CLARKSON COLLEGE OF TECHNOLOGY

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Subject 2: Bracket Plates

subject 1

A Study of Welded Bracket to Web Connections of Rolled I-Sections with Low Web Slenderness Ratios

A Thesis

by

Bruce E. Hopper — author

Submitted in partial fulfillment of the requirements for the degree of

Master of Science

(Civil and Environmental Engineering)

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The undersigned have examined this thesis entitled "A Study of Welded Bracket to Web Connections of Rolled I-Sections with Low Slenderness Ratios" submitted in partial fulfillment of the requirements for the degree of Master of Science (Civil and Environmental Engineering) and deem it worthy of acceptance.

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IN MEMORY OF MY FATHER

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ABSTRACT

This experimental study of welded bracket to web connections examines sections with web slenderness ratios between 7 and 15. Two collapse mechanisms are possible for sections with low web slenderness ratios. One collapse mechanism, defined by Abolitz and Warner involves the development of yield lines in the web in the region around the bracket connection. The other mechanism involves the formation of plastic hinges in the flanges. A suggested design procedure which conforms to the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings has been developed for this type of connection.

VITA

The author was born in Buffalo, New York on April 17, 1959. He attended Iroquois Central High School from which he graduated in 1977. He entered Clarkson College that fall and completed his undergraduate studies in civil engineering in May of 1981. In April of his senior year at Clarkson, he was awarded a fellowship from the American Institute of Steel Construction to be used for his graduate program at Clarkson. This thesis is the result of his graduate program at Clarkson.

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Symbol	
a	T-distance (distance between web fillets)
b	Length of section between simple supports
e	Eccentricity of the load applied to the bracket
f_a	Actual axial compressive stress
f_b	Actual bending stress
h	Thickness of a plate
k	Shape factor for the collapse mechanism
m_e	Elastic moment per unit length
m_p	Ultimate plastic moment per unit length
r	Radius of gyration
t_f	Flange thickness
t_w	Web thickness
u,v	Dimensions of the extent of the collapse mechanism
x	Distance to the center of the bracket from one end of the section
A	Cross sectional area
F_a	Allowable axial compressive stress
F_y	Yield stress
G	Amplifier gain setting
G_f	Strain gage gage factor
P	Load applied to the bracket
P_u	Ultimate load of the section
R	Saftey factor for determining the allowable axial compressive stress

Symbol	
R_o	Transducer output at the rated maximum
S	Section modulus
T	T-distance (distance between the web fillets)
V_{ex}	Excitation voltage
V_{out}	Output voltage
W_e	External work
W_i	Internal work
β_1	Angle of flange rotation
β_2	Angle of web rotation
ε	Strain
ε_b	Bending strain
ε_m	Membrane strain
ε_{top}	Measured strain on the top of the web
ε_{bottom}	Measured strain on the bottom of the web
$\varepsilon_1, \varepsilon_2$	Principal strains
Δ	Deflection of the web at the corner of the bracket
δ	Deflection of the bracket at the point of load application
μ	Web slenderness ratio
ϕ	Relative angle of rotation of the plate segments in the collapse mechanism
Σ	Summation symbol

CHAPTER I

INTRODUCTION

TOPIC

Bracket to web connections as illustrated in Figure 1.1 are common structural connections. This experimental program funded by an American Institute of Steel Construction Fellowship investigated the load carrying capacity of these connections. The sections tested had a range of web slenderness ratios from 7.67 to 14.84, where the web slenderness ratio is the T distance of a section divided by the web thickness. Previous experimental data indicates that the ultimate loads of sections with a ratio greater than 15 correlate very well with the yield line theory developed by Abolitz and Warner [1]. However, those sections with a slenderness ratio of less than 10 developed a new collapse mechanism. The scope of this work was to define the geometry of this new mechanism and determine the critical web slenderness ratio for the mechanism.

Part 4 of the eighth edition of the AISC Manual of Steel Construction [2] (hereafter referred to as the Steel Manual) provides design guidelines for welded bracket to flange connections. However there are no design guidelines for welded bracket to web connections. Previous research has suggested that serious structural failure may occur for

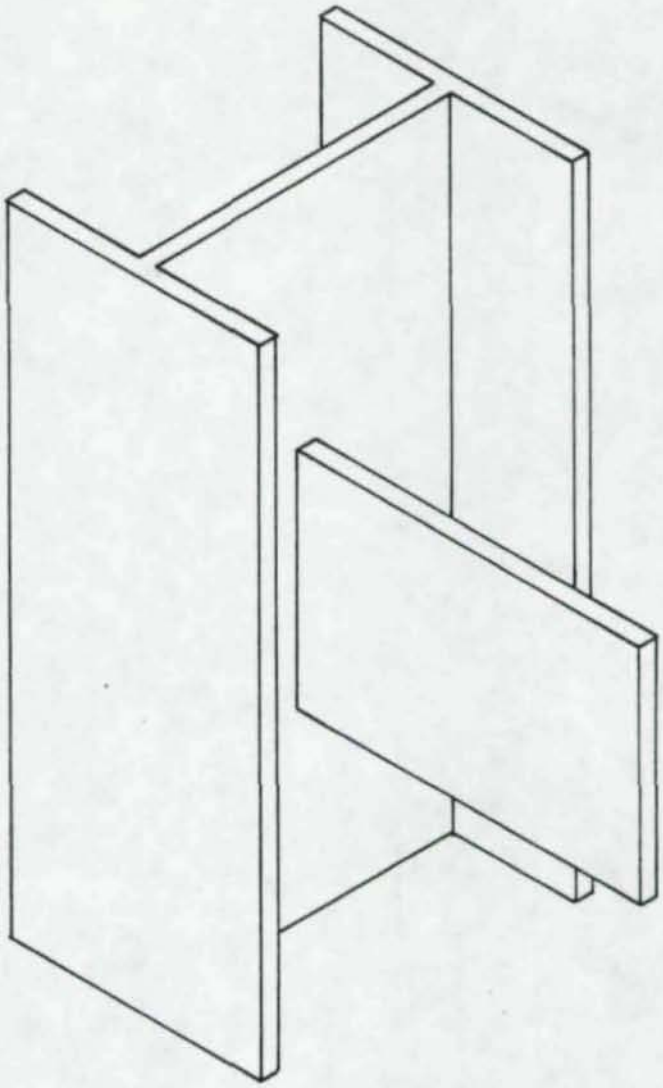


Figure 1.1 A typical welded bracket to web connection.

web slenderness less than 15 [3,5]. Twenty percent of the wide flange sections listed in the eighth edition of the Steel Manual have a web slenderness ratio less than 15. It is hoped that research in this area will lead to the development of efficient design guidlines for the welded bracket to web connections.

BACKGROUND

Joseph Hoptay [3] completed a study at Clarkson College in January of 1979 which investigated the ultimate load carrying capacity of sections with web slenderness ratios between 36 and 45. The testing program consisted of a total of eight tests on two sections: W10x15 (μ=36) and W12x16.5 (μ=45). Each section was tested with two bracket lengths, 8 inches and 12 inches.

Hoptay concluded that the elastic solution based on first yield of the material and the Mises yield criterion gives a very conservative load capacity. He proceeded to correlate his data with two theories: a yield line theory posed by Abolitz and Warner [1] and a deflection criterion posed by Save and Massonnet [4]. The data indicated that these sections could safely support the loads predicted by Abolitz and Warner's theory if the flanges acted like simple supports to the web and the plastic moment capacity is substituted for the elastic moment capacity. The data

further indicated that membrane effects were a significant factor in the load capacity of the connection, and Hoptay posed that these effects would decrease as the slenderness ratio decreased.

As a result of Hoptay's conclusions, James Walsh [5] undertook a study of bracket to web connections on sections with web slenderness ratios between 8 and 25 which was completed at Clarkson College in December of 1980. The testing program consisted of a total of eight tests on three sections: W4x13 (μ =8.9), W5x16 (μ =13.8) and W8x24 (μ =24.3); each section was tested with the same bracket lengths as Hoptay used, 8 inches and 12 inches, to allow the data to be compared.

Walsh also correlated his data with the theories of Abolitz and Warner, and Save and Massonnet. He found that if the shape factor was based on simply supported edges, the yield line theory predicted the ultimate load of sections with a web slenderness ratio between 13 and 25. His data also indicated that the effects of membrane strains were less significant than the bending strains at the lower values of the web slenderness ratios. Walsh also concluded that Save and Massonnet's theory correlated well with Abolitz and Warner's if 1.5% of the T distance was used for the failure criterion. Finally, Walsh's data indicated that a new failure mechanism had developed for the W4x13 section, but he was unable to define the geometry of this new

mechanism. He recommended that the theory posed by Abolitz and Warner not be used for sections with a web slendeness ratio less than 13.

OBJECTIVES

The purpose of this study is to experimentally investigate the new failure mechanism which develops for web slenderness ratios less than 13. The geometry of the new mechanism as well as the web slenderness ratio at which it becomes significant is to be determined. The ultimate load as determined from the deflection limits proposed by Save and Massonnet is to be compared to the ultimate load calculated from the expression developed by Abolitz and Warner for each section. The question of whether these theoretical ultimate loads represent a reasonable design load will be examined. The last topic to be investigated is the effect of membrane strains on the capacity of the connection as compared to the effects of the bending strains.

THEORY

The data from this study and the studies by Hoptay and Walsh have been correlated with two theories. The first is a theory by Abolitz and Warner which suggests that portions

of the web of the section form plastic hinges at the ultimate load and the resulting mechanism is responsible for failure. The second theory, by Save and Massonnet, relates the failure of laterally loaded disks to the deflection at the center of the disk. The limiting loads as determined by each theory are compared with the data and the capacity of the bracket is evaluated.

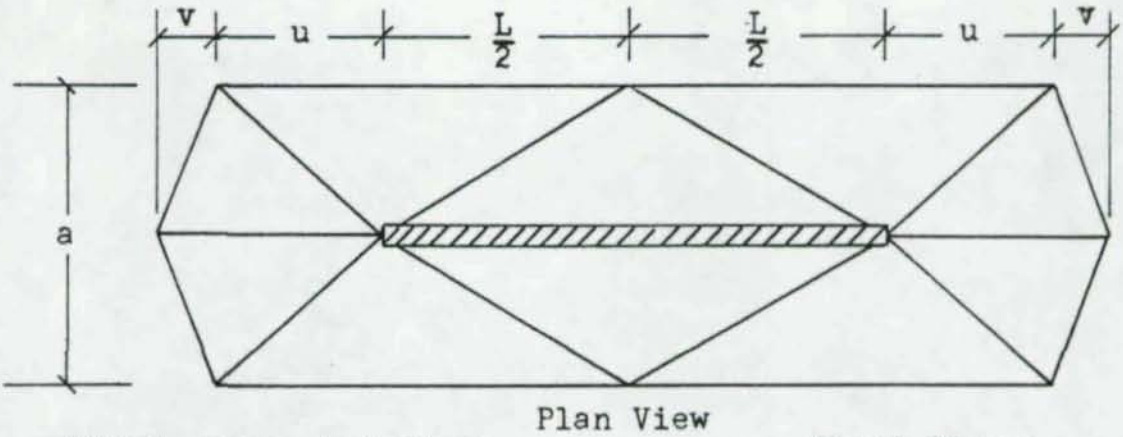
The expression developed by Abolitz and Warner for the ultimate load of a bracket to web connection is:

$$P_u = (kmL)/e \qquad (1.1)$$

where:

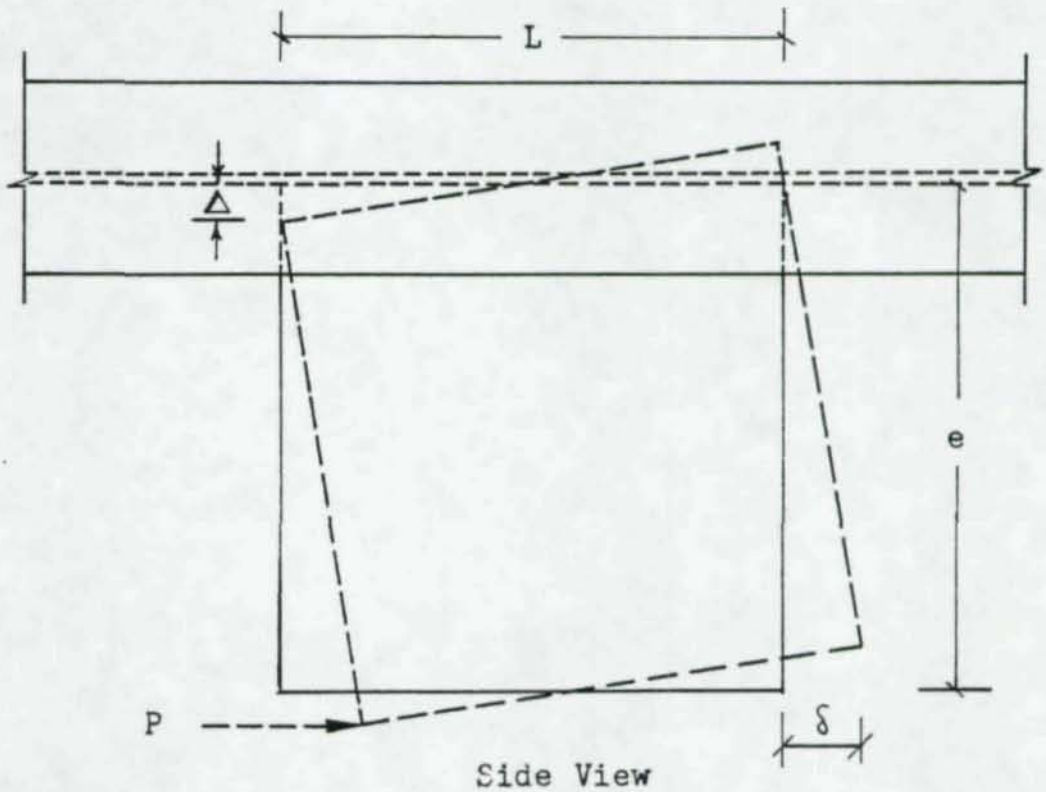
P_u = ultimate load
k = shape factor
m = plastic moment capacity
L = bracket length
e = eccentricity

Equation (1.1) is derived from work principles and the yield line pattern shown in Figure 1.2 (See reference 3). To maintain equilibrium in the bracket to web connection, the work done by the external forces must be equal to the work done by the internal forces. In this case, the external work is equal to the product of the applied load (P) and the distance through which the bracket deflects (δ). By assuming small deflections, δ is given by equation (1.2); and the external work may be expressed by equation (1.3).



Plan View

Simply Supported Edges	Fixed Edges
$u = 3a\sqrt{7}/14$	$u = a\sqrt{3}/6$
$v = a\sqrt{7}/14$	$v = a\sqrt{3}/6$



Side View

Figure 1.2 Yield line pattern at ultimate load

$$\delta = (2 \Delta e)/L \qquad (1.2)$$

where:

δ = deflection of the bracket at the point of load application
Δ = deflection of the web at the corner of the bracket

$$W_e = (2P\Delta e)/L \qquad (1.3)$$

where:

W_e = external work
P = the applied load

The internal work is equal to the summation of the product of the moment capacity per unit length (m) times the relative angle of rotation (ϕ) between the plate segments of the collapse mechanism times the length of the yield line (l) for all the yield lines in Figure 1.2. The internal work may be written as shown in equation (1.4).

$$W_i = \Sigma(m \phi l) \qquad (1.4)$$

where:

W_i = internal work
m = ultimate moment capacity per unit length
ϕ = relative angle of rotation between plate segments
l = length of the yield line

When the external work is equated to the internal work, an expression for the ultimate load is obtained in terms of the unknows u and v. The values of u and v which minimize the value of P_u must be determined. This is done by setting the partial derivative with respect to u and the partial derivative with respect to v equal to zero. The two

resulting equations are solved simultaneously for the values of u and v which correspond to the minimum P_u. These values are substituted back into the original equation to obtain an equation for P_u. The equation derived using the work principles is the upper bound solution for the ultimate load.

Save and Massonnet show from experimental work on circular plates that the ultimate load of a transversly loaded plate is very difficult to define. Typical load-deflection diagrams do not show a sharp break between the regions of small deflections and large permanent deflections for an additional small increment of load. From their experimental data they conclude that failure occures when the deflection of the plate is 2% of the span.

Save and Massonnet define a plate in terms of a slenderness ratio. The slenderness (μ) is a nondimensional ratio of the span to the thickness. If this ratio is small then the body has a thickness comparable to the span and acts like a beam. If the slenderness is large, the body is thin and acts as a membrane. Save and Massonnet limit the slenderness of plates to $10 < \mu < 40$. When applying Save and Massonnet's theory to rolled I sections, the slendeness ratio is equivalent to the web slenderness ratio of the section.

CHAPTER II

TESTING PROGRAM

DESCRIPTION

An experimental testing program was undertaken to meet the objectives in Chapter I. Five sections with a web slenderness ratio less than 15 were chosen: W4x13, W5x16, M5x18.9, W6x25 and S4x9.5. The properties of these sections are given in Table 2.1.

Two test specimens were prepared from each section to allow each section to be tested with two bracket lengths. The first specimen was tested with an 8 inch bracket, and the second was tested with a 12 inch bracket. The thickness of the bracket was chosen to be comparable to the web thickness. The W4x13 and the W5x16 with web thicknesses of .280 and .240 inches respectively were tested with brackets 1/4 (.250) inch thick. The other sections, M5x18.9, W6x25 and S4x9.5 with web thicknesses of .316, .320 and .326 inches respectively, were tested with brackets 5/16 (.3125) inches thick.

The grade of steel ordered for each of the sections was A36. Tension tests were conducted on two test coupons cut from the web of each section according to ASTM Standards, A 370-77. The yield stress for each section was taken as the average of the values obtained from the two coupons. Table

Section	Web Slenderness Ratio	Bracket Length (Inches)	Eccentricity (Inches)	Yield Stress (psi)	T Distance (Inches)	Web Thickness (Inches)	Ultimate[1] Load (Pounds)
W4x13	9.82	8 12	10.5 18.9	47380	2.75	.280	8350 8550
W5x16	14.58	8 12	10.8 18.9	42500	3.50	.240	4890 4950
M5x18.9	10.28	8 12	10.8 18.9	41470	3.25	.316	8450 8700
W6x25	14.84	8 12	14.25 18.9	44600	4.75	.320	6310 8080
S4x9.5[2]	7.67	8 12	10.5 18.9	44170	2.50	.326	11010 11420

1. Ultimate load based on simply supported edges
2. Tests on this section were terminated before the ultimate load was reached due to flange yielding

Table 2.1 Section Properties

2.1 shows that the yield stresses varied from 41470 psi to 47380 psi. The use of steels with different yield stresses was not intended, but it could not be avoided. Hereafter, any references to F_y will be to the experimental value of the yield stress and not the nominal 36000 psi, unless otherwise stated.

The eccentricity was varied in the tests of different bracket length due to the limited capacity of 15 kips of the load cell used to measure the load. Since the ultimate load is inversely proportional to the eccentricity (Equation 1.1), the eccentricity was increased until the calculated ultimate load was under 10 kips. For tests with the 8 inch brackets, the eccentricity was maintained at approximately 10.75 inches for four of the five sections. The eccentricity was increased to 14.25 inches for the test on the W6x25. The eccentricities for the tests involving a 12 inch bracket were held constant for all five sections. The value chosen, 18.9 inches, was the largest required for any of the tests with this bracket length.

The bracket was welded to the web midway between the flanges of the section. However, due to the dimensions of the test frame, the bracket was not centered along the length of the test specimen. The center of the bracket was offset 2 inches in the length direction with respect to the center of the section. A fillet weld, which had a throat dimension equal to the bracket thickness, was used around

the entire perimeter of the bracket. The weld proved to be sufficient for all loads.

Two forms of data were collected from each test and used to establish the geometry of the failure mechanisms. The data consisted of strain readings from several points on the web and deflections for both the web and flanges. Each test section was loaded in 500 pound increments and the strain and deflection data were recorded for each load increment.

The strain readings were used primarily to verify the yield line pattern posed by Abolitz and Warner. Strain gages (gage locations 1-4) were placed on the web at locations where the proposed lines would develop (See Figure 2.1). Additional gages (gage locations 6-10) were placed down the centerline of the section to monitor the extent of the yielding; and on some tests, gages (gage locations 11-12 in Figure 2.2) were placed near the supports to determine the reactions.

Each strain gage location shown in Figure 2.1 except locations 11-12, consisted of a pair of similar strain gages: one on top of the web and the other on the bottom of the web. The top of the web refers to the side to which the bracket is attached. These gages were positioned directly over each other and they were oriented such that their axes coincided. The gages were paired in this manner to provide strain profiles through the web.

Strain rosettes were placed at locations where the principal strain direction was unknown. These locations included positions 1, 2, 3 and 4 in Figure 2.1. A strain rosette was not included at gage location 4 until the tests on the W4x13, W5x16 and the S4x9.5 with the 8 inch bracket were completed.

A strain rosette was substituted for the single axis gage at location 5 on the W4x13 section with the 8 inch bracket. Doing this required gage locations 1 and 3 to be moved. These gages were moved to the same position on the opposite side of the centerline as that given in Figure 2.1. Relocating these gages should not have had any effect on establishing the yield line pattern since this pattern is symmetrical with respect to the centerline of the section.

Similarly, a strain rosette was substituted for a single axis gage in gage location 6 for the test on the W5x16 with the 8 inch bracket. However, this substitution did not affect the location of any other gages.

Two single axis gages were placed on the flanges of the S4x9.5 section with the 12 inch bracket (gage locations 13-14 in Figure 2.3). These gages were placed at the extreme edges of the flanges even with the corners of the bracket. The strain readings from these gages were used to confirm the geometry of the failure mechanism for this section. Throughout the text, positive values of strain will be used to indicate a tensile strain.

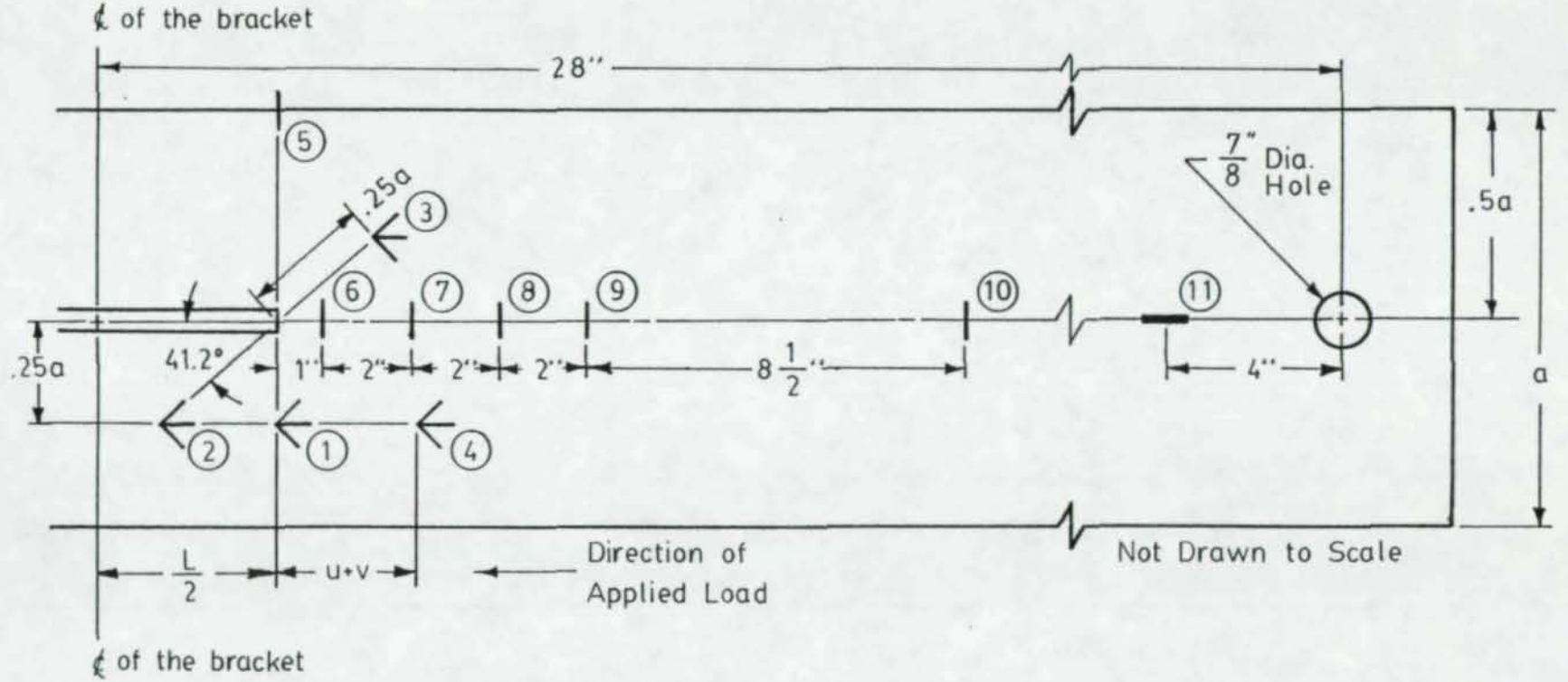


Figure 2.1 Strain gage locations.

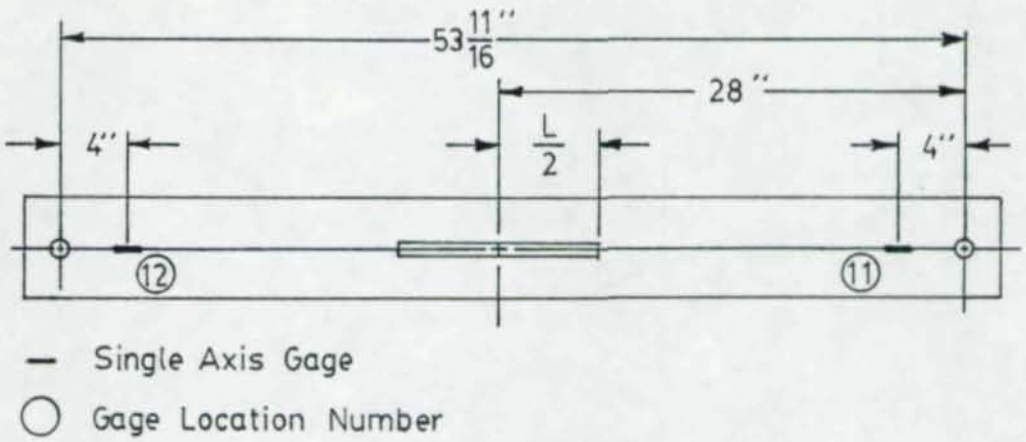


Figure 2.2 Locations of strain gages at the supports.

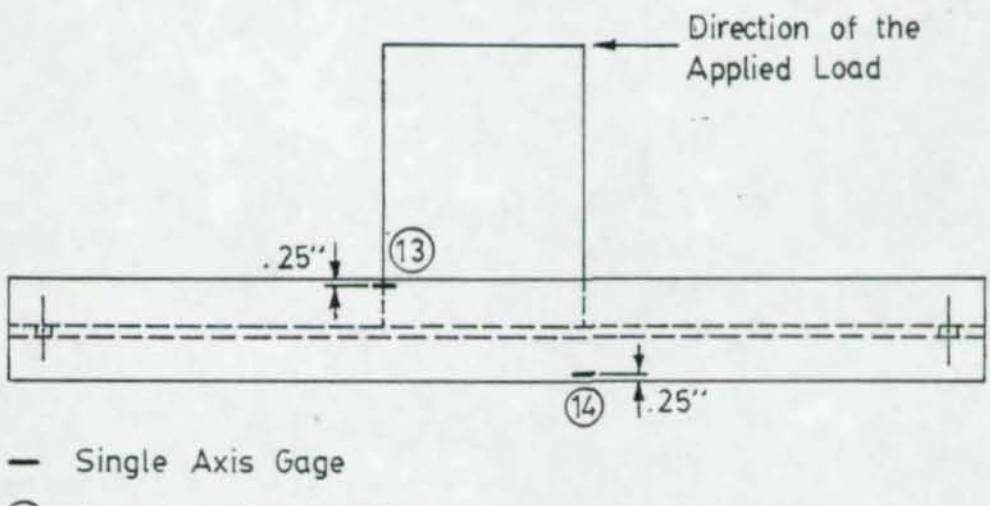


Figure 2.3 Location of the strain gages on the flanges.

The reference axes for the strain rosettes are oriented such that the x axis is parallel to the longitudinal axis of the section. The principal strain directions are given with respect to the x axis: positive angles are measured counterclockwise (See Figure 2.4).

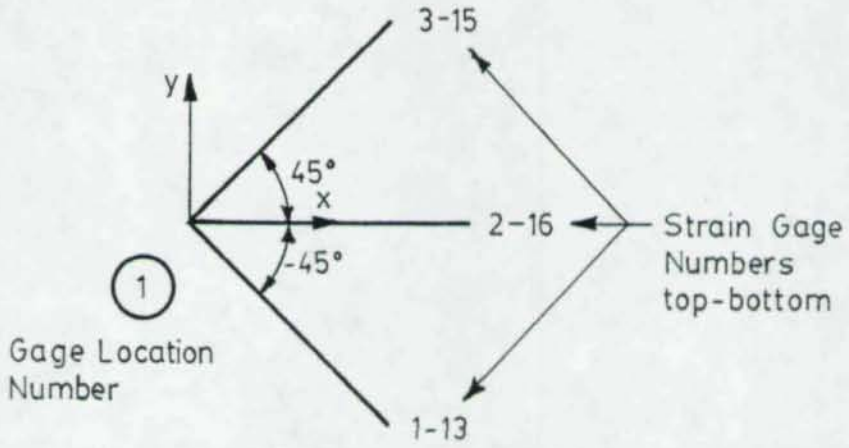


Figure 2.4 The distinction between gage location numbers and individual strain gage numbers.

A distinction should be made between a gage location number and a strain gage number. A gage location is the number referring to the position of either a rosette or a single axis gage on the section. Each strain rosette is composed of three individually numbered strain gages oriented at -45, 0 and +45 degrees respectively. These gages are numbered consecutively from lowest to highest in the same counterclockwise order. For example in Figure 2.4, strain gage number 1 is oriented at -45 degrees, strain gage number 2 at 0 degrees, and number 3 at +45 degrees. The strain data in the appendicies is listed with both the

strain gage number and the gage location number.

The deflections of the web and flanges were measured with dial gages. These dial gages were mounted on an independent test stand shown in Figure 2.5 to avoid any interaction with the loading frame. The sign convention is as follows: positive deflections on the web indicate that the top of the web moved upward out of its plane. Positive deflections of the flanges indicate a deflection outward from the center of the section.

The dial gages were generally placed in groups of three (See Figure 2.6). By using three dial gages, rigid body rotations and translations could be separated from the relative deflections of the section. Three groups of dial gages were used on the web in the region of the bracket; at the leading corner of the bracket (dial gages 4 and 1), at the centerline of the bracket (5, 2 and 7), and at the far corner of the bracket (6, 3 and 8). Groups of dial gages were also placed across the width of both flanges at cross sections through the centerline of the bracket, at the leading corner of the bracket and 15 inches from the leading corner. No symmetry in the bending of the flanges was assumed, so the deflections of both flanges were measured at each cross section.

The centerline deflection of the section was measured using dial gages 27-30. These dial gages were not placed in groups, since the rigid body rotations of the web outside

the bracket region were of no interest.

The strain data was used to verify the existence of the yield lines posed by Abolitz and Warner. The strain rosettes were used to determine the directions of the yield lines. The single axis gages along the centerline were used to determine the extent of the collapse region, because Walsh postulated that the new failure mechanism involved a large portion of the length of the section. The deflection data was used to confirm the collapse mechanism and to evaluate the web-flange interaction.

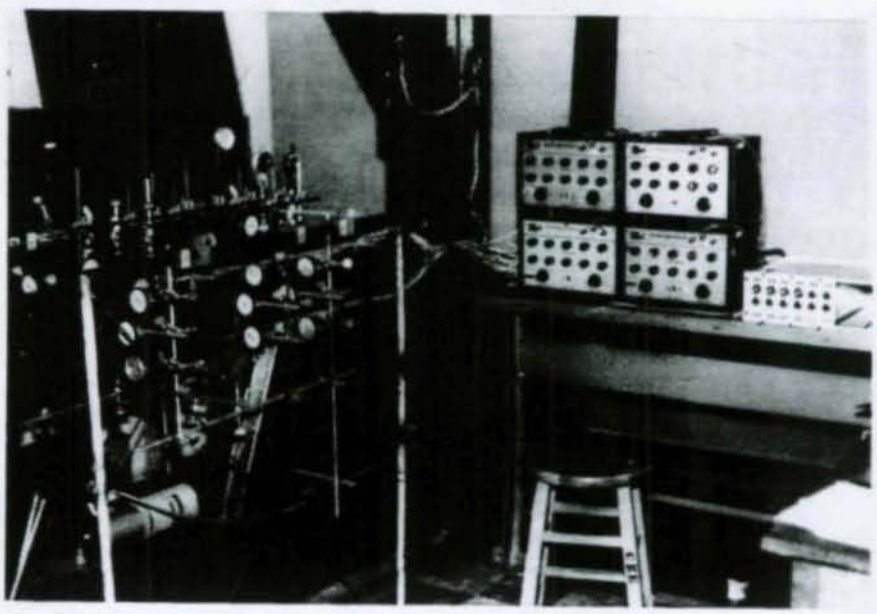


Figure 2.5 The test set-up.

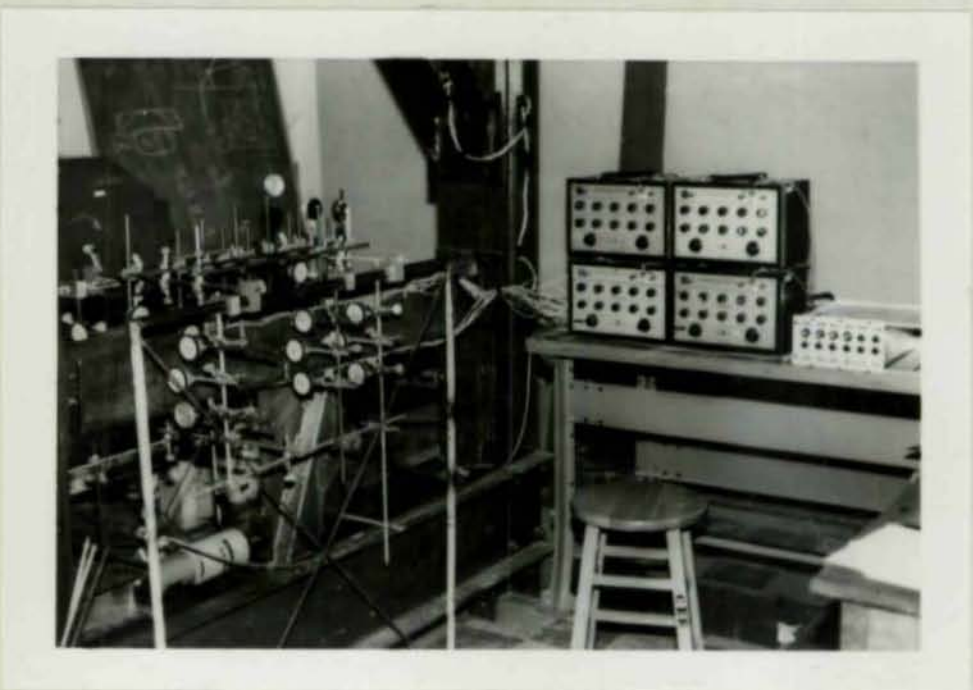


Figure 2.5 The test set-up.

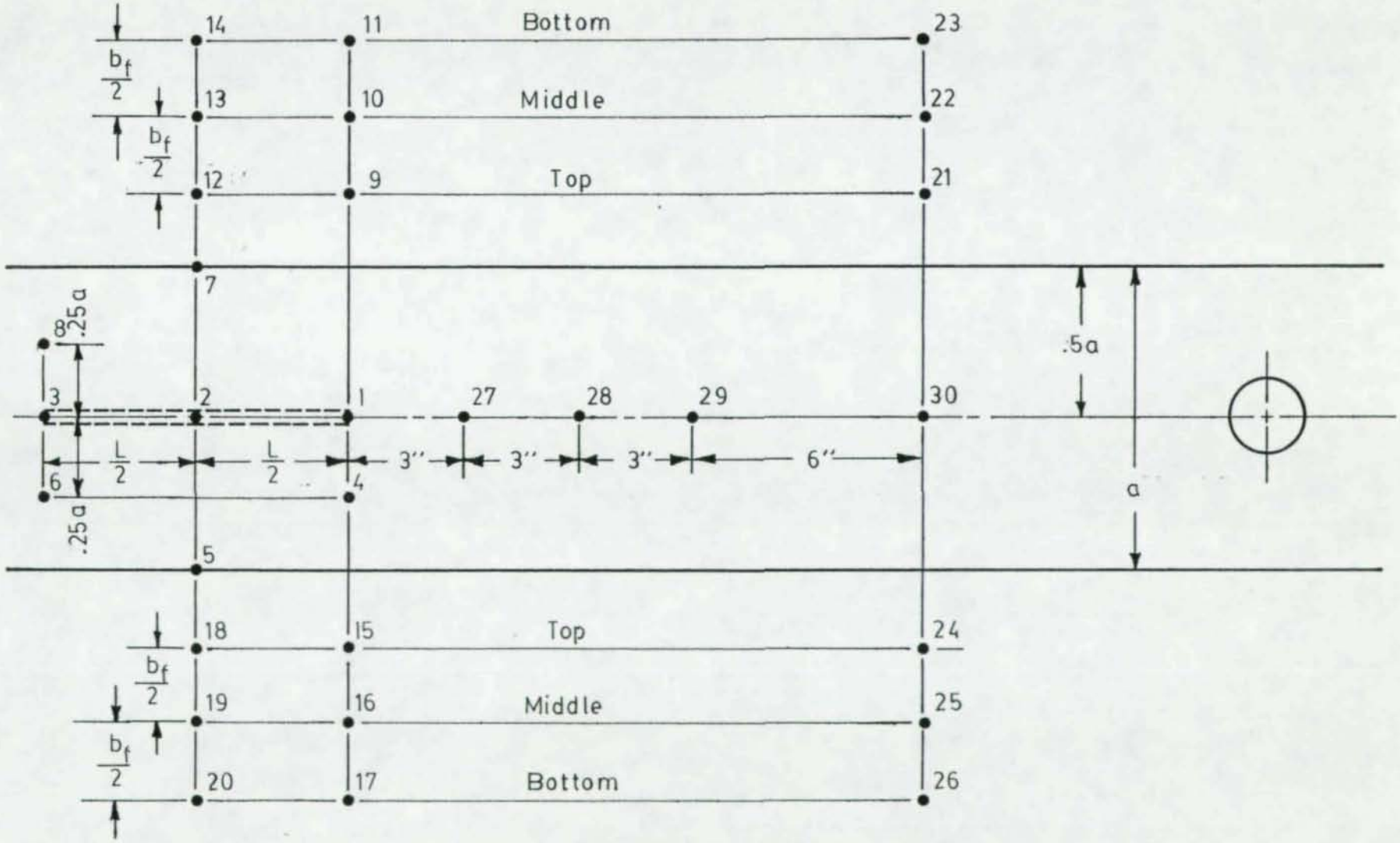


Figure 2.6 Dial gage locations

CHAPTER III

PRESENTATION AND DISCUSSION OF RESULTS

Membrane Strains

The strain data collected from each test was used to determine if the failure mechanism proposed by Abolitz and Warner actually occurred. The strain data represents the total strain at a point: a combination of bending and membrane strain. Since the yield lines in the failure mechanism involve only bending strains, the data must be resolved into its component bending and membrane strains.

The reason for placing strain gages on both sides of the web was to obtain a strain profile. If a linear strain distribution is assumed to exist through the thickness of the web, the values of the bending and membrane strains can be determined from the top and bottom strain readings. Figure 3.1 shows that the membrane strains can be represented by equation (3.1), and the bending strains by equation (3.2).

$$\varepsilon_m = (\varepsilon_{top} + \varepsilon_{bottom})/2 \qquad (3.1)$$

where:

ε_m = membrane strain
ε_{top} = measured strain on top of the web
ε_{bottom} = measured strain on the bottom of the web

$$\varepsilon_b = (\varepsilon_{top} - \varepsilon_{bottom})/2 \qquad (3.2)$$

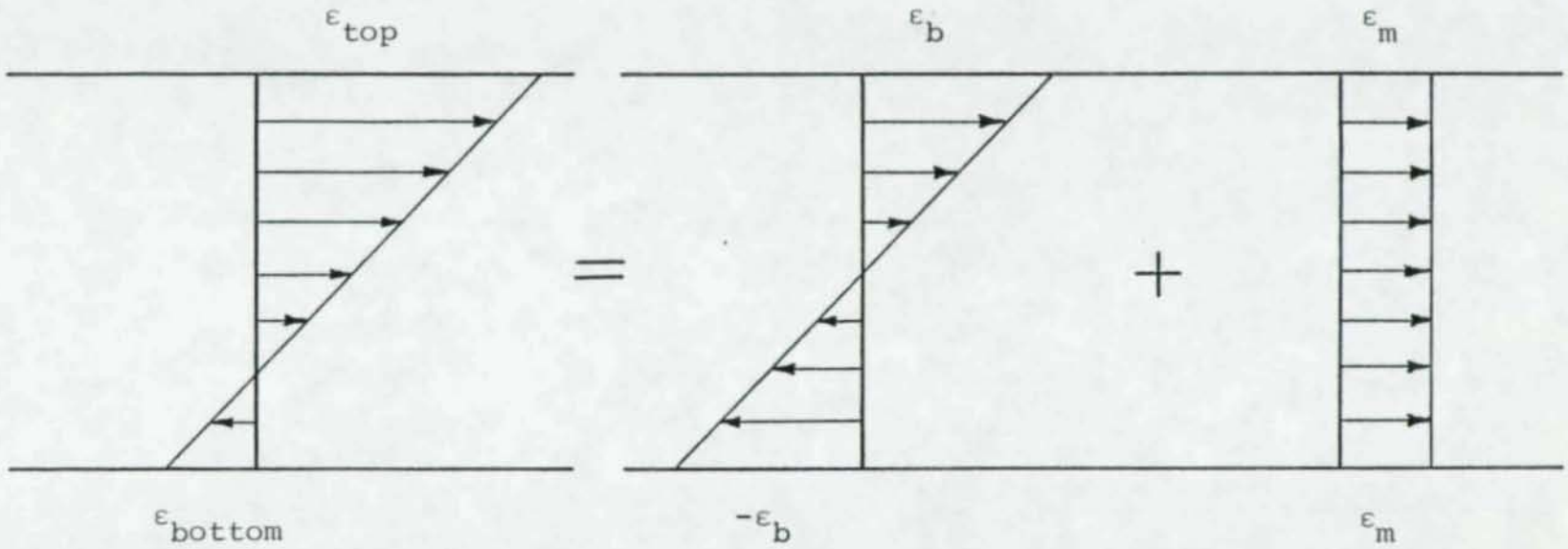
where:

ε_b = bending strain

Once the membrane strains can be separated from the bending strains, their relative importance must be determined. Then, the bending strains are used to verify the locations of the yield lines

Small deflection theory assumes that the effects of membrane strains are negligible [6]. This assumption is known to be valid if the deflections of the plate are small when compared to the thickness of the plate. The maximum deflection for this theory to be valid is limited to two tenths of the thickness of the plate ($\Delta = 0.2h$). If the deflection data indicates that the maximum deflections of the webs are less than 20% of the web thickness, then the effects of the membrane strains can be assumed to be negligible. Table 3.1 lists the maximum deflection and the ratio of the maximum deflection to web thickness for each of the sections at their corresponding ultimate loads. This table shows that the assumptions of small deflection theory do not apply to these tests, because many of the ratios of maximum deflection to web thickness either approximate or exceed 0.2.

Membrane strains become more significant as the maximum deflection increases beyond the two tenths of the plate



ε_{top}	$\varepsilon_b + \varepsilon_m$
ε_{bottom}	$-\varepsilon_b + \varepsilon_m$

Figure 3.1 Strain profile with component bending and membrane strains.

Section	Bracket Length (Inches)	Ultimate Load (Pounds)	Deflection (Δ) (Inches)	T Distance (Inches)	Δ/T	Δ/t_w
W4x13	8	8350	0.043	2.75	0.0157	0.154
	12	8550	0.070		0.0255	0.250
W5x16	8	4890	0.042	3.50	0.0121	0.175
	12	4950	0.060		0.0173	0.250
M5x18.9	8	8450	0.036	3.25	0.0111	0.114
	12	8700	0.063		0.0195	0.199
W6x25	8	6310	0.067	4.75	0.0141	0.204
	12	8080	0.080		0.0169	0.250

Table 3.1 Ratios of maximum deflections at ultimate load to the T distance and the web thickness.

thickness. Membrane action is responsible for a large portion of the load capacity of a plate at deflections approximately equal to the thickness of the plate. In membranes the flexural stiffness is negligible; and lateral loads are resisted by the axial and central shear forces [6]. This action is analagous to a system of stretched cables. Because of this relationship between deflection and membrane action, the maximum deflections may be used to judge the significance of the axial strains.

In the tests performed by Hoptay, the deflections ranged from .73h to .95h at ultimate load. Hoptay concluded that the effects of the membrane strains become less significant as the web slenderness ratio decreases. Walsh's tests verified that the effects of membrane strains are reduced for sections with web slenderness ratios between 8 and 25. The maximum deflections for these sections ranged from .18h to .46h at ultimate load. Table 3.1 indicates that Hoptay's conclusion is again verified for sections with a web slenderness ratio between 8 and 15. The range of maximum deflections at ultimate load for the test sections in this program is .11h to .25h.

A comparison of the maximum bending and maximum membrane strains reveals that the magnitudes of the membrane strains are often comparable to the magnitudes of the bending strains. The ratio of maximum bending strain to maximum membrane strain at ultimate load for each section is

given in Table 3.2. This table shows that in the region around the bracket the membrane strains are not negligible, however they are not as large as the bending strains. The result is that membrane action is responsible for a portion of the load capacity of this type of connection.

Table 3.2 Ratios of maximum absolute bending strain to maximum absolute membrane strain.

Section	Bracket Length (in.)	Gage Number 1	2	3	4
W4x13	8	2:1	4:1	2:1	---
	12	2:1	13:1	1:1	17:1
W5x16	8	4:1	3:1	6:1	---
	12	4:1	1:1	7:1	8:1
M5x18.9	8	1:1	2:1	2:1	17:1
	12	6:1	2:1	4:1	12:1
W6x25	8	5:1	2:1	23:1	23:1
	12	4:1	0.4:1	8:1	7:1

Yield Line Patterns

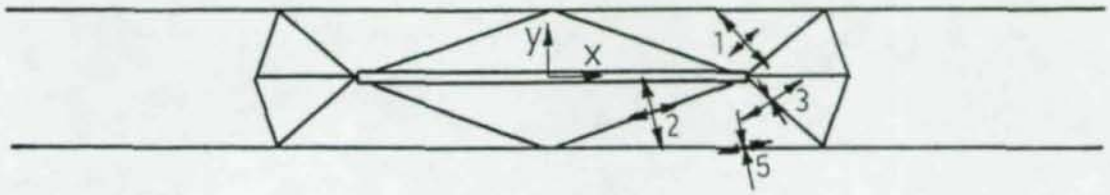
The bending stiffness is responsible for most of the load capacity of plates. For this reason, the bending stresses and strains are of primary concern.

The bending strains are used to verify the existence of the yield lines which were predicted by Abolitz and Warner. The principal bending strains are superimposed on the predicted yield line patterns for each section in Figures 3.2-3.5. In these figures, the load is applied in the

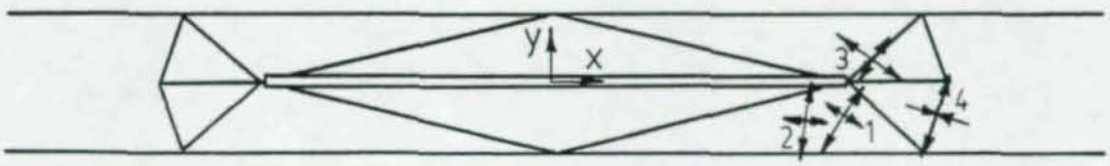
negative x direction and as a result the corner of the bracket on the positive x axis is deflected upward out of the page.

