



REVIEW ON COMPARATIVE STUDY ON RCC AND STEEL STRUCTURE FOR DIFFERENT CRITERIA'S

Bhanu Prakash P.M, Dr.Vijaya Kumar Y.M and T A Srirama Rao

Visvesvaraya Technological University
Karnataka, India

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 this paper we have discuss the various results of the building construction for RCC, Steel and composite structure considering different researches.

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

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.

Literature Review

D.R. Panchal et.al, (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 et.al, (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 is 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 et.al, (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 et.al, (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.al, (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 et.al, (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. Cholekaret.al, (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 et.al, (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.

Mohd Amir Khan et.al, (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 are formed in beams rather than column element because of less axial load.

Gorakh Vinit et.al, (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 are less in steel structure compared to RCC structure due to less dead weight of Steel. Final observation is quick construction will leads 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.

Pallavi Harish Wagh et.al, (2019): As studied steel is a universal construction material in many multi-story 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 et.al, (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 are 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 et.al, (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 'A 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 'A Arc' type bracing and more at double elliptical bracing System.

Kentan Patel et.al, (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 et.al, (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.

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.
5. Steel structure provide Rapid construction, highly durable, it gains strength without taking a time, biodegradable and recyclable, provide long span.
6. It results in less health hazards, less waste, less energy usage, less emissions and better environmental work in low to high rise building.

References

- [1] D.R. Panchal and P.M. Marathe. December, 2011. "Comparative Study of RCC, steel and composite (G+30 storey) Building", ICCTT.
- [2] Renavikar Aniket V, Suryawanshi Yogesh. July, 2013. "Comparative study on analysis and cost of RCC and steel composite structure". ISSN: 2319-7064, Volume 5, Issue 7, IJSR.
- [3] Shashikala. Koppad, Dr. S.V.Itti. November, 2013. "Comparative Study of RCC and Composite Multistoreyed Buildings". ISSN: 2277-3754, Volume 3, Issue 5, IJEIT.
- [4] Zafar Mujawar, Prakارش Sangave, January, 2015. "Comparative Evaluation of Reinforced Concrete, Steel and Composite Structure under the Effect of Static and Dynamic Loading". ISSN: 2248-9622, Volume 5, Issue 1, IJERA, Pg.no:41-44.
- [5] Prakارش Sangave, Nikhil Madur, Sagar Waghmare, Rakesh Shete, Vinayak Mankondi, Vinayak Gundla. February, 2015. "Comparative study of Analysis and Design of RC and steel structure". ISSN: 2229-5518, Volume 6, Issue 2, IJSER.



-
- [6] Sattainathan.A, Nagarajan.N. March, 2015 “Comparative study on the behavior of RCC steel and composite structure (B+G+20 storeys)”. ISSN: 2395-3837, Volume 1, Issue 3, IJACEE, Pg.no:21-26.
 - [7] Swapnil B. Cholekar, Basavalingappa S. M, July-2015. “Comparative analysis of Multistoried RCC and composite building due to mass irregularity”, ISSN: 2395-0072, Volume 2, Issue 4, IRJET.
 - [8] Varsha Patil, Shilpa Kewate, August-2015 “Comparative study on dynamic analysis of composite RCC and steel structure”. ISSN: 2349-4476, Volume 3, Issue 8, IJETMAS.
 - [9] Mohd Amir Khan, July -2017. “Comparative study of RCC and structural steel-concrete composite frame from Linear and Non-Linear Analysis”. ISSN: 2395-0072, Volume 4, Issue 7, IRJET.
 - [10] Gorakh Vinit, Nishit Kadia, Kiranmoy Samanta, October-2018. “Comparative study of RCC and steel structure for different floor Heights”. ISSN: 2349-2163, Volume 5, Issue 10, IJIRAE.
 - [11] Jyothi D N, February-2018 “Comparative Analysis of RCC and Steel structure”. ISSN: 2395-0072, Volume 5, Issue 2, IRJET.
 - [12] Pallavi Harish Wagh, Dr. S. K. Kulkarni, Vishwajeet Kadlag, 2019. “Comparative Study on Analysis and Design of RCC and Composite Structure”, ISSN: 2454-132X, Volume 5, Issue 3, IJARIT.
 - [13] Samadhan jagadale, M.R. Shiyekar, Y.M. Ghugal. July-2019 “Comparative study of Steel, RCC and composite frame building”. ISSN: 2395-0072, Volume 6, Issue 7, IRJET.
 - [14] Madhav Rana, Supervisor ER. Nitin Verma. August-2019. “Dynamic Analysis of Steel frame structure (regular in plane) using curved bracing system”. ISSN: 2278-3075, Volume 8, Issue 10, IJITEE.
 - [15] Kentan Patel, Sonal Thakkar. 2019 “Analysis of CFT (Concrete Filled Steel Tube), RCC and steel building subjected to lateral loading”, ELSEVIER.
 - [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, IJARIE.

Filename: 1
Directory: C:\Users\DELL\Documents
Template: C:\Users\DELL\AppData\Roaming\Microsoft\Templates\Normal.dotm
Title:
Subject:
Author: Windows User
Keywords:
Comments:
Creation Date: 4/16/2021 4:41:00 PM
Change Number: 7
Last Saved On: 4/29/2021 3:09:00 PM
Last Saved By: Windows User
Total Editing Time: 23 Minutes
Last Printed On: 4/29/2021 7:46:00 PM
As of Last Complete Printing
Number of Pages: 4
Number of Words: 2,644 (approx.)
Number of Characters: 15,075 (approx.)