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GEORGE C. MARSHALL SPACE FLIGHT CENTER

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HUNTSVILLE, ALABAMA

BER

BUREAU OF ENGINEERING RESEARCH

Progress Report No. 4

for

NASA Contract NAS8-11155

# SHEAR LAG STUDY OF THREE INTEGRALLY STIFFENED PANELS

by

William K. Rey

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# SHEAR LAG STUDY OF THREE INTEGRALLY STIFFENED PANELS

By William K. Rey*

## SUMMARY

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An experimental study was conducted to determine the effect upon the stress distribution in integrally stiffened panels of varying the ratio of the stiffener area to the sheet area. Three aluminum alloy panels with rectangular integral stiffeners were instrumented with foil strain gages to determine the strain distribution in the stiffeners and the webs under axial compressive loads. The ratio of the stiffener area to the sheet area was approximately one-half, one and two in the three panels tested. Each of the panels was tested under four different loading conditions.

The experimental results were compared with a theoretical analysis. Relatively good agreement was obtained between the experimental results and the theoretical analysis except for the section adjacent to the end at which the load was applied. Author

## INTRODUCTION

Integrally stiffened panels are being utilized in many structures such as the thrust structure of the Saturn C-5 launch vehicle since this type of construction provides the necessary strength with a minimum of weight for certain types of loads. When a concentrated load is applied to one of the stiffeners, the manner in which the load is distributed through the panel is influenced by shearing deformations in the thin webs that connect the stiffeners. This influence is commonly referred to as shear lag. The precise stress distribution throughout a stiffened panel must be known to permit the application of minimum weight design principles.

In a previous study (ref. 1), a survey of the literature indicated a number of theoretical analyses were available for predicting the stress dis-

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tribution in stiffened panels but no experimental data were available for evaluating the different analyses when applied to integrally stiffened panels. Data that are available for panels with stiffeners attached by welding or riveting are of doubtful value when integrally stiffened panels are considered. Furthermore, the data that are available for panels with attached stiffeners were obtained by testing panels in which the total stiffener area was greater than the sheet area whereas some of the integrally stiffened panels of interest have a total stiffener area less than the sheet area.

The test results in this report were obtained in the first phase of an experimental program designed to provide stress distribution data for integrally stiffened panels of various configurations. This phase of the experimental study was undertaken to determine the effect on the stress distribution of varying the ratio of the stiffener area to the sheet area in integrally stiffened flat panels with constant cross-section stiffeners of the same size. Additional tests are planned to investigate the effects of varying the number of stiffeners, using stiffeners of different sizes on the same panel and varying the stiffener area over the panel length.

In order to provide some measure of the effectiveness of the test program, a matrix analysis of each panel based upon the Maxwell-Mohr method of analyzing statically indeterminate structures was accomplished. When additional data become available from later phases of the test program, all of the experimental data will be compared with other theoretical analyses.

## EXPERIMENTAL INVESTIGATION

### Specimens

Three integrally stiffened panels were prepared from a one inch thick 7075-T651 aluminum alloy plate. As indicated in Figure 1, each panel consisted of seven uniformly spaced rectangular stiffeners of constant cross-section. Each panel was twenty-four inches long in the direction of loading by approximately seventeen and five-eighths inches wide. The cross-sections of the panels, identified as Panels B, C, and D, are shown in Figures 2, 3, and 4, respectively.

Bonded resistance type foil strain gages with a gage length of one-eighth of an inch were applied to each panel with a contact cement. As shown in Figure 5, ninety-four uniaxial gages and twenty-four rectangular rosette gages were used on Panels B and C to provide a total of one hundred and sixty-six strain gage channels. On Panel D, as shown in Figure 6, one hundred and ten uniaxial gages and twenty-four rectangular rosette gages were used to supply one hundred and eighty-two strain gage channels.

Machining of the three panels was accomplished in a shaper as shown in Figure 7. Because of the limitations imposed by this machining operation, it was impossible to maintain tolerances as close as desired. The actual cross-sectional dimensions shown in Figures 2, 3, and 4 indicate the variations in web thickness and stiffener cross-sections. The dimensions were very nearly constant over the twenty-four inch length. The aluminum alloy used is stress-relieved by stretching after solution heat-treatment. However, machining evidentally relieves additional stresses which results in some warpage of the panels.

## Equipment

Loading of the panels was accomplished by a hydraulic 60,000 pound universal testing machine equipped with a load maintainer. Considerable effort was expended in attempts to insure that loads were applied in the desired manner. As shown in Figure 8, loads were applied so as to minimize the introduction of any bending moment into the panels. Each of the panels was tested under four different loading conditions which are identified in Figure 9 as loading conditions I, II, III, IV.

Each of the strain gage channels on the panels served as one of the arms in a Wheatstone bridge circuit. In order to provide temperature compensation, three foil gages mounted in small aluminum blocks (dummy gage blocks) served as the other three arms of the Wheatstone bridge. Each strain gage channel was equipped with an individual dummy gage block in order to permit switching outside of the bridge and minimize the effect of changes in contact resistance. The dummy gage blocks were mounted in a frame adjacent to the testing machine as shown in Figure 10.

Current was applied to the Wheatstone bridges by a size 8D, 12-volt, lead-acid storage battery. A variable resistor in series with each of the bridge circuits permitted the voltage impressed on each bridge to be reduced to approximately ten volts and provided the means for calibrating each bridge. The output of the bridge circuits was routed through a two hundred channel cross-bar type switching unit to an amplifier. The output of the amplifier was in turn supplied to a four digit digital voltmeter and a digital printer. An overall view of the testing machine and associated instrumentation is shown in Figure 10. The control console is shown in Figure 11 with the digital voltmeter at top, channel selector and indicator below the voltmeter, amplifier and amplifier power supply below the selector, digital printer below the amplifier and the power supply for the printer at the bottom of the console.

Figures 12 and 13 are photographs of the two sides of a panel positioned in the testing machine.

## Test Procedure

Prior to each test, current was applied to all the strain gage channels for a period of approximately one hour during which the temperature of the panel increased due to heating by the gage current. Temperature equilibrium in the panel was achieved prior to testing.

After achieving temperature equilibrium, a pre-load was applied to the panel and all strain gage bridges were balanced and calibrated. Calibration was accomplished by shunting a known resistor across one arm of the bridge to simulate a pre-determined strain and adjusting the voltage applied to that bridge so that the pre-determined strain was indicated by the digital voltmeter. Periodically, during each test, the calibration was verified to compensate for any decay in the battery voltage.

For the loading conditions identified at I, II, and III in Figure 9, a preliminary test was conducted to determine if the same load was being applied to each of the loaded stiffeners and if the load was being symmetrically supported by the base. This was accomplished by monitoring all the strain gages on the loaded stiffeners and the strain gages on all stiffeners at the section adjacent to the supporting base. This preliminary test was also used to detect bending introduced by misalignment of the panel or loading fixtures. Adjustments were made on the basis of the preliminary tests until satisfactory loading was achieved. Improvements in the supporting base and loading fixtures were made during the test program to simplify the load balancing procedure. Therefore, not all of the tests were conducted with exactly the same loading and supporting fixtures.

For loading conditions I, II, and II, loads were applied in 1000 pound increments up to a maximum load of 5000 pounds on Panels B and C and in 500 pound increments up to a maximum load of 2500 pounds on Panel D. For loading condition IV, loads were applied in 500 pound increments up to a maximum load of 2500 pounds on Panels B and C and in 250 pound increments up to a maximum load of 1250 pounds on Panel D. At each increment of load the strain was recorded by the digital printer for each of the strain gage channels.

The data recorded by the digital printer was plotted as load versus net strain for each of the strain gage channels. This preliminary plot of the data was used to correct for any zero shift during testing and also to detect inoperative gage channels or other apparent errors in the data. From the corrected curves, the strain corresponding to a load of 1000 pounds was determined for each channel. This corrected strain was used in a computer program to determine the stress at each of the gage locations. For each rosette location, the computer program determined the magnitude and direction of the principal stresses, the magnitude and direction of the maximum shearing stress, the normal stresses parallel and normal to the stiffeners and the shearing stress parallel to the stiffeners. The computer program is given in Appendix A in Fortran II.

## MATRIX ANALYSIS

In order to provide a comparison between the experimental results and one of the available theoretical analyses, an analysis based upon the Maxwell-Mohr method was performed for each panel using matrix notation. This type of analysis is the same as the analysis referred to as Method I in reference 1. The generalized force system employed in the analysis is identified in Figure

14 in which the generalized forces $q_1$ through $q_{36}$ represent the axial forces in the stiffeners at the indicated locations and $q_{37}$ through $q_{60}$ represent the shear flow in the indicated web. The generalized force system is shown in greater detail in Figure 15 for that portion of the panel between stiffeners 2 and 3 and between 2.7 and 5.7 inches from the loaded end. The forces in the stiffeners, $q_1$ through $q_{36}$, are assumed to be positive when compressive and the shear flows, $q_{37}$ through $q_{60}$, are assumed positive when the shear flow acts upward on the left-hand edge of a web element as shown in figure 15. The generalized force system was selected to provide a direct comparison between the theoretical analysis and the experimental results by providing a generalized force at each of the strain gage locations in the stiffeners. The notation used in the matrix analysis corresponds to the notation used in reference 2.

## Matrix of Flexibility Coefficients

The matrix of flexibility coefficients, $\left[a_{ij}\right]$, is a 60 x 60 symmetrical matrix, given by

$$\left[a_{ij}\right] = \begin{bmatrix} a_{1,1} & a_{1,2} & a_{1,3} & \cdot & \cdot & \cdot & \cdot & a_{1,60} \\ a_{2,1} & a_{2,2} & a_{2,3} & & & & & a_{2,60} \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ a_{60,1} & a_{60,2} & a_{60,3} & & & & & a_{60,60} \end{bmatrix}$$

Referring to Figure 1 and 14 for the necessary dimensions and denoting the equivalent stiffener areas of stiffeners 1, 2, 3, and 4 as $A_1$, $A_2$, $A_3$, $A_4$, respectively, the 124 non-zero flexibility coefficients are:

$$a_{1,1} = a_{9,9} = \frac{L_1}{3A_1E}$$

$$a_{1,2} = a_{2,1} = a_{8,9} = a_{9,8} = \frac{L_1}{6A_1E}$$

$$a_{2,2} = a_{8,8} = \frac{L_1 + L_2}{3A_1E}$$

$$a_{3,3} = a_{4,4} = a_{5,5} = a_{6,6} = a_{7,7} = \frac{2L_2}{3A_1E}$$

$$a_{2,3} = a_{3,2} = a_{3,4} = a_{4,3} = a_{4,5} = a_{5,4} = a_{5,6} = a_{6,5} = a_{6,7} = a_{7,6}$$

$$= a_{7,8} = a_{8,7} = \frac{L_2}{6A_1E}$$

$$a_{10,10} = a_{18,18} = \frac{L_1}{3A_2E}$$

$$a_{10,11} = a_{11,10} = a_{17,18} = a_{18,17} = \frac{L_1}{6A_2E}$$

$$a_{11,11} = a_{17,17} = \frac{L_1 + L_2}{3A_2E}$$

$$a_{12,12} = a_{13,13} = a_{14,14} = a_{15,15} = a_{16,16} = \frac{2L_2}{3A_2E}$$

$$a_{11,12} = a_{12,11} = a_{12,13} = a_{13,12} = a_{13,14} = a_{14,13} = a_{14,15} = a_{15,14}$$

$$= a_{15,16} = a_{16,15} = a_{16,17} = a_{17,16} = \frac{L_2}{6A_2E}$$

$$a_{19,19} = a_{27,27} = \frac{L_1}{3A_3E}$$

$$a_{19,20} = a_{20,19} = a_{26,27} = a_{27,26} = \frac{L_1}{6A_3E}$$

$$a_{20,20} = a_{26,26} = \frac{L_1 + L_2}{3A_3E}$$

$$a_{21,21} = a_{22,22} = a_{23,23} = a_{24,24} = a_{25,25} = \frac{2L_2}{3A_3E}$$

$$a_{20,21} = a_{21,20} = a_{21,22} = a_{22,21} = a_{22,23} = a_{23,22} = a_{23,24} = a_{24,23}$$

$$= a_{24,25} = a_{25,24} = a_{25,26} = a_{26,25} = \frac{L_2}{6A_3E}$$

$$a_{28,28} = a_{36,36} = \frac{L_1}{3A_4E}$$

$$a_{28,29} = a_{29,28} = a_{35,36} = a_{36,35} = \frac{L_1}{6A_4E}$$

$$a_{29,29} = a_{35,35} = \frac{L_1 + L_2}{3A_4E}$$

$$a_{30,30} = a_{31,31} = a_{32,32} = a_{33,33} = a_{34,34} = \frac{2L_2}{3A_4E}$$

$$a_{29,30} = a_{30,29} = a_{30,31} = a_{31,30} = a_{31,32} = a_{32,31} = a_{32,33} = a_{33,32}$$

$$= a_{33,34} = a_{34,33} = a_{34,35} = a_{35,34} = \frac{L_2}{6A_4E}$$

$$a_{37,37} = a_{44,44} = \frac{L_1 b_1}{Gt_1}$$

$$a_{38,38} = a_{39,39} = a_{40,40} = a_{41,41} = a_{42,42} = a_{43,43} = \frac{L_2 b_1}{Gt_1}$$

$$a_{45,45} = a_{52,52} = \frac{L_1 b_2}{Gt_2}$$

$$a_{46,46} = a_{47,47} = a_{48,48} = a_{49,49} = a_{50,50} = a_{51,51} = \frac{L_2 b_2}{Gt_2}$$

$$a_{53,53} = a_{60,60} = \frac{L_1 b_3}{Gt_3}$$

$$a_{54,54} = a_{55,55} = a_{56,56} = a_{57,57} = a_{58,58} = a_{59,59} = \frac{L_2 b_3}{Gt_3}$$

The remaining 3476 elements of $\left[a_{ij}\right]$ are zero.

## Unit External Load Matrix

The twenty-four generalized forces $q_{11}$ through $q_{18}$, $q_{20}$ through $q_{27}$ and $q_{29}$ through $q_{36}$ were selected as the redundants. The unit external load matrix, $\left[g_{im}\right] = \left[g_{jn}\right]$, is a 60 x 4 matrix obtained by replacing the external loads by unit loads.

The elements of the first column of $\left[g_{im}\right]$ represent the values of the generalized forces in the determinate structure when $P_1 = 1$ and $P_2 = P_3 = P_4 = 0$. They are:

$$g_{1,1} = g_{2,1} = g_{3,1} = \quad . \quad . \quad . \quad . \quad = g_{9,1} = 1$$

$$g_{10,1} = g_{11,1} = g_{12,1} = \quad . \quad . \quad . \quad . \quad = g_{60,1} = 0$$

The elements of the second column of $\left[g_{im}\right]$, obtained by setting $P_2 = 1$ and $P_1 = P_3 = P_4 = 0$, are:

$$g_{1,2} = 0$$

$$g_{2,2} = g_{3,2} = g_{4,2} = \quad . \quad . \quad . \quad . \quad = g_{10,2} = 1$$

$$g_{11,2} = g_{12,2} = g_{13,2} = \quad . \quad . \quad . \quad . \quad = g_{36,2} = 0$$

$$g_{37,2} = \frac{1}{L_1}$$

$$g_{38,2} = g_{39,2} = g_{40,2} = \quad . \quad . \quad . \quad . \quad = g_{60,2} = 0$$

The elements of the third column of $\left[g_{im}\right]$, obtained by setting $P_3 = 1$ and $P_1 = P_2 = P_4 = 0$, are:

$$g_{1,3} = 0$$

$$g_{2,3} = g_{3,3} = g_{4,3} = \quad . \quad . \quad . \quad . \quad = g_{9,3} = 1$$

$$g_{10,3} = g_{11,3} = g_{12,3} = \quad . \quad . \quad . \quad . \quad = g_{18,3} = 0$$

$$g_{19,3} = 1$$

$$g_{20,3} = g_{21,3} = g_{22,3} = \quad . \quad . \quad . \quad . \quad = g_{36,3} = 0$$

$$g_{37,3} = \frac{1}{L_1}$$

$$g_{38,3} = g_{39,3} = g_{40,3} = \quad . \quad . \quad . \quad . \quad = g_{44,3} = 0$$

$$g_{45,3} = \frac{1}{L_1}$$

$$g_{46,3} = g_{47,3} = g_{48,3} = \quad . \quad . \quad . \quad . \quad = g_{60,3} = 0$$

The elements of the fourth column of $\left[g_{im}\right]$, obtained by setting $P_4 = 1$ and $P_1 = P_2 = P_3 = 0$, are:

$g_{1,4} = 0$

$g_{2,4} = g_{3,4} = g_{4,4} = \quad . \quad . \quad . \quad . \quad = g_{9,4} = 1$

$g_{10,4} = g_{11,4} = g_{12,4} = \quad . \quad . \quad . \quad . \quad = g_{27,4} = 0$

$g_{28,4} = 1$

$g_{29,4} = g_{30,4} = g_{31,4} = \quad . \quad . \quad . \quad . \quad = g_{36,4} = 0$

$g_{37,4} = \frac{1}{L_1}$

$g_{38,4} = g_{39,4} = g_{40,4} = \quad . \quad . \quad . \quad . \quad = g_{44,4} = 0$

$g_{45,4} = \frac{1}{L_1}$

$g_{46,4} = g_{47,4} = g_{48,4} = \quad . \quad . \quad . \quad . \quad = g_{52,4} = 0$

$g_{53,4} = \frac{1}{L_1}$

$g_{54,4} = g_{55,4} = g_{56,4} = \quad . \quad . \quad . \quad . \quad = g_{60,4} = 0$

Unit Redundant Force Matrix

The unit redundant force matrix, $\left[g_{ir}\right] = \left[g_{js}\right]$, is a 60 x 24 matrix. The elements of this matrix are the values of the generalized forces when the redundant forces are replaced by unit loads. The twenty-four redundants, $q_{11}$ through $q_{18}$, $q_{20}$ through $q_{27}$ and $q_{29}$ through $q_{36}$, were identified as redundants one through twenty-four, respectively ($q_{11}$ as redundant number one, $q_{12}$ as redundant number two, etc., with $q_{36}$ as redundant number twenty-four). For example, the elements in the first column of $\left[g_{ir}\right]$ are the values of the generalized forces when $q_{11}$ is replaced by a unit force while the other twenty-three redundants are zero. The 138 non-zero elements of $\left[g_{ir}\right]$ are:

$$\left.\begin{aligned} g_{11+n+9m,\,1+n+m} &= 1 \\ g_{2+n,\,1+n+8m} &= -1 \end{aligned}\right\} \quad \begin{aligned} &\text{where } n = 0, 1, 2, \ldots, 7 \\ &\text{and } m = 0, 1, 2 \end{aligned}$$

$$
\left.
\begin{aligned}
g_{37+8n,1+8m} &= -\frac{1}{L_1} \\
g_{38+8n,1+8m} &= \frac{1}{L_2} \\
g_{38+8n,2+8m} &= -\frac{1}{L_2} \\
g_{39+8n,2+8m} &= \frac{1}{L_2} \\
g_{39+8n,3+8m} &= -\frac{1}{L_2} \\
g_{40+8n,3+8m} &= -\frac{1}{L_2} \\
g_{40+8n,4+8m} &= -\frac{1}{L_2} \\
g_{41+8n,4+8m} &= \frac{1}{L_2} \\
g_{41+8n,5+8m} &= -\frac{1}{L_2} \\
g_{42+8n,5+8m} &= \frac{1}{L_2} \\
g_{42+8n,6+8m} &= -\frac{1}{L_2} \\
g_{43+8n,6+8m} &= \frac{1}{L_2} \\
g_{43+8n,7+8m} &= -\frac{1}{L_2} \\
g_{44+8n,7+8m} &= \frac{1}{L_1} \\
g_{44+8n,8+8m} &= -\frac{1}{L_1}
\end{aligned}
\right\}
\begin{array}{l}
\text{where } m = 0, 1, 2 \\
\quad \text{and } n = 0, 1, \ldots\ldots, m
\end{array}
$$

External Load Matrix

For the four loading conditions considered, the external load matrix, $\left[P_{mn}\right]$, is a diagonal matrix. To simplify computations, the external loads were considered as unit loads. Therefore,

$$\left[P_{mn}\right] = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

## Matrix Computation

After forming the $\left[a_{ij}\right]$, $\left[g_{im}\right]$, $\left[g_{ir}\right]$, and $\left[P_{mn}\right]$ matrices, the following matrix operations were performed:

1. Evaluate $\left[a_{rn}\right] = \left[g_{ri}\right]\left[a_{ij}\right]\left[g_{jn}\right]$ where $\left[g_{ri}\right]$ is the transpose of $\left[g_{ir}\right]$.
2. Evaluate $\left[a_{rs}\right] = \left[g_{ri}\right]\left[a_{ij}\right]\left[g_{js}\right]$
3. Evaluate $\left[a_{rs}{}^{-1}\right]$, the inverse of $\left[a_{rs}\right]$.
4. Evaluate $\left[G_{rm}\right] = -\left[a_{rs}{}^{-1}\right]\left[a_{rn}\right]$
5. Evaluate $\left[G_{im}\right] = \left[g_{im}\right] + \left[g_{ir}\right]\left[G_{rm}\right]$
6. Evaluate $\left[q_{in}\right] = \left[G_{im}\right]\left[P_{mn}\right]$

The matrix, $\left[q_{in}\right]$, is a 60 x 4 matrix the elements of which represent the magnitudes of the generalized forces for the four loading conditions considered. In this case, since $\left[P_{mn}\right]$ is a unit matrix, $\left[q_{in}\right] = \left[G_{im}\right]$.

The computer program used for the above matrix computations is given in Appendix B.

The numerical values used in the matrix analysis were as follows:

For all panels: $L_1 = 2.700''$, $L_2 = 3.000''$, $E = 10.5 \times 10^6$ psi,

$G = 3.9 \times 10^6$ psi.

For Panel B: $b_1 = 2.6154''$, $b_2 = 2.6095''$, $b_3 = 2.6085''$

$t_1 = 0.0985''$, $t_2 = 0.0935''$, $t_3 = 0.0995''$

$A_1 = 0.4114 \text{ in}^2$, $A_2 = 0.5300 \text{ in}^2$, $A_3 = 0.5286 \text{ in}^2$,

$A_4 = 0.2698 \text{ in}^2$.

For Panel C: $b_1 = 2.840''$, $b_2 = 2.846''$, $b_3 = 2.6085''$

$t_1 = 0.099''$, $t_2 = 0.1015''$, $t_3 = 0.09925''$

$A_1 = 0.6684 \text{ in}^2$, $A_2 = 0.7917 \text{ in}^2$, $A_3 = 0.7908 \text{ in}^2$,

$A_4 = 0.3938 \text{ in}^2$

For Panel D: $b_1 = 2.7675''$, $b_2 = 2.77675''$, $b_3 = 2.770''$

$t_1 = 0.096''$, $t_2 = 0.1005''$, $t_3 = 0.1005''$

$A_1 = 0.2743 \text{ in}^2$, $A_2 = 0.4139 \text{ in}^2$, $A_3 = 0.4203 \text{ in}^2$,

$A_4 = 0.2122 \text{ in}^2$.

The results of the matrix analysis are given in Tables I through IV for Panel B, Tables V through VIII for Panel C and Tables IX through XII for Panel D. In each of these tables, the stress in each stiffener is given at nine locations corresponding to the locations of the generalized forces in the stiffeners and the shearing stress in each web is given at eight locations.

## DATA

The experimental data are given in Tables XIII through XLIV. The data from two tests of Panel B for each of the four loading conditions are given in Tables XIII through XX. The data from two tests of Panel C for each of the four loading conditions are given in Tables XXI through XXVIII. The data from three tests of Panel D for each of the four loading conditions are given in Tables XXIX through XL. The averages of the three tests of Panel D for each of the four loading conditions are given in Tables XLI through XLIV. In each of these tables, the stress in each stiffener is given at nine locations corresponding to the uniaxial strain gage locations shown in Figures 5 and 6. The state of stress at each of the strain rosette locations shown in Figures 5 and 6 is expressed in terms of the normal stress perpendicular to the stiffeners ($\sigma_x$), the normal stress parallel to the stiffeners ($\sigma_y$), and the shearing stress ($\tau_{xy}$). Positive normal stresses are compressive stresses.

The results of the matrix analysis are plotted along with the experimental results in Figures 16 through 75. For each of the four loading conditions on a panel, the theoretical analysis and the experimental results are shown in a series of five curves as follows:

a) the normal stress, $\sigma_y$, in each of the stiffeners versus the distance from the loaded end of the panel (Figures 16, 21, 26, 31, 36, 41, 46, 51, 56, 61, 66, 71);
b) the shearing stress, $\tau_{xy}$, in each web versus the distance from the loaded end of the panel (Figures 17, 22, 27, 32, 37, 42, 47, 52, 57, 62, 67, 72);
c) the normal stress, $\sigma_y$, parallel to the stiffeners in each web versus the distance from the loaded end of the panel (Figures 18, 23, 28, 33, 38, 43, 48, 53, 58, 63, 68, 73);
d) the normal stress, $\sigma_x$, perpendicular to the stiffeners in each web versus the distance from the loaded end of the panel (Figures 19, 24, 29, 34, 39, 44, 49, 54, 59, 64, 69, 74);
e) the chordwise distribution of the normal stress, $\sigma_y$, in the stiffeners across eight panel sections (Figures 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75).

## ANALYSIS OF RESULTS

The theoretically predicted distribution of the normal stress in the stiffeners was in good agreement with the experimentally determined values for all panels although the agreement was not uniform throughout the panels. In general, the largest difference between the theoretically predicted stresses in the stiffeners and the experimentally determined stresses occurred at the loaded end of the panel and the differerence decreased as the distance from the loaded end increased. In all panels for all loading conditions, the theoretical and experimental stresses were very nearly equal to each other at the supported end of the panel. In Panels B and C the experimental stress was less than the theoretical stress in the loaded stiffener at the section adjacent to the applied load whereas in Panel D the experimental stress exceeded the theoretical stress at that section. This difference in behavior of the three panels may be attributed to the relative size of the stiffeners. The experimental results indicate that in Panels B and C the applied load was not uniformly distributed across the cross-section of the larger and thicker stiffeners of these panels at the gage section 0.3 inch below the applied load resulting in experimental stresses on the surface of the stiffeners less than the theoretical stresses which were based upon an assumed uniform distribution across a stiffener cross-section. In Panel D, with relatively small stiffeners, the test results indicate that the load had not diffused from the stiffener into the web at the section adjacent to the applied load resulting in experimental stresses that were larger than the theoretical stresses. As explained in reference 1, the analysis used assumed that the effective stiffener area consisted of the actual stiffener area plus one-half of the web area on each side of the stiffener. The theoretical analysis and the experimental results indicate that the panels were long enough to achieve an essentially uniform stress distribution across the cross-section at the supported end of the panel.

The experimentally determined shearing stresses in the webs agreed very closely with the theoretical stresses at certain sections but were in poor agreement at other sections. In general, the agreement was somewhat closer in Panels C and D than in Panel B. In all tests, the theoretical and experimental shearing stresses in the webs were nearly equal in the webs adjacent to the loaded stiffener. The largest differences between the theoretical and experimental shearing stresses in the webs occurred in the webs farthest from the loaded stiffener and at sections near the top (loaded end) of the panel. These differences may be due in part to the failure to achieve boundary conditions at the loaded end in the tests that correspond to the boundary conditions assumed in the theoretical analysis.

The theoretical analysis assumed that the normal stress in the webs acting perpendicular to the stiffeners was zero. The test results indicate that at certain sections this normal stress was relatively large for some of the loading conditions. However, the variation in this normal stress over the panel length was frequently erratic. This normal stress may have been introduced into the panel by the test boundary conditions at both the loaded end and the supported end of the panel since strains normal to the stiffeners were restrained. This restraint would produce stresses in the web normal to the stiffeners.

As previously noted, the theoretical analysis was based upon an effective stiffener area that included the area of adjacent webs. Therefore, the theoretical analysis assumed that the normal stress in the webs acting parallel to the stiffeners was equal to the normal stress in the stiffeners to which the webs were attached. Since the strain gauge rosettes were placed on the webs midway between the stiffeners, a direct comparison of theoretical and experimental stress was not made. However, the experimental data indicates that, as the distance from the loaded end of the panel increased, the normal stress in the webs acting parallel to the stiffeners approached the normal stress in the stiffeners in agreement with the stress distribution assumed for the idealized panel.

## CONCLUDING REMARKS

Since the three test panels were of the same general configuration and only one theoretical analysis was considered, it is not possible to make any broad generalizations concerning the validity of the theoretical analysis. However, the general trend of agreement between the experimental results and the theoretical analysis implies that a satisfactory experimental procedure was employed and also that the idealized structure and assumed stress distribution used in the theoretical analysis approaches the actual conditions. Since the relative agreement between the theoretical and experimental results was the same for all three panels, the accuracy of the theoretical analysis appears to be independent of the ratio of the stiffener area to the sheet area. The test results show that the ratio of stiffener area to sheet area does affect the stress distribution in a stiffened panel.

The effects of varying the number of stiffeners, using stiffeners of different sizes on the same panel and tapering the stiffener cross-section over the length of the panel are now being investigated under the terms of NASA Contract NAS8-20164.

## APPENDIX A

## COMPUTER PROGRAM FOR REDUCTION OF TEST DATA

This program in Fortran II was used for test data obtained from 110 uniaxial gages and 24 rosette gages providing 182 strain gage channels. Modifications were necessary when a different number of gages were used.

```
C                              INPUT-OUTPUT FORMATS
C
1     FORMAT (40X,54HTHE FOLLOWING DATA ARE THE RESULT OF THE RESOLUTION
      1 of,2/,35X,65HSTRESSES FROM STRAINS OBTAINED DURING A TESTING PROG
      2RAM CONDUCTED,2/,35X,56HAT THE UNIVERSITY OF ALABAMA UNDER CONTRAC
      3T NAS 8-11155.,3/,40X,24HALL STRESSES ARE IN PSI.,2/,40X,48HALL AN
      4GLES ARE IN DEG. MEASURED FROM THE X AXIS.,4/)
2     FORMAT (/,6F10.2,/)
3     FORMAT (36X,58HTHE FOLLOWING MATERIAL PROPERTIES ARE USED IN CALCU
      1LATION,,2/,36X,23HMODULUS OF ELASTICITY -,F4.1,6X,21HMODULUS OF RI
      2GIDITY -,F4.1,2/,52X,16HPOISSONS RATIO -,F15.8,3/)
4     FORMAT (40X,2A5,/)
5     FORMAT (55X,8HTEST NO.,2A5,2/)
6     FORMAT (14(13F6.1,/))
7     FORMAT (31X,17HUNIAXIAL GAGE NO.,I3,6X,8HSTRAIN -,F7.1,6X,9HSIGMA
      1Y -,F12.6,2/)
8     FORMAT (55X,11HROSETTE NO.,I4,2/,40X,9HSIGMA X -,F12.6,9X,9HSIGMA
      1Y -,F12.6,2/,40X,9HSIGMA 1 -,F12.6,9X,9HTHETA 1 -,F12.6,2/,40X9HS
      2IGMA 2 -,F12.6,9X,9HTHETA 2 -,F12.6,2/,40X,9HSIGMA S -,F12.6,9X,9H
      3THETA S -,F12.6,2/,40X,8HTAU XY -,F12.6,10X,7HTAU S -,F12.6,2/)
C
C
C                              START PROGRAM
C
      DIMENSION GF(4), C(2), E(182), S(182), V(10)
      PRINT 1,
      READ 2, A, G, GF
      C(1)=(A/(2.0*G))-1.0    $    C(2)=A/(1.0-C(1)*C(1))
```

```
      PRINT 3, A, G, C(1)
10    READ 4, T, O
      PRINT 5, T, O
      READ 6, E
      DO 11 I=1, 110
11    S(I)=2.0*E(I)*A/GF(1)
      PRINT 7, (I, E(I), S(I), I=1,110)
      DO 13 I=111,180,3
      DO 12 J=1,3
12    E(I+J-1)=2.0*E(I+J-1)/GF(J+1)
      V(8)=E(I)-E(I+1)+E(I+2) $ V(4)=C(2)*(E(I)+C(1)*E(I+2))
      V(6)=C(2)*(E(I+2)+C(1)*E(I)) $ V(7)=(V(4)+V(6))/2.0
      V(9)=(V(6)-V(4))/2.0 $ V(1)=C(2)*(V(8)+C(1)*E(I+1))
      V(2)=C(2)*(E(I+1)+C(1)*V(8)) $ V(8)=(V(1)-V(2))/2.0
      V(10)=SQRT(V(9)*V(9)+V(8)*V(8)) $ V(3)=V(7)-V(10)
      V(5)=V(7)+V(10) $ V(4)=ARCTAN(V(9)/ABS(V(8)))
      IF (V(8)) 21,22,23
21    V(6)=90.0*(V(4)/3.14159265-1.0) $ GO TO 13
22    IF (V(9)) 32,31,31
31    V(6)=-45.0 $ GO TO 13
32    V(6)=45.0 $ GO TO 13
23    V(6)=-V(4)*90.0/3.14159265
13    V(4)=90.0+V(6) $ V(8)=45.0+V(6) $ PRINT 8, I, (V(J), J=1,10)
      IF (E(182)) 10, 10, 40
40    STOP
      END
```

## APPENDIX B

## COMPUTER PROGRAM FOR MATRIX ANALYSIS

The following program in Fortran IV was used to perform the necessary matrix computations.

```
C     MAIN ROUTINE
      REAL L1, L2
      DIMENSION GRI(24,60),ARS(24,24),UNIT(24,24),GRM(24,4),CARN(24,4),
     1    ARN(24,4),AIJ(60,60),TEMP2(60,4),GIR(60,24),GIM(60,4),
     2    GJN(60,4),QIN(60,4),TEMP1(34,60),PMN(4,4),A(4)
      EQUIVALENCE (ARS(1,1),GRI(1,1)),(UNIT(1,1),GRI(1,25)),(GRM(1,1),
     1    GRI(1,49)),(CARN(1,1),GRI(1,53)),(ARN(1,1),GRI(1,57)),
     2    (TEMP2(1,1),AIJ(1,1)),(GIR(1,1),AIJ(1,5)),(GIM(1,1),AIJ(1,29))
     3    ,(GJN(1,1),AIJ(1,33)),(GIN(1,1),AIJ(,37))
      DATA L1,L2,B1,B2,B3/2.7,3.0,2.7675,2.77675,2.77/
      DATA T1,T2,T3/0.096,0.1005,0.1005/,E,G/10.5E+6,3.9E+6/
      DATA (A(I),I=1,4)/0.2743,0.4139,0.4203,0.2122/
5     FORMAT(35H1THE UNIT REDUNDANT FORCE MATRIX IS///60(2(12F10.6,/),/)
     1)
13    FORMAT(89H1THE MATRIX OF FLEXIBILITY COEFFICIENTS IS (VALUES HAVE
     1BEEN SCALED BY A FACTOR OF 10**6)///60(5(6P12F10.6,/),/))
20    FORMAT(18H1THE MATRIX ARN IS//)
21    FORMAT(22X,4E20.9,/)
29    FORMAT(58H1THE MATRIX ARS IS SINGULAR. EXECUTION HAS BEEN TERMINAT
     1ED/1H1)
41    FORMAT(19H1THE MATRIX CARN IS//)
43    FORMAT(18H1THE MATRIX QIN IS//)
44    FORMAT(33H1THE UNIT EXTERNAL LOAD MATRIX IS///60(22X,4F10.6,/),/)
C     COMPUTE THE ELEMENTS OF THE MATRIX PMN
      DO 30 I=1,4
      DO 33 J=1,4
33    PMN(I,J)=0
30    PMN(I,I)=1
C     COMPUTE THE ELEMENTS OF THE MATRIX GRI WHICH IS THE TRANSPOSE OF
```

```
C        THE UNIT REDUNDANT FORCE MATRIX GIR.
      DO 1 I=1,24
      DO 1 J=1,60
1     GRI(I,J) = 0
      DO 2 K=1,8
      N = K-1
      DO 2 L=1,3
      M = L-1
      GRI(1+N+8*M,11+N+9*M) = 1
2     GRI(1+N+8*M,2+N) = -1
      DO 3 K=1,3
      M = K-1
      DO 3 L=1,K
      N = L-1
      GRI(1+8*M,37+8*N) = -1.0/L1
      DO 4 I=1,6
      GRI(I+8*M,37+I+8*N) = 1.0/L2
4     GRI(I+1+8*M,37+I+8*N) = -1.0/L2
      GRI(7+8*M,44+8*N) = 1.0/L1
3     GRI(8+8*M,44+8*N) = -1.0/L1
      PRINT 5, GRI
C     COMPUTE THE MATRIX OF FLEXIBILITY COEFFICIENTS AIJ
      DO 6 I=1,60
      DO 6 J=I,60
6     AIJ(I,J) = 0
      DO 7 I=1,4
      T = L1/(3.0*E*A(I))
      AIJ(9*I-8,9*I-8) = T
      AIJ(9*I,9*I) = T
      T = L1/(6.0*E*A(I))
      AIJ(9*I-8,9*I-7) = T
      AIJ(9*I-1,9*I) = T
      T = (L1+L2)/(3.0*E*A(I))
      AIJ(9*I-7,9*I-7) = T
      AIJ(9*I-1,9*I-1) = T
      T = (2.0*L2)/(3.0*E*A(I))
```

```
      DO 8 J=2,6
 8    AIJ(9*I-J,9*I-J) = T
      T = L2/(6.0*E*A(I))
      DO 7 J=1,6
 7    AIJ(9*I-J-1,9*I-J) = T
      T = (L1*B1)/(G*T1)
      AIJ(37,37) = T
      AIJ(44,44) = T
      T = (L2*B1)/(G*T1)
      DO 9 I=38,43
 9    AIJ(I,I) = T
      T = (L1*B2)/(G*T2)
      AIJ(45,45) = T
      AIJ(52,52) = T
      T = (L2*B2)/(G*T2)
      DO 10 I=46,51
 10   AIJ(I,I) = T
      T = (L1*B3)/(G*T3)
      AIJ(53,53) = T
      AIJ(60,60) = T
      T = (L2*B3)/(G*T3)
      DO 11 I=54,59
 11   AIJ(I,I) = T
      DO 12 I=1,60
      DO 12 J=I,60
 12   AIJ(J,I) = AIJ(I,J)
      PRINT 13,((AIJ(I,J),J=1,60),I=1,60)
C     PERFORM THE MATRIX MULTIPLICATION TEMP1 = GRI * AIJ.
      DO 14 I=1,24
      DO 14 J=1,60
      TEMP1(I,J) = 0
      DO 14 K=1,60
 14   TEMP1(I,J) = GRI(I,K)*AIJ(K,J)+TEMP1(I,J)
C     SET GIR EQUAL TO THE TRANSPOSE OF GRI.
      DO 15 I=1,60
      DO 15 J=1,24
```

```
15    GIR(I,J) = GRI(J,I)
C     CLEAR ALL ELEMENTS OF MATRIX GJN TO ZERO.
      DO 16 I=1,60
      DO 16 J=1,4
16    GJN(I,J) = 0
C     COMPUTE NON-ZERO ELEMENTS OF MATRIX GJN FROM FORMULAE.
      DO 17 I=2,9
      DO 17 J=1,4
17    GJN(I,J) = 1
      GJN(1,1) = 1
      GJN(10,2) = 1
      GJN(19,3) = 1
      GJN(28,4) = 1
      DO 18 I=2,4
18    GJN(37,I) = 1.0/L1
      GJN(45,3) = 1.0/L1
      GJN(45,4) = 1.0/L1
      GJN(53,4) = 1.0/L1
      PRINT 44,((GJN(I,J),J=1,4),I=1,60)
C     PERFORM THE MATRIX MULTIPLICATION ARN = TEMP1 * GJN
      DO 19 I=1,24
      DO 19 J=1,4
      ARN(I,J) = 0
      DO 19 K=1,60
19    ARN(I,J) = TEMP1(I,K)*GJN(K,J)+ARN(I,J)
      PRINT 20
      PRINT 21,((ARN(I,J),J=1,4),I=1,24)
C     PERFORM THE MATRIX MULTIPLICATION ARS = TEMP1 * GIR
      DO 23 I=1,24
      DO 23 J=1,24
      ARS(I,J) = 0
      DO 23 K=1,60
23    ARS(I,J) = TEMP1(I,K)*GIR(K,J)+ARS(I,J)
C     SET UP IDENTITY MATRIX UNIT FOR INVERSION
      DO 25 I=1,24
      DO 24 J=1,24
```

```
24    UNIT(I,J) = 0
25    UNIT(I,I) = 1
C     INVERT THE MATRIX ARS AND LEAVE RESULT IN THE MATRIX UNIT.
      DO 32 M=1,24
28    T = ARS(M,M)
      IF(T.NE.0.0) GO TO 35
      DO 26 J=M,24
      IF(ARS(J,M).EQ.0.0) GO TO 26
      DO 27 L=M,24
      T = ARS(M,L)
      ARS(M,L) = ARS(J,L)
27    ARS(J,L) = T
      GO TO 28
26    CONTINUE
      PRINT 29
      STOP
35    K1 = M+1
      DO 34 L=K1,48
34    ARS(M,L) = ARS(M,L)/T
      DO 32 K=1,24
      IF(K.EQ.M) GO TO 32
      S = ARS(K,M)
      K1 = M+1
      DO 31 L=K1,48
31    ARS(K,L) = ARS(K,L)-S*ARS(M,L)
32    CONTINUE
C     PERFORM THE MATRIX MULTIPLICATION GRM = -UNIT * ARN
      DO 36 I=1,24
      DO 36 J=1,4
      GRM(I,J) = 0
      DO 36 K=1,24
36    GRM(I,J) = -UNIT(I,K)*ARN(K,J)+GRM(I,J)
C     PERFORM THE MATRIX MULTIPLICATION TEMP2 = GIR * GRM
      DO 37 I=1,60
      DO 37 J=1,4
      TEMP2(I,J) = 0
```

```
      DO 37 K=1,24
37    TEMP2(I,J) = GIR(I,K)*GRM(K,J)+TEMP2(I,J)
C     PERFORM THE MATRIX ADDITION GIM = GJN + TEMP2
      DO 38 I=1,60
      DO 38 J=1,4
38    GIM(I,J) = GJN(I,J)+TEMP2(I,J)
C     PERFORM THE MATRIX MULTIPLICATION CARN = TEMP1 *GIM
      DO 39 I=1,24
      DO 39 J=1,4
      CARN(I,J) = 0
      DO 39 K=1,60
39    CARN(I,J) = TEMP1(I,K)*GIM(K,J)+CARN(I,J)
      PRINT 41
      PRINT 21,((CARN(I,J),J=1,4),I=1,24)
C     PERFORM THE MATRIX MULTIPLICATION QIN = GIM * PMN.
      DO 42 I=1,60
      DO 42 J=1,4
      QIN(I,J) = 0
      DO 42 K=1,4
42    QIN(I,J) = GIM(I,K)*PMN(K,J)+QIN(I,J)
      PRINT 43
      PRINT 21,((QIN(I,J),J=1,4),I=1,60)
      STOP
      END
```

## REFERENCES

1. Rey, William K.: Matrix Shear Lag Analysis Utilizing A High-Speed Digital Computer. Section IV of the Summary Report for NASA Contract NAS8-5012, November 1962.

