FURTHER STUDY OF THE GRAVITY LOADING BASE TEST METHOD

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(ABSTRACT)

Presently, the industry accepted method for determining the positive moment strength of gravity loaded standing seam metal roof systems is the “Base Test Method”. The Base Test Method provides a means for determining the positive moment strength of a multiple span, multiple purlin line standing seam roof system using the results from a set of six single span, simply supported, two-purlin line experimental tests. A set of six base tests must be conducted for each combination of purlin profile, deck panel profile, clip type, and intermediate bracing configuration. The primary objective of this study is to investigate the possibility of eliminating some of the roof system parameters specifically, clip type, purlin flange width, and roof panel thickness.

This study used the results from nine series of tests. Each series consists of 11 to 14 gravity loaded base tests. The first three series were used to examine the effects of clip type on the strength of standing seam roof system. The final six series was used to examine the effects of flange width and roof panel thickness. All nine series were constructed using Z-purlin sections with flanges facing the same direction (like orientation).

Based on the results of this study, clip type, purlin flange width, and roof panel thickness all have an effect on the strength of standing seam roof systems. Although none of the roof components can be completely eliminated from the required test matrix, by using trend relationships an acceptable test protocol was developed that results in a significant reduction in the number of required base tests.

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CHAPTER 1
INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

The metal roof has been in use by the building industry for many decades. Conventional metal roofs were used on residential buildings, on agricultural structures, as coverings for prefabricated metal buildings, and, in rare cases, on commercial buildings. As the metal building industry developed better roofing components, the purlin supported metal roof became a popular choice for commercial as well as industrial buildings. The primary reason for this new found popularity could be attributed to the advent of the standing seam roof system. The standing seam roof system provides a viable alternative to the traditional trough-fastened roof system. This system offers improvement in the aesthetics, durability, and maintenance of the roof system. Both the through-fastened and standing seam roof systems are generally supported by Z- or C-shaped cold-formed steel purlins, which span between hot rolled steel rafters. Typical purlin sections are illustrated in Figure 1.1.

One disadvantage to the conventional through-fastened roof system is its vulnerability to leaks and subsequent corrosion. The corrugated roof panels are attached directly to the purlins by means of a mechanical fastener. Self-tapping screws pass through the roof panel and attach directly to the top flange of the purlin. Over time, due to thermal expansion and contraction, the holes created by the fastener enlarge, allowing moisture to penetrate the roof.

An advantage of a through-fastened roof is that the deck provides full lateral support to the top flange of the purlin. Research has shown that by assuming constrained bending, that is deflection only in the vertical direction, the American Iron and Steel Institute (AISI) Specification provisions can be used to obtain the design capacities for a through-fastened roof system, Brooks and Murray (1989).

By using the standing seam roof system, the persistent leakage problem can virtually be eliminated. The standing seam roof system accomplishes this by using a different type of connection between the roof panel and the support purlin. The panel is attached to a clip, which is embedded into the standing seam or joint between adjoining panels (see Figure 1.2). The clip is attached to the top flange of the support purlin by means of a self-drilling screw. Consequently, there are no holes in the panel caused by the placement of the fastener and the standing seam is typically above the water plane of the roof.

However, this type of clip-seam configuration does have disadvantages. The system provides only partial lateral support to the top flange of the Z- or C-section support purlin, creating a much more complex design problem. When either section is gravity loaded in the plane of the web, and it is not constrained, the system will tend to rotate and deflect both laterally and vertically (see Figure 1.1). These movements introduce both normal and torsional stresses in the support member, which is different from those stresses, found in a section that is in a constrained bending mode.

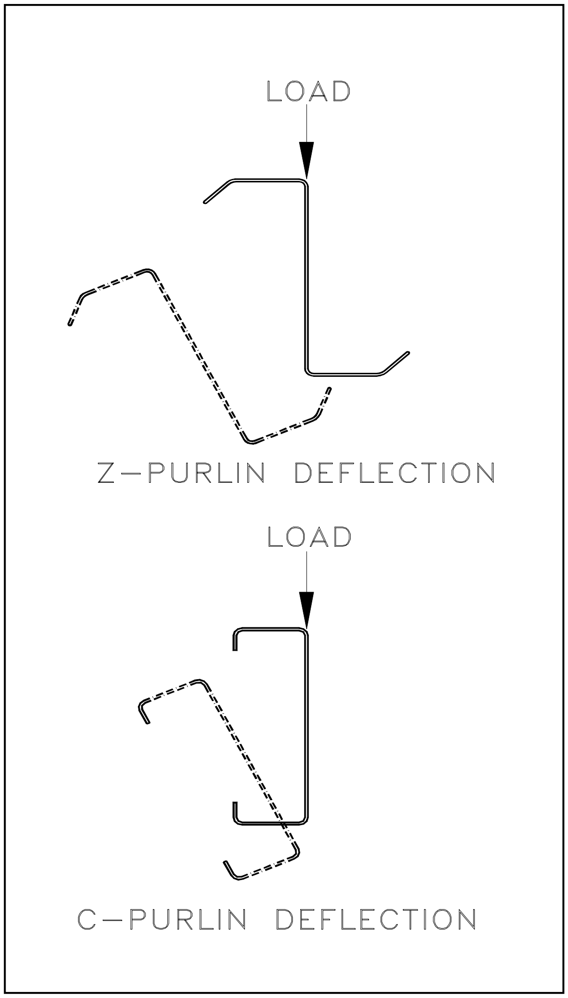

Figure 1.1 Deflection of Purlins

With the addition of lateral braces, the amount of lateral support can be improved. Lateral braces may be attached at specific locations along the purlin length preventing out of plane movement. In addition, lateral bracing

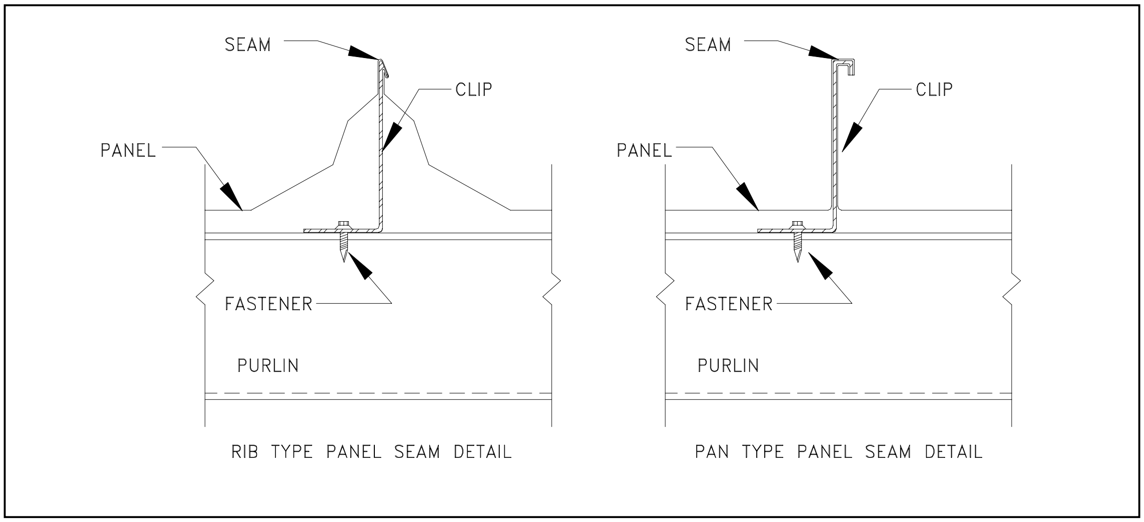

Figure 1.2 Typical Standing Seam Roof Seam Detail

of the purlin is provided at the support rafters. In effect, lateral bracing decreases the unbraced length of the purlin between support braces.

Obviously, the determination of the design strength of the standing seam roof system is more complex than the straightforward design procedure of the through-fastened roof system. Due to the complexity of the behavior of the standing seam roof system a simple, but, accurate design procedure for predicting the capacity of the gravity loaded standing seam roof system is needed. Presently the industry accepted design procedure is referred to as the "Base Test Method" (AISI *Specifications for* 1999). The Base Test Method uses the experimental results from single span, two purlin line, gravity loaded standing seam roof systems with nominally identical components as those used in the actual system construction.

As a rule manufacturers produce a variety of components for use in their standing seam roof systems. They may have different size purlins, deck panels, and clip types with a set of six base tests required for each combination. As an example, assuming a manufacturer has:

- 2 – Purlin Flange Widths (2 ½ in. or 3 ½ in.)
- 2 – Deck Thicknesses (22 ga. or 24 ga.)

- 1 – Deck Profile (Standing Seam)
- 3 – Clip Types (Low Sliding, High Sliding, Low Fixed)
- 6 – Tests required Per Configuration

The required number of base tests is: [2 X 2 X 1 X 3] X 6 or 78 tests.

Consequently, a large economic burden is imposed on the manufacturer. The purpose of this study is to eliminate, if possible, some of the roof system parameters from the test matrix such as: clip type, purlin flange width, and roof panel thickness.

1.2 Literature Review

Due to the somewhat recent development of standing seam metal roof systems, a limited amount of research has been performed on the strength of cold-formed purlins supporting standing seam panels.

Rivard and Murray (1986) conducted twelve experimental tests using standing seam panels. The experimental work included six single span tests and six continuous span tests. The single span test lengths were 20 ft. and the continuous span test consisted of three spans, each having a length of 23 ft. Each test used an 8-in. Z-section with the top compression flanges facing the same direction. The purlin lines were spaced at 5 ft. on center for all the tests conducted. The experimental test matrix utilized various panel and clip type combinations, as well as differing bracing configurations. In addition, both pan type panels and rib type panels were used. A pan type panel is defined as a panel where a single ninety-degree bend is found at the seam between adjoining panels. The rib type panel is defined as a panel where several bends are found at the joint between panels. Bracing was provided at the support rafters, third point, and midpoint depending on the test parameters.

Rivard and Murray used this testing to establish verification of the then current design methods for predicting anchorage forces in Z-purlin supported standing seam roof systems. Their research also involved developing methods for predicting the ultimate strength of a standing seam roof system. Rivard and Murray used three different procedures in predicting the ultimate failure loads of the roof system: (1) The 1986

American Iron and Steel Institute (AISI) Specification provisions assuming full lateral restraint and lateral buckling strength, (2) the 1986 AISI Specification provisions for lateral buckling strength, and (3) a method which incorporated the Structural Stability Research Council allowable stress equation and the 1986 AISI equations, termed by Rivard and Murray (1986) as the “Alternate Method”.

Rivard’s predictions of the ultimate failure loads using the 1986 AISI Specification assuming full lateral restraint and lateral buckling strength varied from 2 percent conservative to 248 percent unconservative, when compared to the actual failure loads. When the 1986 AISI Specification provisions for lateral buckling strength were used for capacity predictions, the results obtained ranged from 76 percent conservative to 32 percent unconservative. The alternate method, using the “K” correction factor, predicted the ultimate failure loads of the systems with results ranging from 58 percent conservative to 12 percent unconservative. Rivard concluded that additional test data would need to be obtained to either refine the 1986 AISI lateral buckling strength provision or confirm the alternate method.

Carbollo, Holzer and Murray (1989) used four approaches to predict the strength of Z-purlin supported standing seam roof systems under gravity loading. In the first approach, the 1986 AISI lateral buckling provisions were used to calculate a predicted failure load of the systems. This provided a basis for comparing the degree of lateral support that the standing seam roof system affords the purlins. When the system was assumed to be laterally unbraced the error was in the range of 37 percent to 86 percent conservative, depending on the bracing configuration. The data from Rivard and Murray’s six single span tests were compared to predicted failure loads. When the predicted loads were calculated for a fully lateral braced condition, the results were 22 percent to 35 percent unconservative.

Their second method is based on deflection correlation between that of a standing seam roof system and that of a through-fastened (conventional) roof system. The assumption is that the deflection of a standing seam and conventional roof are the same at ultimate loads. A mathematical model was developed to predict the stiffness of a standing seam roof system. The 1986 AISI Specification provides the means for predicting the deflection at the failure load of a conventional system. Using the stiffness for a standing seam roof system and the deflection obtained for the 1986 AISI Specification, a predicted failure load for the standing seam roof system was obtained. When the test results from the single span test conducted by Rivard and Murray (1986) were compared to the loads predicted by this method, the results ranged from 3 percent to 28 percent unconservative.

Their third method used stress correlation to predict the failure load. The approach predicted the failure load by using the stresses calculated from the allowable flexural capacity of the cross section and the general flexural formula. The allowable flexural capacity was based on the local buckling provisions in the 1986 AISI specification. Using the flexural capacity obtained from the mathematical model developed in his second method, an ultimate load is predicted. The general flexure equation was used to obtain stresses based on the predicted ultimate load. These stresses were used to scale the actual stresses of the cross section. When this method was applied to the data from Rivard and Murray (1986), the results ranged from 0 percent to 22 percent conservative.

Their fourth method was referred to as the "Base Test Method". This method predicts the ultimate load of a continuous span, multiple span system by scaling the failure load of a single span, two purlin line, gravity loaded, standing seam roof system. The method requires that a set of tests be performed for each distinct combination of deck style, clip type and purlin size. The Base Test Method is comprised of two parts. In the first part, a single span experimental test is performed using nominally identical purlins, clips and deck panels as used in actual field construction. From these experimental tests a maximum moment is calculated from the failure load of the system. The second part of the Base Test Method consists of a stiffness analysis. This analysis is performed on one purlin line of the actual design system from which the maximum positive and negative moments are obtained. This method was evaluated by using data from Rivard and Murray (1986), along with data from two single spans and two confirming multiple span tests conducted by Carbollo. Of the four test methods used the Base Test Method proved to be the most practical and reasonable approach to predict the capacity of a standing seam roof system. This procedure predicted loads that were 28 percent conservative to 3 percent unconservative. They were on average 98 percent accurate.

Brooks and Murray (1989) conducted a series of nine tests to verify the accuracy of the Base Test Method. Each test series consisted of a single span test and a multiple span-confirming test. The single span tests had a span length of 25 ft; the multiple span tests consisted of three span lengths of 23 ft. 6 in. Three or four purlin lines were used in the multiple span tests, depending on the orientation of the purlin cross section. For purlins facing same direction three purlin lines were used and four purlin lines were used in opposite facing or opposed purlin orientation. Four of the tests conducted used Z-purlins braced at the supports. Three test sets used Z-purlins facing opposite directions. One test was performed using C-purlins braced at the supports. The type of clip and style of deck was varied between test sets. This practice permitted the evaluation of as many different construction parameters as possible. The results of this series of tests showed that the Base Test Method predicted the strength of the multiple span tests with an accuracy of 0.87 (unconservative) to 1.02 (conservative). These percentages were obtained by dividing the actual failure loads by the predicted failure loads obtained from the confirming tests.

Rayburn and Murray (1990) conducted a series of tests in which the primary goal was to eliminate some of the parameters from the manufacture's test matrix for the Base Test Method. The testing explored the effects of purlin orientation, purlin size and type, span length, and the presence or absence of insulation on the strength characteristics of a standing seam roof system. A linear relationship was found to exist between the percentage of through-fastened strength and fully constrained section strength of the purlins used in the standing seam roof system. This relationship made it possible to predict the strength of a standing seam roof system by conducting only a few base tests. Rayburn also observed that the strength relationship between the percentage of through-fastened strength and fully constrained sections from tests conducted with Z-purlins like facing could be used as a conservative design practice. This would eliminate the need to conduct base tests with Z-purlins of opposite orientation. There were no conclusions stated as to the effects of span length on the strength capacity of the standing seam roof system.

Anderson and Murray (1990) conducted a series of eight test sets to verify the Base Test Method for uplift loaded standing seam roof system. These tests included a single span, two purlin line base test and the corresponding multispan, multipurlin line confirmation test. Four of the eight test sets conducted employed rafter bracing only and the remaining four test sets included third-point bracing as well as rafter bracing. One test was conducted using a rafter braced C-section while the remainder of the tests were conducted using Z-sections. The actual failure load obtained during testing was compared to the load predicted by the Base Test Method. The ratio of these two values ranged from 0.78 (unconservative) to 1.16 (conservative) with an average of 1.0 and a standard deviation of 0.171. It was concluded that although, on average, the predicted load was the same as the actual failure load, the range or scatter of the data did not provide evidence that the Base Test Method provided an accurate prediction for uplift loading.

Pugh and Murray (1991) used three analytical models in conjunction with the Base Test Method to predict the failure capacity of an uplift loaded standing seam roof system. The analytical models included the LaBoube Method (LaBoube et. al. 1988), the Wallace and Murray Method (Wallace and Murray 1979), and the Pekoz Equation (Pekoz and Serrette 1991). The database used in this research was derived from testing conducted at Virginia Tech in 1990 and 1991. An additional series of test sets were conducted in which the primary purpose was to reevaluate the four test sets from Anderson and Murray's (1990) data base and to extend the data base for uplift capacity of standing seam roof systems. The test matrix included single span, two purlin line base tests and the corresponding multispan, multipurlin line confirmation tests. In addition, the matrix included results obtained from variations in purlin orientation, lateral bracing, clip type, and deck panel type.

It was observed that of the two stress analysis models, the LaBoube model gave the best results, but only for simple spans. The predictions from the Wallace and Murray method were too poor for use in both the base tests and the three span confirming tests. The Pekoz Equation gave poor results for the base test and very good results for the multi-span test. However, because of the unusual effective length factor and its effect on the model, it was not recommended for use in design. Moreover, the three analytical models could not distinguish between purlins facing the same direction and opposed purlins. In addition, the LaBoube and the Wallace and Murray methods had to use the fictitious load method to approximate the effects of intermediate bracing. Therefore, it was concluded that the most reliable method for predicting the failure load for standing seam roof system is the Base Test Method.

Research conducted using the Base Test Method for gravity loading at Virginia Tech resulted in its inclusion in the American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members, 1996 Edition. Supplement No. 1-Appendix A of the Specification (1999), includes some small changes to the Base Test Method in addition to providing provisions for the Base Test Method to be used for uplift loading.

1.3 Scope of Research

Verification of the Base Test Method has been established through extensive experimental and analytical research. The Base Test Method is now the accepted design procedure for predicting the strength of gravity and uplift loaded standing seam roof systems. The primary purpose of the current research is to evaluate the possible elimination of clip type, purlin flange width, and roof panel thickness from a manufactures required test matrix for a standing seam roof system.

1.4 Overview

Chapter II contains background information regarding the Base Test Method along with the procedural sequence for conducting the base test. Also the restrictions and limitations for the Base Test Method are covered in this chapter. Chapter III provides the experimental test program details and an explanation of the test designation system used in the test matrix. The results of the base tests conducted in this study are presented in Chapter IV. An analysis of test results and their effects on the standing seam roof system ultimate strength is found in Chapter V. Chapter VI contains project findings and recommendations for implementation.

CHAPTER II

THE BASE TEST METHOD

2.1 The Base Test Method for Gravity Loading

The basic concept of the Base Test Method is to predict the flexural failure load of a multiple span, multi-purlin line standing seam roof system from the experimental failure load of a set of two purlin line, single span, gravity loaded tests. The purpose of the Base Test Method is to obtain the reduction factor to be used in determining the nominal, positive moment flexural strength of a purlin supporting a standing seam roof system. This method involves several steps before a design load is obtained.

The initial step requires that a set of six base tests be conducted; three using the manufacturers thinnest purlin and three using the thickest purlin. All tests must be conducted with nominally identical components. The only variations allowed are purlin thickness and edge stiffener length. This phase of the procedure is completed in the laboratory by loading full-scale single span, two purlin line systems to failure. A uniformly distributed gravity load is applied to the experimental roof system and an ultimate failure load is obtained. The failure loading for each test is calculated using:

$$w_{ts} = w + w_d + 2 \times P_L \times \left(\frac{d}{B} \right) \qquad \text{(Eq. 2.1)}$$

Where

w_{ts} = Maximum applied loading, plf.
w = Maximum pressure differential, plf.
w_d = Equivalent uniform loading due to panel and purlin weight, plf.
B = Purlin spacing, in.

$$P_L = 0.041 \times \left(\frac{b^{1.5}}{d^{0.90} \times t^{0.06}} \right) \times (w + w_d) \qquad \text{(Eq. 2.2)}$$

and

b = Flange width of purlin, in.
d = Depth of purlin, in.
t = Thickness of purlin, in.

The force P_L has the following restrictions (AISI Supplement No.1 1999): *The expression $2P_L(d/B)$ takes into account the effect of the overturning moment as defined in Section D3.2.1 of the AISI Specifications. The expression $2P_L(d/B)$ is to be applied only to Z-sections under gravity loading when the purlin flanges are facing in the same direction or if the ridge purlin subjected to gravity loading is the failing member. The $2P_L(d/B)$ expression shall not be included in systems were discrete point braces are used and restrained from lateral movement.*

The maximum positive moment is determined from the experimental failure load. For gravity loading, a positive moment is defined as one that causes compression in purlin flange attached to the clips and deck panels. The magnitude of this positive moment, obtained from the single span base test, is the limiting maximum positive moment that the system can resist. From the single span failure load, w_{ts}, the maximum single span failure moment is calculated using the following equation:

$$M_{ts} = \frac{1}{8} \times w_{ts} \times L^2 \qquad \text{(Eq. 2.3)}$$

Where M_{ts} is maximum failure moment lb-ft.
w_{ts} is the maximum applied loading, plf.
L is the purlin span length, ft.

Using the AISI Specifications for the Design of Cold-Formed Steel Structural Members (Supplement No. 1 1999), the constrained bending strength is calculated as:

$$M_{nt} = S_{et} \times F_{yt} \qquad \text{(Eq. 2.4)}$$

Where M_{nt} is the constrained bending strength, lb-in.
S_{et} is the effective section modulus using measured cross-sectional dimensions, in^3.
F_{yt} is the measured yield strength, psi.

For each test, the modification factor, R_t, is calculated using the following equation:

$$R_t = \frac{M_{ts}}{M_{nt}} \qquad \text{(Eq. 2.5)}$$

After test completion, the physical and material properties are determined in accordance with ASTM A370 using coupon specimens taken from the failed purlin. In addition, the experimental results of the six base tests, three conducted with the thinnest purlins and three conducted with the thickest purlins, are then used to develop the reduction factor equation (AISI *Specifications for* 1999). For purlins of the same profile, specified steel grade, and panel system as tested, the reduction factor is determined from the following equation:

$$R = \left(\frac{R_{t_{\max}} - R_{t_{\min}}}{\overline{M}_{nt_{\max}} - \overline{M}_{nt_{\min}}} \right) \times \left(M_n - \overline{M}_{nt_{\min}} \right) + R_{t_{\min}} \leq 1.0 \qquad \text{(Eq. 2.6)}$$

Where:

$R_{t_{\min}}$ = Mean minus one standard deviation of the modification factors of the three thinnest purlins tested.

$R_{t_{\max}}$ = Mean minus one standard deviation of the modification factors of the three thickest purlins tested.

M_n = Nominal Flexural strength of section for which R is being evaluated $M_n = S_e F_y$.

$\overline{M}_{nt_{\min}}$ = Average flexural strength of the thinnest section tested.

$\overline{M}_{nt_{\max}}$ = Average flexural strength of the thickest section tested.

Figure 2.1 shows an example of the experimentally determined modification factors from the six base tests. The straight line connecting the points is a trend line plotted at one standard deviation below the mean R_t value for each set of tests, that is, Eq. 2.6.

The reduction factor from Equation 2.6 provides the designer with a nominal flexural strength reduction factor for purlins in a simple span or continuous span, multiple purlin line, supporting a standing seam roof system.

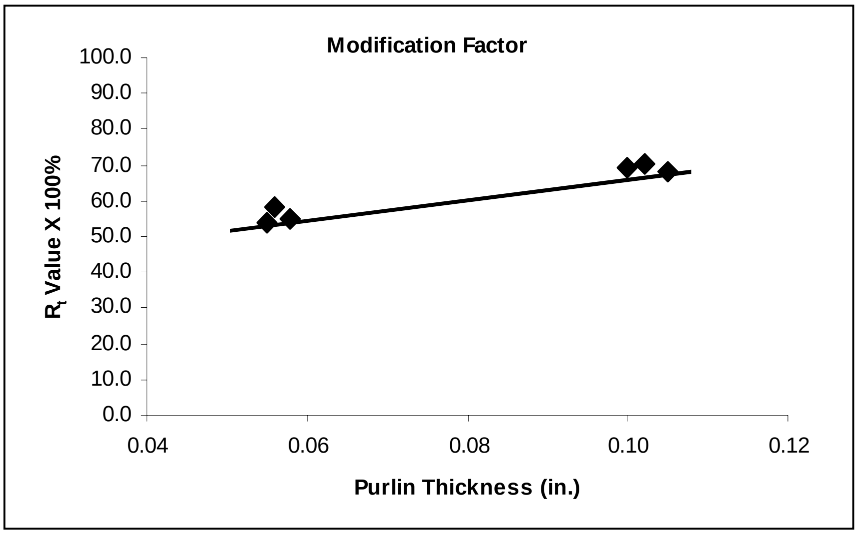

Figure 2.1 Modification Factor

2.2 Restrictions and Limitations

Based on results obtained through experimentation, the Base Test Method provides a means of calculating allowable design loads for a standing seam roof system. As with any method, which involves experimental results, certain restrictions and limitations must be adhered to insuring safety requirements are met.

In accordance with the AISI 1996 Specifications For The Design of Cold-Formed Steel Structural Members, the following restrictions and limitations are required when using the Base Test Method: the panels, clips, purlin depth, purlin profile (excluding thickness and edge stiffener length), and bracing configuration used in the base test must be nominally identical to those used in the actual standing seam roof system and must be installed according to field erection practices. The largest span length in an actual roof system cannot exceed the span length used in the base test. Likewise, the purlin spacing in the actual roof system cannot exceed the spacing used in the base test. Based on these criteria, a set of base tests must be performed for each combination of deck, clip, bracing, and purlin size that will be designed. No fewer than six tests are required for each combination of purlin profile and panel system. Due to the variations in components, and the complex structural behavior of the standing seam roof system, an analytical method for eliminating specific system parameters is probably not possible.

CHAPTER III

TESTING DETAILS

3.1 Test Program and Components Used

This research was undertaken to investigate the possibility of eliminating certain parameters from the current required test matrix used in the Base Test Method for determining the positive moment strength of standing seam metal building roof systems. The investigation was conducted with a number of combinations of roof system components. Members of the Metal Building Manufactures Association (MBMA) supplied the components used in the testing program. Nominally identical purlins, panels, and clips were used in each set of single span tests conducted. Subsequent chapters provide a description of test results, test analysis and recommended test procedures. An overview of the test components used in the testing program follows.

