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Comparative Study of Dynamic Response of Multistorey Building using Response Spectrum and Time History Methods

SiddelaJony, D AdityaSairam

P.G. Student, Department of Civil Engineering, VasireddyVenkatadri institute of technology, Guntur, Andhra pradesh, India

Assistant Professor, Department of Civil Engineering, VasireddyVenkatadri institute of technology, Guntur, Andhra pradesh, India

ABSTRACT: Multi storied structures, when designed, are made to fulfill basic aspects and serviceability. All the challenges faced by structural engineers were taken as opportunities to develop software such as STAAD PRO, ETABS, SAP etc. The design results using STAAD PRO and ETABS of a rectangular RCC building, for regular plan configuration, are obtained and compared. The main purpose of this study is to carry out a detailed analysis on simulation tools ETABS and STAAD PRO, which have been used for analysis and design of rectangular Plan with vertical regular and rectangular Plan multi-storey building In this paper the earthquake resistance of a G+11 multi-storey building is analyzed using Dynamic analysis methods with the help of E-TABS 9.7.4 software and STAAD PRO. The building is analyzed in Zone 2, Zone 3, Zone 4, and Zone 5 with medium soils in Dynamic Analysis by using ETABS and STAAD PRO. The parameters studied were storey drift, storey shears and support reactions.

I. INTRODUCTION

Natural disasters are inevitable and it is not possible to get full control over them. The history of human civilization exhibits that guy has been fighting with natural failures from its foundation however natural failures like floods, cyclones, earthquakes, volcanic eruptions have various times not simplest disturbed the ordinary lifestyles pattern but additionally induced massive losses to lifestyles and belongings and interrupted the manner of improvement.

Structures are the primary indicator of social growth of the county. Every human has wished to possess cozy houses on an average most commonly one spends his two-third life occasions within the houses. The protection civic feel of the responsibility, These are the few motives which are accountable that the man or woman do utmost effort and pay tough-earned saving in owning houses.

The design is created by using ETABS software. The constructing subjected to every the vertical hundreds additionally as horizontal masses. The vertical load consists of lifeless load of structural elements equivalent to beams, columns, slabs etc. The horizontal load includes the wind forces so building is intended for lifeless load, reside load and wind load as per IS 875. The constructing is meant as two dimensional vertical body and analyzed as per IS 456-2000. The help is taken via program furnished in institute and for this reason the computations of hundreds, moments and shear forces and received

A.REGULAR CONFIGURATION:

Normal configuration is seismically concept. Those configurations have low heights to base ratio, symmetrical plane, uniform section and elevation and accordingly have balanced resistance. Those configurations would have most torsion

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resistance due to locations of shear partitions and bracings. Uniform floor heights, brief spans and direct load path play a massive function in seismic resistance of the building

II..METHODOLOGY

A. METHODS FOR EARTHQUAKE ANALYSIS OF STRUCTURES:

- Linear Static Procedure
- Linear dynamic Procedure
- Nonlinear Static Procedure (Pushover analysis)
- Nonlinear dynamic procedure As per IS-1893:2002,

Methods Adopted are

- Response Spectrum Method
- Time history method

B. Response spectrum method:

The illustration of maximum response of idealized single degree freedom device having sure duration and damping, during earthquake floor motions. This analysis is executed in step with the code is 1893-2002 (part1). Right here form of soil, seismic region aspect must be entered from is 1893-2002(part1). The usual response spectra for sort of soil considered is implemented to constructing for the analysis in etabs 9.7.4 and Staad.pro
The result of a response spectrum evaluation the usage of the reaction spectrum from a ground movement is normally extraordinary from that which might be calculated immediately from a linear dynamic evaluation the use of that ground motion at once, on the grounds that section records is lost inside the manner of producing the response spectrum.

C. Time history analysis:

In this evaluation dynamic reaction of the building can be calculated at every time intervals. This evaluation may be carried out with the aid of taking recorded ground motion statistics from past earthquake database. This analysis overcomes all risks of response spectrum evaluation if there may be no involvement of nonlinear conduct.

