

STRUCTURAL

DESCRIPTION

In the lighting design portion of this thesis, skylights were added to the large instrumental rehearsal room to include daylight as an integral part of the lighting system. The existing roof over this space is composed of a PVC membrane on rigid insulation supported by 1-1/2" steel deck which rests on the steel beams. There are notable structural implications in penetrating this roof to create daylight apertures. First, structural framing must be placed between the beams to support the skylight glazing. This will distribute the load of the glazing to the beams which span the width of the rehearsal space. Also, the beams must be re-spaced to accommodate the location and size of the skylight wells. The new beam spacing is slightly wider than what exists, making a longer span for the steel deck. This new beam spacing will also result in asymmetrical loading of the girders at the end of the beam spans. The following analysis will determine if any changes to the roof structure need to be made due to the addition of skylights as set forth previously in this thesis.

ANALYSIS

Roof design loads;

- live snow load – 30 psf
- dead load – 35 psf
- skylight unit weight - 0.24 kip
- loading factors, dead – 1.2, live - 1.6

Framing selection;

- loading applied in a STAAD model
- max shear – 0.676 kip
- max moment – 1.26 kip-ft
- select C3x3.5

Beam testing;

- loading applied in a STAAD model
- existing member size W24x68
- max shear – 17.7 kip
- max moment – 214 kip-ft
- W24x68 member size sufficient

Girder testing, case A;

- loading applied in a STAAD model
- existing member size W21x44
- max shear – 10.9 kip
- max moment – 53.9 kip-ft
- W21x44 member size sufficient

Girder testing, case B;

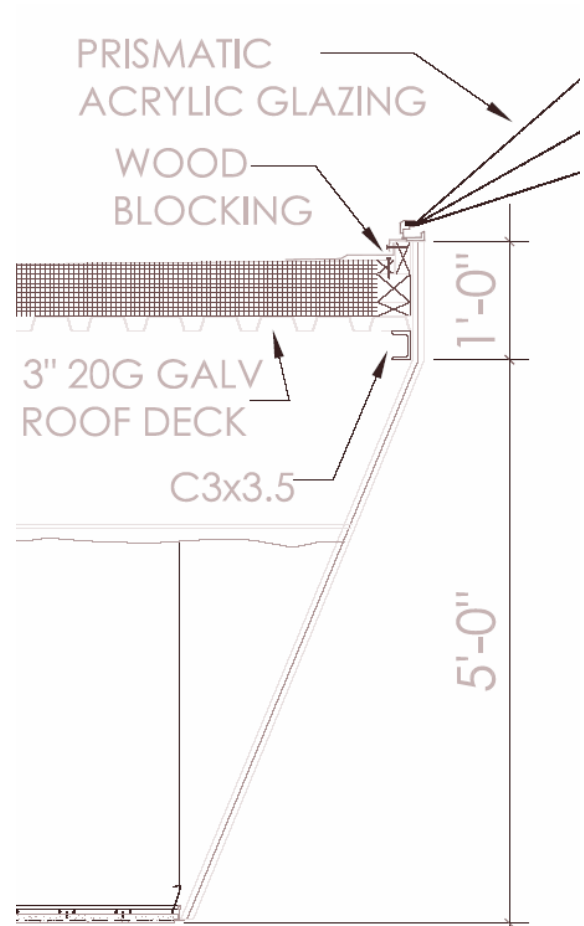
- loading applied in a STAAD model
- existing member size W21x44
- max shear – 24.3 kip
- max moment – 63.6 kip-ft
- W21x44 member size sufficient

Girder testing, case C;

