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A Review Paper on Comparative Analysis on RCC Structure with Energy Dissipation Device and Composite Structure

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Abstract: ***In recent years considerable attention has been paid to research and development of structural vibration control devices with particular emphasis on mitigation of wind and seismic response of buildings. Many vibration-control measures like passive, active, semi-active and hybrid vibration control methods have been developed. Base isolation is a passive vibration control system. The isolator partially reflects and partially absorbs input seismic energy before it gets transmitted to the superstructure. Lead rubber bearing isolators are placed between the superstructure and foundation, which reduces the horizontal stiffness of the system. It thereby increases the time period of the structure and decreases the spectral acceleration of the structure. The superstructure acts like a rigid body, thus inter storey drift is reduced. This study is concerned with the effects of various vertical irregularities on the seismic response of a structure and controls this response using base isolation. The objective of the study is to carry out response spectrum analysis.***

The predominant lateral loads acting upon building structures are earthquake and wind induced forces. If wind load is much greater than earthquake load, the lateral force resisting system required to tackle wind loading may be enough to resist the smaller earthquake load. In this situation, a seismic base isolator will not bring any benefit to the building system. Furthermore, if time period of a building without isolator is greater, incorporation of isolator will not bring much difference to the building behavior with respect to seismic load. Additionally, for buildings with lower structural time periods, incorporation of an isolator will greatly alter the seismic behavior.

Keywords: RCC Structure, Energy dissipation device, Composite Structure, Joint Displacement, Base Shear, ETABS.

I. INTRODUCTION

In India conventional concrete is very common material in construction especially in case of medium and low-rise buildings. Also, in case of high-rise buildings steel is popularly used and the composite construction is not that much popular but it is possible that composite construction can be more beneficial useful in case of medium and high-rise structure. Steel concrete composite structure can be built in place of RC structures to get maximum advantage of steel and concrete and to produce efficient and economic structures. It depends on nature of building and material used and according to those properties the type of material can be chosen for best results. Composite construction is formed when two heterogynous materials are bonded together effectively so that they act together as a single element in the structure. Composite construction is new techniques are used frequently to save the cost of the construction and to make structure economical. In this paper we have discus the various results of the building construction for RCC, Steel and composite structure considering different researches. Composite steel-concrete structures are used widely in modem bridge and building construction. A composite member is formed when a steel component, such as an I section beam, is attached to a concrete component, such as a floor slab or bridge deck. Throughout this paper, we will refer to the steel and concrete as the components of the member, which are further made up of elements, such as the flanges or web of the steel I-section component, or the reinforcement in the slab.

II. LITERATURE REVIEW

A.H barbat, L.M. Bozzo (1997): survey of numerical simulation of base isolation for vibration manage of building and their system's taking earthquake into foremost consideration, at the area of conventional nonlinear analysis an opportunity linear technique is discusses.

Tian Xue MIN, and LU Ming (2008): experimental and analytical evaluation of a base isolation system with rubber bearing is achieved on a constructing height 31m having eight floor. flexible connecting tool of isolation layer layout and the connection method of isolation bearing without top fixing plates are brought, seismic reaction reduced extensively

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D.R. Panchal (2011): In this paper studied about the Steel concrete composite systems have become quite popular in Civil engineering field because of their advantages against conventional construction. From the results steel structure is better than RCC but the composite option for high rise building is economical among all three options. Dead load of steel structure can be reduced by 32% with respect to RCC structure and composition structure is 30% compare to RCC structure. Axial load in column can be reduced by 46% in steel structure and reduced by 7% in composite structure as compared to RCC structure.

Renavikar Aniket V (2013): In this study STAAD.Pro software is used for analysis. Steel - Concrete composite frame system can provide an effective and economical structure to most of this problem in medium to high rise building can be achieved. The cost of steel structure can be reduced compared to RCC structure due to reduction in dimensions of the steel members. An axial force, bending moment and deflections in RCC is more compared to steel composite structure which leads to increase in cost. Connecting the members are easy will leads to quick completion of structure under earthquake consideration and more benefits because of the inherent ductility characteristics, Steel's concrete structure will perform best Result compare to RCC structures.

