RESPONSE SPECTRUM ANALYSIS OF GRID SLAB AT CONSTRUCTION STAGE : USING ETABs

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Abstract : While analyzing a multi-Storied RCC frame buildings, conventionally all the probable loads are applied after modeling the entire building frame. But in practices of RCC frame structures it is constructed in various stages. According to the stability of RCC frame varies at each construction stage. Even during RCC construction freshly placed concrete floor is supported on previously casted floor by formwork. Thus, the loads assumed in traditional analysis will vary in transient situation. Obviously, results obtained by the conventional analysis will be unsuitable. Therefore, the frame should be analysis at every construction stage taking into consideration variation in loads. The phenomenon known as Construction Stage Analysis considers these uncertainties precisely. Construction stage analysis revealed more criticality of the structural component during construction stage due to additional forces, which must be considered during designing and analysis phase of the high rise building. The aim of this study is to carry out seismic analysis of grid slab structure considering construction stage by using ETABs.

IndexTerms **– Construction Stage Analysis, Response Spectrum Analysis, Grid Slab, Seismic Parameters.**

I. INTRODUCTION

A structure is most vulnerable to failure while it is under construction. Structural failures comprising components, assemblies or partially completed structures frequently happen during the progression of construction. A collapse during construction may not essentially point toward a construction error. It may be the effect of an error made during design. A failure for the period of construction is all the time economically disagreeable, and in the some case may consequence injury or death. Efforts to reduce the possible essential failure during the construction phase will decrease the threat of harm, and of unexpected costs and delays. Possibly the most impressive structural failures during construction are those resulting from the lack of stability. The designer considers structure as a completed unit, with all elements interrelating to resist the loads. Stability of the finalized building be governed by the existence of all structural members, including floors. It is observed that the configuration of the incomplete structure is continually altering, and firmness often relies on temporary bracing.

Construction stage analysis is enormously important in evaluating the stability of incomplete structures. Another recurring cause of structural failures during construction is excessive construction loading. Often the loads applied to structural members while construction is taking place, are in excess of service loads anticipated by the designer.

This is due to fresh floors are supported by previously cast floors by the false work system. Analysis of the stability requirements for these asymmetrical, incomplete, and constantly moving assemblies presents a exciting problem to the most capable structural engineers. The Construction Stage Analysis that reflects the fact of the sequential application of construction loads during level by level construction of multi-storey buildings can provide more reliable results and hence the method should be adopted in usual practice.

II. MODELLING OF RC BUILDING

Three building is modeled as G+5 Reinforced Concrete building using ETABs. The building considered is having plan area of 36m x 36m. The floor to floor height is taken as 4m. The dimension of rib is 200mm x 700mm. The column have a dimension of 900mm x 900mm for G+5 storey building. The thickness of roof and floor slab is 100mm and that of stem is 200mm. The columns is assumed to be fix. The grade of concrete used is M30 and grade of steel used is Fe 500. Two seismic zone are considered i.e, Zone IV and Zone V. The importance factor considered is 1 with the soft, medium and hard type of soil. Typical strorey imposed load is 4 kn/m^2, typical storey floor finish is 1 kn/m^2, roof imposed load is 1.5 kn/m^2, roof floor finish is 1 kn/m^2. The typical plan of the structure is shown in Figure 1.