Purlins. The Z-purlin was used exclusively in the test sequences. The physical properties of the purlins varied in depth, thickness, flange width, and edge stiffener length. Five feet on center spacing was used in all tests. Third point bracing was used in one test series (Series 3) conducted in this study. Tensile coupon tests were performed on material obtained form the web of failed purlin from each test.

Panels. Both “rib” and “pan” type panels were used in the tests. Panel widths, thickness, and seam details vary according to the manufacturer. However, the basic shapes are relatively standard. Generic cross sections of the test panels are illustrated in Figure 3.1. Panel widths were 18 in. and 24 in. and the thicknesses were 22 ga. and 24 ga. Methods of attaching or “seaming” adjacent panels to prevent separation varied according to manufacturer. Some panels simply snap together while others require the use of a hand seamer in conjunction with an electrical seamer to lock the central joint.

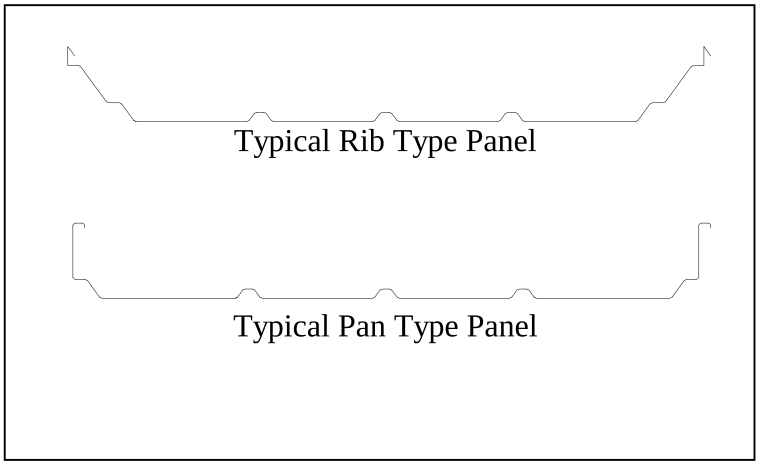

Figure 3.1 Typical Cross-Sections of Deck Panels

Clips. Both one piece fixed and two-piece sliding clips (see Figure 3.2) were used in the testing. As with roof panels, the exact dimensions and configurations vary with manufacturer. Nevertheless the mode of installation and basic shapes are somewhat consistent. The clips are generally fastened to the purlin by means of two self-drilling self-tapping screws positioned through predrilled holes in the clip base. The one-piece fixed clip does not permit movement of the purlin relative to the deck. Conversely, the two-piece sliding clip allows relative

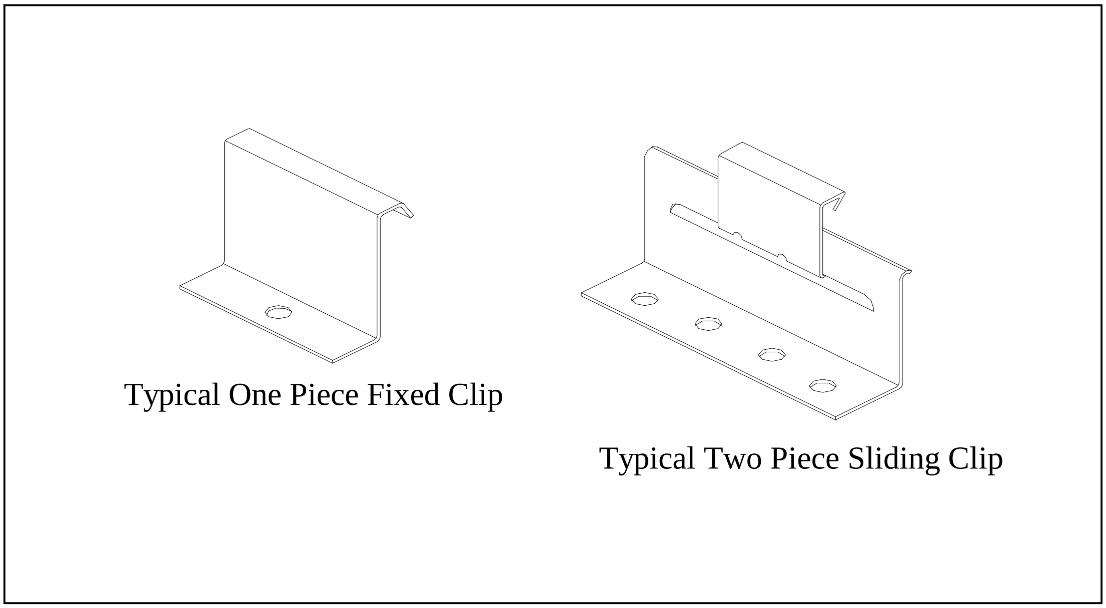

Figure 3.2 Typical Standing Seam Roof Clip Types

movement, within the limits of the clip, between the roof panel and purlin, thus facilitating movement in the roof system when subjected to temperature expansion and contraction.

Insulation. Typical metal building insulation was used in one test series. A 6 in. thick fiberglass building insulation was used in the tests. The insulation is placed between the top flange of the purlin and the base of the clip.

Thermal Blocks. For each test constructed using the tall sliding clip a 2 ¾ in. wide by 1 in. thick thermal block was used as recommended in the field erection drawings.

Bracing. There were two basic types of bracing configurations used in the testing, bracing at the support rafters and lateral bracing at third points. The purlins were supported at each end by an H-section, which acts as a support rafter. Bracing at the support was accomplished by the use of anti-roll clips. One face of the anti-roll clip was bolted directly to the top flange of the support rafter. The other face was connected to the web of the purlin using ½ in. diameter bolts. This bracing prevents the purlin form deflecting laterally or twisting at the rafter.

Third point bracing, when used, was achieved by utilizing a mechanical device designed by Ceco Metal Buildings (Pugh and Murray 1992). This device is comprised of a hot rolled angle section bolted to the bottom flange of each purlin at a third point with two ¼ in. diameter bolts. Rollers are attached to both ends of the angle section. These rollers are then positioned so that they will engage a frame, which in turn is connected directly to the reaction floor. The frame is constructed of one horizontal and two vertical pieces of hot-rolled channel section. The frame prevents the angle attached to the purlins from displacing laterally. However, vertical displacement is permitted due to the presence of the rollers on the ends of the angle. The typical bracing configuration for both support bracing and third point bracing is illustrated in Figure 3.3.

3.2 Testing Setup and Procedure

All of the tests conducted were constructed and loaded to failure using a vacuum chamber. The chamber was made by connecting galvanized steel panels together to form a rectangular box (see Figure 3.4). The wall panels measure 3 ft. 6 in. high and are bolted directly to the laboratory floor. The plan dimensions of the vacuum chamber measured 8 ft. wide by 31 ft. long. To seal the top of the vacuum chamber a 6-mil sheet of polyethylene was draped over the entire chamber. The sheet of polyethylene was secured and made air tight using wood 2 X 4's, 4 in. "C" clamps, and duct tape.

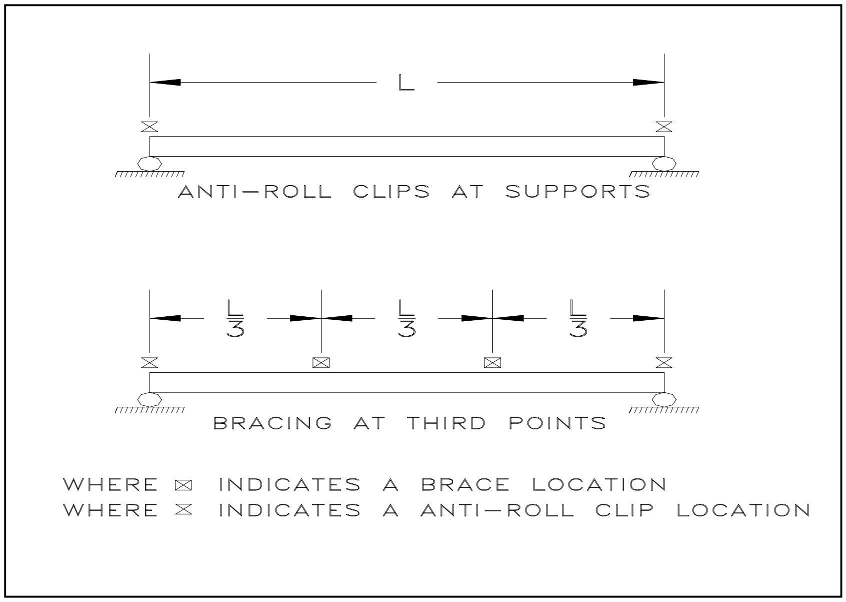

Figure 3.3 Bracing Configurations for Base Test

Steal beams were located at either end of chamber and were used to support the purlins. These beams were simply supported using ½ in. diameter steel rollers in conjunction with short beam sections referred to as "stands". To prevent excessive lateral deflection of the roof system anti-roll clips were installed at the supports on the ridge and eave purlins. The purlins were bolted through the web directly to the anti-roll clips using four ½ in. bolts. The cross-section of the test setup is illustrated in Figure 3.5.

Application of a uniformly distributed gravity load was achieved by the removal of air inside the vacuum chamber. The air was evacuated by the use of an electric motor driven vacuum pump. The pump was connected to the chamber by a series of PVC pipes. Valves were installed in the wall panels of the chamber so that the airflow into the chamber could be regulated. The pressure differential between the air inside the chamber and the atmosphere was measured using a U-tube manometer and a pressure differential transducer.

Three linear displacement transducers were used to measure the deflection of the standing seam roof system being tested. The vertical deflection of both the ridge and eave purlin was measured. Each deflection was measured independently at the mid-span,

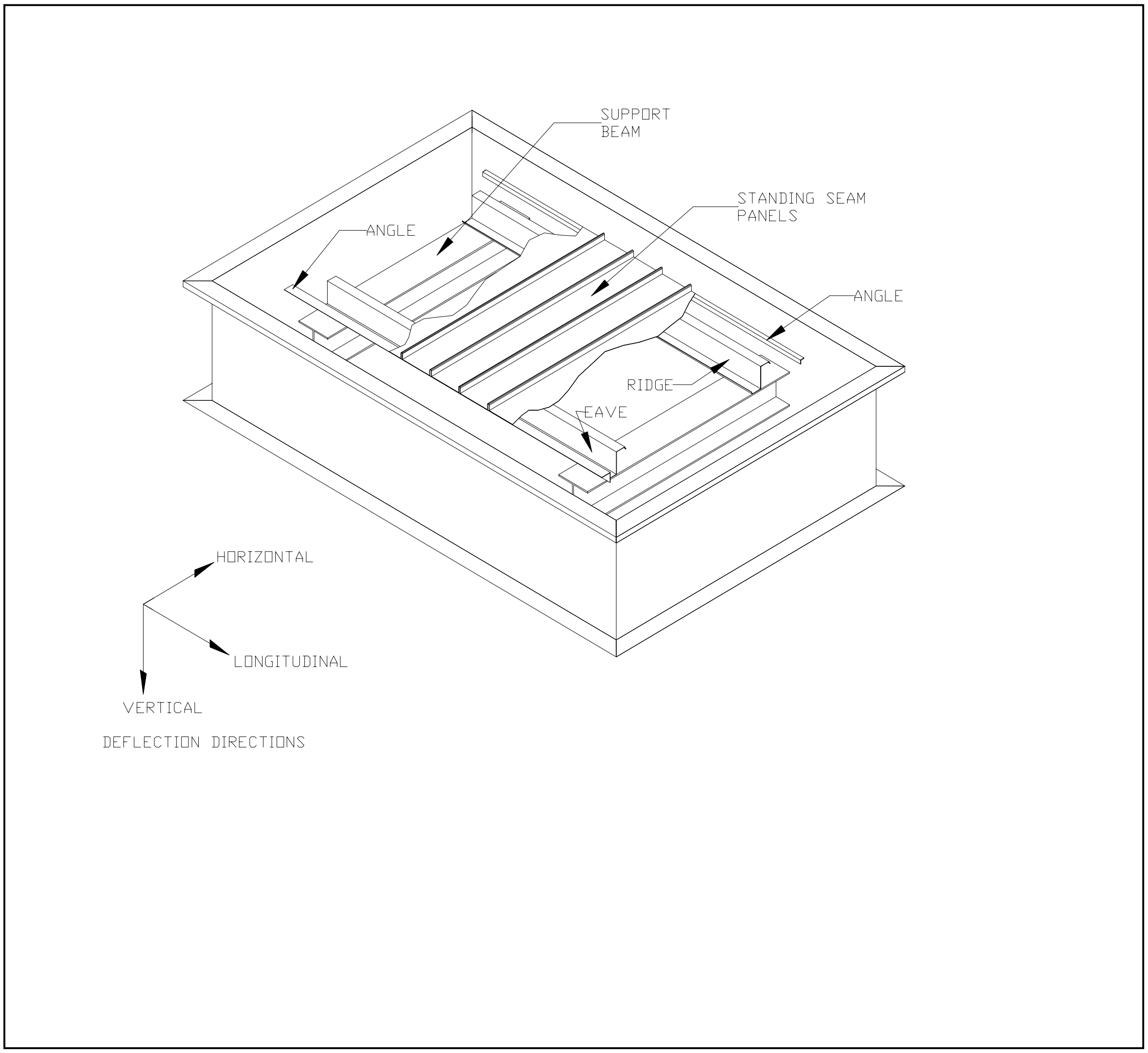

Figure 3.4 Test Chamber

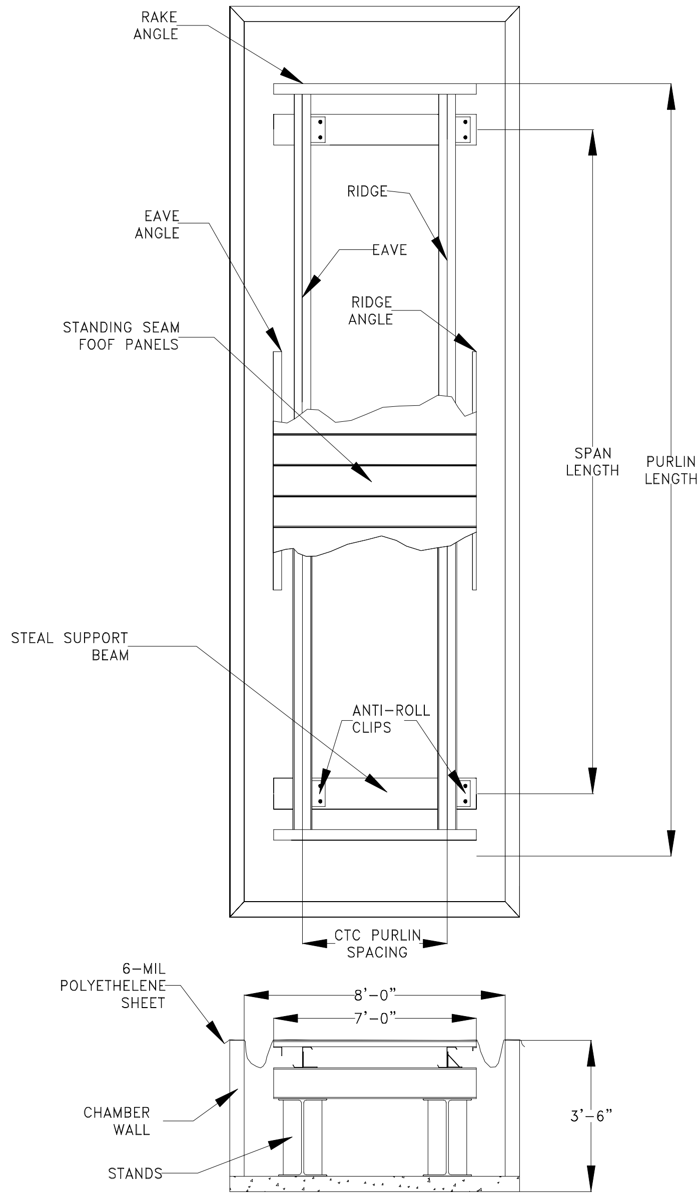

Figure 3.5 Test Setup Cross Section and Plan View

the positive sense was taken as down. In addition, the lateral (horizontal) deflection of the top flange of the ridge purlin was measured at mid-span. Positive lateral deflection was taken as movement away from the eave purlin. All data was recorded using a P-C based acquisition system.

Each test was preloaded to approximately 10% of predicted failure load. This was done to settle bolts in holes, remove any slack in the system, and to ensure that all testing components were functioning properly. This load was removed and then all equipment settings were zeroed before beginning the actual loading of the standing seam roof system. A typical load versus deflection plot is illustrated in Figure 3.6.

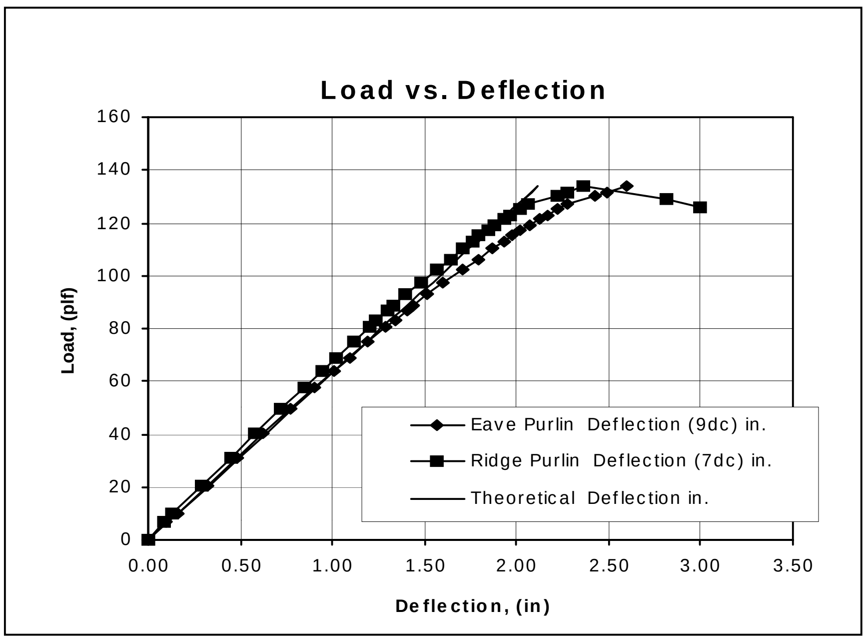

Figure 3.6 Typical Load Verses Vertical Deflection Plot

3.3 Tensile Coupon Test.

Two coupon samples were taken from the low stress web area of a failed purlin in each base test. The coupons were machined and tests were performed in accordance with ASTM A370 standard specifications. The yield stress of the coupons was determined using the 0.2% offset method on stress versus strain plots generated from the test data. This yield stress was used to determine the AISI constrained bending strength for the tests.

CHAPTER IV

EXPERIMENTAL RESULTS OF BASE TESTS

4.1 General

Ten test series, Series 1 through 10, were conducted for this project. The first three series were used to examine the effects of clip type on the strength of a standing seam roof system. The final six series of test examined two additional parameters, flange width and roof panel thickness. All ten series used Z-purlins with flanges facing same direction (like orientation). An overview of the test matrix used in this project is presented in Table 4.1. Complete base test results for each test conducted are found in Appendices A through J, for Series 1 through 10, respectively. Each set of results contains a complete summary sheet defining test parameters, and experimental test results.

Roof component testing combinations used, along with graphical test results are found in the following sections. The experimental failure load from each base test is expressed as a ratio of the experimental failure load divided by the fully constrained bending strength, times 100 percent, that is, the "R_t-value" times 100 percent (see Eq. 2.5).

4.2 Test Specimen Identification

The following test identification system was used for this study.

Example: S1-10Z0.100-C3

- The first letter-number combination in each test designation is the series number (e.g. S1 indicates Series 1).

- The second identifier indicates the depth of purlin, purlin section, and purlin thickness tested. For example 10Z0.100 signifies a 10 in. Z-purlin with a thickness of 0.100 in.
- The third identifier signifies the type of clip used in the test. C1 (Low Sliding), C2 (Low Fixed), and C3 (Tall Sliding).

An overview of the test matrix used in this project is presented in Table 4.1 showing the span length, purlin depth, purlin flange width, panel gage, and bracing configuration used in each test series conducted in this study.

Table 4.1 TEST MATRIX

Series	Number of Tests	Span Length	Purlin Depth (in)	Purlin Flange Width (in)	Panel Gage	Insulation	Bracing
Series 1	11	25'-0"	10	2 ½	24	None	Support
Series 2	12	25'-0"	8	2 ½	24	None	Support
Series 3	12	25'-0"	8	2 ½	24	None	1/3 Point
Series 4	**Data not included in final report**						
Series 5	14	29'-4 ½"	10	3 ½	24	None	Support
Series 6	13	29'-4 ½"	10	3 ½	22	None	Support
Series 7	14	29'-4 ½"	10	2 ½	24	None	Support
Series 8	14	29'-4 ½"	10	2 ½	22	None	Support
Series 9	14	29'-4 ½"	8	2 ½	24	None	Support
Series 10	14	29'-4 ½"	8	2 ½	22	None	Support

Note: Each series consisted of tests using three clip types and two purlin thicknesses.

4.3 Test Series

Series 1. Series 1 consisted of eleven tests. All eleven tests used 10 in. Z-purlins with a span length of 25 ft 0 in. The roof components were "pan" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.1. (Note, for comparison purposes all figures have been placed at the end of this chapter).

The failure mode for all the tests in this series, except test S1-10Z0.100-C2 (Test 04), was buckling or distortion of the compression lip, flange, and web of the eave purlin. This failure occurred at the clip located closest to the mid-span of the purlin in all but one test. In test S1-10Z0.100-C2 (Test 04) the ridge purlin failed rather than the eave purlin.

Series 2. Series 2 consisted of twelve tests. All twelve tests used 8 in. Z-purlins with a span length of 25 ft 0 in. The roof components were "pan" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.2.

The failure mode for all the tests in this series, except tests S2-08Z0.060-C3 (Test 14) and S2-08Z0.060-C2 (Test 16), buckling or distortion of the compression lip, flange, and web of the ridge purlin near the clip located closest to the mid-span of the purlin. In tests S2-08Z0.060-C3 (Test 14) and S2-08Z0.060-C2 (Test 16) the eave purlin failed rather than the ridge purlin.

Series 3. Series 3 consisted of twelve tests. All twelve tests used 8 in. Z-purlins with a span length of 25 ft 0 in. The roof components were "pan" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Lateral bracing at third points was used. No insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.3.

In this series eight eave purlins and four ridge purlins failed by buckling or distortion of the compression lip, flange, and web of the purlin near the clip located closest to the mid-span of the purlin.

Series 4. Series 4 was supplemental testing completed in an attempt to substantiate data obtained from proprietary data. An additional four tests were completed and the results failed to support the initial data. Due to this discrepancy this series is not included in the final data.

Series 5. Fourteen tests were conducted in Series 5. Each of the fourteen tests used 10 in. Z-purlins with a span length of 29 ft 4 ½ in. The nominal purlin flange width for this series measured 3 ½ in. The roof components consisted of 24-gage "rib" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used in conjunction with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.4.

For all the tests in this series with the thin (0.070-in.) purlin thickness, the failure mode was buckling or distortion of the compression lip, flange, and web of the eave purlin near the clip located closest to the mid-span of the failed purlin. In tests with the heavier (0.100-in.) purlin thickness the predominant mode of failure was elastic lateral torsional or distortional buckling with only minor evidence of local buckling. Five of the seven tests experienced this type of failure. In addition, several of the tests showed evidence of clip failure, primarily the tall floating clip. The thinner material used on the upper tab of the clip separated causing a tear to occur at the junction between the base of clip and the clip tab. This clip failure occurred immediately after the roof system being tested reached the failure load.

Series 6. Thirteen tests were conducted in Series 6. Each of the thirteen tests used 10 in. Z-purlins with a span length of 29 ft 4 ½ in. The nominal purlin flange width for this series measured 3 ½ in. The roof components were 22-gage "rib" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.5.

The mode of test failures for this series was similar to that of the previous series, Series 5. Failure modes included local buckling of the compression lip, flange, and web, along with elastic lateral torsional or distortional buckling and clip separation in limited cases.

Series 7. Fourteen tests were conducted in Series 7. Each of the fourteen tests used 10 in. Z-purlins with a span length of 29 ft 4 ½ in. The nominal purlin flange width for this series measured 2 ½ in. The roof components consisted of 24-gage "rib" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.6.

The mode of test failures for this series was similar to Series 5. Failure modes included local buckling of the compression lip, flange, and web, along with elastic lateral torsional or distortional buckling and clip separation in limited cases.

Series 8. Fourteen tests were conducted in Series 8. Each of the fourteen tests used 10 in. Z-purlins with a span length of 29 ft 4 ½ in. The nominal purlin flange width for this series measured 2 ½ in. The roof components were 22-gage "rib" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.7.

The mode of test failures for this series was similar to Series 5. Failure modes included local buckling of the compression lip, flange, and web, along with elastic lateral torsional or distortional buckling and clip separation in limited cases.

Series 9. Fourteen tests were conducted in Series 9. Each of the fourteen tests used 8 in. Z-purlins with a span length of 29 ft 4 ½ in. The nominal purlin flange width for this series measured 2 ½ in. The roof components were 24-gage "rib" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.8.

The mode of test failures for this series was similar to Series 5. Failure modes included local buckling of the compression lip, flange, and web, along with elastic lateral torsional or distortional buckling and clip separation in limited cases.

Series 10. Fourteen tests were conducted in Series 10. Each of the fourteen tests used 8 in. Z-purlins with a span length of 29 ft 4 ½ in. The nominal purlin flange width for this series measured 2 ½ in. The roof components consisted of 22-gage "rib" type panels, two separate "sliding" clip heights, and one "fixed" clip height. Anti-roll clips were used at the supports of both the ridge and eave purlin. Neither lateral bracing nor insulation was used. Styrofoam spacer blocks were used with the high sliding clip. The experimental reduction factor (R_t-Value) obtained for each test conducted in this series is shown in Figure 4.9.

The mode of test failures for this series was similar to Series 5. Failure modes included local buckling of the compression lip, flange, and web, along with elastic lateral torsional or distortional buckling and clip separation in limited cases.

