

last step is shown in Table 3. The followings are the description of plastic hinge level for Fig. 8 to 11.

- B : ●
- IO : ●
- LS : ●
- CP : ●
- C : ●
- D : ●
- E : ●

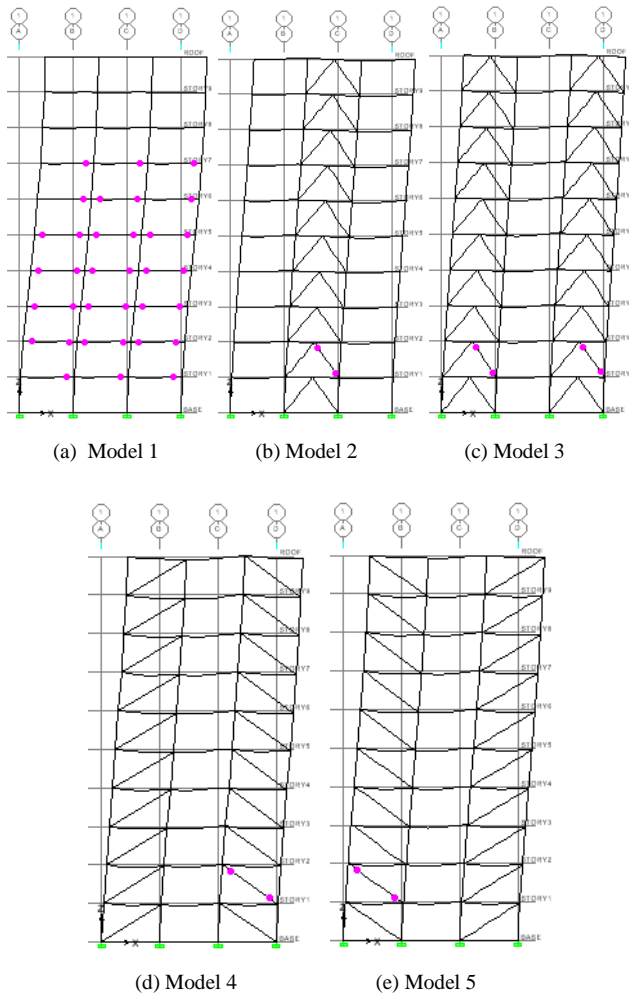


Fig. 8 The plastic hinge in the first step for earthquake in x direction

Based on Fig. 8, the plastic hinge in the first step of model 1 for the earthquake in x direction has 34 plastic hinges on beam. Model 2, 4, and 5 have 2 plastic hinges on bracing. Model 3 has 4 plastic hinges on bracing. All plastic hinges occur at B level.

In Fig. 9, the plastic hinge in the first step of model 1 for the earthquake in x direction has 24 plastic hinges on beam. Model 2, 4, and 5 have 2 plastic hinges on bracing. Model 3 has 4 plastic hinges on bracing. All plastic hinges occur at B level.

In Fig. 10, the plastic hinge in the last step of model 1 for earthquake in x direction have 3 plastic hinges on beam at B level, 33 plastic hinges on beam, and 4 plastic hinges on column at IO level, 16 plastic hinges on beam at LS level, and 8 plastic hinges on beam at D level. Model 2 have 26 plastic hinges on beam at B level, 6 plastic hinges on beam

at IO level, 4 plastic hinges on bracing at C level, 9 plastic hinges on bracing at D level, and 7 plastic hinges on bracing at E level. Model 3 have 16 plastic hinges on beam at B level, 4 plastic hinges on bracing at C level, and 23 plastic hinges on bracing at D level. Model 4 have 5 plastic hinges on bracing at IO level, 4 plastic hinges on bracing at C level, and 12 plastic hinges on bracing at D level. Model 5 have 9 plastic hinges on bracing at IO level, 4 plastic hinges on bracing at C level, and 17 plastic hinges on bracing at D level.

