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A Review Article on Comparison Between Rcc And Composite Materials In Multi Storey G+2 Building

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Abstract **-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. 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.**

Keywords- **Comparative Study, Composite, Comparison Aspects, Drift, Lateral Acceleration, Base Shear, Mass Irregularity, Overturning Moment.**

I.INTRODUCTION

Low rise buildings were generally selected in India as common option but now a days in India population is rapidly increasing and due to that the requirement of construction of medium and high-rise buildings is also increasing. Reinforced concrete members are mostly used in framing system because this system is most convenient and economical for low rise buildings.

But for medium and high-rise buildings this type of structures are no longer economical because of hazardous form work, less stiffness, span restriction, and increased dead load. Composite structure can be suitable in that case. Composite construction is having wide range of scope. It is very necessary to select suitable type of building as per requirement of owner as well as construction site. [1] As compared to other developing countries the use of steel for construction purpose is very less in India. Steel structural members are prone to local and lateral buckling.

Concrete structural members are generally thick and less likely to buckle but they are subjected to creep and shrinkage with time. Steel is more ductile material and so it can absorb more shocks and impact loadings. Thus, composite structure is made to take the benefit of both of the materials. It is shown that the performance of building during an earthquake depends upon several factors like stiffness, ductility, lateral strength and simple and regular configuration. So to come on a final decision of comparison all three types of buildings should be compared by displacement, base shear, storey drift and lateral force. [2]

II. COPOSITE MULTISTORIED BUILDINGS

The primary structural components use in composite construction consists of the following elements.
1. Composite slab
2. Composite beam
3. Composite column
4. Shear connector

A sandwich structure is a fabricated material that consists of two thin, stiff facing sheets joined to either side of a low density core material or structure. The separation of the facings by a lightweight core acts to significantly increase the second moment of area (and hence the bending stiffness) of the material cross-section with only a small increase in weight [1].

This construction is often used in lightweight applications such as aircrafts, marine applications, wind turbine blades, industrial platforms and floors. The face sheets of sandwich panels provide structural stiffness and protect the core against damage and weathering. During loading, the face sheets take both compressive and tensile loads and core is subjected to shear loads between the faces, thus providing high bending stiffness. Sandwich structures are used in applications requiring high stiffness to weight ratios, since for a given weight, the sandwich

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structures has a much higher moment of inertia compared to solid or I-beam structures [2]. A wide range of materials can be used for sandwich facings and cores. Common facing materials include metals (e.g. Steel or Aluminium) and composite (e.g. fiberreinforcedpolymers). Common core materials or structures include metallic stiffeners, foams (polymer or metallic), honeycombs and balsa wood. The core-to-facing joint is nor ally achieved through adhesive bonding or welding. Figure 1. shows some sandwich structure configurations [3].

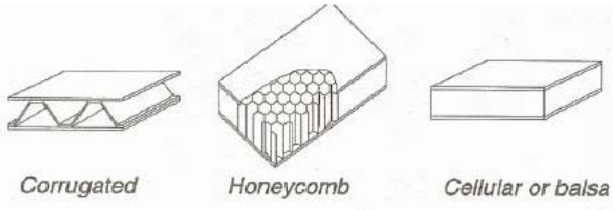

Fig.1 Typical sandwich configurations.

The core of a sandwich structures can be of almost any material or architecture, but in general, cores fall into four types.

III.COMPOSITE STRUCTURES

The structures in which composite sections made up of two different types of materials such as steel and concrete are used for beams, and columns. This paper includes comparative study of R.C.C. with Steel Concrete Composite (G+2) story buildings which situated in Indore earthquake zone II and wind speed 44m/s. Equivalent Static Method of Analysis is used. For modeling of Composite & R.C.C. structures, STAAD-Pro software is used and the results are compared. Comparative study includes deflection, axial force and shear force, bending moment in column and beam, cost. It is found that composite structure is more economical and speedier than R.C.C structure.

IV. LITERATURE REVIEW

Prof. Dr. M. Abdel Salam & Dr. Nadia E. Bondok (2015) A generalizes model presenting the sandwich beams was developed to calculate the flexural rigidity and sandwich beams dynamic characteristics.

