A COMPARATIVE ANALYSIS OF THE ENERGY CHARACTERISTICS ON STATIC MULTI-STORE BUILDINGS IN SEISMIC ZONES

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Abstract
India, which is in a "seismic mild zone," will not be able to assess seismic force, subsequent vulnerability, and performance of RC structures under seismic load with the appropriate static force approach. From prior earthquakes, it may be inferred that poorly assessed and constructed structures might cause significant devastation and harm to people's lives. It is established that many constructions sustain partial or complete damage as a result of earthquakes. In order to provide security against earthquake forces during installation, structural engineers and examiners never neglected this aspect while designing multi-story structures. The linear investigation methods of "Response Spectrum & Equivalent Static Lateral Force" approaches are used in this book to study the seismic response of a "residential G+10 RC frame building" in accordance with IS- 1893-2002-Part-1. These examineshave carried out by deliberating diverse seismic regions. A different reaction such as SD, lateral force, BS, & displacements hasplotted to compare the results of dynamic &static analysis.
Keywords: Response spectrum (RS) analysis, Dynamic analysis; Equivalent static analysis; SeismicZones, base shear (BS), Story drift (SD), story shear (SS)

1. Introduction

An earthquake may be distinguished as the sudden release of elastic energy through a fault and the following shaking of the ground brought on by the slide. The deadliest natural disasters are earthquakes. Each year, the planet is struck by about 1 lakh earthquakes with a magnitude greater than 3. A reasonable estimate places the number of lives lost and injuries costing 100 billions of dollars as high as 15 million throughout recorded history. Moreover, the Indian Subcontinent, particularly its northeastern region, will be the world's most earthquake-prone region. The Richter scale and the sense of earthquake magnitude were first created by Richter. The magnitude value will be determined using seismograph records of the earthquake's ground motion. There are many different explanations of magnitude in use, and each one might offer a somewhat different value of magnitude. Therefore, the magnitude will be not very precise number. The work [6] examined to represent the “reinforced concrete building” nature. A diverse response such as SS, SD, seismic weight, & base shear.TheZone V type III soil has bigger value of SD, BS, SSbetween all seismicregions.

The work [1] surveyed a “residential building G+13” storied. The building was examined for earthquake loads with the use of ETABS. If material properties were linear, dynamic &static examination was executed. A diverse response such as base shear & displacement has estimated and it was detected that displacement enhanced with height of the building.

M. Lakshmi et al.[2] surveyed to represent model examination to learn the attitude of building with the use of RS technique. In this manuscript, dynamic examination of 4 storied “Reinforced Concrete building” was deliberated with the use of ETABS &STAAD prosoftware. To analyze, RS technique was utilized to examine BS. The base shear varianceamong ETABS & STAAD PRO was just 1.3%.

The work [3] studieddynamic& static examination of “G+9 multistoried building”. The linear seismic study was completed by equivalent dynamic &static approach using STAAD-Pro as per the IS-1893-2002-Part-1. Displacements werecalculated. We might observe that values for displacements of columns are 40 to 45% bigger for dynamic analysis than values obtained for static examination.

The work [4] studied different shapes ishighlyaffected while earthquakes,particularly in “high seismic zones”. The higher BS is getting in Rectangular shape building &lesser BS is getting in L shape building. The outcomes are verified that C shape building is much vulnerable compare to all other different shapes.

The work [5] surveyed values are dissimilar for dynamic &static analysis is insignificant for lower stories and increased

in higher stories. Whereas compared to irregular configuration, the SD value will be high in regular configuration. The building height is enhanced then story drift will be also enhanced.

GirumMindaye et al. [6] surveyed"Dynamic story shear" will be lower than "static story shear" for whole instances. The SS, maximum story displacement, BS,lateral force, and overturning moment have enhanced in X, Y directions as "seismic zone" goes from II to V for similar frame kind building in both techniques.

