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Review on Performance Analysis of Steel Concrete Composite Section

Mr. BhushanVilas Kale[1]
Student, M.E,
Dept. of Civil Engineering, KJ Educational Institutes,
KJ College of Engineering and Management Research, Pune

Prof. Undre A. R.[2]
Professor,
Dept. of Civil Engineering, KJ Educational Institutes,
KJ College of Engineering and Management Research, Pune

Prof. Pujari A. B.[3]
Assistant Professor,
Dept. of Civil Engineering, KJ Educational Institutes,
KJ College of Engineering and Management Research, Pune

***Abstract*—Buildings in high-seismic areas must be designed with particular attention to their lateral stability during extreme earthquakes. Nonlinear phenomena in structural mechanics such as nonlinear material behaviour, large deformations or contact problems have become standard modelling tasks. Because of a rapid development in the hardware sector resulting in more and more powerful processors together with decreasing costs of memory it is nowadays possible to perform simulations even for models with millions of degrees of freedom. In a mathematical sense the finite element solution always just gives one an approximate numerical solution of the considered problem. Sometimes it is not always an easy task for an engineer to decide whether the obtained solution is a good or a bad one. If experimental or analytical results are available it is easily possible to verify any finite element result. However, to predict any structural behaviour in a reliable way without experiments every user of a finite element package should have a certain background about the finite element method in general. In addition, he should have fundamental knowledge about the applied software to be able to judge the appropriateness of the chosen elements and algorithms.**

Keyword: FEM, Composite, RCC

I. INTRODUCTION

The use of composite structures is increasingly present in civil construction works. Steel-concrete composite beams, particularly, are structures consisting of two materials, a steel section located mainly in the tension region and a concrete section, located in the compression cross-sectional area, both connected by metal devices known as shear connectors. One type of these connectors is called head studs as The main functions of these studs are to allow for the joint behavior of the beam-slab, to restrict longitudinal slipping and uplifting at the elements interface and to take shear forces. Double steel-concrete composite continuous beam is a new structural system developed on the basis of single steel concrete one, in which there is also a bottom reinforced concrete slab connected to a steel profile in the negative moment regions through the head studs, therefore with two interfaces. Comparing with the traditional single steel-concrete composite continuous beam, its advantage is that effectively limits the crack width of the negative moment area, and also improves the stress state of section, so that it is suitable to the composite continuous beam with a larger span. The mechanical properties of the double composite beam obviously depend on their respective properties and interactions. In the negative applied.

bending moment area, the concrete slab cracks under tension and then the interface slip occurs between steel profile and concrete slab, with non-linear features, it makes great impact on the structure of the internal forces and deformation. Therefore, it is necessary to present a finite element model to study the mechanical properties of the double steel-concrete composite beam in negative moment regions.

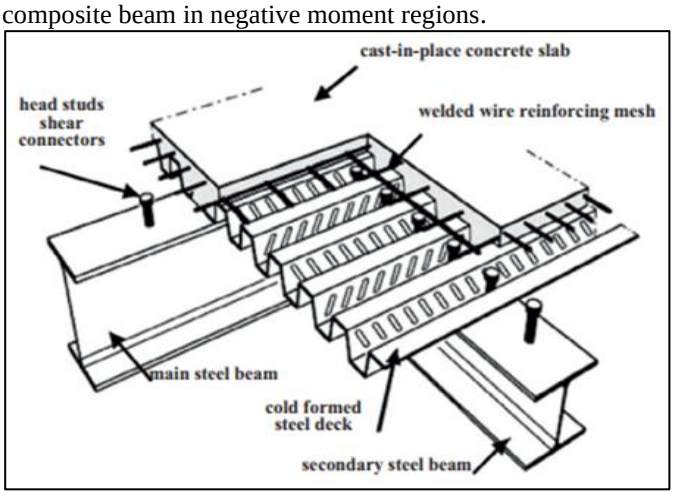

Fig 1 Composite Structure with Metal Decking

II. STATE OF DEVELOPMENT

Qing Quan Liang et.al. (2005) The verified finite element model is than employed to quantify the contributions of the concrete slab and composite action to the moment and shear capacities of composite beams. The effect of the degree of shear connection on the vertical shear strength of deep composite beams loaded in shear is studied. Design models for vertical shear strength including contributions from the concrete slab and composite action and for the ultimate moment–shear interaction is proposed for the design of simply supported composite beams in combined bending and shear. The proposed design models provide a consistent and economical design procedure for simply supported composite beams.

