Seismic Analysis of G + 6 Residential Building

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in Partial Fulfillment of the Requirements
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BY

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CERTIFICATE

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DECLARATION

I hereby declare that the project entitled **"Seismic Analysis of G + 6 Residential Building"** submitted by me in the partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology (Civil Engineering) of B.B.D.U, is record of my own work carried under the supervision and guidance of **Er. Shubhranshu Jaiswal.** To the best of my knowledge this project has not been submitted to **B.B.D. University** or any other University or Institute for the award of any degree.

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In the sense of great pleasure and satisfaction I present this project entitled **"Seismic Analysis of G + 6 Residential Building".** The completion of this project is no doubt a product of invaluable support and contribution of number of people. I would like to express my sincere thanks to my guide **Er. Shubhranshu Jaiswal**. (Asst. Professor, Department of Civil Engineering) for his continuous help and valuable suggestions and also providing encouraging environment, without which my project and its documentation would not have been possible. I am also grateful to my Head of Department (**Civil Department)** for his valuable help, encouragement and inspiration. The completion of any task is not only the reward to the person activity involved in accomplishing it, but also the persons involved in inspiring and guiding. I am grateful to my friends for their constant motivation and comments that has helped me to complete this report.

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ABSTRACT

Arranging a design so that decreasing mischief during a shudder makes the construction very uneconomical, as the seismic quake may or most likely will not occur in its life time and is an remarkable wonder. In this paper a G+6 existing RCC circled structure has been down and out down and arranged using STAAD-Pro V8i. The construction is arranged by IS 1893(Part 1):2002 for quake powers in different seismic zones. The essential objections of the paper are to consider the assortment of steel rate, most limit shear power, most noteworthy bowing second, and most noteworthy redirection in different seismic zone. Assortments are certainly higher from zone II to zone V. The steel rate, most limit shear power, most noteworthy bowing second, most limit redirection is augmentations from zone II to zone V and cost assessment.

Keywords: Auto CADD STAAD-Pro, steel rate, Maximum Shear power, Maximum Bending Second, Maximum Deflection, Seismic zones.

CHAPTER 1

1.1 INTRODUCTION

Building construction is the engineering deals with the construction of building such as residential houses. In a simple building can be define as an enclose space by walls with roof, food, cloth and the basic needs of human beings. In the early ancient times humans lived in caves, over trees or under trees, to protect themselves from wild animals, rain, sun, etc. as the times passed as humans being started living in huts made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. Rich people live in sophisticated condition houses.

Buildings are the important indicator of social progress of the county. Every human has desire to own comfortable homes on an average generally one spends his two-third life times in the houses. The security civic sense of the responsibility. These are the few reasons which are responsible that the person do utmost effort and spend hard earned saving in owninghouses.

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

A building frame consists of number of bays and storey. A multi-storey, multi-paneled frame is a complicated statically intermediate structure. A design of R.C building of G+6 storey frame work is taken up. The building in plan (40*28) consists of columns built monolithically forming a network. The size of building is 40x28m. The number of columns are 85. it is residential complex.The design is made using software on structural analysis design (staad-pro). The building subjected to both the vertical loads as well as horizontal loads. The vertical load consists of dead load of structural components such as beams, columns, slabs etc and live loads. The horizontal load consists of the wind forces thus building is designed for dead load, live load and wind load as **per IS 875**. The building is designed as two dimensional vertical frame and analyzed for the maximum and minimum bending moments and shear forces by trial and error methods as per **IS 456-2000**. The help is taken by software available in institute and the computations of loads, moments and shear forces and obtained from this software.

Early modern and the industrial age:

With the emerging knowledge in scientific fields and the rise of new materials and technology, architecture engineering began to separate, and the architect began to concentrate on aesthetics and the humanist aspects, often at the expense of technical aspects of building design.Mean while, the industrial revolution laid open the door for mass production and consumption. Aesthetics became a criterion for the middle class as ornamental products, once within the province of expensive craftsmanship, became cheaper under machine production.Vernacular architecture became increasingly ornamental. House builders could use current architectural design in their work by combining features found in pattern books and architectural journals.

Modern architecture:

The Bauhaus Dessau architecture department from 1925 by Walter Gropius.The dissatisfaction with such a general situation at the turn of the 20th century gave rise to many new lines of thought that served as precursors to modern architecture. Notable among these is detachers' derkbund, formed in 1907 to produce better quality machine made objects. The rise of the profession of industrial design is usually placed here. Following this lead, the Bauhaus school, founded in Weimar, Germany in 1919, redefined the architectural bounds prior set throughout history viewing the creation of a building as the ultimate synthesis—the apex—of art, craft and technology. Seismic quake has changed into a risk to human progression from the day of its reality, annihilating living souls, property and the man-made designs. Mass of a construction being intended to controls seismic outline, regardless of building steadiness, as quake begins torpidity compel that breezes up identifying with the design's mass. Portraying out designs should act deftly amidst the seismic shaking without underhandedness may deliver the undertaking monetarily extraordinary? This paper is acquainted with improve the efficiency of ceaseless shudder chance lightening methodologies and its limit of getting constructions, systems and people, to investigate a multistory RCC building (G +6 Story) for Zone 3 and 4 to look at seismic lead of multi storey RCC working for express shaking power with respect to reactions, to consider the impacts of various Seismic zones on execution of multi-story filling in to the degree seismic, to know the relationship between various methods for seismic assessment and their seismic reactions, to accomplish helpful learning on basic assessment,seismic appraisal, drawing out and deciding of aide partitions utilizing standards of Earthquake Resistant Design. Likewise, we are organizing such a (G + 6) private structure. That if any zone changes zone infers that if the zone changes from zone 3 to zone 4, by then the construction arranged by us will be steady. Moreover, by processing this, we will see the sum it costs to collect such a construction.

MOMENT RESISTING FRAMES;- The structure whose individuals and joints oppose the powers essentially brought about by flexure is Moment Resisting Structure.

1.2 OBJECTIVES OF PROJECT

Doing a total plan of the principle auxiliary components of a multi –celebrated structure including sections, pillars, segments and footing. Getting genuine involvement in the building rehearses. The structure ought to be orchestrated to the point that it can transmit dead, the breeze and forced loads in an immediate way to the establishments.

CHAPTER 2

2.1 LITERATURE REVIEW

Brajesh Chandra and Jai Krishna (1965), in this investigation, decided the amount of steel fortification in the structures with the end goal of practical and effective outcomes. So as to fix the most extreme level of steel in the investigation, proposals have been given considering the vitality factor. As indicated by his investigations, the amount of steel ought to be with the end goal that the vitality consumed by the fortification amid quake does not surpass the vitality retention breaking point of workmanship, and the amount of support ought not be extremely little, so that there is an expansive twisting in support.

Lakshmi Gayathri, J C Wason, V.Thiruvengadam (2004) this investigation centers around expense showing of structure arranged and point by point in the various seismic zones of India. The model gives measures of solid,fortification and covering materials for the unit zone of floors. In end the creator communicates that 8 storied structure organized in zone 5 , the support rate has increase up to 69% appearing differently in relation to gravity stacking case, and it similarly communicated that for a 10 storied structure orchestrated in zones 2, 3, 4 and 5 cost extended as 5, 10, 20 and 30% independently.

Kiran Kumar (2013): Writer's examination on the adjustment in the measure of steel and cement for RCC encircled structure for the various seismic districts of India. They have planned the structure for gravitational burdens and the seismic powers, which can impact development. As per his exploration, he reasoned that the distinction in help reactions for outer columns expanded from 11.59% to 41.71% and on account of the shore sections, from Zone II to Zone V between 17.72% to 63.7% and on account of inside is. Section, this is exceptionally low. On account of strong amount, the measure of cement for Zone V is expanded with outer III and zone sections, in light of the fact that the expansion in help responses with the impact of the sidelong powers and the distinction in the inner segments is exceptionally low. The rate contrast of steel in the outside shaft is from 0.54% to 1.23% and inner bar is 0.78% to 1.4%. Fortification has not changed for seismic and non-seismic plan.

Parela Karunakara (2014): for the whole structure among gravity and seismic burden. Cost variety for double versus non-bendable subtleties is 4.06%. The author attempted endeavors to discover the level of steel rate and strong volume in various seismic districts and the effect on the general expense of variety and development. Be that as it may, as per his exploration, because of the expansion in help reactions, strong amounts have expanded in the external and edge sections; The variety in interior segment foot is extremely low. Reinforcement variety 12.96, 18.35, 41.39, 89.05%

S. Thanmozhi, Sunyan Verma, A. Malar (2014) the authors of this study compared the comparison between the base shear of RCC framed building located in different earthquake regions of India. They found that the software yields higher base shear results compared to Staad Pro and Manual calculation. Compared to the manual results of Zone 2, the increase in shear increased by 5.45% and 18.67%, in the case of Staad Pro, based on their research. Similarly, for Zone 3, 4, 5, it has been increased from 1.07% to 18.67%.

(A) Basic codes for design

The design should be carried so as to conform to the following:

1) IS 456: 2000 – Plain and reinforced concrete – code of practice (fourth revision)

2) National Building Code 2005

3) Loading Standards IS 875 (Part 1-5): 1987 – Code of practice for design loads (other than earthquake) for buildings and structures (second revision).

