

Seismic Retrofitting of Existing Multistory Building with Bracing on Outer Periphery on Building

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ABSTRACT: Retrofitting structure with x braced system is such a one system they can resist lateral load due to earthquake, and wind load. Basically enhancing the strength of lateral resisting capacity need retrofitting of structure, structure will not fail due to lateral load. Looking at the record of the previous earthquake shows that today's time structure earthquake should be an earthquake resistant because the earthquake in a day or night without any warning any times it comes, it causes loss of public wealth. The structure also gets lost from earthquake. Whenever we construct high rise building, we have to consider the effect of lateral forces.

These lateral forces are generated by the earthquake and wind. It is important to analyze the building whenever a minor earthquake occurs, a building can resist earthquake without damage and to avoid damage during major earthquake, it is necessary the member should be ductile. The purpose of this paper is that retrofitted building should be designed. We design of 12 storey building according to IS: 456-2000 using ETABs software. Seismic analysis of retrofitting structure of aim is that improve the seismic performance of building we are using x type bracing provide on outer periphery on building. We check the effect of distribution of steel braced system throughout the height of high rise building.

INTRODUCTION

For improving the lateral resisting capacity of structure many methods are developed for retrofitting of structure. For retrofitting many methods like concrete jacketing, steel bracing, shear wall method. We are using x bracing system for retrofitting of RC structure. Many researchers are doing study that how we can construct earthquake resistant structure, and they also give guide line for retrofitting or earthquake resistant structure. Retrofitting of structure also provide for safety from natural hazard such as tropical cyclones, severe wind and tornadoes etc. retrofitted structure reduce the natural hazard and give safety for non structural element. Retrofitted structure does not mean that they are earthquake proof structure, they only. If retrofitted structure is properly designed they give better performance during earthquake.

Bracing provide on structure for resist lateral load i.e. earthquake and wind load. We are doing comparison study of x bracing for applying different span, to check the minimum value of drift and displacement in both direction i.e. horizontal and vertical direction.

The retrofitting process

(a) Decision to brace a structure-

Before retrofitting of structure with x type bracing, we should have proper knowledge about a particular seismic zone, in which zone we are retrofitted building are designed. After analyzing we should have knowledge about seismic response of structure of without retrofitted structure. If seismic response is not good, then we will decide retrofitting replacement is best. Retrofitting of structure will be good because it enhance the seismic response of structure.

(b) Design of the bracing system

Design of bracing system also depend on load pattern, bracing pattern etc. we should try that braced system give minimum value of drift and displacement, good elasticity and bracing system should be able to carry the additional load. During the connection of bracing joint should have proper designed and we should avoid the chances of local failure of joint. We should have proper knowledge about which type of connection (welded, pin) will be best for retrofitting of structure. Foundation of structure should be enough strengthening because retrofitted structures act greater force on foundation.

During retrofitting of structure with bracing, we can insert bracing in structure because it gives lateral strength, ductility

and stiffness. For retrofitting of structure we apply bracing on outer periphery on column. Design criteria of bracing, type of connection are main factor affecting the strength and ductility of retrofitted structure.

METHODOLOGY

We take a high rise building model and will analyze for seismic zones 5 and zone 3 and whatever result will come such as displacement and drift will comprise to retrofit and without retrofitted building. The seismic analysis is carried out by using Response spectrum method using FEM based ETABs (2013) software code -

Rcc design-IS: 456-2000 Steel design -IS: 800-2007

Seismic design - IS: 1893-2002(part-1)

Description of the sample building

Table 1:Description of RC modal	
Type of frame	Reinforced Concrete Frame
Plan size	60mX40m
RC Building	12 storey building
Storey height	3 meters
Beam size	300mm X 600mm
Column size	400 mmX500mm
Thickness of slab	150 mm
Live load	3 KN/m ²
Floor finish load	1 KN/m ²
Unit weight of concrete	25kN/m ³
Yield strength of steel	500 N/mm ²
Seismic zone	5 &3
Sub soil type	2(medium)
Importance factor	1
Response factor	5
Method of analysis	Equivalent static method

(1) For seismic analysis of building we are using ETABs (2013) software.

