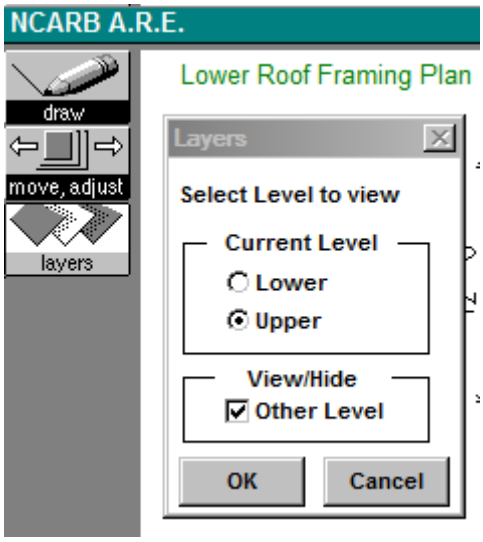
How to Approach the Structural Systems Vignette:

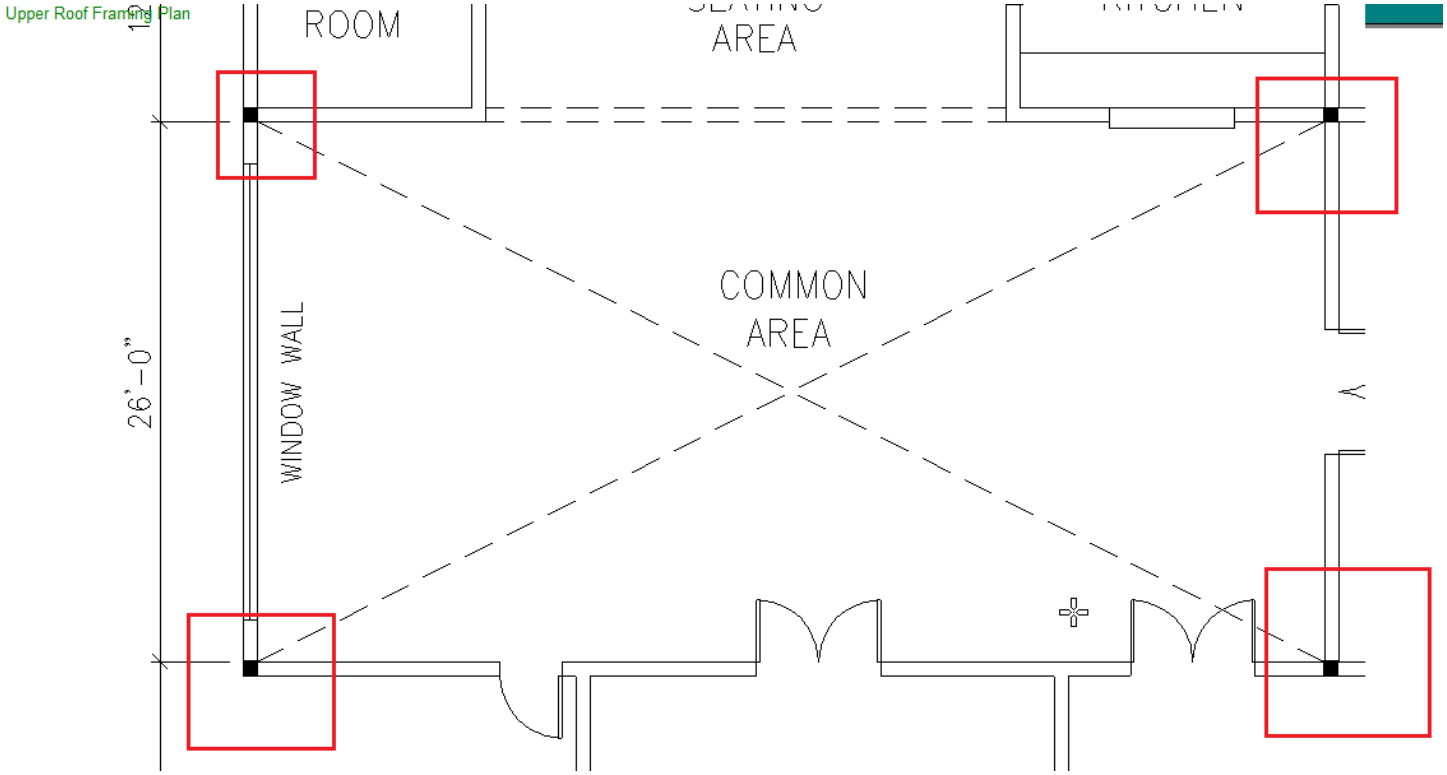
I've read much on areforum.org that the 'column and beam' approach is easier and less complicated than the 'bearing wall' approach. So, this guide outlines how to solve the structural vignette using the column and beam approach.