Gage locations 3 and 4 lie directly on a yield line. The principal strain directions which are expected for these gages are oriented along and perpendicular to the yield line. For the given loading, the principal strain acting perpendicular to the yield line under gage 3 should be a tensile strain; and the strain acting perpendicular to the yield line under gage 4 should be a compressive strain. As the figures illustrate, the alignment of the strains is generally as expected, within a small angle. Figures 3.2-3.5 indicate the direction of the maximum tensile strain for gage 3 is nearly perpendicular to the direction of the yield line while the minimum strain is in the direction of the yield line for all the sections. The principal compressive strain for gage 4 always acts nearly perpendicular to the yield line, while the principal tensile strain acts in the direction of the yield line, again for all the sections. These gages do verify the directions of the corresponding yield lines.

Unlike gages 3 and 4, gages 1 and 2 do not lie directly on a yield line. The principal strain directions for these gages are not as consistent as are the principal strain directions of gages 3 and 4. As the locations of gages 1 and 2 approach a yield line, their principal strains tend to

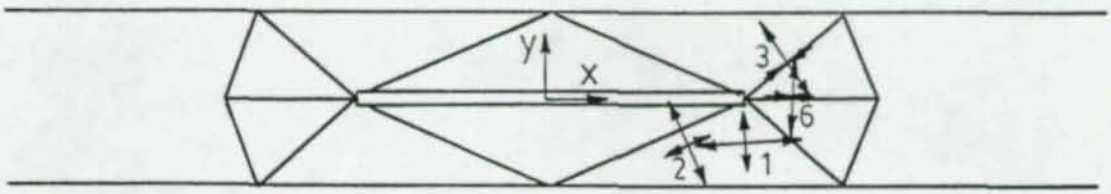


(a) 8 inch bracket

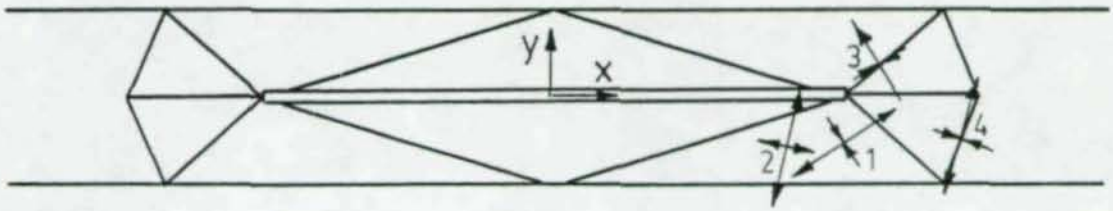


(b) 12 inch bracket

Figure 3.2 Superposition of the principle strains on the yield line patterns for the W4x13 at ultimate load.

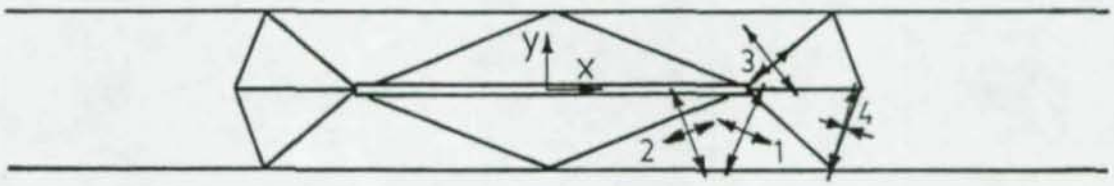


(a) 8 inch bracket

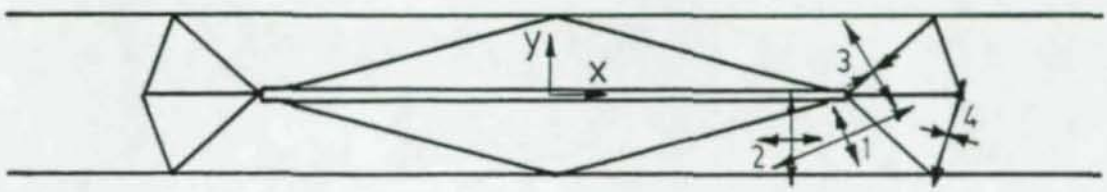


(b) 12 inch bracket

Figure 3.3 Superposition of the principle strain directions on the yield line patterns for the W5x16 at ultimate load.

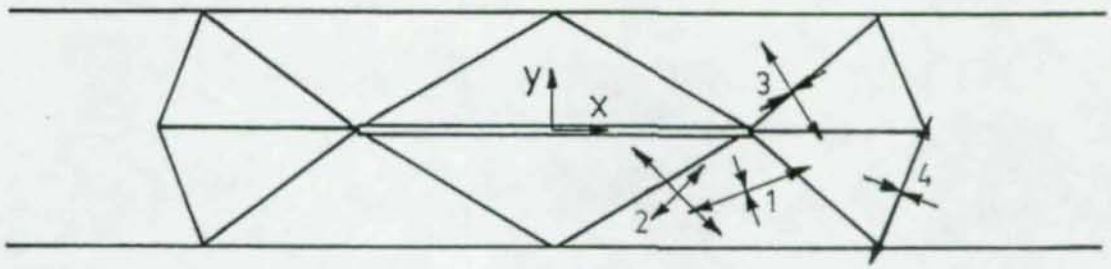


(a) 8 inch bracket

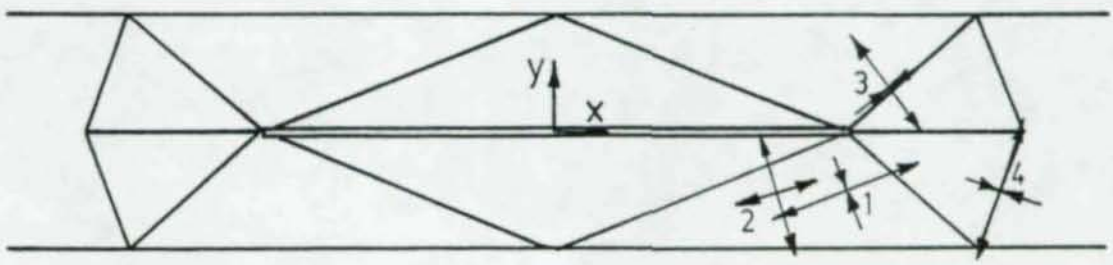


(b) 12 inch bracket

Figure 3.4 Superposition of the principle strain directions on the yield line patterns for the M5x18.9 at ultimate load.



(a) 8 inch bracket



(b) 12 inch bracket

Figure 3.5 Superposition of the principle strain directions on the yield line patterns for the W6x25 at ultimate load.

be oriented perpendicular and in the direction of the yield line. For example, gage 2 is located closer to a yield line for tests with an 8 inch bracket than it is for tests with a 12 inch bracket. This is true for all the sections. In each of the figures, the directions of the principal strains for gage 2 seem to coincide with the direction of the yield line for the tests using the 8 inch bracket. The principal strain directions for this same gage location on tests with the 12 inch bracket are disoriented with respect to the direction of the yield line. The reason for this is explained as follows.

There is a redistribution of stresses within the plate segments of the collapse mechanism as the yield lines develop. Only bending moments exist along the yield lines: no transverse shears or twisting moments are present. In theory, all the bending occurs at the yield line and not within the plate segments. In reality, bending is distributed over a small region on both sides of the yield line. For this reason, the principal strains in the vicinity of the yield lines are oriented in the direction of the yield line. Points near the center of the plate segment are affected by the strain directions from other yield lines, and as a result their principal directions do not coincide with any one yield line.

The directions of the yield lines have been verified by the data, but the question of whether a fully plastic cross

section develops still remains. A fully plastic section, with a rectangular stress block extending inward to the neutral axis, is only a theoretical case. To achieve a strain equal to the yield strain at the neutral axis would require an infinite strain at the most extreme fibers. In actuality, a strain reading over twice the value of the yield strain indicates that over half of the cross section is plastic. In this case, a yield line has formed.

The values of the bending strains for each section are given in Table 3.3. The table shows that the strains for gages 1 and 2 generally were just over the value of the yield strain. These two locations are far from forming plastic hinges at the ultimate load if the extreme fibers were just reaching yield. The strain values at location 3 indicate that the strain at the extreme fibers is almost always greater than twice the value of the yield strain. This means that over half of the cross section has reached the yield stress, or over half of the cross section is plastic. As a result, this cross section has undergone considerable rotations, and a yield line can be assumed to exist. Table 3.3 also shows that although the principal strain directions for gage 4 do correspond to the direction of the proposed yield line, no yielding has occurred in any of the sections. The above results show that at the calculated ultimate load, the collapse mechanism is not fully developed. The lack of yielding may be explained by

			Bending Strains (Microstrain)			Membrane Strains (Microstrain)		
Section	Bracket Length (in.)	Gage Number	Maximum Strain	Minimum Strain	Theta* (Deg.)	Maximum Strain	Minimum Strain	Theta* (Deg.)
W4x13	8	1	2870	640	132.	600	-1460	7.
		2	1680	80	106	450	40	81.
		3	3360	-800	34.	1140	-1370	-14.
	12	1	3360	1520	57.	1880	440	-16.
		2	2120	360	82.	160	-80	37.
		3	4380	1940	-38.	3830	-2020	16.
		4	1390	-490	73.	50	-80	-34.
W5x16	8	1	1590	-150	3.	450	-50	-3.
		2	1550	50	114.	470	-70	-38.
		3	3490	-1190	124.	300	-560	40.
	12	1	2280	-280	33.	-10	-510	9.
		2	3430	530	76.	1340	-2960	-21.
		3	4460	-1540	121.	550	-670	31.
		4	1140	-510	73.	20	-130	-5.

* Theta is measured to the direction of the maximum strain.

Table 3.3 Maximum and minimum bending and membrane strains and their directions at ultimate load.

			Bending Strains (Microstrain)			Membrane Strains (Microstrain)		
Section	Bracket Length (in.)	Gage Number	Maximum Strain	Minimum Strain	Theta* (Deg.)	Maximum Strain	Minimum Strain	Theta* (Deg.)
M5x18.9	8	1	5390	740	66.	1590	-5000	-18.
		2	3090	520	112.	1120	-1430	-32.
		3	3420	10	37.	1460	-30	24.
		4	860	-450	-17.	-10	-50	-11.
	12	1	2180	-270	23.	370	180	5.
		2	2630	550	90.	850	-1570	-29.
		3	4640	-1510	121.	1210	-800	30.
		4	1290	-470	74.	40	-110	-41.
W6x25	8	1	2360	-820	21.	520	-110	62.
		2	1780	-340	-45.	780	-420	-11.
		3	3600	-1730	122.	160	-150	24.
		4	700	-450	67.	10	-30	35.
	12	1	2430	-1330	21.	690	-150	75.
		2	1250	700	106.	790	-3300	-19.
		3	4050	-2030	121.	480	-490	18.
		4	970	-470	71.	50	-140	104.

* Theta is measured to the direction of the maximum strain.

Table 3.3 Continued

considering the interaction between the web and flange which is described later.

The deflection data should also indicate whether or not the failure mechanism posed by Abolitz and Warner exists. Most of the deflection out of the plane of the web should be confined to a small region around the bracket connection.

The deflection data does support the existence of the failure mechanism. Figures 3.6-3.9 show the deflections along the centerline of each section. In each of the figures, the distance along the centerline is measured with respect to the center of the bracket: the 8 inch brackets extend from -4 to +4 inches, and the 12 inch brackets from -6 to +6 inches. As shown in Figures 3.6-3.9, the extent of the failure mechanism is generally restricted to within 3 inches from the corner of the bracket except in Figure 3.9. The plot of centerline deflection for the W6x25 still shows a considerable deflection 3 inches out. The data shows that the extent of the failure mechanism is somewhere between 3 and 6 inches from the corner of the bracket. This result is expected since only the W6x25 has a u+v distance greater than 3 inches as shown in Table 3.4. The distance u+v is the furthest extent of the collapse mechanism along the centerline of the section. The break in the centerline deflection curves at approximately 20 inches in Figures 3.6-3.9 does not represent a plastic hinge, but results from assuming a zero deflection at the support.

Table 3.4 u and v distances for each section.

Section	u	v	u+v
W4x13	1.559	0.520	2.079
W5x16	1.984	0.661	2.646
M5x18.9	1.843	0.614	2.457
W6x25	2.693	0.898	3.591
S4x9.5	1.417	0.472	1.890

The plots of the centerline deflections also indicate that there are significant deflections down the length of the section. This can be explained in part by considering the interaction between the web and flanges. The support which the flanges provide to the web is neither fixed or simple as Abolitz and Warner assume in their theory.

Typical cross sections through various points along the length of the section are given in Figure 3.10. Figure 3.10 Section A-A shows that as the bracket is loaded, the web forces the flanges to rotate. Figure 3.10 Section B-B shows that a similar action occurs at the other end of the bracket, except the deflections are in the opposite directions. As a result, the flanges undergo a reversal in rotation over the length of the bracket. At these cross sections, the action is the web deflection, the reaction is the flange rotation. This reversal in flange rotation can be seen in Figure 3.11 for the W4x13 section with the 12 inch bracket.

The flanges develop resistance to this rotation in part due to their torsional stiffness. The remaining resistance

is derived from that region of the web which is outside the collapse mechanism. Section C-C of Figure 3.10 shows how the internal moments in the web resist the flange rotation. At any cross section outside of the collapse region, the action is the rotation of the flanges; the reaction is the deflection of the web. It is assumed that the web is deflected into a circular arc by the rotation of the flanges. This arc provides the deflection which was measured along the centerline. The interaction between the flanges and the web produced the bending strains which were measured along the centerline. However, due to the uniform distribution of bending across the width of the web, no yield line exists along the centerline of the section outside the collapse mechanism.

These internal moments are also responsible for the lack of the predicted yield line under gage location 4 which was discussed previously. The internal bending moments developed in the web by the flange rotations outside the collapse mechanism (negative bending) opposed the internal moments being developed at the theoretical yield line (positive bending). The value of the positive bending strains may have been greater than the value of the yield strain, but combined with the negative bending strains, the total is less than the yield strain. Hence, no yield line.

With this understanding of the flange-web interaction, Figures 3.12-3.14 can be used to illustrate how the support

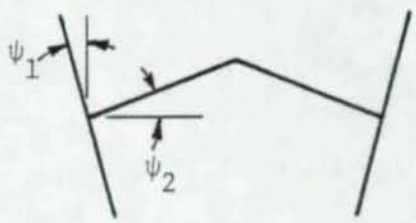
given to the edge of the web by the flanges differs from either a fixed support or simple support. The difference between a simple edge support and the flanges is obvious. The simple support provides no resistance to rotations of the plate segments of the web (See Figure 3.14). The fixed support, unlike the flanges, restrains all rotations. In this case, the value of the reaction is equal to the plactic moment capacity of the web. Figure 3.12 shows how a plastic hinge must exsist along the entire length of the boundary between the flange and web. For the case of the actual flange support, the value of the reaction along this boundary can change as shown in Figure 3.13 due to the rotation of the flanges. The unique feature of the support from the flange is the moment applied to the web outside the failure region.

The question of which type of support the flanges approximate can be answered by examining the ratio of the angle of web rotation to the angle of flange rotation (See Table 3.5). If the flanges acted as a fixed support ($\psi_1=0$), the ratio of web to flange rotation would be infinite. In the case of the simple support ($\psi_1=\psi_2$), the ratio would equal one. Table 3.5 shows the ratio of web rotation to flange rotation for all the sections. This Table indicates that the flanges provide some resistance to rotation of the web, but not enough to be considered as fixed supports. For this reason, the ultimate load is determined using the

expression developed for a plate with simply supported edges.

Table 3.5 Ratio of angle of web rotation to the angle of flange rotation at ultimate load.

Section	Bracket Length (in.)	Angle of Flange Rotation (rad.x1000)	Angle of Web Rotation (rad.x1000)	Ratio
W4x13	8	9.89	31.1	3.15
	12	13.8	16.3	1.18
W5x16	8	10.1	11.9	1.17
	12	13.5	19.1	1.42
M5x18.9	8	6.24	10.1	1.61
	12	10.8	17.0	1.61
W6x25	8	4.25	22.3	5.24
	12	10.0	22.0	2.20



The flange also differs from both the simple support or fixed support in the type of lateral support given to the web (support against forces applied perpendicular to the plane of the web). Both the simple support and the fixed support restrain all lateral motion while the flanges do not. The flanges act like continuous elastic supports. If the flanges have the flexural stiffness to resist the

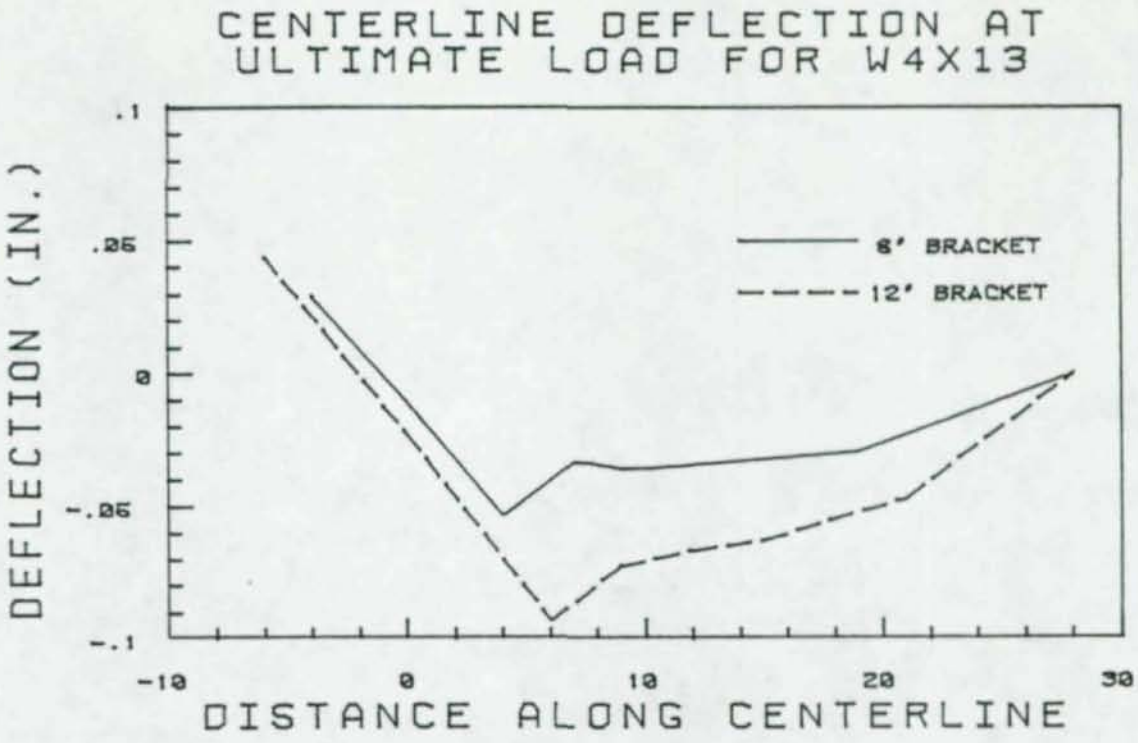


Figure 3.6 Deflections along the centerline of the W4x13 sections at ultimate load.

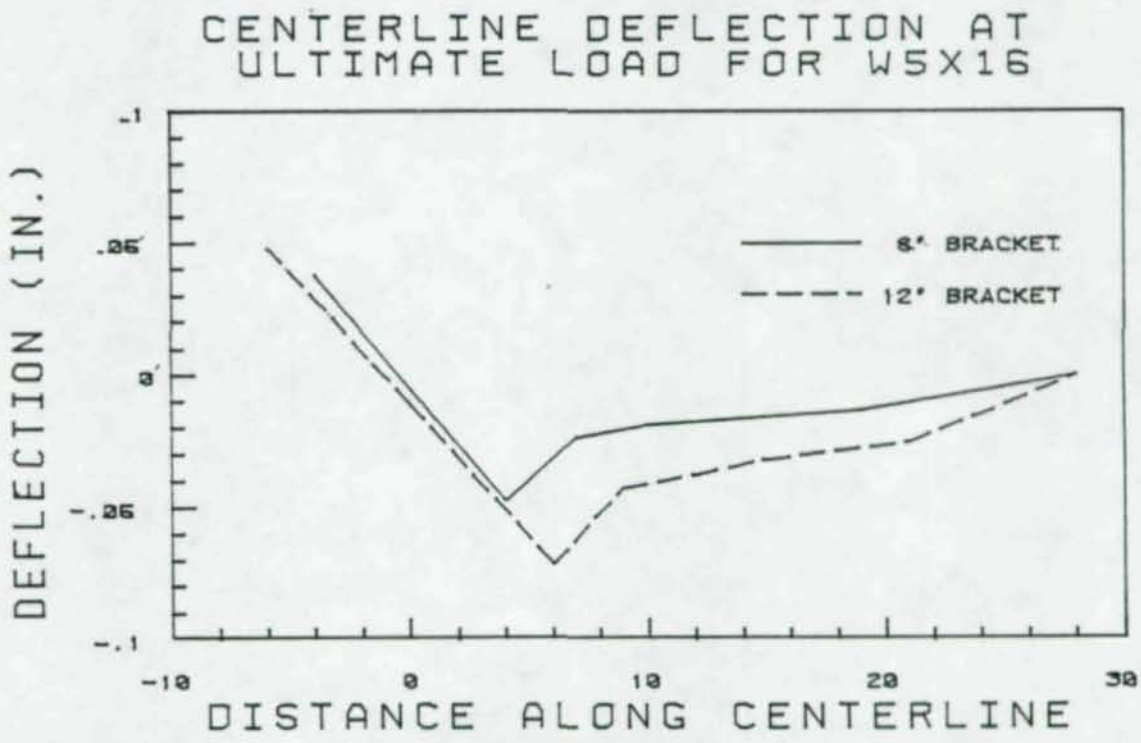


Figure 3.7 Deflections along the centerline of the W5x16 sections at ultimate load.

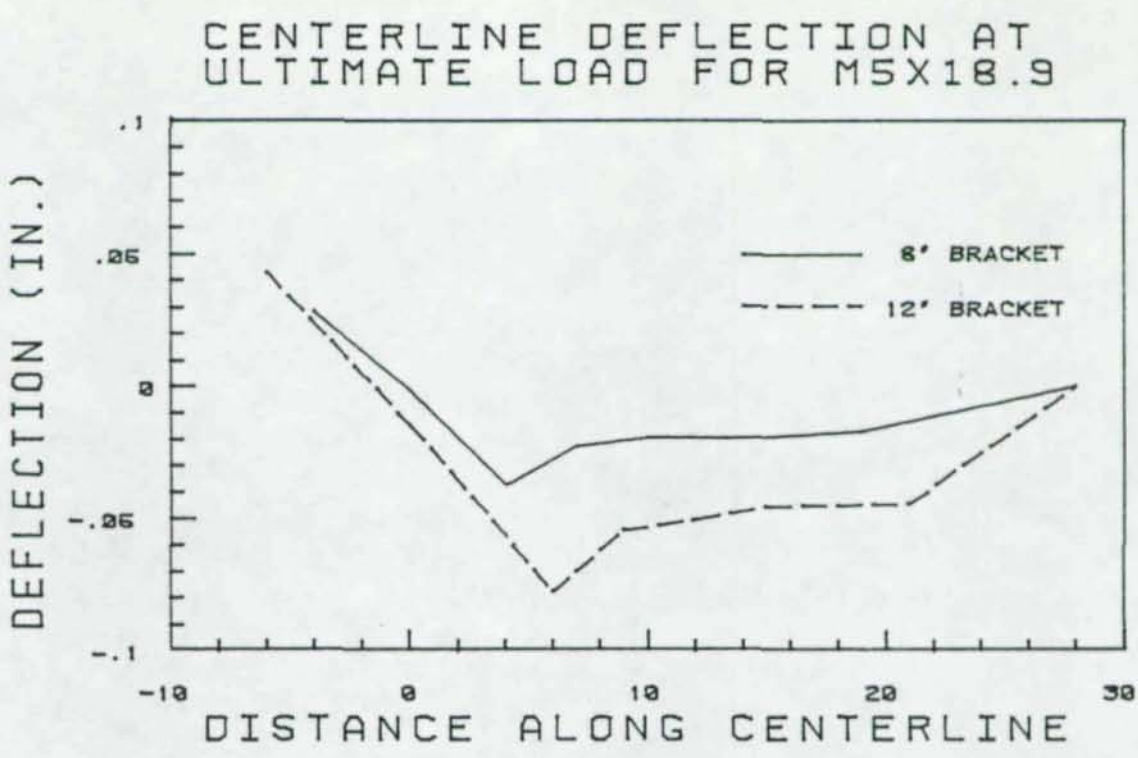


Figure 3.8 Deflections along the centerline of the M5x18.9 sections at ultimate load.

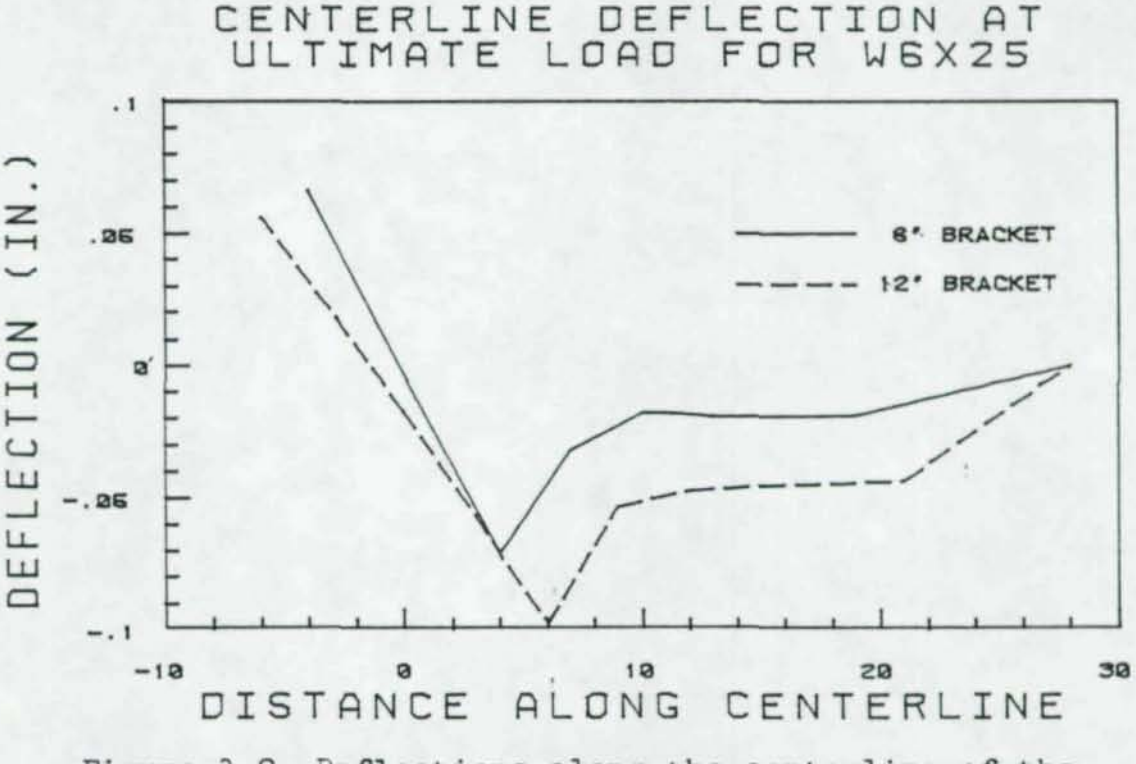


Figure 3.9 Deflections along the centerline of the W6x25 sections at ultimate load.

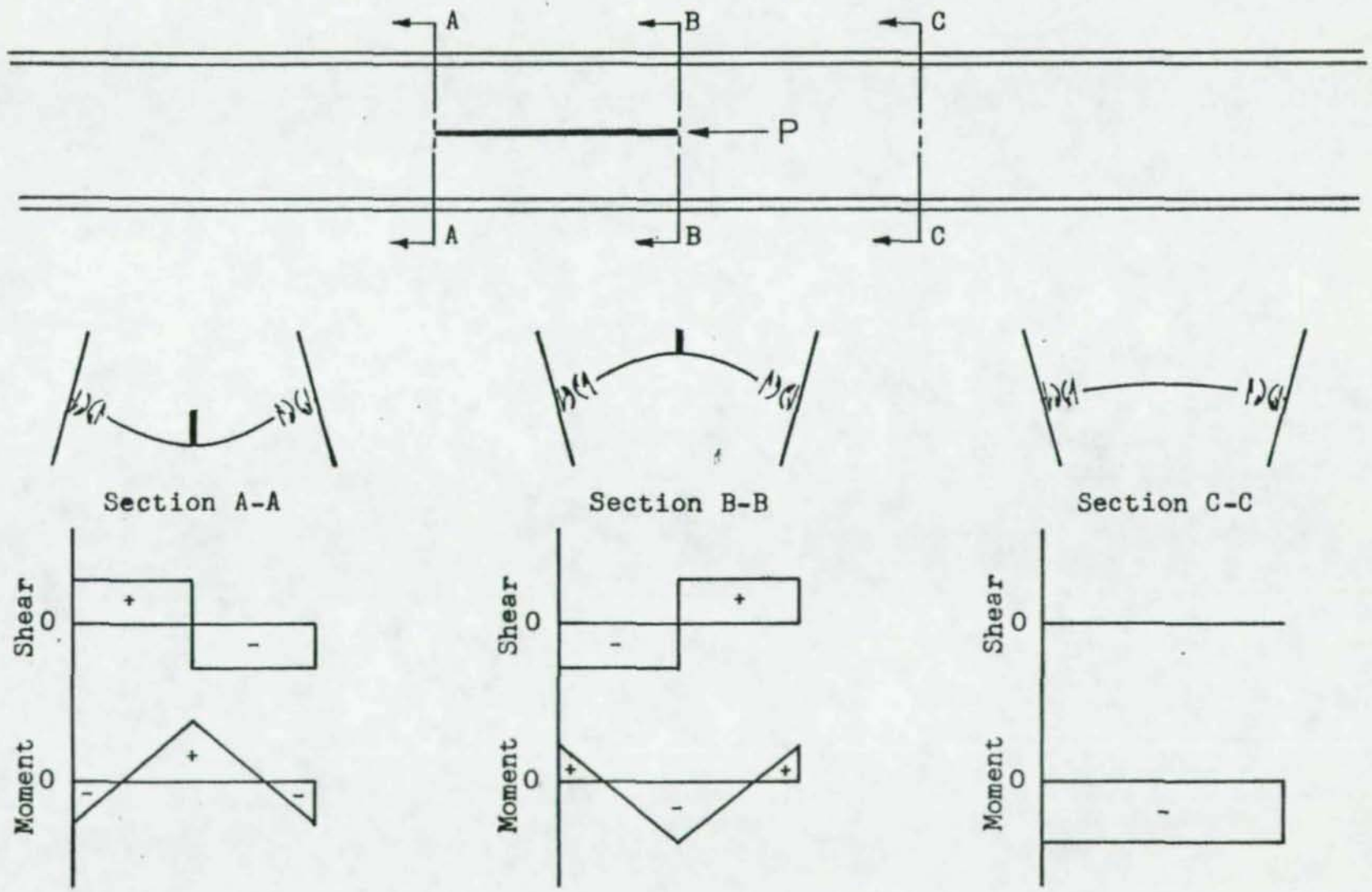


Figure 3.10 Typical cross sections showing internal forces at ultimate load.

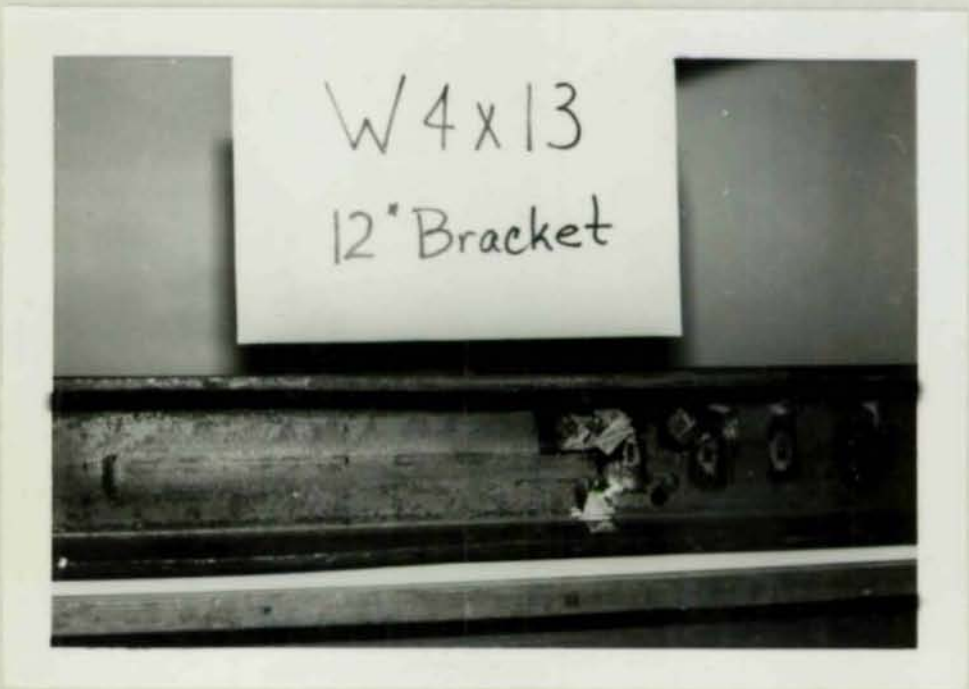


Figure 3.11 Reversal of flange rotations for the W4x13 section with the 12 inch bracket.

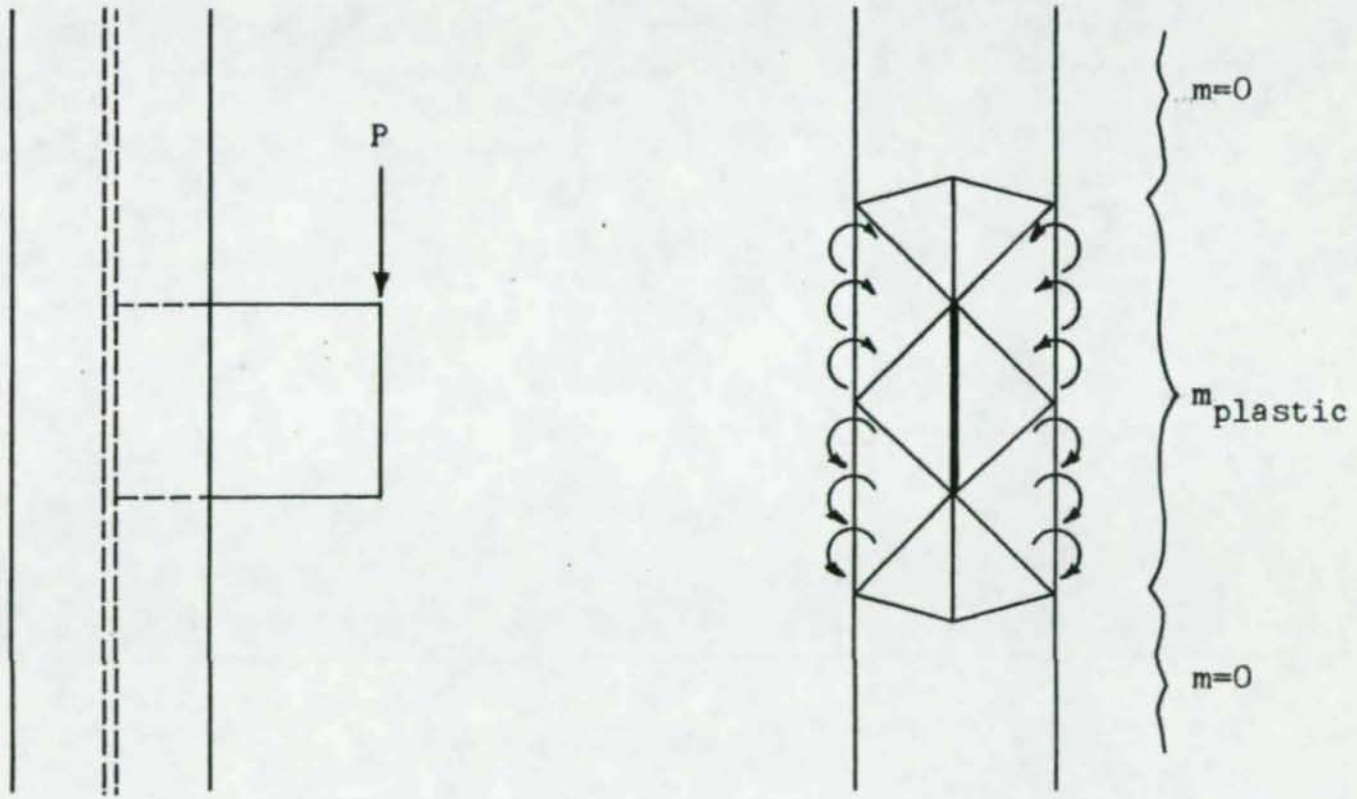


Figure 3.12 Forces imposed on the web by fixed supports.

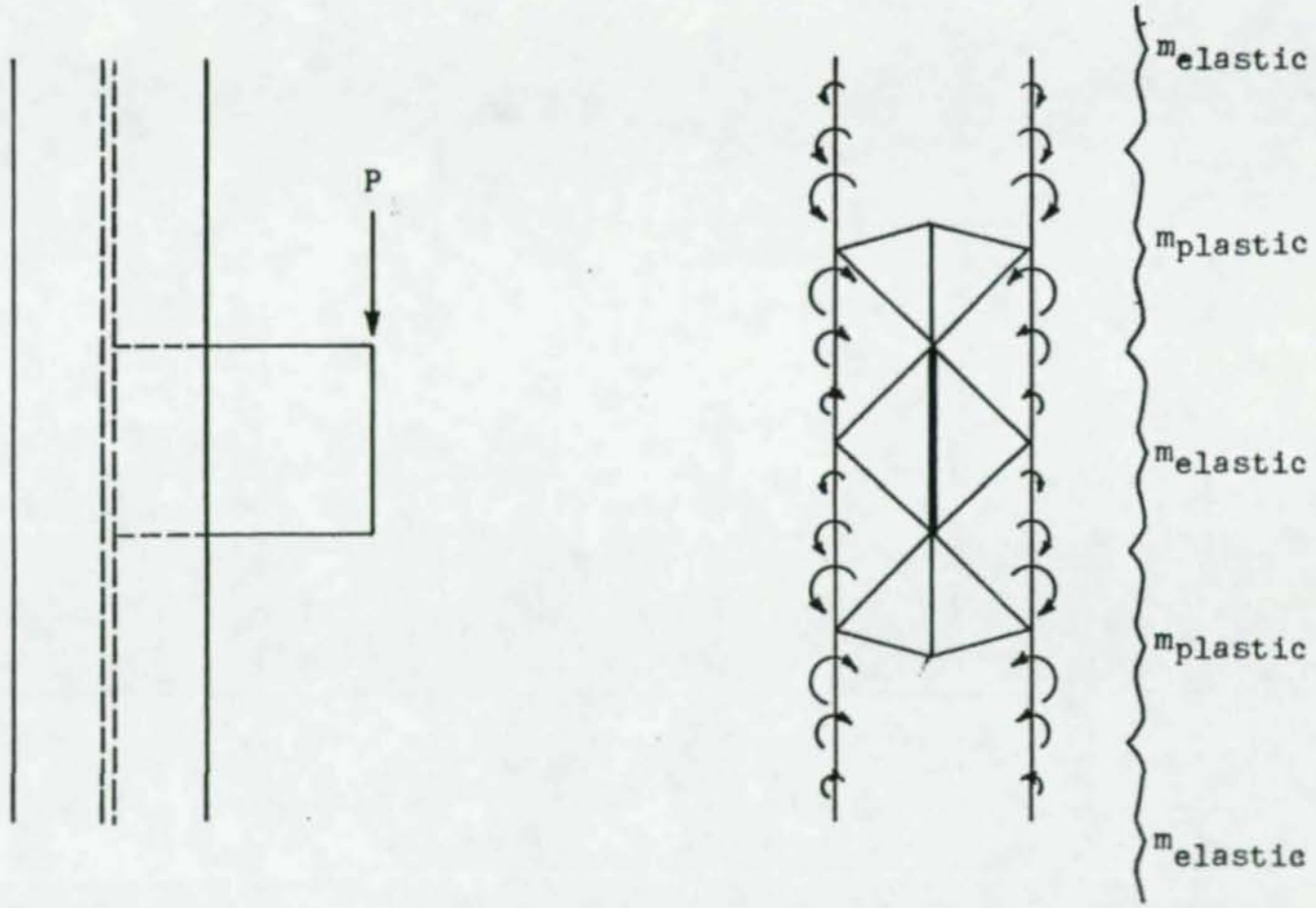


Figure 3.13 Forces imposed on the web by the flanges.

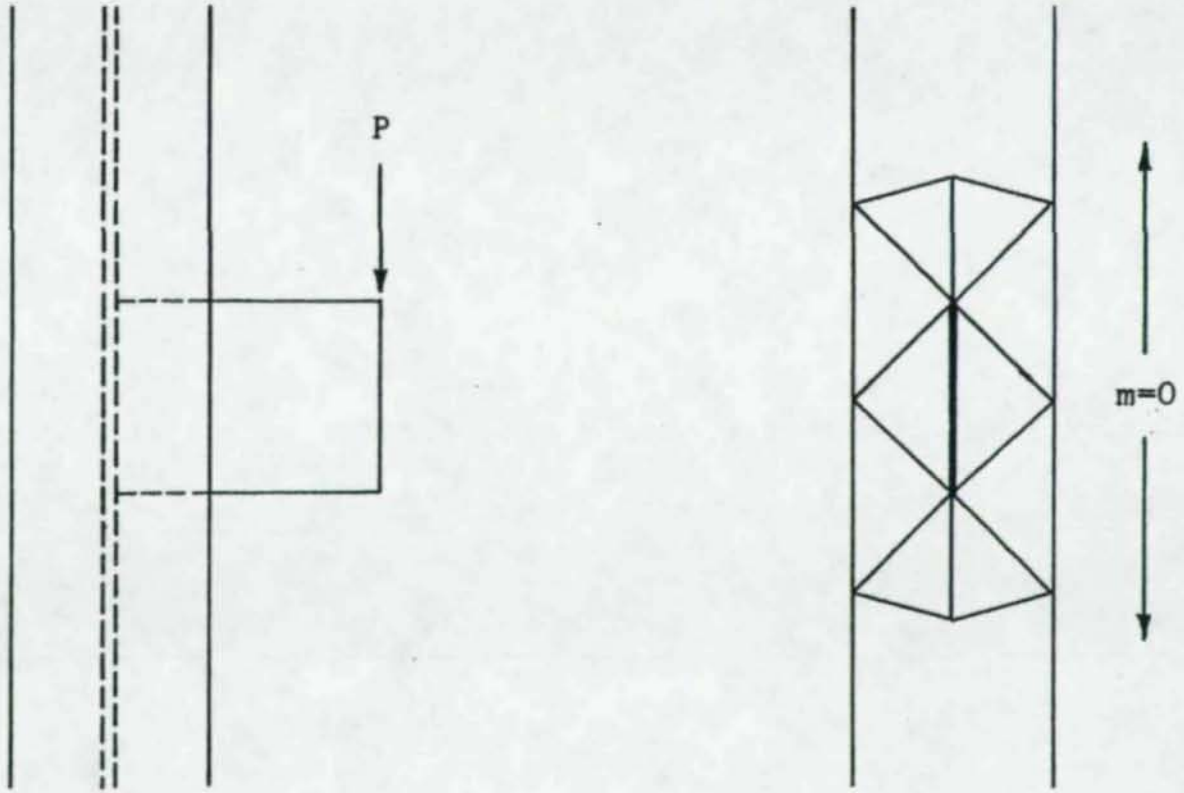


Figure 3.14 Forces imposed on the web by simple supports.

lateral forces applied to it by the web, then the collapse mechanism may develop. Otherwise, the flanges will fail before the collapse mechanism can fully develop in the web. Flange failure occurs for the S4x9.5 section with 8 and 12 inch brackets.

New Failure Mechanism

Up to this point the discussion has included all the sections tested except the S4x9.5 sections. The reason for this is that the webs of the S sections (the S4x9.5 with an 8 inch bracket, and the S4x9.5 with the 12 inch bracket) lacked the lateral support from the flanges necessary to fully develop the collapse mechanism posed by Abolitz and Warner. Instead, a new collapse mechanism developed in the flanges.

The new mechanism is composed of two plastic hinges in the flanges even with the corners of the bracket. The mechanism is illustrated in Figure 3.15. This new mechanism first became evident in the test on the S4x9.5 section with the 8 inch bracket (Figure 3.16). To verify the new mechanism, strain gages were placed at the extreme edges of the flanges as shown in Figure 2.1b (gages 37 and 38). The data indicates that yielding in the flanges occurs at about 3350 pounds which is considerably below the value of 11420 pounds, the ultimate load for the web.

To understand the new mechanism, Figure 3.17 illustrates a test section with an approximately equivalent loading, and the corresponding shear and moment diagrams. Abolitz and Warner show that the load transmitted to the web by the bracket cannot be the normally assumed linear distribution. Instead, a major portion of the load is transferred within the first inch from the corner of the bracket. For simplicity, the load is assumed to be transferred to the web in two concentrated loads located at the corners of the brackets as shown. The approximate load which corresponds to yielding of the outer edges of the flanges may be determined by substituting the expression for the maximum moment into the flexure formula. The axial stresses must be included to obtain the actual load. For the case of the S4x9.5, this load corresponds to 3410 pounds (See Table 3.6). By using a linear interpolation between the data points, the data shows the first yield occuring at 3350 pounds.

Both the strain data and the deflection data confirm that failure begins at 3000 pounds. Figure 3.18 is a plot of load versus curvature derived from the strain data for the flanges. This figure shows that the load-curvature curve becomes nonlinear at approximately 3000 pounds indicating the onset of failure. Similarly, the plot of load versus maximum deflection of the web (Figure 3.19) becomes nonlinear at 3000 pounds. Here are two independent forms of

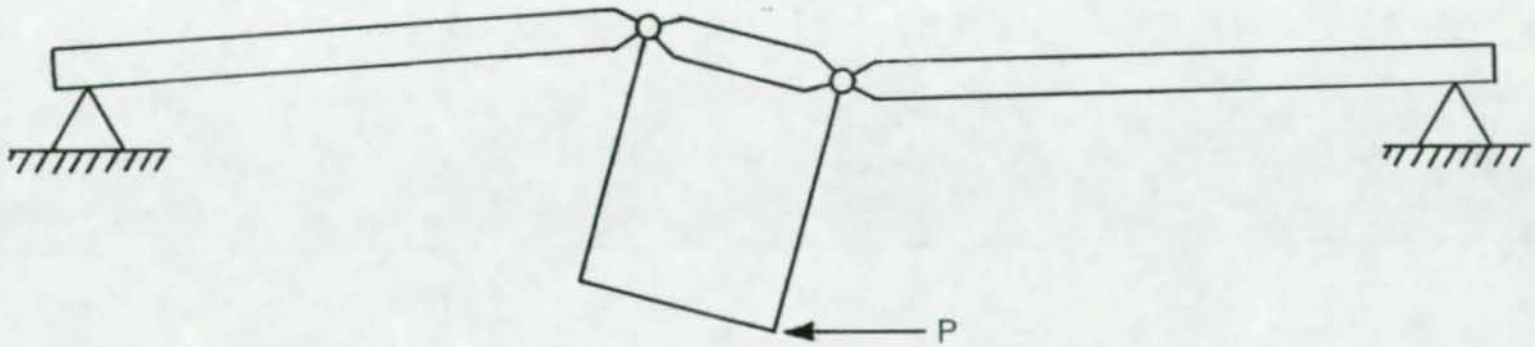
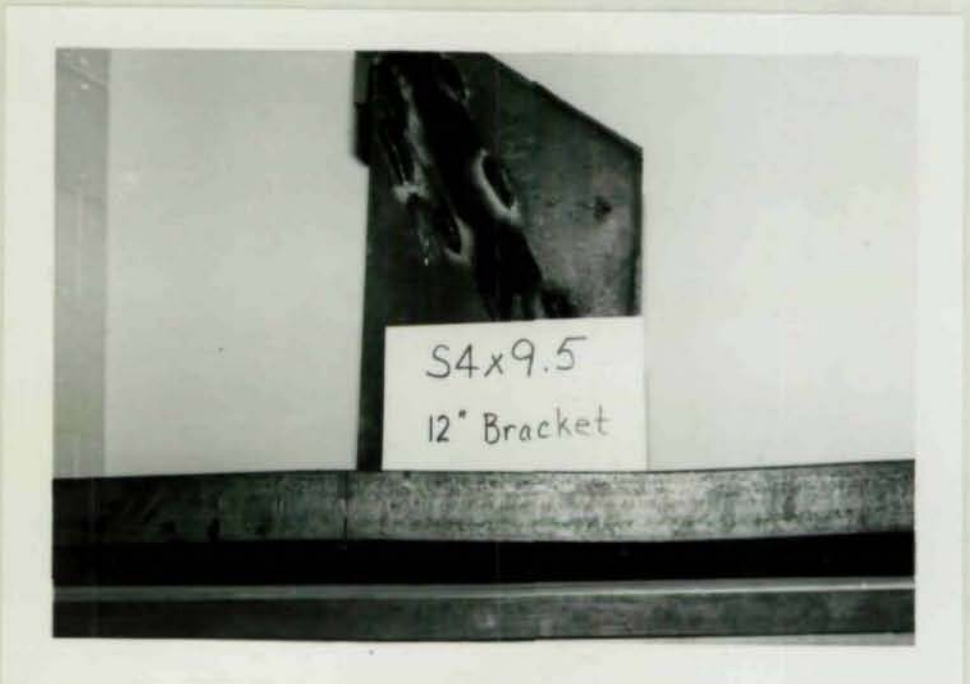


Figure 3.15 The new failure mechanism.

