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Comparative Study on seismic analysis and Retrofitting of an Existing Building

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Abstract: ***The target of this undertaking is to examine and comprehend the impact of utilizing retrofitting strategies on a structure against the seismic unique burden. The investigation is completed on four models of a G+4 building. Model 1 was not exposed to any seismic burden and was discovered to be protected against the arrangement load and live burden and its blend. Model 2 was exposed to dynamic seismic burden and its mix and the disappointment of primary individuals was noted. Accordingly retrofitting was done in the following two models. In Model 3 the structure was retrofitted with bracings were as in Model 4 section jacketing and in Model 5 shear divider were utilized. Boundaries like removal, time history, firmness and base shear were chosen subsequent to leading a careful writing audit. Time-frame of the structure was ascertain according to IS1893-2016, and Zone factor was chosen as 0.1 and 0.16 alongside significance factor as 1 and Soil type as II from a similar code. Then, at that point the same static examination and reaction range investigation was completed on Models 2,3,4 and 5 individually and there results were arranged. In light of the outcomes acquired for the given boundaries and dynamic stacking condition it was reasoned that retrofitting the structure will in general decrease the impacts of dynamic stacking on the design. Further it was noticed that retrofitting the structure with shear divider gave the best suitable outcomes. As it diminished the time-frame of the structure by 32.72% and furthermore lessen the sidelong relocation and story float in both X and Y heading by a decent edge.***

Keywords: Bracing, column jacketing, shear wall, ETABS2016, Equivalent static analysis, Response Spectrum Analysis.

I. INTRODUCTION

Earthquakes area unit one amongst the foremost damaging natural hazards inflicting sizable loss of life and support. It is the surface shaking of the world that's sufficiently violent to cause severe damage and kill thousands of people. they're triggered by the Earth's crust's fulminant unleash of energy arising from tectonic plate movements. This power is free within the variety of seismal waves. Earthquakes area unit the foremost surprising and devastating natural disasters. within the worst case situation, the large amount of energy free throughout an earthquake will cause vital damage or destroy vital buildings. In this age of high-rise building harm from an earthquake to poorly built building / structure to resist earthquake forces can lead to greater lives and infrastructure loss. It is therefore very essential to identify the conduct of buildings during an earthquake. A large variety of existing buildings in Asian country square measure severely deficient against earthquake forces and also the variety of such buildings is growing terribly speedily. This has been highlighted within the past earthquake.

Describes a specific treatment approach and philosophy at intervals the sector of structural conservation. the method of implementing a injury detection and characterization strategy for engineering structures is observed as Structural Health observance (SHM). Here injury is outlined as changes to the fabric and/or geometric properties of a structural system, as well as changes to the boundary conditions and system property, that adversely have an effect on the system's performance. The restoration method involves the observation of a system over time mistreatment sporadically sampled dynamic response measurements from associate degree array of sensors, the extraction of damage-sensitive options from these measurements, and therefore the applied math analysis of those options to see the of system health. For long run structurasl analysis, the output of this method is sporadically updated info concerning the power of the structure to perform its supposed perform in light-weight of the inevitable aging and degradation ensuing from operational environments. once extreme events, like earthquakes or blast loading, structural analysis is employed for speedy condition screening and aims to produce, in close to real time, reliable info concerning the integrity of the structure. the main restoration techniques includes non-destructive testing Half- cell potential check on RC members, pervasion check on RC members, analysis which has Chloride determination check in concrete samples, sulfate determination check in

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Concrete samples, determination of hydrogen ion concentration level in concrete. With the growing rate of degradation within the nation's infrastructure, the requirement for as well as non-destructive testing (NDT) and field instrumentation in engineering programme has become additional apparent than ever before. Non-destructive testing or Non-destructive testing (NDT) may be a wide cluster of study techniques utilized in science and business to guage the properties of a fabric, part or system while not inflicting injury.

II. OBJECTIVE OF PROPOSED STUDY

A. *Introduction*

This undertaking targets assessing A current multi-story working against seismal masses and recommending retrofitting methods to diminish the full removal of the structure and increment the recurrence of seismal vibrations, exploitation the underlying designing code ETABS form sixteen. Technique for utilization of a seismal retrofitting procedure has been completely fledged. Notwithstanding, the objective is to accomplish a property and efficient construction with supported reasonableness and overstated pliability.

B. *Objectives*

1) Study of general displacement and brittle failure by assessing building capacity for seismic loads.
2) Analyzing the over all behaviour of the structure regarding safety, efficiency and ductility.
3) Comparing the retrofitting technique according to IS 1893-2016.

C. *Methodology*

1) At First a Autocad plan of an existing building should be imported into ETABS. Modelling and analysis is carried out using ETABS ver.16
2) The moment resisting frame is analyzed for Dead, Live, and Earth quake load combinations. After the moment resisting frame fails for the above combinations the lateral load resisting systems are introduced to the moment resting frame
3) Then the model is analyzed for Dead, Live, and Earth quake loads with lateral load resisting systems incorporated in the structure.
4) Behavior of lateral load resisting system i.e., retrofitting techniques model are studied.
5) Earth quake analysis is carried out with equivalent static method and response spectrum method.

III. ANALYSIS OF EXISTING G+4 STOREY BUILDING

The RC Buildings used in this study is four storied (G+4). Building have floor plan with 23(x direction) × 17 (y direction) as shown in fig. 2.1.

Following data is considered for analysis :

1) Type of frame – Special Moment Resisting Frame
2) No. of Stories – G+4
3) Zone (Z) – II & III
4) Importance factor (I) – 1
5) Response reduction factor (R) – 3
6) Slab thickness – 100mm and 150 mm
7) Size of beam – 200mm×450mm, 200mm×600mm
8) Size of column – 200mm×450mm, 200mm×750mm
9) Live load – 2 kN/m3
10) Height of floor – 3
11) Soil strata – Medium
12) Density of concrete – 25 kN/m3
13) M-20 and M-25 Concrete is used.
14) Fe-500 & Fe-250 steel is used.
15) Steel Bracing section – ISMB 450.
16) Equivalent static method.
17) Response spectrum.