- Part 1: Dead load

- Part 2: Imposed (live) loads
- Part 3: Wind loads
- Part 4: Snow loads
- Part 5: Special loads and load combinations 4) Design Handbooks
- SP 16: 1980 – Design Aids (for Reinforced Concrete) to IS 456: 1978
- SP 24: 1983 – Explanatory handbook on IS 456: 1978
- •SP 34: 1987 – Handbooks on Concrete Reinforced and Detailing.

B. Features of the Auto CADD

AutoCAD is a computer-aided design software developed by the company Autodesk (hence the name **AutoCAD**). It allows you to draw and edit digital 2D and 3D designs more quickly and easily than you could by hand. The files can also be easily saved and stored in the cloud, so they be accessed anywhere at any time.

C. Features of the STAAD Pro

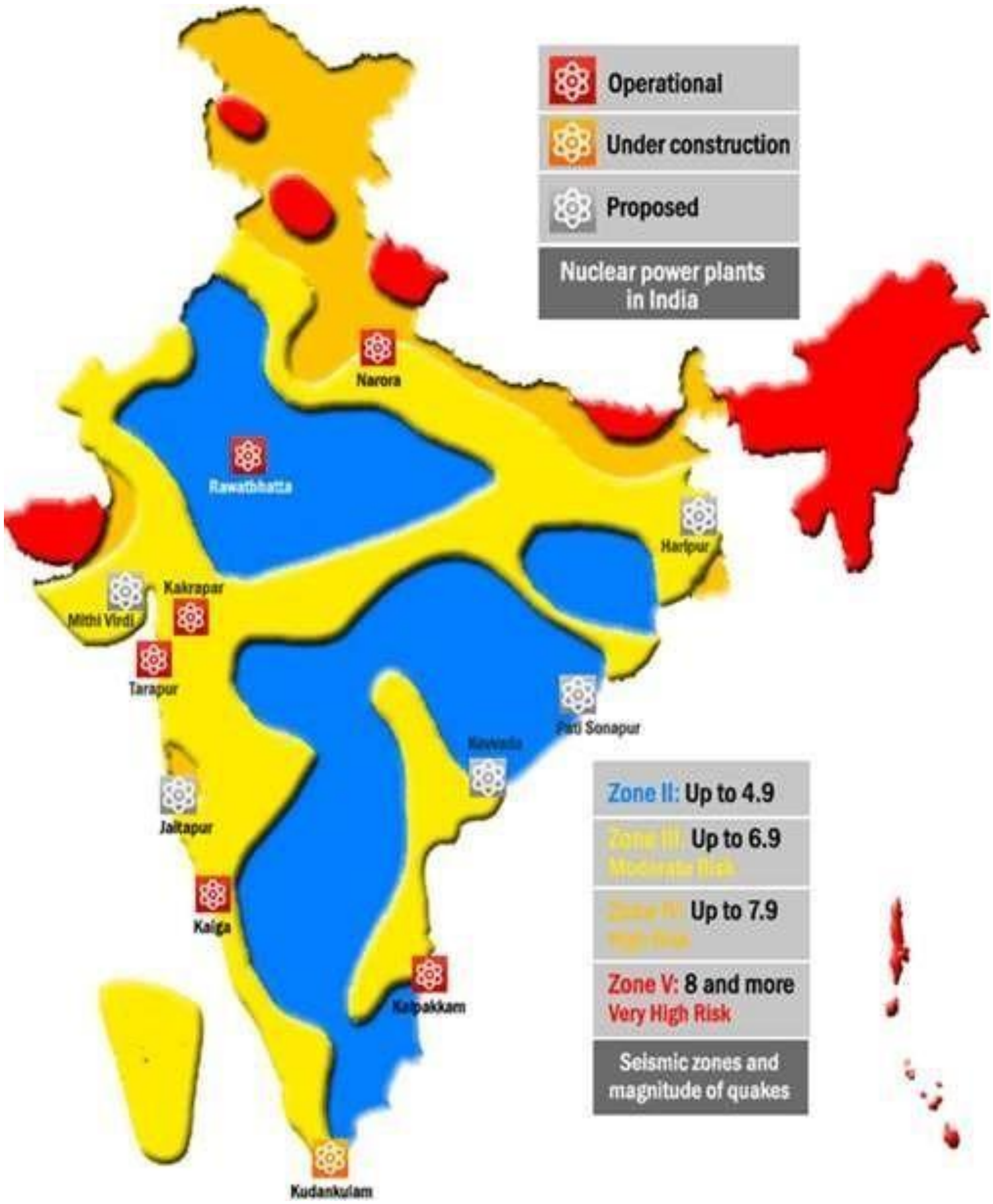
1) The STAAD-Pro Graphical User Interface:- It is utilized to create them model, which would then be able to be investigated utilizing the STAAD engineer. After examination and configuration is finished, the GUI can likewise be utilized to see the outcomes graphically.

2) The STAAD-Pro analysis and design engine:- It is a broadly useful count engineer for auxiliary examination and incorporated Steel, Concrete, Timber and Aluminum structure.

2.2 SEISMIC DESIGN FORCE

Seismic quake shaking is sporadic and time variety. In any case, most arrangement codes address the tremorprompted latency powers as the net effect of such self-assertive shaking as design corresponding static equal power.This power is called as the Seismic Design Base Shear VB and stays the fundamental sum drew in with the force based shudder safe construction of designs. This power depends upon the seismic threat at the site of the construction addressed by the Seismic Zone Factor Z. Codes reflect this by the introduction of a Structural Flexibility Factor Sa/g. This perspective is given the help of Response Reduction Factor R, which is greater for adaptable structures and humbler for feeble ones Thus, the arrangement of seismic quake impacts isn't named as earthquakeproof plan. Or maybe, the seismic quake demand is evaluated only reliant on thoughts of the probability of confirmation, and the arrangement of shake impacts is named as seismic quake safe construction against the conceivable assessment of the interest. The Design Base Shear VB is taken by the Indian Seismic Code IS 1893 (Part 1) – 2007.

Fig. 1(Seismic zones & magnitude of quakes)



CHAPTER 3

3.1 METHODOLOGY

In the event that the structure not appropriately planned and built with required quality they may cause enormous demolition of structures due to earthquakes. Reaction range investigation is a useful strategy for seismic assessment of structure when the structure shows linear response. Broad writing review by alluding books, particular papers did to grasp fundamental thought of subject.

• Selection of a fitting arrangement of G+6, story building.

• Computation of burdens and determination of primer cross-segments of various basic individuals.

• Geometrical displaying/exhibit and basic investigation of working for different stacking conditions according to.

• IS Codal arrangements. Understanding of results consolidate base shear, story buoy and story preoccupation.

• In the current work it is proposed to finish seismic examination of multi-story RCC structures using.

•Response Spectrum Analysis method considering mass anomaly with the assistance of STAAD PRO programming.

STATEMENT OF THE PROJECT:-

Analysis and Design of Residential Building (G+6)

Specifications are as:-

RCC Building

Size of beam= 700mm X 450mm

Size of column = 450mm X 450mm

Slab thickness =150 mm Height of each

floor = 3 m Material Concrete

Support Fixed

LOAD CALCULATION: Self Weight of slab = 0.15 X 25=3.75

Exterior wall = 0.35 X 2.45 X 20= 17.15+2=19.15

Partition wall = 0.2 X 2.45 X 20=9.8+2=11.8

Parapet wall = 0.2 X 1.5 X 20 =6+2=8

Plaster for two face = .02 X 2.65 X 1 X 18 X 2=2

Seismic Load

Method of analysis

1. Equivalent static method
2. Lumped mass model method
3. Response spectrum method

Code used

IS 1893-2002

$V_b = A_h \times W$

Where V_b = design seismic base shear

A_h= Average response acceleration coefficient

W= Seismic weight of the building

Load Conditions and Structural System Response :

The concepts presented in this section provide an overview of building loads and their effect on the structural response of typical wood-framed homes. As shown in Table, building loads can be divided into types based on the orientation of the structural action or forces that they induce: vertical and horizontal (i.e., lateral) loads. Classification of loads are described in the following sections.

Building Loads Categorized by Orientation:

Types of loads on an hypothetical building are as follows.

- Vertical Loads
- Dead (gravity)
- Live (gravity)
- Snow(gravity)
- Wind(uplift on roof)

- Seismic and wind (overturning)
- Seismic(vertical ground motion)

Horizontal (Lateral) Loads:

Direction of loads is horizontal w.r.t to the building.

- Wind
- Seismic(horizontal ground motion)
- Flood(static and dynamic hydraulic forces
- Soil(active lateral pressure)

Vertical Loads :

Gravity loads act in the same direction as gravity (i.e., downward or vertically) and include dead, live, and snow loads. They are generally static in nature and usually considered a uniformlydistributed or concentrated load. Thus, determining a gravity load on a beam or column is a relatively simple exercise that uses the concept of tributary areas to assign loads to structural elements, including the dead load (i.e., weight of the construction) and any applied loads(i.e., live load). For example, the tributary gravity load on a floor joist would include the uniform floor load(dead and live) applied to the area of floor supported by the individual joist. The structural designer then selects a standard beam or column model to analyze bearing connection forces (i.e., reactions) internal stresses (i.e., bending stresses, shear stresses, and axial stresses) and stability of the structural member or system a for beam equations.