(a) 8 inch bracket



(b) 12 inch bracket

Figure 3.16 Flange failures in the S4x9.5 sections.

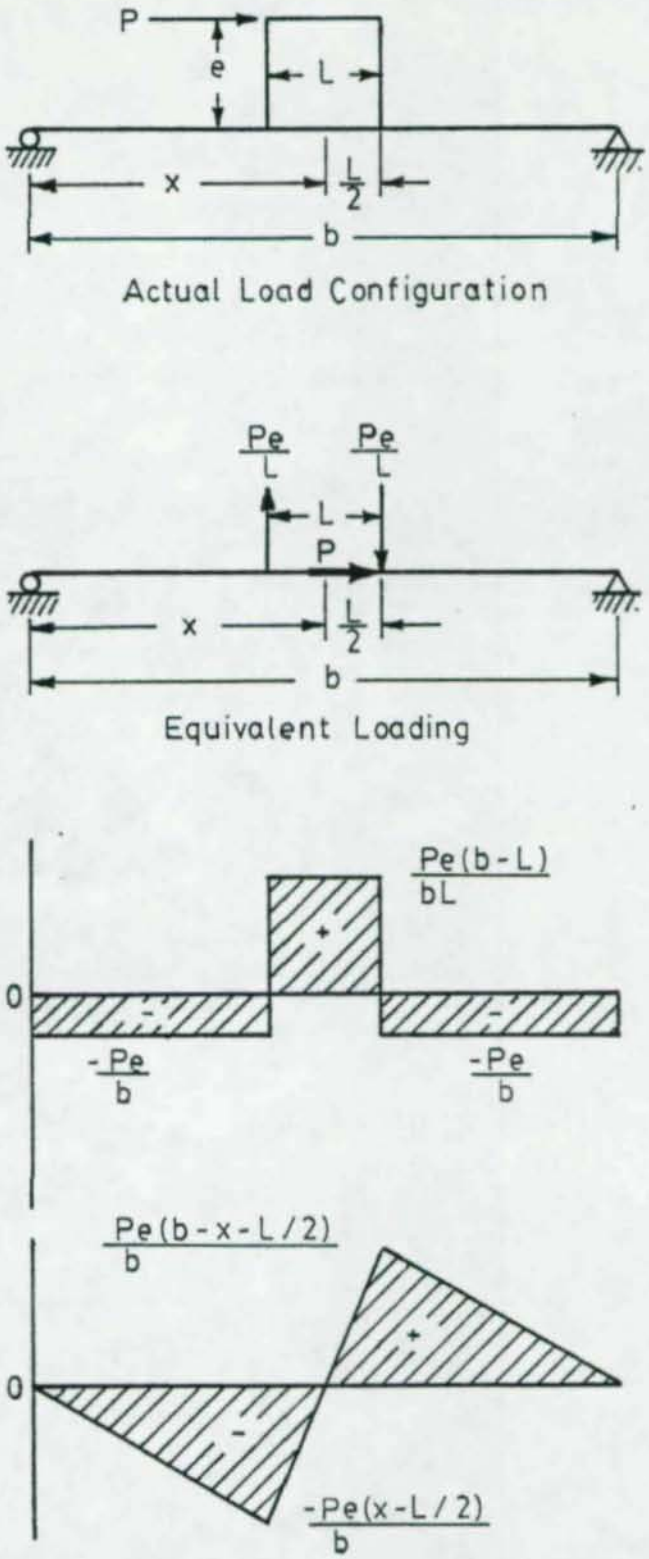


Figure 3.17 A simplified equivalent loading for bracket to web connections and the corresponding shear and moment diagrams.

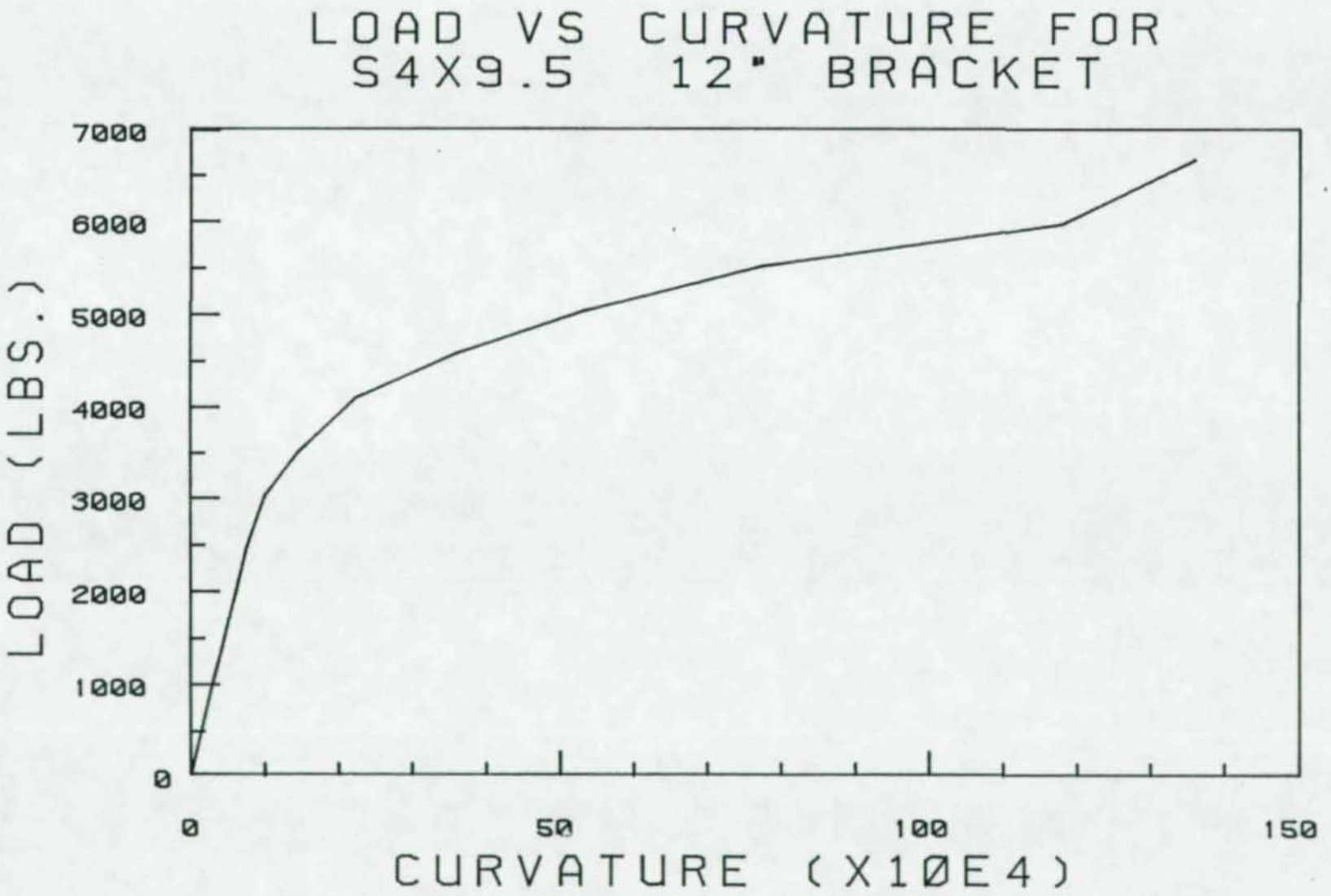


Figure 3.18 Load versus curvature plot for the S4x9.5 section with the 12 inch bracket.

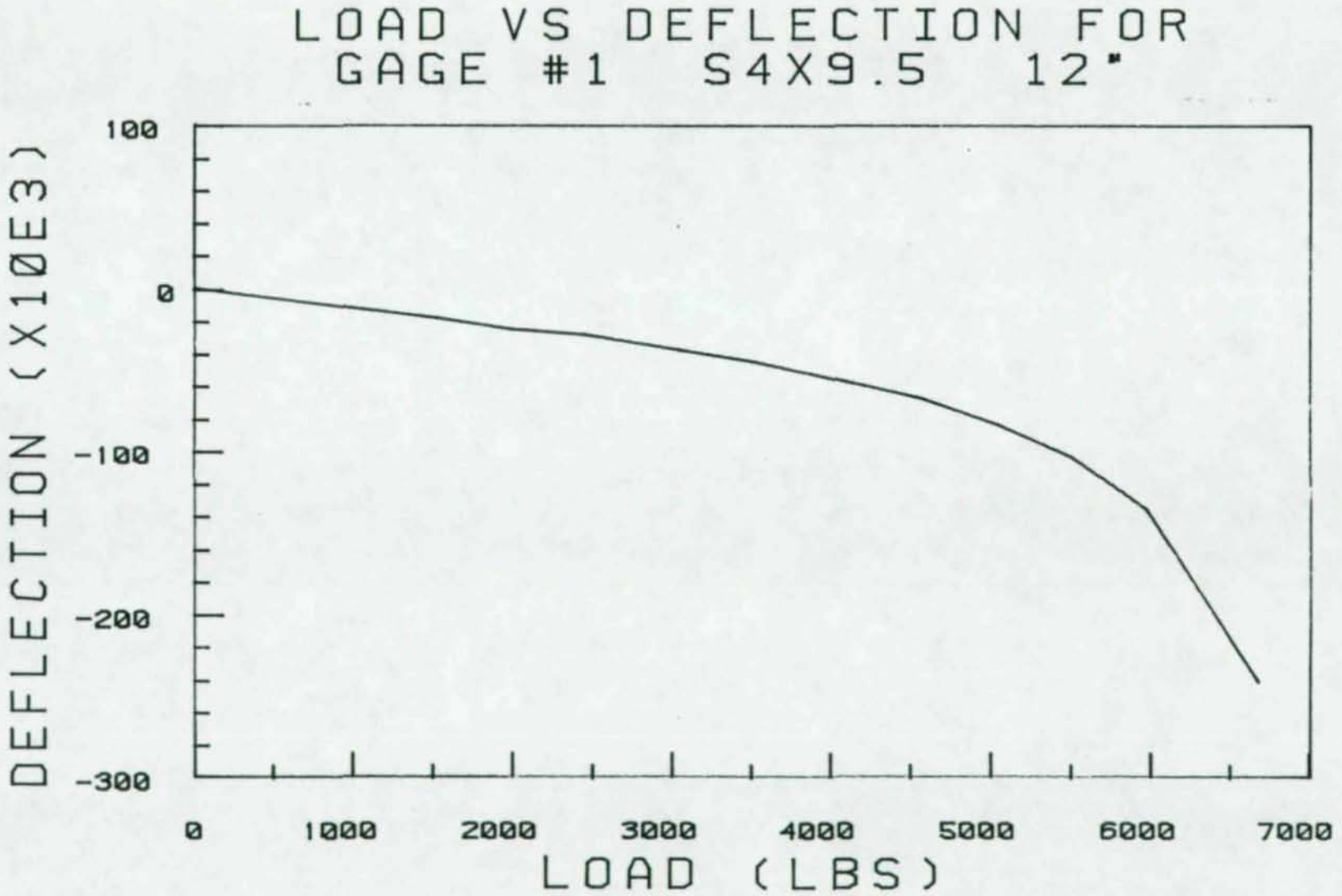


Figure 3.19 Load versus maximum deflection for the S4x9.5 section with the 12 inch bracket.

data which yield the same value when failure begins.

The difference in the failure patterns between the S4x9.5 sections and the other sections can be seen in the plots of the centerline deflection versus load. Figure 3.20 is a plot of the centerline deflection versus load for the S4x9.5 sections. The sharp peak at the end of the bracket (a characteristic of the web failure mechanism) which is evident in Figures 3.6-3.9 is missing in Figure 3.20. This result is expected since the failure mechanism develops a smooth S shaped deflection pattern.

Comparison of Results

Once both failure mechanisms are understood, the results of each test can be compared on a deflection versus load diagram. Several parameters are varied for each test, including the T distance, the web thickness, the yield stress, the bracket length and the eccentricity. Before the comparisons can be made, the results must be normalized. The parameter chosen to normalize the load is the value of the ultimate load give in equation (1.1) because its value is a function of each of these parameters. The maximum deflection of the web for each section must also be normalized, because the T distances of the sections varied. The normalizing factor chosen is 2% of the T distance. This parameter is used by Save and Massonnet as the limiting

deflection at failure for plates. The normalized load-deflection diagram is shown in Figure 3.21.

The normalized load-deflection curves clearly indicate the different load capacities of the two failure mechanisms. The two S4x9.5 sections (with 8 inch and 12 inch bracket) are represented by the curves numbered 5. This section, which exhibited a flange failure, plots considerably lower than the others. The curve for the test of the W4x13 section with the 12 inch bracket also plots lower than the other curves. The reason for this became evident when the applied load reached about $1.4P_u$ during the test. At this point, the W4x13 section clearly showed the S shape characteristic of the flange failure. Based on this, some of the deflection in excess of 2%T at the calculated ultimate load is due to the elastic deflections of the flanges and not the web failure mechanism.

The remaining sections: W5x16, M5x18.9, W6x25 and the W4x13 section with the 8 inch bracket, all have a maximum deflection less than 2%T at the calculated ultimate load. This indicates that Abolitz and Warner's theory based on yield lines is slightly more conservative than Save and Massonnet's deflection theory for predicting the ultimate load. This may be in part due to the effects of membrane strains in increasing the load capacity of the connection.

The web slenderness ratio of the W4x13 section (9.82) should have excluded it from the above discussion, because

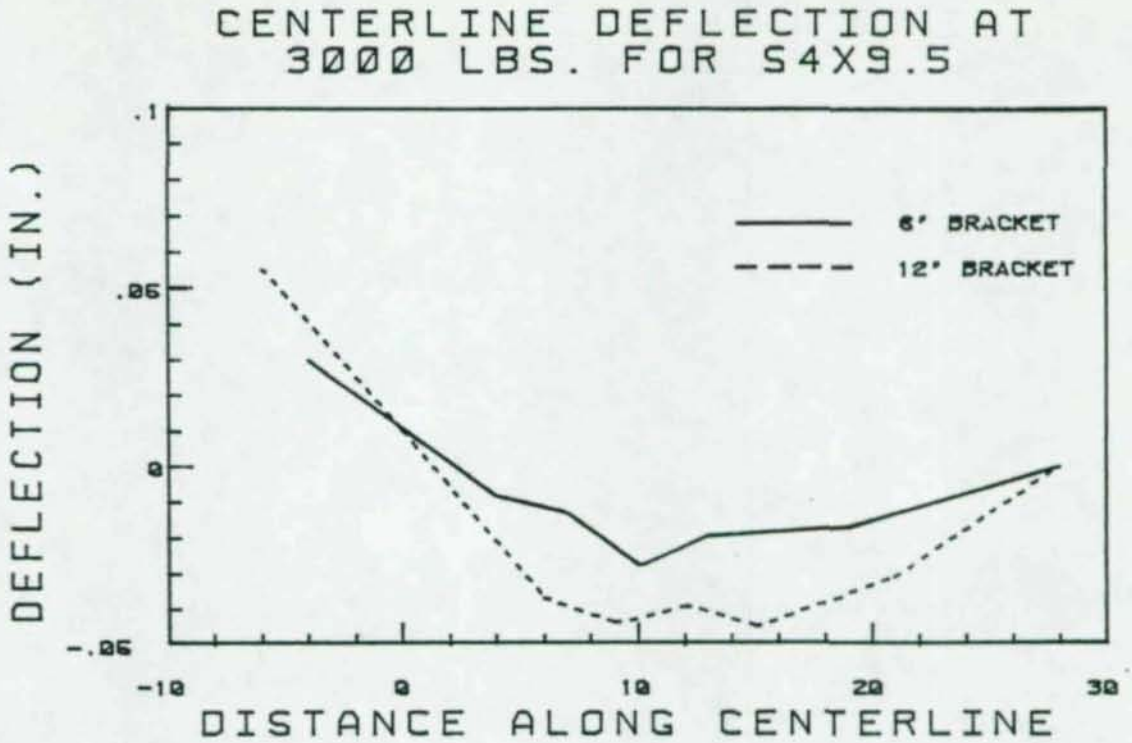


Figure 3.20 Centerline deflections for the s4x9.5 sections.

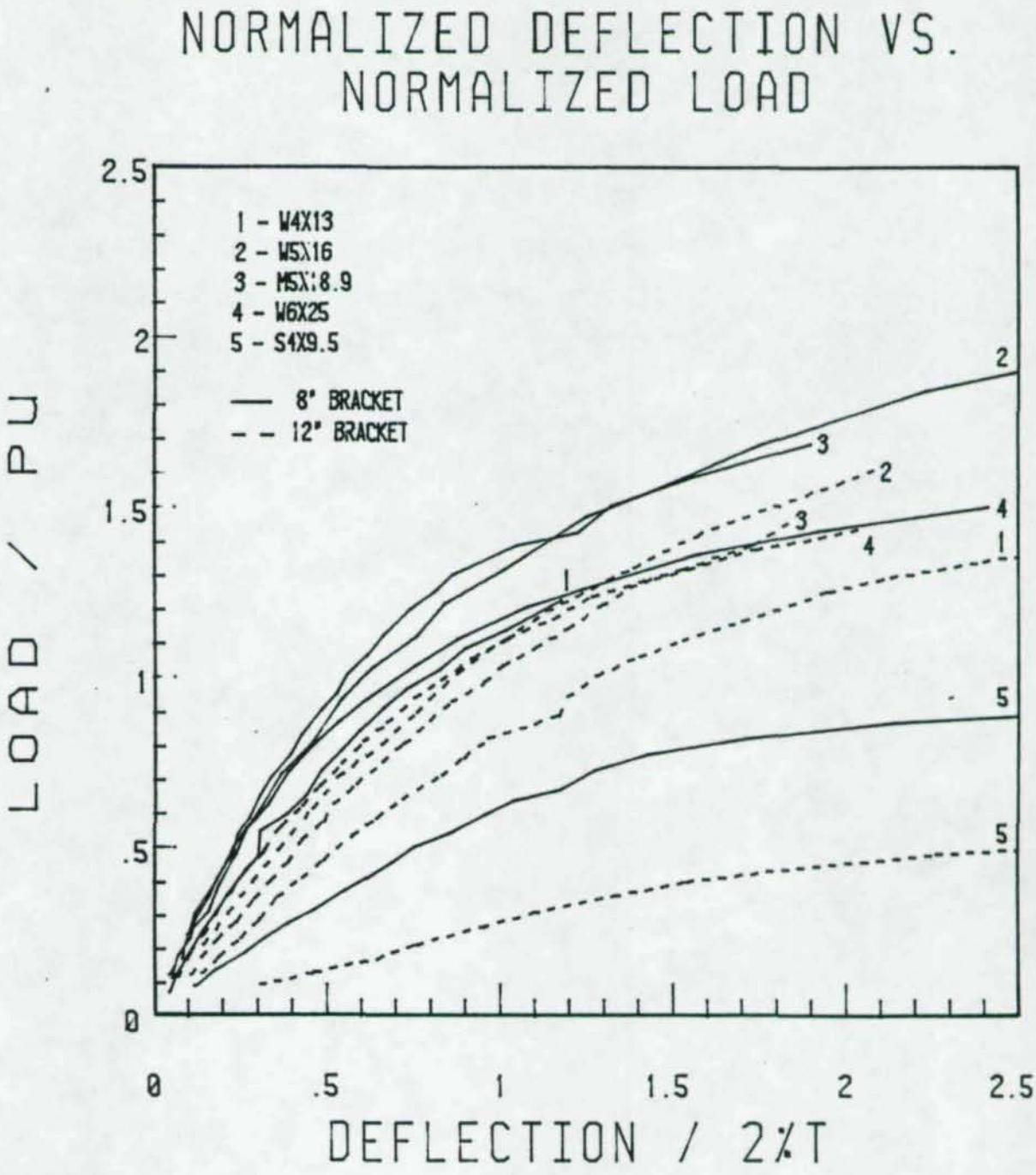


Figure 3.21 Plot of normalized load versus normalized deflection.

both Save and Massonnet's theory and Abolitz and Warner's theory are based on plates with a slenderness ratio greater than ten. The reasons for including it are that the web slenderness ratio for the W4x13 section is deemed sufficiently close to 10, and its normalized load deflection plot is consistent with the others.

Suggested Design Procedure

The first question in the design of this type of connection is whether the failure will occur in the flanges or the web. This can be done by comparing the load which can be resisted by the flanges to the ultimate load of the web. The equations below for determining the ultimate load of the flanges are designed to be in compliance with sections 1.5 and 1.6 of the eighth edition of the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings referred to hereafter as the AISC Specifications. The load calculated from these equations must be compared to the load calculated from the expression developed by Abolitz and Warner, equation (1.1). The smaller of these two loads is to be used as the capacity of the connection.

The capacity of the flanges will be designed for the loading given in figure 3.17. As the figure shows, the maximum moment (M_{max}) is given by equation (3.3) if $x<b/2$ or

equation 3.4 if x>b/2. At x=b/2 either equation applies.

$$M_{max} = (Pe/b)(b-x-L/2) \qquad x<=b/2 \qquad (3.3)$$

$$M_{max} = (Pe/b)(x-L/2) \qquad x>=b/2 \qquad (3.4)$$

The capacity of the flanges is not determined by the bending stresses alone; the stresses due to the axial load must also be considered as given in Section 1.6 of the AISC specifications. The axial stresses are assumed to act uniformly over the entire cross section.

The sections tested in this study are subjected only to the bracket load, and therefore the sections are assumed to fall into the category where f_a/F_a=<0.15. By making this assumption, equation 1.6-2 of the AISC specifications may be used. Equation 1.6-2 provides a simple means for determining the first approximation of the ultimate load for the flanges. If this equation is multiplied by F_y on both sides, equation 3.5 results. The second term has been eliminated since there is no bending about the x axis. Once a value is calculated for P, the requirements of section 1.6 will be re-examined.

$$F_y(f_a/F_a+f_{by}/F_{by}) < F_y \qquad (3.5)$$

where:

f_a = axial stress
f_b = bending stress
F_a = allowable axial stress
F_b = allowable bending stress

If the requirements of Section 1.5.1.4.3 of the AISC specifications are met, F_b in equation (3.5) may be replaced with $0.75F_y$ or equation 1.5-5b. In this study, $0.75F_y$ is the appropriate value. RF_y may be substituted into equation (3.5) if equation 1.5-1 of the AISC specifications is placed in the form of $F_a=RF_y$ where R is given by equation (3.6). This substitution is possible only if $b/r<C_c$. The value of the axial stress ($f_a=P/A$) may also be substituted into equation (3.5). With these substitutions, the allowable bending stress may be expressed by equation (3.7).

$$R = [1-(Kl/r)^2/(2C_c^2)] / \qquad (3.6)$$

$$[5/3+3(Kl/r)/(8C_c)-(Kl/r)^3/(8C_c^3)]$$

$$f_b =< 0.75[F_y-P/(RA)] \qquad (3.7)$$

This expression can be substituted into the flexure formula in place of the bending stress. If the expressions for the maximum moment are also substituted into the flexure

formula, the following equations (3.8) and (3.9) result. This value of P represents the load at which the flanges will fail.

$$P = (0.75F_y Sb)/\{e[b-x-L/2+Sb/(RAe)]\} \qquad x=<b/2 \quad (3.8)$$

where:

S = section modulus

$$P = (0.75F_y Sb)/\{e[x-L/2+Sb/(RAe)]\} \qquad x=>b/2 \quad (3.9)$$

Equations (3.8) and (3.9) only provide an approximation to the load capacity of the flanges (A similar derivation based on equations 1.6-1a and 1.6-1b of the AISC Specifications is shown in Appendix B). The load P derived from the appropriate equation ((3.8) for x<b/2 or (3.9) for x>b/2) must be examined to insure that it meets the requirements of sections 1.5.1.4.3 and 1.6.1 of the AISC Specifications. The requirements of section 1.5.1.3 are based on geometric properties and the yield stress of the material and hence they need not be re-examined.

To determine the capacity of the connection, the value of the load obtained from either equation (3.8) or (3.9) must be compared to the value of the ultimate load obtained from equation (1.1). The shape factor k and the moment capacity in equation (1.1) are given by equations (3.10) and (3.11) respectively. For x<b/2, the design capacity of the section is the smaller value of load given by (3.8) or

(1.1). Similarly for x>b/2, the design capacity is the smaller value of load given by (3.9) or (1.1). If the smaller value of the load is given by (3.8) or (3.9) then failure will occur in the flanges, whereas if (1.1) yields the smaller value the failure will occur in the web.

$$k = 2a/L + 2L/a + 2\sqrt{7} \tag{3.10}$$

$$m = F_y t_w^2/4 \tag{3.11}$$

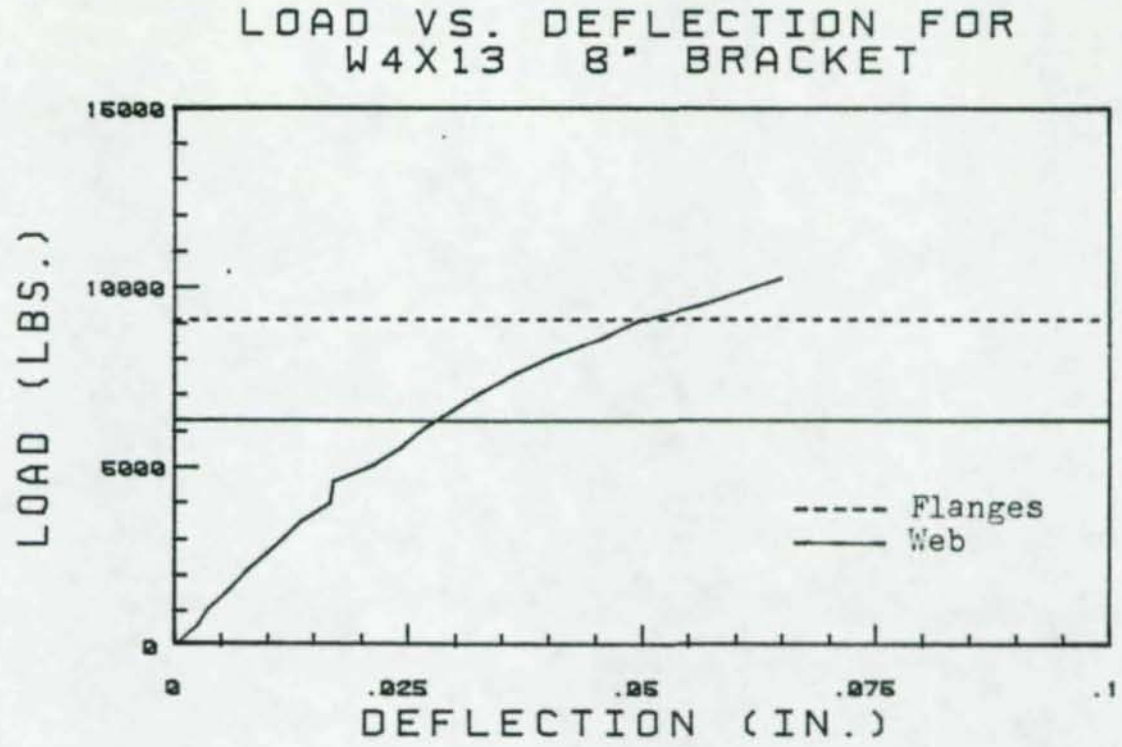
The values of the ultimate load based upon the nominal yield stress of 36 ksi and the experimental values of the yield stress determined from equations (3.9) and (1.1) are shown in Table 3.6. This table clearly indicates that web failures could be expected to occur first in all but the S sections and the W4x13 with the 12 inch bracket.

The values determined in the above procedure represent resonable estimates of a design load for sections subjected only to bracket loads. This can be seen by examining Figures 3.22-3.26. Both the values of the ultimate load, from equation (1.1) and equation (3.8) or 3.8 are superimposed on the load deflection curves. These curves indicate that the lower value of the ultimate load intersects the load-deflection curve at the point where it becomes nonlinear. This is the case irregardless of which equation yielded the smallest value for the ultimate load.

Figure 3.22b illustrates how the two values of ultimate load are independent of each other. Both values intersect the load deflection curve at the end of the linear region.

		Nominal Yield Stress (36000 psi)		Experimental Value of the Yield Stress	
Section	Bracket Length (in.)	Ultimate Load for the Flanges (pounds)	Ultimate Load for the Web (pounds)	Ultimate Load for the Flanges (pounds)	Ultimate Load for the Web (pounds)
W4x13	8	9090	6340	11690	8350
	12	6070	6490	7910	8550
W5x16	8	13720	4140	16110	4890
	12	9320	4190	11070	4950
M5x18.9	8	14610	7340	16670	8450
	12	9870	7540	11400	8700
W6x25	8	20090	5100	24630	6310
	12	16980	6520	20910	8080
S4x9.5	8	3310	8980	4050	11010
	12	2100	9300	2610	11420

Table 3.6 Ultimate loads for the flanges and web based upon the nominal yield stress and the experimental value of the yield stress.



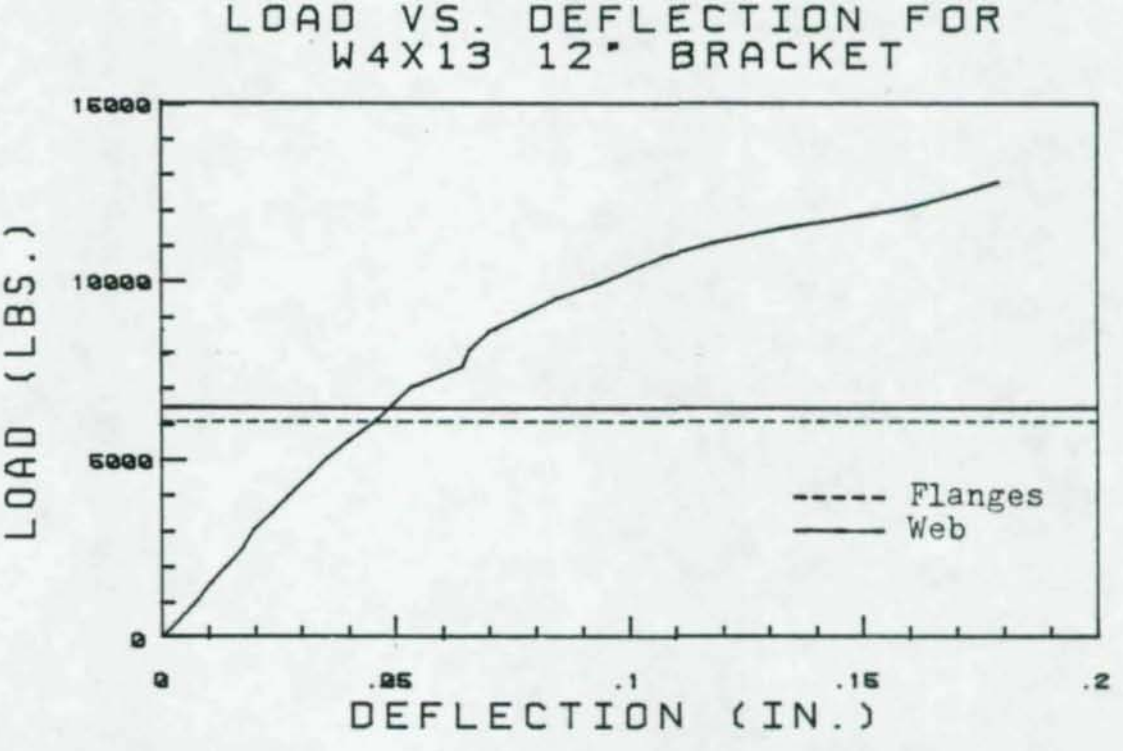
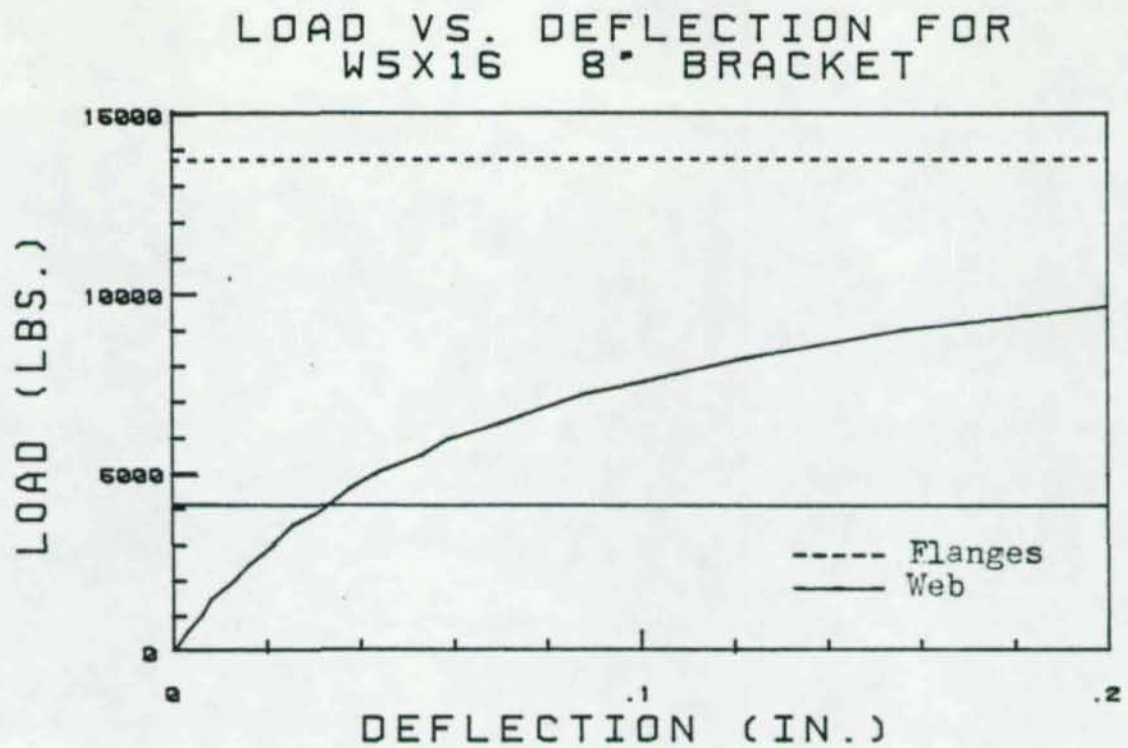


Figure 3.22 Plot of load versus maximum deflection with the calculated ultimate loads superimposed for the W4x13 sections.



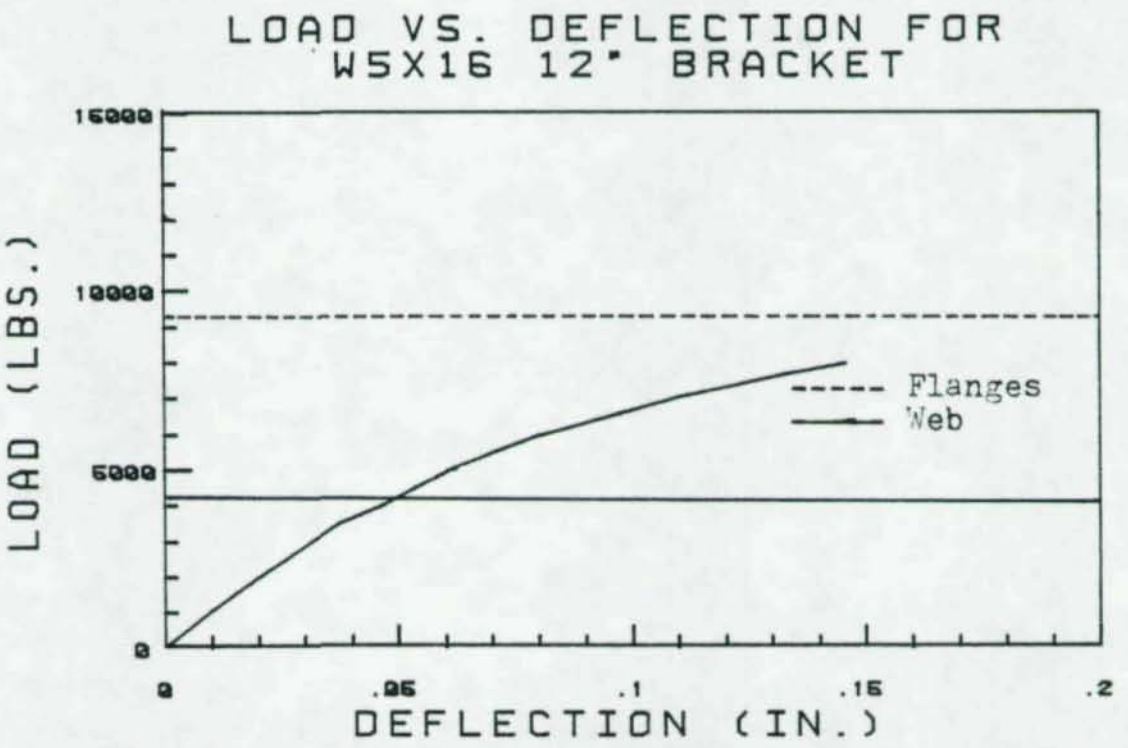
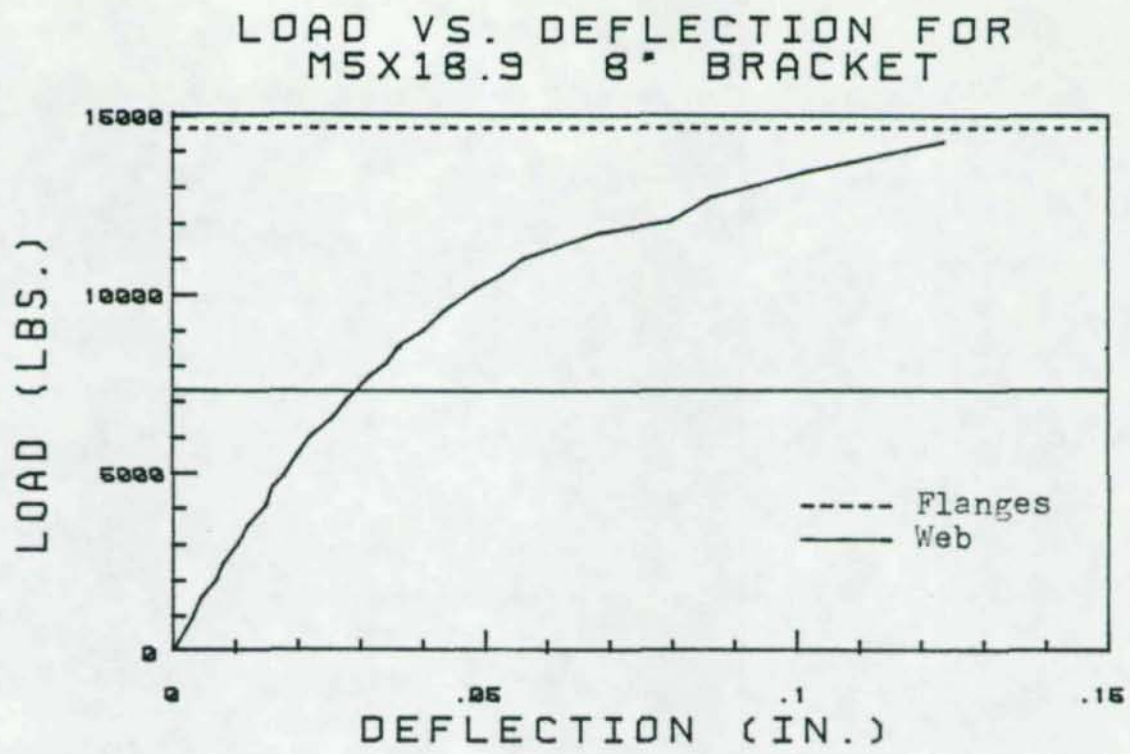


Figure 3.23 Plot of load versus maximum deflection with the calculated ultimate loads superimposed for the W5x16 sections.



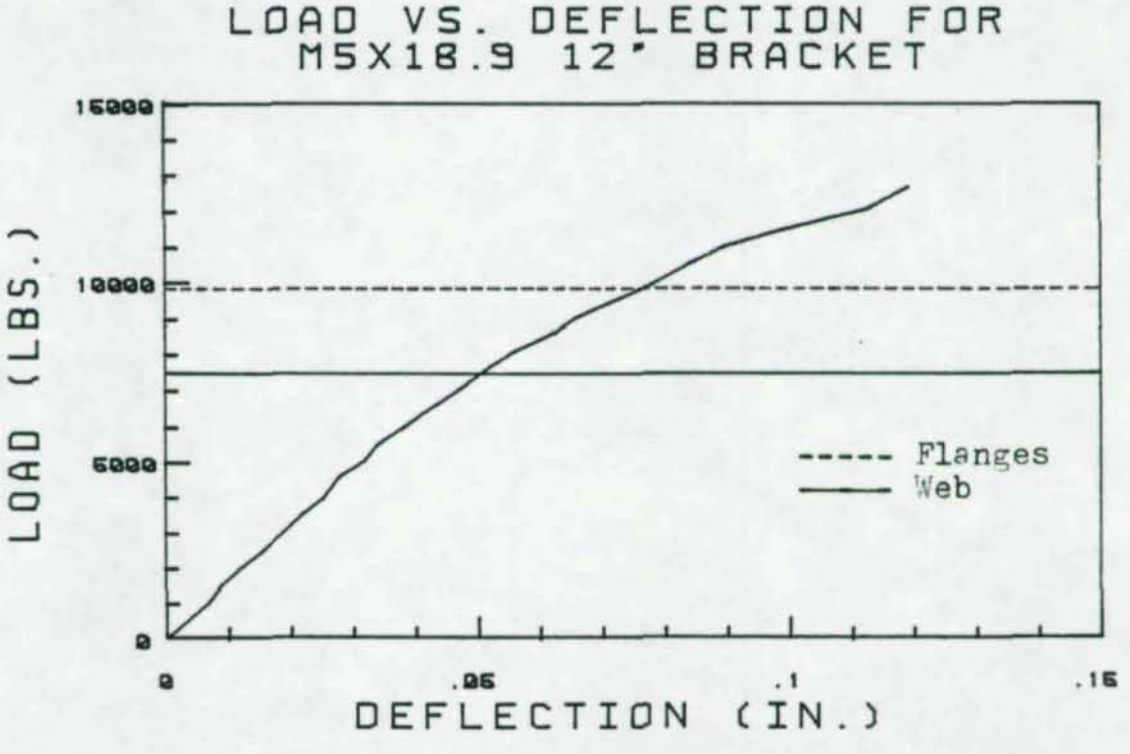
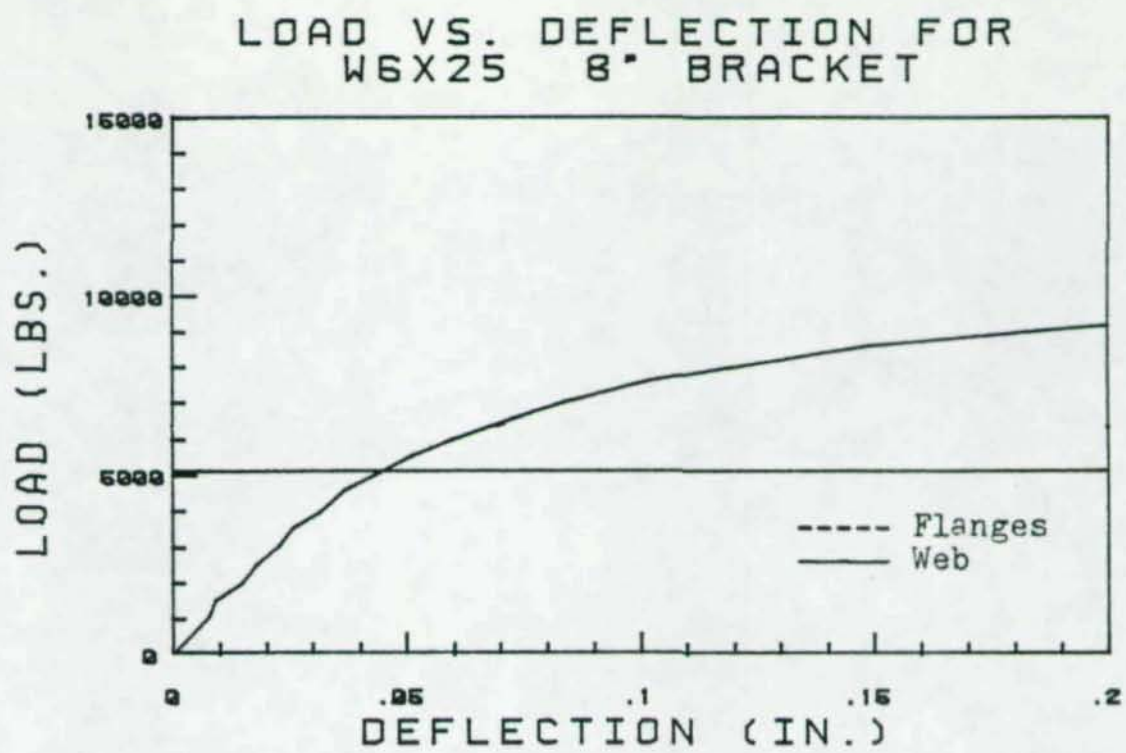


Figure 3.24 Plot of load versus maximum deflection with the calculated ultimate loads superimposed for the M5x18.9 sections.