2. Bruhn, E. F.: Analysis and Design of Flight Vehicle Structures. Tri-State Offset Company, 1965.

TABLE I. - MATRIX ANALYSIS OF PANEL B FOR LOADING CONDITION I
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | Stiff. No. 2 | Web. No. 2 | Stiff. No. 3 | Web. No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 2430.7 | | 0 | | 0 | | 0 |
| 1.5 | | 1195.6 | | 456.3 | | 121.8 | |
| 3.0 | 1657.8 | | 382.6 | | 156.1 | | 121.3 |
| 4.5 | | 650.6 | | 377.2 | | 108.5 | |
| 6.0 | 1190.5 | | 545.7 | | 294.9 | | 241.3 |
| 7.5 | | 352.9 | | 275.1 | | 86.9 | |
| 9.0 | 937.0 | | 596.9 | | 391.9 | | 337.5 |
| 10.5 | | 197.3 | | 188.1 | | 64.3 | |
| 12.0 | 795.3 | | 607.3 | | 455.4 | | 408.6 |
| 13.5 | | 111.9 | | 122.5 | | 44.4 | |
| 15.0 | 714.9 | | 604.8 | | 495.3 | | 457.8 |
| 16.5 | | 62.4 | | 74.8 | | 28.3 | |
| 18.0 | 670.1 | | 600.0 | | 519.0 | | 489.0 |
| 19.5 | | 31.0 | | 39.3 | | 15.2 | |
| 21.0 | 647.8 | | 596.5 | | 531.3 | | 505.9 |
| 22.5 | | 9.2 | | 12.0 | | 4.7 | |
| 23.7 | 641.9 | | 595.4 | | 534.6 | | 510.6 |

TABLE II. - MATRIX ANALYSIS OF PANEL B FOR LOADING CONDITION II
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | Stiff. No. 2 | Web. No. 2 | Stiff. No. 3 | Web. No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 1886.8 | | 0 | | 0 |
| 1.5 | | -591.8 | | 807.7 | | 175.8 | |
| 3.0 | 382.6 | | 1205.1 | | 296.4 | | 175.0 |
| 4.5 | | -227.1 | | 411.0 | | 134.8 | |
| 6.0 | 545.7 | | 860.9 | | 438.4 | | 324.2 |
| 7.5 | | -71.2 | | 211.3 | | 88.0 | |
| 9.0 | 596.9 | | 709.4 | | 500.8 | | 421.5 |
| 10.5 | | -14.5 | | 114.0 | | 53.7 | |
| 12.0 | 607.3 | | 641.0 | | 531.0 | | 480.9 |
| 13.5 | | 3.4 | | 63.4 | | 31.5 | |
| 15.0 | 604.8 | | 609.4 | | 546.8 | | 515.8 |
| 16.5 | | 6.7 | | 35.0 | | 17.7 | |
| 18.0 | 600.0 | | 594.6 | | 555.4 | | 535.4 |
| 19.5 | | 4.9 | | 17.3 | | 8.8 | |
| 21.0 | 596.5 | | 588.2 | | 559.6 | | 545.1 |
| 22.5 | | 1.7 | | 5.1 | | 2.6 | |
| 23.7 | 595.4 | | 586.5 | | 560.7 | | 547.7 |

TABLE III. - MATRIX ANALYSIS OF PANEL B FOR LOADING CONDITION III
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | Stiff. No. 2 | Web. No. 2 | Stiff. No. 3 | Web. No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 0 | | 1891.8 | | 0 |
| 1.5 | | -241.4 | | -876.6 | | 487.5 | |
| 3.0 | 156.1 | | 296.4 | | 1225.4 | | 485.4 |
| 4.5 | | -193.4 | | -472.0 | | 148.9 | |
| 6.0 | 294.9 | | 438.4 | | 890.8 | | 650.1 |
| 7.5 | | -134.9 | | -260.1 | | 23.1 | |
| 9.0 | 391.9 | | 500.8 | | 739.8 | | 675.7 |
| 10.5 | | - 88.4 | | -150.2 | | - 12.7 | |
| 12.0 | 455.4 | | 531.0 | | 667.2 | | 661.6 |
| 13.5 | | - 55.6 | | - 88.4 | | - 18.1 | |
| 15.0 | 495.3 | | 546.8 | | 630.5 | | 641.7 |
| 16.5 | | - 33.0 | | - 50.9 | | - 14.3 | |
| 18.0 | 519.0 | | 555.4 | | 611.5 | | 625.9 |
| 19.5 | | - 17.0 | | - 25.9 | | - 8.4 | |
| 21.0 | 531.3 | | 559.6 | | 602.5 | | 616.6 |
| 22.5 | | - 5.1 | | - 7.8 | | - 2.7 | |
| 23.7 | 534.6 | | 560.7 | | 600.1 | | 613.9 |

TABLE IV - MATRIX ANALYSIS OF PANEL B FOR LOADING CONDITION IV
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 0 | | 0 | | 1853.2 |
| 1.5 | | -93.8 | | -282.5 | | -743.0 | |
| 3.0 | 60.7 | | 87.5 | | 242.7 | | 1113.4 |
| 4.5 | | -83.6 | | -229.0 | | -361.0 | |
| 6.0 | 120.7 | | 162.1 | | 325.1 | | 714.0 |
| 7.5 | | -66.9 | | -162.5 | | -175.3 | |
| 9.0 | 168.8 | | 210.8 | | 337.9 | | 520.0 |
| 10.5 | | -49.5 | | -108.3 | | - 89.3 | |
| 12.0 | 204.3 | | 240.5 | | 330.8 | | 421.2 |
| 13.5 | | -34.2 | | - 69.0 | | - 47.2 | |
| 15.0 | 228.9 | | 257.9 | | 320.9 | | 369.0 |
| 16.5 | | -21.8 | | - 41.4 | | - 25.0 | |
| 18.0 | 244.5 | | 268.7 | | 313.0 | | 341.4 |
| 19.5 | | -11.7 | | - 21.5 | | - 12.0 | |
| 21.0 | 253.0 | | 272.6 | | 308.3 | | 328.1 |
| 22.5 | | - 3.6 | | - 6.5 | | - 3.5 | |
| 23.7 | 205.3 | | 273.9 | | 307.0 | | 324.6 |

TABLE V. - MATRIX ANALYSIS OF PANEL C FOR LOADING CONDITION I
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 1496.1 | | 0 | | 0 | | 0 |
| 1.5 | | 938.6 | | 324.1 | | 91.2 | |
| 3.0 | 1120.7 | | 204.7 | | 81.4 | | 62.1 |
| 4.5 | | 587.4 | | 283.3 | | 84.2 | |
| 6.0 | 859.8 | | 316.1 | | 158.8 | | 125.7 |
| 7.5 | | 363.6 | | 224.6 | | 71.9 | |
| 9.0 | 698.2 | | 366.1 | | 218.2 | | 180.1 |
| 10.5 | | 227.4 | | 167.5 | | 57.3 | |
| 12.0 | 597.2 | | 387.0 | | 261.1 | | 223.4 |
| 13.5 | | 141.6 | | 118.2 | | 42.6 | |
| 15.0 | 534.3 | | 394.6 | | 290.6 | | 255.6 |
| 16.5 | | 84.8 | | 77.2 | | 28.9 | |
| 18.0 | 496.6 | | 396.7 | | 309.4 | | 277.4 |
| 19.5 | | 44.3 | | 42.5 | | 16.4 | |
| 21.0 | 476.9 | | 397.0 | | 319.6 | | 289.9 |
| 22.5 | | 13.5 | | 13.3 | | 5.2 | |
| 23.7 | 471.5 | | 396.9 | | 322.5 | | 293.4 |

TABLE VI. - MATRIX ANALYSIS OF PANEL C FOR LOADING CONDITION II
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 1263.1 | | 0 | | 0 |
| 1.5 | | -511.9 | | 631.7 | | 139.5 | |
| 3.0 | 204.7 | | 871.6 | | 171.6 | | 95.0 |
| 4.5 | | -250.7 | | 359.7 | | 115.0 | |
| 6.0 | 316.1 | | 639.2 | | 266.9 | | 181.9 |
| 7.5 | | -112.6 | | 203.4 | | 83.3 | |
| 9.0 | 366.1 | | 518.8 | | 313.8 | | 244.9 |
| 10.5 | | - 47.0 | | 118.0 | | 56.4 | |
| 12.0 | 387.0 | | 455.7 | | 338.0 | | 287.5 |
| 13.5 | | - 17.2 | | 69.2 | | 36.4 | |
| 15.0 | 394.6 | | 422.7 | | 350.9 | | 315.1 |
| 16.5 | | - 4.8 | | 39.7 | | 22.1 | |
| 18.0 | 396.7 | | 405.6 | | 357.9 | | 331.8 |
| 19.5 | | - 0.6 | | 20.1 | | 11.5 | |
| 21.0 | 397.0 | | 397.7 | | 361.3 | | 340.5 |
| 22.5 | | 0.1 | | 6.1 | | 3.5 | |
| 23.7 | 396.9 | | 395.6 | | 362.2 | | 342.8 |

TABLE VII. - MATRIX ANALYSIS OF PANEL C FOR LOADING CONDITION III
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 0 | | 1264.5 | | 0 |
| 1.5 | | -203.6 | | -694.4 | | 408.4 | |
| 3.0 | 81.4 | | 171.6 | | 885.5 | | 277.9 |
| 4.5 | | -174.1 | | -417.4 | | 166.5 | |
| 6.0 | 158.8 | | 266.9 | | 662.1 | | 403.8 |
| 7.5 | | -133.7 | | -252.6 | | 52.9 | |
| 9.0 | 218.2 | | 313.8 | | 544.9 | | 443 8 |
| 10.5 | | - 96.6 | | -157.1 | | 7.5 | |
| 12.0 | 261.1 | | 338.0 | | 481.6 | | 449.5 |
| 13.5 | | - 66.3 | | - 98.3 | | - 7.6 | |
| 15.0 | 290.6 | | 350.9 | | 446.6 | | 443.7 |
| 16.5 | | - 42.3 | | - 59.4 | | - 9.9 | |
| 18.0 | 309.4 | | 357.9 | | 427.5 | | 436.2 |
| 19.5 | | - 23.0 | | - 31.3 | | - 7.0 | |
| 21.0 | 319.6 | | 361.3 | | 418.0 | | 431.0 |
| 22.5 | | - 7.1 | | - 9.6 | | - 2.4 | |
| 23.7 | 322.5 | | 362.2 | | 415.5 | | 429.3 |

TABLE VIII. - MATRIX ANALYSIS OF PANEL C FOR LOADING CONDITION IV
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 0 | | 0 | | 1269.7 |
| 1.5 | | -77.6 | | -212.2 | | -627.7 | |
| 3.0 | 31.0 | | 47.5 | | 139.0 | | 842.5 |
| 4.5 | | -71.7 | | -182.9 | | -354.3 | |
| 6.0 | 62.9 | | 90.9 | | 201.9 | | 574.6 |
| 7.5 | | -61.1 | | -141.5 | | -197.8 | |
| 9.0 | 90.0 | | 122.4 | | 221.9 | | 425.1 |
| 10.5 | | -48.7 | | -103.0 | | -112.9 | |
| 12.0 | 111.7 | | 143.8 | | 224.8 | | 339.7 |
| 13.5 | | -36.3 | | - 71.2 | | - 65.1 | |
| 15.0 | 127.8 | | 157.5 | | 221.9 | | 290.5 |
| 16.5 | | -24.6 | | - 45.7 | | - 36.8 | |
| 18.0 | 138.7 | | 165.9 | | 218.1 | | 262.7 |
| 19.5 | | -13.9 | | - 24.9 | | - 18.5 | |
| 21.0 | 144.9 | | 170.2 | | 215.5 | | 248.8 |
| 22.5 | | - 4.4 | | - 7.7 | | - 5.5 | |
| 23.7 | 146.7 | | 171.4 | | 214.7 | | 245.0 |

TABLE IX. - MATRIX ANALYSIS OF PANEL D FOR LOADING CONDITION I
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 3645.6 | | 0 | | 0 | | 0 |
| 1.5 | | 1423.9 | | 504.6 | | 141.7 | |
| 3.0 | 2300.1 | | 560.9 | | 234.3 | | 181.2 |
| 4.5 | | 706.8 | | 399.6 | | 123.0 | |
| 6.0 | 1558.1 | | 761.6 | | 432.7 | | 355.9 |
| 7.5 | | 350.5 | | 273.4 | | 94.0 | |
| 9.0 | 1190.0 | | 806.4 | | 561.4 | | 489.4 |
| 10.5 | | 181.1 | | 174.7 | | 65.7 | |
| 12.0 | 999.9 | | 805.1 | | 639.6 | | 582.9 |
| 13.5 | | 96.0 | | 106.8 | | 42.9 | |
| 15.0 | 899.1 | | 794.1 | | 685.4 | | 643.9 |
| 16.5 | | 50.6 | | 61.7 | | 26.0 | |
| 18.0 | 846.0 | | 784.4 | | 711.0 | | 680.7 |
| 19.5 | | 24.2 | | 31.1 | | 13.5 | |
| 21.0 | 820.6 | | 778.5 | | 723.7 | | 699.9 |
| 22.5 | | 7.0 | | 9.3 | | 4.1 | |
| 23.7 | 814.0 | | 776.8 | | 727.0 | | 705.1 |

TABLE X. - MATRIX ANALYSIS OF PANEL D FOR LOADING CONDITION II
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 2416.0 | | 0 | | 0 |
| 1.5 | | -593.6 | | 849.1 | | 197.9 | |
| 3.0 | 560.9 | | 1487.7 | | 420.4 | | 253.0 |
| 4.5 | | -191.1 | | 401.8 | | 145.5 | |
| 6.0 | 761.6 | | 1062.0 | | 604.2 | | 459.8 |
| 7.5 | | - 42.7 | | 193.7 | | 89.3 | |
| 9.0 | 806.4 | | 891.2 | | 679.1 | | 586.7 |
| 10.5 | | 12.4 | | 99.3 | | 51.3 | |
| 12.0 | 805.1 | | 819.7 | | 713.6 | | 659.5 |
| 13.5 | | 10.5 | | 52.9 | | 28.5 | |
| 15.0 | 794.1 | | 788.5 | | 731.1 | | 700.0 |
| 16.5 | | 9.3 | | 28.1 | | 15.3 | |
| 18.0 | 784.4 | | 774.5 | | 740.3 | | 721.6 |
| 19.5 | | 5.6 | | 13.5 | | 7.3 | |
| 21.0 | 778.5 | | 768.5 | | 744.8 | | 732.0 |
| 22.5 | | 1.8 | | 4.0 | | 2.1 | |
| 23.7 | 776.8 | | 767.0 | | 746.0 | | 734.7 |

TABLE XI. - MATRIX ANALYSIS OF PANEL D FOR LOADING CONDITION III
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 0 | | 2379.3 | | 0 |
| 1.5 | | -248.0 | | -878.1 | | 507.7 | |
| 3.0 | 234.3 | | 420.4 | | 1484.5 | | 602.1 |
| 4.5 | | -189.0 | | -432.9 | | 135.6 | |
| 6.0 | 432.7 | | 604.2 | | 1076.8 | | 841.8 |
| 7.5 | | -122.5 | | -219.9 | | 13.3 | |
| 9.0 | 561.4 | | 679.1 | | 909.6 | | 860.6 |
| 10.5 | | - 74.5 | | -118.4 | | - 15.4 | |
| 12.0 | 639.6 | | 713.6 | | 835.7 | | 838.7 |
| 13.5 | | - 43.6 | | - 65.7 | | - 17.0 | |
| 15.0 | 685.4 | | 731.1 | | 800.7 | | 814.6 |
| 16.5 | | - 24.4 | | - 36.0 | | - 12.1 | |
| 18.0 | 711.0 | | 740.3 | | 783.6 | | 797.3 |
| 19.5 | | - 12.1 | | - 17.7 | | - 6.7 | |
| 21.0 | 723.7 | | 744.8 | | 775.8 | | 787.8 |
| 22.5 | | - 3.6 | | - 5.2 | | - 2.1 | |
| 23.7 | 727.0 | | 746.0 | | 773.8 | | 785.1 |

TABLE XII. - MATRIX ANALYSIS OF PANEL D FOR LOADING CONDITION IV
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | Stiff. No. 2 | Web No. 2 | Stiff. No. 3 | Web No. 3 | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | 0 | | 0 | | 2356.3 |
| 1.5 | | -95.9 | | -284.5 | | -787.3 | |
| 3.0 | 90.6 | | 126.5 | | 324.6 | | 1349.5 |
| 4.5 | | -83.2 | | -221.4 | | -355.6 | |
| 6.0 | 178.0 | | 229.9 | | 420.9 | | 844.2 |
| 7.5 | | -63.6 | | -147.9 | | -161.0 | |
| 9.0 | 244.7 | | 293.4 | | 430.3 | | 615.4 |
| 10.5 | | -44.5 | | - 92.5 | | - 77.2 | |
| 12.0 | 291.4 | | 329.8 | | 419.4 | | 505.7 |
| 13.5 | | -29.0 | | - 55.5 | | - 38.7 | |
| 15.0 | 321.9 | | 350.0 | | 407.3 | | 450.8 |
| 16.5 | | -17.6 | | - 31.7 | | - 19.6 | |
| 18.0 | 340.4 | | 360.8 | | 398.7 | | 422.9 |
| 19.5 | | - 9.1 | | - 15.8 | | - 9.2 | |
| 21.0 | 350.0 | | 366.0 | | 393.9 | | 409.8 |
| 22.5 | | - 2.8 | | - 4.7 | | - 2.6 | |
| 23.7 | 352.6 | | 367.4 | | 392.5 | | 406.5 |

TABLE XIII. - TEST RESULTS FOR PANEL B

(Loading Condition I, Test No. 7)
P = 1 kip

| y | Stiff No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff No. 3 | Web. No. 3 | | | Stiff No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 1962.8 | | | | 0 | | | | 0 | | | | 0 |
| 1.5 | | 11.4 | 602.8 | 782.3 | | -579.8 | -46.8 | 39.6 | | -698.8 | -34.1 | 1.5 | |
| 3.0 | 2133.3 | | | | 205.9 | | | | 79.0 | | | | 56.2 |
| 4.5 | | 261.0 | 1080.1 | 697.1 | | 54.9 | 202.0 | 357.7 | | 60.5 | 20.9 | 108.1 | |
| 6.0 | 1538.7 | | | | 442.9 | | | | 164.3 | | | | 70.7 |
| 7.5 | | 138.3 | 983.5 | 573.8 | | 61.6 | 333.2 | 394.2 | | 279.8 | 234.1 | 152.2 | |
| 9.0 | 1035.4 | | | | 582.1 | | | | 261.9 | | | | 176.8 |
| 10.5 | | 96.0 | 856.6 | 301.4 | | 125.6 | 451.0 | 353.1 | | 320.6 | 368.8 | 143.1 | |
| 12.0 | 867.1 | | | | 632.1 | | | | 363.9 | | | | 305.7 |
| 13.5 | | 77.0 | 737.7 | 197.9 | | -- | -- | -- | | 186.1 | 471.9 | 108.1 | |
| 15.0 | 731.9 | | | | 602.9 | | | | 432.5 | | | | 405.5 |
| 16.5 | | 36.4 | 653.0 | 112.6 | | 116.6 | 560.2 | 164.4 | | 150.6 | 513.7 | 79.1 | |
| 18.0 | 669.5 | | | | 615.5 | | | | 490.7 | | | | 474.1 |
| 19.5 | | 6.8 | 613.6 | 74.6 | | 50.2 | 620.3 | 111.1 | | 130.6 | 565.0 | 59.4 | |
| 21.0 | 517.7 | | | | 553.1 | | | | 513.6 | | | | 513.6 |
| 22.5 | | 59.3 | 573.6 | 7.6 | | 177.2 | 606.1 | 50.2 | | 169.5 | 595.1 | 39.6 | |
| 23.7 | 567.7 | | | | 546.9 | | | | 513.6 | | | | 496.9 |

TABLE XIV. - TEST RESULTS FOR PANEL B

(Loading Condition I, Test No. 8)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 2054.3 | | | | 0 | | | | 0 | | | | 0 |
| 1.5 | | -21.1 | 604.0 | 759.5 | | -550.4 | -45.0 | 53.3 | | -665.2 | -68.1 | 4.6 | |
| 3.0 | 2070.9 | | | | 266.2 | | | | 72.8 | | | | 45.8 |
| 4.5 | | 182.0 | 1007.6 | 722.9 | | 121.5 | 195.3 | 377.4 | | 46.6 | 16.1 | 100.4 | |
| 6.0 | 1509.5 | | | | 453.3 | | | | 135.2 | | | | 64.5 |
| 7.5 | | 215.7 | 968.7 | 528.1 | | 207.6 | 412.8 | 424.6 | | 348.1 | 253.6 | 127.8 | |
| 9.0 | 1095.8 | | | | 531.8 | | | | 268.3 | | | | 180.9 |
| 10.5 | | 111.5 | 866.1 | 298.3 | | 144.3 | 494.9 | 340.9 | | 288.0 | 357.5 | 129.4 | |
| 12.0 | 864.9 | | | | 613.4 | | | | 386.8 | | | | 297.3 |
| 13.5 | | 35.1 | 748.2 | 190.2 | | -- | -- | -- | | 190.6 | 403.7 | 97.4 | |
| 15.0 | 723.6 | | | | 607.1 | | | | 459.5 | | | | 403.4 |
| 16.5 | | 22.5 | 673.1 | 95.9 | | 62.4 | 558.0 | 162.8 | | 147.4 | 504.3 | 70.0 | |
| 18.0 | 636.3 | | | | 594.7 | | | | 505.3 | | | | 482.4 |
| 19.5 | | 26.9 | 612.3 | 60.9 | | 78.0 | 605.0 | 102.0 | | 125.9 | 550.9 | 48.7 | |
| 21.0 | 567.7 | | | | 578.1 | | | | 540.6 | | | | 511.5 |
| 22.5 | | 67.2 | 609.6 | -9.1 | | 124.5 | 596.2 | 59.4 | | 93.4 | 564.6 | 50.2 | |
| 23.7 | 548.9 | | | | 536.5 | | | | 567.7 | | | | 565.6 |

TABLE XV. - TEST RESULTS FOR PANEL B

(Loading Condition II, Test No. 6)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 1530.3 | | | | 0 | | | | 0 |
| 1.5 | | 133.3 | 462.0 | -464.2 | | -5.8 | 563.5 | 811.2 | | -252.7 | -29.3 | 102.0 | |
| 3.0 | 203.8 | | | | 1507.4 | | | | 247.4 | | | | 99.8 |
| 4.5 | | -115.1 | 766.9 | -310.5 | | -62.8 | 664.4 | 499.2 | | 55.0 | 227.0 | 214.6 | |
| 6.0 | 484.5 | | | | 914.8 | | | | 434.6 | | | | 262.0 |
| 7.5 | | -56.5 | 683.2 | -63.9 | | -100.1 | 639.0 | 270.9 | | 79.0 | 447.4 | 127.8 | |
| 9.0 | 582.2 | | | | 719.4 | | | | 503.2 | | | | 395.0 |
| 10.5 | | -34.9 | 649.1 | -15.2 | | 6.8 | 626.1 | 153.7 | | 122.6 | 479.1 | 94.4 | |
| 12.0 | 580.1 | | | | 640.4 | | | | 534.4 | | | | 480.3 |
| 13.5 | | 17.6 | 609.1 | 27.4 | | -- | -- | -- | | 56.1 | 539.2 | 62.4 | |
| 15.0 | 565.6 | | | | 611.3 | | | | 551.0 | | | | 530.2 |
| 16.5 | | -- | -- | -- | | -4.0 | 618.2 | 76.1 | | 105.9 | 602.2 | 35.0 | |
| 18.0 | 532.3 | | | | 571.8 | | | | 565.5 | | | | 561.4 |
| 19.5 | | 39.3 | 599.9 | 15.2 | | 44.0 | 614.0 | 53.3 | | 98.2 | 616.2 | 27.4 | |
| 21.0 | 515.6 | | | | 553.1 | | | | 582.2 | | | | 569.7 |
| 22.5 | | 101.2 | 563.1 | -15.2 | | 110.6 | 616.3 | 24.3 | | 65.8 | 642.4 | 44.1 | |
| 23.7 | 501.1 | | | | 503.2 | | | | 542.7 | | | | 534.4 |

TABLE XVI. - TEST RESULTS FOR PANEL B

(Loading Condition II, Test No. 7)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 1526.2 | | | | 0 | | | | 0 |
| 1.5 | | 55.8 | 451.8 | -491.6 | | -64.8 | 534.8 | 792.9 | | -229.4 | -8.7 | 112.6 | |
| 3.0 | 216.2 | | | | 1522.0 | | | | 255.8 | | | | 95.6 |
| 4.5 | | -124.5 | 751.2 | -307.4 | | -116.8 | 724.7 | 497.7 | | 56.6 | 231.7 | 200.9 | |
| 6.0 | 499.0 | | | | 908.6 | | | | 403.1 | | | | 262.0 |
| 7.5 | | -72.0 | 698.6 | -67.0 | | -42.7 | 638.1 | 260.2 | | 86.8 | 445.9 | 129.4 | |
| 9.0 | 576.0 | | | | 740.2 | | | | 515.6 | | | | 401.3 |
| 10.5 | | 41.0 | 654.6 | -10.6 | | -30.4 | 613.2 | 156.8 | | 79.2 | 484.8 | 91.3 | |
| 12.0 | 584.3 | | | | 652.9 | | | | 544.8 | | | | 484.5 |
| 13.5 | | -10.3 | 611.9 | 24.3 | | -- | -- | -- | | 46.8 | 548.5 | 59.4 | |
| 15.0 | 573.9 | | | | 607.1 | | | | 592.6 | | | | 553.8 |
| 16.5 | | 13.0 | 619.9 | 10.6 | | 50.0 | 570.4 | 74.6 | | 85.7 | 566.1 | 45.6 | |
| 18.0 | 536.4 | | | | 569.7 | | | | 567.6 | | | | 588.4 |
| 19.5 | | 12.8 | 570.0 | 25.9 | | 93.6 | 614.6 | 53.3 | | 88.8 | 588.0 | 27.4 | |
| 21.0 | 511.5 | | | | 551.2 | | | | 553.1 | | | | 476.0 |
| 22.5 | | 62.4 | 570.5 | -22.8 | | 102.8 | 605.3 | 28.9 | | 90.4 | 592.7 | 44.1 | |
| 23.7 | 507.3 | | | | 526.0 | | | | 553.1 | | | | 584.3 |

TABLE XVII. - TEST RESULTS FOR PANEL B

(Loading Condition III, Test No. 6)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 1580.2 | | | | 0 |
| 1.5 | | 51.2 | 17.7 | 16.7 | | 403.2 | 505.5 | -722.9 | | 372.6 | 623.8 | 735.1 | |
| 3.0 | 8.3 | | | | 253.7 | | | | 1844.2 | | | | 401.3 |
| 4.5 | | 36.3 | 195.5 | -181.1 | | 47.7 | 785.8 | -476.4 | | 111.9 | 966.0 | 261.8 | |
| 6.0 | 99.8 | | | | 430.4 | | | | 1064.6 | | | | 767.2 |
| 7.5 | | -34.5 | 329.0 | -184.2 | | -82.7 | 728.2 | -296.8 | | -153.5 | 861.7 | 32.0 | |
| 9.0 | 274.5 | | | | 515.6 | | | | 873.3 | | | | 798.4 |
| 10.5 | | -9.4 | 404.2 | -153.7 | | -102.6 | 645.2 | -185.7 | | -158.5 | 772.7 | 27.4 | |
| 12.0 | 345.2 | | | | 544.8 | | | | 738.1 | | | | 781.8 |
| 13.5 | | -48.0 | 449.1 | -82.2 | | -- | -- | -- | | -64.1 | 722.2 | -7.6 | |
| 15.0 | 399.2 | | | | 544.8 | | | | 669.5 | | | | 729.8 |
| 16.5 | | -6.1 | 463.6 | -47.2 | | -11.8 | 619.7 | -50.2 | | -42.6 | 688.4 | 16.7 | |
| 18.0 | 422.1 | | | | 542.7 | | | | 684.1 | | | | 682.0 |
| 19.5 | | 21.8 | 473.3 | -32.0 | | 20.8 | 643.4 | -21.3 | | 30.4 | 709.1 | 21.3 | |
| 21.0 | 451.2 | | | | 528.1 | | | | 640.4 | | | | 657.0 |
| 22.5 | | 97.9 | 528.7 | -67.0 | | 116.8 | 610.1 | 0 | | 124.8 | 683.6 | 62.4 | |
| 23.7 | 455.4 | | | | 467.8 | | | | 559.3 | | | | 603.0 |

TABLE XVIII. - TEST RESULTS FOR PANEL B

(Loading Condition III, Test No. 7)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 2060.5 | | | | 0 |
| 1.5 | | 37.2 | 12.9 | 12.2 | | 341.3 | 542.3 | -695.5 | | 349.0 | 515.8 | 660.5 | |
| 3.0 | 0 | | | | 249.5 | | | | 1653.0 | | | | 393.0 |
| 4.5 | | 19.2 | 181.3 | -176.5 | | -34.4 | 811.5 | -456.6 | | 129.0 | 980.3 | 238.9 | |
| 6.0 | 135.2 | | | | 430.4 | | | | 1091.6 | | | | 719.4 |
| 7.5 | | -54.6 | 330.4 | -182.6 | | -124.7 | 701.2 | -295.3 | | -113.3 | 846.5 | 41.1 | |
| 9.0 | 280.7 | | | | 507.3 | | | | 867.0 | | | | 773.5 |
| 10.5 | | -49.8 | 382.0 | -162.8 | | -117.1 | 637.3 | -187.2 | | -77.9 | 767.3 | 21.3 | |
| 12.0 | 353.5 | | | | 534.4 | | | | 765.2 | | | | 756.8 |
| 13.5 | | -29.4 | 468.0 | -76.1 | | -- | -- | -- | | -98.3 | 693.7 | 16.7 | |
| 15.0 | 432.5 | | | | 551.0 | | | | 702.8 | | | | 731.9 |
| 16.5 | | 12.6 | 495.0 | -35.0 | | -92.5 | 600.1 | -47.2 | | -56.5 | 683.2 | 12.2 | |
| 18.0 | 442.9 | | | | 553.1 | | | | 663.3 | | | | 696.5 |
| 19.5 | | -24.5 | 519.6 | -13.7 | | 26.9 | 612.3 | -3.0 | | 48.8 | 665.6 | 15.2 | |
| 21.0 | 445.0 | | | | 536.4 | | | | 619.6 | | | | 640.4 |
| 22.5 | | 74.7 | 533.2 | -44.1 | | 87.5 | 645.7 | -4.6 | | 115.5 | 667.9 | 35.0 | |
| 23.7 | 492.8 | | | | 490.7 | | | | 586.3 | | | | 619.6 |

TABLE XIX. - TEST RESULTS FOR PANEL B

(Loading Condition IV, Test No. 6)

P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 0 | | | | 1707.0 |
| 1.5 | | -51.2 | -17.7 | 44.1 | | 94.5 | -0.5 | -44.1 | | 372.0 | 461.5 | -592.0 | |
| 3.0 | 2.1 | | | | 41.6 | | | | 187.1 | | | | 1418.0 |
| 4.5 | | 29.6 | 39.4 | -44.1 | | 102.9 | 160.4 | -225.2 | | -36.4 | 681.9 | -379.0 | |
| 6.0 | 12.5 | | | | 114.4 | | | | 363.9 | | | | 860.8 |
| 7.5 | | 26.7 | 92.4 | -89.8 | | 8.7 | 273.3 | -202.4 | | -144.0 | 494.9 | -222.2 | |
| 9.0 | 66.6 | | | | 180.9 | | | | 401.3 | | | | 627.9 |
| 10.5 | | 0.5 | 149.9 | -82.2 | | -42.4 | 293.0 | -140.0 | | -137.9 | 451.3 | -91.3 | |
| 12.0 | 116.9 | | | | 218.3 | | | | 363.9 | | | | 488.6 |
| 13.5 | | -7.1 | 176.3 | -53.3 | | -- | -- | -- | | -85.5 | 386.3 | -48.7 | |
| 15.0 | 156.0 | | | | 249.5 | | | | 361.8 | | | | 422.1 |
| 16.5 | | 13.0 | 175.0 | -36.5 | | -0.6 | 282.6 | -53.3 | | -59.2 | 366.2 | -19.8 | |
| 18.0 | 187.1 | | | | 247.4 | | | | 334.8 | | | | 384.6 |
| 19.5 | | -16.3 | 210.6 | -16.7 | | 4.2 | 309.2 | -39.6 | | -9.6 | 354.3 | -1.5 | |
| 21.0 | 187.1 | | | | 249.5 | | | | 318.1 | | | | 338.9 |
| 22.5 | | 16.4 | 246.8 | -30.4 | | 55.3 | 301.9 | -16.7 | | 19.3 | 356.2 | 15.2 | |
| 23.7 | 207.9 | | | | 226.6 | | | | 291.1 | | | | 326.4 |