Different cases such as sandwich beams multi layer cores, sandwich beams multi cells, sandwich beams with holes in its cores having different shapes and different orientations were investigated. The finite element code ANSYS 11 was used for free vibration analysis of the sandwich beams; the natural frequencies and mode shapes and the static deflection of the sandwich beams were calculated. There are many wide varieties of core materials geometry currently in use. Among them, honeycomb, foam, balsa and corrugated cores are the most widely used. Usually honeycomb cores are made of aluminum or of composite materials: Nomex, glass thermoplastic or glass-phenolic. The other most commonly used core materials are expanded foams, which are often the most to achieve reasonably high thermal tolerance, though thermoplastic foams and aluminum foam are also used.

A generalized model is developed. The model is able to investigate the effect of the number of cores, multi cells, and the holes shape and their orientation w.r.t. the beam axis on the static rigidities, natural frequencies and hence on the dynamic properties of the sandwich beams. The finite element code ANSYS 11 was used for free vibration analysis, the natural frequencies, mode shapes and the static deflection of the sandwich beams are calculated. The investigation revealed that the static and dynamic responses of the sandwich beams can be adjusted the increasing of the number of cores or the number of cells.

Mahmadsabee (2015) STAAD and ETAB are the present-day leading design software's in the market. Many design Companies using this ultimate encoded software. Consequently, this venture development of the project mainly deals with the virtual analysis of the results obtained commencing the design of concrete frame multi-story structure when designed using STAAD and ETAB software separately. In these modern days the Buildings are made to fulfil our basic aspects and better Serviceability.

IshaBedi, Girish Sharma (2017) An RCC framed structure is basically an assembly of slabs,beams,columns, and foundation inter-connected to each other as a unit.The load transfer, in such a structure, takes place from the slabs to the beams,from the beams to the columns and then to the lower columns and finally to the foundation which in turn transfers it to the soil. However, for a load bearing structure, the loads are directly transferred to the soil through the walls that are designed to specifically carry the loads. Since brick is weak in compressive strength in comparison to 1:2:4 cement concrete, the width of load bearing walls for buildings having more than four storeys become abnormally thick and for such cases, framed structures are designed.

The floor area of an R.C.C framed structure building is 10 to 12 percent more than that of a load bearing walled building. Hence, there is an actual economy in case of RCC framed structures, especially where the cost of land is very high. We proposed to analyze and perform acomparative study of RCC Frame Structures using Staad.Pro, ETABS, and SAP. From the proposed research analysis, we conclude that Staad.Pro is much more efficient. The values of force derivative are low as Compared to ETABS and SAP

Zhi-jia Zhang Bin Han (2017) The vibration performance of sandwich beams with honeycomb-corrugation hybrid cores was investigated in this paper. The method of homogenization was employed to obtain the equivalent macroscopic stiffness of honeycomb-corrugation hybrid cores. Finite element methods and modal analysis techniques have been used to predict their vibration characteristics (i.e. their natural frequencies and mode shapes). It is shown that in most cases the predictions by using the equivalent homogenization model (2D model) agree well with the experimental and three-dimensional finite element calculated results.

Modal testing was performed on sandwich beam under clamed-free boundary condition. The first three natural frequencies and the corresponding mode shapes of sandwich beam were reported. Experimental equipment consisted of an impact hammer, a B&K type accelerometer, a charge amplifier, a clamping system and a LMS-Test-Lab modal analysis system as shown in . The experiment was carried out by multi-point excitation and single point measurement.

The equivalent elastic constants of equivalent model of honeycomb-corrugation hybrid core have been derived employing the homogenization method. The equivalent model (2D numerical model) has been used to predict the vibration characteristic of sandwich beams. In comparison with results obtained by using 3D numerical model and experimental tests, the equivalent model can give acceptable predictions for mode analysis of sandwich beam with honeycomb-corrugation hybrid cores. Moreover, it was found the filling honeycomb had an effect on weakening the anisotropy of the stiffness and suppressing the local mode shape for sandwich beam.

Vidhya Purushothaman, Vineetha Guruprasad (2018) Sandwich beams are composite systems having high stiffness-to-weight and Strength-to weight ratios and are used as light weight load bearing components. The use of thin, strong skin sheets adhered to thicker, lightweight core materials has allowed industry to build strong, stiff, light, and durable structures.