1. Start with the upper level

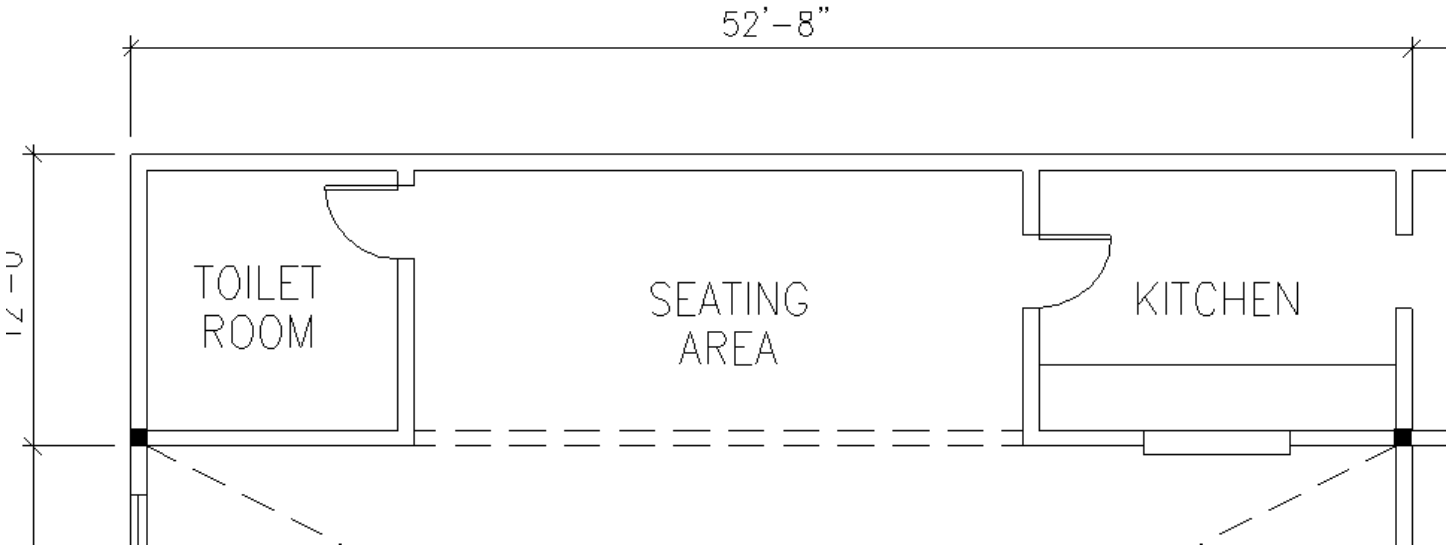


Starting with the upper level allows you to see where the columns are transferred down to. This helps to eliminate what could be a fatal error with the vignette.

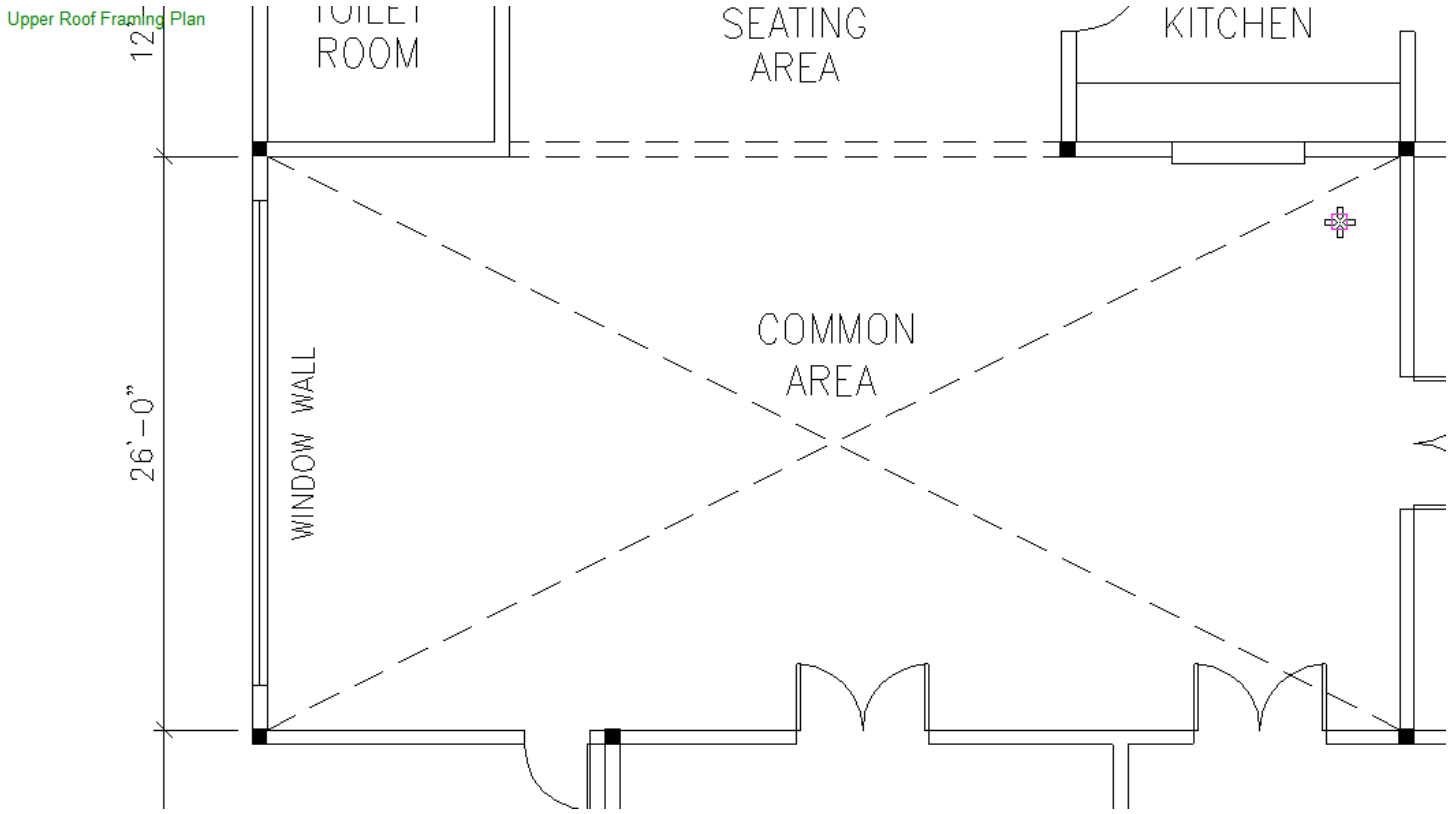
2. The program states that the common area is the only double story space in this layout
3. Lets start by drawing the columns in each of the corners in the upper level.



This gives us an ideas of the span between columns.



So, we have 52'-8" between our drawn columns. Thinking ahead to the beam requirement, we need to take into consideration the spacing between beams. ***The consensus on areforum.org is that the maximum span between beams should be 40'-0"…*** which means to be efficient, we need to add one more column in between these columns…not two, but one.

