



ANALYSIS AND DESIGN OF MULTI STORIED BUILDING SUBJECTED TO SEISMIC LOADING USING COMPOSITE AND RCC STRUCTURES

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Abstract: The exhibition of structure during a seismic tremor relies on a few components, for example, solidness, malleability, horizontal quality and Simple and normal setup. In the past for the plan of a structure the decision was typically between a solid structure and a brick work structure however because of the disappointment of numerous multi-celebrated and low-ascent R.C.C. what's more, workmanship structures because of tremor constrained the auxiliary architects to search for the elective strategy for development. Solid structures are cumbersome and confer progressively seismic weight and less redirection while Steel structures educate more avoidances and malleability to the structure which is advantageous in opposing seismic powers. In such conditions, utilization of composite development is specifically noteworthy, because of its critical potential in improving the seismic presentation of structure absent substantially more changes in assembling and development strategies. Steel solid composite development is worked instead of RCC structures to get greatest advantage of steel and concrete and to create proficient and monetary structure. Composite development consolidates the better properties of both steel and cement alongside lesser cost, quick development, imperviousness to fire, high solidness and prevalent seismic execution qualities. In this way it has increased wide acknowledgment worldwide as an option in contrast to unadulterated steel and solid development. In this investigation an endeavor has been made to break down, plan, and think about seismic execution of multi-story RCC and Composite steel building arranged in seismic zone III is consider Analytical outcomes are contrasted with accomplish the most reasonable opposing framework and financial structure against the seismic powers.

CHAPTER – 1 INTRODUCTION

1.0 Introduction

RCC structures are basic in India because of their flexibility to request, accessibility of material and talented labor. This makes RCC increasingly moderate, in contrast with its steel. Specifically, steel structures don't require arrangement of colossal measurements than RCC structures since steel areas have higher quality. Then again, steel structures face warm extension and erosion which causes decrease in the life expectancy of the structure, when contrasted with a RCC structure. Henceforth, to take out such impediments of decrease in life expectancy, composite structures assume a significant job.

1.1 Composite development

A composite structure is being built with a mix of steel part and solid part to make them go about as one unit. This structure can give a monetary validity with high sturdiness, fast erection and better seismic execution attributes. Co-productive of warm development of both steel and cement is almost the equivalent, with this its inductions that because of higher level of steel in composite segment, the structure conduct for warm extension is relatively better to that of a RCC structure or a steel structure. Composite structure because of its holding nature and organization result for higher quality, solidness and execution. Composite deck piece, composite shaft, composite section, shear connector are essential basic components in a composite structure.

The composite floor framework is only a composite deck piece which comprises of metal deck that is associated with a steel bar with the assistance of shear studs, where a solid

section is laid on the metal deck. The metal deck is set between two steel bars where it serves to with stand the solid work; it can deliver an unbending flat stomach while disseminating wind and seismic shears to the horizontal burden opposing frameworks.

The essential auxiliary parts use in composite development comprises of the accompanying components

1.2 Gravity Loads

Gravity burdens are the vertical powers that follow up on a structure. The heaviness of the structure, human inhabitance and snow are a wide range of burdens that need to have a total burden way to the ground.

1.3 Lateral Burdens

Sidelong loads are live loads that are applied parallel to the ground that is they are level forces following up on a structure. They are assorted to gravity stacks for example which are vertical, dropping forces.

The most broadly perceived sorts are:

- Wind Load
- Seismic Load
- Water and Earth Weight

Wind weight may not be an imperative stress for pretty much nothing, tremendous, low-level structures, anyway ends up being more centrality with stature the use of lighter materials and the usage of shapes that my impact the movement of air, regularly housetop structures. Enormous seismic weights can be constrained on a structure during a quake. They are most likely going to be reasonably brisk burdens stood out from wind loads. Structures in zones of seismic development ought to be purposely planned to ensure they don't miss the mark if a shudder should occur.

1.4 Earth Quake

A seismic tremor is an unforeseen tremble or advancement of the world's outside layer which starts regularly at or underneath the surface. The word conventional is central here, since it blocks incapacitate, waves achieved by atomic tests, man-had effects, and so on. The whole world is contained plates. The assembly between the two plates is called as inadequacy.