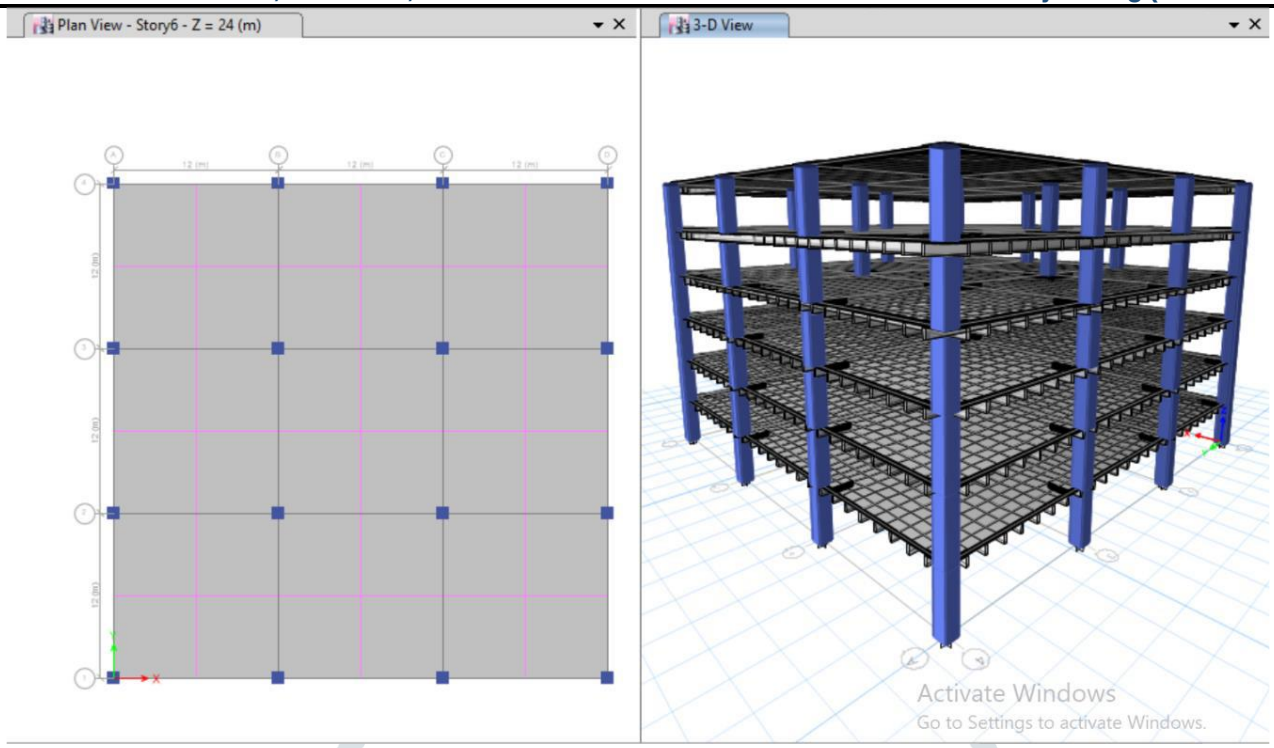


Fig.1 G+5 Storey Building Plan

III. ANALYSIS RESULT

The results are derived by the analysis of model in ETABs for Response spectrum analysis and construction stage analysis for G+5 storey structure for soft, medium and hard soil type and for seismic zone IV and V.
Moment and Reaction are shown below for G+5 for different soil type and for different seismic zone.