In this Section describes the methodology of the thesis work..The methodology includes study of sandwich beam and ANSYS software. The whole thesis work is divided into the following sequential steps. The following flowchart represents the methodology of the thesis work to be completed. Sandwich beam is analysed in ANSYS software and the results where compared. This section represents the validation result of finite element model for the visco elastic rubber core sandwich beam with 0.03m hick core. The following conclusions are obtained from the study using of steel-rubber-steel specimen are, Based on the deformation; Truss core is more better which have low deformation, Based on the vibration; Circular core produces an effective responses

P. Bangarubabu, et.al. Studied the effectiveness of the sandwich structures; the effects of distributed viscoelastic layer treatment on the loss factors are studied. The dynamics of bare beam with free and constrained viscoelastic layers are investigated. The viscoelastic layer is bonded uniformly on the beam. Frequency dependent young's modulus and loss factors are considered in the model of viscoelastic material. From the experiments it is observed that beams with constrained viscoelastic layer provide higher loss factors than free layer. The dynamics of sandwich beams is modeled using hexahedral element (3-D element). The predicted Eigen frequencies obtained from the model are compared with the experimental results in cantilever boundary condition using free and constraint layers. Modal strain energy approach is used to predict loss factors. Results show that higher loss factor is obtained using constrained viscoelastic layers.

Recently, Hsueh et al. studied the biaxial strength of thin multilayered disks. An analytical Model of general closed-form solutions is developed for the elastic stress distributions subjected to biaxial flexure tests. studied the designs of hierarchical cellular sandwich beams and plates with high structural efficiency. Based on experimental tests of cellular plates with different densities of porosity and different hole arrangements over the cross-section, the measured results of effective elastic constant related to the bending stiffness showed a good agreement with the shape factors and material indices. Alternatively.

Wang and McDowell and Hayes et al. studied extruded metal honeycombs, i.e., the so-called linear cellular alloys (LCA).The first work was focused on the maximization design of elastic torsion and bending rigidities of the circular sandwich bar structure in terms of the triangular subcell geometry of the sandwich core while the second work was to understand the heat transfer and mechanical behaviors.

M. R. Doddamani, et.al. Studied the dynamic analysis of jute-epoxy sandwiches with fly ash reinforced functionally gradient (FG) flexible, compliant rubber core is presented. By using conventional casting technique FG samples are prepared. Presence of gradation is quantified by weight method. He studies the influence of fly ash weight fraction, jute orientation and core to total thickness (C/H) of sandwich on damping ratio (DR) and natural frequency (NF).

Dr.P.S. SenthilKumar studied the damping characteristics of Hybrid polymer composite, which can be used in many applications and in engineering structures. The study aims to characterize the mechanical and damping properties of prepare a glass-epoxy composite with addition of carbon (600mesh) fillers with different weight fractions. By using Hand lay-up and vacuum bag molding technique, the carbon filler are reinforcement and fabricated. By using free and forced vibration test with different amplitudes the damping characteristics were evaluated. The result indicates that with increase in weight percentage of carbon reinforcement content the damping characteristics improved. Further it was found that glass fiber –epoxy matrix with 5% carbon particles better damping properties which can be used for structural application.

Y. Mohammadi et.al. Studied the free vibration analysis of sandwich plates with power-law FG face sheets. By considering the in-plane stresses of the core, the high-order sandwich plate theory is improved. The equations of motion are reduce from twenty three equations to eleven equations by using a new approach and then solve them. Both unsymmetrical and symmetric sandwich plates are considered in this analysis. Good agreement is found between theoretical predictions of the fundamental frequency parameters and the results obtained from other references for simply supported sandwich plates with functionally graded face sheets. The results also revealed that as the side-to-thickness ratio and the core-to-face sheet thickness ratio affect the fundamental frequency parameters significantly.

M Siva Prasad et.al. Studied that Sandwich beams are composite systems used as light weight load bearing components having high stiffness-to-weight and Strength-to weight ratios. The use of thin, strong skin sheets adhered to thicker, lightweight core materials has allowed industry to build strong, stiff, light, and durable structures. Due to the use of viscoelastic polymer material, sandwich beams can exhibit time-dependent behavior. This study examines the behavior of sandwich beams from by the viscoelastic rubber core. Finite element (FE) method is used to analyze the overall transient responses, harmonic responses and the static responses of the sandwich systems subject to a concentrated point load at the mid span of thebeam.

V.N. Burlayenko and T. Sadowski studied that for analyzing of the dynamic response of sandwich plates with partially damaged face sheet-to-core interface a finite element model has been developed. Damaged detached at the interface is taken into account for simulation of sandwich plates,, vibrations for understanding the effect of intermittent dynamic contact between the fragments. By using the ABAQUS/ Explicit code, Transient and forced dynamic responses of the sandwich plates damaged by debonding have been obtained. The influence of the local strongly nonlinear contact behavior on the global dynamics of the sandwich plates is examined.

