Seismic Performance of Multistoried Building with Diaphragm Discontinuity

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Abstract— Now a day's many of structures are destructed totally or partially due to effect of earthquake. So it is very essential to determine the seismic response of each building. In multistoried building damages due to earthquake generally initiates at locations where there is presence of structural weaknesses. The major reasons of failure of structure during the earthquake are irregularities. Buildings with opening in slab re subjected to damages due to action of the lateral loads. There are many multistoried buildings provided with opening for the purpose of stair cases, lighting, architectural features or shafts. Openings are provided at various locations such as center, at corners end and at periphery with building having various shaped columns. This opening in diaphragms causes stresses at discontinues joints with building element. The effects of opening in slab were investigated. Therefore diaphragms are required to be designed as a part of the seismic force-resisting system of every new building as they distribute lateral forces to the vertical elements of lateral force resisting system. Diaphragms acts different according to configuration of the building and type of load acting on it. Concrete diaphragms having different elements which plays important role in resisting lateral forces. In this thesis an attempt is made to try to know the seismic performance of multistoried building with diaphragm discontinuity by comparing with seismic performance of multistoried building without diaphragm opening.

Keywords: diaphragm, Response spectrum Analysis, Maximum Dead Load, Base Shear, Maximum Storey Drifts

I. INTRODUCTION

In many countries, strong earthquake have taken the life of millions of people due to the impact of strong vibration on building. Earthquake ground motions(EQGMs) are the most dangerous natural hazards where both economic and life losses occurs. most of losses are due to building collapse or damages. It is necessary to design a structure to perform well under seismic loads. Many engineers and architectures trying to use best method possible to which can reduce the seismic effect on the structures.

The irregularities in the building structure might be because of irregular distribution in their mass, strength and stiffness along the height of building. Hence, extensive research is required for achieving ultimate performance even with poor configuration. In a structural engineering, a diaphragm is a structural system used to transfer lateral loads to shear walls or frames primarily through in a plane shear stress. Lateral loads are usually wind and earthquake load. Gravity and earthquake loads flow in a continuous and smooth path through the horizontal and vertical elements of structure transferred to the supporting ground.

Diaphragms are required to be designed as a part of the seismic force-resisting system of every new building as they distribute lateral forces to the vertical elements of lateral force resisting system. In plan, Opening in the diaphragm considerably weakens slab capacities Discontinuities in lateral stiffness of the diaphragm are due to openings, cut-outs, adjacent floors at different levels or change in thickness of diaphragm.

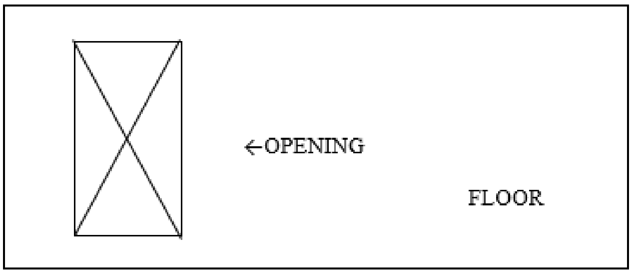

Fig. 1: Diaphragm discontinuity

II. MODELLING AND ANALYSIS

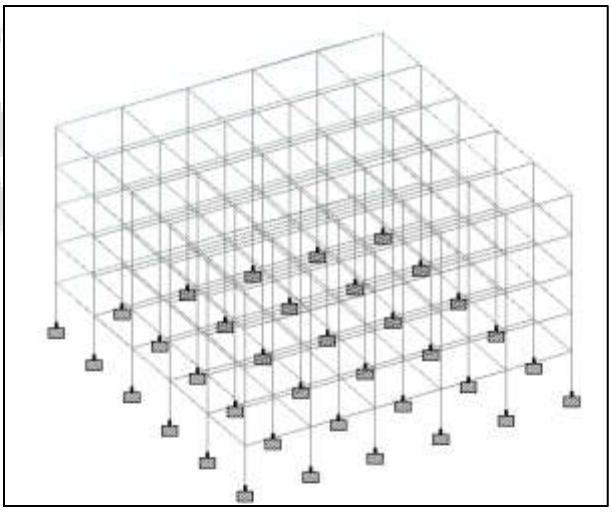

Fig. 2: 2D view of structure in Stadd pro v8i.

