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A REVIEW PAPER ON DESIGN AND COMPARISON OF MULTI-STORIED BUILDINGOF R.C.C SECTION AND COMPOSITE SECTIONBY STAAD. PRO V8I AND MANUAL

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ABSTRACT

The goal of this study is to establish whether the composite frame system, which consists of steel girders functioning monolithically with concrete, has proven a practical substitute for the traditional steel and reinforced concrete method in high rise construction. With several uses and intricate geometry, large and super tall buildings have been a popular architectural type in Mumbai and Kolkata. In tall building structures, composite construction is frequently utilized and, along with concrete and steel construction, forms the mix structure. Based on the findings of the research, the building mix is specifically planned for a given location in order to maximize cost effectiveness. Engineers come up with new sorts of composite construction for walls and columns. The structural level and member level material distribution are more versatile and inventive. However, it is important to thoroughly check the accuracy of computer model analysis. To ensure the success of its implementation, additional studies in composite structure design and construction must be conducted.

Keywords: Composite beam, column, RCC column, RCC beam, Shear Connector, STAAD.Pro V8i Software.

1. INTRODUCTION

The structure of the twenty-first century has progressively entered the realm of composite structure as a result of the quick growth of society, using a range of structural forms, such as "high performance steel + high - performance steel of high performance concrete." As is often known, the composite section of a structural member is made up of regular steel sections and concrete, typically of a higher quality. It takes up less space than concrete parts do. The composite sections of structural components are preferred for high-rise buildings in India because they can withstand significant lateral loads without collapsing. This occurs as a result of the extensive usage of Fe-250 grade standard sections as opposed to Fe-415 & Fe-500 grade of steel, which makes the beam-column joints highly ductile. Rapid urbanization has occurred due to population increase, the development of industrial and commercial activity, and the ongoing migration of rural residents to India's major cities. Therefore, it is clear that the horizontal space restriction is becoming a serious issue for Metros. The construction of numerous multi-story buildings is necessary to take advantage of the situation's maximum vertical space utilization, but the affordability of these buildings for large segments of the population, particularly the middle class in our country, calls for their efficient and economical design. While the idea of cost comparison taking the time value of money into account is widely supported and used throughout the world, notably in South East Asia, it has not yet received the proper consideration in India. Because it has a lower direct construction cost than the alternatives, reinforced cement concrete is widely used in construction in India. INSDAG has been attempting to persuade architects, designers, builders, and government organizations of the value of considering the Life Cycle Cost (LCC) of a structure and the materials they choose for their projects. However, research must be done to find alternate options that will lower direct construction costs while still using modern technology that are already common in industrialized nations. While the idea of cost comparison taking the time value of money into account is widely supported and used throughout the world, notably in South East Asia, it has not yet received the proper consideration in India. Because it has a lower direct construction cost than the alternatives, reinforced cement concrete is widely used in construction in India. INSDAG has been attempting to persuade architects, designers, builders, and government organizations of the value of considering the Life Cycle Cost (LCC) of a structure and the materials they choose for their projects. However, research must be done to find alternate options that will lower direct construction costs while still using modern technology that are already common in industrialized nations. When we look at the scenario of composite construction in India, efforts are underway for making beams in composite construction as evidence by Bureau of Indian Standards introducing a separate code. IS: 11384:1985. There are organisations, which have taken interest in producing metal decking sheet suitable for composite construction.