The selection of an appropriate analytic model is, however no trivial matter, especially if the structural system departs significantly from traditional engineering assumptions are particularly relevant to the structural systems that comprise many parts of a house, but to varying degrees. Wind uplift forces are generated by negative (suction) pressures acting in an outward direction from the surface of the roof in response to the aerodynamics of wind flowing over and around the building.

As with gravity loads, the influence of wind up lift pressures on a structure or assembly(i.e., roof) are analyzed by using the concept of tributary areas and uniformly distributed loads. The major difference is that wind pressures act perpendicular to the building surface (not in the direction of gravity) and that pressures vary according to the size of the tributary area and its location on the building, particularly proximity to changes in geometry (e.g., eaves, corners, and ridges).Even though the wind loads are dynamic and highly variable, the design approach is based on a maximum static load (i.e., pressure) equivalent. Vertical forces are also created by overturning reactions due to wind and seismic lateral loads acting on the overall building and its lateral force resisting systems, Earthquakes also produce vertical ground motions or accelerations which increase the effect of gravity loads. However, Vertical earthquake loads are usually considered to be implicitly addressed in the gravity load analysis of a light-frame building.

Lateral Loads:

The primary loads that produce lateral forces on buildings are attributable to forces associated with wind, seismic ground motion, floods, and soil. Wind and seismic lateral loads apply to the entire building. Lateral forces from wind are generated by positive wind pressures on the windward face of the building and by negative pressures on the leeward face of the building, creating a combined push and-pull effect. Seismic lateral forces are generated by a structure's dynamic inertial response to cyclic ground movement.

The magnitude of the seismic shear (i.e., lateral)load depends on the magnitude of the ground motion, the buildings mass, and the dynamic structural response characteristics(i.e., dampening, ductility ,natural period of vibration ,etc).for houses and other similar low rise structures, a simplified seismic load analysis employs equivalent static forces based on fundamental Newtonian mechanics(F=ma) with somewhat subjective(i.e., experience-based) adjustments to account for inelastic, ductile response characteristics of various building systems. Flood loads are generally minimized by elevating the structure on a properly designed foundation or avoided by not building in a flood plain. Lateral loads from moving flood waters and static hydraulic pressure are substantial. Soil lateral loads apply specifically to foundation wall design, mainly as an –out-of-planel bending load on the wall. Lateral loads also produce an overturning moment that must be offset by the dead load and connections of the building. Therefore, overturning forces on connections designed to restrain components from rotating or the building from overturning must be considered.

Since wind is capable of the generating simultaneous roof uplift and lateral loads, the uplift component of the wind load exacerbates the overturning tension forces due to the lateral component of the wind load. Conversely the dead load may be sufficient to offset the overturning and uplift forces as is the case in lower design wind conditions and in many seismic design conditions.

Structural systems :

As far back as 1948,it was determined that ―conventions in general use for wood, steel and concrete structures are not very helpful for designing houses because few are applicable‖(NBS,1948).More specifically, the NBS document encourages the use of more advanced methods of structural analysis for homes. Unfortunately. the study in question and all subsequent studies addressing the topic of system performance in housing have not led to the development or application of any significant improvement in the codified design practice as applied to housing systems.This lack of application is partly due to conservative nature of the engineering process and partly due to difficulty of translating the results of narrowly focused structural systems studies to general design applications. Since this document is narrowly scoped to address residential construction, relevant system.Based studies and design information for housing are discussed, referenced, and applied as appropriate. If a structural member is part of system, as it typically the case in light frame residential construction, its response is altered by the strength and stiffness characteristics of the system as a whole.

In general, system performance includes two basic concepts known as load sharing and composite action. Load sharing is found in repetitive member systems(i.e., wood framing) and reflects the ability of the load on one member to be shared by another or, in the case of a uniform load, the ability of some of the load on a weaker member to be carried by adjacent members. Composite action is found in assemblies of components that, when connected to one another, from a ―composite member‖ with greater capacity and stiffness than the sum of the component parts.However, the amount of composite action in a system depends on the manner in which the various elements are connected. The aim is to achieve a higher effective section modulus than the component members are taken separately. For example, when floor sheathing is nailed and glued to floor joists, the floor system realizes a greater degree of composite action than a floor with sheathing that is merely nailed;

the adhesive between components helps prevents shear slippage, particularly if a rigid adhesive is used. Slippage due to shear stresses transferred between the component parts necessitates consideration of partial composite action, which depends on the stiffness of an assembly's connections. Therefore, consideration of the floor system of fully composite T-beams may lead to an un conservative solution.

Whereas the typical approach of only considering the floor joist member without composite system effect will lead to a conservative design. This guide addresses the strength- enhancing effect of sharing and partial composite action when information is available for practical design guidance. Establishment of repetitive member increase factors (also called system factors) for general design use is a difficult task because the amount of system effect can vary substantially depending on system assembly and materials.

Therefore, system factors for general design use are necessarily conservative to cover broad conditions. Those that more accurately depict system effects also require a more exact description of and compliance with specific assembly details and material specifications. It should be recognized however that system effects do not only affect the strength and stiffness of light-frame assemblies(including walls, floors and roofs).They also alter the classical understanding of how loads are transferred among the various assemblies of a complex wood- framed home. For example, floor joists are sometimes doubled under non load-bearing partition walls –because of the added dead load and resulting stresses determined in accordance with accepted engineering practice.Such practice is based on a conservative assumption regarding a load path and the structural response. That is, the partition wall does create an additional load, but the partition wall is relatively rigid and actually acts as a deep beam, particularly when the top and bottom are attached to the ceiling and floor framing, respectively. As the floor is loaded and deflects, the interior wall helps resist the load. Of course, the magnitude of effect depends on the wall configuration (i.e., amount of openings) and other factor.

The above example of composite action due to the interaction of separate structural systems or subassemblies points to the improved structural response of the floor system such that it is able to carry more dead and live than if the partition wall were absent .on whole-house assembly test has demonstrated this effect (Hurst,1965).Hence ,a double joist should not be required under a typical non load-bearing partition; In fact, a single joist may not even be required directly below the partition, assuming that the floor sheeting is adequately specified to support the partition between the joists. While this condition cannot yet be duplicated in a standard analytic form conductive to simple engineering analysis, A designer should be aware of the concept when making design assumption regarding light frame residential constructions.At this point, the readership should consider that the response of a structural system, Not just its individual elements, determines the manner in which a structure distributes and resists horizontal and vertical loads. For wood framed systems, the departure from calculations based are classical engineering mechanics (i.e., single members with standard tributary areas and assumed elastic behavior)and simplistic assumptions regarding load path can be substantial.

Design loads for residential buildings :

General

Loads are a primary consideration in any building design because they define the nature and magnitude of hazards are external forces that a building must resist to provide a reasonable performance(i.e., safety and serviceability)through out the structure’s useful life. The anticipated loads are influenced by a building’s intended use (occupancy and function),configuration(size and shape)and location(climate and site conditions).Ultimately, the type and magnitude of design loads affect critical decisions such as material collection, construction details and architectural configuration.

Thus, to optimize the value (i.e., performance versus economy) of the finished product, it is essential to apply design loads realistically. While the buildings considered in this guide are primarily single-family detached and and attached dwellings, the principles and concepts related to building loads also apply to other similar types of construction, such as low-rise apartment buildings. In general, the the design loads recommended in this guide are based on applicable provisions of the ASCE 7 standard-Minimum Design ;loads for buildings and other structures (ASCE,1999).the ASCE 7 standard represents an acceptable practice for building loads in the United states and is recognized in virtually all U.S. building codes. For this reason, the reader is encouraged to become familiar with the provisions, commentary, and technical references contained in the ASCE 7 standard. In general structural design of housing has not been treated as a unique engineering discipline or subjected to a special effort to develop better, more efficient design practices. Therefore, this part of the guide focuses on those aspects aspects of ASCE 7 and other technical resources that are particularly relevant to the determination of design loads for residential structures.The guide provide supplemental design assistance to address aspects of residential construction where current practice is either silent or in need of improvement. Residential buildings methods for determining design loads are complete yet tailored to typical residential conditions. as with any design function, the designer must ultimately understand and approve the loads for a given project as well as the overall design methodology, including all its inherent strengths and weakness.

Since building codes tend to vary in their treatment of design loads the designer should, as a matter of due diligence, identify variances from both local accepted practice and the applicable code relative to design loads as presented in this guide, even though the variances may be considered technically sound. Complete design of a home typically requires the evaluation of several different types of materials. Some material specifications use the allowable stress design (ASD) approach while others use load and resistance factor design (LRFD).

Dead Loads:

Dead loads consist of the permanent construction material loads compressing the roof, floor, wall, and foundation systems, including claddings, finishes and fixed equipment. Dead load is the total load of all of the components of the components of the building that generally do not change over time, such as the steel columns, concrete floors, bricks, roofing material etc.In staad pro assignment of dead load is automatically done by giving the property of the member.

