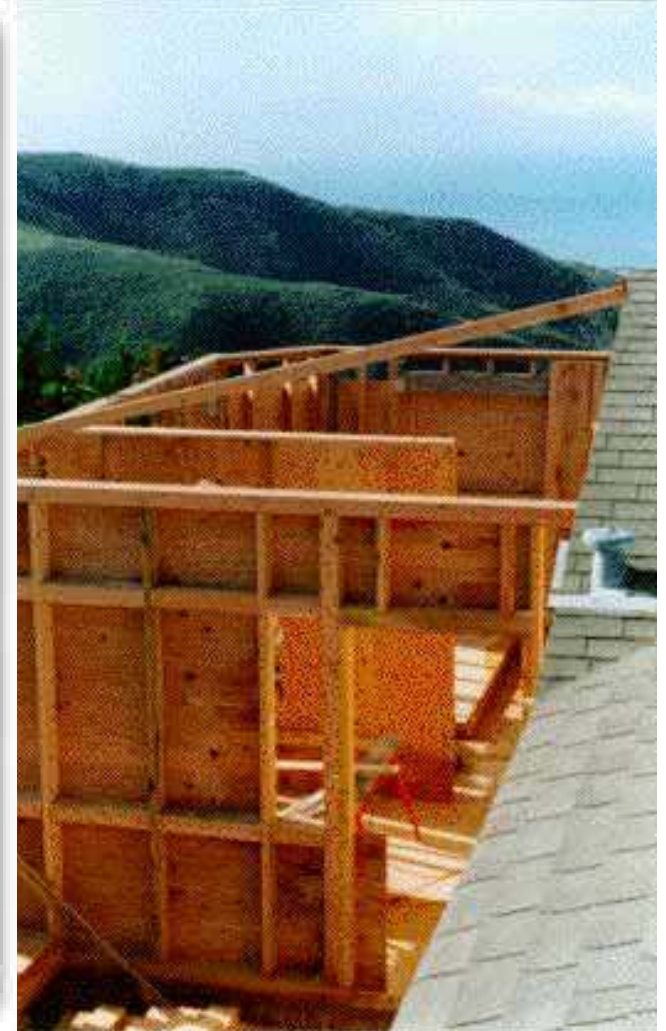


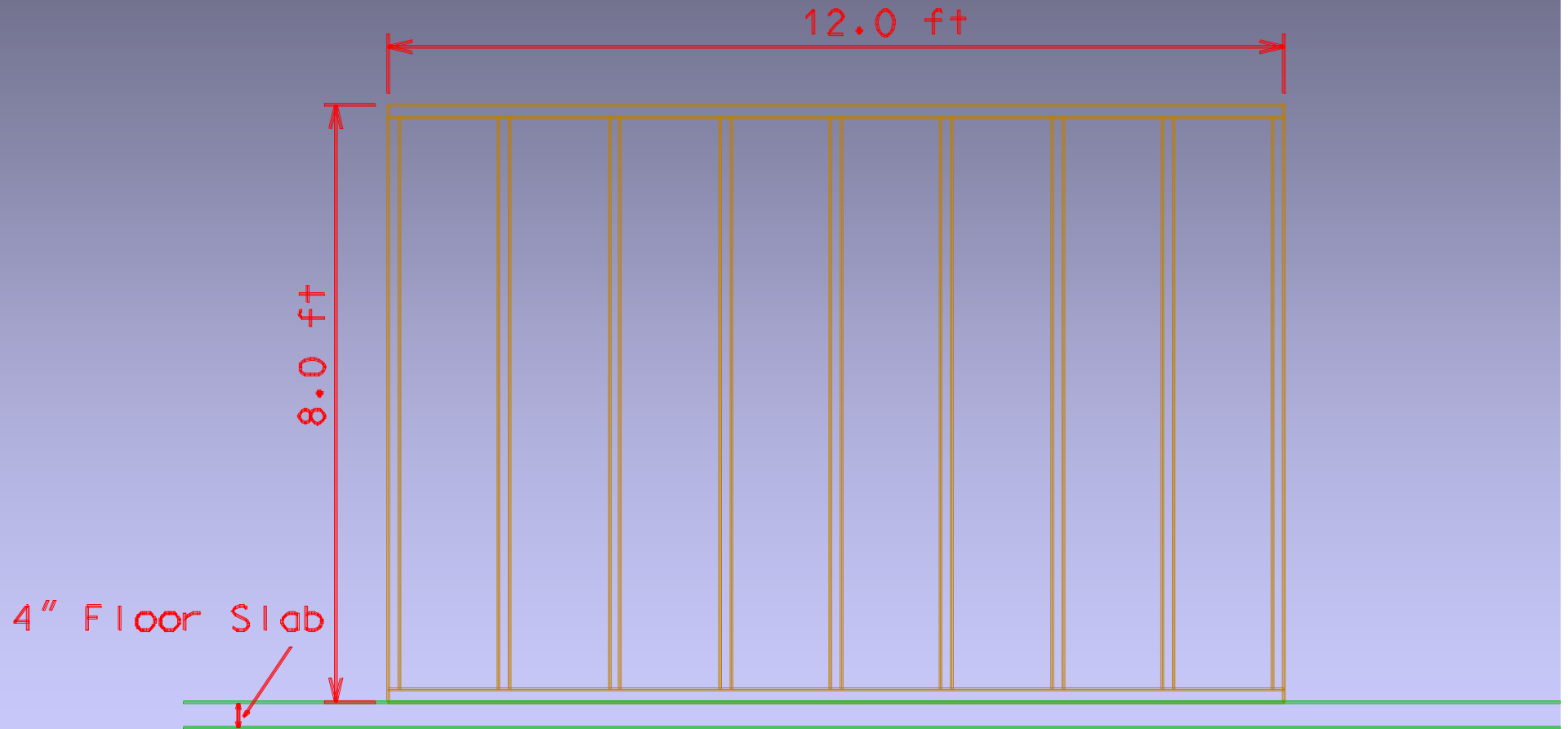
Lecture #17

What is a shear wall ?

