STUDY ON DYNAMIC BEHAVIOUR OF HIGH RISER DUAL SYSTEM WITH IN-PLANE DISCONTINUITY IN VERTICAL ELEMENTS RESISTING LATERAL LOADS

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Abstract - *The purpose of the existent examination is to conduct Equivalent Static analysis and Time history Analysis (THA) of vertically irregular RC building frames and to conduct the seismic analysis that relates to Equivalent static analysis and Time history analysis. Five categories of irregularities namely mass irregularity, stiffness irregularity, vertical geometry irregularity. In-Plane Discontinuity in Vertical Elements Resisting Lateral Force and Discontinuity in Capacity were contemplated.*

1. INTRODUCTION

In the course of seismic tremors, failure of structure evolves at factors of weak point. This weak spot arises due to discontinuity in mass, stiffness, and geometry of the structure. the systems having this discontinuity are termed as irregular structures. Irregular systems make a contribution to a huge part of city infrastructure. Vertical irregularities are one of the major reasons of disasters of structures in the course of earthquakes. For example systems with soft storey had been the maximum exquisite structures which collapsed. So, the effect of vertical irregularities inside the seismic overall performance of structures will become definitely important. Height-wise adjustments in stiffness and mass render the dynamic characteristics of these buildings distinct from the normal building. When such structures are built in excessive seismic zones, the evaluation and design turns into extra complicated.IS 1893 defines vertical anomalies.

1.1 INPLANE DISCONTINUITY

In an in-plane discontinuity ,in-plane offset of the lateral force resisting elements will be greater than the length of those elements.

1.2 DUAL SYSTEM

A dual system is a structural system in actual fact whole frame delivers sustenance for gravity loads, and conflicts lateral loads afforded by a particularly detailed moment-resisting frame and shear walls or braced frames. Both shear walls and frames play a part in resisting the lateral loads ensuing from earthquakes or wind or storms, and the portion of the forces resisted by each one be contingent on its rigidity, modulus of elasticity and its ductility, and the prospect to develop plastic hinges in its parts. The moment-resisting frame may be either steel or concrete, but concrete intermediate frames cannot be used in seismic zones 3 or 4.

1.3 OBJECTIVES

1 To study the consequence of in-plane discontinuity of vertical components resisting lateral loads, shear walls are reflected as vertical elements.

2. In-plane discontinuity are well thought-out as per the provisions given in IS 1893-2002, norms for seismic resistant design of structure for altered heights for zone 5.

3. Shear walls in ground floor and upper floors consists of in-plane discontinuity, and influence of this in-plane discontinuity on conduct of high rise RC structure is studied in assessment with regular RC frame without in-plane discontinuity.

4. Equivalent Static and time history analysis is conducted to find out the responses using ETABS Software

1.4 METHODOLOGY

1. RCC building with square plan of total measurement of 40 m × 40 m ,is studied currently.
2. Three forms of RCC structures are considered. One regular RC frame, second shear wall frame and third shear wall with in-plane discontinuity.
3. The above 3 structure are modeled and analyzed for three diverse heights of 20, 40 and 60 storey, each storey being 3 m in height.
4. Lateral loads as per IS 1893- 2016 are well-thought-out, consigned and responses are tabulated, graphs are plotted.
5. Dynamic time history outcomes are tabulated.
6. Lastly, inferences are made.

2. MODELLING AND ANALYSIS

The common method of modeling the regular structure is illustrated. The same modeling practice employed to model the different other configurations, to study the seismic performance of various structural configuration of structure.

- Model 1: Regular building. – 20 storey
- Model 2: Regular building with Shear wall – 20 storey
- Model 3: Regular building with Shear wall and in plane discontinuity – 20 storey.
- Model 4: Regular building – 40 storey.
- Model 5: Regular building with Shear wall – 40 storey.
- Model 6: Regular building with Shear wall and in plane discontinuity – 40 storey.
- Model 7: Regular building. – 60 storey.
- Model 8: Regular building with Shear wall – 60 storey.
- Model 9: Regular building with Shear wall and in plane discontinuity – 60 storey.

2.1 MATERIAL PROPERTIES

- Grade of reinforcing steel: FE 500
- Characteristic strength of concrete, fck= 40 MPa
- Ultimate strain in bending, Ɛcu =l0.0035

2.2 MODEL GEOMETRY

- Number of storeys = 20.
- Number of bays along X Direction = 8 Bays,

  Y Direction = 8 Bays,
- Storey height = 3.0 meters at Ground Floor, Remaining Floors.
- Bay width along X Direction = 5 m,

  Y Direction = 5 m.