Dead load calculation

Weight=Volume x Density

Self weight floor finish=0.12*25+1=3kn/m^2

The above example shows a sample calculation of dead load. Dead load is calculated as per **IS 875 part 1**

Live Load:

Live loads are produced by the use and occupancy of a building. Loads include those from human occupants, furnishings, no fixed equipment, storage, and construction and maintenance activities. As required to adequately define the loading condition, loads are presented in terms of uniform area loads, concentrated loads, and uniform line loads. The uniform and concentrated live loads should not be applied simultaneously n a structural evaluation. Concentrated loads should be applied to a small area or surface consistent with the application and should b e located or directed to give the maximum load effect possible in end- use conditions. For example. The stair load of 300 pounds should be applied to the center of the stair tread between supports.

In staad we assign live load in terms of U.D.L .we has to create a load case for live load and select all the beams to carry such load. After the assignment of the live load the structure appears as shown below.

For our structure live load is taken as **25 N/mm** for design. Live loads are calculated as per **IS 875 part 2**

Wind load:

In the list of loads we can see wind load is present both in vertical and horizontal loads.This is because wind load causes uplift of the roof by creating a negative(suction) pressure on the top of the roof wind produces non static loads on a structure at highly variable magnitudes. the variation in pressures at different locations on a building is complex to the point that pressures may become too analytically intensive for precise consideration in design. Therefore, wind load specifications attempt to amplify the design problem by considering basic static pressure zones on a building representative of peak loads that are likely to be experienced. The peak pressures in one zone for a given wind direction may not, However, occur simultaneously in other zones. For some pressure zones, The peak pressure depends on an arrow range of wind direction. Therefore, the wind directionality effect must also be factored into determining risk consistent wind loads on buildings.

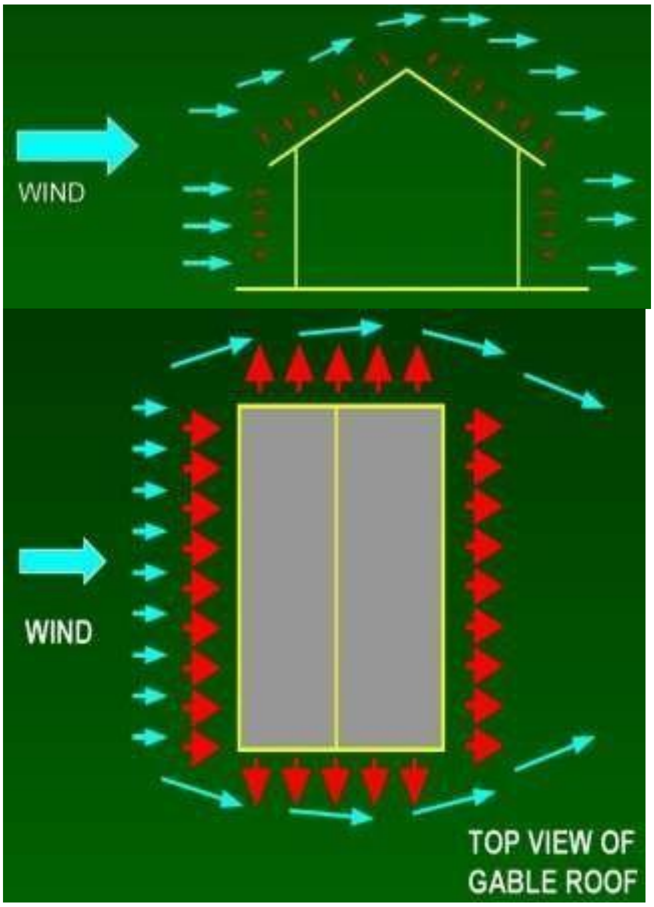


Fig.2.(A diagram of wind load)

In fact, most modern wind load specifications take account of wind load directionality and other effects in determining nominal design loads in some simplified form(sbcci,1999; ASCe,1999).this section further simplifies wind load design specifications to provide an easy yet effective approach for designing designing typical residential buildings. Because they vary substantially over the surface of a building. wind load star considered at two different scales. on large scale, the load produced on the overall building are on major structural systems that sustain wind loads from from more than one surface of building, are considered the main wind force resisting systems (MWFRS).the MWFRS of a home includes the shear walls, Diaphragms that create the lateral force resisting systems(LFRS).As well as the structural systems such as trusses that experience loads from two surfaces are regimes of the building.

The wind loads applied to the MWFRS account for the large affects of time varying wind pressures on the surface are surfaces of the building. On a Smaller scale, pressures are somewhat greater on localized surface area of the building, particularly near abrupt changes in building geometry (i.e., eaves, ridges, and corners). These higher wind pressures occur on smaller areas, particularly affecting the loads borne by components and cladding (e.g., sheathing, windows, doors, purling, studs).The components and cladding (C&C) transfer localized time-varying loads to the MWFRS, at which point the loads average out both spatially and temporally since, at a given time, some components may beat near peak loads while others are at substantially less thanpeak.

The next section presents a simplified method for determining both MWFRS and C&C wind loads. Since the loads in the section 3.6.2 are determined for specific applications, the calculation of MWFRS and C&C wind loads is implication the values provided. Design example 3.2 in section 3.10 demonstrate the calculation of wind loads by applying the simplified method of the following section 3.6.2to several design conditions associated with wind loads and the load combinations.

Century, modernism morphed into the international style, an aesthetic epitomized in many ways by the Twin Towers of New York's world trade center.Many architects resisted modernism, finding it devoid of the decorative richness of ornamented styles. Yet as the of the movement lost influence in the late 1970s, postmodernism developed as a reaction against the austerity of Modernism. Robert ventures' contention that a –decorated shed‖ (an ordinary building which is functionally designed inside and embellished on the outside) was better than a –Duck‖ (a building in which the whole form and its function are tied together) gives an idea of this approach.

Assignment of wind speed is quite different compared to remaining loads. We have to define a load case prior to assignment.

After designing wind load can be assigned in two ways

1. collecting the standard values of load intensities for a particular heights and assigning of the loads for respective height.

2. calculation of wind load as per **IS 875 part 3.**

We designed our structure using second method which involves the calculation of wind load using wind speed.

In Hyderabad we have a wind speed of 45 kmph for 10 m height and this value is used in calculation.

Design wind speed:

The basic wind speed (Vb) for any site shall be obtained the following effects to get design wind velocity at any height (Vz) for the chosen structure.

Risk level

Terrain roughness, height and size of the structure and

Local topography

It can be mathematically expressed as follows: Vs.=Vb X K1 X K2 X

K3Where,

Vz= design wind speed at any height Z in m/s K1= probability factor (risk coefficient)

K2=terrain height and structure size factor and

K3=topography factor

Floor load:

Floor load is calculated based on the load on the slabs. Assignment of floor load is done by creating a load case for floor load. After the assignment of floor load our structure .

The intensity of the floor load taken is: **0.0035 N/mm^2**
-ve sign indicates that floor load is acting downwards.

Load combinations:

All the load cases are tested by taking load factors and analyzing the building in different load combination as per **IS:456** and analyzed the building for all the load combinations and results are taken and maximum load combination is selected for the design Load factors as per **IS:456-2000**

Live load	dead load	wind load
1.5	1.5	0
1.2	1.2	1.2
0.9	0.9	0.9

Table.1 (Load combination value)

When the building is designed for both wind and seismic loads maximum of both is taken. Because wind and seismic do not come at same time as per code.
Structure is analyzed by taking all the above combinations.

COLUMNS:

A column or strut is a compression member, which is used primary to support axial compressive loads and with a height of at least three it is least lateral dimension.

A reinforced concrete column is said to be subjected to axially loaded when line of the resultant thrust of loads supported by column is coincident with the line of C.G 0f the column I the longitudinal direction.

Depending upon the architectural requirements and loads to be supported,R.C columns may be cast in various shapes i.e square ,rectangle, and hexagonal ,octagonal,circular.Columns of L shaped or T shaped are also sometimes used in multistoried buildings.

The longitudinal bars in columns help to bear the load in the combination with the concrete.The longitudinal bars are held in position by transverse reinforcement, or lateral binders.

The binders prevent displacement of longitudinal bars during concreting operation and also check the tendency of their buckling towards under loads.

Positioning of columns:

Some of the guiding principles which help the positioning of the columns are as follows:-

- Columns should be preferably located at or near the corners of the building and at the intersection of the wall, but for the columns on the property line as the following requirements some area beyond the column, the column can be shifted inside along a cross wall to provide the required area for the footing with in the property line. alternatively a combined or a strap footing may be provided.

- The spacing between the column is governed by the lamination on spans of supported beams,
- as the spanning of the column decides the the span of the beam. As the span of the of the
- beam increases, the depth of the beam, and hence the self weight of the beam and the total.

Effective length:

The effective length of the column is defined as the length between the points of contraflexure of the buckled column. The code has given certain values of the effective length for normal usage assuming idealized and conditions shown in appendix D of IS – 456.
A column may be classified based as follows based on the type of loading:

- Axially loaded column
- A column subjected to axial load and uneasily bending
- A column subjected to axial load and biaxial bending.

