Section 4.0

Structural Breadth

4.0 Structural Breadth

4.1 Introduction

As part of my study which looked into making my building more "green" or environmentally friendly I analyzed the effects of adding 4'x8' skylights into a portion of my buildings roofing frame. To add the daylight forty (49) skylights are being proposed for this 141' x 283' space, this approximately adds 1568 S.F. of window skylights to the existing roof structure. The skylights are spaced approximately every 25' in the north/south direction and every 40' in the east and west direction. To make sure that the addition of skylights would have no harmful effects to the structure I performed a study on the roof framing plan and used the Vulcraft 2003 Steel Joists and Joist Girders to support the minimal effect that the skylights would have on the structure strength of the roof.

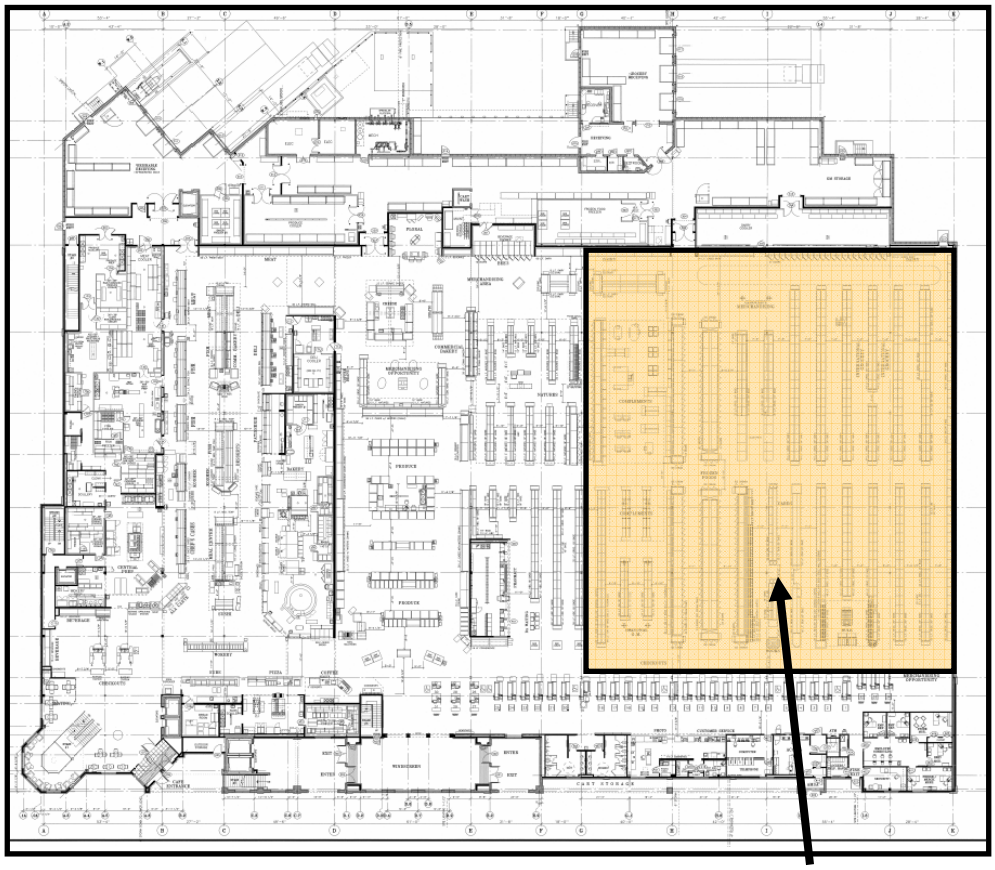

Figure 4-1 First Floor

Shaded Area represents location of skylights

4.2 Design Goals

The sky lighting system was created with regard to the daylighting needs of the grocery space but structural considerations were also taken into account. The skylights were laid out with consideration to the existing design and especially the joist span; orienting the longer side of (8') in the east west direction so not to disrupt the current framing of the roof.

4.3 Structural Considerations and Design

Placing the skylights within the spans between the joists which were typically designed 6'0" apart allowed the girder spacing to maintain the same distance as the currently designed roof. The smallest joist spacing was 5'7" which was more than adequate and still allowed the skylights to be dropped in the joist spacing with ease.

