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Research Article

ANALYSIS AND DESIGN OF RESIDENTIAL BUILDING WITH TRANSFER SLAB

MAHENDRA PRATAP SINGH[1*], GOPINATH S[2], SATISH GOUD[1], ABHILAKH KUMAR SINGH[1] AND VIJAY KUMAR P[1]

[1]Undergraduate students, B. Tech Civil Engineering, SRM University, KTR campus, India 603202

[2]Assistant Professor (O.G), Department of Civil Engineering, SRM University, KTR campus, India 03202

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ABSTRACT

Transfer slab is the kind of frame in which upper storey column are directly supported over the slab or from which picked up columns may be started where there are no columns underneath. By using this technique the overall cost of the building can be reduced and excess stories can be constructed in the same height of the building due to eliminations of beams and same columns in the foundations or upper stories . This technique will allow to use more area with cheaper formwork . The purpose of this paper is to get better understanding about the Transfer slab analysis and design. The residential building model is analyzed using the software STAAD.PRO V8i .IS codes like IS456-2000, ACI-318-08 are used for guidelines.

INTRODUCTION

In today's modernizing world construction field has grown a lot and due to this a new concept of vertical city has been in the limelight for more than 100 years and the design feature also describe the prosperity and richness of a locality in recent 20 years a new advanced feature has been involved in design known as transfer slab. It is a planer structure which reduces the dead weight and also eliminate beams which helps in enhancing floor area. (Mohana and Kavan, 2015).

Transfer slab can be supported on walls or directly over the columns. It mostly act as a flexural member and design is similar to beams. Transfer slab are economical as they have no beams and hence reduced the height of the structure by 10-15%. This technique is the one of the rapidly developing technology in India . Material advanced, Improvement in quality of construction, easierdesign and numerical technique has helped a lot in rapid growth in India (Patel and Dubey, 2016).

The Transfer slab system is a special structure form of a reinforced concrete construction, using transfer slab the construction of the building is easier, architectural flexibility, economical and height of the building can be reduced by eliminating beams. Due to the absence of deep beams transverse stiffness is low, this cause damage of non-structural members when subjected to earthquake loads (Lande and Raut, 2015). Transverse slab is the reinforced concrete slab supported on columns, this type of system is used where more space is required like auditorium, parking etc. This is more flexible then traditional normal system, in this Transfer slab with drop and head is good combination to reduce moment with less thickness of the slab (Sawant, 2016). As a floor system plays an important role in overall cost of the building by reducing thickness of each structural floor, a post-tensioned floor system is invented which reduces construction time and cost. Post-tensioned

***Corresponding authors email: mahendrapratapsingh1206@gmail.com; gopinath.gusto@gmail.com**

concrete is a method of producing pre-stressed concrete, masonry and other structural elements the tension pre-stressing which means including internal force into a concrete (Bahoria and Parbat, 2013). Flat-slab is a slab provided without beam resting directly on supports like columns or walls. Design and analysis of transverse slab is difficult to compare to normal building (Patil and Sigi, 2014). Transverse slab is directly supported on concrete column, these are generally employed for architectural reasons for large rooms like auditorium, showroom, theatre, where column free space is required, by this system cracks may form in concrete due to bending moment and shear force develops near the column which causes failure of transverse slab, so need to provide drop panel above the column (Deshpande, *et al.*, 2014). The loads of the horizontal system i.e., gravity and dead load is transmitted to the vertical framing system, where vertical framing system are generally subjected to axial compression (More and Sawant, 2015). In this process, the floor system is subjected primarily to flexure and transverse shear, where as the vertical frame elements are generally subjected to axial compression, often coupled with flexure and shear. RC slabs with long spans extended over several bays and only supported by columns, without beams known as transfer slab. transfer slab system is very simple to construct and is efficient in that it requires the minimum building height for a given number of stories. In general, in this type of system, 100 percent of the slab load has to be transmitted by the floor system in both directions (transverse and longitudinal) towards the columns. The construction is simple and economical because of the simplified form work, the ease of placement of reinforcement. The plain ceiling gives an attractive and pleasing appearance; in absence of beams, provision of acoustical treatment is easy. In general transfer slab construction is economical for spans up to 10m and relatively light loads. Compare to the RCC less self weight, which results in reduced dead load, which also has a beneficial effect upon the columns and foundations. A transfer slab made of reinforced concrete slab and it is directly supported by concrete columns and not required to used intermediate beams.