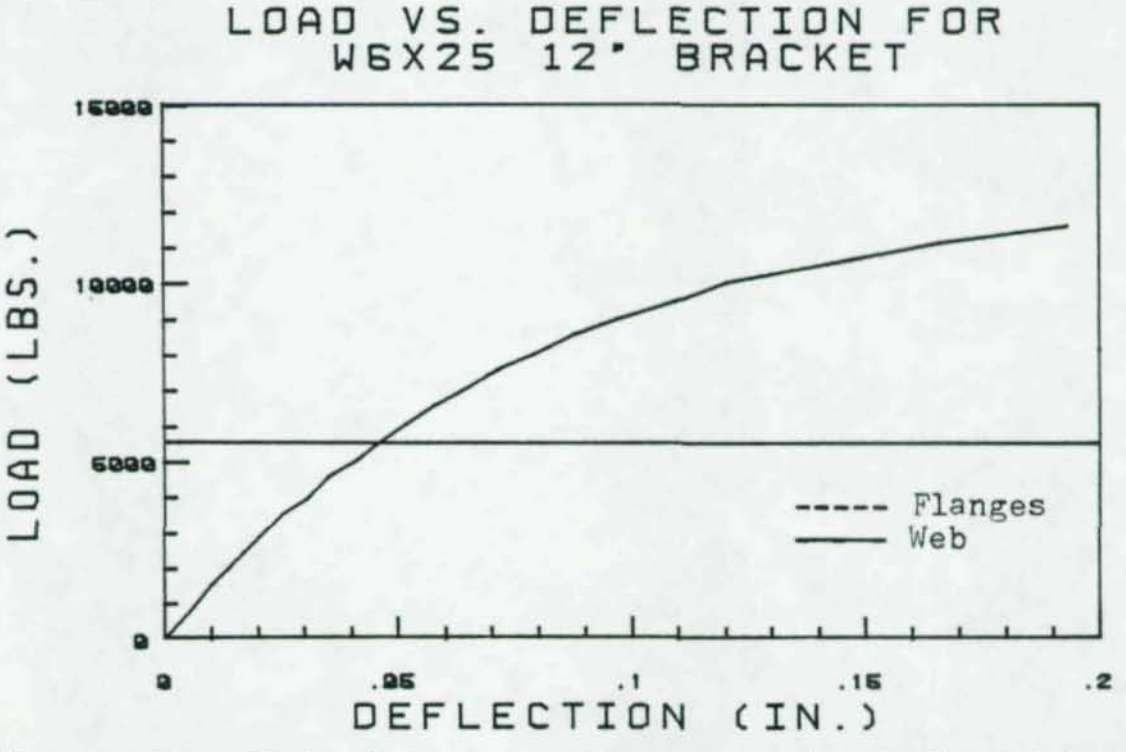
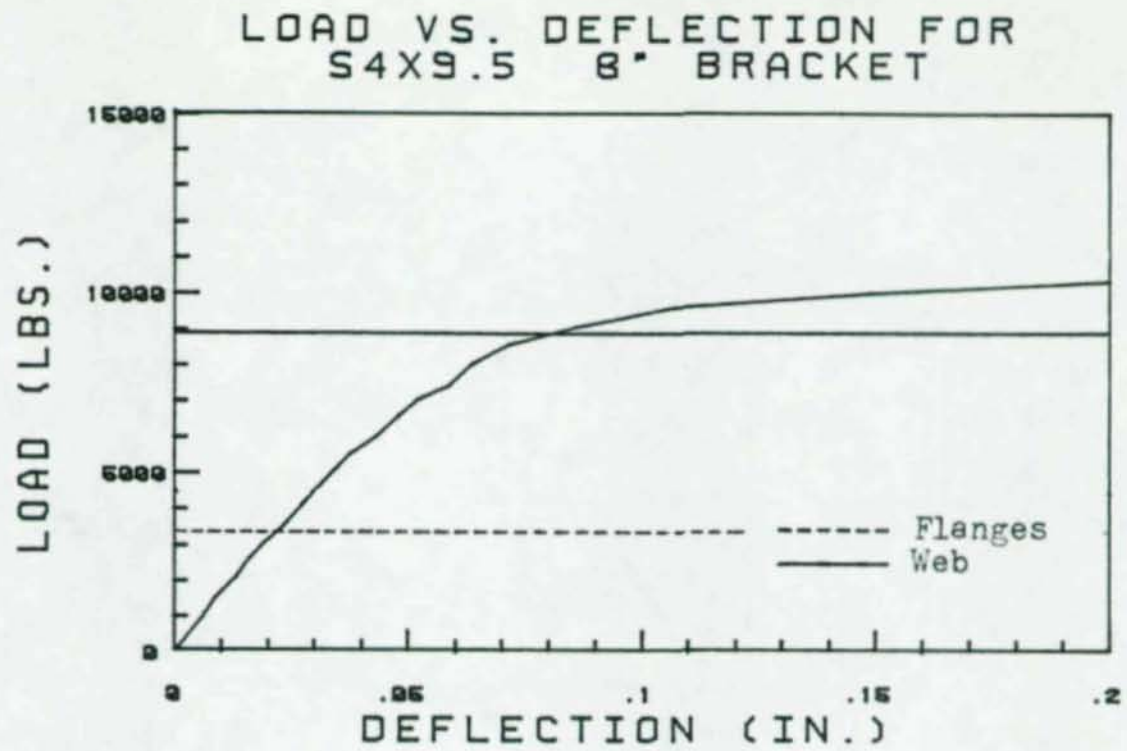


Figure 3.25 Plot of load versus maximum deflection with the calculated ultimate loads superimposed for the W6x25 sections.



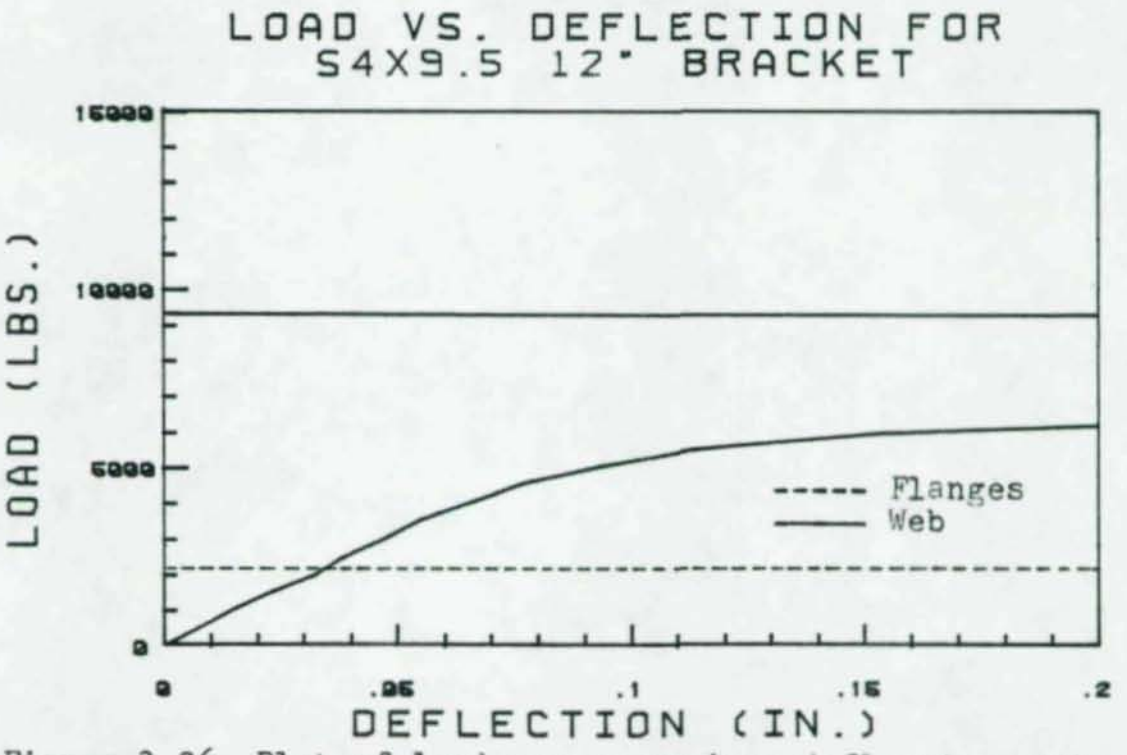


Figure 3.26 Plot of load versus maximun deflection with the calculated ultimate loads superimposed for the S4x9.5 sections.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Four conclusions relating to the objectives of the experimental study have been drawn. These conclusions are based upon the data collected on two tests on each of five sections of different sizes. Each section size was tested with two bracket lengths, 8 inches and 12 inches.

1) Membrane action is responsible for a significant portion of the load carrying capacity of welded bracket to web connections of sections with low web slenderness ratios. As Joseph Hoptay proposed, the membrane strains become less significant when compared to the bending strains as the web slenderness ratio decreases.

2) The collapse mechanism proposed by Abolitz and Warner does not fully develop in sections with low web slenderness ratios. The interaction between the web and the flanges transfers some of the bending to portions of the web outside the collapse region thereby interferring with the development of the yield lines. The ultimate load determined by the expression proposed

by Abolitz and Warner does represent a reasonable estimate of the design capacity of the connection. Even though the flanges do partly restrain the rotation of the plate segments in the web, the shape factor based on simply supported edges should be used.

3) The new failure mechanism which developed at low web slenderness ratios is comprised of two plastic hinges in the flanges of the section. The data indicates that there is no critical web slenderness ratio at which this new mechanism occurs. The new mechanism is a function of both the web slenderness and the moment of inertia of the section about the Y-Y axis.

4) The ultimate load determined using Abolitz and Warner's theory based on plates with simply supported edges compares very well to the value of the ultimate load determined from a theory developed by Save and Massonnet. Save and Massonnet's theory defines the ultimate load of a simply supported plate as the load which causes a maximum deflection of 2% of the plate thickness. Abolitz and Warner's theory which does not account for membrane effects is slightly more conservative than Save and Massonnet's theory.

RECOMMENDATIONS FOR FURTHER STUDY

Further studies in welded bracket to web connections may consider:

1) the effects of eccentricity on the load capacity of welded bracket to web connections. The load capacity may be altered due to the changing effects of membrane strains.

2) the effects of different bracket lengths on a section. It is speculated that the bracket length compared to the T-distance is a significant factor in determining which failure mechanism will occur.

3) how heavier sections will respond to the same load configuration. Many of the larger W10, W12 and W14 sections have web slenderness ratios between 7 and 15. These sections have heavier flanges which may act more as fixed supports to the edges of the web. With the heavier flanges, the web collapse mechanism may fully develop.

4) performing a finite element analysis of welded bracket to web connections.

APPENDIX A

TEST PROCEDURE

Test Specimen Preparation

The test procedure involved applying a static concentrated load to the bracket of a test specimen and recording strain and deflection data from predetermined points on the web and flanges. The load was increased by 500 pound increments and the strain and deflection data were recorded at each load increment until the specimen had failed. The values of the strains and loads were recorded and stored on a floppy disk by a North Star Horizon microcomputer. The deflection data had to be recorded by hand before it could be entered into the computer and stored on the disk.

The load was applied to the bracket with an Enerpac model RCH-202 20 ton hydraulic ram and an Enerpac model PM 621 hydraulic pump. A two inch ball and socket joint was placed between the ram and the bracket to accomodate the bracket rotations. (see Figure A1). A 15000 pound capacity Thwing-Albert model 3000F load cell was placed between the ram and support to measure the applied load. The load cell was interfaced to the microcomputer through a Measurements Group 2100 Strain Gage Conditioner and Amplifier System. The details of the interfacing are given in the section on

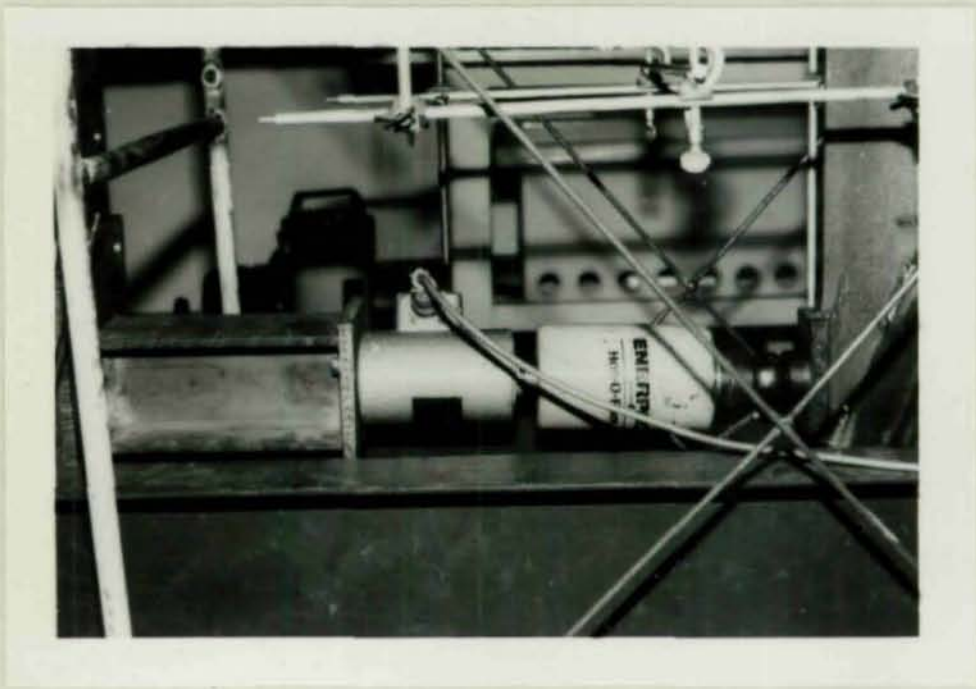


Figure A1 Load cell, hydraulic ram and ball and socket joint.

the Data Acquisition System.

The strains were measured on both sides of the web using two types of strain gages: rectangular strain rosettes or single axis strain gages. Strain rosettes were used wherever the principal strain directions were unknown. The strain gages for these tests were purchased from two manufacturers: BLH Electronics and Precision Measurements. The strain gages used on the W4x13 with the 8 inch bracket were BLH FAER-25R-12-S6EL strain rosettes, and BLH FAE-25-12-S6ES single axis gages. The strain rosettes used in the remaining tests were manufactured by Precision Measurements, however several sizes were used: F 040 R, F 096 R, F 200 R. If more than one size was used on a test section, like strain gages were paired at a strain gage location (top and bottom of the web). Only one style of single axis gage was purchased from Precision Measurements, the F 320, which was used on all but the first test.

The deflections were measured using three types of dial gages. Approximately half of the dial gages were manufactured by the L. S. Starrett Co. with graduations of .0001 inches and a range of .200 inches. One quarter of the dial gages were manufactured by Soiltest Inc. with graduations of .001 inches and a range of 1.000 inch, and the remaining dial gages were manufactured by Central Tool Co. Two styles of dial gages manufactured by Central were used; one style had graduations of .001 inches with a range

of 1.000 inch, and the other style had graduations of .01 millimeters and a range of 25.4 millimeters.

The preparation of each test specimen began by cutting the section to a length of 58 inches. A line, centered between the flanges and used to locate the strain gages, dial gages and the bracket was scribed down the entire length of the specimen on both sides of the web. One end of the specimen was chosen to be the reference point for measurements along the length. Two 7/8 inch diameter holes were drilled using a drill press, both centered on the scribed centerline; the first was two inches from the reference end, and the other was 55 11/16 inches from the same end. These holes were used to secure the specimen in the test frame. Two more holes whose use will be described later were drilled using a No. 28 drill in a drill press to assure that they were drilled perpendicularly through the web. These holes were located in one inch from the reference end and 3a/8 inches on either side of the scribed centerline.

The next step was to determine the locations of the strain gages and to transfer this information to the test specimen. The strain gages were placed on both sides of the web so that strain profiles could be determined. To insure that one gage was positioned directly over another and that both were properly aligned, their positions were drawn very accurately on a piece of thin aluminum flashing. This

template was used to roughly locate the position of the strain gages on the specimen with respect to the center of the 7/8 inch diameter hole nearest the reference end and the scribed centerline. The strain gage locations were transferred to the web through 1/16 inch diameter holes in the template using a permanent felt tip marker.

Once the general locations were transferred to the web, the job of removing the rust and mill scale began. The rust and scale were removed with a grindstone in a model 250-5 Dremel Moto-Tool. When the pits had been removed, the surface was polished using the flat side of an emery grinding disk. It was found that further polishing with a rubber polishing wheel was unnecessary. All the strain gage locations were then covered with several layers of masking tape to protect them from welding splatter or any marring while the bracket was being attached.

The size of the bracket was determined next. The bracket thickness was chosen to be comparable to the web thickness. The W4X13 and W5X16 sections, with web thicknesses of 0.280 inches and 0.240 inches respectively, had brackets of 1/4 (.25) inch plate steel. The remaining sections; M5X18.9, W6X25 and S4X9.5, with web thicknesses of 0.316 inches, 0.320 inches and 0.326 inches respectively, had brackets of 5/16 (.3125) inch plate steel. The bracket length was either 8 inches or 12 inches, and the width was the desired eccentricity plus 2 inches.

The bracket was centered between the flanges; but due to the dimensions of the test frame, the bracket was centered about a point 30 inches from the reference end of the specimen. This meant that the corner of the 8 inch bracket was 26 inches from the reference end while the corner of the 12 inch bracket was 24 inches from that same end. The bracket, centered between the flanges and positioned perpendicular to the web, was welded around its perimeter with a fillet weld of the same dimension as the plate thickness using a 6013 electrode. At this time a 1x1x3/16 angle was welded to both sides of the bracket, from the point of load application to the opposite corner, to act as stiffeners for the plate. Also, a 3x4x1/2 inch plate was welded perpendicular to the bracket to serve as a bearing surface for the load. When the welding was finished, the specimen was ready for the strain gages to be applied.

Once the masking tape had been removed, the final strain gage locations were transferred to the web. The template was positioned one end with respect to the center of the 7/8 inch diameter hole nearest the reference end and the the other with respect to scribed centerline. The locations of the two small holes were transferred to the template and then drilled with the No. 28 drill Two headless No. 6 x 1 1/4 inch screws were placed in the holes in the web and nutted on both sides such that equal portions protruded from each side. The headless screws and the

scribed centerline provided the three reference points needed to accurately locate the template on either side of the web. The positions of the strain gages were lightly etched into the web and cleaned with cotton balls saturated with acetone. The strain gages were glued in place using Elmer's Epoxy and weighted as the epoxy cured for 12 hours.

After all the strain gages were glued in place, the test specimen was placed in the test frame and secured with two 3/4 inch diameter A-325 bolts. The bolt at the tension support (at the reference end) was not tightened so that the locations where the strains were measured would be nearly free of axial strains. All the reaction for the axial load was taken at the compression end.

Once the specimen was secured, the lead wires were soldered to the strain gages and connected to the Model 225 BLH Switching and Balancing Unit. The wiring configuration is described later under the Data Acquisition System. The strain gages were then balanced to insure that they were functioning before the dial gages were mounted.

The dial gages were mounted on an independent test stand to avoid any interaction with the load frame (see Figure 2.5). These dial gages were used to measure the absolute deflections of various points on the web and flanges. The contributions to the deflections due to the load frame were assumed to be insignificant. Each indicator was placed perpendicular to the plane of either the web or

flange to avoid measuring any deflections in that plane. The deflection readings were recorded by hand during the test, and typed into the computer after the testing was finished.

The Data Acquisition System

A data system, based on a microcomputer, was developed for this testing program. A North Star Horizon microcomputer was responsible for reading and recording the values of the load and the strains. The deflection data, which was entered into the computer at a later time, was also stored on a floppy disk with the strain data.

The North Star Horizon, which utilizes a Zilog Z-80 microprocessor, is equipped with two disk drives (for 5 1/4 inch floppy disks) and 64 kilobytes of random access memory. The North Star is interfaced with a Lear-Siegler ADM3 Interactive Display Terminal. To enable the North Star to be interfaced with the strain gage signal conditioners, a Cromemco D+7A Input/Output Analog/Digital interface was installed. This A/D interface has an 8 bit resolution with an accuracy of 20 millivolts and an I/O voltage range of -2.56 to +2.54 volts on the analog ports. The D+7A interface is equipped with 7 analog input ports, 7 analog output ports, 1 digital input port and 1 digital output port.

Other components of the data system include a Vishay Measurements Group 2100 System Strain Gage Conditioner and Amplifier System and four BLH Model 225 Switching and Balancing Units. The transducers (load cell and strain gages) have already been descibed in the section on the test procedure.

The description of the system begins with the strain gage connections to the switching and balancing unit. This switching and balancing unit allows ten strain gages to be connected to one conditioner channel. The active gage is connected between the black and white terminals of the channel inputs, and the compensating gage is connected between the white and green terminals. One compensating gage is used for all the strain gages connected to one switching and balancing unit. The switching and balancing unit includes internal resistors to complete the Wheatstone bridge between the black and red, and the red and green terminals. To include these resistors in the circuit, the gage resistance dial must be set to the appropriate value (120 ohms); and the bridge selector set for the two arm bridge.

The connection between the BLH switching and balancing unit and the strain gage conditioner is as shown in Figure A2. With this connection, the excitation voltage is supplied to the black and green terminals (from pins B and C on the strain gage conditioner), and the output from the

strain gage is supplied to the conditioner from the white and green terminals (to pins A and D on the strain gage conditioner). Shielded cable is used for this connection with the shield being connected to pin F on the strain gage conditioner. This configuration give positive voltages for tensile strains.

The load cell is connected directly to one of the six conditioner channels as shown in Figure A3. With this configuration, the conditioner yields positive voltages for compressive loads.

Each of the five conditioner channels (one is connected to the load cell, four are connected to switching and balancing units) is connected to one port of the A/D interface. The output voltage from each conditioner channel must be matched to the input voltage range of the A/D interface by adjusting the bridge excitation voltage and the amplifier gain on that channel.

The output voltage may be determined by multiplying the transducer output by the gain setting. The output of a transducer is equal to the excitation voltage (V_{ex}) times the output of the transducer at the rated maximum (R_o). The output voltage from the conditioner is given by equation (A1). There are two unknowns in equation (A1): V_{ex} and G. One value must be assumed and the other calculated using the assumed value in equation (A1). To minimize the effects of electrical interference in the signal, the gain should be

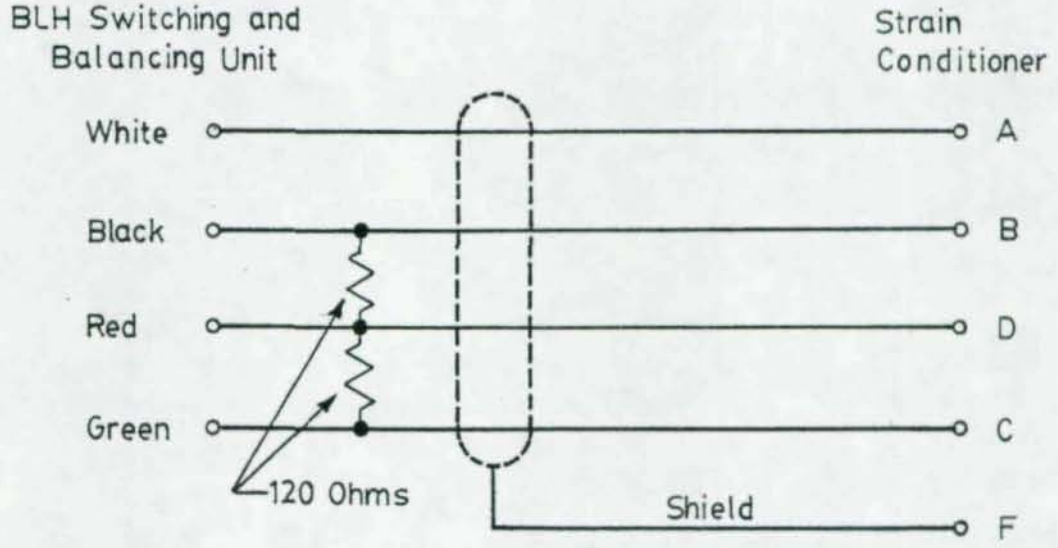


Figure A2 Schematic of the connection between the BLH Switching and Balancing Units and the 2100 System Strain Gage Conditioner and Amplifier.

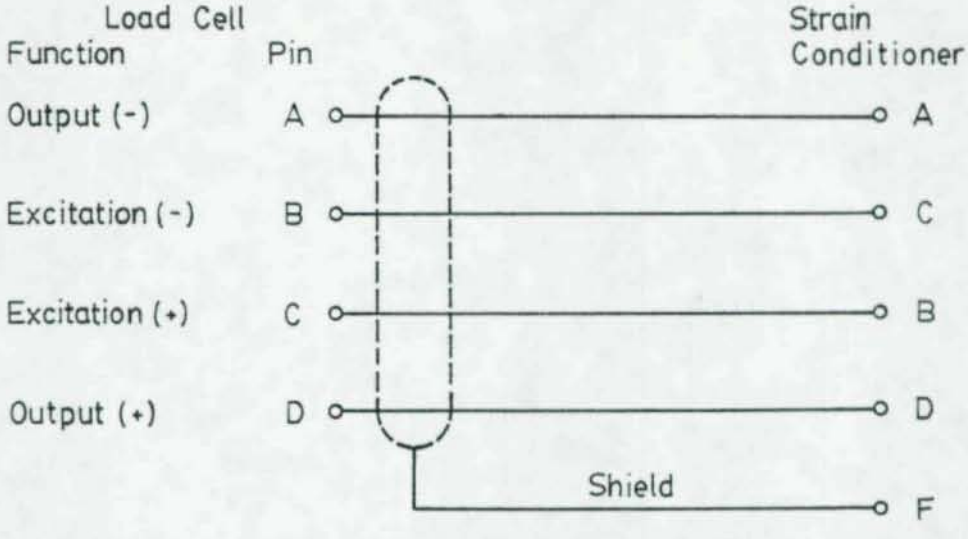


Figure A3 Schematic of the connection between the load cell and the 2100 System Strain Gage Conditioner and Amplifier System.

minimized as much as possible. This can be done by increasing the excitation voltage, however do not allow the excitation voltage to exceed the maximum excitation voltage for the transducer.

$$V_{out} = V_{ex} R_o G \qquad (A1)$$

For example, the rated output of the load cell is 0.3 mV/V, and the desired gain setting is 120. To achieve the desired conditioner output voltage of 2.56 volts at 15000 pounds, the excitation voltage must be 7.11 volts.

The bridge excitation voltage and the amplifier gain for strain gages are determined in a similar manner from equation (A2). The value of R_o in equation (A1) is be replaced with the value of the maximum strain reading divided by the gage factor. Since there are three unknowns in the equation, the value of two variables must be given from which the value of the third may determined. In this case, the maximum strain reading is 15000 microstrain and the bridge excitation voltage is 3.00 V, and the value of the gain is calculated.

$$V_{out} = V_{ex}(\varepsilon)_{max} G/(G_f) \qquad (A2)$$

The scaling of the input from the conditioner to the real units begins with the A/D conversion. The Cromemco

converts the analog input signal into its equivalent digital signal in two's compliment binary notation. The digital equivalent is then input into the microcomputer. Any inputs digital inputs over 127 must have 256 subtracted form them because of the 2's compliment notation. This inputting sequence is done several times to obtain an average value of the input signal. The averaging, which is equivalent to placing a capacitor in the input line is done to reduce the effects of electrical interference in the data.

The actual scaling of the average of the input to real units of microstrain is done using linear interpolation. The ratio of the value of the strain reading to the maximum strain reading must equal the ratio of the average of the inputs to the absolute value of the maximum input value as shown in equation (A3). Equation (A3) can be solved for the value of the strain reading.

$$\frac{\text{Average of N5 inputs}}{\text{Absolute maximum input}} = \frac{\text{value of strain}}{\text{maximum strain value}} \qquad \text{(A3)}$$

The program lines listed in Figure A4 are the lines from the testing program which perform the inputting of the digital signal from the A/D interface and scale it to the strain value. The summation of N5 inputs for averaging is done in the FOR-NEXT loop (lines 21800-22200). The actual scaling is done in line 22300. The average of the inputs is given by A/N5 which is divided by the absolute maximum of

the inputs (the values of the inputs range from -128 to +127 therefore the absolute maximum is 128). Equation (A2) can be solved to give the maximum strain value. In the program the conditioner output voltage (V_{out}) is replaced with its value of 2.56. The constant 1.0E6 is included to convert the strain readings to units of microstrain.

```
21700 A=0
21800 FOR J=1 TO N5
21900 B=INP(P)
22000 IF B>127 THEN B=B-256
22100 A=A+B
22200 NEXT
22300 A=((A/N5)/128)*2.56*1.0E6*G5/(G2*E)
```

where:

```
A = the sum of N5 inputs
B = value of an individual input
E = value of the excitation voltage
G2= value of the gain setting on the conditioner
G5= value of the gage factor
N5= number to average over
```

Figure A4 Subroutine which scales the input to units of microstrain.

The interval between the minimum strain value and the maximum strain value was broken into 256 increments due to the 8 bit precision of the A/D interface. In the testing program, the strain interval which could be measured had values between -15000 and +14882 microstrain. Therefore, the actual value of the strain could lie within a range from -60 to +60 microstrain from the recorded value of the

strain. However the accuracy of the measured strain was generally much less than the plus or minus 60 microstrain. Often the digital value of the input would vary as much as 3 due to electrical interference. This meant that the value of the strain could lie anywhere within an interval of 350 microstrain. Averaging the input values reduces the effects of the electrical interference. The strain data listed in Appendix C is rounded to the nearest microstrain. The actual strain value is within the interval of approximately plus or minus 60 microstrain from the recorded strain value. Since the recorded strain value is the midpoint of the interval, its value without rounding to the nearest 10 or 100 is used as the best approximation of the real strain However, the values which are stored in the data files are stored with the 8 bit precision to which they were recorded. Any processing which was done by the microcomputer was done with the 8 bit precision and the results were then rounded off.

The computer system was calibrated in a Tinius Olsen Universal Testing Machine with a 12000 pound capacity. The load cell was calibrated in compression only by applying a load to it directly using the Tinius Olsen. The load displayed by the computer was compared to the value of the load displayed on the Tinius Olsen. The values of the excitation voltage and the gain settings were modified until the two values of the load were in agreement.

The strain measuring equipment was also calibrated in the Tinius Olsen. A sample of A36 steel of known constant cross sectional area was placed in the Tinius Olsen. The sample was loaded in tension and the strain was read from two single axis gages fixed to the sample. The measured strain was compared to the strain value determined using Hook's law (E=29,000,000 psi), and the system was modified as for the load cell until the strain values were in agreement.

Data Reduction System

The microcomputer also played an important role in the data reduction. The data which was stored on a floppy disk was readily available for processing and presentation in both tabular and graphical form. The computer provided fast and consistent processing of the data from each test.

Software was written in North Star Basic to enable the North Star to drive both a Tektronix 4662 Interactive Digital Plotter and a Lear-Siegler terminal enhanced to emmulate a Tektronix 4010 graphics terminal. The graphics routines were assembled in a program which would produce line plots of data files containing x-y coordinate pairs. All of the line plots of data throughout the text were produced using the North Star graphics.

The North Star was used to resolve the strain data into

principal strains and directions. This information is tabulated in Appendix D. Software was also developed which produced polar plots of strain at a point and plots of load versus measured strain values. None of these type of plots are included in this presentation.

The deflection data was also processed using the North Star. Programs were developed which would plot load-deflection curves for any dial gage location. The graphic routines were also used to plot the deflections of a cross section at any level of loading. Cross sections could be chosen which would display the flange and web rotations (perpendicular to the longitudinal axis) or display the deflections out of the plane of the web along the longitudinal axis. Examples of these plots are given in Figures 3.6-3.9.

The system presented above by no means utilizes the North Star to its capacity. The system can be expanded to control the loading and other phases of testing. The processing abilities and the tabular and graphical forms of data presentation have made the North Star Horizon a valuable tool in this study.

Copies of the software developed for this study [7] are available by contacting Dr. Gordon Batson, Dept. of Civil and Environmental Engineering, Clarkson College, Potsdam, New York 13676.

APPENDIX B

ALTERNATIVE APPROXIMATION TO THE FLANGE CAPACITY

Equations (3.8) and (3.9) provide a first approximation to the load capacity of the flanges of sections with welded bracket to web connections. These two expressions were developed from equation 1.6-2 of the AISC Specifications without the restriction of $f_a/F_a<0.15$. The value of the load derived from the appropriate equation (3.8) or (3.9) must be examined with respect to the requirements of sections 1.5.1.4.3 and 1.6.1. The value of P from the expressions is reduced until it conforms to the requirements of these two sections.

An alternative approach is to use equations 1.6-1a and 1.6-1b of the AISC Specifications to develop the expressions for the load capacity of the flanges. These alternative expressions shown below (B1)-(B4) are again only approximations for the load capacity. The value of P from these expressions must be reduced until it again conforms to the requirements of sections 1.5.1.4.3 and 1.6.1. Since (B1)-(B4) are cumbersome and because they yield only an approximation of the load, it is suggested that equations (3.8) and (3.9) are used instead.

For $x \leq b/2$

$$P = \left(\frac{.75SRA^2F'_{ey}}{2C_{my}}\right)\left[\left(\frac{F_y}{AF'_{ey}} + \frac{1}{RA} + \frac{C_{my}e(b - x - L/2)}{.75Sb}\right)\right.$$

$$\left. - \sqrt{\left(\frac{F_y}{AF'_{ey}} + \frac{1}{RA} + \frac{C_{my}e(b - x - L/2)}{.75Sb}\right)^2 - \frac{4F_y}{RA^2F'_{ey}}} \right] \qquad \text{(B1)}$$

$$P = \frac{.75F_ySb}{e(b - x - L/2 + \frac{1.25Sb}{Ae})} \qquad \text{(B2)}$$

For $x \geq b/2$

$$P = \left(\frac{.75SRA^2F'_{ey}}{2C_{my}}\right)\left[\left(\frac{F_y}{AF'_{ey}} + \frac{1}{RA} + \frac{C_{my}e(x - L/2)}{.75Sb}\right)\right.$$

$$\left. - \sqrt{\left(\frac{F_y}{AF'_{ey}} + \frac{1}{RA} + \frac{C_{my}e(x - L/2)}{.75Sb}\right)^2 - \frac{4F_y}{RA^2F'_{ey}}} \right] \qquad \text{(B3)}$$

$$P = \frac{.75F_ySb}{e(x - L/2 + \frac{1.25Sb}{Ae})} \qquad \text{(B4)}$$

APPENDIX C

STRAIN DATA

The strain data is listed with the following sign convention. Tensile strains are represented by positive strain readings.

The gage location is given by the gage location number. This number refers to a location shown in Figures 2.1, 2.2 or 2.3. In the case of strain rosettes, the individual gages are numbered as shown in Figure 2.4. The lower gage number corresponds to the strain gage on top of the web (on the side with the bracket), and the higher number corresponds to the strain gage on the bottom of the web. The number of a strain gage in a rosette on the bottom of the web is 12 more than the number of the corresponding gage on top. For example, the strain gage lying directly under strain gage number 1 is 13. This is always the case except on the S4x9.5 section with the 8 inch bracket. This section was tested with only 3 strain rosettes on a side so the top and bottom numbers differ only by 9 (for example gage 1 lies directly over gage 10). Similarly for the single axis gages, the gage with the higher of the two strain gage numbers at a single strain gage location is on the bottom side of the web.

	GAGE LOCATION NUMBER									
	5	5	5	1	1	1	2	2	2	3
LOAD (LBS)	STRAIN GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
586.	31.	12.	31.	64.	56.	73.	68.	3.	19.	50.
1055.	55.	32.	56.	81.	70.	130.	117.	-0.	39.	98.
1523.	81.	48.	82.	66.	180.	211.	164.	1.	50.	174.
2109.	119.	80.	120.	46.	431.	335.	239.	-13.	64.	312.
2109.	120.	82.	121.	8.	432.	282.	203.	-14.	64.	279.
2577.	150.	104.	150.	82.	519.	359.	281.	-228.	79.	476.
2578.	-358.	-125.	-159.	121.	519.	362.	282.	-28.	79.	496.
2567.	333.	82.	-185.	102.	517.	360.	282.	-47.	49.	480.
3047.	-458.	112.	-198.	123.	596.	478.	324.	-45.	70.	906.
3454.	-538.	149.	-207.	123.	695.	558.	399.	-46.	87.	1068.
3984.	644.	187.	-230.	122.	910.	677.	517.	-54.	110.	1290.
4570.	-758.	192.	-253.	84.	1067.	832.	627.	-61.	149.	1381.
4570.	-784.	200.	-277.	86.	1107.	832.	634.	-71.	150.	1376.
5039.	-901.	228.	-282.	46.	1223.	950.	713.	-47.	226.	1443.
5508.	-1026.	268.	-314.	5.	1229.	1146.	832.	-31.	306.	1580.
6094.	-1217.	308.	-350.	-35.	1264.	1381.	1074.	-29.	425.	1694.
6557.	-1386.	346.	-351.	-76.	950.	1611.	1225.	35.	578.	1825.
7031.	-1611.	387.	-396.	-106.	951.	1851.	1301.	101.	618.	1900.
7610.	-2036.	455.	-473.	-113.	4993.	2166.	1424.	211.	738.	2047.
7616.	-2078.	431.	-482.	-113.	9205.	2118.	1415.	210.	733.	2003.
8084.	-2392.	502.	-589.	-116.	2345.	2241.	1417.	232.	762.	2098.
8555.	-3017.	504.	-902.	-225.	3615.	2706.	1532.	266.	777.	2232.
9079.	-3841.	505.	-1338.	-123.	7503.	3056.	1534.	268.	738.	2489.
9170.	-3988.	462.	-1435.	-114.	6358.	3070.	1533.	237.	697.	2570.
9492.	-4803.	462.	-1877.	-133.	7602.	3413.	1533.	127.	580.	2825.
10254.	-6679.	462.	-3049.	-229.	14921.	4239.	1647.	125.	580.	3489.

TABLE C1 STRAIN DATA FOR THE W4X13 SECTION WITH THE 8 INCH BRACKET.

	GAGE LOCATION NUMBER									
	3	3	5	5	5	1	1	1	2	2
LOAD	STRAIN GAGE NUMBER									
(LBS)	11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
586.	49.	76.	61.	31.	20.	-27.	-45.	-118.	49.	-1.
1055.	98.	121.	125.	57.	31.	-27.	-68.	-220.	98.	-18.
1523.	179.	200.	186.	81.	48.	-11.	-77.	-306.	179.	-21.
2109.	314.	272.	275.	119.	73.	43.	-44.	-369.	310.	-37.
2109.	64.	249.	280.	120.	73.	48.	-36.	-423.	63.	-39.
2577.	101.	323.	345.	150.	102.	74.	-59.	-579.	102.	-48.
2578.	1004.	320.	349.	-69.	94.	78.	-53.	-580.	-266.	-57.
2567.	1420.	321.	311.	-93.	66.	39.	-47.	-580.	-268.	-79.
3047.	1577.	355.	392.	-84.	112.	41.	-85.	-664.	-344.	-79.
3454.	1617.	400.	468.	-82.	151.	69.	-124.	-858.	-385.	-83.
3984.	1738.	475.	561.	-82.	202.	115.	-162.	-1051.	-463.	-87.
4570.	1916.	524.	626.	-90.	249.	155.	-202.	-1208.	-541.	-90.
4570.	1931.	556.	626.	-86.	238.	167.	-203.	-1208.	-543.	-113.
5039.	2008.	560.	738.	-89.	282.	230.	-267.	-1327.	-619.	-109.
5508.	2166.	596.	821.	-91.	356.	272.	-321.	-1600.	-698.	-114.
6094.	2245.	631.	977.	-89.	435.	468.	-438.	-1992.	-779.	-114.
6557.	2255.	599.	1141.	-87.	518.	625.	-517.	2359.	-855.	-116.
7031.	2284.	597.	1487.	-91.	600.	741.	-635.	-2693.	-932.	-121.
7610.	2284.	595.	2194.	-125.	867.	896.	-831.	-3250.	-1003.	-152.
7616.	2253.	480.	2264.	-124.	906.	891.	-841.	-3279.	-1018.	-148.
8084.	2243.	482.	2789.	142.	1137.	1017.	-949.	-3630.	-1073.	-150.
8555.	2200.	473.	3813.	-149.	1453.	1177.	-1169.	-4100.	-1136.	-145.
9079.	2166.	368.	4982.	-125.	1881.	1409.	-1341.	-4689.	-1244.	-147.
9170.	2120.	361.	5516.	-122.	1882.	1405.	-1416.	-4835.	-1283.	-112.
9492.	2115.	359.	6799.	-122.	2247.	1641.	-1533.	-5391.	-1401.	-112.
10254.	2106.	360.	9860.	-122.	3286.	2345.	-1885.	-6920.	-1751.	-109.

TABLE C1 CONTINUED.

	GAGE LOCATION NUMBER									
	2	3	3	3	6	7	8	9	6	7
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
586.	-18.	32.	-60.	-78.	128.	72.	32.	22.	-150.	-79.
1055.	-45.	57.	-106.	-155.	229.	132.	57.	42.	-276.	-150.
1523.	-61.	82.	-120.	-182.	331.	182.	82.	55.	-377.	-205.
2109.	-103.	120.	-178.	-306.	446.	262.	120.	81.	661.	-295.
2109.	-108.	121.	-181.	-311.	411.	268.	121.	83.	-681.	-308.
2577.	-134.	150.	-233.	-397.	517.	317.	151.	102.	869.	-348.
2578.	-146.	-630.	-243.	-409.	516.	316.	152.	103.	-876.	-361.
2567.	-171.	-654.	-260.	-429.	516.	306.	116.	72.	-893.	-383.
3047.	-191.	-789.	-309.	-530.	636.	347.	154.	110.	-1048.	-464.
3454.	-218.	-910.	-356.	-592.	753.	424.	191.	112.	-1210.	-503.
3984.	-263.	-1005.	-421.	-680.	910.	503.	231.	150.	-1484.	-618.
4570.	-300.	-1005.	-466.	-789.	1067.	581.	270.	185.	-1680.	-661.
4570.	-308.	-1316.	-468.	-811.	1066.	581.	283.	187.	-1680.	-662.
5039.	-351.	-1529.	-540.	-831.	1222.	659.	321.	189.	-1876.	-772.
5508.	-438.	-1728.	-600.	-859.	1422.	738.	348.	228.	-2110.	-857.
6094.	-465.	-2037.	-660.	-856.	1696.	857.	395.	264.	-2504.	-943.
6557.	-472.	-2309.	-736.	-859.	1890.	934.	439.	305.	-2756.	-1053.
7031.	-417.	-2580.	-781.	-853.	2091.	1020.	470.	317.	-3053.	-1169.
7610.	-307.	-2980.	-930.	-814.	2480.	1133.	543.	361.	-3604.	-1329.
7616.	-305.	-3017.	-932.	-815.	2473.	1135.	544.	347.	-3634.	-1401.
8084.	-226.	-3297.	-1010.	-817.	2708.	1213.	594.	385.	-3983.	-1519.
8555.	-101.	-3761.	-1160.	-810.	3178.	1362.	648.	424.	-4452.	-1640.
9079.	44.	-4232.	-1322.	-853.	3647.	1480.	704.	464.	-5041.	-1872.
9170.	7.	-4337.	-1397.	-927.	3761.	1505.	601.	462.	-5161.	-1874.
9492.	-105.	-4919.	-1515.	-927.	4117.	1541.	700.	462.	-5628.	-2107.
10254.	357.	-6677.	-1866.	-928.	5176.	1870.	817.	580.	-7155.	-2575.

TABLE C1 CONTINUED.

LOAD (LBS)	GAGE LOCATION NUMBER 8 STRAIN GAGE NUMBER 31	GAGE LOCATION NUMBER 9 STRAIN GAGE NUMBER 32
0.	0.	0.
586.	-22.	-27.
1055.	-55.	-44.
1523.	-78.	-57.
2109.	-112.	-82.
2109.	-112.	-82.
2577.	-142.	-100.
2578.	-142.	-100.
2567.	-142.	-100.
3047.	-178.	-124.
3454.	-198.	-141.
3984.	-238.	-170.
4570.	-272.	-190.
4570.	-272.	-190.
5039.	-310.	-217.
5508.	-346.	-245.
6094.	-393.	-275.
6557.	-440.	-310.
7031.	-480.	-343.
7610.	-546.	-385.
7616.	-546.	-385.
8084.	-592.	-418.
8555.	-651.	-458.
9079.	-714.	-498.
9170.	-714.	-498.
9492.	-770.	-540.
10254.	-868.	-606.

TABLE C1 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	721.	555.	206.	234.	-38.	92.	263.	573.	505.	19.
1523.	1089.	853.	255.	221.	-119.	143.	354.	890.	693.	13.
1992.	1566.	1211.	316.	232.	-163.	190.	503.	1316.	1031.	21.
2461.	1850.	1458.	358.	287.	-197.	266.	657.	1595.	1229.	22.
3047.	2233.	1790.	426.	331.	-294.	360.	827.	2004.	1525.	25.
3516.	2468.	1988.	544.	335.	-322.	417.	971.	2291.	1756.	25.
3984.	2627.	2147.	693.	448.	-198.	542.	1134.	2624.	1985.	27.
4570.	2734.	2303.	934.	662.	-61.	626.	1361.	2976.	2183.	24.
5039.	2778.	2461.	1243.	777.	114.	730.	1567.	3391.	2459.	29.
5508.	2780.	2580.	1589.	828.	233.	855.	1790.	3724.	2658.	28.
6108.	2774.	2781.	2119.	863.	309.	1055.	2152.	4307.	3013.	29.
6563.	2785.	2944.	2469.	866.	345.	1209.	2438.	4799.	3287.	28.
7032.	2792.	3046.	2796.	810.	348.	1288.	2697.	5164.	3515.	-10.
7605.	2931.	3298.	3278.	810.	348.	1403.	3050.	5862.	3865.	-10.
8613.	3166.	3870.	4109.	927.	466.	1641.	3755.	6928.	4456.	-15.
9082.	3284.	4124.	4593.	927.	508.	1758.	4226.	7398.	4846.	-100.
9492.	3510.	4575.	5285.	1045.	583.	1994.	4816.	8339.	5394.	-109.
9961.	3728.	5274.	6447.	1184.	715.	2229.	5630.	9280.	5984.	-104.
10723.	3990.	5986.	7757.	1423.	936.	2685.	6667.	10339.	6803.	-119.
11074.	4225.	6577.	8928.	1630.	1054.	2935.	7401.	11150.	7288.	-107.
11484.	4578.	7633.	10928.	1868.	1392.	3523.	8568.	12220.	8104.	-231.
12070.	5380.	9515.	14091.	2576.	1877.	4461.	10675.	14104.	9513.	-342.
12773.	5754.	10446.	14929.	2926.	2112.	5051.	11755.	14925.	10218.	-356.
13125.	6579.	12436.	14929.	3397.	2580.	5962.	13987.	14925.	11627.	-471.

TABLE C2 STRAIN DATA FOR THE W4X13 SECTION WITH THE 12 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD (LBS)	STRAIN GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	-17.	90.	97.	332.	-363.	-131.	-63.	-208.	-270.	308.
1523.	-40.	114.	105.	858.	-493.	-192.	-106.	-312.	-384.	416.
1992.	-51.	153.	91.	1113.	-629.	-306.	-155.	-454.	-557.	477.
2461.	-74.	203.	53.	1183.	-821.	-355.	-205.	-584.	-635.	533.
3047.	-88.	249.	41.	1111.	-1511.	-464.	-253.	-677.	-802.	674.
3516.	-109.	278.	15.	1043.	-1753.	-515.	-151.	-781.	-915.	563.
3984.	-132.	320.	-25.	958.	-1920.	-585.	-168.	-1172.	-1093.	571.
4570.	-154.	385.	-35.	869.	-2015.	-677.	-75.	-1319.	-1361.	508.
5039.	-171.	431.	-25.	730.	-2078.	-712.	-36.	-1628.	-1649.	452.
5508.	-192.	490.	-3.	626.	-2150.	-743.	-46.	-1602.	-1921.	372.
6108.	-213.	559.	11.	433.	-2223.	-787.	-87.	-1532.	-2422.	249.
6563.	-236.	623.	20.	307.	-2259.	-809.	-109.	-1462.	-2805.	181.
7032.	-271.	703.	12.	159.	-2318.	-871.	-151.	-1433.	-3262.	113.
7605.	-283.	746.	-33.	-21.	-2358.	-925.	-202.	-1367.	-3898.	28.
8613.	-326.	898.	-53.	-312.	-2511.	-1089.	-324.	-1313.	-5041.	-84.
9082.	-366.	954.	-49.	-508.	-2571.	-1210.	-427.	-1282.	-5041.	-166.
9492.	-472.	942.	-122.	-821.	-2708.	-1394.	-584.	-1289.	-6537.	-238.
9961.	-500.	1058.	-122.	-1272.	-2956.	-1528.	-705.	-1201.	-7544.	-366.
10723.	-597.	1171.	-122.	-1765.	-3548.	-1779.	-941.	-1175.	-8960.	-484.
11074.	-599.	1272.	-6.	-2240.	-4131.	-1984.	-1059.	-1166.	-9914.	-474.
11484.	-734.	1298.	123.	-3007.	-5063.	-2128.	-1295.	-1090.	-11320.	-474.
12070.	-937.	1522.	586.	-4361.	-6913.	-2449.	-1750.	-1055.	-14039.	-467.
12773.	-967.	1603.	940.	-5190.	-8145.	-2593.	-1991.	-1057.	-15096.	-352.
13125.	-1182.	1758.	1627.	-6424.	-10144.	-2711.	-2248.	-1116.	-15096.	-170.

