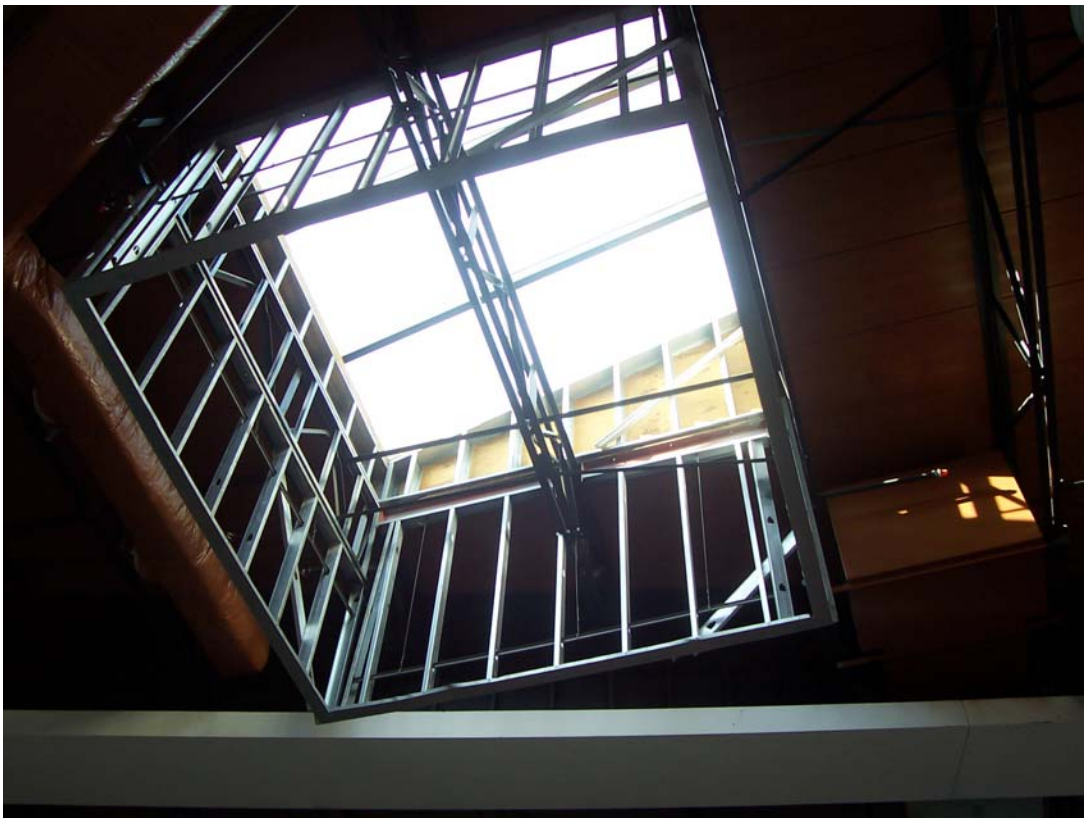
Background:

In the entrance of the building, there is a skylight. The roof of the building has an exposed truss system. The truss system goes right through the center of the skylight. The look is unattractive and makes little sense.



The intent for this analysis is to check the possibility of removing the joist from the center of the skylight. Cost, schedule and load impacts will be taken into effect. The roof truss system will then be redesigned.

The Structural Analysis:

Due to the spacing, each joist is figured to carry 155PLF LL and 125 PLF DL as shown below (figure 1). This means that when the joist is cut half of the length of the joist will be multiplied by the 1.6LL+1.2DL to yield a point load on the beam that will support it. This load will be evenly distributed to each joist that supports the beam. The beam also supports the skylights weight which is divided evenly between each beam (figure 2). A plan view of the steel can be found below in figure 3.