Ebrahim Sadeghpour et.al. Studied that the free vibration response of a de bonded curved sandwich beam by using a high order theory. The Rayleigh-Ritz method and the Lagrange's principle are employed to derive and solve the governing equations. Since the real contact condition at the de bonded region is nonlinear, two linear with contact and without contact‖ models are employed.

Sudhakar R et.al. Studied that for the free vibration analysis of composite and sandwich arches a higher- order refined model with seven degrees of freedom per node is developed. As the cross-sectional warping is accurately modeled by this theory, it does not require any shear correction factor The strain field is modeled through cubic axial, cubic transverse shear and linear transverse normal strain components.

Vidhya Purushothaman Sandwich beams offer designers a number of advantages, as the high strength to weight ratio, flexibility, high bending and buckling resistances. Sandwich construction results higher natural frequencies than none sandwich constructions, also it developed an adaptive tuned vibration absorber. In the present work, the natural frequencies and mode shapes of the sandwich beam structure are calculated under different core configuration and different core materials. Finite element (FE) method is used to analyze the beam. Sandwich beams are composite systems having high stiffness-to-weight and strength-to weight ratios and are used as light weight load bearing components. The use of thin, strong skin sheets adhered to thicker, lightweight core materials has allowed industry to build strong, stiff, light, and durable structures.

There is a recent developments and successful applications of sandwich beams for structural engineering and construction. These include fibre composite railway sleepers, composite walers, and fibre composite replacement bridge girders. Sandwich beam is subject to a concentrated point load at the mid span of the beam. A systematic procedure is presented for comparing the relative performance of sandwich beams with various combinations of materials in the beam using ANSYS software.

V. ADVANTAGES OF COMPOSITE BEAMS

- Keeping the span and loading unaltered, more economical steel section in terms of depth and weight) is adequate in composite construction compared with conventional non-composite construction.
- Encased steel beam sections have improved fire resistance and corrosion.

- It satisfied requirement of long span construction a modern trend in architectural design.
- Composite construction is amenable to fast track construction because of use of rolled steel sections. 5. Composite sections have higher stiffness than the corresponding steel sections and thus the deflection is lesser.
- Permits easy structural repairs/ modification.
- Provides considerable flexibility in design and ease of fabrication.
- Enables easy construction scheduling in congested sites.
- Reduction in overall weight of the structure and there by reduction in foundation cost.
- Suitable to resist repeated earthquake loading which requires high amount of resistance and ductility [4][5][6][7].

VI.THE ADVANTAGES OF COMPOSITE COLUMNS

- Increased strength for a given cross sectional dimension.
- Increased stiffness, leading to reduced slenderness and increased bulking resistance.
- Good fire resistance in the case of concrete encased columns [8].
- Corrosion protection in encased columns.
- Significant economic advantages over either pure structural steel or reinforced concrete alternatives.
- Identical cross sections with different load and moment resistances can be produced by varying steel thickness, the concrete strength and reinforcement. This allows the outer dimensions of a column to be held constant over a number of floors in a building, thus simplifying the construction and architectural detailing.
- Erection of high rise building in an extremely efficient manner.
- Formwork is not required for concrete filled tubular sections [9][10][11][12].

VII. CONCLUSION

Analysis and design of four various building can be done and comparison can be made between them and from that result conclusions can be drawn out are as follows: -

1. In case of a composite structural system because of the lesser magnitude of the beam end forces and moments compared to an R.C.C system, one can use lighter section in a composite structure. Thus, it is reducing the self-weight and cost of the structural components.
2. The downward reaction (Fy) and bending mome'nt in other two direction for composite structural system is less. Thus one can use smaller size foundation in case of composite construction compared to an R.C.C construction.
3. Under earthquake consideration because of inherent ductility characteristics, steel-concrete composite structure performs better than a R.C.C structure.
4. In the cost estimation for building structure no savings in the construction time for the erection of the composite structure is included.
   As compared to RCC structures, composite structures require less construction time due to the quick erection of the steel frame and ease of formwork for concrete. Including the construction period as a function of total cost in the cost estimation will certainly result in increased economy for the composite structure.
5. The cost comparison reveals that steel-concrete composite design structure is more economical in case of high rise buildings and construction is speedy.

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