TABLE XX. - TEST RESULTS FOR PANEL B

(Loading Condition IV, Test No. 7)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 0 | | | | 1696.6 |
| 1.5 | | 4.7 | 1.6 | 19.8 | | 75.9 | -7.0 | -62.4 | | 361.2 | 478.5 | -657.5 | |
| 3.0 | 10.4 | | | | 41.6 | | | | 180.9 | | | | 1403.5 |
| 4.5 | | 7.8 | 23.5 | -38.0 | | 120.0 | 174.6 | -223.7 | | 25.8 | 732.5 | -406.4 | |
| 6.0 | 21.2 | | | | 112.3 | | | | 349.3 | | | | 865.0 |
| 7.5 | | -9.0 | 96.7 | -85.2 | | 1.0 | 274.8 | -216.1 | | -53.8 | 567.7 | -210.0 | |
| 9.0 | 60.3 | | | | 158.0 | | | | 386.7 | | | | 625.8 |
| 10.5 | | 2.1 | 154.6 | -83.7 | | -23.8 | 299.5 | -146.1 | | -96.1 | 440.8 | -89.8 | |
| 12.0 | 118.5 | | | | 189.2 | | | | 372.2 | | | | 486.6 |
| 13.5 | | -8.7 | 184.1 | -51.7 | | -- | -- | -- | | -71.5 | 391.1 | -44.1 | |
| 15.0 | 155.9 | | | | 245.4 | | | | 355.6 | | | | 417.9 |
| 16.5 | | -25.6 | 207.4 | -32.0 | | -64.1 | 289.7 | -54.8 | | -43.7 | 363.3 | -13.7 | |
| 18.0 | 193.4 | | | | 232.9 | | | | 330.6 | | | | 370.1 |
| 19.5 | | -0.7 | 212.3 | -18.3 | | -13.0 | 270.0 | -32.0 | | 4.4 | 359.1 | -3.0 | |
| 21.0 | 185.0 | | | | 228.7 | | | | 309.8 | | | | 341.0 |
| 22.5 | | 5.4 | 213.9 | -35.0 | | 18.1 | 289.0 | -10.7 | | 13.6 | 349.9 | 15.2 | |
| 23.7 | 214.2 | | | | 195.4 | | | | 301.5 | | | | 311.9 |

TABLE XXI. - TEST RESULTS FOR PANEL C

(Loading Condition I, Test No. 9)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 1312.0 | | | | 0 | | | | 0 | | | | 0 |
| 1.5 | | -50.9 | 514.7 | 718.4 | | -350.4 | -38.1 | 67.0 | | -511.7 | -52.4 | 15.2 | |
| 3.0 | 1253.8 | | | | 180.9 | | | | 37.4 | | | | 20.8 |
| 4.5 | | 106.5 | 697.4 | 581.4 | | 102.8 | 147.5 | 289.2 | | 9.3 | 3.2 | 67.0 | |
| 6.0 | 941.9 | | | | 311.9 | | | | 81.1 | | | | 35.3 |
| 7.5 | | 85.9 | 628.5 | 447.5 | | 219.5 | 288.1 | 321.1 | | 160.2 | 146.9 | 74.6 | |
| 9.0 | 729.8 | | | | 355.5 | | | | 176.7 | | | | 101.9 |
| 10.5 | | 98.2 | 603.7 | 313.5 | | 137.6 | 338.7 | 258.7 | | 160.4 | 203.9 | 92.8 | |
| 12.0 | 575.9 | | | | 395.0 | | | | 230.8 | | | | 197.5 |
| 13.5 | | 20.4 | 518.5 | 200.9 | | 71.0 | 373.9 | 202.4 | | 113.8 | 180.8 | 32.0 | |
| 15.0 | 499.0 | | | | 407.5 | | | | 309.8 | | | | 268.2 |
| 16.5 | | 41.9 | 471.9 | 139.9 | | 159.7 | 454.5 | 307.1 | | 140.7 | 348.1 | 60.9 | |
| 18.0 | 451.2 | | | | 413.8 | | | | 336.8 | | | | 316.0 |
| 19.5 | | 34.1 | 448.4 | 86.8 | | 44.9 | 431.4 | 94.4 | | 111.3 | 373.0 | 35.0 | |
| 21.0 | 422.1 | | | | 397.1 | | | | 345.1 | | | | 328.5 |
| 22.5 | | 116.3 | 460.3 | 45.7 | | 49.6 | 433.0 | 71.5 | | 102.2 | 430.4 | 22.8 | |
| 23.7 | 386.7 | | | | 378.4 | | | | 356.6 | | | | 336.8 |

TABLE XXII. - TEST RESULTS FOR PANEL C

(Loading Condition I, Test No. 10)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 1345.2 | | | | 0 | | | | 0 | | | | 0 |
| 1.5 | | -54.0 | 517.7 | 733.6 | | -372.1 | -41.5 | -206.9 | | -538.1 | -69.8 | -1.5 | |
| 3.0 | 1264.2 | | | | 185.0 | | | | 49.9 | | | | 37.4 |
| 4.5 | | 30.3 | 684.1 | 605.7 | | 70.1 | 111.6 | 290.7 | | -14.0 | -4.8 | 71.5 | |
| 6.0 | 925.2 | | | | 286.9 | | | | 72.8 | | | | 66.5 |
| 7.5 | | 103.0 | 655.3 | 455.1 | | 169.9 | 275.0 | 318.1 | | 110.5 | 121.4 | 95.9 | |
| 9.0 | 731.9 | | | | 355.5 | | | | 166.3 | | | | 110.2 |
| 10.5 | | 31.5 | 601.4 | 305.9 | | 122.1 | 341.7 | 264.9 | | 186.8 | 226.8 | 100.4 | |
| 12.0 | 588.4 | | | | 413.8 | | | | 230.8 | | | | 199.6 |
| 13.5 | | 9.5 | 510.6 | 187.2 | | 99.0 | 383.6 | 193.3 | | 132.7 | 287.1 | 62.4 | |
| 15.0 | 499.0 | | | | 411.7 | | | | 314.0 | | | | 362.0 |
| 16.5 | | 75.8 | 450.5 | 127.8 | | 92.8 | 377.3 | 138.5 | | 108.1 | 336.8 | 47.2 | |
| 18.0 | 449.1 | | | | 415.8 | | | | 338.9 | | | | 316.0 |
| 19.5 | | 46.5 | 436.1 | 95.9 | | 58.7 | 398.7 | 89.8 | | 105.2 | 377.4 | 35.0 | |
| 21.0 | 395.0 | | | | 390.9 | | | | 357.6 | | | | 330.6 |
| 22.5 | | 80.5 | 427.1 | 44.1 | | -80.1 | 587.7 | 77.6 | | 91.3 | 397.5 | 33.5 | |
| 23.7 | 393.0 | | | | 380.5 | | | | 365.9 | | | | 334.8 |

TABLE XXIII. - TEST RESULTS FOR PANEL C

(Loading Condition II, Test No. 8)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 1226.7 | | | | 0 | | | | 0 |
| 1.5 | | 123.3 | 404.1 | -523.6 | | 57.3 | 431.5 | 678.8 | | -226.4 | -36.8 | 63.9 | |
| 3.0 | 141.4 | | | | 981.4 | | | | 143.5 | | | | 52.0 |
| 4.5 | | -47.8 | 511.6 | -313.6 | | -36.9 | 532.0 | 433.8 | | -13.5 | 120.1 | 141.5 | |
| 6.0 | 282.8 | | | | 659.1 | | | | 253.7 | | | | 164.3 |
| 7.5 | | -3.0 | 460.5 | -111.1 | | -20.1 | 458.8 | 228.3 | | 36.5 | 258.0 | 89.8 | |
| 9.0 | 336.8 | | | | 507.3 | | | | 330.6 | | | | 253.7 |
| 10.5 | | -23.3 | 424.4 | -27.4 | | -4.7 | 418.4 | 112.6 | | 22.7 | 290.6 | 76.1 | |
| 12.0 | 370.1 | | | | 430.4 | | | | 347.2 | | | | 301.5 |
| 13.5 | | -34.4 | 416.5 | 7.6 | | -3.2 | 410.6 | 74.6 | | 19.8 | 356.2 | 36.5 | |
| 15.0 | 370.1 | | | | 411.7 | | | | 361.8 | | | | 349.3 |
| 16.5 | | 18.4 | 388.9 | 25.9 | | 6.0 | 401.3 | 56.3 | | 54.1 | 397.1 | 18.3 | |
| 18.0 | 361.8 | | | | 388.8 | | | | 403.4 | | | | 380.5 |
| 19.5 | | 52.6 | 417.4 | 41.1 | | 24.7 | 407.7 | 44.1 | | 20.1 | 418.6 | 15.2 | |
| 21.0 | 353.2 | | | | 388.8 | | | | 401.2 | | | | 382.6 |
| 22.5 | | 94.2 | 357.0 | 6.1 | | 85.2 | 441.2 | 30.4 | | 20.1 | 418.6 | -15.2 | |
| 23.7 | 353.2 | | | | 374.3 | | | | 388.8 | | | | 370.1 |

TABLE XXIV. - TEST RESULTS FOR PANEL C

(Loading Condition II, Test No. 9)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 1241.3 | | | | 0 | | | | 0 |
| 1.5 | | 97.4 | 366.4 | -520.5 | | 88.3 | 438.1 | 703.1 | | -228.1 | -79.0 | 62.4 | |
| 3.0 | 133.1 | | | | 991.8 | | | | 151.8 | | | | 56.1 |
| 4.5 | | -18.3 | 525.9 | -312.0 | | 26.7 | 549.8 | 444.4 | | -16.7 | 98.2 | 153.7 | |
| 6.0 | 274.5 | | | | 671.6 | | | | 289.0 | | | | 160.1 |
| 7.5 | | -24.7 | 469.7 | -108.1 | | -40.3 | 435.1 | 220.7 | | 17.8 | 226.6 | 92.8 | |
| 9.0 | 345.1 | | | | 515.6 | | | | 351.4 | | | | 247.4 |
| 10.5 | | 1.6 | 449.7 | -21.3 | | 4.6 | 421.6 | 121.8 | | -14.6 | 265.3 | 70.1 | |
| 12.0 | 353.5 | | | | 438.7 | | | | 357.6 | | | | 303.6 |
| 13.5 | | 40.2 | 429.8 | 10.7 | | -15.6 | 410.4 | 80.7 | | -23.7 | 312.0 | 36.5 | |
| 15.0 | 363.9 | | | | 413.8 | | | | 376.3 | | | | 347.2 |
| 16.5 | | 49.4 | 395.5 | 41.1 | | 38.6 | 412.6 | 57.8 | | -19.0 | 338.6 | 32.0 | |
| 18.0 | 372.2 | | | | 405.4 | | | | 382.6 | | | | 380.5 |
| 19.5 | | 33.9 | 386.0 | 35.0 | | 26.3 | 424.9 | 42.6 | | -21.9 | 379.1 | 10.7 | |
| 21.0 | 355.5 | | | | 388.8 | | | | 399.2 | | | | 380.5 |
| 22.5 | | 58.6 | 373.8 | 13.7 | | 86.8 | 445.9 | 47.2 | | 26.1 | 387.5 | 3.0 | |
| 23.7 | 343.1 | | | | 368.0 | | | | 386.7 | | | | 368.0 |

TABLE XXV. - TEST RESULTS FOR PANEL C

(Loading Condition III, Test No. 8)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 1137.3 | | | | 0 |
| 1.5 | | 37.2 | 12.9 | -12.2 | | 252.6 | 436.7 | -630.1 | | 306.6 | 376.4 | 537.2 | |
| 3.0 | 0 | | | | 145.5 | | | | 998.0 | | | | 249.5 |
| 4.5 | | 50.1 | 137.9 | -170.5 | | -25.9 | 564.9 | -426.1 | | 25.4 | 632.6 | 196.3 | |
| 6.0 | 41.6 | | | | 264.0 | | | | 706.9 | | | | 440.8 |
| 7.5 | | -36.5 | 199.4 | -194.8 | | -66.6 | 467.6 | -273.9 | | -15.1 | 572.8 | 35.0 | |
| 9.0 | 131.0 | | | | 314.0 | | | | 571.8 | | | | 507.3 |
| 10.5 | | -23.9 | 249.5 | -137.0 | | -40.3 | 447.6 | -196.3 | | -102.2 | 484.4 | -4.6 | |
| 12.0 | 203.8 | | | | 359.7 | | | | 492.8 | | | | 503.2 |
| 13.5 | | -16.1 | 285.5 | -86.8 | | -14.1 | 415.1 | -109.6 | | -69.6 | 483.2 | -27.4 | |
| 15.0 | 247.4 | | | | 370.1 | | | | 465.7 | | | | 490.7 |
| 16.5 | | -8.2 | 309.0 | -42.6 | | -51.3 | 402.2 | -57.8 | | -32.4 | 483.6 | -12.2 | |
| 18.0 | 278.6 | | | | 365.9 | | | | 457.4 | | | | 472.0 |
| 19.5 | | 21.2 | 310.9 | -19.8 | | -6.3 | 413.7 | -28.9 | | -9.2 | 479.2 | -10.7 | |
| 21.0 | 286.9 | | | | 363.9 | | | | 434.6 | | | | 449.1 |
| 22.5 | | 109.6 | 316.6 | -36.5 | | 63.5 | 437.8 | -3.0 | | 35.8 | 490.6 | -9.1 | |
| 23.7 | 303.6 | | | | 338.9 | | | | 413.8 | | | | 422.1 |

TABLE XXVI. - TEST RESULTS FOR PANEL C

(Loading Condition III, Test No. 9)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 1133.2 | | | | 0 |
| 1.5 | | 23.3 | 8.1 | -7.6 | | 247.9 | 422.6 | -619.4 | | 325.3 | 382 9 | 534.2 | |
| 3.0 | 0 | | | | 153.9 | | | | 998.0 | | | | 262.0 |
| 4.5 | | 405.5 | 265.1 | -41.1 | | 14.4 | 574.7 | -414.0 | | 71.9 | 636.2 | 205.5 | |
| 6.0 | 70.7 | | | | 282.8 | | | | 721.5 | | | | 440.8 |
| 7.5 | | 335.4 | 116.1 | 42.7 | | -49.4 | 494.4 | -266.3 | | -15.1 | 585.3 | 25.9 | |
| 9.0 | 141.4 | | | | 326.4 | | | | 582.2 | | | | 544.8 |
| 10.5 | | -273.7 | 179.7 | -62.4 | | -31.0 | 450.9 | -193.3 | | -99.0 | 493.8 | -7.6 | |
| 12.0 | 197.5 | | | | 338.9 | | | | 524.0 | | | | 517.7 |
| 13.5 | | -8.3 | 284.1 | -85.2 | | -54.3 | 417.8 | -118.7 | | -78.9 | 480.0 | -27.4 | |
| 15.0 | 249.5 | | | | 361.8 | | | | 478.2 | | | | 480.3 |
| 16.5 | | -9.8 | 304.3 | -41.1 | | -46.6 | 403.9 | -62.4 | | -27.7 | 497.7 | -35.0 | |
| 18.0 | 262.0 | | | | 376.3 | | | | 453.3 | | | | 478.2 |
| 19.5 | | -2.0 | 327.8 | 18.3 | | -15.6 | 410.4 | -28.9 | | -16.9 | 493.2 | 0 | |
| 21.0 | 272.4 | | | | 372.2 | | | | 453.3 | | | | 463.7 |
| 22.5 | | 92.6 | 339.8 | -35.0 | | 52.7 | 454.9 | 7.6 | | 71.5 | 498.8 | -13.7 | |
| 23.7 | 305.6 | | | | 343.1 | | | | 424.2 | | | | 440.8 |

TABLE XXVII. - TEST RESULTS FOR PANEL C

(Loading Condition IV, Test No. 7)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 0 | | | | 1218.4 |
| 1.5 | | -46.5 | -16.1 | 15.2 | | 68.1 | -30.5 | -66.9 | | 233.9 | 405.3 | -611.8 | |
| 3.0 | 0 | | | | 0 | | | | 139.3 | | | | 948.1 |
| 4.5 | | 46.7 | 16.2 | 15.3 | | 77.9 | 135.1 | -194.8 | | -38.5 | 514.8 | -377.4 | |
| 6.0 | 10.4 | | | | 72.8 | | | | 207.9 | | | | 594.7 |
| 7.5 | | 102.6 | 35.5 | 30.5 | | 3.6 | 134.3 | -185.7 | | -40.4 | 422.7 | -193.3 | |
| 9.0 | 27.0 | | | | 135.1 | | | | 266.1 | | | | 467.8 |
| 10.5 | | -142.5 | 29.7 | -30.4 | | -33.4 | 208.8 | -143.1 | | -107.5 | 295.5 | -106.5 | |
| 12.0 | 68.6 | | | | 143.5 | | | | 259.9 | | | | 353.5 |
| 13.5 | | -24.4 | 124.6 | -54.8 | | -42.7 | 193.1 | -100.4 | | -110.4 | 348.5 | -63.9 | |
| 15.0 | 81.1 | | | | 170.5 | | | | 230.8 | | | | 299.4 |
| 16.5 | | -7.3 | 138.9 | -31.9 | | -87.7 | 181.7 | -22.8 | | -36.3 | 261.9 | -45.7 | |
| 18.0 | 83.2 | | | | 189.2 | | | | 228.7 | | | | 274.5 |
| 19.5 | | -19.6 | 151.2 | -28.9 | | -24.1 | 199.6 | -21.3 | | -53.4 | 247.7 | -16.7 | |
| 21.0 | 89.4 | | | | 170.5 | | | | 214.2 | | | | 245.3 |
| 22.5 | | 2.1 | 154.6 | -22.8 | | 17.8 | 214.8 | -4.6 | | 22.6 | 265.7 | -9.1 | |
| 23.7 | 116.4 | | | | 145.5 | | | | 207.9 | | | | 235.0 |

TABLE XXVIII. - TEST RESULTS FOR PANEL C

(Loading Condition IV, Test No. 8)
P = 1 kip

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 0 | | | | 1224.7 |
| 1.5 | | 37.2 | 12.9 | 12.2 | | 89.9 | 10.3 | -60.9 | | 260.2 | 397.8 | -613.3 | |
| 3.0 | 0 | | | | 0 | | | | 120.6 | | | | 931.5 |
| 4.5 | | 55.9 | 19.3 | -42.6 | | 59.3 | 128.7 | -197.9 | | 0.3 | 519.9 | -400.3 | |
| 6.0 | 0 | | | | 58.2 | | | | 239.1 | | | | 630.0 |
| 7.5 | | 11.1 | 70.4 | -80.7 | | -7.2 | 163.9 | -190.2 | | -48.2 | 399.2 | -182.6 | |
| 9.0 | 27.0 | | | | 104.0 | | | | 245.3 | | | | 459.5 |
| 10.5 | | -1.3 | 82.7 | -74.6 | | -38.1 | 194.7 | -138.5 | | -104.3 | 304.9 | -100.4 | |
| 12.0 | 58.2 | | | | 139.3 | | | | 249.5 | | | | 361.8 |
| 13.5 | | 17.4 | 114.2 | -62.4 | | -16.4 | 185.6 | -92.8 | | -31.5 | 288.5 | -77.6 | |
| 15.0 | 83.2 | | | | 153.9 | | | | 257.8 | | | | 316.0 |
| 16.5 | | 2.0 | 142.1 | -35.0 | | -19.4 | 201.2 | -56.3 | | -53.3 | 260.1 | -50.2 | |
| 18.0 | 104.0 | | | | 158.0 | | | | 237.0 | | | | 268.2 |
| 19.5 | | 2.1 | 154.6 | -16.7 | | -8.6 | 209.1 | -33.5 | | -20.8 | 258.9 | -24.4 | |
| 21.0 | 108.1 | | | | 137.2 | | | | 228.7 | | | | 255.7 |
| 22.5 | | 51.7 | 155.1 | -25.9 | | 31.8 | 218.9 | -9.1 | | 59.7 | 241.1 | -12.2 | |
| 23.7 | 126.8 | | | | 137.2 | | | | 210.0 | | | | 218.3 |

TABLE XXIX. - TEST RESULTS FOR PANEL D

(Loading Condition I, Test No. 1)
P = 1 kip

| y | Stiff No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff No. 3 | Web. No. 3 | | | Stiff No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 5015.0 | | | | 0 | | | | 0 | | | | 0 |
| 1.5 | | -186.6 | 700.5 | 764.0 | | -778.4 | - 86.5 | - 51.7 | | -930.2 | - 72.5 | - 24.4 | |
| 3.0 | 3376.6 | | | | 370.1 | | | | 137.2 | | | | 62.4 |
| 4.5 | | 324.6 | 1542.9 | 831.0 | | 196.2 | 267.5 | 356.1 | | - 93.1 | - 32.2 | 60.9 | |
| 6.0 | 2083.4 | | | | 657.0 | | | | 162.2 | | | | 74.9 |
| 7.5 | | 153.3 | 1300.6 | 493.1 | | 277.8 | 561.9 | 429.2 | | 283.0 | 256.0 | 130.9 | |
| 9.0 | 1438.8 | | | | 773.5 | | | | 349.3 | | | | 232.9 |
| 10.5 | | 174.3 | 1091.6 | 307.4 | | 272.1 | 693.0 | 331.8 | | 262.0 | 465.0 | 121.8 | |
| 12.0 | 1068.7 | | | | 794.3 | | | | 515.6 | | | | |
| 13.5 | | 74.6 | 940.7 | 161.3 | | 133.0 | 794.5 | 200.9 | | 79.4 | 559.8 | 106.5 | |
| 15.0 | 856.6 | | | | 777.6 | | | | 615.4 | | | | 540.6 |
| 16.5 | | 71.2 | 856.3 | 103.5 | | 86.4 | 778.4 | 118.7 | | - 7.1 | 646.3 | 63.9 | |
| 18.0 | 785.9 | | | | 752.7 | | | | 706.9 | | | | 657.0 |
| 19.5 | | 21.3 | 780.8 | 42.6 | | - 37.7 | 752.1 | 76.1 | | 67.8 | 772.0 | 9.1 | |
| 21.0 | 673.6 | | | | 756.8 | | | | 736.0 | | | | 706.9 |
| 22.5 | | 105.1 | 809.8 | - 51.7 | | 222.2 | 842.3 | 15.2 | | 210.4 | 779.8 | -21.3 | |
| 23.7 | 765.1 | | | | 677.8 | | | | 711.1 | | | | 677.8 |

TABLE XXX. - TEST RESULTS FOR PANEL D

(Loading Condition I, Test No. 2)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 4882.0 | | | | 0 | | | | 0 | | | | 128.9 |
| 1.5 | | -174.2 | 713.2 | 782.3 | | -756.6 | -70.6 | -36.5 | | -1006.2 | -1.8 | -36.5 | |
| 3.0 | 3318.4 | | | | 353.5 | | | | 54.1 | | | | 41.6 |
| 4.5 | | 301.2 | 1570.8 | 827.9 | | 168.3 | 257.9 | 371.4 | | -46.6 | -16.1 | 88.3 | |
| 6.0 | 2079.2 | | | | 673.7 | | | | 170.5 | | | | 83.2 |
| 7.5 | | 171.9 | 1307.0 | 493.1 | | 274.7 | 552.5 | 432.2 | | 236.4 | 239.9 | 146.1 | |
| 9.0 | 1418.0 | | | | 765.1 | | | | 345.1 | | | | 232.9 |
| 10.5 | | 75.0 | 1065.6 | 277.0 | | 262.8 | 689.8 | 334.8 | | 178.2 | 435.9 | 118.7 | |
| 12.0 | 1052.1 | | | | 785.9 | | | | 499.0 | | | | 415.8 |
| 13.5 | | 83.9 | 943.9 | 146.1 | | 151.3 | 726.0 | 200.9 | | 185.0 | 604.6 | 76.1 | |
| 15.0 | 831.7 | | | | 748.5 | | | | 586.3 | | | | 544.8 |
| 16.5 | | 33.9 | 843.4 | 85.2 | | 80.0 | 734.6 | 106.5 | | 114.0 | 688.2 | 48.7 | |
| 18.0 | 748.5 | | | | 752.7 | | | | 677.8 | | | | 657.0 |
| 19.5 | | 49.2 | 765.5 | 45.7 | | 43.1 | 796.7 | 21.3 | | 139.0 | 763.4 | 0 | |
| 21.0 | 698.6 | | | | 752.7 | | | | 731.9 | | | | 702.8 |
| 22.5 | | 95.7 | 781.6 | -36.5 | | 136.2 | 828.9 | -9.1 | | 142.3 | 797.8 | -9.1 | |
| 23.7 | 736.0 | | | | 665.3 | | | | 711.1 | | | | 752.7 |

TABLE XXXI. - TEST RESULTS FOR PANEL D

(Loading Condition I, Test No. 3)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 4998.4 | | | | 0 | | | | 0 | | | | 128.9 |
| 1.5 | | -152.5 | 704.0 | 791.4 | | -734.9 | -79.8 | -45.7 | | -945.6 | -44.6 | -27.4 | |
| 3.0 | 3310.1 | | | | 382.6 | | | | 79.0 | | | | 49.9 |
| 4.5 | | 306.2 | 1586.4 | 849.2 | | 103.1 | 235.3 | 386.6 | | -55.9 | -19.3 | 85.2 | |
| 6.0 | 2091.7 | | | | 682.0 | | | | 178.8 | | | | 70.7 |
| 7.5 | | 196.7 | 1307.3 | 493.1 | | 268.5 | 558.7 | 426.1 | | 230.2 | 246.0 | 140.0 | |
| 9.0 | 1447.1 | | | | 794.3 | | | | 357.6 | | | | 220.4 |
| 10.5 | | 96.8 | 1106.4 | 292.2 | | 300.0 | 702.7 | 334.8 | | 206.1 | 445.6 | 115.7 | |
| 12.0 | 1085.3 | | | | 785.9 | | | | 494.8 | | | | 420.0 |
| 13.5 | | 83.9 | 943.9 | 158.3 | | 129.6 | 735.2 | 210.0 | | 166.4 | 598.2 | 70.0 | |
| 15.0 | 914.8 | | | | 765.1 | | | | 627.9 | | | | 548.9 |
| 16.5 | | 52.6 | 849.9 | 91.3 | | 123.6 | 766.3 | 118.7 | | 135.7 | 704.0 | 51.7 | |
| 18.0 | 773.5 | | | | 777.6 | | | | 711.1 | | | | 627.9 |
| 19.5 | | 170.3 | 832.4 | 0 | | 67.9 | 797.0 | 33.5 | | 108.1 | 769.3 | 24.4 | |
| 21.0 | 773.5 | | | | 790.1 | | | | 711.1 | | | | 690.3 |
| 22.5 | | 80.2 | 784.6 | -33.5 | | 136.2 | 828.9 | -3.0 | | 170.2 | 807.4 | -12.2 | |
| 23.7 | 785.9 | | | | 682.0 | | | | 702.8 | | | | 636.2 |

TABLE XXXII. - TEST RESULTS FOR PANEL D

(Loading Condition II, Test No. 1)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 4104.4 | | | | 0 | | | | 0 |
| 1.5 | | 160.5 | 679.3 | -557.0 | | 39.2 | 587.4 | 803.6 | | -294.6 | -18.8 | 76.1 | |
| 3.0 | 324.4 | | | | 1921.2 | | | | 349.3 | | | | 162.2 |
| 4.5 | | -176.5 | 953.6 | -219.2 | | -99.0 | 938.8 | 429.2 | | 44.5 | 306.5 | 176.5 | |
| 6.0 | 711.1 | | | | 1156.0 | | | | 578.0 | | | | 353.5 |
| 7.5 | | -65.1 | 892.3 | -42.6 | | -15.8 | 817.9 | 194.8 | | 72.8 | 441.1 | 124.8 | |
| 9.0 | 815.0 | | | | 869.1 | | | | 652.9 | | | | 524.0 |
| 10.5 | | 15.3 | 837.0 | 36.5 | | -56.2 | 770.6 | 124.8 | | 45.7 | 656.2 | 54.8 | |
| 12.0 | 790.1 | | | | 781.8 | | | | 715.2 | | | | |
| 13.5 | | -189.7 | 716.1 | 30.4 | | 27.6 | 799.6 | 79.1 | | 52.1 | 725.0 | 24.4 | |
| 15.0 | 756.8 | | | | 752.7 | | | | 731.9 | | | | 657.0 |
| 16.5 | | -183.5 | 709.9 | 30.4 | | 43.1 | 796.7 | 39.6 | | 80.1 | 759.6 | -3.0 | |
| 18.0 | 706.9 | | | | 769.3 | | | | 740.2 | | | | 748.5 |
| 19.5 | | 30.4 | 759.1 | 3.0 | | 46.3 | 831.1 | 18.3 | | 74.0 | 790.8 | -9.1 | |
| 21.0 | 661.2 | | | | 752.7 | | | | 723.6 | | | | 765.1 |
| 22.5 | | 89.5 | 787.8 | -60.9 | | 136.2 | 828.9 | -21.3 | | 139.2 | 813.3 | -18.3 | |
| 23.7 | 744.4 | | | | 657.0 | | | | 694.5 | | | | 731.2 |

TABLE XXXIII. - TEST RESULTS FOR PANEL D

(Loading Condition II, Test No. 2)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 4154.3 | | | | 0 | | | | 0 |
| 1.5 | | 80.0 | 709.7 | -593.6 | | -1.0 | 615.1 | 800.5 | | -306.9 | -6.4 | 76.1 | |
| 3.0 | 345.1 | | | | 1937.8 | | | | 345.1 | | | | 133.1 |
| 4.5 | | -157.8 | 985.0 | -200.9 | | -198.1 | 962.7 | 447.5 | | 38.3 | 312.7 | 176.5 | |
| 6.0 | 719.4 | | | | 1172.7 | | | | 578.0 | | | | 357.6 |
| 7.5 | | 6.2 | 883.7 | -57.8 | | 6.0 | 833.8 | 203.9 | | 73.2 | 541.0 | 118.7 | |
| 9.0 | 810.9 | | | | 894.1 | | | | 673.7 | | | | 532.3 |
| 10.5 | | 34.3 | 836.4 | 24.4 | | 18.2 | 771.4 | 130.9 | | 73.6 | 665.9 | 94.4 | |
| 12.0 | 810.9 | | | | 790.1 | | | | 731.9 | | | | 619.6 |
| 13.5 | | -49.9 | 814.4 | -15.2 | | 43.1 | 796.7 | 76.1 | | 45.9 | 731.2 | 24.4 | |
| 15.0 | 773.5 | | | | 773.5 | | | | 748.5 | | | | 694.5 |
| 16.5 | | -12.6 | 827.3 | 39.6 | | 43.1 | 796.7 | 63.9 | | 2.6 | 749.4 | 30.4 | |
| 18.0 | 744.4 | | | | 761.0 | | | | 761.0 | | | | 744.4 |
| 19.5 | | -51.7 | 769.8 | 0 | | 108.1 | 769.3 | 18.3 | | 83.4 | 819.0 | -18.3 | |
| 21.0 | 744.4 | | | | 756.8 | | | | 748.5 | | | | 744.4 |
| 22.5 | | 92.6 | 772.2 | -517.4 | | 126.7 | 775.7 | -24.4 | | 167.2 | 848.0 | -27.4 | |
| 23.7 | 773.5 | | | | 669.5 | | | | 748.5 | | | | 698.6 |

TABLE XXXIV. - TEST RESULTS FOR PANEL D

(Loading Condition II, Test No. 3)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 4121.0 | | | | 0 | | | | 0 |
| 1.5 | | 67.6 | 722.0 | -672.7 | | 169.2 | 532.6 | 901.0 | | -254.2 | 3.5 | 91.3 | |
| 3.0 | 320.3 | | | | 1954.5 | | | | 353.5 | | | | 128.0 |
| 4.5 | | -30.4 | 1070.7 | -210.0 | | -61.5 | 1026.6 | 471.8 | | 60.0 | 328.5 | 197.9 | |
| 6.0 | 719.4 | | | | 1168.5 | | | | 603.0 | | | | 369.9 |
| 7.5 | | 9.4 | 918.1 | -48.7 | | -6.3 | 871.1 | 210.0 | | 60.8 | 553.3 | 118.7 | |
| 9.0 | 823.4 | | | | 902.4 | | | | 665.3 | | | | 548.9 |
| 10.5 | | 37.1 | 852.8 | 27.4 | | 67.9 | 797.0 | 124.8 | | 51.9 | 675.0 | 54.8 | |
| 12.0 | 802.6 | | | | 794.3 | | | | 694.5 | | | | 636.2 |
| 13.5 | | 30.7 | 809.0 | 39.6 | | 55.4 | 784.3 | 63.9 | | 42.8 | 721.8 | 21.3 | |
| 15.0 | 752.7 | | | | 773.5 | | | | 731.9 | | | | 694.5 |
| 16.5 | | 39.9 | 787.3 | 24.4 | | 70.9 | 781.4 | 48.7 | | 52.3 | 774.9 | 12.2 | |
| 18.0 | 715.2 | | | | 740.2 | | | | 748.5 | | | | 736.0 |
| 19.5 | | 67.8 | 772.0 | 9.1 | | 74.0 | 790.8 | 15.2 | | 74.0 | 790.8 | -3.0 | |
| 21.0 | 686.1 | | | | 736.0 | | | | 756.8 | | | | 752.7 |
| 22.5 | | 198.1 | 817.1 | -33.5 | | 111.3 | 803.7 | -21.3 | | 145.4 | 807.2 | -12.2 | |
| 23.7 | 769.3 | | | | 640.4 | | | | 740.2 | | | | 702.8 |

TABLE XXXV. - TEST RESULTS FOR PANEL D

(Loading Condition III, Test No. 1)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 4241.6 | | | | 0 |
| 1.5 | | 46.6 | 16.1 | 15.2 | | 293.8 | 683.9 | -797.5 | | 395.9 | 644.4 | 733.6 | |
| 3.0 | 0 | | | | 316.0 | | | | 1962.8 | | | | 548.9 |
| 4.5 | | -8.4 | 246.6 | -185.7 | | 6.6 | 1008.6 | -447.5 | | 97.0 | 1156.4 | 176.5 | |
| 6.0 | 141.4 | | | | 590.5 | | | | 1239.2 | | | | 981.4 |
| 7.5 | | 4.6 | 434.1 | -203.9 | | -105.4 | 895.0 | -277.0 | | -83.1 | 1060.7 | -24.4 | |
| 9.0 | 386.7 | | | | 682.0 | | | | 973.1 | | | | 985.5 |
| 10.5 | | -13.6 | 552.5 | -130.9 | | -111.9 | 801.3 | -155.2 | | -114.4 | 966.7 | -60.9 | |
| 12.0 | 524.0 | | | | 686.1 | | | | 885.7 | | | | 910.7 |
| 13.5 | | -25.7 | 629.8 | -63.9 | | -34.4 | 811.5 | -115.7 | | -86.8 | 876.5 | -70.0 | |
| 15.0 | 623.8 | | | | 702.8 | | | | 860.8 | | | | 852.5 |
| 16.5 | | -19.3 | 683.6 | -45.7 | | -6.6 | 771.2 | -57.8 | | 6.1 | 858.7 | -51.7 | |
| 18.0 | 640.4 | | | | 727.7 | | | | 785.9 | | | | 835.8 |
| 19.5 | | -3.6 | 755.6 | -30.4 | | 49.2 | 790.5 | -39.6 | | 15.3 | 837.0 | -36.5 | |
| 21.0 | 627.9 | | | | 715.2 | | | | 831.7 | | | | 856.6 |
| 22.5 | | 98.8 | 791.0 | -94.4 | | 133.0 | 819.5 | -48.7 | | 170.3 | 832.4 | -30.4 | |
| 23.7 | 777.6 | | | | 657.0 | | | | 777.6 | | | | 748.5 |

TABLE XXXVI. - TEST RESULTS FOR PANEL D

(Loading Condition III, Test No. 2)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 4195.8 | | | | 0 |
| 1.5 | | 37.2 | 12.9 | 12.2 | | 1103.8 | 964.3 | -526.6 | | 405.2 | 647.6 | 730.5 | |
| 3.0 | 0 | | | | 320.2 | | | | 1966.9 | | | | 528.1 |
| 4.5 | | 17.8 | 243.4 | -200.9 | | -33.7 | 1011.3 | -450.5 | | 75.4 | 1165.5 | 179.6 | |
| 6.0 | 141.4 | | | | 578.0 | | | | 1255.8 | | | | 989.7 |
| 7.5 | | -60.5 | 436.5 | -207.0 | | -86.8 | 876.5 | -283.1 | | -67.6 | 1057.8 | -27.4 | |
| 9.0 | 395.0 | | | | 673.7 | | | | 993.9 | | | | 998.0 |
| 10.5 | | -29.2 | 530.5 | -127.8 | | -90.2 | 817.1 | -158.3 | | -98.9 | 963.8 | -63.9 | |
| 12.0 | 511.5 | | | | 686.1 | | | | 885.7 | | | | 935.6 |
| 13.5 | | 5.3 | 633.9 | -82.2 | | -12.8 | 777.4 | -100.4 | | 71.4 | 873.5 | -67.0 | |
| 15.0 | 598.8 | | | | 702.8 | | | | 831.7 | | | | 910.7 |
| 16.5 | | 5.5 | 683.9 | -39.6 | | 12.0 | 777.6 | -57.8 | | -9.5 | 836.7 | -36.5 | |
| 18.0 | 611.3 | | | | 748.5 | | | | 802.6 | | | | 825.7 |
| 19.5 | | 33.5 | 718.5 | -30.4 | | 33.8 | 793.5 | -42.6 | | 27.8 | 849.6 | -36.5 | |
| 21.0 | 648.7 | | | | 723.6 | | | | 781.8 | | | | 790.1 |
| 22.5 | | 111.1 | 753.7 | -100.4 | | 157.9 | 844.8 | -60.9 | | 120.7 | 831.9 | -30.4 | |
| 23.7 | 731.9 | | | | 640.4 | | | | 736.0 | | | | 706.9 |