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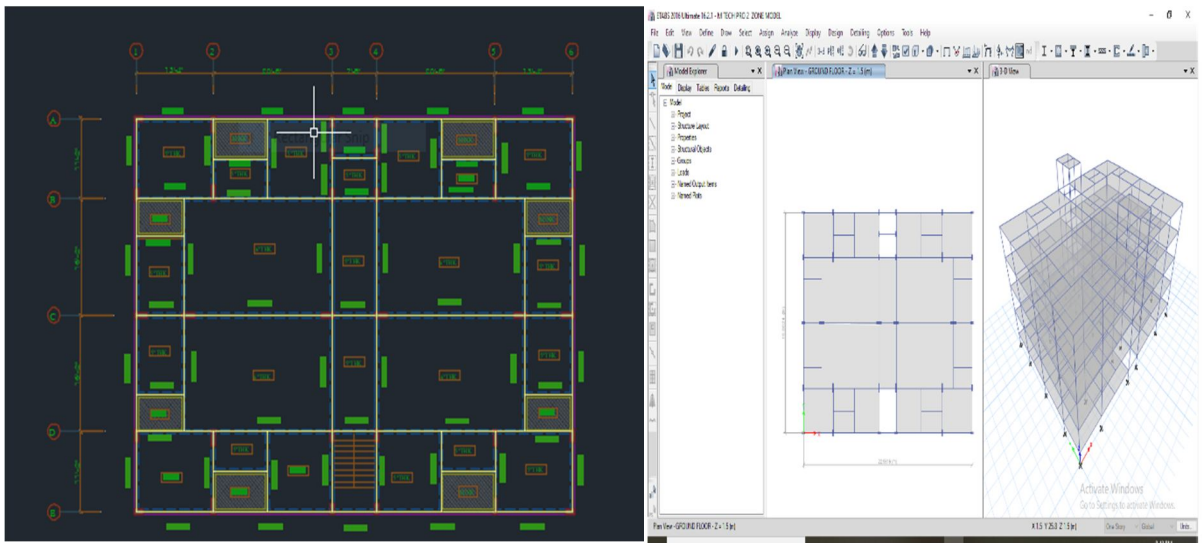


Fig.1: Plan

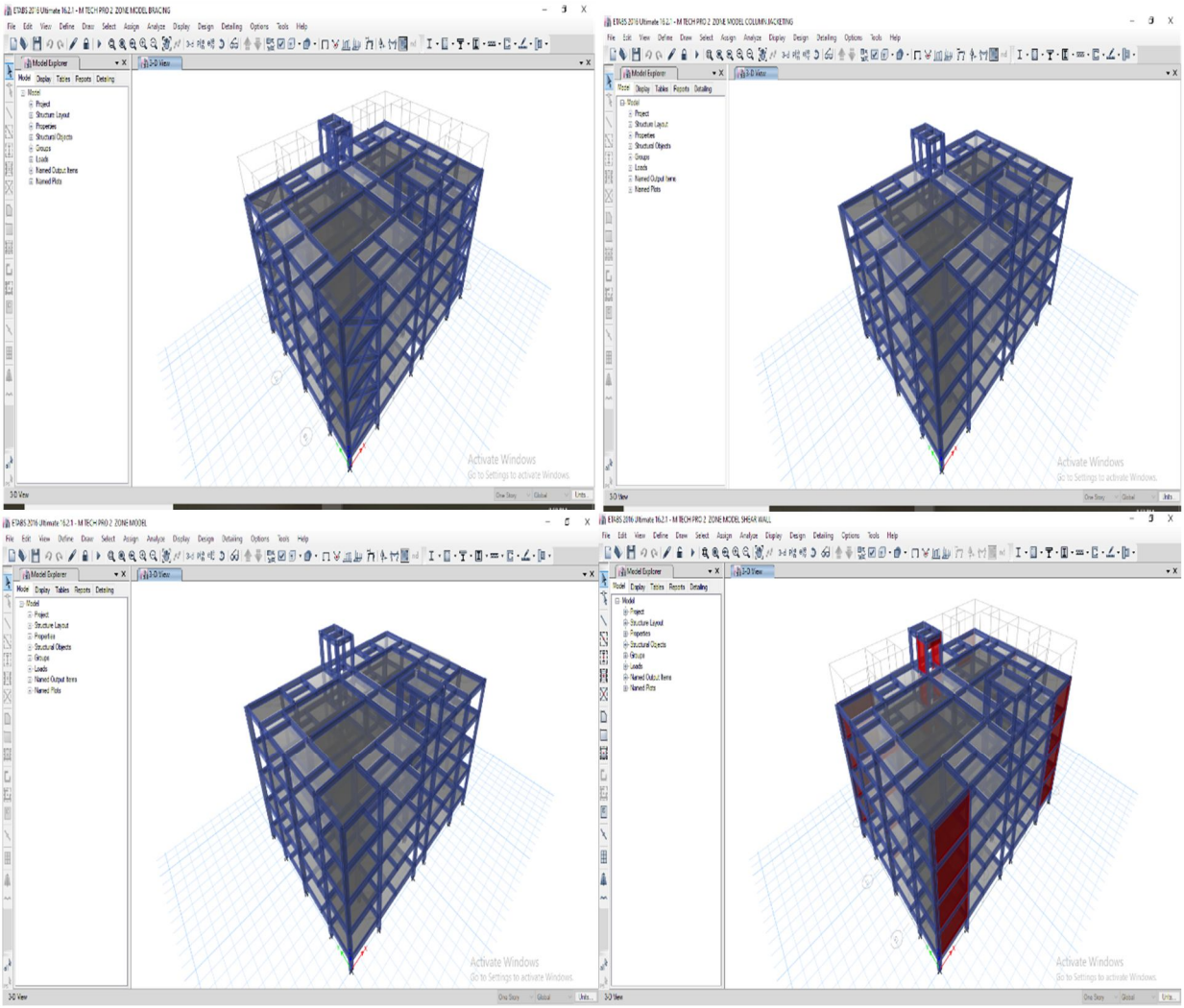


Fig.2: 3D view of the Bracing, Column Jacketing, Regular and shear wall structure

