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BUILDING PERFORMANCE OF STEEL

Premika Gurung[1], Ankit Kumar[2]

[1]Premika Gurung, Student, Radha Govind Group of Institutions, Uttar Pradesh
[2]Ankit Kumar, Guide & Assistant Professor, Radha Govind Group of Institutions, Uttar Pradesh

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ABSTRACT

In the steel structure multiple storey building concrete (r/c) where the share wall instructed with 10 uni-axial accelerometer's .the main aim of this multiple storey structure they providing in real time information regarding to the strength of the structure.in work.

The design of joints should be like that they can resist the lateral load. The different material readings are taken to analyse the building of the structure .the dynamic properties are also to determine form the readings are compared with each other for checking suitable purpose.
A 3D (FEM) will be shown with the different grade of the components. The non-linear analysis was formed on the analytical model to obtain the capacity curve and the performance point .the building performance show that the good performance level and the buildings are earthquake resistance which I have done.

INTRODUCTION

1.1 GENERAL

The structural system is one of the difficult engineered system that for society s economic and industrial prosperity. How to design the safe buildings for public. The uses of standardized code and the suitable methodology have been done. The seismic work of building or any structure the strength of building, damage, shrinkage, failure during the natural hazards for that the design of the structure should be safer and more durable .now a days the engineers developed created the many techniques and analytical methods which can be used to design the durable and reliable structure.

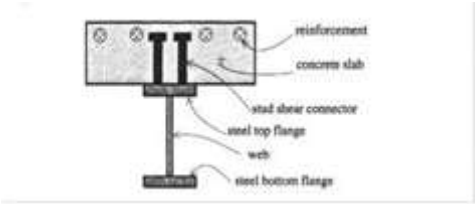
Now a day the maximum uses of steel composite and member's loadings construction can be doing is more advantage foe the steel design structure. In the structure the sufficient low or minimum stiffness and frame work is vulnerable to earthquake and natural hazards in the steel structures the low rise buildings the assigned load is normal.

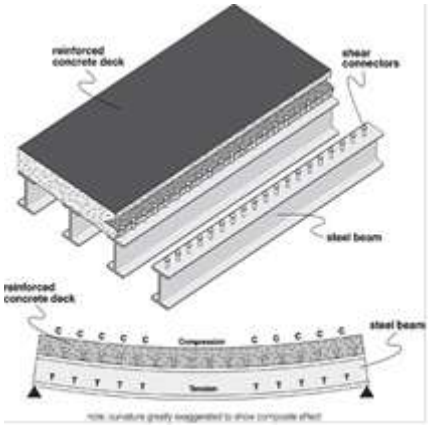
In construction industries the country India the maximum buildings design are reinforcement cement concrete are used in steel structure design less in India as compare to the others countries like japan, china, Paris etc. in India now a days it is developing more and the construction techniques are done by using steel structures.

Construction materials in coming days if the steel structures is relevant and more convenient , economical in nature that is the steel structures design will be done by solving the problems in the multiple storey high rise building.

1.1. A Composite Structures

In the steel structure design if the I-section beam is fixed with the mixed acting force and moments are transfer between both concrete and beam. Like examples floor, types





Bridges and wall after the steel compress members are formed in this composite steel design the T-beam is shown in fig 1.1. In every performance of beam is the compression zone the high strength concrete will be there and in tension zone the high steel strength will be there.

In the any of the construction in that structure both the zone have to use both the higher strength material for the more economical and ductility.

Composite Steel-Concrete beam

The figure composite steel beam fig 1.2 shows with the reinforcement cement concrete deck and the shear connection on steel structure which on tension and compression zone in steel beam in this building performance of the composite steel concrete. The main present aim study is that the design beam is composing of concrete and the steel composite behave like to large beam in the tension zone.

The concrete is very weak and stronger to the compression but in steel beam the compression area the steel is buck and in this beam of the material are composite which are used all material for the maximum profiles or benefits.

In this I-section is made by the goals steel loads and the pre-cast

Reinforcement cement concrete slab and all the loads spam forces pressure to be the same and the composite beam is constant in future that will be more economic and convention beams.

Steel beam that is also used in building slope or prone fire or places to enlarge or rise the confrontation of fire.