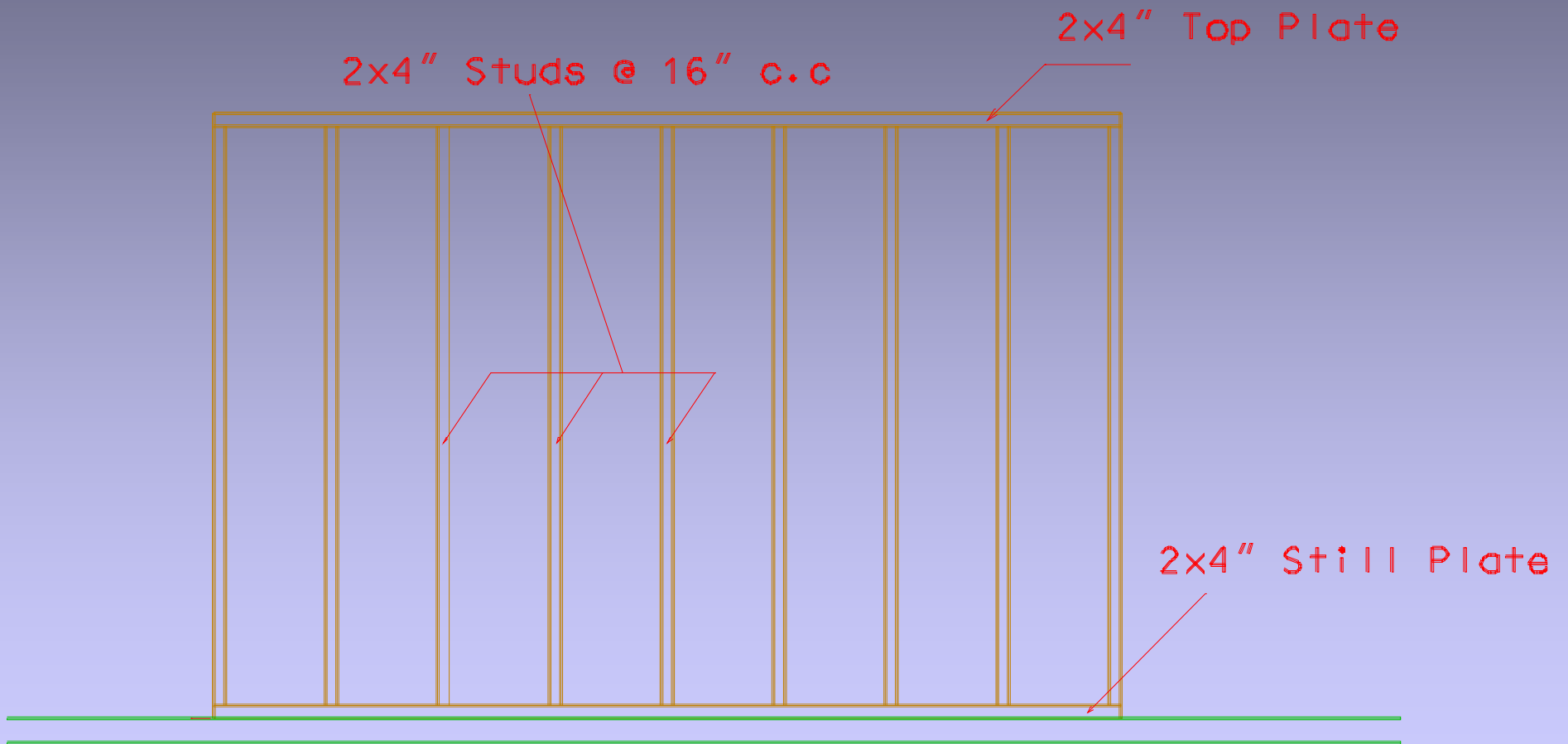
Consider the simple analogy of a typical residential interior stud wall.



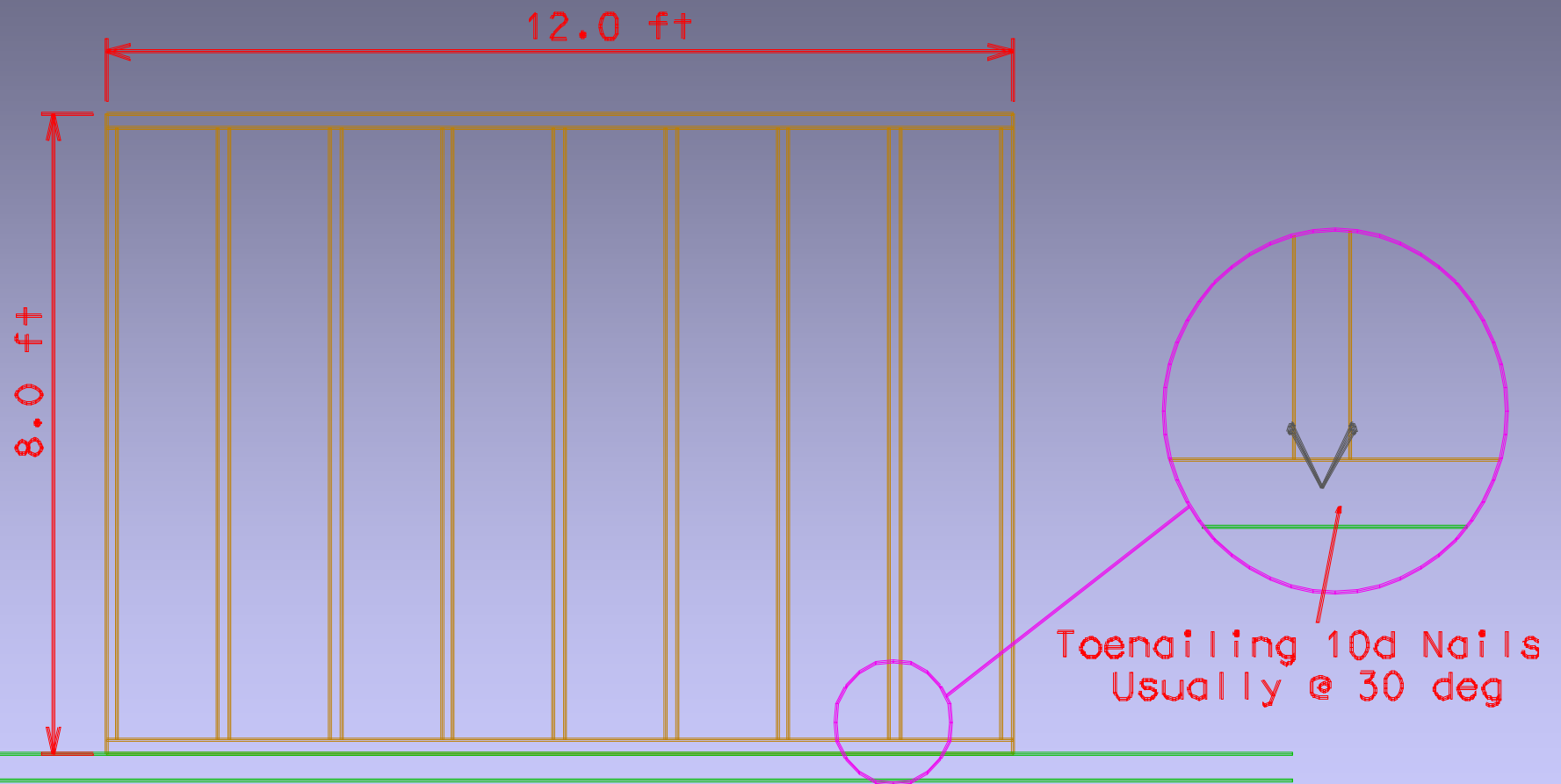
Consider a 12' long by 8' high stud wall sitting on a concrete slab.