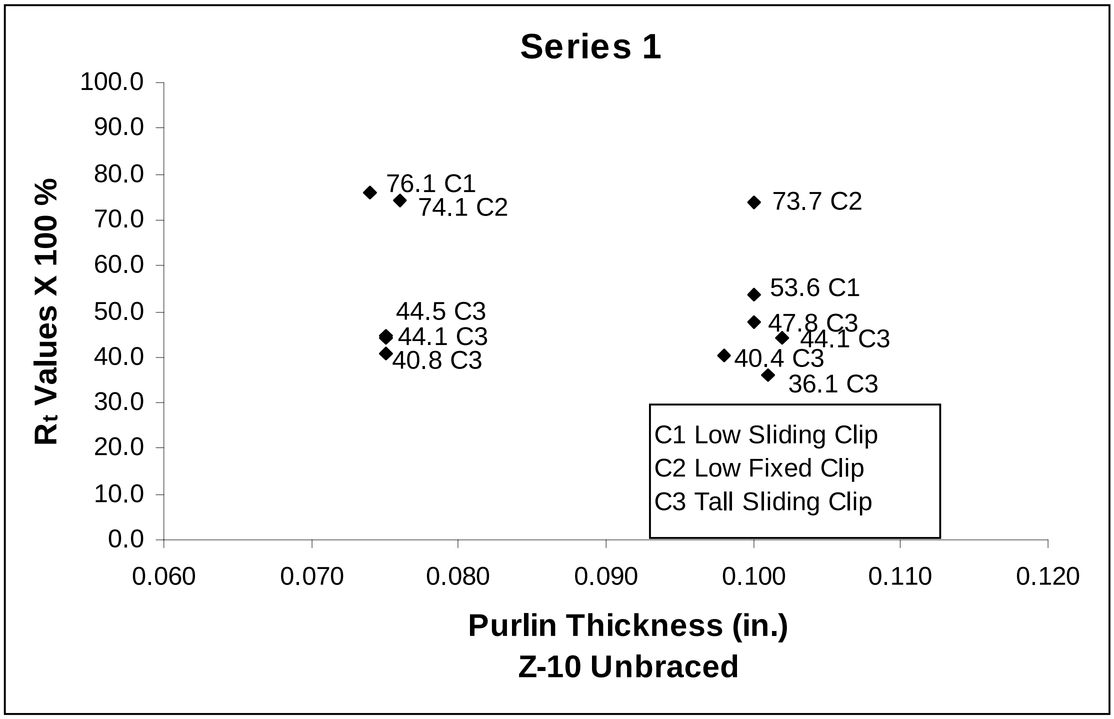

Figure 4.1 Series 1 Reduction Factor Values

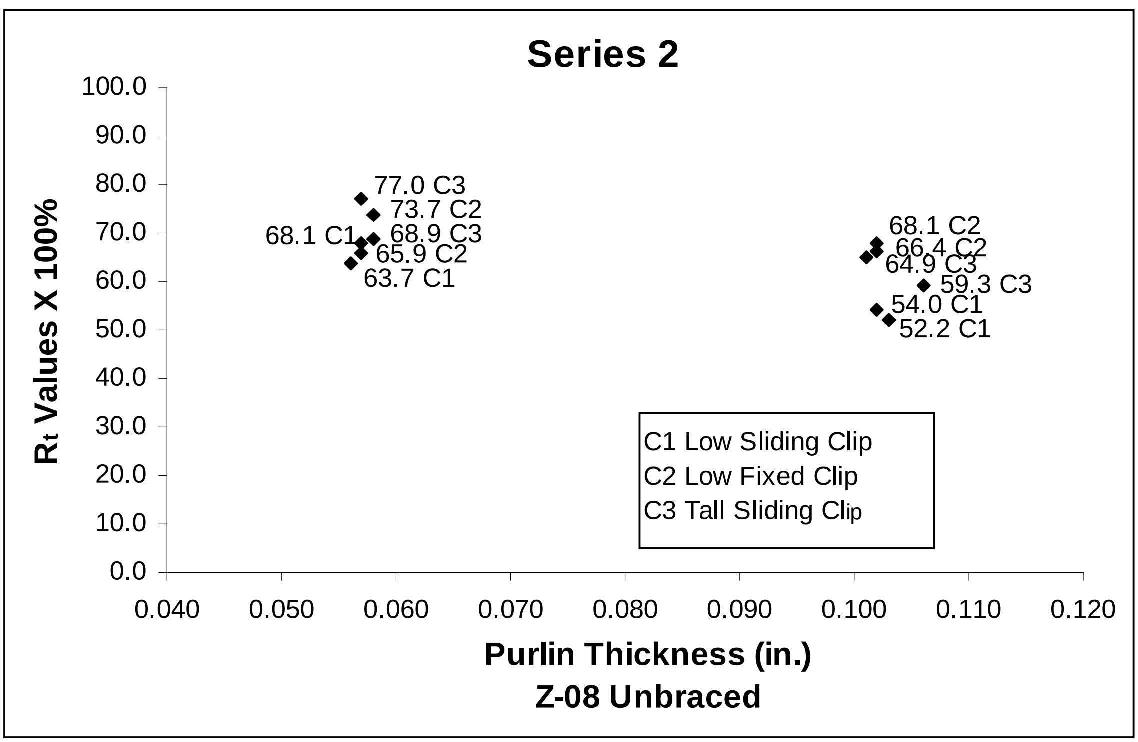

Figure 4.2 Series 2 Reduction Factor Values

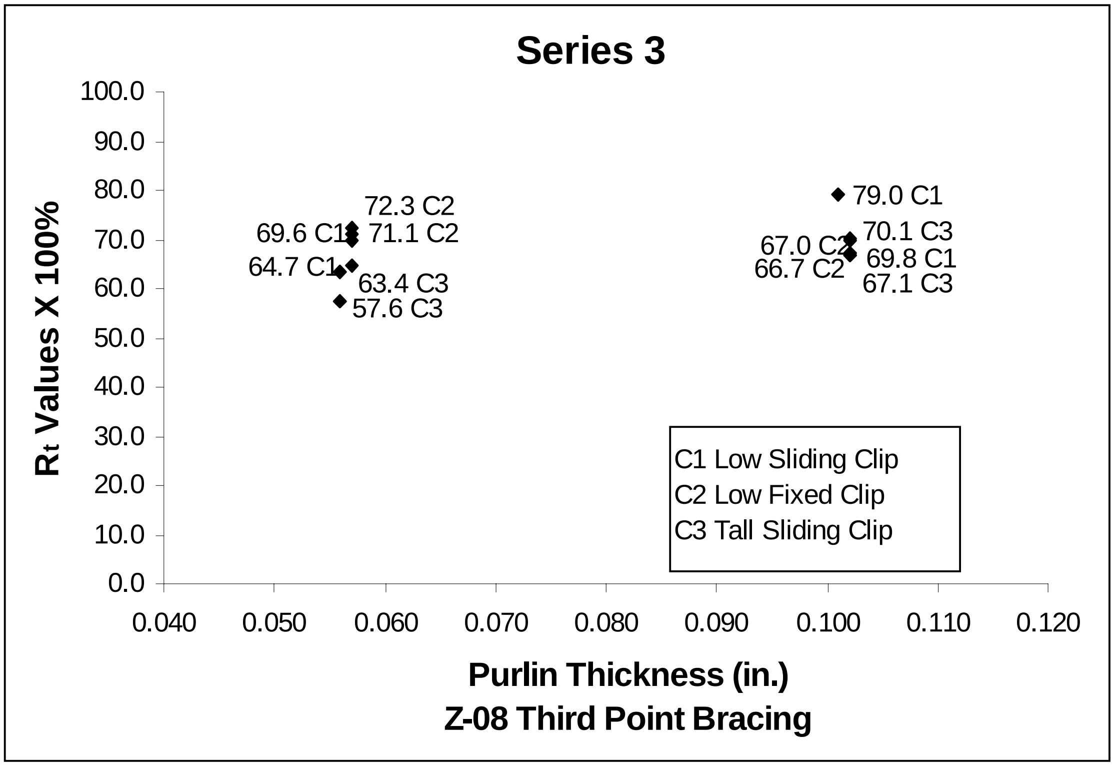

Figure 4.3 Series 3 Reduction Factor Values

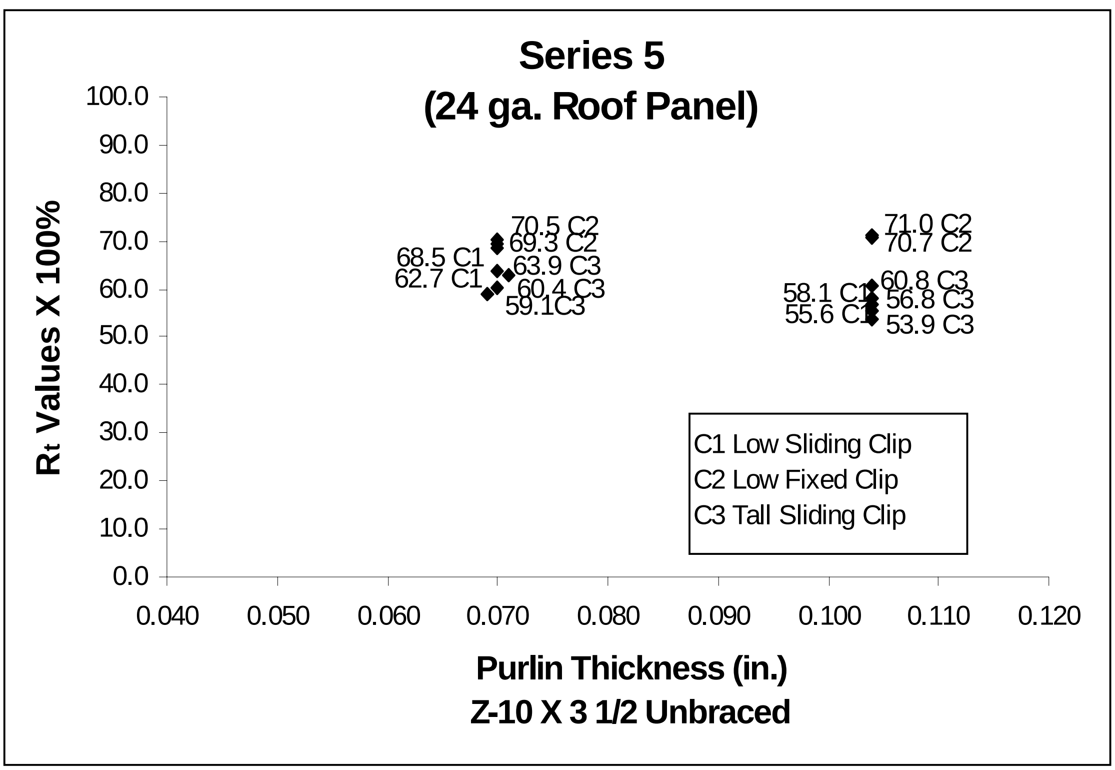

Figure 4.4 Series 5 Reduction Factor Values

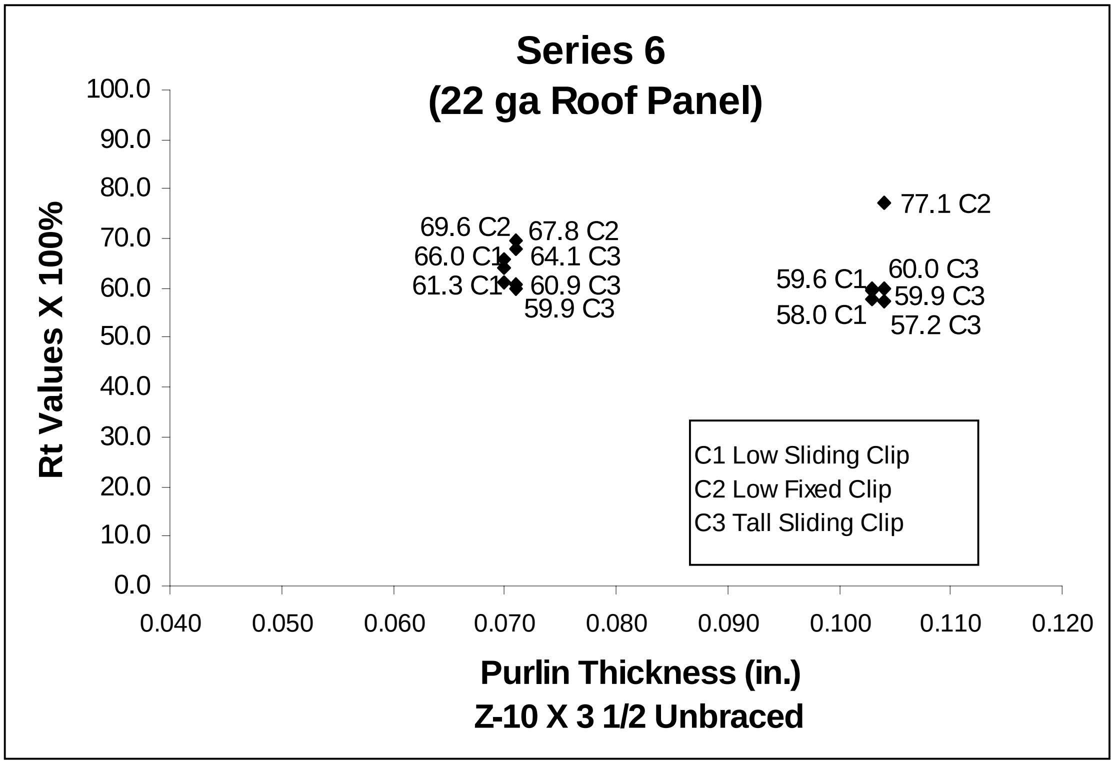

Figure 4.5 Series 6 Reduction Factor Values

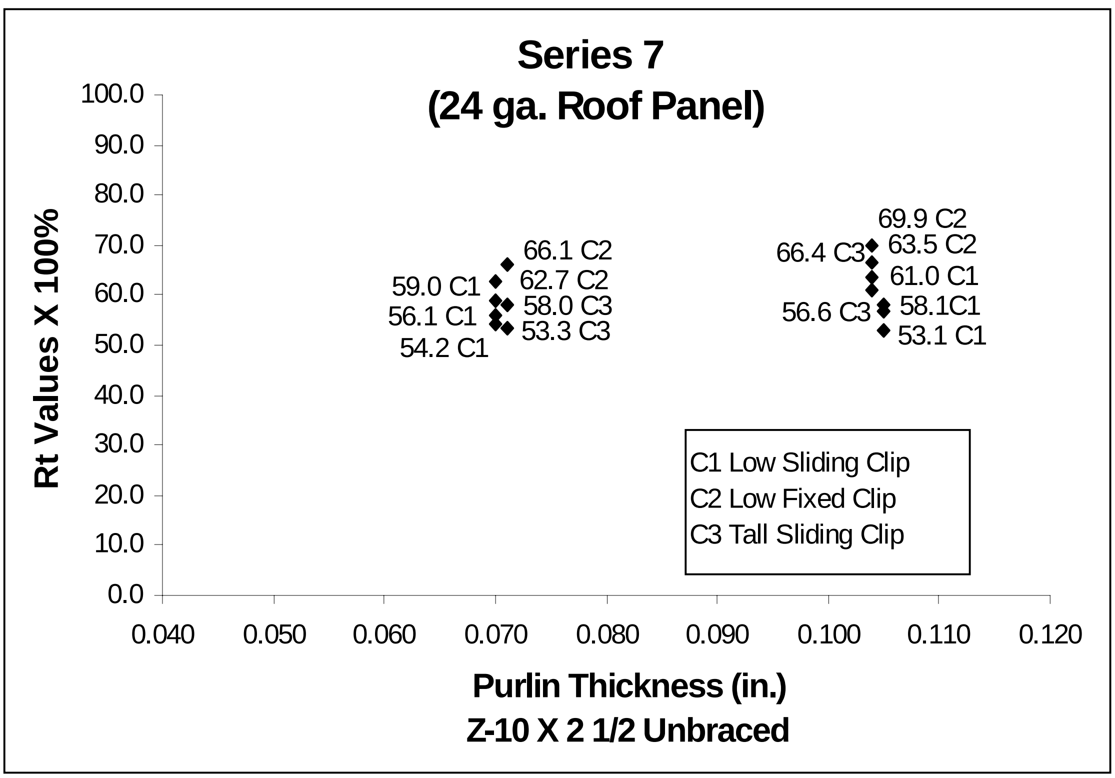

Figure 4.6 Series 7 Reduction Factor Values

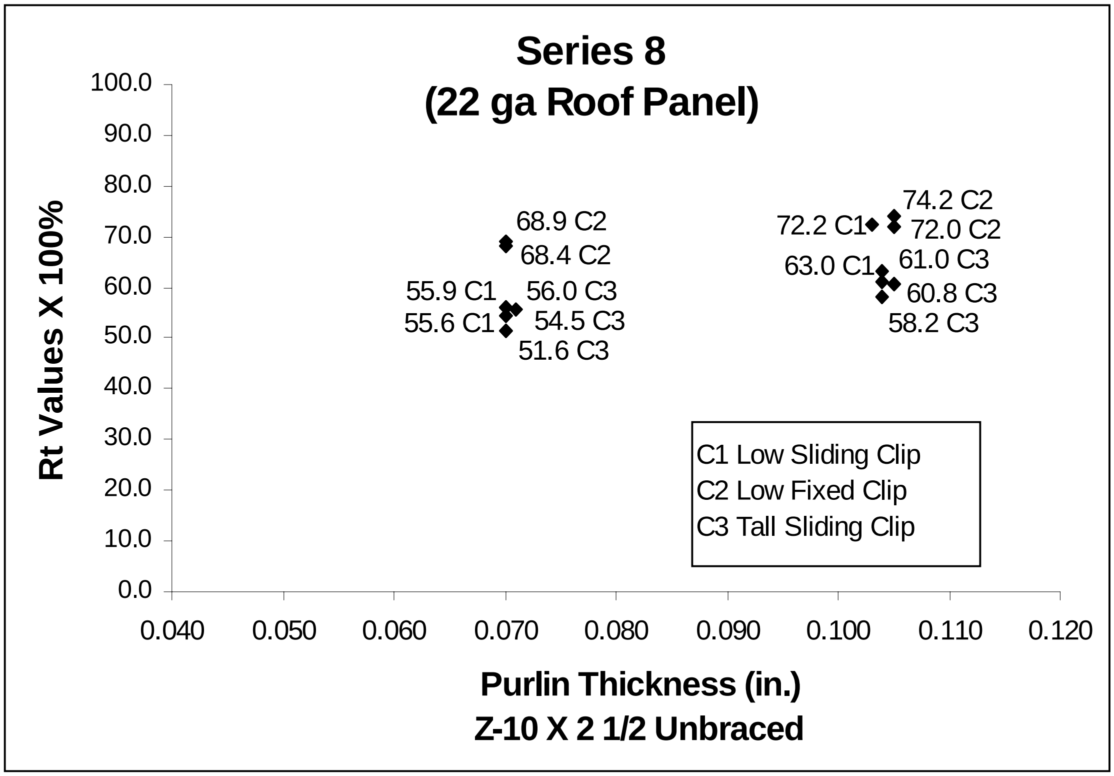

Figure 4.7 Series 8 Reduction Factor Values

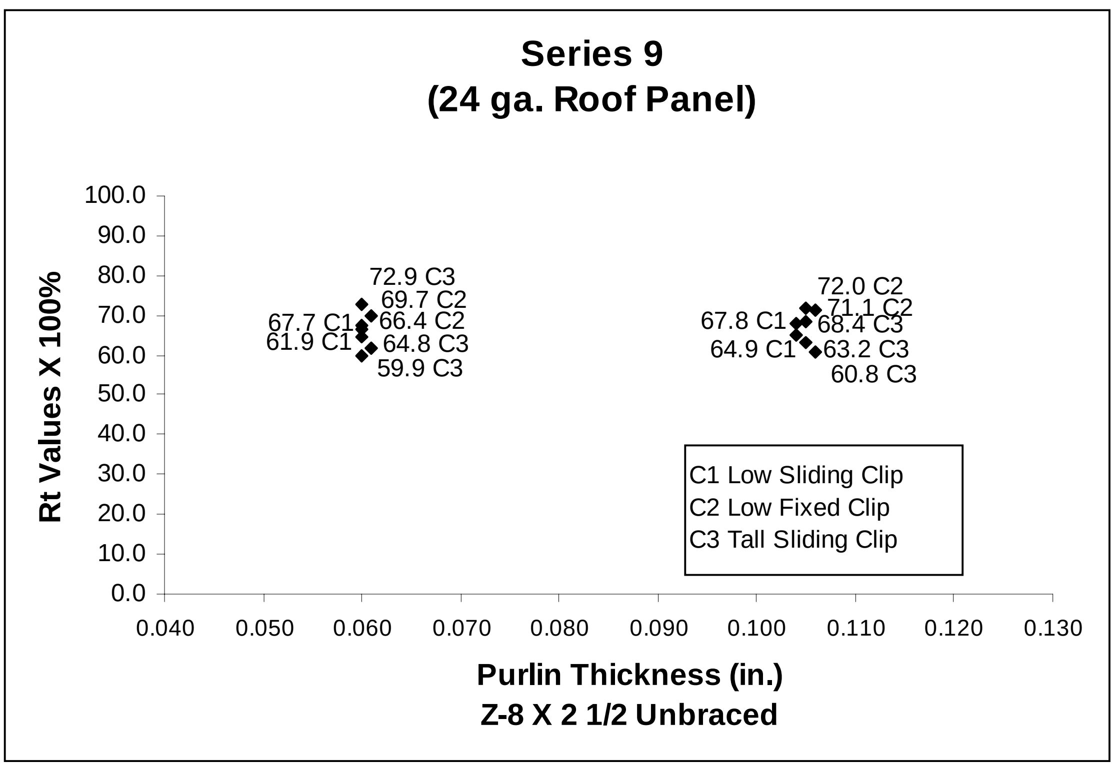

Figure 4.8 Series 9 Reduction Factor Values

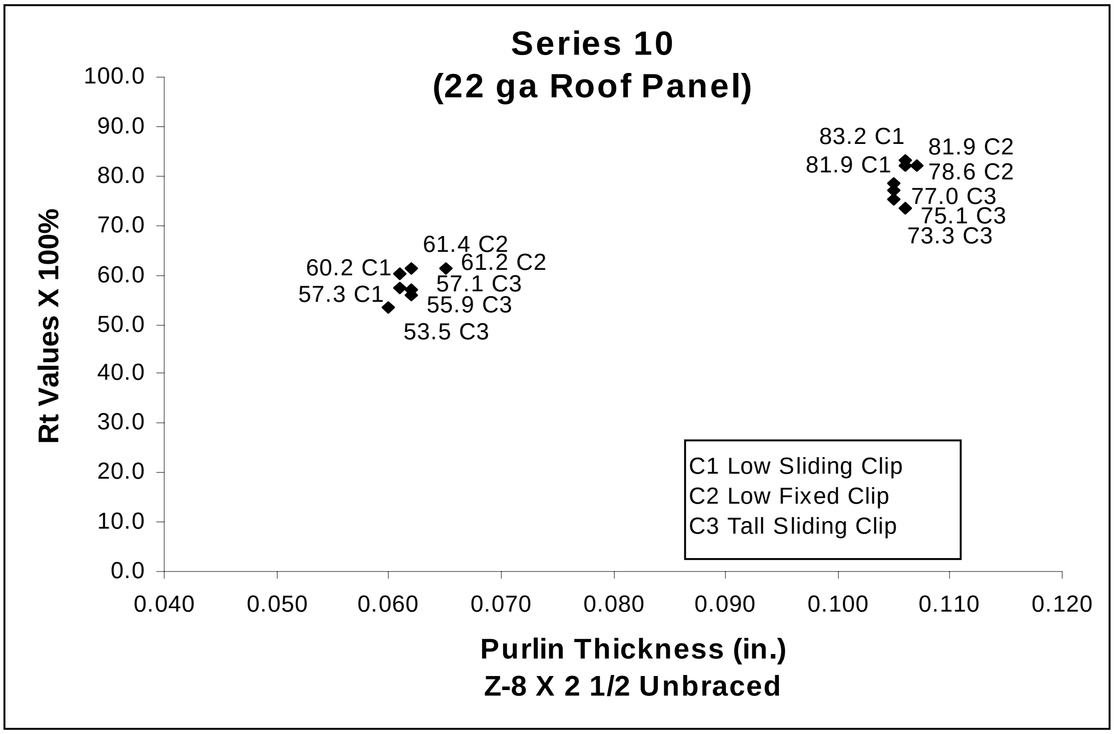

Figure 4.9 Series 10 Reduction Factor Values

CHAPTER V

ANALYSIS OF TEST RESULTS

5.1 Introduction

The primary objective of this study was to examine the possibility of eliminating some roof system parameters from a manufacture's required test matrix for the Base Test Method. The results from the ten series of tests discussed in Chapter IV are now used to evaluate the effects of clip type, purlin flange width, and roof panel thickness on the standing seam roof system strength.

5.2 Effect of Clip Type

It is evident from Figures 4.1 through 4.9 that a relationship exists between clip type and roof system strength. In all series, regardless of component variations used in the base test, one clip type gives lower results. Within the parameters of an individual series the same clip type controls for both the thin and thick purlin web thickness. For all except Series 7 the tall sliding clip gave the lowest set of R_t-values. In Series 7, the low sliding clip gave the lowest results.

5.3 Effect of Purlin Flange Width

To evaluate the effects of purlin flange width on the strength of purlins supporting a standing seam roof system, Figures 5.1 through 5.4 are used. The test data shown in Figures 5.1 and 5.2 is from tests using 10 in. Z-purlins having nominal thicknesses of 0.075 in. and 0.100 in. and 22 gage roof panels. The test data for Figures 5.3 and 5.4 was obtained using the same 10 in. deep purlins with 24 gage roof panels.

