Handout #2
Term Project

For the steel building frame (allotted individually), perform a Modal Pushover Analysis (MPA) for the given earthquake acceleration record (with the appropriate ground motion scale factor) and compare the results with those from a nonlinear response history analysis using the same record and scale factor. You need to submit a term project report and also give a presentation.

The following results should be compared from the two analyses:

i. Maximum base shear
ii. Maximum roof displacement
iii. Maximum interstory drift ratio for the 3rd story (counting from 1st story at the ground level)
iv. Maximum bending moment in the left external column in the 3rd story.

Please note the following important instructions:

1. To perform structural analysis, you can use either of these softwares: DRAIN-2DX, OpenSEES, & SAP2000.
2. Consider only elastic-perfectly plastic moment-rotation (for flexural members) and force deformation (for axial members) behaviors.
3. Don't use any load or resistance factor.
4. Use σ_y = 50 ksi, E = 29000 ksi
5. Consider rigid floor diaphragm effect at each floor.
6. For columns, use a bilinear P-M interaction diagram with the third point at (0.15P_u, M_u).
7. Don't consider any large deformation effect (P-delta, etc).
8. Don't consider any buckling.
9. Use the response spectrum for the ground motion to estimate ultimate roof displacement in pushover analysis
10. For Figures 1-17, use the following information:

- Story height = 12 ft
- Bay length = 15 ft
- External columns: W14x500; Internal columns: W14x247; Beams: W33x118; Bracings: C3x5
- Uniformly distributed gravity load on all horizontal (beam) members = 0.23 kip/in
- Inertial mass (horizontal only) = 0.75 kip-in/sec^2 for each node

11. For Figures 18-34, use the following information:

- Story height = 10 ft
- Bay length = 20 ft
- External columns: W12x72; Internal columns: W12x72; Beams: W8x67; Bracings: C5x9
- Uniformly distributed gravity load on all horizontal (beam) members = 0.08 kip/in
- Inertial mass (horizontal only) = 2.5 kip-in/sec^2 for each floor