TABLE XXXVII. - TEST RESULTS FOR PANEL D

(Loading Condition III, Test No. 3)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 4187.5 | | | | 58.2 |
| 1.5 | | -83.8 | -29.0 | -3.0 | | 262.6 | 639.8 | -706.2 | | 408.3 | 632.0 | 672.7 | |
| 3.0 | 0 | | | | 303.6 | | | | 2021.0 | | | | 503.2 |
| 4.5 | | -27.0 | 265.1 | -179.6 | | -92.7 | 982.6 | -423.1 | | 38.0 | 1127.6 | 173.5 | |
| 6.0 | 149.7 | | | | 582.2 | | | | 1251.7 | | | | 952.3 |
| 7.5 | | -1.6 | 440.2 | -197.9 | | -155.2 | 844.5 | -289.2 | | -111.0 | 1051.1 | -3.0 | |
| 9.0 | 378.4 | | | | 669.5 | | | | 989.7 | | | | 1056.2 |
| 10.5 | | -38.4 | 552.3 | -124.8 | | -143.0 | 782.2 | -155.2 | | -173.4 | 938.0 | 33.5 | |
| 12.0 | 515.6 | | | | 711.1 | | | | 898.2 | | | | 939.8 |
| 13.5 | | -28.8 | 630.4 | -79.1 | | -68.7 | 758.0 | -100.4 | | 55.8 | 895.5 | -51.7 | |
| 15.0 | 565.5 | | | | 706.9 | | | | 848.3 | | | | 869.1 |
| 16.5 | | -10.0 | 686.8 | -42.6 | | -34.6 | 761.5 | -48.7 | | -52.8 | 855.0 | -12.2 | |
| 18.0 | 648.7 | | | | 719.4 | | | | 810.9 | | | | 819.2 |
| 19.5 | | 21.1 | 730.9 | -30.4 | | 27.6 | 799.6 | -42.6 | | 52.6 | 849.9 | -30.4 | |
| 21.0 | 669.5 | | | | 715.4 | | | | 790.1 | | | | 785.9 |
| 22.5 | | 129.7 | 760.2 | -88.3 | | 157.8 | 819.8 | -36.5 | | 188.9 | 838.9 | -30.4 | |
| 23.7 | 748.5 | | | | 648.7 | | | | 711.1 | | | | 723.6 |

TABLE XXXVIII. - TEST RESULTS FOR PANEL D

(Loading Condition IV, Test No. 1)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 0 | | | | 4220.8 |
| 1.5 | | 0 | 0 | 0 | | 27.9 | 9.7 | -63.9 | | 302.9 | 637.1 | -733.6 | |
| 3.0 | 0 | | | | 45.7 | | | | 286.9 | | | | 1904.6 |
| 4.5 | | 87.1 | 88.4 | -42.6 | | -5.4 | 231.0 | -249.6 | | -145.7 | 897.7 | -377.4 | |
| 6.0 | 0 | | | | 170.5 | | | | 453.3 | | | | 1006.3 |
| 7.5 | | -5.7 | 156.1 | -109.6 | | -51.4 | 364.8 | -228.3 | | -103.2 | 629.6 | -188.7 | |
| 9.0 | 104.0 | | | | 303.6 | | | | 469.9 | | | | 723.6 |
| 10.5 | | -11.6 | 237.2 | -97.4 | | -51.3 | 389.8 | -143.1 | | -60.3 | 486.4 | -103.5 | |
| 12.0 | 241.2 | | | | 307.7 | | | | 453.3 | | | | 536.4 |
| 13.5 | | -42.4 | 293.1 | -60.9 | | -7.7 | 446.4 | -106.5 | | -153.3 | 479.2 | -79.1 | |
| 15.0 | 278.6 | | | | 378.4 | | | | 449.1 | | | | 465.7 |
| 16.5 | | -32.9 | 346.2 | -45.7 | | -94.6 | 433.0 | -82.2 | | -106.9 | 445.4 | -51.7 | |
| 18.0 | 332.7 | | | | 395.0 | | | | 590.5 | | | | 432.1 |
| 19.5 | | -11.0 | 412.0 | -36.5 | | 35.6 | 428.2 | -57.8 | | -14.0 | 428.4 | -51.7 | |
| 21.0 | 345.1 | | | | 432.5 | | | | 407.5 | | | | 357.6 |
| 22.5 | | 54.2 | 434.6 | -76.1 | | 76.0 | 475.4 | -67.0 | | 116.2 | 447.8 | -57.8 | |
| 23.7 | 365.9 | | | | 403.4 | | | | 390.9 | | | | 345.1 |

TABLE XXXIX. - TEST RESULTS FOR PANEL D

(Loading Condition IV, Test No. 2)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 0 | | | | 4108.5 |
| 1.5 | | -27.9 | -9.7 | 9.1 | | 96.2 | 16.6 | -82.2 | | 346.7 | 743.8 | -855.3 | |
| 3.0 | -37.4 | | | | 49.9 | | | | 316.0 | | | | 1892.1 |
| 4.5 | | -9.1 | 46.7 | -57.8 | | 56.6 | 244.2 | -249.6 | | 25.1 | 965.1 | -441.4 | |
| 6.0 | 0 | | | | 174.7 | | | | 499.0 | | | | 1014.7 |
| 7.5 | | 208.5 | 230.2 | -33.5 | | -29.8 | 355.6 | -219.2 | | -50.2 | 714.5 | -161.3 | |
| 9.0 | 79.0 | | | | 274.5 | | | | 440.8 | | | | 702.8 |
| 10.5 | | 87.7 | 263.2 | -48.7 | | -85.5 | 361.3 | -127.8 | | -122.1 | 548.2 | -103.5 | |
| 12.0 | 187.1 | | | | 316.0 | | | | 474.1 | | | | 507.3 |
| 13.5 | | -26.9 | 290.1 | -63.9 | | -26.6 | 365.0 | -88.3 | | -44.8 | 483.5 | -63.9 | |
| 15.0 | 299.4 | | | | 353.5 | | | | 449.1 | | | | 469.9 |
| 16.5 | | 4.4 | 359.1 | -33.5 | | -76.2 | 364.5 | -70.0 | | 4.6 | 434.1 | -45.7 | |
| 18.0 | 307.7 | | | | 370.1 | | | | 436.6 | | | | 428.3 |
| 19.5 | | -8.0 | 371.5 | -33.5 | | 38.5 | 387.6 | -48.7 | | 35.6 | 428.2 | -39.6 | |
| 21.0 | 365.9 | | | | 399.2 | | | | 424.2 | | | | 407.5 |
| 22.5 | | 47.8 | 365.8 | -63.9 | | -38.5 | 387.6 | -48.7 | | 78.9 | 409.9 | -27.4 | |
| 23.7 | 399.2 | | | | 378.4 | | | | 390.9 | | | | 353.5 |

TABLE XL. - TEST RESULTS FOR PANEL D

(Loading Condition IV, Test No. 3)
P = 1 kip

| y | Stiff. No. 1 | Web No. 1 | | | Stiff. No. 2 | Web No. 2 | | | Stiff. No. 3 | Web No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | -29.1 | | | | -33.3 | | | | 0 | | | | 4125.1 |
| 1.5 | | -46.6 | -16.1 | 15.2 | | 83.6 | -21.0 | -70.0 | | 374.4 | 703.5 | -827.9 | |
| 3.0 | -45.7 | | | | 0 | | | | 270.3 | | | | 1875.4 |
| 4.5 | | -43.3 | 18.3 | -36.5 | | 31.8 | 218.9 | -243.5 | | -21.6 | 924.0 | -395.7 | |
| 6.0 | 0 | | | | 158.0 | | | | 478.2 | | | | 1031.3 |
| 7.5 | | 15.9 | 121.9 | -88.3 | | -20.5 | 333.9 | -203.9 | | -50.3 | 689.5 | -155.2 | |
| 9.0 | 95.6 | | | | 249.5 | | | | 478.2 | | | | 590.5 |
| 10.5 | | -5.6 | 181.0 | -79.1 | | -8.1 | 346.5 | -118.7 | | -122.2 | 523.3 | -97.4 | |
| 12.0 | 174.7 | | | | 299.4 | | | | 457.4 | | | | 532.3 |
| 13.5 | | -33.2 | 246.3 | -51.7 | | 16.8 | 371.8 | -94.4 | | -100.7 | 464.2 | -45.7 | |
| 15.0 | 262.0 | | | | 324.4 | | | | 440.8 | | | | 445.0 |
| 16.5 | | -73.3 | 323.9 | -60.9 | | -57.7 | 346.0 | -70.0 | | -69.8 | 433.3 | -33.5 | |
| 18.0 | 282.8 | | | | 345.1 | | | | 390.9 | | | | 382.6 |
| 19.5 | | -1.9 | 340.3 | -57.8 | | -26.7 | 340.1 | -76.1 | | -29.7 | 380.6 | -36.5 | |
| 21.0 | 382.6 | | | | 353.5 | | | | 357.6 | | | | 316.0 |
| 22.5 | | 26.1 | 375.0 | -97.4 | | 41.6 | 372.0 | -100.4 | | 44.7 | 381.4 | -42.6 | |
| 23.7 | 399.2 | | | | 349.3 | | | | 303.6 | | | | 274.5 |

TABLE XLI. - AVERAGE OF TEST RESULTS FOR PANEL D

(Loading Condition I; Test Nos. 1, 2, 3; P = 1 kip)

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 4965.1 | | | | 0 | | | | 0 | | | | 85.9 |
| 1.5 | | -171.1 | 705.9 | 779.2 | | -756.6 | -79.0 | -44.6 | | -960.7 | -39.6 | -29.4 | |
| 3.0 | 3335.0 | | | | 368.7 | | | | 90.1 | | | | 51.3 |
| 4.5 | | 301.7 | 1566.7 | 836.0 | | 155.9 | 253.6 | 371.4 | | -65.2 | -22.5 | 78.1 | |
| 6.0 | 2084.8 | | | | 670.9 | | | | 170.5 | | | | 76.3 |
| 7.5 | | 173.9 | 1305.0 | 493.1 | | 273.7 | 557.7 | 429.2 | | 249.9 | 247.3 | 139.0 | |
| 9.0 | 1434.6 | | | | 777.6 | | | | 350.7 | | | | 228.7 |
| 10.5 | | 115.4 | 1087.9 | 292.2 | | 278.3 | 695.2 | 333.8 | | 215.4 | 448.8 | 118.7 | |
| 12.5 | 1068.7 | | | | 788.6 | | | | 503.1 | | | | 418.1 |
| 13.5 | | 80.8 | 942.8 | 155.2 | | 138.0 | 751.9 | 203.9 | | 143.6 | 587.5 | 84.2 | |
| 15.0 | 867.7 | | | | 763.7 | | | | 609.9 | | | | 544.8 |
| 16.5 | | 52.6 | 849.9 | 93.3 | | 96.7 | 759.8 | 114.6 | | 80.8 | 651.6 | 54.8 | |
| 18.0 | 769.3 | | | | 761.0 | | | | 698.6 | | | | 647.3 |
| 19.5 | | 80.2 | 792.9 | 29.4 | | 24.4 | 781.9 | 43.6 | | 185.8 | 768.2 | 11.2 | |
| 21.0 | 715.2 | | | | 766.5 | | | | 726.3 | | | | 700.0 |
| 22.5 | | 93.7 | 792.0 | 40.6 | | 164.9 | 833.4 | 1.0 | | 174.3 | 795.0 | -14.2 | |
| 23.7 | 762.3 | | | | 675.0 | | | | 708.3 | | | | 688.9 |

TABLE XLII. - AVERAGE OF TEST RESULTS FOR PANEL D

(Loading Condition II; Test Nos. 1, 2, 3; P = 1 kip)

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 4126.6 | | | | 0 | | | | 0 |
| 1.5 | | 102.7 | 703.7 | -607.8 | | 69.1 | 578.4 | 835.0 | | -285.2 | -7.2 | 81.2 | |
| 3.0 | 329.9 | | | | 1937.8 | | | | 349.3 | | | | 141.4 |
| 4.5 | | 121.6 | 1003.1 | -210.0 | | -119.5 | 976.0 | 449.5 | | 47.6 | 315.9 | 183.6 | |
| 6.0 | 716.6 | | | | 1165.7 | | | | 586.3 | | | | 360.3 |
| 7.5 | | -16.5 | 898.0 | -49.7 | | -5.1 | 840.9 | 202.9 | | 68.9 | 511.8 | 120.7 | |
| 9.0 | 816.4 | | | | 888.5 | | | | 663.9 | | | | 535.1 |
| 10.5 | | 28.9 | 842.1 | 29.4 | | 9.9 | 779.7 | 126.8 | | 57.1 | 665.7 | 68.0 | |
| 12.0 | 801.2 | | | | 788.7 | | | | 713.9 | | | | 627.9 |
| 13.5 | | -69.6 | 779.8 | 18.2 | | 42.0 | 793.5 | 73.0 | | 46.9 | 732.1 | 23.4 | |
| 15.0 | 761.0 | | | | 766.6 | | | | 737.4 | | | | 682.0 |
| 16.5 | | -52.0 | 774.8 | 31.5 | | 52.4 | 791.6 | 50.7 | | 45.0 | 761.3 | 13.2 | |
| 18.0 | 722.2 | | | | 756.8 | | | | 749.9 | | | | 742.9 |
| 19.5 | | 85.3 | 767.0 | 4.0 | | 76.1 | 797.1 | 17.3 | | 77.1 | 800.2 | -10.1 | |
| 21.0 | 697.2 | | | | 748.5 | | | | 742.9 | | | | 754.1 |
| 22.5 | | 126.7 | 792.4 | -48.7 | | 124.7 | 802.8 | -22.3 | | 150.6 | 822.8 | -19.3 | |
| 23.7 | 762.4 | | | | 655.6 | | | | 727.7 | | | | 710.9 |

TABLE XLIII. - AVERAGE OF TEST RESULTS FOR PANEL D

(Loading Condition III; Test Nos. 1, 2, 3; P = 1 kip)

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | 0 | | | | 0 | | | | 4208.3 | | | | 19.4 |
| 1.5 | | 0 | 0 | 8.0 | | 553.4 | 762.7 | -676.8 | | 403.1 | 641.3 | 712.3 | |
| 3.0 | 0 | | | | 313.3 | | | | 1983.6 | | | | 526.7 |
| 4.5 | | -5.9 | 251.7 | -188.7 | | -39.9 | 1000.8 | -440.4 | | 70.1 | 1149.8 | 176.5 | |
| 6.0 | 144.2 | | | | 583.6 | | | | 1248.9 | | | | 974.5 |
| 7.5 | | -19.2 | 436.9 | -202.9 | | -115.8 | 872.0 | -283.1 | | -87.2 | 1056.5 | 18.3 | |
| 9.0 | 386.7 | | | | 675.1 | | | | 985.6 | | | | 1013.2 |
| 10.5 | | -27.1 | 545.1 | -127.8 | | -115.0 | 800.2 | -156.2 | | -128.9 | 956.2 | -30.4 | |
| 12.0 | 517.0 | | | | 694.4 | | | | 889.9 | | | | 928.7 |
| 13.5 | | -16.4 | 634.7 | -75.1 | | -38.6 | 782.3 | -105.5 | | 13.5 | 881.8 | -62.9 | |
| 15.0 | 596.0 | | | | 704.2 | | | | 846.9 | | | | 877.4 |
| 16.5 | | -7.9 | 681.8 | -42.6 | | -9.7 | 770.1 | -54.8 | | -18.7 | 850.1 | -33.5 | |
| 18.0 | 633.5 | | | | 731.9 | | | | 799.8 | | | | 826.9 |
| 19.5 | | 17.0 | 735.0 | -30.4 | | 36.9 | 794.5 | -41.6 | | 31.9 | 845.5 | -34.5 | |
| 21.0 | 648.7 | | | | 718.1 | | | | 801.2 | | | | 810.9 |
| 22.5 | | 113.2 | 768.3 | -94.4 | | 149.6 | 828.0 | -48.7 | | 160.0 | 834.4 | -30.4 | |
| 23.7 | 752.7 | | | | 648.7 | | | | 741.6 | | | | 726.3 |

TABLE XLIV. - AVERAGE OF TEST RESULTS FOR PANEL D

(Loading Condition IV; Test Nos. 1, 2, 3; P = 1 kip)

| y | Stiff. No. 1 | Web. No. 1 | | | Stiff. No. 2 | Web. No. 2 | | | Stiff. No. 3 | Web. No. 3 | | | Stiff. No. 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| in. | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ | $\sigma_x$ | $\sigma_y$ | $\tau_{xy}$ | $\sigma_y$ |
| 0.3 | -9.7 | | | | -11.1 | | | | 0 | | | | 4151.5 |
| 1.5 | | -24.8 | -8.6 | 8.1 | | 69.2 | 1.8 | -72.0 | | 341.3 | 694.8 | -805.6 | |
| 3.0 | -27.7 | | | | 31.9 | | | | 291.1 | | | | 1890.7 |
| 4.5 | | 11.6 | 51.1 | -45.6 | | 27.7 | 231.4 | -247.6 | | -47.4 | 928.9 | -404.8 | |
| 6.0 | 0 | | | | 167.7 | | | | 476.8 | | | | 1017.4 |
| 7.5 | | 72.9 | 169.4 | -77.1 | | -33.9 | 351.4 | -217.1 | | -67.9 | 677.9 | -168.4 | |
| 9.0 | 92.9 | | | | 275.9 | | | | 463.0 | | | | 672.3 |
| 10.5 | | 23.5 | 227.1 | -75.1 | | -48.3 | 366.2 | -129.9 | | -101.5 | 519.3 | -101.5 | |
| 12.0 | 201.0 | | | | 307.7 | | | | 461.6 | | | | 525.3 |
| 13.5 | | -34.2 | 276.5 | -58.8 | | -5.8 | 394.4 | -96.4 | | -99.6 | 475.6 | -62.9 | |
| 15.0 | 280.0 | | | | 352.1 | | | | 446.3 | | | | 460.5 |
| 16.5 | | -33.9 | 343.1 | -46.7 | | -76.5 | 381.2 | -74.1 | | -57.4 | 437.6 | -43.6 | |
| 18.0 | 307.7 | | | | 370.1 | | | | 472.7 | | | | 414.3 |
| 19.5 | | -7.0 | 374.6 | -42.6 | | 15.8 | 385.3 | -60.9 | | -2.7 | 412.4 | -42.6 | |
| 21.0 | 364.5 | | | | 395.1 | | | | 396.4 | | | | 360.4 |
| 22.5 | | 42.7 | 391.8 | -79.1 | | 26.4 | 411.7 | -72.0 | | 79.9 | 413.0 | -42.6 | |
| 23.7 | 388.1 | | | | 377.0 | | | | 361.8 | | | | 324.4 |

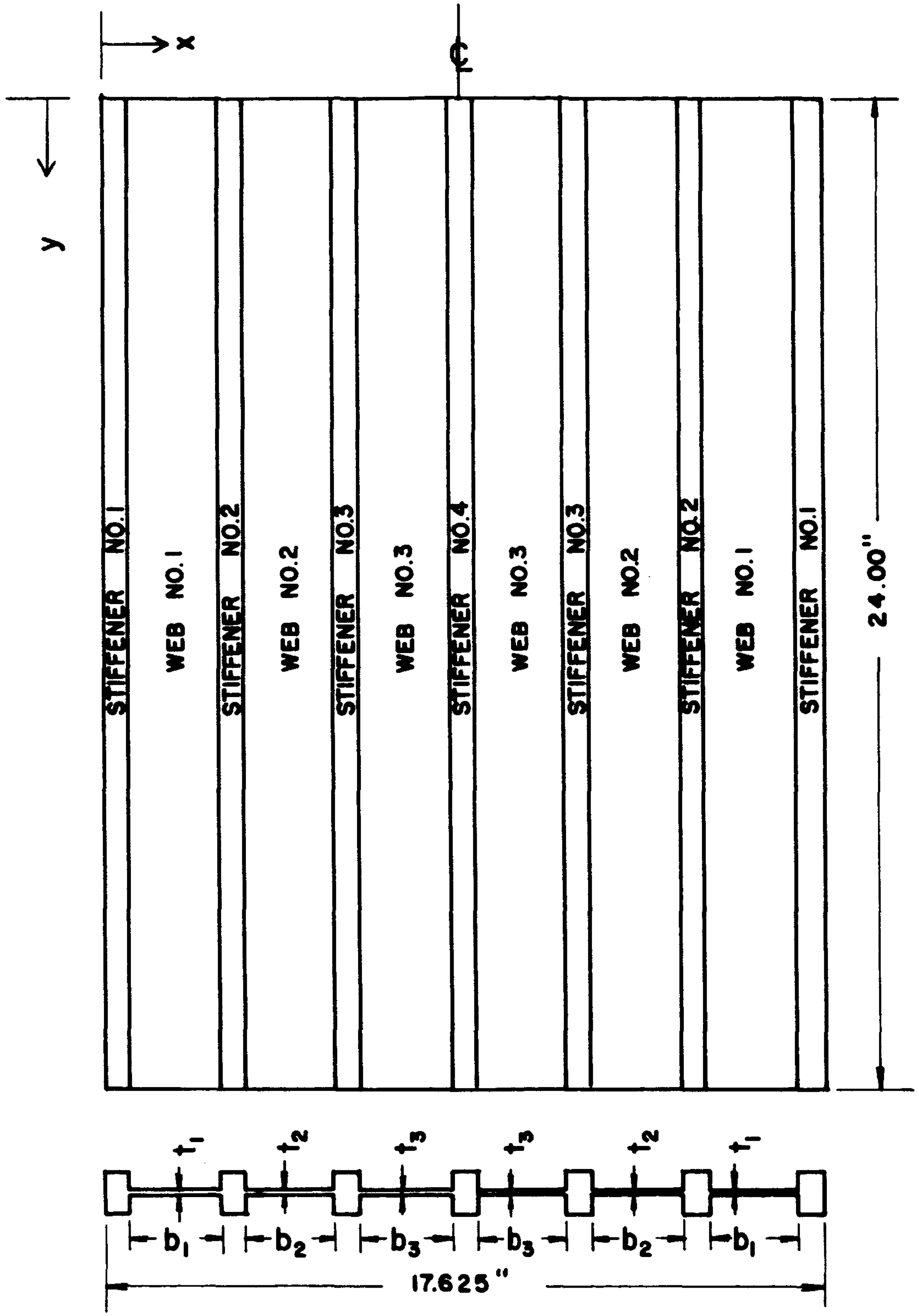
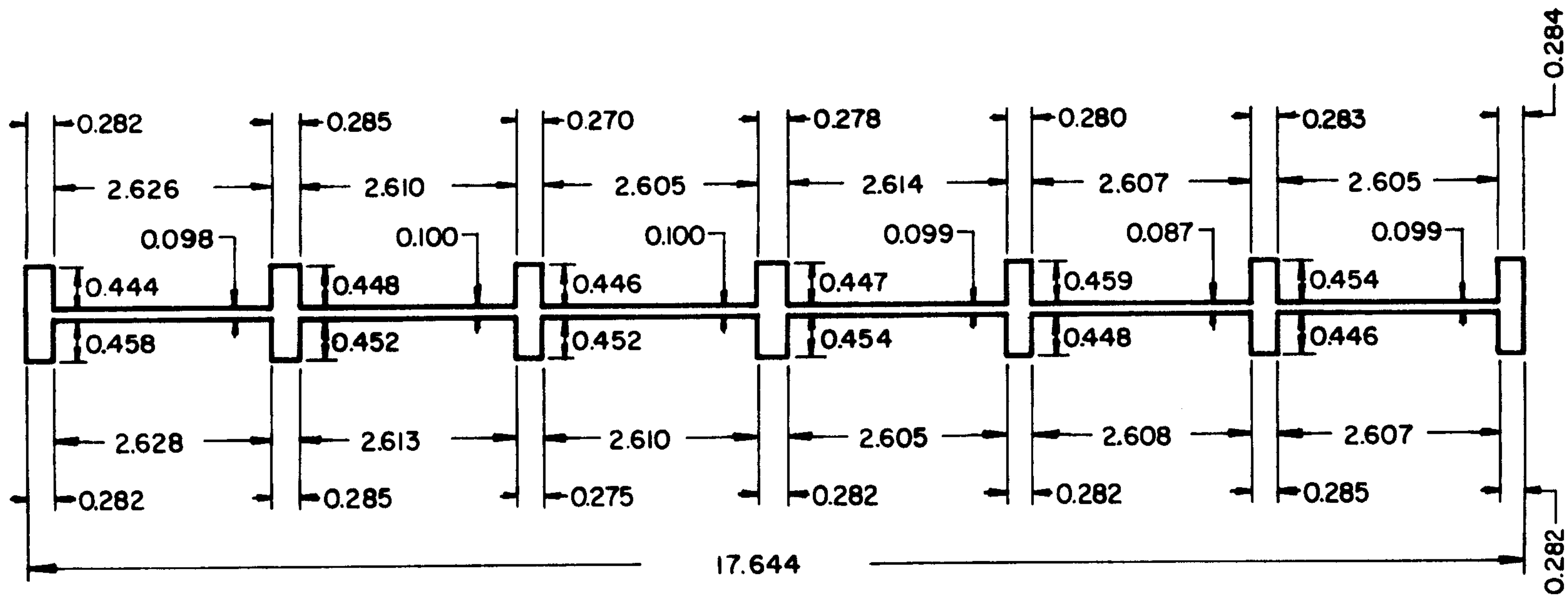


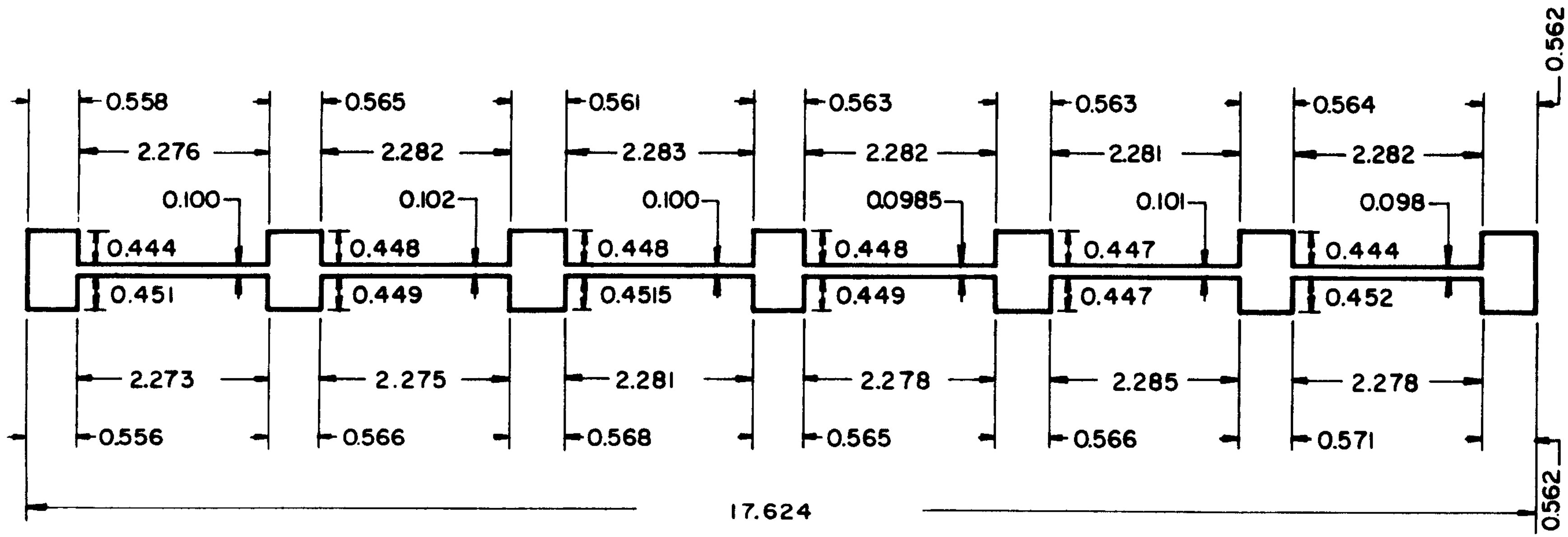

FIGURE I.—TYPICAL PANEL CONFIGURATION.




PANEL LENGTH 24.00

ALL DIMENSIONS IN INCHES

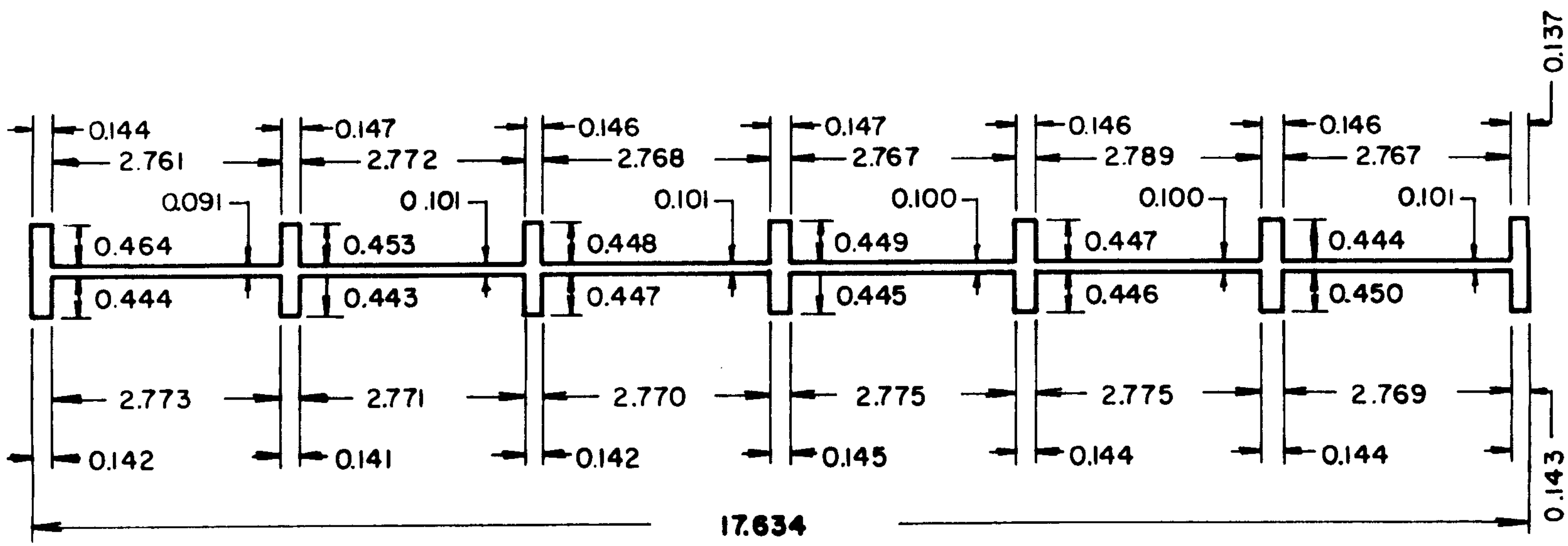
FIGURE 2.— CROSS-SECTION OF PANEL B.




PANEL LENGTH 24.00

ALL DIMENSIONS IN INCHES

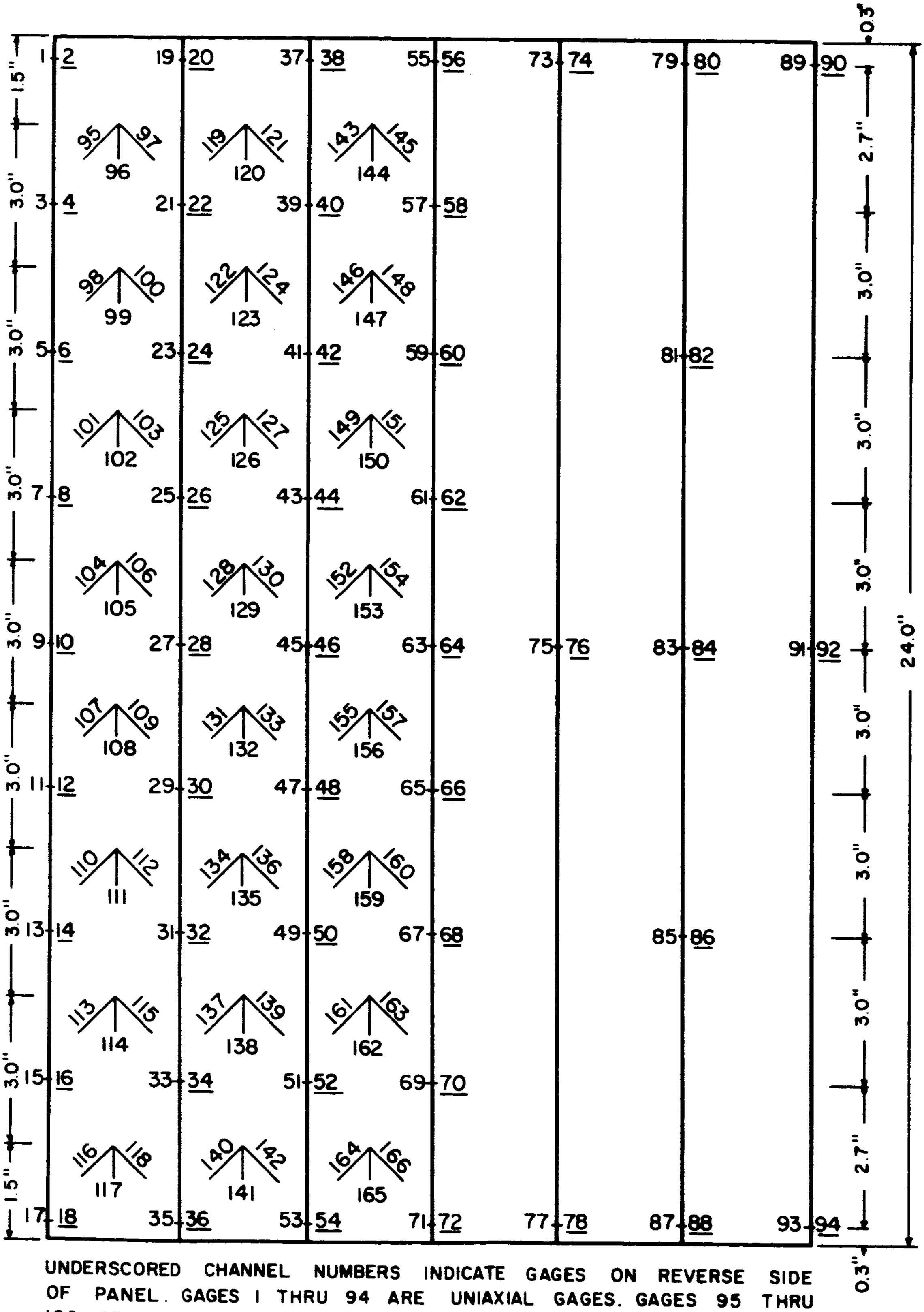
FIGURE 3. — CROSS-SECTION OF PANEL C.




PANEL LENGTH 24.00

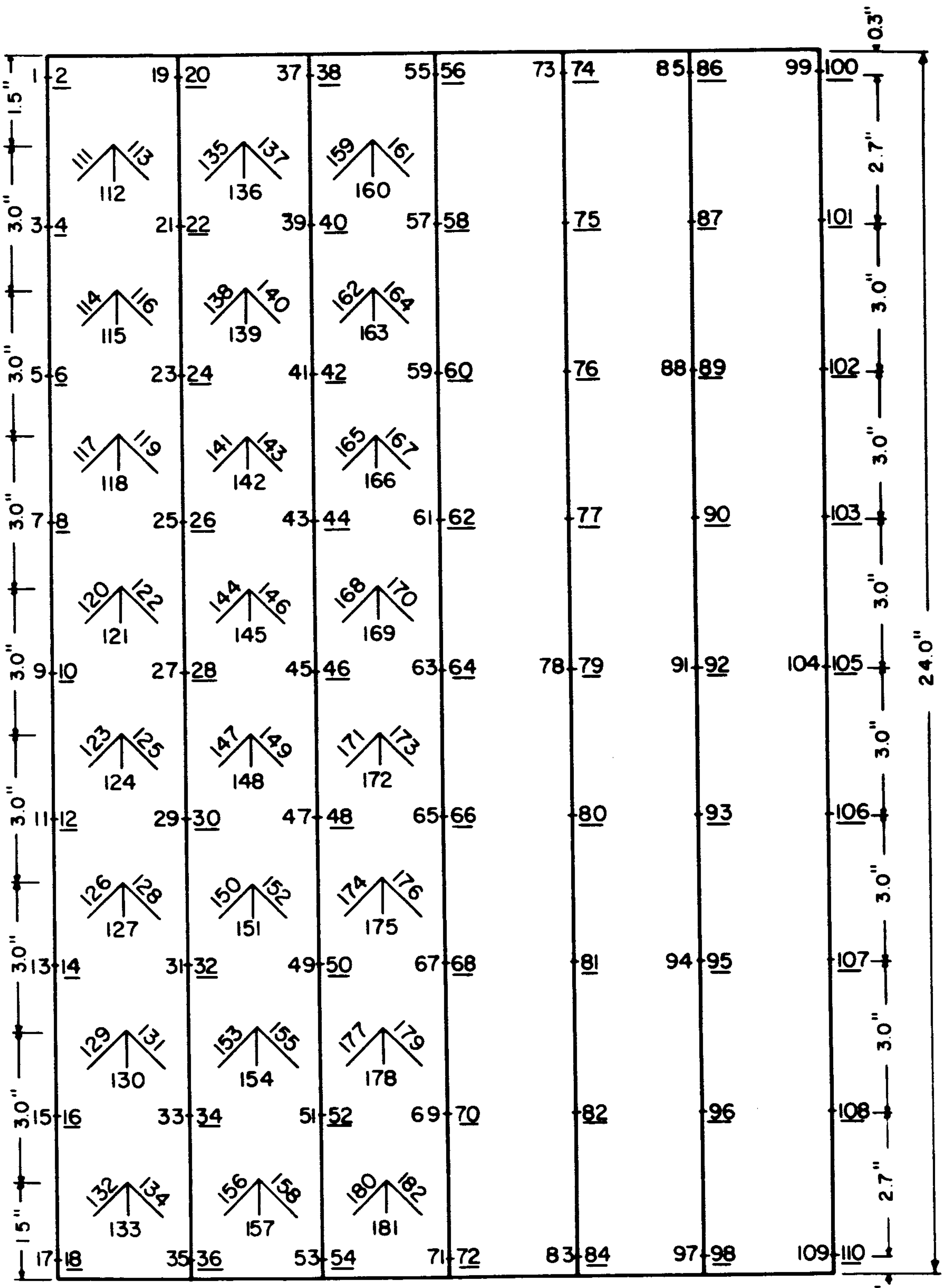
ALL DIMENSIONS IN INCHES

FIGURE 4. — CROSS-SECTION OF PANEL D .




UNDERSCORED CHANNEL NUMBERS INDICATE GAGES ON REVERSE SIDE OF PANEL. GAGES 1 THRU 94 ARE UNIAXIAL GAGES. GAGES 95 THRU 166 ARE ROSETTES.

**FIGURE 5.— STRAIN GAGE CHANNELS FOR PANELS B AND C.**




UNDERSCORED CHANNEL NUMBERS INDICATE GAGES ON REVERSE SIDE OF PANEL. GAGES 1 THRU 110 ARE UNIAXIAL GAGES. GAGES 111 THRU 182 ARE ROSETTES.