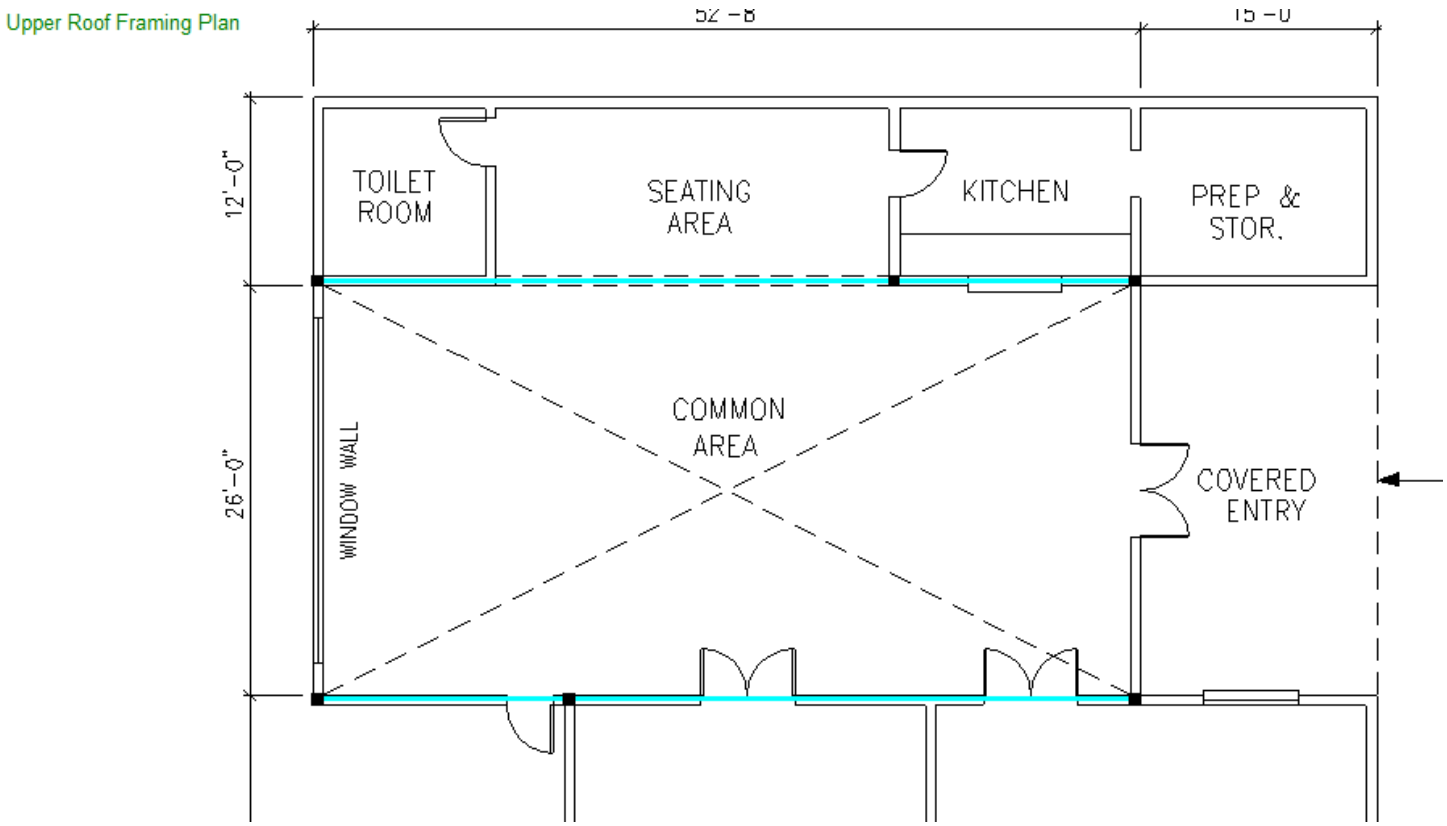


With the column added to the north wall and the south wall, we have the appropriate spacing of columns. When spacing the columns on the upper level, take a look at the lower level to see if there are any corners that can be used for framing.

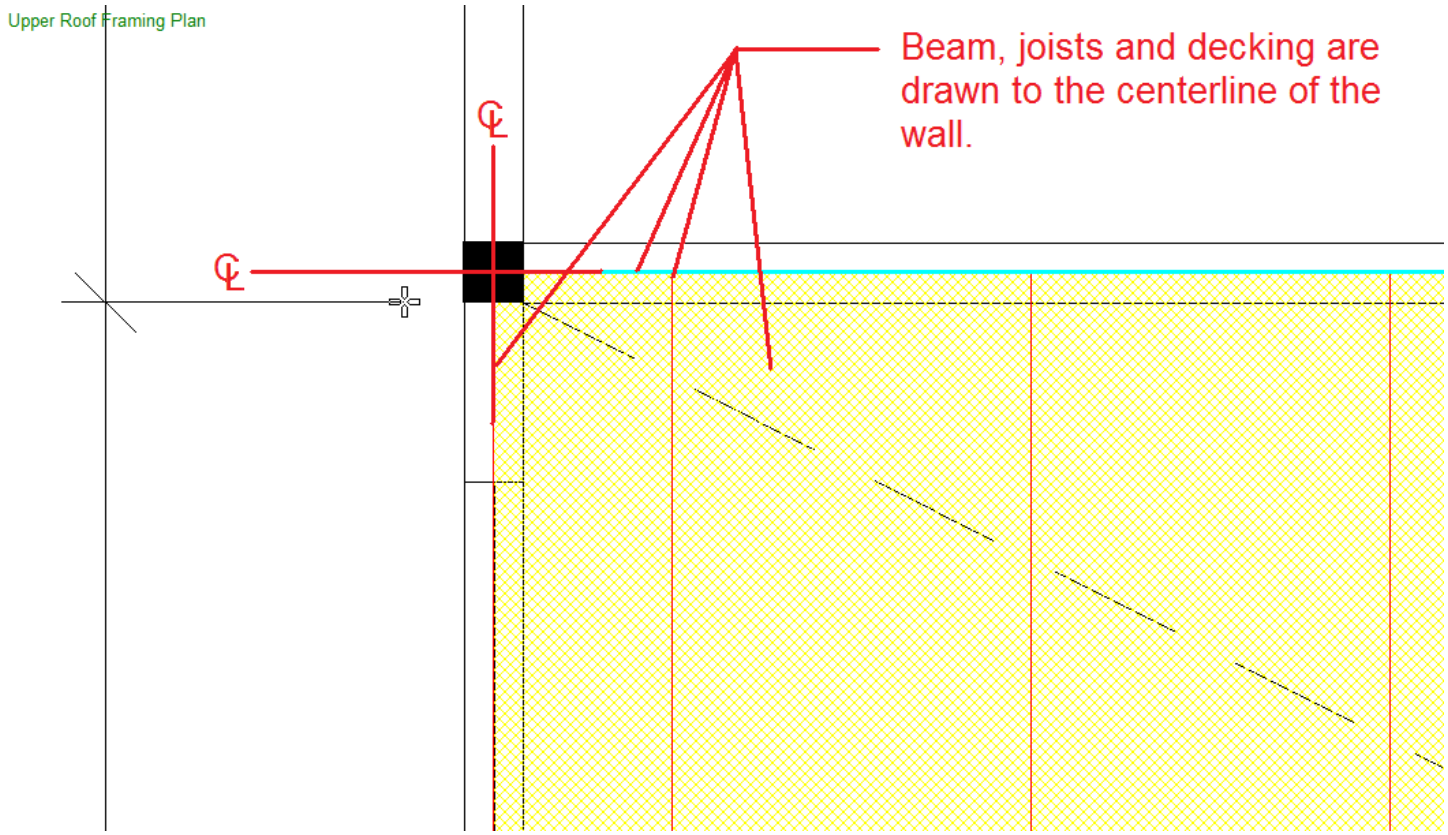
4. Next, lets add the beam.