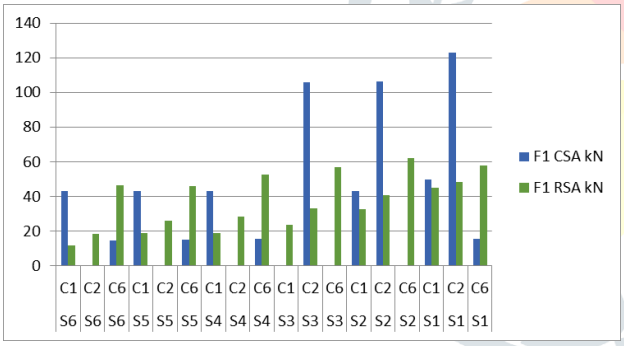


Fig. 2 G+5 Z4S1 REACTION F1

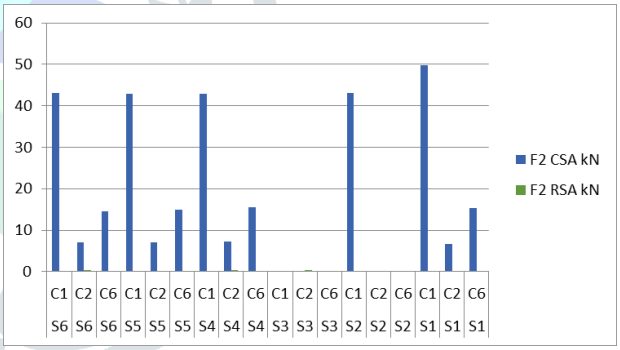


Fig 3 G+5 Z4S1 REACTION F2

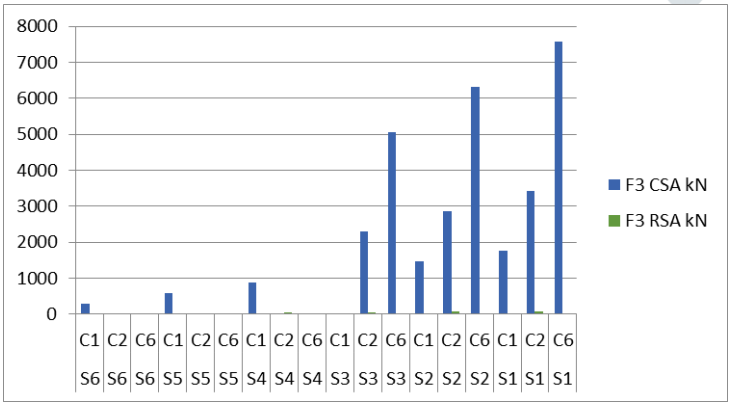


Fig. 4 G+5 Z4S1 REACTION F3

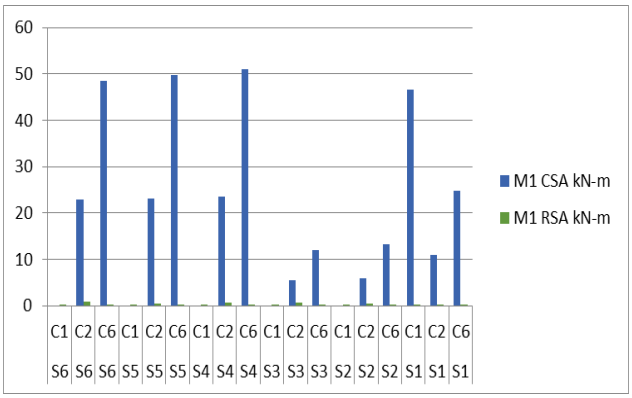


Fig 5 G+5 Z4S1 MOMENT M1

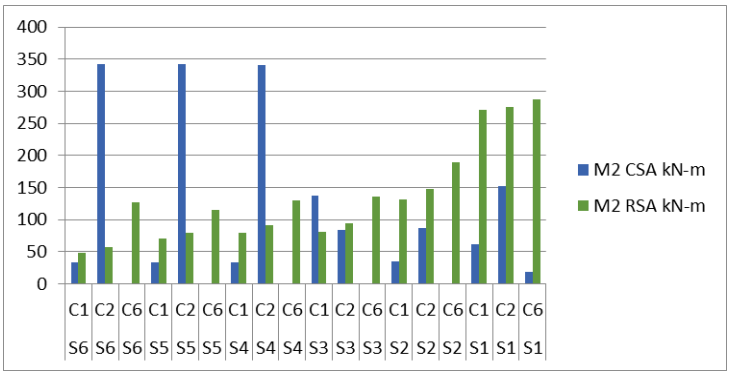


Fig 6 G+5 Z4S1 MOMENT M2

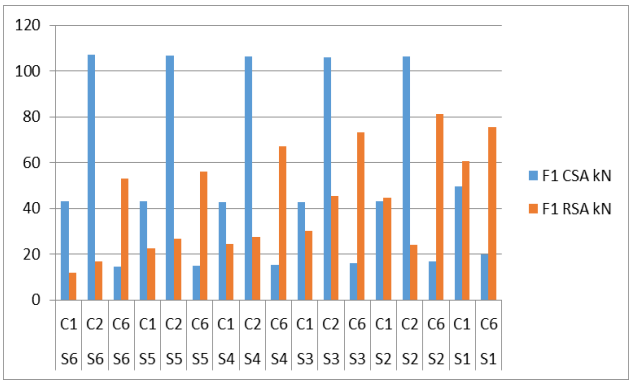