**FIGURE 6.— STRAIN GAGE CHANNELS FOR PANEL D.**

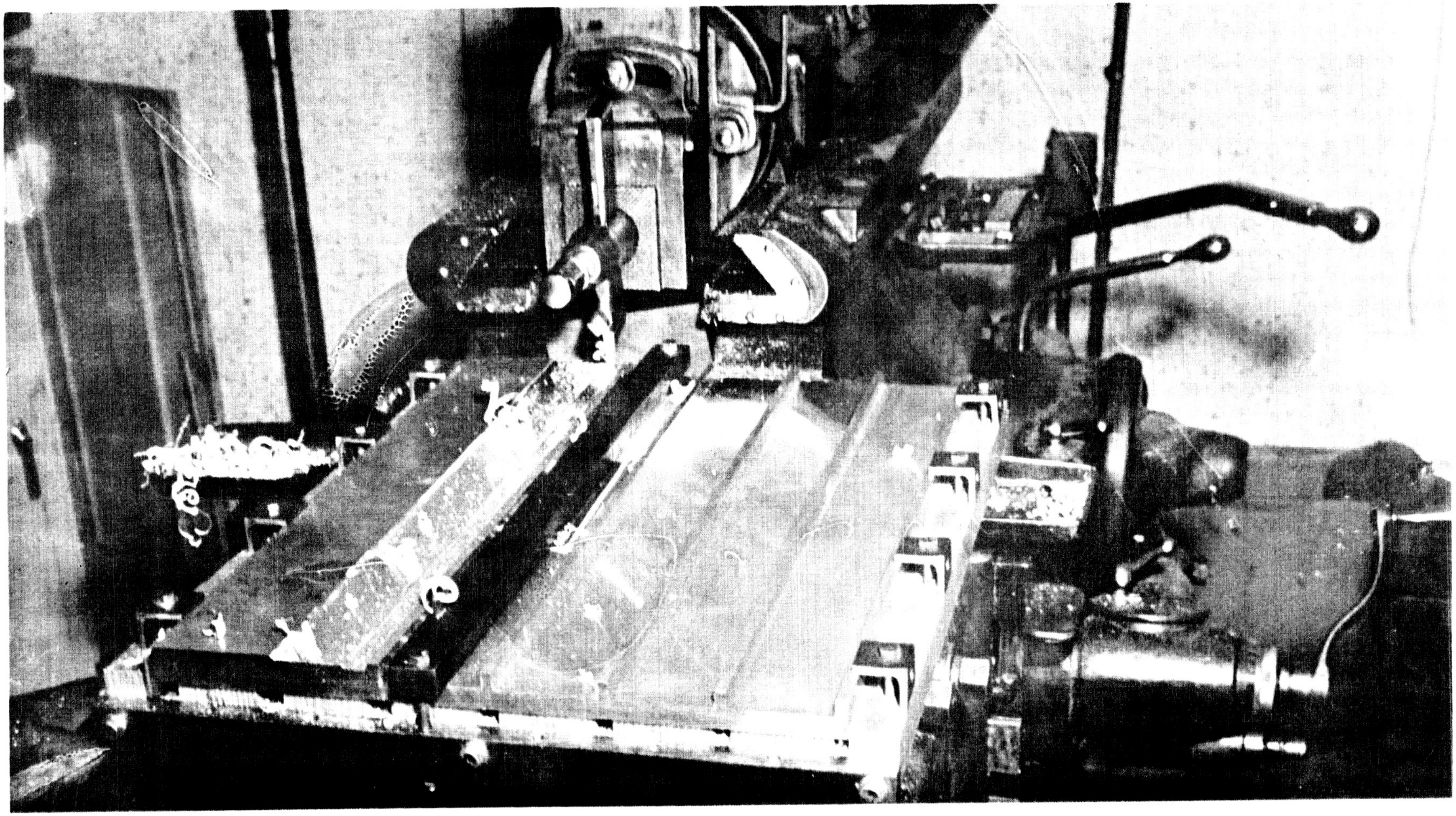


FIGURE 7.—MACHINING OF PANEL.

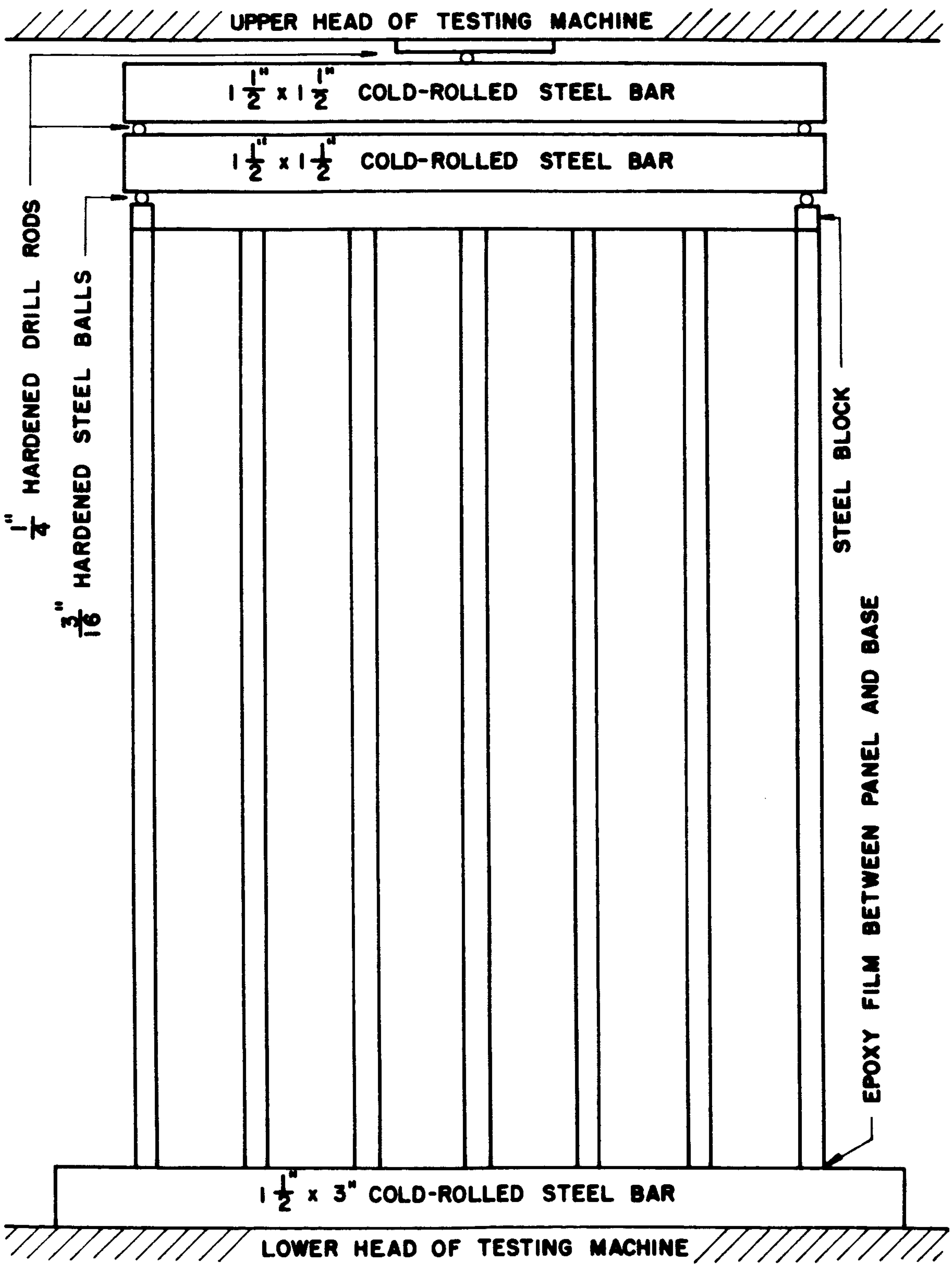



FIGURE 8.—TYPICAL LOADING ARRANGEMENT.

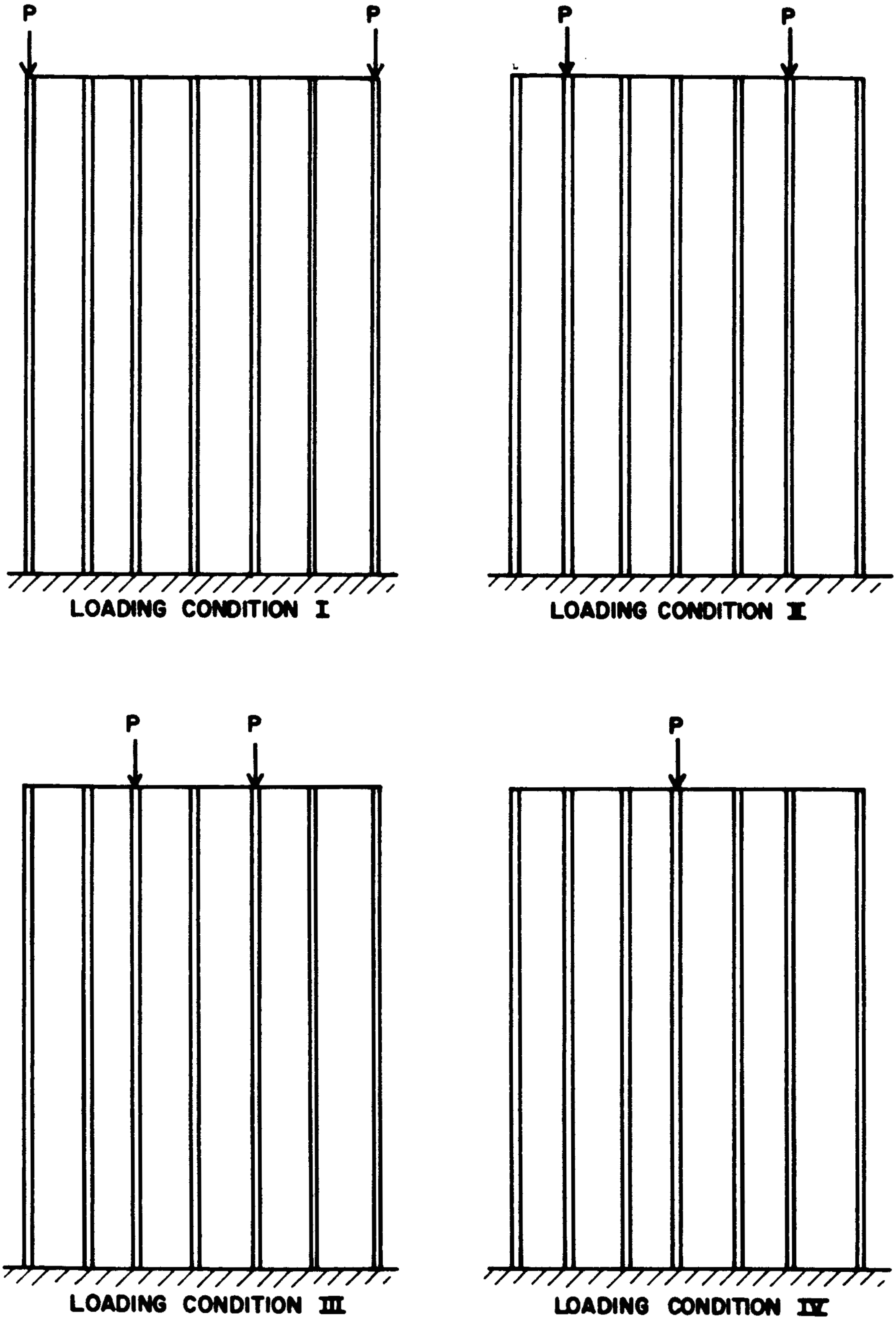



FIGURE 9. — FOUR LOADING CONDITIONS.

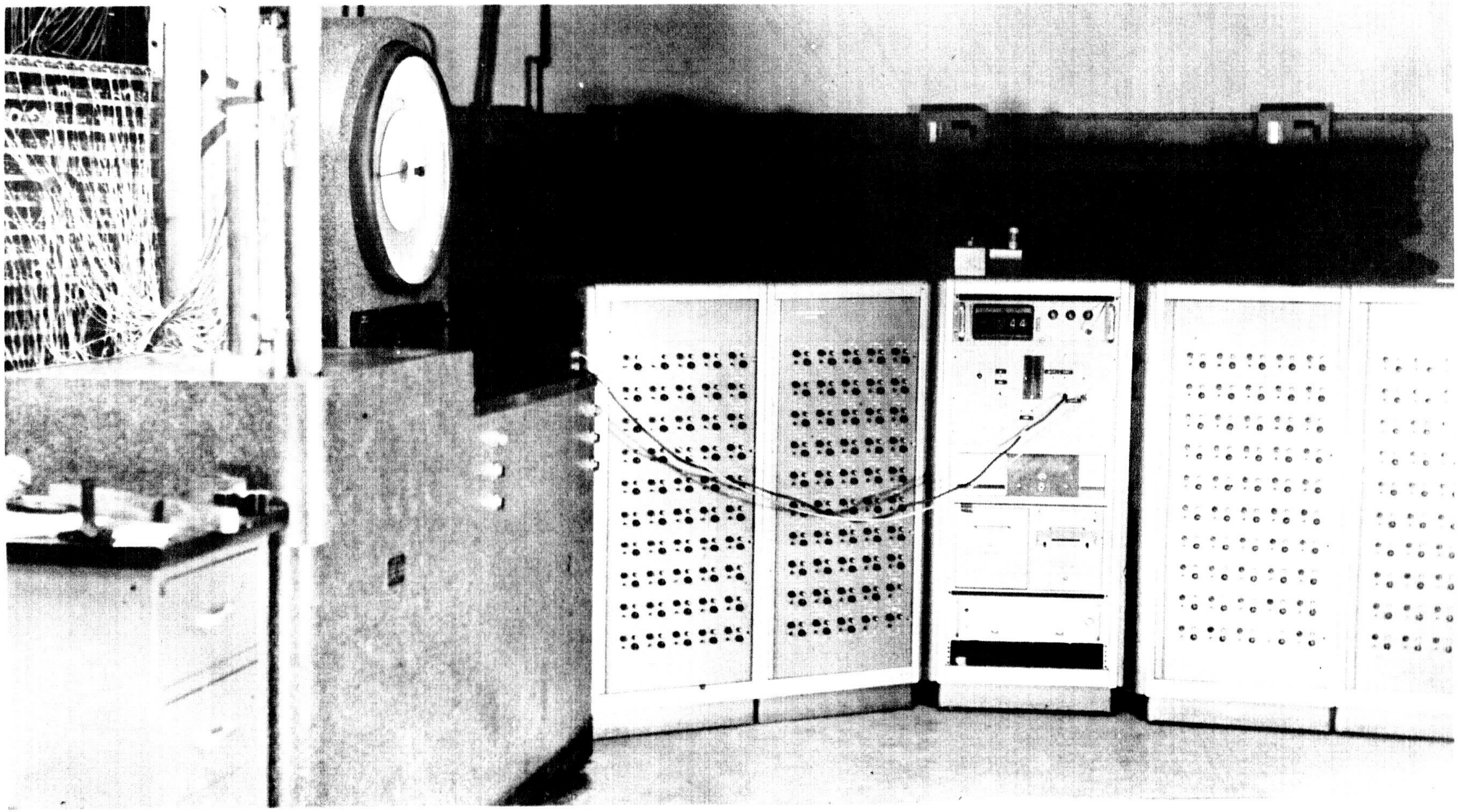


FIGURE 10.—OVERALL VIEW OF TEST EQUIPMENT.

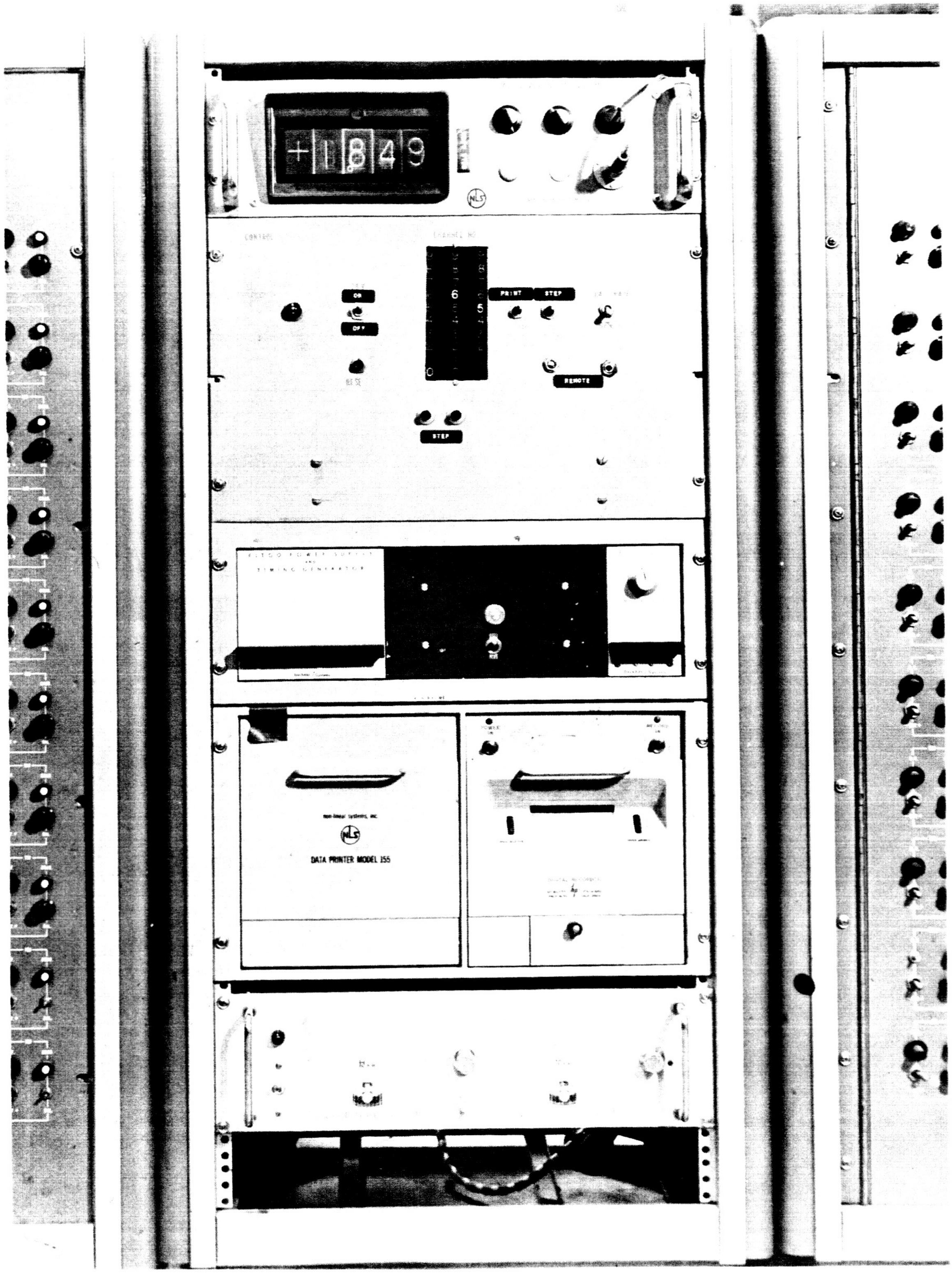



**FIGURE 11. — CONTROL CONSOLE.**

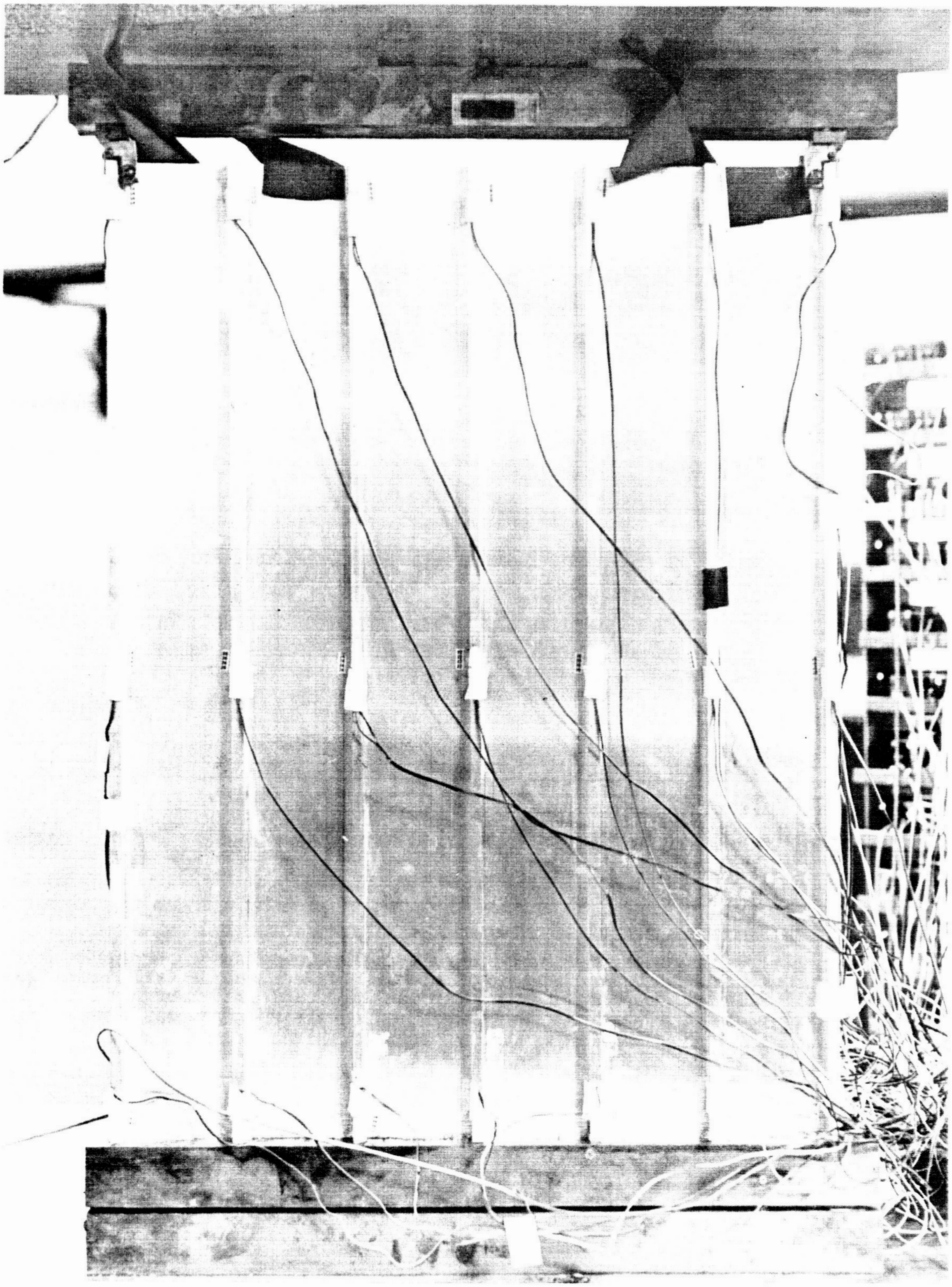


FIGURE 12.—FRONT VIEW OF PANEL .

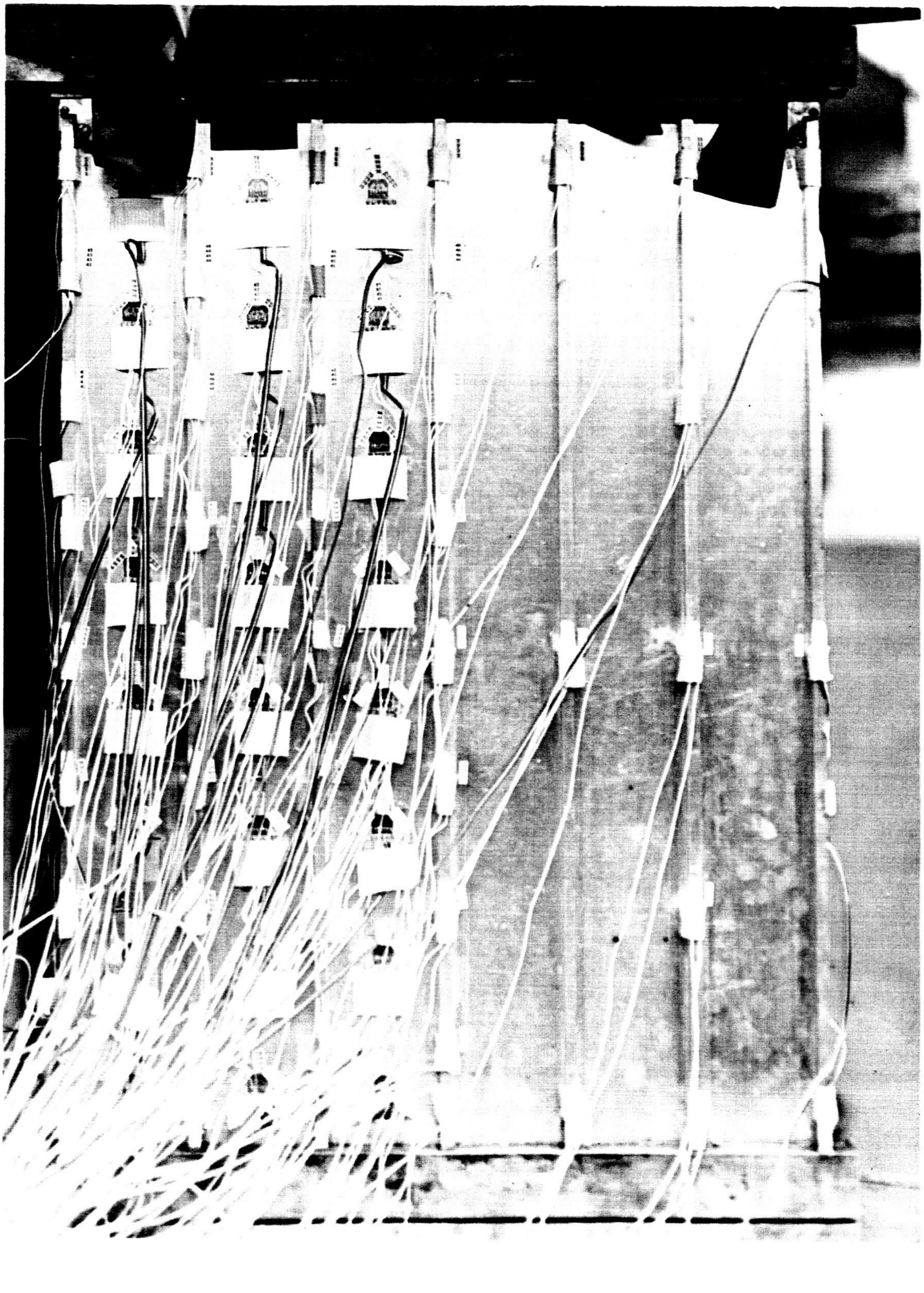


FIGURE 13.—REAR VIEW OF PANEL.

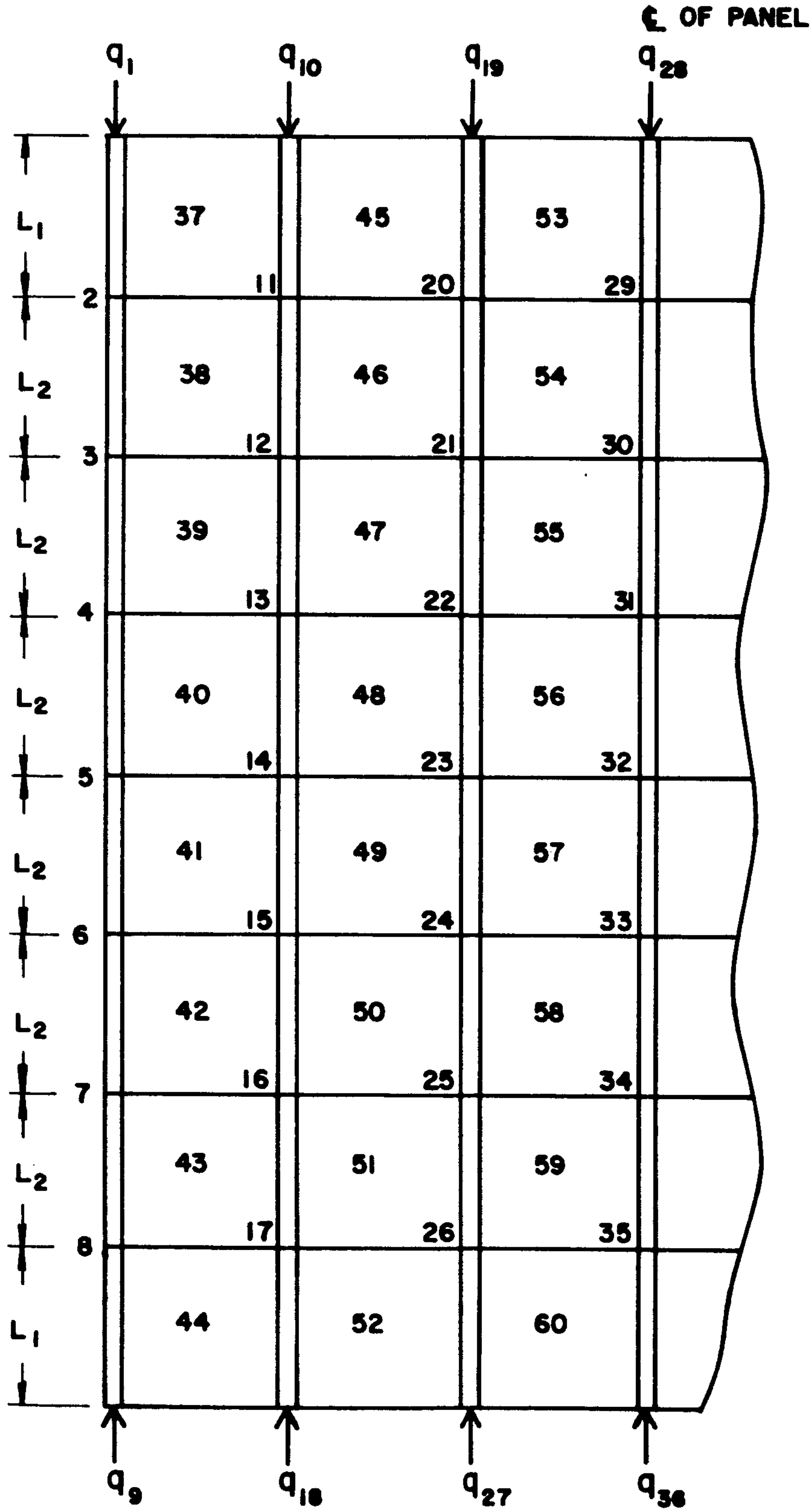



FIGURE 14.—GENERALIZED FORCE SYSTEM.

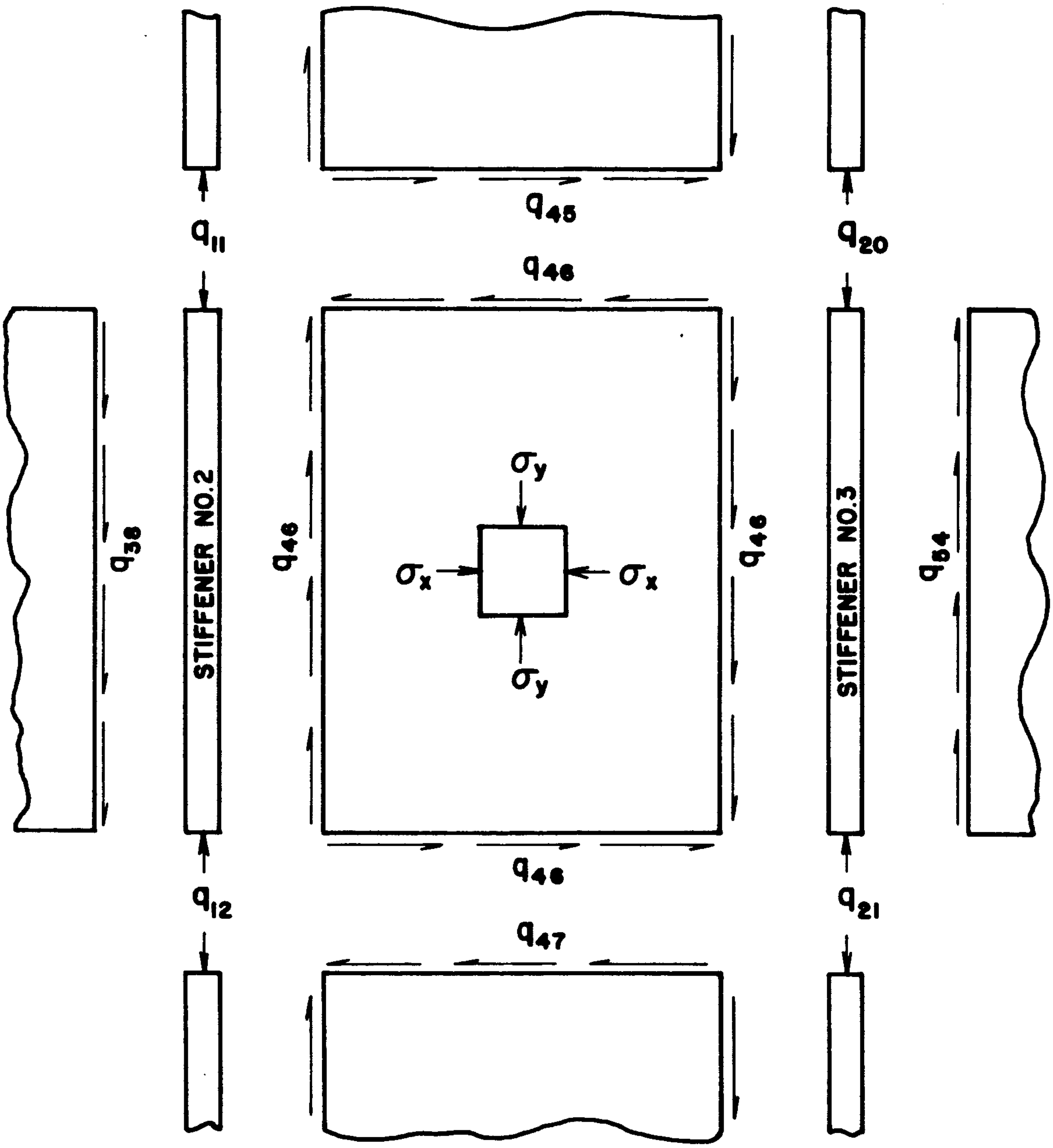



FIGURE 15. — GENERALIZED FORCE SYSTEM DETAILS.

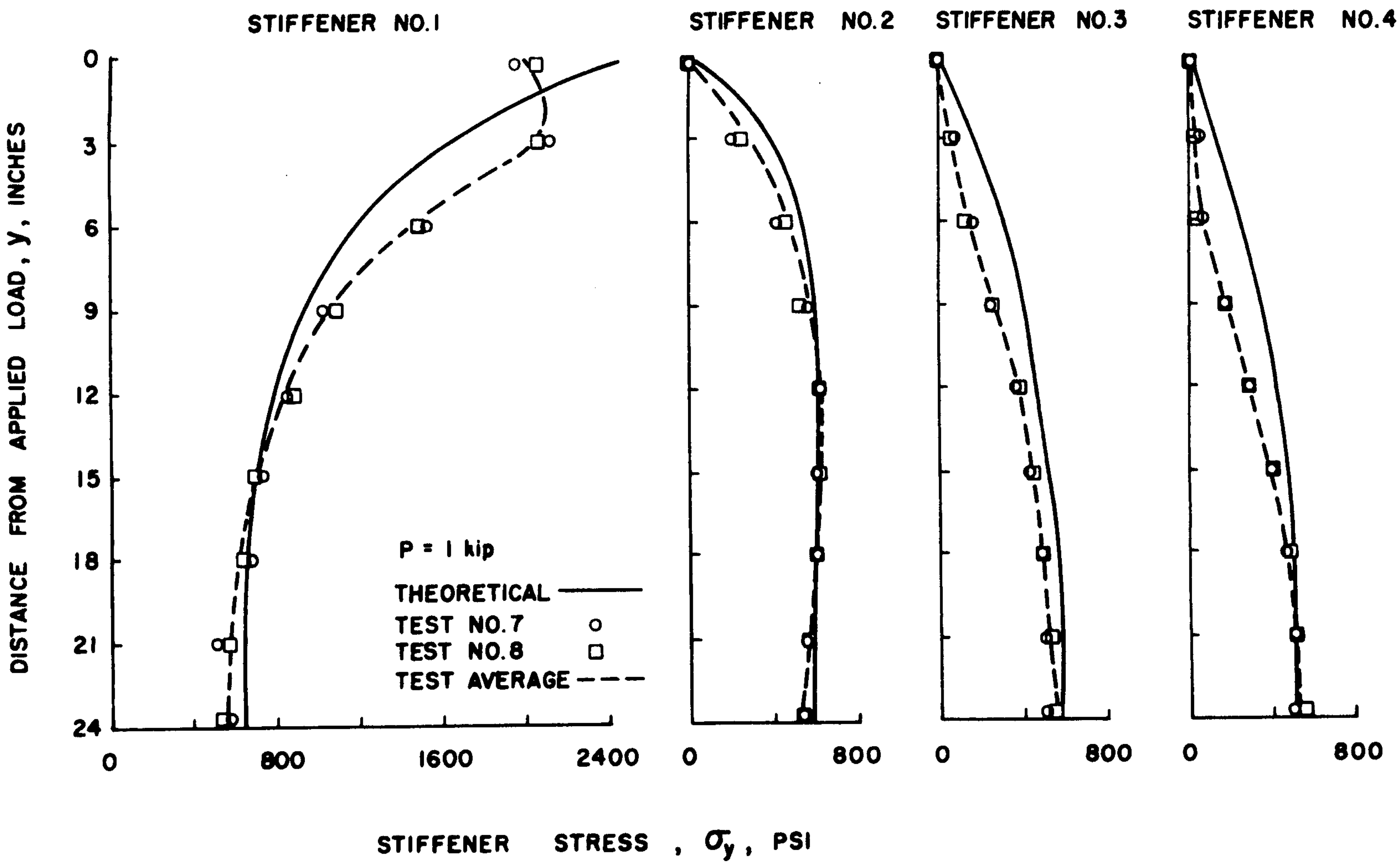



FIGURE 16. — NORMAL STRESS IN STIFFENERS OF PANEL B FOR LOADING CONDITION I.