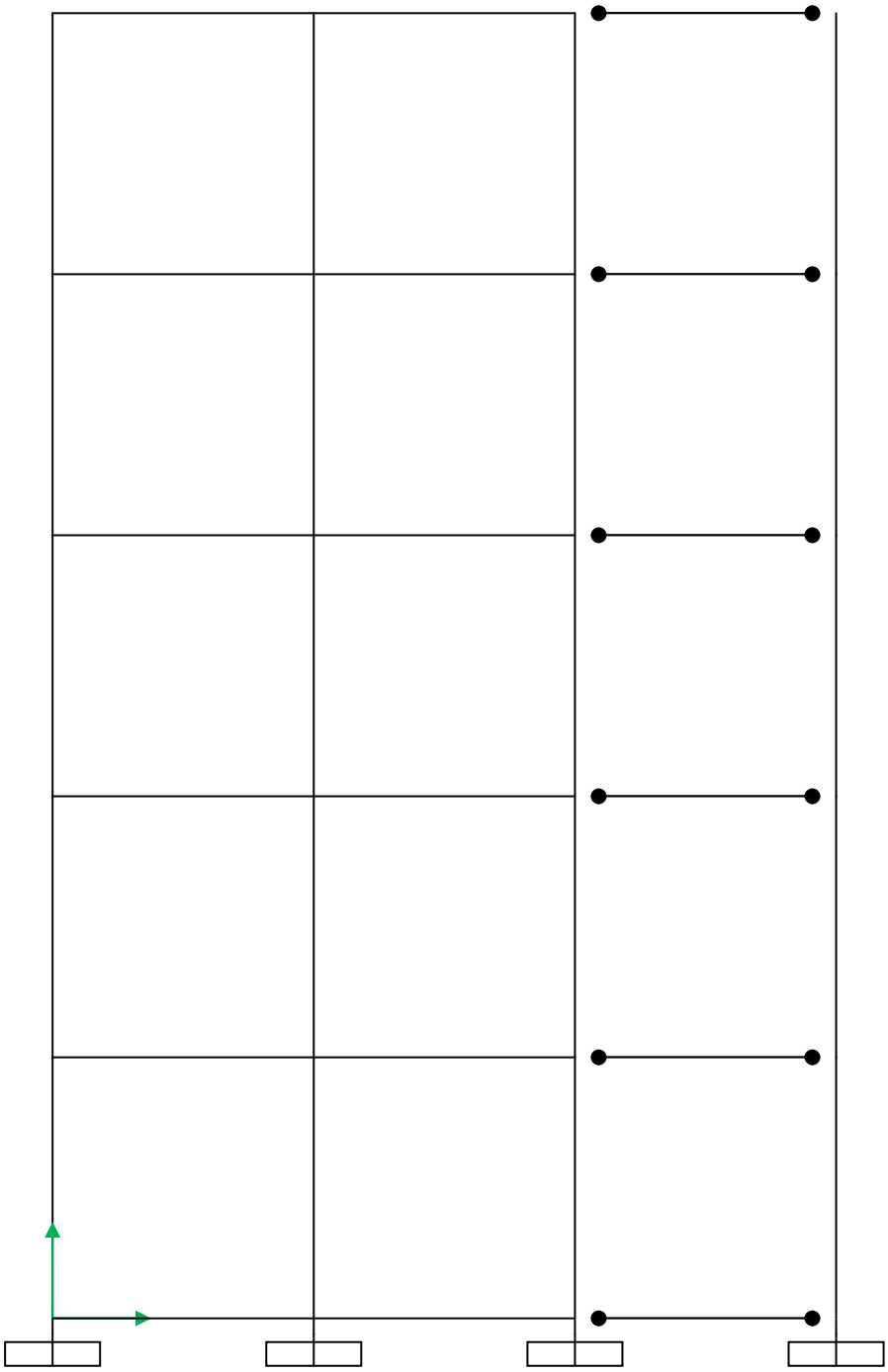


Figure 1

Ground motion scale factor: 30

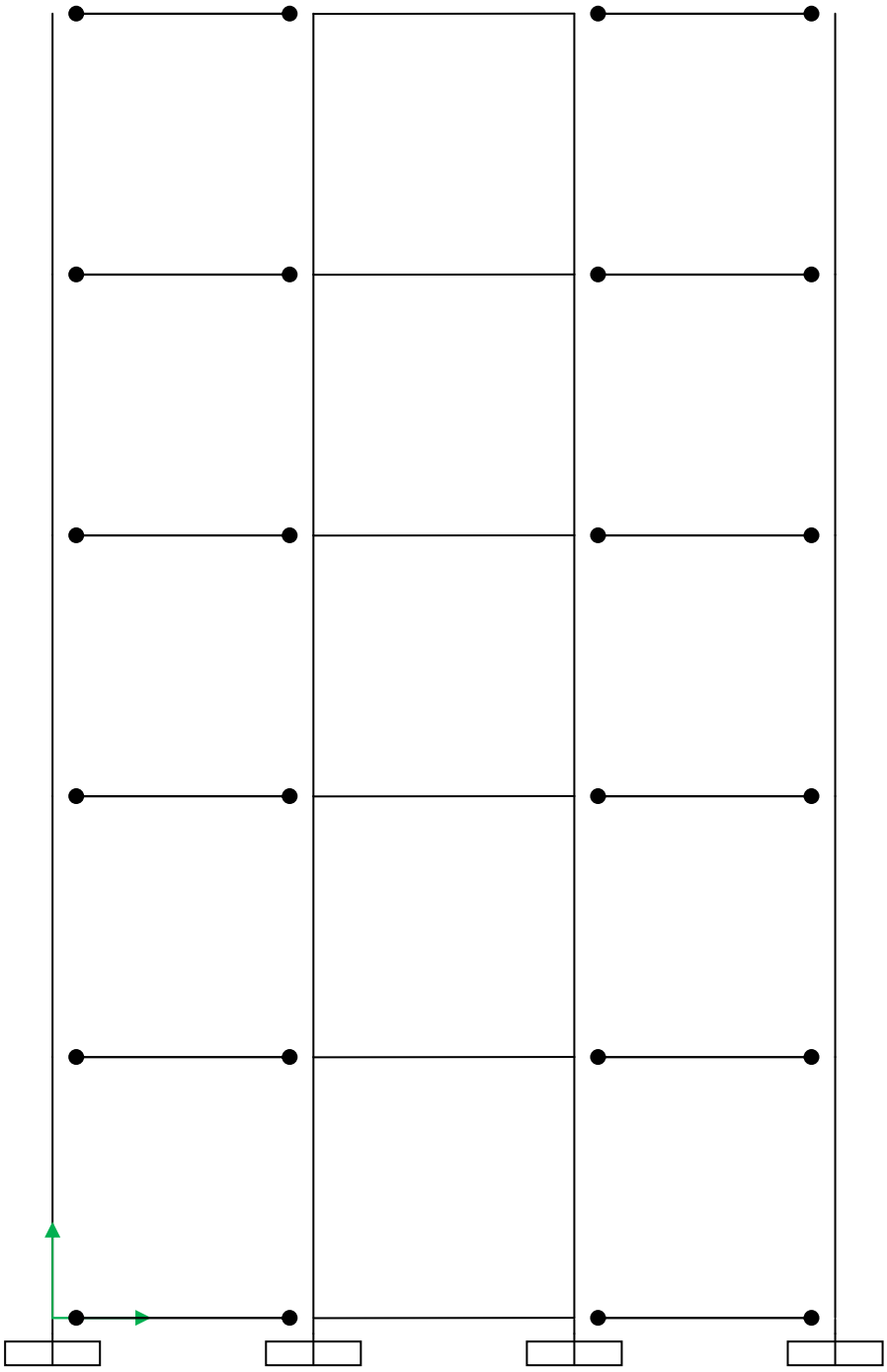


Figure 2

Ground motion scale factor: 20

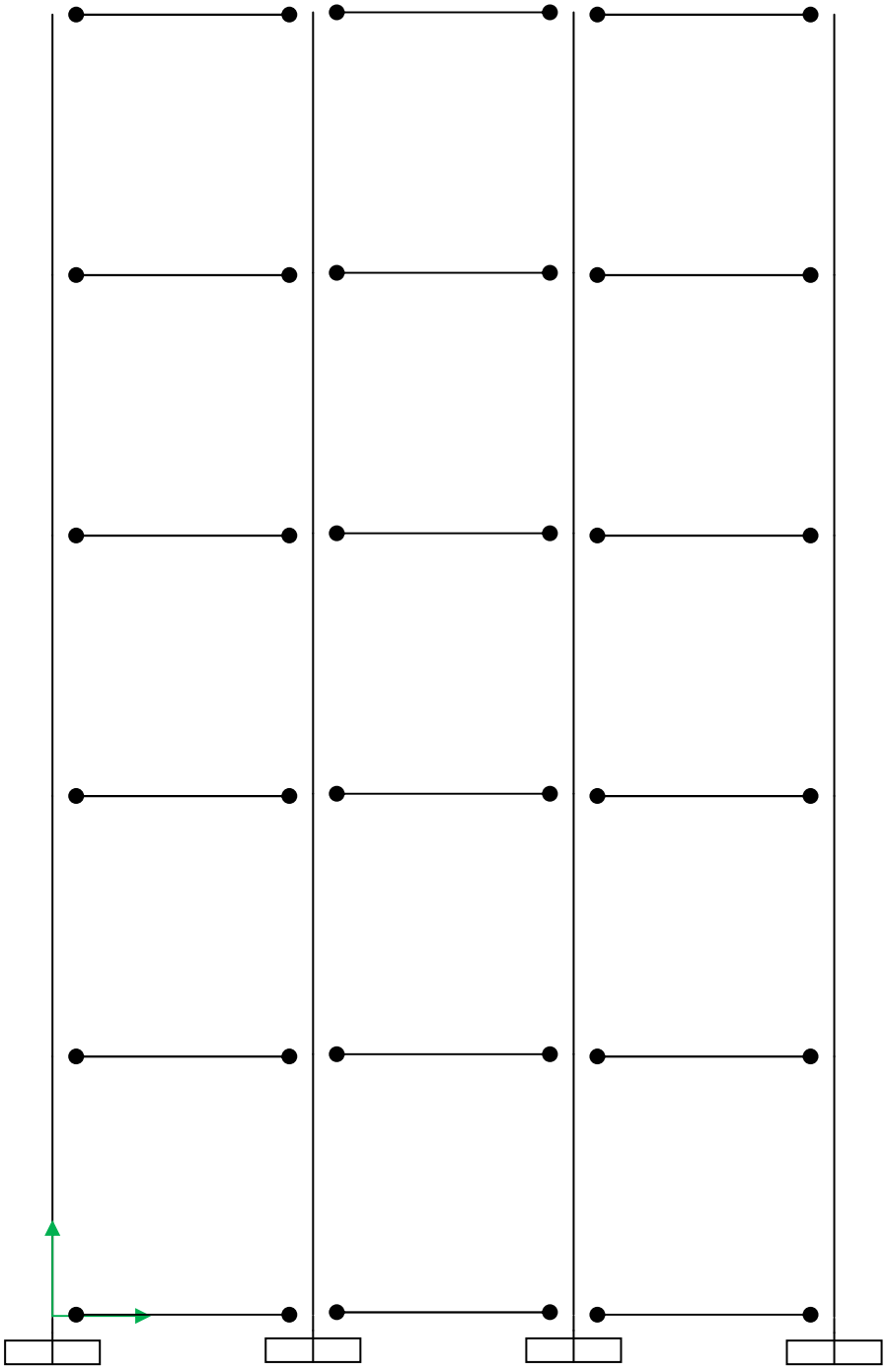


Figure 3

Ground motion scale factor: 12

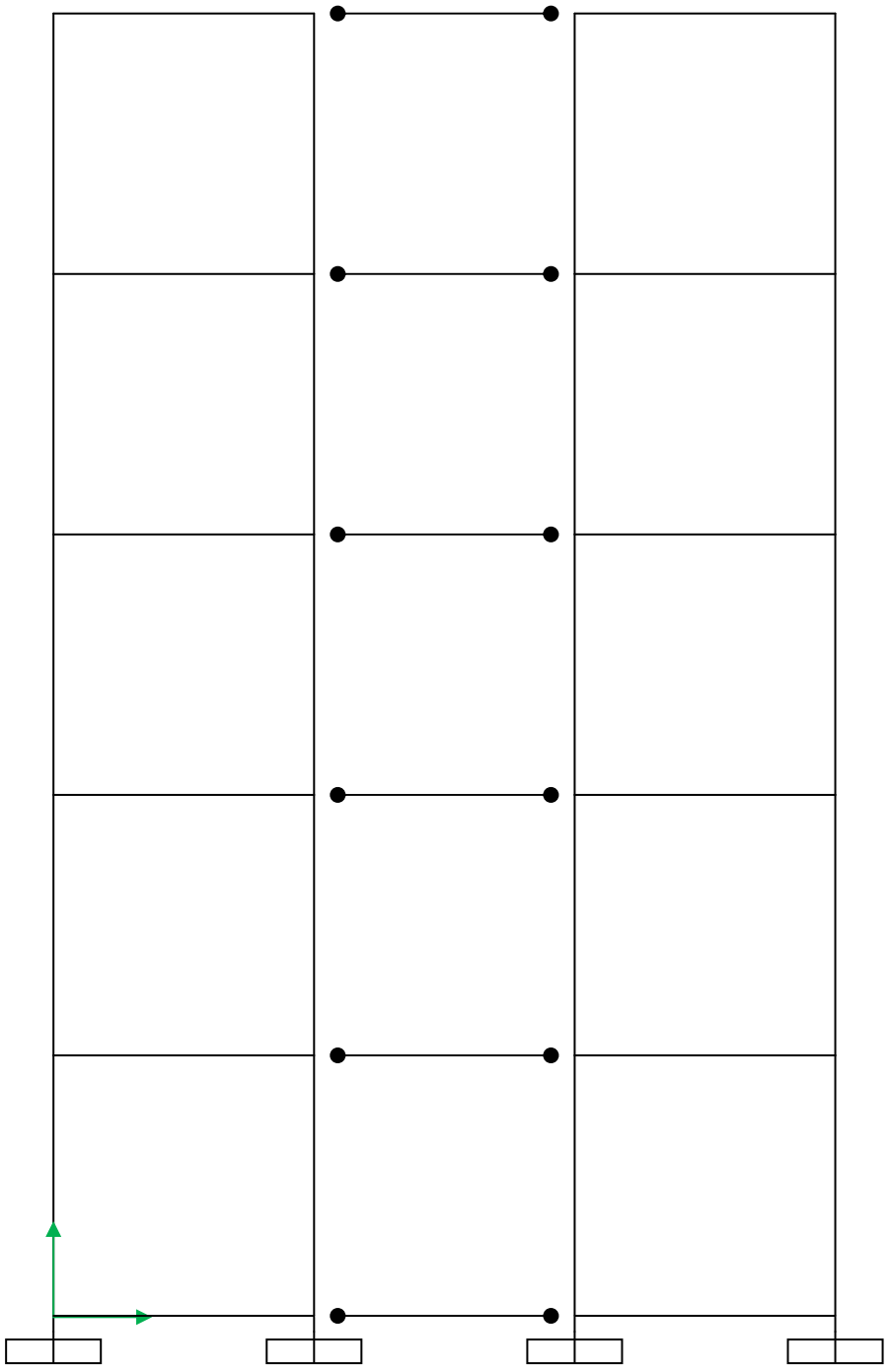


Figure 4

Ground motion scale factor: 38

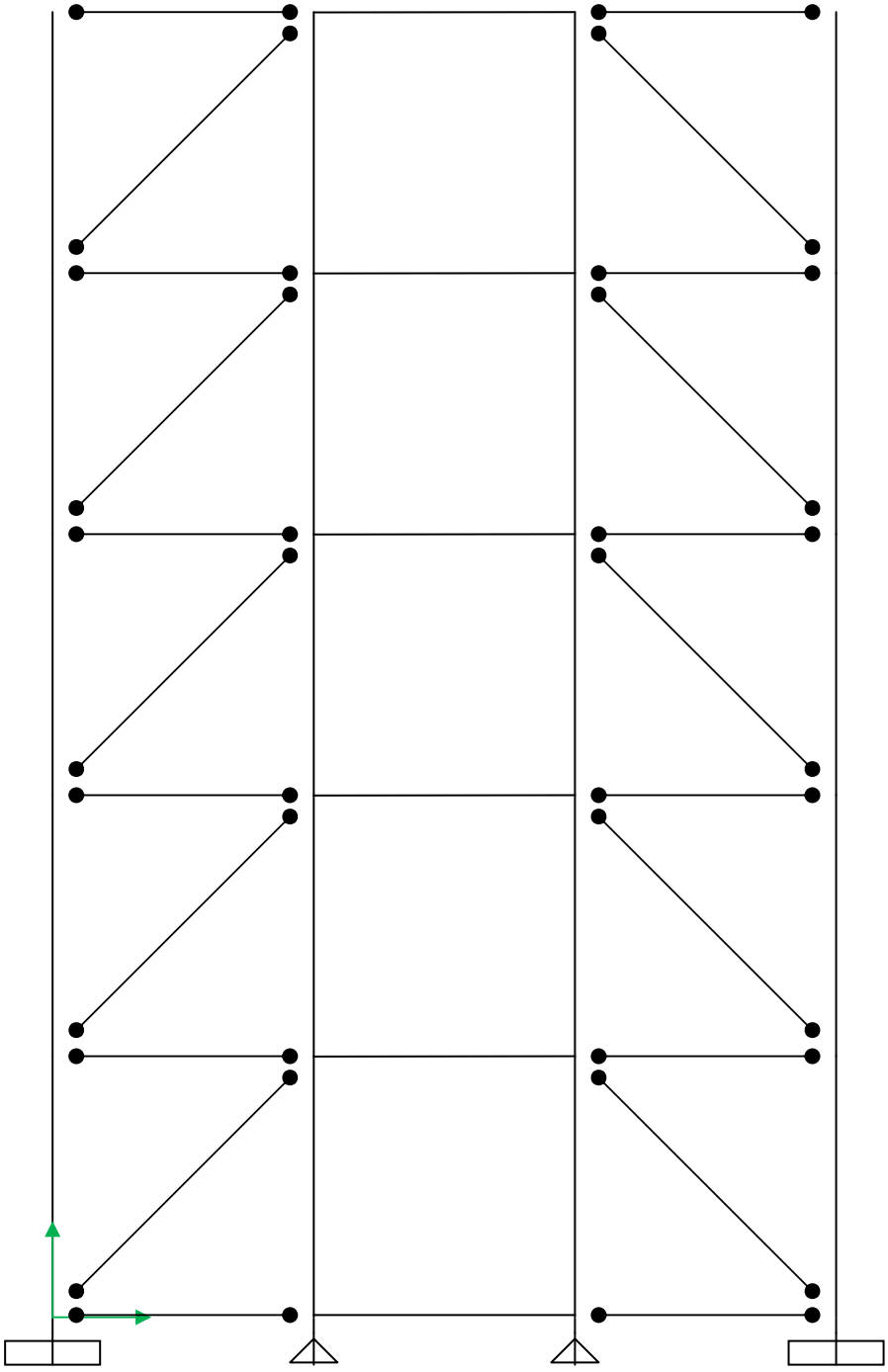


Figure 5

Ground motion scale factor: 30

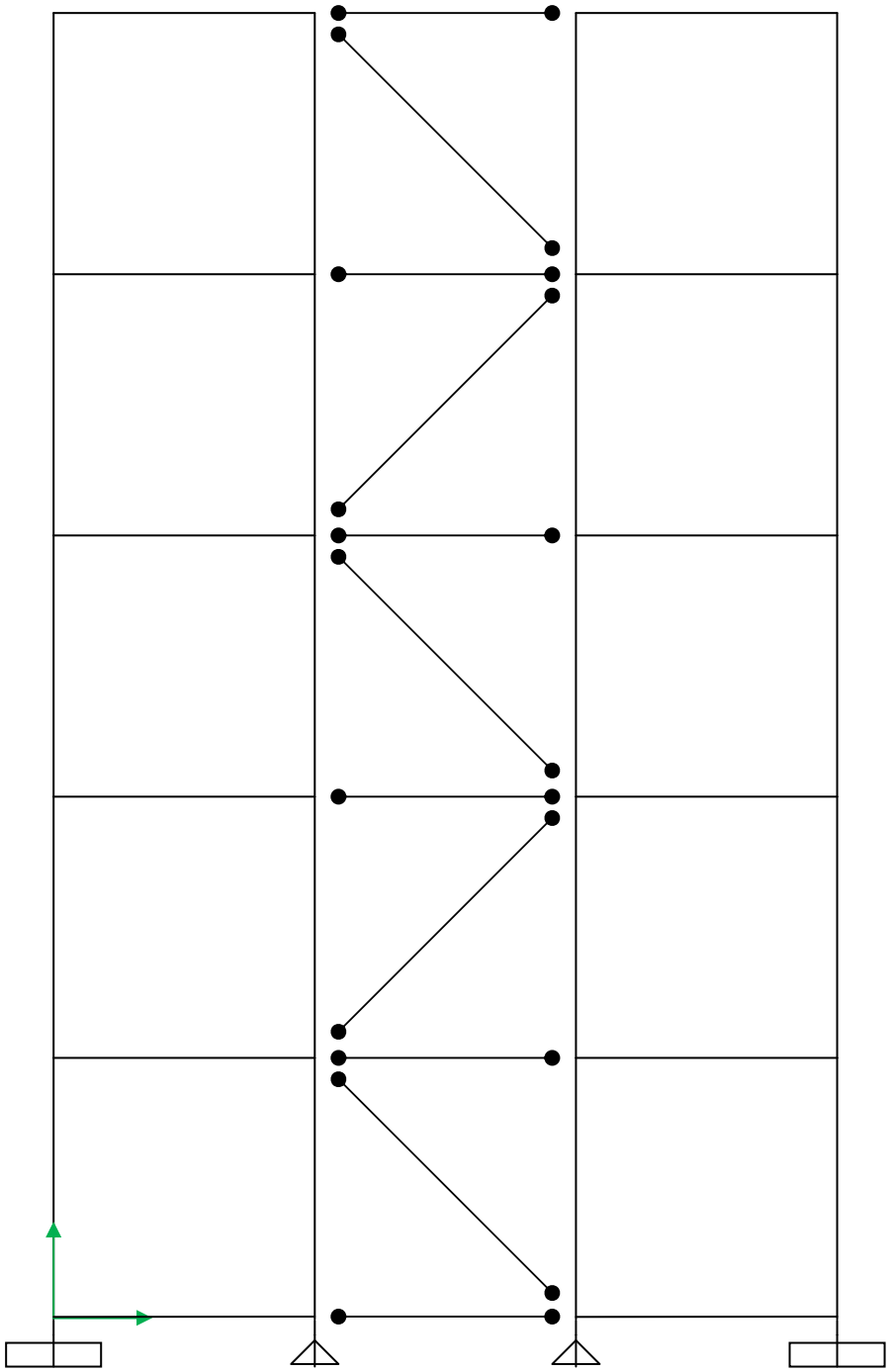


Figure 6

Ground motion scale factor: 36

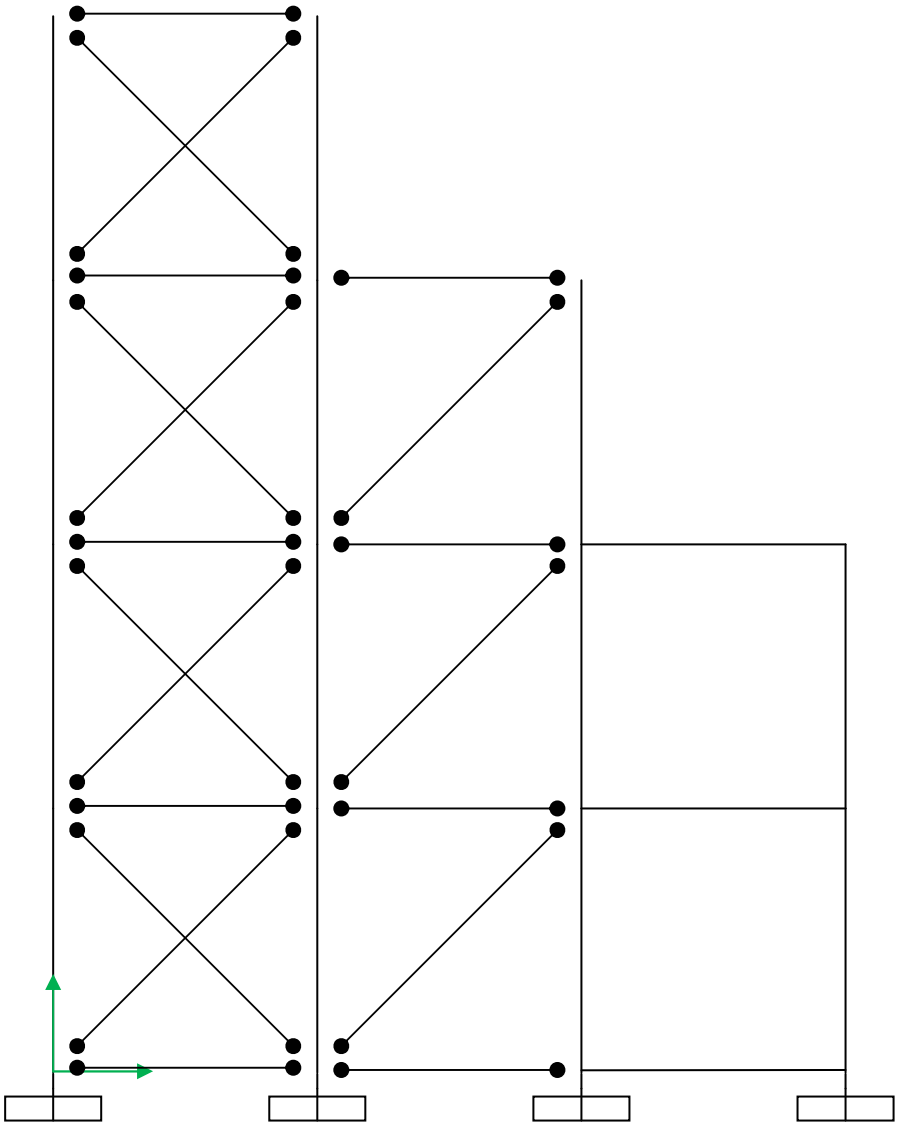
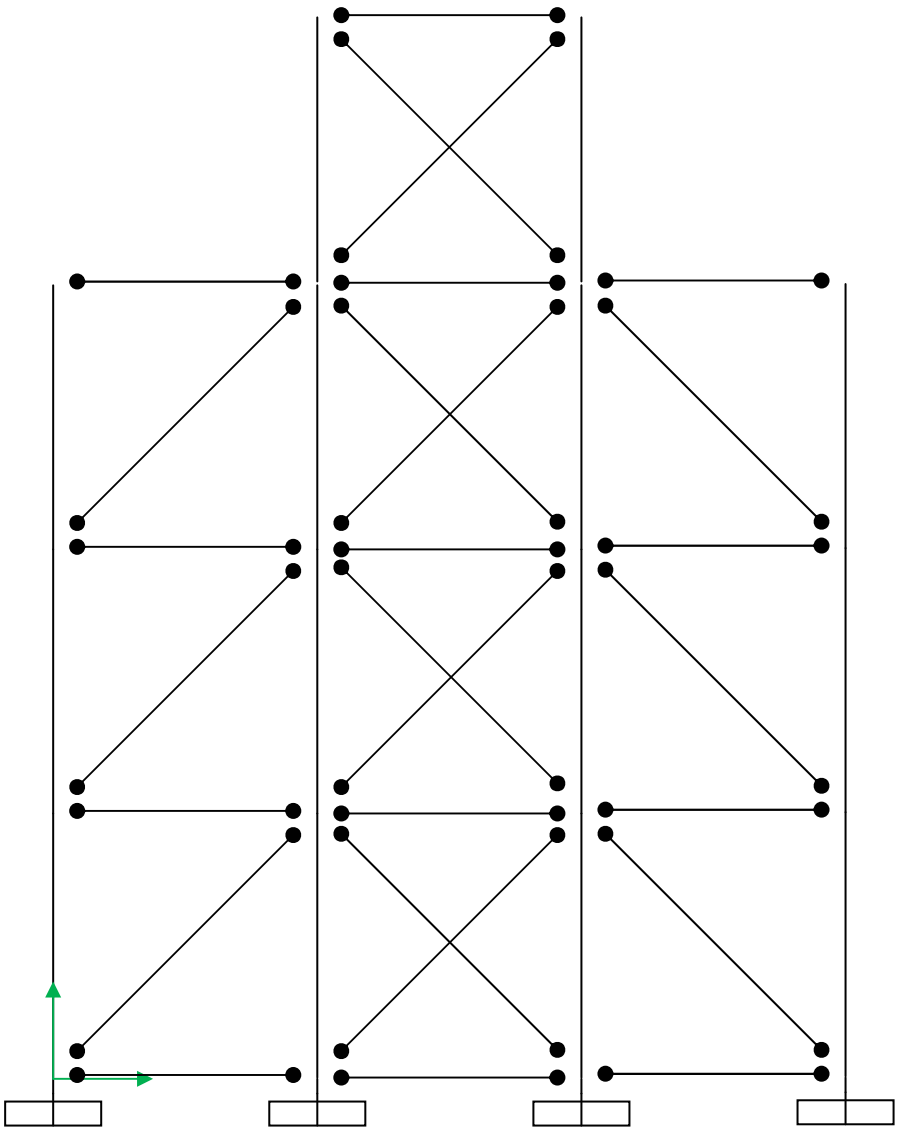