Fig 7 G+5 Z4S2 REACTION F1

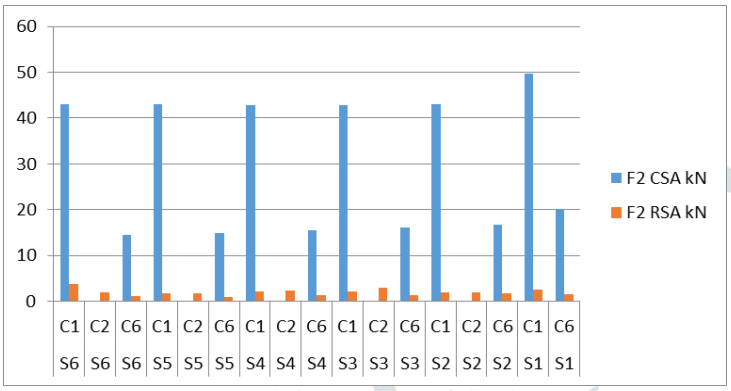


Fig 8 G+5 Z4S2 REACTION F2

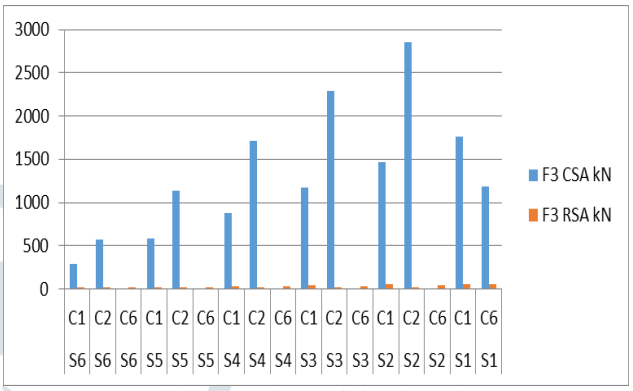


Fig 9 G+5 Z4S2 REACTION F3

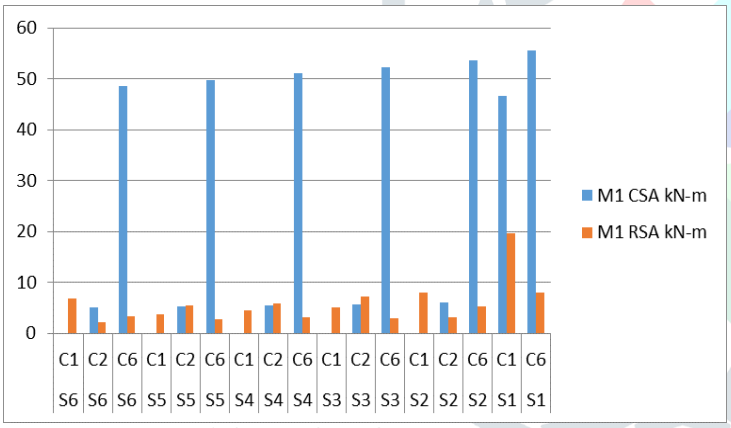


Fig 10 G+5 Z4S2 MOMENT M1

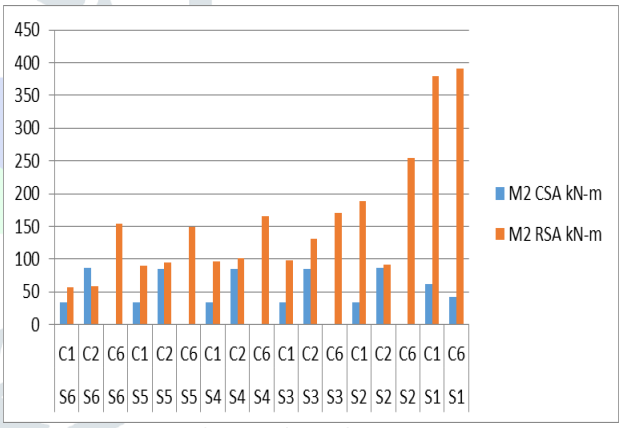


Fig 11 G+5 Z4S2 MOMENT M2

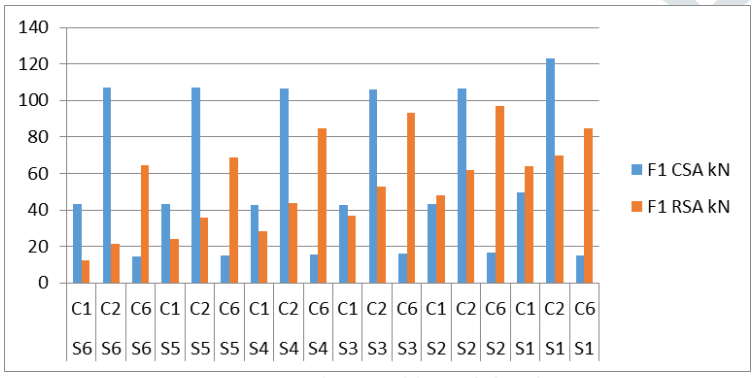


Fig 12 G+5 Z4S3 REACTION F1