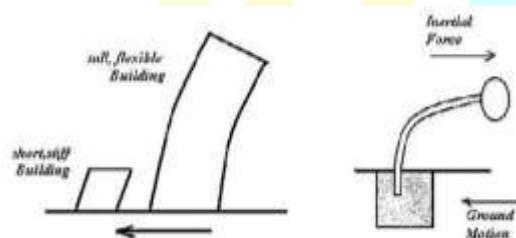


Fig 5. Displacement of Building according to their Height & Stiffness

1.7 Building Stiffness and Flexibility | Earthquake Engineering

If two bars of same length and same cross-a sectional area – one made of adaptable material and another of a delicate material. Moreover, a draw is applied on the two bars until they break, by then it is seen that the bendable bar reaches

out by a gigantic total before it breaks, while the delicate bar breaks out of the blue on landing at its most extraordinary quality at a relatively small extending. Among the material used in structure advancement, steel is adaptable, while stone work and bond are feeble.

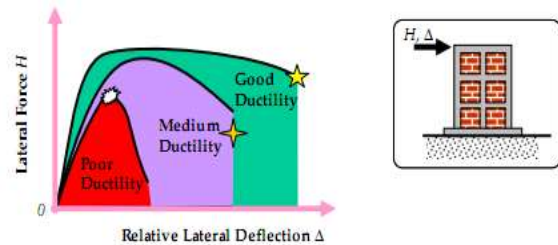


Fig 6. Different types of Ductility

The correct structure parts ought to be made flexible. The mistake of areas can impact the quality of structure, yet disillusionment of a bar causes confined effect. Thusly, it is more astute to make bars to be adaptable weak associations at that point areas. This system for arranging RC structures is known as the strong area delicate column structure method. Exceptional arrangement game plans from IS: 13920-1993 for RC structures ensures that acceptable flexibility is given in the people where mischief is ordinary.

Objectives

Following is the primary goal of the present examination:
To explore the seismic presentation of RCC and composite casing building Comparison of self-weight and Axial burden on structure.
Reaction range examination is performed to break down the seismic idea of the structures.

Scope of the Present Study

In the present investigation, demonstrating of RCC and composite edge structure is completed utilizing E-Tabs programming and the outcomes so acquired are looked at and the ends are drawn dependent on the tables and diagrams got.

CHAPTER – 2 LITERATURE REVIEW

This part manages a concise survey of the past and late examination performed by scientists on RCC and Composite edge structure by utilizing reaction range investigation.

K. Mukesh Kumar, H. Sudarsana Rao thought about low to tall structure (5, 10, 15 celebrated) RCC and composite structures in zone-1V and directed Response Spectrum, Non-straight time history examination to accomplish different parameters and presumed that composite structures are better than RCC structures (high raised structures).

Kumawat, Mahesh Suresh dealt with the G+9 story business working under seismic zone-III for Equivalent static and Response range examination of both RCC and Composite structure utilizing SAP2000 programming. It is inferred that Composite structure is more affordable than RCC structure with the assistance of different parameters.

Rajendra R. Bhoir, Vinay Kamble considered two private G+15 celebrated structures. Composite and RCC structure

are broke down and planned in ETAB programming with two distinctive story statures, 3m and 4m. They found that contrasted with RCC structure the profundity of pillars in Composite structure is less with diminished cross-segment of the composite segment. The general expense for RCC structure is more than the Composite Structure.

D.R. Panchal and P.M. Marathe displayed a 30 celebrated structure with composite and RCC structure in quake zone IV of India. As the heap changes for various story levels, diverse cross segments at the distinctive story levels are considered. From the outcomes it is seen that, Composite structure is more appropriate than the RCC structure.

Vinay Sanjeev Kumar Damam considered G+15 celebrated structure and broke down it for both composite segment building and R.C.C constructing and presumed that the redirection and story float in Composite structure is twice than that of R.C.C. structure however the redirection is inside as far as possible.

Shashikala. Koppad considered 15 celebrated structures with both RCC and Composite structures situated in seismic zone III of India. Cost investigation is determined for composite and RCC structures and presumed that cost is more for RCC framework in correlation with Composite framework.

Dr.W.N. Deulkar: Reported that the steel composite structures are framed by associating the steel pillars with cement or profiled deck section with the assistance of mechanical shear connectors so chunk and bar goes about as a solitary unit. He proposed that steel solid composite structure is seen as progressively protected and efficient. Oneself load of the steel solid composite structure is decreased by 9.48% when contrasted with strengthened solid structure.