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Atif M. Abdel Hafez et.al. (2012) This paper presents the behavior of simply supported concrete-steel composite beams with corrugated web under vertical loads using the commercial finite element (FE) software ANSYS. The three-dimensional (FE) model is used to simulate the overall flexural and shear behaviour of simply supported composite beams with corrugated web subjected to vertical loads. This study covers: load deflection behavior and load strain curve. The reliability of the model is demonstrated by comparison with experimental results test carried out by author and others. Two identical composite beams with corrugated web were tested to failure under vertical loads. The comparison shows good agreement. A parametric study was undertaken using the validated model performed using finite element program. The parametric analysis was executed to study the effect of web thickness on the behaviour of concrete-steel composite beam under vertical loads.

David Leaf and Jeffrey A Laman (2013) This paper presents laboratory test results and analyses the ultimate flexural strength of the tested composite beams using currently available methods and compares to observed behaviour. Additionally, simplified finite element models of the composite beam were developed with results also compared to the data obtained from the tests. Based on the results of these analyses, recommendations for design are made that allow accurate determination of composite beam flexural strength.

Shweta A. Wagh, and Dr. U. P. Waghe (2014) The use of steel in construction industry is very low in India compared to many developing countries. There is a great potential for increasing the volume of steel in construction, especially in the current development needs India and not using steel as an alternative construction material and not using it where it is economical is a heavy loss for the country. In this paper study of Four various multi-storeyed commercial buildings i.e. G+12, G+16, G+20, G+24 are analysed by using STAAD-Pro software. Where design and cost estimation is carried out using MS-Excel programming and from obtained result comparison can be made between R.C.C and composite structure.

Dr. D. R. Panchal (2014) In the present work, a simplified method of composite slabs, beams and columns design is used and software is developed with pre- and post- processing facilities in VB.NET. All principal design checks are incorporated in the software. The full and partial shear connection and the requirement for transverse reinforcement are also considered. To facilitate direct selection of steel section, a database is prepared and is available at the back end with the properties of all standard steel sections. Screen shots are included in the paper to illustrate the method employed for selecting the appropriate section and shear connectors and thus to verify the design adequacy.

EhabEllobody and Ben Young (2014) This paper presents an investigation on behaviour and design of composite beams with stiffened and unstiffened web openings. The composite beams were simply supported and had profiled steel sheeting oriented transversely to the steel beams. Nonlinear 3-D finite element models were developed to analyse the inelastic behaviour of composite beam components comprising the steel beam, concrete slab, profiled steel sheeting, headed stud shear connectors, reinforcement bars as well as interfaces among these components. In addition, the load-slip characteristic of the headed stud shear connectors in composite slabs with profiled steel sheeting were carefully incorporated into the finite element models. The finite element models of the composite beams have been validated against published experimental results.

Prof. Vijay S Sawant et.al. (2015) In present study, literature work of comparison of steel and concrete composite building frame work by different researchers in seismic performance. The composite connections are consider in all four cases, as beam in RCC to column in steel, column in RCC to beam in steel , beam and column both in RCC and also both in Steel. Equivalent static method and Response Spectrum method will be used for analysis. Also same modules compared on SAP 2000 software. Cost effectiveness based on material cost for all types of building frames will be determined. Comparative study concludes that the composite frames will be best suited among all the four types of constructions in terms of material cost benefit added with better seismic behaviour.

Anju.T and Smitha. K. (2015) Composite structures consisting of concrete slab and rolled up steel sections are widely used structural members in bridges and high rise buildings. The composite action is established by connecting the concrete slab and the steel section by using shear connectors. In this paper, four different types of shear connectors have been analyzed and the best connector for a particular composite beam has been evaluated based on its performance under static load keeping the loading and the amount of steel in the connector as a common aspect.

Li Xiayuan et.al. (2015)the paper is devoted to the behaviour of steel-concrete beam with Hybrid Full Web and Truss system subjected to four-point loading mode. Steel-concrete composite beam with HFWT system was investigated both experimental and computational using finite element technic. In the finite element analysis, test specimens was modelled using finite element software ABAQUS and a non-linear analysis was performed. A large amount of Finite element models were built. The effects of the shear span ratio the angle *a* between lateral truss plane and vertical plane in cross section; the angle *b* between inclined truss and vertical plane in longitudinal plane were reported. A shear strength equation that considers the shear contribution of the concrete flange and the shear strength provided by the web of the steel beam and inclined truss system is proposed.