- Similar procedure is used to model with different storey height, that is building with 40 and 60 storey.

2.3 PLAN AND VIEW OF BUILDING

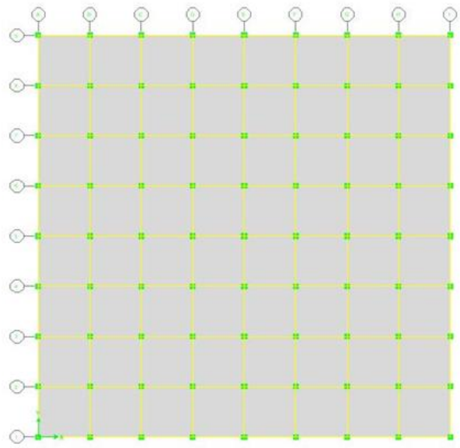

Fig-1: Plan View of Building type-1

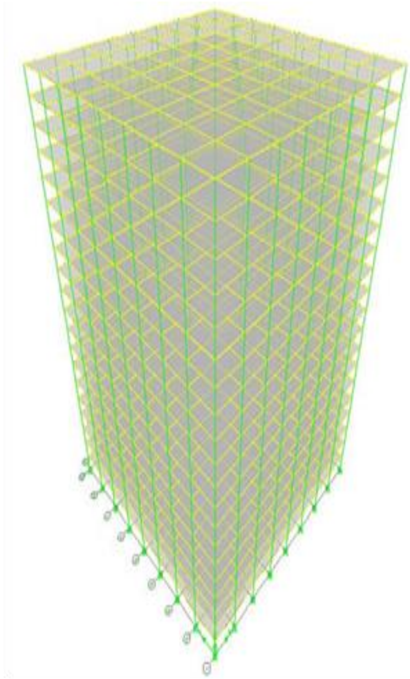

Fig- 2: 3D View of Type –1

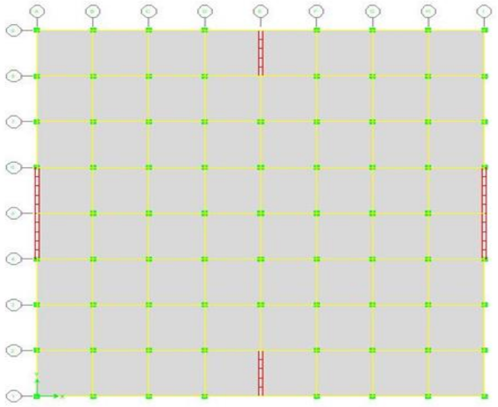

Fig-3: Plan View of Building type-2

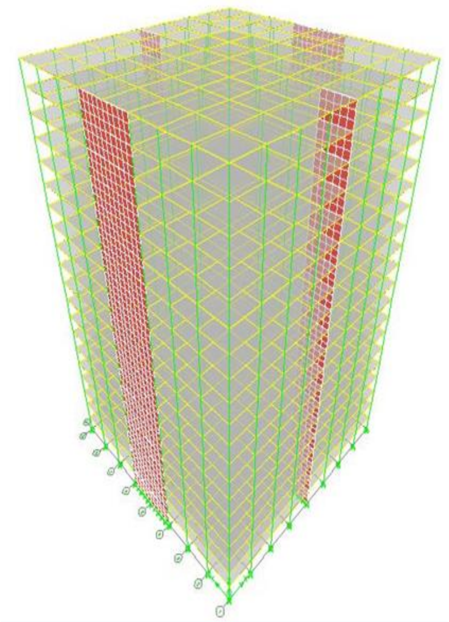

Fig- 4: 3D View of Type –2

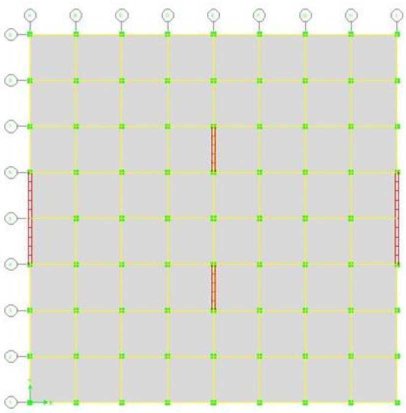

Fig-5: Plan View of Building type -3

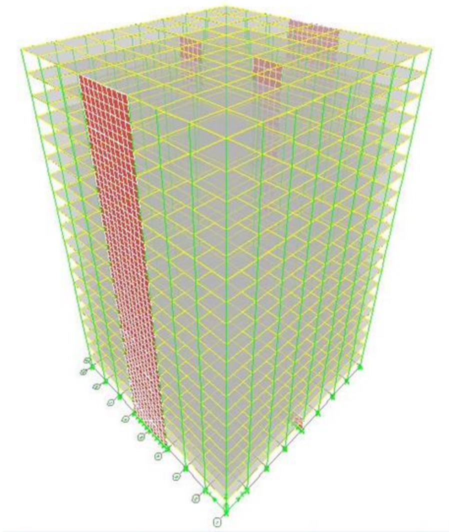

Fig-6: 3D View of Type –3

3. RESULTS

3.1 MODAL ANALYSIS

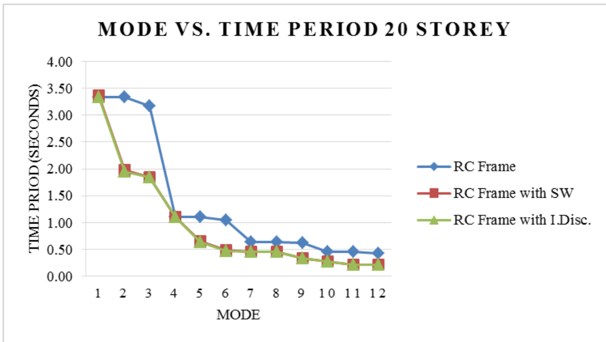

Chart -1: Mode v/s time period 20 storey

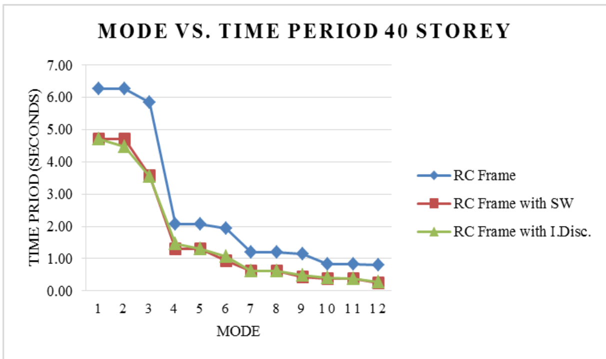

Chart -2: Mode v/s time period 40 storey

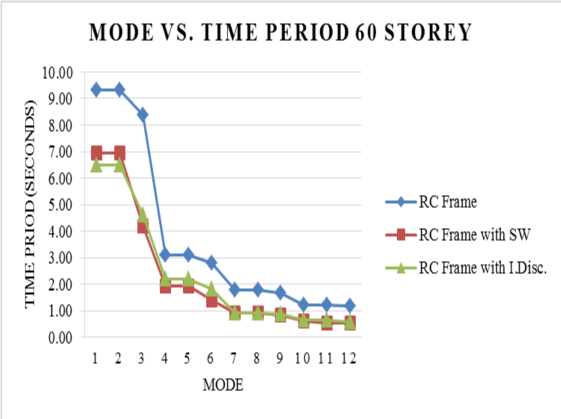