Shashikala. Koppad (2013): In medium and high rise building the RCC structure are no longer economical because of hazardous from work, less stiffness, span restriction and increasing dead weight composite structure are suitable for economical construction. Steel structural members are subjected to local and lateral buckling. RCC members are generally having more dimension and less likely to buckle but they are subjected to Creep and shrinkage with respect to loading. Combination of construction material is steel-concrete with wide application in buildings. The cost effectiveness of steel-concrete construction is due to improve in overall performance in construction technologies.

Zafar Mujawar (2015): In Steel-concrete composite structures has gained wide application like faster connecting Technology which saves lot of time in construction which makes the easy to complete the structure with minimum time. Availability of internal space is more compare to RCC structure and also improves the life expectancy of the composite structure. From the experimental Results Base shear is reduced in composite structure by 29% and composite structure reduced by 29% compare to RCC structure. Axial forces in steel structure are reduced by 48% and composite structure reduced by 50% compare to RCC structure. From the results it concludes that reduce in axial force on footing will leads to reduce in size of footing and also composite structure can be completed in short duration.

Prakarsh Sangaveet (2015): In some of the countries the implementation of steel structures is very less. In metropolitan cities like Delhi, Mumbai, Bangalore, etc. is very much require to use steel concrete composite structure because of lack of horizontal expansion. Steel industry is one of the booming industries in almost all part of the world and composite construction are having wide application in Strength, Time and cost is most important parameter in construction point of view. Maximum storey displacement is increased by 8% in steel frame with infill, compared to RCC structure and they are better resistance during earthquake without failure. In steel framed structure bending moment in beams and column, also axial force is less comparing to RCC structure.

Sattainathan.A (2015): In this study Steel-concrete composite system has become quite popular compare RCC structure. Many engineers are not familiar in analysis and design because of complexity. Steel-concrete composite construction is the system to implement because of their advantages against conventional construction. The result says Steel-concrete system can provide extremely economical structural system with high durability, Rapid erection and superior seismic performance characteristics. Composite structures have best results in Steel to the concrete.

Swapnil B. Cholekar (2015): The best way to produce efficient and economical design of Building System is composite Steel concrete construction and it is necessary in present construction world. Due to increase in population the requirement of medium to high rise building becomes efficient for the public. Steel-concrete structures are typically to produce efficient and economical construction in case of regular structures. The joint displacement values in the structures are less in composite structures compare to RCC structures. Dead Weight of composite structures is less compared to RC structure will give better response in base shear values are decreased by 18%.

Varsha Patil (2015): Steel structures in fact the elastic behavior up to relatively high and usually well define stress level by quite easy to connect the beam member in short time. Service requirement in the market, it is necessary to reduce the construction time and cost by adopting simple and effective construction methodologies. The Two main benefits in fast construction are like reduction in investment in the form of interest and early return of capital invested. Most efficient utilization of Steel concrete composite construction will lead to more usable space and joint displacement at top are less due to higher stiffness in members compare to RCC steel structure.

Bhavin H. Zaveri (2016) In India concrete is very popular material of construction especially in case of medium and low-rise buildings. And in case of high-rise buildings steel is generally used and the composite construction is not such popular but it is possible that composite construction can be more beneficial in case of medium and high-rise buildings.

Steel concrete composite construction can be built in place of RCC structures to get maximum advantage of steel and concrete and to produce efficient and economic structures. It is the decision of contractor or owner that which type of properties they require in the field and according to those properties the type of material can be chosen. This paper shows comparison of various aspects of building construction for steel, RCC as well as composite buildings considering various researches acted on this topic.