Richard Frans et.al. (2017) Nowadays, castellated beam becomes popular in building structural as beam members. This is due to several advantages of castellated beam such as increased depth without any additional mass, passing the under floor service ducts without changing of story elevation. However, the presence of holes can develop various local effects such as local buckling, lateral torsional buckling

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caused by compression force at the flange section of the steel beam. Many studies have investigated the failure mechanism of castellated beam and one technique which can prevent the beam fall into local failure is the use of reinforced concrete slab as lateral support on castellated beam, so called composite castellated beam. Besides of preventing the local failure of castellated beam, the concrete slab can increase the plasticity moment of the composite castellated beam section which can deliver into increasing the ultimate load of the beam

Tiejiong Lou et.al. (2019) This paper evaluates the flexural performance and quantifies the secondary moments in two-span prestressed steel-concrete composite beams. A nonlinear model capable of simulating the full-range nonlinear behavior of continuous prestressed composite beams is validated against experimental results. A parametric numerical investigation is then conducted to examine the effectiveness of strengthening a continuous steel-concrete composite beam with external tendons of different cross section areas. In addition, secondary moments in continuous prestressed composite beams having different tendon layouts under symmetrical and unsymmetrical loads are investigated. The results indicate that external prestressing not only increases significantly the ultimate load carrying capacity but also improves the moment redistribution ability of continuous steel-concrete composite beams. Moreover, the analysis shows that significant secondary moments are present in continuous prestressed composite beams throughout the loading history. It is therefore necessary to consider secondary moments in the strength design of this structural typology

III. CONCLUSION

This paper focuses only on the literature review of previously published studies. The findings of this studyThe composite action is established by connecting the concrete slab and the steel section by using shear connectors.There are different types of shear connectors can be use andfind the best connector for a particular composite beam can be evaluate based on its performance under static load keeping the loading and the amount of steel in the connector as a common aspect.For further study to analysesbehavior of the connections and design parameters of composite members used in composite sections for different configurations under seismic loading conditions.

IV. REFRENCES

[1] Q.Q. Liang 2005 “Strength Analysis of Steel–Concrete Composite Beams in Combined Bending and Shear” Journal of Structural Engineering, 131(10),1593-1600.
[2] Atif M. Abdel Hafez, M.M. Ahmed, A.S. Alamary, A.M. Mohmoud 2012 “Behaviour of simply supported composite concrete steel beam with corrugated web under vertical loads” Journal of Engineering Sciences, Assiut University, Vol. 40, No 1, pp.93-108
[3] David Leaf and Jeffrey Laman. 2013 “Testing and analysis of composite steel concrete beam flexural strength “ International journal of structural and civil engineering research . Vol. 2, No. 3
[4] Shwetawagh and, Dr. U. P. Waghe. 2014 “Comparative Study of R.C.C and Steel Concrete Composite Structures” International Journal of Engineering Research and Applications Vol. 4, Issue 4, pp.369-376
[5] Dr. D. R. Panchal 2014 “Advanced Design of Composite Steel-Concrete Structural element” International Journal of Engineering Research and Applications Vol. 4, Issue 7(Version 2), pp.124-138
[6] EhabEllobody and Ben Young 2014 “Behaviour and Design of Composite Beams with Stiffened and Unstiffened Web Openings” Advances in Structural Engineering Vol. 18 No. 6 2015 893
[7] Prof. Vijay S Sawant, Prof. Yogesh R Suryawanshi, Aniket V Renavikar. 2015 “Survey on Comparison of Steel and Concrete Composite Beam Column Connections” International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 4,
[8] Anju. T, Smitha. K .K 2015. “Finite Element Analysis of Composite Beam with Shear Connectors” International Conference on Emerging Trends in Engineering, Science and Technology pp.179 – 187
[9] Li Xiayuan, Wan Shui, Zhang Jiandong, Liu Wenjuan Zhang Fengping 2015 “Shear capacity of steel-concrete composite beams with Hybrid Full Web and Truss System” 4th International Conference on Sustainable Energy and Environmental Engineering. Pp.171-175
[10] Richard Frans1, Herman Parung, AchmadBakriMuhiddin, and Rita Irmawaty. 2017 “Finite element modelling of composite castellated beam” MATEC Web of Conferences 138, 02009 , DOI: 10.1051/201713802009
[11] Tiejiong Lou, Theodore L. Karavasili. “Numerical assessment of the nonlinear behavior of continuous prestressedsteel-concrete composite beams” Science Direct, Engineering structures 190,116/127

IS CODES:

i. ***IS 456 : 2000*** *-Plain and Reinforced Concrete Code of Practice. - BUREAU OF INDIAN STANDARDS, NEW DELHI.*
ii. ***IS 3935:1966*** *– Code of PracticeFor Composite construction.*
iii. ***IS 11384:1985*** *– Code of PracticeFor Composite constructionin structural steel and concrete.*
iv. ***IS 800 : 2007*** *- Code of PracticeGeneral construction in steel*

AUTHOR PROFILE

Student, M.E, Dept. of Civil Engineering, KJ educational institutes, KJ college of engineering and management research, Pune