Steel-Concrete Composite Columns

A steel concrete composite columns is that in this column the member are compression which have height strength or stronger members which is filled with full concrete section of high heat rolled of steel materials or concrete RCC structure members. In this composite columns column the section is filled by the section which have steel which concrete the both components are mixed and contract or communicate together by the bond .then the load of beam and columns both it will be withstand or counter the external load in this tubular steel section the composite construction the load will bear in the section the concrete will filled in the tubular section. in the I-section both the concrete and steel both the component are in the better and ductile in a way and it will follows the procedure of the ductile and easy way. The combination of both steel and concrete is in such a way that both of the materials use their attributes in the most effective way.

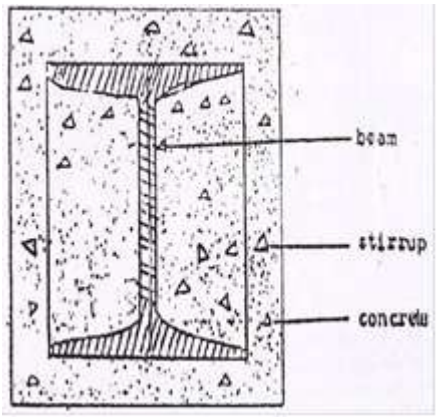


Figure 1.3 Concrete encased steel column

In the above I-section it will prefer the small or the lighter weight and the lighter strength steel and it will required small of low weight foundations which are mainly used in the I-section.

In the above I-section steel composite construct the concrete used steel are used and in the section the frame work of the columns is withstand in the beam and it will filled by the concrete stirrups is done .in the construction the speedy or less time will be taken and construction will be done in minimum of time in the height rise buildings efficient work will be done and it will found the better sign will be found.

ANALYTICAL

2.1 GENERAL

In the present analytical study that the different types of materials components and the different types of frame models of the steel frame as well as RCC frames the buildings of the different demission's, loads of the multiple stories is to be design as per IS code 1893-2000, with the steel tables reference using stat pro V8i ss6.
In this performance of the steel and RCC both the buildings has been calculated or design by seismic, response spectrum (static methods).

The report of this thesis or the project the structure performance are analysis and RCC structure response spectrum methods are used the multiple storied G+10 model and design these are implements by the procedure carrying out of structural estimations or calculated.

- The structure modelling is done by using stat pro V8i ss6 and the section materials dimensions of all the storey properties are assigned.
- All the loads are like gravity members loads are applied in the RCC structure the all the loads of seismic applied like as per the IS code of the acting structure which will be calculated or evaluate the both the structure.

- As per the IS code the RCC structure load are evaluated (456-2002) the lateral load as per the IS code (1893-2000)
- The loads and the members are assigned as per the structural design code.
- The model RCC structure is response spectrum seismic loads is design that is earthquake resistance structure and that will analysis all the deflection and displacement will be shown in the stat pro V8i ss6.
- In the steel structure only the load pressure force are assigned.
- Models are analysis for the static methods where the models are earthquake resistance.

2.2 DESIGN AS PER IS 1893 (PART 1): 2002

In this design process the seismic buildings total base share (V_B) according to the natural direction will be design by the following equation and the design expression.

$$V_B = A_h W \quad (3.0)$$

Where,

W= weight of the building (seismic loads)

A_h=by using the T_a it will design the lateral acceleration response spectrum by using the natural fundamental vibration.

$$A_h = \frac{Z}{2}\frac{I}{R}\frac{S_a}{g} \quad (3.1)$$

A_h=(horizontal design acceleration)

Provided that for any structure with T≤ 0.1s, the value of horizontal acceleration will not be taken Z/4 the value of I/R it can be used only in the value.

Where Z= zone factor the structure maximum earthquake or seismic loads are consider in all structure zones.in the another factor the denominator of Z is that will be used for increase the maximum seismic load resist considered

Zone factor it is designed the beneficial design basic earthquake.

$\frac{S_a}{g}$ =It is the response spectrum acceleration of the aggregate , sand and the structural is design as per the IS code (1893-2000).