Mohd Amir Khan (2017): This paper deals with Structural steel-concrete composite have light in weight as compared to RC structure which gives economical foundation design. Better property combination leads to high strength in structural frames. More lateral load capacity in composite structural frame compared to RCC frame. The lateral displacement of the Steel-concrete composite frame can be minimized and overturning-moment is decreased compared to RCC frame. The Steel concrete composite structure frame fallows strong column weak beam behavior as hinges is formed in beams rather than column element because of less axial load.

Gorakh Vinit (2018): In this paper analysis and design of multistory building in popular software called STAAD.pro. Here, ISMB sections are used in beams. It provides thick web that can effectively carry the load from the slab. Wide flange sections are used in column design because it provides excellent section behavior in load transformation, with high bending and buckling resistance. Axial load is less in steel structure compared to RCC structure due to less dead weight of Steel. Final observation is quick construction will lead to quicker returns on the investor capital and more benefits.

Jyothi D N (2018): This paper concludes that the steel structure is more resistance compared to the RCC structure. Steel structure has less Dead weight even the bending moment and shear force acting are also less comparing to RCC structure. Steel structural members have high strength per unit mass. Even for high rise structures the size of steel structural elements is small, saving space in construction and improving aesthetic view. Rapid construction technique is another important advantage of steel structure and also it is possible to fabricate in the workshop because standard sections of steel are available in market also it can be easily transported to the site.

Paulo A. G. Piloto (2018): This work investigates the thermal behavior of composite slabs with steel deck under controlled test conditions corresponding to a fire from the bottom. This composite solution consists of a concrete topping cast on the top of a steel deck. The concrete is typically reinforced with a steel mesh and may also contain individual rebars. The deck also acts as reinforcement and may be exposed to accidental fire conditions from the bottom. This composite solution is widely used in every type of buildings and requires fire resistance, in accordance to regulations and standards. Composite slabs need to meet fire-safety requirements according to building codes. The fire assessment of this type of elements is normally made using standard fire tests. Two samples are being prepared to be tested and should take into account the criterion for stability (R), Integrity (E) and insulation (I).

Pallavi Harish Wagh (2019): As studied steel is a universal construction material in many multistory commercial buildings and factories as well as in bridges also. Both Steel and concrete results in quick construction and good bonding properties. The two different materials are completely compatible and complementary to each other. Steel concrete composite construction are the single unit under loading they have almost same thermal expansion. This method is more economic than complete steel and Reinforced concrete structures. Weight of Steel and concrete structure is reduced as compared to RCC structure due to small structural steel section. It results in minimizing the foundation cost. Comparison of Story Drift for RCC and Composite Structures varies from 22% to 32%. Due to increase in axial load in RCC structures have higher values in bending moment and shear force.

Samadhan jagadale (2019): In this study the Composite structures are latest concepts for high rise building and they are resulted in rapid construction. Steel frame obtain good response compare to RCC but the composite frame is suitable for high rise buildings. From the results the lateral displacement of top story of Composite frame is 15% more than RCC frame 17% less than steel frame. In G+7 story beam Maximum shear force in Composite frame is nearly 40.45% greater than RCC frame and 112.29% less than Steel frame and Maximum bending moment for composite frame is 23.42% greater than RCC frame and 178.83% less than Steel frame. Axial load on footing is higher for RCC frame than composite frame and steel frame which equals to 24% and 81% respectively. Finally cost for G+7 story building for composite frame is nearly half than Steel frame and 15% higher than RCC frame.

Madhav Rana (2019): In this study Steel structure gives better resistance against lateral and various other load combinations. Steel is a recyclable material depending upon the property requirement it can be used. The Brazing systems are well known to increase the stiffness of any type of building usually it is provided at the corners to resist against loading. Maximum displacement at corner columns for ‘An Arc’ type brazing ‘Av Arc’ type bracing, single elliptical and double elliptical bracing is carried out. ‘Av Arc’ bracing has the least maximum displacement and it is the most effective bracing system. The final result for material quantity of steel is less in ‘An Arc’ type bracing and more at double elliptical bracing System.