A commonly asked question is: **Should I draw beams continuously, or stop and start the beam at intermediate columns?**
Either approach is OK. Drawing continuous beams is quicker.

When we draw the beams, draw it in the centerline of the wall that it is being placed into.



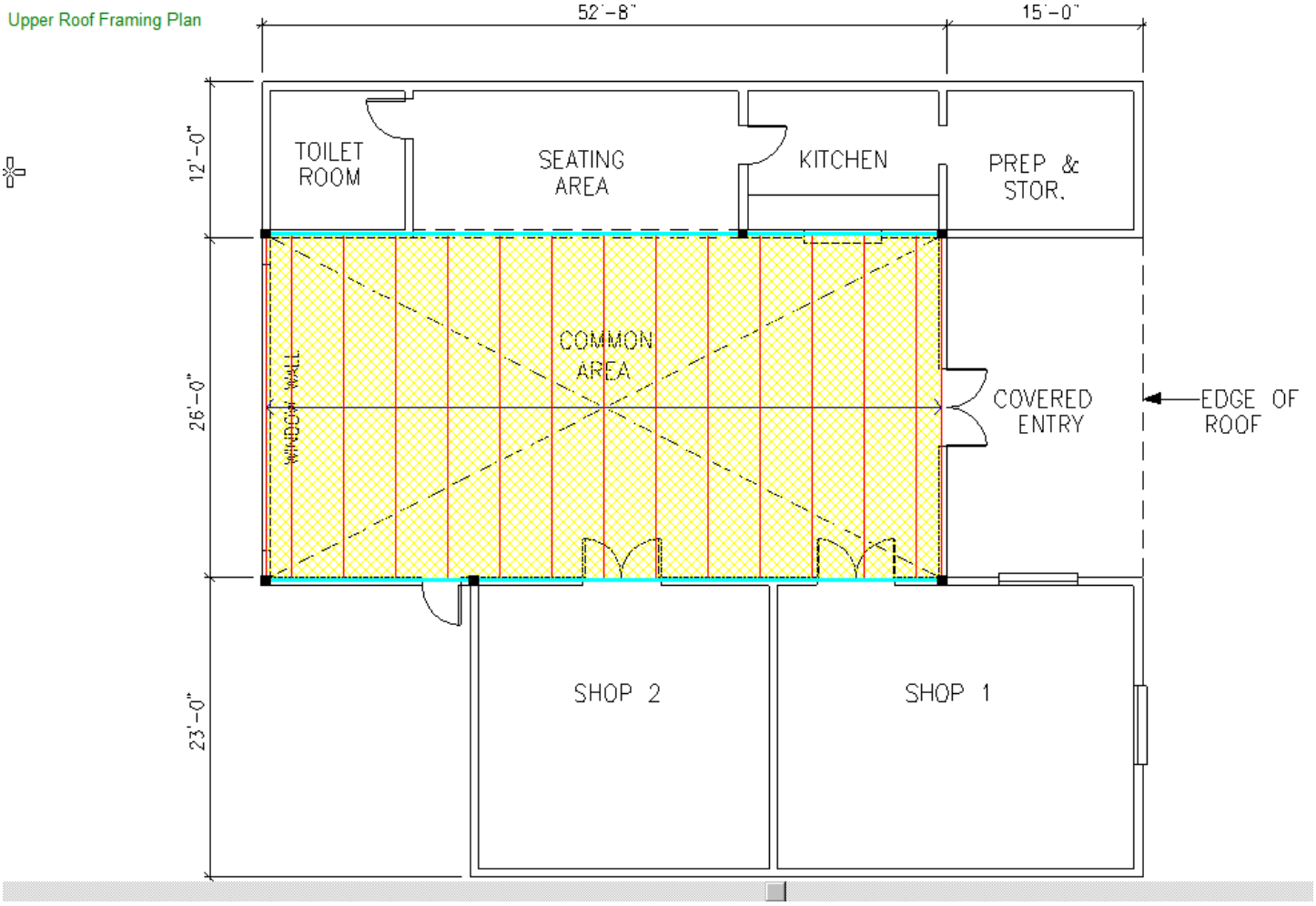
Now lets draw the joists and decking. Decking always run perpendicular to the joists. Both the joists and decking should be drawn to the centerline of the wall. This is important for all decking, joists and beams you draw in this vignette! The program states that you cannot cantilever beams, so sticking to this method avoids doing that.