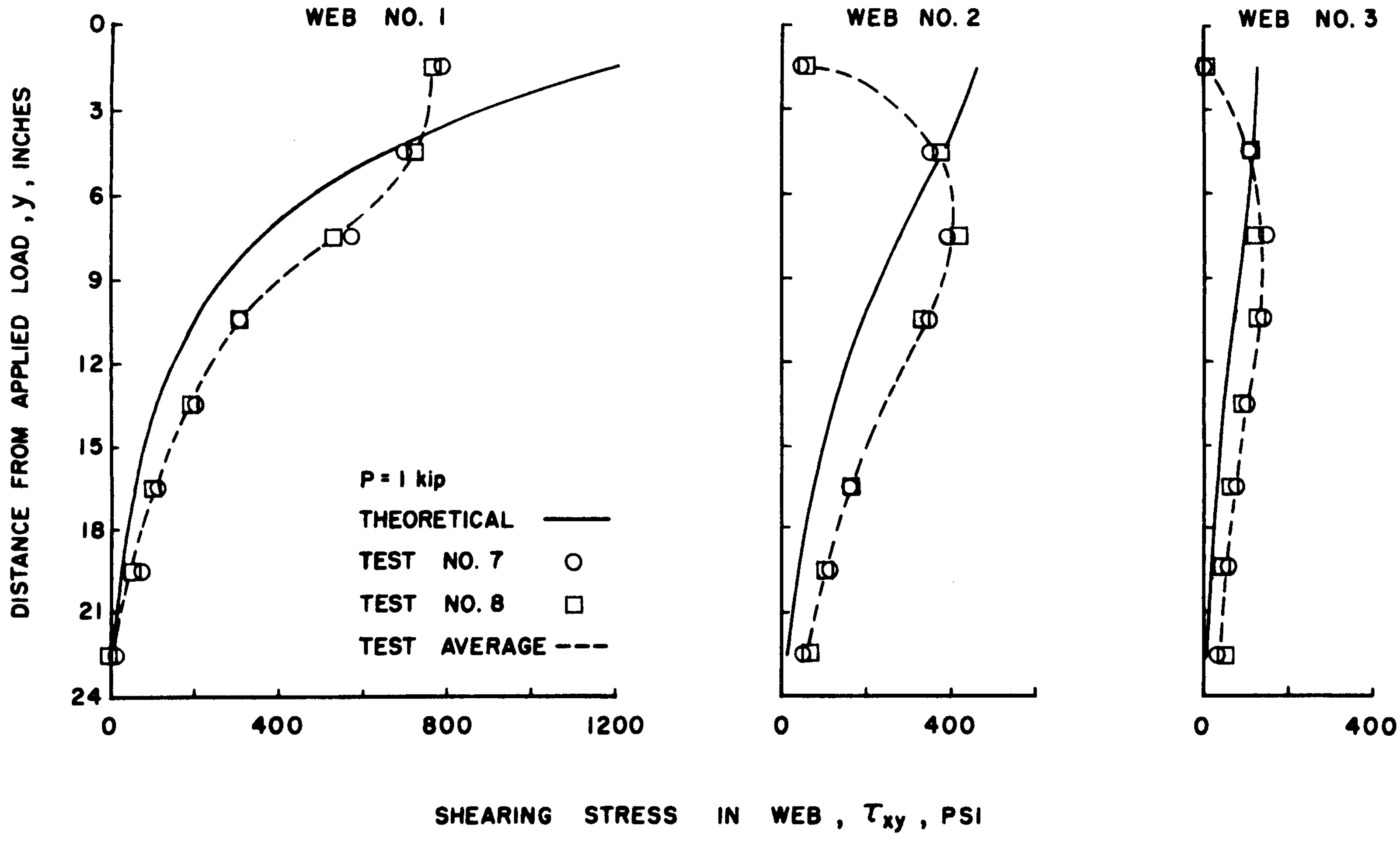



FIGURE 17.- SHEARING STRESS IN WEB OF PANEL B FOR LOADING CONDITION I.

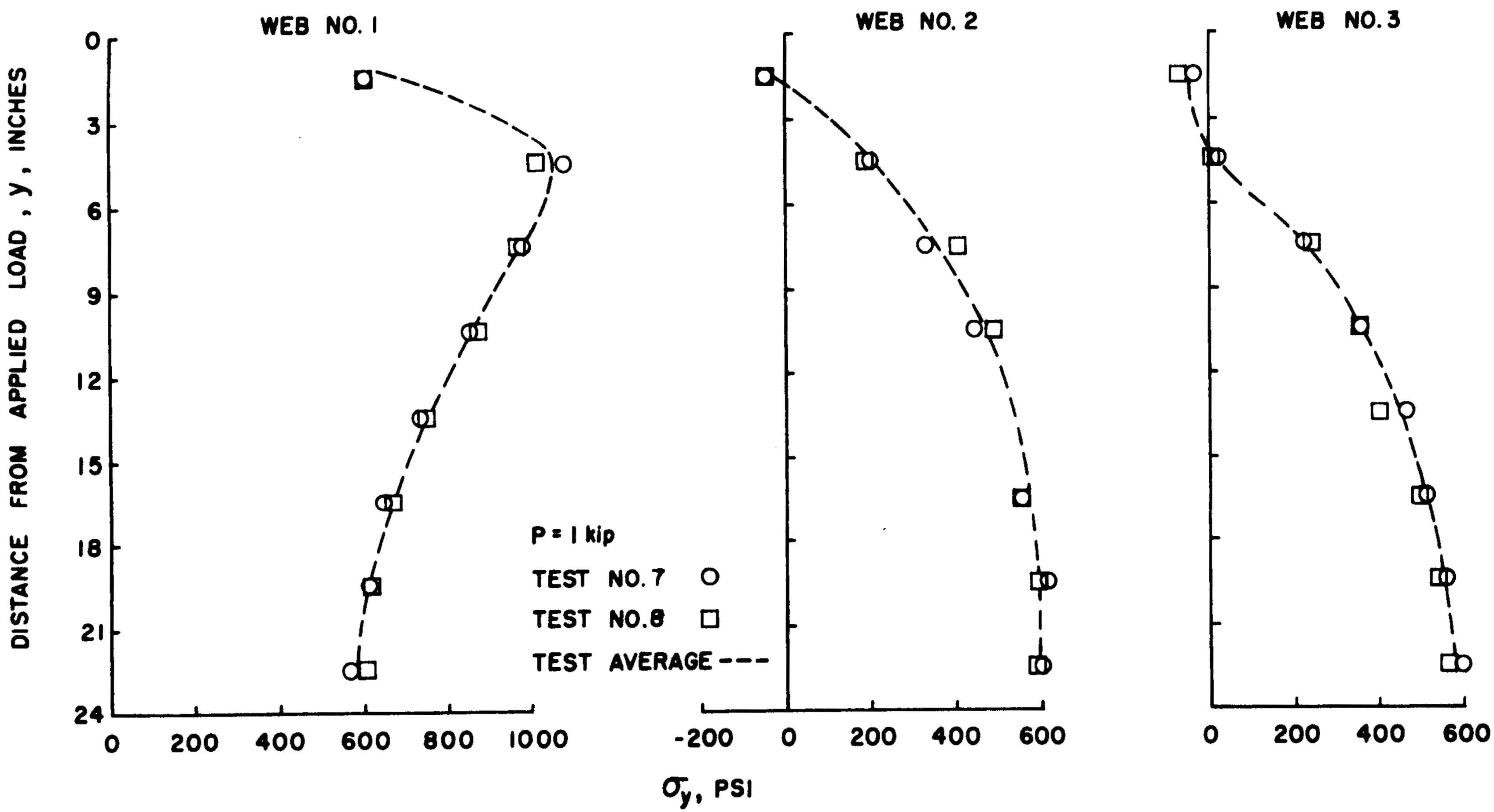



FIGURE 18.- NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION I.

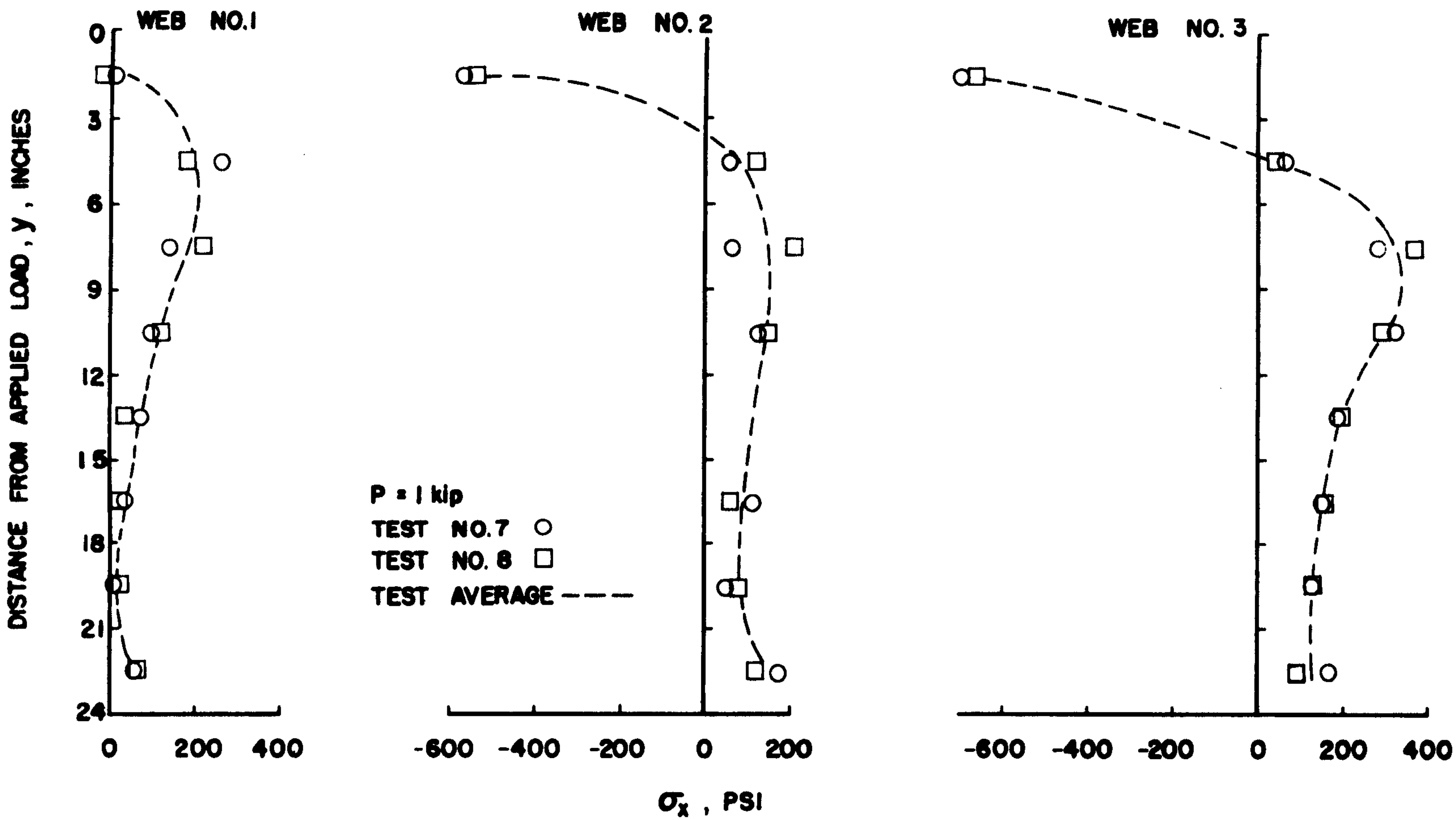



FIGURE 19.— NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION I.

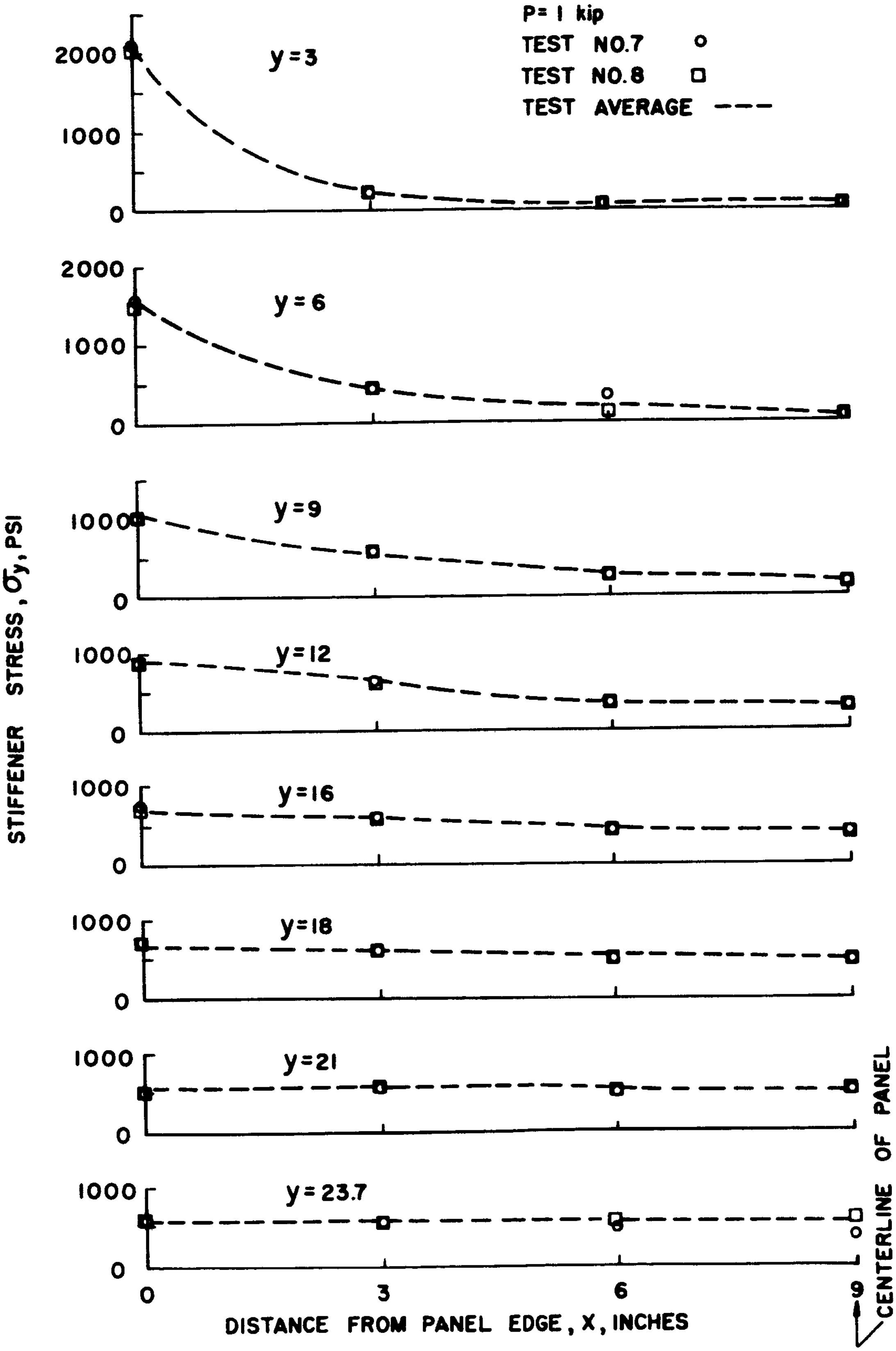



FIGURE 20.- CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL B FOR LOADING CONDITION I.

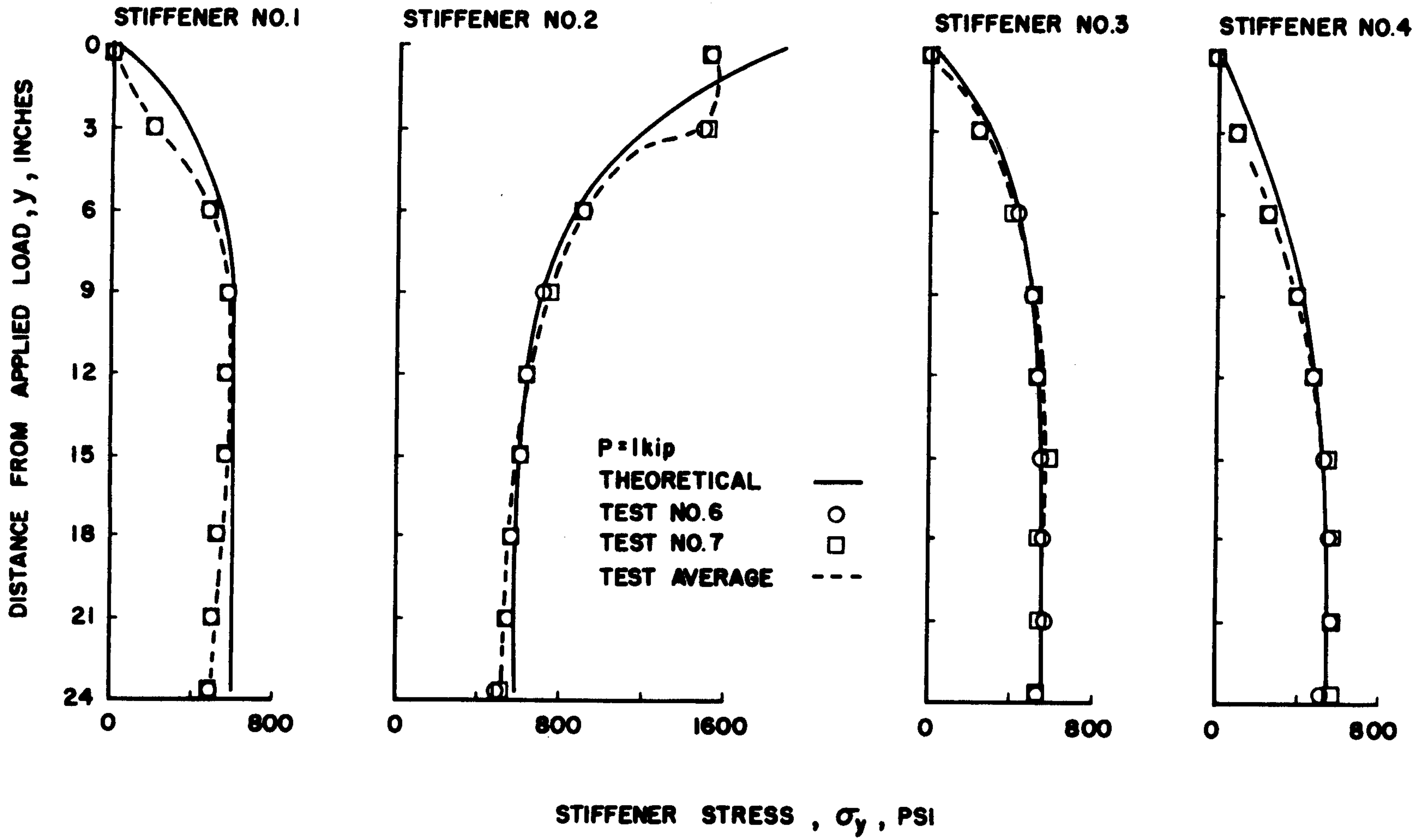



FIGURE 21.— NORMAL STRESS IN STIFFENERS OF PANEL B FOR LOADING CONDITION II.

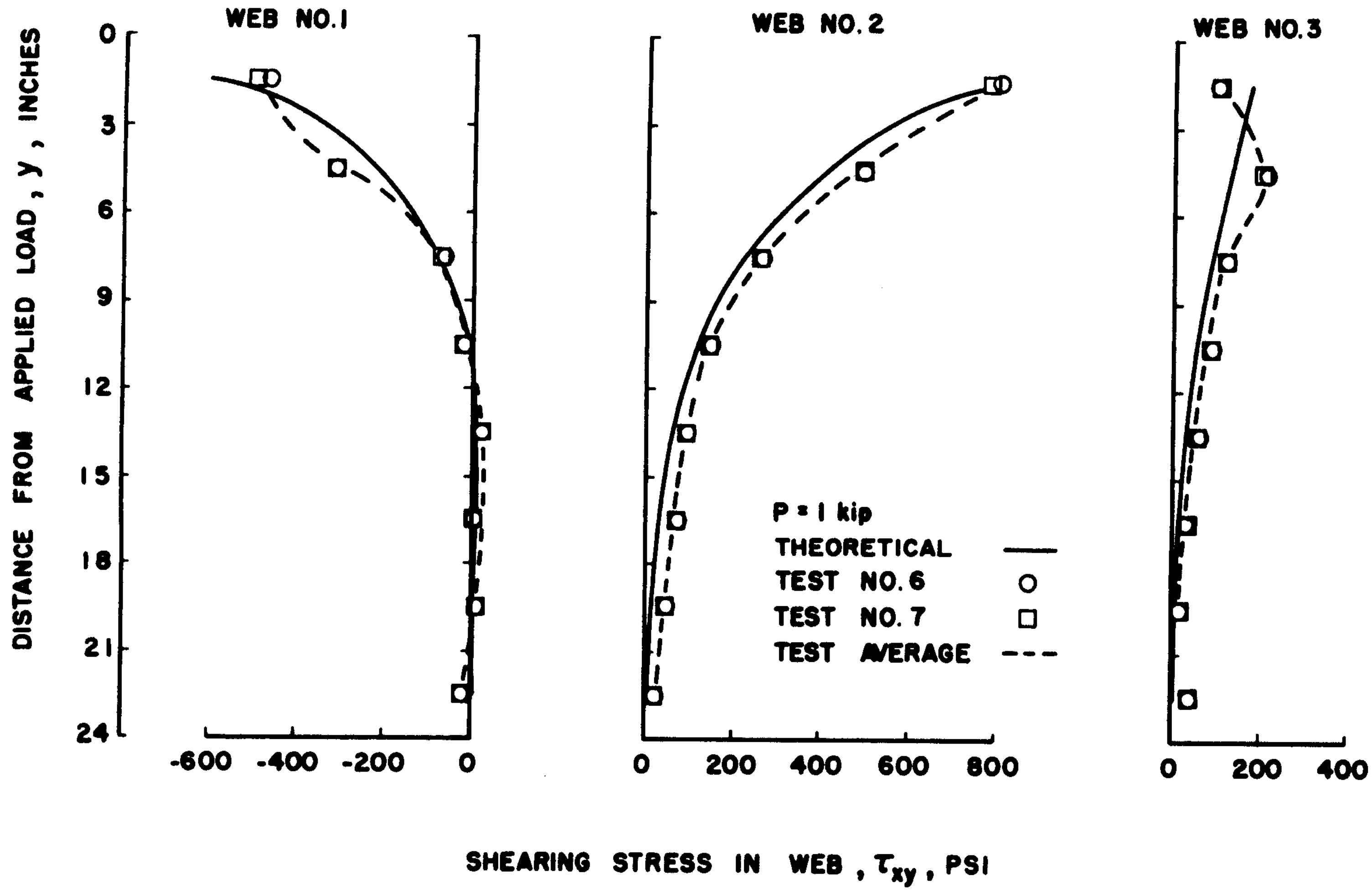



FIGURE 22. - SHEARING STRESS IN WEB OF PANEL B FOR LOADING CONDITION II.

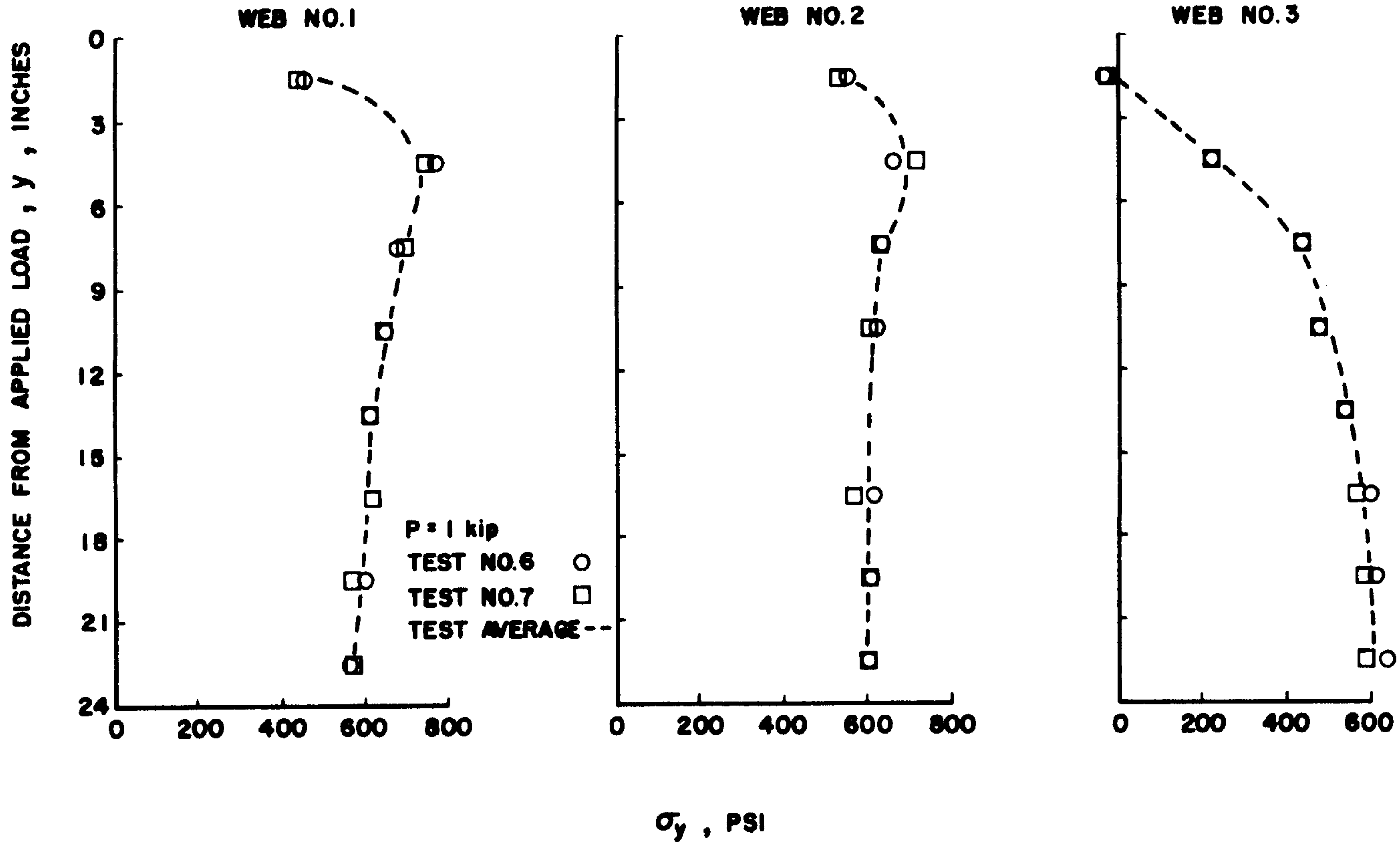



FIGURE 23.– NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION II.

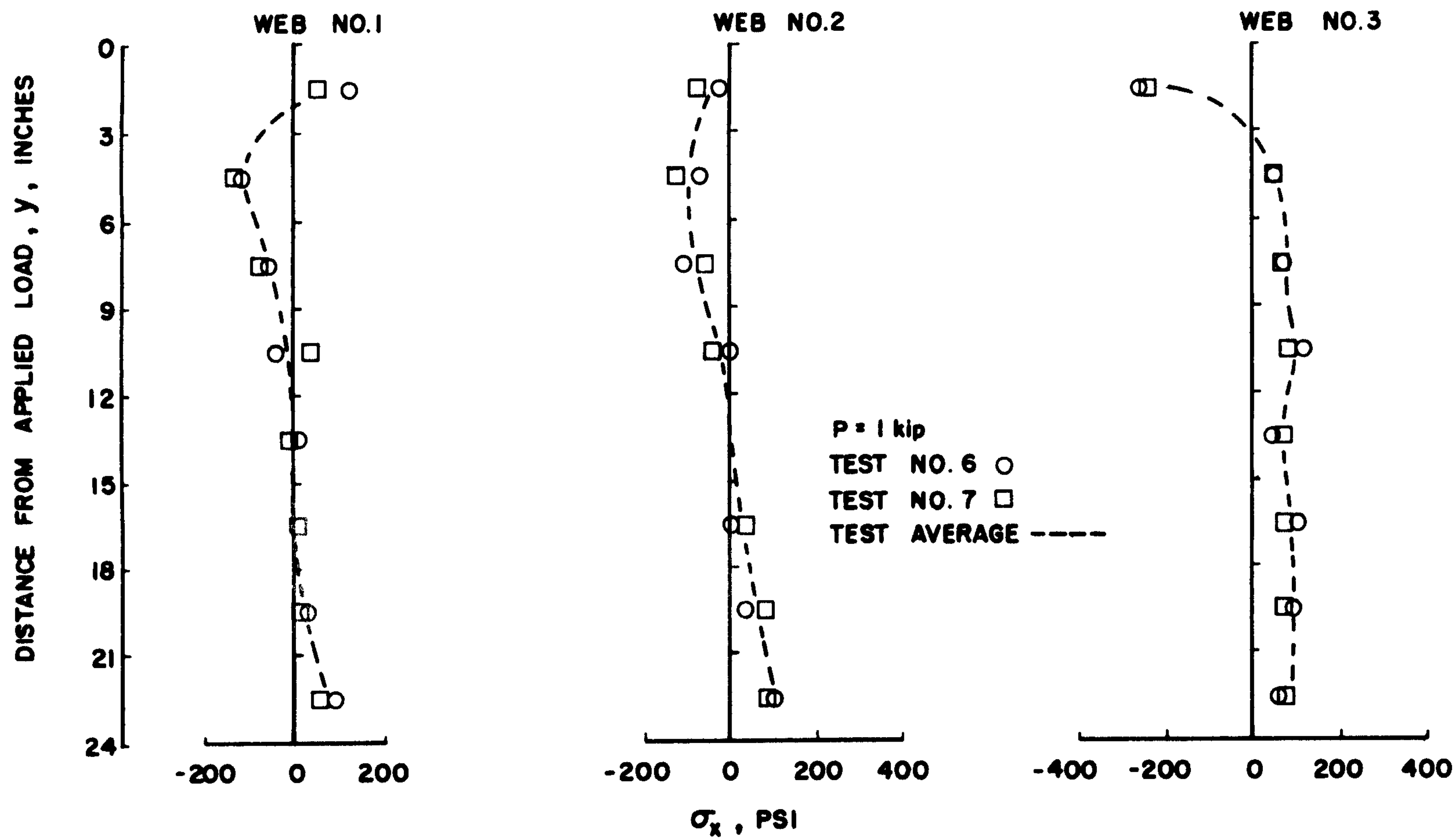



FIGURE 24.— NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION II.

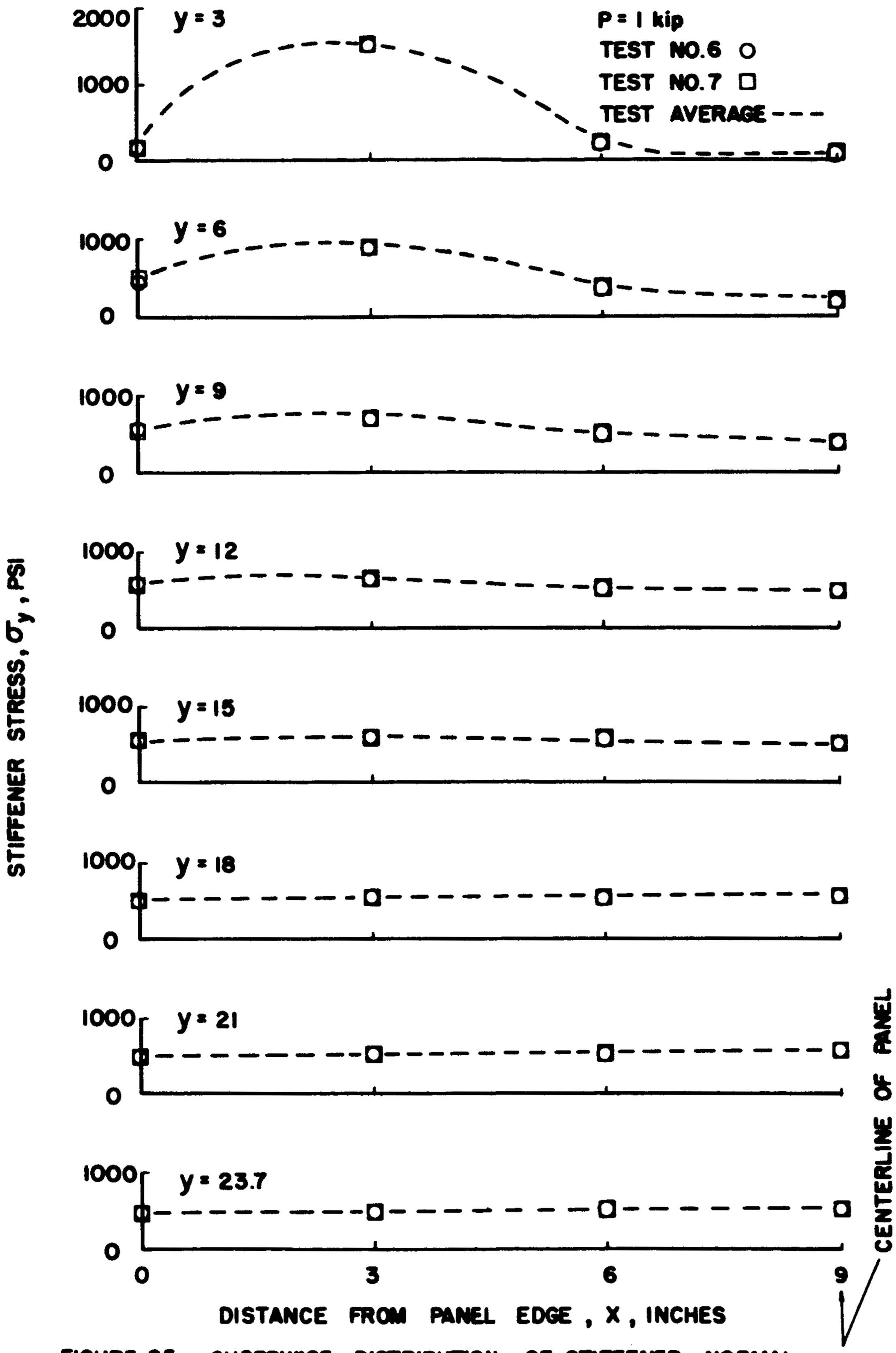



FIGURE 25.—CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL B FOR LOADING CONDITION II.

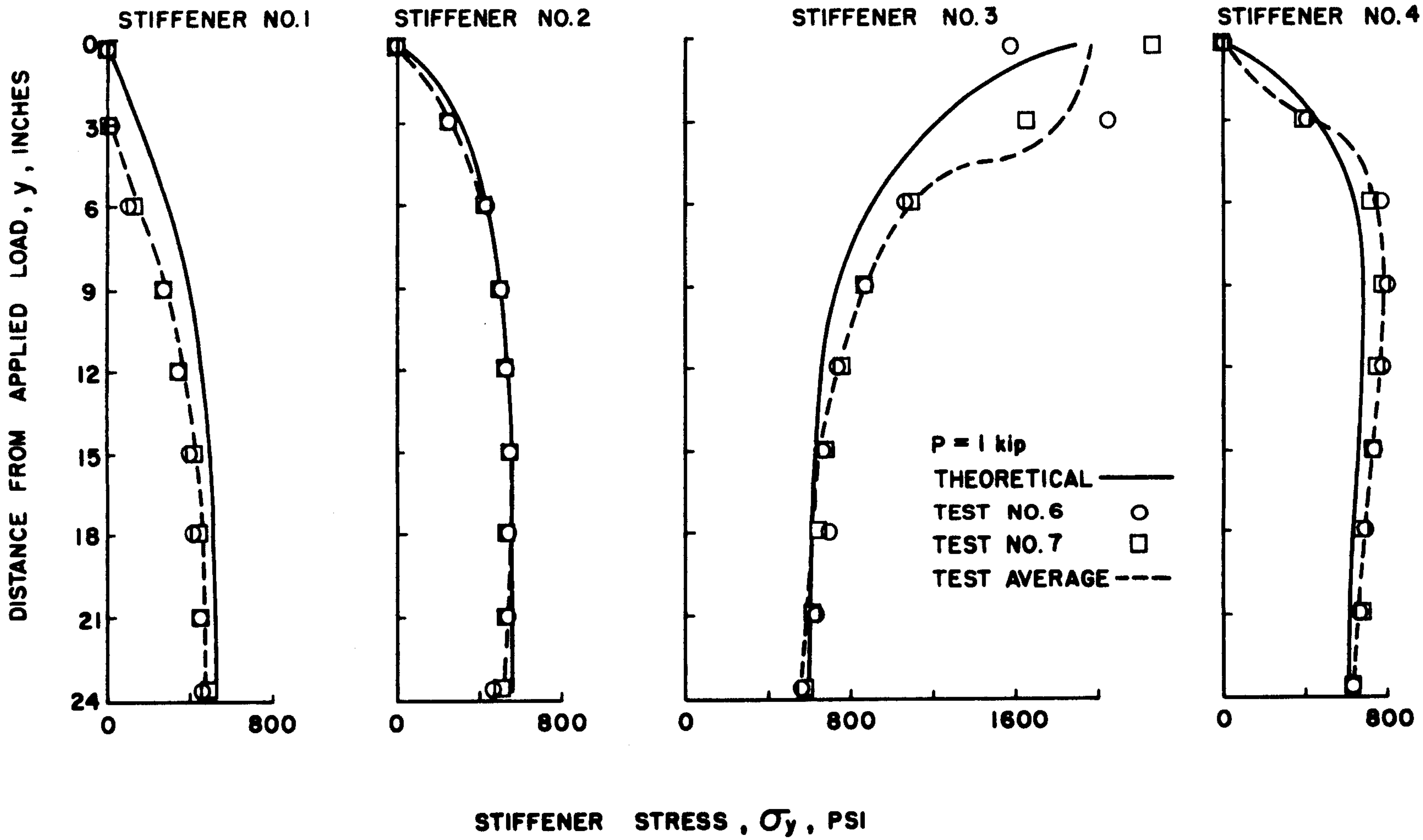



FIGURE 26.– NORMAL STRESS IN STIFFENER OF PANEL B FOR LOADING CONDITION III.