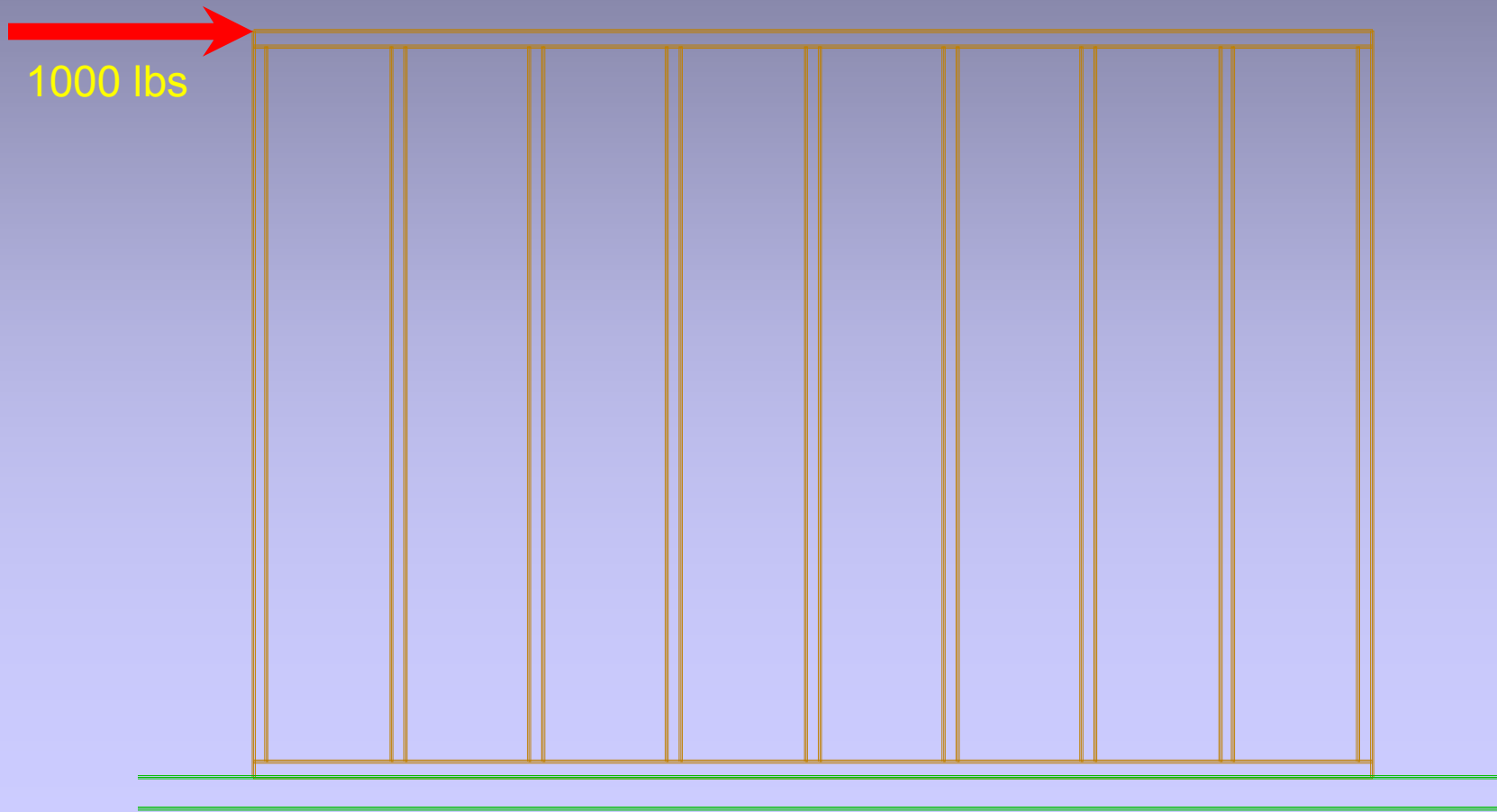
A stud wall is built from 2"x 4" wooden or steel studs placed every 16" on center, with 2"x 4" pieces at the top and the bottom.