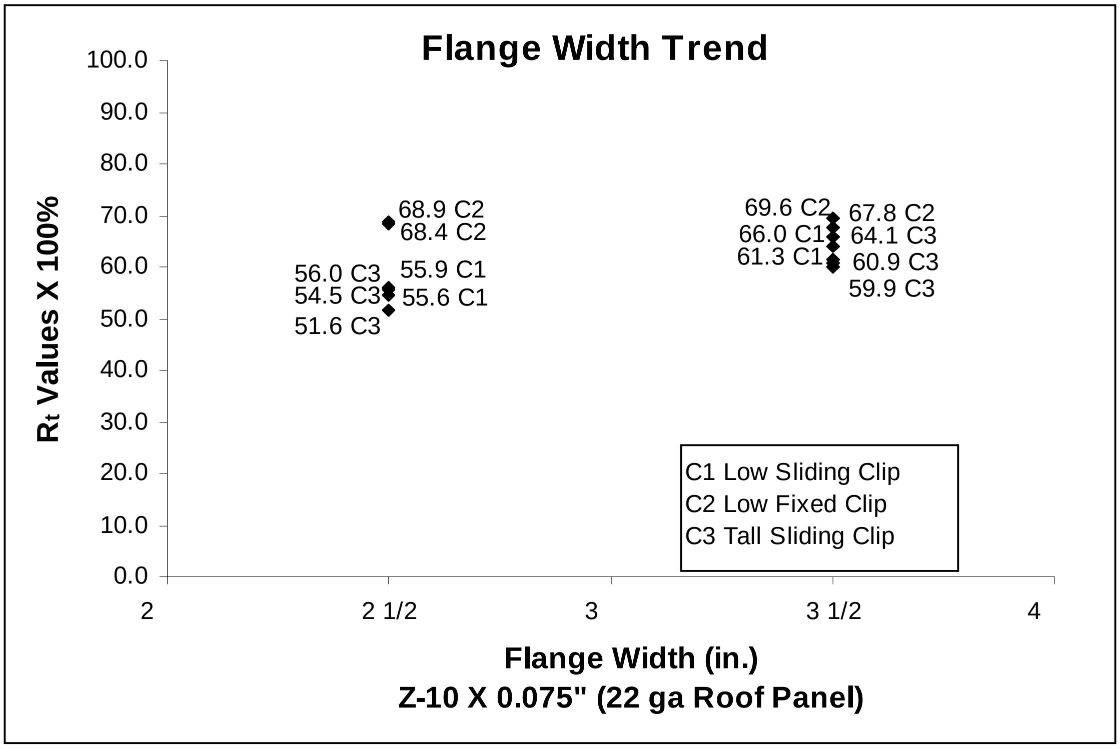

Figure 5.1 Flange Width Effects With 22 ga Roof Panel (Light Purlin)

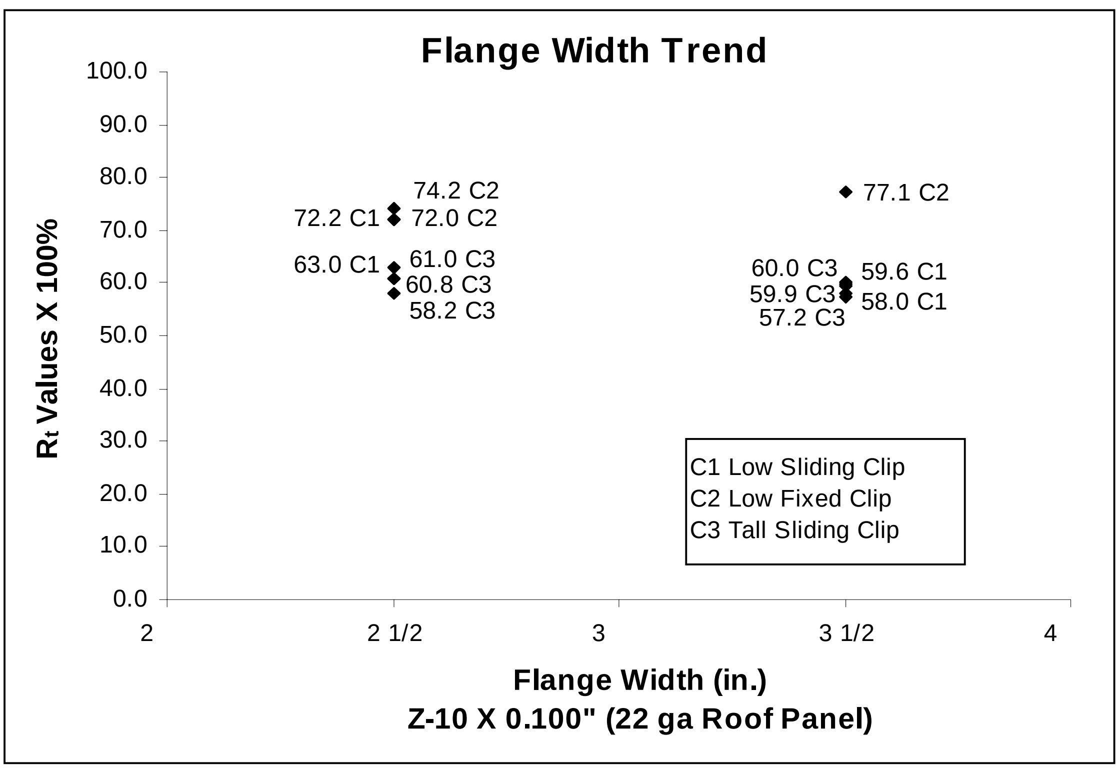

Figure 5.2 Flange Width Effects With 22 ga Roof Panel (Heavy Purlin)

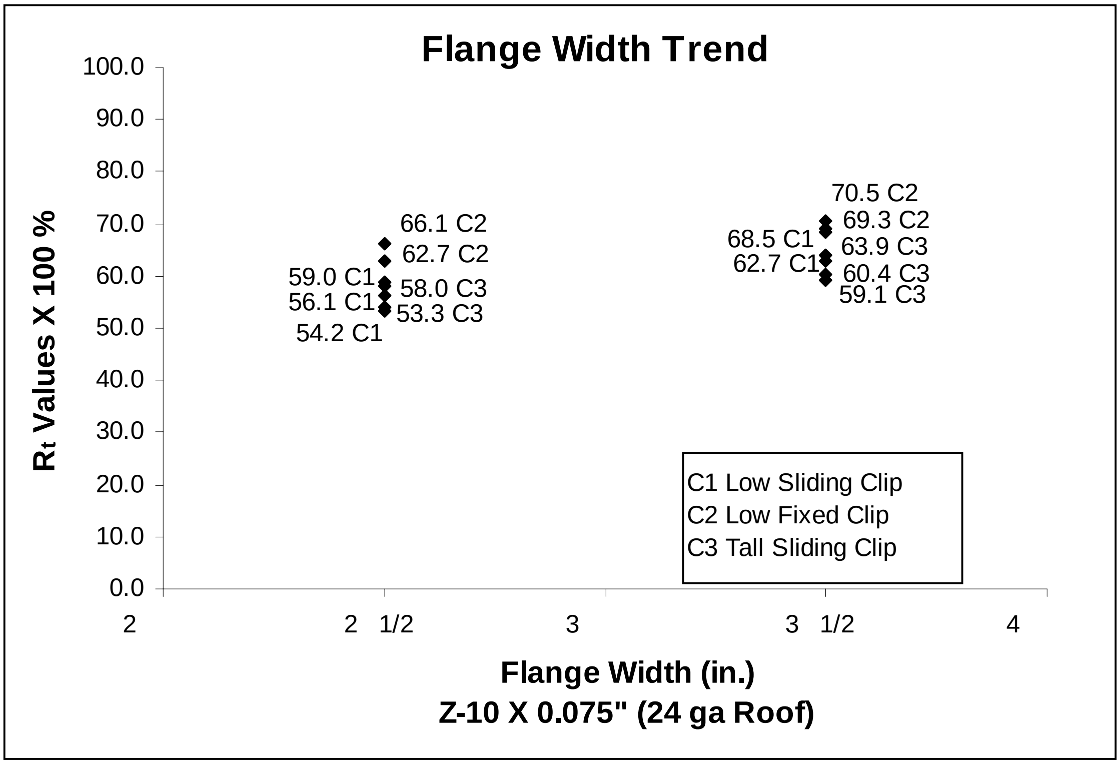

Figure 5.3 Flange Width Effects With 24 ga Roof Panel (Light Purlin)

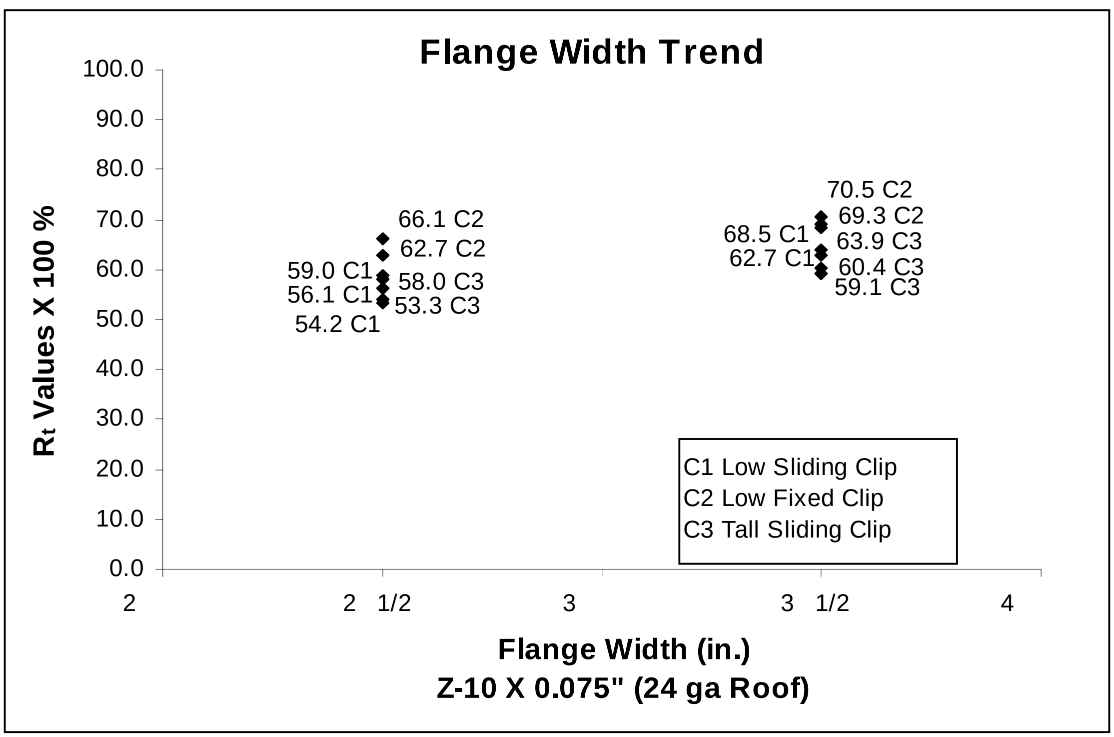

Figure 5.4 Flange Width Effects With 24 ga Roof Panel (Heavy Purlin)

To show that there is no effect on system strength due to purlin flange width the R_t-values for a given clip type for both flange widths must be effectively the same. To investigate this relationship, the average R_t-value for the controlling clip type, was calculated for each of the test data series shown in Figures 5.1 through 5.4. These calculated values are listed in Table 5.1.

Table 5.1 Average R_t-Values (Flange Width Trend)

Series (Fig.)	Flange Width (in.)	Panel Gage	Purlin Depth (in.)	Purlin Thickness (in.)	Controlling Clip Type	Average R_t-Value X 100%	Percent Difference	Note
5.1	2 ½	22	10	0.075	Tall Sliding	54.0	12.3	R_t Smaller for 2 ½ in. Flange
5.1	3 ½	22	10	0.075	Tall Sliding	61.6		
5.2	2 ½	22	10	0.100	Tall Sliding	60.0	-1.7	Essentially the Same
5.2	3 ½	22	10	0.100	Tall Sliding	59.0		
5.3	2 ½	24	10	0.075	Low Sliding	56.4	14.0	R_t Smaller for 2 ½ in. Flange
5.3	3 ½	24	10	0.075	Low Sliding	65.6		
5.4	2 ½	24	10	0.100	Low Sliding	57.4	-0.9	Essentially the Same
5.4	3 ½	24	10	0.100	Low Sliding	56.9		

Note: Positive percent difference indicates lower strength values obtained with 2 ½ in. flange width.
Negative percent difference indicates lower strength values obtained with 3 ½ in. flange width.

From the data in Table 5.1, it is evident that flange width effects the strength of the thinner purlins but has minimal effect on the thicker purlins. For the thinner purlins, lower average R_t-values resulted when the narrower flange width was used.

5.4 Effects of Roof Panel Thickness

To evaluate the effects of roof panel thickness on the strength of a standing seam roof system, test data from Figures 5.5 through 5.10 was analyzed. Figures 5.5 and 5.6 contain test data generated using 10 in. Z-purlins having nominal thicknesses of 0.075 in. and 0.100 in. and 2 ½ in. flange widths. The test data for Figures 5.7 and 5.8 was obtained using the same 10 in. deep purlins with 3 ½ in. flange widths. For Figure 5.9 and 5.10 test data was obtained from tests conducted with both light and heavy 8 in. Z-purlins with flange widths of 2 ½ in.

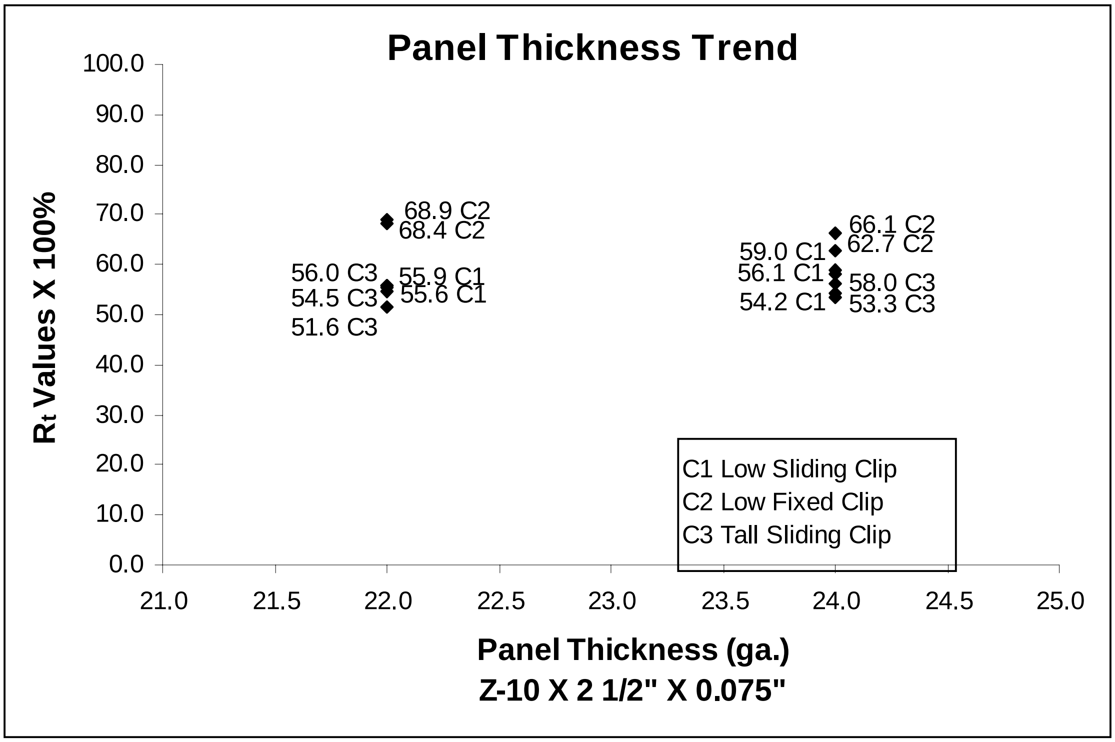

Figure 5.5 Roof Panel Effects, 2 ½ in. Flange Width, Light Purlin

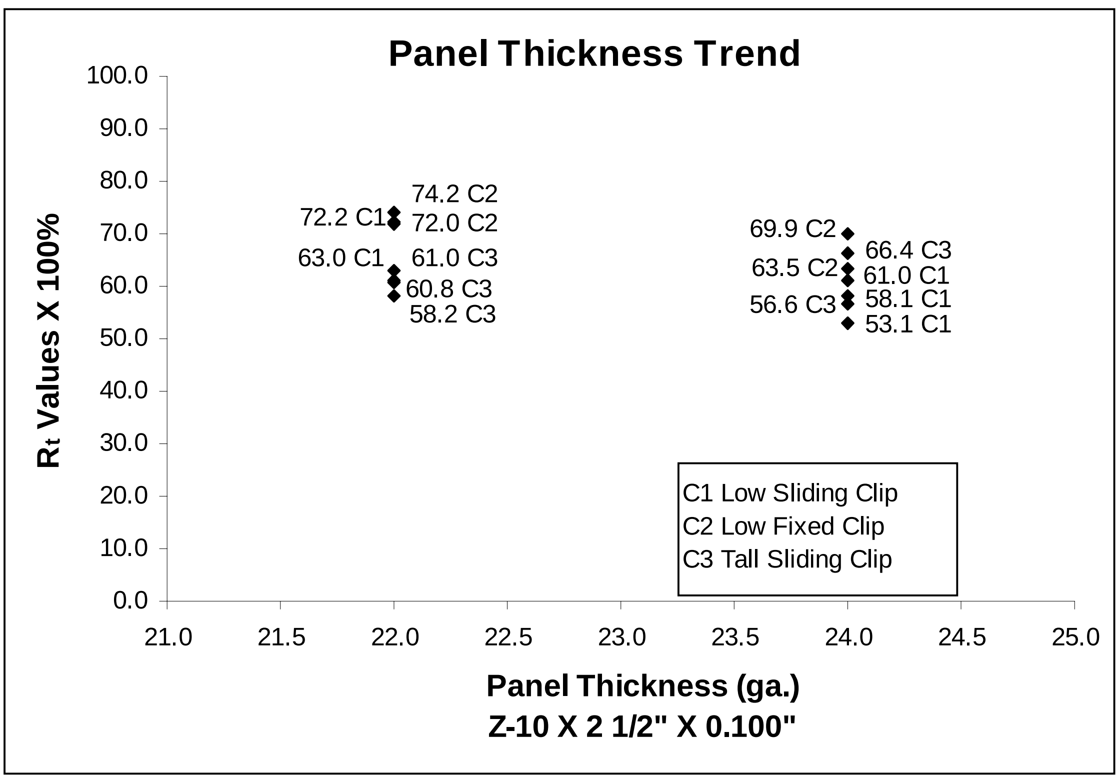

Figure 5.6 Roof Panel Effects, 2 ½ in. Flange Width, Heavy Purlin

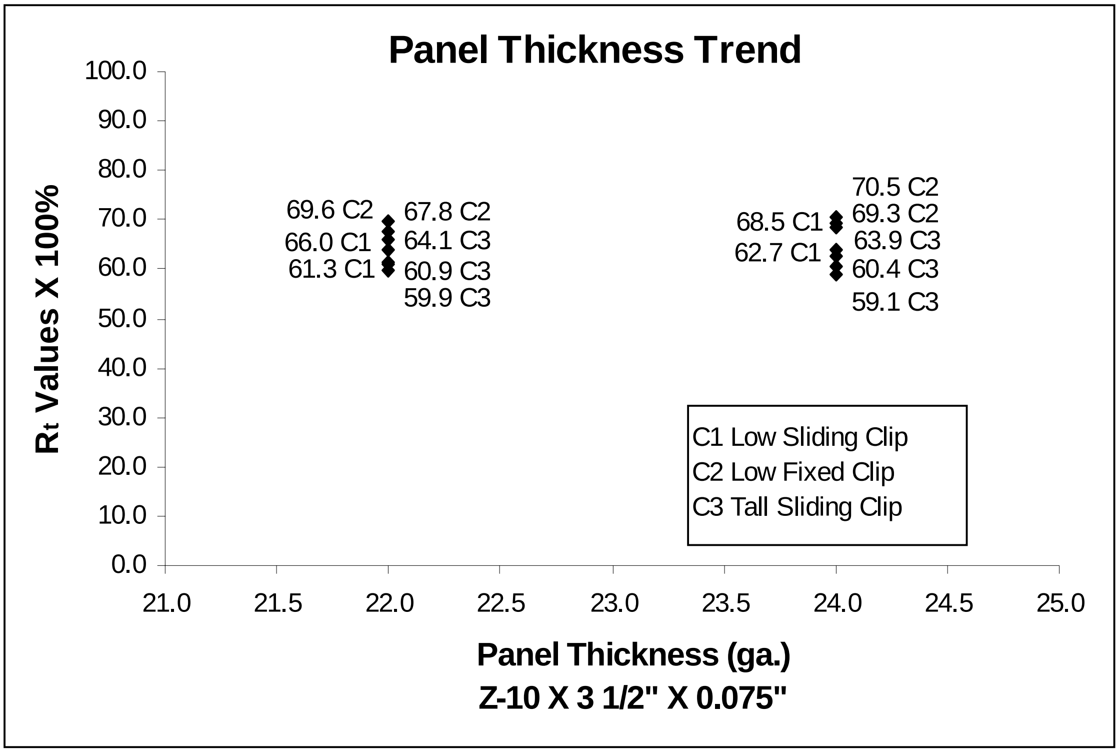

Figure 5.7 Roof Panel Effects, 3 ½ in. Flange Width, Light Purlin

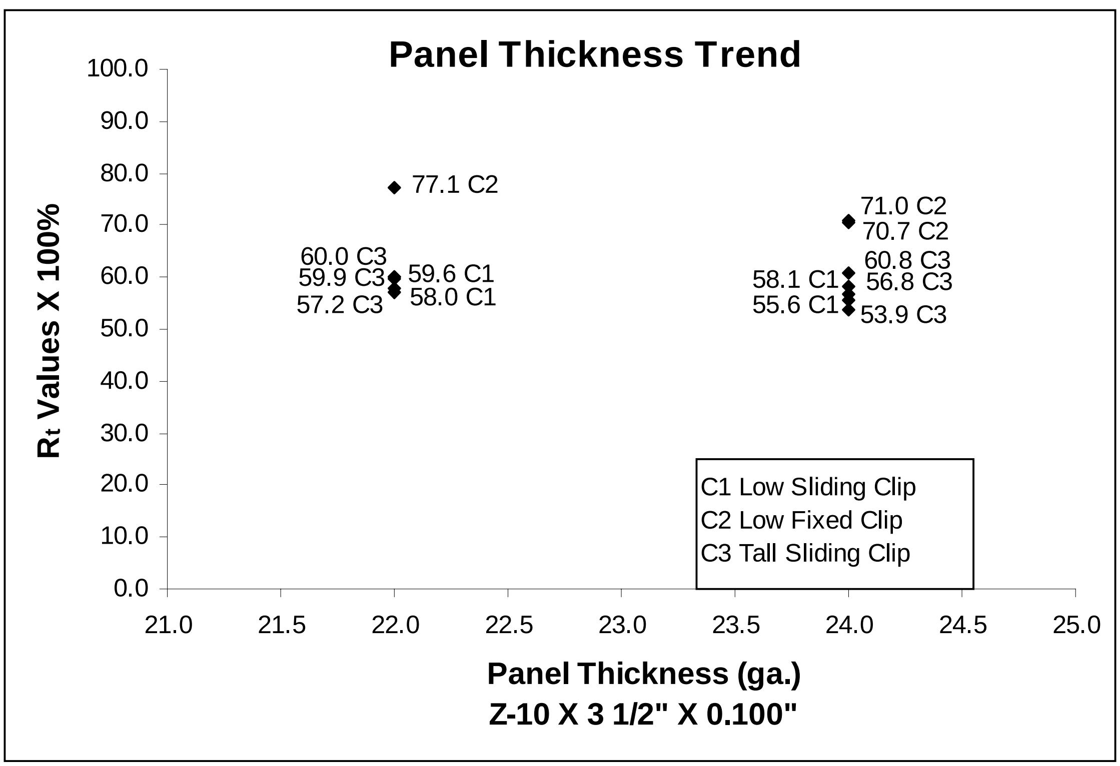

Figure 5.8 Roof Panel Effects, 3 ½ in. Flange Width, Heavy Purlin

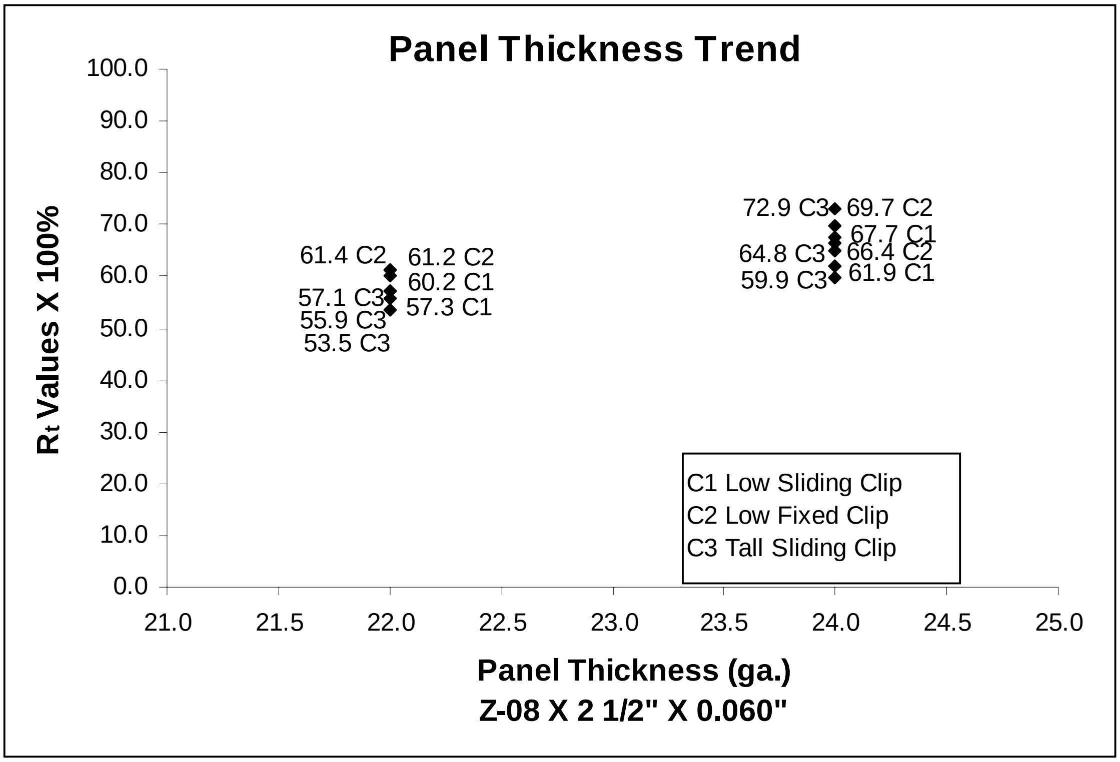

Figure 5.9 Roof Panel Effects, 2 ½ in. Flange Width, Light Purlin

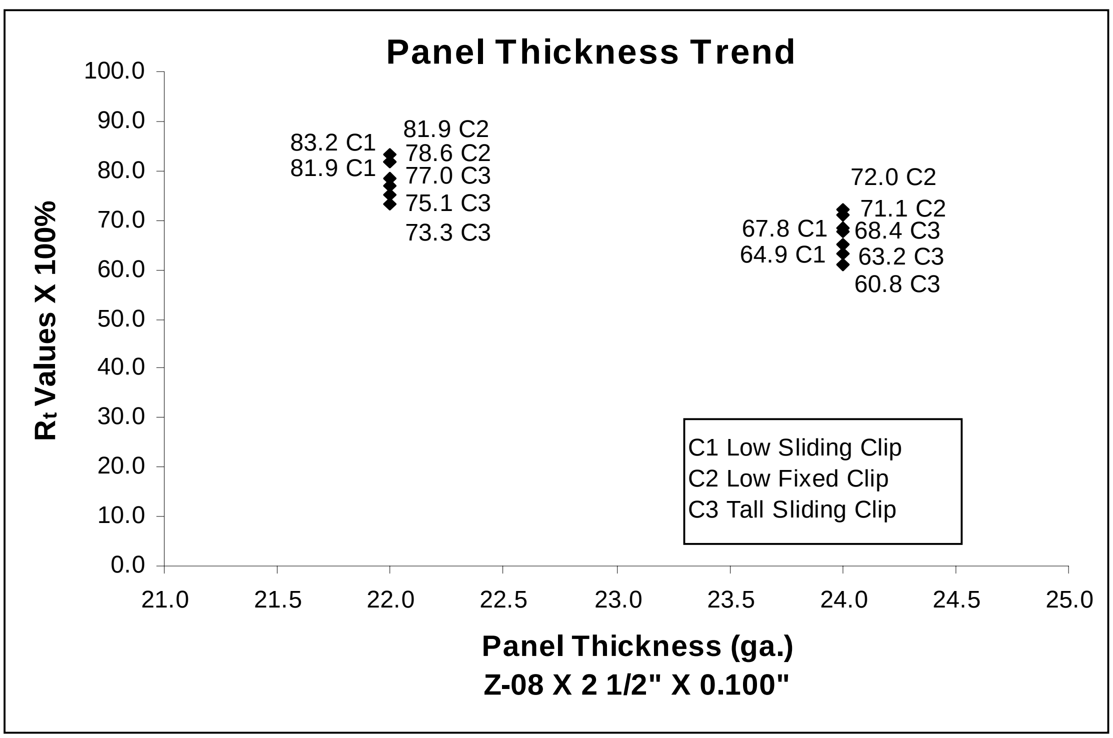

Figure 5.10 Roof Panel Effects, 2 ½ in. Flange Width, Heavy Purlin

To establish what effect roof panel thickness has on system strength, the R_t-values for a given clip type for both panel gages must be effectively the same. Once again the average R_t-value, for controlling clip type, was calculated for each of the test data series shown in Figures 5.5 through 5.10. These calculated values are tabulated in Table 5.2.

