

Andrew Ordway
Steel Design Project
CE 409
12/7/06

Hotel and Restaurant Building

Dimensions

Roof

Width: 200 ft

Length: 250 ft

Foot Print

Width: 200 ft

Length: 150 ft

Height: 95 ft

Frame Sections Used

Cantilever Beams: W44 X 244

Main Columns: TS 16 X 16 X 5/8

Cantilevered columns: TS 4 X 4 X 5/16

Bracing: L 6 X 6 X 3/4

Mega Bracing: L 8 X 8 X 9/8

Floor Beams: W10 X 33

Floor Girders: W30 X 33

Roof Beams: W10 X 33

Shell Sections Used

Floor Slab: 5" concrete

Roof Slab: 3" concrete

Loads Applied

DL= Self Weight

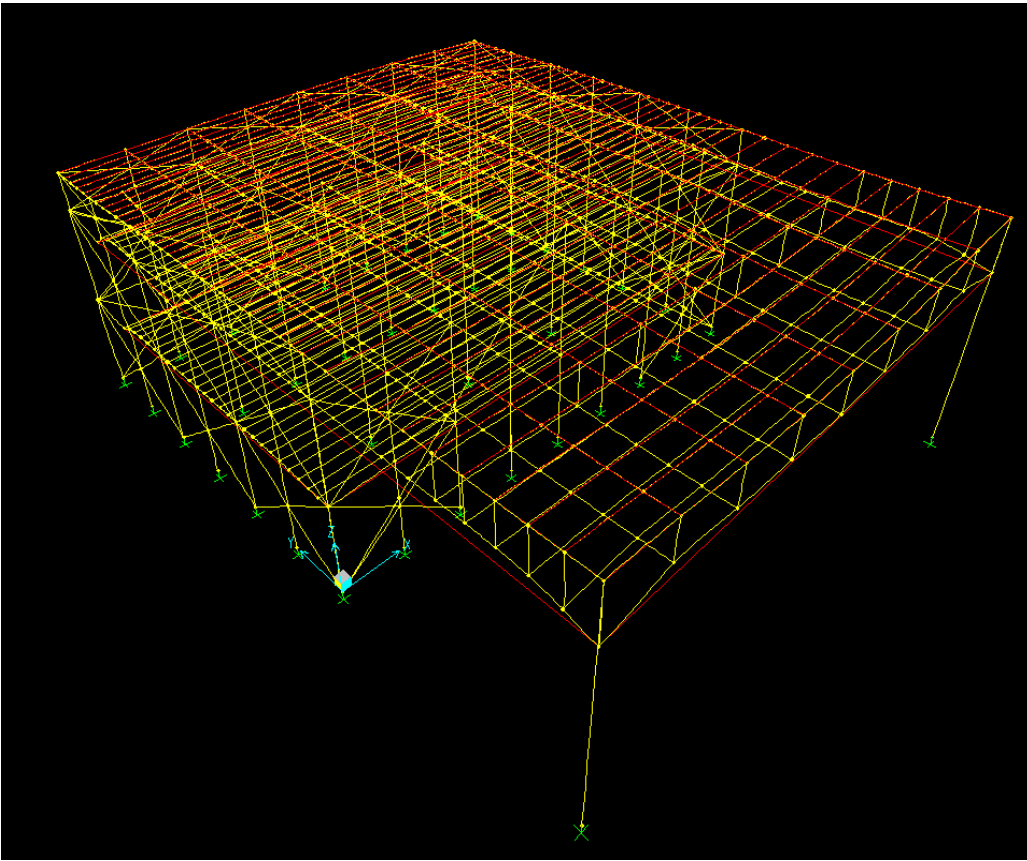
Floor Live Load = 100 psf

Roof Live Load = 20 psf

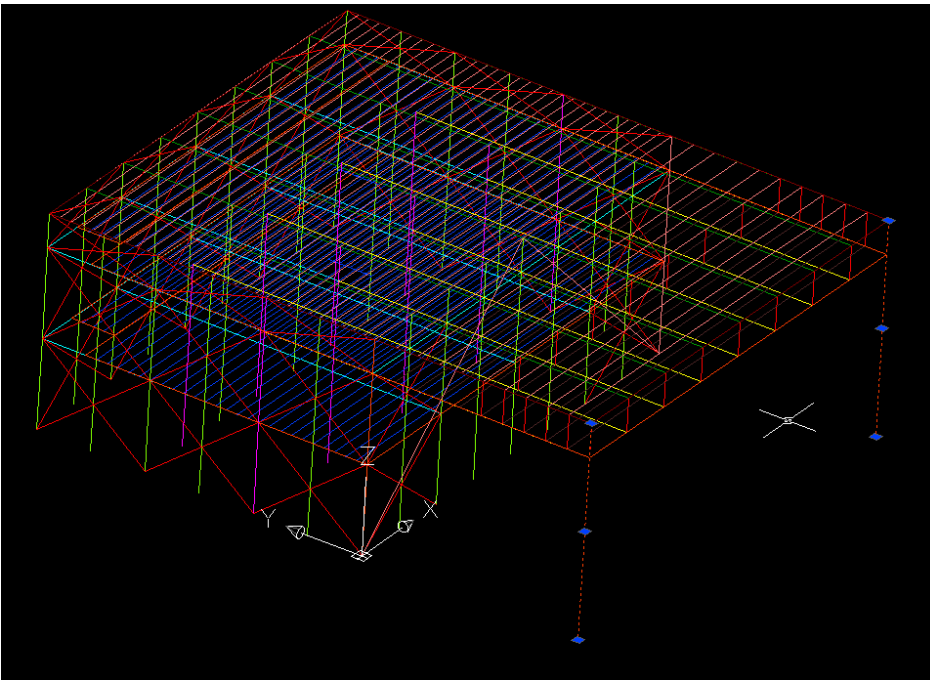
Max Displacement

Joint Displacement = 1.85 in

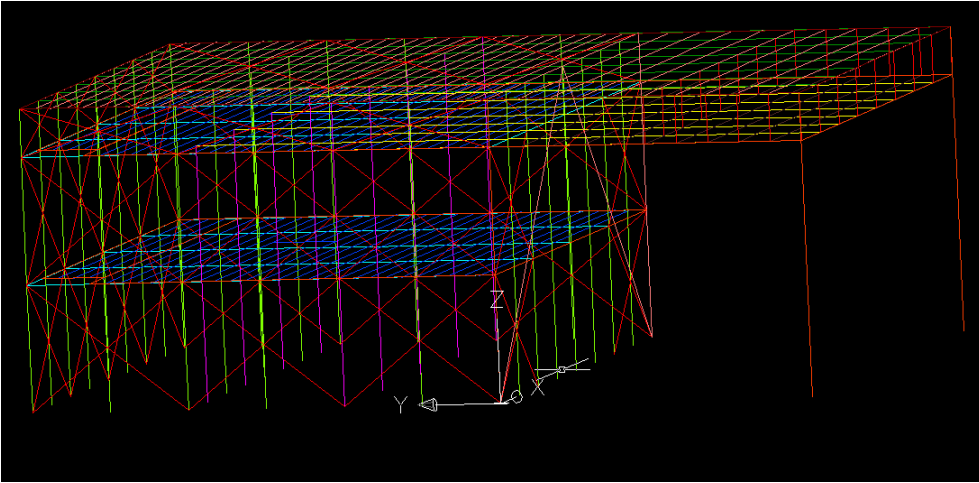
This structure was conceived in my imagination and was originally going to feature a 100 ft cantilever, but the structure was unstable. Without the two hefty columns supporting the restaurant overlook part of the building, there were vertical deflections of 26 feet.