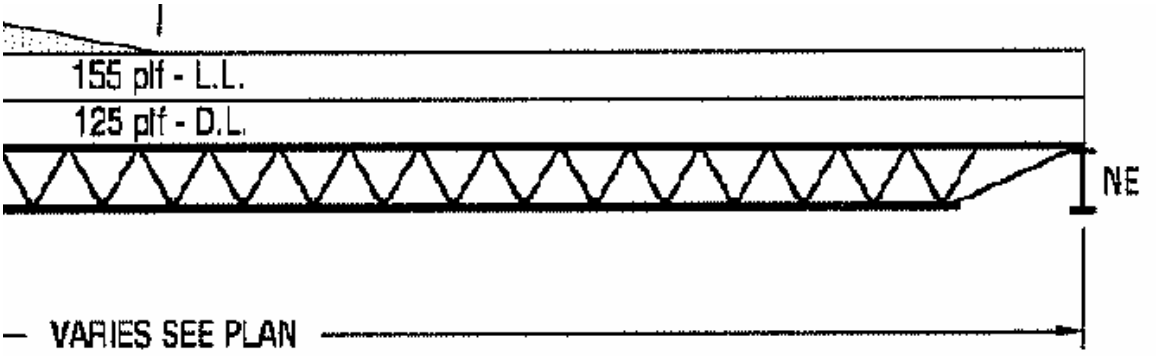


Figure 1: Roof Joist with distributed roof live and dead loads

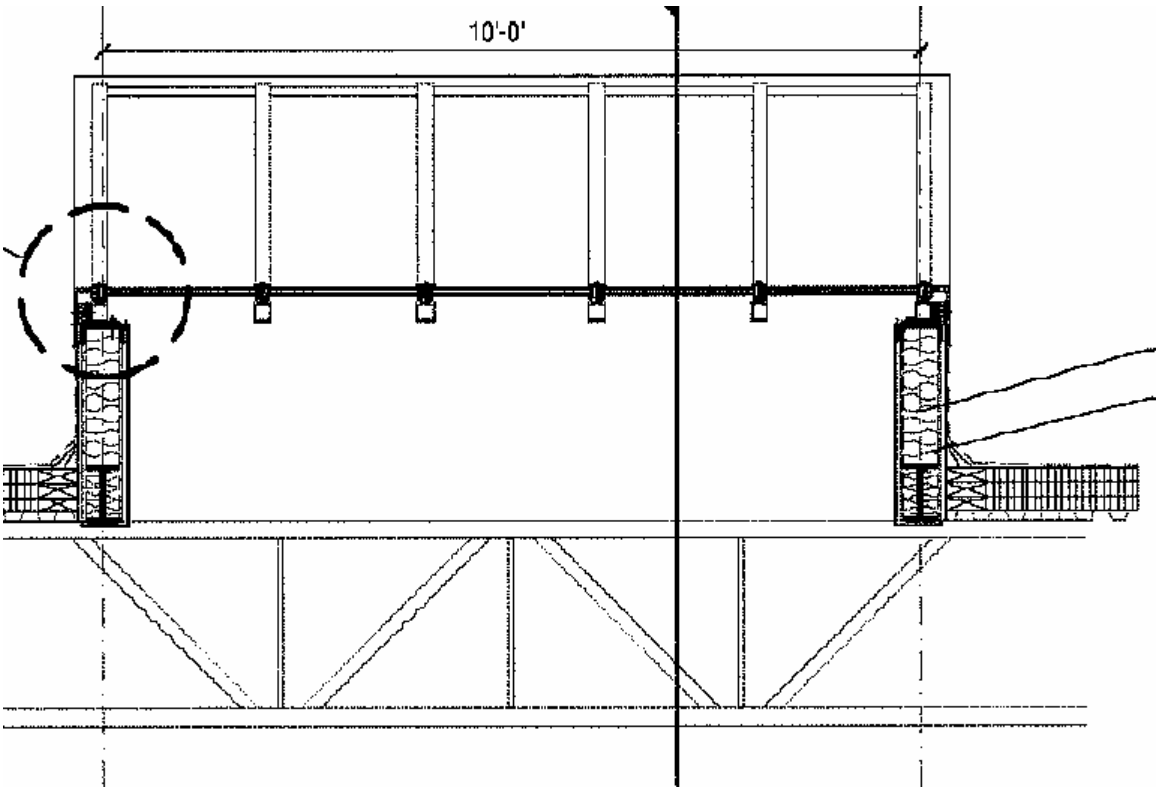


Figure 2: Section of the skylight showing how load is carried by beams

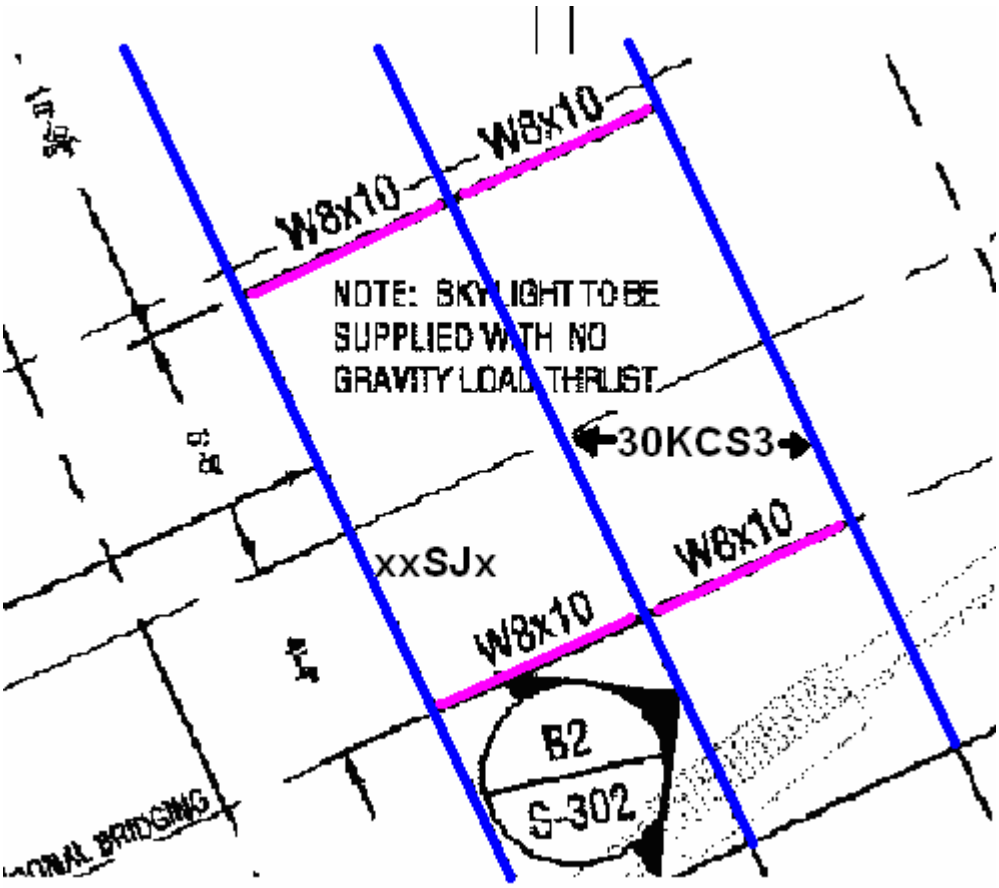


Figure 3: Plan view of steel for skylight area

The total point load that the joist yields on the beam is 398 plf times 15 and 8 feet yielding in a load of 5970 lbs on the out northwest side and 3184 on the southeastern side. This point load can be supported by the W8x10 that is specified. This will also allow the beam to carry the load of the skylight which is estimated with an even distribution to weigh 160 psf. This means that with the 3000 or 6000 lbs point load the beam will also carry an 800 plf distributed load. This loading is ok on the W10x15.

Next to check are the joists. Because of the loading that was figured out above it is determined that there will be a 7000 and 5600 lb point load on each joist. The joists are 30KCS3 which can carry 8000 lbs shear and a nominal joist which can carry approximately 6000 lbs. This means that the joists will be sufficient. A structural program was then used to check my calculations. The loads are shown in figure 4 and the resultant joist design is shown in figure 5

The last thing to look at is the how the joist will connect to the beam. It was suggested to hang the joists from the beam using welded steel plates. This surrounds the end of the joist and is to be suspended from the beam. A diagram of this can be found in figure 6