Using this method will be on the proper ground movement and shall be finished the usage of ordinary principles of dynamics. On this approach, the mathematical version of the constructing is subjected to accelerations from earthquake statistics that constitute the predicted earthquake at the base of the structure.

Basic parameters considered for the analysis are

- Utility of building : Residential building
- Number of stories : G+11
- Shape of building : Rectangle
- Type of walls : Shear wall, Brick wall
- Geometric details
  - Ground floor : 4.0m
  - floor to floor height : 3.0m
- Material details
  - Concrete Grade : M25 (COLUMNS AND BEAMS)
  - All Steel Grades : HYSD reinforcement of Grade Fe415
  - Bearing Capacity of Soil : 200 KN/m^2
- Type Of Construction : R.C.C FRAMED structure

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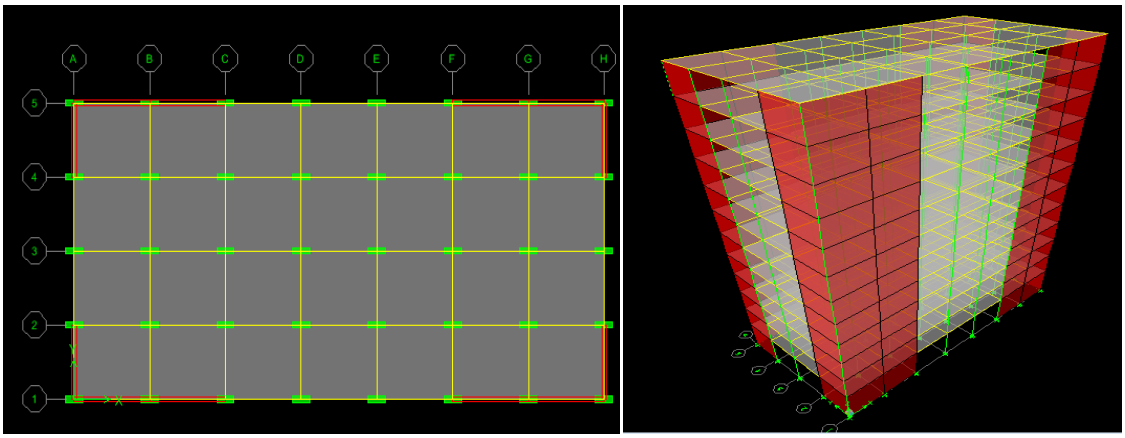
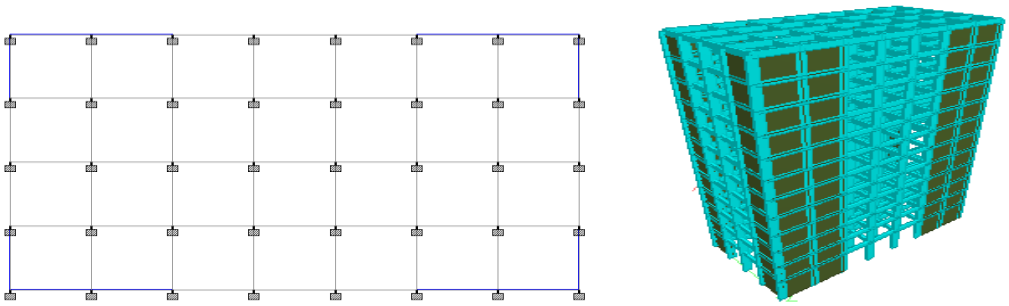
- Shear wall thickness :230 mm

D. Plan of the building & 3D VIEW of the building in E-Tabs



E. Plan of the building & 3D VIEW of the building in STAAD.Pro



F. **Load combinations:**

In the limit state design of reinforced and prestressed concrete structures, the following load combinations shall be accounted for as per IS1893 (part1):2002

1. 1.5(DL+IL)
2. 1.2(DL+IL±EL)
3. 1.5(DL±EL)
4. 4 0.9DL±1.5EL

Out of 32 combinations, we obtained the following combinations having maximum storey drift & storey shear