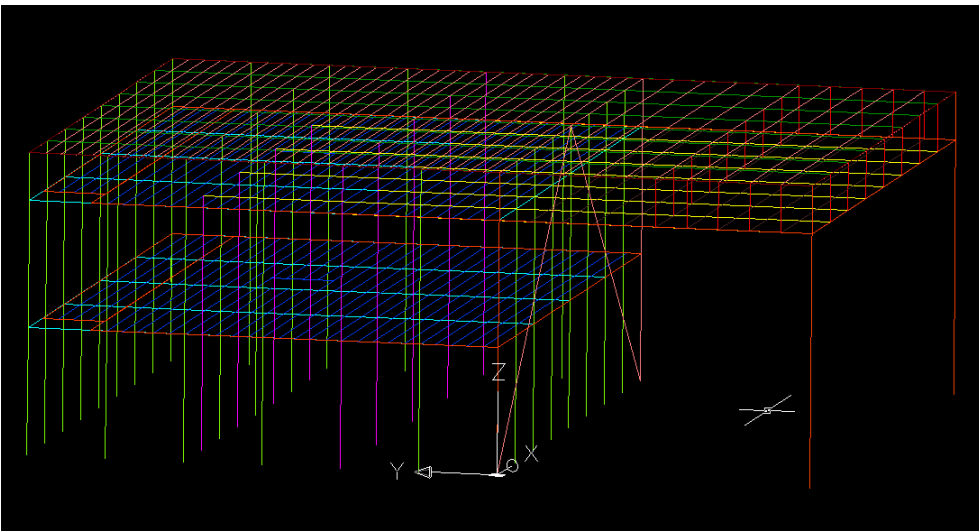
The SAP 2000 model of the building: SKY



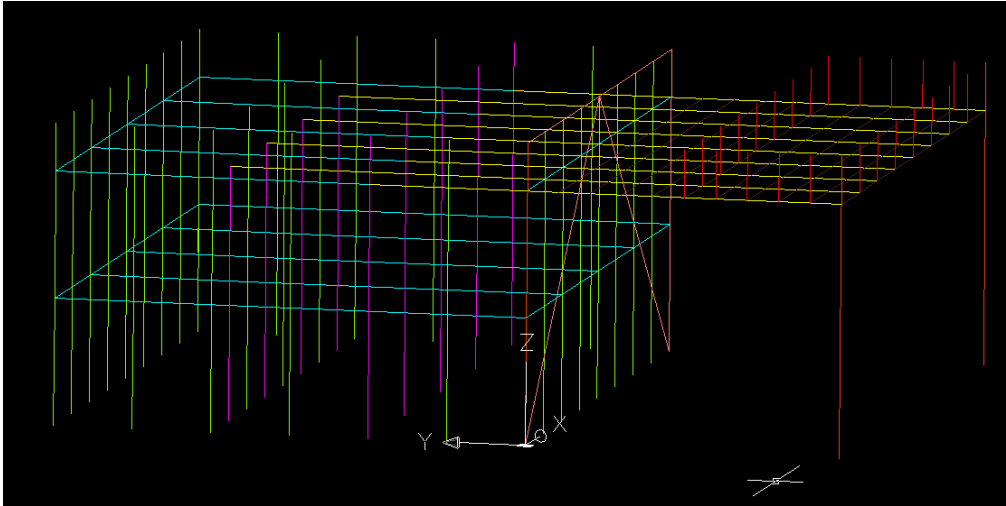
AutoCAD 2006 Model of SKY



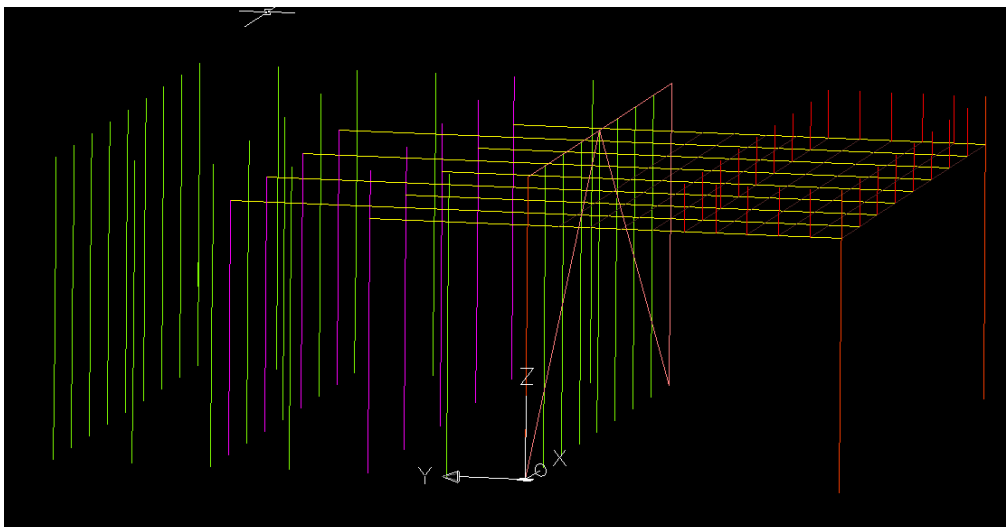