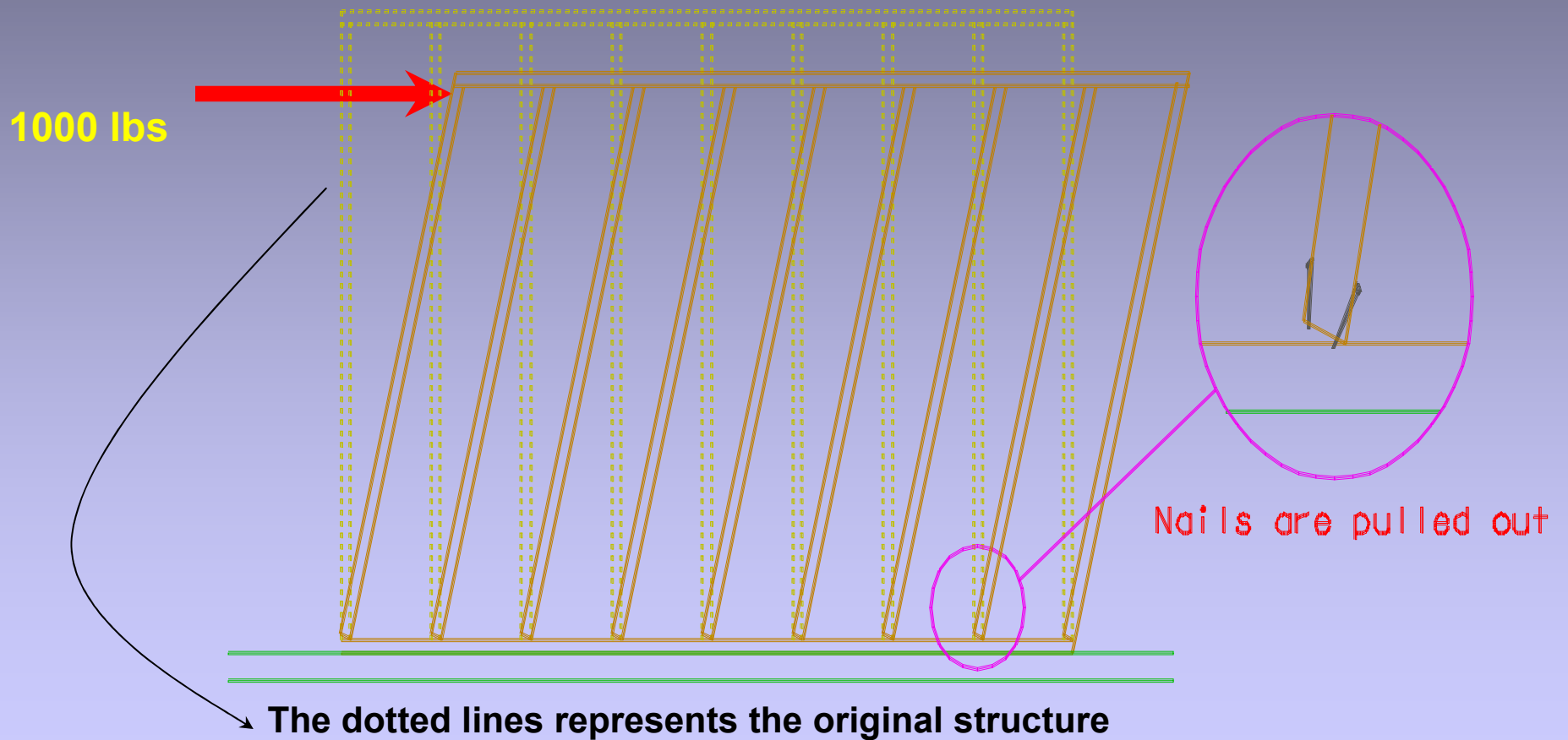
The studs are secured with “toe-nailing” 10d nails @ 30°.



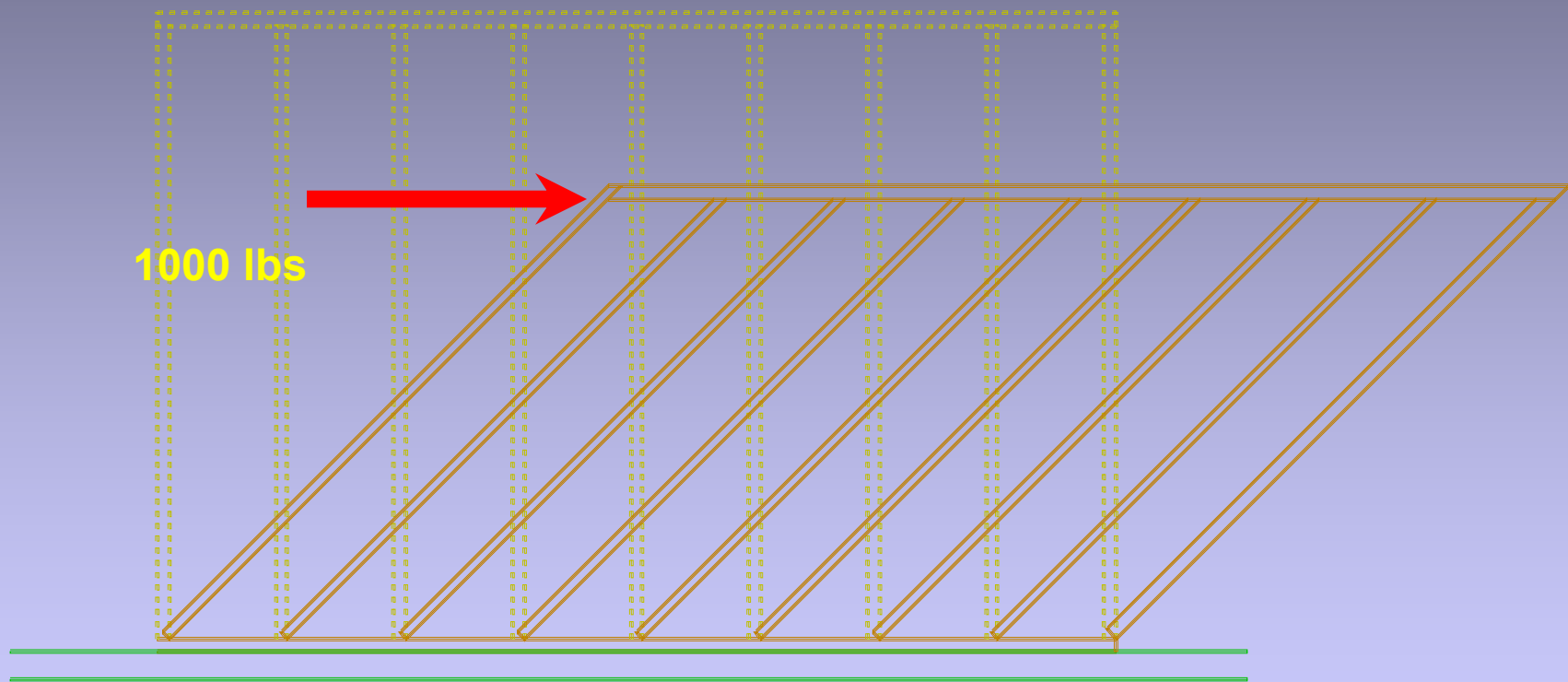
Consider now the application of a large horizontal load to the stud wall coming from wind or seismic loads.



The shear wall will “rack” and some nails are pulled out.



As the load is continually applied, the stud frame racks more and more until it collapses.