The work [8] surveyed the displacement values of dynamic &static survey attained. The outcomes of dynamic analysis have roughly uneconomical due to displacement values are greater than correspondingstaticexamination.

1.1 EarthquakesEffect on High Growth Buildings

While a building is exposed to earthquake vibrations its foundation will transferfrom a ground. These vibrations might be deformation, quite intense, &makingpressuresthrough the structure creatingupperboundaries of building swing from some mm to numerous inches' reliant on their mass, length, & size. This is consistentlyrelevant for buildings lengths, if multi or single storied in" high-risk earthquake zones".

A building requires being a little flexible and havingmodules that might withstand the stresses initiated in numerousbuilding parts because of horizontal movements initiated by earthquakes. The "Bureau of Indian Standards"obviouslyprovides in its code IS 4326 that a segment will be to be specified among buildings. The separation segment will be distinct as gap of identified width among neighboring buildings or same building parts, either left covered or uncovered appropriately to allow movement to evade hammering because of earthquake.

In instance of tall, multi storied residential and commercial multiplexesextension joints have been offered whereas height of building beats a length identified by the code. This extension joint will be given for releasing stresses because of construction material expansion owing to temperature variations. At this time, buildings havecompletelydivided & gap of 1 to 2 is offered that is occupied with flexible material. Nevertheless, this will be a mainissue. The structural modules around the expansion joint are strictly damaged and there is chain response of forces in complete structure is not designed. In areas where "high intensity earthquakes"haveexpected the protections are to be taken: The expansion joints appropriate gap as need because of movement of 2buildingparts the because of earthquake be offered in complete buildings. These must provide facts of

- The condition of soil &bearing capability.
- Earthquake region for that building is designed.

I.S. Codes utilized fordesign

All relaxations in building byelaws that are generally offered at completion time must be included exclusively in innovative byelaws at sanction time, and no relaxations must be allowed later to verify that no changes in structural design have been made after authorization. After the foundations are cast and at each floor level, the builder must submit a structural certificate to the municipal authority.This must represent the RCC;reinforcementcaste isverified& according to his structural plan submitted to body at sanction time. The general wall framework among neighboring buildings must be totallyabolished.

A. Important of "Seismic DesignCodes"

The ground shakingswhileearthquake cause deformations & forces in structures. The structures require to be planned withstand such deformations & forces. The seismic codes support to increaseperformance of structures so that might withstand the earthquake effect without importantdamage of property & life. The whole countries in world have processessketched in seismic code to support engineersindesigning, planning, describing and building constructions.

a. An earthquake resistant has 4qualities in it,specifically:

i) Best Structural Configuration

ii) Lateral Strength

iii) Adequate Stiffness

iv) Good Ductility

b. IndianSeismicCodes:

Seismic codes are unique to each country or location. They consider local seismology, approved building typologies, seismic risk, and construction methods and materials.The "Bureau of Indian Standards (BIS)" the subsequent Seismic Codes:

IS 1893 (PART 1) 2002, "Indian Standard Criteria for Earthquakes Resistant of Design Structures" (5threvision).

1.2 RESEARCH IMPORTANCE

To regular building in structures, examine and plan of "G+10 storied structure" according to (IS1893:2002) provisioncode.

The important objective of this current study is to execute dynamic &static analysis of multistoried building in various seismic regions.