TABLE C2 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	15.	-9.	13.	-83.	-231.	327.	130.	84.	55.	-3.
1523.	9.	-28.	11.	-132.	-330.	410.	179.	114.	80.	-5.
1992.	25.	-28.	24.	-169.	-472.	572.	247.	158.	110.	1.
2461.	24.	-33.	25.	-209.	-610.	706.	302.	197.	137.	0.
3047.	73.	-42.	36.	-253.	-780.	882.	370.	244.	168.	2.
3516.	113.	-39.	32.	-300.	-927.	1013.	430.	271.	187.	78.
3984.	165.	-49.	25.	-353.	-1104.	1176.	475.	311.	211.	-14.
4570.	213.	-43.	50.	-410.	-1296.	1399.	555.	354.	250.	93.
5039.	255.	-50.	81.	-451.	-1490.	1655.	642.	425.	275.	-12.
5508.	303.	-48.	87.	-511.	-1685.	1859.	705.	465.	316.	-13.
6108.	361.	-38.	128.	-595.	-2050.	2210.	826.	543.	363.	-12.
6563.	384.	-34.	144.	-650.	-2314.	2463.	907.	603.	401.	92.
7032.	408.	-34.	180.	-706.	-2653.	2782.	997.	662.	440.	181.
7605.	441.	-29.	231.	-780.	-3184.	3193.	1101.	704.	501.	-6.
8613.	461.	122.	355.	-1052.	-4388.	3956.	1304.	830.	579.	-133.
9082.	461.	348.	491.	-1179.	-5173.	4443.	1316.	940.	591.	-17.
9492.	497.	517.	772.	-1313.	-5167.	4950.	1450.	997.	677.	17.
9961.	572.	522.	837.	-1402.	-7476.	5665.	1557.	1070.	711.	-5.
10723.	600.	734.	1060.	-1574.	-9293.	6737.	1791.	1193.	825.	-5.
11074.	711.	946.	1286.	-1767.	-10613.	7467.	1836.	1309.	931.	-5.
11484.	906.	990.	1528.	-1993.	-12541.	8445.	2027.	1425.	945.	-5.
12070.	1287.	1421.	2006.	-2463.	-15432.	10387.	2270.	1641.	1073.	96.
12773.	1755.	1767.	2474.	-3042.	-15432.	11919.	2516.	1793.	1292.	101.
13125.	2461.	2228.	2942.	-3714.	-15432.	14008.	2761.	1943.	1420.	115.

TABLE C2 CONTINUED.

	GAGE LOCATION NUMBER							
	5	6	7	8	9	10	11	12
LOAD	STRAIN GAGE NUMBER							
(LBS)	31	32	33	34	35	36	37	38
0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	231.	-330.	-108.	-68.	-43.	9.	6.	-13.
1523.	318.	-627.	-150.	-90.	-61.	10.	9.	-19.
1992.	444.	-887.	-201.	-127.	-84.	13.	12.	-29.
2461.	553.	-1038.	-249.	-160.	-110.	15.	13.	-33.
3047.	703.	-1038.	-314.	-200.	-137.	17.	18.	-40.
3516.	821.	-1656.	-365.	-241.	-162.	-1.	5.	-47.
3984.	970.	-1953.	-435.	-281.	-183.	2.	5.	-52.
4570.	1173.	-2244.	-502.	-323.	-213.	6.	6.	-55.
5039.	1355.	-2603.	-576.	-364.	-246.	10.	7.	-77.
5508.	1616.	-2948.	-640.	-407.	-286.	6.	12.	-89.
6108.	2060.	-3477.	-749.	-482.	-323.	9.	10.	-94.
6563.	2469.	-3887.	-818.	-526.	-359.	6.	10.	-111.
7032.	3013.	-4309.	-908.	-581.	-392.	1.	16.	-123.
7605.	3770.	-4881.	-1008.	-643.	-440.	1.	20.	-129.
8613.	5700.	-6065.	-1295.	-833.	-594.	-121.	-110.	-128.
9082.	6915.	-6671.	-1307.	-840.	-596.	-108.	-25.	-128.
9492.	8629.	-7398.	-1418.	-951.	-604.	-108.	-4.	-128.
9961.	10793.	-8250.	-1550.	-956.	-714.	-121.	-6.	-130.
10723.	13824.	-9807.	-1833.	-1078.	-832.	-123.	-4.	-138.
11074.	15403.	-10799.	-1915.	-1194.	-837.	-123.	-6.	-140.
11484.	15403.	-12276.	-2122.	-1304.	-950.	-123.	-4.	-160.
12070.	15403.	-15283.	-2478.	-1540.	-1068.	-123.	-9.	-240.
12773.	15403.	-15523.	-2841.	-1689.	-1186.	-123.	-4.	-249.
13125.	15403.	-15523.	-3418.	-1894.	-1303.	-123.	-4.	-249.

TABLE C2 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	6	6	6	3
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
582.	108.	102.	131.	123.	31.	50.	110.	36.	119.	167.
1055.	215.	204.	250.	233.	49.	100.	207.	69.	230.	316.
1496.	296.	282.	343.	330.	66.	122.	247.	54.	314.	444.
1992.	425.	487.	455.	475.	119.	150.	272.	-21.	382.	687.
2461.	457.	722.	478.	901.	190.	182.	291.	-80.	415.	884.
2998.	525.	996.	610.	1354.	303.	248.	332.	-176.	479.	1230.
3516.	568.	1208.	719.	1562.	423.	266.	412.	-290.	524.	1556.
3984.	647.	1474.	841.	1665.	497.	265.	469.	-412.	557.	1982.
4570.	757.	1792.	920.	1759.	549.	241.	549.	-538.	640.	2449.
5039.	875.	2140.	1032.	1858.	582.	164.	629.	-649.	760.	2927.
5508.	1068.	2605.	1147.	2106.	654.	98.	729.	-813.	906.	3576.
5508.	1094.	2615.	1144.	2136.	661.	102.	723.	-808.	911.	3570.
5959.	1224.	2935.	1250.	2352.	693.	49.	876.	-889.	1055.	4118.
6444.	1505.	3481.	1429.	2573.	767.	-25.	1066.	-1040.	1257.	4966.
7207.	1973.	4478.	1737.	2919.	812.	-27.	1381.	-1306.	1733.	6325.
7557.	2441.	5500.	1974.	3388.	925.	-246.	1618.	-1419.	2083.	7600.
8222.	3166.	7162.	2561.	4210.	1063.	-253.	2067.	-1546.	2792.	9413.
9006.	4319.	9727.	3529.	5619.	1503.	-365.	2912.	-1647.	3964.	12469.
9844.	6191.	13602.	5605.	7782.	2224.	-382.	4439.	-1433.	5831.	14895.

TABLE C3 STRAIN DATA FOR THE W5X16 SECTION WITH THE 8 INCH BRACKET.

	GAGE LOCATION NUMBER									
	3	3	1	1	1	2	2	2	6	6
LOAD	STRAIN GAGE NUMBER									
(LBS)	11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
582.	65.	71.	-70.	-94.	-129.	-103.	-34.	-56.	-98.	-13.
1055.	123.	140.	-157.	-201.	-261.	-220.	-62.	-112.	-190.	-18.
1496.	125.	122.	-220.	-268.	-329.	-283.	-65.	-148.	-259.	23.
1992.	87.	8.	-299.	-337.	-374.	-396.	-66.	-212.	-348.	164.
2461.	71.	-74.	-343.	-436.	-451.	-460.	-49.	-310.	-365.	360.
2998.	72.	-212.	-371.	-561.	-502.	-540.	-15.	-426.	-379.	699.
3516.	63.	-338.	-413.	-707.	-565.	-629.	-25.	-477.	-376.	949.
3984.	96.	-491.	-428.	-853.	-607.	-737.	-36.	-466.	-339.	1274.
4570.	164.	-632.	-433.	-1010.	-638.	-832.	-36.	-373.	-304.	1672.
5039.	278.	-774.	-373.	-1186.	-650.	-923.	-32.	-273.	-266.	2097.
5508.	407.	-968.	210.	-1442.	-690.	-1005.	-7.	-120.	-219.	2691.
5508.	401.	-972.	388.	-1440.	-711.	-991.	-18.	-124.	-229.	2687.
5959.	516.	-1071.	649.	-1601.	-705.	-1095.	-8.	-43.	-218.	3086.
6444.	685.	-1283.	526.	-1898.	-703.	-1255.	-6.	154.	-171.	3856.
7207.	1019.	-1590.	659.	-2347.	-678.	-1584.	-25.	425.	-79.	4957.
7557.	1272.	-1829.	909.	-2970.	-702.	-1860.	-58.	669.	-9.	4970.
8222.	1724.	-2153.	-63.	-3950.	-895.	-2248.	-73.	1062.	125.	4970.
9006.	2482.	-2614.	12653.	-5657.	-1419.	-3079.	-153.	1726.	329.	11598.
9844.	3612.	-2851.	1012.	-7751.	-2161.	-4251.	-278.	2545.	799.	14898.

TABLE C3 CONTINUED.

	GAGE LOCATION NUMBER									
	6	3	3	3	5	7	8	9	10	5
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
582.	-101.	-169.	-45.	-60.	-191.	89.	37.	29.	21.	175.
1055.	-209.	-348.	-92.	-113.	-382.	163.	73.	52.	22.	348.
1496.	-277.	-494.	-113.	-108.	-545.	221.	106.	76.	29.	499.
1992.	-303.	-839.	-220.	-22.	-805.	309.	155.	111.	39.	732.
2461.	-341.	-1194.	-258.	10.	-1031.	368.	183.	131.	33.	946.
2998.	-405.	-1669.	-264.	137.	-1343.	470.	262.	167.	26.	1238.
3516.	-466.	-2127.	-291.	287.	-1650.	559.	294.	198.	24.	1514.
3984.	-497.	-2686.	-323.	568.	-2026.	661.	346.	244.	23.	1860.
4570.	-566.	-3418.	-356.	1069.	-2498.	762.	433.	304.	54.	2293.
5039.	-646.	-4109.	-358.	1440.	-3059.	861.	475.	333.	62.	2825.
5508.	-752.	-5020.	-342.	1904.	-3896.	974.	537.	362.	71.	3690.
5508.	-769.	-5062.	-371.	1884.	-3890.	949.	472.	348.	8.	3744.
5959.	-870.	-5649.	-366.	2222.	-4608.	1051.	586.	345.	4284.	4467.
6444.	-1067.	-6774.	-254.	2911.	-5899.	1087.	593.	461.	49.	6035.
7207.	-1410.	-8587.	-80.	3974.	-8353.	1317.	709.	488.	126.	9050.
7557.	-1755.	-10116.	-14.	5005.	-10487.	1428.	811.	582.	126.	11482.
8222.	-2253.	-12225.	207.	6546.	-13804.	1558.	828.	589.	126.	15349.
9006.	-3020.	-15928.	909.	9381.	-17961.	1669.	966.	686.	139.	17805.
9844.	-3690.	-17448.	2574.	14009.	-17961.	2095.	1246.	1053.	338.	17805.

TABLE C3 CONTINUED.

	GAGE LOCATION NUMBER					
	7	8	9	10	11	12
LOAD	STRAIN GAGE NUMBER					
(LBS)	31	32	33	34	35	36
0.	0.	0.	0.	0.	0.	0.
582.	-66.	-33.	-25.	0.	4.	8.
1055.	-138.	-65.	-41.	0.	2.	16.
1496.	-195.	-95.	-66.	-3.	7.	18.
1992.	-271.	-133.	-91.	-6.	5.	25.
2461.	-344.	-169.	-119.	-16.	4.	27.
2998.	-435.	-211.	-153.	-21.	6.	29.
3516.	-519.	-260.	-185.	-26.	5.	31.
3984.	-620.	-305.	-223.	-35.	5.	35.
4570.	-746.	-367.	-265.	-46.	5.	40.
5039.	-868.	-421.	-301.	-52.	6.	42.
5508.	-992.	-480.	-341.	-64.	7.	49.
5508.	-992.	-480.	-341.	-64.	4.	46.
5959.	-1097.	-522.	-376.	-70.	7.	49.
6444.	-1247.	-588.	-418.	-80.	3.	48.
7207.	-1485.	-692.	-490.	-97.	1.	49.
7557.	-1660.	-754.	-533.	-106.	-1.	53.
8222.	-1925.	-843.	-582.	-125.	0.	62.
9006.	-2604.	-1020.	-680.	-150.	-2.	71.
9844.	-3410.	-1197.	-764.	-175.	-1.	76.

TABLE C3 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
-1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1050.	67.	206.	371.	496.	284.	106.	408.	40.	-7.	-26.
1523.	32.	302.	549.	849.	538.	127.	637.	29.	-52.	-43.
1992.	-53.	390.	727.	1166.	801.	75.	893.	-12.	-124.	-83.
2461.	-92.	509.	897.	1364.	1026.	76.	1219.	-15.	-204.	-97.
3047.	-141.	662.	1110.	1495.	1117.	196.	1629.	-6.	-290.	-98.
3509.	-207.	815.	1289.	1564.	1198.	225.	2025.	39.	-372.	-97.
3984.	-340.	1038.	1544.	1674.	1316.	323.	2578.	118.	-528.	-133.
4453.	-416.	1263.	1747.	1775.	1395.	389.	3157.	228.	-632.	-180.
5036.	-528.	1533.	2032.	1930.	1523.	436.	3805.	368.	-729.	-183.
5508.	-612.	1864.	2315.	2083.	1612.	473.	4495.	515.	-851.	-219.
5918.	-651.	2117.	2509.	2162.	1752.	438.	5041.	562.	-1010.	-248.
6563.	-774.	2829.	3112.	2483.	1998.	559.	6335.	796.	-1131.	-275.
7031.	-892.	3431.	3716.	2731.	2273.	675.	7327.	1030.	-1372.	-412.
7617.	-895.	4290.	4633.	3214.	2717.	800.	8816.	1279.	-1497.	-538.
7969.	-912.	4746.	5132.	3458.	2843.	921.	9712.	1515.	-1613.	-548.

TABLE C4 STRAIN DATA FOR THE W5X16 SECTION WITH THE 12 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD (LBS)	STRAIN GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
-1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1050.	-42.	124.	-150.	-216.	-400.	-211.	-14.	-405.	-481.	13.
1523.	-67.	195.	-190.	-325.	-615.	-181.	16.	-650.	-795.	41.
1992.	-127.	258.	-232.	-464.	-843.	-141.	130.	-1088.	-1181.	154.
2461.	-146.	301.	-237.	-579.	-1018.	-147.	262.	-1808.	-1580.	83.
3047.	-171.	406.	-294.	-739.	-1262.	-277.	301.	-2830.	-2095.	91.
3509.	-215.	486.	-294.	-899.	-1420.	-345.	299.	-3510.	-2634.	116.
3984.	-235.	580.	-236.	-1102.	-1704.	-454.	256.	-4153.	-3437.	133.
4453.	-297.	655.	-214.	-1298.	-1997.	-555.	200.	-4525.	-4168.	167.
5036.	-376.	698.	-152.	-1573.	-2411.	-727.	98.	-4947.	-5019.	106.
5508.	-384.	816.	-152.	-1931.	-2789.	-864.	-15.	-5421.	-5912.	200.
5918.	-391.	893.	-34.	-2160.	-3253.	-985.	-32.	-5789.	-6756.	207.
6563.	-504.	1028.	209.	-2776.	-4083.	-1247.	-143.	-6523.	-8318.	332.
7031.	-523.	1062.	450.	-3257.	-4817.	-1466.	-261.	-7233.	-9518.	453.
7617.	-627.	1196.	823.	-4015.	-6020.	-1827.	-405.	-8245.	-11236.	705.
7969.	-732.	1297.	1056.	-4477.	-6737.	-2060.	-506.	-8811.	-12287.	917.

TABLE C4 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
-1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1050.	61.	-3.	41.	-114.	-288.	421.	185.	105.	71.	-1.
1523.	164.	-4.	60.	-179.	-469.	653.	266.	160.	111.	0.
1992.	291.	1.	80.	-248.	-665.	916.	363.	221.	156.	6.
2461.	420.	-3.	90.	-331.	-868.	1174.	437.	255.	169.	-3.
3047.	586.	11.	226.	-413.	-1142.	1566.	570.	342.	241.	-4.
3509.	764.	16.	277.	-498.	-1339.	1891.	654.	387.	274.	-6.
3984.	1087.	31.	325.	-611.	-1674.	2439.	785.	471.	350.	30.
4453.	1351.	57.	365.	-719.	-1988.	2932.	902.	552.	396.	33.
5036.	1711.	98.	400.	-856.	-2424.	3570.	1013.	622.	463.	34.
5508.	2036.	163.	485.	-1010.	-2940.	4284.	1138.	715.	519.	36.
5918.	2403.	226.	518.	-1152.	-3497.	4860.	1190.	809.	570.	-7.
6563.	3218.	357.	760.	-1336.	-4472.	6108.	1385.	831.	599.	-7.
7031.	3813.	575.	992.	-1492.	-5421.	6985.	1462.	944.	702.	10.
7617.	4802.	835.	1243.	-1798.	-6748.	8521.	1649.	1057.	829.	101.
7969.	5486.	1048.	1458.	-1922.	-7606.	9460.	1788.	1069.	834.	106.

TABLE C4 CONTINUED.

	GAGE LOCATION NUMBER							
	5	6	7	8	9	10	11	12
LOAD	STRAIN GAGE NUMBER							
(LBS)	31	32	33	34	35	36	37	38
-1.	0.	0.	0.	0.	0.	0.	0.	0.
1050.	373.	-694.	-178.	-86.	-60.	6.	13.	-13.
1523.	567.	-1051.	-262.	-128.	-92.	10.	19.	-15.
1992.	785.	790.	-347.	-183.	-122.	13.	21.	-17.
2461.	979.	-2080.	-442.	-230.	-155.	-9.	6.	-45.
3047.	1272.	-2731.	-565.	-308.	-223.	-16.	-2.	-53.
3509.	1545.	-3268.	-670.	-352.	-242.	-12.	-11.	-53.
3984.	1971.	-4077.	-804.	-425.	-310.	-21.	19.	-63.
4453.	2440.	-4870.	-942.	-489.	-349.	-26.	-6.	-63.
5036.	3113.	-5701.	-1122.	-588.	-401.	-138.	-29.	-143.
5508.	3973.	-6665.	-1243.	-644.	-507.	-140.	-34.	-143.
5918.	5054.	-7511.	-1381.	-752.	-515.	-142.	-22.	-143.
6563.	7447.	-9097.	-1613.	-873.	-626.	-142.	-22.	-143.
7031.	9525.	-10417.	-1847.	-936.	-628.	-142.	-22.	-143.
7617.	13142.	-12466.	-2108.	-1006.	-747.	-142.	-22.	-143.
7969.	15196.	-13673.	-2333.	-1115.	-800.	-142.	-22.	-143.

TABLE C4 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
952.	256.	221.	133.	236.	-11.	51.	190.	90.	69.	-15.
1523.	433.	444.	111.	703.	-6.	63.	435.	182.	121.	-23.
1992.	526.	543.	103.	980.	-5.	51.	553.	330.	266.	-32.
2461.	667.	711.	69.	1374.	137.	52.	721.	508.	393.	-37.
3047.	834.	905.	69.	1766.	354.	121.	931.	666.	507.	-59.
3507.	944.	1013.	82.	2004.	475.	122.	1078.	806.	586.	-67.
4102.	1058.	1205.	132.	2368.	625.	87.	1295.	979.	688.	-71.
4570.	1140.	1329.	190.	2652.	737.	19.	1526.	1138.	783.	-77.
4978.	1171.	1452.	262.	2872.	828.	-107.	1685.	1256.	867.	-85.
5508.	1228.	1559.	341.	3039.	926.	-311.	1928.	1421.	948.	-122.
5977.	1259.	1693.	453.	3153.	985.	-387.	2151.	1572.	1014.	-115.
6548.	1321.	1881.	616.	3306.	1094.	-465.	2474.	1792.	1110.	-126.
7031.	1377.	2002.	728.	3389.	1137.	-463.	2674.	1924.	1182.	-128.
7673.	1452.	2229.	915.	3503.	1222.	-470.	3057.	2157.	1261.	-159.
8086.	1492.	2378.	1051.	3587.	1257.	-419.	3300.	2300.	1300.	-153.
8555.	1559.	2518.	1211.	3689.	1296.	-355.	3573.	2471.	1377.	-187.
9023.	1614.	2741.	1399.	3770.	1373.	-306.	3928.	2616.	1438.	-193.
9492.	1691.	2970.	1603.	3921.	1443.	-229.	4301.	2833.	1493.	-228.
10137.	1805.	3256.	1856.	4062.	1532.	-144.	4762.	3067.	1558.	-265.
10608.	1876.	3525.	2107.	4129.	1524.	-111.	5173.	3225.	1530.	-323.
11017.	1981.	3746.	2340.	4351.	1644.	-12.	5525.	3406.	1638.	-360.
11719.	2153.	4233.	2768.	4593.	1762.	122.	6332.	3649.	1669.	-353.
12070.	2602.	5520.	3763.	5294.	2115.	480.	7948.	4347.	1760.	-513.
12718.	2708.	5525.	3871.	5409.	2117.	501.	8063.	4364.	1859.	-518.
13418.	3404.	7169.	5466.	6453.	2585.	1068.	10227.	5173.	1998.	-708.
14238.	3884.	8467.	6813.	7307.	2938.	1656.	12111.	5878.	2231.	-857.

TABLE C5 STRAIN DATA FOR THE M5X18.9 SECTION WITH THE 8 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD	STRAIN GAGE NUMBER									
(LBS)	11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
952.	-12.	67.	-175.	53.	-212.	-149.	-51.	-128.	-154.	-49.
1523.	-33.	100.	-172.	268.	-368.	-254.	-111.	-245.	-293.	-73.
1992.	-28.	139.	-240.	301.	-472.	-347.	-141.	-322.	-398.	-92.
2461.	-47.	163.	-252.	433.	-576.	-433.	-186.	-407.	-511.	-103.
3047.	-72.	199.	-320.	546.	-734.	-510.	-222.	-525.	-685.	-87.
3507.	-80.	220.	-379.	581.	-884.	-582.	-236.	-608.	-808.	-76.
4102.	-110.	250.	-491.	604.	-1246.	-676.	-272.	-784.	-1035.	-59.
4570.	-122.	275.	-557.	580.	-1770.	-803.	-314.	-891.	-1218.	-43.
4978.	-141.	314.	-611.	513.	-2489.	-935.	-378.	-954.	-1378.	-47.
5508.	-154.	360.	-681.	409.	-3488.	-954.	-478.	-1036.	-1592.	-25.
5977.	-182.	387.	-750.	290.	-4324.	-917.	-574.	-1127.	-1800.	-10.
6548.	-235.	357.	-847.	38.	-5505.	-939.	-595.	-1278.	-2116.	-20.
7031.	-233.	392.	-941.	-68.	-6088.	-1054.	-578.	-1318.	-2349.	-15.
7673.	-256.	463.	-1023.	-212.	-7166.	-1289.	-461.	-1515.	-2704.	-13.
8086.	-317.	477.	-1056.	-341.	-7789.	-1506.	-447.	-1776.	-2935.	-10.
8555.	-350.	555.	-1150.	-572.	-8577.	-1748.	-435.	-2338.	-3264.	-13.
9023.	-350.	585.	-1204.	-807.	-9414.	-1974.	-458.	-3159.	-3643.	-3.
9492.	-355.	604.	-1289.	-1000.	-10341.	-2233.	-461.	-3877.	-3922.	74.
10137.	-383.	708.	-1343.	-1291.	-11421.	-2590.	-473.	-4813.	-4456.	105.
10608.	-449.	797.	-1407.	-1630.	-12573.	-2943.	-578.	-5676.	-4901.	110.
11017.	-468.	827.	-1515.	-1872.	-13288.	-3289.	-581.	-6335.	-5289.	107.
11719.	-505.	891.	-1599.	-2451.	-14928.	-3877.	-696.	-7520.	-5995.	215.
12070.	-599.	1060.	-1762.	-3556.	-15045.	-5276.	-931.	-9858.	-7524.	326.
12718.	-604.	1063.	-1879.	-3634.	-15045.	-5410.	-934.	-9983.	-7648.	328.
13418.	-821.	1296.	-2011.	-5158.	-15045.	-7400.	-1284.	-12671.	-9603.	549.
14238.	-941.	1416.	-2242.	-6452.	-15045.	-9301.	-1555.	-15012.	-11346.	787.

TABLE C5 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD (LBS)	STRAIN GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
952.	88.	5.	16.	-67.	-17.	180.	65.	27.	24.	-8.
1523.	178.	9.	17.	-87.	-33.	304.	115.	72.	41.	-14.
1992.	208.	5.	28.	-131.	-50.	412.	159.	88.	56.	-15.
2461.	255.	6.	38.	-150.	-49.	530.	208.	116.	87.	6.
3047.	319.	2.	46.	-202.	-63.	679.	247.	140.	95.	4.
3507.	349.	-2.	34.	-248.	-80.	782.	280.	162.	106.	-11.
4102.	420.	3.	54.	-293.	-99.	969.	334.	192.	132.	-9.
4570.	457.	-18.	33.	-349.	-119.	1082.	346.	186.	119.	-25.
4978.	502.	-26.	36.	-384.	-143.	1232.	368.	209.	139.	-38.
5508.	589.	-18.	77.	-430.	-167.	1386.	414.	243.	152.	-34.
5977.	659.	1.	94.	-450.	-163.	1580.	489.	273.	168.	-25.
6548.	767.	34.	138.	-502.	-199.	1799.	527.	303.	198.	-29.
7031.	828.	60.	166.	-513.	-216.	1993.	579.	317.	211.	-38.
7673.	964.	118.	248.	-560.	-226.	2310.	642.	353.	256.	-25.
8086.	1087.	127.	279.	-585.	-249.	2528.	672.	385.	261.	-19.
8555.	1219.	138.	338.	-624.	-282.	2761.	740.	426.	281.	-25.
9023.	1381.	196.	394.	-681.	-327.	3084.	803.	460.	316.	-26.
9492.	1545.	267.	460.	-787.	-360.	3395.	857.	485.	328.	-21.
10137.	1778.	358.	508.	-931.	-398.	3833.	913.	517.	355.	-21.
10608.	1984.	460.	585.	-1048.	-462.	4283.	973.	553.	373.	-19.
11017.	2166.	542.	657.	-1141.	-518.	4642.	1038.	589.	402.	-13.
11719.	2478.	737.	747.	-1316.	-596.	5114.	1123.	630.	438.	-17.
12070.	3313.	1064.	996.	-1715.	-820.	6673.	1216.	713.	478.	-21.
12718.	3328.	1064.	1036.	-1757.	-847.	6873.	1312.	713.	485.	-25.
13418.	4461.	1544.	1476.	-1994.	-1081.	8759.	1420.	831.	599.	-25.
14238.	5536.	1915.	1869.	-2241.	-1329.	10581.	1615.	928.	656.	-16.

TABLE C5 CONTINUED.

	GAGE LOCATION NUMBER							
	5	6	7	8	9	10	11	12
LOAD	STRAIN GAGE NUMBER							
(LBS)	31	32	33	34	35	36	37	38
0.	0.	0.	0.	0.	0.	0.	0.	0.
952.	144.	-180.	-63.	-32.	-23.	-3.	6.	-5.
1523.	280.	-370.	-104.	-50.	-36.	0.	13.	-12.
1992.	380.	-536.	-141.	-73.	-20.	-2.	17.	-16.
2461.	475.	-704.	-168.	-87.	-63.	0.	19.	-24.
3047.	607.	-920.	-208.	-110.	-81.	-5.	19.	-32.
3507.	708.	-1078.	-236.	-126.	-90.	-4.	21.	-35.
4102.	858.	-1302.	-288.	-155.	-112.	-6.	24.	-43.
4570.	984.	-1485.	-319.	-172.	-125.	-6.	23.	-50.
4978.	896.	-1656.	-354.	-186.	-136.	-7.	29.	-57.
5508.	1250.	-1894.	-396.	-215.	-157.	-9.	27.	-64.
5977.	1401.	-2115.	-438.	-240.	-174.	-11.	28.	-68.
6548.	1599.	-2389.	-493.	-266.	-191.	-9.	30.	-76.
7031.	1754.	-2597.	-535.	-289.	-210.	-12.	33.	-85.
7673.	2024.	-2947.	-602.	-324.	-233.	-17.	32.	-93.
8086.	2220.	-3176.	-645.	-350.	-250.	-18.	37.	-97.
8555.	2471.	-3453.	-696.	-373.	-270.	-18.	34.	-108.
9023.	2791.	-3769.	-758.	-404.	-294.	-22.	38.	-112.
9492.	3158.	-4096.	-813.	-432.	-313.	-25.	39.	-119.
10137.	3695.	-4553.	-893.	-472.	-344.	-33.	40.	-130.
10608.	4242.	-4983.	-366.	-514.	-371.	-34.	39.	-137.
11017.	4731.	-5320.	-1016.	-537.	-388.	-38.	42.	-141.
11719.	5846.	-6104.	-1136.	-601.	-436.	-50.	45.	-154.
12070.	8259.	-7406.	-1283.	-671.	-484.	-59.	43.	-162.
12718.	8647.	-7802.	-1365.	-709.	-510.	-65.	47.	-167.
13418.	12295.	-9503.	-1613.	-799.	-573.	-80.	46.	-175.
14238.	16190.	-11432.	-1905.	-906.	-644.	-96.	51.	-179.

TABLE C5 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	147.	169.	208.	185.	17.	79.	234.	73.	61.	16.
1523.	176.	253.	313.	317.	21.	73.	346.	78.	50.	18.
1992.	194.	331.	401.	579.	61.	62.	460.	79.	17.	21.
2461.	230.	432.	491.	881.	149.	-36.	625.	81.	-13.	24.
3043.	281.	537.	592.	1145.	226.	-172.	791.	118.	-32.	-3.
3516.	296.	660.	705.	1301.	282.	-207.	958.	166.	-41.	-6.
3984.	326.	773.	823.	1440.	346.	-222.	1147.	224.	-34.	-7.
4570.	324.	893.	927.	1546.	389.	-208.	1349.	293.	-27.	-6.
5039.	330.	1018.	1071.	1651.	457.	-172.	1580.	361.	-5.	-6.
5470.	333.	1127.	1179.	1703.	475.	-138.	1743.	450.	0.	-11.
5977.	326.	1256.	1304.	1779.	505.	-92.	2023.	491.	-9.	-11.
6563.	328.	1438.	1464.	1861.	590.	-11.	2317.	566.	-19.	-8.
7031.	319.	1572.	1617.	1942.	635.	66.	2586.	643.	-25.	-6.
7617.	308.	1763.	1776.	2017.	706.	109.	2932.	727.	-46.	-11.
8086.	326.	1907.	1895.	2101.	749.	140.	3177.	788.	-69.	-6.
8578.	326.	2116.	2092.	2222.	826.	201.	3571.	874.	-93.	-13.
9023.	323.	2279.	2221.	2279.	865.	234.	3836.	923.	-121.	-12.
9466.	326.	2521.	2389.	2374.	947.	275.	4271.	998.	-163.	-41.
9961.	352.	2797.	2641.	2497.	1031.	328.	4705.	1105.	-236.	-52.
10547.	327.	3062.	2835.	2605.	1066.	341.	5194.	1186.	-300.	-125.
11016.	443.	3415.	3076.	2806.	1184.	341.	5684.	1292.	-369.	-125.
11484.	445.	3773.	3536.	3040.	1303.	459.	6375.	1368.	-473.	-125.
12070.	563.	4483.	4019.	3315.	1532.	573.	7336.	1534.	-608.	-134.
12656.	682.	5075.	4615.	3670.	1658.	696.	8288.	1659.	-759.	-222.

TABLE C6 STRAIN DATA FOR THE M5X18.9 SECTION WITH THE 12 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD	STRAIN GAGE NUMBER									
(LBS)	11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	-17.	85.	-85.	-93.	-129.	-172.	-51.	-159.	-238.	-33.
1523.	-33.	108.	-102.	-131.	-170.	-214.	-64.	-286.	-400.	-22.
1992.	-44.	140.	-117.	-191.	-241.	-143.	-100.	-548.	-544.	-25.
2461.	-68.	173.	-133.	-262.	-334.	-164.	-89.	-973.	-764.	-1.
3043.	-115.	203.	-153.	-349.	-463.	-232.	-100.	-1389.	-1060.	30.
3516.	-119.	245.	-150.	-416.	-553.	-271.	-92.	-1698.	-1312.	59.
3984.	-126.	287.	-136.	-488.	-665.	-339.	-67.	-1995.	-1602.	130.
4570.	-138.	328.	-117.	-565.	-746.	-387.	-69.	-2239.	-1913.	161.
5039.	-166.	402.	-106.	-658.	-828.	-458.	-82.	-2405.	-2223.	208.
5470.	-191.	435.	-102.	-716.	-895.	-517.	-98.	-2527.	-2457.	248.
5977.	-218.	479.	-84.	-801.	-989.	-574.	-102.	-2643.	-2810.	281.
6563.	-249.	533.	-34.	-930.	-1070.	-659.	-105.	-2742.	-3189.	350.
7031.	-276.	592.	27.	-1031.	-1162.	-716.	-131.	-2802.	-3570.	405.
7617.	-287.	670.	77.	-1143.	-1290.	-791.	-171.	-2869.	-4036.	469.
8086.	-310.	709.	129.	-1251.	-1379.	-834.	-194.	-2917.	-4328.	536.
8578.	-343.	764.	199.	-1387.	-1532.	-888.	-238.	-2959.	-4842.	563.
9023.	-406.	758.	170.	-1553.	-1609.	-1004.	-303.	-3023.	-5250.	531.
9466.	-432.	867.	278.	-1716.	-1843.	-1025.	-308.	-3025.	-5722.	626.
9961.	-439.	881.	286.	-1865.	-2062.	-1129.	-421.	-3044.	-6220.	756.
10547.	-442.	992.	404.	-2082.	-2294.	-1240.	-428.	-3134.	-6786.	770.
11016.	-456.	1093.	555.	-2360.	-2546.	-1360.	-537.	-3141.	-7449.	857.
11484.	-557.	1124.	758.	-2674.	-2893.	-1483.	-652.	-3190.	-8200.	1020.
12070.	-576.	1244.	994.	-3151.	-3377.	-1604.	-766.	-3259.	-9264.	1348.
12656.	-675.	1355.	1319.	-3670.	-3955.	-1865.	-905.	-3372.	-10441.	1584.

TABLE C6 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD (LBS)	STRAIN GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	192.	-10.	17.	-59.	-142.	253.	103.	62.	44.	-1.
1523.	316.	-29.	26.	-92.	-214.	362.	153.	91.	64.	7.
1992.	391.	-41.	30.	-120.	-297.	458.	199.	124.	88.	8.
2461.	493.	-33.	38.	-162.	-397.	602.	257.	161.	109.	7.
3043.	623.	-35.	56.	-197.	-524.	769.	332.	203.	146.	13.
3516.	714.	-54.	69.	-250.	-652.	915.	381.	231.	160.	2.
3984.	852.	-55.	69.	-293.	-762.	1093.	447.	281.	196.	2.
4570.	982.	-52.	87.	-342.	-905.	1275.	512.	318.	220.	3.
5039.	1114.	-52.	103.	-395.	-1040.	1477.	581.	358.	247.	-5.
5470.	1176.	-53.	119.	-436.	-1184.	1641.	636.	387.	275.	4.
5977.	1341.	-38.	138.	-511.	-1336.	1880.	721.	428.	306.	5.
6563.	1472.	-24.	186.	-597.	-1544.	2134.	796.	480.	345.	-1.
7031.	1637.	-12.	225.	-660.	-1738.	2392.	877.	545.	381.	0.
7617.	1820.	15.	261.	-769.	-1991.	2738.	954.	598.	424.	12.
8086.	1973.	23.	254.	-844.	-2160.	2964.	1008.	638.	454.	19.
8578.	2190.	85.	291.	-966.	-2508.	3363.	1108.	709.	491.	32.
9023.	2354.	101.	345.	-1045.	-2712.	3625.	1157.	731.	540.	40.
9466.	2624.	146.	405.	-1203.	-3072.	4032.	1229.	792.	573.	41.
9961.	2898.	228.	472.	-1332.	-3478.	4489.	1323.	861.	626.	44.
10547.	3217.	292.	532.	-1444.	-3912.	4904.	1393.	906.	663.	7.
11016.	3587.	315.	635.	-1655.	-4496.	5582.	1508.	926.	677.	67.
11484.	4007.	472.	764.	-1786.	-5211.	6199.	1621.	1029.	788.	72.
12070.	4644.	653.	890.	-1999.	-6181.	7190.	1753.	1132.	792.	79.
12656.	5341.	875.	1108.	-2264.	-7368.	8345.	1875.	1274.	910.	79.

TABLE C6 CONTINUED.

	GAGE LOCATION NUMBER					
	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER					
(LBS)	31	32	33	34	35	36
0.	0.	0.	0.	0.	0.	0.
1055.	151.	-311.	-106.	-61.	-45.	-1.
1523.	230.	-449.	-148.	-86.	-65.	-0.
1992.	313.	-614.	-194.	-108.	-84.	-3.
2461.	416.	-825.	-244.	-137.	-109.	-1.
3043.	533.	-1132.	-319.	-187.	-132.	-17.
3516.	618.	-1372.	-359.	-218.	-159.	-17.
3984.	768.	-1649.	-437.	-241.	-190.	-17.
4570.	904.	-1938.	-494.	-276.	-212.	-21.
5039.	1045.	-2250.	-553.	-324.	-252.	-18.
5470.	1178.	-2509.	-611.	-355.	-255.	-17.
5977.	1347.	-2956.	-714.	-396.	-291.	-23.
6563.	1553.	-3381.	-787.	-437.	-336.	-20.
7031.	1740.	-3818.	-872.	-491.	-371.	-26.
7617.	1996.	-4357.	-970.	-557.	-408.	-47.
8086.	2118.	-4687.	-1044.	-560.	-450.	-56.
8578.	2481.	-5286.	-1165.	-676.	-455.	-56.
9023.	2724.	-5662.	-1182.	-676.	-523.	-95.
9466.	3088.	-6256.	-1328.	-766.	-572.	-121.
9961.	3582.	-6863.	-1415.	-810.	-574.	-124.
10547.	4179.	-7590.	-1536.	-919.	-688.	-175.
11016.	4785.	-8320.	-1658.	-926.	-693.	-177.
11484.	5726.	-9288.	-1893.	-1040.	-705.	-177.
12070.	7089.	-10612.	-2014.	-1161.	-814.	-177.
12656.	8666.	-12077.	-2266.	-1275.	-936.	-177.

TABLE C6 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	24.	166.	240.	403.	141.	26.	298.	41.	-22.	-30.
1523.	-0.	258.	378.	535.	205.	22.	450.	45.	-54.	-45.
1992.	-47.	360.	533.	691.	304.	1.	638.	34.	-115.	-64.
2463.	-122.	462.	698.	926.	548.	36.	839.	10.	-194.	-89.
3047.	-172.	560.	829.	1180.	675.	-40.	1027.	-22.	-261.	-105.
3514.	-219.	654.	942.	1330.	779.	-63.	1187.	-31.	-331.	-141.
3984.	-288.	797.	1137.	1526.	950.	-71.	1448.	-49.	-452.	-145.
4511.	-370.	907.	1414.	1673.	1050.	-107.	1689.	-59.	-565.	-179.
5036.	-449.	1104.	1576.	1795.	1161.	-147.	1967.	-62.	-728.	-215.
5508.	-444.	1455.	1834.	1917.	1251.	-222.	2358.	-67.	-919.	-255.
5977.	-370.	1774.	2119.	2082.	1339.	-320.	2847.	-100.	-1150.	-291.
6547.	-332.	2126.	2427.	2267.	1575.	-422.	3465.	-183.	-1449.	-339.
7031.	-249.	2801.	2766.	2524.	1793.	-531.	4097.	-290.	-1760.	-414.
7617.	-101.	3571.	3290.	3185.	1919.	-695.	4953.	-420.	-2253.	-482.
7969.	-132.	4079.	3601.	3595.	1958.	-848.	5489.	-495.	-2715.	-580.
8580.	-238.	5082.	4540.	4426.	2426.	-984.	6679.	-726.	-3556.	-727.
9023.	-480.	6540.	6055.	5603.	3015.	-1200.	8070.	-960.	-4366.	-805.
9492.	-837.	7611.	7575.	7125.	3823.	-1435.	9361.	-1306.	-5301.	-962.

TABLE C7 STRAIN DATA FOR THE W6X25 SECTION WITH THE 8 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD (LBS)	STRAIN GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	-34.	82.	-73.	-207.	-236.	-329.	-24.	-92.	-387.	-52.
1523.	-50.	114.	-70.	-286.	-284.	-397.	91.	-136.	-593.	-70.
1992.	-71.	164.	-72.	-395.	-380.	-492.	173.	-100.	-764.	-93.
2463.	-87.	214.	-70.	-539.	-459.	-557.	223.	-86.	-1011.	-124.
3047.	-109.	244.	-28.	-676.	-549.	-630.	245.	-120.	-1573.	-149.
3514.	-134.	263.	-2.	-764.	-625.	-685.	253.	-112.	-1880.	-182.
3984.	-170.	323.	14.	-903.	-701.	-764.	241.	-86.	-2202.	-38.
4511.	-191.	369.	50.	-1066.	-758.	-830.	218.	-46.	-2621.	83.
5036.	-220.	416.	52.	-1235.	-851.	-907.	200.	18.	-2235.	120.
5508.	-229.	480.	95.	-1485.	-1055.	-1075.	125.	116.	-2328.	158.
5977.	-269.	531.	97.	-1727.	-1143.	-1227.	54.	216.	-2876.	272.
6547.	-285.	563.	336.	-2078.	-1538.	-1488.	-29.	360.	-3817.	443.
7031.	-343.	641.	475.	-2417.	-1885.	-1777.	-116.	516.	-4993.	647.
7617.	-381.	688.	580.	-3064.	-2460.	-2226.	-369.	691.	-5639.	905.
7969.	-477.	690.	804.	-3761.	-2937.	-2554.	-493.	808.	-5754.	1188.
8580.	-531.	774.	1387.	-4826.	-4117.	-3265.	-961.	1152.	-7858.	2047.
9023.	-618.	802.	2188.	-5959.	-5510.	-4213.	-1312.	1435.	-7860.	3105.
9492.	-735.	805.	3524.	-6919.	-7499.	-5367.	-1780.	1978.	-9592.	4983.

TABLE C7 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	13.	20.	20.	-66.	-389.	400.	175.	75.	51.	-11.
1523.	-14.	28.	33.	-99.	-582.	601.	237.	107.	73.	-4.
1992.	1.	35.	46.	-131.	-790.	845.	329.	149.	96.	1.
2463.	17.	35.	49.	-178.	-1048.	1143.	417.	183.	110.	-10.
3047.	24.	44.	59.	-204.	-1274.	1421.	516.	227.	153.	9.
3514.	48.	63.	76.	-244.	-1467.	1703.	604.	269.	168.	12.
3984.	78.	72.	107.	-294.	-1751.	2054.	673.	310.	203.	13.
4511.	218.	101.	120.	-329.	-2036.	2460.	774.	364.	232.	11.
5036.	669.	131.	179.	-395.	-2341.	2919.	876.	390.	272.	21.
5508.	1031.	183.	204.	-447.	-2759.	3556.	1001.	447.	316.	38.
5977.	1314.	228.	237.	-500.	-3157.	4069.	1112.	473.	314.	42.
6547.	1747.	281.	301.	-548.	-3823.	5012.	1236.	541.	359.	42.
7031.	2116.	353.	341.	-598.	-4512.	5986.	1339.	583.	354.	82.
7617.	2900.	463.	456.	-827.	-5676.	7304.	1539.	590.	386.	84.
7969.	3609.	704.	575.	-949.	-6661.	8395.	1667.	621.	453.	94.
8580.	5482.	941.	690.	-1167.	-8916.	10696.	1821.	706.	472.	62.
9023.	7795.	1290.	809.	-1410.	-11072.	12847.	2023.	725.	501.	91.
9492.	10847.	1758.	1031.	-1525.	-13183.	15273.	2151.	819.	581.	94.

TABLE C7 CONTINUED.

	GAGE LOCATION NUMBER							
	5	6	7	8	9	10	11	12
LOAD	STRAIN GAGE NUMBER							
(LBS)	31	32	33	34	35	36	37	38
0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	438.	-551.	-172.	-74.	-40.	-7.	4.	-20.
1523.	621.	-790.	-215.	-90.	-55.	-5.	14.	-20.
1992.	842.	-1033.	-290.	-122.	-75.	-10.	15.	-29.
2463.	1085.	-1502.	-374.	-173.	-109.	-38.	-9.	-37.
3047.	1330.	-1864.	-462.	-207.	-126.	-40.	-3.	-39.
3514.	1571.	-2143.	-529.	-221.	-134.	-39.	-2.	-39.
3984.	1885.	-2598.	-629.	-282.	-174.	-40.	3.	-76.
4511.	2187.	-3089.	-726.	-303.	-205.	-41.	7.	-80.
5036.	2545.	-3641.	-828.	-347.	-215.	-45.	8.	-84.
5508.	3070.	-4327.	-971.	-407.	-254.	-45.	24.	-115.
5977.	3510.	-4847.	-1102.	-488.	-261.	-120.	-22.	-117.
6547.	4359.	-5817.	-1228.	-490.	-368.	-120.	-0.	-117.
7031.	5450.	-6787.	-1437.	-609.	-368.	-120.	-0.	-117.
7617.	7148.	-8242.	-1587.	-609.	-382.	-120.	-5.	-119.
7969.	8725.	-9455.	-1829.	-728.	-390.	-120.	-0.	-117.
8580.	5315.	-12135.	-2315.	-852.	-489.	-120.	-0.	-117.
9023.	4597.	-14912.	-2800.	-871.	-494.	-120.	-0.	-119.
9492.	4214.	-18002.	-3387.	-988.	-567.	-140.	-0.	-136.

TABLE C7 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
938.	115.	167.	202.	185.	43.	50.	254.	57.	5.	5.
1523.	107.	254.	319.	245.	132.	-103.	393.	56.	-46.	18.
1992.	79.	315.	422.	267.	145.	-761.	512.	55.	-84.	-12.
2461.	-8.	355.	537.	286.	190.	-1175.	643.	53.	-149.	-35.
3047.	-54.	417.	669.	359.	293.	-1446.	811.	18.	-197.	-52.
3516.	-97.	481.	793.	496.	425.	-1585.	960.	37.	-248.	-58.
3984.	-176.	556.	952.	524.	486.	-1590.	1147.	50.	-318.	-61.
4570.	-263.	648.	1117.	561.	551.	-1583.	1390.	48.	-406.	-65.
5039.	-305.	719.	1206.	604.	603.	-1576.	1574.	54.	-485.	-76.
5508.	-363.	811.	1366.	615.	644.	-1585.	1779.	50.	-578.	-69.
6035.	-459.	935.	1520.	646.	728.	-1586.	2030.	9.	-723.	-77.
6563.	-545.	1121.	1672.	680.	802.	-1623.	2316.	7.	-872.	-106.
7031.	-573.	1293.	1844.	935.	901.	-1618.	2590.	-21.	-1004.	-144.
7601.	-619.	1587.	2112.	1011.	1010.	-1660.	3039.	-20.	-1202.	-152.
8029.	-664.	1809.	2273.	1094.	1081.	-1694.	3351.	-36.	-1366.	-188.
8555.	-702.	2072.	2556.	1391.	1207.	-1673.	3799.	-34.	-1613.	-196.
9023.	-706.	2378.	2843.	1536.	1301.	-1700.	4156.	-48.	-1824.	-223.
9492.	-743.	2735.	3161.	1786.	1446.	-1737.	4655.	-72.	-2137.	-270.
9609.	-785.	2737.	3203.	1772.	1409.	-1827.	4683.	-144.	-2219.	-267.
10020.	-787.	2976.	3440.	1846.	1525.	-1755.	5038.	-144.	-2453.	-366.
10664.	-1021.	3700.	4169.	2254.	1887.	-1854.	6095.	-267.	-3162.	-516.
11133.	-1142.	4183.	4772.	2496.	2129.	-1854.	6855.	-385.	-3551.	-516.
11602.	-1408.	4909.	5620.	2979.	2604.	-1854.	8091.	-506.	-4263.	-600.