L.G. Kalurkar: Reported that the firmness in composite structure is expanded by 12% to 15% transverse way and about 6% to 10% longitudinal way when contrasted with strengthened solid structure. In composite structure the horizontal removal are decreased from 41% to 58% transverse way and about 37% to 57% longitudinal way than the strengthened solid structure.

CHAPTER – 3 METHODOLOGY

3.0 General

Structures on the earth are generally shown to sort of weight: Static and Dynamic. Static Loads are unfaltering with time while dynamic burdens are time moving. Everything considered the majority of basic structure structures are engineered with the assumption that each applied weight is static. The effect of dynamic weight isn't considered in light of how the structure is now and again shown to dynamic stacking; extensively more in this manner, its idea in appraisal makes the game course of action powerfully got and tedious.

Seismic Methods of Analysis Procedures

Unequivocally when the structure model is picked, it is required to perform assessment to pick the seismically impelled powers in the structure. There are different strategies for examination which gives different degrees of precision. The evaluation system can be planned dependent on three portions.

- 1) The sort of remotely applied burdens
- 2) the direct of structure or colleague materials
- 3) and the kind of essential model picked.

Four frameworks are being utilized for seismic evaluation of structures: two straight procedure, and two nonlinear methods of reasoning.

- Linear Static Procedure (LSP)
- Nonlinear Static Procedure (NSP) and
- Linear Dynamic Procedure (LDP)
- Nonlinear Dynamic Procedure (NDP)

3.2.1 Static Analysis

The quickest framework for seismic examination of multi-cheered structures is static evaluation. In this technique the structure is perceived to remain adaptable while being shown to static power load advancement related with the gigantic procedure for vibration in this the forces are applied straightforwardly along the two administrator tomahawks i.e., the longitudinal and examine tomahawks.

Direct Static Procedure

In an energetic static method, the structure is showed up as a relative single-level of-validity (SDOF) system with a straight versatile liberality and a misty gooey damping. The seismic data is showed up by a vague parallel power with the objective to make diminish loads and strains from the tremor it addresses. In setting on an estimation of the standard head repeat of the structure using exploratory affiliations or Rayleigh's approach, the horrendous energizing is settled from the reasonable response extend which, copied by the mass of the structure, comprehends the impacts, steadfast quality corruption, yet furthermore power rot by goodness of foreseen inelastic lead. The level power is then disregarded on the stature of the structure and the relating inside forces and discharges are settled using direct versatile assessment. Straight system are real when the customary level of nonlinearity is low. This is examined by part courses of action to limit degrees (DCRs) of under 2.0.

Non-Linear Static Procedure

The Nonlinear Static Procedure is engaging generally structures. This philosophy is an improvement over the LSP or LDP as in it permits the inelastic direct of the structure. In any case, this ought to be utilized related to the Linear Dynamic Procedure if mass imperativeness for the significant mode is low. This framework expects an enormous measure of static enduring level load over the stature of the structure. This framework is routinely simple to be done and gives information the quality, misshapening and the adaptability of the structure and the doling out of the referencing. These separations to see central people inclined to show up everything considered remote point states during the tremor. In any case, this structure contains many obliged questions which carelessness the get-together of weight

plans, the effect of higher modes, and the effect of resonating.

3.2.2 Dynamic Analysis

In light of consistent movement in work area selecting limits seismic appraisal programming, there has been a move among practicing engineers towards routine usage of dynamic assessment instead of static evaluation for multi-perceived structures. The utilization of dynamic evaluation is kept up in view of its ability to unequivocally address the effects of different procedures for vibration. Besides, the delayed consequences of dynamic evaluation can be used to pick if fundamental inelastic direct is more than likely going to occur and, in this manner, can be said pick if reasonably complex static or dynamic appraisal is protected.

After a short time, a three-dimensional amazing evaluation is required for an epic number of different sorts of key structures that are made in Seismic Zone 4. The parallel power essentials suggest a few systems that can be used to pick the scattering of seismic powers inside a structure.

The fundamental ideal situation of using the forces got from an interesting appraisal as the explanation behind an associate structure is that the vertical vehicle of forces may be basically not equivalent to the forces got from a comparable static weight assessment. All things considered, the use of dynamic exnation will make essential plans that are more tremor safe than structures organized using static burdens.

