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Evaluation of Joints in the Prefabricated Multi-storey Buildings

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Abstract: In this paper a reinforced structure and precast structure are modelled in Etabs. The plan of the both the structures are same. The modelling of the precast structures was done by releasing moments in the structure. Loads are applied to the both structures are same. Analysis and design was done to the structure. The results of the both structures are compared. Then for the seismic loads the joints of the precast structure are designed and studied.

Keywords: Reinforced structure, precast structure, Etabs, Comparison of results, Design of joints

I. INTRODUCTION

Generally concrete is good in compression and weak in tension. So in order to overcome the weakness in the tensile strength reinforcement is placed in the concrete so it is known as reinforced concrete. Now a days in order to complete work fast precast structures are used. Precast structures are easy to cast and easy to construction in site. The time taken for the construction is also very less when compared with the normal construction.

In this paper a normal structure is modelled in etabs. The same plan is modelled in as the precast structure in etabs. The analysis and design was done. The results which are compared with each other. For the seismic loads the joints are designed.

II. METHODOLOGY

1. Review of Literature
2. Calculating dimensions and loads
3. Modelling RCC structure in etabs
4. Analysis and design of the structure
5. Modelling prefabricated structure in etabs
6. Comparison of both results
7. Study of the joints

III.CACULATION OF DIMENSIONS

Precast structure are modelled by releasing moments of the RCC structure. The moments are calculated by using the below formula

$M=wl^2/12$

By using this formula the moments on each beam are calculated. The size of beams and the columns are same for the both the structures.

Size of the beams =0.23*0.45m

Size of the columns =0.23*0.53m

Length of the each column=3m

IV.MATERIAL SPECIFICATION

For the reinforced concrete structure and precast concrete structure the grade of the concrete is M30 and the HYSD bars of Fe500 grade was used.

IV.MODEL AND ANALYSIS OF REINFORCED CONCRETE AND PRECAST CONCRETE STRUCTURE

The floor plan and the model of the reinforced concrete structure are shown in the below figures

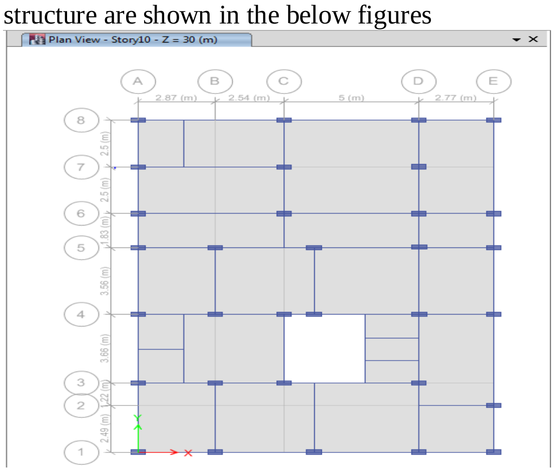

Figure-1 floor plan of the rcc structure

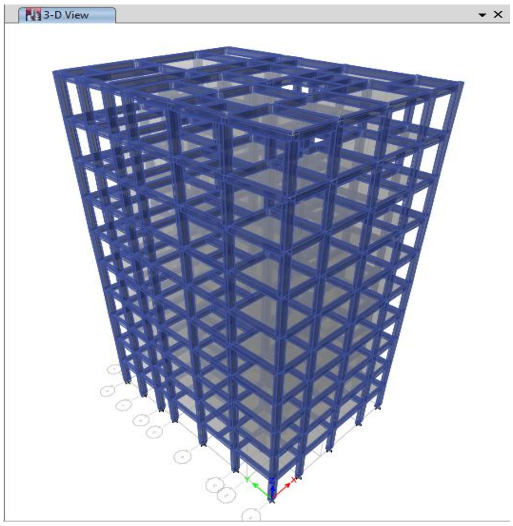

Figure-2 shows rcc structure model

For the same plan the precast model is modelled in the etabs. By releasing the joints in the structure. The floor plan of the precast structure is shown in below Fig-3

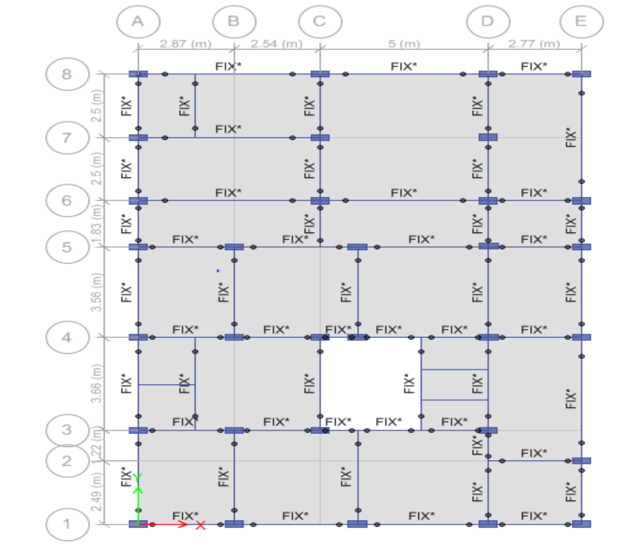

Figure-3 shows precast structure floor plan

By applying the loads to the both structures and analysis was done to the structure. The maximum deflection occurred in rcc structure is shown in the Fig-4