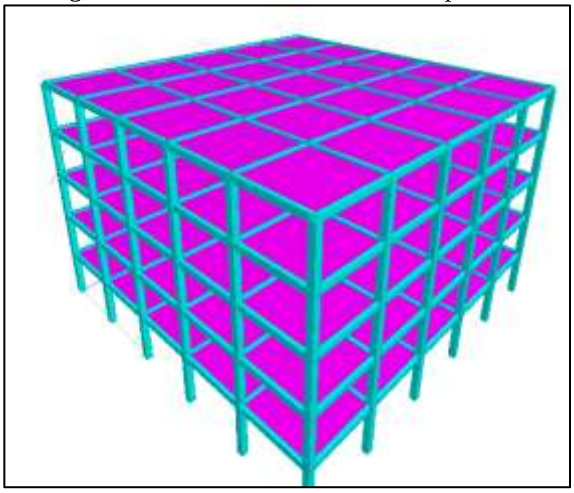

Fig. 3: 3D view of a structure in Stadd v8i.

A. Shear Force (Fx)

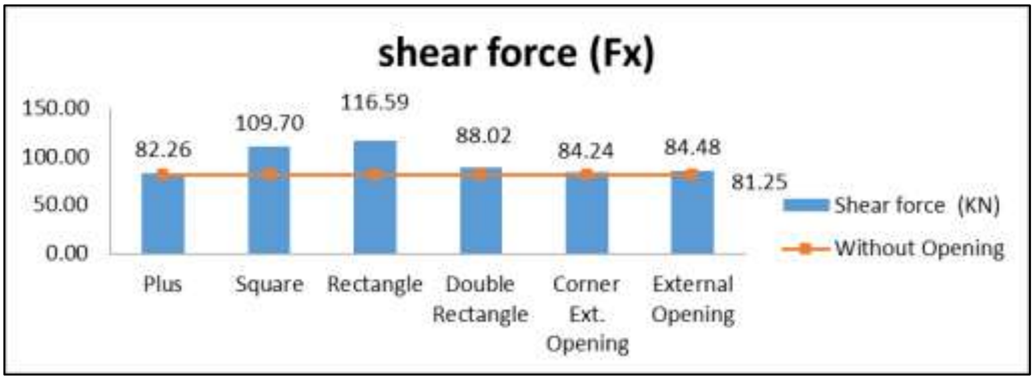

Fig. 4: comparison for shear force of multistoried building with and without diaphragm opening.

B. Shear force (Fy)

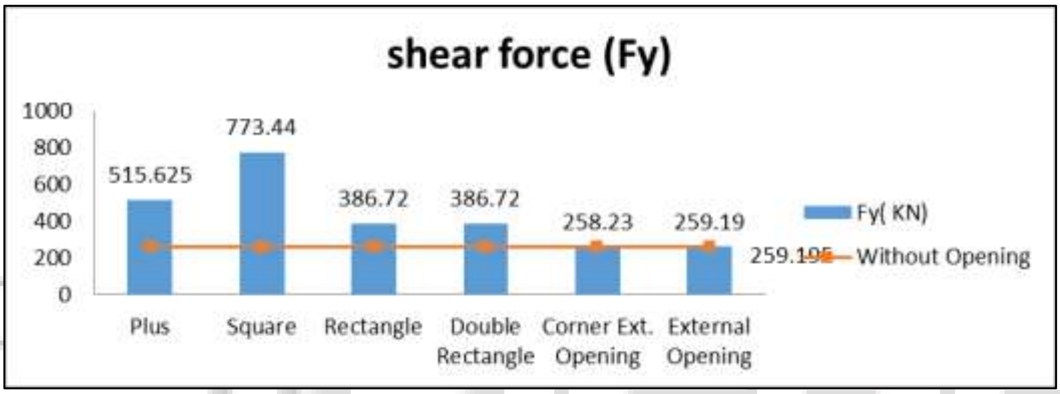

Fig. 5: comparison for shear force in a Y direction of multistoried building with and without diaphragm opening.