Lateral Bracing Wraps the entire structure to provide lateral support



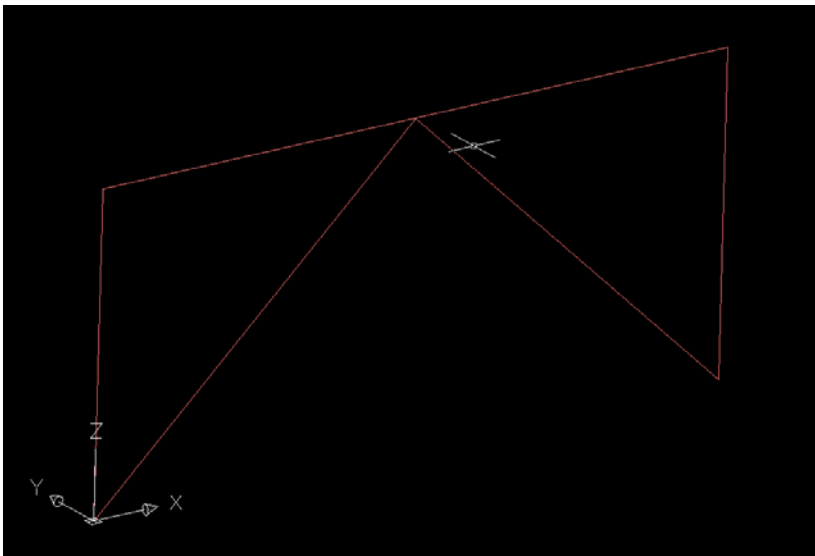
Large Box Columns throughout the Building sustain tremendous vertical loads both tensile (due to the cantilever) and compressive.



