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Seismic Analysis of Concentric Bracing In High Rise Steel Structure

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Abstract – *Now a days steel bracing are major and important part of the RCC as well as steel Structure. In any high rise structure to reduce displacement and modal time bracing are use. It play imp role to make structure stable from wind force and seismic force. In this present study concentric bracing are use on high rise steel structure and seismic effect of bracing system is studied using IS 1893:2016. Seismic analysis has been conducted to evaluate the effect of different bracing at different arrangement in high rise steel structure. Analysis is carried on X bracing, diagonal bracing, inverted V bracing and V bracing For this study G+15 high rise steel structure is mode by using IS 800:2007on ETABS 2016. Seismic zone is III and soil is medium soil with response reduction factor is 5*

Keywords: ***Concentric bracing, high rise steel structure, response spectre method, displacement, base shear.***

INTRODUCTION

Recently all over the world steel are commonly use in construction. For any high rise steel structure steel are commonly used as a structural material. Steel are more stable than RCC. Steel bracing are use to make structure more stiffed. Steel bracing reduce displacement and modal time of structure and also help to reduce story drift. Generally steel bracing improve base shear of structure. Stability of structure can be increases by using steel bracing against wind and earthquake. Bracing can be apply on bridge transmissions towers etc. it is easy to construed and it is in bolted in connection.

There are two types of bracing

1) Concentric bracing 2) Eccentric bracing

Concentric bracing are that bracing which intersect at node and the centroid of member is passes through the same point. Concentric bracing are easy to construct and reduce strory displacement and model time period. Concentric bracing in stability of structure. Eccentric bracing are that bracing which are depend on link that are created through eccentricity with either beam or column. It also reduce displacement and model time period.

DETAILS OF THE STRUCTURE

1. Modeling and analysis

High rise steel structure of G+15 are modeled on ETABS. Analysis is carried out on ETABS software. Different type of bracing systems for building are modeled and analysis for seismic load. The plan dimension of the building is 16m X 24m and height of story is 3m

2. Properties of building

No of stories	:	G+15
Beam	:	ISMB 300
Column	:	ISMB 600
Bracing	:	150X150X15

3. Loading details

Floor load and members weight and calculated as per general consideration as per IS 875 Part I. live load is 4 KN/N as per IS 875 Part II