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2. LITERATURE REVIEW

In 2017, Dr. MD. Subhan researched the current, Although steel and concrete composite sections have been used and discussed all over the world, filled tubular columns need greater consideration. ANSYS software is used to suggest a considerably nonlinear model with appropriate boundary conditions. In order to understand the maximum deformation, load it can withstand, and stress distribution, this work offers a nonlinear finite element study of a concrete-enclosed steel column subjected to reverse cyclic, buckling, and monotonic loading conditions.In 2017, Anamika Tedia1 attempted to use Steel-concrete composite construction refers to the use of concrete to encase steel sections for use as columns and mechanical shear connectors to join the concrete slab or profiled deck slab to the steel beam so that they function as a one piece. For a comparative assessment of a G+5 storey office building with a height of 3.658 meters and located in earthquake zone III (Indore) with a wind speed of 50 m/s, steel-concrete composite with R.C.C. alternatives is taken into consideration. The building's total plan is 56.3 m by 31.94 m. It employs the equivalent static method of analysis. Staad-pro software is used to simulate composite and R.C.C. structures, and the results are compared. It is discovered that composite constructions are more cost-effective.Bin Zeng and Zhenwen Gong, 2017The study's findings demonstrate that the power spectrum of the node displacement response produced under the influence of wind loads can be used to rationally optimize the construction. The aforesaid findings lead to the conclusion that the optimized design based on finite element model has a wide significance, is an effective effort to eliminate design blindness, and has significant engineering value.2017) Tariq M. Nahhas, For modeling and analysis, this study used the ETABS software program. The outcomes differ from the comparisons published for test locations in the USA. Conclusion: For both ELFP and MRSA, SBC base shear is generally larger. The findings, however, cannot be universally accepted as accurate. The same is true for situations that cause overturning. As a result, we are unable to state that SBC is always more conservative than UBC.Chinese city of Shenzhen's Foreign Languages School (2017)In this study, we used the Finite Element Analysis (FEA) method to model a cantilever beam made of a sandwich structure in Abaqus to determine the best design guidelines for reducing stress and displacement when a uniform load is applied. Additionally, we discovered how the core shape affected the displacement and tension in the beam.The CSCC beam (Confined Steel Concrete Composite Beam), which is a concrete beam shuttered with cold formed steel sheet and functions as a composite beam thanks to shear connectors and bracings, was the subject of an experimental investigation by Dr. Chaterjee in 2016. The bond between the sheet and the concrete is taken up by stud shear connectors. The strength and ductility of the system are influenced by the passive confinement provided by the cold formed sheet at the sides and bottom. These beams offer excellent concrete confinement. Eight CSCC beams in all are tested, and the complete behavior of the beams is observed to forecast how the beams will physically respond to three different types of loads such as pure bending, pure torsion and combined bending and torsion. Two point loading was obtained for pure bending. The deformation criteria (deflection, moment and flexural rigidity) are also included in the investigation throughout the entire load history experimentally. The results obtained by the experimental values which are found to be in good agreement.(2016) R Prabhakara, The steel grade was maintained at Fe415 and the concrete grade was M30. The primary mechanism of load slide, load transfer, and shear transfer are overridden by composite action. When designing and building composite buildings, a strong link between the two components must be achieved under flexure-shear. T-shear connections were used to join the steel and concrete portions of this construction project. There were three alternative ways to use T-shear connectors. Two points of loading were used to test the beam specimens. The findings of the experiments also showed a relationship between the composite beams' increased load carrying capacity and the span-to-depth and shear-to-depth ratios.A straightforward computing method is created by K. Sathish Kumar in 2016 to forecast the general behavior of a composite beam with a shear connector under bending. Different shear connector spacing should be taken into account while changing the cold form sheet. Four series of composite beams were tested as part of the experiments. The tests that were conducted were utilized to confirm the theoretical hypotheses and determine the flexural strength of the beams. Concrete cubes and cylinders used as companion specimens underwent tests to determine their elastic modulus and compressive strength. After that, the segment was bent, and a change in behavior was seen. Studying the impact of numerous significant characteristics on composite beams in conjunction with bending is crucial.(2016) Abhishek Sanjay Mahajan The effect of FEC (Fully Encased Composite) on a G+ 20 story special moment frame is presented in the study.In this study, two distinct structures are taken into account for comparison during the seismic analysis. For a G+20 storey structure, linear static analysis and nonlinear static analysis, often known as "Pushover analysis," are performed. Using ETAB software, the building is assessed and designed for seismic loading. The FEMA 36 standards are used to follow the special pushover analysis procedure, and ATC 40 is taken into account for hinge construction. The Base shear, Modal time period, Storey displacement, and Storey drift results for the two structures are compared. Due to the composite's increased lateral stiffness, time and storey displacement studies demonstrate a considerable.