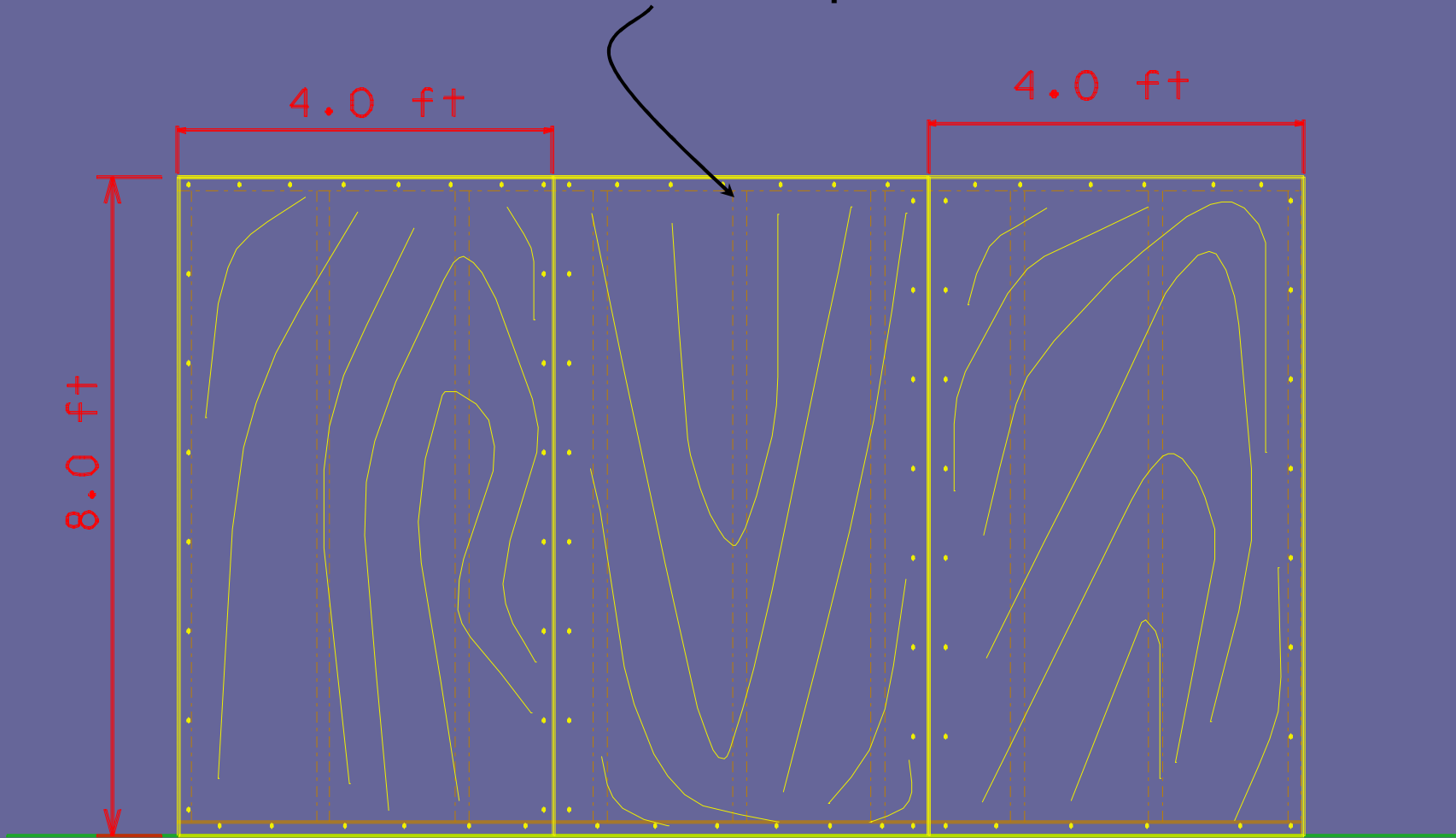


**Eventually, the stud wall collapses, as this California house.**

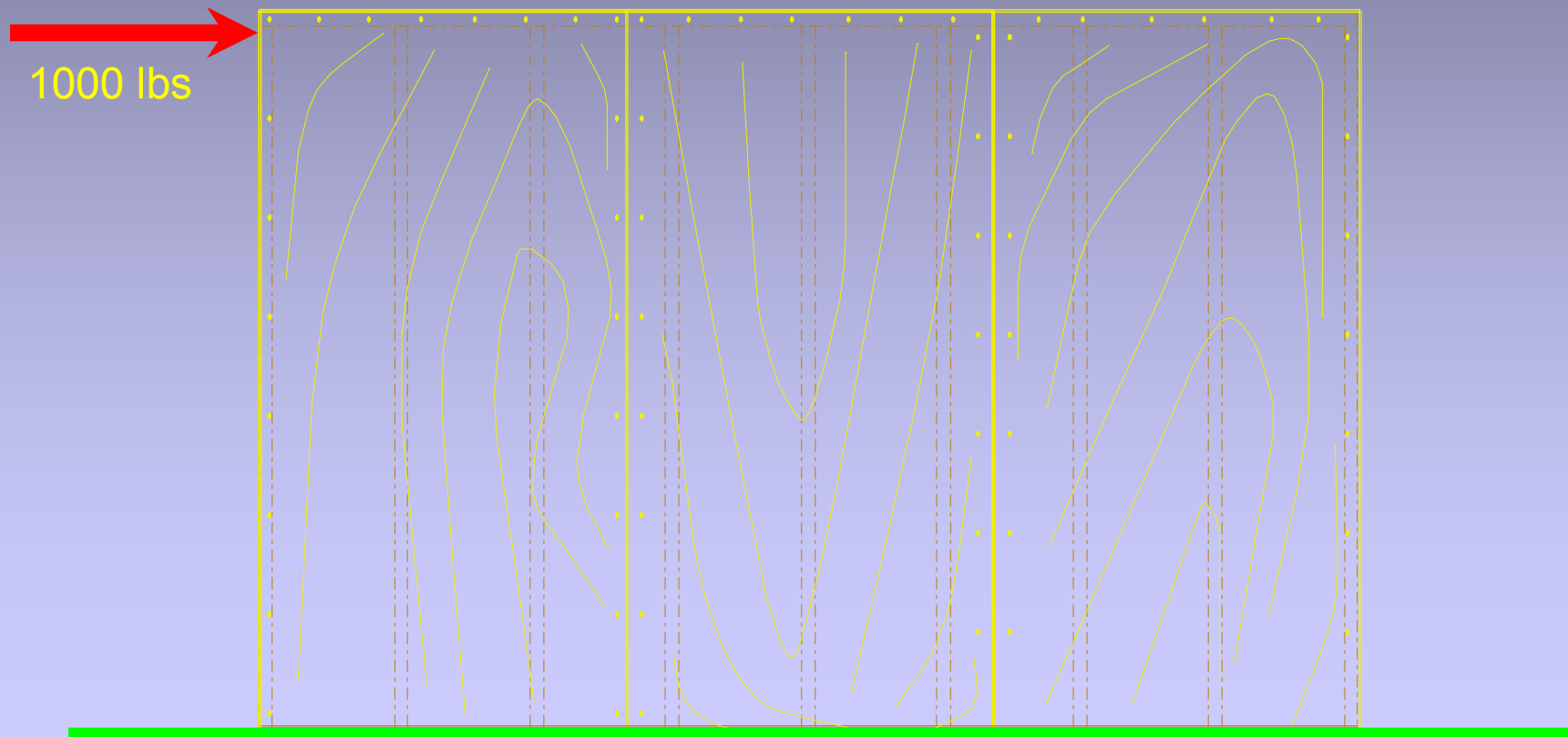