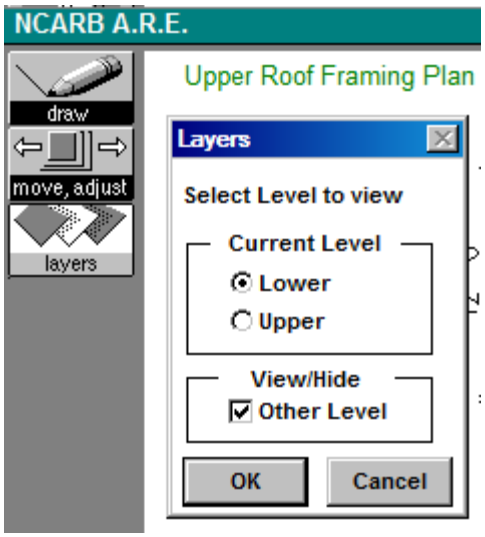
Keep in mind that we use 48” o.c. joists because the program says the deck can support a span up to 4’-0” you can use 32” o.c. but that wouldn’t be as efficient as 48” o.c. joists.

- **What is the maximum span of joists?**
  30'-0”

Ok now we have the upper level complete.



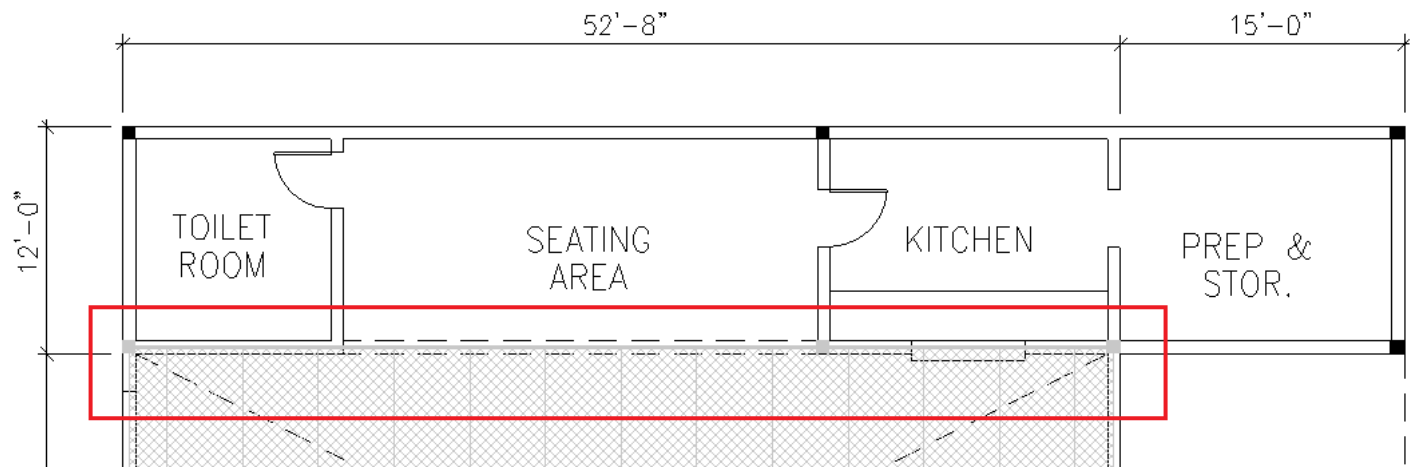
5. Now lets move to the lower level.



Using the principles discussed above, lets add joists, columns, beams and decking to the lower level.

Keeping in mind the spacing of the beams, add columns so they do not exceed 40'-0" in length, but without drawing too many columns.

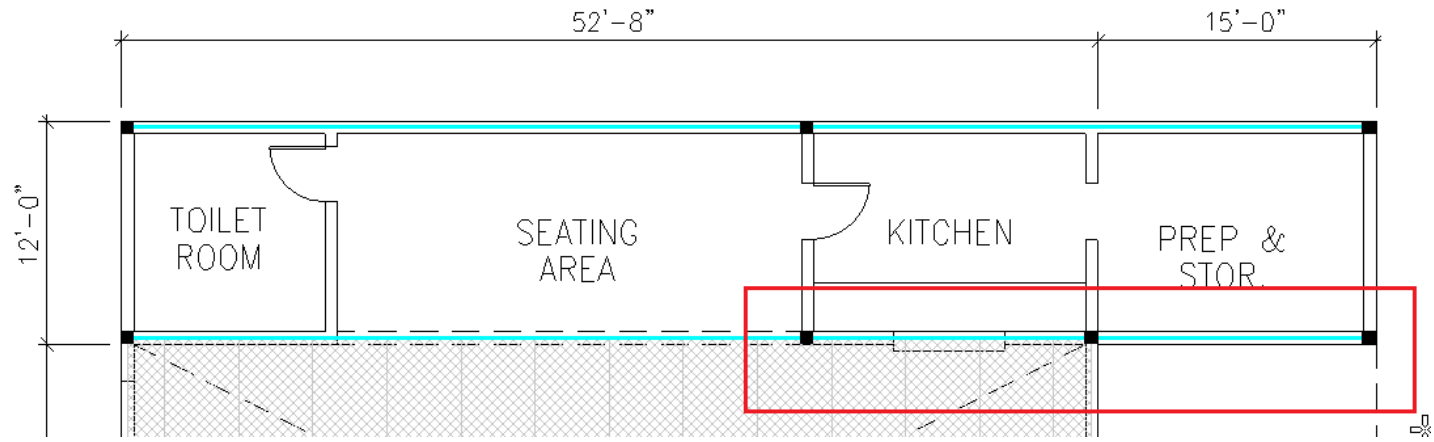
Lower Roof Framing Plan



By drawing the upper level first, we are able to see an overlay of the upper floor plan, which allows us to place the columns directly under (as seen in the red box)

So we add the remaining columns and then draw the beam for both sides:

Lower Roof Framing Plan

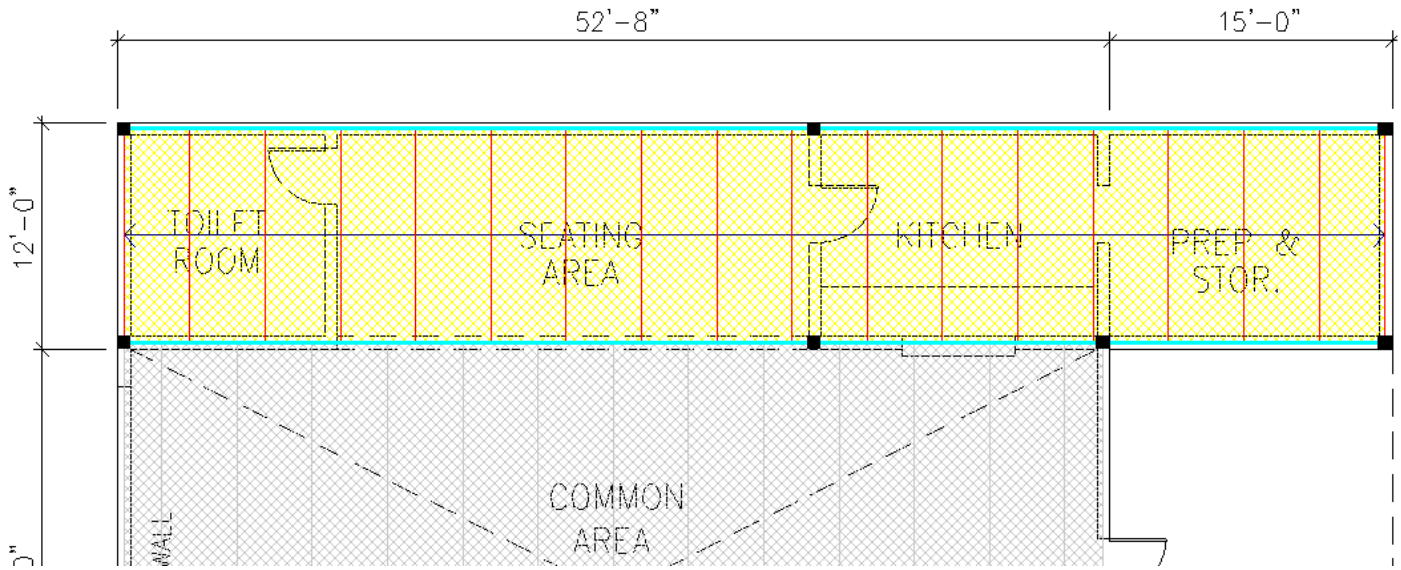


We have 3 beams within 15'-0" of each other! This is necessary because: The column on the left most within the red box is supporting a column from above (beams cannot transfer column loads) The middle column in the red box is supporting the column from above and the column to the right most in the red box needs to support the south east corner of the roof above the **toilet room, seating area, kitchen** and **prep & stor. rooms**.

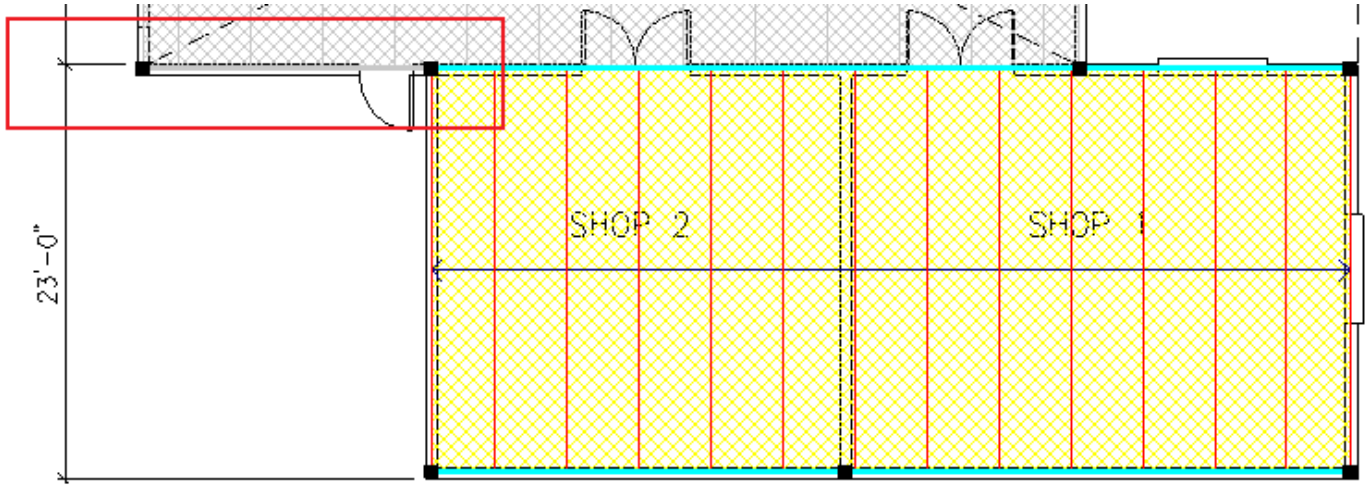
6. Now let's draw the decking and joists.

Looking at the **toilet room, seating area, kitchen area** and **prep & stor. rooms,** it is highly efficient to draw the joists and decking as one continuous element spanning the rooms together.

Lower Roof Framing Plan



Now lets draw the decking, joists, beams and columns for **shop 1** and **shop 2** using the using the techniques listed above.