1. DCON7= 1.5(D.L+EQX)
2. DCON8=1.5(D.L-EQX)
3. DCON9=1.5(D.L+EQZ)
4. DCON10=1.5(D.L-EQZ)

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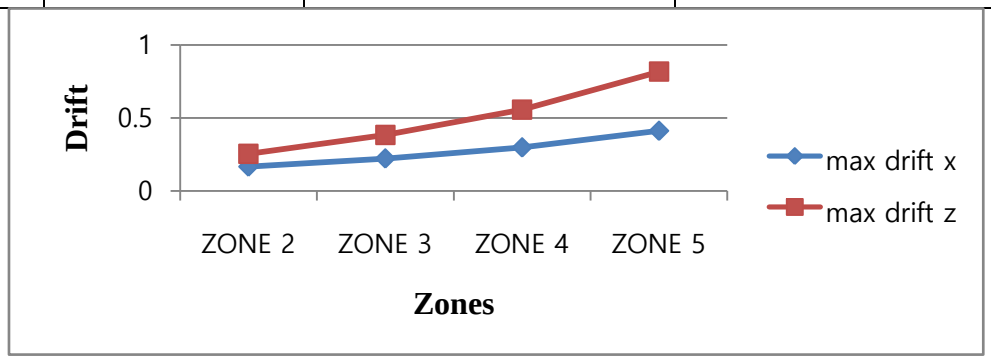
III.RESULTS

A. ETABS

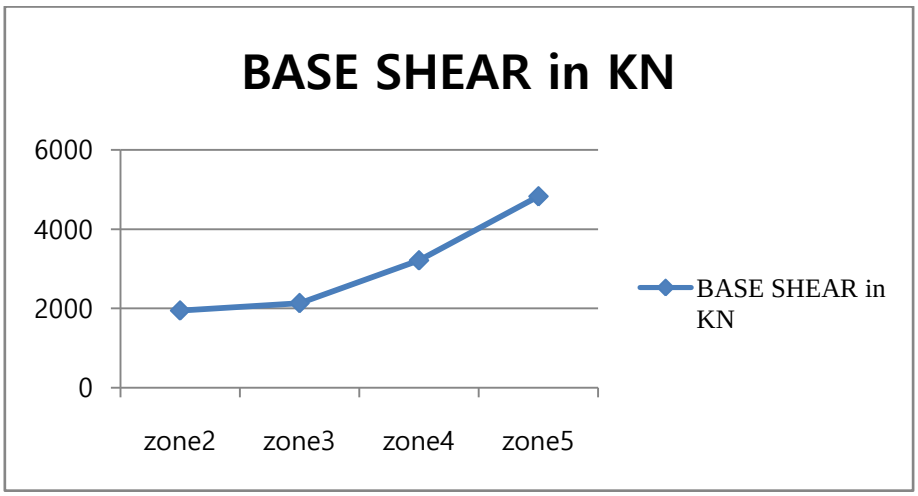
1. Storey drift in all zones

STOREY DRIFT IN mm			
	ZONES	max drift x	max drift z
ETABS	ZONE 2	0.166	0.254
	ZONE 3	0.222	0.383
	ZONE 4	0.298	0.556
	ZONE 5	0.412	0.816



2. Base shear in all zones

BASE SHEAR in KN		
	Zones	Base Shear
ETABS	zone2	1947.69
	zone3	2135.27
	zone4	3212.1
	zone5	4825.57