Figure 7

Ground motion scale factor: 58



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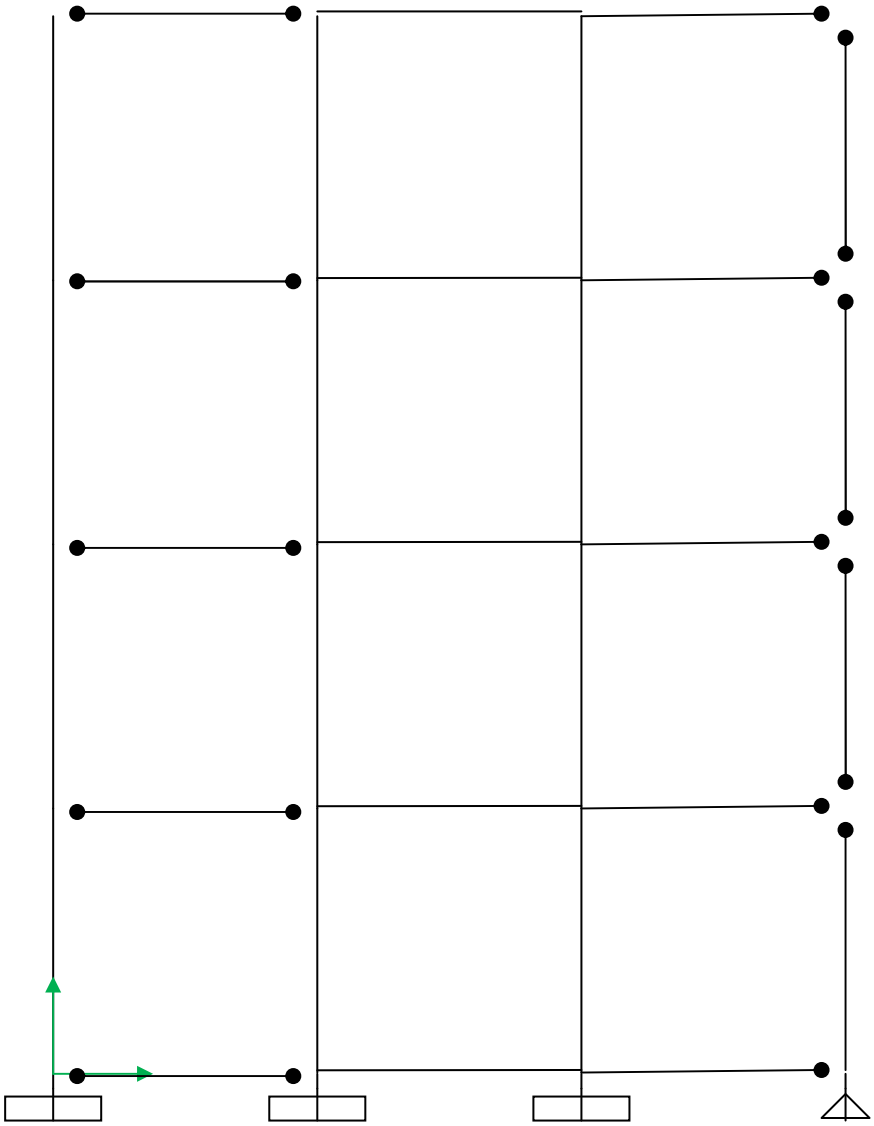


Figure 9

Ground motion scale factor: 23

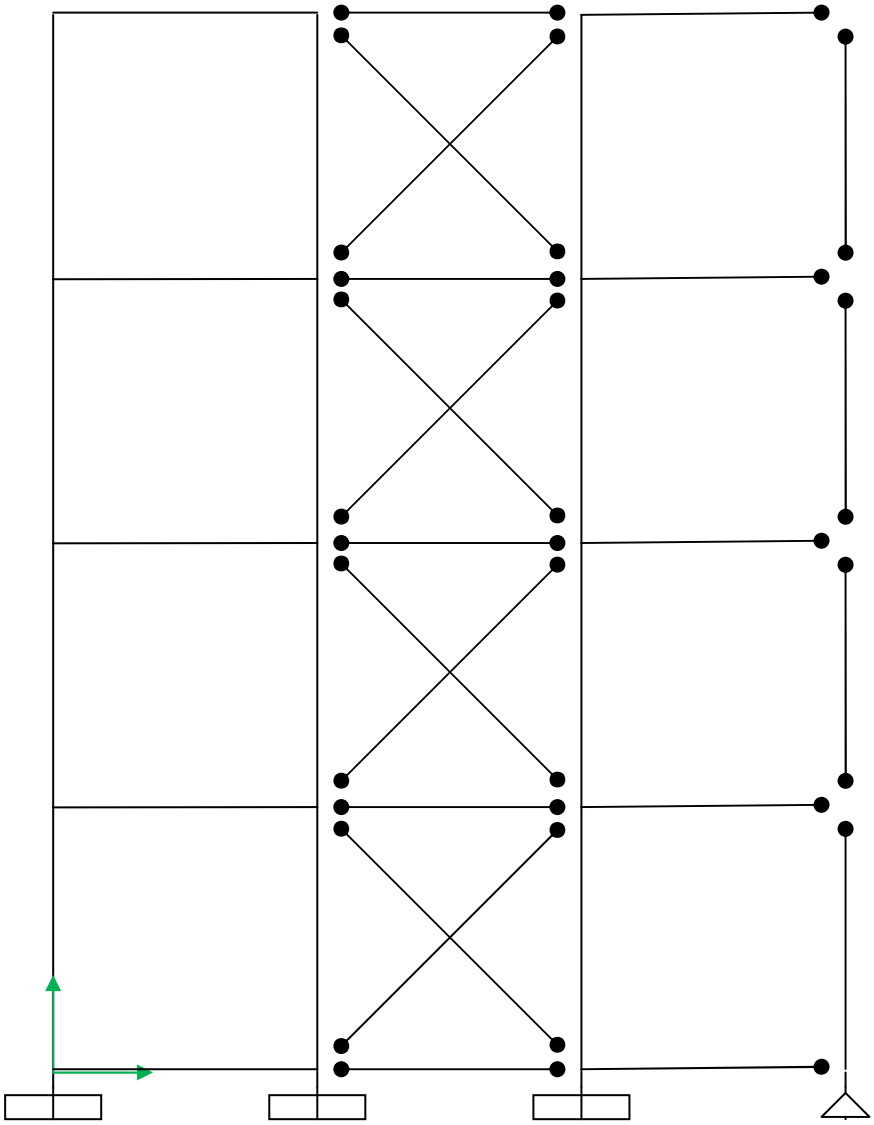
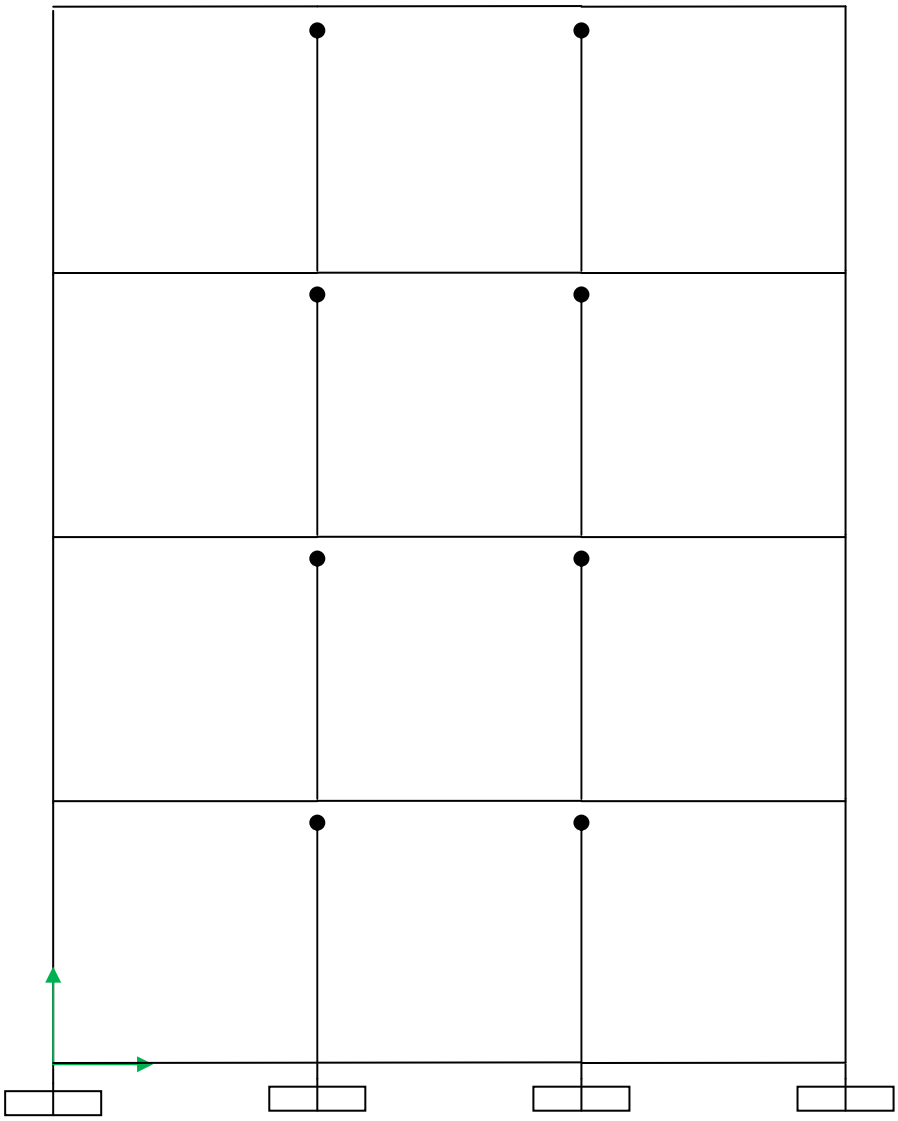


Figure 10

Ground motion scale factor: 35



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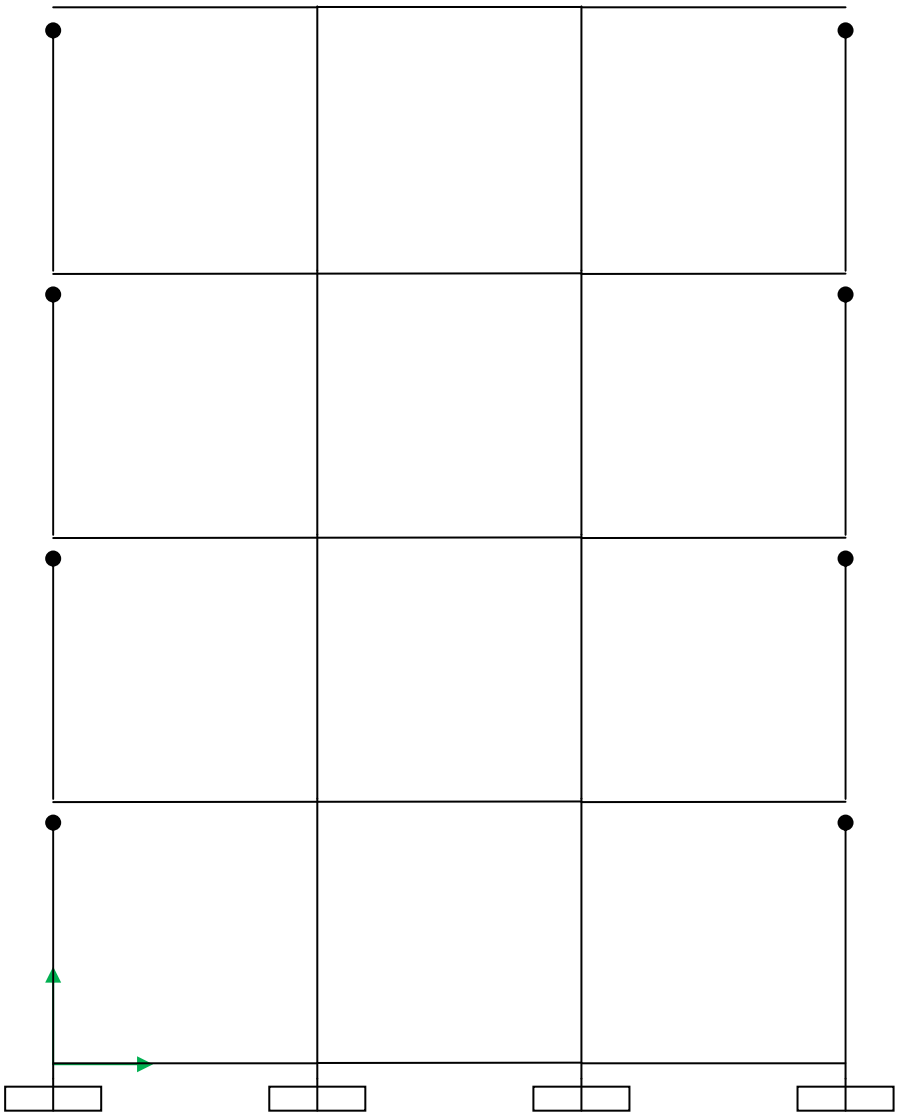

