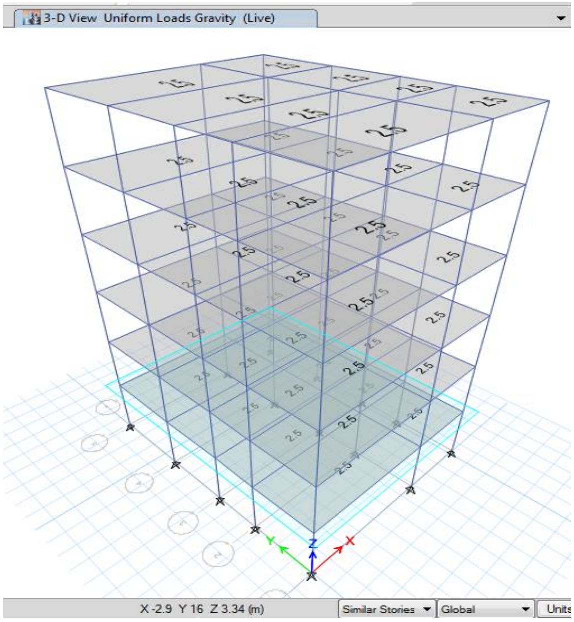
sample load calculations per m2 are shown below.

## ARCHITECTURAL PLANS




## Ground Floor plan




**ETABS Design 3D Model**

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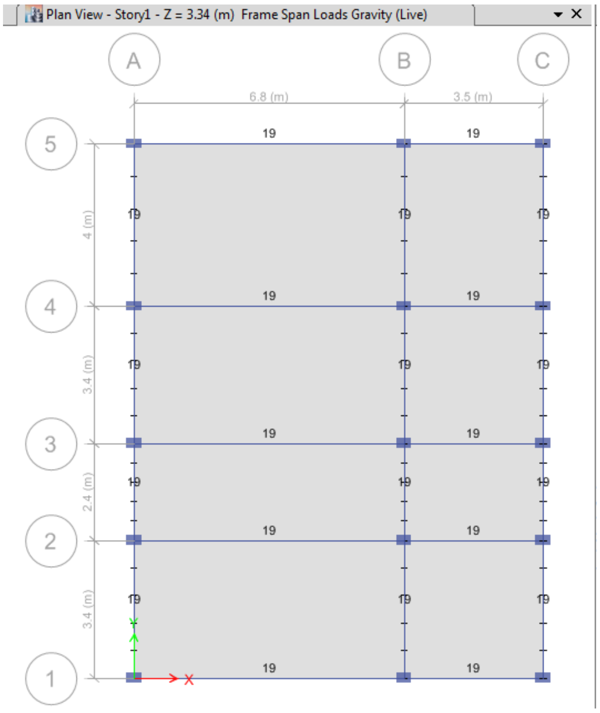
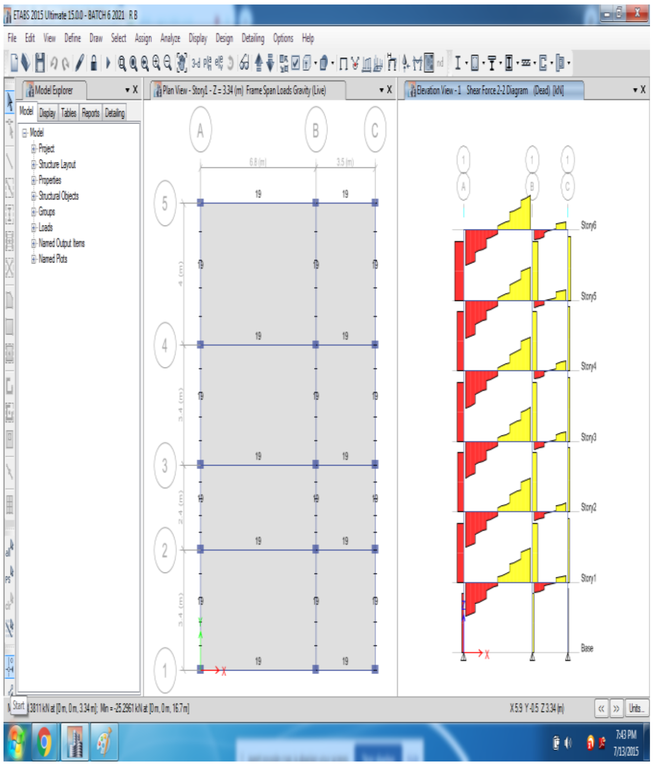
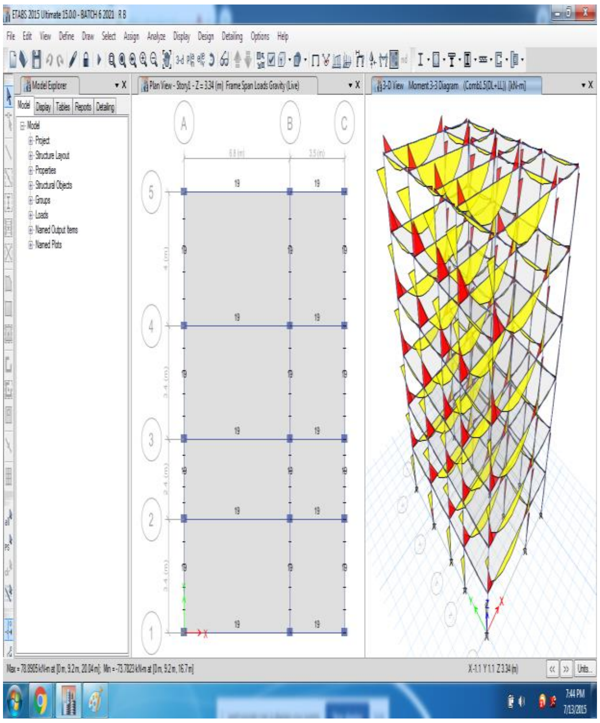



**Live Loads On Beams**



**Shear force diagram**



**Bending Moment Diagram**

# CONCLUSION

A G + 5 commercial building has been analyzed on ETABS and using the analysis results the design has been carried out manually. Loads were applied on the ETABS design model as per IS 875 Part I and Part II. Recommendations from IS 456:2000 were strictly followed for design of each RCC member.

With help of softwere we can complete our work in less time with accuracy in it .

Analysis of beams and columns can be performed using Softwares such as ETABS, the analysis results can be extracted in much less time compared to manual analysis. Details of each and every member can be obtained except footing and staircase using ETABS.All the List of failed beams and column can be obtained by the software. Accuracy is improved by using software

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