Axially loaded columns:

All compression members are to be designed for a minimum eccentricity of load into principal directions. In practice, a truly axially loaded column is rare ,if not nonexistent.Therefore, every column should be designed for a minimum eccentricity .clause 22.4 of IS code E_{min}=(L/500)+(D/300) ,subjected to a minimum of 200 mm.
Where L is the unsupported length of the column (see 24.1.3 of the code for definition unsupported length) and D is the lateral dimension of the column in the direction under the consideration.

Axial load and uniaxial bending:

A member subjected to axial force and bending shall be designed on the basis of

- The maximum compressive strength in concrete in axial compression is taken as 0.002
- The maximum compressive strength at the highly compressed extreme fiber in concrete

subjected to highly compression and when there is no tension on the section shall be 0.0035-0.75 times the strain at least compressed extreme fiber.

Design charts for combined axial compression and bending are in the form of intersection diagram in which curves for P_u/f_{ck} bD verses M_u/f_{ck} bD^2 are plotted for different values of p/f_{ck} where p is reinforcement percentage.

Axial load and biaxial bending:

The resistance of a member subjected to axial force and biaxial bending shall be obtained on the basis of assumptions given in 38.1 and 38.2 with neutral axis so chosen as to satisfy the equilibrium of load and moment about two weeks.

Alternatively such members may be designed by the following equation: $(M_{ux}/ M_{uy})^{\alpha n}$ +$(M_{uy}/ M_{uy1})^{\alpha n}$<=1.0

M_{ux}&M_{uy}=moment about x and Y axis due to design loads

M_{ux1}&M_{uy1}=maximum uniaxial moment capacity for an axial load of P_u bending about x and y

axis respectively.

αn is related to P_u/p_{uz} p_{uz}=0.45 X f_{ck} X A_c+0.75 X f_y X A_{sc}

For values of p_u/P_{uz}=0.2 to 0.8, the values of αn vary linearly from 1.0 to 2.0 for values less than 0.2, αn is values greater than 0.8 , α_n is 2.0

The main duty of column is to transfer the load to the soil safely.columns are designed for compression and moment. The cross section of the column generally increase from one floor to another floor due to the addition of both live and dead load from the top floors. Also the amount if load depends on number of beams the columns is connected to. As beam transfer half of the load to each column it is connected.

Column design:

A column may be defined as an element used primary to support axial compressive loads and with a height of a least three times its lateral dimension. The strength of column depends upon the strength of materials, shape and size of cross section, length and degree of proportional and dedicational restrains at its ends.

A column may be classify based on deferent criteria such as

1.) shape of the section

2.) slenderness ratio(A=L+D)

3.) type of loading, land

4.) pattern of lateral reinforcement.

The ratio of effective column length to least lateral dimension is released to as slenderness ratio.

In our structure we have 3 types of columns.

C Column with beams on two sides

C Columns with beams on three sides

C Columns with beams on four sides

So we require three types of column sections. So create three types of column sections and assign to the respective columns depending on the connection. But in these structure we adopted same cross section throughout the structure with a rectangular cross section .In foundations we generally do not have circular columns if circular column is given it makes a circle by creating many lines to increase accuracy.

The column design is done by selecting the column and from geometry page assigns the dimensions of the columns. Now analyze the column for loads to see the reactions and total loads on the column by seeing the loads design column by giving appropriate parameters like

1. Minimum reinforcement, max, bar sizes, maximum and minimum spicing.
2. Select the appropriate design code and input design column command to all the column.
3. Now run analysis and select any column to collect the reinforcement details

The following figure shows the reinforcement details of a beam in staad. The figure represents details regarding

1. Transverse reinforcement
2. Longitudinal reinforcement

Output:

Due to very huge and detailed explanation of staad output for each and every coloumn we have shown a column design results below showing the amount of load,moments,amount of steel required,section adopted etc.

The main problem with staad is it takes all coloumns also as beams initially before design and continue the same.so here output of column 1 which os actually 131st beam as most of beams are used in drawing the plan.

FOOTINGS:

Foundations are structural elements that transfer loads from the building or individual column to the earth .If these loads are to be properly transmitted, foundations must be designed to prevent excessive settlement or rotation, to minimize differential settlement and to provide adequate safety against sliding and overturning.

GENERAL:

1.) Footing shall be designed to sustain the applied loads, moments and forces and the induced reactions and to assure that any settlements which may occur will be as nearly uniform as possible and the safe bearing capacity of soil is not exceeded.

2.) Thickness at the edge of the footing: in reinforced and plain concrete footing at the edge shall be not less than 150 mm for footing on the soil nor less than 300mm above the tops of the pile for footing on piles.

BEARING CAPACITY OF SOIL:

The size foundation depends on permissible bearing capacity of soil. The total load per unit area under the footing must be less than the permissible bearing capacity of soil to the excessive settlements.

Foundation design:

Foundations are structure elements that transfer loads from building or individual column to earth this loads are to be properly transmitted foundations must be designed to prevent excessive settlement are rotation to minimize differential settlements and to provide adequate safety isolated footings for multi storey buildings. These may be square rectangle are circular in plan that the choice of type of foundation to be used in a given situation depends on a number of factors.

1.) Bearing capacity of soil

2.) Type of structure

3.) Type of loads

4.) Permissible differential settlements

5.) economy

A footing is the bottom most part of the structure and last member to transfer the load. In order to design footings we used staad foundation software.

These are the types of foundations the software can deal. Shallow (D<B)

C 1. Isolated (Spread) Footing *C* 2.Combined (Strip) Footing *C* 3.Mat (Raft) Foundation

Deep (D>B)

C 1.Pile Cap

C 2. Driller Pier

The advantage of this software is even after the analysis of staad we can update the following prosperities if required.

The following Parameters can be updated:

C Column Position

C Column Shape *C* Column Size *C* Load Cases

C Support List

After the analysis of structure at first we has to import the reactions of the columns from staad pro using import button.

3.2. PROCEDURE

Step -1: First of all, we should have a plan of G+6 residential building so draw a plan with the help of Auto CADD software.

Step - 2: Creation of nodal focuses. In view of the segment situating of plan we entered the hub focuses into the STAAD document.

Step - 3: Representation of bars and segments. By utilizing include bar order we had drawn the shafts and segments between the comparing hub focuses.

Step - 4: 3D perspective on structure here we have utilized the Transitional recurrent order in Y heading to get the 3D perspective on structure.

Step - 5: Supports and property doling out. After the formation of structure the backings at the base of structure are indicated as fixed. Likewise the Materials were determined and cross segment of shafts and segments individuals was doled out.

Step - 6: 3D rendering view. Subsequent to relegating the property the 3d rendering perspective on the structure can be appeared.

Step - 7: Assigning of seismic burdens. So as to relegate Seismic loads right off the bat we have characterized the seismic burdens as indicated by the code IS1893:2002 with appropriate floor loads. Burdens are included burden case subtleties in +X,- X, +Z,- Z headings with determined seismic factor.

Step - 8: Assigning of wind loads. Wind loads are characterized according to IS 875 PART 3 dependent on power determined and introduction factor. At that point loads are included burden case subtleties in +X,- X, +Z,- Z headings.

Step - 9: Assigning of dead loads. Dead loads are determined according to IS 875 PART 1 for outer dividers, inner dividers, parapet divider including selfweightof structure.

Step - 10: Assigning of live loads. Live loads are relegated for each floor as 3KN/m2 dependent on IS 875 PART 2.

Step - 11: Adding of burden blends. Subsequent to relegating all the heaps, the heap mixes are given with appropriate factor of security according to IS 875 PART 5.

Step - 12: Analysis. After the fruition of all the above advances we have played out the examination and checked for blunders.

Step - 13: Design. At last solid plan is proceeded according to IS 456: 2000 by characterizing appropriate plan orders for various basic segments. After the allocating of orders again we performed investigation for any mistakes.