4. Seismic loading

Seismic load is given as per IS 1893:2016 Part II

Zone	:	3
Zone Factor	:	0.16
Soil type	:	Medium

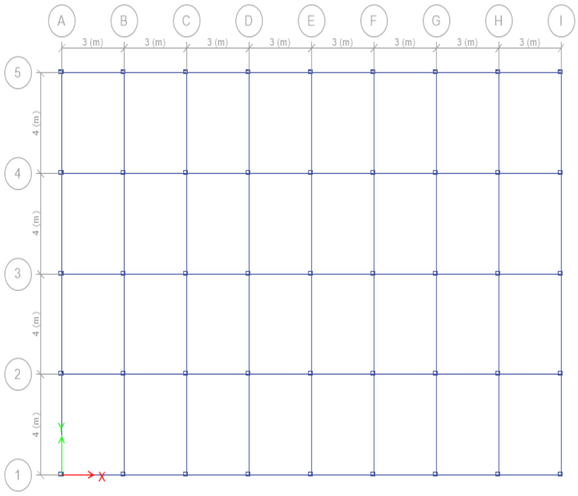


Fig 1: Plan of Study Work

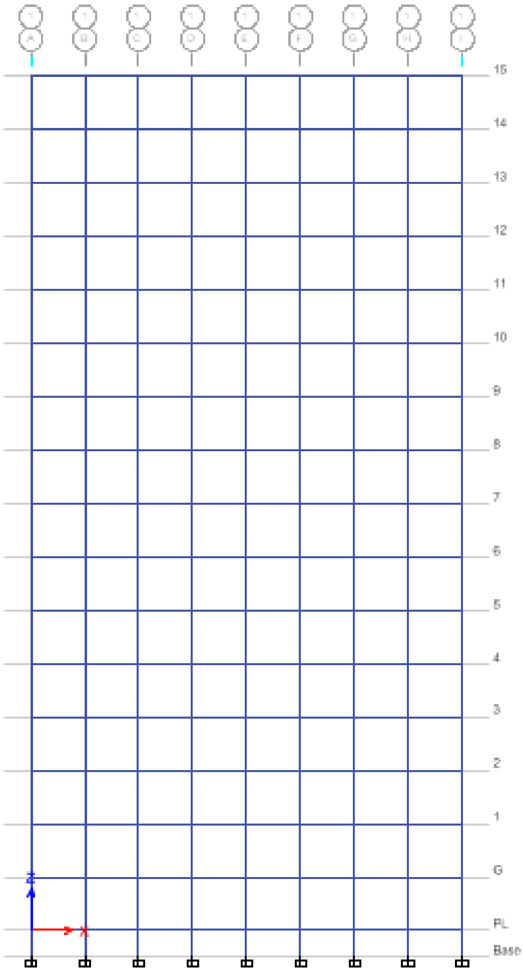
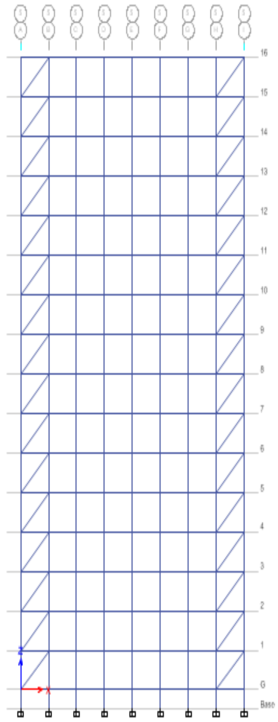
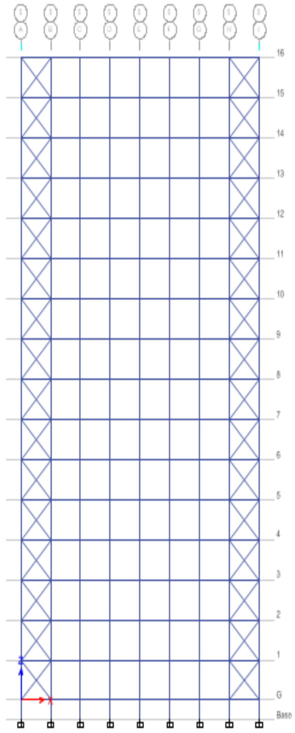