Now reinforce the structure with 4' x 8' plywood or drywall sheets.

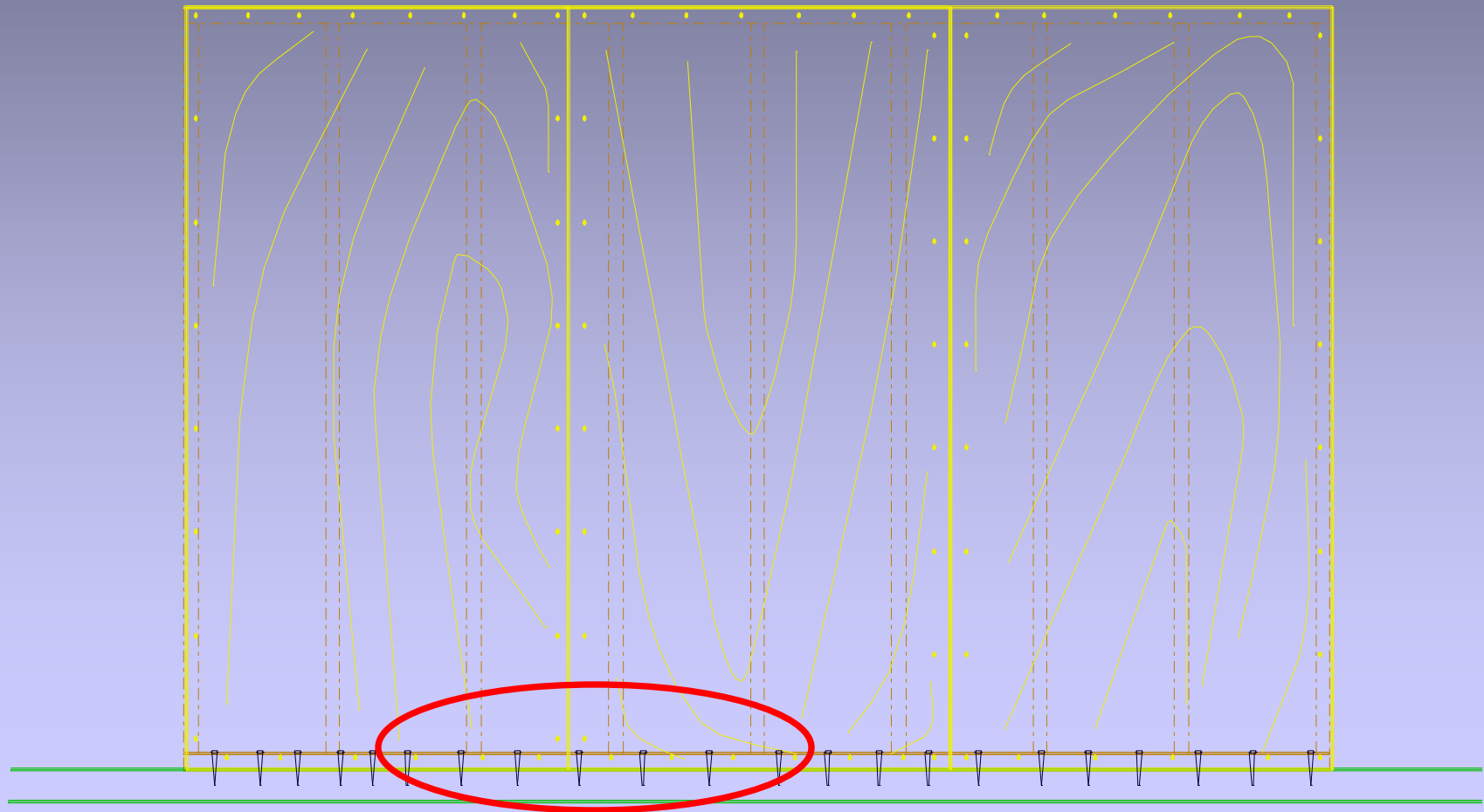
The dotted lines represent the stud walls.