2. METHODOLOGY

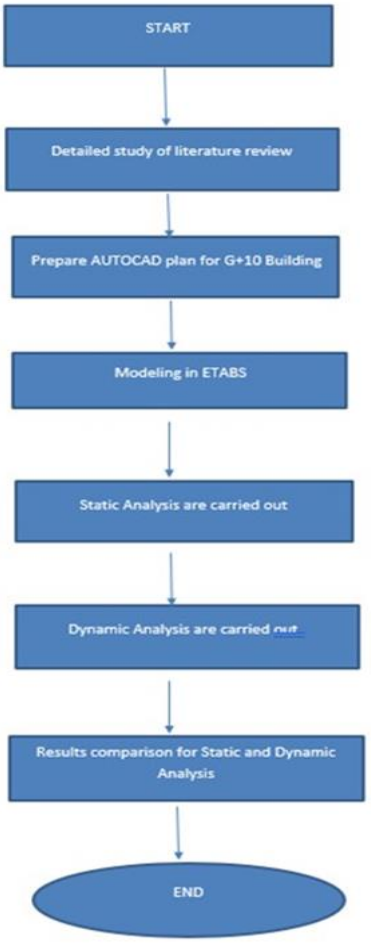

Figure.1. Design flow chart

A. Equivalent linear static analysis:

In equivalent static technique, Seismic examination of more structures is still carried out on assumption thatlateral force will be corresponding to actual loading. In this techniqueneeds low energydue to we don't require estimating the essential period, and shapes of higher natural modes of vibration are not essential. The BS will be a total horizontal mass that might be estimated by the multiplication of acceleration coefficient and lump mass of thestructure.

B. Response spectrum technique:

This technique is also recognized as Modal technique or Mode Superposition Model. In this method, we are getting the maximum response of any structure because of earthquake. Fundamentally, it will be application of structure in that building response regarding time and provide the accurate result. As per IS1893- 2002 the value RS might be estimated according to the zone factors and importance factor, there are values of Z, I and R are provided in Indian codes &computational program might be estimate the time period as per soil condition. Normally, this technique is applicable to investigation of structures dynamic response that isgeometrical or asymmetrical regions of discontinuity, in their linear range of behavior. The examine& modeling the buildings in ETABS software to performSD, SS force, displacement, and BS of regular utilizing corresponding static &RS technique to compare the outcomes. The member dimensions &properties of material were allocated. The load groupings of live, dead, seismic loads have allocated. The examination will be carried outoutcomeshave been surveyed.

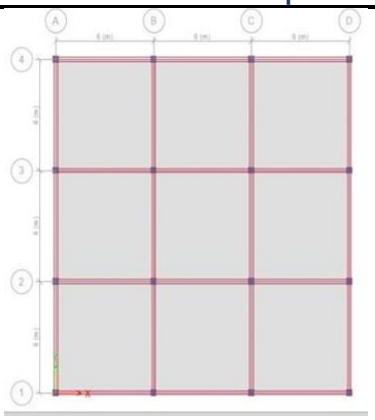

Figure 2: Building plan

3. BUILDINGDATA

S.NO	Parameters	Values
1	Live Load	2.5kn/mm^2
2	External wall thickness	0.2m
3	Slab thickness	0.15m
4	Beam size	0.25mX0.3m
5	Column sizes	0.5m*0.5m
6	Height of the floor	3m
7	Height of the structure	34m
8	Length of the structure	18m
9	Width of the structure	18m
10	Total plinth area	324m^2
11	No of floors	G+10
12	Density of concrete	25KN/M^3
13	Seismic zone factors for respective zones Zone III	0.16
14	Type of Soil	Medium as per 1893
15	Grade of concrete	M40
16	Grade of Steel	Fe500
17	Importance factor	1
18	Damping ratio	5%
19	Response reduction factor	5
20	Type of soil on site	Black cotton soil

Table.1. Building data

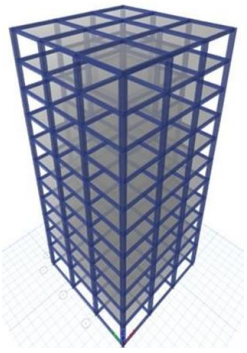

Figure.3. 3D model

4. Results andDiscussion

The RCC frame buildings have been examined &planned in dynamically & statically, the outcomes have been compared for groups“Maximum Story drift (MSD), Maximum Story shear (MSS)”for provided building and outcomes are below:

Zone	Maximum drift in mm
Zone 2	0. 01
Zone 3	0.04
Zone 4	0.06
Zone 5	0.1

Table.1. IMSD (mm) in zones

The MSD(mm) is high in zone5,whilecompared to zone 2, 3, &4. MSD in milli meter in zones is whereas low in zone2.