While analyzing for "Non-linear static analysis the performance point for the FEC is significantly much more as compared to the RCC model.Harish M. L. and Vinay N. (2015) The primary mechanism of load slide, load transfer, and shear transfer are overridden by composite action. When designing and building composite buildings, a strong link between the two components must be achieved under flexure-shear. The beam specimens' cracking load, load-deflection behavior, ultimate load, and failure pattern were examined. The experimental results show a 38.09% rise to 214.28% in the load carrying capability of the composite beams. The findings of the experiments also showed a relationship between the composite beams' increased load carrying capacity and the span-to-depth and shear-to-depth ratios. The mid-span deflection at ultimate load for the composite beams was reduced by 50% when compared to control beams. It was observed that, the steel-concrete composite beams failed due to shear- compression failure in the shear span.Smith, K. K. (2015)Bridges and tall buildings frequently use composite constructions as structural elements. These structures are made of a concrete slab and rolled up steel pieces. By employing shear connectors to join the steel section and concrete slab, the composite action is established. The optimal shear connection for a specific composite beam has been determined in this study based on its performance under static load while retaining the loading and the amount of steel in the connector as a common aspect.Priya K. Shanmuga (2015),The strength and ductility of the system are influenced by the passive confinement provided by the cold formed sheet at the sides and bottom. These beams offer excellent concrete confinement. To forecast the physical reaction of the beams under three distinct forms of loading, such as pure bending, pure torsion, and combined bending and torsion, eight CSCC beams in total are tested. For pure bending, two point loading was attained. The examination spans the complete load history empirically, taking into account the deformation criteria (deflection, moment, and flexural rigidity). The outcome of the experiments that is to determined to be in good agreement with the experimental values.(2015) Jeeva K. This project compares the structural behavior of steel and steel-concrete composite structures at four different storey levels, from G+7 (21.35m) to G+10 (30.05m) constructions, using reaction spectrum and pushover analyses. Pushover analysis, a non-linear static analysis, is a common method for assessing the performance of both new and existing structures. It is used to anticipate seismic forces and deformation requirements. The findings show that SRC structures are more flexible and have high longitudinal displacement values; nevertheless, in comparison to steel structures, composite structures have lower longitudinal displacement and drift values along the lateral direction. Maximum displacement and bases shear are reported to occur in G+10 storey steel constructions.2015's G. Augustine Maniraj Pandian2, The aforementioned parameters obtained through pushover analysis and those obtained by linear response spectrum analysis are contrasted. The findings show that SRC structures are more flexible and have high longitudinal displacement values; nevertheless, in comparison to steel structures, composite structures have lower longitudinal displacement and drift values along the lateral direction. Maximum displacement and bases shear are reported to occur in G+10 storey steel constructions.2015's Zhou Wangbao, Li Shu-jin, Through numerical studies, it is discovered that the findings from the suggested method are in good agreement with those from ANSYS. Thus, its accuracy is confirmed, and the following insightful inferences for engineering design can be made. Under dynamic excitation, there are clear shear lag effects in the bottom steel beam plate and top concrete slab. With increased shear connections, this shear lag gets longer. On the period and deflection amplitude of vibration of composite box beams, it has little effect. As the number of shear connections grows, the amplitude of deflection and strains in concrete slabs decrease. However, there is no clear relationship between the effect of shear connections and the period of vibration(2014) Dr. Savita Maru, Steel-concrete composite construction refers to the use of concrete to encase steel sections for use as columns and mechanical shear connectors to join the concrete slab or profiled deck slab to the steel beam so that they function as a one piece.For a comparative assessment of the G+5 storey office building with a height of 3.658 meters and located in earthquake zone III (Indore) with a wind speed of 50 m/s, steel-concrete composite with R.C.C. alternatives is taken into consideration. The building's total plan is 56.3 m by 31.94 m. It employs the equivalent static method of analysis. Using the staad-pro modeling program, composite and R.C.C. structures are modeled, and the results are compared. It is discovered that composite structures are more cost-effective.Erika Mastromarino and Francesco Trentadue (2014)The truss structure supports the precast floor system during the construction phase, and the resisting system is that of a simply supported steel truss. Once the concrete has hardened, the truss structure becomes the reinforcing element of a steel-concrete composite beam, where it is also in a pre-stressed condition due to the loads carried before the concrete has hardened. The impact of the diagonal bars on the bending stiffness of this composite beam is examined within this framework. The evaluation of the equivalent bending stiffness is done first by deriving a closed-form solution. The impact of the geometrical and mechanical properties of shear reinforcement is then investigated. Finally, results obtained from parametric and numerical analyses are discussed.(2014) Hiroshi MutsuyoshiAccording to the test results, all of the composite beams significantly outperformed single HFRP I-beams without a UHPFRC slab in terms of stiffness and strength. To forecast the stiffness and strength of the composite beam, a fibber model was created, and the accuracy of the model was confirmed. The outcomes of the experiment and