CHAPTER 4 MODELLING OF STRUCTURE

4.1 Seismic Analysis Procedure as per the Code:

Exactly when a structure is exposed to seismic tremor, it responds by vibrating. A seismic tremor power can be subsided into three ordinarily inverse headings the two even direction (x and y) and the vertical course (z). This development causes the structure to vibrate or shake in all of the three headings; the staggering direction of shaking is level. All of the structures are basically planned for gravity loads-compel proportionate to mass time's gravity in the vertical bearing. Because of the basic factor of security used as a piece of the arrangement judgments, most structures tend to be sufficient guaranteed against vertical shaking. Vertical accelerating should moreover be considered in structures with generous reaches, those in which trustworthiness for blueprint, or for general sufficiency assessment of structures.

IS 1893 (segment 1) code recommending that pathetic fascinating appraisal, or pseudo static assessment should be finished depending on the centrality of the issue. IS 1893(part1): 2002 grasps use of explicit appraisal using response go structure and proportionate parallel power reasoning for working of stature under 40 m in each seismic zone.

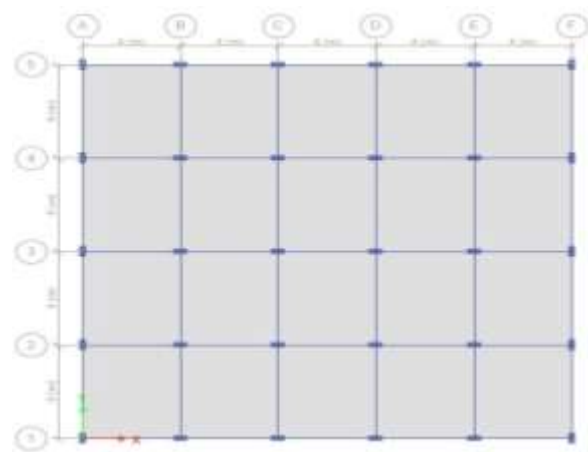


Fig 9: The plan of structure 20mx20m

4.2 Modelling

ETABS is one of the items which works over limited component technique created by PCs and structures, Inc. (CSI), which is utilized for planning and investigation the tall structures with limited component strategies.

Bay Frame:

Inserting no. of bays in x-axis and y-axis with spacing between the bays



Fig 12: Model quick templates

Giving the storey details, which contains storey height and no. of stories?