TABLE C8 STRAIN DATA FOR THE W6X25 SECTION WITH THE 12 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD	STRAIN GAGE NUMBER									
(LBS)	11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
938.	-17.	61.	-71.	-138.	-194.	-160.	-47.	-89.	-239.	7.
1523.	-52.	94.	-77.	-215.	-230.	-212.	-5.	-291.	-590.	-8.
1992.	-71.	120.	-89.	-307.	-307.	-289.	-32.	-1037.	-808.	98.
2461.	-114.	128.	-91.	-336.	-398.	-356.	-50.	-2255.	-1038.	146.
3047.	-135.	145.	-113.	-462.	-529.	-471.	-49.	-2994.	-1275.	200.
3516.	-150.	171.	-103.	-564.	-590.	-519.	-74.	-3404.	-1417.	230.
3984.	-197.	236.	-45.	-701.	-661.	-565.	-111.	-3584.	-1636.	297.
4570.	-213.	275.	-25.	-884.	-705.	-622.	-128.	-3602.	-1893.	339.
5039.	-258.	316.	3.	-933.	-782.	-678.	-169.	-3579.	-2077.	411.
5508.	-301.	344.	-12.	-1030.	-805.	-733.	-205.	-3555.	-2291.	415.
6035.	-324.	396.	36.	-1185.	-928.	-777.	-222.	-3504.	-2575.	488.
6563.	-332.	435.	155.	-1328.	-986.	-894.	-255.	-3474.	-2877.	576.
7031.	-373.	483.	398.	-1515.	-1106.	-916.	-287.	-3428.	-3199.	680.
7601.	-406.	559.	607.	-1764.	-1191.	-999.	-331.	-3388.	-3631.	737.
8029.	-452.	591.	762.	-1979.	-1312.	-1095.	-385.	-3358.	-3951.	788.
8555.	-470.	646.	990.	-2472.	-1580.	-1253.	-440.	-3292.	-4399.	880.
9023.	-505.	691.	1187.	-2891.	-1904.	-1328.	-499.	-3233.	-4844.	1029.
9492.	-600.	702.	1305.	-3272.	-2388.	-1562.	-608.	-3254.	-5434.	1162.
9609.	-607.	700.	1315.	-3375.	-2453.	-1572.	-610.	-3242.	-5564.	1212.
10020.	-607.	717.	1522.	-3618.	-2691.	-1692.	-716.	-3148.	-5983.	1422.
10664.	-725.	801.	2008.	-4338.	-3631.	-1935.	-870.	-2984.	-7200.	1908.
11133.	-795.	830.	2400.	-4819.	-4319.	-2164.	-1000.	-2789.	-8097.	2389.
11602.	-872.	837.	3143.	-5531.	-5197.	-2416.	-1209.	-2602.	-9514.	3111.

TABLE C8 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD (LBS)	STRAIN GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
938.	17.	7.	16.	-57.	-277.	323.	152.	68.	48.	2.
1523.	68.	6.	13.	-92.	-402.	489.	216.	104.	71.	4.
1992.	76.	9.	27.	-123.	-493.	649.	285.	145.	99.	7.
2461.	118.	10.	29.	-157.	-568.	822.	360.	176.	119.	8.
3047.	237.	-2.	9.	-208.	-690.	1063.	431.	223.	148.	-7.
3516.	328.	-6.	22.	-220.	-784.	1234.	511.	261.	171.	4.
3984.	484.	20.	40.	-284.	-898.	1500.	592.	311.	197.	13.
4570.	652.	22.	50.	-339.	-1047.	1786.	708.	343.	237.	13.
5039.	771.	32.	48.	-371.	-1122.	2027.	788.	397.	269.	15.
5508.	853.	51.	76.	-439.	-1274.	2317.	866.	441.	313.	11.
6035.	1037.	72.	98.	-493.	-1435.	2690.	997.	508.	347.	-6.
6563.	1209.	84.	104.	-567.	-1625.	3078.	1106.	556.	392.	42.
7031.	1388.	104.	132.	-635.	-1789.	3517.	1195.	599.	431.	46.
7601.	1661.	147.	156.	-707.	-1989.	4092.	1293.	666.	467.	51.
8029.	1912.	187.	199.	-758.	-2207.	4663.	1396.	687.	509.	61.
8555.	2364.	214.	182.	-901.	-2435.	5404.	1510.	771.	490.	78.
9023.	2733.	317.	231.	-960.	-2787.	6120.	1554.	822.	577.	86.
9492.	3213.	324.	330.	-1073.	-3156.	7033.	1763.	827.	591.	91.
9609.	3318.	350.	327.	-1078.	-3269.	7206.	1783.	834.	591.	88.
10020.	3692.	439.	334.	-1111.	-3536.	7926.	1790.	933.	603.	91.
10664.	4999.	670.	450.	-1383.	-4348.	9717.	2026.	947.	702.	93.
11133.	5966.	682.	908.	-1430.	-4953.	11179.	2158.	1051.	784.	93.
11602.	7522.	872.	1400.	-1541.	-5909.	13224.	2281.	1068.	830.	93.

TABLE C8 CONTINUED.

	GAGE LOCATION NUMBER					
	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER					
(LBS)	31	32	33	34	35	36
0.	0.	0.	0.	0.	0.	0.
938.	284.	-392.	-134.	-68.	-44.	-4.
1523.	445.	-613.	-205.	-108.	-70.	-12.
1992.	608.	-859.	-270.	-138.	-90.	-12.
2461.	765.	-1096.	-346.	-177.	-129.	-44.
3047.	950.	-1341.	-440.	-218.	-146.	-44.
3516.	1099.	-1580.	-497.	-258.	-186.	-44.
3984.	1296.	-1891.	-603.	-291.	-192.	-45.
4570.	1542.	-2224.	-693.	-345.	-232.	-44.
5039.	1737.	-2491.	-783.	-377.	-264.	-44.
5508.	1944.	-2913.	-896.	-455.	-304.	-47.
6035.	3491.	-1011.	-1014.	-493.	-332.	-44.
6563.	2483.	-4015.	-1145.	-541.	-362.	-49.
7031.	2789.	-4467.	-1297.	-614.	-395.	-78.
7601.	3199.	-5100.	-1442.	-667.	-464.	-89.
8029.	3519.	-5578.	-1573.	-736.	-505.	-125.
8555.	4121.	-6303.	-1816.	-854.	-507.	-125.
9023.	4732.	-7016.	-1937.	-866.	-617.	-125.
9492.	5588.	-7758.	-2063.	-976.	-626.	-125.
9609.	5818.	-7889.	-2180.	-976.	-626.	-125.
10020.	6670.	-8607.	-2301.	-985.	-629.	-125.
10664.	8976.	-10062.	-2786.	-1114.	-748.	-130.
11133.	11159.	-10928.	-3029.	-1298.	-837.	-130.
11602.	14554.	-12502.	-3504.	-1441.	-869.	-242.

TABLE C8 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	1
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
938.	-13.	26.	108.	90.	85.	69.	148.	104.	109.	-35.
1523.	-6.	47.	183.	150.	146.	114.	246.	176.	186.	-60.
2108.	-22.	61.	254.	228.	225.	157.	373.	231.	227.	-85.
2578.	-23.	81.	318.	284.	285.	187.	492.	262.	244.	-106.
3047.	-34.	98.	385.	346.	355.	221.	640.	322.	278.	-130.
3511.	-45.	113.	441.	430.	428.	249.	774.	364.	310.	-150.
4102.	-60.	143.	511.	556.	547.	287.	978.	452.	379.	-174.
4102.	-62.	136.	498.	553.	543.	260.	1007.	448.	379.	-170.
4570.	-70.	140.	571.	613.	608.	299.	1124.	492.	417.	-183.
5039.	-97.	178.	667.	753.	709.	298.	1306.	595.	509.	-199.
5508.	-100.	215.	724.	814.	776.	299.	1439.	731.	580.	-108.
5977.	-134.	262.	815.	964.	904.	291.	1653.	883.	669.	-212.
6563.	-142.	297.	961.	1038.	1003.	302.	1833.	1046.	809.	-248.
7031.	-168.	329.	1090.	1174.	1124.	259.	1997.	1172.	891.	-248.
7395.	-185.	412.	1245.	1288.	1241.	222.	2300.	1365.	1009.	-251.
8027.	-193.	453.	1361.	1402.	1357.	181.	2462.	1515.	1128.	-255.
8555.	-217.	495.	1555.	1522.	1514.	153.	2832.	1751.	1247.	-252.
9082.	-264.	565.	1685.	1676.	1800.	143.	3268.	2002.	1405.	-271.
9609.	-336.	573.	1832.	1806.	2303.	274.	3957.	2526.	1677.	-371.
10009.	-485.	649.	2117.	2159.	3476.	658.	4988.	4047.	2388.	-724.
10500.	-696.	730.	2548.	2798.	4988.	1562.	4988.	4991.	3811.	-1558.
10547.	-730.	690.	2580.	2935.	5987.	1754.	9185.	7600.	3993.	-1706.

TABLE C9 STRAIN DATA FOR THE S4X9.5 SECTION WITH THE 8 INCH BRACKET.

	GAGE LOCATION NUMBER									
	1	1	2	2	2	3	3	3	5	6
LOAD	STRAIN GAGE NUMBER									
(LBS)	11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
938.	-86.	-111.	-113.	-46.	-17.	-174.	-73.	-94.	-44.	143.
1523.	-146.	-202.	-189.	-65.	-30.	-272.	-128.	-152.	-79.	240.
2108.	-203.	-243.	-251.	-102.	-42.	-385.	-152.	-175.	-110.	334.
2578.	-240.	-288.	-312.	-111.	-54.	-455.	-175.	-186.	-134.	426.
3047.	-296.	-333.	-379.	-125.	-58.	-673.	-58.	-196.	-168.	525.
3511.	-337.	-375.	-426.	-140.	-65.	-888.	11.	-192.	-212.	619.
4102.	-410.	-440.	-516.	-156.	-64.	-983.	77.	-105.	-281.	761.
4102.	-421.	-457.	-527.	-171.	-92.	-1241.	61.	-87.	-292.	714.
4570.	-480.	-500.	-603.	-182.	-84.	-1439.	35.	-63.	-336.	859.
5039.	-546.	-563.	-668.	-220.	-83.	-1739.	61.	29.	-412.	948.
5508.	-576.	-592.	-721.	-206.	-64.	-1970.	98.	104.	-462.	1078.
5977.	-641.	-602.	-803.	-214.	-18.	-2500.	181.	261.	-575.	1256.
6563.	-712.	-641.	-916.	-212.	-27.	-2896.	283.	325.	-669.	1417.
7031.	-767.	-657.	-979.	-212.	14.	-3202.	381.	452.	-789.	1572.
7395.	-846.	-683.	-1071.	-239.	70.	-3674.	478.	685.	-932.	1798.
8027.	-921.	-717.	-1130.	-250.	128.	-3949.	494.	814.	-1019.	1988.
8555.	-1038.	-762.	-1230.	-260.	201.	-4423.	454.	999.	-1194.	2253.
9082.	-1197.	-798.	-1331.	-285.	286.	-5005.	376.	1123.	-1396.	2544.
9609.	-1480.	-873.	-1451.	-303.	375.	-5009.	180.	1275.	-1657.	2915.
10009.	-2103.	-1030.	-1738.	-401.	493.	-7400.	-564.	1323.	-2196.	3330.
10500.	-3505.	-1265.	-2091.	-570.	726.	-10211.	-1860.	1325.	-3080.	4235.
10547.	-3795.	-1312.	-2194.	-566.	785.	-10682.	-2093.	1323.	-3225.	4296.

TABLE C9 CONTINUED.

	GAGE LOCATION NUMBER									
	7	8	9	10	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
938.	53.	27.	21.	1.	39.	-155.	-45.	-14.	-10.	7.
1523.	95.	44.	20.	4.	74.	-282.	-84.	-31.	-14.	11.
2108.	131.	63.	41.	-6.	109.	-406.	-125.	-47.	-16.	12.
2578.	169.	86.	47.	1.	141.	-510.	-149.	-56.	-25.	14.
3047.	209.	102.	52.	-5.	184.	-628.	-180.	-64.	-27.	19.
3511.	238.	113.	65.	1.	224.	-748.	-208.	-79.	-32.	20.
4102.	290.	141.	78.	2.	293.	-949.	-255.	-97.	-42.	27.
4102.	277.	137.	64.	-19.	299.	-973.	-258.	-97.	-47.	14.
4570.	311.	147.	66.	-22.	346.	-1109.	-299.	-121.	-43.	21.
5039.	343.	173.	86.	-18.	392.	-1307.	-321.	-126.	-44.	16.
5508.	397.	189.	104.	-17.	450.	-1508.	-354.	-138.	-47.	18.
5977.	464.	224.	109.	-22.	587.	-1830.	-408.	-172.	-62.	8.
6563.	512.	259.	115.	-21.	673.	-2093.	-458.	-180.	-95.	20.
7031.	573.	265.	132.	-28.	751.	-2330.	-512.	-208.	-94.	20.
7395.	631.	308.	149.	-19.	918.	-2712.	-586.	-258.	-109.	16.
8027.	693.	323.	156.	-15.	1021.	-2995.	-624.	-279.	-114.	24.
8555.	786.	356.	185.	-19.	1199.	-3390.	-698.	-299.	-134.	24.
9082.	860.	401.	193.	-13.	1396.	-3799.	-784.	-341.	-169.	22.
9609.	935.	432.	217.	-16.	1700.	-4150.	-863.	-380.	-177.	21.
10009.	953.	464.	229.	-25.	2121.	-4579.	-975.	-385.	-132.	-19.
10500.	1066.	469.	220.	-25.	2878.	-5314.	-980.	-491.	-165.	-14.
10547.	1066.	469.	220.	-25.	2904.	-5440.	-980.	-491.	-173.	-17.

TABLE C9 CONTINUED.

LOAD (LBS)	GAGE LOCATION NUMBER 11 STRAIN GAGE NUMBER 31	12 32
0.	0.	0.
938.	15.	-8.
1523.	22.	-13.
2108.	28.	-21.
2578.	37.	-22.
3047.	46.	-25.
3511.	50.	-32.
4102.	58.	-37.
4102.	58.	-37.
4570.	65.	-45.
5039.	65.	-45.
5508.	76.	-55.
5977.	84.	-60.
6563.	94.	-67.
7031.	98.	-73.
7395.	104.	-79.
8027.	109.	-86.
8555.	115.	-90.
9082.	125.	-97.
9609.	132.	-101.
10009.	140.	-104.
10500.	139.	-113.
10547.	139.	-113.

TABLE C9 CONTINUED.

	GAGE LOCATION NUMBER									
	1	1	1	2	2	2	3	3	3	4
LOAD	STRAIN GAGE NUMBER									
(LBS)	1	2	3	4	5	6	7	8	9	10
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	127.	207.	214.	190.	53.	-0.	285.	188.	156.	-8.
1523.	154.	331.	355.	289.	88.	-6.	446.	710.	530.	-11.
1992.	155.	427.	463.	376.	101.	-25.	572.	1043.	769.	-32.
2461.	168.	554.	607.	462.	136.	-27.	769.	1385.	1142.	-32.
3047.	182.	661.	764.	593.	180.	-54.	1004.	1691.	1432.	-37.
3511.	178.	759.	882.	711.	222.	-60.	1209.	1932.	1666.	0.
4102.	153.	913.	1044.	851.	290.	-105.	1443.	2305.	1991.	-66.
4570.	176.	1048.	1165.	932.	305.	-130.	1705.	2558.	2231.	-64.
5039.	174.	1225.	1281.	1133.	334.	-172.	2043.	2971.	2586.	-82.
5509.	265.	1466.	1382.	1244.	365.	-195.	2470.	3552.	3056.	-92.
5977.	658.	2488.	1589.	1326.	368.	-322.	3502.	5018.	4441.	-66.
6680.	2355.	5559.	2109.	1624.	441.	-612.	7203.	10884.	7781.	85.

TABLE C10 STRAIN DATA FOR THE S4X9.5 SECTION WITH THE 12 INCH BRACKET.

	GAGE LOCATION NUMBER									
	4	4	1	1	1	2	2	2	3	3
LOAD (LBS)	STRAIN GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	51.	147.	-55.	-111.	-80.	-145.	-18.	-27.	-340.	317.
1523.	76.	221.	-69.	-153.	-72.	-215.	-30.	-39.	-638.	822.
1992.	73.	271.	-72.	-194.	-71.	-283.	-48.	-61.	-825.	1048.
2461.	111.	339.	-98.	-220.	-70.	-348.	-49.	-61.	-1005.	1033.
3047.	120.	437.	-118.	-291.	-70.	-429.	-53.	-66.	-1274.	1077.
3511.	148.	503.	-144.	-339.	-66.	-507.	-55.	-88.	-1462.	1099.
4102.	165.	606.	-192.	-455.	-70.	-627.	-83.	-128.	-1846.	1064.
4570.	167.	712.	-245.	-576.	-94.	-697.	-87.	-178.	-2104.	1001.
5039.	203.	816.	-345.	-771.	-115.	-829.	-122.	-255.	-2448.	875.
5509.	269.	944.	-529.	-1070.	-188.	-953.	-178.	-337.	-2889.	607.
5977.	507.	1259.	-951.	-1734.	-290.	-1075.	-193.	-464.	-3670.	-116.
6680.	1449.	2056.	-2274.	-4008.	-487.	-1360.	-189.	-687.	-5055.	-2457.

TABLE C10 CONTINUED.

	GAGE LOCATION NUMBER									
	3	4	4	4	5	6	7	8	9	10
LOAD	STRAIN GAGE NUMBER									
(LBS)	21	22	23	24	25	26	27	28	29	30
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	14.	-0.	-7.	-113.	-68.	222.	83.	40.	14.	-18.
1523.	5.	38.	-5.	-176.	-141.	289.	126.	61.	18.	-23.
1992.	57.	51.	-4.	-232.	-196.	404.	168.	80.	31.	-22.
2461.	35.	66.	-2.	-291.	-264.	518.	213.	93.	33.	-34.
3047.	23.	83.	-5.	-365.	-339.	683.	275.	122.	41.	-39.
3511.	98.	93.	-9.	-417.	-402.	808.	316.	143.	59.	-40.
4102.	146.	104.	-12.	-506.	-487.	999.	393.	167.	66.	-50.
4570.	189.	108.	-46.	-576.	-566.	1180.	442.	191.	77.	-65.
5039.	214.	99.	-80.	-646.	-656.	1368.	513.	215.	80.	-72.
5509.	128.	55.	-176.	-757.	-744.	1664.	592.	249.	90.	-74.
5977.	-172.	-61.	-413.	-926.	-909.	1989.	679.	265.	105.	-76.
6680.	-957.	-333.	-1225.	-1475.	-1728.	2810.	722.	268.	108.	-87.

TABLE C10 CONTINUED.

	GAGE LOCATION NUMBER							
	5	6	7	8	9	10	13	14
LOAD	STRAIN GAGE NUMBER							
(LBS)	31	32	33	34	35	36	37	38
0.	0.	0.	0.	0.	0.	0.	0.	0.
1055.	65.	-329.	-83.	-40.	-14.	13.	-375.	-320.
1523.	118.	-524.	-117.	-55.	-16.	23.	-546.	-483.
1992.	168.	-683.	-158.	-71.	-24.	25.	-717.	-636.
2461.	230.	-848.	-199.	-87.	-35.	30.	-875.	-801.
3047.	294.	-1088.	-262.	-129.	-51.	24.	-1187.	-1053.
3511.	355.	-1272.	-306.	-134.	-65.	26.	-1697.	-1206.
4102.	466.	-1635.	-341.	-171.	-67.	28.	-2578.	-2388.
4570.	541.	-1839.	-391.	-190.	-76.	29.	-4136.	-3207.
5039.	586.	-2030.	-477.	-247.	-136.	-9.	-6122.	-4565.
5509.	701.	-2316.	-499.	-255.	-136.	-9.	-8878.	-6857.
5977.	708.	-2455.	-528.	-325.	-136.	-29.	-13559.	-10398.
6680.	1555.	-3053.	-601.	-372.	-145.	-73.	-15634.	-15647.

TABLE C10 CONTINUED.

APPENDIX D

PRINCIPAL STRAINS AND DIRECTIONS

The sign convention used in this appendix is the same as used throughout the thesis, positive strain readings indicate tensile strains.

The maximum strain is given as E_1 and the minimum strain as E_2. The angle theta is measured clockwise (in degrees) from the x axis of the gage to the maximum strain. The locations and the orientations of the strain rosettes are shown in Figures 2.1-2.4. As stated before, the top of the web refers to the side to which the bracket is attached.

LOAD (LBS)	GAGE LOCATION 5 TOP E_1	E_2	θ	GAGE LOCATION 5 BOTTOM E_1	E_2	θ
586.	50.	12.	90.	63.	18.	123.
1055.	79.	32.	89.	129.	26.	123.
1523.	115.	48.	90.	195.	40.	121.
2109.	160.	80.	90.	289.	59.	121.
2109.	159.	82.	90.	295.	58.	121.
2577.	196.	104.	90.	366.	82.	119.
2578.	-92.	-425.	18.	540.	-96.	102.
2567.	333.	-185.	136.	496.	-118.	102.
3047.	131.	-787.	8.	617.	-112.	101.
3454.	175.	-921.	9.	732.	-113.	101.
3984.	644.	-231.	134.	878.	-115.	101.
4570.	236.	-1247.	10.	998.	-122.	100.
4570.	242.	-1303.	10.	985.	-121.	100.
5039.	285.	-1468.	10.	1151.	-131.	100.
5508.	333.	-1673.	10.	1307.	-130.	99.
6094.	391.	-1959.	11.	1547.	-134.	99.
6557.	451.	-2188.	12.	1798.	-138.	99.
7031.	514.	-2520.	12.	2261.	-174.	101.
7610.	625.	-3135.	12.	3314.	-253.	101.
7616.	608.	-3168.	12.	3425.	-254.	101.
8084.	697.	-3677.	12.	3962.	-36.	102.
8555.	721.	-4640.	12.	5655.	-389.	101.
9079.	748.	-5928.	11.	7311.	-448.	102.
9170.	709.	-6133.	11.	7930.	-532.	103.
9492.	734.	-7414.	11.	9696.	-650.	103.
10254.	763.	-10492.	9.	14031.	-886.	103.

TABLE D1 PRINCIPAL STRAINS AND DIRECTIONS FOR THE W4X13 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
586.	82.	55.	80.	-20.	-125.	151.
1055.	149.	63.	72.	-12.	-234.	150.
1523.	222.	55.	30.	10.	-327.	149.
2109.	471.	-90.	16.	75.	-401.	150.
2109.	463.	-173.	13.	92.	-468.	151.
2577.	550.	-109.	12.	127.	-632.	150.
2578.	544.	-61.	12.	133.	-635.	151.
2567.	545.	-83.	12.	111.	-653.	153.
3047.	645.	-44.	15.	107.	-730.	151.
3454.	756.	-76.	16.	142.	-931.	150.
3984.	980.	-181.	14.	190.	-1127.	149.
4570.	1172.	-257.	16.	228.	-1281.	148.
4570.	1206.	-289.	15.	237.	-1278.	147.
5039.	1352.	-357.	16.	279.	-1376.	145.
5508.	1443.	-292.	21.	333.	-1661.	145.
6094.	1595.	-249.	25.	510.	-2034.	142.
6557.	1631.	-96.	39.	3679.	-696.	78.
7031.	1855.	-110.	43.	775.	-2727.	141.
7610.	5153.	-3101.	8.	925.	-3278.	140.
7616.	9280.	-7275.	4.	921.	-3309.	140.
8084.	2804.	-680.	21.	1044.	-3658.	139.
8555.	4031.	-1550.	16.	1193.	-4117.	138.
9079.	7709.	-4777.	7.	1423.	-4704.	138.
9170.	6612.	-3656.	9.	1419.	-4849.	138.
9492.	7860.	-4580.	8.	1657.	-5408.	138.
10254.	15113.	-11102.	5.	2363.	-6937.	137.

---TABLE D1 CONTINUED.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
586.	90.	-4.	106.	53.	-22.	122.
1055.	166.	-9.	103.	111.	-58.	119.
1523.	228.	-13.	104.	203.	-85.	118.
2109.	338.	-35.	104.	354.	-146.	118.
2109.	297.	-30.	103.	65.	-109.	129.
2577.	601.	-241.	97.	106.	-138.	127.
2578.	412.	-51.	103.	-45.	-367.	11.
2567.	408.	-77.	104.	-71.	-369.	9.
3047.	471.	-76.	104.	-64.	-471.	11.
3454.	572.	-86.	104.	-67.	-535.	10.
3984.	734.	-107.	104.	-69.	-657.	10.
4570.	896.	-120.	104.	-69.	-773.	10.
4570.	914.	-130.	104.	-92.	-758.	10.
5039.	1041.	-102.	103.	-86.	-884.	10.
5508.	1224.	-86.	102.	-96.	-1040.	8.
6094.	1593.	-94.	101.	-90.	-1154.	9.
6557.	1826.	-23.	100.	-83.	-1244.	10.
7031.	1883.	36.	101.	-64.	-1285.	12.
7610.	2016.	146.	101.	-43.	-1267.	17.
7616.	2002.	146.	101.	-36.	-1288.	17.
8084.	2007.	172.	100.	5.	-1305.	20.
8555.	2120.	189.	102.	83.	-1320.	24.
9079.	2091.	181.	102.	187.	-1387.	27.
9170.	2087.	143.	103.	195.	-1471.	25.
9492.	2101.	12.	104.	159.	-1664.	23.
10254.	2237.	-10.	104.	510.	-1904.	30.

TABLE D1 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP			GAGE LOCATION 3 BOTTOM		
	E_1	E_2	θ	E_1	E_2	θ
586.	82.	44.	69.	43.	-90.	118.
1055.	125.	93.	68.	72.	-170.	121.
1523.	202.	172.	61.	99.	-199.	121.
2109.	321.	263.	159.	136.	-322.	124.
2109.	465.	63.	92.	137.	-327.	124.
2577.	707.	92.	97.	171.	-418.	124.
2578.	1010.	-194.	176.	-222.	-817.	11.
2567.	1423.	-623.	178.	-238.	-845.	11.
3047.	1616.	-355.	172.	-286.	-1033.	10.
3454.	1678.	-210.	170.	-325.	-1178.	11.
3984.	1830.	-66.	167.	-391.	-1295.	11.
4570.	2007.	-102.	168.	-453.	-1342.	7.
4570.	2014.	-83.	168.	-417.	-1710.	11.
5039.	2101.	-98.	168.	-451.	-1909.	14.
5508.	2273.	-97.	168.	-475.	-2112.	16.
6094.	2369.	-43.	167.	-463.	-2430.	18.
6557.	2422.	2.	165.	-469.	-2700.	20.
7031.	2472.	25.	164.	-443.	-2990.	21.
7610.	2527.	116.	161.	-445.	-3348.	24.
7616.	2508.	-24.	162.	-440.	-3392.	24.
8084.	2540.	41.	160.	-435.	-3679.	25.
8555.	2574.	131.	157.	-430.	-4141.	26.
9079.	2720.	137.	152.	-459.	-4627.	27.
9170.	2750.	182.	150.	-527.	-4738.	27.
9492.	2932.	253.	146.	-480.	-5366.	27.
10254.	3500.	349.	138.	-337.	-7269.	28.

TABLE D1 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
1055.	737.	190.	145.	386.	-652.	167.
1523.	1127.	217.	147.	900.	-1288.	172.
1992.	1622.	260.	147.	1159.	-1697.	173.
2461.	1930.	278.	148.	1242.	-2010.	172.
3047.	2344.	316.	148.	1267.	-2737.	169.
3516.	2582.	429.	148.	1237.	-2976.	168.
3984.	2742.	577.	148.	1178.	-3123.	167.
4570.	2849.	820.	149.	1112.	-3162.	166.
5039.	2901.	1120.	150.	1004.	-3107.	165.
5508.	2899.	1470.	152.	937.	-3089.	164.
6108.	2915.	1977.	158.	796.	-3007.	162.
6563.	2981.	2273.	167.	706.	-2945.	161.
7032.	3046.	2542.	0.	602.	-2908.	159.
7605.	3365.	2845.	21.	457.	-2847.	158.
8613.	4163.	3112.	32.	284.	-2848.	154.
9082.	4619.	3258.	37.	184.	-2804.	151.
9492.	5302.	3492.	39.	8.	-2838.	147.
9961.	6459.	3716.	41.	-97.	-2981.	140.
10723.	7760.	3986.	43.	-121.	-3550.	136.
11074.	8928.	4225.	45.	1.	-4138.	133.
11484.	10930.	4575.	46.	178.	-5118.	129.
12070.	14097.	5374.	46.	772.	-7100.	126.
12773.	14930.	5752.	44.	1209.	-8414.	125.
13125.	15255.	6253.	34.	2012.	-10530.	125.

TABLE D2 PRINCIPAL STRAINS AND DIRECTIONS FOR THE W4X13 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
1055.	376.	-50.	100.	-56.	-282.	170.
1523.	486.	-121.	94.	-94.	-410.	169.
1992.	586.	-163.	92.	-143.	-617.	171.
2461.	750.	-197.	91.	-181.	-758.	168.
3047.	985.	-294.	89.	-236.	-905.	171.
3516.	1075.	-323.	88.	-133.	-1163.	173.
3984.	1190.	-200.	88.	-110.	-1647.	169.
4570.	1349.	-62.	91.	-21.	-1975.	170.
5039.	1393.	114.	91.	53.	-2394.	169.
5508.	1450.	233.	89.	33.	-2378.	170.
6108.	1616.	302.	86.	-24.	-2295.	170.
6563.	1751.	324.	83.	-58.	-2213.	171.
7032.	1789.	308.	81.	-113.	-2191.	172.
7605.	1921.	292.	79.	-176.	-2116.	173.
8613.	2177.	391.	78.	-317.	-2085.	176.
9082.	2275.	410.	77.	-426.	-2066.	179.
9492.	2569.	470.	77.	-583.	-2100.	2.
9961.	2827.	586.	76.	-685.	-2045.	7.
10723.	3338.	770.	75.	-862.	-2092.	15.
11074.	3674.	891.	76.	-916.	-2233.	19.
11484.	4239.	1152.	74.	-1003.	-2216.	29.
12070.	5411.	1626.	75.	-1055.	-2449.	45.
12773.	6146.	1832.	75.	-1040.	-2611.	51.
13125.	7139.	2220.	74.	-1049.	-2778.	56.

TABLE D2 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
1055.	608.	160.	16.	331.	-585.	9.
1523.	927.	120.	12.	447.	-822.	9.
1992.	1376.	159.	13.	532.	-1063.	11.
2461.	1655.	231.	12.	595.	-1206.	11.
3047.	2075.	277.	11.	762.	-1491.	11.
3516.	2370.	357.	11.	691.	-1494.	14.
3984.	2706.	414.	11.	747.	-1675.	16.
4570.	3044.	499.	9.	764.	-1913.	18.
5039.	3462.	564.	9.	795.	-2189.	20.
5508.	3786.	663.	8.	813.	-2431.	22.
6108.	4360.	805.	7.	860.	-2921.	24.
6563.	4845.	881.	6.	906.	-3326.	24.
7032.	5204.	1008.	6.	968.	-3822.	25.
7605.	5897.	1018.	5.	1063.	-4520.	26.
8613.	6950.	1261.	4.	1236.	-5816.	26.
9082.	7415.	1657.	3.	1186.	-5766.	26.
9492.	8352.	1858.	3.	1464.	-7503.	26.
9961.	9285.	2330.	1.	1633.	-8605.	26.
10723.	10339.	3131.	1.	1863.	-10223.	26.
11074.	11150.	3538.	180.	2126.	-11329.	26.
11484.	12227.	4444.	178.	2524.	-12938.	26.
12070.	14146.	6042.	176.	3301.	-16052.	26.
12773.	14999.	6974.	174.	3861.	-17202.	27.
13125.	15232.	10383.	165.	4399.	-17035.	27.

TABLE D2 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP E_1	E_2	θ	GAGE LOCATION 4 BOTTOM E_1	E_2	θ
1055.	134.	-25.	77.	23.	-116.	164.
1523.	179.	-52.	77.	25.	-184.	165.
1992.	240.	-66.	77.	43.	-239.	165.
2461.	320.	-95.	77.	50.	-292.	164.
3047.	388.	-114.	77.	64.	-359.	165.
3516.	441.	-138.	77.	70.	-409.	164.
3984.	512.	-166.	77.	72.	-474.	163.
4570.	606.	-196.	77.	105.	-558.	163.
5039.	678.	-218.	77.	136.	-637.	164.
5508.	766.	-248.	76.	154.	-713.	164.
6108.	866.	-278.	76.	208.	-840.	164.
6563.	961.	-310.	76.	234.	-917.	164.
7032.	1060.	-367.	75.	274.	-1014.	164.
7605.	1120.	-385.	75.	333.	-1143.	165.
8613.	1335.	-452.	75.	543.	-1473.	162.
9082.	1379.	-525.	73.	770.	-1600.	160.
9492.	1448.	-616.	75.	1087.	-1884.	161.
9961.	1613.	-660.	75.	1159.	-2039.	161.
10723.	1821.	-769.	75.	1457.	-2297.	161.
11074.	1951.	-786.	75.	1762.	-2583.	161.
11484.	2013.	-947.	74.	2018.	-3020.	162.
12070.	2379.	-1199.	74.	2666.	-3708.	161.
12773.	2491.	-1245.	74.	3295.	-4570.	161.
13125.	2783.	-1496.	74.	3990.	-5477.	161.

TABLE D2 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
582.	141.	98.	74.	-69.	-130.	140.
1055.	266.	199.	75.	-157.	-262.	139.
1496.	364.	275.	74.	-220.	-329.	139.
1992.	490.	391.	9.	-299.	-374.	135.
2461.	723.	212.	1.	-331.	-464.	117.
2998.	999.	137.	3.	-295.	-577.	104.
3516.	1213.	74.	4.	-258.	-720.	100.
3984.	1480.	9.	4.	-169.	-865.	97.
4570.	1795.	-118.	2.	-50.	-1021.	96.
5039.	2143.	-236.	2.	177.	-1200.	96.
5508.	2606.	-391.	1.	1044.	-1523.	100.
5508.	2615.	-377.	0.	1231.	-1554.	102.
5959.	2935.	-462.	0.	1684.	-1741.	102.
6444.	3482.	-547.	179.	1822.	-2000.	99.
7207.	4481.	-771.	179.	2422.	-2441.	98.
7557.	5508.	-1093.	178.	3280.	-3074.	97.
8222.	7173.	-1446.	178.	3016.	-3974.	93.
9006.	9740.	-1892.	178.	18906.	-7672.	106.
9844.	13607.	-1812.	179.	6775.	-7925.	96.

TABLE D3 PRINCIPAL STRAINS AND DIRECTIONS FOR THE W5X16 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP			GAGE LOCATION 2 BOTTOM		
	E_1	E_2	θ	E_1	E_2	θ
582.	153.	20.	107.	-28.	-131.	14.
1055.	301.	31.	105.	-49.	-283.	14.
1496.	416.	35.	107.	-50.	-380.	12.
1992.	565.	60.	110.	-49.	-560.	11.
2461.	1044.	39.	113.	-41.	-730.	6.
2998.	1546.	57.	114.	-12.	-954.	3.
3516.	1727.	102.	116.	-20.	-1086.	4.
3984.	1806.	123.	118.	-20.	-1184.	7.
4570.	1883.	117.	120.	8.	-1213.	11.
5039.	1961.	61.	122.	55.	-1251.	15.
5508.	2201.	2.	123.	148.	-1273.	19.
5508.	2235.	4.	123.	134.	-1249.	19.
5959.	2458.	-58.	123.	200.	-1337.	22.
6444.	2669.	-120.	124.	340.	-1441.	26.
7207.	3049.	-158.	123.	568.	-1726.	31.
7557.	3500.	-357.	125.	779.	-1969.	33.
8222.	4391.	-433.	124.	1142.	-2328.	36.
9006.	5824.	-570.	125.	1782.	-3135.	39.
9844.	8041.	-641.	125.	2594.	-4299.	40.

TABLE D3 CONTINUED.

LOAD (LBS)	GAGE LOCATION 6 TOP E_1	E_2	θ	GAGE LOCATION 6 BOTTOM E_1	E_2	θ
582.	193.	36.	88.	-13.	-186.	179.
1055.	368.	69.	88.	-18.	-380.	178.
1496.	509.	52.	86.	23.	-558.	179.
1992.	679.	-25.	85.	164.	-816.	1.
2461.	790.	-85.	86.	360.	-1066.	0.
2998.	991.	-181.	86.	699.	-1482.	180.
3516.	1228.	-292.	88.	949.	-1791.	179.
3984.	1439.	-413.	89.	1276.	-2112.	179.
4570.	1728.	-539.	89.	1676.	-2546.	178.
5039.	2040.	-650.	89.	2104.	-3015.	178.
5508.	2450.	-815.	88.	2702.	-3674.	178.
5508.	2444.	-811.	88.	2698.	-3696.	178.
5959.	2823.	-891.	89.	3101.	-4189.	177.
6444.	3364.	-1042.	89.	3878.	-5116.	177.
7207.	4426.	-1312.	88.	4996.	-6485.	177.
7557.	5129.	-1427.	88.	5035.	-6799.	176.
8222.	6421.	-1562.	87.	5086.	-7215.	174.
9006.	8550.	-1674.	87.	11706.	-14397.	176.
9844.	11740.	-1470.	87.	15051.	-17942.	176.

TABLE D3 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
582.	192.	46.	111.	-26.	-204.	19.
1055.	365.	91.	110.	-49.	-412.	20.
1496.	508.	57.	113.	-32.	-570.	23.
1992.	775.	-80.	116.	29.	-891.	31.
2461.	989.	-179.	118.	97.	-1281.	31.
2998.	1353.	-334.	119.	267.	-1799.	30.
3516.	1702.	-484.	120.	441.	-2281.	31.
3984.	2143.	-652.	121.	726.	-2845.	33.
4570.	2619.	-803.	122.	1213.	-3562.	35.
5039.	3093.	-939.	123.	1607.	-4276.	35.
5508.	3746.	-1139.	124.	2111.	-5227.	35.
5508.	3742.	-1143.	124.	2092.	-5269.	35.
5959.	4307.	-1259.	124.	2447.	-5873.	36.
6444.	5172.	-1490.	125.	3193.	-7057.	35.
7207.	6549.	-1814.	126.	4357.	-8970.	35.
7557.	7869.	-2098.	126.	5421.	-10532.	36.
8222.	9719.	-2459.	126.	7028.	-12707.	36.
9006.	12855.	-3000.	126.	10054.	-16601.	36.
9844.	15216.	-3172.	127.	14585.	-18024.	37.

TABLE D3 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
1050.	372.	67.	47.	-137.	-414.	148.
1523.	549.	32.	44.	-176.	-628.	145.
1992.	731.	-57.	41.	-224.	-852.	142.
2461.	909.	-103.	39.	-234.	-1022.	139.
3047.	1134.	-166.	37.	-293.	-1264.	137.
3509.	1338.	-255.	35.	-293.	-1421.	133.
3984.	1640.	-436.	33.	-225.	-1716.	130.
4453.	1901.	-569.	31.	-193.	-2018.	129.
5036.	2251.	-747.	29.	-115.	-2448.	128.
5508.	2631.	-928.	28.	-73.	-2867.	125.
5918.	2906.	-1048.	27.	47.	-3334.	126.
6563.	3725.	-1387.	25.	367.	-4241.	124.
7031.	4475.	-1652.	24.	660.	-5027.	124.
7617.	5543.	-1805.	24.	1104.	-6301.	124.
7969.	6120.	-1900.	24.	1386.	-7066.	124.

TABLE D4 PRINCIPAL STRAINS AND DIRECTIONS FOR THE W5X16 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
1050.	497.	106.	132.	2.	-618.	171.
1523.	852.	123.	139.	76.	-907.	166.
1992.	1195.	46.	144.	268.	-1496.	164.
2461.	1433.	7.	148.	514.	-2469.	163.
3047.	1550.	141.	146.	698.	-3805.	163.
3509.	1629.	159.	147.	804.	-4659.	162.
3984.	1745.	253.	148.	854.	-5461.	162.
4453.	1842.	322.	147.	843.	-5924.	162.
5036.	2004.	362.	147.	778.	-6452.	162.
5508.	2150.	406.	146.	727.	-7012.	162.
5918.	2273.	327.	149.	739.	-7513.	162.
6563.	2595.	447.	148.	694.	-8463.	162.
7031.	2879.	527.	150.	654.	-9352.	162.
7617.	3408.	607.	150.	598.	-10671.	163.
7969.	3616.	762.	149.	539.	-11410.	163.

TABLE D4 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
1050.	463.	-62.	116.	141.	-561.	25.
1523.	726.	-141.	116.	282.	-914.	27.
1992.	1029.	-261.	116.	504.	-1394.	25.
2461.	1390.	-375.	117.	620.	-1781.	28.
3047.	1842.	-504.	117.	830.	-2340.	29.
3509.	2260.	-607.	118.	1062.	-2932.	29.
3984.	2824.	-773.	120.	1438.	-3788.	30.
4453.	3421.	-896.	121.	1769.	-4585.	30.
5036.	4089.	-1013.	121.	2143.	-5452.	31.
5508.	4797.	-1154.	122.	2575.	-6451.	31.
5918.	5372.	-1341.	122.	2986.	-7340.	31.
6563.	6749.	-1544.	122.	3898.	-8998.	32.
7031.	7743.	-1788.	123.	4587.	-10293.	32.
7617.	9339.	-2020.	123.	5710.	-12144.	32.
7969.	10253.	-2154.	123.	6479.	-13281.	32.

TABLE D4 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP E_1	E_2	θ	GAGE LOCATION 4 BOTTOM E_1	E_2	θ
1050.	167.	-69.	70.	55.	-172.	165.
1523.	262.	-110.	70.	83.	-267.	165.
1992.	361.	-187.	71.	115.	-363.	164.
2461.	420.	-216.	71.	138.	-472.	164.
3047.	566.	-258.	71.	276.	-678.	167.
3509.	697.	-308.	72.	337.	-819.	167.
3984.	804.	-357.	71.	404.	-984.	166.
4453.	916.	-441.	71.	465.	-1127.	165.
5036.	1029.	-515.	73.	534.	-1292.	164.
5508.	1155.	-558.	71.	658.	-1504.	164.
5918.	1236.	-591.	71.	736.	-1663.	162.
6563.	1472.	-719.	72.	1020.	-1999.	163.
7031.	1448.	-799.	69.	1322.	-2239.	162.
7617.	1620.	-961.	69.	1688.	-2650.	161.
7969.	1816.	-1066.	70.	1970.	-2844.	161.

TABLE D4 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
952.	261.	128.	147.	53.	-441.	178.
1523.	508.	36.	158.	277.	-817.	175.
1992.	626.	3.	159.	311.	-1023.	175.
2461.	823.	-87.	159.	449.	-1277.	175.
3047.	1045.	-142.	160.	566.	-1620.	175.
3507.	1173.	-147.	160.	607.	-1870.	174.
4102.	1361.	-171.	161.	652.	-2388.	173.
4570.	1481.	-152.	162.	683.	-3009.	170.
4978.	1581.	-148.	164.	717.	-3817.	168.
5508.	1676.	-108.	165.	777.	-4946.	165.
5977.	1785.	-73.	167.	808.	-5882.	164.
6548.	1947.	-10.	169.	793.	-7145.	162.
7031.	2056.	49.	171.	787.	-7816.	162.
7673.	2262.	105.	173.	856.	-9045.	161.
8086.	2400.	143.	174.	868.	-9713.	160.
8555.	2531.	239.	176.	812.	-10539.	160.
9023.	2746.	267.	178.	784.	-11402.	159.
9492.	2971.	323.	179.	794.	-12424.	158.
10137.	3256.	405.	1.	781.	-13545.	158.
10608.	3530.	453.	2.	750.	-14730.	157.
11017.	3756.	565.	3.	675.	-15478.	157.
11719.	4260.	661.	5.	579.	-17107.	156.
12070.	5591.	774.	7.	-181.	-16626.	153.
12718.	5599.	980.	7.	-298.	-16626.	153.
13418.	7356.	1514.	10.	-1191.	-15865.	149.
14238.	8794.	1904.	13.	-1877.	-15410.	144.

TABLE D5 PRINCIPAL STRAINS AND DIRECTIONS FOR THE M5X18.9 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP			GAGE LOCATION 2 BOTTOM		
	E_1	E_2	θ	E_1	E_2	θ
952.	323.	-37.	105.	-50.	-227.	4.
1523.	887.	-121.	110.	-111.	-389.	1.
1992.	1213.	-182.	111.	-141.	-528.	2.
2461.	1589.	-163.	114.	-185.	-655.	2.
3047.	1955.	-69.	117.	-222.	-813.	179.
3507.	2173.	-47.	119.	-235.	-954.	179.
4102.	2517.	-62.	121.	-269.	-1191.	177.
4570.	2782.	-111.	123.	-312.	-1383.	178.
4978.	2972.	-207.	125.	-378.	-1511.	180.
5508.	3095.	-367.	128.	-476.	-1514.	178.
5977.	3197.	-431.	129.	-562.	-1482.	173.
6548.	3334.	-493.	130.	-568.	-1649.	171.
7031.	3416.	-491.	130.	-564.	-1808.	174.
7673.	3525.	-491.	131.	-454.	-2351.	177.
8086.	3613.	-445.	130.	-439.	-2843.	177.
8555.	3723.	-389.	130.	-408.	-3678.	175.
9023.	3802.	-338.	130.	-377.	-4757.	172.
9492.	3960.	-268.	130.	-334.	-5776.	171.
10137.	4105.	-187.	129.	-287.	-7116.	171.
10608.	4184.	-166.	129.	-336.	-8283.	170.
11017.	4413.	-74.	128.	-315.	-9308.	170.
11719.	4671.	44.	128.	-375.	-11022.	170.
12070.	5414.	359.	126.	-547.	-14588.	170.
12718.	5548.	362.	126.	-558.	-14836.	171.
13418.	6699.	822.	123.	-896.	-19176.	172.
14238.	7701.	1262.	121.	-1177.	-23136.	172.

TABLE D5 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
952.	202.	57.	118.	89.	-155.	49.
1523.	462.	94.	119.	178.	-294.	47.
1992.	574.	245.	121.	208.	-398.	45.
2461.	728.	386.	127.	256.	-512.	43.
3047.	937.	501.	128.	328.	-694.	40.
3507.	1079.	585.	132.	369.	-828.	38.
4102.	1296.	688.	134.	462.	-1077.	36.
4570.	1526.	783.	134.	522.	-1283.	34.
4978.	1686.	867.	134.	581.	-1456.	34.
5508.	1929.	948.	134.	688.	-1692.	33.
5977.	2151.	1014.	134.	781.	-1922.	33.
6548.	2474.	1110.	135.	908.	-2258.	33.
7031.	2674.	1182.	135.	994.	-2515.	32.
7673.	3057.	1261.	135.	1154.	-2894.	32.
8086.	3300.	1300.	135.	1284.	-3132.	33.
8555.	3573.	1377.	135.	1436.	-3481.	33.
9023.	3930.	1436.	133.	1622.	-3884.	33.
9492.	4303.	1491.	134.	1823.	-4200.	33.
10137.	4765.	1555.	133.	2096.	-4775.	33.
10608.	5177.	1525.	133.	2324.	-5241.	33.
11017.	5533.	1630.	132.	2523.	-5645.	33.
11719.	6359.	1642.	131.	2915.	-6432.	33.
12070.	7989.	1719.	130.	3834.	-8044.	33.
12718.	8120.	1802.	130.	3865.	-8186.	33.
13418.	10333.	1892.	129.	5122.	-10264.	33.
14238.	12278.	2064.	128.	6308.	-12118.	33.

TABLE D5 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP E_1	E_2	θ	GAGE LOCATION 4 BOTTOM E_1	E_2	θ
952.	82.	-30.	67.	28.	-90.	161.
1523.	132.	-56.	70.	35.	-113.	160.
1992.	172.	-65.	67.	50.	-176.	162.
2461.	211.	-86.	69.	63.	-206.	162.
3047.	262.	-122.	69.	78.	-278.	162.
3507.	289.	-136.	69.	76.	-326.	161.
4102.	345.	-166.	71.	103.	-393.	162.
4570.	382.	-184.	71.	89.	-456.	161.
4978.	439.	-210.	71.	95.	-505.	162.
5508.	484.	-245.	69.	140.	-589.	163.
5977.	541.	-269.	71.	165.	-614.	162.
6548.	541.	-310.	73.	224.	-692.	162.
7031.	580.	-316.	72.	260.	-713.	162.
7673.	665.	-361.	71.	358.	-800.	162.
8086.	735.	-411.	73.	391.	-849.	162.
8555.	834.	-466.	73.	452.	-938.	163.
9023.	867.	-475.	72.	530.	-1016.	163.
9492.	872.	-496.	71.	632.	-1152.	162.
10137.	997.	-555.	71.	737.	-1310.	160.
10608.	1123.	-648.	70.	864.	-1452.	160.
11017.	1153.	-685.	70.	975.	-1573.	159.
11719.	1262.	-724.	71.	1169.	-1748.	158.
12070.	1449.	-902.	69.	1592.	-2243.	157.
12718.	1453.	-908.	69.	1628.	-2321.	157.
13418.	1792.	-1205.	69.	2229.	-2680.	157.
14238.	1946.	-1388.	69.	2743.	-3070.	157.