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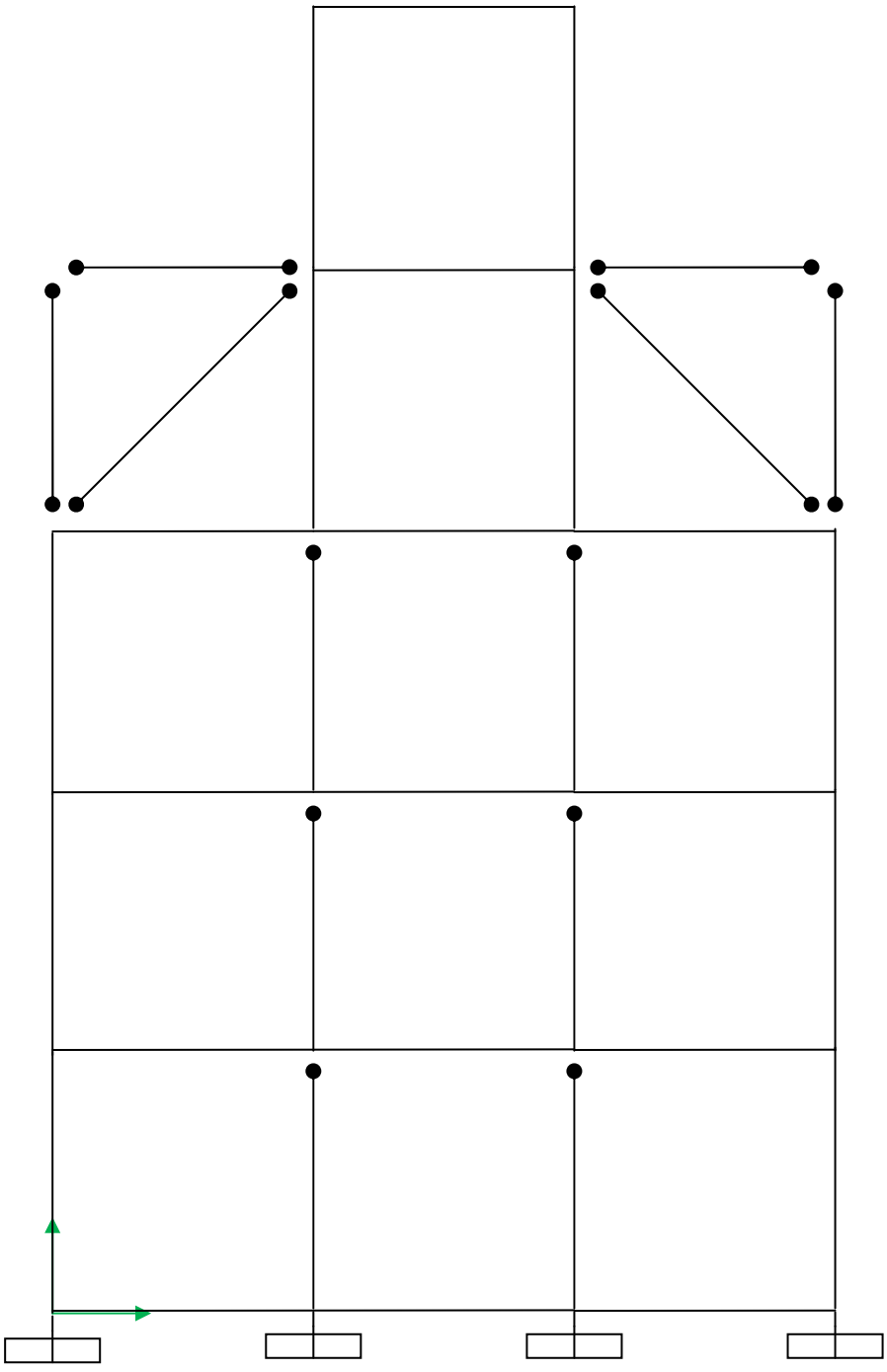