The aim of our paper is to analyze and design a

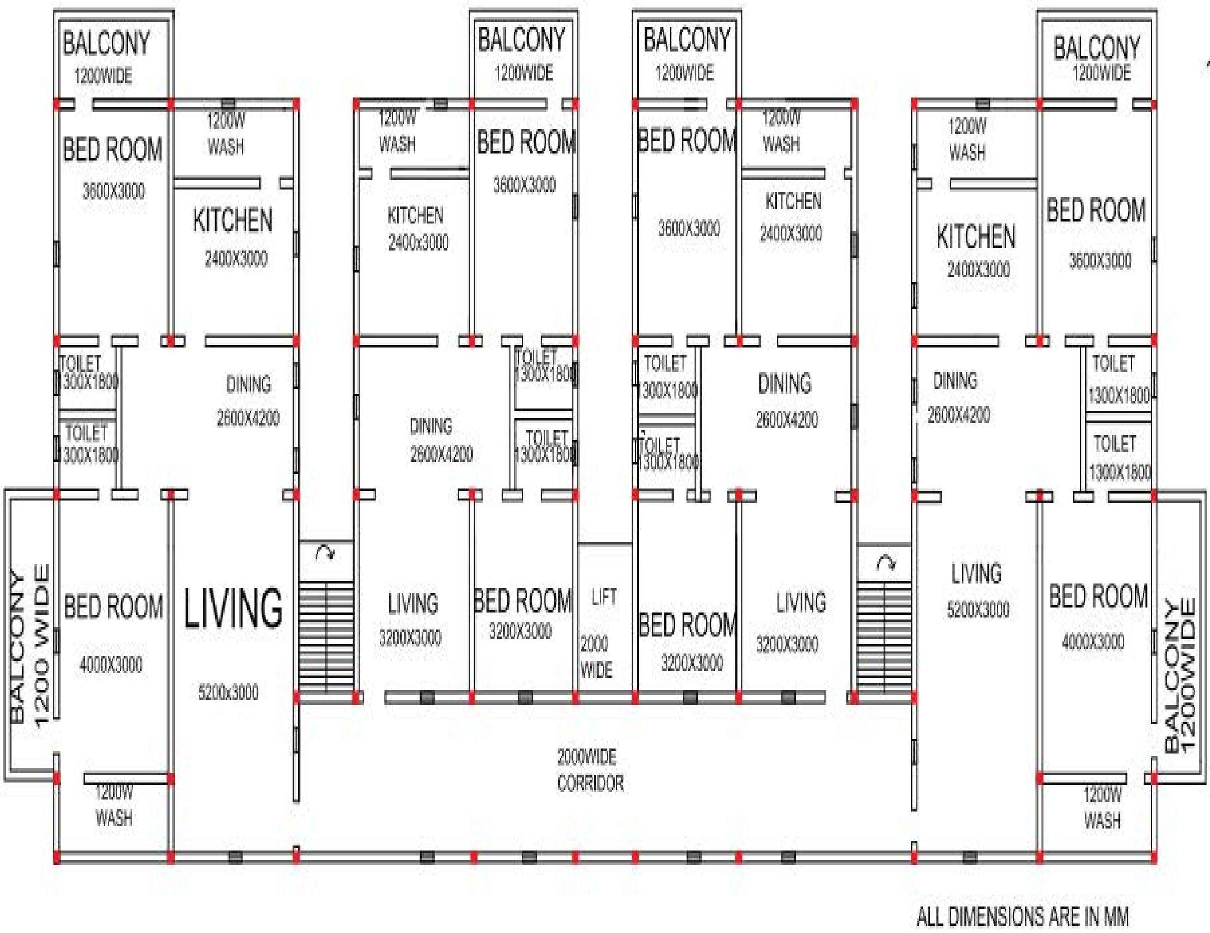

Fig. 1 Modelling.

building with Transfer slabs instead of conventional building type with regular structural components. It is designed by using M30 grade concrete and Fe415 steel. Analysis & Design of the building with Transfer slab is done by using STAAD.ProV8i software. The benefits of choosing transfer slabs include a minimum depth solution, speed of construction, flexibility in the plan layout (both in terms of the shape and column layout), a flat soffit (clean finishes and freedom of layout of services) and scope and space for the use of flying forms.

METHODOLOGY

With reference to the National Building Code, plan for the building is made, and two models are made in Staad.ProV8i. One model with beams and columns in all floors (typical) is made and analyzed for with reference to IS. From the results load acting on the top two stories have been found out and the same is applied as concentrated load in the next model which excludes eight columns in top two stories. Then the second model is analyzed according to IS.

MODELLING

Analysis

This project requires the analysis of the building in order to find out the magnitude of loads and their distribution. Hence, the software that has been used for the analysis was Staad.Pro. Initially, the building was modeled with all the structural elements of a conventional building, i.e., Slabs, Beams and Columns in place. The modeling of the structure was done using nodes. The various loads that would act on the structure were defined along with the properties of the structural elements. The analysis was carried out and the loads and the moments were determined, after which, all the interior beams were replaced by drop panels on all storey, which would transfer the load from the slabs to the columns. The ninth and tenth storey of the building were relieved of the interior columns on which load was the low. The structure was modeled again with the application of these modifications, and the magnitude for the moments and loads was obtained from the analysis results, after which, the structural elements were designed manually and have been checked for safety (Fig. 1).

RESULTS AND DISCUSSION

The linear dynamic analysis was carried out on two different models, one consisting all structural members and other one with only slab, exterior beams and columns up to 8th floor. And the various values of deflection, axial forces and bending moment of the models were used for eliminating beams and columns in final model.

CONCLUSION

Flat-slab building structures possesses major advantages over traditional slab-beam-column structures because of the free design of space, shorter construction time, architectural –functional and economical aspects. Because of the absence of deep beams and shear walls, flat-slab structural system is significantly more flexible for lateral loads then traditional RC frame system and that make the system more vulnerable under seismic events. The purely flat-slab RC structural system is considerably more flexible for horizontal loads than the traditional RC frame structures which contributes to the increase of its vulnerability to seismic effects. The critical moment in design of these systems is the slab-column connection, i.e., the penetration force in the slab at the connection, which should retain its bearing capacity even at maximal displacements. The ductility of these structural systems is generally limited by the deformability capacity of the column-slab connection. To increase the bearing capacity of the flat-slab structure under horizontal loads, particularly when speaking about seismically prone areas and limitation of deformations, modifications of the system by adding structural elements are necessary.

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