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IV. RESULT AND DISCUSSIONS

The outcomes are gotten from the investigation of G+4 RC outlined elevated structure by utilizing identical static and reaction range technique in Zone II and III for various boundaries like story relocation, story float, story solidness, time span and base shear.

A. Equivalent static analysis

1) Story Displacement

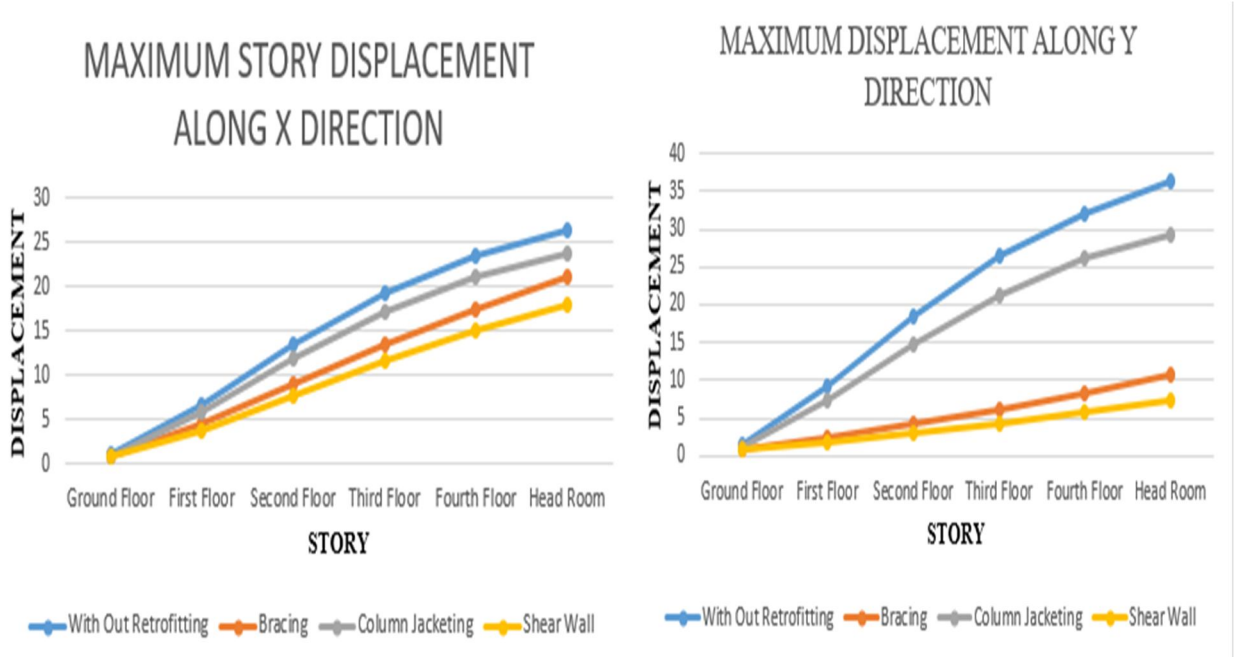


Fig 3: Maximum Story displacement (mm) in both X and Y direction for G+4 building model in zone 2.