Rocky or hard soil profile

$0 \le T \le 0.1 \quad : \frac{S_a}{g} = 1 + 20T$

$0.1 \le T \le 0.6: \frac{S_a}{g} = 2.5$

$0.4 \le T \le 4.0: \frac{S_a}{g} = \frac{1}{T}$

1. Medium soil profile

$0 \le T \le 0.1 \quad : \frac{S_a}{g} = 1 + 20T$

$0.1 \le T \le 0.44: \frac{S_a}{g} = 2.5$

$0.55 \le T \le 4.2: \frac{S_a}{g} = \frac{1.36}{T}$

2. Soft soil profile

$0 \le T \le 0.1: \frac{S_a}{g} = 1 + 15T$

$0.1 \le T \le 0.67: \frac{S_a}{g} = 2.5$

$0.67 \le T \le 4.0: \frac{S_a}{g} = \frac{1.67}{T}$

Where,

'T' is the time period of the building in sec.

'$\frac{S_a}{g}$' is the spectral acceleration coefficient

Calculating the values of spectral acceleration coefficients corresponding to the different time periods, the seismic spectrum (response) shown in Figure 1.4 it will shows the all three types of soil types.

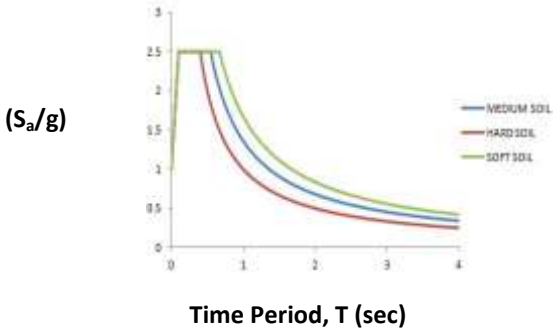


FIGURE 1.4 Response Spectra for Rock and Soil Sites for 5 per cent damping

In this response spectrum for the rock and soil site the design equation of this expression is that the base share (VB) according to the direction

Will design by the equation (3.0) and it will evaluate all the heights along the equation.

$$Q_i = V_B * (W_i h_i^2 / \sum W_j h_j^2)$$

Where

J= 1-n (no of stories)

$Q_{i=}$ the lateral force design or slab i,

$W_{i=}$ weight of the slab I,

n= the multiple stories of the building where the maximum number of mass where it will be located to the different zones.

Base shear

In the seismic response base the maximum evaluation the force are horizontal for the structural in the base section which will be estimate the base share.

First we have to look the soil time and test the soil where the construction located.

The area the ground motion of the ground level is the seismic and economical nature.

- Soil condition at site.
- There is seismic in ground motion.
- The ductility level and over strength are localized with the various methods of structure and structure of the total weight.
- The period of the natural vibration of structure and then the fundamental will be subjected to the dynamic loadings.

2.3 CAPACITY BASED DESIGN

Capacity based design it is defined that the building capacity design of the structure us to use all in inelastic in the deformations demands the only structure will be converted in the formation path or a way in all the selected structure designed the plastic hinged are used for the durable of the position and symmetric way .the capacity design is that it has yield and strength condition. In this structure is there is a weak member that the yield it will make developed in the strength and the most efficient stronger condition Euro Code-8 specifies that capacity design is to be carried out for ductile and non-ductile systems. It suggests capacity design is to be performed such that-

Σ Moment $_{column} \geq 1.3 \Sigma$ Moment $_{beam}$

The multiple storey buildings the mechanism cannot be accepted by the incomplete capacity design as per the Euro code 8. Indian code IS 13920:1992 (Ductile detailing of RC frames) restricts the formation of shear hinges at beam ends, but have not categorically enforced the weak beam- strong column concept. However according to IS 13920:1992 capacity design is to be performed such that-

Σ Moment $_{column} \geq 1.1 \Sigma$ Moment $_{beam}$

2.4 ANALYSIS METHODS

There are so many methods of any structure or design analysis for the structure such as:

- (Linear)static analysis
- (Linear)dynamic analysis
- (Non-linear) static analysis
- (Non-linear) dynamic analysis

NONLINEAR STATIC ANALYSIS

Nonlinear static analysis is that it will defined the all the materials load where the force are applied the non-linear static analysis that it will analysis the net frame model which will be to design the non-linear pushover .where if the hinge are applied it will design each and every high where that is used the following steps or the formation that will be design pushover analysis methods.

The elastic is hidden in the structural buildings.

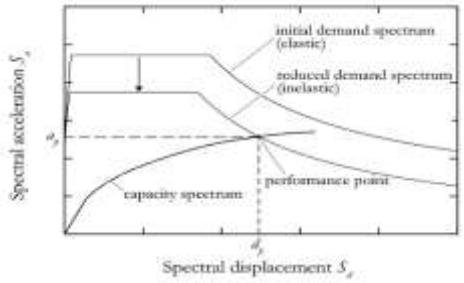


FIGURE 1.5: Typical Seismic Demand versus Capacity

The pushover analysis the different loads are applied like members, loads which will be distributed in the different zones.