Table 5.2 Average R_t-Values (Panel Thickness Trend)

Series (Fig.)	Panel Gage	Flange Width (in.)	Purlin Depth (in.)	Purlin Thickness (in.)	Controlling Clip Type	Average R_t-Value X 100%	Percent Difference	Note
5.5	22	2 ½	10	0.075	Tall Sliding	54.0	3.1	Essentially the Same
5.5	24	2 ½	10	0.075	Tall Sliding	55.7		
5.6	22	2 ½	10	0.100	Tall Sliding	60.0	2.4	Essentially the Same
5.6	24	2 ½	10	0.100	Tall Sliding	61.5		
5.7	22	3 ½	10	0.075	Tall Sliding	61.6	-0.9	Essentially the Same
5.7	24	3 ½	10	0.075	Tall Sliding	61.1		
5.8	22	3 ½	10	0.100	Tall Sliding	59.0	-3.1	Essentially the Same
5.8	24	3 ½	10	0.100	Tall Sliding	57.2		
5.9	22	2 ½	8	0.060	Tall Sliding	55.5	15.8	R_t for Tests With 22 ga. Panels is Lower
5.9	24	2 ½	8	0.060	Tall Sliding	65.9		
5.10	22	2 ½	8	0.100	Tall Sliding	75.1	-17.2	R_t for Tests With 24 ga. Panels is Lower
5.10	24	2 ½	8	0.100	Tall Sliding	64.1		

Note: Positive percent change indicates lower strength values obtained with 22 ga. roof panel thickness.
Negative percent change indicates lower strength values obtained with 24 ga. roof panel thickness.

From this data it is apparent that panel thickness does not significantly effect the strength of systems constructed with 10 in. deep Z-purlins. However, there is an effect on the strength of the systems constructed using 8 in. deep purlins. For the thinner 8 in. purlin tests the 22 gage roof panel gives lower results. Conversely, the 24 gage roof panel thickness gives lower results for the thicker 8 in. deep purlin tests.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

6.1 Summary

This study used results obtained from nine series of gravity loaded base tests of standing seam roof systems. Each series consisted of 11 to 14 base tests. The initial three series were used to examine the effects of clip type on the strength of the roof systems. The final six series of tests were used to examine the effects of flange width and roof panel thickness. All nine series were constructed using Z-purlin sections with flanges facing the same direction (like orientation).

6.2 Recommended Procedure

Based on the data analyzed in the study, clip type, purlin flange width, and roof panel thickness all have an effect on the strength of standing seam roof systems. By comparing the strength reduction factors obtained from the tests using various roof components, the following trends were found: a single clip type produced the lowest results when compared to the other clips. Tests using purlins with a narrow flange width resulted in lower strengths for both thin and thick purlins of the same nominal cross-section. Finally, roof panel thickness was found to have no effect on the strength of systems constructed with 10 in. deep purlins but did effect the strength when 8 in. deep purlins were used. Although none of the roof components can be completely eliminated from a test matrix, by using trend relationships an acceptable test protocol can be developed for reducing the number of tests required for the Base Test Method.

For example, assuming a manufacturer has three clip types, two flange widths for each purlin type, and two nominally identical panel profiles rolled in two gages, the following procedure will result in a R-value relationship for all combinations with relatively few base tests. This proposed procedure assumes that the combination of one panel thickness, one clip type, and the purlin cross section with the narrower flange width results in the lowest R_t-value for all other combination of parameters. The procedure is:

- The clip type, which is thought to result in the lowest R_t-value, is selected. For illustration, type C3 (tall sliding) is assumed.
- Using this clip type, the thinner panel, and the purlin with the narrow flange width, two base tests are conducted for one depth purlin of the same nominal cross-section. One base test is conducted with the thinnest purlin and one test with the thickest purlin in the inventory.
- With the R_t-values from the two tests a trend line is found as shown in Figure 6.1. Depending on the details of the system, the trend line can have either positive or negative slope as shown.

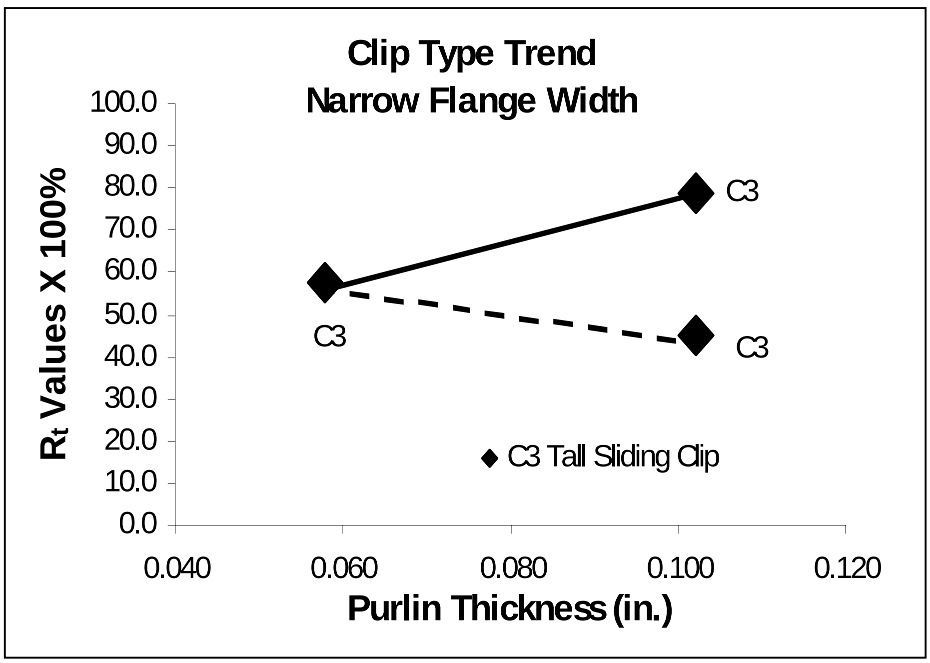

Figure 6.1 Possible Clip Type Trend Relationships

- To verify the choice of clip, two additional tests are conducted using the purlin thickness that resulted in the lower R_t-value, one with each of the other two clip types (C1 and C2). In Figure 6.1, the thinner purlin controls for the solid trend line in and the thicker purlin controls for the dashed trend line.

- If the original clip type does indeed result in the lowest R_t-value as shown in Figure 6.2, the choice of clip type is verified.

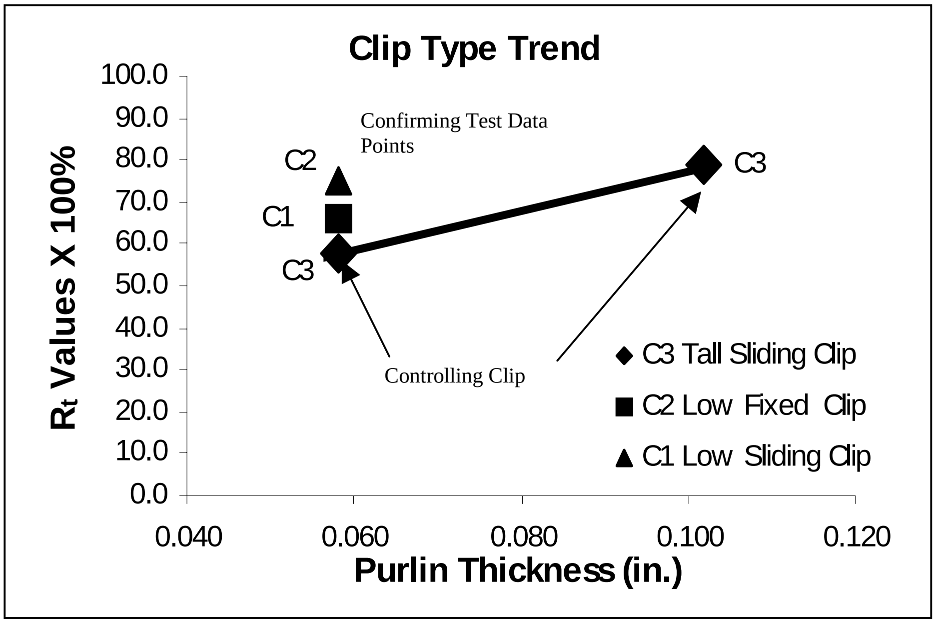

Figure 6.2 Confirmation of Initial Choice of Clip Type

- If the original clip does not result in the lowest R_t-value, a test using the clip with the lowest R_t-value and the other purlin thickness is conducted. Figure 6.3 shows

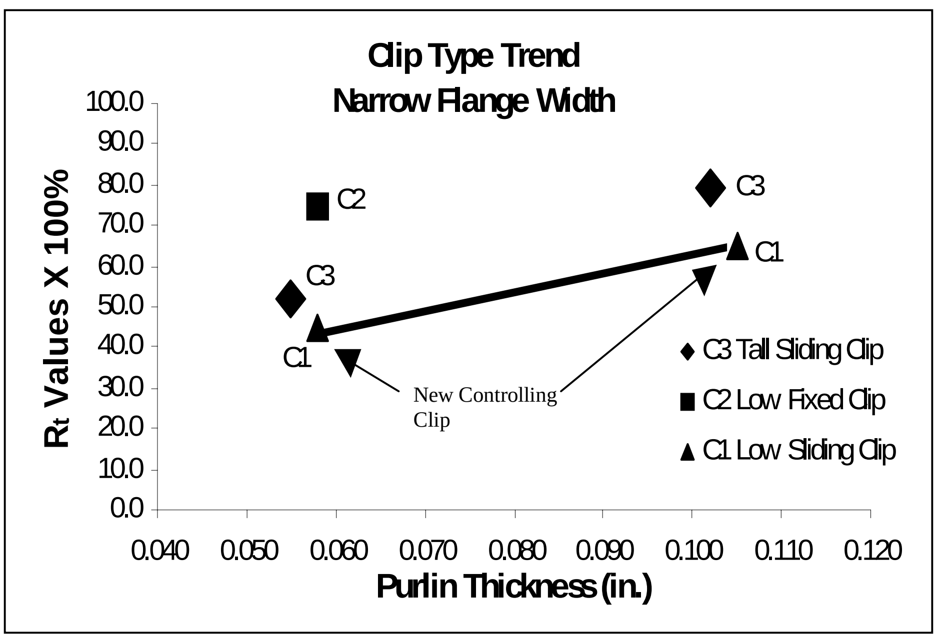

Figure 6.3 Confirmation of Clip Type

the resulting data, assuming type C2 is the controlling clip type.

- Knowing the controlling clip type, two additional tests are required to validate the choice of panel thickness: one test is conducted using the controlling clip-type, the thinner purlin and the other panel thickness; the other test is conducted using the selected clip-type, the thicker purlin thickness and the other panel thickness.
- Using the combination of clip-type and panel thickness, which resulted in the lowest R_t-value for the two purlin thicknesses, the remaining four tests required for the Base Test Method are then conducted and the R-value relationship, Equation 2.6, is developed. Figure 6.4 shows the completed test sequence and the final R-value line.

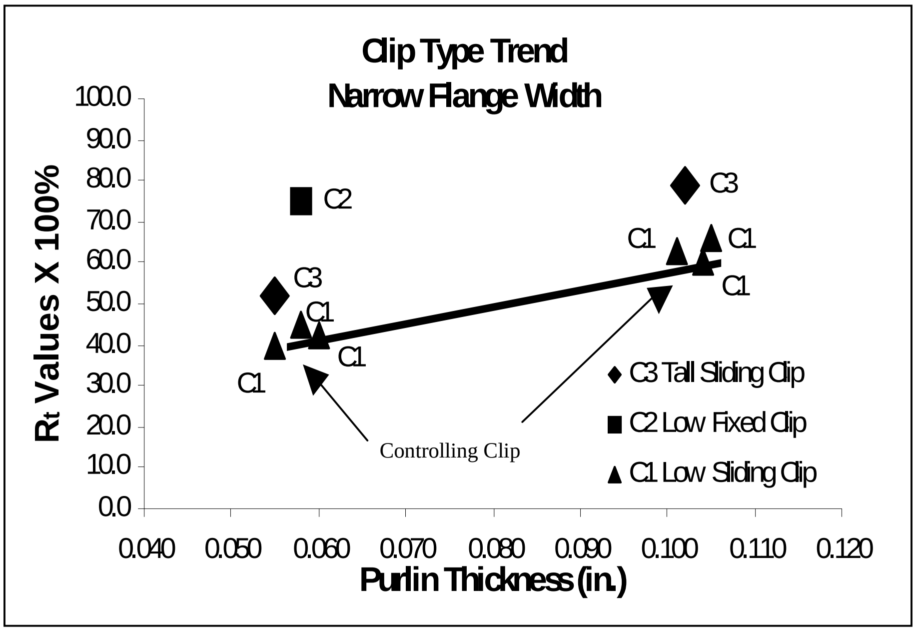

Figure 6.4 Final Results

Using the proposed reduction procedure and assuming only one purlin depth and one purlin cross-section, the minimum required number of tests, for an inventory with three clip types, two flange widths, and two panel thicknesses, is:

- 2 – Tests with the initial clip type assumption to determine slope of the trend line (one thin and one thick purlin).
- 2 – Tests to confirm initial clip-type selection (two remaining clip types).

- 1 – Tests to determine panel thickness trend (with controlling clip type).
- 4 – Tests required to meet the requirements of the Base Test Method.

That is, 2 + 2 + 1 + 4 or 9 tests. Thus, the required number of base tests is reduced from 78 tests (see Section 1.1) to 9 tests, best-case scenario. The worst-case scenario requires 14 tests.

6.3 Illustrative Example

The following demonstrates the recommended design procedure using the test data from test Series 9 and 10, Appendices H and I, respectively. The following components were used in the two test series:

- Three clip types: low sliding clip (C1), low fixed clip (C2), and tall sliding clip (C3)
- 8 in. deep Z-purlin with at least two web thicknesses.
- Two flange widths: 2 ½ in. and 3 ½ in.
- 22 ga. and 24 ga. roof panel thicknesses having nominally identical profiles.

The first step is to select a clip type. Assuming the tall sliding clip, C3, controls, the initial two tests are conducted using the thinnest and thickest 8 in. deep Z-purlins with 2 ½ in. flange width (narrow flange) and the 22 ga. roof panel. The results of these tests are shown in Figure 6.5. The thinner purlin gives the lower R_t-value of 57.1 percent.

Based on these results, tests are conducted using the other two clip types, low fixed, C2, and low sliding, C3, are tested using the thinner purlin thickness, with all other roof components remaining nominally the same. The resulting R_t-values for the tests with the low fixed and low sliding clip are shown in Figure 6.6. The R_t-values obtained where 61.4 percent and 60.2 percent, confirming that the high sliding clip controls. If the original clip selection did not result in the lowest R-value, a test using the clip with the lowest R-value and the other purlin thickness would be conducted.

After finding the controlling clip type and purlin thickness that results in the lowest R_t-value, the next step is to validate the panel thickness assumption. To do this, a test constructed using the same clip type and purlin thickness with the other roof panel

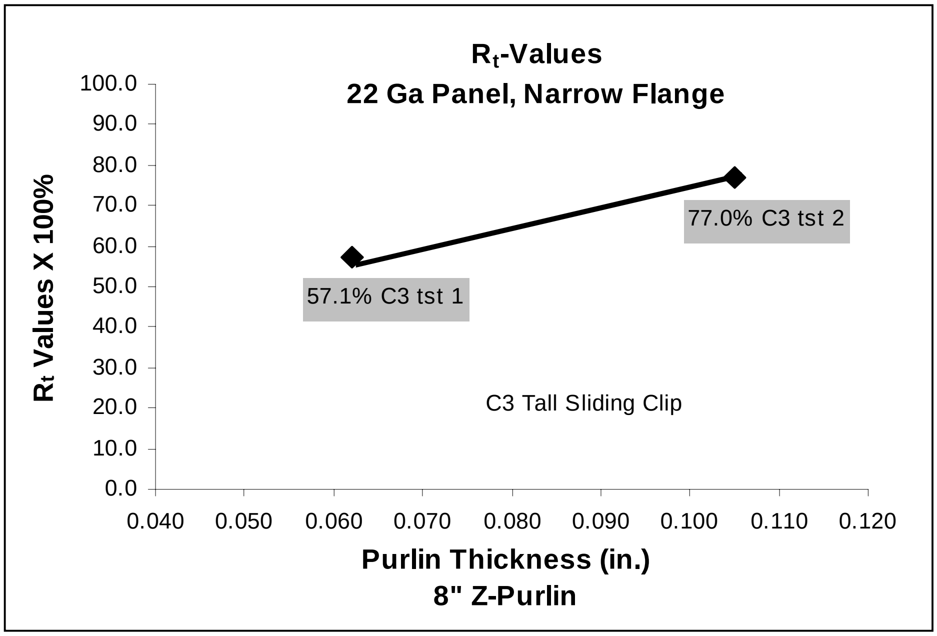

Figure 6.5 Initial Tests with Assumed Controlling Clip Type

thickness is constructed. From Figure 6.6, the high sliding clip, C3, and the thinner purlin result in the lowest R_t-value. Therefore, a test is conducted using the same clip type and purlin thickness but with 24 gage deck material. The resulting R_t-value is 64.8 percent, which is greater than the R_t-value of 57.1 percent when the 22-gage roof panel was used as shown in Figure 6.7.

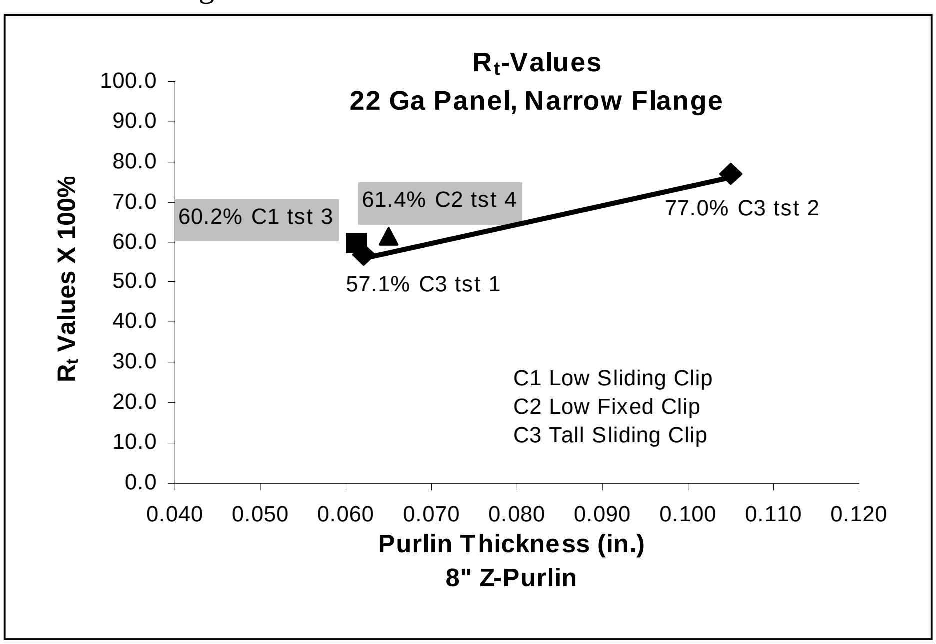

Figure 6.6 Controlling Clip Type Verification

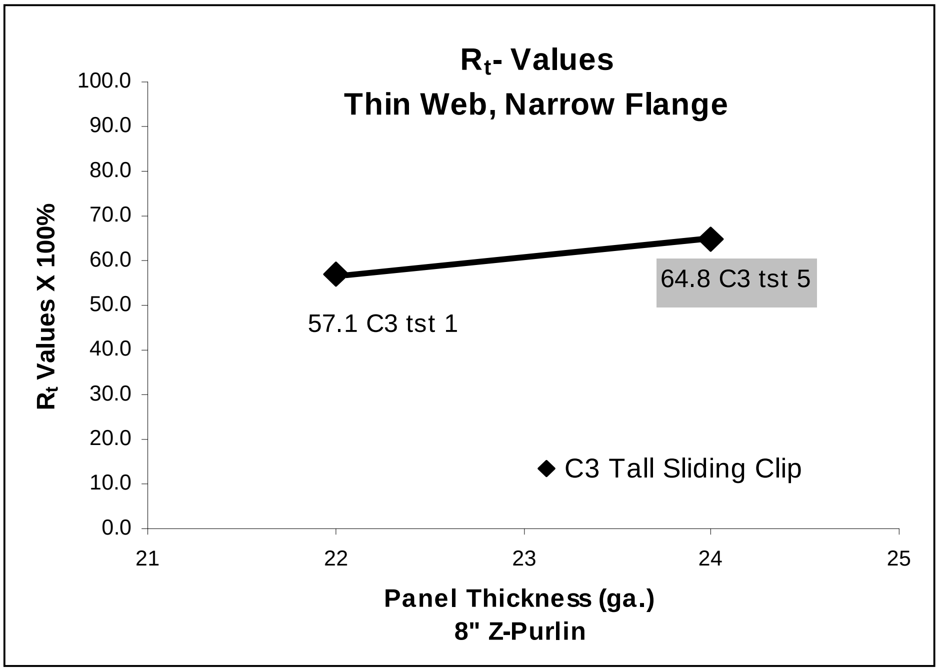

Figure 6.7 Roof Panel Trend Verification

Knowing the combination of clip-type and panel thickness, which results in the lowest R_t-value for the two-purlin thicknesses, four additional tests are required to satisfy the requirements of the Base Test Method. Figure 6.8 shows the results of the completed

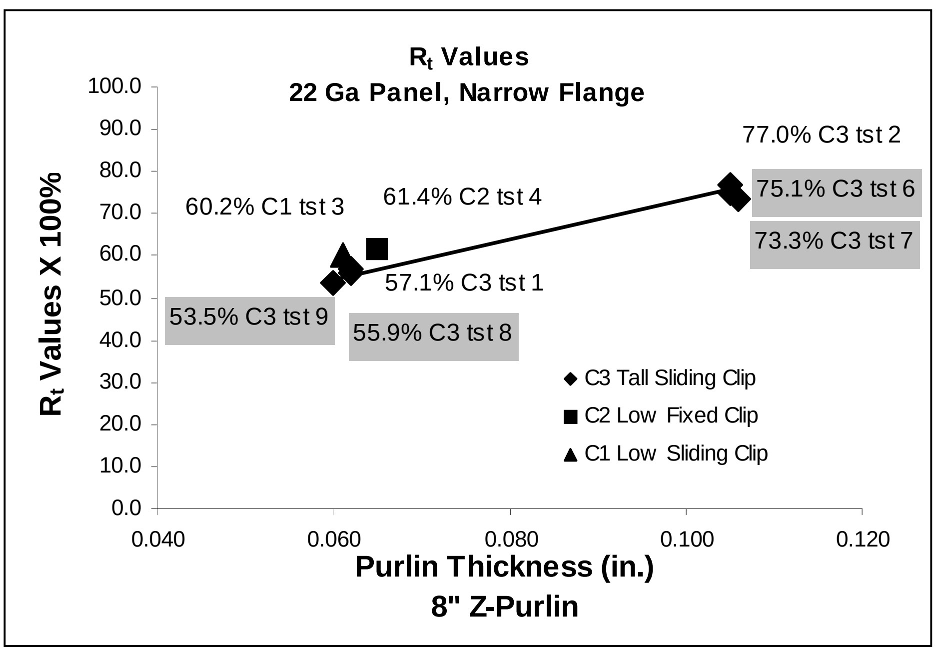

Figure 6.8 Final Verification

Table 6.1 Summary of Gravity Loading Base Test Results

Test No.	Purlin Thickness (in.)	R_t-value	$M_{nt} = S_{eff} * F_y$ (K-in.)
1	0.062	0.571	110.5
8	0.062	0.559	118.3
9	0.060	0.535	116.3
Average		0.555	115.03
Standard Deviation		0.018	
2	0.105	0.770	215.3
6	0.105	0.751	218.3
7	0.106	0.733	219.7
Average		0.751	217.77
Standard Deviation		0.019	

test sequence. Based on the test data generated, the expression for the reduction factor (Equation 2.6) is developed as follows. From data in table 6.1,

$$R_{t_{\min}} = 0.555 - 0.018 = 0.537$$

$$R_{t_{\max}} = 0.751 - 0.019 = 0.733$$

$$\overline{M}_{nt_{\min}} = 115.03 \text{ K-in.}$$

$$\overline{M}_{nt_{\max}} = 217.77 \text{ K-in.}$$

Thus, the reduction factor equation using the data from this example is:

$$R = \left(\frac{0.733 - 0.537}{217.77 - 115.04} \right) \times \left(M_n - 115.03 \right) + 0.537$$

$$= \left(1.908 \times 10^{-3} \right) \times \left(M_n - 115.03 \right) + 0.537$$

Where M_n = nominal flexural strength of section for which R is being evaluated (S_e*F_y).