(2) For seismic analysis load consider as per IS: 1893-2002

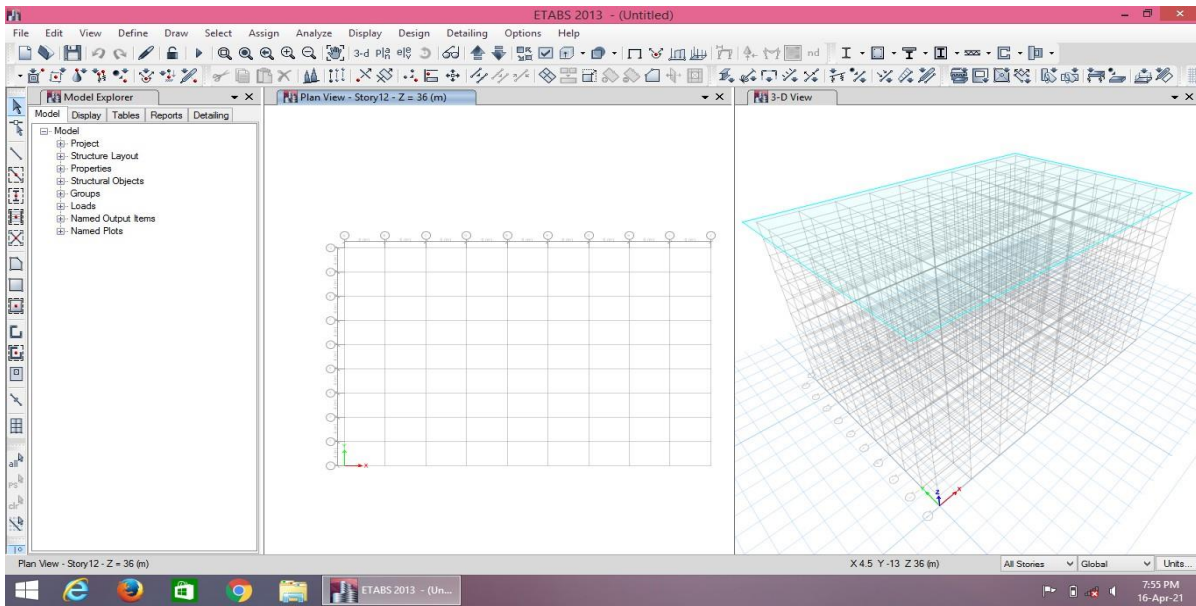


Fig. 1: Plan of building

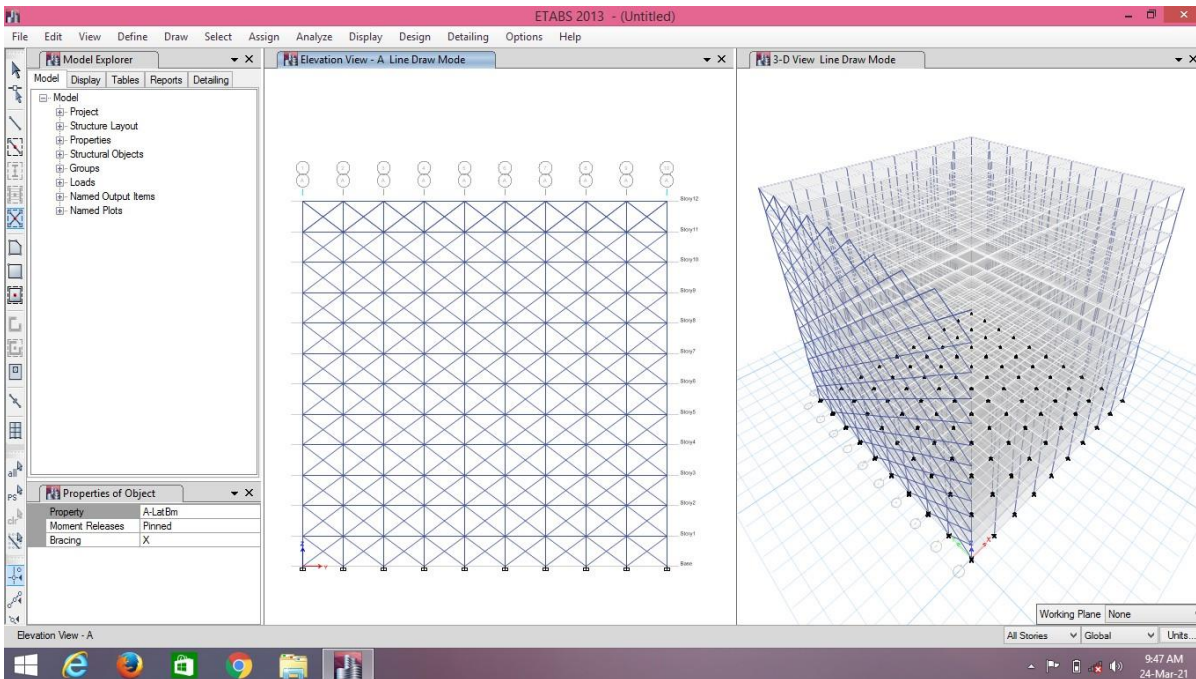


Fig.2: X braced on continuous span

RESULT AND DISCUSSION -
(a) Storey drift

It is observed that retrofitting with x type bracing on continuous span give minimum of drift in X- direction and Y-direction compare to unbraced system. We find that 68.32% in X- direction and 60.53 % in Y- direction for seismic zone 5 and 64.86% in x direction and 58.28% in Y direction for seismic zone 3 reduce value in braced system, compare to un braced system.

Table 2 : Storey drift for seismic zone5				
Storey	Without Bracing		With X bracing	
	X-direction	Y-direction	X-direction	Y-direction
Storey12	0.000447	0.000447	0.000282	0.000381
Storey11	0.000665	0.000708	0.000269	0.000429
Storey10	0.000897	0.000946	0.000306	0.000470
Storey 9	0.001091	0.001138	0.000339	0.000400
Storey 8	0.001245	0.001289	0.000373	0.000522
Storey 7	0.001361	0.001402	0.000396	0.000534
Storey6	0.001445	0.001482	0.000410	0.000535
Storey 5	0.001502	0.001533	0.000416	0.000524
Storey 4	0.001535	0.001561	0.000414	0.000503
Storey 3	0.001546	0.001568	0.000403	0.000470
storey 2	0.000447	0.000447	0.000282	0.000381
Storey 1	0.000665	0.000708	0.000269	0.000429

Table 3 : Storey drift for seismic zone 3				
Storey	Without Bracing		With X bracing	
	X-direction	Y-direction	X-direction	Y-direction
Storey12	0.000243	0.000205	0.000193	0.000185
Storey11	0.000302	0.000316	0.000127	0.000192
Storey10	0.000399	0.000421	0.000153	0.000210
Storey 9	0.000485	0.000506	0.000155	0.000223
Storey 8	0.000553	0.000573	0.000175	0.000232
Storey 7	0.000605	0.000623	0.000185	0.000237
Storey6	0.000642	0.000659	0.000191	0.000246
Storey 5	0.000668	0.000682	0.000194	0.000241
Storey 4	0.000683	0.000694	0.000193	0.000229
Storey 3	0.000687	0.000697	0.000184	0.000210
storey 2	0.000678	0.000689	0.000193	0.000229
Storey 1	0.000476	0.000547	0.000313	0.000313

(b) Lateral displacement