Chart-3: Mode V/s Time period 60 Storey

3.2 EQUIVALENT STATIC ANALYSIS

3.2.1 STOREY SHEAR

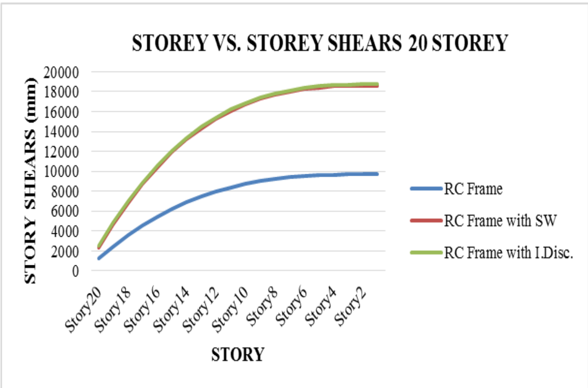

Chart-4: Storey shear– 20 Storey

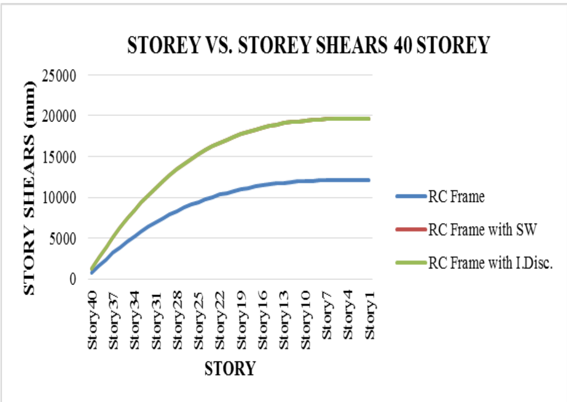

Chart-5: Storey shear– 40 Storey

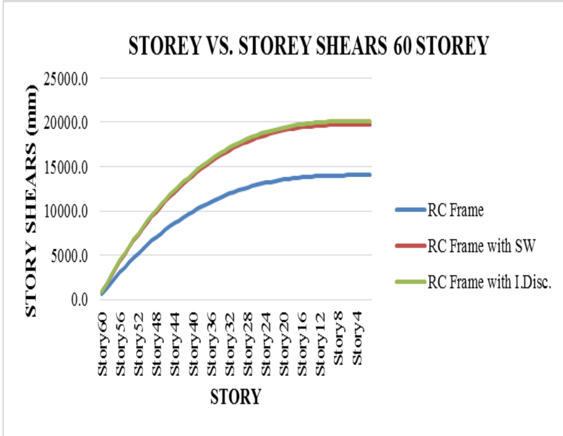

Chart-6: Storey shear– 60 Storey

3.3 STOREY DISPLACEMENTS

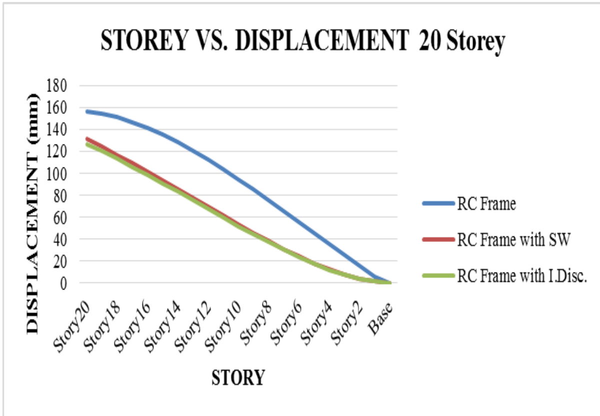

Chart-7: Storey v/s Displacements – 20 Storey

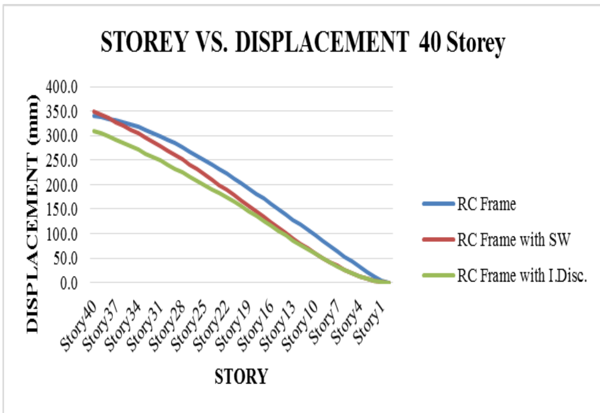

Chart-8: Storey v/s Displacements – 40 Storey

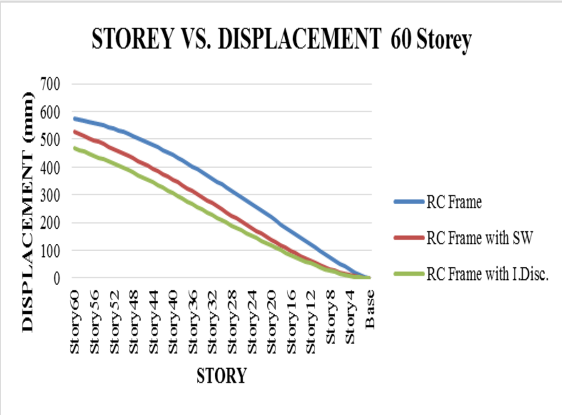

Chart-9: Storey v/s Displacements – 60 Storey

3.4 STOREY DRIFTS

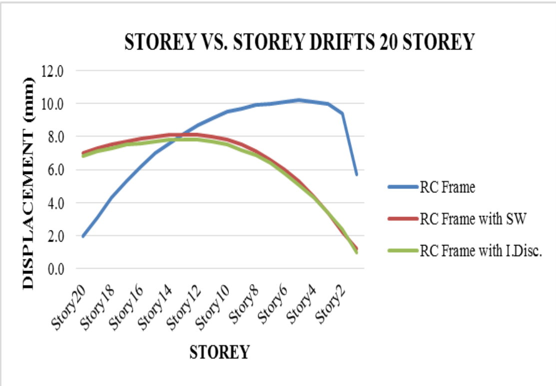

Chart-10: Storey v/s Drifts –20 Storey

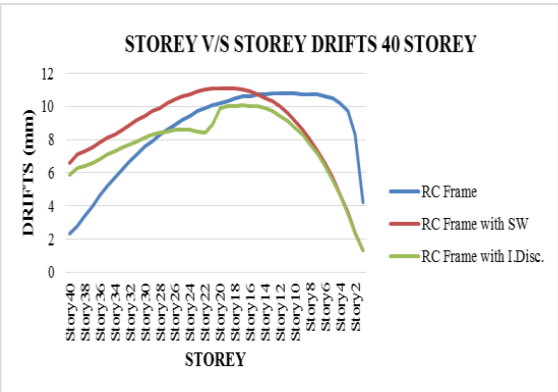

Chart-11: Storey vs. Drifts – 40 Storey