Figure 13

Ground motion scale factor: 45

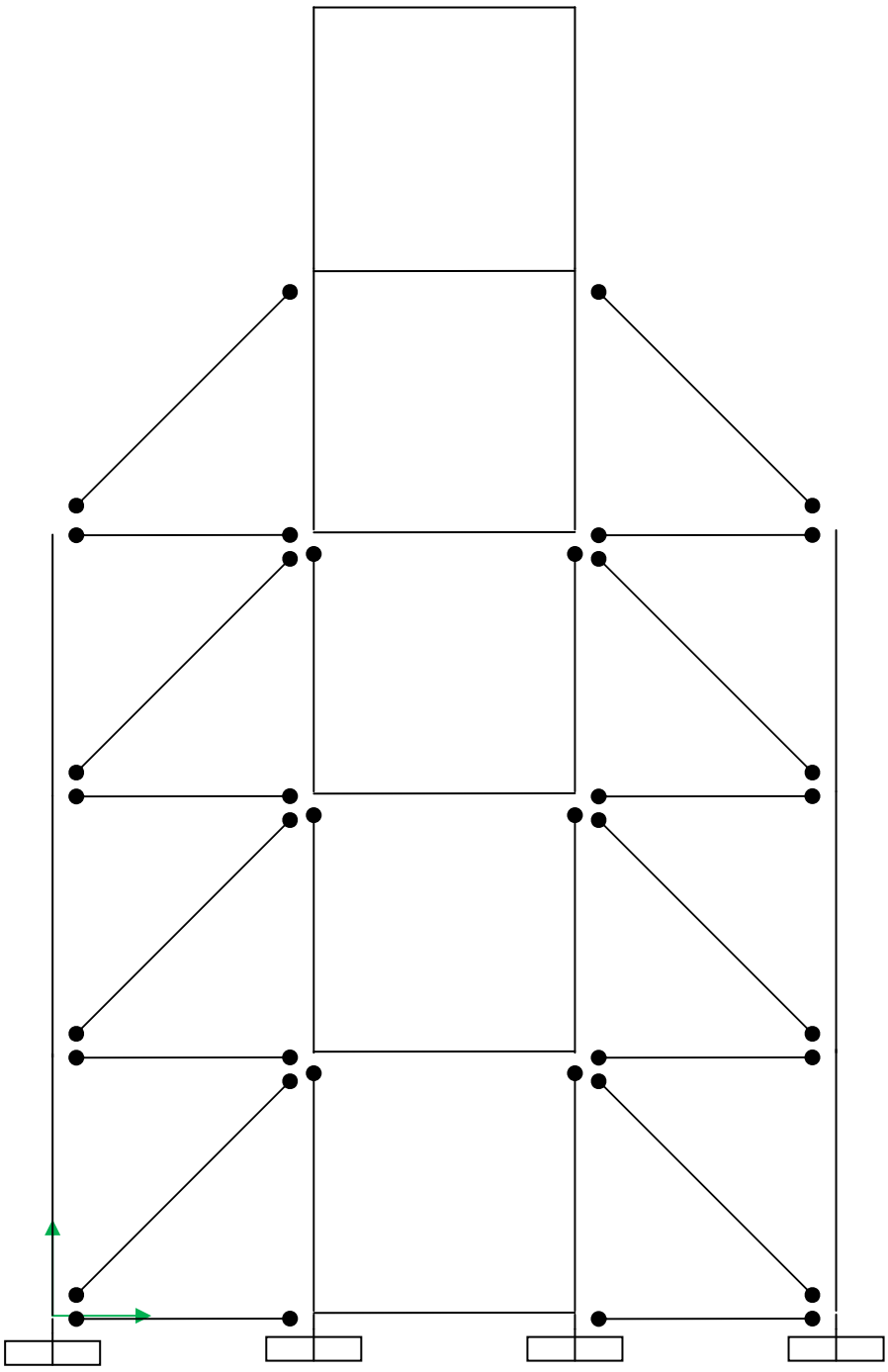


Figure 14

Ground motion scale factor: 45

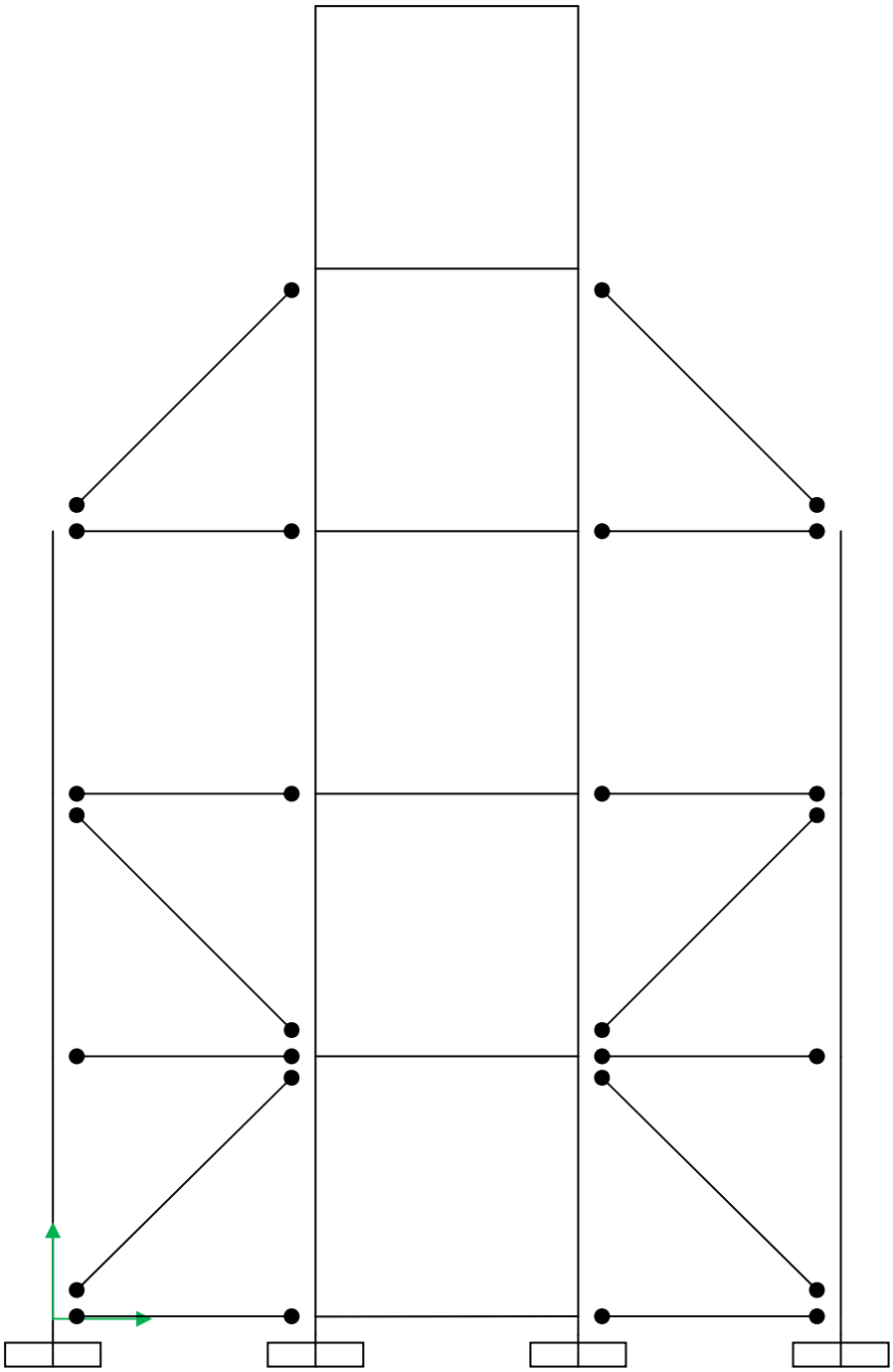


Figure 15

Ground motion scale factor: 50

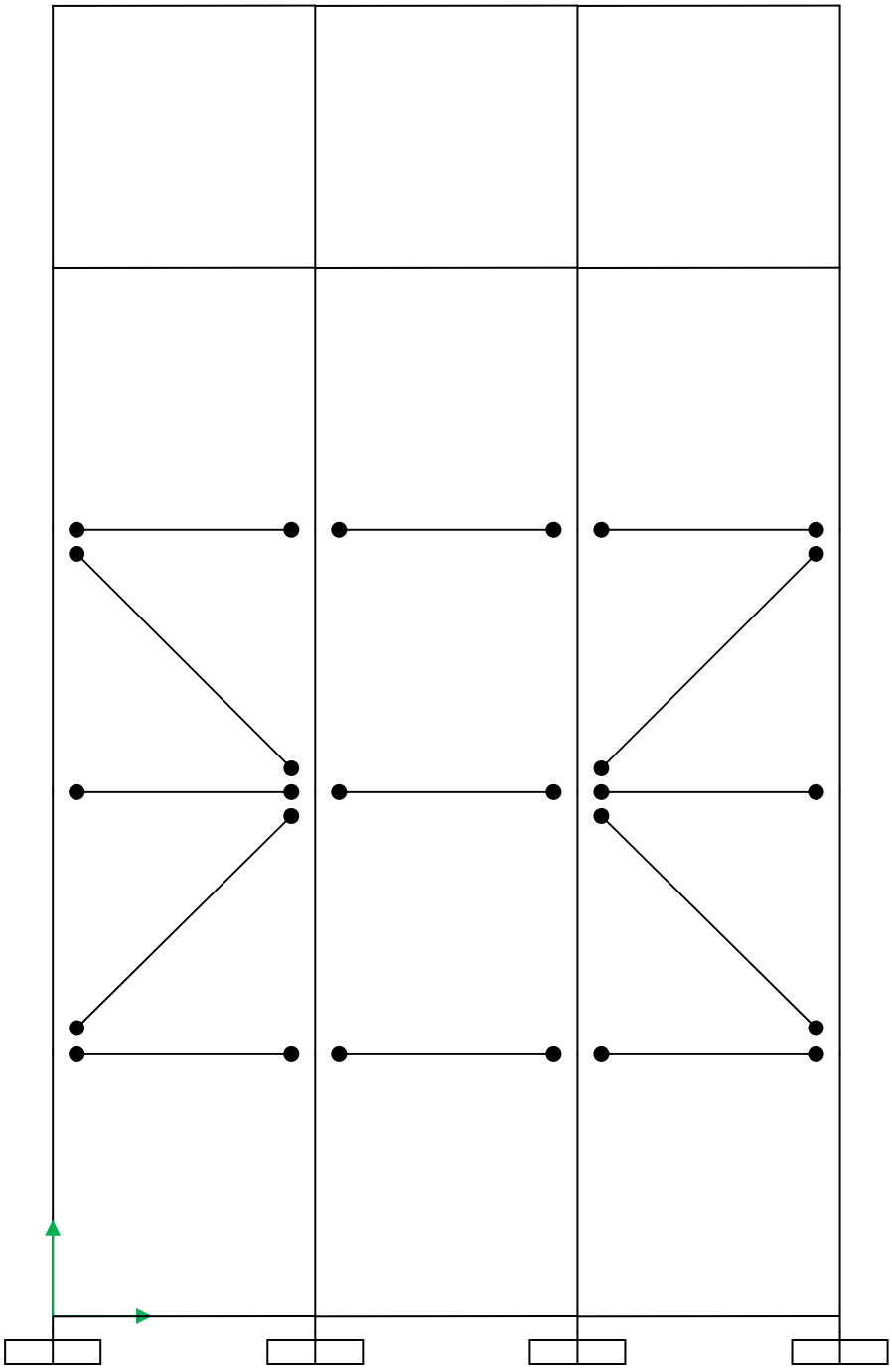


Figure 16

Ground motion scale factor: 25

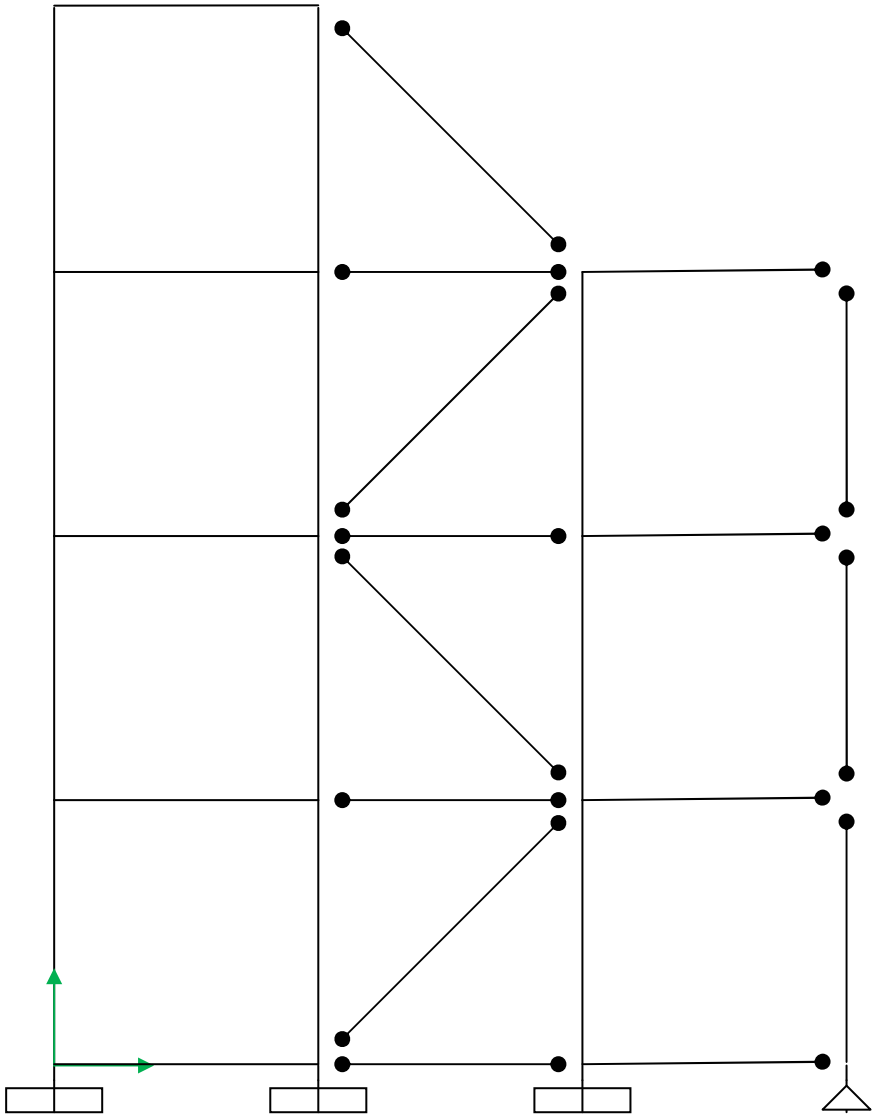


Figure 17

Ground motion scale factor: 50

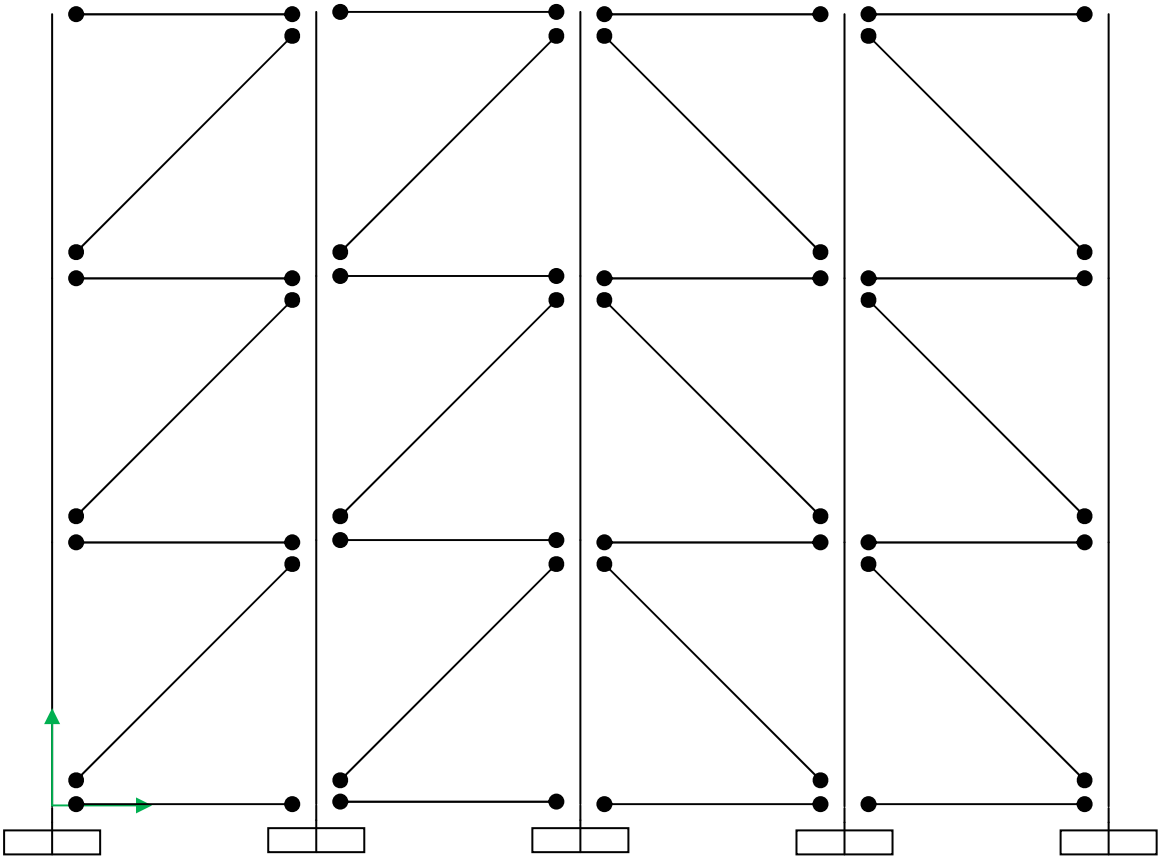
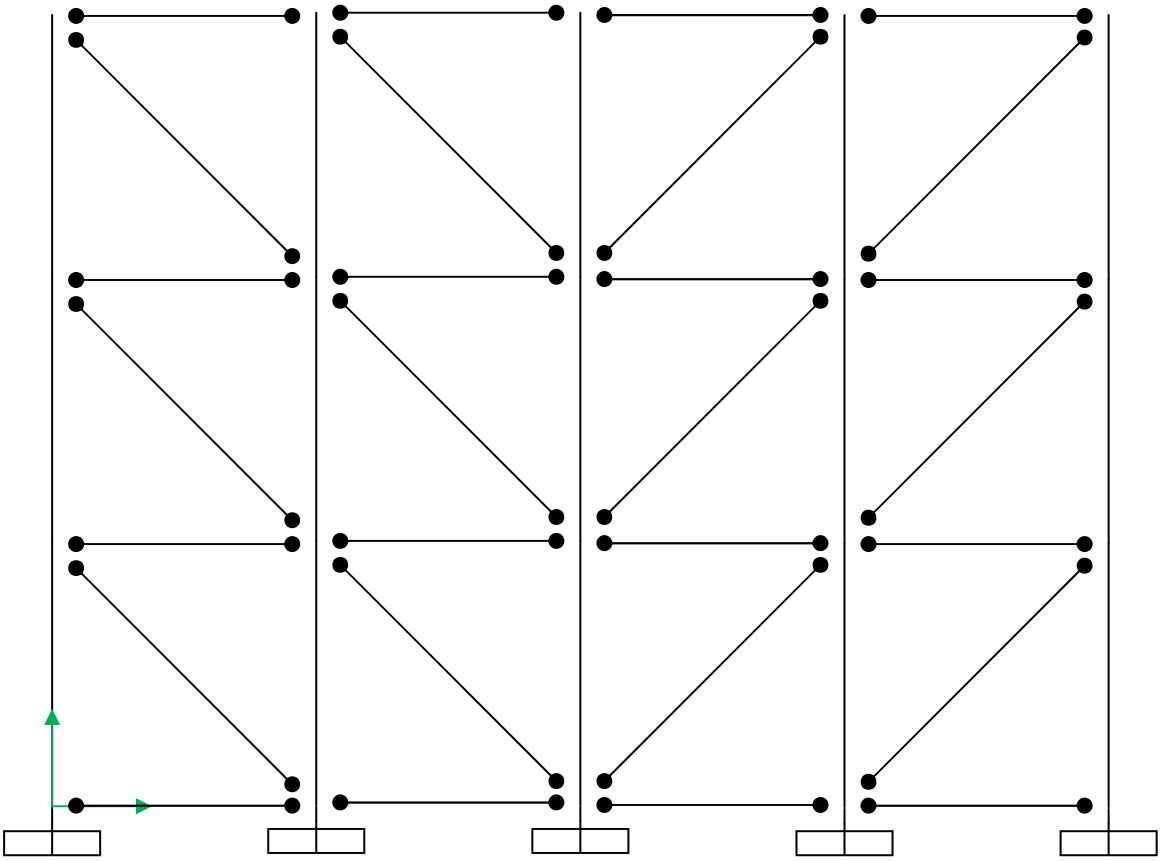


Figure 18

Ground motion scale factor: 30



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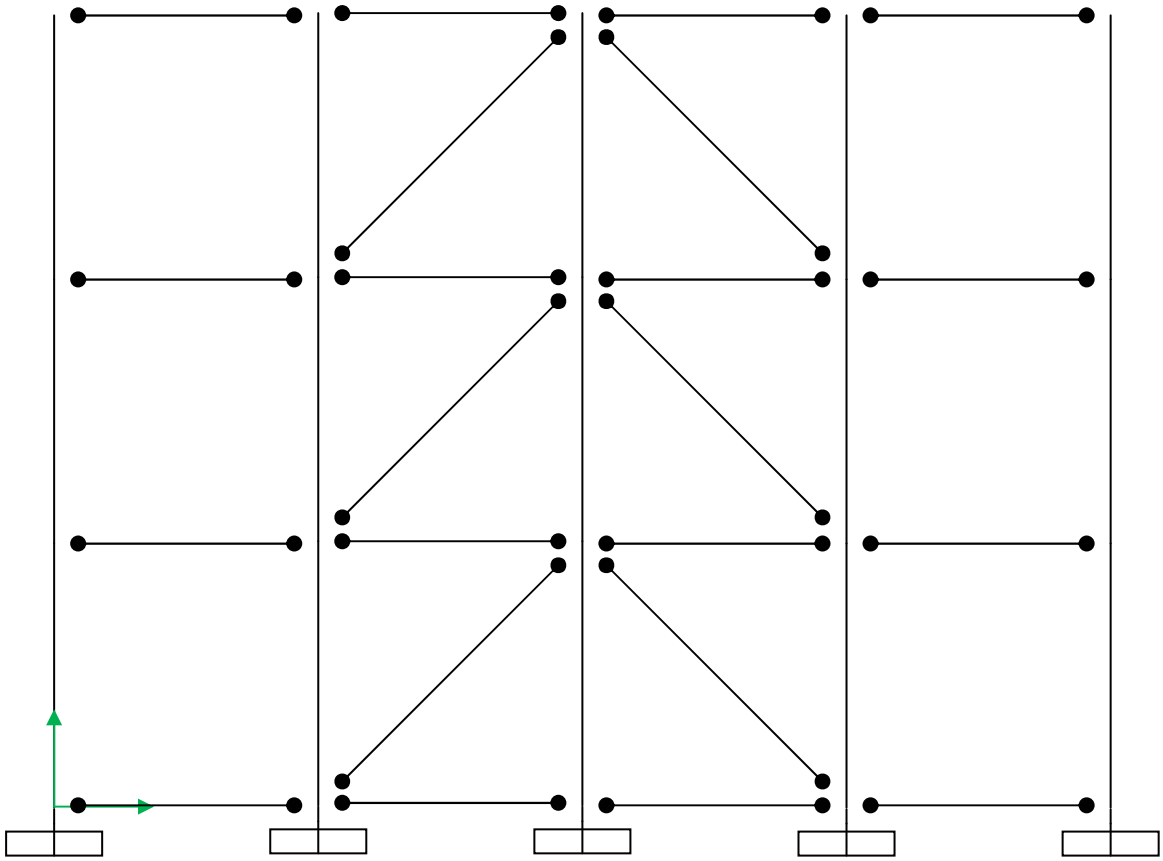