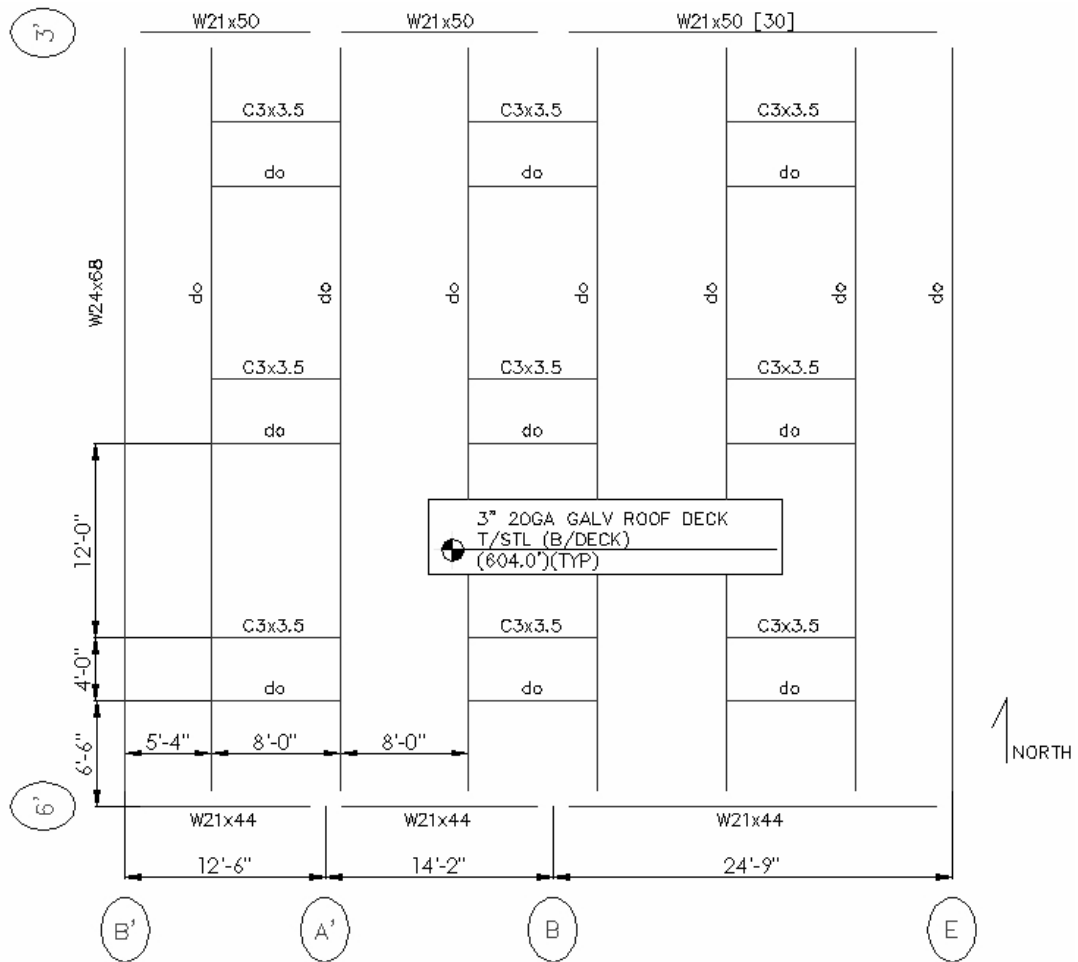
- loading applied in a STAAD model
- existing member size W21x44
- max shear – 32.4 kip
- max moment – 180 kip-ft
- W21x44 member size sufficient

Steel deck testing;

- roof decking must be changed from 1-1/2" 20 gauge deck to 3" 20 gauge deck to accommodate the 8' span caused by the new beam spacing
- determined using Wheeling Deck Product Selection Guide



STRUCTURAL PLAN



CONCLUSION

The addition of skylights and the associated framing (C3x3.5) does not require the existing structural design to be changed. However, the spacing of the north-south beams at 8' on center is too wide for the original steel deck to be used. The critical condition is in between the skylight penetrations, where there is a single 8' span. This condition requires 3", 20 gauge steel decking to safely support the roof live and dead loads. STAAD analysis for each loading case is included in the appendix.