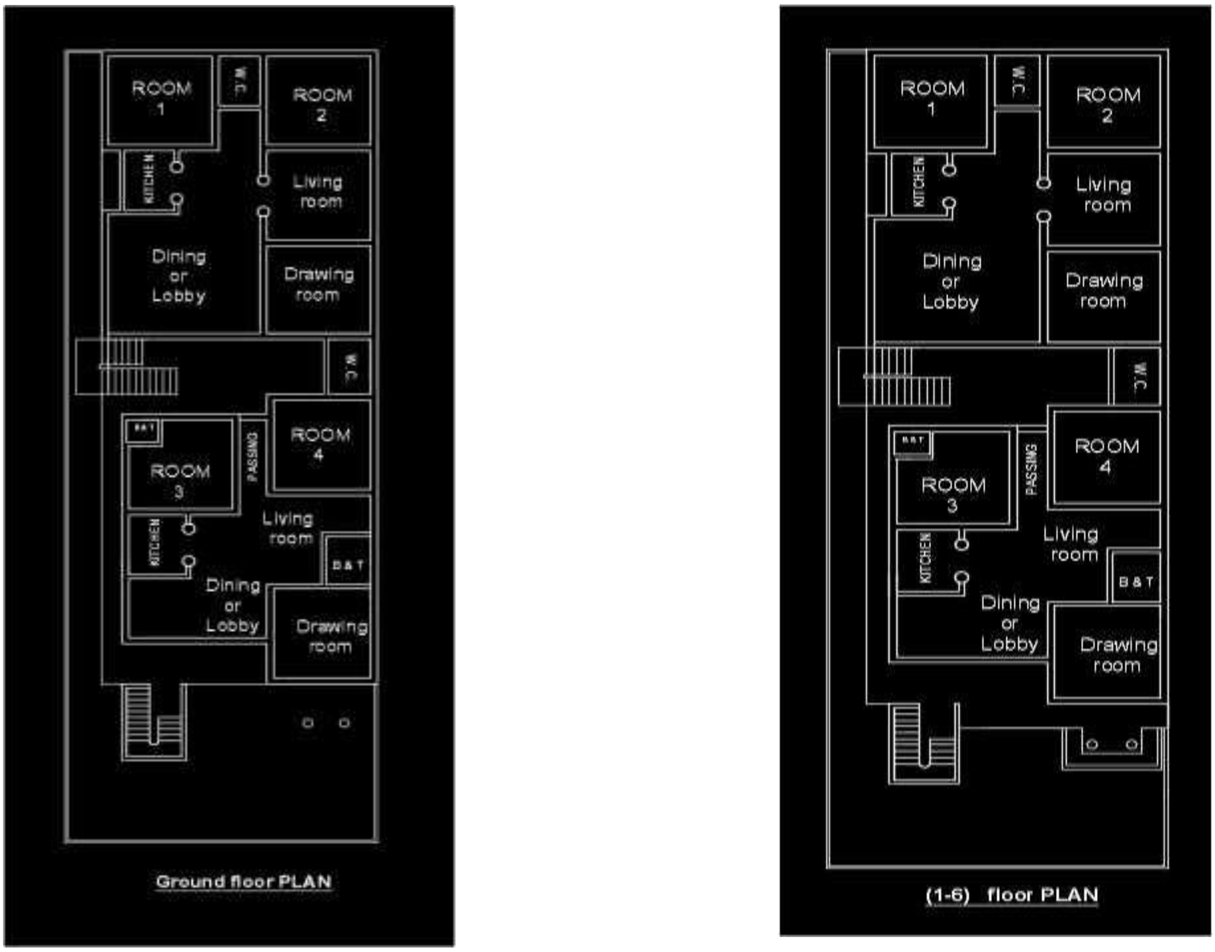


Fig-3: PLAN OF BUILDING

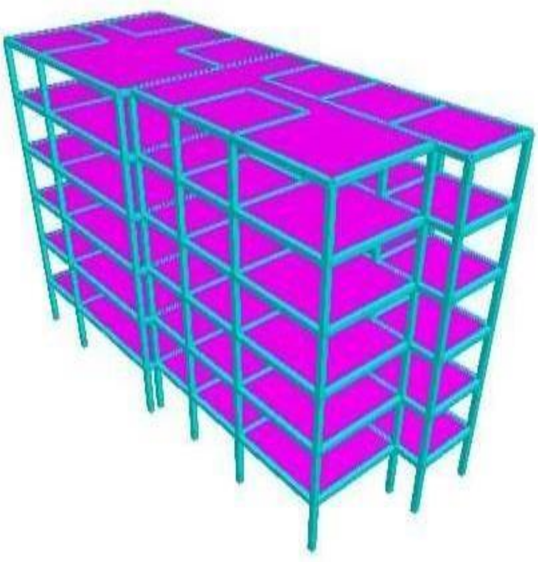


Fig-4: 3D Rendered View

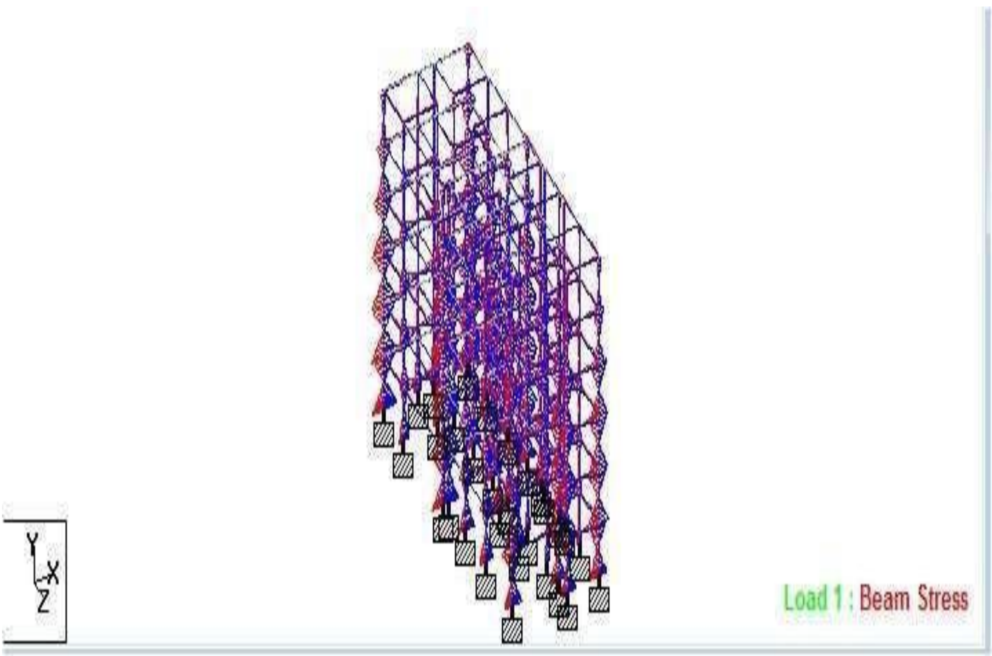


Fig-5: Beam Stress

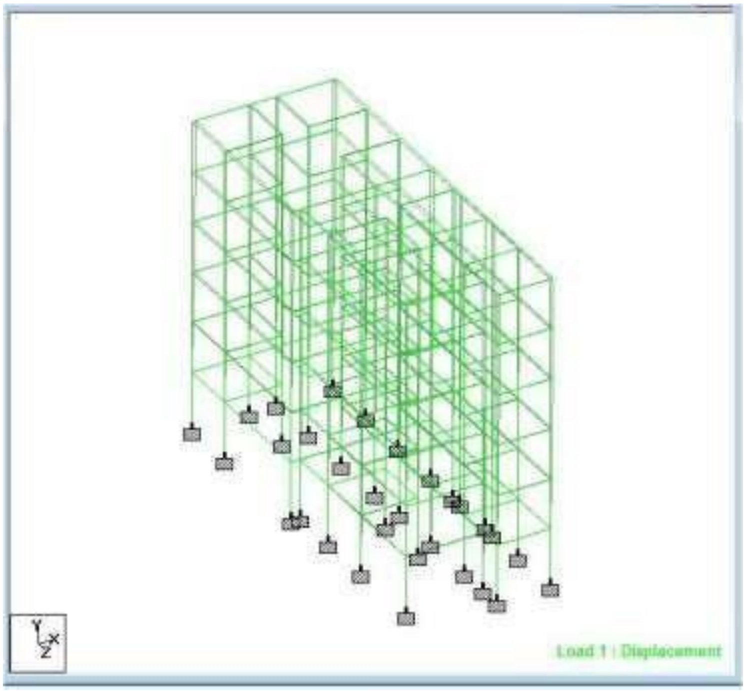


Fig-6: Displacement of Load 1