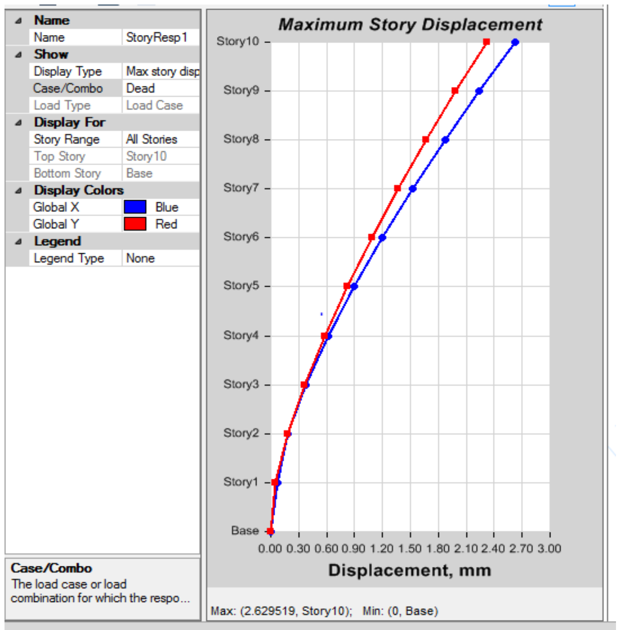

Figure-4 shows rcc structure maximum deflection

The maximum storey drift deflection occurred at dead load is shown in the below Fig-5

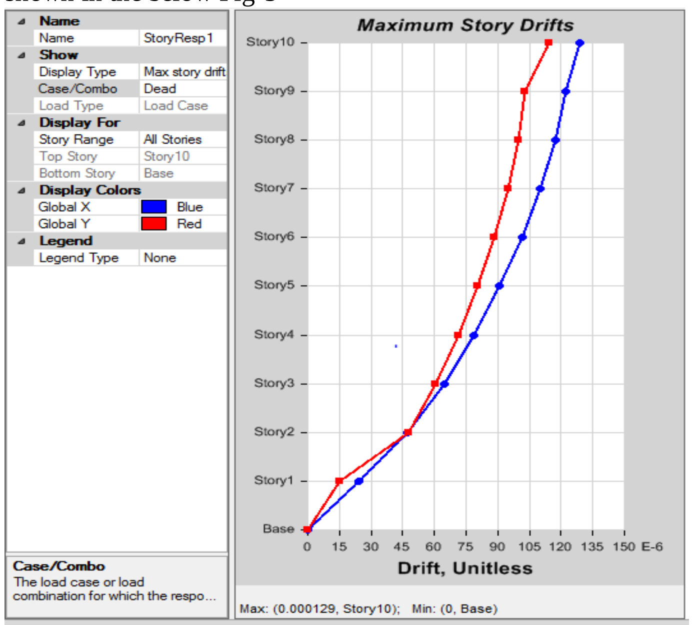

Figure-5 shows rcc structure maximum storey drift

For the same loads the analysis is also done for the precast structure. The results which occurred for the structure are shown. The maximum deflection which occurred in the precast structure is shown in the below Fig-6.

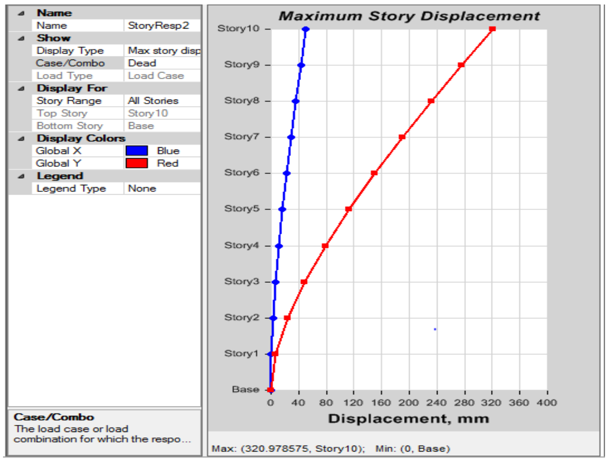

Figure-6 shows precast structure maximum displacement

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	1.099	15296.4288	302.7801
Y	1.476	15296.4288	225.4557
X + Ecc. Y	1.099	15296.4288	302.7801
Y + Ecc. X	1.476	15296.4288	225.4557
X - Ecc. Y	1.099	15296.4288	302.7801
Y - Ecc. X	1.476	15296.4288	225.4557