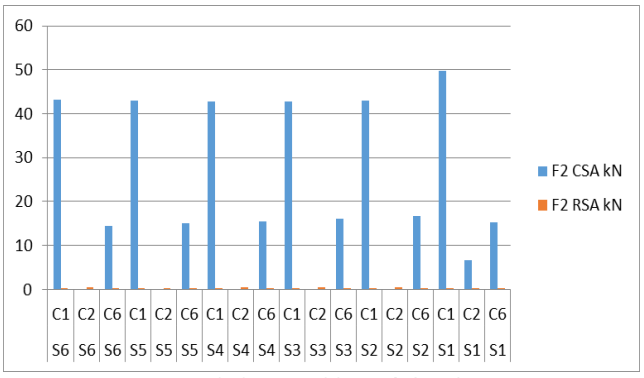


Fig 13 G+5 Z4S3 REACTION F2

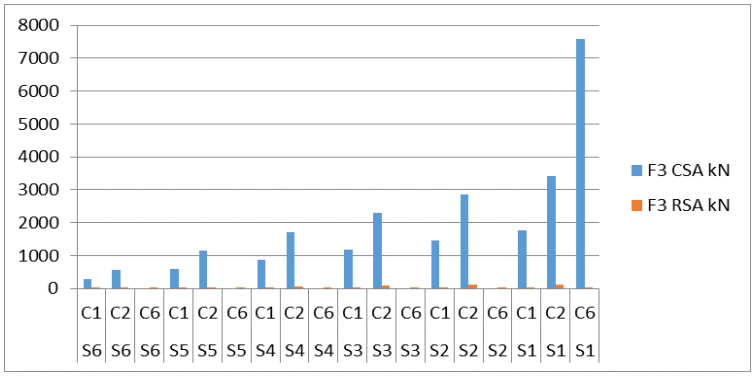
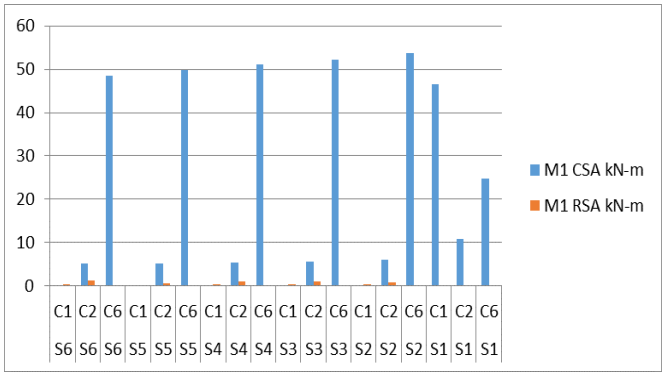


Fig 14 G+5 Z4S3 REACTION F3



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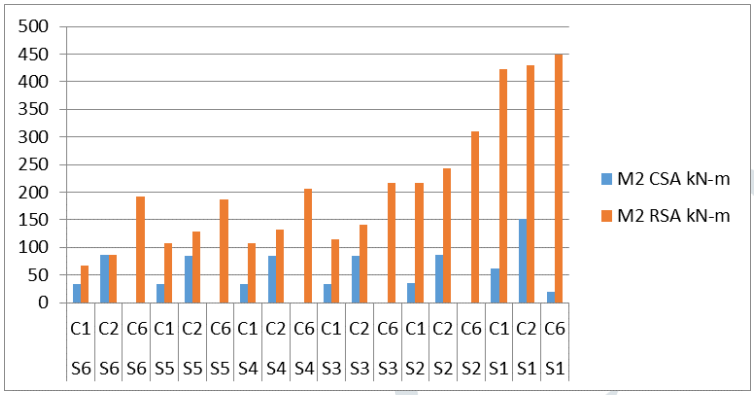


Fig 16 G+5 Z4S3 MOMENT M2

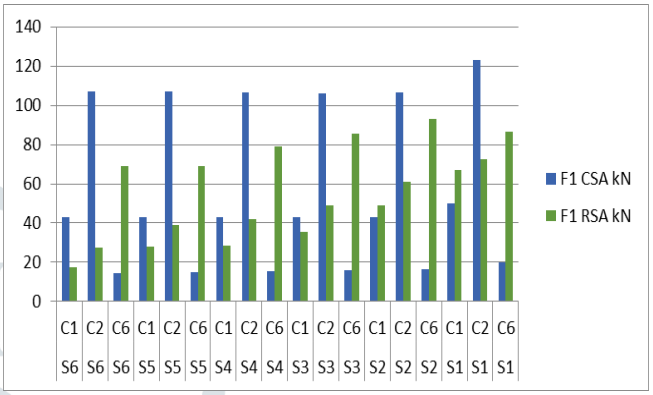
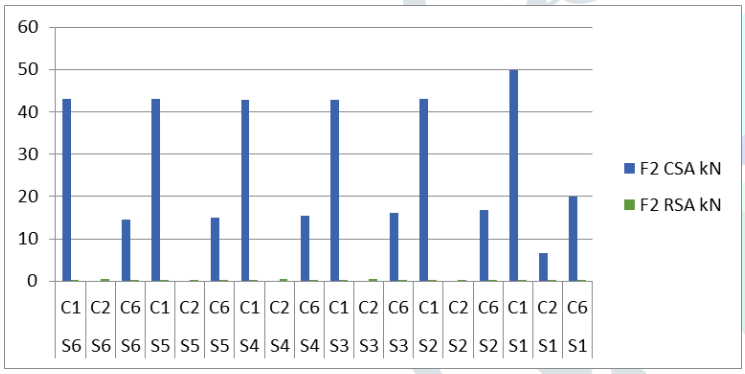