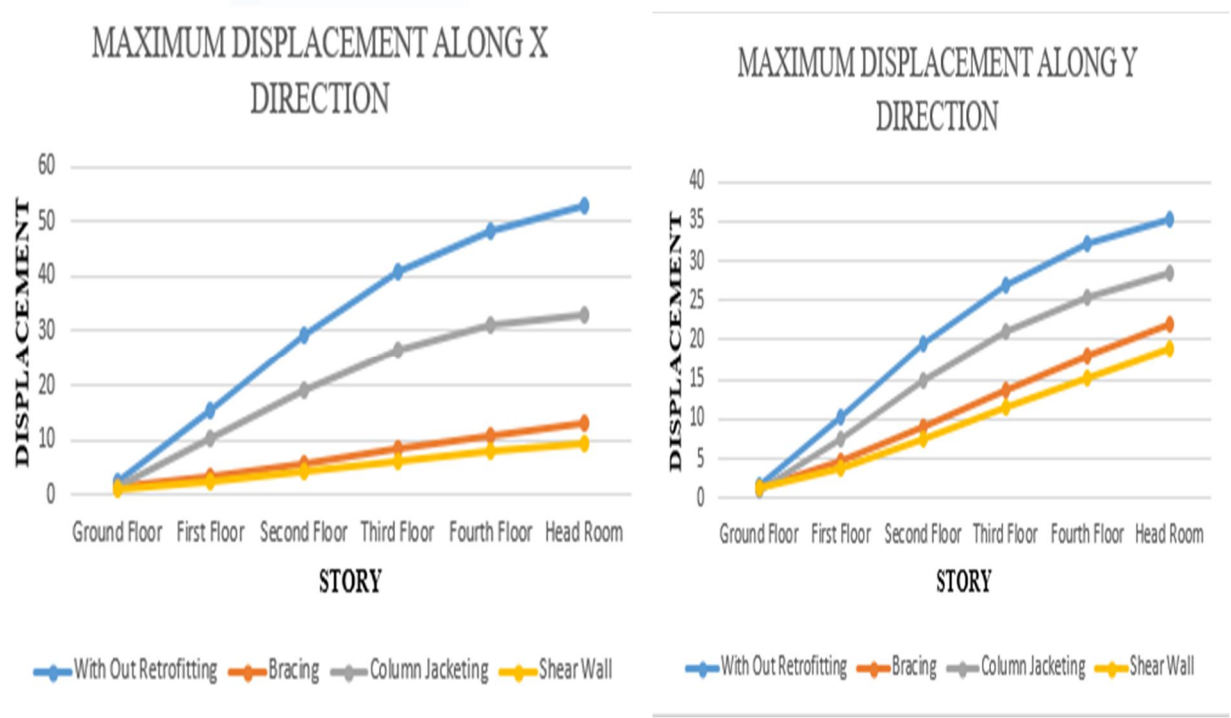


Fig 4: Maximum Story displacement (mm) in both X and Y direction for G+4 building model in zone 3.

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2) Story Drift

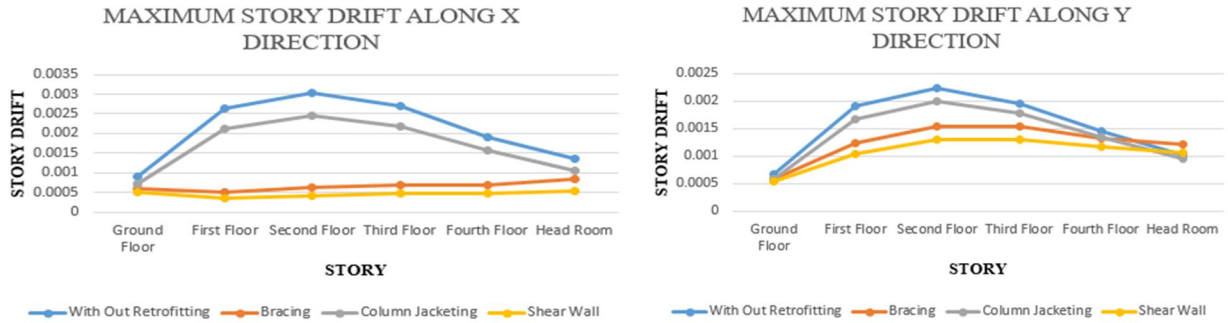


Fig 5: Maximum Story drift (mm) in both X and Y direction direction for G+4 building model in zone 2.

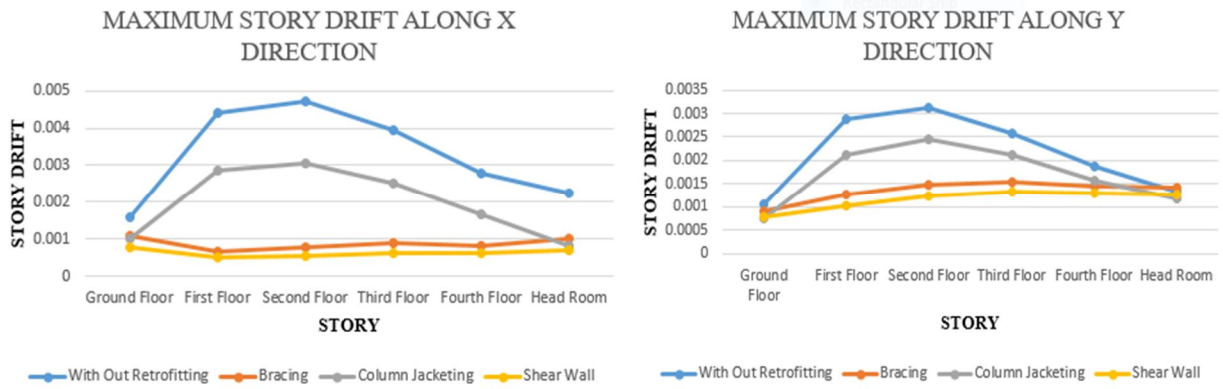


Fig 6: Maximum Story drift (mm) in both X and Y direction direction for G+4 building model in zone 3.

3) Story Stiffness

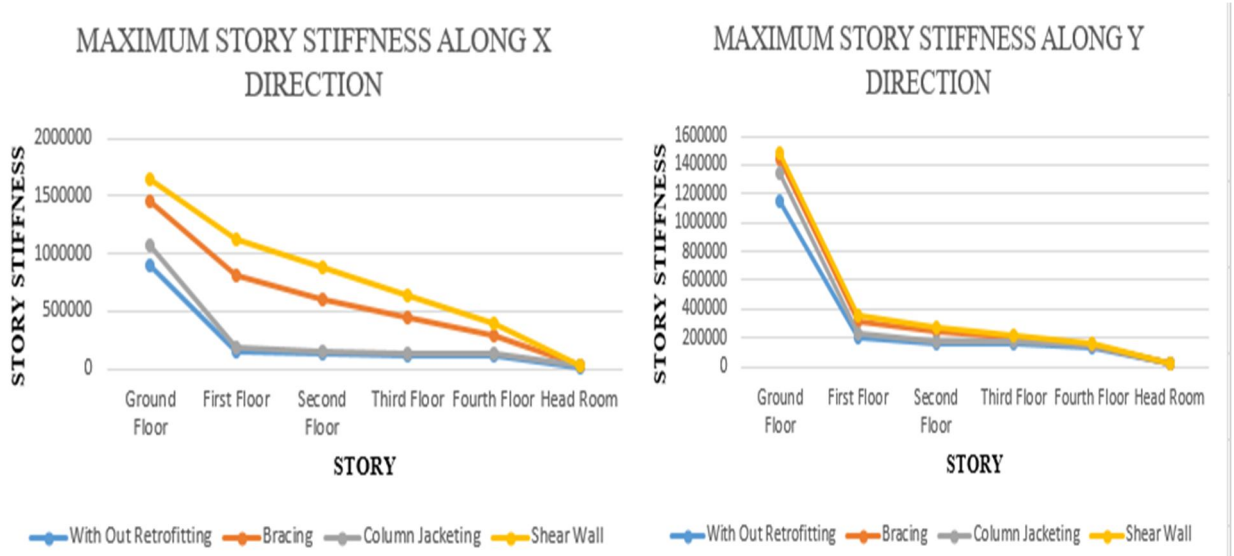


Fig 7: Maximum Story stiffness in both X and Y direction direction for G+4 building model in zone 2.

