Meeting Building Code Requirements

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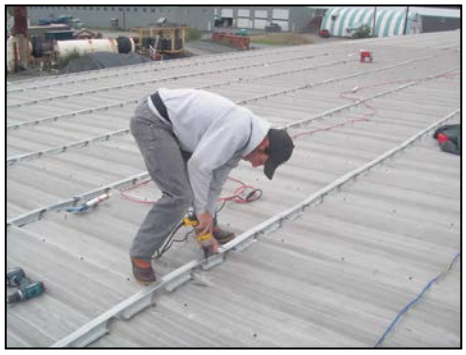


When retrofitting an existing metal building with a new "Metal-over-Metal" roof overlay, it is extremely important to address building code requirements that have changed since the building was originally constructed. Several factors should be considered during the planning process to ensure the existing building's roof and its new roof will perform for many years and will not be subject to catastrophic failures. These factors include:

- Compensating for the added weight of the new Roof Hugger sub-framing system and the new metal roof being installed over the existing roof
- Being in compliance with newly adopted code changes having to do with gravity loads (snow, etc.) and wind speed increases.

ROOF HUGGER, INC. leads the retrofit metal re-roof industry by their continued development of products and low profile sub-framing systems that satisfy these factors. To validate their systems, Roof Hugger has performed years of laboratory testing to validate the system(s) to be installed on the existing building roof and to confirm their capability of strengthening existing building purlins. In theory, the Roof Hugger sub-purlins increase the effective depth of the existing building zee or cee-shaped purlins by the depth of the Roof Hugger sub-purlin. In layman terms, if you have an existing purlin that is 8" deep and you add a 2" deep Roof Hugger sub-purlin, the result is similar to a depth of 10".

The importance of this testing is that by using Roof Hugger Sub-Purlins, the increased loads on the existing purlins caused by the added weight of the sub-framing and new metal roof is offset. In fact additional capacity is typically realized. A "Metal-over-Metal" retrofit of an existing metal building usually adds approximately 1.5 to 2.5 pounds per square foot (PSF), depending on material gauges and sub-purlin spacing. This has always been a concern in the engineering community because building engineers know that when adding weight in this type of retrofit application, the building's original design loads will be reduced. In other words, if you have a building that was initially designed for a 20 PSF live load plus a 2 PSF dead load, the 22 PSF combined total of these loads would be reduced to 19.5 PSF assuming a 2.5 PSF retrofit assembly. This could essentially cause the building's design to fall below minimum building code requirements. For this example; retrofitting the metal building with the Roof Hugger sub-framing system can results in an increase up to 31.24 PSF from the original 22 PSF purlin capacity as illustrated in Table No. 1 *(42% increase for a 16-gauge purlin)*.

TABLE 1 – PURLIN STRENGTH INCREASE WITH STANDARD PROFILE ROOF HUGGERS
(1/4" Bridge Above Major Rib Cutouts)

Existing Purlin Size 25' Bay Spacing	Maximum Purlin Span	Wind Uplift Increase	Gravity Load Increase
8 X 2.5 Zee x 16 GA	25'-0"	85%	42%
8 X 2.5 Zee x 14 GA	25'-0"	50%	37%
8 X 2.5 Zee x 12 GA	25'-0"	0.20%	25%

ROOF HUGGER began of testing several years ago, with the most recent tests being performed in the summer of 2010. The recent battery of testing was to identify the amount of purlin strength increase that is obtained using standard profile Roof Huggers. With a standard profile Roof Hugger there is approximately ¼" of web material in the Hugger web cut-out, which is above the existing roof panel's major ribs as shown in Figure A. The earlier conducted tests utilized specially fabricated Roof Huggers that had a minimum of 1" of web material above the Hugger's cut-out for the existing major panel rib as shown in Figures B and C. The amount of Wind Uplift and Gravity Load increases for these special Roof Huggers are provided in Table No. 2.

TABLE 2 – PURLIN STRENGTH INCREASE WITH SPECIAL FABRICATED ROOF HUGGERS
(1" Bridge Above Major Rib Cutouts)

Existing Purlin Size 25' Bay Spacing	Maximum Purlin Span	Wind Uplift Increase	Gravity Load Increase
8 X 2.5 Zee x 16 GA	25'-0"	94%	79%
8 X 2.5 Zee x 14 GA	25'-0"	65%	66%
8 X 2.5 Zee x 12 GA	25'-0"	22%	37%

All testing is in accordance with the American Iron & Steel Institute's (AISI) Cold-formed Steel Specifications for Base Load Testing. The specifications included a series of tests that utilized 8-inch deep purlins spaced at 5'-0" on center, spanning 25'-0" as in a 25'-0" metal building bay (frame to frame). Purlin gauges tested were 16, 14 and 12. All purlins were standard Light-Gauge Steel Institute (LGSI) shapes.