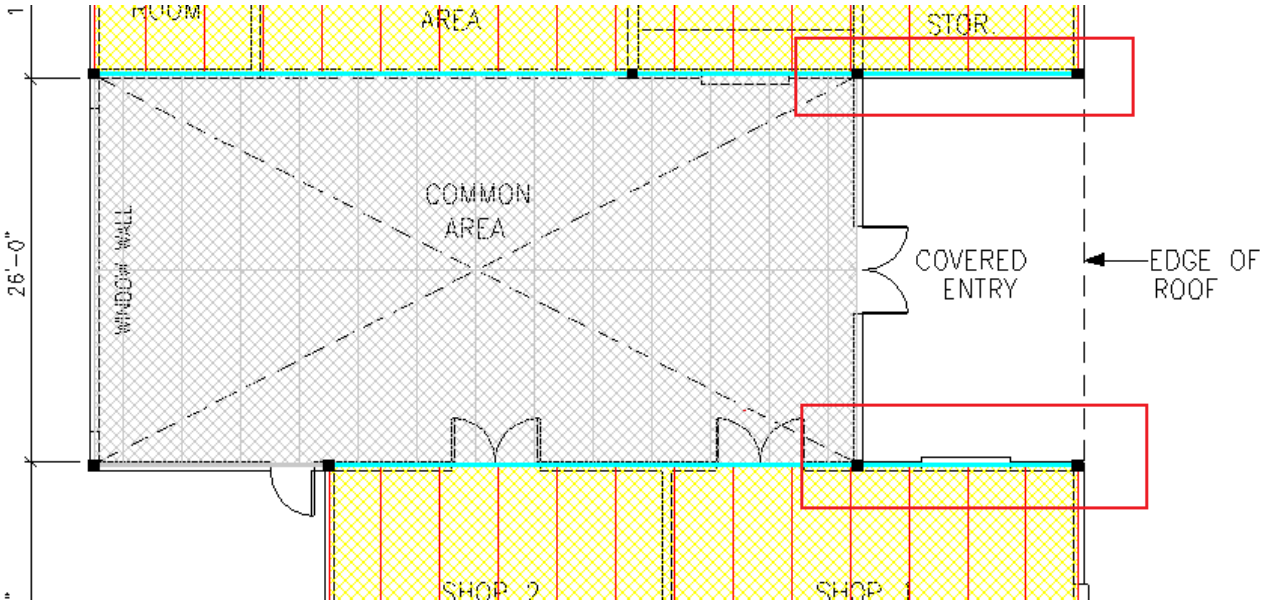


Lets look for a second at the area in the **red** box above. I have seen this mistake on the forum often. There is NO BEAM required in this area. It does not carry any joists above it.

A simple thing to remember for beams is: DOES THE BEAM CARRY ANYTHING? YES – THEN I NEED A BEAM. It's simple.. beams carry joists. Beams on this vignette DO NOT act as drag struts..just beams. Yes JUST BEAMS

Remember: decking is supported by joists, joists are supported by beams and beams are supported by columns. Simple, yes, but when you're in a panic in the exam, this can ease the thought process. **DO NOT CANTILEVER BEAMS**

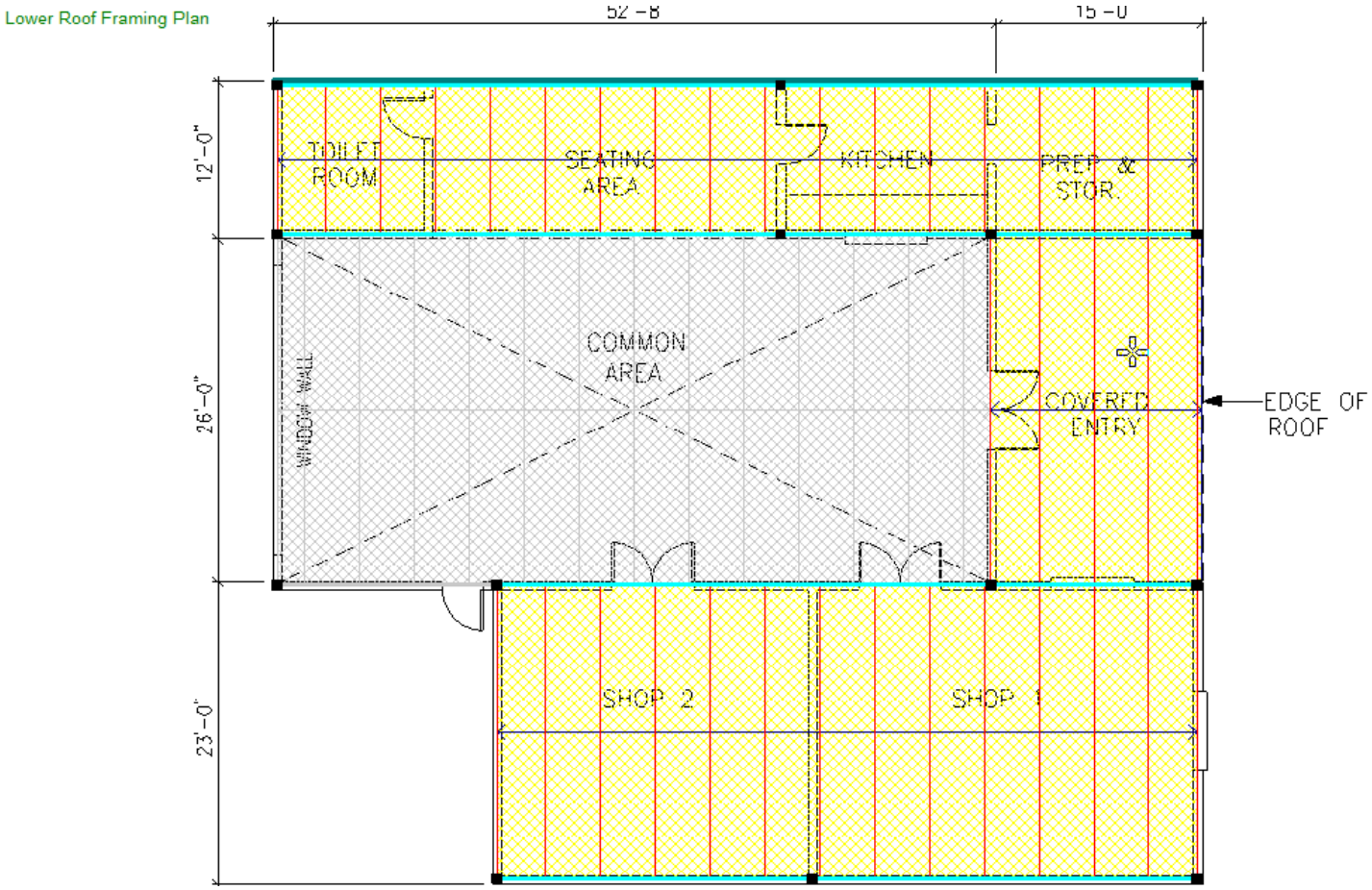
7. Now we have the **covered entry** left to draw.