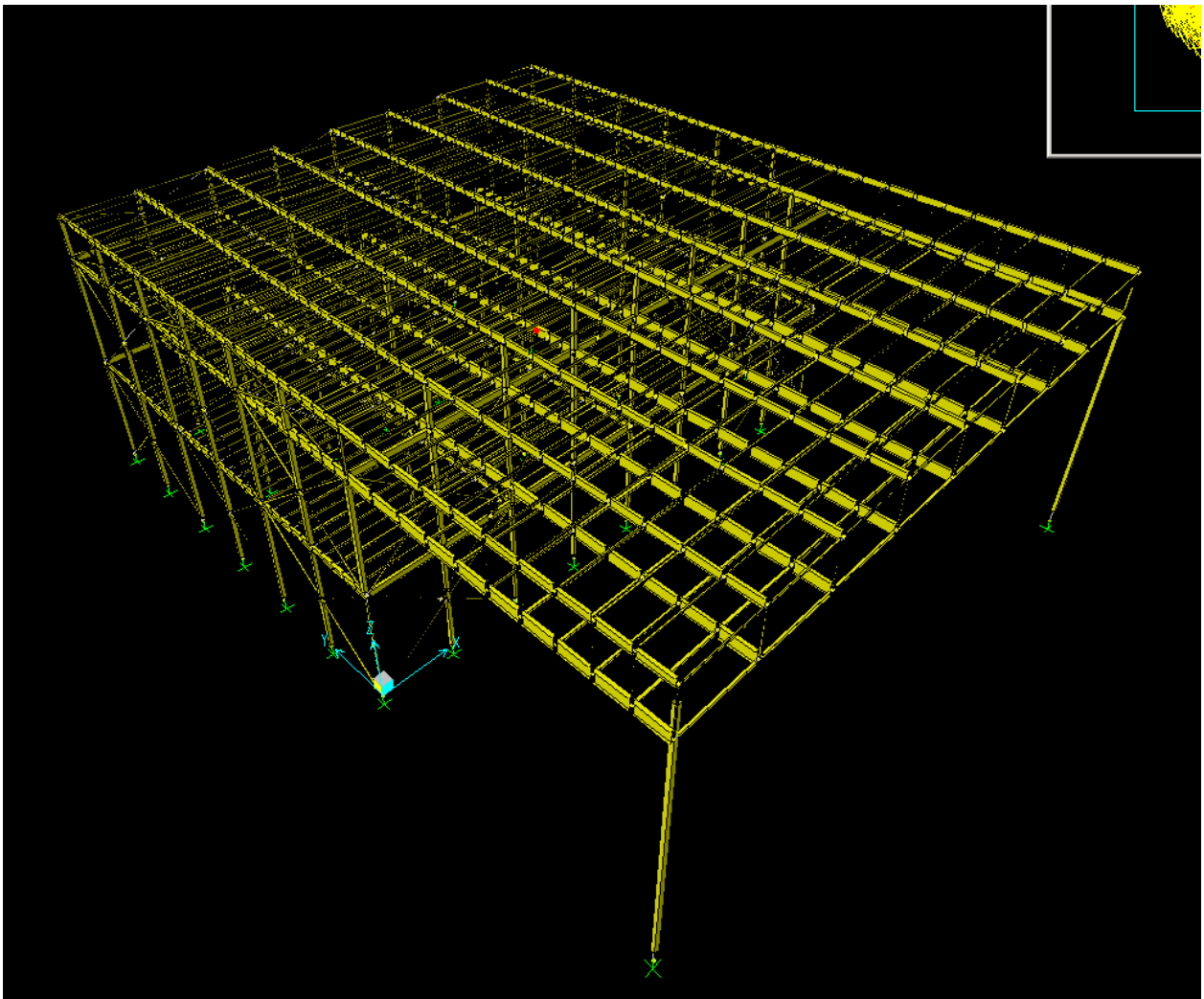
The Blue Floor Girders are spaced 50 feet apart and need a tremendous depth (33") to sustain their loads.



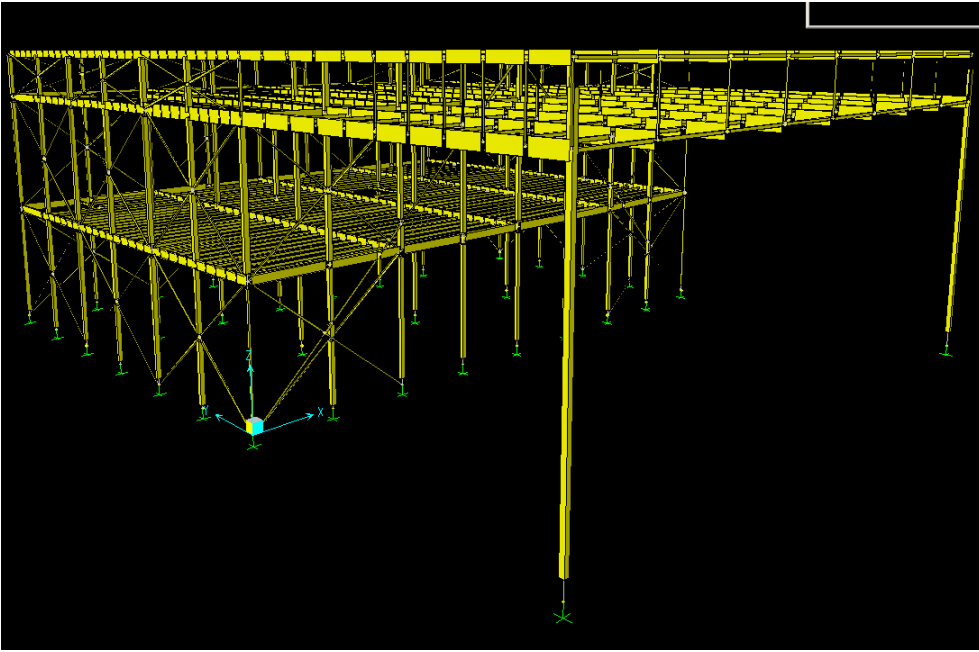
The Purple columns are connected to the ends of the cantilevered columns and can possibly sustain high tension loads.