Removing concrete will reduce dead load but may create a stress concentration at that point. Any additional capacity not used by the joist will be sufficient to compensate for any added stresses incurred from the addition of glass windows. In addition the skylights are designed to be 6" above the flush roof which then will help protect the roof from any unnecessary dead loads that build up from flying debris, snow, or sometime are designed skylights being raised. The typical skylight detail was taken from the existing drawings and is used for HVAC equipment extrusions but what this detail helps illustrate is how the new proposed skylights will sit in between the joist spaces and how it will work.

4.3.1 Typical Detail for Skylight

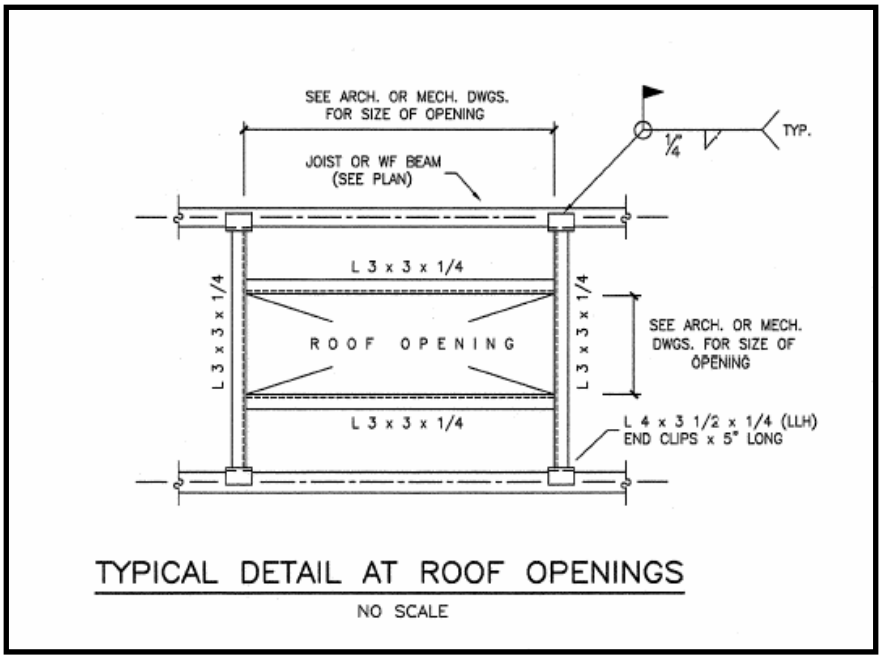

Figure: 4.2 New Skylight Detail

4.3.2 Roof Framing Plan and Skylight Plan

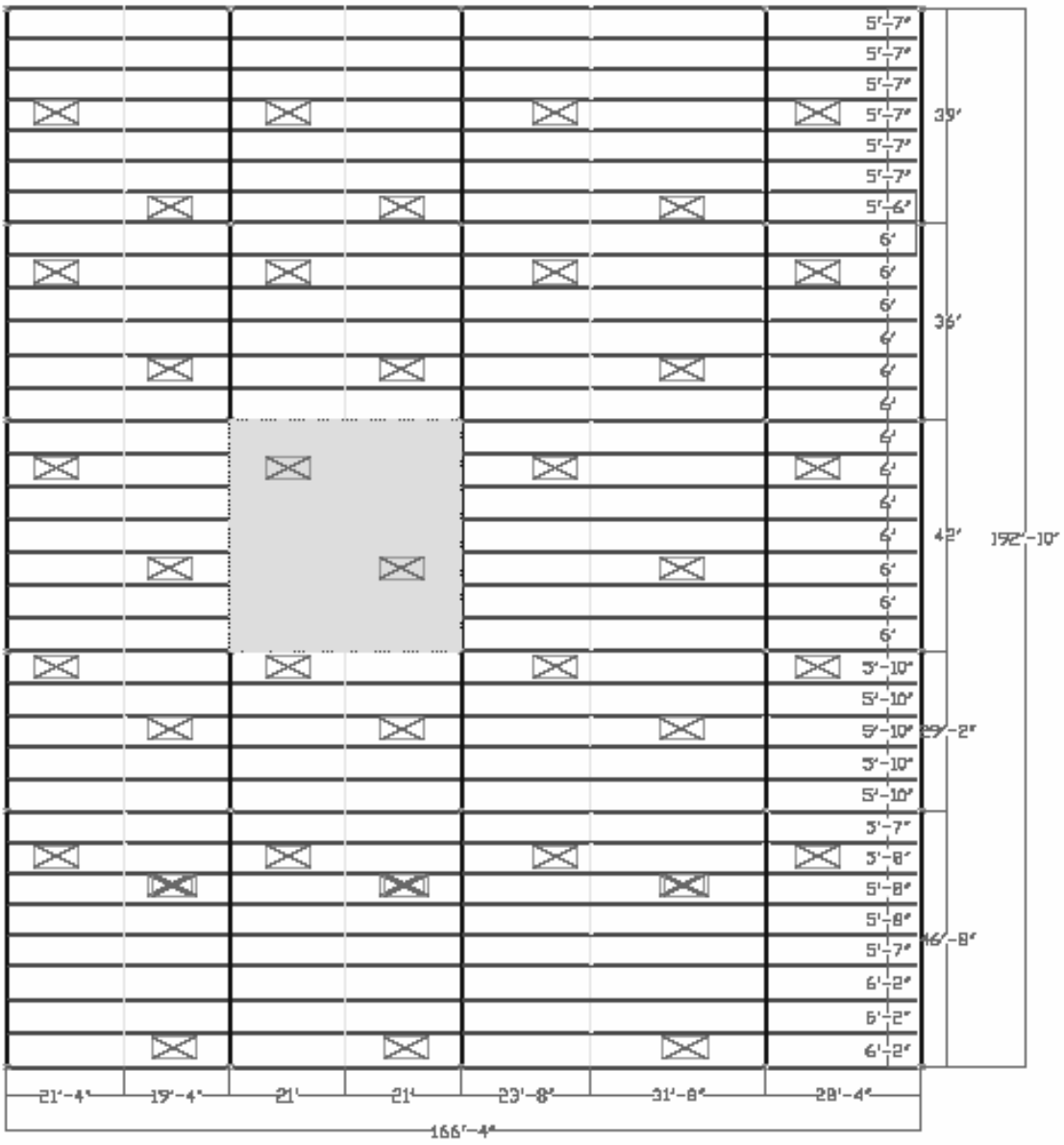

Figure: 4-3
Roofing Plan and Skylight Plan

4.4 Joist Girder Span Test