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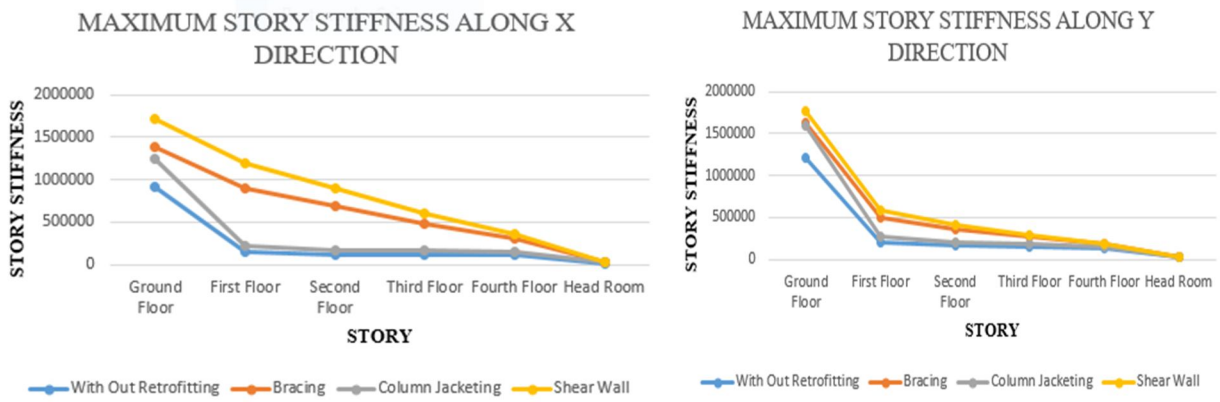


Fig 8: Maximum Story stiffness in both X and Y direction direction for G+4 building model in zone 3.

4) Base Shear

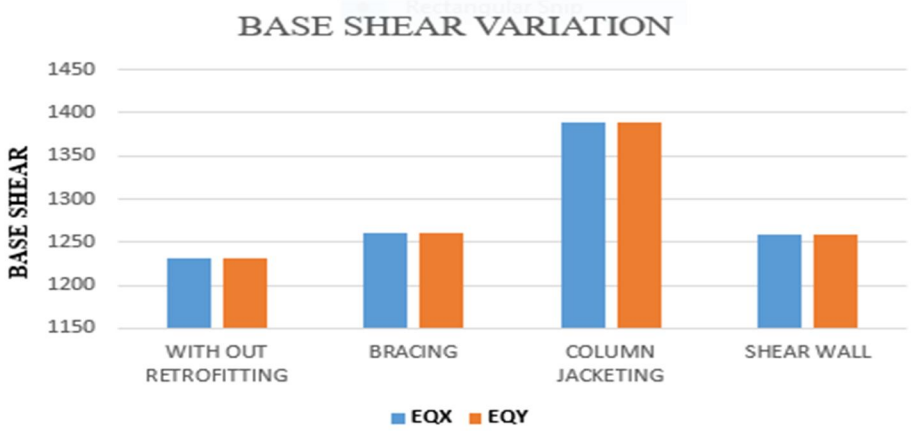


Fig 9 :Base Shear variation in Equivalent Static method in zone 2.

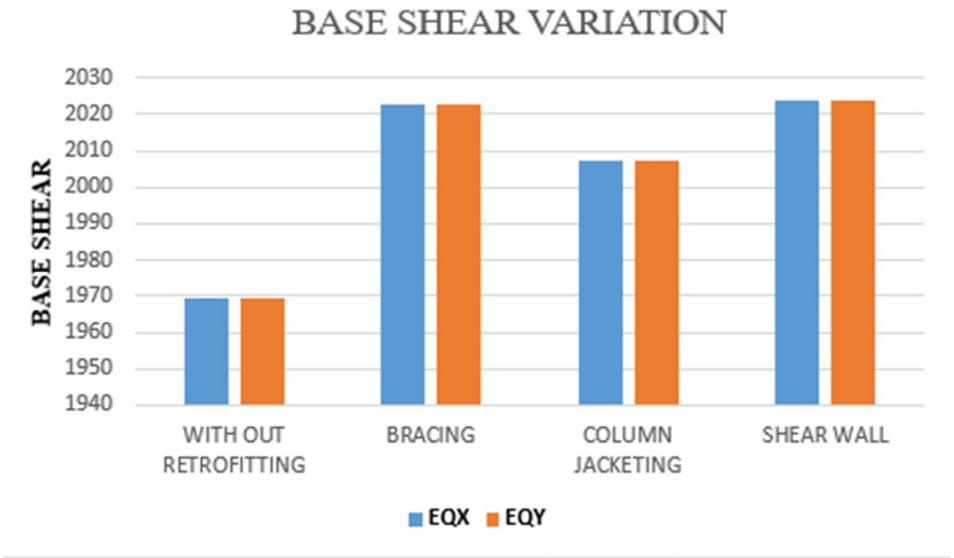


Fig 10 :Base Shear variation in Equivalent Static method in zone 3.