Fig 17 G+5 Z5S1 REACTION F1



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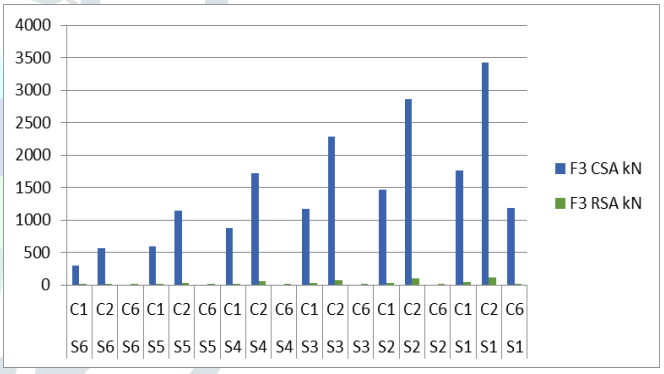

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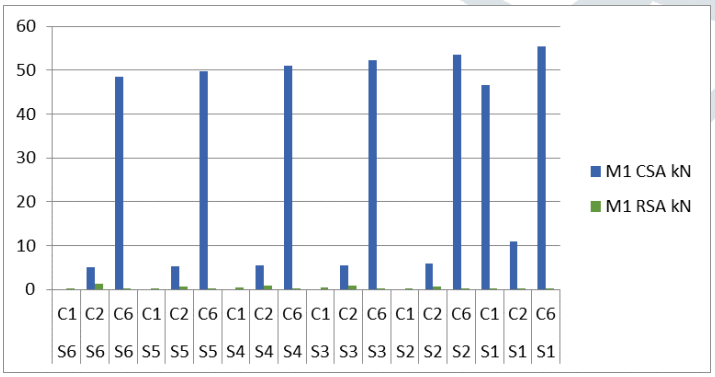


Fig 20 G+5 Z5S1 MOMENT M1

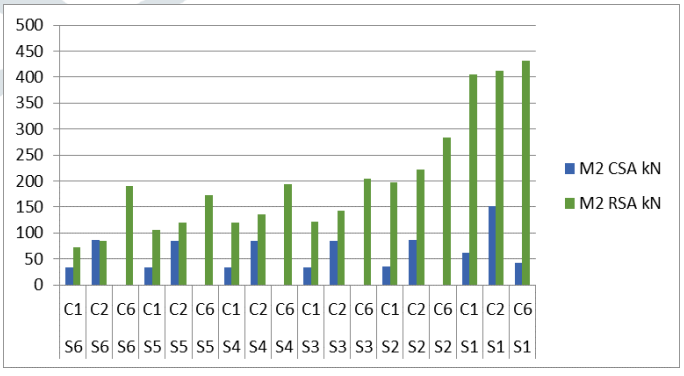
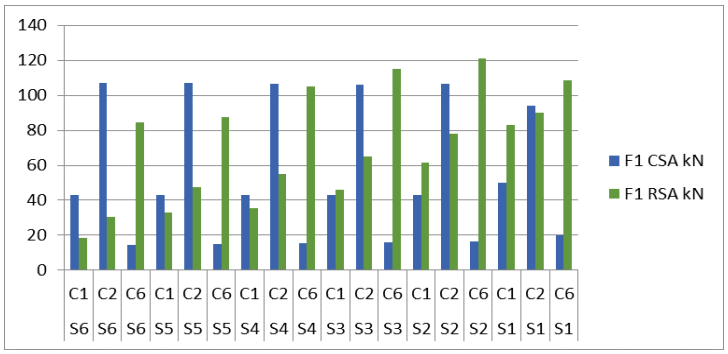