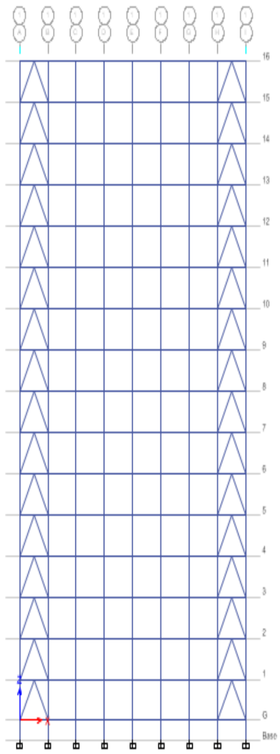
Fig2: Elevation of G+15



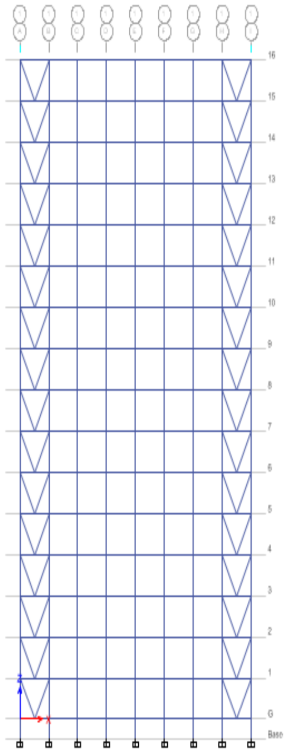
Corner diagonal bracing



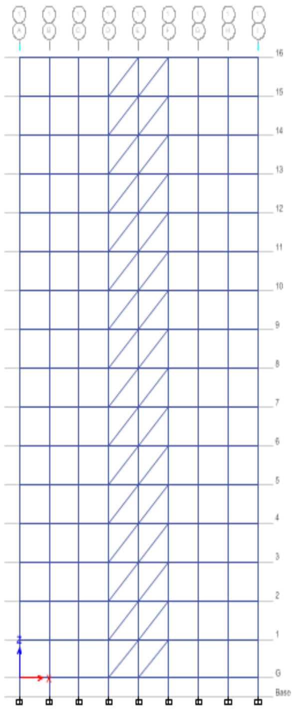
Corner X bracing



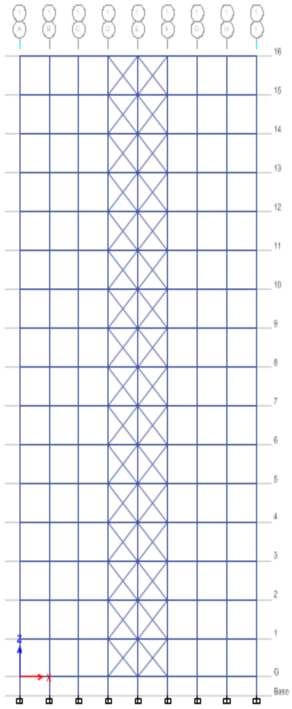
Corner inverted V bracing



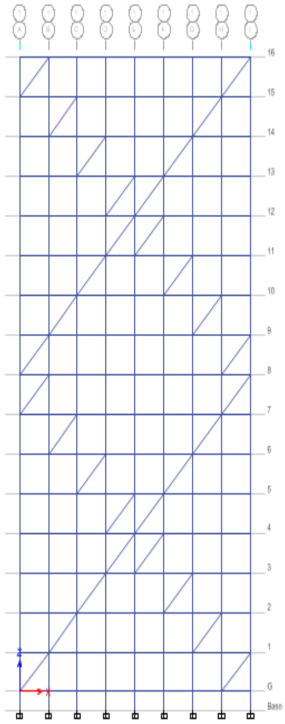
Corner V bracing



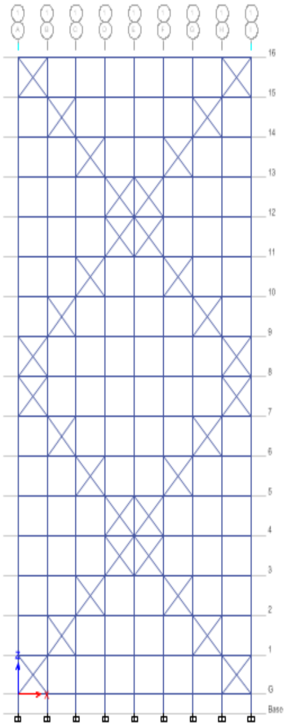
Center diagonal bracing



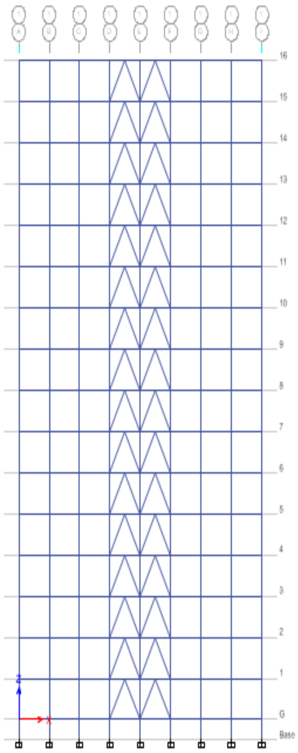
Center X bracing



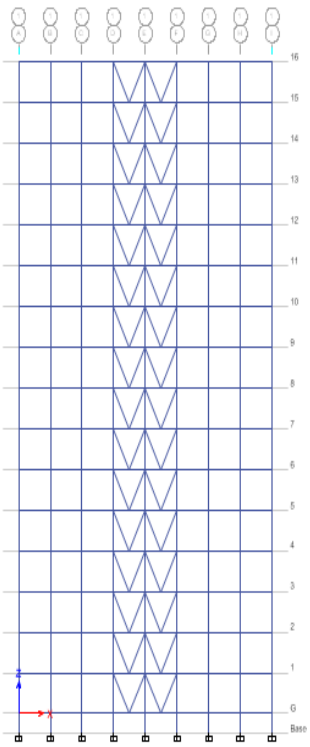
Cross pattern diagonal bracing



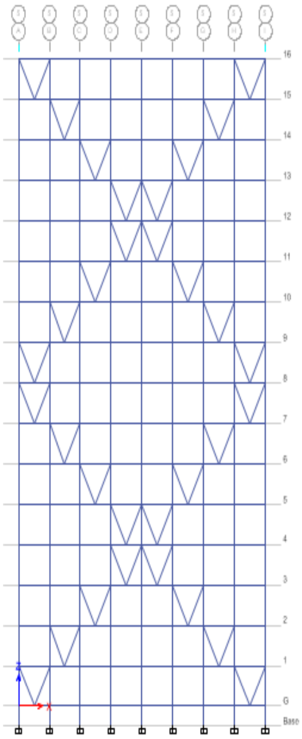
Cross pattern X bracing



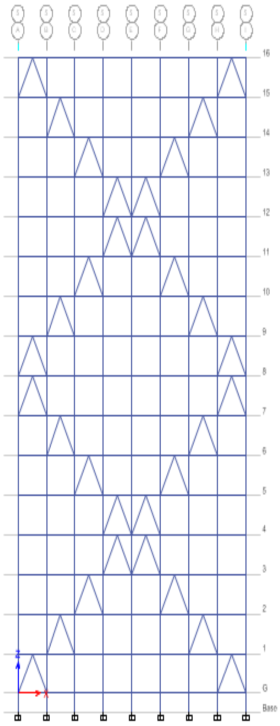
Center inverted V bracing



Center V bracing



Cross pattern V bracing



Cross pattern inverted V bracing

RESULT

1) Model time Period

1.1 Comparison between model period (second) of bracing at different location

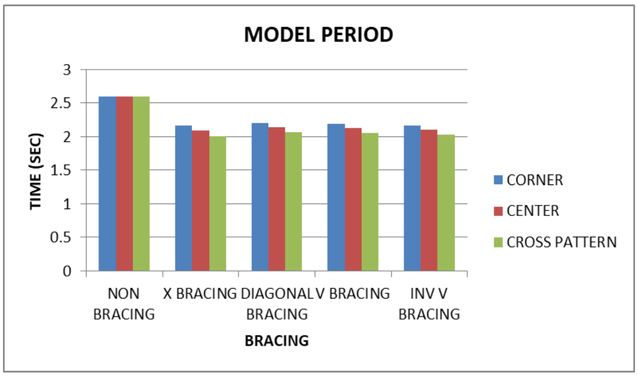