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B. Response Spectrum analysis

1) Story Displacement

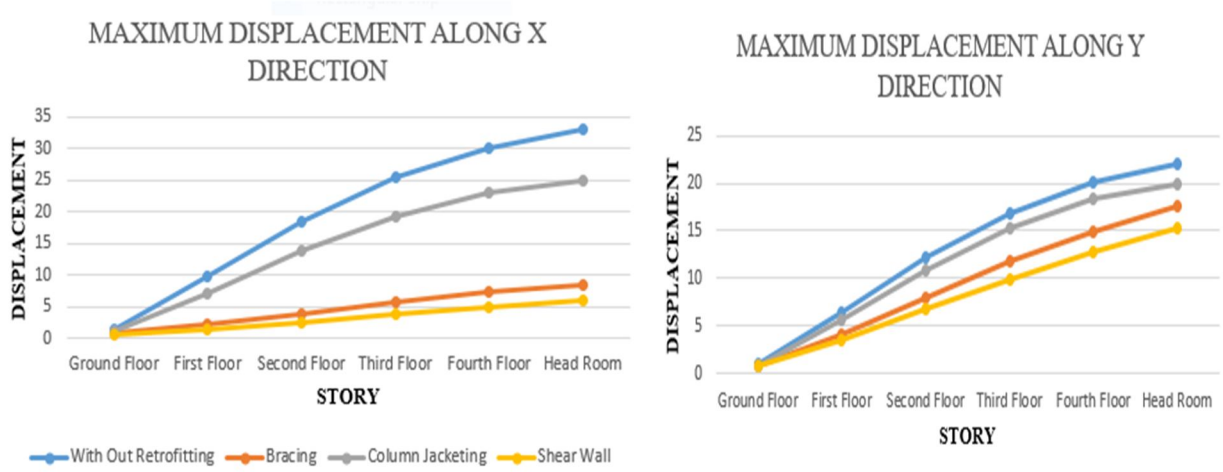


Fig 11: Maximum Story displacement (mm) in both X and Y direction for G+4 building model in zone 2.

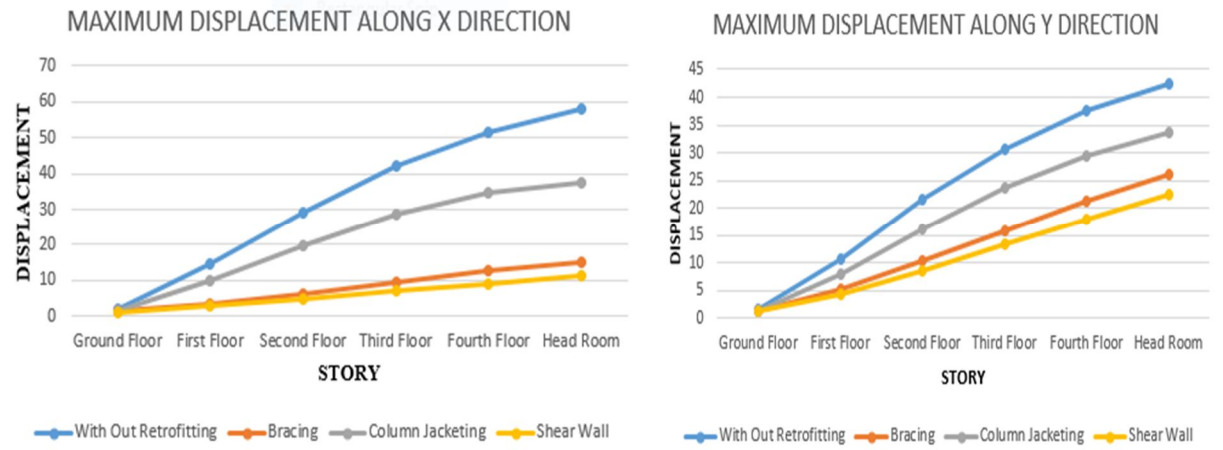


Fig 12: Maximum Story displacement (mm) in both X and Y direction for G+4 building model in zone 3.

2) Story Drift

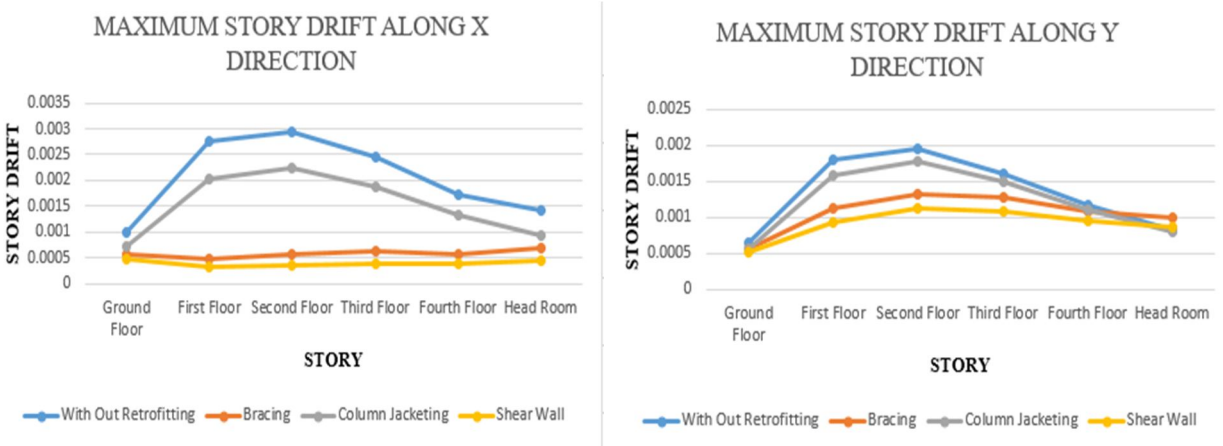


Fig 13: Maximum Story drift (mm) in both X and Y direction direction for G+4 building model in zone 2.