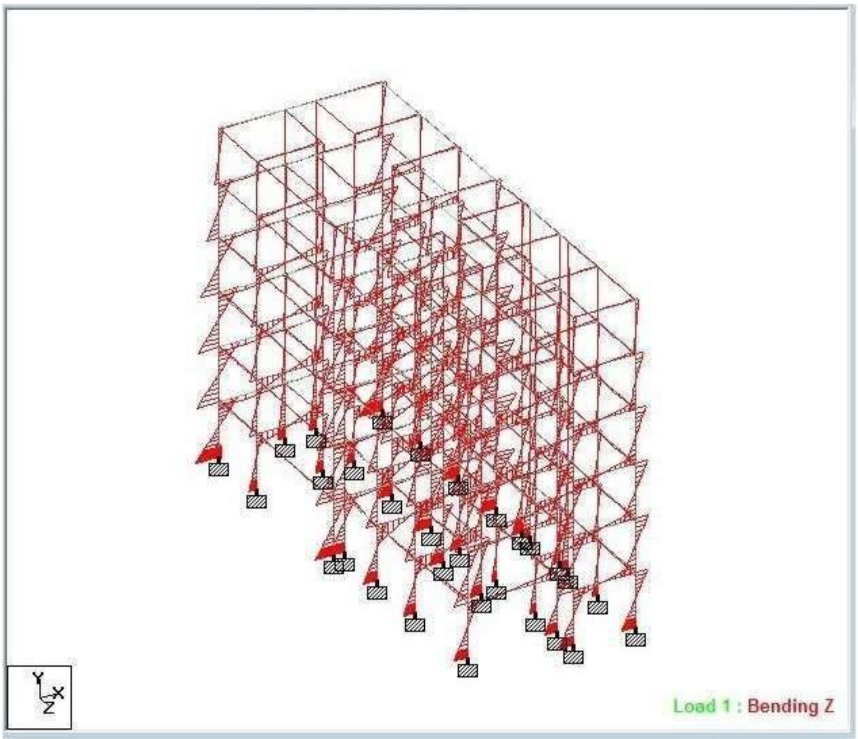
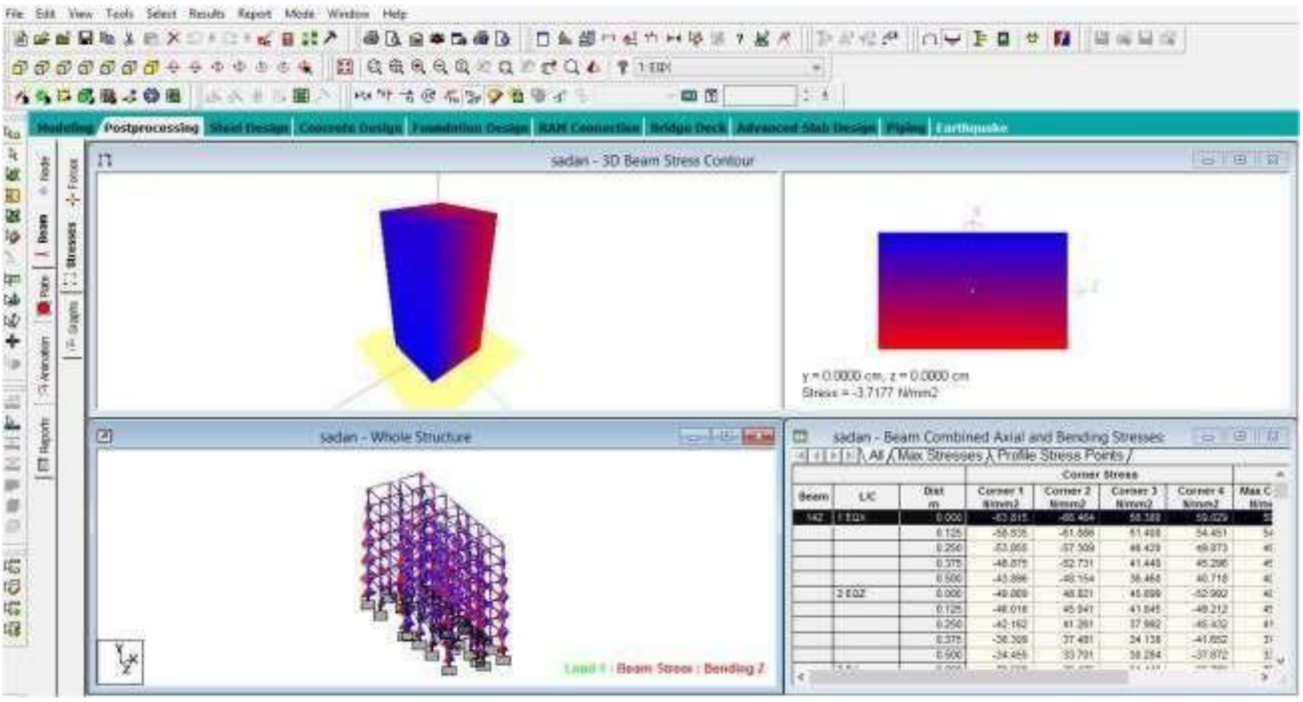
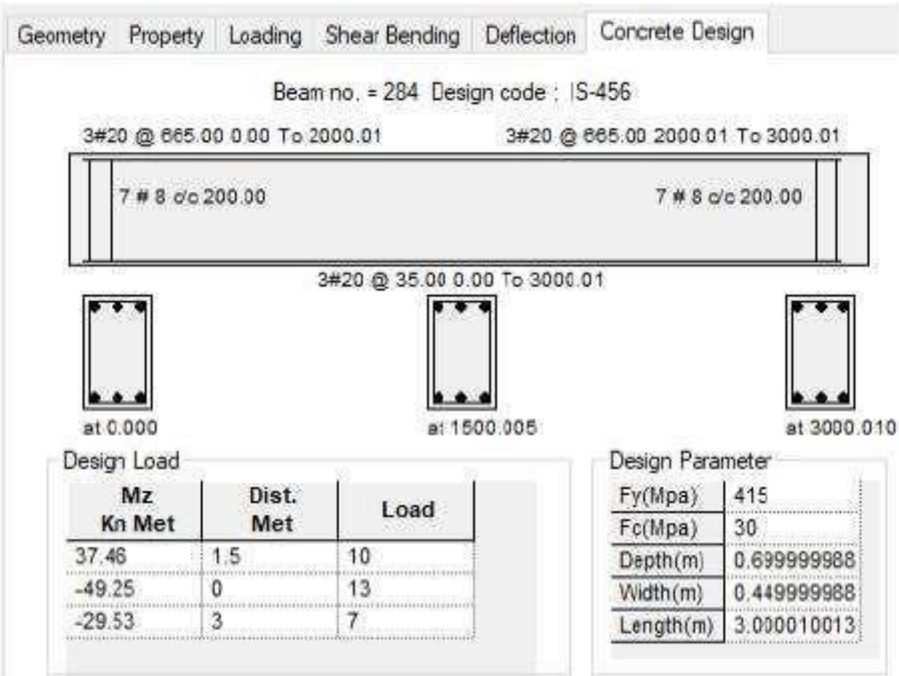


Fig-7: Bending in Z direction

Fig-8: BEAM STRESS (Maximum Absolute)



CONCRETE DESIGN:-



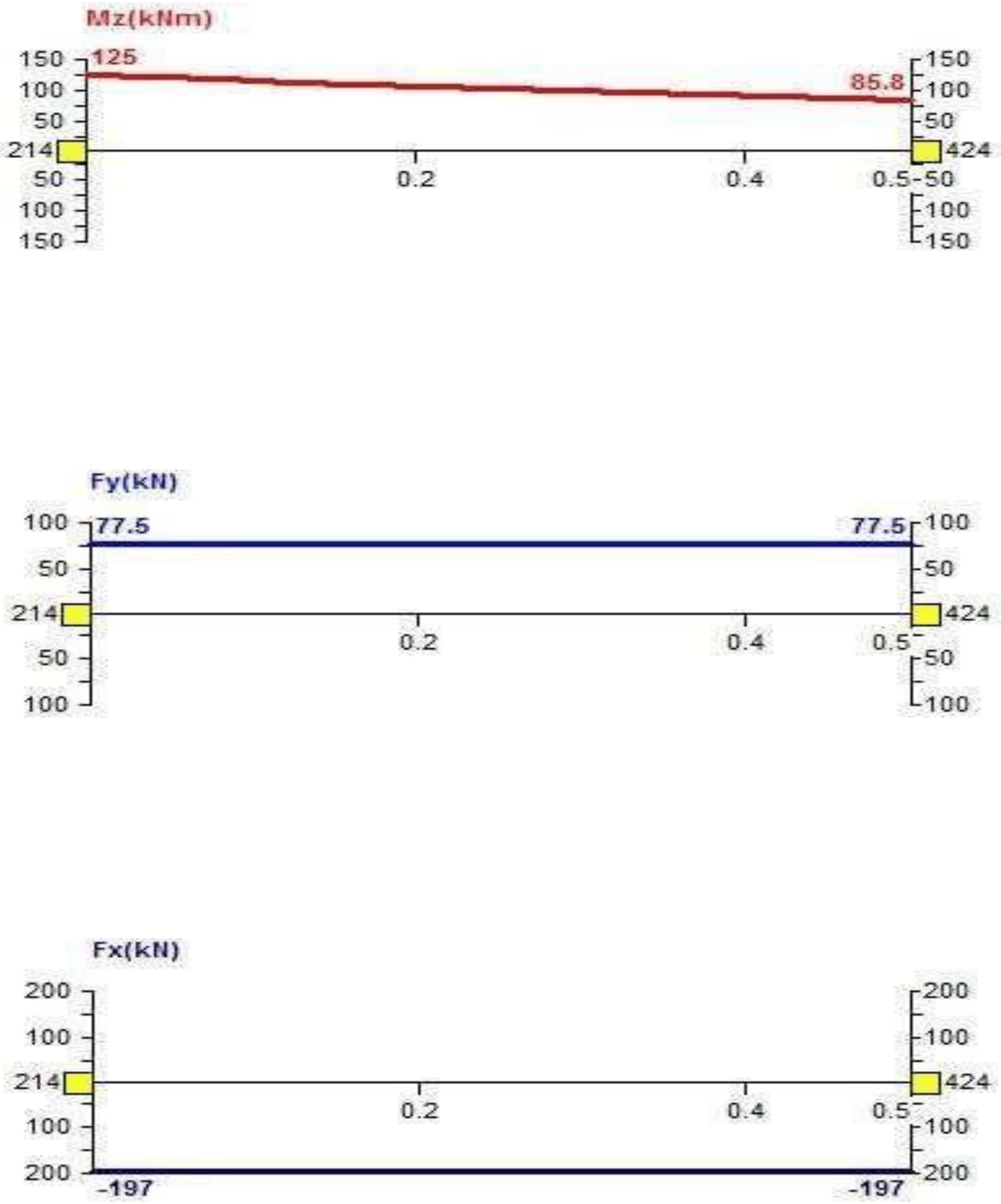


Fig-9: BEAM GRAPGH

Story Drift :

