A REVIEW PAPER ON COMPARATIVE STUDY ON RCC AND COMPOSITE STRUCTURE FOR SEISMIC ANALYSIS USING RESPONSE SPECTRUM METHOD

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ABSTRACT

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 The Present Work, Steel Concrete Composite, Steel And R.C.C Options Are Considered For Comparative Study Of G+25 Storey Commercial Building Which Is Situated In Earthquake Zone Iv. Equivalent Static Method Of Analysis Is Used. For Modeling Of Composite, Steel And R.C.C. Structures, Etabs Software Is Used And The Results Are Compared; And It Is Found That Composite Structure Is Found To Be More Economical.

Keywords: Rcc Structure, Steel Structure, Composite Structure, Joint Displacement, Base Shear.

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 Modern 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

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

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.


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.


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
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 follows 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 behaviour 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). The scope of this investigation concerns the fire rating for insulation (I). Numerical simulation was performed through Matlab PDE Toolbox for the thermal effects of standard fire exposure. The results are also compared with the simplified method proposed by Eurocode, which seems to be unsafe.

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 28.80% Compare To Rcc 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.


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 Discuss The Various Results Of The Building Construction 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.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. 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

In this review paper, it is shown that steel, RCC and composite structures can be compared in various aspects under various conditions. But I found fire protection is very important in case of steel or composite structure. It can lead to change the design criteria such as thickness of slab, nominal cover etc. And other thing is soil conditions it can be changed other than hard soil and can be compared for worst conditions. In India, generally these aspects are not considered fully. But practical applications of these comparisons can make structure more safe and more economical. And more accurate comparison processes and aspects can be developed.

V. REFERENCES


[16] Anil S.Savadi, Dr. Vinod Hosur. “Comparative Study Of RCC, Steel And Composite Structures For Industrial Building”. Issn: 2395- 4396, Volume 5, Issue 4, IJARIIE.

Mohammed Imran, Shaik Abdulla, S.M. Hasmi 'Comparative Analysis Of Reinforced Concrete & Composite Structures Subjected To Static & Dynamic Loads'

Muhammed Sabith K, Dr. Sabeena M. V. 'Seismic Analysis Of Irregular Composite Structures With Shear Connectors Using Etabs'

Mustafa M. Wagh "A Review On Comparative Study Of Composite Rcc And Steel Structure"


Er. Tushar Loya, Er. Ravindra Bansode, Dr. M.R. Shiyekar ‘Comparative Study On Analysis And Design Of Steel Building And Conventional Rc Building’


Abdul Qahir Darwish 'A Review On Steel Concrete Composite Structures'


Dr. Ramakrishna Hegde, Mr. Bhavani Shankar, Mohammed Farooq ‘Parametric Study Of Rcc, Steel And Composite Structures Under Seismic Loading’

Nileshkumar V. Ganwani ‘Comparative Study Of Rcc And Steel-Concrete Composite Building Based On Seismic Analysis’


Shweta A. Wagh*, Dr. U. P. Waghe** ‘Comparative Study Of R.C.C And Steel Concrete Composite Structures'


Rathod, Sunil, Swati Sham Bhokare, Aniket Arun Shivatare, Pradip Sanjay Dhiwar, Swapnil Maruti Sathe, Rajesh Navnath Shinde, And Ug Student. 2017."Comparative Pushover Analysis Of Rcc, Steel And Compositehigh Rise Building Frame (G+11) By Using Etabs” 17 (2): 975–6744.


Paulo A. G. Piloto, Lucas M.S. Prates, Carlos Balsa, Ronaldo Rigobello ‘Fire Resistance Of Composite Slabs With Steel Deck: Experimental Analysis And Numerical Simulation.'