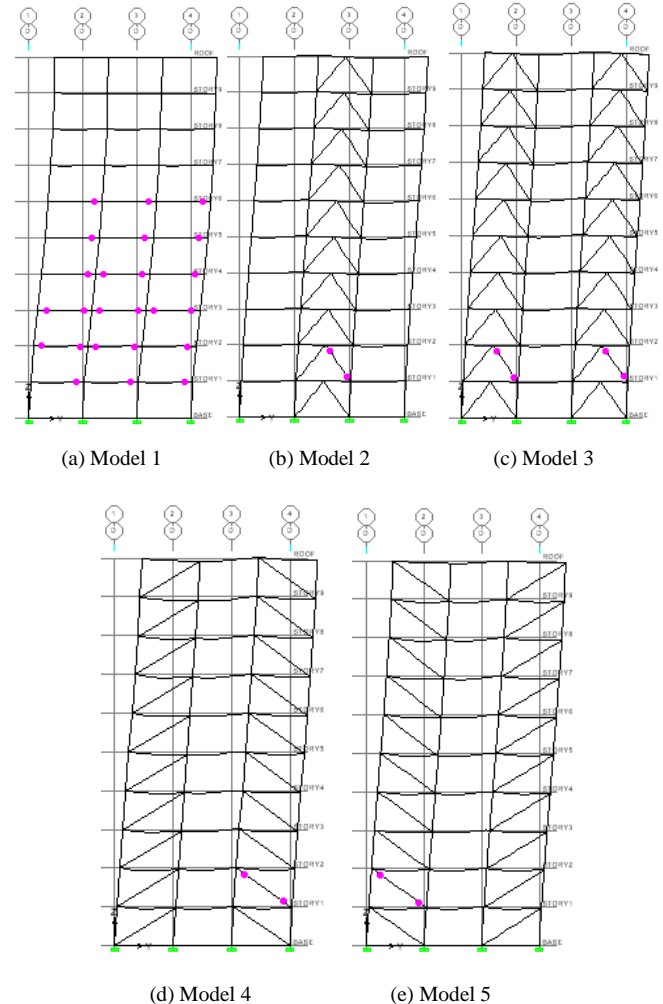


Fig. 9 The plastic hinges in the first step for earthquake in y direction

In Fig. 11, the plastic hinge in the last step of model 1 for earthquake in y direction have 9 plastic hinges on beam at B level, 18 plastic hinges on beam at IO level, 11 plastic hinges on beam and 2 plastic hinges on column at LS level, 6 plastic hinges on beam at D level, and 7 plastic hinges on beam and 2 plastic hinges on column at E level. Model 2 have 17 plastic hinges on beam at B level, 6 plastic hinges on beam at IO level, 4 plastic hinges on bracing at C level, 4 plastic hinges on bracing at D level, and 6 plastic hinges on bracing at E level. Model 3 have 10 plastic hinges on beam at B level, 7 plastic hinges on beam and 2 plastic hinges on bracing at IO level, 16 plastic hinges on bracing at D level, and 2 plastic hinges on bracing at E level. Model 4 have 4 plastic hinges on bracing at IO level, 3 plastic hinges on bracing at C level, and 16 plastic hinges on bracing at D

level. Model 5 have 9 plastic hinges on beam at B level, 12 plastic hinges on bracing at IO level, 2 plastic hinges on bracing at C level, and 16 plastic hinges on bracing at D level.