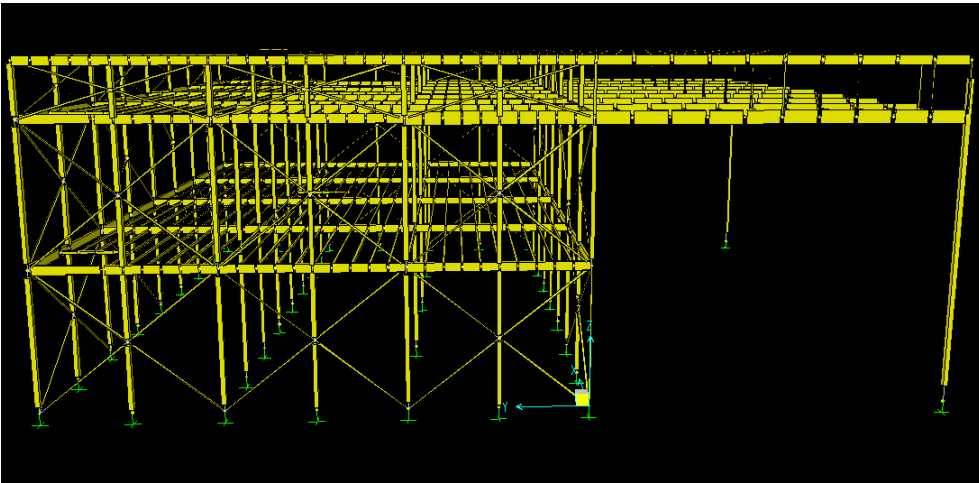
This single Mega Brace Provides lateral support for the central part of the building



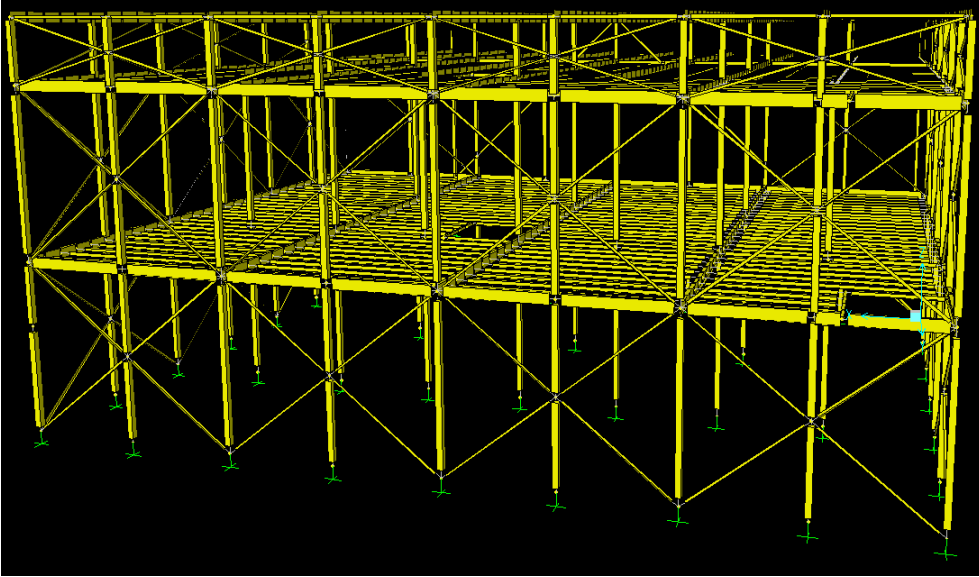
Here we can see the actual dimensions of the framing members