Fig 13: Storey data



Fig 18: Modifying the properties of reinforcement

Mass per unit volume, $M = 76.9729 \text{ kN/m}^3$

Modulus of elasticity, $E = 200000 \text{ Mpa}$

Coefficient of thermal Expansion, $A = 0.0000117$

3.2.3 Steel

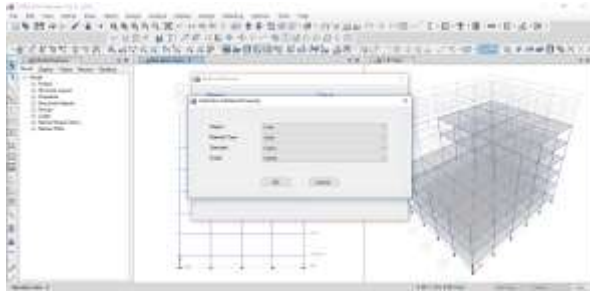


Fig 19: The properties of steel



Fig 20: Modifying the properties of steel

3.2.2 Section Properties of columns

Column 300mm x 580 mm

Adding a frame property

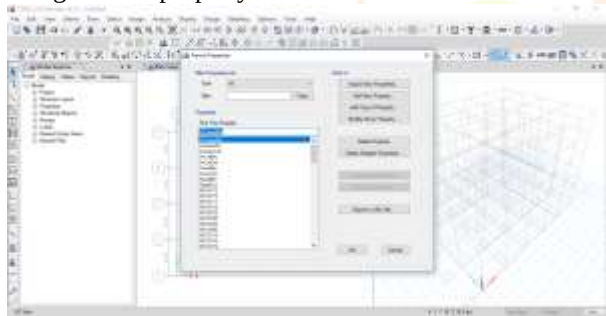


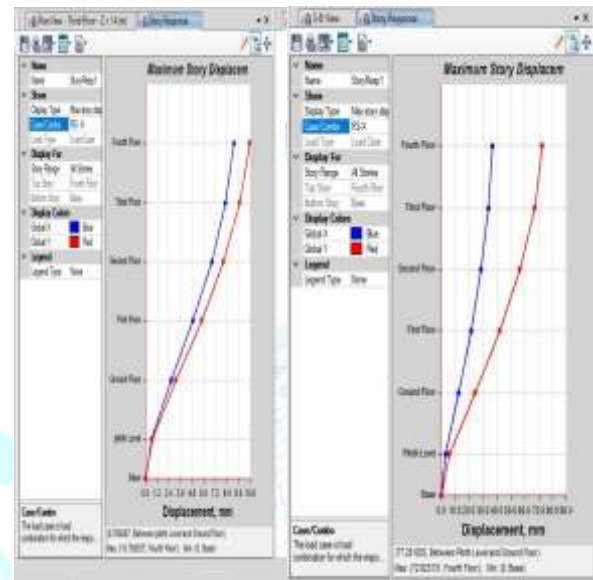
Fig 21: frame property

CHAPTER 6 RESULT AND DISCUSSION

RCC model and composite model are planned according to IS 800:2007 and IS 456:2000 by utilizing e-Tabs programming and following diagrams are acquired.

1. Maximum Storey Displacement

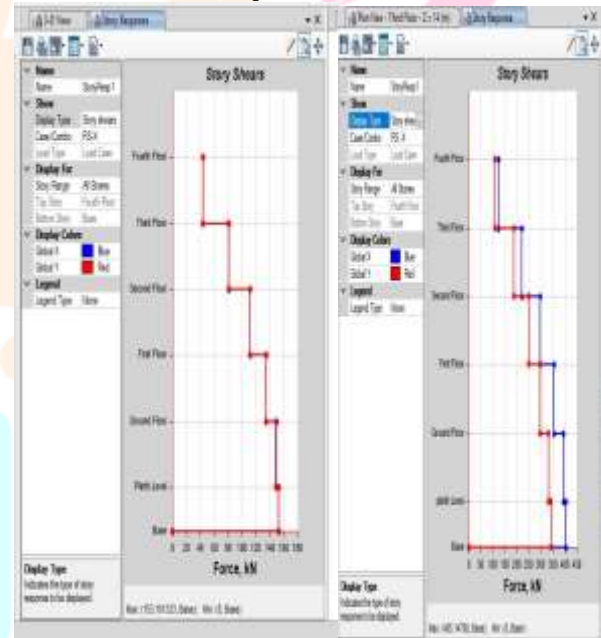
RCC model Composite Model



Result: from the over two models story dislodging is more in Composite structure which is 72.823 mm.

2. Maximum storey shear

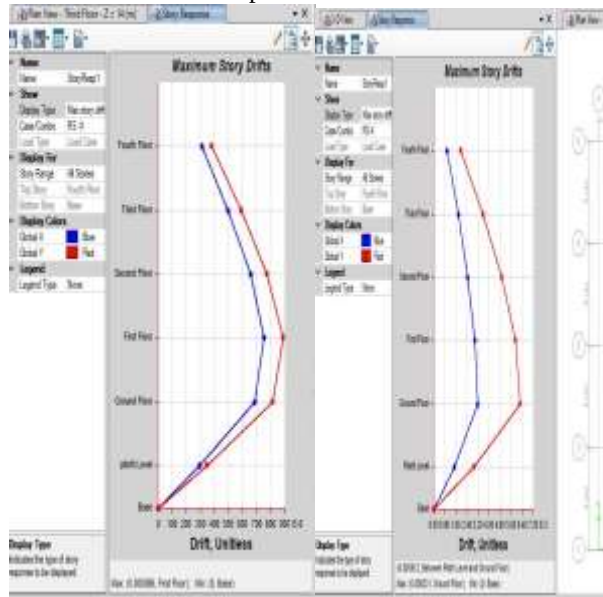
RCC model Composite model



Result: from the over two models story shear is more in Composite structure which is 405.147.