TABLE D5 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
1055.	209.	146.	53.	-80.	-133.	151.
1523.	313.	176.	42.	-101.	-170.	139.
1992.	407.	189.	36.	-116.	-242.	130.
2461.	509.	212.	31.	-129.	-338.	127.
3043.	622.	252.	29.	-147.	-469.	128.
3516.	760.	241.	26.	-140.	-563.	126.
3984.	893.	257.	26.	-122.	-679.	126.
4570.	1029.	222.	24.	-90.	-773.	124.
5039.	1189.	212.	25.	-59.	-875.	121.
5470.	1318.	194.	24.	-46.	-951.	121.
5977.	1473.	157.	24.	-12.	-1061.	120.
6563.	1681.	110.	23.	90.	-1193.	117.
7031.	1855.	82.	24.	187.	-1321.	116.
7617.	2071.	13.	23.	262.	-1476.	116.
8086.	2229.	-8.	22.	355.	-1605.	115.
8578.	2475.	-56.	22.	460.	-1792.	115.
9023.	2656.	-111.	22.	499.	-1939.	113.
9466.	2912.	-198.	21.	631.	-2195.	114.
9961.	3229.	-236.	21.	638.	-2415.	115.
10547.	3522.	-360.	20.	819.	-2709.	115.
11016.	3875.	-356.	19.	1069.	-3061.	114.
11484.	4349.	-369.	20.	1364.	-3499.	114.
12070.	5082.	-500.	19.	1743.	-4126.	114.
12656.	5772.	-475.	20.	2216.	-4851.	114.

TABLE D6 PRINCIPAL STRAINS AND DIRECTIONS FOR THE M5X18.9 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
1055.	259.	6.	102.	-51.	-280.	2.
1523.	408.	-18.	107.	-60.	-440.	174.
1992.	686.	-45.	112.	-27.	-663.	160.
2461.	956.	-111.	120.	59.	-1196.	160.
3043.	1195.	-222.	124.	106.	-1728.	160.
3516.	1346.	-253.	125.	159.	-2127.	161.
3984.	1481.	-263.	126.	210.	-2544.	162.
4570.	1589.	-252.	126.	238.	-2864.	162.
5039.	1694.	-215.	126.	232.	-3095.	162.
5470.	1753.	-188.	126.	221.	-3265.	162.
5977.	1839.	-151.	125.	219.	-3436.	163.
6563.	1920.	-69.	125.	205.	-3605.	163.
7031.	2012.	-4.	124.	174.	-3692.	164.
7617.	2081.	45.	125.	128.	-3787.	164.
8086.	2169.	72.	125.	102.	-3853.	164.
8578.	2293.	130.	125.	54.	-3901.	164.
9023.	2351.	161.	125.	-28.	-3999.	165.
9466.	2440.	209.	125.	-38.	-4012.	165.
9961.	2562.	263.	125.	-166.	-4007.	165.
10547.	2676.	270.	125.	-190.	-4184.	166.
11016.	2866.	281.	126.	-319.	-4182.	166.
11484.	3116.	384.	125.	-449.	-4225.	167.
12070.	3376.	512.	127.	-571.	-4291.	167.
12656.	3760.	606.	125.	-747.	-4491.	168.

TABLE D6 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
1055.	261.	33.	115.	192.	-239.	46.
1523.	388.	8.	116.	317.	-400.	43.
1992.	511.	-34.	117.	394.	-547.	42.
2461.	697.	-85.	117.	507.	-778.	39.
3043.	868.	-108.	119.	659.	-1095.	37.
3516.	1038.	-120.	120.	775.	-1374.	35.
3984.	1234.	-121.	120.	952.	-1701.	34.
4570.	1442.	-120.	121.	1112.	-2043.	33.
5039.	1688.	-112.	121.	1280.	-2388.	33.
5470.	1839.	-96.	122.	1381.	-2662.	32.
5977.	2146.	-132.	122.	1576.	-3045.	32.
6563.	2455.	-156.	122.	1767.	-3484.	31.
7031.	2733.	-172.	122.	1976.	-3909.	31.
7617.	3095.	-209.	122.	2218.	-4434.	31.
8086.	3349.	-241.	122.	2409.	-4764.	31.
8578.	3765.	-287.	122.	2665.	-5318.	31.
9023.	4046.	-331.	122.	2838.	-5734.	31.
9466.	4510.	-401.	122.	3157.	-6254.	31.
9961.	4951.	-482.	123.	3499.	-6820.	31.
10547.	5469.	-576.	123.	3831.	-7401.	31.
11016.	5978.	-662.	123.	4251.	-8113.	32.
11484.	6723.	-821.	123.	4756.	-8949.	31.
12070.	7738.	-1009.	123.	5548.	-10167.	31.
12656.	8754.	-1225.	123.	6358.	-11459.	31.

TABLE D6 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP E_1	E_2	θ	GAGE LOCATION 4 BOTTOM E_1	E_2	θ
1055.	125.	-25.	76.	22.	-92.	167.
1523.	168.	-43.	77.	31.	-153.	170.
1992.	219.	-57.	77.	36.	-197.	170.
2461.	281.	-84.	78.	53.	-247.	167.
3043.	339.	-139.	77.	74.	-306.	167.
3516.	390.	-150.	76.	90.	-394.	168.
3984.	444.	-164.	76.	96.	-444.	167.
4570.	503.	-181.	75.	122.	-516.	166.
5039.	616.	-219.	75.	145.	-592.	166.
5470.	673.	-249.	76.	166.	-656.	166.
5977.	748.	-280.	76.	201.	-749.	165.
6563.	841.	-316.	76.	263.	-884.	165.
7031.	937.	-350.	76.	311.	-983.	165.
7617.	1033.	-375.	76.	372.	-1126.	164.
8086.	1104.	-401.	76.	383.	-1203.	163.
8578.	1192.	-441.	76.	460.	-1341.	162.
9023.	1242.	-496.	77.	525.	-1470.	162.
9466.	1372.	-546.	76.	623.	-1680.	162.
9961.	1387.	-559.	76.	736.	-1839.	161.
10547.	1472.	-605.	74.	831.	-1983.	161.
11016.	1604.	-636.	74.	965.	-2305.	161.
11484.	1727.	-728.	75.	1158.	-2472.	161.
12070.	1880.	-770.	74.	1377.	-2724.	160.
12656.	2038.	-904.	74.	1696.	-3085.	159.

TABLE D6 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
1055.	246.	18.	36.	-57.	-251.	119.
1523.	391.	-13.	35.	-25.	-330.	112.
1992.	555.	-69.	34.	2.	-455.	111.
2463.	734.	-157.	33.	72.	-601.	108.
3047.	880.	-223.	33.	178.	-755.	107.
3514.	1012.	-288.	32.	234.	-861.	107.
3984.	1228.	-379.	31.	321.	-1007.	106.
4511.	1494.	-449.	33.	465.	-1172.	105.
5036.	1711.	-584.	31.	550.	-1349.	104.
5508.	2064.	-674.	28.	678.	-1638.	105.
5977.	2410.	-661.	27.	831.	-1877.	104.
6547.	2798.	-703.	26.	1148.	-2350.	106.
7031.	3415.	-899.	22.	1374.	-2784.	107.
7617.	4199.	-1010.	20.	1672.	-3552.	108.
7969.	4731.	-1262.	19.	2214.	-4347.	107.
8580.	5932.	-1630.	20.	3057.	-5787.	109.
9023.	7764.	-2188.	21.	4109.	-7431.	111.
9492.	9343.	-2605.	22.	5408.	-9383.	114.

TABLE D7 PRINCIPAL STRAINS AND DIRECTIONS FOR THE W6X25 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
1055.	416.	12.	124.	11.	-432.	16.
1523.	545.	12.	127.	114.	-646.	10.
1992.	694.	-2.	131.	212.	-804.	11.
2463.	932.	31.	139.	272.	-915.	12.
3047.	1189.	-49.	140.	296.	-1046.	11.
3514.	1345.	-78.	141.	313.	-1110.	12.
3984.	1556.	-101.	143.	323.	-1172.	13.
4511.	1713.	-146.	143.	326.	-1203.	15.
5036.	1852.	-204.	145.	349.	-1237.	18.
5508.	1991.	-296.	145.	369.	-1328.	22.
5977.	2167.	-404.	145.	407.	-1418.	26.
6547.	2417.	-572.	148.	504.	-1632.	30.
7031.	2719.	-726.	149.	626.	-1887.	33.
7617.	3298.	-809.	145.	745.	-2280.	37.
7969.	3671.	-924.	142.	850.	-2596.	39.
8580.	4517.	-1075.	142.	1154.	-3267.	44.
9023.	5699.	-1296.	142.	1436.	-4214.	44.
9492.	7235.	-1546.	141.	1979.	-5368.	46.

TABLE D7 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
1055.	325.	-49.	119.	54.	-428.	28.
1523.	493.	-96.	119.	69.	-676.	26.
1992.	701.	-178.	119.	98.	-861.	26.
2463.	926.	-281.	119.	138.	-1132.	27.
3047.	1144.	-378.	119.	240.	-1789.	26.
3514.	1315.	-459.	119.	296.	-2129.	26.
3984.	1594.	-598.	120.	471.	-2595.	24.
4511.	1848.	-725.	121.	713.	-3116.	24.
5036.	2129.	-890.	122.	927.	-2493.	29.
5508.	2537.	-1098.	122.	1214.	-2512.	32.
5977.	3060.	-1364.	122.	1564.	-3126.	32.
6547.	3738.	-1722.	122.	2116.	-4185.	31.
7031.	4440.	-2103.	122.	2683.	-5560.	30.
7617.	5364.	-2665.	122.	3468.	-6207.	31.
7969.	5900.	-3126.	123.	4127.	-6271.	32.
8580.	7167.	-4044.	123.	6225.	-8601.	32.
9023.	8676.	-4972.	123.	8400.	-8466.	34.
9492.	10084.	-6024.	123.	11736.	-10482.	33.

TABLE D7 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP			GAGE LOCATION 4 BOTTOM		
	E_1	E_2	θ	E_1	E_2	θ
1055.	109.	-56.	69.	38.	-84.	158.
1523.	151.	-81.	68.	58.	-130.	159.
1992.	216.	-116.	68.	77.	-174.	159.
2463.	275.	-150.	67.	90.	-232.	159.
3047.	319.	-180.	68.	106.	-265.	159.
3514.	342.	-220.	67.	136.	-317.	159.
3984.	438.	-260.	69.	174.	-395.	160.
4511.	491.	-301.	68.	203.	-431.	159.
5036.	550.	-350.	68.	275.	-539.	160.
5508.	614.	-389.	66.	329.	-593.	158.
5977.	686.	-446.	67.	385.	-657.	158.
6547.	713.	-489.	66.	467.	-734.	158.
7031.	811.	-584.	65.	542.	-786.	157.
7617.	862.	-656.	65.	725.	-1089.	157.
7969.	884.	-773.	65.	959.	-1204.	155.
8580.	957.	-910.	63.	1212.	-1437.	154.
9023.	1011.	-1014.	64.	1545.	-1666.	151.
9492.	1021.	-1179.	63.	1996.	-1763.	150.

TABLE D7 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
938.	203.	114.	40.	-71.	-194.	132.
1523.	327.	100.	35.	-55.	-252.	116.
1992.	434.	67.	35.	-44.	-352.	113.
2461.	552.	-22.	36.	-67.	-423.	120.
3047.	686.	-70.	37.	-70.	-572.	118.
3516.	812.	-116.	37.	-20.	-673.	114.
3984.	976.	-201.	37.	112.	-818.	111.
4570.	1152.	-297.	36.	256.	-985.	107.
5039.	1252.	-352.	35.	281.	-1060.	108.
5508.	1420.	-417.	35.	329.	-1146.	106.
6035.	1599.	-539.	34.	436.	-1328.	107.
6563.	1804.	-677.	32.	660.	-1492.	106.
7031.	2012.	-741.	31.	1030.	-1738.	106.
7601.	2350.	-857.	29.	1432.	-2017.	106.
8029.	2583.	-974.	28.	1719.	-2269.	106.
8555.	2918.	-1064.	27.	2233.	-2823.	105.
9023.	3274.	-1136.	27.	2608.	-3326.	106.
9492.	3687.	-1269.	26.	2755.	-3838.	107.
9609.	3721.	-1303.	26.	2811.	-3949.	107.
10020.	4007.	-1355.	26.	3109.	-4278.	107.
10664.	4929.	-1781.	25.	3703.	-5326.	109.
11133.	5603.	-1973.	26.	4157.	-6076.	111.
11602.	6601.	-2389.	26.	5111.	-7165.	111.

TABLE D8 PRINCIPAL STRAINS AND DIRECTIONS FOR THE W6X25 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
938.	218.	17.	111.	-39.	-211.	12.
1523.	256.	-114.	145.	-2.	-501.	175.
1992.	400.	-894.	154.	70.	-1397.	165.
2461.	523.	-1413.	156.	268.	-2880.	161.
3047.	687.	-1774.	156.	371.	-3837.	162.
3516.	878.	-1967.	156.	414.	-4336.	161.
3984.	935.	-2002.	157.	403.	-4551.	161.
4570.	998.	-2020.	157.	370.	-4594.	162.
5039.	1054.	-2026.	157.	309.	-4566.	162.
5508.	1091.	-2062.	158.	254.	-4542.	162.
6035.	1167.	-2107.	159.	214.	-4495.	162.
6563.	1246.	-2189.	159.	137.	-4505.	163.
7031.	1440.	-2123.	157.	93.	-4437.	163.
7601.	1564.	-2212.	157.	19.	-4406.	164.
8029.	1662.	-2262.	157.	-65.	-4388.	164.
8555.	1900.	-2182.	156.	-176.	-4369.	165.
9023.	2046.	-2210.	155.	-260.	-4301.	166.
9492.	2288.	-2239.	154.	-419.	-4397.	167.
9609.	2275.	-2331.	154.	-425.	-4388.	168.
10020.	2376.	-2285.	155.	-567.	-4273.	168.
10664.	2858.	-2458.	155.	-785.	-4134.	171.
11133.	3149.	-2507.	155.	-967.	-3986.	174.
11602.	3726.	-2601.	155.	-1206.	-3812.	178.

TABLE D8 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
938.	273.	-15.	120.	63.	-285.	24.
1523.	423.	-76.	121.	154.	-676.	26.
1992.	551.	-124.	121.	275.	-1007.	22.
2461.	689.	-194.	122.	377.	-1296.	22.
3047.	888.	-274.	120.	525.	-1562.	23.
3516.	1039.	-327.	121.	622.	-1712.	24.
3984.	1233.	-404.	122.	797.	-1949.	25.
4570.	1493.	-510.	122.	973.	-2215.	26.
5039.	1686.	-596.	122.	1125.	-2430.	27.
5508.	1901.	-700.	122.	1219.	-2658.	27.
6035.	2174.	-866.	122.	1431.	-2969.	28.
6563.	2469.	-1025.	123.	1648.	-3316.	28.
7031.	2766.	-1180.	123.	1883.	-3693.	28.
7601.	3237.	-1400.	123.	2172.	-4143.	28.
8029.	3566.	-1581.	123.	2425.	-4464.	29.
8555.	4025.	-1839.	124.	2860.	-4895.	30.
9023.	4393.	-2061.	124.	3269.	-5379.	31.
9492.	4907.	-2389.	124.	3774.	-5995.	31.
9609.	4947.	-2483.	124.	3895.	-6141.	31.
10020.	5304.	-2719.	125.	4331.	-6621.	31.
10664.	6409.	-3476.	125.	5701.	-7901.	32.
11133.	7240.	-3936.	124.	6768.	-8900.	32.
11602.	8548.	-4720.	124.	8460.	-10453.	32.

TABLE D8 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP E_1	E_2	θ	GAGE LOCATION 4 BOTTOM E_1	E_2	θ
938.	90.	-25.	75.	27.	-77.	161.
1523.	170.	-59.	80.	32.	-118.	159.
1992.	195.	-87.	76.	50.	-163.	161.
2461.	226.	-133.	76.	59.	-206.	161.
3047.	252.	-160.	76.	49.	-259.	159.
3516.	293.	-180.	75.	60.	-286.	161.
3984.	408.	-234.	76.	97.	-362.	159.
4570.	466.	-256.	76.	117.	-434.	160.
5039.	546.	-305.	76.	127.	-466.	159.
5508.	623.	-347.	77.	171.	-558.	159.
6035.	698.	-379.	77.	208.	-628.	159.
6563.	730.	-401.	76.	234.	-716.	158.
7031.	796.	-457.	75.	277.	-808.	159.
7601.	909.	-503.	75.	330.	-891.	158.
8029.	963.	-560.	75.	391.	-963.	158.
8555.	1037.	-588.	74.	422.	-1110.	157.
9023.	1103.	-634.	74.	523.	-1166.	155.
9492.	1166.	-734.	75.	617.	-1366.	158.
9609.	1172.	-739.	75.	630.	-1357.	157.
10020.	1127.	-776.	73.	689.	-1360.	155.
10664.	1232.	-947.	71.	949.	-1662.	154.
11133.	1323.	-1009.	72.	1287.	-2036.	160.
11602.	1342.	-1105.	72.	1778.	-2447.	163.

TABLE D8 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
938.	112.	-17.	55.	-33.	-113.	125.
1523.	192.	-15.	57.	-59.	-204.	129.
2108.	265.	-32.	56.	-76.	-252.	122.
2578.	330.	-35.	56.	-97.	-298.	122.
3047.	399.	-48.	55.	-111.	-352.	119.
3511.	456.	-59.	55.	-128.	-398.	118.
4102.	523.	-71.	53.	-138.	-476.	116.
4102.	510.	-73.	53.	-134.	-493.	117.
4570.	589.	-88.	55.	-131.	-552.	114.
5039.	681.	-112.	53.	-135.	-627.	114.
5508.	735.	-112.	52.	-19.	-681.	113.
5977.	822.	-140.	50.	-102.	-712.	110.
6563.	973.	-153.	51.	-113.	-776.	108.
7031.	1104.	-181.	51.	-77.	-828.	106.
7395.	1255.	-195.	50.	-30.	-903.	105.
8027.	1372.	-204.	50.	7.	-978.	104.
8555.	1572.	-234.	51.	82.	-1096.	103.
9082.	1695.	-275.	49.	178.	-1247.	101.
9609.	1846.	-350.	50.	272.	-1516.	98.
10009.	2127.	-496.	49.	359.	-2113.	94.
10500.	2560.	-708.	48.	687.	-3510.	88.
10547.	2596.	-746.	49.	784.	-3803.	88.

TABLE D9 PRINCIPAL STRAINS AND DIRECTIONS FOR THE S4X9.5 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP E_1	E_2	θ	GAGE LOCATION 2 BOTTOM E_1	E_2	θ
938.	91.	68.	149.	-14.	-116.	34.
1523.	155.	110.	153.	-19.	-201.	30.
2108.	241.	145.	156.	-33.	-260.	34.
2578.	305.	166.	158.	-35.	-331.	30.
3047.	379.	189.	159.	-33.	-405.	30.
3511.	466.	214.	157.	-36.	-454.	30.
4102.	606.	237.	156.	-28.	-553.	30.
4102.	607.	206.	157.	-52.	-567.	29.
4570.	674.	238.	157.	-38.	-649.	29.
5039.	818.	233.	154.	-45.	-707.	31.
5508.	895.	218.	155.	-15.	-770.	30.
5977.	1063.	192.	155.	29.	-849.	32.
6563.	1166.	173.	156.	43.	-986.	30.
7031.	1329.	104.	156.	83.	-1048.	31.
7395.	1476.	34.	156.	127.	-1128.	33.
8027.	1624.	-41.	156.	177.	-1178.	34.
8555.	1799.	-125.	157.	245.	-1274.	35.
9082.	2085.	-265.	160.	320.	-1365.	37.
9609.	2518.	-437.	164.	405.	-1481.	38.
10009.	3608.	-791.	170.	515.	-1760.	39.
10500.	5055.	-695.	174.	731.	-2095.	43.
10547.	6034.	-1345.	175.	791.	-2201.	42.

TABLE D9 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
938.	160.	97.	109.	-61.	-207.	17.
1523.	265.	166.	109.	-108.	-315.	18.
2108.	400.	199.	113.	-115.	-445.	20.
2578.	531.	205.	115.	-123.	-519.	21.
3047.	686.	232.	116.	11.	-880.	16.
3511.	835.	250.	116.	112.	-1193.	16.
4102.	1054.	303.	116.	217.	-1305.	18.
4102.	1092.	295.	116.	262.	-1591.	19.
4570.	1221.	321.	116.	294.	-1796.	21.
5039.	1414.	401.	116.	418.	-2129.	22.
5508.	1521.	498.	119.	529.	-2395.	23.
5977.	1726.	596.	120.	777.	-3016.	23.
6563.	1903.	740.	121.	963.	-3533.	23.
7031.	2060.	828.	122.	1159.	-3910.	23.
7395.	2362.	947.	123.	1445.	-4434.	24.
8027.	2518.	1072.	124.	1582.	-4717.	25.
8555.	2883.	1196.	125.	1758.	-5181.	26.
9082.	3327.	1347.	125.	1901.	-5783.	26.
9609.	3994.	1640.	128.	1883.	-5617.	28.
10009.	5037.	2339.	143.	1976.	-8054.	30.
10500.	5234.	3565.	158.	1877.	-10763.	33.
10547.	9375.	3804.	146.	1856.	-11215.	33.

TABLE D9 CONTINUED.

LOAD (LBS)	GAGE LOCATION 1 TOP E_1	E_2	θ	GAGE LOCATION 1 BOTTOM E_1	E_2	θ
1055.	228.	114.	25.	-22.	-113.	98.
1523.	381.	129.	26.	12.	-153.	91.
1992.	503.	114.	26.	51.	-194.	90.
2461.	663.	112.	26.	52.	-220.	87.
3047.	820.	126.	29.	105.	-292.	87.
3511.	950.	111.	28.	132.	-342.	85.
4102.	1144.	53.	27.	199.	-461.	85.
4570.	1293.	49.	26.	244.	-583.	85.
5039.	1472.	-17.	24.	324.	-783.	84.
5509.	1675.	-27.	21.	374.	-1090.	83.
5977.	2565.	-318.	9.	541.	-1782.	82.
6680.	5561.	-1096.	179.	1395.	-4156.	81.

TABLE D10 PRINCIPAL STRAINS AND DIRECTIONS FOR THE S4X9.5 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	GAGE LOCATION 2 TOP			GAGE LOCATION 2 BOTTOM		
	E_1	E_2	θ	E_1	E_2	θ
1055.	199.	-9.	123.	4.	-176.	20.
1523.	299.	-16.	125.	4.	-259.	21.
1992.	389.	-39.	125.	-6.	-338.	21.
2461.	475.	-40.	126.	7.	-416.	21.
3047.	605.	-66.	127.	18.	-513.	22.
3511.	725.	-74.	127.	23.	-618.	20.
4102.	858.	-112.	130.	8.	-764.	20.
4570.	941.	-138.	130.	-1.	-874.	18.
5039.	1149.	-188.	129.	-34.	-1050.	17.
5509.	1262.	-212.	129.	-86.	-1204.	17.
5977.	1337.	-333.	130.	-117.	-1422.	14.
6680.	1626.	-614.	133.	-123.	-1924.	11.

TABLE D10 CONTINUED.

LOAD (LBS)	GAGE LOCATION 3 TOP E_1	E_2	θ	GAGE LOCATION 3 BOTTOM E_1	E_2	θ
1055.	293.	148.	122.	349.	-674.	10.
1523.	714.	263.	5.	866.	-1499.	8.
1992.	1056.	286.	7.	1115.	-1882.	9.
2461.	1424.	488.	12.	1120.	-2089.	9.
3047.	1738.	698.	12.	1197.	-2447.	10.
3511.	1982.	893.	12.	1263.	-2626.	12.
4102.	2365.	1068.	12.	1307.	-3008.	14.
4570.	2614.	1322.	12.	1312.	-3227.	15.
5039.	3024.	1605.	11.	1279.	-3513.	17.
5509.	3605.	1922.	10.	1115.	-3876.	19.
5977.	5119.	2824.	12.	592.	-4434.	22.
6680.	10896.	4088.	2.	-885.	-5127.	37.

TABLE D10 CONTINUED.

LOAD (LBS)	GAGE LOCATION 4 TOP			GAGE LOCATION 4 BOTTOM		
	E_1	E_2	θ	E_1	E_2	θ
1055.	150.	-11.	52.	18.	-132.	156.
1523.	225.	-15.	52.	55.	-193.	150.
1992.	278.	-39.	54.	76.	-257.	151.
2461.	344.	-37.	51.	97.	-322.	151.
3047.	450.	-50.	54.	121.	-404.	151.
3511.	524.	-20.	56.	135.	-459.	151.
4102.	622.	-82.	54.	158.	-559.	151.
4570.	743.	-94.	56.	157.	-624.	149.
5039.	845.	-111.	55.	146.	-693.	149.
5509.	968.	-115.	53.	91.	-793.	147.
5977.	1265.	-72.	49.	-54.	-933.	140.
6680.	2126.	15.	34.	-249.	-1559.	120.

TABLE D10 CONTINUED.

APPENDIX E

DEFLECTION DATA

The locations of the dial gages are shown in Figure 2.6. Figure 2.6 is drawn as seen from the bottom side of the web (the bracket is attached to the top of the web). Positive readings for dial gages on the web indicate deflections upward out of the page or plane of the web (away from the top of the web). Positive readings for dial gages on the flanges indicate deflections outward from the center of the section.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
586.	-.0020	.0005	.0020	-.0005	.0010	.0020	.0002	.0020	-.0005	-.0003
1055.	-.0030	.0006	.0040	-.0010	.0015	.0040	.0002	.0030	-.0015	-.0005
1523.	-.0050	.0006	.0060	-.0015	.0020	.0050	.0002	.0040	-.0020	-.0008
2109.	-.0070	.0007	.0080	-.0025	.0020	.0080	.0002	.0060	-.0025	-.0011
2577.	-.0090	.0009	.0100	-.0035	.0025	.0095	.0002	.0080	-.0035	-.0018
3047.	-.0110	.0009	.0120	-.0045	.0030	.0110	.0002	.0090	-.0045	-.0018
3453.	-.0130	.0006	.0125	-.0065	.0020	.0120	-.0005	.0100	-.0045	-.0018
3984.	-.0170	-.0003	.0140	-.0085	.0020	.0140	-.0016	.0115	-.0055	-.0018
4570.	-.0200	-.0029	.0160	-.0095	.0010	.0150	-.0024	.0120	-.0065	-.0018
5038.	-.0230	-.0017	.0170	-.0125	.0010	.0160	-.0036	.0130	-.0070	-.0018
5508.	-.0270	-.0027	.0190	-.0145	.0000	.0180	-.0047	.0140	-.0085	-.0018
6094.	-.0305	-.0037	.0205	-.0165	-.0010	.0200	-.0062	.0150	-.0095	-.0018
6556.	-.0350	-.0052	.0220	-.0190	-.0020	.0210	-.0075	.0160	-.0105	-.0017
7031.	-.0390	-.0064	.0230	-.0215	-.0030	.0220	-.0091	.0170	-.0125	-.0017
7610.	-.0450	-.0084	.0250	-.0255	-.0050	.0235	-.0110	.0185	-.0155	-.0017
8084.	-.0500	-.0097	.0270	-.0285	-.0060	.0250	-.0126	.0190	-.0165	-.0017
8555.	-.0570	-.0114	.0300	-.0325	-.0070	.0270	-.0146	.0210	-.0185	-.0017
9078.	-.0630	-.0134	.0330	-.0365	-.0090	.0290	-.0168	.0240	-.0215	-.0017
9492.	-.0710	-.0150	.0360	-.0405	-.0100	.0315	-.0188	.0250	-.0235	-.0017
10254.	-.0830	-.0181	.0415	-.0465	-.0130	.0350	-.0230	.0295	-.0265	-.0017

TABLE E1 DEFLECTION DATA FOR THE W4X13 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
586.	.0000	.0010	-.0003	-.0020	-.0014	.0002	.0015	.0008	.0003	-.0004
1055.	.0000	.0024	-.0005	-.0040	-.0027	.0005	.0033	.0011	.0004	-.0004
1523.	.0005	.0025	-.0013	-.0055	-.0032	.0010	.0046	.0017	.0006	-.0004
2109.	.0010	.0045	-.0010	-.0070	-.0044	.0013	.0066	.0022	.0008	-.0004
2577.	.0010	.0056	-.0011	-.0080	-.0055	.0018	.0083	.0029	.0011	-.0004
3047.	.0020	.0085	-.0007	-.0090	-.0071	.0017	.0095	.0033	.0011	-.0010
3453.	.0030	.0085	-.0008	-.0100	-.0082	.0019	.0107	.0036	.0010	-.0015
3984.	.0050	.0102	-.0008	-.0120	-.0094	.0022	.0127	.0044	.0012	-.0020
4570.	.0060	.0117	-.0007	-.0130	-.0112	.0021	.0142	.0044	.0008	-.0032
5038.	.0050	.0125	-.0012	-.0150	-.0115	.0021	.0157	.0051	.0009	-.0036
5508.	.0060	.0138	-.0015	-.0160	-.0145	.0020	.0173	.0057	.0010	-.0044
6094.	.0080	.0156	-.0014	-.0180	-.0168	.0017	.0190	.0064	.0010	-.0054
6556.	.0090	.0168	-.0014	-.0190	-.0185	.0017	.0207	.0071	.0011	-.0061
7031.	.0100	.0179	-.0014	-.0200	-.0198	.0019	.0223	.0079	.0011	-.0071
7610.	.0120	.0194	-.0014	-.0210	-.0222	.0017	.0242	.0095	.0012	-.0084
8084.	.0140	.0203	-.0015	-.0220	-.0237	.0016	.0255	.0104	.0011	-.0093
8555.	.0160	.0215	-.0016	-.0240	-.0244	.0018	.0275	.0116	.0010	-.0108
9078.	.0180	.0215	-.0031	-.0270	-.0278	.0018	.0294	.0225	.0008	-.0119
9492.	.0210	.0225	-.0036	-.0290	-.0285	.0019	.0316	.0235	.0005	-.0134
10254.	.0235	.0255	-.0036	-.0320	-.0341	.0019	.0361	.0257	.0002	-.0156

TABLE E1 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23
0.	.0000	.0000	.0000
586.	-.0010	-.0010	-.0009
1055.	-.0020	-.0025	-.0021
1523.	-.0030	-.0035	-.0030
2109.	-.0050	-.0050	-.0045
2577.	-.0050	-.0070	-.0058
3047.	-.0050	-.0080	-.0075
3453.	-.0050	-.0090	-.0089
3984.	-.0120	-.0120	-.0111
4570.	-.0120	-.0140	-.0129
5038.	-.0120	-.0170	-.0148
5508.	-.0120	-.0190	-.0169
6094.	-.0220	-.0220	-.0192
6556.	-.0240	-.0240	-.0211
7031.	-.0240	-.0270	-.0232
7610.	-.0240	-.0310	-.0261
8084.	-.0330	-.0350	-.0280
8555.	-.0340	-.0370	-.0305
9078.	-.0340	-.0400	-.0329
9492.	-.0370	-.0440	-.0352
10254.	-.0430	-.0490	-.0390

TABLE E1 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0120	-.0045	.0030	-.0110	-.0030	.0020	-.0040	.0015	-.0030	-.0017
1523.	-.0160	-.0057	.0040	-.0140	-.0040	.0030	-.0060	.0025	-.0040	-.0018
1992.	-.0210	-.0072	.0060	-.0180	-.0050	.0050	-.0080	.0035	-.0050	-.0020
2461.	-.0250	-.0081	.0080	-.0220	-.0060	.0070	-.0090	.0045	-.0060	-.0021
3047.	-.0290	-.0093	.0100	-.0244	-.0070	.0090	-.0100	.0065	-.0080	-.0021
3516.	-.0340	-.0103	.0110	-.0300	-.0080	.0100	-.0110	.0075	-.0100	-.0022
3984.	-.0380	-.0110	.0140	-.0340	-.0080	.0130	-.0120	.0095	-.0110	-.0022
4570.	-.0430	-.0113	.0170	-.0380	-.0090	.0150	-.0140	.0115	-.0130	-.0022
5039.	-.0480	-.0126	.0190	-.0430	-.0100	.0170	-.0150	.0135	-.0150	-.0022
5508.	-.0540	-.0144	.0210	-.0480	-.0120	.0190	-.0170	.0145	-.0170	-.0023
6108.	-.0620	-.0161	.0260	-.0530	-.0120	.0230	-.0190	.0175	-.0190	-.0027
6563.	-.0670	-.0176	.0280	-.0580	-.0140	.0250	-.0210	.0195	-.0220	-.0027
7032.	-.0720	-.0187	.0310	-.0620	-.0140	.0280	-.0220	.0205	-.0230	-.0027
7605.	-.0850	-.0206	.0350	-.0680	-.0150	.0310	-.0240	.0225	-.0270	-.0027
8086.	-.0880	-.0222	.0400	-.0750	-.0170	.0350	-.0260	.0255	-.0290	-.0028
8613.	-.0940	-.0234	.0440	-.0800	-.0170	.0390	-.0280	.0275	-.0320	-.0032
9082.	-.1020	-.0246	.0490	-.0860	-.0180	.0430	-.0300	.0305	-.0331	-.0038
9492.	-.1100	-.0258	.0540	-.0920	-.0190	.0480	-.0310	.0335	-.0370	-.0044
9961.	-.1210	-.0272	.0620	-.1010	-.0190	.0550	-.0330	.0395	-.0410	-.0048
10723.	-.1360	-.0284	.0750	-.1120	-.0200	.0660	-.0350	.0455	-.0460	-.0057
11074.	-.1470	-.0296	.0840	-.1200	-.0210	.0740	-.0370	.0515	-.0500	-.0065
11484.	-.1630	-.0308	.0970	-.1310	-.0220	.0850	-.0390	.0595	-.0550	-.0078
12070.	-.1940	-.0343	.1210	-.1520	-.0240	.1050	-.0450	.0735	-.0660	-.0101
12773.	-.2160	-.0370	.1400	-.1690	-.0260	.1220	-.0530	.0805	-.0760	-.0110

TABLE E2 DEFLECTION DATA FOR THE W4X13 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	.0020	-.0020	-.0016	-.0009	-.0005	.0023	.0050	.0010	.0015	.0010
1523.	.0020	-.0020	-.0018	-.0014	-.0015	.0023	.0060	.0020	.0017	.0010
1992.	.0040	-.0019	-.0018	-.0017	-.0035	.0020	.0080	.0010	.0015	.0010
2461.	.0050	-.0018	-.0018	-.0017	-.0055	.0020	.0090	.0010	.0015	.0020
3047.	.0070	-.0018	-.0020	-.0017	-.0085	.0020	.0100	.0010	.0013	.0020
3516.	.0080	-.0018	-.0021	-.0019	-.0105	.0022	.0110	.0000	.0011	.0020
3984.	.0100	-.0017	-.0021	-.0021	-.0125	.0023	.0130	.0000	.0012	.0020
4570.	.0120	-.0016	-.0021	-.0024	-.0145	.0023	.0150	-.0010	.0012	.0030
5039.	.0130	-.0015	-.0021	-.0027	-.0165	.0025	.0190	-.0020	.0012	.0030
5508.	.0150	-.0014	-.0021	-.0027	-.0185	.0025	.0200	-.0020	.0014	.0030
6108.	.0160	-.0015	-.0021	-.0028	-.0205	.0024	.0240	-.0030	.0022	.0050
6563.	.0180	-.0016	-.0024	-.0031	-.0215	.0024	.0270	-.0030	.0024	.0060
7032.	.0190	-.0017	-.0025	-.0033	-.0235	.0023	.0290	-.0030	-.0046	.0070
7605.	.0210	-.0017	-.0026	-.0036	-.0265	.0022	.0330	-.0040	-.0046	.0080
8086.	.0240	-.0017	-.0027	-.0039	-.0305	.0020	.0370	-.0040	-.0046	.0080
8613.	.0260	-.0016	-.0028	-.0043	-.0325	.0019	.0400	-.0050	-.0046	.0080
9082.	.0280	-.0013	-.0029	-.0044	-.0365	.0019	.0430	-.0050	-.0046	.0090
9492.	.0300	-.0009	-.0030	-.0048	-.0395	.0019	.0470	-.0050	-.0046	.0100
9961.	.0320	-.0001	-.0033	-.0057	-.0455	.0019	.0510	-.0060	-.0046	.0110
10723.	.0350	.0010	-.0033	-.0065	-.0515	.0015	.0580	-.0050	.0023	.0110
11074.	.0380	.0023	-.0028	-.0068	-.0565	.0008	.0630	-.0050	.0020	.0110
11484.	.0410	.0036	-.0022	-.0072	-.0635	-.0001	.0680	-.0050	.0017	.0110
12070.	.0480	.0077	-.0013	-.0078	-.0785	-.0016	.0800	-.0040	.0008	.0120
12773.	.0560	.0146	-.0003	-.0116	-.0885	-.0016	.0880	-.0050	.0001	.0140

TABLE E2 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0002	-.0016	.0003	.0060	.0031	.0010	-.0110	-.0100	-.0090	-.0072
1523.	.0000	-.0013	.0007	.0070	.0028	.0000	-.0140	-.0130	-.0120	-.0096
1992.	.0000	-.0015	.0007	.0080	.0030	.0000	-.0190	-.0170	-.0160	-.0126
2461.	.0000	-.0017	.0007	.0080	.0030	-.0010	-.0220	-.0200	-.0190	-.0148
3047.	.0000	-.0020	.0009	.0080	.0030	-.0020	-.0260	-.0240	-.0240	-.0180
3516.	.0000	-.0021	.0003	.0070	.0030	.0000	-.0290	-.0280	-.0260	-.0201
3984.	.0000	-.0021	.0001	.0070	.0029	.0000	-.0330	-.0310	-.0300	-.0224
4570.	.0001	-.0022	-.0002	.0070	.0028	.0000	-.0370	-.0350	-.0330	-.0252
5039.	.0002	-.0021	-.0003	.0070	.0026	.0000	-.0410	-.0390	-.0370	-.0278
5508.	.0001	-.0017	.0002	.0070	.0023	.0000	-.0460	-.0430	-.0400	-.0303
6108.	.0002	-.0015	-.0002	.0090	.0020	.0000	-.0520	-.0480	-.0450	-.0338
6563.	.0004	-.0010	-.0007	.0080	.0021	.0000	-.0560	-.0510	-.0490	-.0364
7032.	.0003	-.0008	-.0009	.0080	.0023	.0000	-.0600	-.0540	-.0520	-.0387
7605.	.0004	-.0001	-.0010	.0090	.0029	.0000	-.0650	-.0590	-.0560	-.0417
8086.	.0003	.0001	-.0011	.0090	.0030	.0000	-.0700	-.0630	-.0600	-.0447
8613.	.0002	.0007	-.0013	.0100	.0030	.0000	-.0730	-.0670	-.0630	-.0471
9082.	.0001	.0008	-.0014	.0100	.0031	.0020	-.0780	-.0710	-.0670	-.0497
9492.	.0001	.0008	-.0019	.0100	.0037	.0030	-.0820	-.0750	-.0700	-.0520
9961.	.0002	.0009	-.0024	.0100	.0040	.0030	-.0870	-.0800	-.0740	-.0554
10723.	.0002	.0009	-.0031	.0100	.0040	.0040	-.0940	-.0860	-.0790	-.0589
11074.	.0002	.0006	-.0036	.0090	.0040	.0050	-.0980	-.0900	-.0830	-.0613
11484.	.0002	-.0002	-.0040	.0090	.0049	.0070	-.1050	-.0950	-.0880	-.0649
12070.	.0000	-.0012	-.0050	.0090	.0054	.0090	-.1170	-.1070	-.0970	-.0707
12773.	-.0005	-.0031	-.0050	.0080	.0060	.0110	-.1270	-.1150	-.1030	-.0744

TABLE E2 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
582.	-.0040	-.0008	.0020	-.0040	-.0010	.0020	.0000	.0020	-.0010	.0004
1055.	-.0070	-.0007	.0060	-.0060	-.0010	.0050	.0000	.0040	-.0020	.0041
1496.	-.0090	-.0007	.0080	-.0080	-.0010	.0080	.0000	.0060	-.0010	.0036
1992.	-.0140	-.0011	.0110	-.0110	-.0010	.0100	.0000	.0090	-.0030	.0036
2461.	-.0180	-.0017	.0140	-.0150	-.0010	.0140	-.0010	.0110	-.0060	.0035
2997.	-.0240	-.0027	.0180	-.0190	-.0020	.0160	-.0020	.0140	-.0090	.0035
3516.	-.0290	-.0031	.0230	-.0230	-.0020	.0190	-.0020	.0170	-.0110	.0036
3984.	-.0360	-.0038	.0280	-.0280	-.0020	.0220	-.0020	.0200	-.0140	.0036
4570.	-.0430	-.0048	.0330	-.0340	-.0030	.0270	-.0030	.0240	-.0180	.0038
5039.	-.0500	-.0056	.0390	-.0390	-.0040	.0300	-.0040	.0280	-.0200	.0039
5508.	-.0600	-.0065	.0470	-.0460	-.0040	.0360	-.0040	.0300	-.0240	.0040
5959.	-.0660	-.0070	.0530	-.0500	-.0040	.0400	-.0040	.0360	-.0270	.0039
6444.	-.0780	-.0071	.0620	-.0570	-.0050	.0470	-.0050	.0430	-.0300	.0041
7207.	-.0950	-.0073	.0790	-.0700	-.0050	.0590	-.0049	.0540	-.0360	.0041
7557.	-.1080	-.0075	.0910	-.0790	-.0050	.0680	-.0050	.0620	-.0380	.0044
8221.	-.1310	-.0085	.1130	-.0940	-.0060	.0850	-.0060	.0760	-.0430	.0044
9006.	-.1650	-.0086	.1490	-.1170	-.0060	.1090	-.0060	.0970	-.0500	.0038
9844.	-.2220	-.0102	.1980	-.1500	-.0070	.1430	-.0080	.1270	-.0560	.0048

TABLE E3 DEFLECTION DATA FOR THE W5X16 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
582.	.0030	.0002	.0020	.0020	-.0020	.0001	.0010	.0000	-.0003	-.0010
1055.	.0100	.0039	.0051	.0050	-.0050	-.0019	.0020	-.0020	-.0015	-.0020
1496.	.0100	.0038	.0037	.0040	-.0090	-.0038	.0020	-.0040	-.0035	-.0030
1992.	.0120	.0038	.0036	.0040	-.0120	-.0038	.0020	-.0040	-.0035	-.0030
2461.	.0140	.0039	.0039	.0040	-.0140	-.0037	.0080	-.0050	-.0035	-.0020
2997.	.0170	.0039	.0041	.0050	-.0170	-.0036	.0110	-.0060	-.0035	-.0010
3516.	.0190	.0037	.0042	.0060	-.0190	-.0036	.0140	-.0070	-.0034	-.0010
3984.	.0220	.0033	.0042	.0060	-.0220	-.0036	.0170	-.0080	-.0034	.0000
4570.	.0260	.0029	.0044	.0070	-.0250	-.0036	.0200	-.0090	-.0035	.0010
5039.	.0290	.0026	.0044	.0070	-.0300	-.0041	.0230	-.0090	-.0035	.0010
5508.	.0320	.0023	.0044	.0070	-.0320	-.0041	.0270	-.0100	-.0035	.0020
5959.	.0350	.0022	.0044	.0070	-.0320	-.0041	.0290	-.0110	-.0035	.0020
6444.	.0440	.0013	.0044	.0080	-.0390	-.0041	.0330	-.0110	-.0035	.0030
7207.	.0440	.7231	.0044	.0080	-.0430	-.0041	.0380	-.0120	-.0035	.0030
7557.	.0470	.0010	.0044	.0080	-.0450	-.0053	.0400	-.0130	-.0035	.0030
8221.	.0520	.0003	.0044	.0090	-.0450	-.0021	.0430	-.0130	-.0037	.0040
9006.	.0580	.0001	.0045	.0090	-.0620	-.0001	.0480	-.0140	-.0039	.0040
9844.	.0670	.0029	.0076	.0130	-.0780	-.0154	.0500	-.0200	-.0078	.0020

TABLE E3 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
582.	.0020	.0026	.0030	.0000	-.0028	-.0030	-.0025	-.0021	-.0024	-.0023
1055.	.0040	.0052	.0060	.0000	-.0056	-.0060	-.0045	-.0034	-.0035	-.0033
1496.	.0040	.0046	.0060	.0000	-.0057	-.0040	-.0060	-.0045	-.0043	-.0033
1992.	.0040	.0046	.0060	.0000	-.0039	-.0040	-.0085	-.0067	-.0065	-.0054
2461.	.0030	.0037	.0050	.0000	-.0041	-.0030	-.0105	-.0083	-.0078	-.0063
2997.	.0020	.0037	.0060	.0000	-.0038	-.0030	-.0133	-.0105	-.0098	-.0083
3516.	.0020	.0037	.0060	.0000	-.0039	-.0030	-.0156	-.0124	-.0115	-.0100
3984.	.0010	.0037	.0070	.0000	-.0039	-.0030	-.0183	-.0145	-.0134	-.0108
4570.	.0010	.0039	.0070	.0000	-.0041	-.0030	-.0215	-.0170	-.0156	-.0123
5039.	.0000	.0037	.0080	.0000	-.0041	-.0030	-.0244	-.0193	-.0175	-.0135
5508.	.0000	.0040	.0080	.0000	-.0042	-.0020	-.0278	-.0218	-.0197	-.0154
5959.	.0000	.0041	.0090	.0000	-.0045	-.0020	-.0295	-.0249	-.0207	-.0163
6444.	.0000	.0047	.0100	.0000	-.0046	-.0020	-.0329	-.0254	-.0229	-.0179
7207.	.0000	.0060	.0120	.0000	-.0058	-.0030	-.0377	-.0286	-.0258	-.0200
7557.	.0020	.0045	.0170	-.0230	.6581	-.0080	-.0408	-.0310	-.0276	-.0213
8221.	.0040	.0119	.0190	-.0260	-.0085	-.0050	-.0457	-.0336	-.0300	-.0234
9006.	.0060	.0147	.0240	-.0290	-.0119	-.0080	-.0520	-.0380	-.0339	-.0262
9844.	.0100	.0045	.0300	-.0360	-.0175	-.0130	-.0632	-.0449	-.0402	-.0310

TABLE E3 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1050.	-.0150	-.0049	.0040	-.0140	-.0080	.0010	-.0020	.0050	-.0110	.0001
1523.	-.0210	-.0059	.0080	-.0190	-.0090	.0040	-.0030	.0080	-.0150	.0001
1992.	-.0270	-.0069	.0120	-.0240	-.0100	.0070	-.0040	.0110	-.0180	.0001
2461.	-.0330	-.0075	.0160	-.0290	-.0100	.0100	-.0050	.0140	-.0210	.0001
3047.	-.0400	-.0080	.0220	-.0330	-.0110	.0140	-.0050	.0190	-.0260	.0001
3509.	-.0460	-.0087	.0270	-.0370	-.0110	.0170	-.0050	.0230	-.0290	.0001
3984.	-.0560	-.0098	.0340	-.0440	-.0110	.0220	-.0060	.0280	-.0340	.0001
4453.	-.0640	-.0108	.0400	-.0500	-.0120	.0260	-.0070	.0330	-.0380	.0001
5036.	-.0730	-.0114	.0490	-.0570	-.0120	.0320	-.0080	.0390	-.0430	.0001
5508.	-.0830	-.0120	.0570	-.0630	-.0130	.0380	-.0090	.0450	-.0480	-.0002
5918.	-.0920	-.0124	.0660	-.0690	-.0130	.0440	-.0100	.0510	-.0520	-.0005
6563.	-.1100	-.0127	.0820	-.0810	-.0130	.0550	-.0100	.0620	-.0600	-.0013
7031.	-.1230	-.0128	.0960	-.0900	-.0140	.0630	-.0110	.0710	-.0660	-.0020
7617.	-.1450	-.0127	.1230	-.1040	-.0140	.0780	-.0110	.0860	-.0750	-.0031
7969.	-.1580	-.0122	.1320	-.1120	-.0140	.0870	-.0110	.0940	-.0800	-.0039

