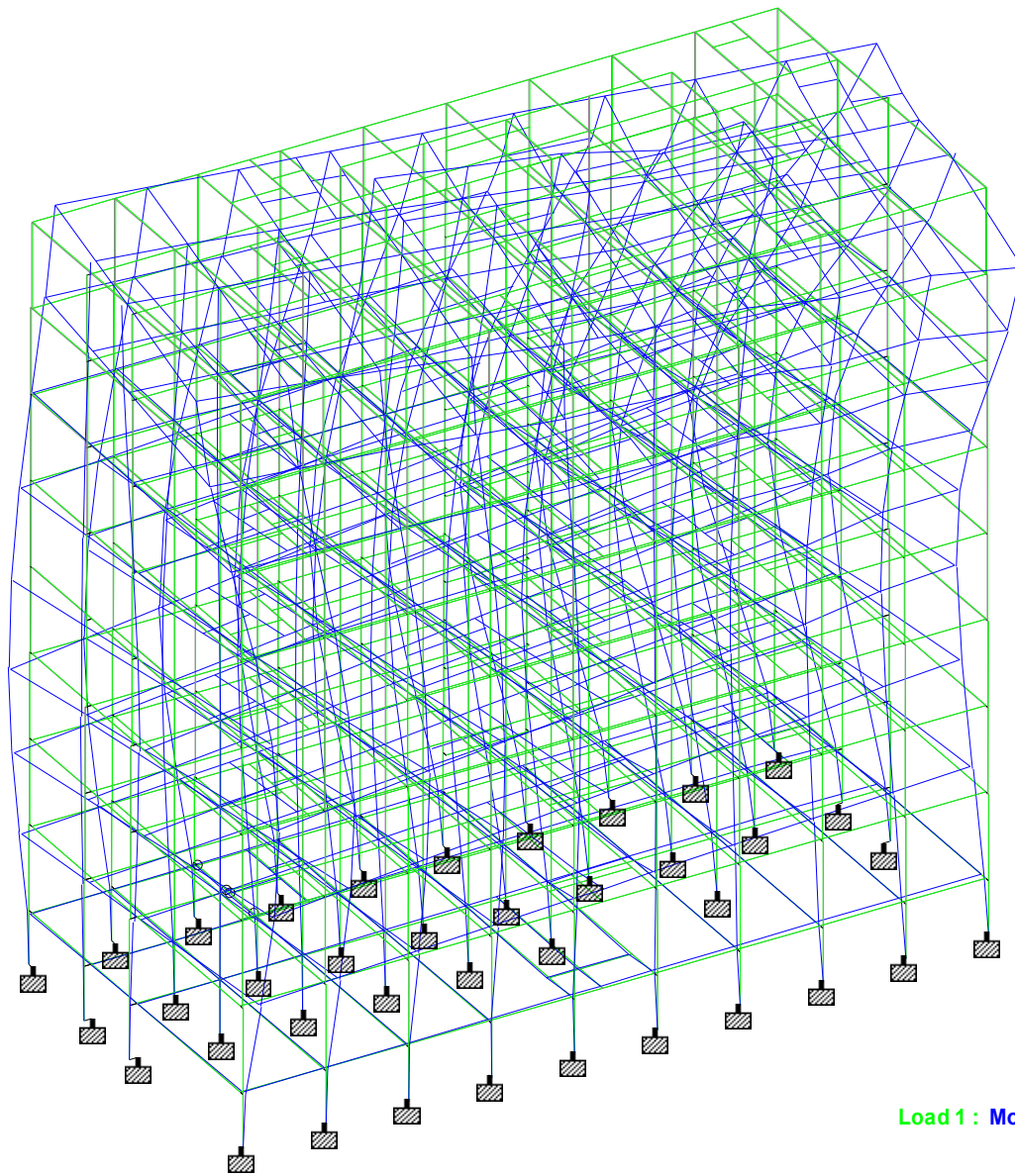