3. Maximum storey drift

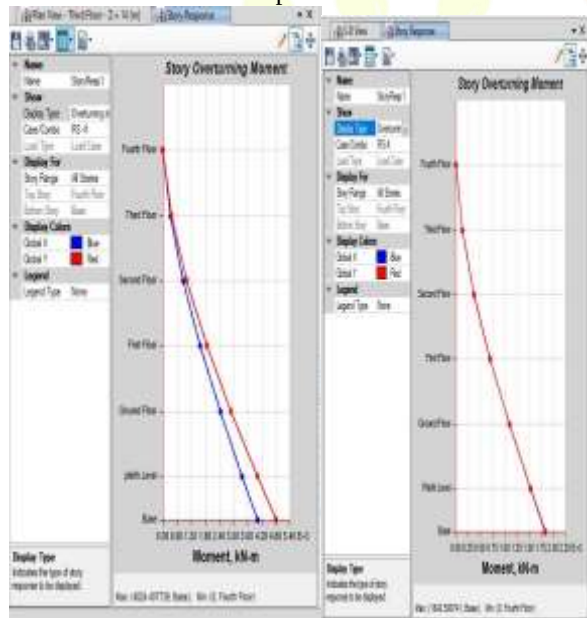
RCC model Composite model



Result: from the over two models it is seen that story float is high in RCC model from the start floor.

4. Overturning moment

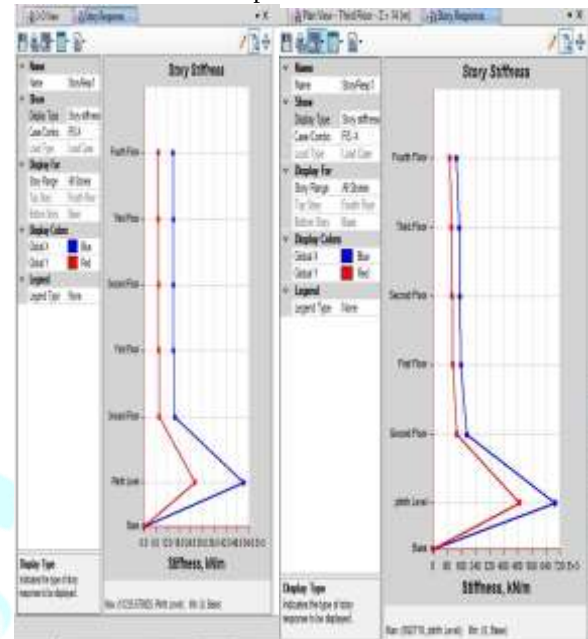
RCC model Composite model



Result: from the over two models it is seen that toppling minute is high in RCC model at base.

5. Stiffness

RCC Model Composite model



Result: from the over two models it is seen that story solidness is high in composite model.

From the Above outcomes we infer that composite structure giving better outcome against toppling, firmness and story floats whereas removal esteem in composite structure is more with contrast with RCC model.

CHAPTER 6 CONCLUSION

Examination and plan of structure should be possible and correlation can be made among them and from that outcome ends can be drawn-out are as per the following:

- As we are utilizing steel part for bars, the solid is decreased in bar areas.
- In composite structure, the section size is lesser than the RCC structure which additionally decreases the volume of cement. As concrete lessens, the strengthening steel likewise diminished.
- Under quake thought as a result of inalienable flexibility attributes, steel-solid composite structure performs superior to anything a R.C.C structure.
- Due to decrease in cement and strengthening steel in composite structure, it is financially savvy than RCC structure.
- As contrasted with RCC structures, composite structures require less development time because of the snappy erection of the steel edge and simplicity of formwork for cement. Counting the development time frame as an element of complete expense in the cost estimation will absolutely bring about expanded economy for the composite structure.
- The removals in composite structure are more than the RCC structure, however it is sheltered all things considered in admissible cutoff points.
- The story floats are comparable in the two structures.
- The story powers in Composite structure are not exactly the RCC structure. Along these lines composite

structure can give preferable execution over RCC structure.

- The pivotal powers, shear powers, bowing snapshots of composite structure in segments are lesser when contrasted with RCC structure and it can invigorate more and soundness to the structure.
- The bar shear powers are higher in RCC structure with increment in stature contrasted with Composite structure. While, the shaft bowing minutes are comparable in both RCC and Composite structure.
- The self-weight of the structure is more in RCC structure than the Composite structure, because of this; base shear is less in composite structure than the RCC structure.