In order for the purlin strengthening to be accomplished, it is necessary to lap each Roof Hugger to one another at each end using 4 to 6 fasteners. The standard Roof Huggers are lapped as shown in Figure A.

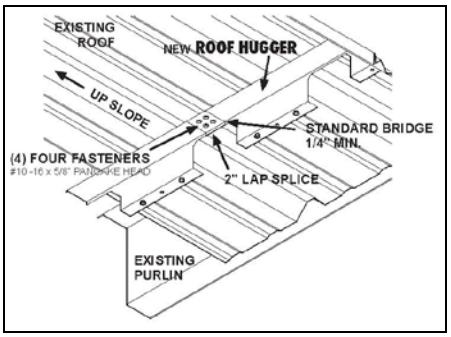


Figure A – Lap for Standard Roof Hugger – (All Purlin Gauges)

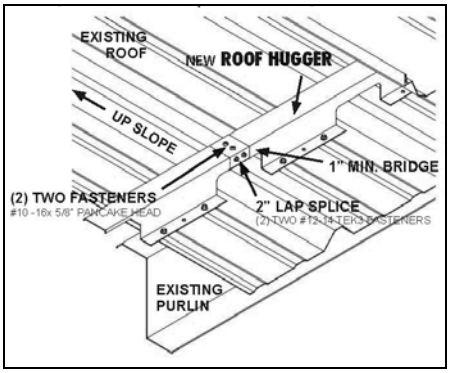


Figure B – Lap for Special Roof Hugger – (16 & 14 GA Purlins)

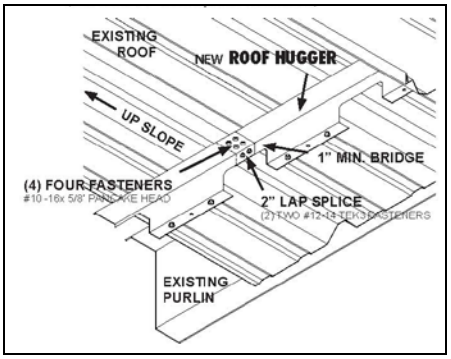
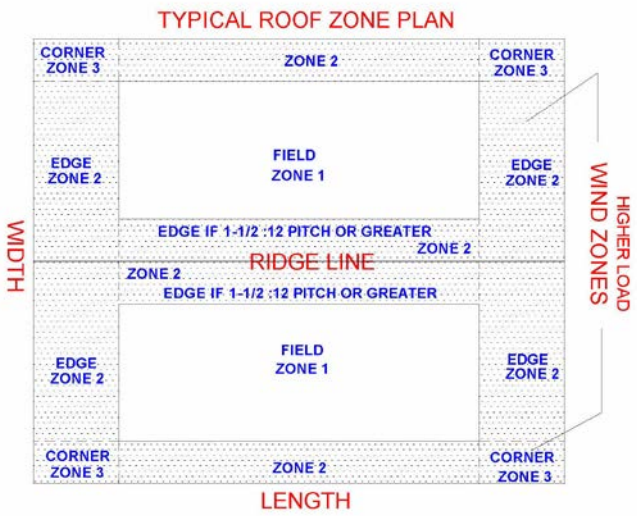


Figure C – Lap for Special Roof Hugger – (12 GA Purlins)

In addition to purlin strengthening, Roof Hugger has developed assemblies that make it possible to satisfy wind speeds that are common in coastal areas where these speeds have been upgraded in recent years due to catastrophic hurricane damage. There are millions of square feet of metal buildings in these high wind areas that were initially designed to withstand wind speeds from 90 to 110 miles per hour (MPH), but now are a minimum of 33% below the current code requirements. Many of these buildings must be upgraded to 120 MPH and greater wind speeds when they are re-roofed.

Building roofs have basically 3 areas that are subjected to varying degrees of wind pressures:

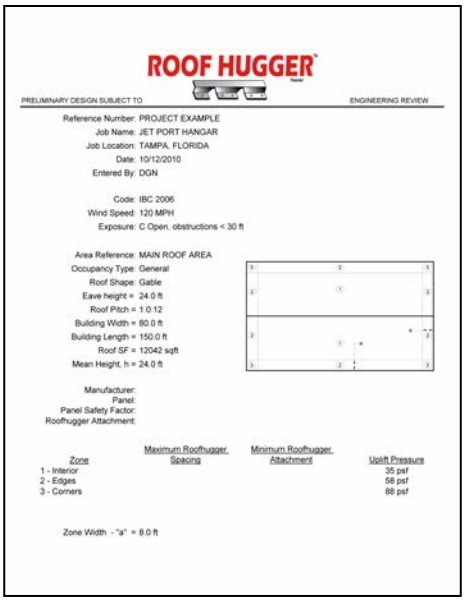


These areas are known as Zone 1 or the "Field", Zone 2 or the "Perimeter/Edge" and Zone 3 or the "Corners". Corners have the greatest wind uplift pressure. The amount of pressure the new roof must withstand is dictated by the roof's geometry (width, length, eave height, gable, mono-slope or hipped). The new metal roof's capability to resist these uplift forces controls the location of the additional sub-structure. To satisfy these needs, the Roof Hugger sub-framing system must be engineered to provide support to the new metal roof system at the required intervals/spacing dictated by panel's manufacturer. This is true whether the new roof is a thru-fastened or standing seam with clips.

Nearly all metal roof manufacturers test their roofing products in accordance with the American Society for Testing Materials, ASTM E-1592. This testing determines under laboratory conditions, the ultimate wind uplift pressures that the metal roof can sustain before failure.

Most older metal buildings have purlins spaced at distances greater than what is required in wind prone areas. Roof Hugger has developed "Integral" low-profile sub-framing assemblies that allow the installation of new framing members between the existing purlins. As shown in Figure D, low profile "Sub-Rafters" are installed running up slope from one existing purlin to the next. This allows standard low-profile Roof Huggers to be attached to the sub-rafters in between the existing purlins reducing the span of the panel and increasing its wind uplift capacity.

Roof Hugger has automated software that makes it possible to run a 'Preliminary Design Analysis" of your specific project. Additionally we have many panel manufacturers E-1592 test values to assist us in determining the correct panel and attachment spacing for your project. Please contact us about this free service on your next retrofit project.



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PRELIMINARY DESIGN SUBJECT TO ENGINEERING REVIEW

Reference Number: PROJECT EXAMPLE
Job Name: JET PORT HANGAR
Job Location: TAMPA, FLORIDA
Date: 10/12/2010
Entered By: DGN

Code: IBC 2006
Wind Speed: 120 MPH
Exposure: C Open, obstructions < 30 ft

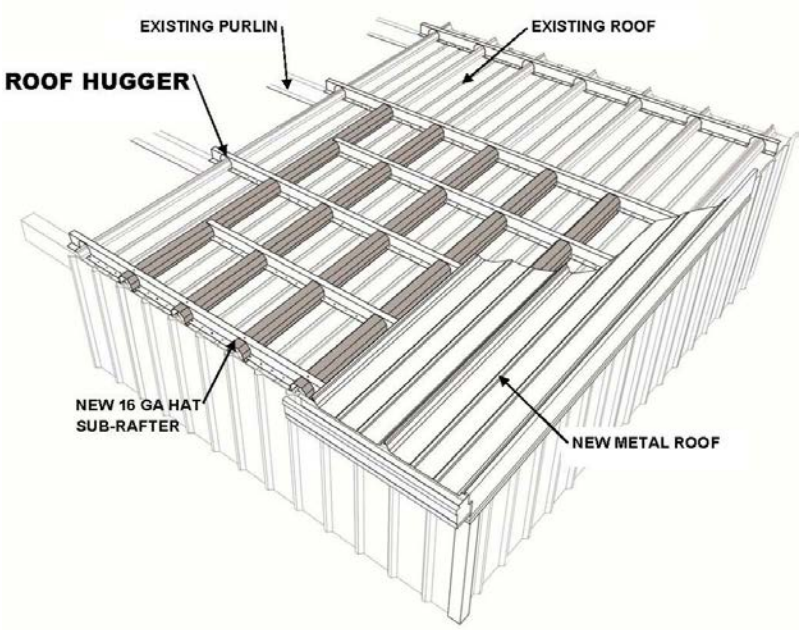
Area Reference: MAIN ROOF AREA
Occupancy Type: General
Roof Shape: Gable
Eave height = 24.0 ft
Roof Pitch = 1.0:12
Building Width = 80.0 ft
Building Length = 150.0 ft
Roof SF = 12042 sqft
Mean Height, h = 24.0 ft

Manufacturer:
Panel:
Panel Safety Factor:
Roofhugger Attachment:

Zone	Maximum Roofhugger Spacing	Minimum Roofhugger Attachment	Uplift Pressure
1 - Interior			35 psf
2 - Edges			58 psf
3 - Corners			88 psf

Zone Width - "a" = 8.0 ft

Figure D - Low-profile "Integral" Hugger sub-framing to satisfy corner and edge zone wind uplift pressures. The assembly shown is suitable for most metal roof systems, contact Roof Hugger for other assemblies available to meet Building Code Requirements.



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Patented Retrofit Sub-framing Solutions