STORY	HEIGHT	LOAD	AVG.DISP(CM)		DRIFT(CM)		RATIO	STATUS
	METER		X	Y	X	Y		
BASE=	0.00						ALLOW DRIFT = L/40	
1.	0.00	1	0.0000	0.0000	0.0000	0.0000	L / 999999	PASS
		2	0.0000	0.0000	0.0000	0.0000	L / 999999	PASS
		3	0.0000	0.0000	0.0000	0.0000	L / 999999	PASS
		4	0.0000	0.0000	0.0000	0.0000	L / 999999	PASS
2.	0.50	1	0.1444	-0.0002	0.1444	0.0002	L / 346	PASS
		2	0.0001	0.1988	0.0001	0.1988	L / 251	PASS
		3	-0.0020	0.0035	0.0020	0.0035	L / 14344	PASS
		4	-0.0006	0.0007	0.0006	0.0007	L / 67913	PASS
3.	3.00	1	2.3916	-0.0080	2.2472	0.0077	L / 111	PASS
		2	0.0024	4.3505	0.0023	4.1517	L / 60	PASS
		3	-0.0712	0.1255	0.0693	0.1220	L / 2049	PASS
		4	-0.0223	0.0265	0.0217	0.0258	L / 9702	PASS
4.	6.00	1	5.5864	-0.0242	3.1947	0.0162	L / 94	PASS
		2	0.0084	12.9253	0.0060	0.5747	L / 35	FAIL*

WARNING:THE INTER STORY DRIFT EXCEEDS THE ALLOWABLE LIMIT L / 40 FOR 1893 LOAD CASE

STORY	HEIGHT	LOAD	X	Y	X	Y	RATIO	STATUS
		3	-0.2138	0.3752	0.1426	0.2497	L / 1201	PASS
		4	-0.0650	0.0779	0.0427	0.0514	L / 1201	PASS
5.	9.00	1	8.6769	-0.0393	3.0905	0.0152	L / 97	PASS
		2	0.0157	23.8060	0.0073	10.8807	L / 27	FAIL*

WARNING:THE INTER STORY DRIFT EXCEEDS THE ALLOWABLE LIMIT L / 40 FOR 1893 LOAD CASE

STORY	HEIGHT	LOAD	X	Y	X	Y	RATIO	STATUS
		3	-0.3583	0.6259	0.1445	0.2507	L / 1196	PASS
		4	-0.1049	0.1264	0.0399	0.0484	L / 6193	PASS
6.	12.00	1	11.2967	-0.0517	2.6198	0.0123	L / 114	PASS
		2	0.0223	35.6622	0.0066	11.8562	L / 25	FAIL*

WARNING:THE INTER STORY DRIFT EXCEEDS THE ALLOWABLE LIMIT L / 40 FOR 1893 LOAD CASE

STORY	HEIGHT	LOAD	X	Y	X	Y	RATIO	STATUS
		3	-0.5050	0.8793	0.1467	0.2534	L / 118	PASS

						/	4	
		4	**-0.1427**	**0.1719**	**0.0378**	**0.0455 L /**	**658 8**	**PASS**
7.	**15.00**	**1**	**13.0921**	**-0.0606**	**1.795 4**	**0.0089 L /**	**167**	**PASS**
		2	**0.0273**	**47.3755**	**0.005 0**	**11.7134 L /**	**25**	**FAIL***

WARNING:THE INTER STORY DRIFT EXCEEDS THE ALLOWABLE LIMIT L / 40 FOR 1893 LOAD CASE

		3	**-0.6525**	**1.1373**	**0.1475**	**0.2580 L /**	**1162**	**PASS**
		4	**-0.1796**	**0.2152**	**0.036 9**	**0.0433 L /**	**6933**	**PASS**
8.	**1 6.00**	**1**	**13.9191**	**-0.0653**	**0.8271**	**0.0047 L /**	**363**	**PASS**
		2	**0.0304**	**58.3419**	**0.0031**	**10.9664 L /**	**27**	**FAIL***
WARNING:THE INTER STORY DRIFT EXCEEDS THE ALLOWABLE LIMIT L / 40 FOR 1893 LOAD CASE								
		3	**-0.7979**	**1.3647**	**0.1455**	**0.2274 L /**	**1319**	**PASS**
		4	**-0.1924**	**0.2312**	**0.0128**	**0.0160 L /**	**18733**	**PASS**
	FINISH							

CHAPTER 4

4.1. RESULT

Parameters	Zone III	Zone IV
Steel Percentage of column	2.36	3.54
Beam Displacement	14.60 mm	17.30 mm
Maximum Bending Moment	123 kN-m	132 kN-m
Maximum Shear Force	1.90 kN	2.10 kN
Node Displacement	10 mm	11.2 mm

Table.2 (Zone wise value of different parameter)

So we see that when we design the building for zone 3 and zone 4, then steel percentage for zone 3 is 2.36 and zone 4 is 3.54. It becomes 1.14% more steel is required.

Cost Estimation:-

Total valume of concrete= 661.74 CU Meter

BAR DIA (in mm)	WEIGHT (in staad) (kg)
8	142796.00
10	340.00
12	289856.00
16	172675.47
TOTAL =	605667.50 kg

Table.3 (Bar estimation)

Quantity of steel:-

605667.50 kg (zone 3)

6813750938 kg (zone 4)

Total cost of building:-

3600 x 1800 x 6 = 38,880,000/- (zone 3)

3600 x 2090 x 6 = 45,144,000/- (zone 4)

CHAPTER 5

5.1. CONCLUSION

- After analysis the G+6 storey building structure, concluded that structure is safe in loading like dead load , windnload and seismic load. Member dimensions (Beam, Column, Slab, Footing) are changed by calculating the load type and it's quantity applied on it.

- We found that if a building is converting from zone 3 to zone 4, then if we take12.5% more steel, the building will also be maintained in zone 4

- We found that there is a 13.875% variation in cost due to change in the quantity of steel.

A. REFERENCE

[1] Mr. Kiran Kumar and Mr. Papa rao g (2013): ―Comparison of percentage steel and concrete quantities of a r.c building in different seismic zones‖, volume: 02.

[2] Karunakar Perla (2014) ―Earthquake Resistant Design- Impact on Cost of Reinforced Concrete Buildings‖ International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3.

[3] Salahuddin Shakeeb S M, Prof Brij Bhushan S, Prof Maneeth P D, Prof Shaik Abdulla (2015) ―Comparative study on percentage variation of steel in different seismic zones of India‖.

[4] Inchara k p, Ashwini g (2016): A study on comparison of percentage steel and concrete quantities of a r.c irregular building in different seismic zones‖.

[5] IS: 1893 (part-I) 2002: criteria for earthquake resistant design of structures, part-i general provisions and buildings, fifth revision, bureau of Indian standards, New Delhi.

[6] IS: 456-2000: Indian standard code of practice for plain and reinforced concrete.

[7] IS:875 (part 1)1987 : code of practice for Design loads (other than earthquake) For buildings and structures Part 1 dead loads – unit weights of building materials and Stored materials (second revision).

[8] IS: 875 (part 2)-1987: Code of practice (other than earthquake) part2: imposed loads (2nd revision).

[9] T. Anusha, S. V. Narsi Reddy, T. Sandeep, Earthquake Resistance Design-Impact On Cost Of Reinforced Concrete Builidings.

[10] 10.Sunayana Varma, A. Malar, S. Thenmozhi, T. Suriya, Comparative Study of Seismic Base Shear of Reinforced Concrete Framed Structures in Different Seismic Zone.

[11] V.Thiruvengadam, J.C.Wason , Lakshmi Gayathri, cost modeling of reinforced concrete buildings designed for seismic effects.

[12] B. Suresh, P.M.B Raj Kiran Nanduri, earthquake analysis and design vs non earthquake analysis and design using staad pro.

[13] H.M. Salem, A.K. El-Fouly ,H.S. Tagel-Din, Toward an economic design of reinforced concrete Structures against progressive collapse.

[14] Andreas J. Kappos, Alireza Manafpour, Seismic design of R/C buildings with the aid of advanced analytical techniques.

[15] Rashad, Gehad E, Medhekar, Manoj S Jain, Suggested Reinforcement Requirement for Flexural Members in IS:4326.

[16] Dr Vinod Hosur, EarthQuake Resistant Design of Building Structure.

[17] Sunayana Varma, A. Malar, S. Thenmozhi, T. Suriya, Comparative Study of Seismic Base Shear of Reinforced Concrete Framed Structures in Different Seismic Zone.

[18] Design Aids for Reinforced concrete to IS: 456- 1978(SP-16), Bureau of Indian. standards, New Delhi.

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