The load can be provided as per the procedure of the load distribution methods. The loads distribution shall be modified by the various loadings, procedure the pushover analysis methods it will evaluate the buildings performance structure by the analysis of the pushover that non-linear static methods that is known as pushover methods which is under the loads and the uniform loads .in the structure the response spectrum methods curve are formed the pushover analysis using the seismic response methods with the earthquake resistance loads.

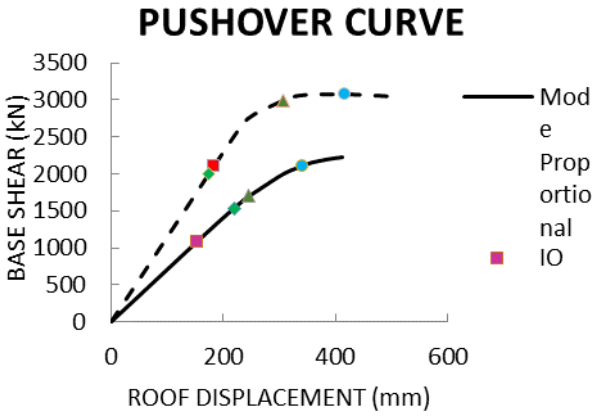


FIGURE 3.5 A Typical Pushover Curve

NONLINEAR DYNAMIC ANALYSIS

The Non-linear response of structure is very sensitive to the structural modelling and ground motion characteristics. The aim case of present project is that to represent the load distribution and the curved in the present structure the ground motion is to evaluation for the vibration and natural hazards in the building storey the servile, duration and ductile, strength the components the possible material are used the prevent all the possible deformation modes in the pushover modes the load can be provided as per the procedure od load distribution methods and the n it can From randomly selected ground motion excitations. Structure by the analysis of the push over that are nonlinear methods. It is easily modify by the various loadings procedure the pushover analysis methods it will evaluated the buildings performance this is the most rational method available for assessing building performance.

2.5 PERFORMANCE OF BUILDING DESIGN

In the structure earthquake occurs that earthquake conditions of that buildings structure will be well-defined and it will be in point on the proper scale measuring and it will see how much damage or how much loss is there by earthquake in addition of formalities the damage or loss may be the operational capabilities and property .There are four performance levels such as-

Each structural building performance or design level will be fallows as

- The describe level of that operational performance of building structural will always fallows the less limits damage function of the structural analysis system.
- In the non-structural performance it will be define and describe the damages and collapse for that the limit state methods are used and then the damage function of the non-structural in this thesis structure the RCC multiple stories it is a seismic analysis load are assigned.
- It indicates the state of damage of the structure .in other words, the plastic rotation is an indicator of amount of damage level. In this structure the performance level is that there are many techniques to perform the performance level.
- Immediate maintenance safety of that whole particular groups of employee and also provided the collapse detector, shrinkage prevention. The main and important ductility of that structure this all are performance level to evaluated and calculate the total loss of the structure or damage due to the earthquake occurs.
- In this case the minimum earthquake occurs that time in which the only evaluated the limited damages .the basic and vertical and lateral forces resisting system of the buildings retain nearly all of their pre earthquake strength and stiffness.

The structural damages of the loss building are very low due to the earthquake strength of seismic load. The basic and vertical and lateral force resisting systems of the building retain nearly all of their pre –earthquake strength and stiffness. The risk of working injury as a result of structural damage is very low

- in the low earthquake when sometimes the structural will remain safe sometimes it will damage the some significant areas loss and but in some parts it will damage or break the structure and the cost of the maintenance is very high.in the structural performance by the default of structural material or the elements sometimes the damage will be occurs by the less ductile or the problems in the structural material components. In the outside or inside the building or structure the natural falling hazards sometimes the maximum damage or any delicate cases will be occurs that is caused during the earthquake or other natural hazards .While doing work inside the building the safety must be important and other expected problems or risk the end of the result the structural damage is low .the structural damage will be maintain or repair will be possible the structure and the building structure .in some reason it may not be practical in economics cases.
- In this collapse detector the earthquake is the components or the buildings material is not good in ductile that material will not be lasting in future that's why the collapse occurs during the hazards. The main research study of these points is to use high strength material and high ductile

components if the natural hazards occur that time the damage will minimum losses will be there.