Since we have two areas of beams in-between the covered entry, (In the **red** box above) the most efficient way to approach this solution is to span the joists between this entry. Keep in mind also that the span between these beams is 26'-0", which is less than the 30'-0" maximum desired span length. Yes the joists spanning east and west would carry more load, but this approach requires extra beams.

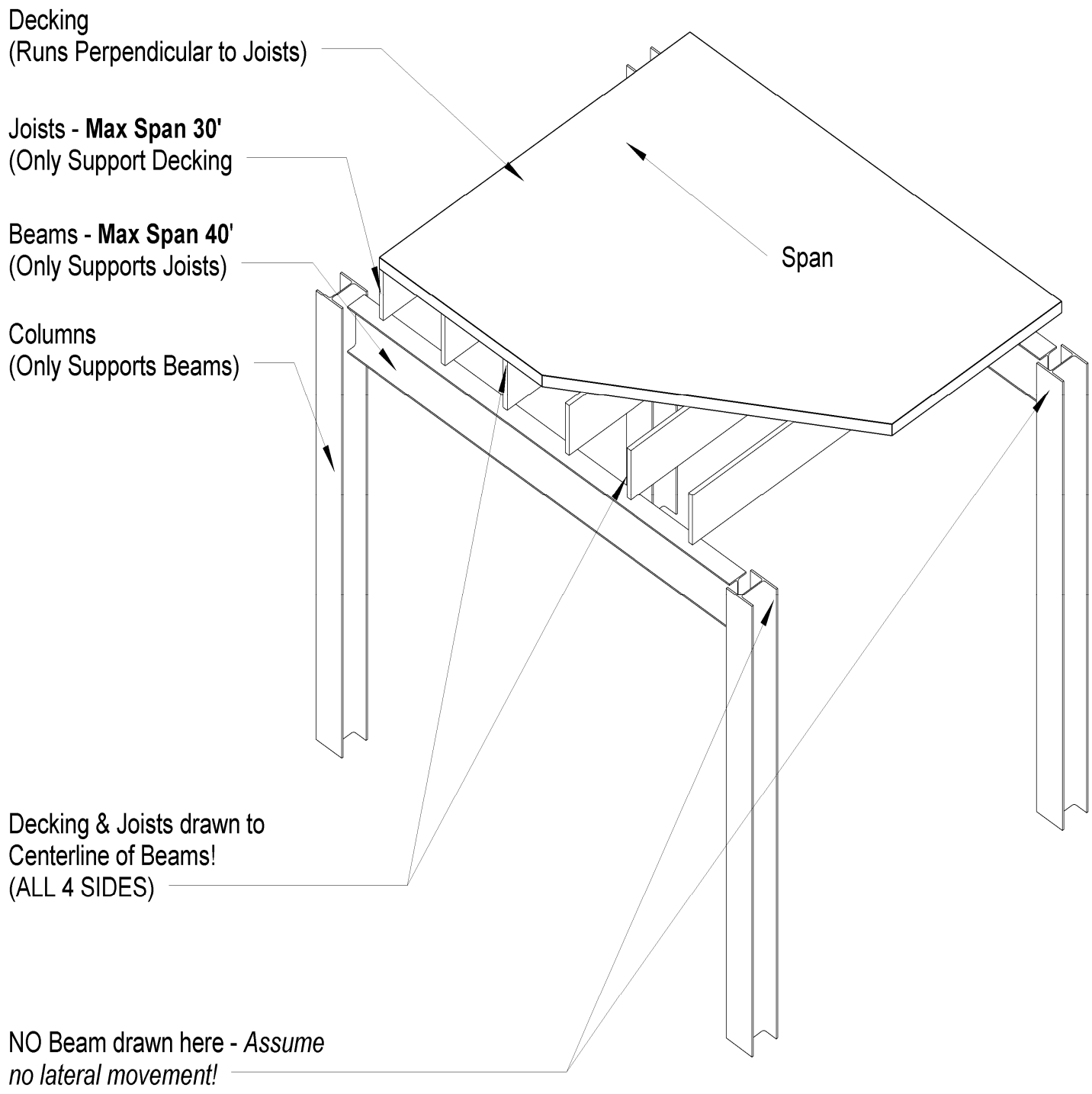
All we need to add are joists and the covered decking. No more beams or columns. Efficient.

Completed lower level:



DOUBLE CHECK YOUR WORK – You should have plenty of time to double and triple check your work! Trace the decking to see that its perpendicular to the joists, trace joists to a beam and trace the beams to both sides to make sure they go to a column on both sides!

VISUALIZE:



Questions / Concepts (from areforum.org)

- What is the maximum span of joists?
  30'

- What is the maximum span of beams?
  40'

- Where should I draw the columns, beams, bearing walls, joist boundaries, and decking boundaries?
  Draw all elements to the center lines of the base plan walls.

- Should I use bearing walls and/or columns?
  All-column and beam solutions are recommended, because there are less rules to remember.

- Should I include a beam underneath a clerestory window (if the lower roof joists run parallel to the clerestory)?
  Coach says, "yes." lug-nut says "no." Lengthy discussion here:
  http://www.areforum.org/forums/showthread.php?t=203291

- If a rectangular decking section can span over multiple joist areas, should I draw the decking as one or two elements?
  Either approach is OK.

- Should I draw beams continuously, or stop and start the beam at intermediate columns?
  Either approach is OK. Drawing continuous beams is quicker.

- Can joists and/or beams extend from an interior space to an exterior "covered entry" space?
  Coach says "yes"

- Can I cantilever joists and/or beams?
  No, per the vignette's program