Fig 21 G+5 Z5S1 MOMENT M2



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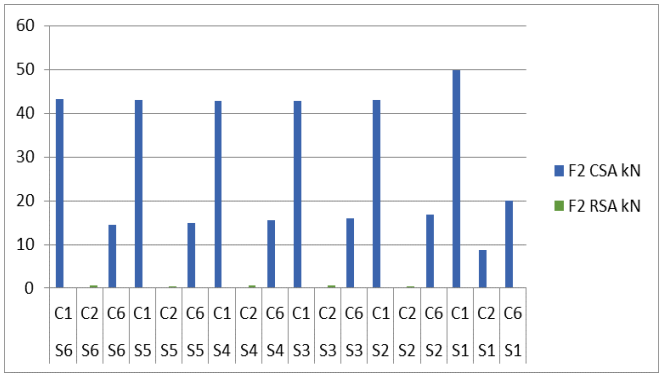
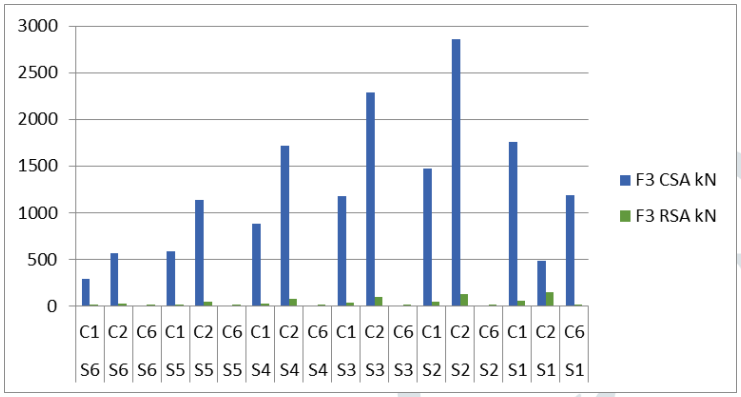


Fig 23 G+5 Z5S2 REACTION F2



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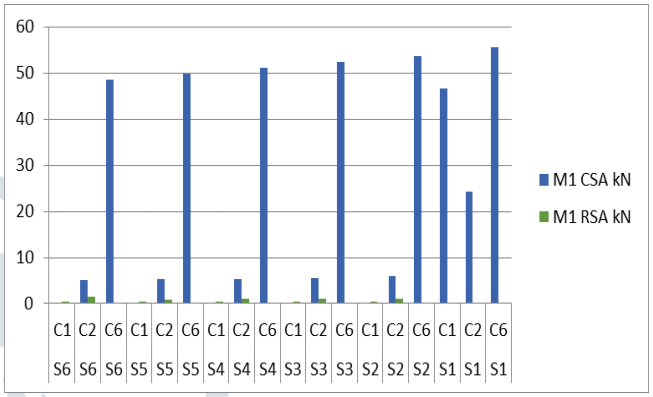


Fig 25 G+5 Z5S2 MOMENT M1

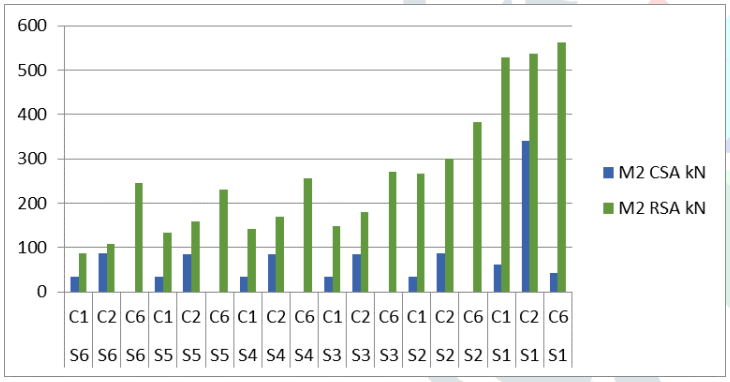
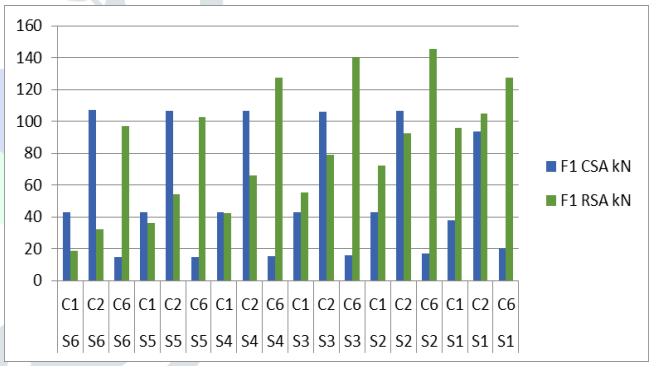