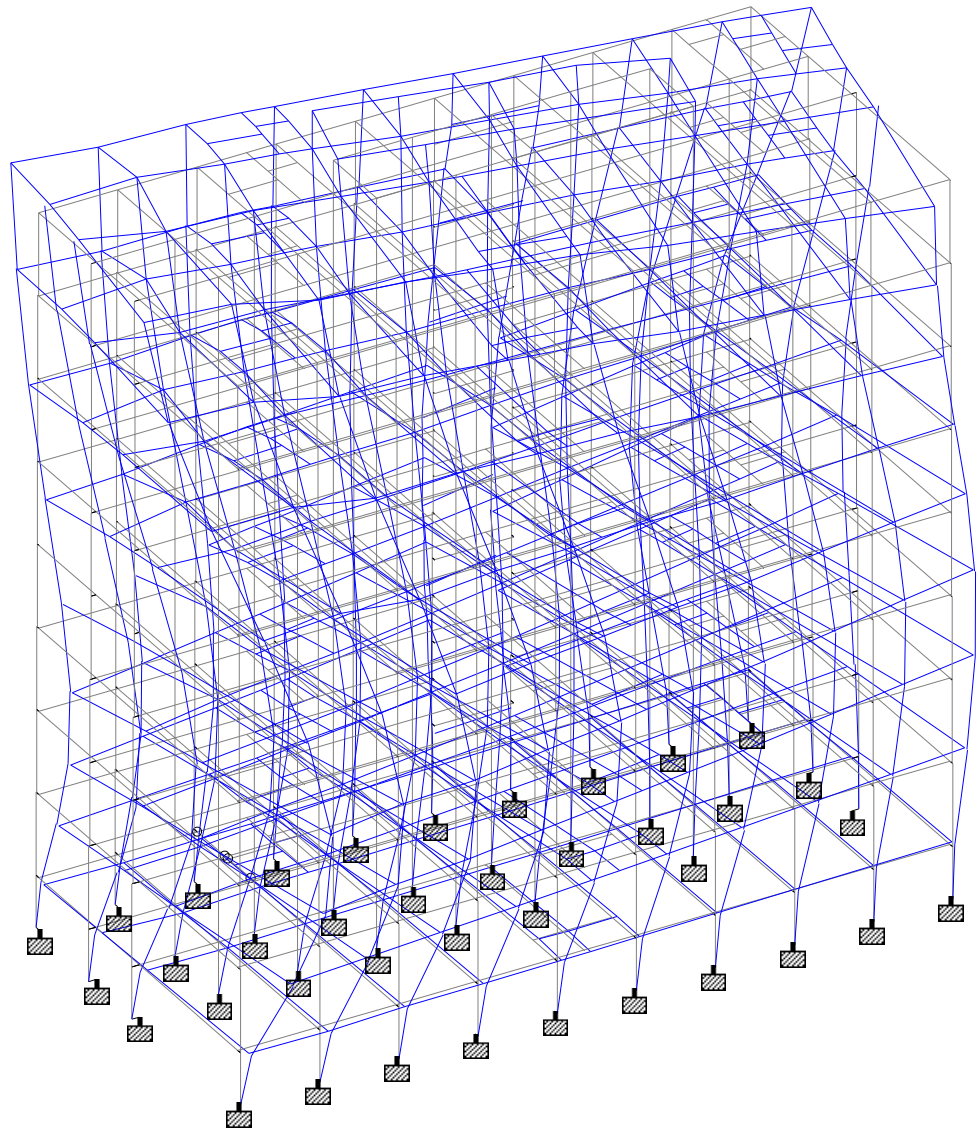