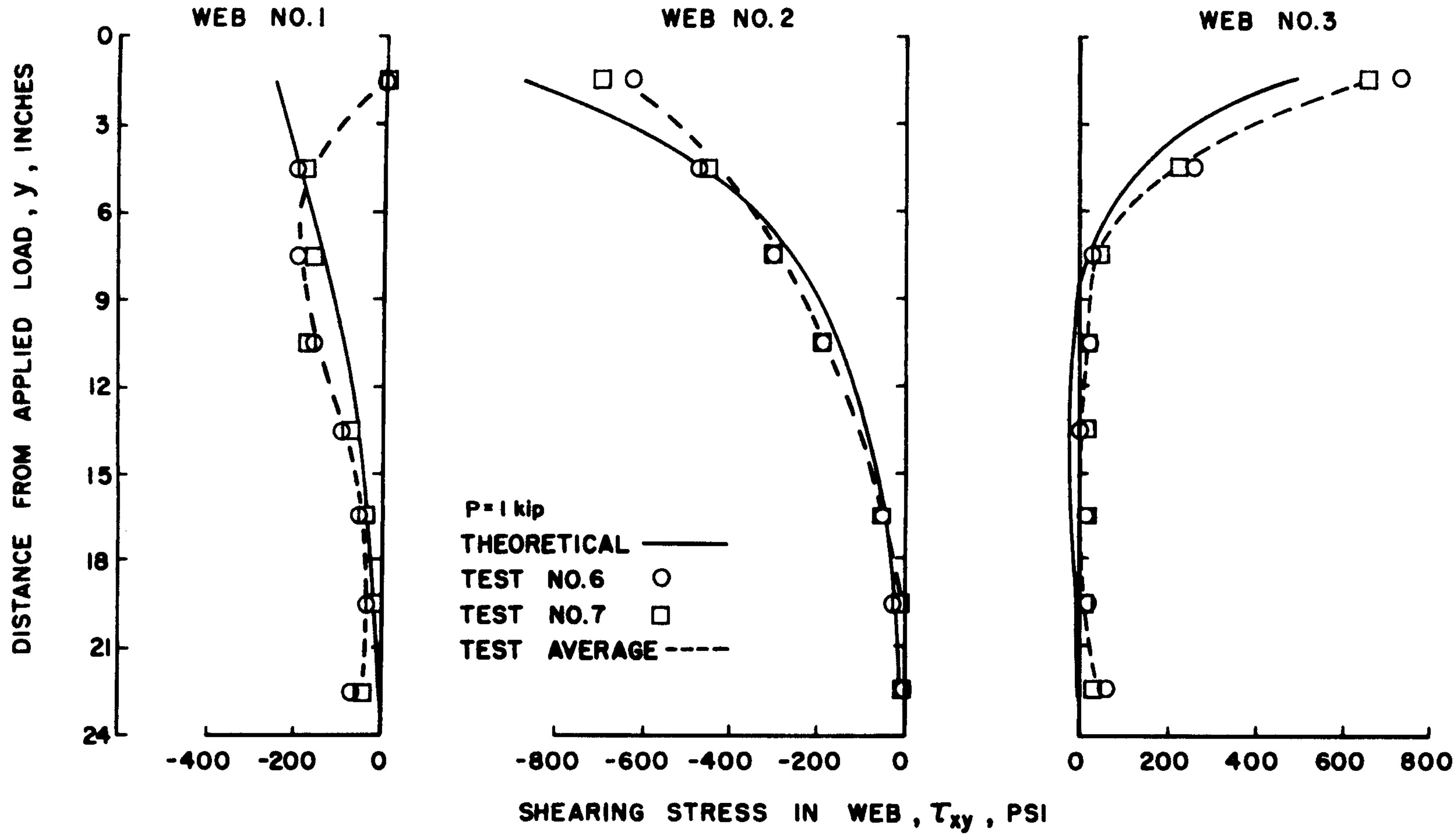



FIGURE 27.- SHEARING STRESS IN WEB OF PANEL B FOR LOADING CONDITION III.

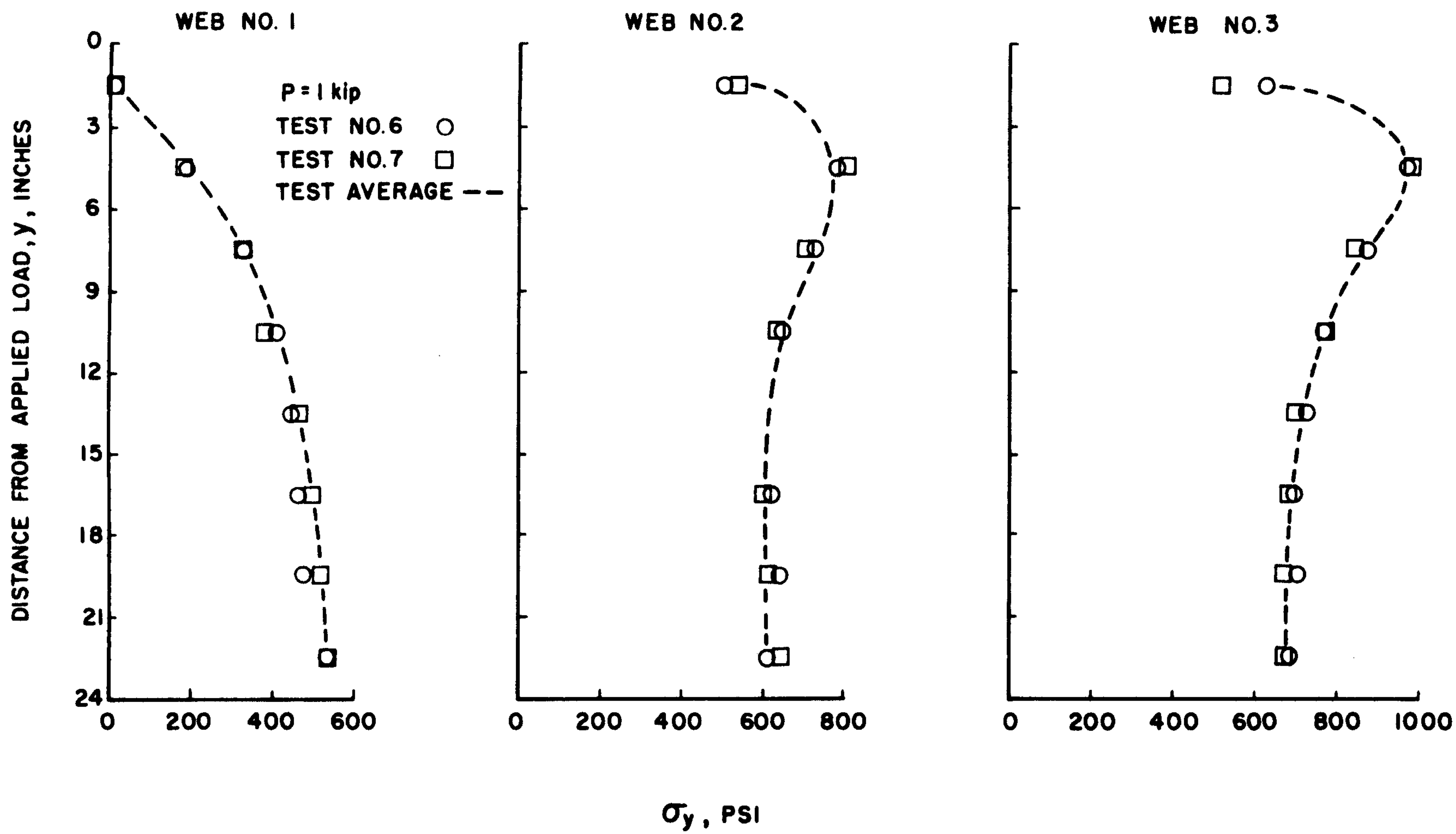



FIGURE 28.- NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION III.

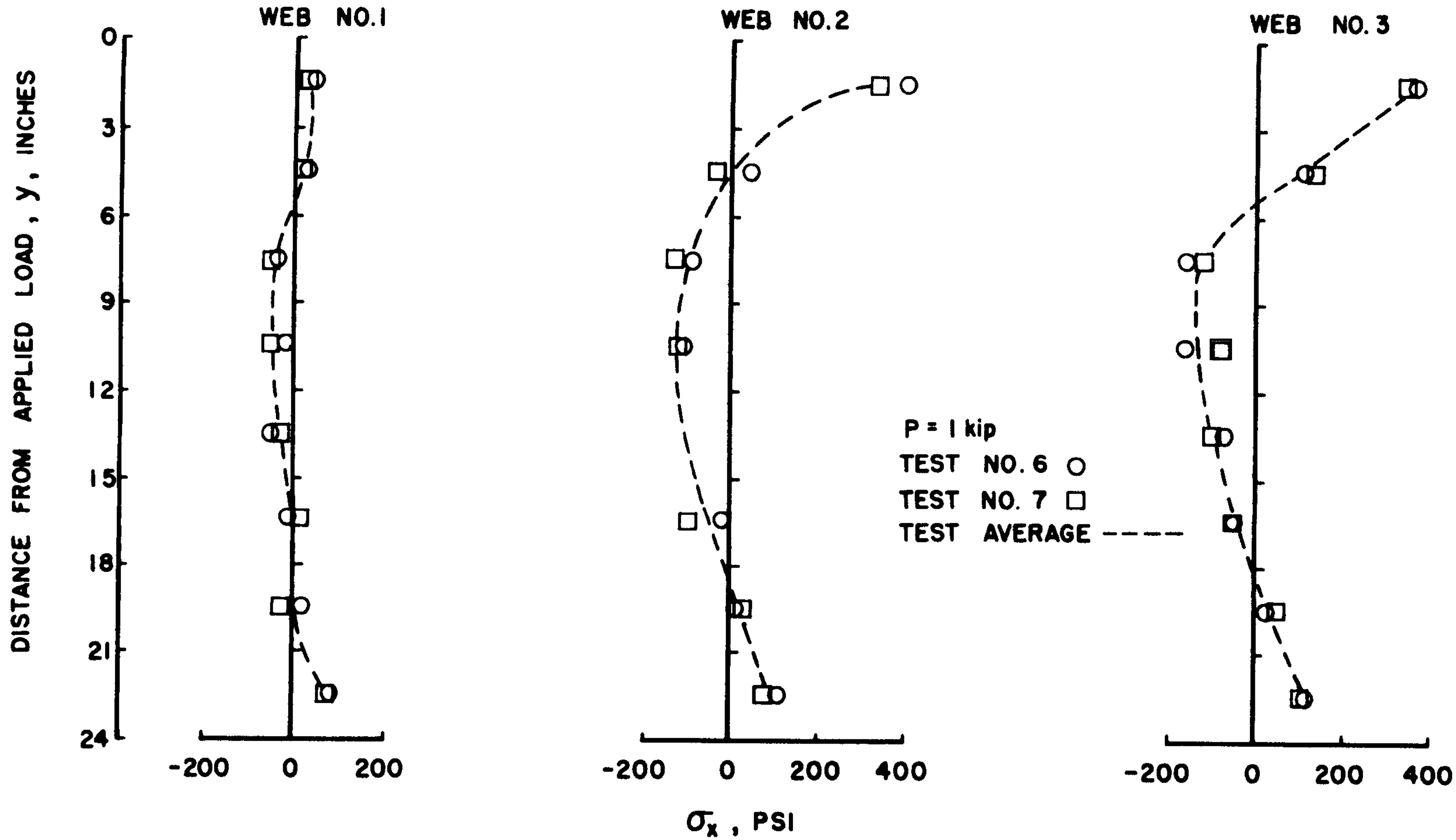



FIGURE 29.– NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION III.

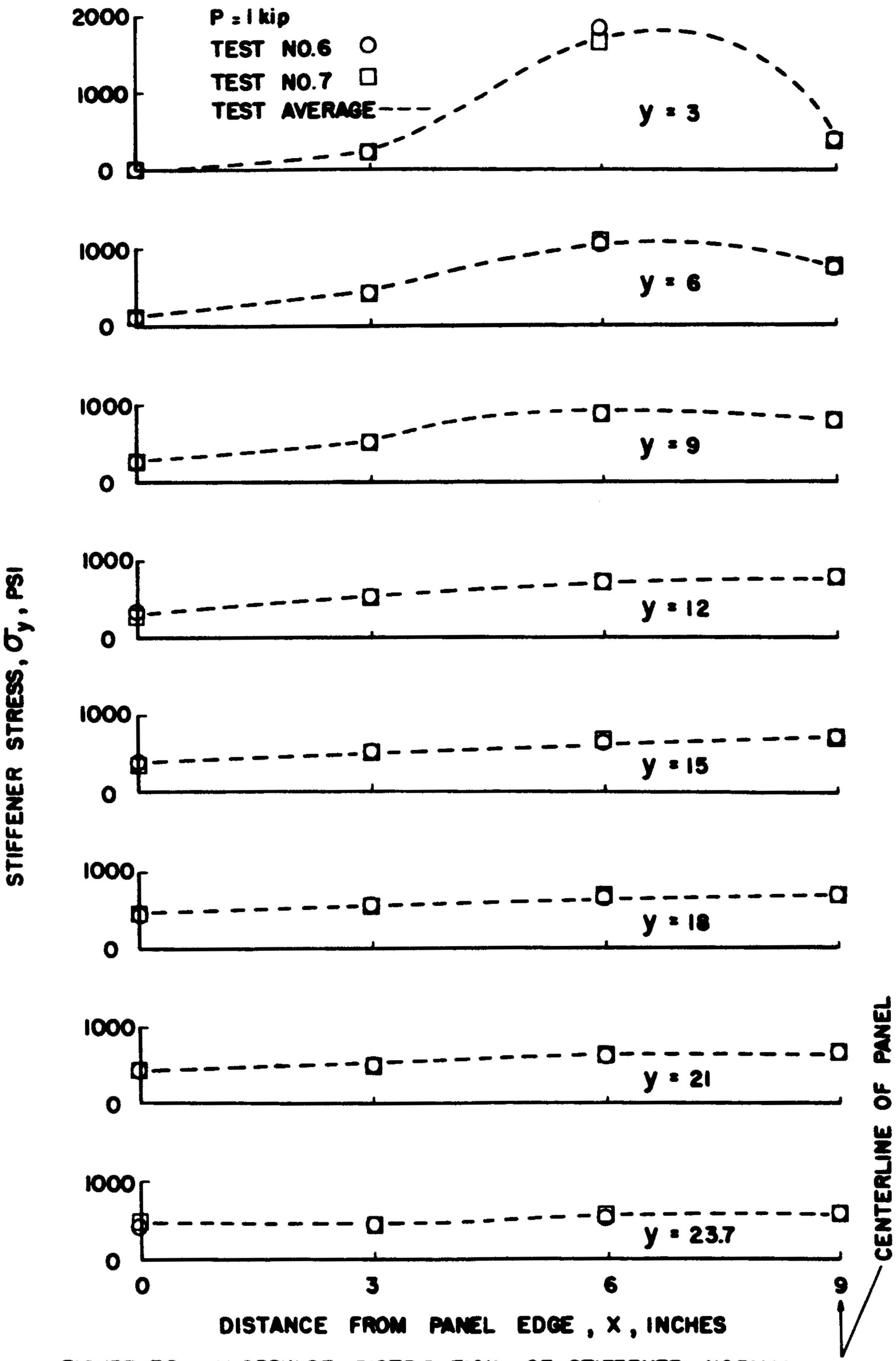



FIGURE 30.– CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL B FOR LOADING CONDITION III.

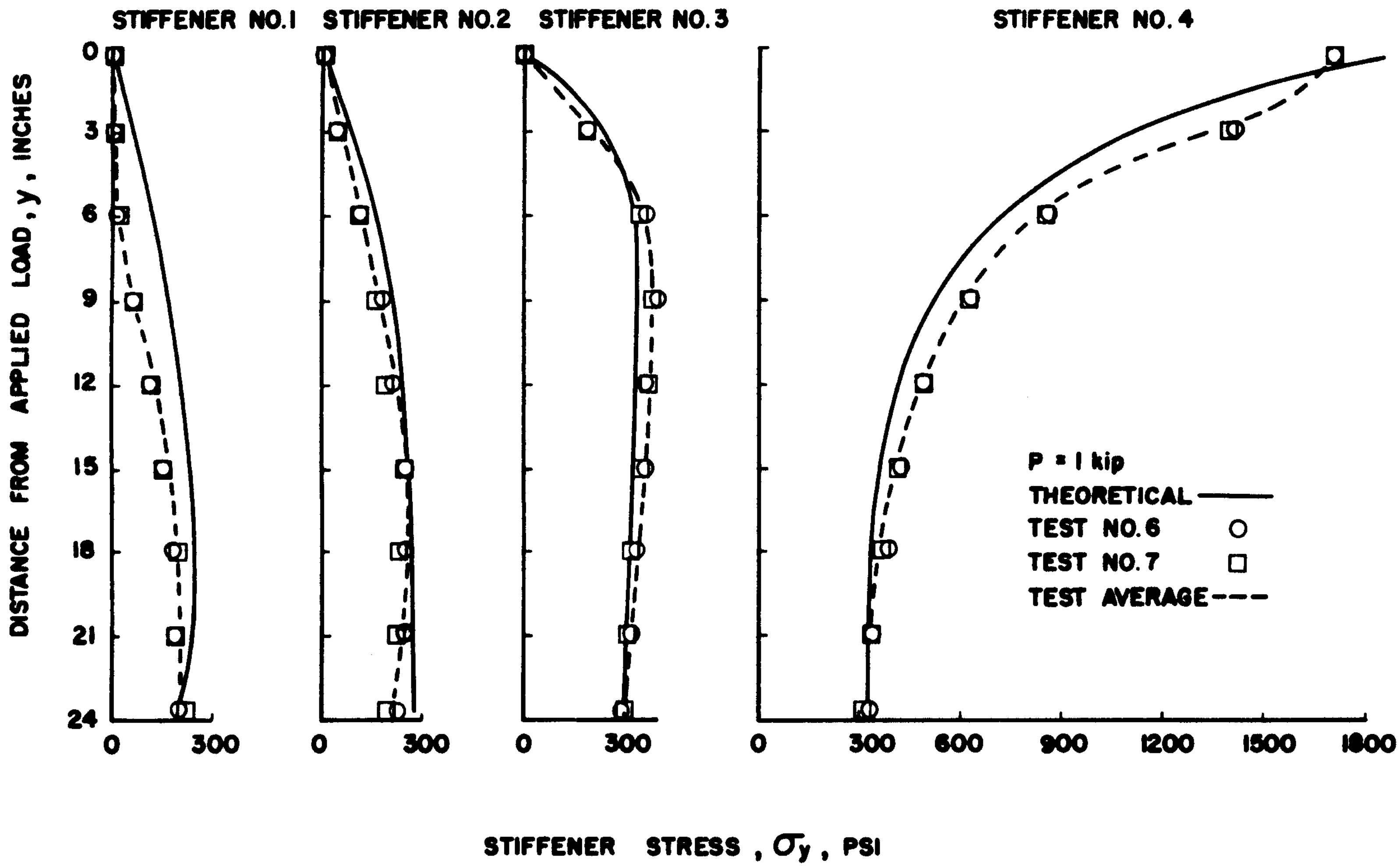



FIGURE 31.— NORMAL STRESS IN STIFFENERS OF PANEL B FOR LOADING CONDITION IV.

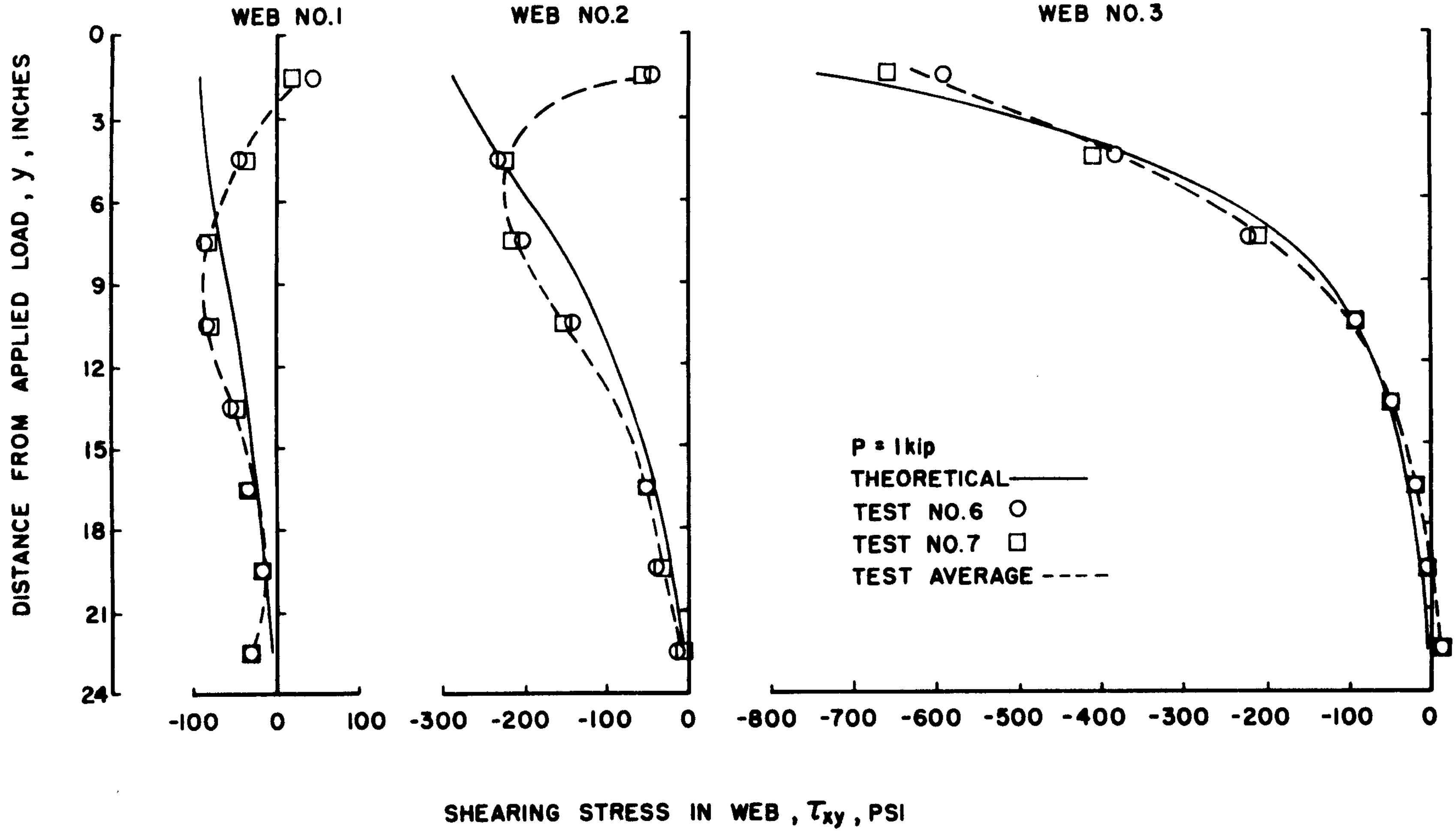



FIGURE 32.— SHEARING STRESS IN WEB OF PANEL B FOR LOADING CONDITION IV.

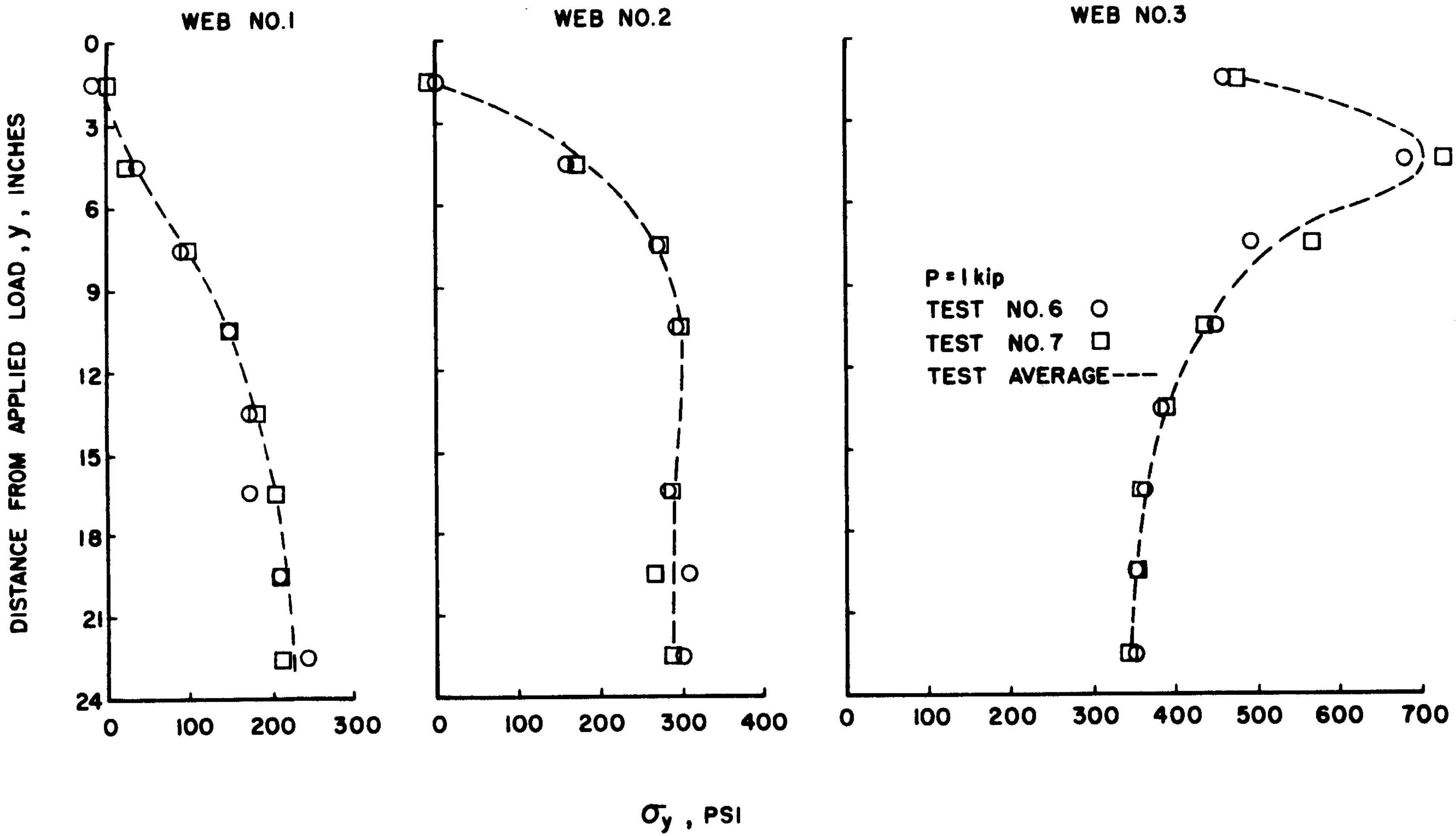



FIGURE 33.- NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION IV.

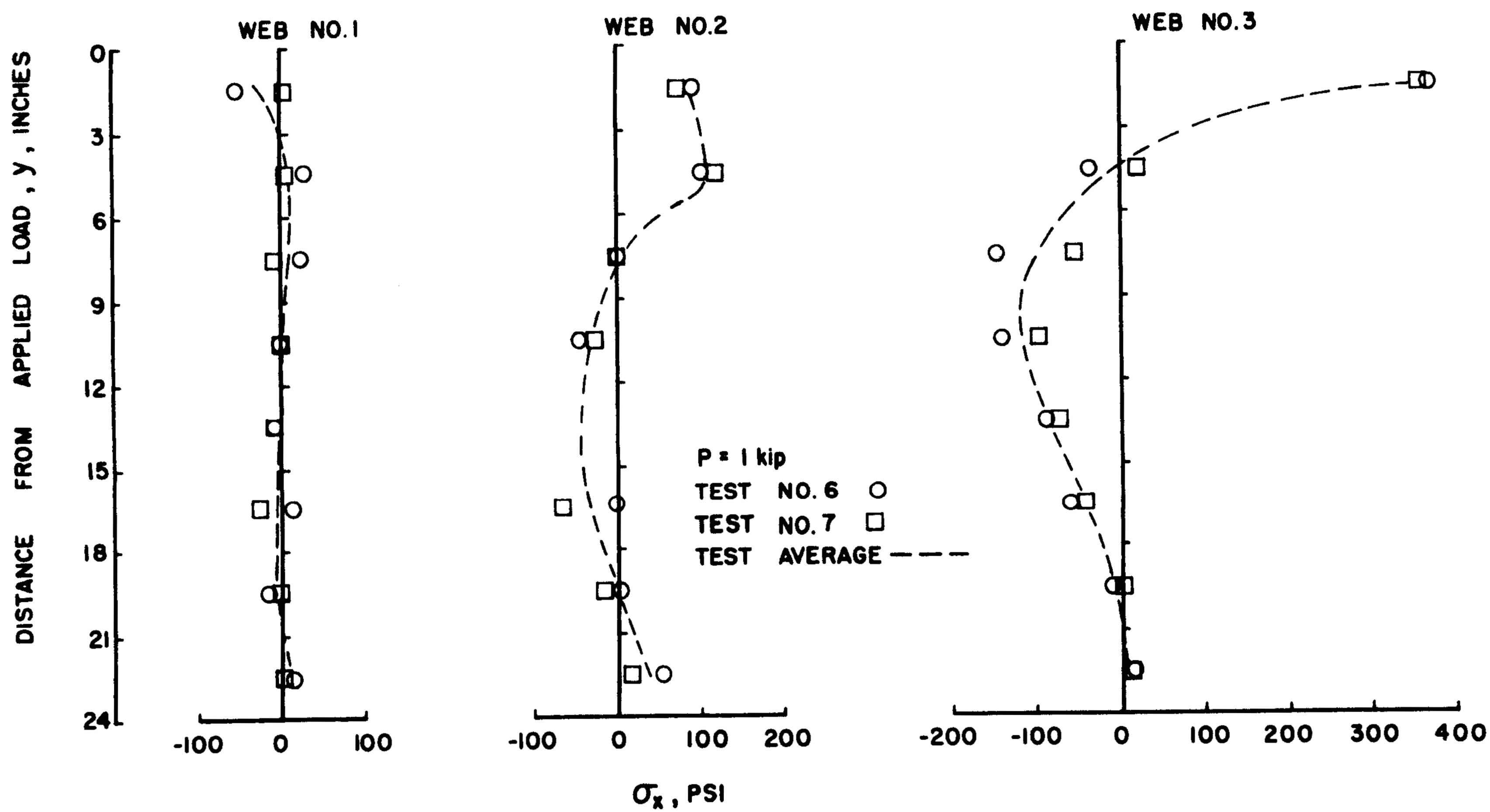



FIGURE 34.- NORMAL STRESS IN WEB OF PANEL B FOR LOADING CONDITION IV.

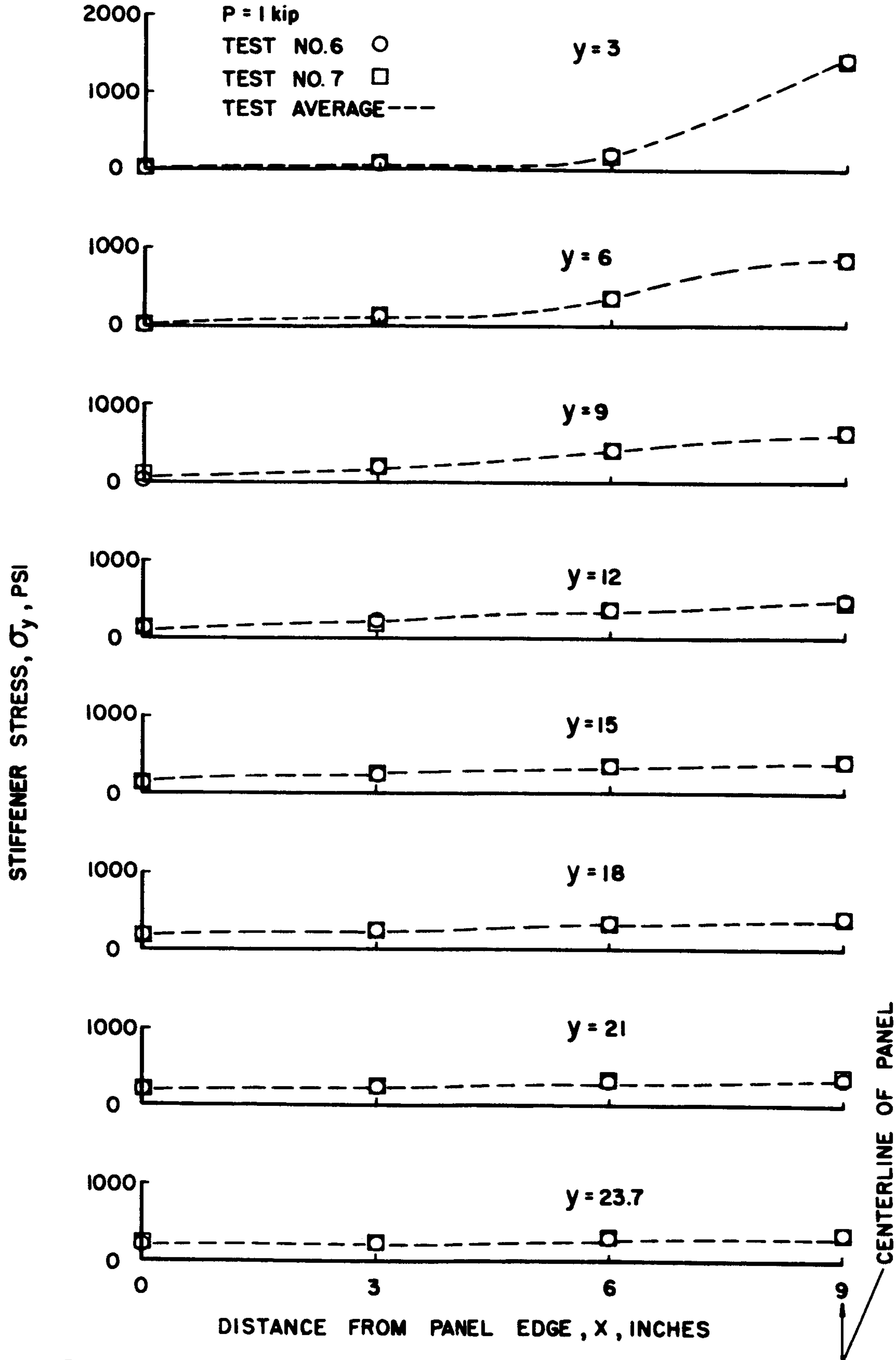



FIGURE 35.– CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL B FOR LOADING CONDITION IV.

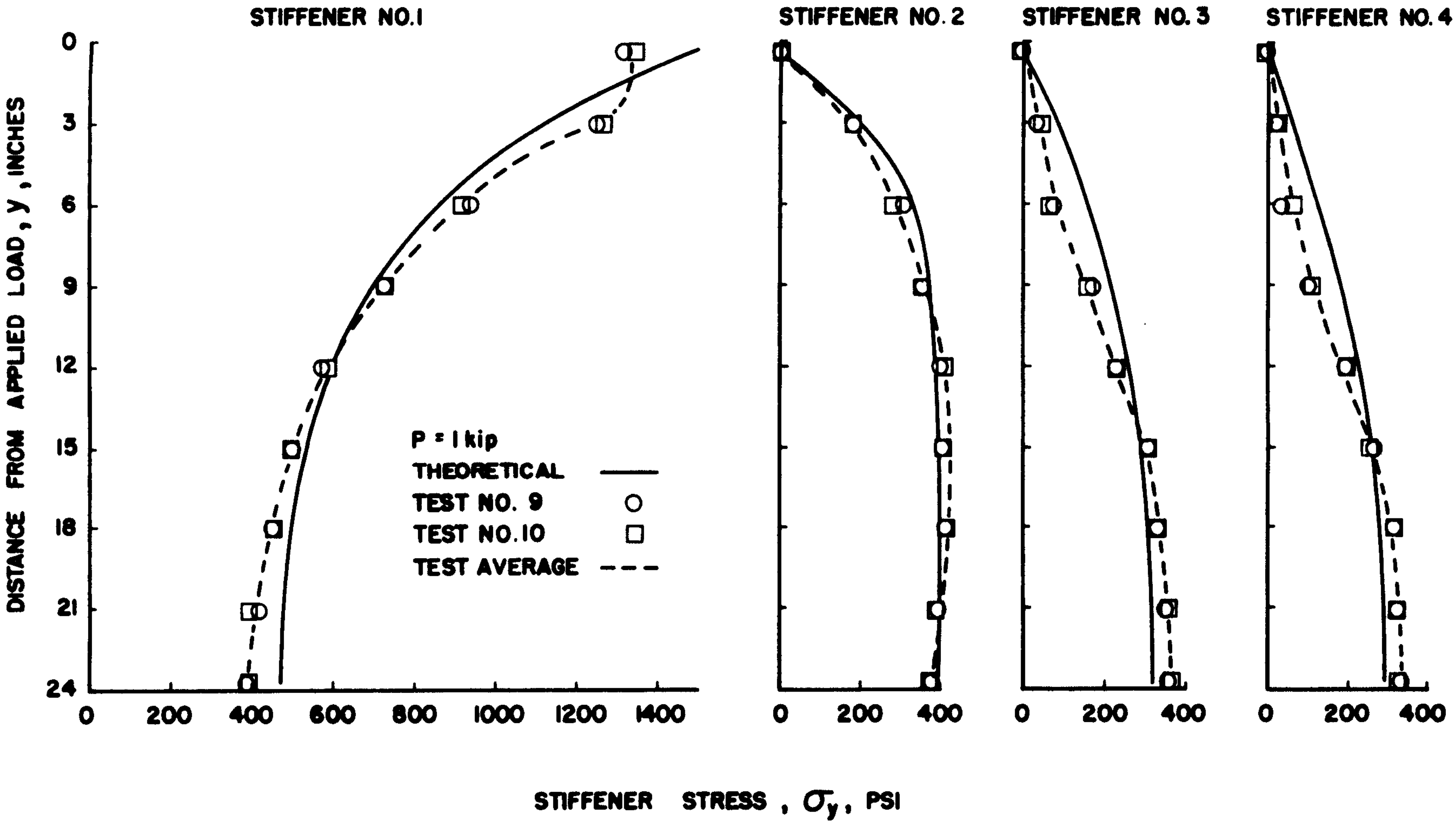



FIGURE 36.— NORMAL STRESS IN STIFFENERS OF PANEL C FOR LOADING CONDITION I.