C. Torsion

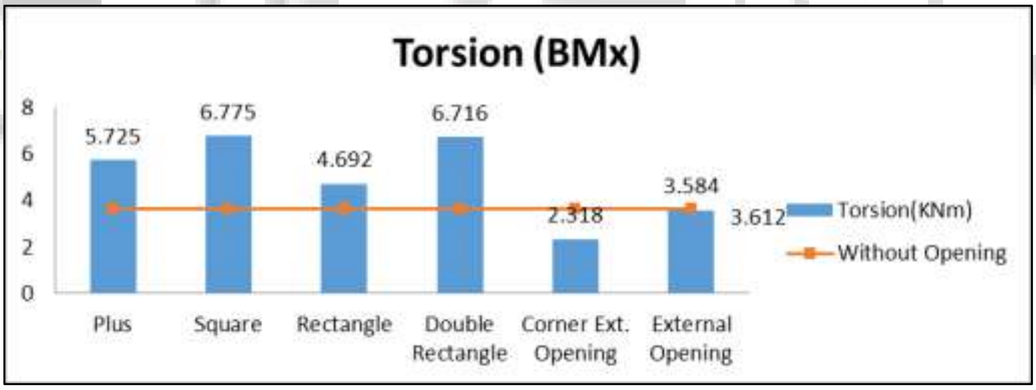

Fig. 6: comparison for torsion in multistoried building with and without diaphragm opening.

D. Bending Moment (BMy)

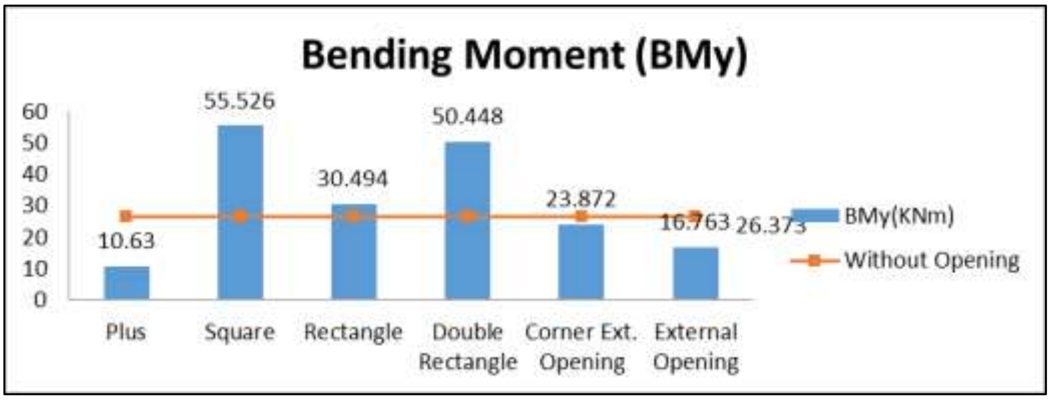

Fig. 7: comparison for bending moment in Y direction of multistoried building with and without diaphragm opening.

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E. Bending moment (BMz)

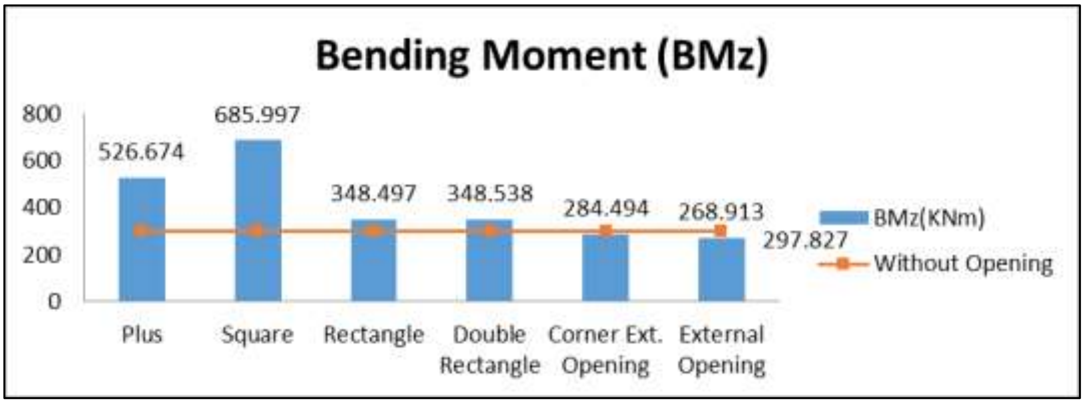

Fig. 8: comparison for bending moment in Z direction in multistoried building with and without diaphragm opening.