PERCENTAGE FAILURE IN COLUMNS

TYPE OF ANALYSIS	NO. OF COLUMNS	NO. OF COLUMNS FAILING	% COLUMNS FAILING
WITHOUT INFILL	342	247	72.22%
WITH INFILL	342	89	26.02%
PROPOSAL-I	342	16	4.68%
PROPOSAL-II	342	82	23.98%
PROPOSAL-III	342	257	75.15%
PROPOSAL-IV	342	261	76.3%

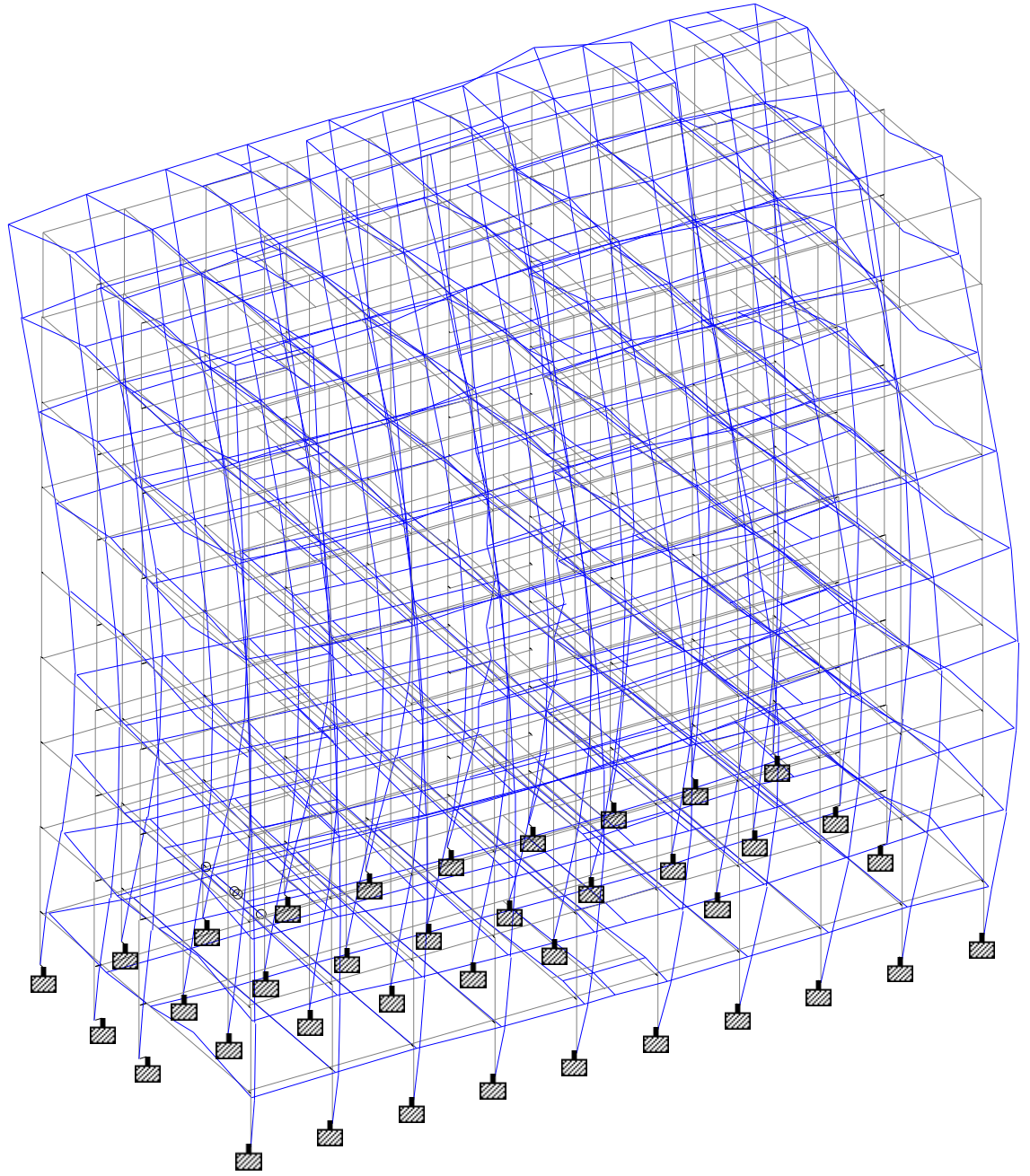


PROPOSAL-I : -MODE SHAPE 5



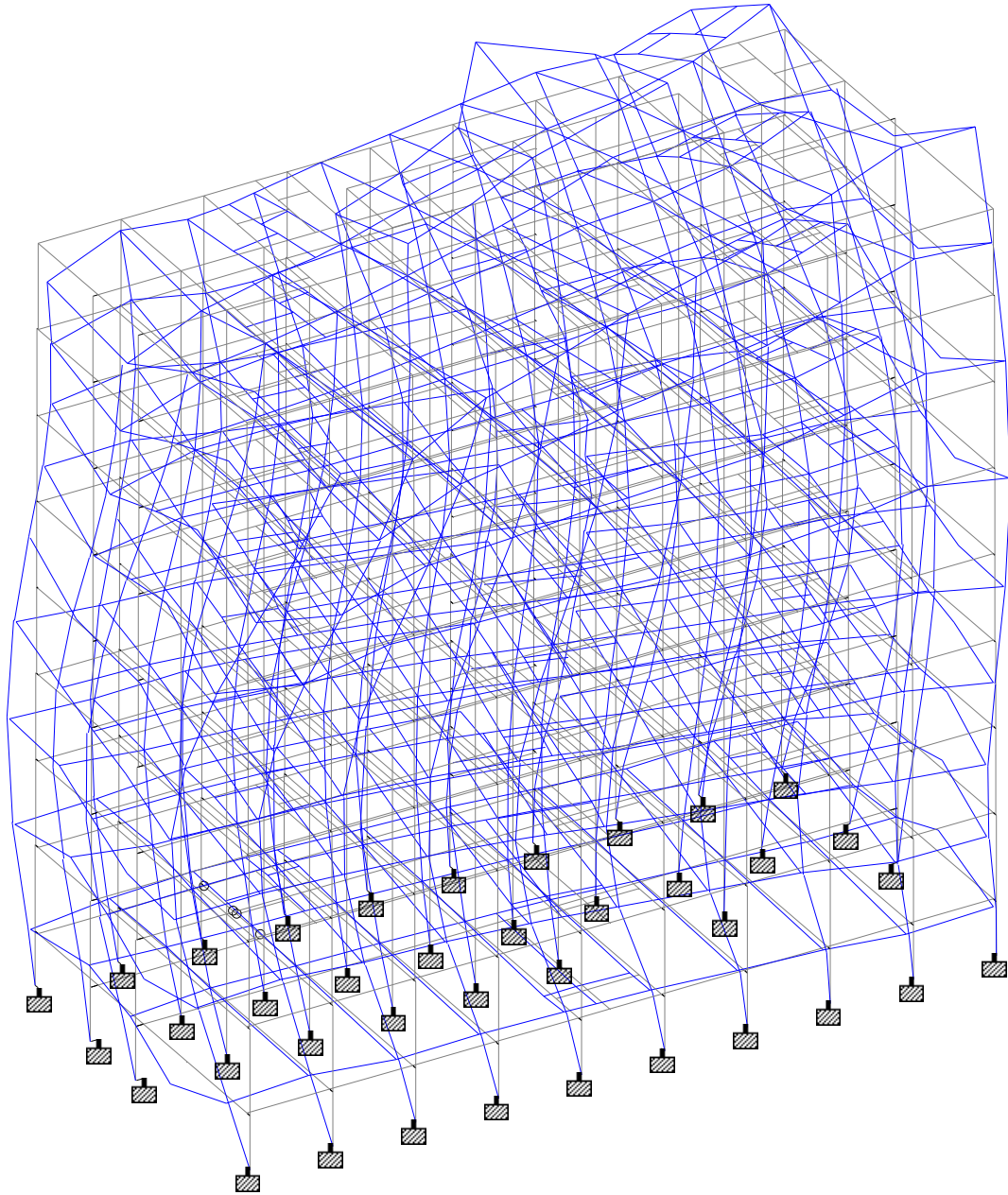
Load

PROPOSAL-I : -MODE SHAPE 6



Load

PROPOSAL-II : -MODE SHAPE 6



PROPOSAL-II : -MODE SHAPE 5

DISCUSSION OF RESULTS

11. DISCUSSION OF RESULTS

➤ Deflection in structure as per the latest prevailing codes such as

1. Max. Deflection in “without infill analysis” = 79.5mm
2. Max. Deflection in “with infill analysis” = 57.5mm
3. Max. Deflection in “Retrofit Proposal - I” = 50.8mm
4. Max. Deflection in “Retrofit Proposal - II” = 44.4mm
5. Max. Deflection in “Retrofit Proposal - III” = 84.88mm
6. Max. Deflection in “Retrofit Proposal - IV” = 84.33mm

Permissible deflection = 57.8mm (Ht. of building = 28.93m above ground)

Hence, Proposals-I, II & IV are well within safer limit.