Figure 20

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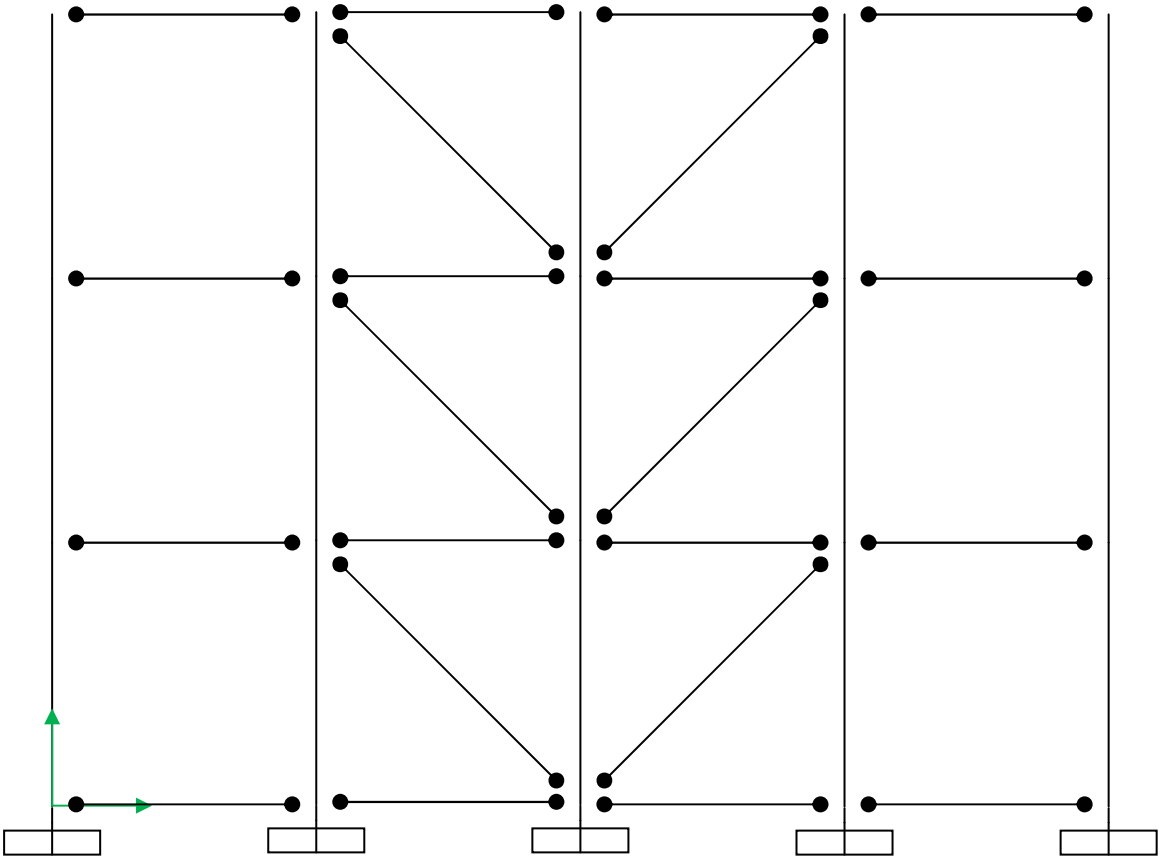

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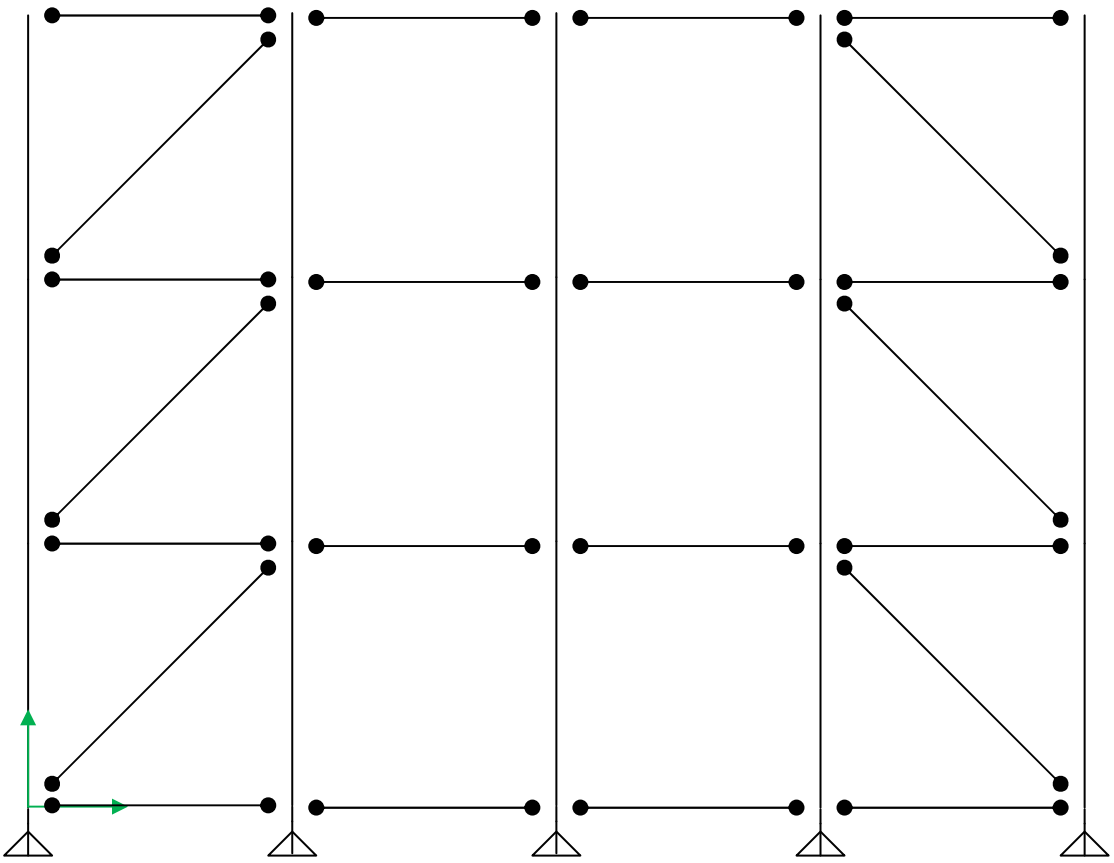
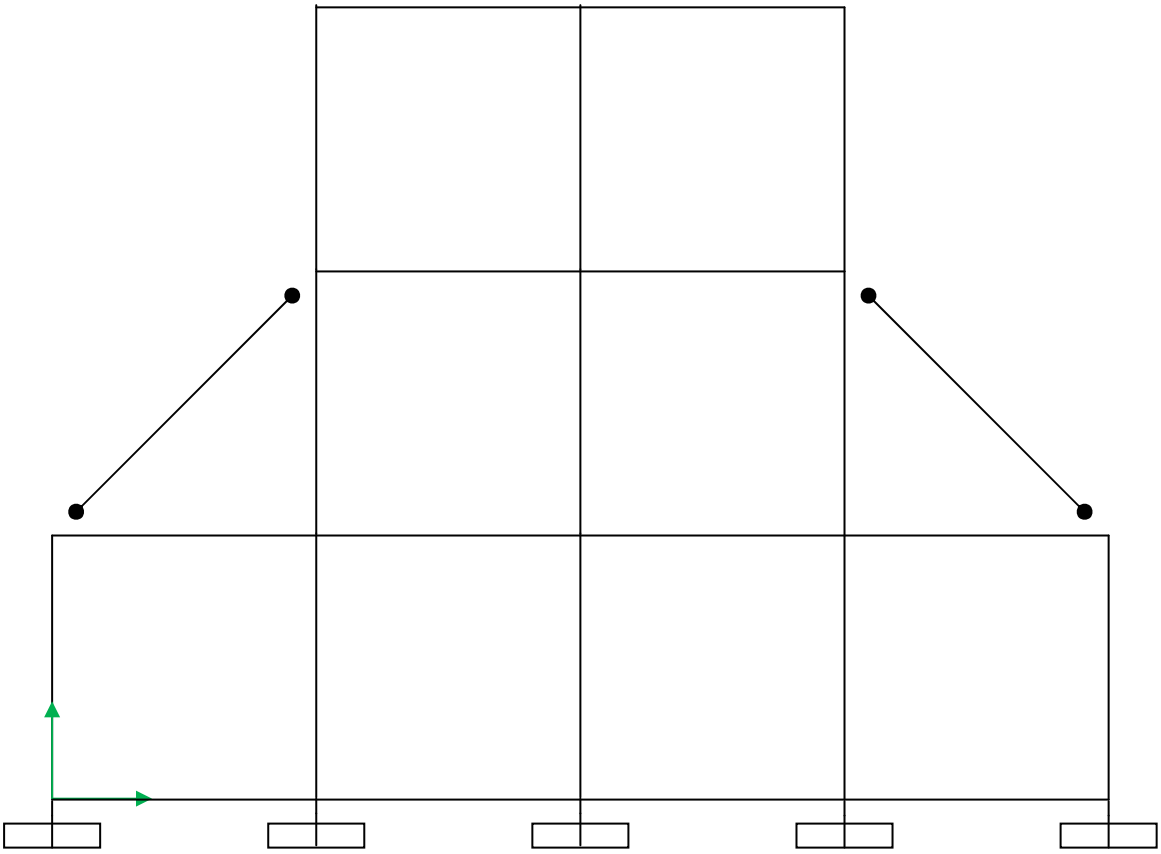


Figure 22

Ground motion scale factor: 20



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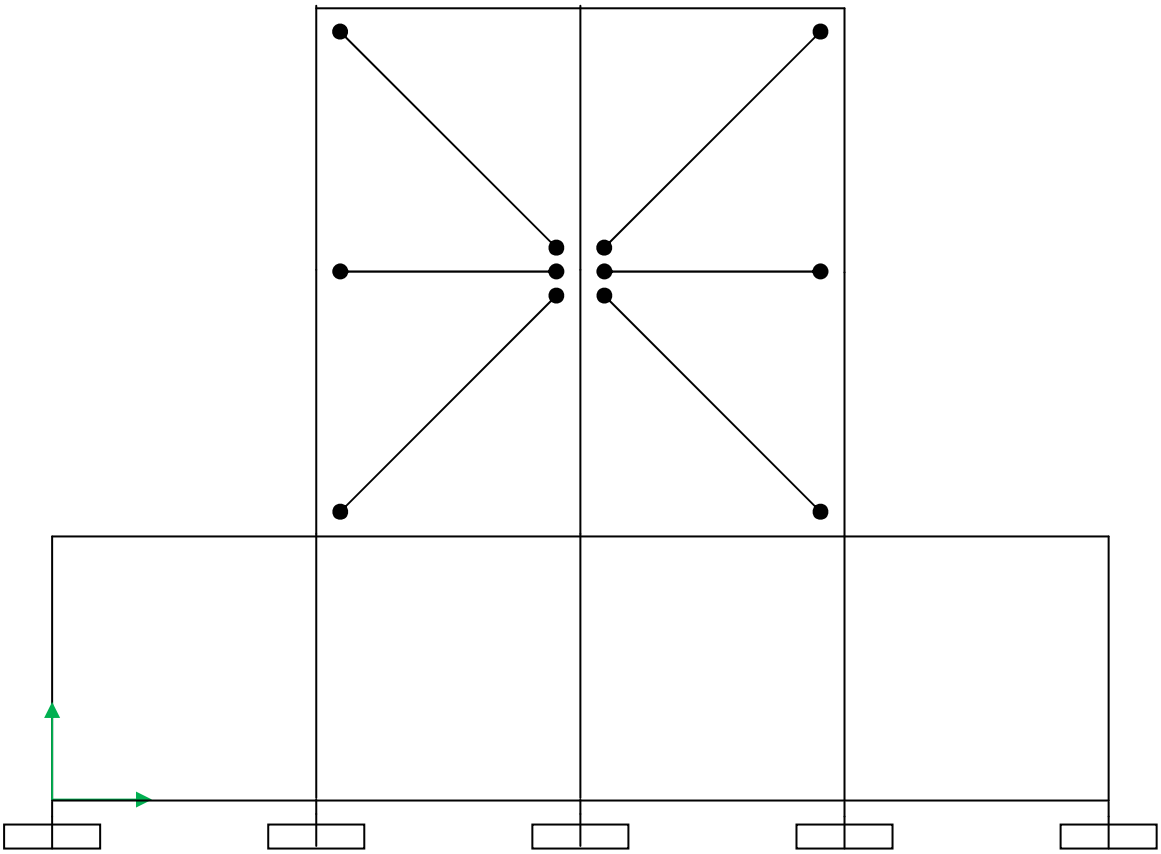
Ground motion scale factor: 20



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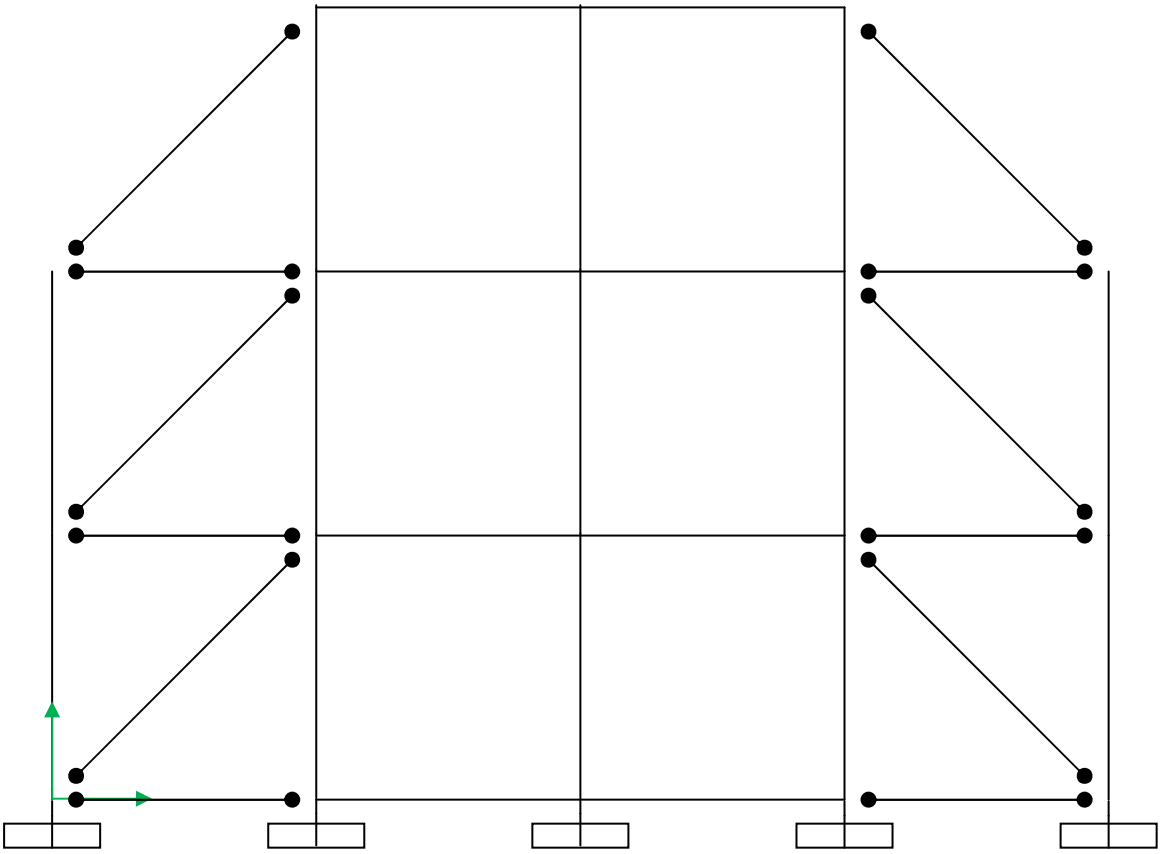