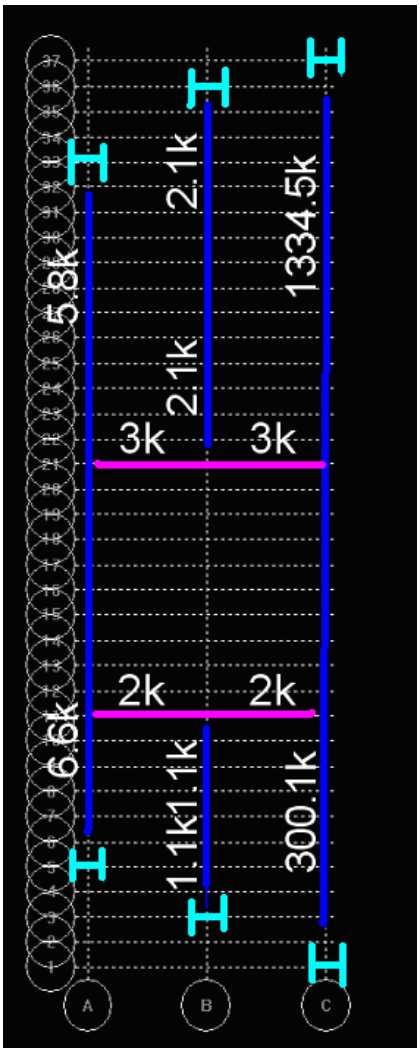


Figure 4: beam and joist loads

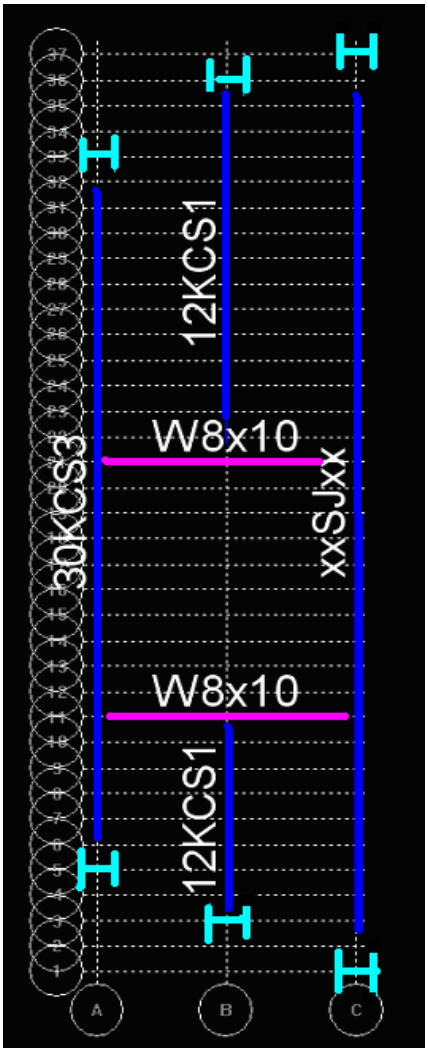


Figure 5: beam and joist design

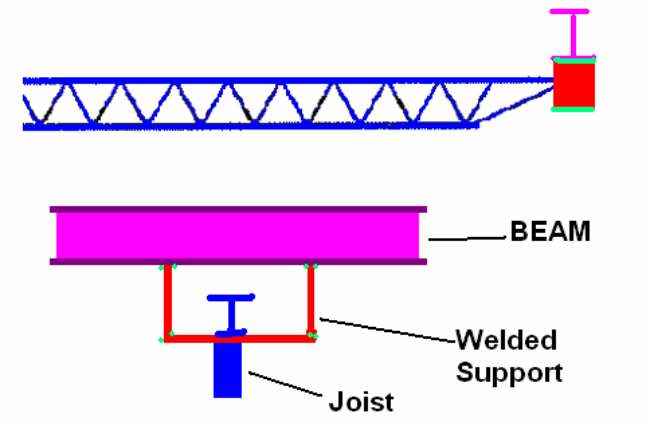


Figure 6: Welded plates that support joist from beam.

The Cost Effects:

Name	Unit	Original Amount	New Amount
30KCS3	13.13 per LF	69 LF ($905.97)	36 LF ($472.68)
12KCS1	9.57 per LF	0	23 LF ($220.11)
Welding	51.60 per LF	0	4 LF ($206.40)
1” Steel Plate	39 per SF	0	2 SF ($78.00)
Everything Else Same			
	Total	$905.97	$977.19

This yields a total difference of $71.22 more to remove the beam.

The Schedule Effects:

Name	Unit	Original Amount	New Amount
Welding	12 per Day	0	4 LF (+2hr 40 min)
Connect Joist	10 per hour	6	8 (+12 min)

Because everything else takes the same amount of time there is an increase in erecting time of 2 hours and 52 minutes due to the welding of the plates.

Results:

The Joist can be removed and replaced for an additional $72 and 3 hours of work. To do so, the center beam (30KCS3) may be replaced with two 12KCS1 while every thing else remains the same.

Conclusion:

It is my recommendation that the Joist be removed and replaced from the center of the skylight. The additional time is not enough that it will delay the project and the cost is negligible.