If the initial choice of roof panel thickness did not result in the lowest R-value, as shown in Figure 6.7, three additional tests would be required to determine the controlling combination. For example, suppose that an R_t-value of 45.0 percent resulted when the 24 gage roof panel was used, as shown in figure 6.9.

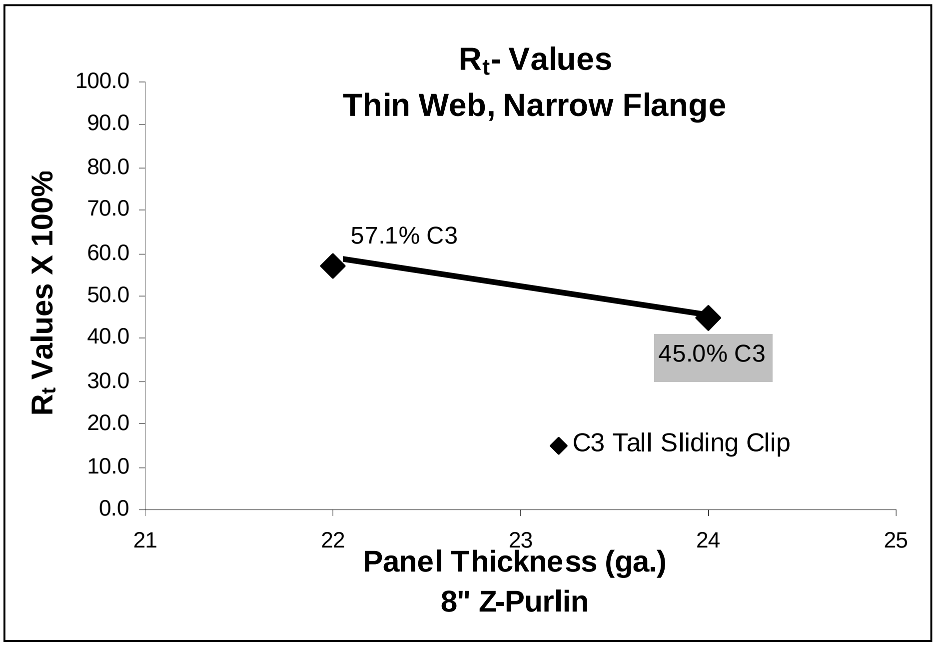

Figure 6.9 Roof Panel Thickness Trend

Next a controlling purlin thickness, with the now controlling panel thickness, needs to be determined. A test is constructed using the same clip type and panel thickness with the thicker purlin. With the R_t-values from the two tests a trend line is found as shown in Figure 6.10. The thinner purlin gives the lower R_t-value of 45.0 percent. That is the thinner purlin is the controlling purlin thickness for the roof system constructed with the 24 gage roof panel.

To verify the controlling clip, two additional tests are conducted using the purlin thickness, which resulted in the lower R_t-value, one with each of the other two clip types (C1 and C2). These two data points are plotted and used to verify that the initial controlling clip type continues to give the lowest R_t- value. The resulting R_t-values for the test with the low fixed and low sliding clip are shown in Figure 6.11. The R_t-values

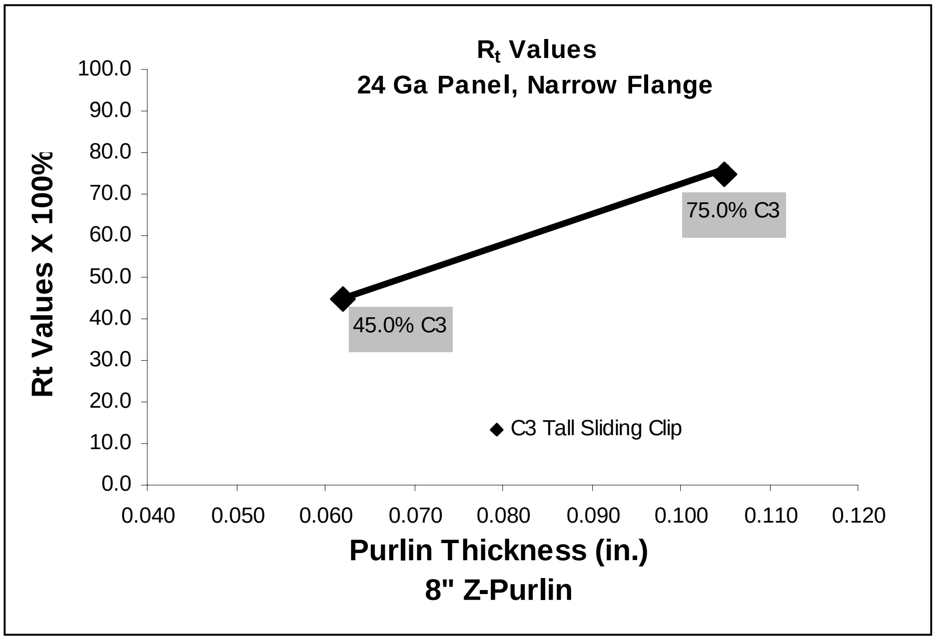

Figure 6.10 Determination of Panel Thickness Trend

obtained where 55.0 percent and 65.0 percent, confirming that the high sliding clip controls.

Knowing the combination of clip-type and purlin thickness, which resulted in the lowest R_t-value for the 24 ga roof materials, the remaining four tests required for the

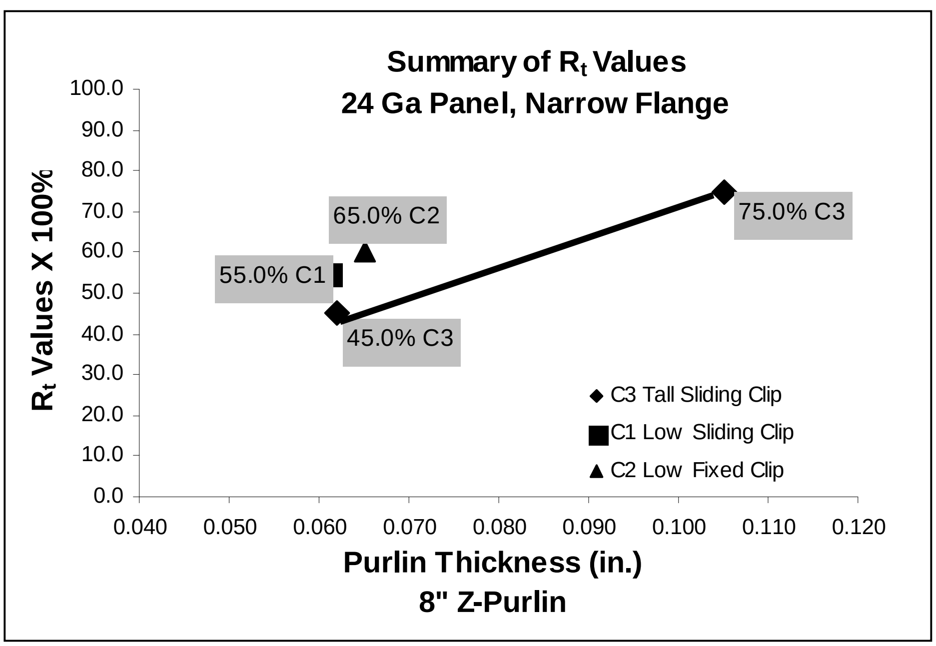

Figure 6.11 Controlling Clip Type Verification

Base Test Method are then conducted and the R-value relationship, Equation 2.6, is then developed, as shown in the previous example.

Based on the results from this testing scenario the required number of base tests increases from 9 to 11 tests. Obviously the number of tests is still significantly lower than the 78 tests required from the original test procedure

In summary, the proposed test protocol will provide a significant savings to manufactures. The protocol eliminates the need to conduct a series of base tests for each set of roof system component configurations produced by the manufacturer.

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APPENDIX A

Series 1 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION: Chief Test 1 (Z10)
DATE: 11/24/98

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam
Span………………………………………	1@30'-0"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing…………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners…………………………	None
Purlin Orientation………………………	Both top flanges toward ridge
Insulation…………………………..	6" Metal Building Insulation
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.076"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.27	in. of water
Applied Line Loading =	44.199	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.43	plf
Ridge Purlin Correction =	6.17	plf
Total Applied Load =	54.69	plf
Maximum Moment =	73.83	kip in.

THEORETICAL FAILURE LOAD: (F_y= 54.7 ksi)

Moment = $F_y S_{eff}$ =	54.7(3.31)	181.1	kip-in.
Equivalent Line Load =	134.12	plf	

R-VALUE:

R = Failure/Theoretical = 54.69/134.12 0.408

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: Chief Test 2 (Z10)
DATE: 10/21/98

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam
Span………………………………………	1@30'-0"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing…………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners…………………………	None
Purlin Orientation………………………	Both top flanges toward ridge
Insulation…………………………..	6" Metal Building Insulation
Clip Type…………………………………	High, Sliding
Purlin Thickness………………………	0.076"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.30	in. of water
Applied Line Loading =	44.754	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.40	plf
Ridge Purlin Correction =	5.78	plf
Total Applied Load =	55.09	plf
Maximum Moment =	74.37	kip in.

THEORETICAL FAILURE LOAD: (F_y= 53.0 ksi)

Moment = $F_y S_{eff}$ =	53.0(3.18)	168.5	kip-in.
Equivalent Line Load =	124.84	plf	

R-VALUE:

R = Failure/Theoretical = 55.09/124.84 0.441

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: Chief Test 3 (Z10)
DATE: 11/30/98

TEST DESCRIPTION:

Loading…………………………………… Gravity
Panel Type……………………………… Standing Seam
Span…………………………………….. 1@30'-0"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing………………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners………………………… None
Purlin Orientation……………………… Both top flanges toward ridge
Insulation………………………….. 6" Metal Building Insulation
Clip Type………………………………… High, Sliding
Purlin Thickness……………………… 0.077"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 2.51 in. of water

Applied Line Loading = 49.035 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 4.47 plf
Ridge Purlin Correction = 6.64 plf

Total Applied Load = 59.72 plf
Maximum Moment = 80.62 kip in.

THEORETICAL FAILURE LOAD: (F_y= 55.7 ksi)

Moment = $F_y S_{eff}$ = 55.7(3.25) 181.0 kip-in.
Equivalent Line Load = 134.09 plf

R-VALUE:

R = Failure/Theoretical = 59.72/134.09 0.445

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	Chief Test 4 (Z10)
DATE:	9/24/98

TEST DESCRIPTION:

Loading………………………………………	Gravity
Panel Type…………………………………	Standing Seam
Span…………………………………………	1@30'-0"
Purlin Spacing……………………………	5' o.c. with 1' deck overhang
Lateral Bracing……………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners……………………………	None
Purlin Orientation………………………	Both top flanges toward ridge
Insulation…………………………..	6" Metal Building Insulation
Clip Type…………………………………	High, Sliding
Purlin Thickness…………………………	0.103"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.95	in. of water
Applied Line Loading =	77.113	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.97	plf
Ridge Purlin Correction =	8.07	plf
Total Applied Load =	89.78	plf
Maximum Moment =	121.21	kip in.

THEORETICAL FAILURE LOAD: (F_y= 55.3 ksi)

Moment = $F_y S_{eff}$ =	55.3(4.97)	274.8	kip-in.
Equivalent Line Load =	203.59 plf		

R-VALUE:

R = Failure/Theoretical = 89.78/203.59 0.441

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	Chief Test 5 (Z10)
DATE:	11/24/98

TEST DESCRIPTION:

Loading……	Gravity
Panel Type……	Standing Seam
Span……	1@30'-0"
Purlin Spacing……	5' o.c. with 1' deck overhang
Lateral Bracing……	None
Anti-roll Clips……	At the supports of the ridge and eave purlin
Web Stiffeners……	None
Purlin Orientation……	Both top flanges toward ridge
Insulation……	6" Metal Building Insulation
Clip Type……	High, Sliding
Purlin Thickness……	0.100"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.74	in. of water
Applied Line Loading =	72.887	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.80	plf
Ridge Purlin Correction =	8.24	plf
Total Applied Load =	85.45	plf
Maximum Moment =	115.36	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.1 ksi)

Moment = $F_y S_{eff}$ =	64.1(4.46)	285.9	kip-in.
Equivalent Line Load =	211.77	plf	

R-VALUE:

R = Failure/Theoretical = 85.45/211.77 0.404

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: Chief Test 6 (Z10)
DATE: 11/24/98

TEST DESCRIPTION:

Loading…………………………………… Gravity
Panel Type……………………………… Standing Seam
Span…………………………………… 1@30'-0"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing………………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners………………………… None
Purlin Orientation……………………… Both top flanges toward ridge
Insulation………………………….. 6" Metal Building Insulation
Clip Type………………………………… High, Sliding
Purlin Thickness……………………… 0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.50	in. of water
Applied Line Loading =	68.217	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.97	plf
Ridge Purlin Correction =	7.77	plf
Total Applied Load =	80.79	plf
Maximum Moment =	109.07	kip in.

THEORETICAL FAILURE LOAD: (F_y= 65.8 ksi)

Moment = $F_y S_{eff}$ =	65.8(4.59)	302.0	kip-in.
Equivalent Line Load =	223.72 plf		

R-VALUE:

R = Failure/Theoretical = 80.79/223.72 0.361

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S1-10Z0.100-C1 Test 01
DATE:	7/1/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span……………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.100"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.29	in. of water
Applied Line Loading =	142.24	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.66	plf
Total Applied Load =	151.90	plf
Maximum Moment =	142.41	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.9 ksi)

Moment = $F_y S_{eff}$ =	56.9 (4.67) =	265.7	kip-in.
Equivalent Line Load =	283.44 plf		

R-VALUE:

R = Failure/Theoretical = 151.90/283.44= 0.536

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S1-10Z0.100-C3 Test 02
DATE:	7/1/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness……………………	0.100"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.28	in. of water
Applied Line Loading =	122.53	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.73	plf
Total Applied Load =	132.26	plf
Maximum Moment =	123.99	kip in.

THEORETICAL FAILURE LOAD: (F_y= 55.1 ksi)

Moment = $F_y S_{eff}$ =	55.1 (4.71) =	259.5	kip-in.
Equivalent Line Load =	276.82	plf	

R-VALUE:

R = Failure/Theoretical = 132.26/276.82= 0.478

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S1-10Z0.075-C1 Test 03
DATE: 7/1/99

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, Pan
Span…………………………………1@25'-0"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips………………………At the supports of the ridge and eave purlin
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type……………………………Low, Sliding
Purlin Thickness……………………0.074"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.86	in. of water
Applied Line Loading =	133.79	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.33	plf
Total Applied Load =	142.12	plf
Maximum Moment =	133.24	kip in.

THEORETICAL FAILURE LOAD: (F_y= 51.2 ksi)

Moment = $F_y S_{eff}$ = 51.2 (3.42) = 175.1 kip-in.
Equivalent Line Load = 186.78 plf

R-VALUE:

R = Failure/Theoretical = 142.12/186.78= 0.761

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S1-10Z0.100-C2 Test 04
DATE: 7/1/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, Pan
Span……………………………………1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing…………………………None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners………………………… None
Purlin Orientation………………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low,Fixed
Purlin Thickness……………………… 0.100"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	10.13	in. of water
Applied Line Loading =	197.44	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.76	plf
Total Applied Load =	207.20	plf
Maximum Moment =	194.25	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.2 ksi)

Moment = $F_y S_{eff}$ =	56.2(4.69) =	263.6	kip-in.
Equivalent Line Load =	281.15	plf	

R-VALUE:

R = Failure/Theoretical = 207.2/281.15= 0.737

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S1-10Z0.075-C2 Test 17
DATE: 9/22/99

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, Pan
Span………………………………… 1@25'-0"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Low, Fixed
Purlin Thickness……………………… 0.076"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 7.16 in. of water

Applied Line Loading = 139.6 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 4.36 plf

Total Applied Load = 147.96 plf
Maximum Moment = 138.71 kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.6 ksi)

Moment = $F_y S_{eff}$ = 59.6(3.14) = 187.1 kip-in.
Equivalent Line Load = 199.62 plf

R-VALUE:

R = Failure/Theoretical = 147.96/199.62= 0.741

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX B

Series 2 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S2-08Z0.060-C3 Test 05
DATE: 8/4/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span…………………………………… 1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………High,Sliding
Purlin Thickness…………………… 0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.64	in. of water
Applied Line Loading =	70.992	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.69	plf
Total Applied Load =	77.69	plf
Maximum Moment =	72.83	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.5 ksi)

Moment = $F_y S_{eff}$ =	63.5(1.49) =	94.6	kip-in.
Equivalent Line Load =	100.92	plf	

R-VALUE:

R = Failure/Theoretical = 77.69/100.92= 0.770

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.100-C3 Test 06
DATE:	8/9/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	High,Sliding
Purlin Thickness……………………	0.101"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.80	in. of water
Applied Line Loading =	132.54	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.81	plf
Total Applied Load =	141.35	plf
Maximum Moment =	132.52	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.2 ksi)

Moment = $F_y S_{eff}$ =	60.2(3.39) =	204.1	kip-in.
Equivalent Line Load =	217.68	plf	

R-VALUE:

R = Failure/Theoretical = 141.35/217.68= 0.649

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S2-08Z0.060-C1 Test 07
DATE: 8/11/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span…………………………………… 1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low,Sliding
Purlin Thickness……………………… 0.056"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.18	in. of water
Applied Line Loading =	62.061	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.66	plf
Total Applied Load =	68.72	plf
Maximum Moment =	64.43	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.8 ksi)

Moment = $F_y S_{eff}$ = 64.8(1.56) = 101.1 kip-in.
Equivalent Line Load = 107.83 plf

R-VALUE:

R = Failure/Theoretical = 68.72/107.83= 0.637

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S2-08Z0.060-C2 Test 08
DATE: 8/12/99

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, Pan
Span…………………………………… 1@25'-0"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Low, Fixed
Purlin Thickness…………………… 0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.46	in. of water
Applied Line Loading =	67.408	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.73	plf
Total Applied Load =	74.14	plf
Maximum Moment =	69.50	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.9 ksi)

Moment = $F_y S_{eff}$ =	63.9(1.65) =	105.4	kip-in.
Equivalent Line Load =	112.46	plf	

R-VALUE:

R = Failure/Theoretical = 74.14/112.46= 0.659

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.100-C1 Test 09
DATE:	8/24/99

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	Low, Sliding
Purlin Thickness……………………	0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.74	in. of water
Applied Line Loading =	111.95	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.88	plf
Total Applied Load =	120.83	plf
Maximum Moment =	113.27	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.5 ksi)

Moment = $F_y S_{eff}$ =	60.5(3.47) =	209.9	kip-in.
Equivalent Line Load =	223.93	plf	

R-VALUE:

R = Failure/Theoretical = 120.83/223.93= 0.540

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.100-C2 Test 10
DATE:	8/25/99

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam, Pan
Span………………………………………	1@25'-0"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing…………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners…………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type…………………………………	Low, Fixed
Purlin Thickness………………………	0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.47	in. of water
Applied Line Loading =	142.44	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.88	plf
Total Applied Load =	154.50	plf
Maximum Moment =	144.85	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.8 ksi)

Moment = $F_y S_{eff}$ =	61.8(3.44) =	212.6	kip-in.
Equivalent Line Load =	226.76	plf	

R-VALUE:

R = Failure/Theoretical = 154.5/226.76= 0.681

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S2-08Z0.100-C1 Test 11
DATE: 8/26/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, Pan
Span……………………………………1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips………………………At the supports of the ridge and eave purlin
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type………………………………Low, Sliding
Purlin Thickness……………………0.103"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.58	in. of water
Applied Line Loading =	108.77	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.91	plf
Total Applied Load =	117.68	plf
Maximum Moment =	110.32	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.9 ksi)

Moment = $F_y S_{eff}$ = 60.9(3.47) = 211.3 kip-in.
Equivalent Line Load = 225.41 plf

R-VALUE:

R = Failure/Theoretical = 117.68/225.41= 0.522

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S2-08Z0.100-C2 Test 12
DATE: 8/31/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span…………………………………… 1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low, Fixed
Purlin Thickness……………………… 0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.17	in. of water
Applied Line Loading =	139.88	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.91	plf
Total Applied Load =	148.79	plf
Maximum Moment =	139.49	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.4 ksi)

Moment = $F_y S_{eff}$ =	60.4(3.48) =	210.2	kip-in.
Equivalent Line Load =	224.20	plf	

R-VALUE:

R = Failure/Theoretical = 148.79/224.2= 0.664

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.100-C3 Test 13
DATE:	9/2/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.106"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.77	in. of water
Applied Line Loading =	131.97	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.08	plf
Total Applied Load =	141.05	plf
Maximum Moment =	132.24	kip in.

THEORETICAL FAILURE LOAD: (F_y= 62.1 ksi)

Moment = $F_y S_{eff}$ =	62.1(3.59) =	222.9 kip-in.
Equivalent Line Load =	237.80 plf	

R-VALUE:

R = Failure/Theoretical = 141.05/237.8= 0.593

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.060-C3 Test 14
DATE:	9/6/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25’-0"
Purlin Spacing…………………………	5’ o.c. with 1’ deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.058"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.50	in. of water
Applied Line Loading =	68.318	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.73	plf
Total Applied Load =	75.05	plf
Maximum Moment =	70.36	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.5 ksi)

Moment = $F_y S_{eff}$ =	61.5(1.66) =	102.1	kip-in.
Equivalent Line Load =	108.90	plf	

R-VALUE:

R = Failure/Theoretical = 75.05/108.9= 0.689

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.060-C1 Test 15
DATE:	9/9/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	Low, Sliding
Purlin Thickness………………………	0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.42	in. of water
Applied Line Loading =	66.725	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.66	plf
Total Applied Load =	73.38	plf
Maximum Moment =	68.80	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.1 ksi)

Moment = $F_y S_{eff}$ =	63.1(1.60) =	101.0	kip-in.
Equivalent Line Load =	107.69	plf	

R-VALUE:

R = Failure/Theoretical = 73.38/107.69= 0.681

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S2-08Z0.060-C2 Test 16
DATE:	9/14/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span………………………………….…	1@25’-0"
Purlin Spacing…………………………	5’ o.c. with 1’ deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness……………………	0.058"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.82	in. of water
Applied Line Loading =	74.519	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.73	plf
Total Applied Load =	81.25	plf
Maximum Moment =	76.17	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.9 ksi)

Moment = $F_y S_{eff}$ =	61.9(1.67) =	103.4	kip-in.
Equivalent Line Load =	110.26	plf	

R-VALUE:

R = Failure/Theoretical = 81.25/110.26= 0.737

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX C

Series 3 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S3-08Z0.100-C3 Test 18
DATE:	10/7/99

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span……………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	Third Point Bracing
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness……………………	0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.56	in. of water
Applied Line Loading =	147.5	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.88	plf
Total Applied Load =	156.38	plf
Maximum Moment =	146.61	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.1 ksi)

Moment = $F_y S_{eff}$ =	60.1(3.48) =	209.1 kip-in.
Equivalent Line Load =	223.09 plf	

R-VALUE:

R = Failure/Theoretical = 156.38/223.09= 0.701

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S3-08Z0.100-C1 Test 19
DATE:	10/13/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span……………………………………	1@25'-0"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	Third Point Bracing
Anti-roll Clips……………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.101"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	8.45	in. of water
Applied Line Loading =	163.89	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.81	plf
Total Applied Load =	173.66	plf
Maximum Moment =	162.81	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.6 ksi)

Moment = $F_y S_{eff}$ = 60.6(3.40) = 206.0 kip-in.

Equivalent Line Load = 219.78 plf

R-VALUE:

R = Failure/Theoretical = 173.66/219.78= 0.790

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.100-C2 Test 20
DATE: 10/22/99

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, Pan
Span…………………………………1@25'-0"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………Low, Fixed
Purlin Thickness……………………0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.09	in. of water
Applied Line Loading =	137.61	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.84	plf
Total Applied Load =	147.19	plf
Maximum Moment =	137.99	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.5 ksi)

Moment = $F_y S_{eff}$ =	60.5(3.42) =	206.9	kip-in.
Equivalent Line Load =	220.70	plf	

R-VALUE:

R = Failure/Theoretical = 147.19/220.7= 0.667

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.060-C2 Test 21
DATE: 10/27/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span………………………………….… 1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low, Fixed
Purlin Thickness……………………… 0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.76	in. of water
Applied Line Loading =	73.267	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.69	plf
Total Applied Load =	79.96	plf
Maximum Moment =	74.96	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.6 ksi)

Moment = $F_y S_{eff}$ =	63.6(1.63) =	103.7	kip-in.
Equivalent Line Load =	110.58	plf	

R-VALUE:

R = Failure/Theoretical = 79.96/110.58= 0.723

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.075-C1 Test 22
DATE: 11/3/99

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, Pan
Span………………………………… 1@25'-0"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Low, Sliding
Purlin Thickness……………………. 0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 3.70 in. of water

Applied Line Loading = 72.244 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 2.69 plf

Total Applied Load = 78.94 plf
Maximum Moment = 74.00 kip in.