It is observed that retrofitting with x type bracing gives the reduction value of lateral displacement. While lateral displacement of maximum value for unbraced system. These lateral displacement value reduce when x bracing placed continuous span on outer periphery on column for retrofitting of structure. X braced system give 62.11% minimum value of lateral displacement for zone 5 and zone 3 top storey compare to UN braced system.

Conclusions

After the analysis of retrofitting structure using x type bracing, it is conclude that retrofitted structure give minimum value of lateral displacement, after the application of x bracing for retrofitting of structure, maximum reduction in lateral displacement occurs. X braced structure of seismic performance is good compare to other type braced structure. Total weight of structure will not change after retrofitting using x type bracing system. We did the comparison between retrofitting structure using x type bracing and UN braced structure.

Following are conclusion of our study-

- (1) Retrofitting of RC building using x type bracing shows economical for seismic zone 5 and zone 3.
- (2) Lateral displacement and storey drift give reduce value for retrofitting of structure using x type bracing compare to without retrofit structure.
- (3) Lateral displacement give 62.11% reeducation for retrofitting of structure compare to without retrofitting of structure.
- (4) Storey drift reduce up to 64.86% in x direction and 58.28% in Y direction for zone 3 retrofitting of structure compare to without retrofit structure.
- (5) Storey drift reduce up to 68.32% in x direction and 60.53% in Y direction for zone 5 retrofitting of structure compare to without retrofit structure.

- (6) Steel bracing of main advantage is that this can be used for retrofit and enhance the strength for structure.
- (7) X type steel bracing also reduce bending moment and shear force on beam and column and bracing also transfer load through axial action.
- (8) Retrofitting of structure using x type steel bracing because it give minimum value of bending moment compare to other type bracing.

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