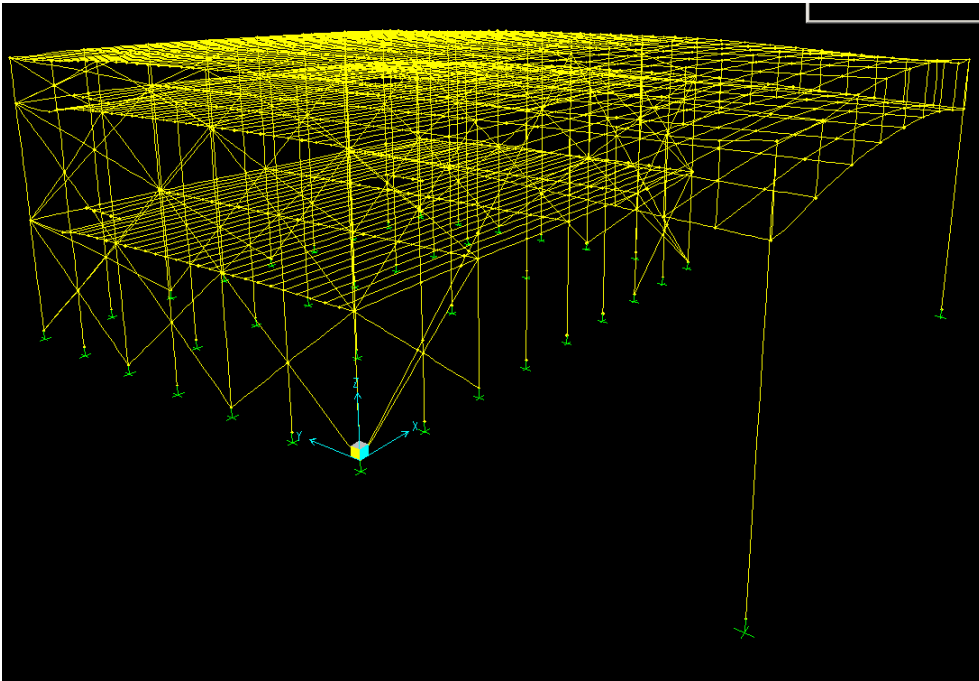
The Cantilever beams supporting the Restaurant are the deepest and heaviest beams in the building.