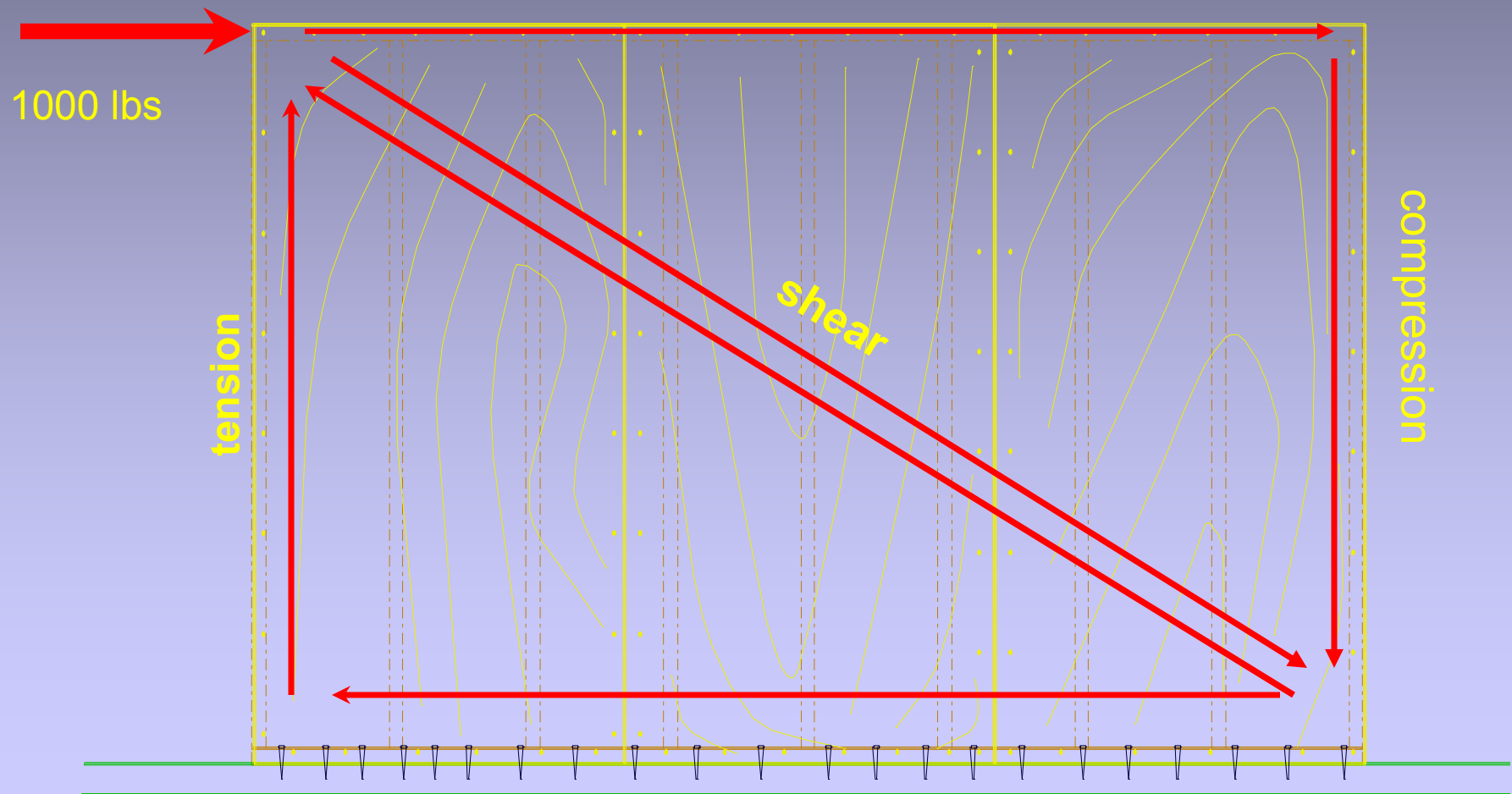
When the shear wall is now pushed, it does not deform but rather slides to the right.



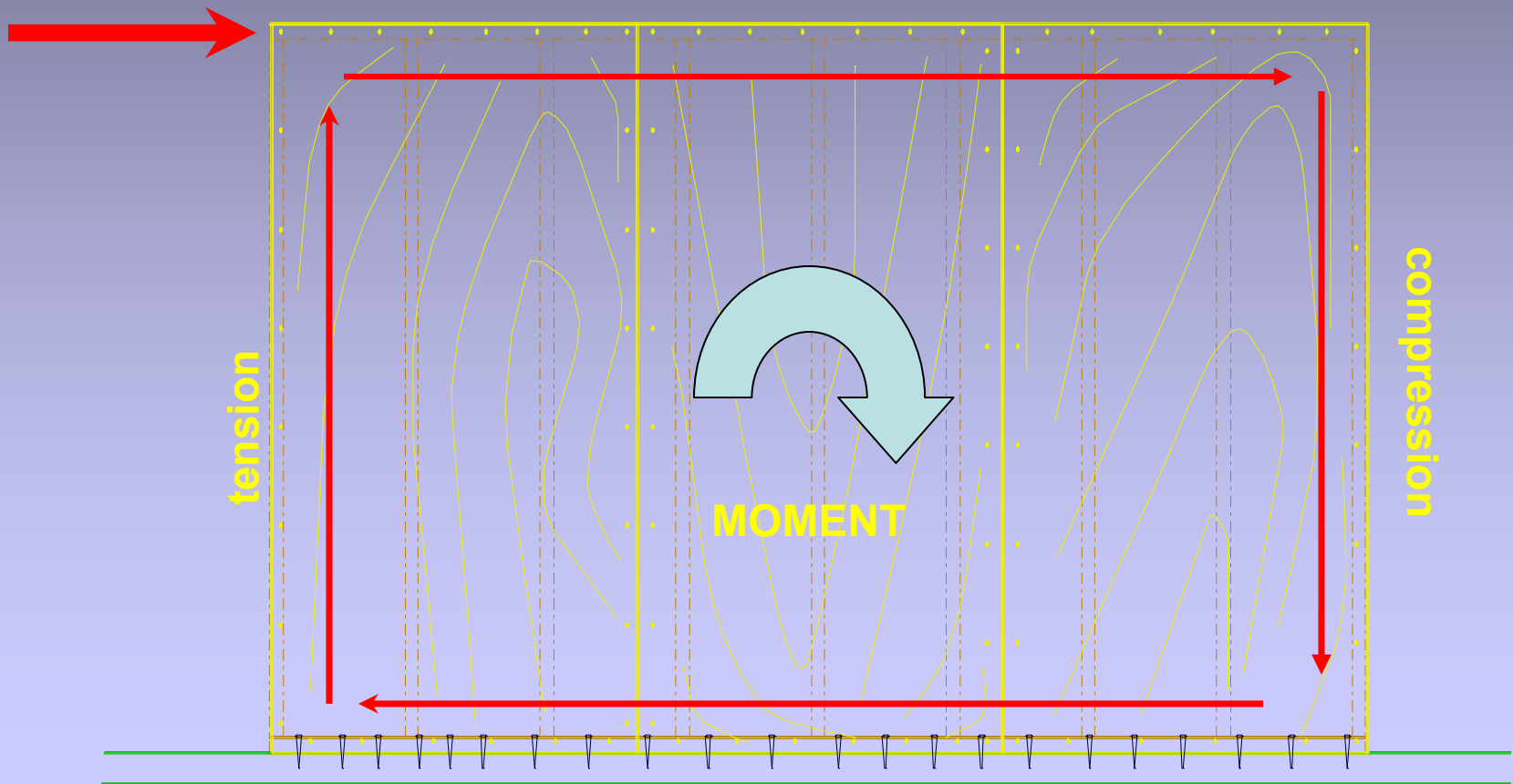
**Finally, the panel is anchored to the floor slab.**