Figure 25

Ground motion scale factor: 38

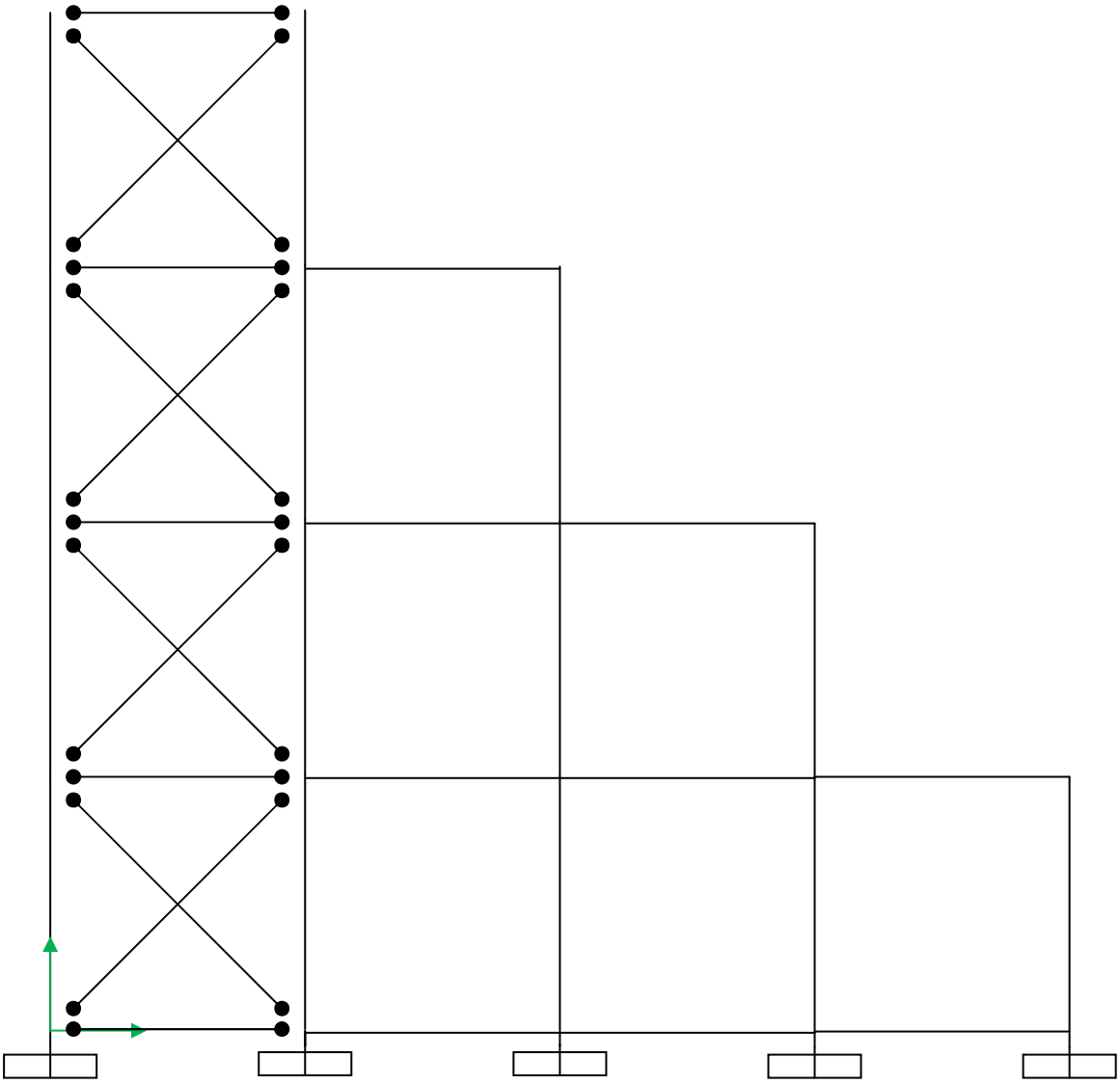


Figure 26

Ground motion scale factor: 25

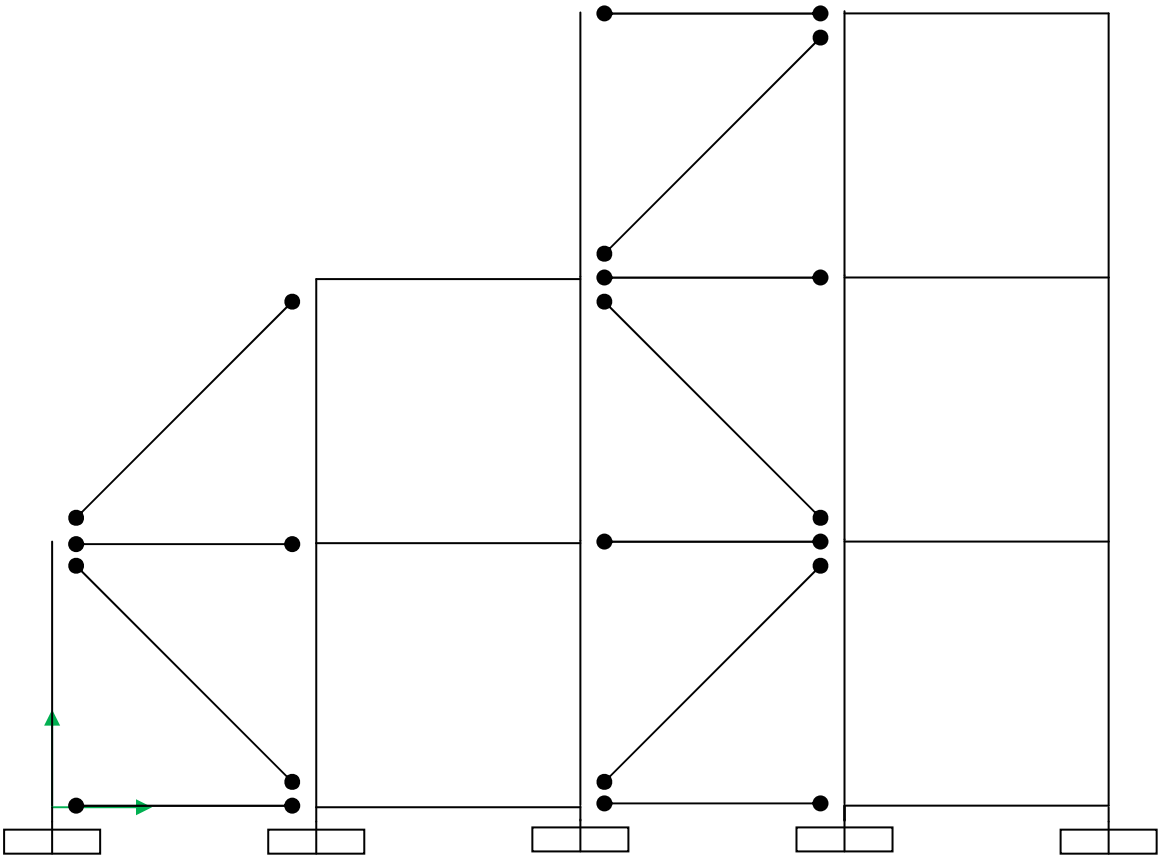


Figure 27

Ground motion scale factor: 35

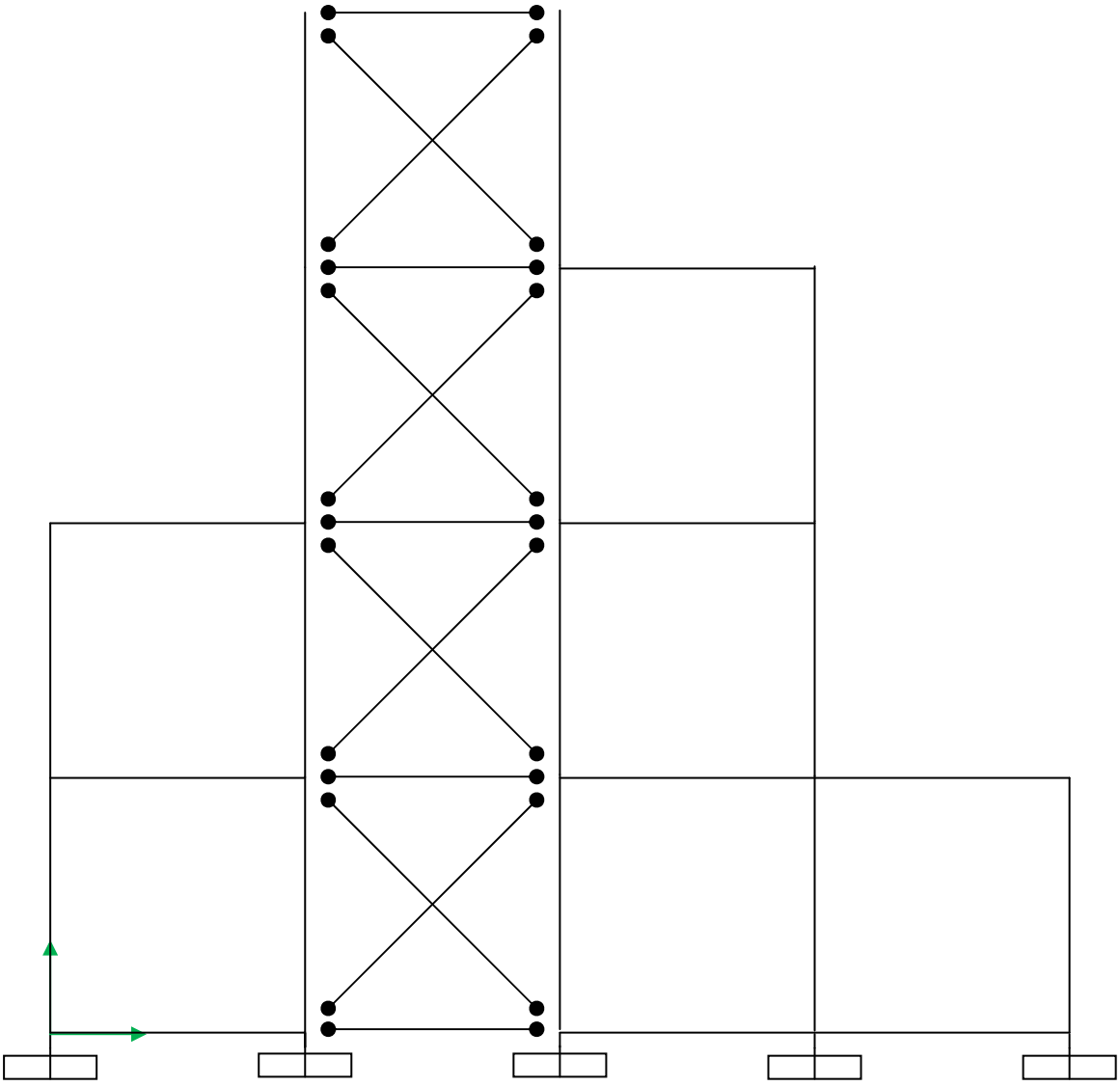


Figure 28

Ground motion scale factor: 25

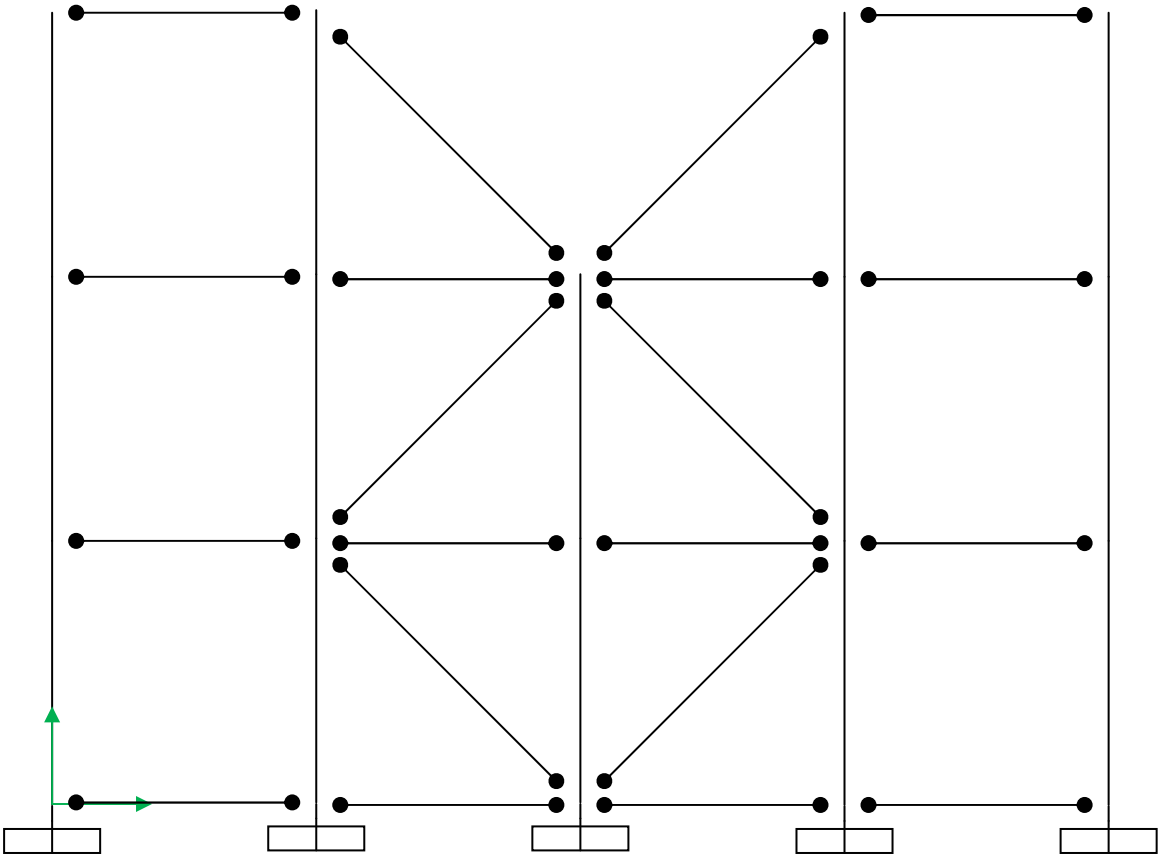


Figure 29

Ground motion scale factor: 40

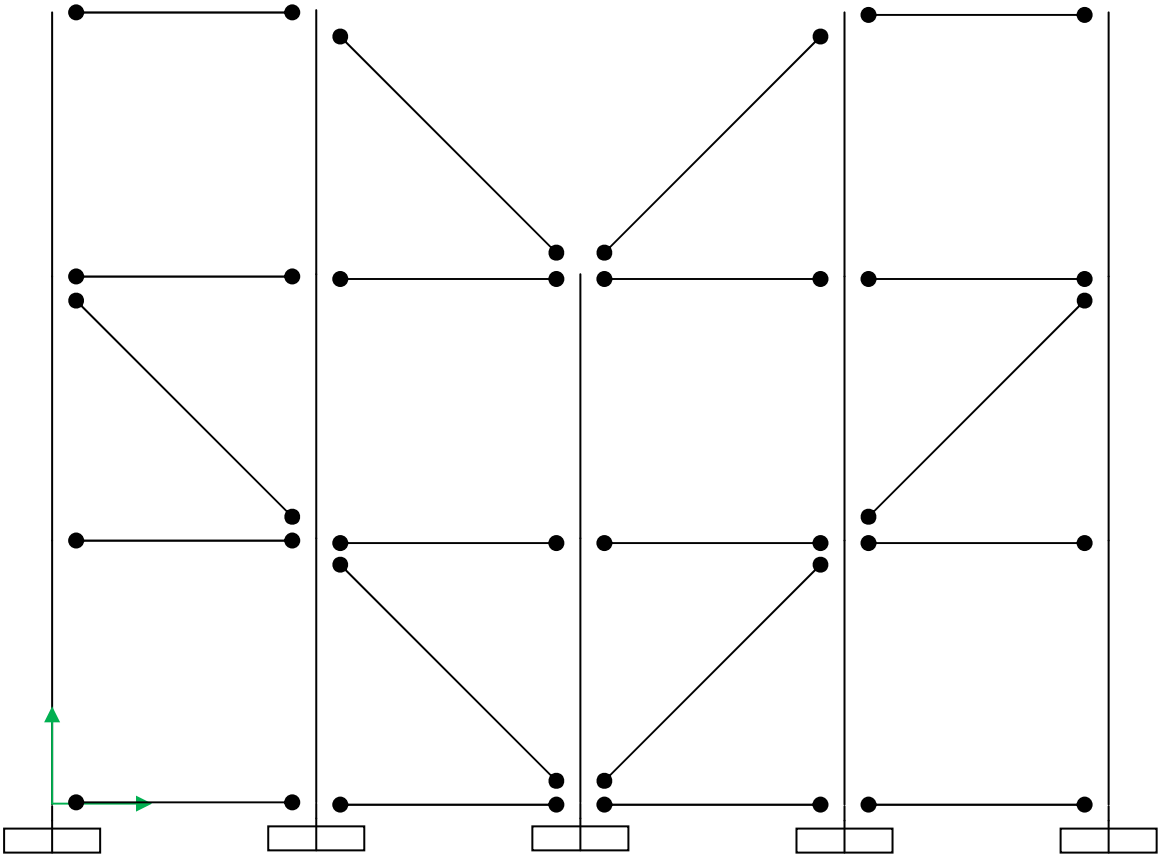


