

November 17, 2015

CWS Architects
434 Cumberland Avenue
Portland, Maine 04101
Attn: Guy Labrecque, Vice President

Unitil Roof Analysis for Original Mechanical Unit
Riverside Industrial Park
Portland, Maine

We have completed our structural analysis of roof joists supporting the larger existing mechanical unit. To facilitate our review, we took field measurements of the joists directly below the unit. Note that this larger unit was located on the upper roof near the recently installed smaller unit (photo 1), and we did not have structural drawing for this portion of the building.

The existing joists were made of rolled cold-formed chord members and round pipe web members. It appears that this portion of the building was constructed as a pre-engineered building utilizing the referenced joists as the roof members in lieu of z-purlins.

The results of our analysis found that the joist top chord and end web member were found to be at their allowable capacity when considering dead load and flat roof snow load. Since the length of unit exceeds 15' however, it is defined by code as a roof projection that will cause drifting snow to form against the unit. By adding the weight of the mechanical unit and the additional drifting snow load, the top chord becomes overstressed by 61%, the bottom chord becomes overstressed by 14%, and the end web member becomes overstressed by 36%. The International Existing Building Code allows for an overstress of 5%, and the calculated values exceed that threshold. Note that the calculations include factors of safety; however, the factors of safety are code minimums and thus we are not permitted to reduce them.

Per your request, we offer the following simplified numeric explanation of the loading. The code required snow loading for the roof is 42 pounds per square foot (psf), and the dead loading is approximately 15 psf. With the joist spanning 39 feet and at 5 foot on center, the joists each support approximately 195 square feet of roof. Projecting the dead and flat roof snow load onto that area, each joist will support 2,925 pounds of dead load and 8,064 pounds of flat roof snow in the design snow event. Drifting snow load adds an additional 1628 pounds to each joist. The addition of the unit added 5,500 pounds to the roof structure and a maximum of 1490 pounds to the affected joists. While the unit may not stress the joist beyond allowable limits when snow is not present, the code requires an analysis of all loading component in combination with snow loads. With snow in combination with the unit weight the joists are shown to be overstressed thus the requirement for reinforcing. A reinforcement sketch dated October 16, 2015 was issued to CWS and implemented by Ouellet Associates.

Unitil Roof Analysis for New Mechanical Unit
Riverside Industrial Park
Portland, Maine

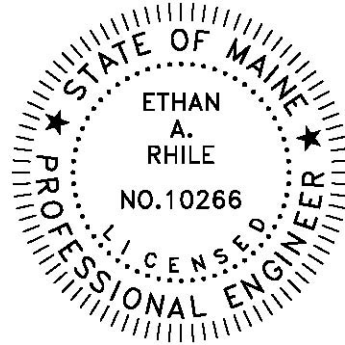
If you have any questions, please do not hesitate to contact me.

Sincerely,

BECKER STRUCTURAL ENGINEERS, Inc.



Ethan A. Rhile, P. E.
Associate



Unitil Roof Analysis for New Mechanical Unit
Riverside Industrial Park
Portland, Maine



Photo 1: Existing mechanical unit location relative to new mechanical unit.