- The performance level will design the damages during the earthquake it will detect single the damages and it will design the building displacement time and the displacement design of the structure performance.

If we want to know how the building performance will be done by the expression of the building performance.

Δ^t= displacement time

Δ^d =displacement design

If Δ_{pp}<Δ_{IO} , it implies **IO** building.

Δ_{pp}>Δ_{IO} &< Δ_{LS} , **LS** building.

Δ_{pp}>Δ_{LS} &< Δ_{CP}, **CP** building.

2.6 INTER-STOREY DRIFT

In the multi storied building structure it will direct earthquake there the low damage occurs when the natural hazards occurs and in the inter storey drift. It will not damage the major losses in during the earthquake time. it will damages the minor areas in the multiple storey buildings the people will get damages lose examples they will physically, mentally and psychology unfit in the structure IS code 1893-2002 the seismic load applied for the response spectrum analysis that resist the earthquake load.

In the inter storey minimum forces assigned the lateral load factor 1.0 it will not exceed 0.04 times the high of the different storey building. It will evaluate or it will design the inner storey drift performance.

During an earthquake, the inter-storey displacements vary with time as different modes dominate the response.

PUSH OVER ANALYSIS

In the pushover analysis the building structure need different components that components should be more ductile ,strength of the building only other structure the base share is there in top of the displacements it will shows or detected the weakness damages ,seepage ,collapse and cracks during the hazards it will analysis the share failure or the materials failure or the materials failure is the structure they applied different loads these members loads seismic load in the building frame the displacement and the formation or the applied procedure of the elastic ,plastic hinges stiffness of the lateral force then only it will complete the any structure.

The entire model it will shows the displacement of evaluated base share and the pattern beams, hinged and the columns. The non-linear response spectrum methods.

EARTHQUAKE GROUND MOTION CONSIDERED

In analysis building the earthquake resist methods is more important to utilize properly and it used response spectrum loads analysis methods. That is static methods in the stories the ground motion of the earthquake considered and it will assigned the particular zone. In the earthquake phase the utilization the spectrum capability ground motion. Structure the SCGMs have been generated using software by Kumar (2002). The generated ground motion represent MCE level of earthquakes and have been presented in Figure 1.11. These ground motion have been used for non-linear time history analysis for the considered buildings.

SEISMIC DESIGN PHILOSOPHY AS PER IS-1893(PART I):2002

- While designing the structure the components must in high in strength and then the structure comprise at least the strength withstand structure during the small earthquake occurs without any loss damages.

- The major earthquake structures (MCE) are withstood without any collapse.

- Some buildings are earthquake equivalent resist if the earthquake hazards will be there sometimes it will be there sometimes it will damage the other non-structural without any loss of the building structure**.**

RESPONSESPECTRUM ANALYSIS

Response spectrum analysis is the main procedure to the multiple storey buildings performance. in the multiple storied buildings the multiple modes response analysis methods are used for the spectra .in the response spectrum there are three zones X, Y ,Z direction and in the load are applied and all the loads and the beams be design in the response spectrum every direction it has defines and other natural hazards damages occurs.

In the spectrum model it will prepared and it will evaluated the direction of X, Y,Z after that graphical model to be follows procedure to be follows for building design.

LIST OF ABBREVATIONS USED

IDR: Inter-storey drift ratio

IO: Immediate occupancy

LS: Life safety

CP: Collapse prevention

RS: Response Spectrum.

NLPOA: Nonlinear pushover analysis

NLTHA: Nonlinear time history analysis

kN: Kilo newton

m: Metre

Mm: Millimetre

Fig: Figure

SCGM: Spectral compatible ground motion.

CONCLUDING REMARKS

The performance of both the building structures whose performance scores was known seismic response spectrum analysis methods .in this structure building it was seen due to the weak of components at beam column joint and the buildings failed against the strong ground motion. All the buildings considered for the study is vulnerable for strong ground motion.

The performances have been evaluated under non-linear static analysis.

1) In the low grade steel results in building with failed in plastic hinge the both beams and columns by formation.

2) As plastic hinge mechanisms forms at the beam column joint time history analysis stops and full output cannot be obtained for the buildings.

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