F. Displacement

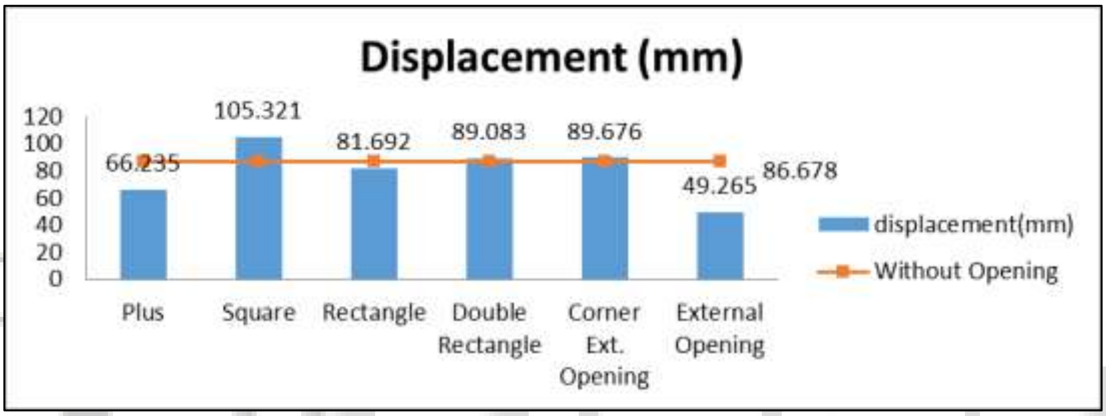

Fig. 9: comparison for displacement in multistoried building with and without diaphragm opening.

G. Base shear

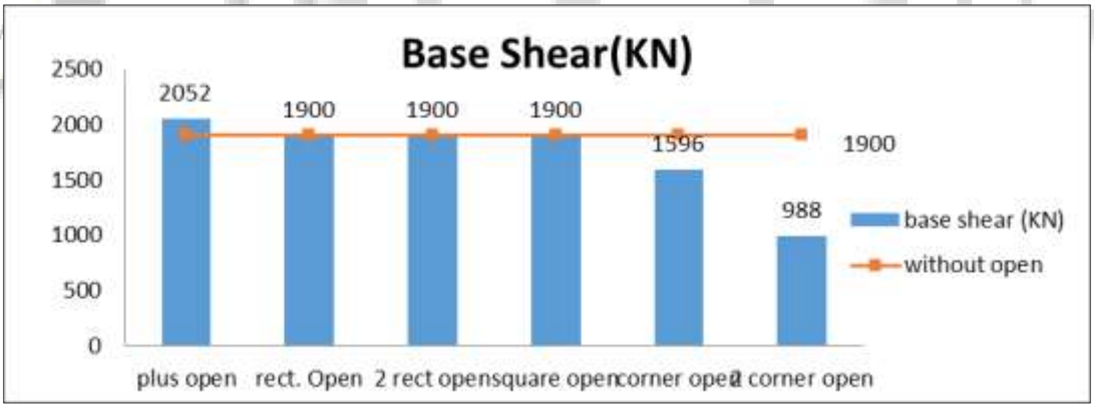

Fig. 10: comparison for base shear in multistoried building with and without diaphragm opening.

III. Conclusion

1) The impact of diaphragm opening of multistoried building on seismic response played a major role in base shear.
2) Provision of diaphragm opening changes the seismic behavior of the building.
3) Models having similar response for all parameters while models having change in the symmetry behaved differently.
4) The diaphragm opening at center founds more effective i.e. internally diaphragm openings are more effective than external diaphragm opening.
5) Shear force of building without any diaphragm opening is less than shear force of a building structure having different types of diaphragm opening. Internal diaphragm opening in a structure having grater shear force values as compared to shear force of a structure having external diaphragm opening.
6) Torsion in a structure having no diaphragm opening is less than torsion in a structure having diaphragm opening internally but the torsion in a structure without diaphragm opening is greater than torsion in a structure having diaphragm opening externally.
7) Bending moment of a structure having no diaphragm opening is less than bending moment of a structure

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having diaphragm opening internally but the bending moment of a structure without diaphragm opening is greater than bending moment of a structure having diaphragm opening externally.

8) Base shear of a structure having no any diaphragm opening is lesser than or equal to base shear of a structure having different types of diaphragm opening internally but; greater than the base shear of a structure having diaphragm discontinuity externally.

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