Fig9**:** Structural of model time Period in second

1.2 Comparison between decrease of model period (% reduction) of bracing at different location in seconds

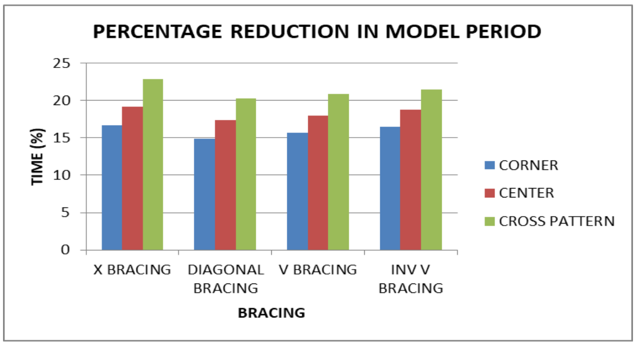


Fig10: Structural of model time Period in percentage

2) Displacement

2.1 Comparison between displacement (mm) of bracing at different location in X direction

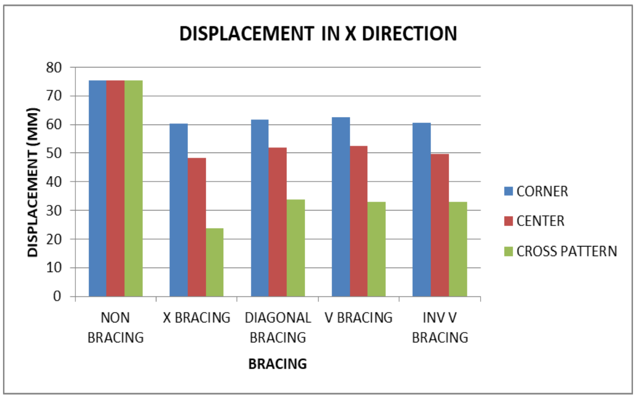


Fig11: G+15 Displacements (mm) in X direction

2.2 Comparison between decrease of displacement(% reduction) of bracing at different location in X direction

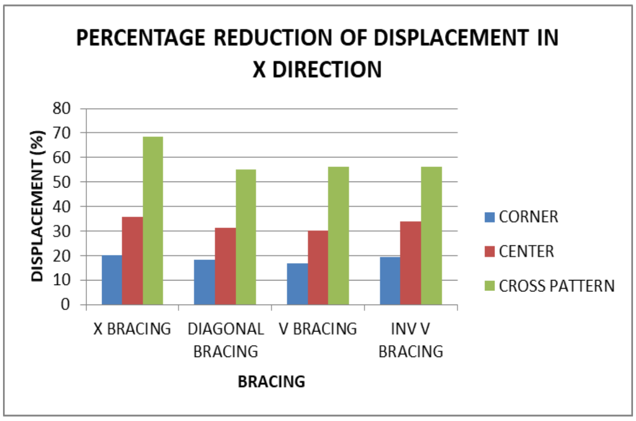


Fig12: G+15 Displacements (%) in X direction

2.3 Comparison between displacement(mm) of bracing at different location in Y direction

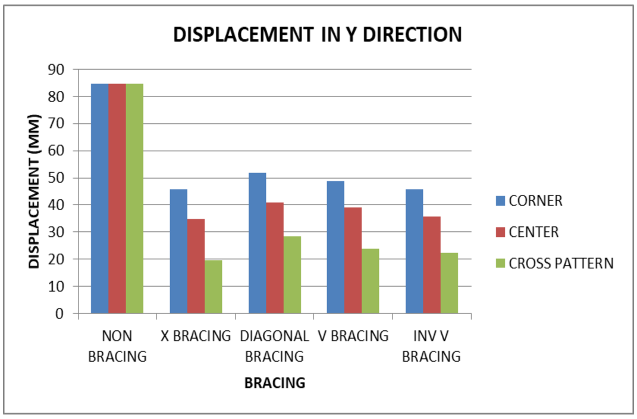


Fig13: G+15 Displacements (mm) in Y direction