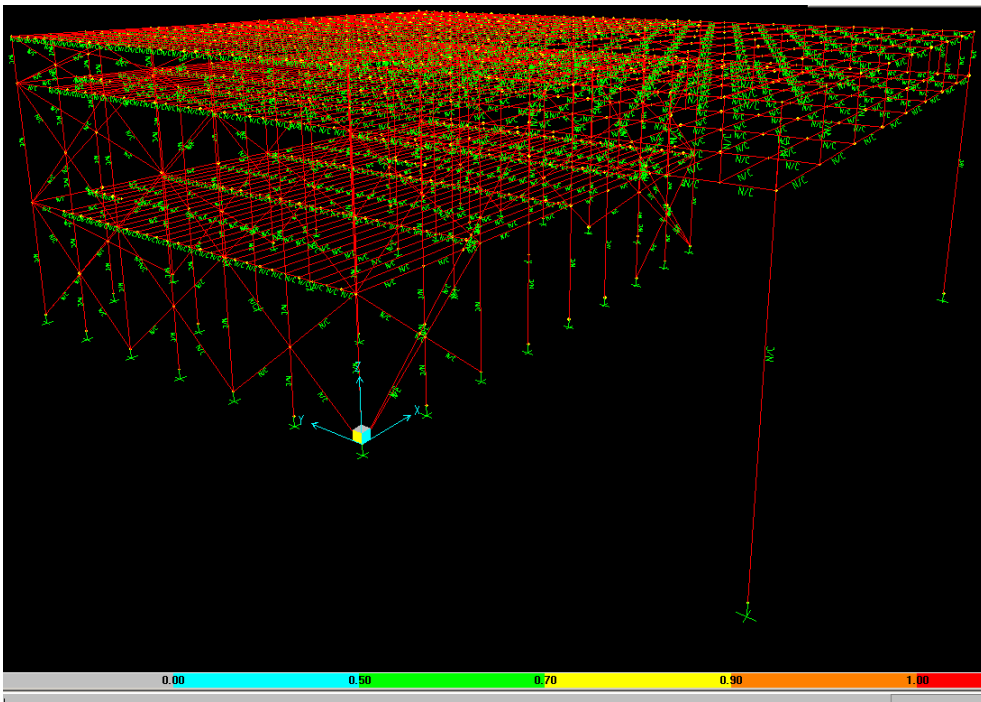
The diagonal bracing is necessary to provide lateral support to the main building. The restaurant relies primarily on minor axis bending capacity to resist lateral forces.



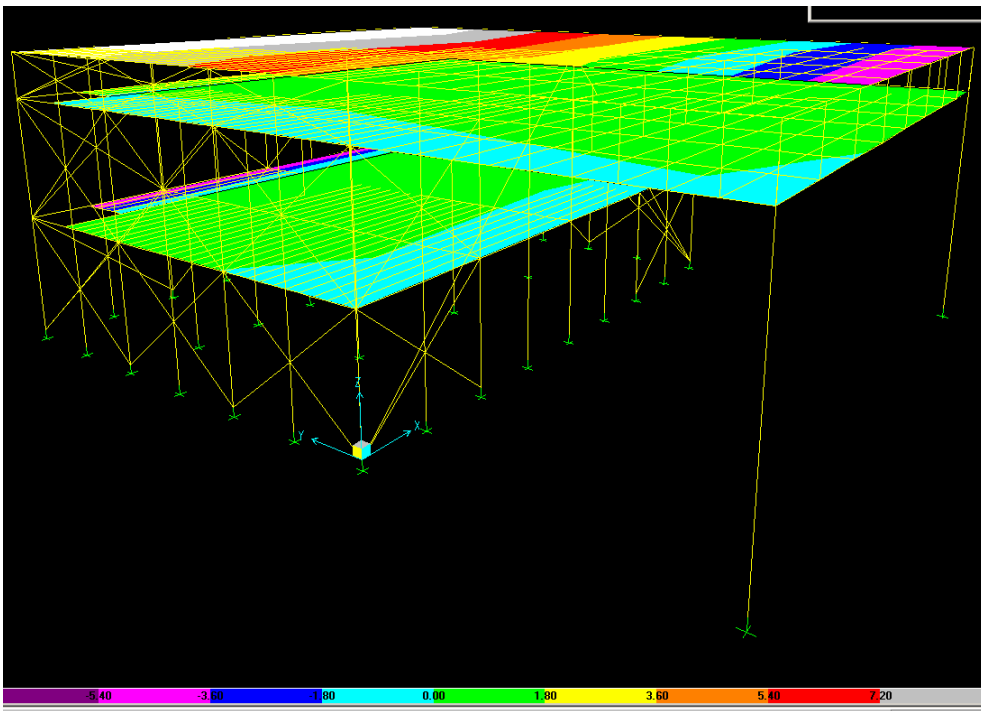
Here we can see the holes cut in the floor beams to make room for the elevator and emergency stairwell shafts.



View of the amplified deflections of the structure under loading.



Stress Ratios



Stresses in the floor and roof slab.