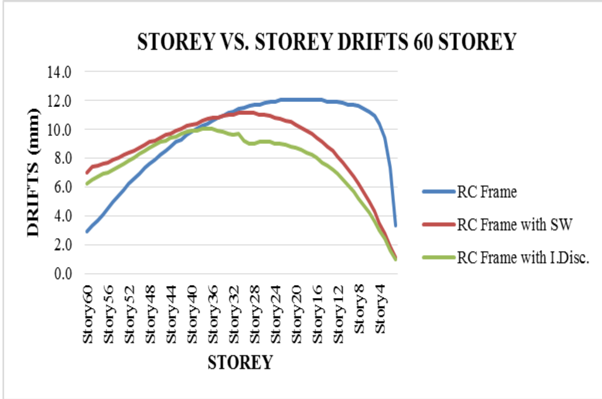

Chart-12: Storey v/s Drifts –60 Storey

3.5 TIME HISTORY ANALYSIS

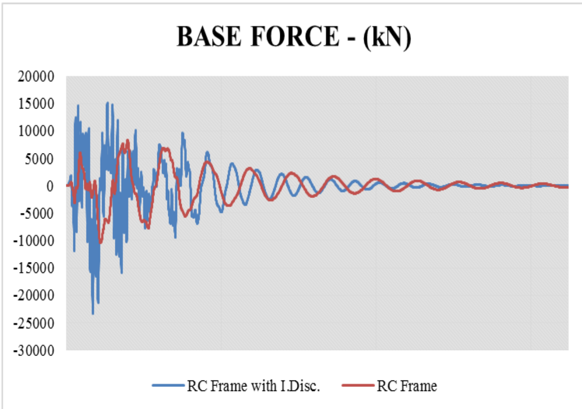

Chart-13: Time history response - Base Force

4. CONCLUSIONS

- The modal analysis resolves that, shear wall system lessens the time period there by rises the frequency of the building, this is due of the presence of shear wall which inturn increases the stiffness

- Increase in storey height time period, storey displacements, storey drifts and base forces has increased considerably.

- Existence of in-plane discontinuity in lateral resisting shear wall systems has a smaller amount of influence on time period and storey shears.

- Presence of in-plane discontinuity shear wall, storey displacement and drifts has reduced related to RC frame and RC frame with shear wall. Henceforth from the analysis it is accomplished that, in-plane discontinuity in structural systems is endorsed where shear wall cannot be arranged for from the foundation level.

- Considerable increase in column and beam forces in shear wall and in-plane discontinuity structures.

- The time history analysis results infers that, Reinforced concrete frame with in-plane discontinuity structure displays enhanced performance in decreasing the peak displacement up to 40 storey, above 40 storey RC frame with shear wall systems improved performance in falling the peak displacements. Hereafter it can be determined that, above 40 storey, in-plane discontinuity structure will have a lesser amount of stability compared to shear wall structures.

5. REFERENCES

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