Figure 30

Ground motion scale factor: 40

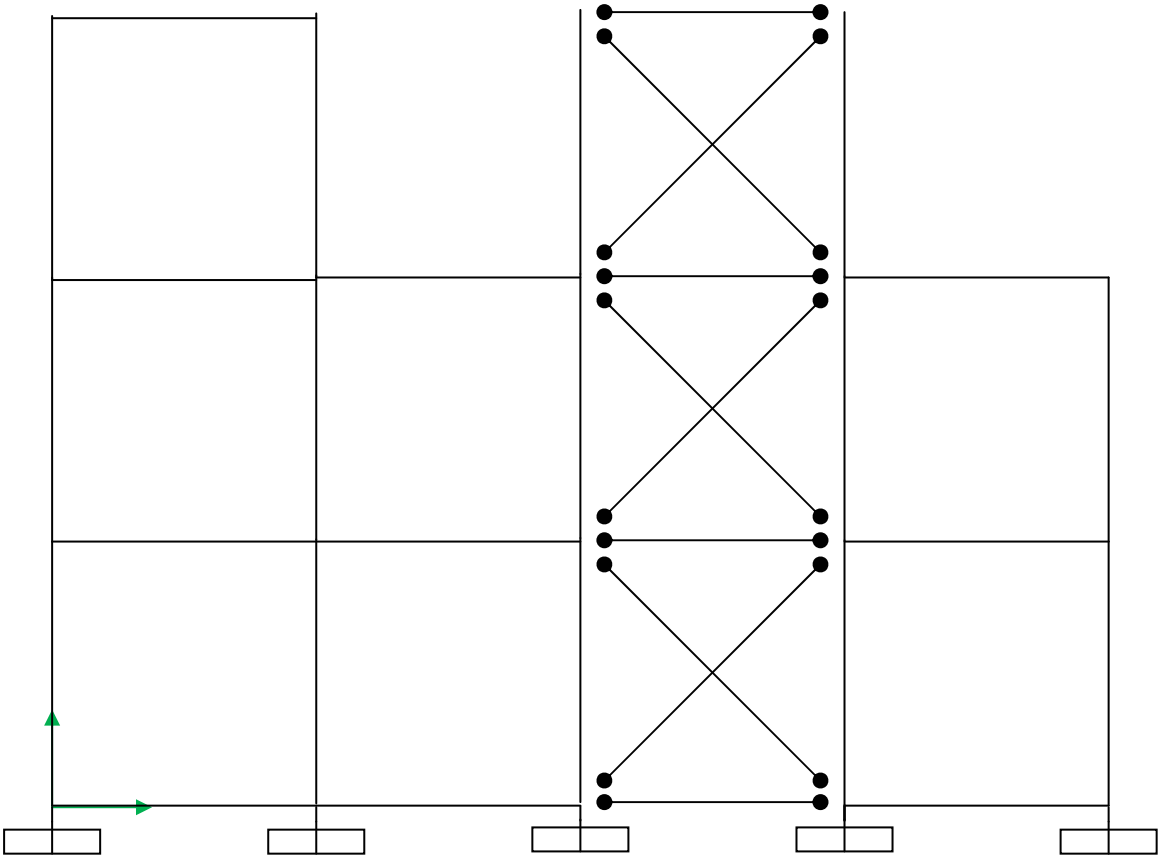
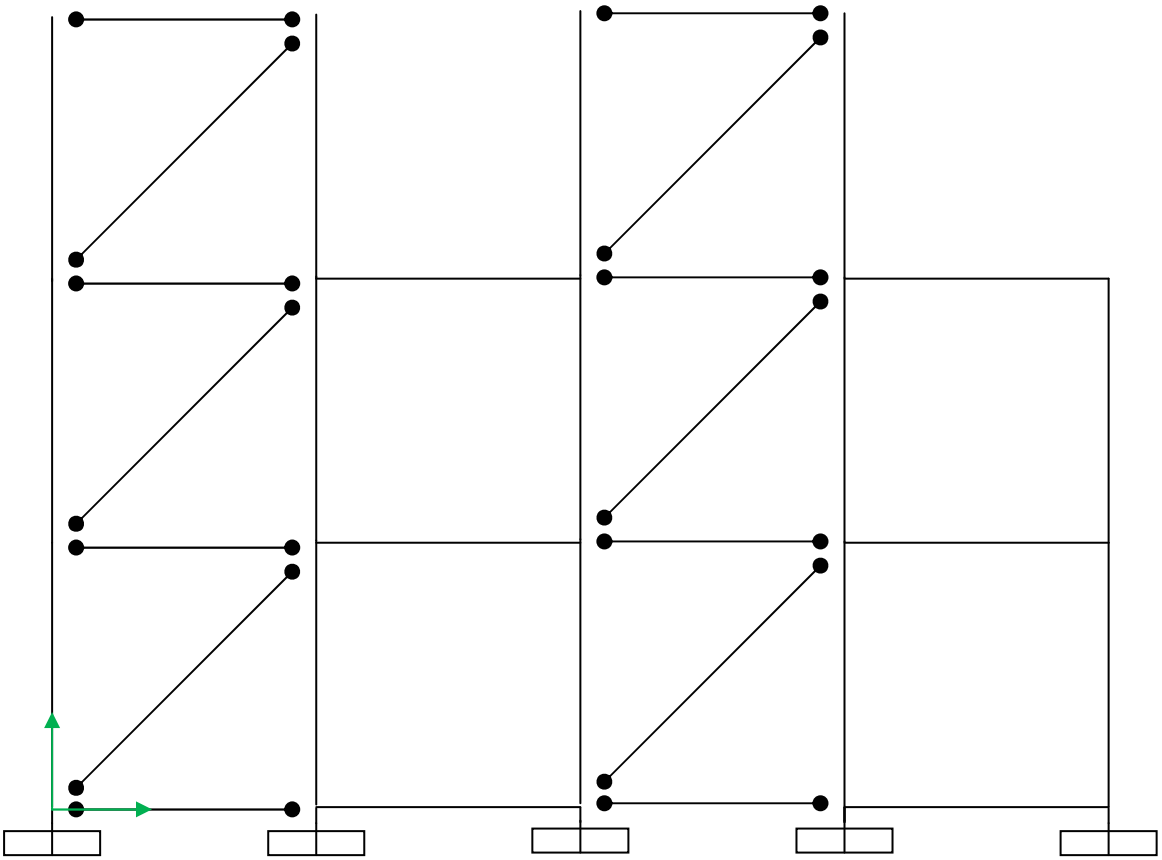


Figure 31

Ground motion scale factor: 20



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Ground motion scale factor: 35

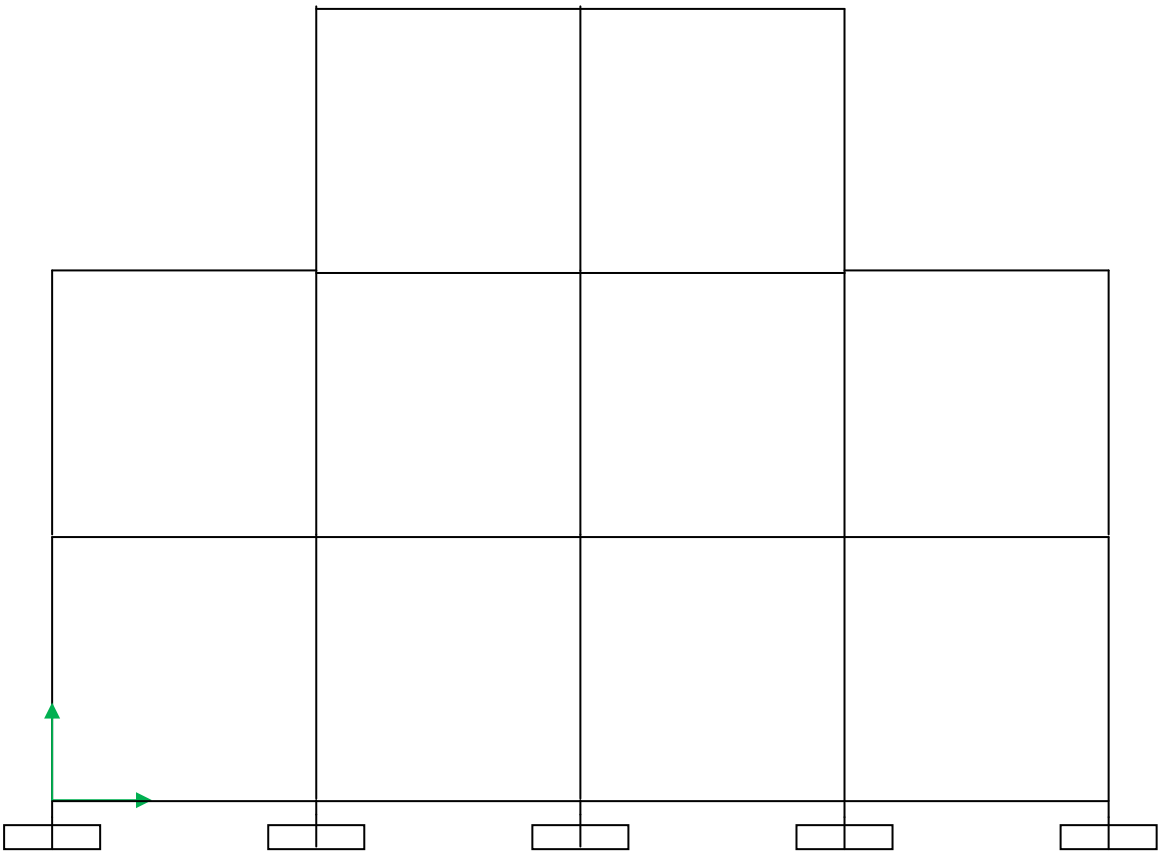

Figure 33

Ground motion scale factor: 10

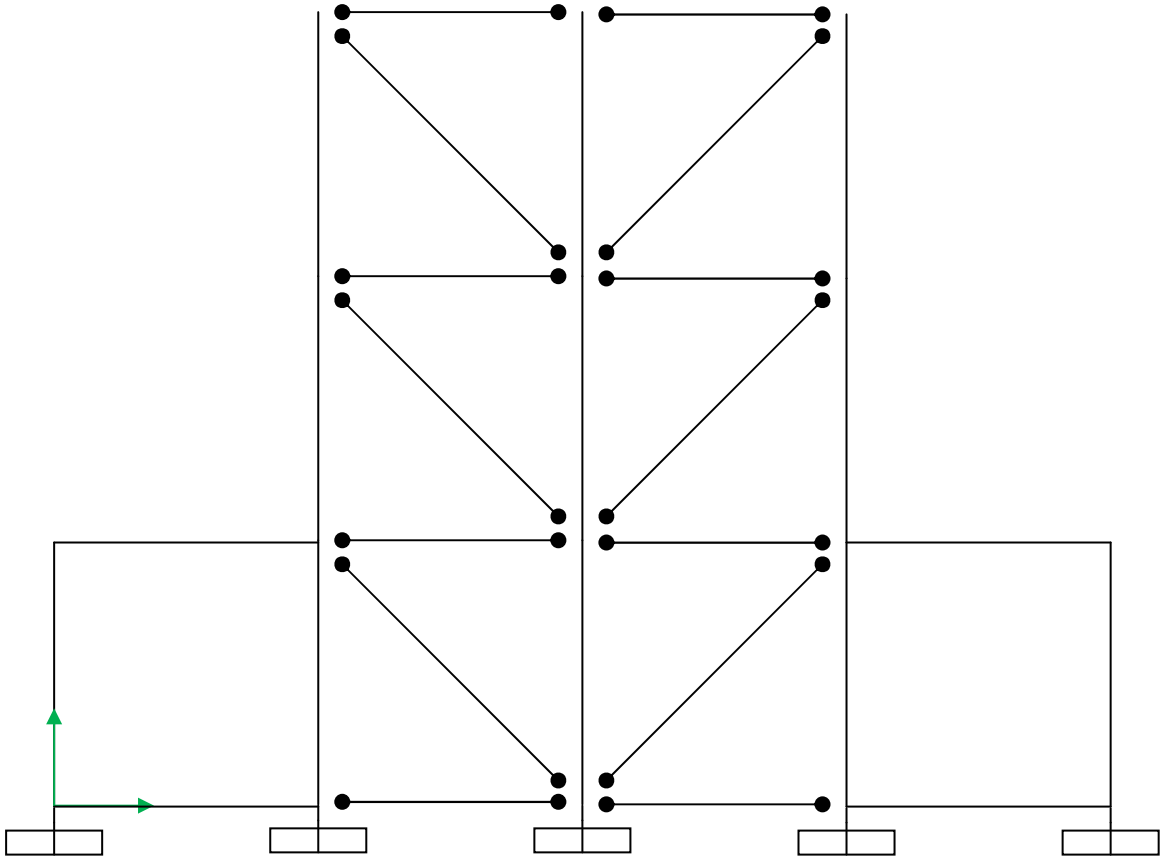

Figure 34

Ground motion scale factor: 35