Kentan Patel (2019): In this study Comparative study of concrete filled steel tube CFT, RC structure and Steel structure is carried out.

Steel concrete composite columns are used extensively in modern building now a day to get best results. It concludes that the use of CFT columns have been consistently applied in the design of High-rise buildings as they provide economical structure in comparison with RCC and Steel structures. In 20 and 30 story building CFT frame structure the load carrying capacity is increased by 19.10% and 11.80% compare to steel structure. Also 27.30% and 22.80% compare to RC structure. The modern material and technique are availability for erection will leads to quick completion of structure under earthquake consideration because of the inherent ductility characteristics in steel.

Anil S.Savadi (2019): In this paper to fulfill the requirements and need of high rise buildings for commercial purpose. Composite structure is best for infrastructural growth and economic structure other than RCC and steel structures. Cost comparison for (G + 2) commercial building is carried out then results are composite beam is 1.7 % less than steel structure and 13.7% less than the RC structure because main advantage is in composite frame structure bar bending and form work is not required. The main parameter in composite structures is more economical than RCC and steel structures. In the erection work like beam, column, etc. Labour requirement is very less in composite structure compared to RCC structure. In composite structure deflection criteria is less compare to steel structure and more in RC structure

Bhanu Prakash P.M (2021) This study investigates about the composite structure is gaining more popularity in developing countries. For medium and high rise building in RCC structure is no longer economical because of increase dead weight, span restriction, low natural frequency and hazardous formwork. Steel and concrete composite structures are becoming more popular nowadays and safe over its design life span. The steel and concrete constructions are best solution for modern buildings. In this paper we have discus the various results of the buildingconstruction for RCC, Steel and composite structure considering different researches.

III. FINDING FROM LITERATURE REVIEW

1) After studying the journal papers, many researchers as said that steel is most universally useful and versatile material for engineers and construction purpose.
2) As a good engineer to save the natural resources is very big task. The main ingredients of cement which are very much expensive as well as on verge of extent. So, it is very important to find out alternative material with respect related properties like strength, Cost and time. Also, engineers are reluctant to accept the composite steel and concrete structure because of unfamiliarity in analysis and design.
3) Availability of structural steel material is easy in market, Like I-section, C-section, Z-shape, L- angle, Rail profile bars, sheet or plates, etc.
4) The predominant lateral loads acting upon building structures are earthquake and wind induced forces. If wind load is much greater than earthquake load, the lateral force resisting system required to tackle wind loading may be enough to resist the smaller earthquake load. In this situation, a seismic base isolator will not bring any benefit to the building system.
5) Steel provides light weight structure in composite concrete steel structure. The dead weight of the structure can be reduced by using light weight material like pre cast aerated concrete walls, panels etc. Easily for alteration and expansion if necessary.
6) Steel structure provide Rapid construction, highly durable, it gains strength without taking a time, biodegradable and recyclable, provide long span.
7) It results in less health hazards, less waste, less energy usage, less emissions and better environmental work in low to high rise building.

IV. CONCLUSION

1) Seismic base shear governs up to larger building height, at greater heights, structural time periods are much larger than the most competent value of limiting time period for incorporating isolator
2) Realistic structural time period and governing seismic load envisage that seismic base isolator of up to 30-40m height can be efficiently incorporated at low to medium soil condition for aseismic RCC buildings
3) The base isolation reduces the responses lateral displacement, shear forces, bending moments, base shear, storey acceleration, interstorey drift as compared to the conventional fixed base structure.
4) Base isolation reduces the stiffness and thereby increases the fundamental period of the building to bring it out of the maximum spectral response region. Therefore, it can be concluded from the results presented here that base isolation is very effective seismic control measures.
5) Dampers help to dissipate the kinetic energy generated in the building due to seismic forces.