TABLE E4 DEFLECTION DATA FOR THE W5X16 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1050.	.0120	-.0044	-.0001	-.0057	.0000	.0000	.0000	.0030	-.0009	-.0060
1523.	.0160	-.0045	.0001	-.0052	-.0030	.0000	.0030	.0030	-.0008	-.0060
1992.	.0190	-.0048	.0001	-.0049	-.0060	.0000	.0070	.0030	-.0009	-.0050
2461.	.0220	-.0048	.0005	-.0043	-.0100	.0000	.0100	.0030	-.0009	-.0050
3047.	.0260	-.0051	.0005	-.0037	-.0140	.0000	.0150	.0030	-.0009	-.0050
3509.	.0290	-.0054	.0005	-.0034	-.0170	.0000	.0190	.0020	-.0009	-.0040
3984.	.0340	-.0058	.0005	-.0029	-.0170	.0000	.0240	.0010	-.0009	-.0030
4453.	.0380	-.0062	.0007	-.0021	-.0260	.0000	.0280	.0000	-.0011	-.0030
5036.	.0430	-.0066	.0007	-.0018	-.0310	.0000	.0320	.0000	-.0012	-.0030
5508.	.0480	-.0069	.0007	-.0014	-.0360	.0000	.0370	.0000	-.0012	-.0020
5918.	.0510	-.0070	.0007	-.0012	-.0410	.0000	.0410	.0000	-.0014	-.0020
6563.	.0570	-.0069	.0008	-.0012	-.0470	.0000	.0470	.0000	-.0015	-.0020
7031.	.0620	-.0067	.0008	-.0010	-.0520	.0000	.0510	.0000	-.0015	-.0020
7617.	.0690	-.0058	.0008	-.0011	-.0600	-.0010	.0580	.0010	-.0016	-.0030
7969.	.0720	-.0051	.0007	-.0011	-.0640	-.0010	.0610	.0020	-.0015	-.0030

TABLE E4 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1050.	.0013	.0000	.0094	.0090	-.0002	-.0100	-.0120	-.0110	-.0104	-.0095
1523.	.0012	.0003	.0095	.0080	-.0002	-.0110	-.0160	-.0140	-.0130	-.0112
1992.	.0012	.0000	.0094	.0080	-.0002	-.0100	-.0200	-.0180	-.0160	-.0135
2461.	.0012	.0000	.0096	.0080	-.0002	-.0100	-.0230	-.0200	-.0184	-.0155
3047.	-.0090	-.0001	.0094	.0080	.0008	-.0090	-.0270	-.0240	-.0212	-.0175
3509.	-.0092	-.0001	.0094	.0070	.0008	-.0080	-.0300	-.0270	-.0236	-.0195
3984.	-.0093	-.0002	.0094	.0070	.0008	-.0070	-.0350	-.0300	-.0267	-.0215
4453.	-.0094	-.0002	.0094	.0060	.0007	-.0070	-.0390	-.0340	-.0297	-.0237
5036.	-.0097	-.0002	.0095	.0050	.0008	-.0060	-.0430	-.0380	-.0325	-.0257
5508.	-.0099	-.0002	.0096	.0050	.0008	-.0050	-.0470	-.0420	-.0355	-.0279
5918.	-.0103	-.0003	.0098	.0050	.0008	-.0050	-.0505	-.0440	-.0378	-.0295
6563.	-.0114	-.0007	.0097	.0050	.0016	-.0030	-.0517	-.0490	-.0420	-.0324
7031.	-.0118	-.0009	.0095	.0040	.0018	-.0020	-.0522	-.0530	-.0450	-.0345
7617.	-.0129	-.0013	.0095	.0040	.0023	.0000	-.0527	-.0580	-.0489	-.0370
7969.	-.0131	-.0019	.0095	.0040	.0027	.0010	-.0531	-.0610	-.0516	-.0389

TABLE E4 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
952.	-.0030	.0003	.0030	-.0020	.0010	.0015	.0000	.0030	.0000	.0023
1523.	-.0050	-.0004	.0040	-.0040	.0000	.0024	.0000	.0030	-.0010	.0028
1992.	-.0070	.0000	.0060	-.0050	.0000	.0038	.0000	.0050	-.0010	.0029
2461.	-.0080	.0000	.0070	-.0060	.0000	.0047	.0000	.0050	-.0020	.0029
3047.	-.0110	-.0005	.0080	-.0090	-.0010	.0047	.0000	.0060	-.0030	.0030
3507.	-.0130	-.0010	.0090	-.0110	-.0010	.0047	.0000	.0070	-.0030	.0030
4102.	-.0160	-.0011	.0100	-.0140	-.0030	.0047	.0000	.0080	-.0040	.0030
4570.	-.0170	-.0011	.0130	-.0130	.0010	.0094	.0000	.0100	-.0050	.0030
4978.	-.0190	-.0010	.0140	-.0140	.0010	.0105	.0000	.0110	-.0060	.0030
5508.	-.0210	-.0010	.0160	-.0160	.0010	.0120	.0000	.0130	-.0070	.0037
5977.	-.0230	-.0010	.0180	-.0180	.0010	.0134	.0000	.0140	-.0070	.0037
6548.	-.0270	-.0012	.0200	-.0210	.0010	.0152	.0000	.0160	-.0090	.0039
7031.	-.0290	-.0012	.0210	-.0230	.0010	.0166	.0000	.0180	-.0100	.0039
7673.	-.0330	-.0015	.0240	-.0250	.0010	.0187	.0000	.0190	-.0120	.0039
8086.	-.0360	-.0016	.0260	-.0270	.0010	.0201	.0000	.0210	-.0140	.0040
8555.	-.0380	-.0016	.0280	-.0300	.0000	.0216	.0000	.0230	-.0160	.0040
9023.	-.0430	-.0027	.0300	-.0330	-.0030	.0217	.0000	.0240	-.0170	.0040
9492.	-.0460	-.0028	.0330	-.0360	-.0020	.0241	.0000	.0260	-.0190	.0040
10137.	-.0510	-.0028	.0360	-.0390	-.0020	.0272	.0000	.0290	-.0200	.0040
10608.	-.0560	-.0029	.0400	-.0420	-.0010	.0295	.0000	.0310	-.0220	.0040
11017.	-.0590	-.0028	.0430	-.0440	-.0020	.0317	.0000	.0340	-.0240	.0040
11719.	-.0710	-.0027	.0520	-.0520	-.0020	.0383	.0000	.0380	-.0290	.0040
12070.	-.0820	-.0022	.0610	-.0590	-.0030	.0444	.0000	.0470	-.0300	.0040
12718.	-.0880	-.0018	.0670	-.0630	-.0030	.0488	.0000	.0490	-.0320	.0040
13418.	-.1020	-.0007	.0810	-.0720	-.0020	.0578	.0000	.0610	-.0360	.0040
14238.	-.1230	.0007	.1000	-.0860	-.0020	.0708	.0000	.0720	-.0420	.0040

TABLE E5 DEFLECTION DATA FOR THE M5X18.9 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
952.	.0030	.0020	.0016	.0007	-.0040	-.0018	.0000	-.0020	-.0018	-.0010
1523.	.0060	.0020	.0018	.0017	-.0040	-.0021	.0000	-.0020	-.0019	-.0010
1992.	.0060	.0020	.0018	.0015	-.0040	-.0020	.0020	-.0020	-.0019	-.0010
2461.	.0070	.0020	.0018	.0015	-.0040	-.0020	.0020	-.0020	-.0018	-.0010
3047.	.0080	.0020	.0018	.0013	-.0050	-.0022	.0040	-.0030	-.0020	-.0010
3507.	.0090	.0030	.0019	.0011	-.0060	-.0022	.0050	-.0030	-.0021	-.0010
4102.	.0090	.0030	.0019	.0007	-.0070	-.0022	.0060	-.0040	-.0023	.0000
4570.	.0100	.0030	.0019	.0007	-.0090	-.0022	.0070	-.0040	-.0025	.0000
4978.	.0110	.0030	.0019	.0007	-.0100	-.0024	.0080	-.0040	-.0027	.0000
5508.	.0130	.0030	.0019	.0007	-.0110	-.0024	.0090	-.0040	-.0033	.0000
5977.	.0140	.0030	.0019	.0007	-.0120	-.0024	.0100	-.0050	-.0034	.0000
6548.	.0150	.0030	.0019	.0007	-.0140	-.0025	.0110	-.0050	-.0039	.0000
7031.	.0160	.0030	.0019	.0007	-.0150	-.0025	.0120	-.0050	-.0041	.0000
7673.	.0180	.0030	.0019	.0009	-.0160	-.0026	.0130	-.0050	-.0043	.0000
8086.	.0200	.0030	.0020	.0013	-.0170	-.0027	.0130	-.0050	-.0046	-.0010
8555.	.0210	.0030	.0021	.0017	-.0180	-.0029	.0140	-.0050	-.0049	-.0010
9023.	.0230	.0030	.0023	.0019	-.0190	-.0030	.0150	-.0050	-.0049	-.0010
9492.	.0250	.0030	.0024	.0019	-.0230	-.0029	.0170	-.0050	-.0049	-.0010
10137.	.0260	.0030	.0024	.0017	-.0250	-.0029	.0180	-.0060	-.0049	-.0010
10608.	.0280	.0040	.0024	.0015	-.0270	-.0029	.0200	-.0060	-.0049	-.0010
11017.	.0290	.0040	.0024	.0012	-.0290	-.0029	.0210	-.0060	-.0049	-.0010
11719.	.0360	.0070	.0024	-.0002	-.0310	-.0029	.0240	-.0060	-.0049	-.0010
12070.	.0360	.0060	.0024	-.0001	-.0350	-.0029	.0280	-.0070	-.0049	.0000
12718.	.0380	.0070	.0024	-.0007	-.0370	-.0029	.0300	-.0070	-.0049	.0000
13418.	.0410	.0080	.0024	-.0012	-.0420	-.0030	.0340	-.0070	-.0049	.0000
14238.	.0460	.0090	.0024	-.0022	-.0460	-.0029	.0390	-.0070	-.0049	.0010

TABLE E5 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
952.	.0030	.0026	.0020	.0790	-.0026	-.0020	-.0020	-.0017	-.0013	-.0010
1523.	.0030	.0035	.0040	.0790	-.0032	-.0040	-.0040	-.0037	-.0030	-.0022
1992.	.0030	.0035	.0040	.0790	-.0032	-.0040	-.0040	-.0040	-.0033	-.0024
2461.	.0030	.0037	.0040	.0790	-.0032	-.0040	-.0050	-.0048	-.0041	-.0030
3047.	.0030	.0040	.0040	.0790	-.0032	-.0040	-.0070	-.0055	-.0059	-.0047
3507.	.0030	.0040	.0040	.0790	-.0032	-.0040	-.0080	-.0077	-.0068	-.0050
4102.	.0030	.0041	.0040	.0780	-.0032	-.0040	-.0100	-.0095	-.0086	-.0065
4570.	.0030	.0041	.0050	.0780	-.0032	-.0040	-.0110	-.0104	-.0096	-.0077
4978.	.0030	.0041	.0050	.0780	-.0032	-.0040	-.0120	-.0109	-.0102	-.0080
5508.	.0020	.0037	.0050	.0780	-.0030	-.0040	-.0140	-.0120	-.0114	-.0090
5977.	.0020	.0037	.0050	.0790	-.0030	-.0040	-.0150	-.0131	-.0126	-.0102
6548.	.0010	.0037	.0050	.0790	-.0030	-.0050	-.0160	-.0148	-.0144	-.0120
7031.	.0010	.0037	.0060	.0790	-.0030	-.0050	-.0180	-.0159	-.0154	-.0126
7673.	.0000	.0037	.0060	.0790	-.0026	-.0060	-.0180	-.0178	-.0174	-.0144
8086.	.0000	.0037	.0070	.0790	-.0023	-.0060	-.0210	-.0189	-.0185	-.0158
8555.	-.0010	.0036	.0070	.0790	-.0015	-.0050	-.0230	-.0189	-.0201	-.0170
9023.	-.0020	.0029	.0070	.0790	-.0008	-.0050	-.0260	-.0235	-.0226	-.0190
9492.	-.0020	.0029	.0080	.0790	-.0008	-.0050	-.0270	-.0249	-.0238	-.0200
10137.	-.0020	.0028	.0080	.0790	-.0007	-.0050	-.0300	-.0271	-.0257	-.0214
10608.	-.0020	.0028	.0090	.0790	-.0006	-.0050	-.0320	-.0285	-.0271	-.0224
11017.	-.0020	.0028	.0090	.0790	-.0004	-.0040	-.0330	-.0290	-.0279	-.0225
11719.	-.0030	.0014	.0080	.0790	.0005	-.0020	-.0370	-.0337	-.0316	-.0256
12070.	-.0040	.0010	.0070	.0790	.0012	.0000	-.0410	-.0370	-.0341	-.0276
12718.	-.0040	.0009	.0070	.0790	.0014	.0000	-.0430	-.0381	-.0350	-.0278
13418.	-.0060	-.0014	.0050	.0800	.0053	.0050	-.0470	-.0416	-.0377	-.0305
14238.	-.0060	-.0014	.0050	.0800	.0053	.0060	-.0520	-.0457	-.0410	-.0324

TABLE E5 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0080	-.0010	.0050	-.0070	-.0040	.0020	.0020	.0050	-.0060	.0013
1523.	-.0110	-.0020	.0060	-.0100	-.0060	.0030	.0020	.0070	-.0090	.0011
1992.	-.0150	-.0031	.0075	-.0140	-.0070	.0040	.0010	.0080	-.0140	.0009
2461.	-.0200	-.0045	.0090	-.0180	-.0090	.0040	.0000	.0080	-.0150	.0008
3043.	-.0250	-.0060	.0110	-.0240	-.0120	.0050	.0000	.0100	-.0190	.0006
3516.	-.0290	-.0070	.0130	-.0270	-.0130	.0060	-.0020	.0120	-.0210	.0003
3984.	-.0330	-.0077	.0150	-.0300	-.0130	.0080	-.0030	.0140	-.0230	.0003
4570.	-.0360	-.0081	.0170	-.0330	-.0140	.0110	-.0040	.0160	-.0240	.0003
5039.	-.0410	-.0090	.0200	-.0360	-.0140	.0130	-.0040	.0170	-.0260	.0003
5470.	-.0440	-.0101	.0220	-.0390	-.0150	.0140	-.0050	.0180	-.0280	.0003
5977.	-.0490	-.0108	.0250	-.0430	-.0150	.0170	-.0060	.0200	-.0310	.0003
6563.	-.0550	-.0120	.0280	-.0470	-.0160	.0190	-.0070	.0230	-.0330	.0003
7031.	-.0600	-.0129	.0310	-.0510	-.0160	.0210	-.0080	.0240	-.0350	.0003
7617.	-.0660	-.0140	.0350	-.0560	-.0170	.0240	-.0100	.0260	-.0370	.0003
8086.	-.0700	-.0140	.0380	-.0600	-.0170	.0260	-.0110	.0280	-.0390	.0000
8578.	-.0770	-.0147	.0420	-.0650	-.0180	.0300	-.0110	.0300	-.0420	-.0003
9023.	-.0810	-.0153	.0450	-.0670	-.0180	.0320	-.0130	.0320	-.0440	-.0007
9466.	-.0880	-.0162	.0500	-.0730	-.0190	.0360	-.0140	.0350	-.0470	-.0010
9961.	-.0950	-.0170	.0550	-.0770	-.0190	.0390	-.0170	.0370	-.0500	-.0011
10547.	-.1020	-.0177	.0600	-.0830	-.0200	.0430	-.0170	.0400	-.0530	-.0014
11016.	-.1080	-.0183	.0650	-.0880	-.0200	.0470	-.0180	.0430	-.0570	-.0019
11484.	-.1190	-.0196	.0720	-.0950	-.0210	.0520	-.0210	.0470	-.0610	-.0030
12070.	-.1340	-.0211	.0820	-.1060	-.0220	.0600	-.0230	.0520	-.0680	-.0041
12656.	-.1420	-.0226	.0930	-.1160	-.0220	.0680	-.0260	.0570	-.0750	-.0057

TABLE E6 DEFLECTION DATA FOR THE M5X18.9 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	.0090	-.0028	.0011	.0050	.0010	-.0027	-.0050	.0030	-.0025	-.0080
1523.	.0120	-.0038	.0010	.0060	.0010	-.0029	-.0060	.0040	-.0031	-.0100
1992.	.0150	-.0049	.0010	.0071	.0010	-.0030	-.0060	.0040	-.0033	-.0110
2461.	.0180	-.0061	.0010	.0082	.0000	-.0033	-.0070	.0060	-.0035	-.0130
3043.	.0210	-.0074	.0010	.0095	.0000	-.0035	-.0070	.0060	-.0038	-.0140
3516.	.0230	-.0076	.0011	.0103	-.0010	-.0037	-.0060	.0060	-.0039	-.0150
3984.	.0250	-.0075	.0013	.0107	-.0040	-.0043	-.0050	.0060	-.0046	-.0150
4570.	.0260	-.0073	.0013	.0106	-.0060	-.0050	-.0030	.0050	-.0053	-.0160
5039.	.0280	-.0072	.0014	.0105	-.0090	-.0050	-.0010	.0050	-.0053	-.0150
5470.	.0300	-.0072	.0014	.0106	-.0110	-.0050	.0000	.0040	-.0053	-.0150
5977.	.0320	-.0070	.0017	.0109	-.0130	-.0050	.0030	.0040	-.0057	-.0150
6563.	.0350	-.0069	.0019	.0110	-.0160	-.0050	.0050	.0030	-.0057	-.0150
7031.	.0370	-.0067	.0022	.0115	-.0190	-.0052	.0080	.0030	-.0055	-.0140
7617.	.0400	-.0064	.0025	.0118	-.0220	-.0052	.0110	.0030	-.0056	-.0140
8086.	.0420	-.0063	.0026	.0118	-.0240	-.0052	.0130	.0040	-.0056	-.0130
8578.	.0440	-.0061	.0027	.0118	-.0270	-.0051	.0160	.0020	-.0056	-.0130
9023.	.0460	-.0061	.0027	.0117	-.0290	-.0052	.0180	.0020	-.0054	-.0130
9466.	.0480	-.0059	.0027	.0117	-.0320	-.0054	.0200	.0020	-.0055	-.0120
9961.	.0510	-.0056	.0027	.0115	-.0350	-.0053	.0230	.0020	-.0054	-.0120
10547.	.0540	-.0051	.0027	.0112	-.0390	-.0057	.0260	.0020	-.0053	-.0120
11016.	.0570	-.0044	.0027	.0108	-.0430	-.0060	.0290	.0020	-.0054	-.0120
11484.	.0590	-.0038	.0027	.0104	-.0470	-.0061	.0330	.0020	-.0054	-.0120
12070.	.0640	-.0021	.0027	.0104	-.0530	-.0065	.0380	.0020	-.0054	-.0120
12656.	.0690	-.0002	.0028	.0090	-.0580	-.0061	.0440	.0030	-.0051	-.0120

TABLE E6 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0060	-.0075	.0010	.0060	-.0017	-.0100	-.0060	-.0070	-.0076	-.0076
1523.	-.0088	-.0076	.0030	.0090	-.0017	-.0130	-.0100	-.0100	-.0109	-.0108
1992.	-.0116	-.0077	.0050	.0120	-.0017	-.0150	-.0120	-.0130	-.0140	-.0138
2461.	-.0117	-.0078	.0080	.0140	-.0023	-.0180	-.0160	-.0170	-.0178	-.0174
3043.	-.0182	-.0082	.0110	.0180	-.0007	-.0210	-.0200	-.0210	-.0220	-.0213
3516.	-.0194	-.0084	.0120	.0190	-.0007	-.0220	-.0230	-.0240	-.0252	-.0237
3984.	-.0195	-.0084	.0120	.0190	-.0007	-.0230	-.0260	-.0260	-.0271	-.0252
4570.	-.0195	-.0084	.0120	.0190	-.0007	-.0230	-.0280	-.0280	-.0292	-.0272
5039.	-.0196	-.0084	.0120	.0190	-.0004	-.0220	-.0310	-.0310	-.0316	-.0291
5470.	-.0196	-.0084	.0120	.0190	-.0005	-.0220	-.0330	-.0330	-.0335	-.0307
5977.	-.0199	-.0084	.0120	.0190	-.0005	-.0220	-.0360	-.0360	-.0362	-.0332
6563.	-.0201	-.0085	.0120	.0190	-.0005	-.0210	-.0400	-.0380	-.0390	-.0353
7031.	-.0204	-.0085	.0120	.0190	-.0007	-.0210	-.0430	-.0410	-.0417	-.0384
7617.	-.0208	-.0088	.0110	.0190	-.0002	-.0210	-.0480	-.0440	-.0448	-.0399
8086.	-.0211	-.0091	.0110	.0190	.0000	-.0210	-.0500	-.0470	-.0466	-.0416
8578.	-.0214	-.0092	.0110	.0190	.0003	-.0200	-.0540	-.0500	-.0432	-.0441
9023.	-.0216	-.0094	.0110	.0190	.0003	-.0200	-.0560	-.0520	-.0514	-.0456
9466.	-.0218	-.0094	.0110	.0190	.0003	-.0200	-.0600	-.0550	-.0539	-.0479
9961.	-.0222	-.0095	.0120	.0190	.0003	-.0200	-.0630	-.0590	-.0568	-.0502
10547.	-.0224	-.0096	.0120	.0190	.0003	-.0200	-.0670	-.0620	-.0594	-.0522
11016.	-.0226	-.0096	.0110	.0190	.0003	-.0200	-.0700	-.0600	-.0621	-.0544
11484.	-.0237	-.0103	.0120	.0180	.0003	-.0200	-.0750	-.0690	-.0661	-.0576
12070.	-.0254	-.0115	.0120	.0180	.0003	-.0190	-.0810	-.0740	-.0706	-.0609
12656.	-.0267	-.0121	.0100	.0200	.0033	-.0150	-.0870	-.0800	-.0751	-.0639

TABLE E6 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0080	-.0003	.0070	-.0078	.0050	.0020	.0010	.0050	-.0040	.0031
1523.	-.0110	-.0018	.0090	-.0091	.0040	.0040	.0000	.0080	-.0050	.0031
1992.	-.0160	-.0010	.0130	-.0121	.0040	.0070	.0000	.0100	-.0070	.0031
2463.	-.0210	-.0030	.0170	-.0159	.0040	.0110	-.0010	.0120	-.0090	.0031
3047.	-.0260	-.0032	.0210	-.0186	.0040	.0130	-.0010	.0150	-.0110	.0026
3514.	-.0290	-.0032	.0250	-.0213	.0030	.0150	-.0010	.0170	-.0130	.0022
3984.	-.0350	-.0036	.0300	-.0243	.0030	.0190	-.0010	.0200	-.0150	.0018
4561.	-.0410	-.0040	.0360	-.0243	.0030	.0220	-.0010	.0220	-.0170	.0014
5036.	-.0480	-.0044	.0420	-.0221	.0030	.0250	-.0020	.0250	-.0190	.0011
5508.	-.0550	-.0042	.0500	-.0344	.0030	.0310	-.0020	.0300	-.0220	.0008
5977.	-.0640	-.0043	.0590	-.0411	.0030	.0350	-.0030	.0350	-.0240	.0006
6547.	-.0760	-.0039	.0700	-.0445	.0030	.0410	-.0030	.0410	-.0260	.0006
7031.	-.0870	-.0034	.0830	-.0537	.0020	.0490	-.0030	.0480	-.0290	-.0001
7617.	-.1050	-.0028	.1010	-.0625	.0020	.0600	-.0030	.0570	-.0310	-.0003
7969.	-.1200	-.0020	.1170	-.0699	.0020	.0680	-.0030	.0650	-.0330	-.0004
8580.	-.1490	-.0004	.1540	-.0840	.0020	.0860	-.0030	.0800	-.0360	-.0009
9023.	-.1820	.0007	.1820	-.1010	.0020	.1020	-.0030	.0980	-.0390	-.0017
9492.	-.2290	.0004	.2220	-.1215	.0020	.1220	-.0030	.1160	-.0430	-.0034

TABLE E7 DEFLECTION DATA FOR THE W6X25 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	.0120	-.0010	.0029	.0163	.0000	-.0015	-.0020	.0020	-.0017	-.0050
1523.	.0130	-.0020	.0028	.0165	-.0020	-.0015	-.0020	.0020	-.0019	-.0050
1992.	.0140	-.0020	.0028	.0165	-.0030	-.0015	.0000	.0020	-.0020	-.0050
2463.	.0160	-.0020	.0026	.0166	-.0050	-.0015	.0020	.0020	-.0020	-.0050
3047.	.0180	-.0030	.0022	.0166	-.0070	-.0014	.0040	.0010	-.0020	-.0050
3514.	.0190	-.0030	.0020	.0166	-.0080	-.0012	.0050	.0010	-.0020	-.0040
3984.	.0210	-.0040	.0017	.0166	-.0100	-.0012	.0070	.0020	-.0020	-.0030
4561.	.0210	-.0040	.0014	.0169	-.0120	-.0012	.0090	.0020	-.0024	-.0030
5036.	.0240	-.0050	.0010	.0170	-.0140	-.0006	.0110	.0010	-.0024	-.0030
5508.	.0260	-.0060	.0010	.0179	-.0140	-.0005	.0130	.0020	-.0024	-.0030
5977.	.0270	-.0060	.0013	.0186	-.0150	-.0005	.0150	.0020	-.0022	-.0030
6547.	.0290	-.0070	.0014	.0189	-.0180	-.0006	.0180	.0020	-.0021	-.0030
7031.	.0300	-.0070	.0014	.0189	-.0200	-.0006	.0200	.0030	-.0018	-.0030
7617.	.0320	-.0080	.0014	.0189	-.0230	-.0007	.0230	.0040	-.0014	-.0030
7969.	.0340	-.0080	.0014	.0189	-.0250	-.0010	.0250	.0040	-.0014	-.0040
8580.	.0370	-.0090	.0014	.0197	-.0280	-.0019	.0270	.0050	-.0014	-.0040
9023.	.0380	-.0110	.0013	.0199	-.0350	-.0029	.0290	.0050	-.0018	-.0050
9492.	.0390	-.0130	.0014	.0200	-.0390	-.0040	.0310	.0050	-.0022	-.0050

TABLE E7 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0050	.0014	.0080	.0040	-.0013	-.0070	-.0050	.0002	-.0040	-.0055
1523.	-.0050	.0014	.0090	.0040	-.0013	-.0060	-.0070	-.0002	-.0050	-.0061
1992.	-.0060	.0014	.0090	.0040	-.0009	-.0060	-.0100	-.0022	-.0063	-.0069
2463.	-.0060	.0014	.0090	.0040	-.0009	-.0050	-.0120	-.0046	-.0085	-.0085
3047.	-.0070	.0013	.0090	.0040	-.0009	-.0050	-.0140	-.0059	-.0096	-.0096
3514.	-.0080	.0010	.0090	.0030	-.0009	-.0040	-.0160	-.0072	-.0108	-.0106
3984.	-.0080	.0007	.0090	.0030	-.0009	-.0040	-.0190	-.0091	-.0124	-.0123
4561.	-.0080	.0006	.0090	.0020	-.0009	-.0030	-.0210	-.0106	-.0138	-.0135
5036.	-.0090	.0004	.0090	.0020	-.0009	-.0030	-.0240	-.0130	-.0158	-.0153
5508.	-.0090	.0004	.0090	.0020	-.0009	-.0020	-.0270	-.0146	-.0171	-.0166
5977.	-.0090	.0008	.0110	.0020	-.0009	-.0020	-.0300	-.0166	-.0188	-.0179
6547.	-.0100	.0007	.0110	.0010	-.0009	-.0010	-.0330	-.0183	-.0202	-.0193
7031.	-.0100	.0005	.0120	.0010	-.0009	-.0010	-.0360	-.0201	-.0221	-.0208
7617.	-.0110	.0004	.0120	.0000	-.0009	-.0010	-.0400	-.0222	-.0245	-.0224
7969.	-.0110	.0002	.0110	.0000	-.0009	.0000	-.0430	-.0235	-.0260	-.0233
8580.	-.0130	-.0001	.0120	.0000	-.0009	.0000	-.0470	-.0254	-.0276	-.0246
9023.	-.0130	-.0002	.0110	-.0010	-.0008	.0000	-.0510	-.0272	-.0295	-.0259
9492.	-.0150	-.0005	.0120	-.0010	-.0006	.0010	-.0570	-.0295	-.0316	-.0277

TABLE E7 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
938.	-.0090	-.0024	.0040	-.0080	-.0063	-.0010	.0020	.0050	-.0100	.0006
1523.	-.0140	-.0041	.0060	-.0130	-.0091	-.0010	.0008	.0060	-.0140	.0004
1992.	-.0190	-.0052	.0080	-.0170	-.0110	.0000	.0008	.0080	-.0180	.0003
2461.	-.0240	-.0069	.0100	-.0220	-.0138	.0000	.0004	.0100	-.0220	.0003
3047.	-.0300	-.0085	.0120	-.0280	-.0165	.0020	-.0004	.0120	-.0270	.0002
3516.	-.0350	-.0096	.0140	-.0320	-.0185	.0030	-.0004	.0130	-.0300	.0004
3984.	-.0420	-.0114	.0170	-.0380	-.0209	.0050	-.0008	.0160	-.0340	.0008
4570.	-.0480	-.0129	.0210	-.0430	-.0228	.0070	-.0012	.0180	-.0380	.0009
5039.	-.0550	-.0140	.0240	-.0480	-.0248	.0090	-.0020	.0200	-.0410	.0011
5508.	-.0600	-.0143	.0270	-.0520	-.0248	.0120	-.0020	.0225	-.0430	.0016
6035.	-.0670	-.0152	.0320	-.0570	-.0252	.0150	-.0031	.0250	-.0470	.0009
6563.	-.0740	-.0164	.0370	-.0610	-.0256	.0190	-.0043	.0280	-.0500	.0009
7031.	-.0810	-.0168	.0420	-.0650	-.0256	.0220	-.0051	.0305	-.0540	.0010
7601.	-.0890	-.0173	.0480	-.0710	-.0256	.0270	-.0055	.0350	-.0560	.0011
8029.	-.0970	-.0178	.0550	-.0760	-.0256	.0310	-.0059	.0380	-.0600	.0004
8555.	-.1070	-.0192	.0640	-.0810	-.0256	.0360	-.0071	.0440	-.0630	.0002
9023.	-.1160	-.0185	.0730	-.0870	-.0256	.0420	-.0079	.0480	-.0660	.0002
9492.	-.1290	-.0191	.0830	-.0930	-.0256	.0480	-.0087	.0550	-.0680	.0002
10020.	-.1400	-.0193	.0930	-.1000	-.0260	.0550	-.0094	.0600	-.0710	-.0003
10664.	-.1670	-.0199	.1150	-.1130	-.0260	.0680	-.0102	.0730	-.0720	.0012
11133.	-.1860	-.0202	.1320	-.1220	-.0260	.0780	-.0110	.0820	-.0760	.0012
11602.	-.2140	-.0207	.1560	-.1360	-.0260	.0920	-.0118	.0960	-.0800	-.0016

TABLE E8 DEFLECTION DATA FOR THE W6X25 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
938.	.0100	-.0057	.0006	.0069	.0040	-.0030	-.0050	.0061	-.0007	-.0070
1523.	.0160	-.0080	.0008	.0089	.0040	-.0010	-.0050	.0079	-.0006	-.0090
1992.	.0200	-.0096	.0005	.0097	.0040	.0000	-.0050	.0093	-.0004	-.0100
2461.	.0230	-.0115	.0008	.0125	.0040	.0000	-.0050	.0108	-.0003	-.0115
3047.	.0280	-.0137	.0002	.0140	.0040	.0000	-.0050	.0123	-.0002	-.0130
3516.	.0320	-.0149	.0006	.0159	.0040	.0000	-.0050	.0131	-.0003	-.0150
3984.	.0360	-.0164	.0011	.0183	.0030	.0000	-.0050	.0141	-.0004	-.0160
4570.	.0420	-.0182	.0014	.0206	.0015	-.0010	-.0040	.0149	-.0007	-.0200
5039.	.0450	-.0194	.0014	.0219	.0000	-.0010	-.0030	.0155	-.0008	-.0190
5508.	.0480	-.0190	.0023	.0237	-.0030	-.0020	-.0010	.0145	-.0008	-.0190
6035.	.0510	-.0196	.0022	.0239	-.0055	-.0020	.0020	.0141	-.0012	-.0180
6563.	.0540	-.0199	.0022	.0252	-.0090	-.0040	.0060	.0132	-.0012	-.0170
7031.	.0570	-.0202	.0024	.0265	-.0120	-.0040	.0090	.0125	-.0013	-.0160
7601.	.0610	-.0205	.0028	.0279	-.0160	-.0050	.0125	.0115	-.0016	-.0160
8029.	.0630	-.0212	.0025	.0280	-.0190	-.0050	.0160	.0113	-.0014	-.0150
8555.	.0640	-.0222	.0023	.0282	-.0235	-.0050	.0200	.0109	-.0013	-.0140
9023.	.0670	-.0228	.0024	.0289	-.0270	-.0060	.0240	.0105	-.0012	-.0140
9492.	.0690	-.0233	.0024	.0290	-.0320	-.0065	.0270	.0100	-.0012	-.0130
10020.	.0720	-.0239	.0024	.0289	-.0355	-.0070	.0310	.0096	-.0012	-.0130
10664.	.0770	-.0225	.0033	.0309	-.0430	-.0070	.0370	.0090	-.0010	-.0120
11133.	.0790	-.0235	.0033	.0309	-.0510	-.0100	.0390	.0070	-.0024	-.0130
11602.	.0810	-.0263	.0033	.0318	-.0570	-.0110	.0460	.0073	-.0012	-.0110

TABLE E8 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
938.	-.0075	.0017	.0130	.0100	-.0023	-.0120	-.0060	-.0070	-.0072	-.0077
1523.	-.0110	.0012	.0160	.0140	-.0017	-.0150	-.0110	-.0110	-.0105	-.0113
1992.	-.0138	.0012	.0190	.0170	-.0013	-.0170	-.0140	-.0140	-.0137	-.0148
2461.	-.0174	.0007	.0210	.0210	-.0005	-.0200	-.0170	-.0170	-.0171	-.0182
3047.	-.0213	.0002	.0240	.0240	.0004	-.0220	-.0210	-.0210	-.0209	-.0220
3516.	-.0235	.0003	.0270	.0260	.0005	-.0240	-.0250	-.0240	-.0234	-.0241
3984.	-.0264	.0003	.0300	.0290	.0008	-.0260	-.0280	-.0280	-.0269	-.0274
4570.	-.0291	.0002	.0330	.0320	.0010	-.0290	-.0320	-.0310	-.0300	-.0303
5039.	-.0308	.0002	.0340	.0340	.0012	-.0300	-.0360	-.0340	-.0329	-.0330
5508.	-.0315	.0002	.0350	.0340	.0017	-.0300	-.0380	-.0360	-.0348	-.0348
6035.	-.0329	-.0007	.0340	.0350	.0034	-.0270	-.0410	-.0390	-.0369	-.0363
6563.	-.0342	-.0015	.0340	.0340	.0042	-.0260	-.0450	-.0410	-.0392	-.0383
7031.	-.0353	-.0021	.0340	.0340	.0047	-.0250	-.0470	-.0430	-.0408	-.0399
7601.	-.0363	-.0023	.0340	.0330	.0047	-.0240	-.0510	-.0450	-.0432	-.0409
8029.	-.0374	-.0030	.0330	.0320	.0056	-.0220	-.0530	-.0470	-.0453	-.0435
8555.	-.0380	-.0035	.0330	.0310	.0057	-.0210	-.0570	-.0500	-.0474	-.0450
9023.	-.0383	-.0036	.0330	.0310	.0059	-.0200	-.0600	-.0520	-.0493	-.0466
9492.	-.0388	-.0037	.0330	.0310	.0062	-.0190	-.0640	-.0550	-.0515	-.0481
10020.	-.0400	-.0036	.0320	.0300	.0068	-.0180	-.0680	-.0570	-.0539	-.0499
10664.	-.0379	-.0017	.0360	.0270	.0037	-.0200	-.0730	-.0610	-.0565	-.0507
11133.	-.0390	-.0027	.0350	.0280	.0047	-.0180	-.0770	-.0630	-.0586	-.0532
11602.	-.0406	-.0040	.0340	.0280	.0059	-.0150	-.0810	-.0660	-.0612	-.0554

TABLE E8 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
938.	-.0020	.0038	.0090	-.0010	.0040	.0090	.0033	.0090	.0000	-.0008
1523.	-.0030	.0058	.0150	-.0020	.0080	.0140	.0048	.0160	.0000	-.0008
2108.	-.0060	.0072	.0210	-.0040	.0090	.0210	.0053	.0200	.0000	-.0009
2578.	-.0080	.0079	.0250	-.0060	.0110	.0250	.0053	.0240	.0000	-.0010
3047.	-.0090	.0102	.0300	-.0070	.0130	.0310	.0080	.0290	.0000	-.0009
3511.	-.0120	.0113	.0350	-.0090	.0140	.0340	.0088	.0330	.0000	-.0009
4102.	-.0150	.0122	.0400	-.0120	.0160	.0400	.0093	.0380	-.0010	-.0009
4570.	-.0180	.0128	.0450	-.0140	.0170	.0440	.0095	.0430	-.0020	-.0001
5039.	-.0210	.0133	.0480	-.0170	.0180	.0470	.0097	.0460	-.0020	.0000
5508.	-.0240	.0137	.0530	-.0200	.0190	.0520	.0097	.0500	-.0020	.0000
5977.	-.0290	.0140	.0570	-.0240	.0200	.0560	.0095	.0540	-.0030	.0000
6563.	-.0330	.0147	.0630	-.0270	.0200	.0620	.0097	.0600	-.0030	-.0001
7031.	-.0370	.0150	.0670	-.0310	.0210	.0650	.0098	.0650	-.0040	-.0001
7395.	-.0420	.0167	.0750	-.0360	.0220	.0720	.0116	.0730	-.0050	-.0002
8027.	-.0450	.0187	.0820	-.0380	.0240	.0790	.0138	.0810	-.0060	-.0002
8555.	-.0480	.0234	.0950	-.0420	.0290	.0920	.0180	.0940	-.0070	-.0002
9082.	-.0530	.0327	.1190	-.0450	.0370	.1140	.0245	.1140	-.0080	-.0003
9609.	-.0520	.0549	.1610	-.0410	.0610	.1580	.0496	.1590	-.0100	-.0007
10009.	-.0630	.0854	.2370	-.0530	.0910	.2320	.0801	.2340	-.0110	-.0007
10500.	-.0920	.1317	.3560	-.0820	.1370	.3490	.1245	.3500	-.0150	-.0022

TABLE E9 DEFLECTION DATA FOR THE S4X9.5 SECTION WITH THE 8 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
938.	.0000	-.0011	-.0017	-.0026	-.0010	.0010	.0030	.0000	.0010	.0010
1523.	-.0010	-.0008	-.0017	-.0031	-.0010	.0011	.0040	.0000	.0014	.0020
2108.	.0000	-.0004	-.0018	-.0036	-.0030	.0011	.0050	.0000	.0014	.0030
2578.	.0000	-.0002	-.0018	-.0038	-.0030	.0011	.0060	.0000	.0014	.0020
3047.	.0000	.0000	-.0018	-.0042	-.0050	.0010	.0070	.0000	.0014	.0030
3511.	.0000	.0001	-.0018	-.0044	-.0050	.0010	.0080	-.0010	.0014	.0030
4102.	.0010	.0004	-.0018	-.0046	-.0060	.0010	.0090	-.0010	.0014	.0030
4570.	.0010	.0017	-.0008	-.0042	-.0070	.0010	.0100	-.0020	.0008	.0030
5039.	.0020	.0021	-.0008	-.0044	-.0080	.0004	.0110	-.0020	.0007	.0030
5508.	.0020	.0024	-.0008	-.0044	-.0090	.0004	.0110	-.0020	.0007	.0030
5977.	.0020	.0030	-.0007	-.0049	-.0110	.0002	.0130	-.0030	.0007	.0030
6563.	.0030	.0031	-.0007	-.0052	-.0120	.0003	.0150	-.0030	.0007	.0030
7031.	.0030	.0033	-.0006	-.0054	-.0130	.0003	.0160	-.0030	.0007	.0030
7395.	.0040	.0033	-.0005	-.0055	-.0140	.0002	.0180	-.0030	.0007	.0030
8027.	.0050	.0039	-.0005	-.0056	-.0160	.0002	.0190	-.0030	.0007	.0030
8555.	.0060	.0037	-.0005	-.0056	-.0170	.0002	.0210	-.0020	.0007	.0030
9082.	.0070	.0044	-.0014	-.0058	-.0200	-.0001	.0230	-.0020	.0007	.0030
9609.	.0080	.0049	-.0014	-.0066	-.0220	-.0007	.0250	-.0010	.0010	-.0050
10009.	.0080	.0059	-.0007	-.0078	-.0250	-.0008	.0280	-.0020	.0013	-.0150
10500.	.0080	.0067	-.0006	-.0097	-.0250	-.0008	.0310	.0020	.0013	-.0450

TABLE E9 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
938.	-.0010	-.0010	-.0050	.0000	.0004	.0010	-.0030	-.0144	-.0046	-.0042
1523.	-.0010	-.0010	-.0050	.0000	.0003	.0010	-.0060	-.0179	-.0088	-.0075
2108.	-.0010	-.0010	-.0050	.0000	.0003	.0010	-.0090	-.0220	-.0131	-.0110
2578.	-.0010	-.0010	-.0050	.0000	.0003	.0010	-.0120	-.0253	-.0168	-.0140
3047.	-.0010	-.0006	-.0055	.0000	.0000	.0015	-.0140	-.0285	-.0198	-.0170
3511.	-.0005	-.0006	-.0055	.0000	-.0002	.0020	-.0170	-.0318	-.0232	-.0199
4102.	-.0008	-.0007	-.0060	-.0002	-.0003	.0022	-.0220	-.0370	-.0288	-.0245
4570.	-.0010	-.0010	-.0070	-.0010	.0000	.0020	-.0260	-.0410	-.0329	-.0279
5039.	-.0010	.0000	-.0060	-.0010	.0000	.0020	-.0290	-.0449	-.0371	-.0313
5508.	-.0005	.0000	-.0070	-.0010	.0000	.0020	-.0330	-.0494	-.0417	-.0360
5977.	-.0020	-.0010	-.0080	-.0010	-.0002	.0030	-.0400	.0000	-.0467	-.0395
6563.	-.0015	-.0010	-.0085	-.0010	-.0006	.0030	-.0430	.0000	-.0520	-.0438
7031.	-.0015	-.0010	-.0090	-.0010	-.0012	.0033	-.0490	.0000	-.0564	-.0473
7395.	-.0010	-.0010	-.0090	-.0016	-.0012	.0035	-.0530	.0000	-.0621	-.0518
8027.	-.0010	-.0010	-.0095	-.0020	-.0012	.0040	-.0570	.0000	-.0702	-.0554
8555.	-.0005	-.0010	-.0100	-.0028	-.0012	.0040	-.0620	.0000	-.0725	-.0602
9082.	.0008	-.0010	-.0100	-.0031	-.0011	.0042	-.0680	.0000	-.0789	-.0655
9609.	.0010	-.0017	-.0110	-.0032	-.0014	.0048	-.0720	.0000	-.0856	-.0725
10009.	.0020	-.0018	-.0105	-.0038	-.0013	.0041	-.0920	.0000	-.1001	-.0818
10500.	.0022	-.0018	-.0104	-.0044	-.0012	.0039	-.1330	.0000	-.1360	-.1024

TABLE E9 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 1	2	3	4	5	6	7	8	9	10
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	-.0130	.0023	.0180	-.0130	.0020	.0130	.0020	.0180	.0010	.0004
1523.	-.0180	.0052	.0280	-.0180	.0040	.0270	.0060	.0290	.0000	.0006
1992.	-.0250	.0073	.0370	-.0230	.0050	.0350	.0080	.0390	-.0020	.0001
2461.	-.0290	.0090	.0460	-.0290	.0070	.0430	.0110	.0480	-.0030	-.0002
3047.	-.0380	.0095	.0560	-.0370	.0080	.0530	.0120	.0580	-.0040	-.0001
3511.	-.0450	.0098	.0630	-.0440	.0080	.0590	.0120	.0640	-.0040	.0000
4102.	-.0570	.0096	.0720	-.0550	.0060	.0690	.0110	.0740	-.0040	.0000
4570.	-.0680	.0092	.0810	-.0660	.0060	.0770	.0100	.0810	-.0040	.0000
5039.	-.0840	.0092	.0920	-.0820	.0030	.0870	.0070	.0930	-.0040	.0000
5509.	-.1040	.0092	.1120	-.1030	.0020	.1070	.0060	.1160	-.0060	.0000
5977.	-.1360	.0169	.1840	-.1340	.0240	.1810	-.0720	.1890	-.0150	-.0001
6680.	-.2410	.0812	.3970	-.2350	.0820	.3940	.0770	.3140	-.0150	-.0001

TABLE E10 DEFLECTION DATA FOR THE S4X9.5 SECTION WITH THE 12 INCH BRACKET.

LOAD (LBS)	DIAL GAGE NUMBER 11	12	13	14	15	16	17	18	19	20
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	.0020	.0009	.0007	.0003	-.0030	-.0003	.0010	.0000	-.0004	.0000
1523.	.0040	.0008	.0042	.0033	-.0040	-.0015	.0010	.0000	-.0013	-.0020
1992.	.0050	-.0006	.0035	.0031	-.0040	-.0015	.0010	.0000	-.0018	-.0040
2461.	.0060	-.0011	.0036	.0039	-.0040	-.0012	.0010	.0010	-.0016	-.0040
3047.	.0070	-.0012	.0036	.0043	-.0040	-.0011	.0010	.0010	-.0016	-.0040
3511.	.0080	-.0012	.0037	.0044	-.0040	-.0010	.0020	.0010	-.0017	-.0040
4102.	.0090	-.0012	.0037	.0048	-.0040	-.0010	.0020	.0010	-.0017	-.0040
4570.	.0100	-.0012	.0037	.0051	-.0040	-.0010	.0030	.0010	-.0018	-.0040
5039.	.0120	-.0012	.0033	.0053	-.0040	-.0010	.0040	.0000	-.0021	-.0060
5509.	.0120	-.0011	.0033	.0049	-.0040	-.0010	.0050	.0000	-.0027	-.0070
5977.	.0110	.0023	.0064	.0058	-.0200	-.0010	.0040	-.0010	-.0031	-.0070
6680.	.0100	.0063	.0088	-.0050	-.0210	-.0008	.0040	-.0010	-.0140	-.0040

TABLE E10 CONTINUED.

LOAD (LBS)	DIAL GAGE NUMBER 21	22	23	24	25	26	27	28	29	30
0.	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1055.	.0010	.0002	.0010	-.0015	-.0008	-.0016	-.0160	-.0150	-.0160	-.0103
1523.	.0020	.0021	.0030	-.0027	-.0020	-.0032	-.0220	-.0230	-.0230	-.0152
1992.	.0020	.0021	.0030	-.0029	-.0019	-.0046	-.0290	-.0230	-.0300	-.0202
2461.	.0020	.0021	.0030	-.0029	-.0018	-.0048	-.0360	-.0300	-.0360	-.0246
3047.	.0020	.0021	.0040	-.0035	-.0019	-.0056	-.0450	-.0400	-.0460	-.0314
3511.	.0010	.0021	.0040	-.0042	-.0019	-.0058	-.0530	-.0480	-.0540	-.0267
4102.	.0010	.0020	.0040	-.0053	-.0019	-.0065	-.0750	-.0600	-.0700	-.0440
4570.	-.0010	.0020	.0040	-.0063	-.0019	-.0070	-.0770	-.0730	-.0760	-.0508
5039.	-.0020	.0019	.0030	-.0088	-.0019	-.0074	-.0930	-.0880	-.0890	-.0554
5509.	-.0060	.0019	.0030	-.0123	-.0020	-.0076	-.1170	-.1110	-.1070	-.0554
5977.	-.0100	.0019	.0030	-.0123	-.0019	-.0076	-.1500	-.1410	-.1330	-.0798
6680.	-.0100	.0018	.0040	-.0123	-.0016	-.0087	-.2850	-.2490	-.2230	-.1309

TABLE E10 CONTINUED.

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