the analysis were in good accord. By adding a UHPFRC slab to the top flange of the HFRP I-beam, the high tensile strength of a carbon FRP in an HFRP tensile flange could be employed efficiently, and the delaminating failure of an HFRP compressive flange could be avoided. According to the study, HFRP-UHPFRC beams were successful and could offer bridge structures a competitive, economical, and sustainable alternative.A Praveen and Balaji A Raju Pre-engineered steel buildings are frequently employed in the construction of industrial buildings, according to a 2013 report. The main benefits of these systems are their extremely quick erection times and higher strength to weight ratios. In PEB construction, some elements like slabs and walls are still created on-site. This work develops a composite panel employing cold form steel section to overcome this constraint. A flexure analysis of the panel is conducted experimentally, and the results are also modelled using the finite element approach.(2012, Mohammad S. Qatu1) The majority of the current (2000–2010) research on the static and buckling behavior (including post buckling) of composite shells is reviewed in this work. With an emphasis on the analysis performed (static, buckling, post buckling, and others), complicating effects in both material (such as piezoelectric) and structure (such as stiffened shells), and the many shell geometries (cylindrical, conical, spherical, and others), this review is conducted. The theory being employed (thin, thick, 3D, nonlinear...) is also taken into consideration. However, more information about the hypotheses has been provided in earlier studies.D.Datta(2011), People from less affluent locations flock in large numbers to the metropolises that offer better living conditions, making these metropolises the ones that are most densely populated. Given the limitations on the metros' ability to expand, it is a difficult undertaking to handle such a big number of migrant people, necessitating the construction of tall skyscrapers. Steel-concrete composite construction is an economical choice for high-rise buildings. Direct construction costs are merely an investment, and cost is a term that fluctuates depending on its purpose. When calculating the Net Construction Cost and Life Cycle Cost of the structures, the strength, resilience to wind and earthquake vibrations, Life Expectancy, and enhanced functionality are taken into account.Datta (2010). The cost-effectiveness of steel-concrete composite construction for high-rise buildings is discussed in this research. Additionally, cost is a term that changes depending on its purpose, and direct construction costs are merely an investment. Assessing the Net Construction Cost and Life Cycle Cost of the structures takes into account their functionality, durability, and resilience to wind and earthquake disturbances.KrishnanKanny (2010), Avinash Ramsaroop (2013), The material attributes, material restrictions, and loading circumstances are the program's inputs. The global and local stresses and strains on each layer were calculated using equations for two-dimensional composites based on Hooke's Law. The Tsai-Wu failure theory was used to analyze the structure's failures. The program's output includes the ideal number of fiber layers needed for the composite laminate as well as information about how each layer should be oriented.Rajneesh & Matsu 2005In this study, two distinct structures are taken into account for comparison during the seismic analysis. For a G+20 storey structure, linear static analysis and nonlinear static analysis, often known as "Pushover analysis," are performed. Using the ETAB software, the building is analyzed and designed for seismic loading. The FEMA 36 standards are used to follow the special pushover analysis procedure, and ATC 40 is taken into account for hinge construction. The Base shear, Modal time period, Storey displacement, and Storey drift results for the two structures are compared. Because of the composite's increased lateral stiffness, time and storey displacement findings exhibit a large variation. While analysing for “Non-linear static analysis the performance point for the FEC is significantly much more as compared to the RCC model.A G+ 5 Storied R.C.C., Steel, and Steel-Concrete Composite Building is taken into consideration for seismic performance for earthquake zone III with medium soil by Dharti D. Soni1, Nirav K. Patel2, and others in 1996. The equivalent static method of analysis (IS: 1983–2002) is used to analyze a total of 3 models. Section is chosen using an optimization technique for a practical and affordable design.

3. CONCLUSION

This review paper offers information on many aspects that aid in comprehending aspects influencing composite structure design and analysis. The potential for composites to gain greater ductility has been investigated, along with factors like material selection. Due to the great ductility of steel, composite structures have sections that are more seismically resistant. Steel components may sustain multiple loading cycles before breaking and can be bent in a ductile way without premature failure. The cross-sectional form of the thick steel plate at the bottom has good flexural capacity and ductility, and the stress factor alpha can be enhanced properly in the review. The flexural capacity can be calculated using the simplified plasticity theory. With the aid of a precise finite element model, the maximum vertical displacements over the short and long terms for continuously supported composite beams may also be estimated. It was also revealed how slip and moisture transfer affected the behavior of steel concrete composite beams. On the other hand, researchers found that natural networks may be used on composite building models with success. Steel concrete composite beams and bridges are the main applications for conventionally headed shear connectors. However, in recent years, investigations on new kinds of shear connectors have been conducted and they are being

employed more frequently. According to studies, epoxy adhesive can be successfully employed as a connector substitute in composite construction.

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