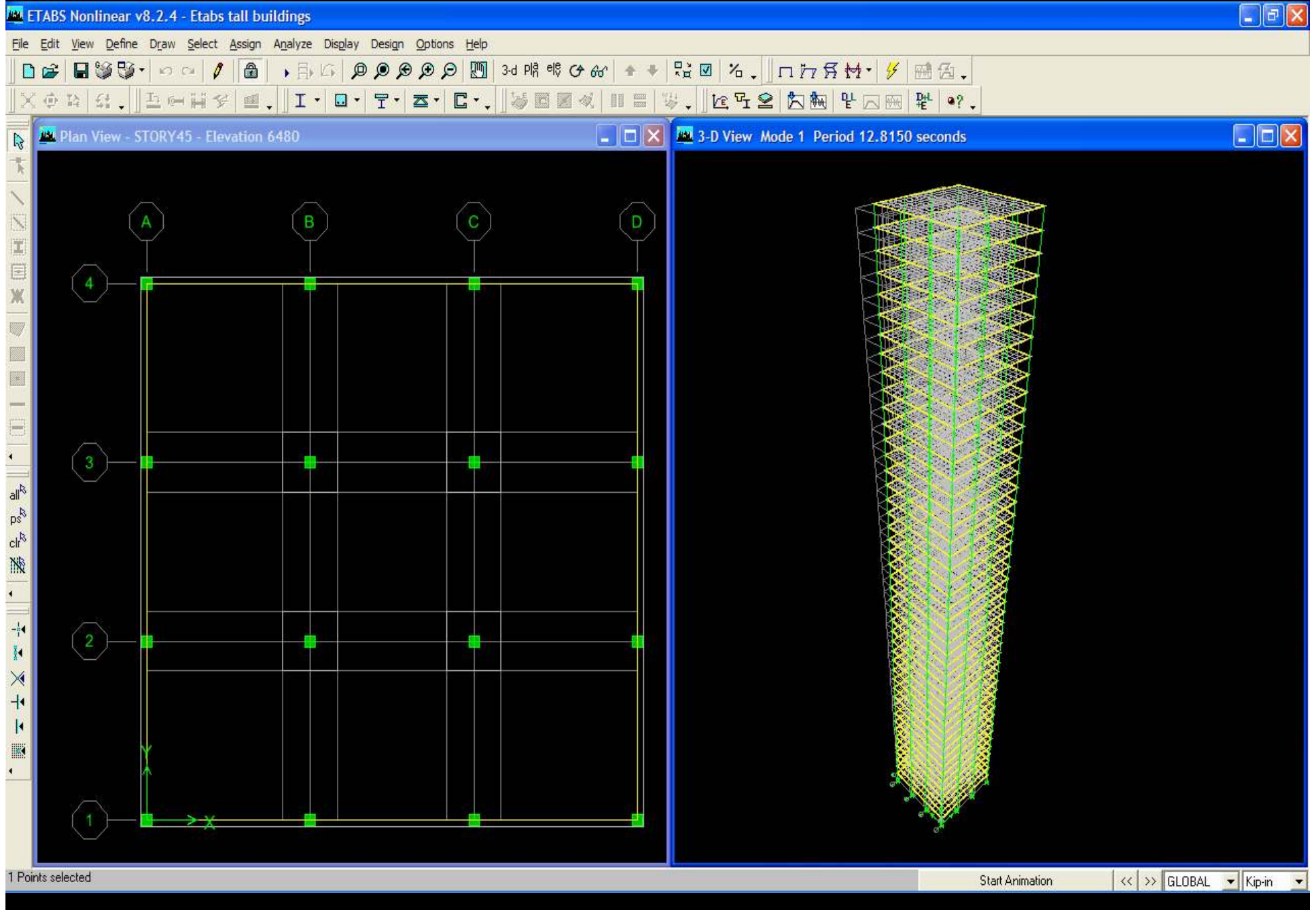
When the load is reapplied, shear appears in the middle of the panel, tension on the left, and compression on the right.

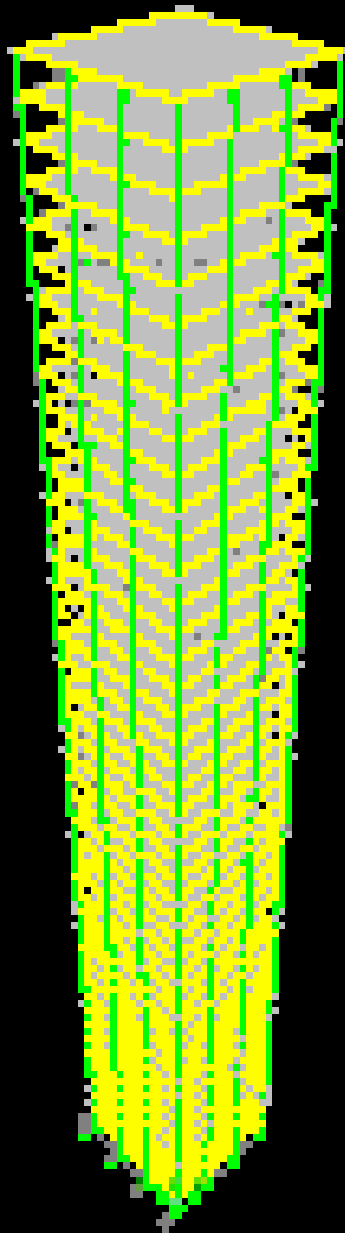


The shears at the center of the panel cancel out. However, the tension and compression forces create a couple which is equal to a moment.



**This is identical to a tall building that bends under wind and seismic loads.**





In a tall building, the columns on the windward side may go into tension, and the columns on the leeward side have an increase of compression. This is the same model we just saw for the stud wall.

Because the tall building is subject to this force couple, it deflects primarily in flexure (bending).

Therefore, a shear wall is perhaps a misnomer, since our model stud wall panel is primarily influenced by the tension on one side and the compression on the other side, also creating a moment. Hence, our “shear wall” is really a short and stubby *flexural wall*.

All shear walls behave like this, including the large and heavy reinforced concrete shear walls we use for our tall buildings in our cities.