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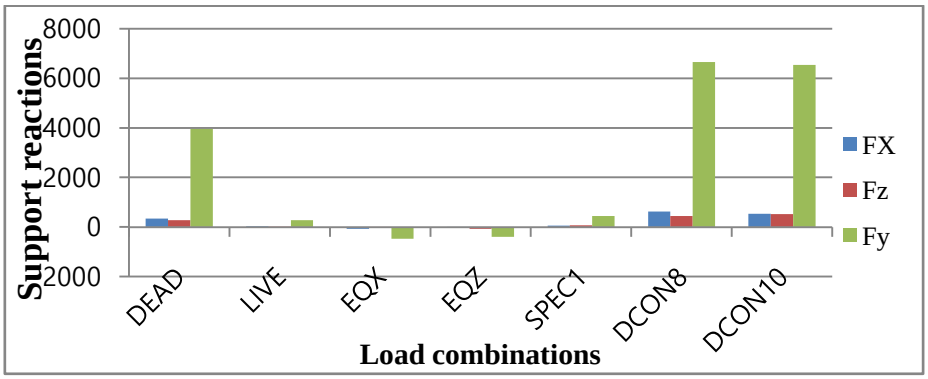
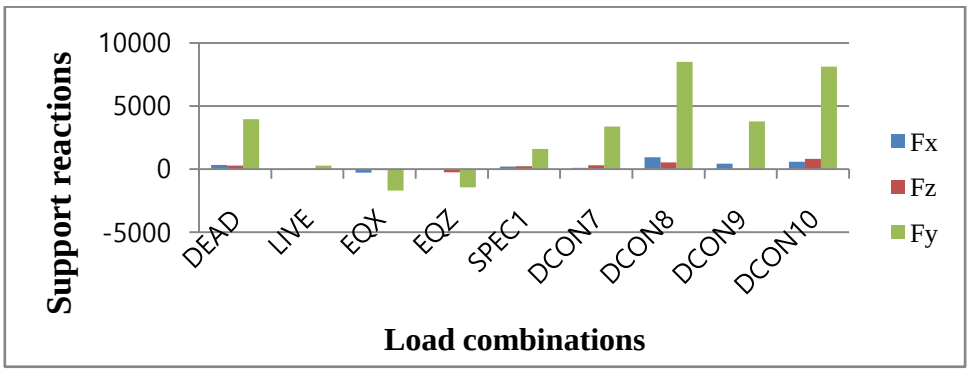
3. Support reactions in zone 2:

Story	Load	Fx	Fy	Fz
BASE	DEAD	340.47	3960.72	276.41
BASE	LIVE	24.86	274.3	20.37
BASE	EQX	-77.03	-474.44	-21.21
BASE	EQZ	-12.82	-401.74	-71.82
BASE	SPEC1	57.94	443.91	60.94
BASE	DCON8	626.25	6652.74	446.43
BASE	DCON10	529.94	6543.7	522.34



4. Support reactions in zone5:

Story	Point	Load	Fx	Fy	Fz	Mx	My	Mz
BASE	1	DEAD	340.47	3960.72	276.41	-24.905	0.034	57.532
BASE	1	LIVE	24.86	274.3	20.37	-2.118	0	4.519
BASE	1	EQX	-277.31	-1707.97	-76.35	-3.729	0.46	-125.058
BASE	1	EQZ	-46.16	-1446.27	-258.54	158.47	-1.195	10.517
BASE	1	SPEC1	208.37	1597.1	218.75	124.481	0.968	92.709
BASE	1	DCON7	94.74	3379.13	300.09	-42.952	0.74	-101.289
BASE	1	DCON8	926.67	8503.03	529.15	-31.764	-0.64	273.884
BASE	1	DCON9	441.46	3771.67	26.8	200.347	-1.742	102.074
BASE	1	DCON10	579.95	8110.49	802.43	-275.063	1.843	70.521



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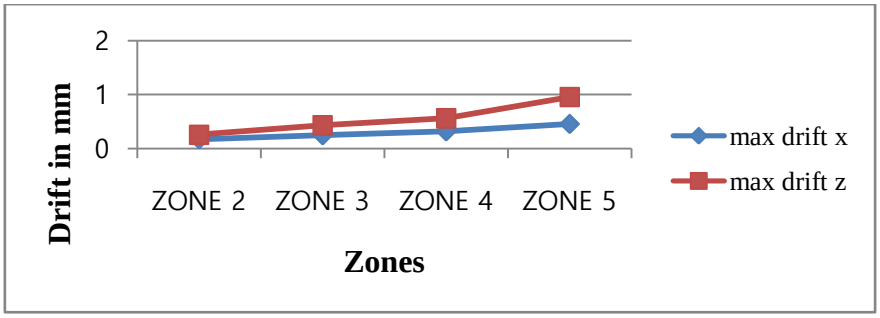
B. STAAD