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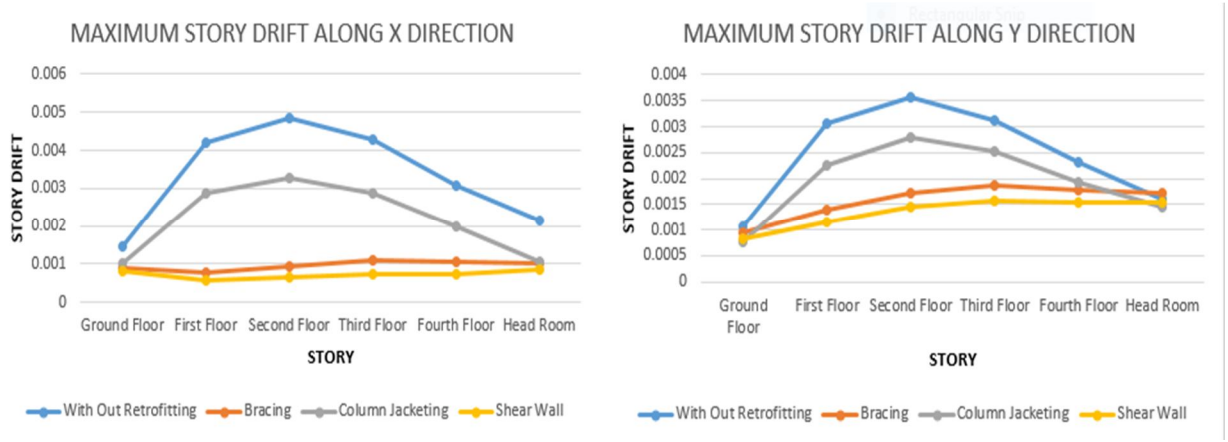


Fig 14: Maximum Story drift (mm) in both X and Y direction direction for G+4 building model in zone 3.

3) Story Stiffness



Fig 15: Maximum Story stiffness in both X and Y direction direction for G+4 building model in zone 2.

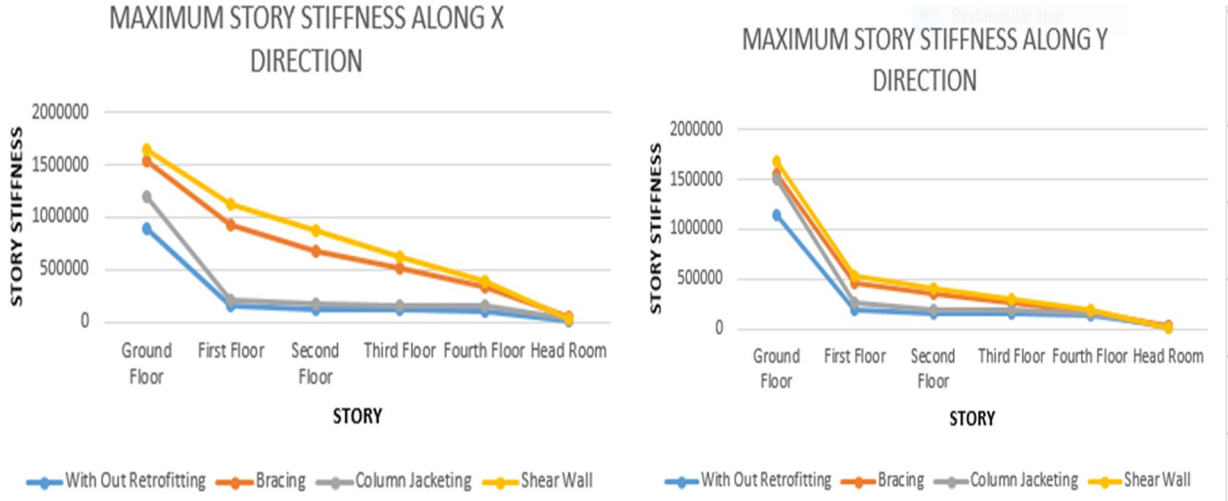


Fig 16: Maximum Story stiffness in both X and Y direction direction for G+4 building model in zone 3.

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4) Base Shear

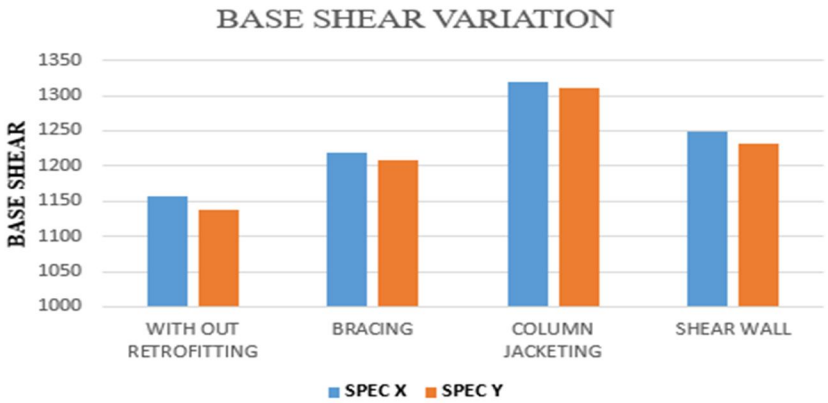


Fig 17 : Base Shear variation in Response Spectrum method in zone 2.