Table-1 shows the base shear values for rcc structure

The maximum storey drift deflection occurred at dead load is shown in the below Fig-7

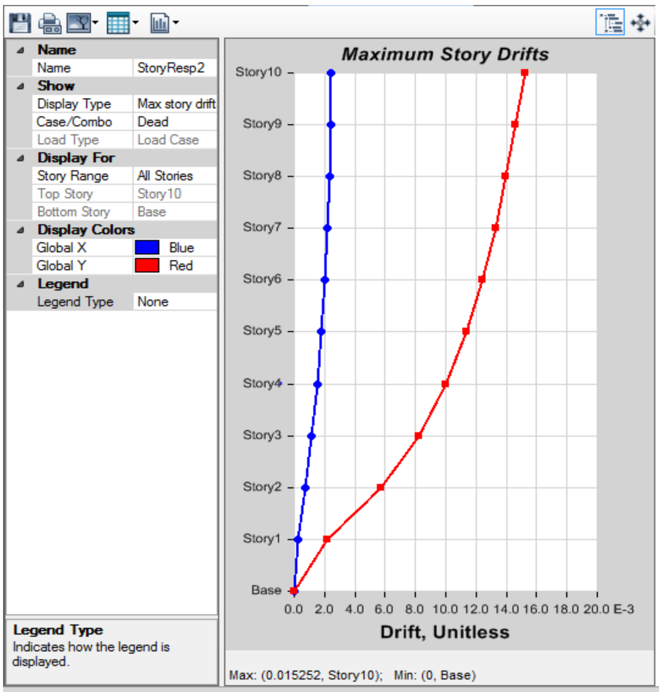

Figure-6 shows precast structure maximum storey drift

Response spectrum is applied to the both the structures. This response spectrum is done automatically according to the etabs software. The results are shown in below Table-1, 2 for the both the structures.

Direction	Period Used (sec)	W (kN)	V_b (kN)
X	5.764	15216.9703	82.7803
Y	7.129	15216.9703	82.7803
X + Ecc. Y	5.764	15216.9703	82.7803
Y + Ecc. X	7.129	15216.9703	82.7803
X - Ecc. Y	5.764	15216.9703	82.7803
Y - Ecc. X	7.129	15216.9703	82.7803

Table-2 shows the base shear values for precast structure

V.TYPES OF THE JOINTS AND STUDY OF THE JOINTS

Types of the joints:-

1. Beam to beam joint
2. Column to beam joint
3. Beam to slab joint

Beam to beam joint:-

Under seismic loads the joints are there are two beams one is normal beam and another one is precast beam are shown in the below Fig-7

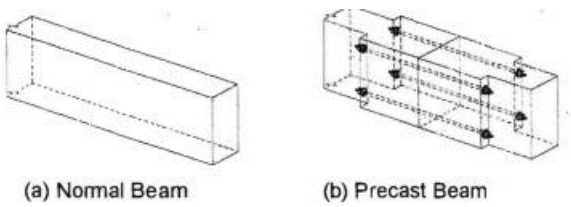

Figure-7 shows normal and precast beam of the structures

Column to beam joint:-

Under seismic loads the joints are there column are designed is shown in shown in the below Fig-8

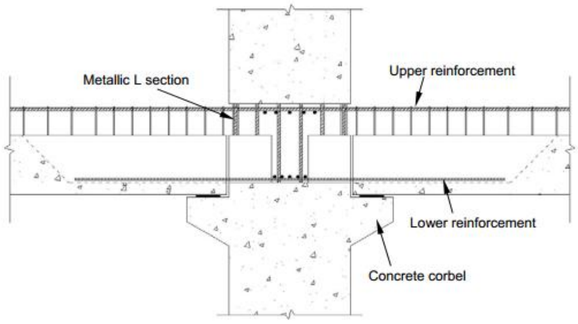

Figure-8 shows column details

Beam to slab joint:-

This joints are very important in the structure, these joints are placed in the structure very carefully while construction. This joint is shown in the Fig-9

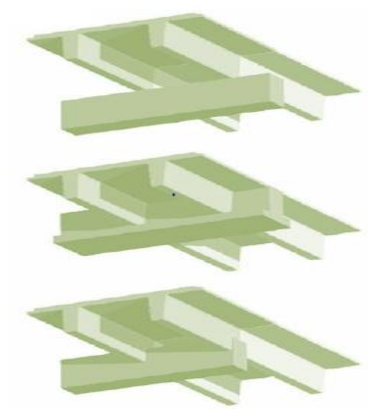

Figure-9 shows beam to slab joint

VI.CONCLUSION

By considering the results that has been concluded, that the deflection and the storey drift occurred in the precast structure is more when compared with the rcc structure. The base shear values are also different when compared with the rcc structure.

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