To prove that the skylight would have no negative effect on the structural strength of the roof, a typical girder span was tested using the Vulcraft steel joists and Girders design guide. The joist girder current size is 40G7N19.0K.

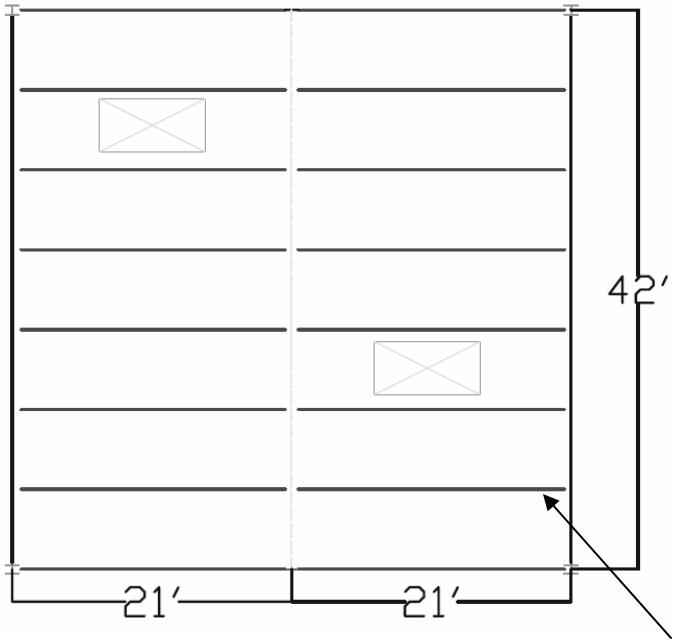

Figure: 4-4 Typical Girder Span

Dead: 7 psf
Live: 30 psf
Snow:30 psf

1) Number of Actual Joist Spaces; N = 7
2) Joist Selection
    a. Span = 42'-0"
    b. T.L. = 6.00 x 67 = 402 plf
    c. From k-Series load tables select a

3) Joist Girder Selection
    a. P= 402 x 42 = 16,884 lbs = 16.8 Kips (use 17 K for depth selection).
    b. 40 inch span is selected from 42' girder span and 6 spaces @ 7'
    (Used rule of about one inch of depth for each foot of span is good design technique.
    c. Joist Girder is designated : 40G7N19.0K

4.5 Conclusion

After studying the structural roofing system on Wegmans Fairfax it was determined that there would be no complications in adding 49 skylights to the roofing plan as long as the skylights remained within the joist spaces. Cross bracing would be implemented into the roof framing plan to provide extra support around the skylights.