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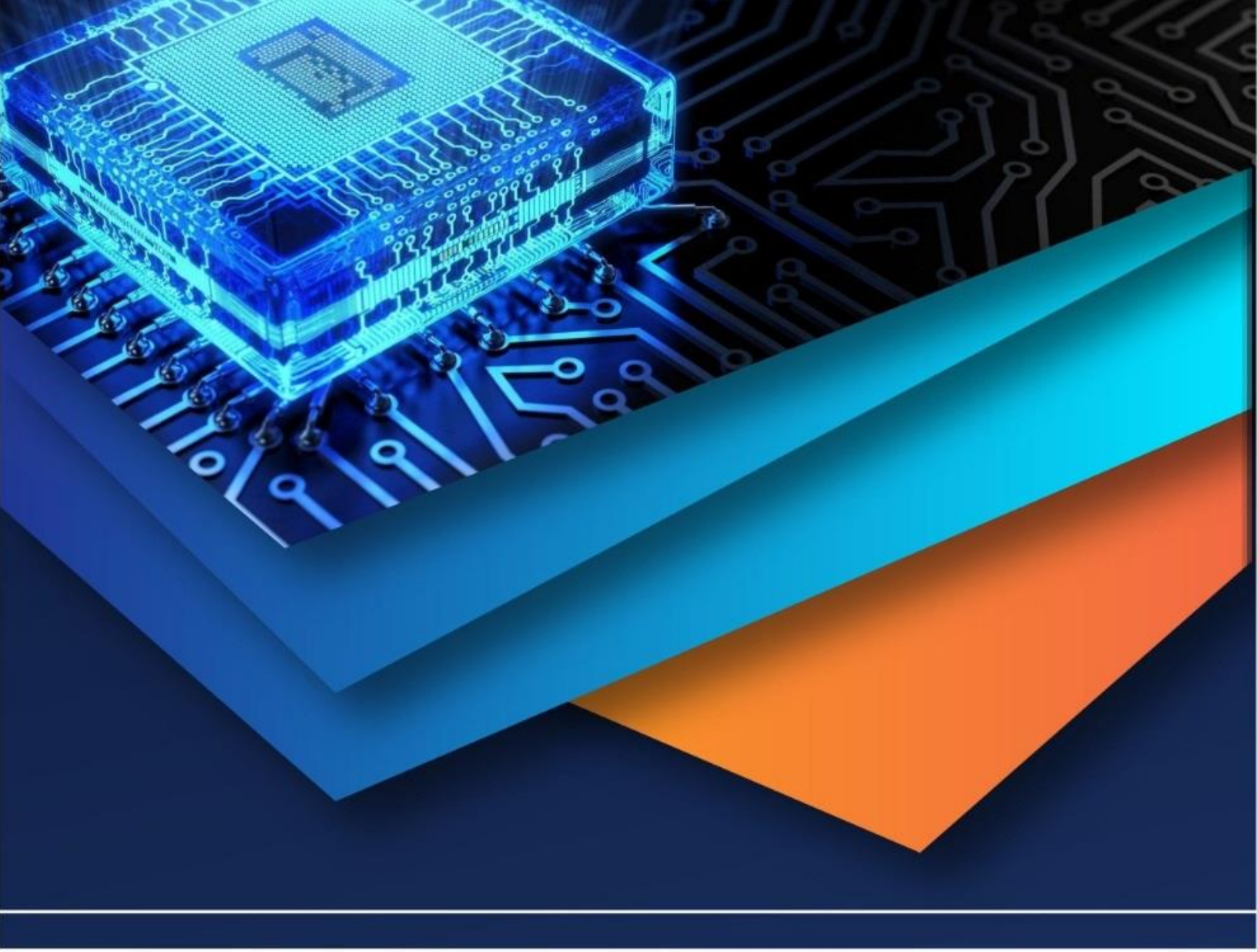

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