2.4 Comparison between decrease of displacement (%reduction) of bracing at different location in Y direction

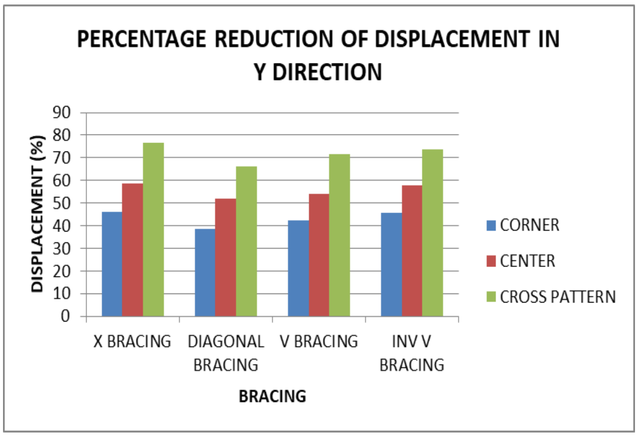


Fig14: G+15 Displacements (%) in Y direction

3) Base shear

3.1 Comparison of base shear(KN) when bracing is applied at different location in X direction

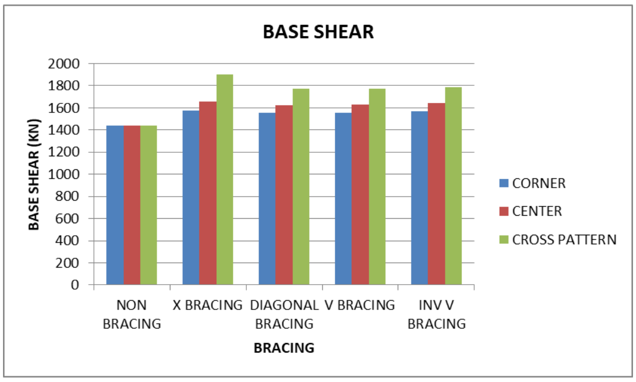


Fig15: G+15 Base Shear (KN) in X direction

3.2 Comparison of percentage in increases in base shear(KN) when bracing is applied at different location in X direction

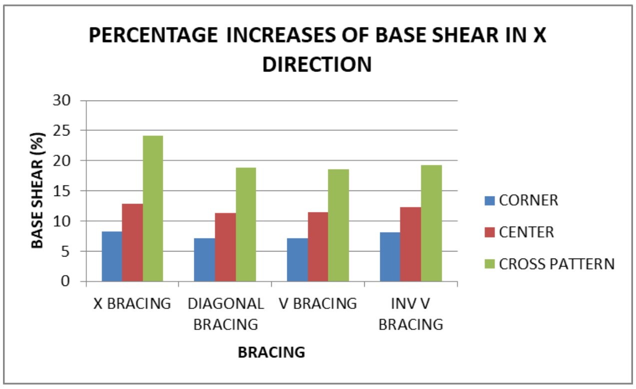


Fig16: G+15 Base Shear (%) in X direction

3.3 Comparison of base shear(KN) when bracing is applied at different location in Y direction

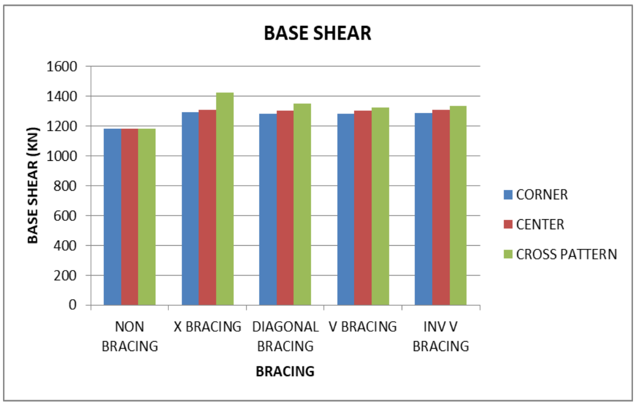


Fig17: G+15 Base Shear (KN) in Y direction

3.4 Comparison of percentage in increases in base shear(KN) when bracing is applied at different location in Y direction

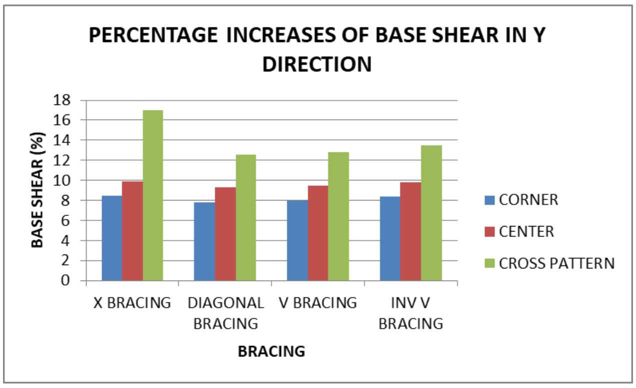


Fig 18 G+15 Base Shear (%) in Y direction

CONCLUSION

The following are the observations from the present analysis.

1. Steel framed structure with concentric X bracing are possessing higher ductility reduction higher strength against seismic force when compared to unbraced, v bracing inverted and diagonal bracing.

2. Cross pattern arragement are improving base shear and reducing displacement and model time period as compare to corner and center arrangement.

3. X barcing are improving base shear and reducing displacement in compare of diagonal bracing, inverted V bracing and V bracing.

4. Overall concentric X bracing giving better result for seismic analysis.

5. By considering lateral stiffness, the concentric X bracing has been found the most suitable one for steel building studied under the present study.

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