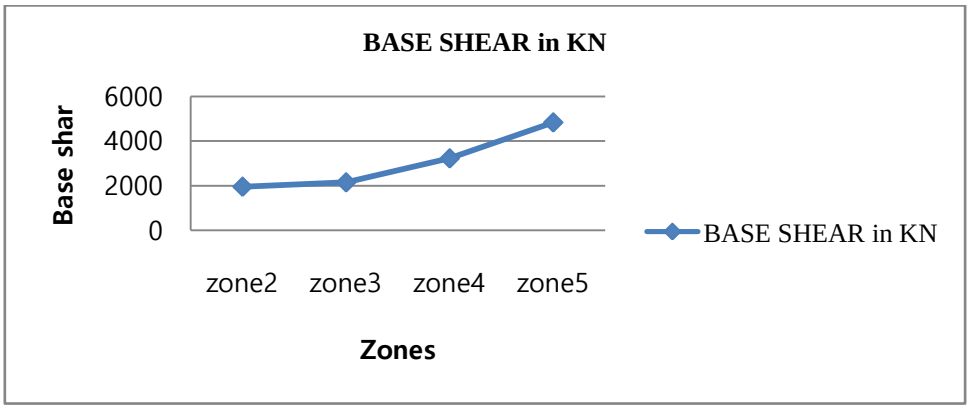
1. Storey drift in all zones:

STOREY DRIFT IN mm			
		max driftx	max drift z
Staad	zone2	0.171	0.259
	zone3	0.245	0.432
	zone4	0.317	0.563
	zone5	0.455	0.954



2. Base shear in Kn:

BASE SHEAR in KN		
	Zones	Base Shear
STAAD	zone2	1955.46
	zone3	2149.47
	zone4	3224.2
	zone5	4836.3



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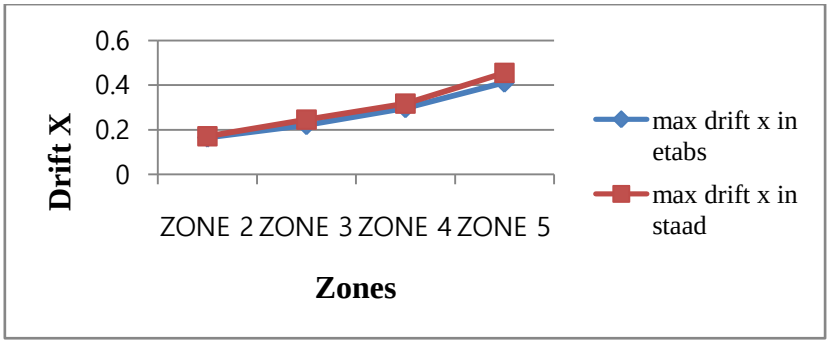
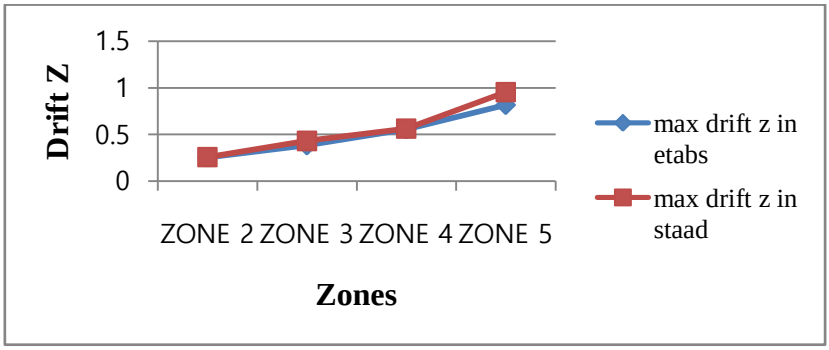
C. COMPARISON:

STORY DRIFT IN mm			
	ZONES	max drift x	max drift z
ETABS	ZONE 2	0.166	0.254
	ZONE 3	0.222	0.383
	ZONE 4	0.298	0.556
	ZONE 5	0.412	0.816
STAAD	ZONE 2	0.171	0.259
	ZONE 3	0.245	0.432
	ZONE 4	0.317	0.563
	ZONE 5	0.455	0.954

Drift comparison between ETABS &STAAD.pro



Drift x comparison



Drift z comparison

1. Base shear in Kn:

BASE SHEAR in KN		
	Zones	Base Shear
ETABS	zone2	1947.69
	zone3	2135.27
	zone4	3212.1
	zone5	4825.57
STAAD	zone2	1955.46
	zone3	2149.47
	zone4	3224.2
	zone5	4836.3