THEORETICAL FAILURE LOAD: (F_y= 65.2 ksi)

Moment = $F_y S_{eff}$ = 65.2(1.63) = 106.3 kip-in.
Equivalent Line Load = 113.36 plf

R-VALUE:

R = Failure/Theoretical = 78.94/113.36= 0.696

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.075-C3 Test 23
DATE: 11/8/99

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, Pan
Span………………………………….… 1@25'-0"
Purlin Spacing……………………….. 5' o.c. with 1' deck overhang
Lateral Bracing……………………… Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness……………………… 0.056"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.08	in. of water
Applied Line Loading =	60.126	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.66	plf
Total Applied Load =	66.79	plf
Maximum Moment =	62.61	kip in.

THEORETICAL FAILURE LOAD: (F_y= 62.9 ksi)

Moment = $F_y S_{eff}$ = 62.9(1.57) = 98.8 kip-in.
Equivalent Line Load = 105.34 plf

R-VALUE:

R = Failure/Theoretical = 66.79/105.34= 0.634

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.075-C3 Test 24
DATE: 11/11/99

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, Pan
Span…………………………………… 1@25'-0"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness……………………… 0.056"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.85	in. of water
Applied Line Loading =	55.577	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.66	plf
Total Applied Load =	62.24	plf
Maximum Moment =	58.35	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.9 ksi)

Moment = $F_y S_{eff}$ = 64.9(1.56) = 101.2 kip-in.
Equivalent Line Load = 107.99 plf

R-VALUE:

R = Failure/Theoretical = 62.24/107.99= 0.576

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.100-C3 Test 25
DATE: 11/12/99

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span………………………………….. 1@25'-0"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Sliding
Purlin Thickness…………………….. 0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.21	in. of water
Applied Line Loading =	92.153	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.88	plf
Total Applied Load =	149.44	plf
Maximum Moment =	140.10	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.3 ksi)

Moment = $F_y S_{eff}$ = 60.3(3.46) = 208.6 kip-in.
Equivalent Line Load = 222.55 plf

R-VALUE:

R = Failure/Theoretical = 149.44/222.55= 0.671

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S3-08Z0.100-C1 Test 26
DATE:	11/19/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	Third Point Bracing
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness……………………	0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.35	in. of water
Applied Line Loading =	136.64	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.88	plf
Total Applied Load =	152.23	plf
Maximum Moment =	142.71	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.6 ksi)

Moment = $F_y S_{eff}$ =	59.6(3.43) =	204.4	kip-in.
Equivalent Line Load =	218.06	plf	

R-VALUE:

R = Failure/Theoretical = 152.23/218.06= 0.698

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.100-C2 Test 27
DATE: 11/30/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span…………………………………… 1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… Third Point Bracing
Anti-roll Clips……………………… At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low, Fixed
Purlin Thickness……………………… 0.102"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 7.16 in. of water

Applied Line Loading = 121.11 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 4.88 plf

Total Applied Load = 148.47 plf
Maximum Moment = 139.19 kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.0 ksi)

Moment = $F_y S_{eff}$ = 60.0(3.46) = 207.6 kip-in.
Equivalent Line Load = 221.44 plf

R-VALUE:

R = Failure/Theoretical = 148.47/221.44= 0.670

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.060-C2 Test 28
DATE: 12/3/99

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, Pan
Span………………………………….… 1@25'-0"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………. Third Point Bracing
Anti-roll Clips………………………. At the supports of the ridge and eave purlin
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………... None
Clip Type………………………………Low, Fixed
Purlin Thickness……………………. 0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.73	in. of water
Applied Line Loading =	72.698	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.69	plf
Total Applied Load =	79.39	plf
Maximum Moment =	74.43	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.4 ksi)

Moment = $F_y S_{eff}$ =	63.4(1.65) =	104.6	kip-in.
Equivalent Line Load =	111.58	plf	

R-VALUE:

R = Failure/Theoretical = 79.39/111.58= 0.711

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S3-08Z0.060-C1 Test 29
DATE: 12/7/99

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, Pan
Span…………………………………	1@25'-0"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	Third Point Bracing
Anti-roll Clips………………………	At the supports of the ridge and eave purlin
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness……………………	0.057"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.25	in. of water
Applied Line Loading =	63.426	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.66	plf
Total Applied Load =	70.09	plf
Maximum Moment =	65.71	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.3 ksi)

Moment = $F_y S_{eff}$ = 64.3(1.58) = 101.6 kip-in.

Equivalent Line Load = 108.37 plf

R-VALUE:

R = Failure/Theoretical = 70.09/108.37= 0.647

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX D

Series 5 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S5-10Z0.100-C3 Test 36
DATE: 2/9/00

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness……………………… 0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 5.64 in. of water

Applied Line Loading = 109.89 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 6.41 plf

Total Applied Load = 120.30 plf
Maximum Moment = 155.71 kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.6 ksi)

Moment = $F_y S_{eff}$ = 58.6 (4.93) = 288.9 kip-in.
Equivalent Line Load = 223.20 plf

R-VALUE:

R = Failure/Theoretical = 120.3/223.20= 0.539

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S5-10Z0.100-C3 Test 37
DATE: 2/10/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips………………………At the supports of the ridge & eave purlin.
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type………………………………High, Sliding
Purlin Thickness………………………0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 6.36 in. of water

Applied Line Loading = 124.08 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 6.41 plf

Total Applied Load = 134.49 plf
Maximum Moment = 174.07 kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.3 ksi)

Moment = $F_y S_{eff}$ = 57.3 (5.00) = 286.5 kip-in.
Equivalent Line Load = 221.35 plf

R-VALUE:

R = Failure/Theoretical = 134.49/221.35= 0.608

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.075-C3 Test 38
DATE:	2/14/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.70	in. of water
Applied Line Loading =	72.072	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.26	plf
Total Applied Load =	80.33	plf
Maximum Moment =	103.98	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.6 ksi)

Moment = $F_y S_{eff}$ = 56.6 (3.04) = 172.1 kip-in.

Equivalent Line Load = 132.94 plf

R-VALUE:

R = Failure/Theoretical = 80.33/132.94= 0.604

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S5-10Z0.075-C3 Test 39
DATE: 2/14/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… High, Sliding
Purlin Thickness…………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.85	in. of water
Applied Line Loading =	74.981	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.30	plf
Total Applied Load =	83.28	plf
Maximum Moment =	107.79	kip in.

THEORETICAL FAILURE LOAD: (F_y= 53.9 ksi)

Moment = $F_y S_{eff}$ = 53.9 (3.13) = 168.7 kip-in.
Equivalent Line Load = 130.34 plf

R-VALUE:

R = Failure/Theoretical = 83.28/130.34= 0.639

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.075-C2 Test 40
DATE:	2/16/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing…………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners…………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type…………………………………	Low, Fixed
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.45	in. of water
Applied Line Loading =	86.795	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.26	plf
Total Applied Load =	95.06	plf
Maximum Moment =	123.04	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.0 ksi)

Moment = $F_y S_{eff}$ =	58.0 (3.01) =	174.6	kip-in.
Equivalent Line Load =	134.88	plf	

R-VALUE:

R = Failure/Theoretical = 95.06/134.88= 0.705

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.075-C2 Test 41
DATE:	2/16/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………..	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………..	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.51	in. of water
Applied Line Loading =	87.863	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.30	plf
Total Applied Load =	96.16	plf
Maximum Moment =	124.46	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.1 ksi)

Moment = $F_y S_{eff}$ =	60.1 (2.99) =	179.7	kip-in.
Equivalent Line Load =	138.83	plf	

R-VALUE:

R = Failure/Theoretical = 96.16/138.83= 0.693

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.100-C2 Test 42
DATE:	2/17/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness……………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.63	in. of water
Applied Line Loading =	148.78	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.44	plf
Total Applied Load =	159.22	plf
Maximum Moment =	206.08	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.9 ksi)

Moment = $F_y S_{eff}$ =	58.9 (4.93) =	290.4	kip-in.
Equivalent Line Load =	224.34	plf	

R-VALUE:

R = Failure/Theoretical = 159.22/224.34= 0.710

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.100-C2 Test 43
DATE:	2/21/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span……………………………………	1@29’-4-1/2"
Purlin Spacing…………………………	5’ o.c. with 1’ deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	8.03	in. of water
Applied Line Loading =	156.2	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.41	plf
Total Applied Load =	166.90	plf
Maximum Moment =	216.03	kip in.

THEORETICAL FAILURE LOAD: (F_y= 62.0 ksi)

Moment = $F_y S_{eff}$ =	62.0 (4.93) =	305.7	kip-in.
Equivalent Line Load =	236.15	plf	

R-VALUE:

R = Failure/Theoretical = 166.9/236.15= 0.707

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.100-C1 Test 45
DATE:	2/23/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29’-4-1/2"
Purlin Spacing…………………………	5’ o.c. with 1’ deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.22	in. of water
Applied Line Loading =	121.35	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.41	plf
Total Applied Load =	131.76	plf
Maximum Moment =	170.54	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.3 ksi)

Moment = $F_y S_{eff}$ =	60.3 (4.87) =	293.7 kip-in.
Equivalent Line Load =	226.88	plf

R-VALUE:

R = Failure/Theoretical = 131.76/226.88= 0.581

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.100-C1 Test 46
DATE:	2/23/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span……………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.90	in. of water
Applied Line Loading =	114.99	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.41	plf
Total Applied Load =	125.40	plf
Maximum Moment =	162.32	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.3 ksi)

Moment = $F_y S_{eff}$ =	60.3 (4.84) =	291.9	kip-in.
Equivalent Line Load =	225.48	plf	

R-VALUE:

R = Failure/Theoretical = 125.40/225.48= 0.556

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.075-C1 Test 47
DATE:	2/24/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.04	in. of water
Applied Line Loading =	78.78	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.33	plf
Total Applied Load =	87.11	plf
Maximum Moment =	112.75	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.2 ksi)

Moment = $F_y S_{eff}$ =	58.2 (3.09) =	179.8	kip-in.
Equivalent Line Load =	138.94	plf	

R-VALUE:

R = Failure/Theoretical = 87.11/138.94= 0.627

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S5-10Z0.075-C1 Test 48
DATE:	2/29/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span……………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of ridge purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.11	in. of water
Applied Line Loading =	80.087	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.30	plf
Total Applied Load =	88.38	plf
Maximum Moment =	114.40	kip in.

THEORETICAL FAILURE LOAD: (F_y= 53.7 ksi)

Moment = $F_y S_{eff}$ =	53.7 (3.11) =	167.0	kip-in.
Equivalent Line Load =	129.03	plf	

R-VALUE:

R = Failure/Theoretical = 88.38/129.03= 0.685

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S5-10Z0.075-C3 Test 49
DATE: 2/29/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type……………………………Standing Seam, (24 ga)
Span……………………………………1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing…………………………None
Anti-roll Clips………………………. At the supports of the ridge & eave purlin.
Web Stiffeners………………………… None
Purlin Orientation………………………Both top flanges toward ridge
Insulation…………………………….. None
Clip Type………………………………High, Sliding
Purlin Thickness……………………… 0.069"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.54	in. of water
Applied Line Loading =	69.03	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.23	plf
Total Applied Load =	77.26	plf
Maximum Moment =	100.00	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.2 ksi)

Moment = $F_y S_{eff}$ = 56.2 (3.01) = 169.2 kip-in.
Equivalent Line Load = 130.69 plf

R-VALUE:

R = Failure/Theoretical = 77.26/130.69= 0.591

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S5-10Z0.100-C3 Test 50
DATE: 3/1/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span………………………………….…	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………….	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.17	in. of water
Applied Line Loading =	120.34	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.44	plf
Total Applied Load =	130.79	plf
Maximum Moment =	169.28	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.1 ksi)

Moment = $F_y S_{eff}$ =	61.1(4.88) =	298.2	kip-in.
Equivalent Line Load =	230.36	plf	

R-VALUE:

R = Failure/Theoretical = 130.79/230.36= 0.568

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX E

Series 6 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.100-C2 Test 44
DATE:	2/22/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	8.34	in. of water
Applied Line Loading =	161.06	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.44	plf
Total Applied Load =	173.05	plf
Maximum Moment =	223.99	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.4 ksi)

Moment = $F_y S_{eff}$ =	59.4(4.89) =	290.5	kip-in.
Equivalent Line Load =	224.41	plf	

R-VALUE:

R = Failure/Theoretical = 173.05/224.41= 0.771

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S6-10Z0.100-C1 Test 51
DATE: 3/1/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, (22 ga)
Span……………………………………1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low, Sliding
Purlin Thickness……………………… 0.103"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 6.42 in. of water

Applied Line Loading = 125.21 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 6.41 plf

Total Applied Load = 135.62 plf
Maximum Moment = 175.53 kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.4 ksi)

Moment = $F_y S_{eff}$ = 60.4 (4.88) = 294.8 kip-in.
Equivalent Line Load = 227.72 plf

R-VALUE:

R = Failure/Theoretical = 135.62/227.72= 0.596

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S6-10Z0.100-C1 Test 52
DATE: 3/3/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………. Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………. None
Anti-roll Clips……………………. At the supports of the ridge & eave purlin.
Web Stiffeners……………………. None
Purlin Orientation…………………. Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… Low, Sliding
Purlin Thickness……………………. 0.103"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.08	in. of water
Applied Line Loading =	118.62	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.34	plf
Total Applied Load =	128.96	plf
Maximum Moment =	166.92	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.6 ksi)

Moment = $F_y S_{eff}$ = 59.6 (4.83) = 287.9 kip-in.
Equivalent Line Load = 222.41 plf

R-VALUE:

R = Failure/Theoretical = 128.96/222.41= 0.580

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.100-C3 Test 53
DATE:	3/6/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.90	in. of water
Applied Line Loading =	115.11	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.38	plf
Total Applied Load =	125.49	plf
Maximum Moment =	162.43	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.4 ksi)

Moment = $F_y S_{eff}$ =	57.4 (4.95) =	284.1	kip-in.
Equivalent Line Load =	219.52	plf	

R-VALUE:

R = Failure/Theoretical = 125.49/219.52= 0.572

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S6-10Z0.075-C3 Test 54
DATE: 3/7/00

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness…………………… 0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.79	in. of water
Applied Line Loading =	73.913	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.36	plf
Total Applied Load =	82.28	plf
Maximum Moment =	106.49	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.6 ksi)

Moment = $F_y S_{eff}$ = 56.6 (3.14) = 177.7 kip-in.

Equivalent Line Load = 137.31 plf

R-VALUE:

R = Failure/Theoretical = 82.28/137.31= 0.599

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S6-10Z0.100-C3 Test 55
DATE: 3/8/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Sliding
Purlin Thickness……………………… 0.103"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 6.33 in. of water

Applied Line Loading = 123.48 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 6.34 plf

Total Applied Load = 133.83 plf
Maximum Moment = 173.22 kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.4 ksi)

Moment = $F_y S_{eff}$ = 59.4 (4.86) = 288.7 kip-in.
Equivalent Line Load = 223.04 plf

R-VALUE:

R = Failure/Theoretical = 133.83/223.04= 0.600

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.075-C3 Test 56
DATE:	3/13/00

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness……………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.95	in. of water
Applied Line Loading =	77.058	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.33	plf
Total Applied Load =	85.39	plf
Maximum Moment =	110.52	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.5 ksi)

Moment = $F_y S_{eff}$ = 56.5 (3.05) = 172.3 kip-in.

Equivalent Line Load = 133.14 plf

R-VALUE:

R = Failure/Theoretical = 85.39/133.14= 0.641

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S6-10Z0.100-C3 Test 57
DATE: 3/13/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.37	in. of water
Applied Line Loading =	124.2	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	6.38	plf
Total Applied Load =	134.57	plf
Maximum Moment =	174.18	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.9 ksi)

Moment = $F_y S_{eff}$ =	58.9 (4.94) =	291.0	kip-in.
Equivalent Line Load =	224.80	plf	

R-VALUE:

R = Failure/Theoretical = 134.57/224.80= 0.599

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.075-C1 Test 58
DATE:	3/13/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.93	in. of water
Applied Line Loading =	76.701	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.30	plf
Total Applied Load =	85.00	plf
Maximum Moment =	110.02	kip in.

THEORETICAL FAILURE LOAD: (F_y= 54.3 ksi)

Moment = $F_y S_{eff}$ =	54.3 (3.07) =	166.7 kip-in.
Equivalent Line Load =	128.79 plf	

R-VALUE:

R = Failure/Theoretical = 85.0/128.79= 0.660

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.075-C1 Test 59
DATE:	3/13/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Sliding
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.82	in. of water
Applied Line Loading =	74.564	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.30	plf
Total Applied Load =	82.86	plf
Maximum Moment =	107.25	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.7 ksi)

Moment = $F_y S_{eff}$ =	57.7 (3.03) =	174.8	kip-in.
Equivalent Line Load =	135.07	plf	

R-VALUE:

R = Failure/Theoretical = 82.86/135.07= 0.613

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.075-C3 Test 60
DATE:	3/14/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness………………………	0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.81	in. of water
Applied Line Loading =	74.328	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.36	plf
Total Applied Load =	82.69	plf
Maximum Moment =	107.03	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.6 ksi)

Moment = $F_y S_{eff}$ =	57.6 (3.05) =	175.7 kip-in.
Equivalent Line Load =	135.73	plf

R-VALUE:

R = Failure/Theoretical = 82.69/135.73= 0.609

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S6-10Z0.075-C2 Test 61
DATE: 3/14/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Short, Fixed
Purlin Thickness………………………	0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.23	in. of water
Applied Line Loading =	82.401	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.36	plf
Total Applied Load =	90.77	plf
Maximum Moment =	117.48	kip in.

THEORETICAL FAILURE LOAD: (F_y= 55.9 ksi)

Moment = $F_y S_{eff}$ = 55.9 (3.10) = 173.3 kip-in.

Equivalent Line Load = 133.88 plf

R-VALUE:

R = Failure/Theoretical = 90.77/133.88= 0.678

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S6-10Z0.075-C2 Test 62
DATE:	3/14/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	Short, Fixed
Purlin Thickness……………………	0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.33	in. of water
Applied Line Loading =	84.48	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	4.36	plf
Total Applied Load =	92.84	plf
Maximum Moment =	120.17	kip in.

THEORETICAL FAILURE LOAD: (F_y= 53.3 ksi)

Moment = $F_y S_{eff}$ =	53.3 (3.24) =	172.7	kip-in.
Equivalent Line Load =	133.42	plf	

R-VALUE:

R = Failure/Theoretical = 92.84/133.42= 0.696

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX F

Series 7 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.100-C1 Test 63
DATE: 03/14/2000

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type……………………………Short, Sliding
Purlin Thickness……………………0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 5.65 in. of water

Applied Line Loading = 110.25 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.73 plf

Total Applied Load = 119.97 plf
Maximum Moment = 155.29 kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.0 ksi)

Moment = $F_y S_{eff}$ = 61.0 (4.79) = 292.2 kip-in.
Equivalent Line Load = 225.75 plf

R-VALUE:

R = Failure/Theoretical = 119.97/225.75= 0.531

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.100-C1 Test 64
DATE: 03/14/2000

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span…………………………………… 1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Short, Sliding
Purlin Thickness……………………… 0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 6.08 in. of water

Applied Line Loading = 118.62 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.69 plf

Total Applied Load = 128.31 plf
Maximum Moment = 166.08 kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.6 ksi)

Moment = $F_y S_{eff}$ = 57.6 (4.73) = 272.4 kip-in.
Equivalent Line Load = 210.49 plf

R-VALUE:

R = Failure/Theoretical = 128.31/210.49= 0.610

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S7-10Z0.100-C3 Test 65
DATE:	03/14/2000

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness…………………… 0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.80	in. of water
Applied Line Loading =	113.04	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.73	plf
Total Applied Load =	122.76	plf
Maximum Moment =	158.90	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.0 ksi)

Moment = $F_y S_{eff}$ =	59.0 (4.76) =	280.8	kip-in.
Equivalent Line Load =	216.98	plf	

R-VALUE:

R = Failure/Theoretical = 122.76/216.98= 0.566

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S7-10Z0.100-C3 Test 66
DATE:	03/15/2000

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Sliding
Purlin Thickness……………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.63	in. of water
Applied Line Loading =	129.3	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.73	plf
Total Applied Load =	139.03	plf
Maximum Moment =	179.95	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.7 ksi)

Moment = $F_y S_{eff}$ =	56.7 (4.78) =	271.0	kip-in.
Equivalent Line Load =	209.39	plf	

R-VALUE:

R = Failure/Theoretical = 139.03/209.39= 0.664

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S7-10Z0.100-C2 Test 67
DATE:	03/15/2000

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Low, Fixed
Purlin Thickness……………………… 0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	7.64	in. of water
Applied Line Loading =	148.95	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.76	plf
Total Applied Load =	158.72	plf
Maximum Moment =	205.43	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.6 ksi)

Moment = $F_y S_{eff}$ =	60.6(4.85) =	293.9	kip-in.
Equivalent Line Load =	227.07	plf	

R-VALUE:

R = Failure/Theoretical = 158.72/227.07= 0.699

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.100-C2 Test 68
DATE: 03/15/2000

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………….1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low, Fixed
Purlin Thickness……………………… 0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.62	in. of water
Applied Line Loading =	129	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.73	plf
Total Applied Load =	138.73	plf
Maximum Moment =	179.57	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.9 ksi)

Moment = $F_y S_{eff}$ = 58.9 (4.80) = 282.7 kip-in.
Equivalent Line Load = 218.43 plf

R-VALUE:

R = Failure/Theoretical = 138.73/218.43= 0.635

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.075-C3 Test 69
DATE: 03/20/2000

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips………………………At the supports of the ridge & eave purlin.
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type……………………………High, Sliding
Purlin Thickness……………………0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.83	in. of water
Applied Line Loading =	74.625	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.89	plf
Total Applied Load =	82.51	plf
Maximum Moment =	106.80	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.4 ksi)

Moment = $F_y S_{eff}$ = 60.4 (3.05) = 184.2 kip-in.
Equivalent Line Load = 142.33 plf

R-VALUE:

R = Failure/Theoretical = 82.51/142.33= 0.580

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.075-C3 Test 70
DATE: 03/20/2000

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Sliding
Purlin Thickness……………………… 0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 3.41 in. of water

Applied Line Loading = 66.55 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 3.89 plf

Total Applied Load = 74.44 plf
Maximum Moment = 96.35 kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.1 ksi)

Moment = $F_y S_{eff}$ = 60.1(3.01) = 180.9 kip-in.
Equivalent Line Load = 139.76 plf

R-VALUE:

R = Failure/Theoretical = 74.44/139.76= 0.533

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S7-10Z0.075-C1 Test 71
DATE:	03/21/2000

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span……………………………………	1@29'-4-1/2"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Short, Sliding
Purlin Thickness……………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.46	in. of water
Applied Line Loading =	67.47	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.82	plf
Total Applied Load =	75.29	plf
Maximum Moment =	97.45	kip in.

THEORETICAL FAILURE LOAD: (F_y= 52.1 ksi)

Moment = $F_y S_{eff}$ =	52.1 (3.17) =	165.2	kip-in.
Equivalent Line Load =	127.60	plf	

R-VALUE:

R = Failure/Theoretical = 75.29/127.60= 0.590

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S7-10Z0.075-C1 Test 72
DATE:	03/22/2000

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… Short, Sliding
Purlin Thickness…………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.67	in. of water
Applied Line Loading =	71.477	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.82	plf
Total Applied Load =	79.30	plf
Maximum Moment =	102.64	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.3 ksi)

Moment = $F_y S_{eff}$ = 63.3 (2.89) = 182.9 kip-in.
Equivalent Line Load = 141.34 plf

R-VALUE:

R = Failure/Theoretical = 79.30/141.34= 0.561

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S7-10Z0.075-C2 Test 73
DATE:	03/22/2000

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Short, Fixed
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.08	in. of water
Applied Line Loading =	79.552	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.85	plf
Total Applied Load =	87.41	plf
Maximum Moment =	113.13	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.2 ksi)

Moment = $F_y S_{eff}$ =	59.2 (3.05) =	180.6	kip-in.
Equivalent Line Load =	139.50 plf		

R-VALUE:

R = Failure/Theoretical = 87.41/139.50= 0.627

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.075-C2 Test 74
DATE: 03/23/2000

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………….…1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips………………………. At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Short, Fixed
Purlin Thickness……………………. 0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.30	in. of water
Applied Line Loading =	83.885	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.89	plf
Total Applied Load =	91.77	plf
Maximum Moment =	118.78	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.3 ksi)

Moment = $F_y S_{eff}$ = 56.3 (3.19) = 179.6 kip-in.

Equivalent Line Load = 138.76 plf

R-VALUE:

R = Failure/Theoretical = 91.77/138.76= 0.661

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.100-C1 Test 75
DATE: 03/27/2000

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span…………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Short, Sliding
Purlin Thickness…………………… 0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.18	in. of water
Applied Line Loading =	120.52	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.80	plf
Total Applied Load =	130.31	plf
Maximum Moment =	168.67	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.6 ksi)

Moment = $F_y S_{eff}$ = 59.6 (4.87) = 290.3 kip-in.
Equivalent Line Load = 224.25 plf

R-VALUE:

R = Failure/Theoretical = 130.31/224.25= 0.581

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S7-10Z0.075-C1 Test 76
DATE: 03/29/2000

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span…………………………………… 1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Short, Sliding
Purlin Thickness……………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.43	in. of water
Applied Line Loading =	66.965	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.85	plf
Total Applied Load =	74.82	plf
Maximum Moment =	96.84	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.4 ksi)

Moment = $F_y S_{eff}$ =	63.4 (2.82) =	178.8	kip-in.
Equivalent Line Load =	138.13 plf		

R-VALUE:

R = Failure/Theoretical = 75.02/142.35 0.542

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX G

Series 8 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.075-C1 Test 77
DATE:	3/29/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span……………………………………….	1@29'-4-1/2"
Purlin Spacing………………………..	5' o.c. with 1' deck overhang
Lateral Bracing……………………….	None
Anti-roll Clips……………………..	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation…………………….	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………….	Short, Sliding
Purlin Thickness…………………….	0.071"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.71	in. of water
Applied Line Loading =	72.31	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.92	plf
Total Applied Load =	80.23	plf
Maximum Moment =	103.85	kip in.