Proposal-III is not helping to control deflection. However another set of combinations of bracings may give desired results.

➤ Number of columns failing in all analysis are as follows:

1. “without infill ” = 247 (72.22%)
2. “with infill ” = 89 (26.02%)
3. “Retrofit Proposal - I” = 16 (4.67%)
4. “Retrofit Proposal - II” = 82 (23.98%)
5. “Retrofit Proposal - III” = 257 (75.15%)
6. “Retrofit Proposal - II” = 261 (76.3%)

Total no. of columns = 342 (no. of STAAD members)

Although no. of column failures in Proposal – II seems higher than that of “with infill analysis”, this may be attributed to the fact that plate connectivity with members in STAAD can not give desired results (since deflection in this case is even lower than Proposal-I). This option will have to be analyzed with different approach to have desired results.

- Proposal – III & IV have not been taken upto foundation, which may be the reason for undesired deflections in column as well as high requirement in reinforcement.
- Max. reactions on foundations due to superstructure :
 1. Existing Structure = 2835 KN, 21.5KNM (DL+LL),
= 3400 KN, 730. KNM (0.9DL+1.5EQ)
 2. “Proposal-I” = 3190 KN, 539KNM(DL + LL)
= 3916 KN, 1831KNM (for 0.9DL+1.5EQ)
 3. “Proposal-II” = 2975 KN, 620.12KNM (for DL + LL)
= 7876 KN, 1885KNM(for 0.9DL+1.5EQ)

There is an increase in vertical load (since we are giving additional members/ elements) of @ 12.5 % and 5% in proposal I & II respectively as compared to that of existing building. However there is significant increase in moments at base in both options(15% in proposal – I & 131.6% in proposal – II)

- Max story drift:

1. Existing Structure = 9.9 MM
2. “Proposal-I” = 3.5 MM
2. “Proposal-II” = 1.4 MM

Story drift has decreased upto 65% in proposal-I & 85 % in proposal-II.

CONCLUSION

12. CONCLUSION

- The building needs retrofitting as per latest prevailing codes (IS456-2000, IS 1893-2002, IS 875:1987, IS13920-1993).
- The columns are failing in deflection check (for existing structural arrangement) criteria and the value is as high as 1.4 times the permissible limit. Hence existing building is not safe in serviceability criteria. As per Story drift criteria proposal – I & II both gives very low values.
- Based on support reactions criteria Proposal-II will need foundation retrofitting to counter for increased moments.
- Deflections in both retrofit proposals, viz. I & II are well within permissible limit and either can be adopted depending on the feasibility on the basis of cost as well as construction.
- Proposal-III & IV needs to be further explored to come to any particular conclusion.

SCOPE OF FUTURE STUDY

13. SCOPE OF FUTURE STUDY

Post Latur earthquake in 1993 and Bhuj earthquake in 2001, the need for amendments in IS codes were imperative. These amendments are being carried out quite successfully. However buildings of pre- Latur or Bhuj or any other earthquake needs to be restored as per now prevailing codes, especially historical monuments and structures of high importance (such as bridges, hospitals, stadiums etc.). As much the behavior of building with two retrofit options have been studied, still the following may be considered in the ways of improvements/options:

- Location of shear walls may be rearranged so as to get still lesser deflections and shear. e.g. Instead of book ends shear walls may be assumed at different column locations.
- Also number of shear wall may be increased or decreased to study different structural behavior.
- External columns (buttresses) may be enlarged in both directions to reduce deflections and requirement of steel in columns.
- Retrofitting with staggered shear wall panel needs to explored.
- The effect of adopted retrofit strategy on foundations needs to be studied and if possible suitable alternative for its retrofitting can be explored.

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14. BIBLIOGRAPHY

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- iii. IS 456:2000 “Code of practice for Plain and Reinforced Concrete”.
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