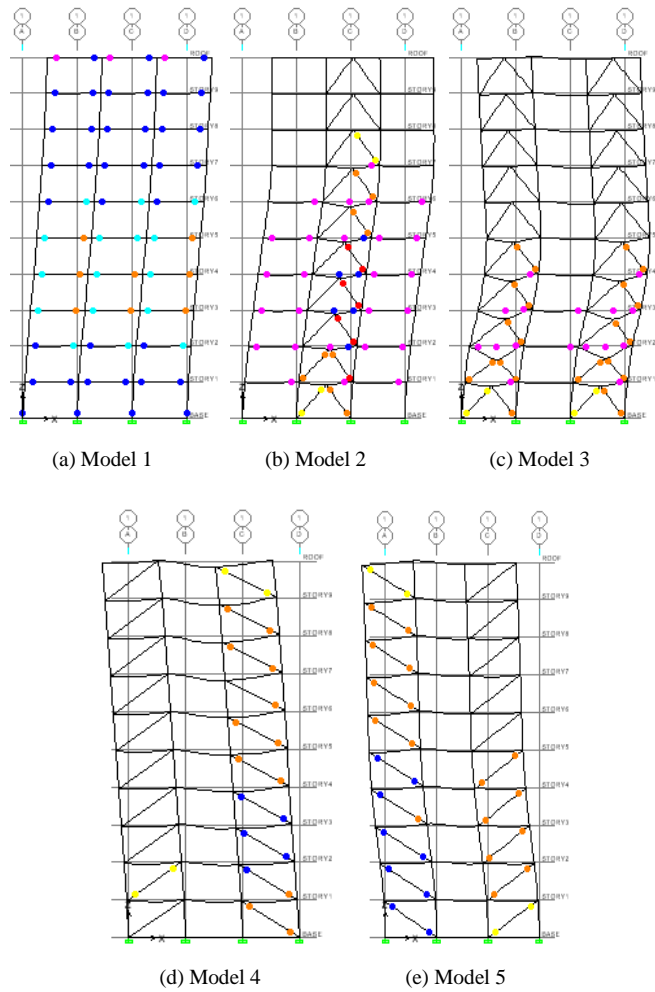


Fig. 10 The plastic hinges in the last step for earthquake in x direction

Based on Table 3, model 4 have the best effectiveness in terms of plastic hinge mechanism compared to other models because model 4 in the last step have the least plastic hinge and plastic hinge on the beam is not occur. It has 42 plastic hinges for the earthquake in x direction and 46 plastic hinges for the earthquake in y direction. In the last step, model 4 is able to reduce plastic hinge 84% from model 1 for the earthquake in x direction and 79% from model 1 for the earthquake in y direction.

TABLE III

THE PERCENTAGE OF PLASTIC HINGE REDUCTION IN THE LAST STEP

Model	Total of plastic hinge		Percentage of plastic hinge reduction to model 1 (%)	
	Earthquake in x direction	Earthquake in y direction	Earthquake in x direction	Earthquake in y direction
1	256	220	0	0
2	164	122	36	45
3	100	86	61	61
4	42	46	84	79
5	60	104	77	53

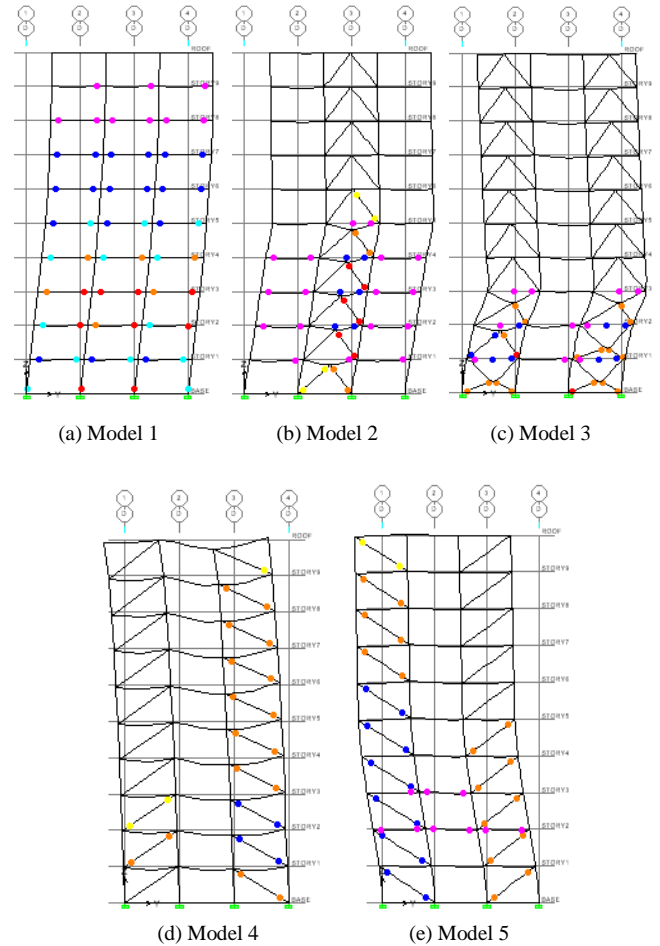


Fig. 11. The plastic hinges in the last step for earthquake in y direction

IV. CONCLUSIONS

The results of pushover analysis in this study conclude these six conclusions, as follows:

The performance level of five models structure for the earthquake in x direction and y direction according to ATC-40 is IO (Immediate Occupancy).

Model 4 have the best effectiveness in terms of plastic hinge mechanism compared to other models, and plastic hinge on the beam does not occur. In the last step, model 4 is able to reduce plastic hinge 84% from model 1 for the earthquake in x direction and 79% from model 1 for the earthquake in y direction.

Model 3 have the greatest capability to carry the forces of an earthquake compared to other models. It is 185% bigger than model 1 for x direction and 181% bigger than model 1 for y direction.

Model 3 have the greatest effectiveness in reducing lateral displacements compared to other models in the amount of 65.47% of model 1 for x direction and 72.14% of model 1 for y direction.

Model 3 have the greatest effectiveness in reducing storey drift compared to other models in the amount of 73.89% of model 1 for x direction and 80.55% of model 1 for y direction.

Model 3 have the greatest effectiveness in reducing drift ratio compared to other models in the amount of 74.59% for x direction and 82.35% for y direction.

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