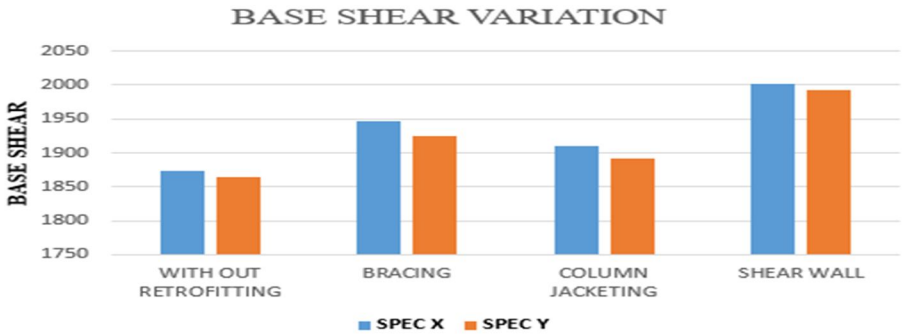


Fig 18 : Base Shear variation in Response Spectrum method in zone 3.

V. CONCLUSIONS

Analysis of RC building is carried out by using equivalent static method and response spectrum method. Following conclusions are drawn based on present study.

A. After the examination of the design with various kinds of primary frameworks, it has been presumed that boundaries like uprooting, float and time-frame of the construction is decreased after the use of retrofitting procedure.

B. The Critical parameters of building is reduced by using shear wall retrofitting technique when compare to the other retrofitting technique.

C. The comparison in Zone-2 it shows that model with shear wall will reduces the story displacement when compared to other retrofitting technique along with the normal bare structure.

D. However, from the comparison in Zone-2 it shows that model with shear wall reduces the story drift when compared to other retrofitting technique along with the normal bare frame structure.

E. The comparison in Zone-2 it shows that model with shear wall will increase the story stiffness and base shear when compared to other retrofitting technique along with the normal bare structure.

F. The comparison in Zone-3 it shows that model with shear wall reduces the story displacement when compared to other retrofitting technique along with the normal bare frame structure.

G. However, from the comparison in Zone-3 it shows that model with shear wall reduces the story drift when compared to other retrofitting technique along with the normal bare frame structure.

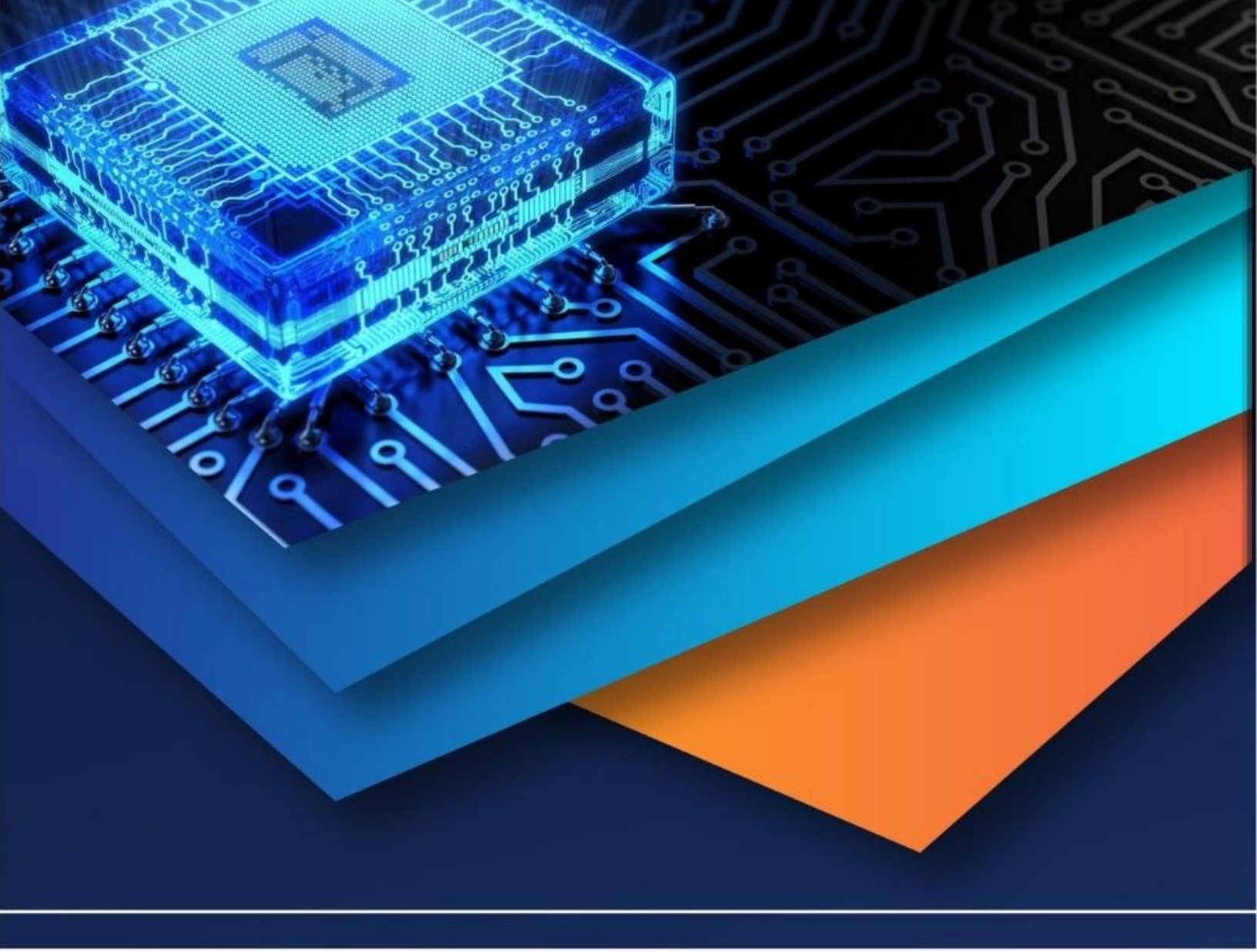
H. It can be concluded that based on the Zone factor and parameters of the building, model with shear wall will withstand the lateral forces which will help in reducing other parameters of the building when compare to the other retrofitting technique and normal bare structure.

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