Base shear comparison between ETABS & STAAD.pro

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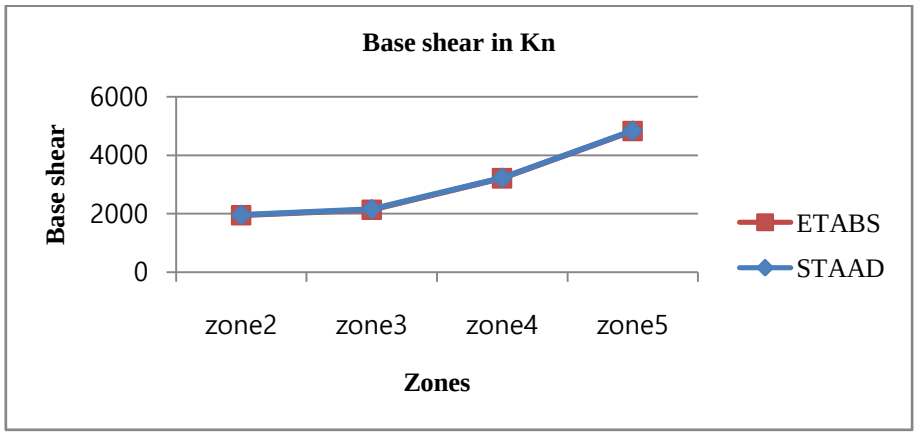
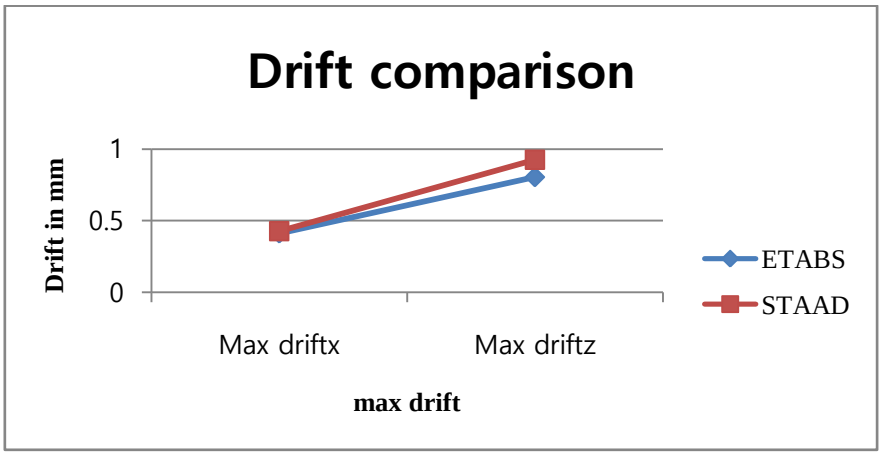


Base shear comparison between ETABS & STAAD.pro in KN

D. **Time History method (ELCENTO Earthquake) comparison:**

Storey drift in mm		
	Max driftx	Max driftz
ETABS	0.412	0.805
STAAD	0.427	0.927

Storey drift comparison between ETABS & STAAD



Drift comparison

IV.CONCLUSION

The following conclusions were made

- Maximum storey drift (drift x) obtained at 12th storey is 0.412mm and drift z is 0.816 mm in Etabs (zone5).
- Maximum storey drift (drift x) obtained at 12th storey is 0.455mm and drift z is 0.954mm in Staad.pro (zone 5).

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- Maximum storey shear is 4836.3KN in Staad.pro as well as 4825.57 KN in Etabs.
- Support reactions are similar in both Etabs& Staad.pro.
- Storey drifts (0.954mm) are found within the limits (<12mm) as specified by code (IS1893-2002 part I) in both response spectrum and time history methods.
- By Provision of shear wall, storey drifts can be effectively reduced.
- Storey drift is maximum in zone5 and minimum in zone 2.
- When compared with response spectrum & time history analysis, Out of all zones considered the building exhibits similar value of storey drift in zone 5.

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