Fig 26 G+5 Z5S2 MOMENT M2



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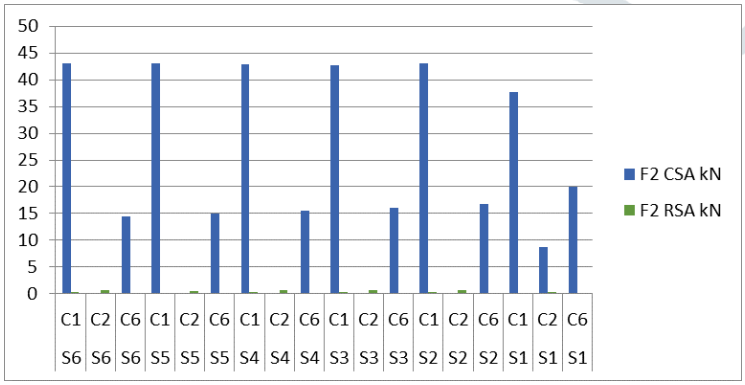

Fig 28 G+5 Z5S3 REACTION F2

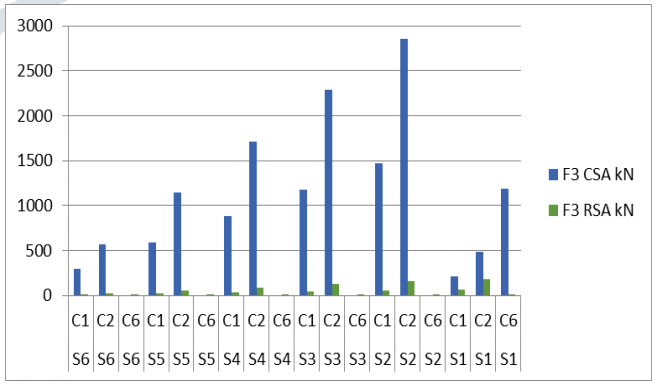

Fig 29 G+5 Z5S3 REACTION F3

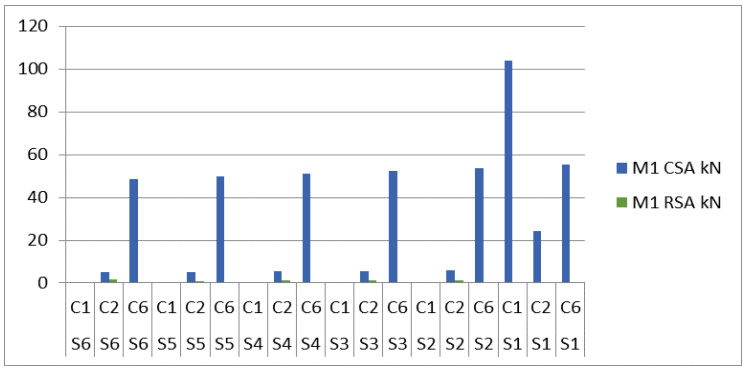

Fig 30 G+5 Z5S3 MOMENT M1

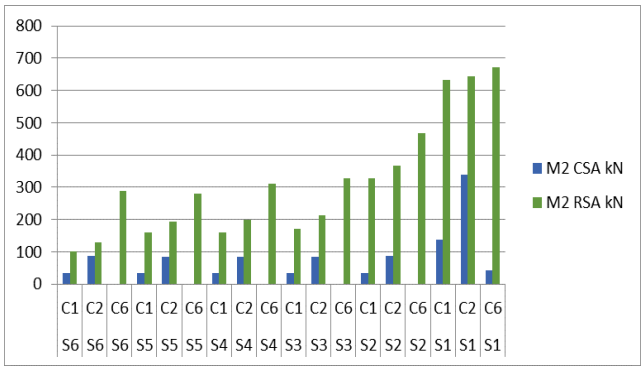

Fig 31 G+5 Z5S3 MOMENT M2

IV. CONCLUSION

- Maximum Support reaction for corner column C1, edge column C2, and interior column C6 the value of the reaction in all three dimension found to be considerably more in case of construction stage analysis than the response spectrum analysis.
- Maximum moment of structure analysed for corner column C1, edge column C2, and interior column C6 the value of the moment with construction stage analysis is found to be more in case of moment in x direction than the dynamic analysis.
- Construction stage analysis shows more criticality of the structural component during construction stage due to additional forces, which must be considered during designing and analysis phase of the high rise structure.
- The effect of construction stage analysis is significant over the response analysis for designing columns.
- Edge columns experiences more axial force as compared to exterior columns, hence it should be designed for actual load considering CSA.
- Construction stage analysis gives the more actual analytical result.
- Construction stage analysis is proved critical even if earthquake forces during the construction are not considered. Hence, Construction stage analysis considering earthquake forces will provide more reliable results and recommended in usual practice

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