THEORETICAL FAILURE LOAD: (F_y= 62.7 ksi)

Moment = $F_y S_{eff}$ =	62.7 (2.98) =	186.8	kip-in.
Equivalent Line Load =	144.36	plf	

R-VALUE:

R = Failure/Theoretical = 80.23/144.36= 0.556

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.075-C1 Test 78
DATE: 3/31/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………….… 1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Short, Sliding
Purlin Thickness……………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 3.61 in. of water

Applied Line Loading = 70.35 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 3.85 plf

Total Applied Load = 78.20 plf
Maximum Moment = 101.22 kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.3 ksi)

Moment = $F_y S_{eff}$ = 63.3 (2.86) = 181.0 kip-in.
Equivalent Line Load = 139.87 plf

R-VALUE:

R = Failure/Theoretical = 78.20/139.87= 0.559

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.075-C3 Test 79
DATE:	3/31/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Sliding
Purlin Thickness…………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.56	in. of water
Applied Line Loading =	69.459	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.85	plf
Total Applied Load =	77.31	plf
Maximum Moment =	100.07	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.8 ksi)

Moment = $F_y S_{eff}$ =	63.8(2.80) =	178.6	kip-in.
Equivalent Line Load =	138.02	plf	

R-VALUE:

R = Failure/Theoretical = 77.31/138.02= 0.560

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.075-C3 Test 80
DATE:	4/3/00

TEST DESCRIPTION:

- Loading………………………………… Gravity
- Panel Type…………………………… Standing Seam, (22 ga)
- Span………………………………… 1@29'-4-1/2"
- Purlin Spacing……………………… 5' o.c. with 1' deck overhang
- Lateral Bracing……………………… None
- Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
- Web Stiffeners……………………… None
- Purlin Orientation…………………… Both top flanges toward ridge
- Insulation………………………….. None
- Clip Type……………………………… High, Sliding
- Purlin Thickness……………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.53	in. of water
Applied Line Loading =	68.747	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.85	plf
Total Applied Load =	76.60	plf
Maximum Moment =	99.15	kip in.

THEORETICAL FAILURE LOAD: (F_y= 62.9 ksi)

Moment = $F_y S_{eff}$ =	62.9(2.89) =	181.8	kip-in.
Equivalent Line Load =	140.44	plf	

R-VALUE:

R = Failure/Theoretical = 76.60/140.44= 0.545

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.075-C2 Test 81
DATE: 4/4/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type………………………… Standing Seam, (22 ga)
Span……………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips…………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… Low, Fixed
Purlin Thickness…………………… 0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.64	in. of water
Applied Line Loading =	90.535	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.85	plf
Total Applied Load =	98.39	plf
Maximum Moment =	127.35	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.7 ksi)

Moment = $F_y S_{eff}$ = 63.7 (2.90) = 184.7 kip-in.
Equivalent Line Load = 142.72 plf

R-VALUE:

R = Failure/Theoretical = 98.39/142.72= 0.689

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.075-C2 Test 82
DATE:	4/5/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span………………………………….…	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.58	in. of water
Applied Line Loading =	89.109	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.85	plf
Total Applied Load =	97.08	plf
Maximum Moment =	125.66	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.1 ksi)

Moment = $F_y S_{eff}$ =	63.1 (2.91) =	183.6	kip-in.
Equivalent Line Load =	141.87	plf	

R-VALUE:

R = Failure/Theoretical = 97.08/141.87= 0.684

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.100-C1 Test 83
DATE: 4/7/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span…………………………………… 1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………Low, Floating
Purlin Thickness……………………… 0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 6.89 in. of water

Applied Line Loading = 134.35 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.73 plf

Total Applied Load = 144.08 plf
Maximum Moment = 186.49 kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.7 ksi)

Moment = $F_y S_{eff}$ = 61.7 (4.80) = 296.2 kip-in.
Equivalent Line Load = 228.81 plf

R-VALUE:

R = Failure/Theoretical = 144.08/228.81= 0.630

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.100-C1 Test 84
DATE: 4/9/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… Low, Floating
Purlin Thickness…………………… 0.103"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 7.56 in. of water

Applied Line Loading = 147.41 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.66 plf

Total Applied Load = 157.07 plf
Maximum Moment = 203.30 kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.8 ksi)

Moment = $F_y S_{eff}$ = 59.8 (4.71) = 281.7 kip-in.
Equivalent Line Load = 217.61 plf

R-VALUE:

R = Failure/Theoretical = 157.07/217.61= 0.722

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.100-C3 Test 85
DATE: 4/11/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing………………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners………………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Floating
Purlin Thickness……………………… 0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.54	in. of water
Applied Line Loading =	127.46	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.76	plf
Total Applied Load =	137.22	plf
Maximum Moment =	177.61	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.0 ksi)

Moment = $F_y S_{eff}$ = 61.0 (4.79) = 292.2 kip-in.
Equivalent Line Load = 225.75 plf

R-VALUE:

R = Failure/Theoretical = 137.22/225.75= 0.608

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.100-C3 Test 86
DATE:	4/17/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Floating
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.32	in. of water
Applied Line Loading =	123.31	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.73	plf
Total Applied Load =	133.04	plf
Maximum Moment =	172.19	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.5 ksi)

Moment = $F_y S_{eff}$ =	61.5 (4.81) =	295.8	kip-in.
Equivalent Line Load =	228.55	plf	

R-VALUE:

R = Failure/Theoretical = 133.04/228.55= 0.582

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.100-C3 Test 87
DATE:	4/17/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Floating
Purlin Thickness………………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.51	in. of water
Applied Line Loading =	126.92	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.73	plf
Total Applied Load =	136.65	plf
Maximum Moment =	176.87	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.2 ksi)

Moment = $F_y S_{eff}$ =	60.2(4.82) =	290.2	kip-in.
Equivalent Line Load =	224.18	plf	

R-VALUE:

R = Failure/Theoretical = 136.65/224.18= 0.610

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S8-10Z0.075-C3 Test 88
DATE:	4/17/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span……………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	High, Floating
Purlin Thickness………………………	0.070"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	3.33	in. of water
Applied Line Loading =	65.007	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.82	plf
Total Applied Load =	72.83	plf
Maximum Moment =	94.26	kip in.

THEORETICAL FAILURE LOAD: (F_y= 62.8 ksi)

Moment = $F_y S_{eff}$ =	62.8 (2.91) =	182.7	kip-in.
Equivalent Line Load =	141.19 plf		

R-VALUE:

R = Failure/Theoretical = 72.83/141.19= 0.516

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.100-C2 Test 89
DATE: 4/18/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………Short, Fixed
Purlin Thickness…………………… .105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 8.33 in. of water

Applied Line Loading = 162.49 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.76 plf

Total Applied Load = 172.26 plf
Maximum Moment = 222.96 kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.8 ksi)

Moment = $F_y S_{eff}$ = 61.8 (4.86) = 300.3 kip-in.
Equivalent Line Load = 232.05 plf

R-VALUE:

R = Failure/Theoretical = 172.26/232.05= 0.742

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S8-10Z0.100-C2 Test 90
DATE: 4/19/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Short, Fixed
Purlin Thickness……………………… .105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 7.97 in. of water

Applied Line Loading = 155.48 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.80 plf

Total Applied Load = 165.28 plf
Maximum Moment = 213.93 kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.1 ksi)

Moment = $F_y S_{eff}$ = 61.1 (4.86) = 296.9 kip-in.
Equivalent Line Load = 229.42 plf

R-VALUE:

R = Failure/Theoretical = 165.28/229.42= 0.720

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX H

Series 9 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.100-C1 Test 91
DATE:	5/17/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Floating
Purlin Thickness……………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.98	in. of water
Applied Line Loading =	97.11	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.01	plf
Total Applied Load =	106.12	plf
Maximum Moment =	137.36	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.6 ksi)

Moment = $F_y S_{eff}$ =	59.6 (3.55) =	211.6 kip-in.
Equivalent Line Load =	163.47 plf	

R-VALUE:

R = Failure/Theoretical = 106.12/163.01= 0.649

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.100-C1 Test 92
DATE:	5/18/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Floating
Purlin Thickness……………………	0.104"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.97	in. of water
Applied Line Loading =	96.954	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.01	plf
Total Applied Load =	105.97	plf
Maximum Moment =	137.16	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.3 ksi)

Moment = $F_y S_{eff}$ =	57.3 (3.53) =	202.3	kip-in.
Equivalent Line Load =	156.27	plf	

R-VALUE:

R = Failure/Theoretical = 105.97/156.27= 0.678

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.060-C1 Test 93
DATE:	4/27/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Short, Floating
Purlin Thickness………………………	.060"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.48	in. of water
Applied Line Loading =	48.264	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.90	plf
Total Applied Load =	55.22	plf
Maximum Moment =	71.48	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.7 ksi)

Moment = $F_y S_{eff}$ =	57.7 (1.83) =	105.6	kip-in.
Equivalent Line Load =	81.58	plf	

R-VALUE:

R = Failure/Theoretical = 55.22/81.58= 0.677

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.060-C1 Test 94
DATE: 5/1/00

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… Short, Floating
Purlin Thickness……………………… 0.061"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.35	in. of water
Applied Line Loading =	45.767	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.90	plf
Total Applied Load =	52.67	plf
Maximum Moment =	68.17	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.0 ksi)

Moment = $F_y S_{eff}$ = 58.0 (1.9) = 110.2 kip-in.
Equivalent Line Load = 85.14 plf

R-VALUE:

R = Failure/Theoretical = 52.67/85.14= 0.619

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.100-C3 Test 95
DATE: 5/19/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type…………………………… Standing Seam, (24 ga)
Span…………………………………… 1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips………………………. At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………….. None
Clip Type………………………………High, Floating
Purlin Thickness……………………… 0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 4.87 in. of water

Applied Line Loading = 94.907 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.05 plf

Total Applied Load = 103.95 plf
Maximum Moment = 134.55 kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.8 ksi)

Moment = $F_y S_{eff}$ = 59.8 (3.56) = 212.9 kip-in.
Equivalent Line Load = 164.48 plf

R-VALUE:

R = Failure/Theoretical = 103.95/164.48= 0.632

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.100-C3 Test 96
DATE: 6/22/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Floating
Purlin Thickness…………………… 0.106"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	4.74	in. of water
Applied Line Loading =	92.43	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.08	plf
Total Applied Load =	101.51	plf
Maximum Moment =	131.39	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.0 ksi)

Moment = $F_y S_{eff}$ = 60.0 (3.6) = 216.0 kip-in.
Equivalent Line Load = 166.88 plf

R-VALUE:

R = Failure/Theoretical = 101.51/166.88= 0.608

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.060-C3 Test 97
DATE:	5/10/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Floating
Purlin Thickness……………………0.060"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.29	in. of water
Applied Line Loading =	44.704	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.83	plf
Total Applied Load =	51.53	plf
Maximum Moment =	66.70	kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.9 ksi)

Moment = $F_y S_{eff}$ =	56.9 (1.81) =	103.0	kip-in.
Equivalent Line Load =	79.57	plf	

R-VALUE:

R = Failure/Theoretical = 51.53/79.57= 0.648

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.060-C3 Test 98
DATE: 5/11/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Floating
Purlin Thickness…………………… 0.060"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.18	in. of water
Applied Line Loading =	42.448	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.86	plf
Total Applied Load =	49.31	plf
Maximum Moment =	63.83	kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.2 ksi)

Moment = $F_y S_{eff}$ = 58.2 (1.83) = 106.5 kip-in.
Equivalent Line Load = 82.29 plf

R-VALUE:

R = Failure/Theoretical = 49.31/82.29= 0.599

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.100-C2 Test 99
DATE:	6/23/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type………………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing…………………………	None
Anti-roll Clips…………………………	At the supports of the ridge & eave purlin.
Web Stiffeners…………………………	None
Purlin Orientation………………………	Both top flanges toward ridge
Insulation……………………………..	None
Clip Type…………………………………	Low, Fixed
Purlin Thickness………………………	0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.56	in. of water
Applied Line Loading =	106.53	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.01	plf
Total Applied Load =	117.43	plf
Maximum Moment =	152.00	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.5 ksi)

Moment = $F_y S_{eff}$ =	60.5 (3.49) =	211.1	kip-in.
Equivalent Line Load =	163.13	plf	

R-VALUE:

R = Failure/Theoretical = 117.43/163.13= 0.720

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.100-C2 Test 100
DATE:	6/26/00

TEST DESCRIPTION:

Loading……………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span………………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	Low, Fixed
Purlin Thickness……………………	0.106"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.60	in. of water
Applied Line Loading =	109.14	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.12	plf
Total Applied Load =	118.37	plf
Maximum Moment =	153.22	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.7 ksi)

Moment = $F_y S_{eff}$ =	60.7 (3.55) =	215.5	kip-in.
Equivalent Line Load =	166.48	plf	

R-VALUE:

R = Failure/Theoretical = 118.37/166.48= 0.711

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S9-08Z0.060-C2 Test 101
DATE:	5/15/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (24 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.060"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.41	in. of water
Applied Line Loading =	46.958	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.83	plf
Total Applied Load =	53.79	plf
Maximum Moment =	69.62	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.6 ksi)

Moment = $F_y S_{eff}$ =	57.6 (1.82) =	104.8	kip-in.
Equivalent Line Load =	80.99	plf	

R-VALUE:

R = Failure/Theoretical = 53.79/80.99= 0.664

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.060-C2 Test 102
DATE: 5/16/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………Low, Fixed
Purlin Thickness……………………0.061"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 2.58 in. of water

Applied Line Loading = 50.166 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 2.90 plf

Total Applied Load = 57.24 plf
Maximum Moment = 74.09 kip in.

THEORETICAL FAILURE LOAD: (F_y= 58.1 ksi)

Moment = $F_y S_{eff}$ = 58.1 (1.83) = 106.3 kip-in.
Equivalent Line Load = 82.14 plf

R-VALUE:

R = Failure/Theoretical = 57.24/82.14= 0.697

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.060-C3 Test 103
DATE: 6/27/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, (24 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips………………………At the supports of the ridge & eave purlin.
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type………………………………High, Floating
Purlin Thickness………………………0.060"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.54	in. of water
Applied Line Loading =	48.672	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.83	plf
Total Applied Load =	56.36	plf
Maximum Moment =	72.95	kip in.

THEORETICAL FAILURE LOAD: (F_y= 53.2 ksi)

Moment = $F_y S_{eff}$ =	53.2 (1.88) =	100.0	kip-in.
Equivalent Line Load =	77.27	plf	

R-VALUE:

R = Failure/Theoretical = 56.36/77.27= 0.729

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S9-08Z0.100-C3 Test 104
DATE: 6/27/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (24 ga)
Span…………………………………1@29’-4-1/2"
Purlin Spacing………………………5’ o.c. with 1’ deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………High, Floating
Purlin Thickness…………………… 0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.00	in. of water
Applied Line Loading =	97.559	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.05	plf
Total Applied Load =	106.61	plf
Maximum Moment =	137.98	kip in.

THEORETICAL FAILURE LOAD: (F_y= 57.5 ksi)

Moment = $F_y S_{eff}$ = 57.5 (3.51) = 201.8 kip-in.
Equivalent Line Load = 155.93 plf

R-VALUE:

R = Failure/Theoretical = 106.61/155.93= 0.684

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

APPENDIX I

Series 10 Test Summaries

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.100-C1 Test 105
DATE:	6/21/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………Low, Floating
Purlin Thickness…………………… 0.106"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.81	in. of water
Applied Line Loading =	130.36	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.18	plf
Total Applied Load =	142.02	plf
Maximum Moment =	183.82	kip in.

THEORETICAL FAILURE LOAD: (F_y= 61.4 ksi)

Moment = $F_y S_{eff}$ = 61.4 (3.6) = 221.0 kip-in.

Equivalent Line Load = 170.77 plf

R-VALUE:

R = Failure/Theoretical = 142.02/170.77= 0.832

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.100-C1 Test 106
DATE: 6/19/00

TEST DESCRIPTION:

Loading………………………………Gravity
Panel Type…………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………Low, Floating
Purlin Thickness……………………0.107"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 6.29 in. of water

Applied Line Loading = 122.71 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 5.08 plf

Total Applied Load = 131.79 plf
Maximum Moment = 170.58 kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.0 ksi)

Moment = $F_y S_{eff}$ = 60.0 (3.47) = 208.2 kip-in.
Equivalent Line Load = 160.85 plf

R-VALUE:

R = Failure/Theoretical = 131.79/160.85= 0.819

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.060-C1 Test 107
DATE:	6/7/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span……………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Floating
Purlin Thickness………………………	0.061"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.27	in. of water
Applied Line Loading =	44.286	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.90	plf
Total Applied Load =	51.18	plf
Maximum Moment =	66.25	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.2 ksi)

Moment = $F_y S_{eff}$ =	64.2 (1.8) =	115.6	kip-in.
Equivalent Line Load =	89.28	plf	

R-VALUE:

R = Failure/Theoretical = 51.18/89.28= 0.573

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.060-C1 Test 108
DATE:	6/8/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span………………………………….…	1@29'-4-1/2"
Purlin Spacing………………………..	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Floating
Purlin Thickness…………………….	0.061"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.44	in. of water
Applied Line Loading =	47.611	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.93	plf
Total Applied Load =	54.54	plf
Maximum Moment =	70.60	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.1 ksi)

Moment = $F_y S_{eff}$ =	64.1 (1.83) =	117.3	kip-in.
Equivalent Line Load =	90.63	plf	

R-VALUE:

R = Failure/Theoretical = 54.54/90.63= 0.602

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.100-C3 Test 109
DATE: 5/31/00

TEST DESCRIPTION:

Loading……………………………… Gravity
Panel Type…………………………. Standing Seam, (22 ga)
Span……………………………….. 1@29'-4-1/2"
Purlin Spacing………………………5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… High, Floating
Purlin Thickness……………………. 0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.10	in. of water
Applied Line Loading =	118.97	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.12	plf
Total Applied Load =	128.08	plf
Maximum Moment =	165.78	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.3 ksi)

Moment = $F_y S_{eff}$ = 60.3 (3.57) = 215.3 kip-in.
Equivalent Line Load = 166.32 plf

R-VALUE:

R = Failure/Theoretical = 128.08/166.32= 0.770

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.100-C3 Test 110
DATE: 6/2/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing………………………None
Anti-roll Clips………………………At the supports of the ridge & eave purlin.
Web Stiffeners………………………None
Purlin Orientation……………………Both top flanges toward ridge
Insulation…………………………..None
Clip Type………………………………High, Floating
Purlin Thickness………………………0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.03	in. of water
Applied Line Loading =	117.49	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.18	plf
Total Applied Load =	126.67	plf
Maximum Moment =	163.95	kip in.

THEORETICAL FAILURE LOAD: (F_y= 59.8 ksi)

Moment = $F_y S_{eff}$ = 59.8 (3.65) = 218.3 kip-in.
Equivalent Line Load = 168.63 plf

R-VALUE:

R = Failure/Theoretical = 126.67/168.63= 0.751

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.060-C3 Test 111
DATE: 6/5/00

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………….… 1@29'-4-1/2"
Purlin Spacing………………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type……………………………… High, Floating
Purlin Thickness……………………… 0.062"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 2.14 in. of water

Applied Line Loading = 41.734 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 3.00 plf

Total Applied Load = 48.73 plf
Maximum Moment = 63.08 kip in.

THEORETICAL FAILURE LOAD: (F_y= 56.4 ksi)

Moment = $F_y S_{eff}$ = 56.4 (1.96) = 110.5 kip-in.
Equivalent Line Load = 85.41 plf

R-VALUE:

R = Failure/Theoretical = 48.73/85.41= 0.571

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.060-C3 Test 112
DATE: 6/6/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, (22 ga)
Span…………………………………1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing…………………………None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners………………………… None
Purlin Orientation……………………Both top flanges toward ridge
Insulation………………………….. None
Clip Type………………………………High, Floating
Purlin Thickness……………………… 0.062"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure = 2.26 in. of water

Applied Line Loading = 44.109 plf
Weight of Deck = 4.00 plf
Weight of Purlin = 3.00 plf

Total Applied Load = 51.11 plf
Maximum Moment = 66.15 kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.6 ksi)

Moment = $F_y S_{eff}$ = 63.6 (1.86) = 118.3 kip-in.
Equivalent Line Load = 91.40 plf

R-VALUE:

R = Failure/Theoretical = 51.11/91.40= 0.559

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.100-C2 Test 113
DATE:	5/21/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span………………………………….…	1@29’-4-1/2"
Purlin Spacing………………………	5’ o.c. with 1’ deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.105"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.30	in. of water
Applied Line Loading =	122.89	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.08	plf
Total Applied Load =	131.97	plf
Maximum Moment =	170.81	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.9 ksi)

Moment = $F_y S_{eff}$ =	60.9 (3.57) =	217.4	kip-in.
Equivalent Line Load =	167.97	plf	

R-VALUE:

R = Failure/Theoretical = 131.97/167.97= 0.786

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.100-C2 Test 114
DATE: 5/30/00

TEST DESCRIPTION:

Loading………………………………… Gravity
Panel Type…………………………… Standing Seam, (22 ga)
Span………………………………… 1@29'-4-1/2"
Purlin Spacing……………………… 5' o.c. with 1' deck overhang
Lateral Bracing……………………… None
Anti-roll Clips……………………… At the supports of the ridge & eave purlin.
Web Stiffeners……………………… None
Purlin Orientation…………………… Both top flanges toward ridge
Insulation………………………….. None
Clip Type…………………………… Low, Fixed
Purlin Thickness…………………… 0.106"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	6.50	in. of water
Applied Line Loading =	126.81	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.08	plf
Total Applied Load =	135.89	plf
Maximum Moment =	175.89	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.0 ksi)

Moment = $F_y S_{eff}$ = 60.0 (3.58) = 214.8 kip-in.
Equivalent Line Load = 165.95 plf

R-VALUE:

R = Failure/Theoretical = 135.89/165.95= 0.819

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.060-C2 Test 115
DATE:	6/9/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type………………………………	Low, Fixed
Purlin Thickness………………………	0.065"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.50	in. of water
Applied Line Loading =	48.243	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	3.10	plf
Total Applied Load =	55.93	plf
Maximum Moment =	72.39	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.5 ksi)

Moment = $F_y S_{eff}$ =	60.5 (1.95) =	118.0	kip-in.
Equivalent Line Load =	91.15	plf	

R-VALUE:

R = Failure/Theoretical = 55.93/91.15= 0.614

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.060-C2 Test 116
DATE:	6/13/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing…………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	Low, Fixed
Purlin Thickness……………………	0.062"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.48	in. of water
Applied Line Loading =	48.126	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.97	plf
Total Applied Load =	55.25	plf
Maximum Moment =	71.51	kip in.

THEORETICAL FAILURE LOAD: (F_y= 63.5 ksi)

Moment = $F_y S_{eff}$ =	63.5 (1.84) =	116.8	kip-in.
Equivalent Line Load =	90.27	plf	

R-VALUE:

R = Failure/Theoretical = 55.25/90.27= 0.612

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION:	S10-08Z0.060-C3 Test 117
DATE:	6/13/00

TEST DESCRIPTION:

Loading…………………………………	Gravity
Panel Type……………………………	Standing Seam, (22 ga)
Span…………………………………	1@29'-4-1/2"
Purlin Spacing………………………	5' o.c. with 1' deck overhang
Lateral Bracing………………………	None
Anti-roll Clips………………………	At the supports of the ridge & eave purlin.
Web Stiffeners………………………	None
Purlin Orientation……………………	Both top flanges toward ridge
Insulation…………………………..	None
Clip Type……………………………	High, Floating
Purlin Thickness……………………	0.060"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	2.11	in. of water
Applied Line Loading =	41.165	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	2.93	plf
Total Applied Load =	48.10	plf
Maximum Moment =	62.25	kip in.

THEORETICAL FAILURE LOAD: (F_y= 64.6 ksi)

Moment = $F_y S_{eff}$ =	64.6 (1.8) =	116.3	kip-in.
Equivalent Line Load =	89.84	plf	

R-VALUE:

R = Failure/Theoretical = 48.10/89.84= 0.535

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

PURLIN TEST SUMMARY

TEST IDENTIFICATION: S10-08Z0.100-C3 Test 118
DATE: 6/25/00

TEST DESCRIPTION:

Loading…………………………………Gravity
Panel Type……………………………Standing Seam, (22 ga)
Span…………………………………… 1@29'-4-1/2"
Purlin Spacing…………………………5' o.c. with 1' deck overhang
Lateral Bracing…………………………None
Anti-roll Clips………………………… At the supports of the ridge & eave purlin.
Web Stiffeners………………………… None
Purlin Orientation………………………Both top flanges toward ridge
Insulation…………………………….. None
Clip Type……………………………….High, Floating
Purlin Thickness……………………… 0.106"

FAILURE MODE:

Combination lateral torsional buckling and local flange and web buckling at maximum moment region of eave purlin.

EXPERIMENTAL FAILURE LOAD:

Pressure =	5.91	in. of water
Applied Line Loading =	108.81	plf
Weight of Deck =	4.00	plf
Weight of Purlin =	5.18	plf
Total Applied Load =	124.49	plf
Maximum Moment =	161.13	kip in.

THEORETICAL FAILURE LOAD: (F_y= 60.7 ksi)

Moment = $F_y S_{eff}$ = 60.7 (3.62) = 219.7 kip-in.
Equivalent Line Load = 169.77 plf

R-VALUE:

R = Failure/Theoretical = 124.49/169.77= 0.733

DISCUSSION:

Linear displacement transducers were used to measure maximum vertical deflections of eave and ridge purlins. A linear displacement transducer was used to measure horizontal deflection of ridge purlin at midspan. Pressure differential measured with a U-tube manometer & pressure transducer. Sweep and self weight effects were minimized.

VITA

The author was born in Indiana, Pennsylvania in July 1962. He graduated from Covington High School in 1981and entered the United States Coast Guard the same year. He was married to Kathryn Belle Harris on March 18, 1989. He has two children, daughter Krysta Renell Trout, born July 3, 1992, and son Elijah McKinley Trout, Born November 9, 1996. His undergraduate studies were done at Dabney S. Lancaster Community College and Virginia Polytechnic Institute and State University. He received his Associates of Science Degree (Suma Cum Laude) in Mechanical Design from Dabney S. Lancaster Community College in 1996 and his Bachelor of Science Degree (Magna Cum Laude) in Civil Engineering from Virginia Polytechnic Institute and State University in 1998.

The author began his graduate studies in August of 1999 at Virginia Polytechnic Institute and State University.

Alvin M. Trout