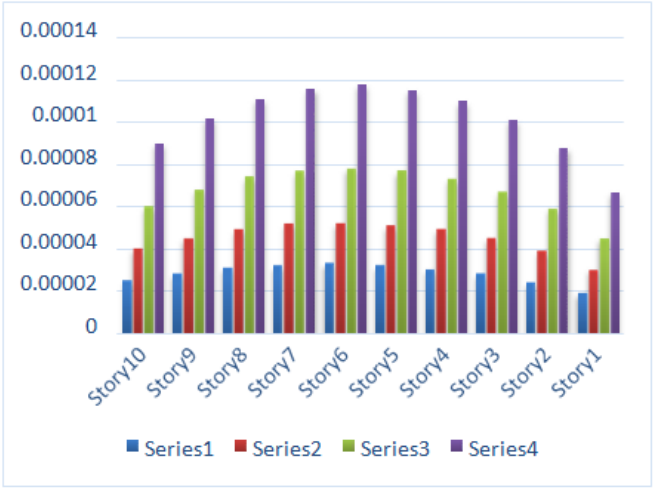

Figure.4. Difference of SD and number of stories

A one-level drift of a multi-story building relative to the level below will be the SD. As the building sways during the earthquake, the inter SD will be the variation in floor and roof displacements of every given storey, normalised by storey height. When compared to zones 2, 3, and 4, storey drift is high in zone 5, but it is relatively low in zone 5.

MSS in “kilo newton” is high in zone 5 while compared to zone 2, 3, and 4.

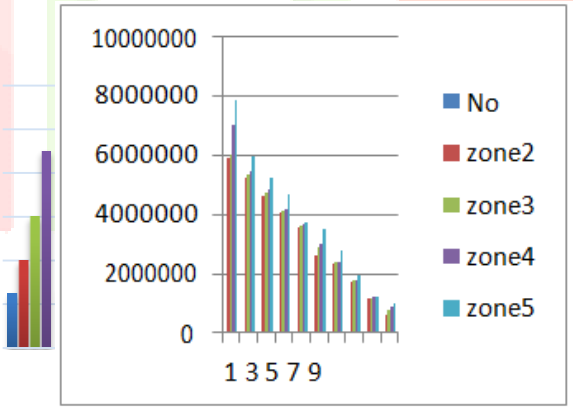

Figure.5. Difference of SS and number of story’s

The element will be described as ratio of SS force when story collapse happens to SS force when total collapse happens. Through a series of dynamic examines, simple formulas have been conditionallysuggested to compute the essential story shear securityfeature, which might be utilized to prevent storycollapse.

Zone	Maximum story shear in kilo Newton
Zone 2	5910432
Zone 3	6034332
Zone 4	7024132
Zone 5	7852416

Table.2. MSS in kilo Newton in zone

The SS will be high in zone 5 while compared to zone 2, 3, and 4. The SS will be very low in zone 2.

Conclusion

The static analysis offers more value for the majority of tale displacement in the X and Y directions.

Because of RS and static analysis, the BS value is effectively enhanced at upper floors.

Whereas a static examination only generates SS in the loading direction, a dynamic RS inquiry creates SS in the X and Y directions.

High height structures require a dynamic assessment since static inspection is insufficient.

Since displacement values are greater than those of dynamic examination, the results of the matching static examination have often been excessively expensive.

The storey drift will be enhanced as building height is enhanced.

The zone 5 has high BS value &that in soft soil in regularconfiguration.

It will be noticed that maximum displacement is incrementing from primary to final storey.Irregular shapes have been harshlydamagedwhile earthquakes particularly in high seismicregions.

In composite structure because of “high ductile nature of steel” it leads to enhanced seismic resistance of composite segment.

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