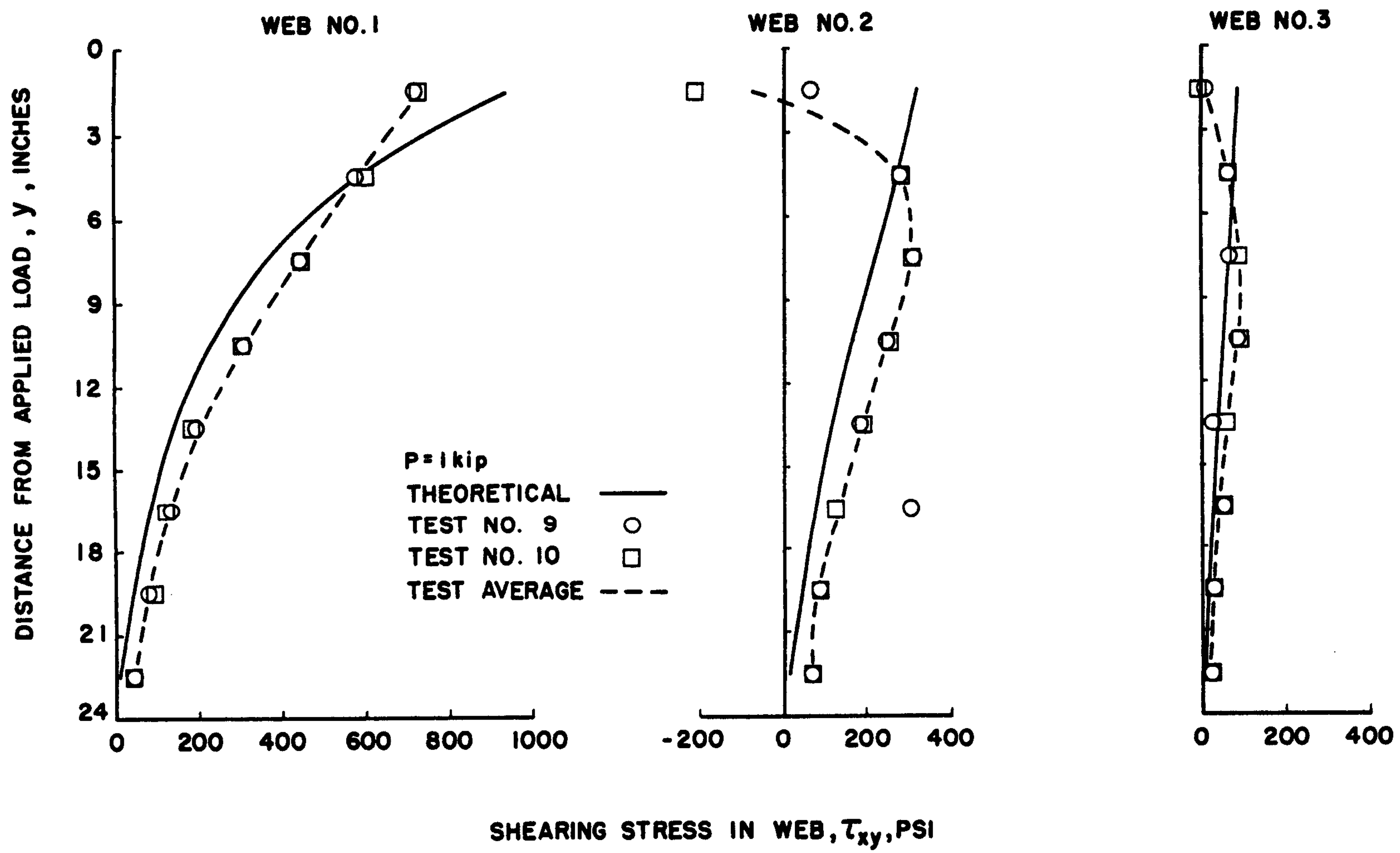



FIGURE 37.- SHEARING STRESS IN WEB OF PANEL C FOR LOADING CONDITION I.

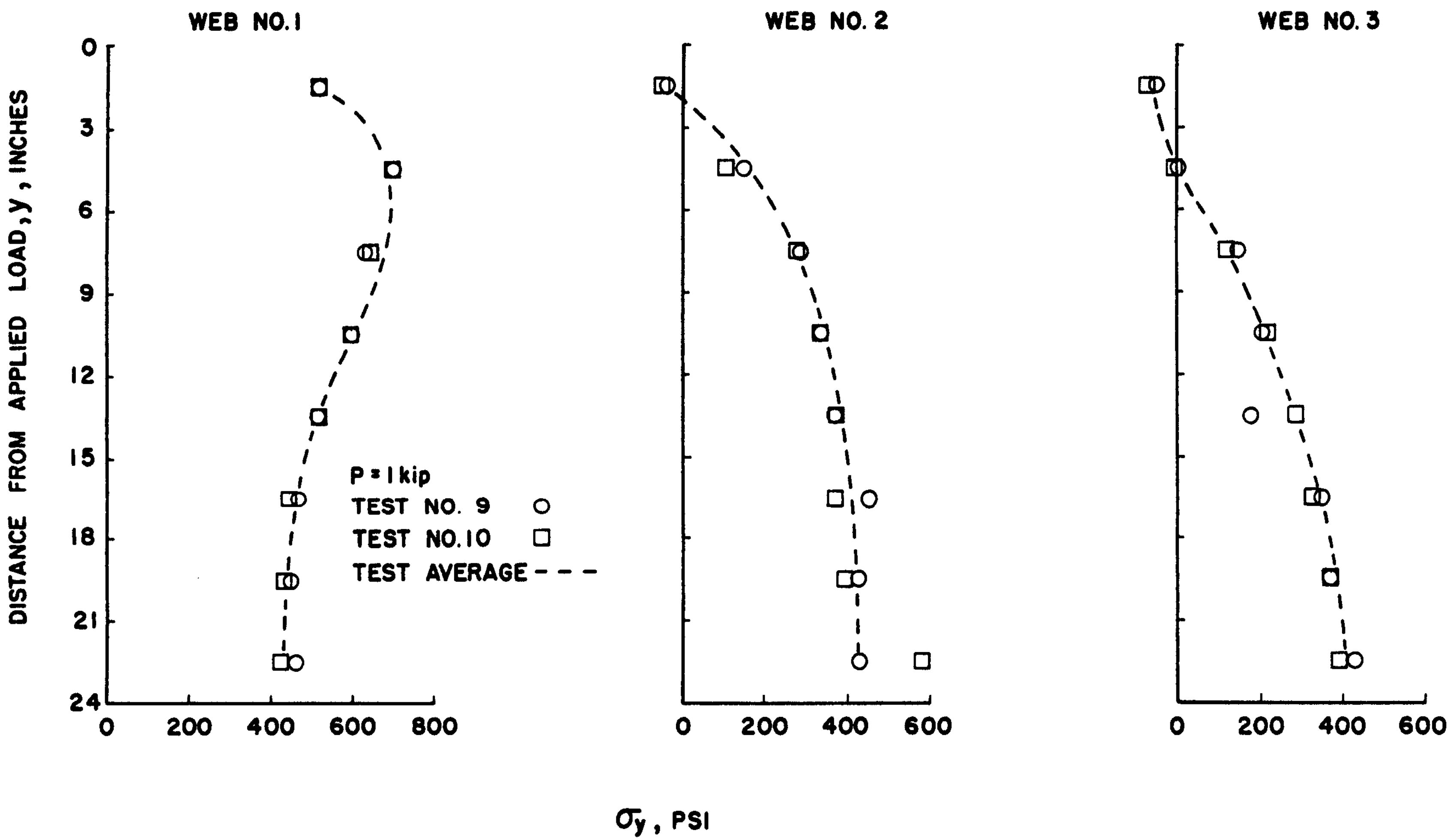



FIGURE 38.-NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION I.

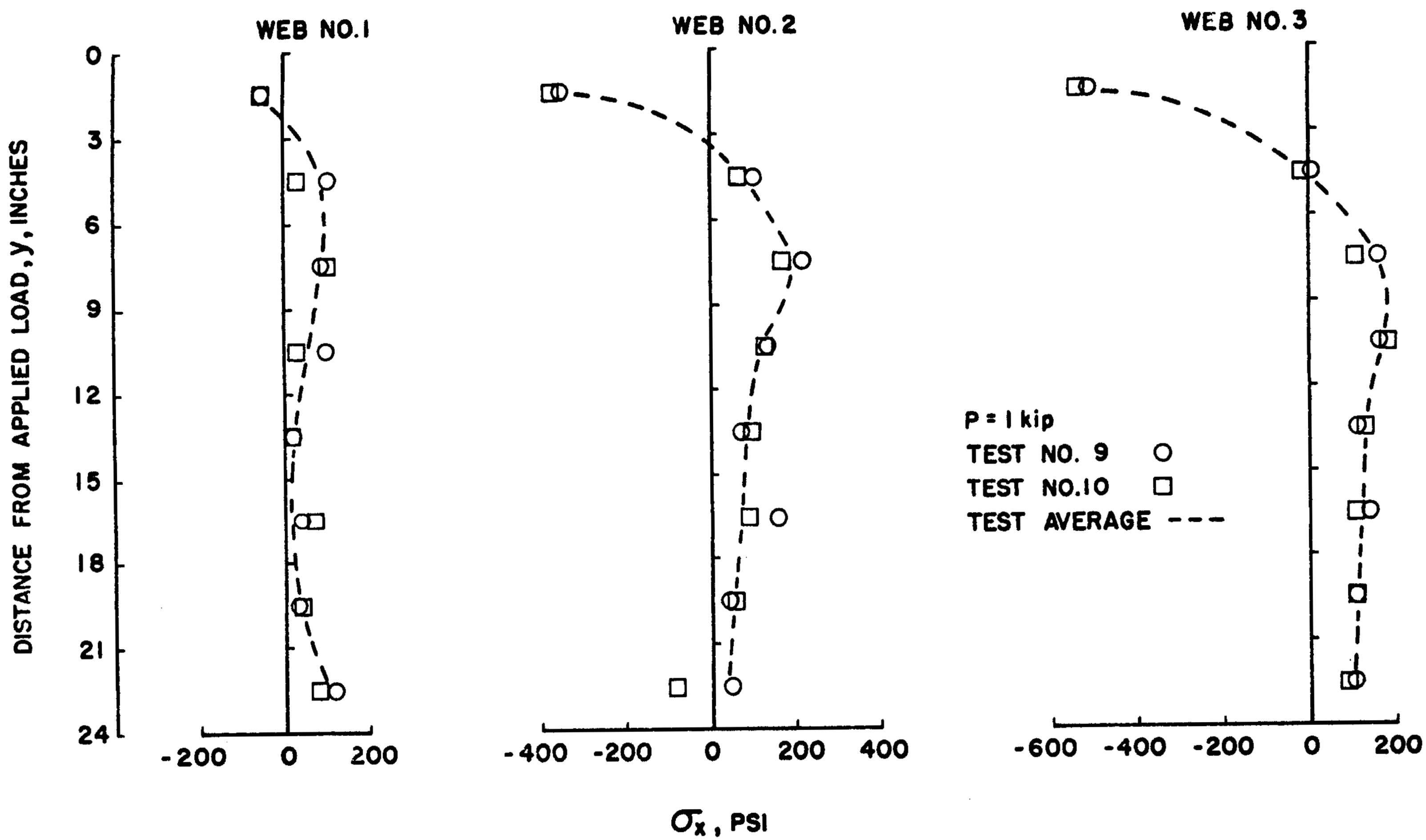



FIGURE 39.-NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION I.

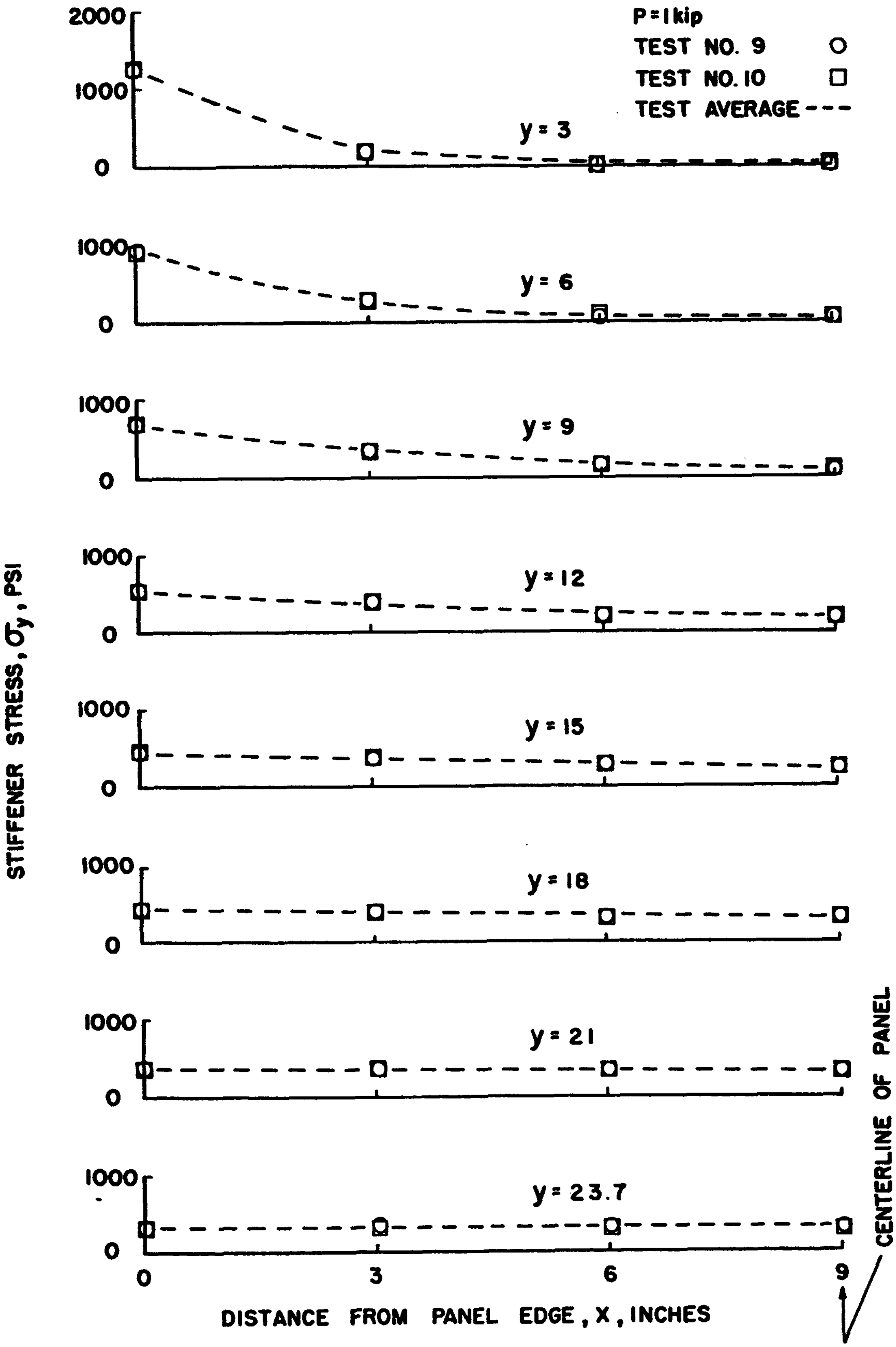



FIGURE 40.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL C FOR LOADING CONDITION I.

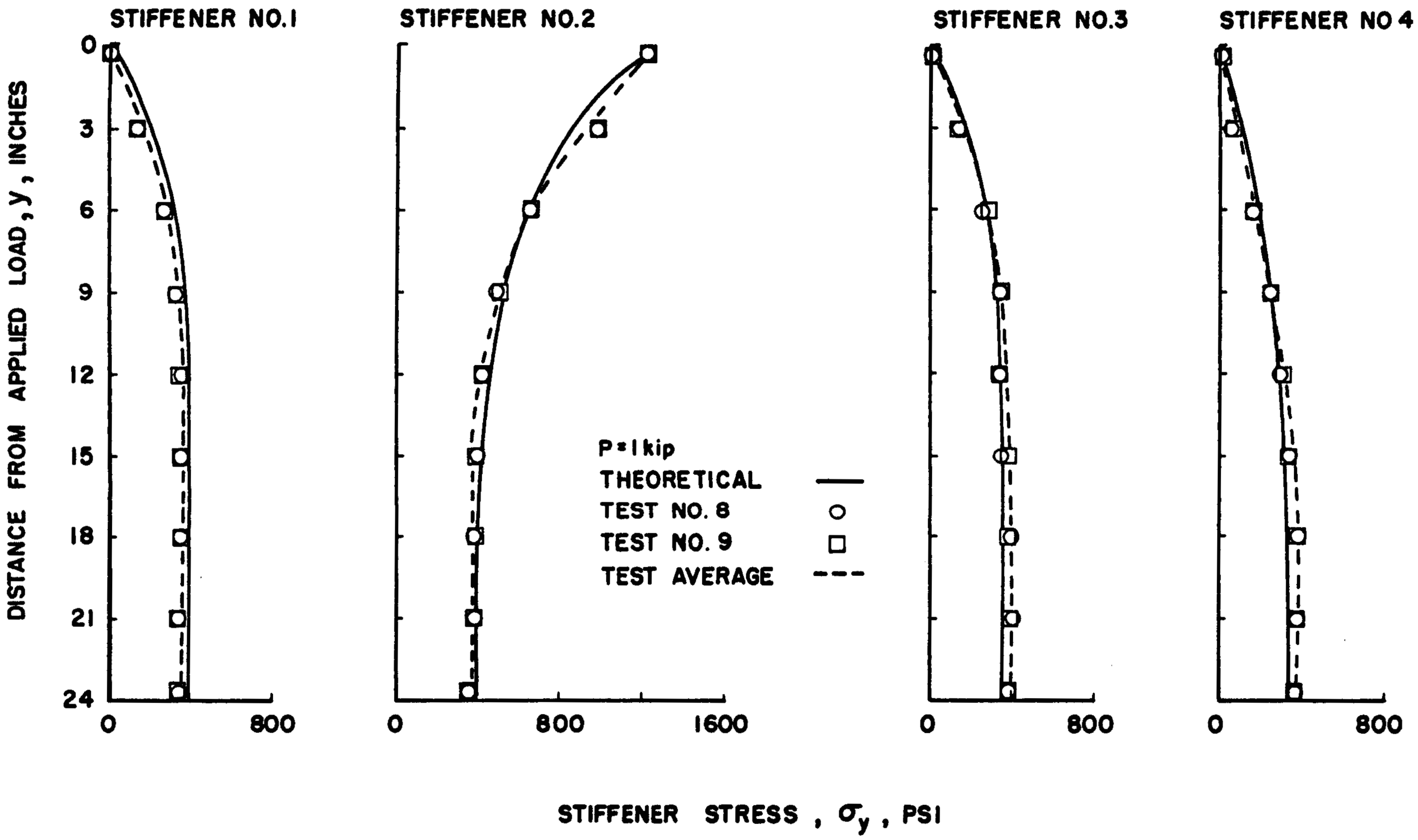



FIGURE 41.— NORMAL STRESS IN STIFFENERS OF PANEL C FOR LOADING CONDITION II.

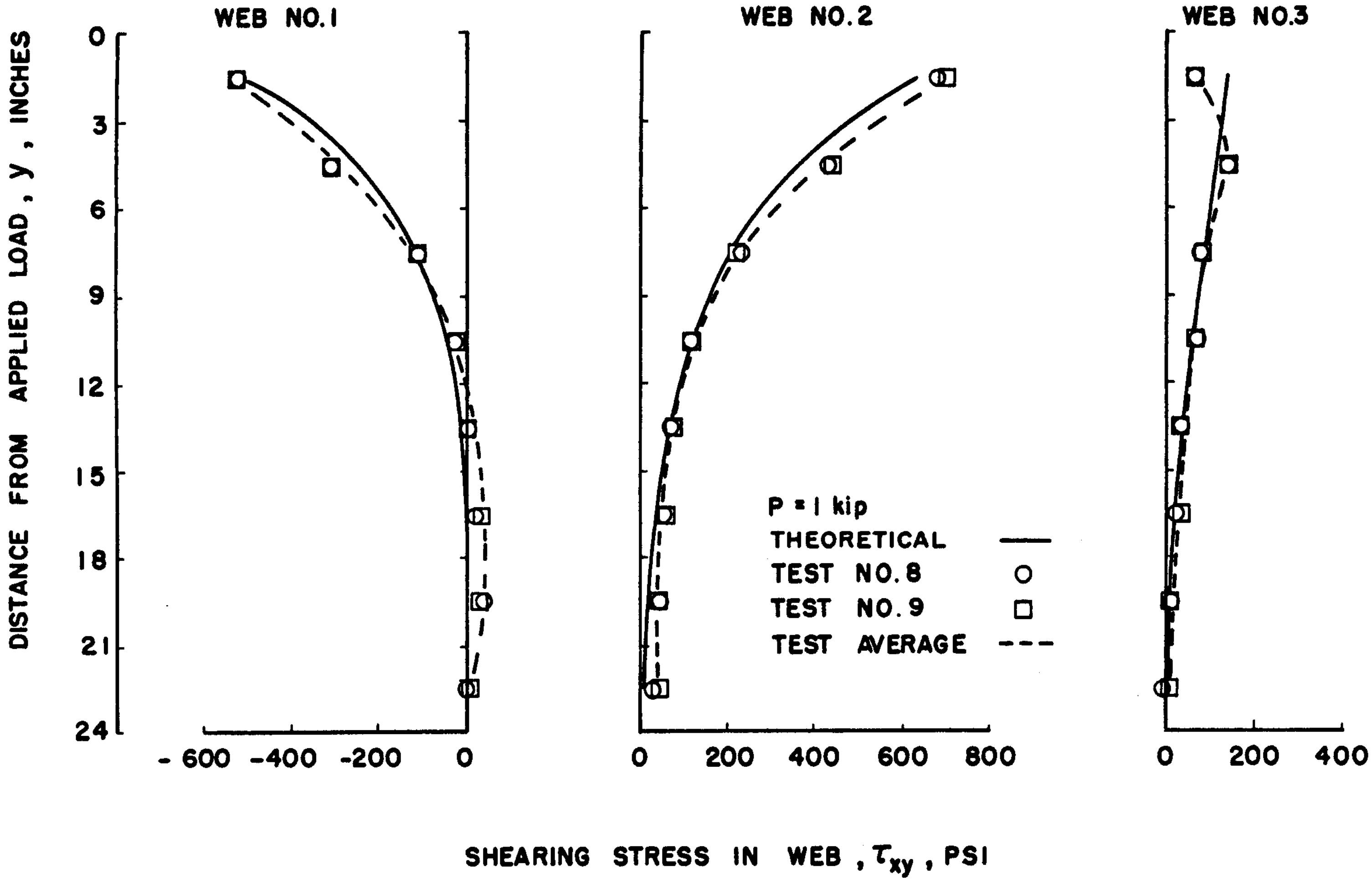



FIGURE 42.- SHEARING STRESS IN WEB OF PANEL C FOR LOADING CONDITION II.

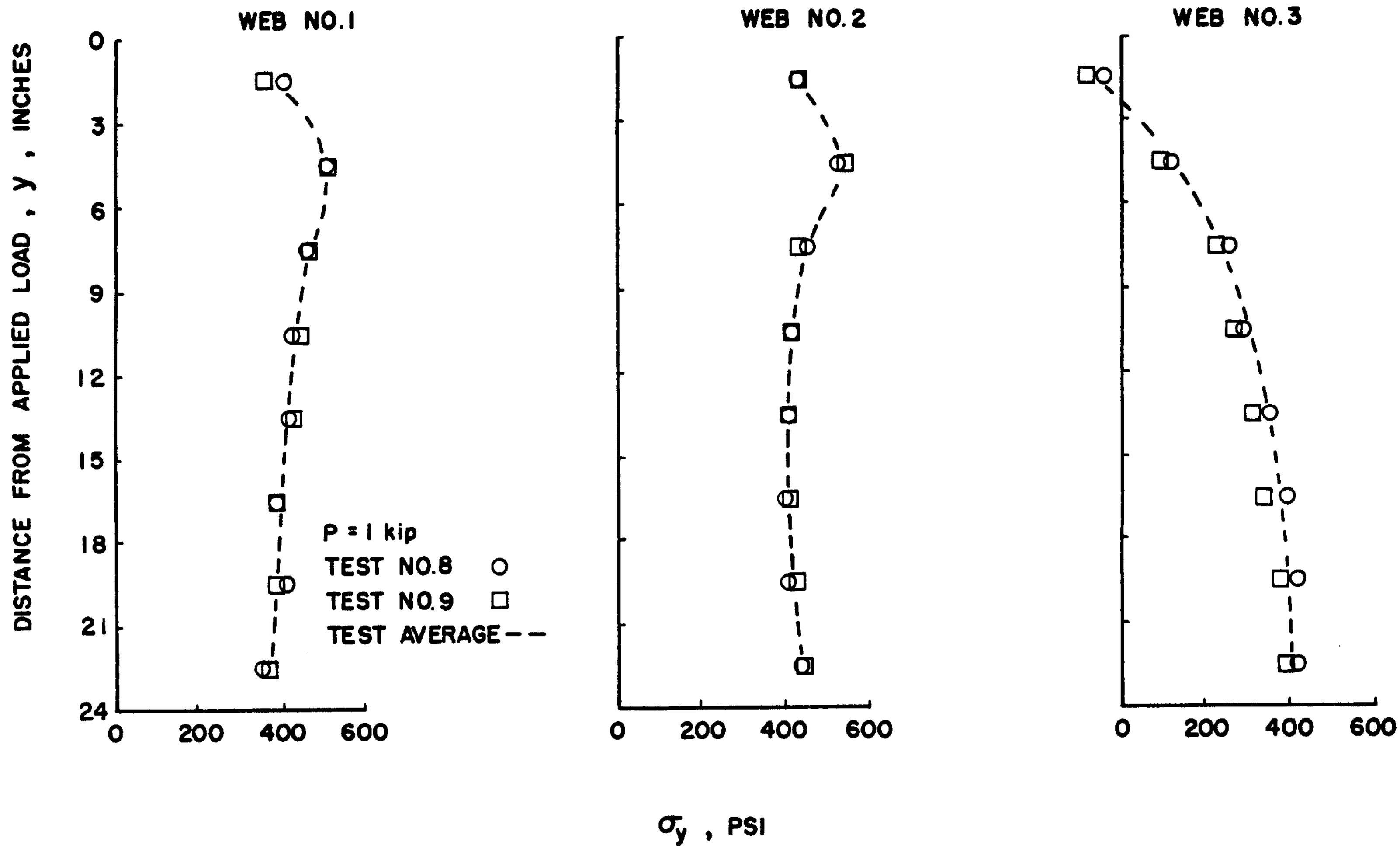



FIGURE 43.—NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION II.

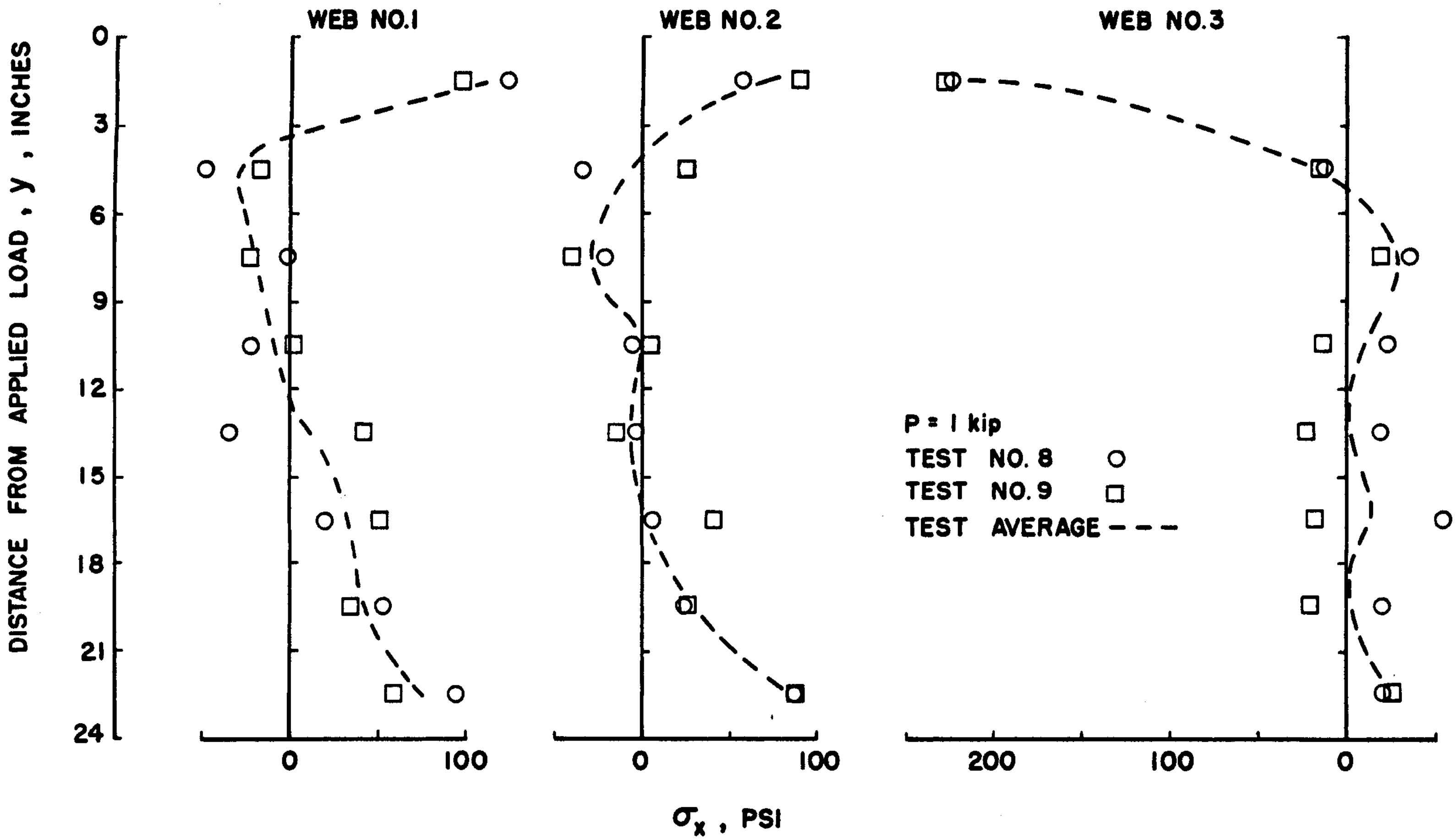



FIGURE 44.— NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION II .

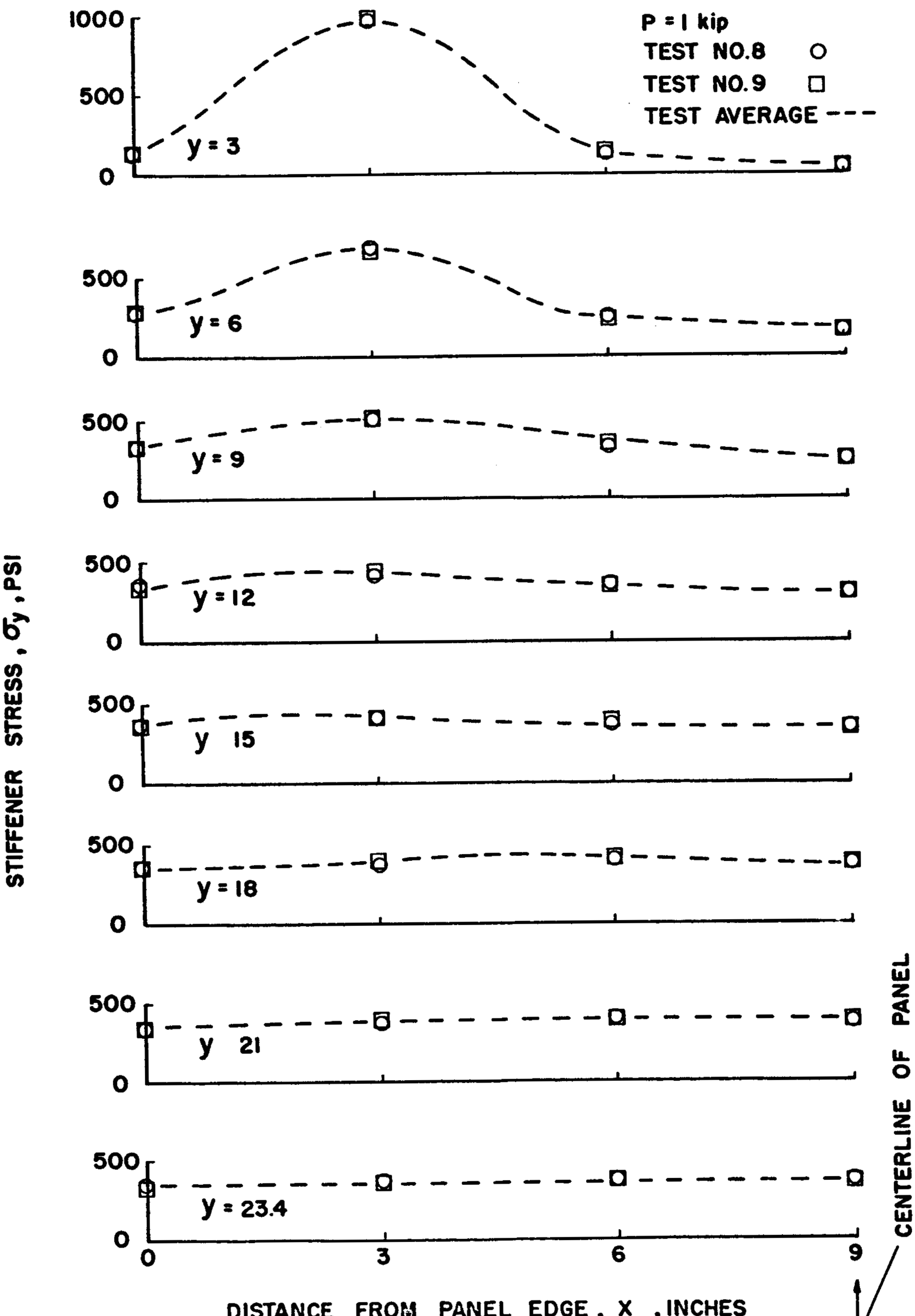



FIGURE 45.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL C FOR LOADING CONDITION II.

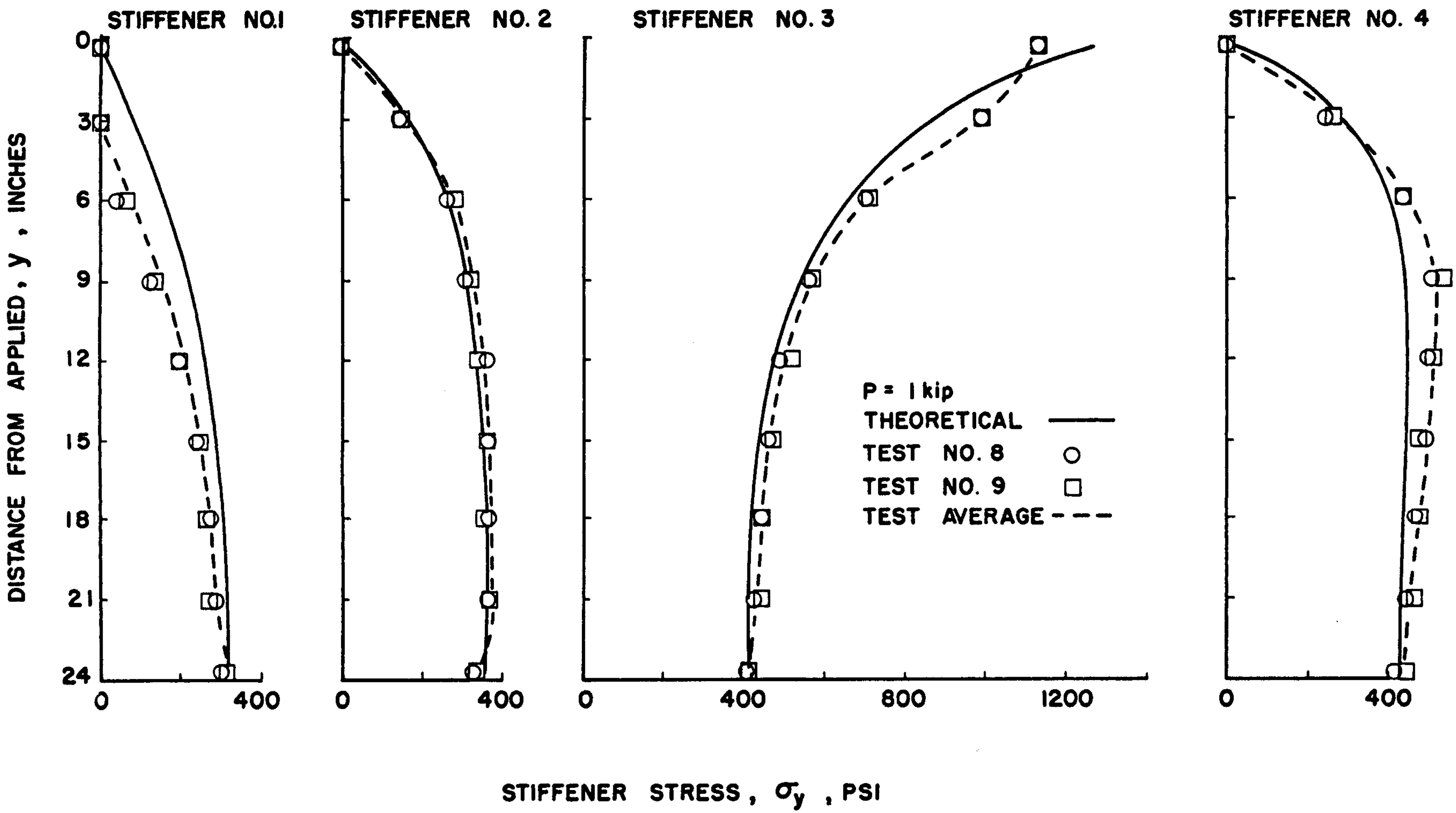



FIGURE 46.— NORMAL STRESS IN STIFFENERS OF PANEL C FOR LOADING CONDITION III .

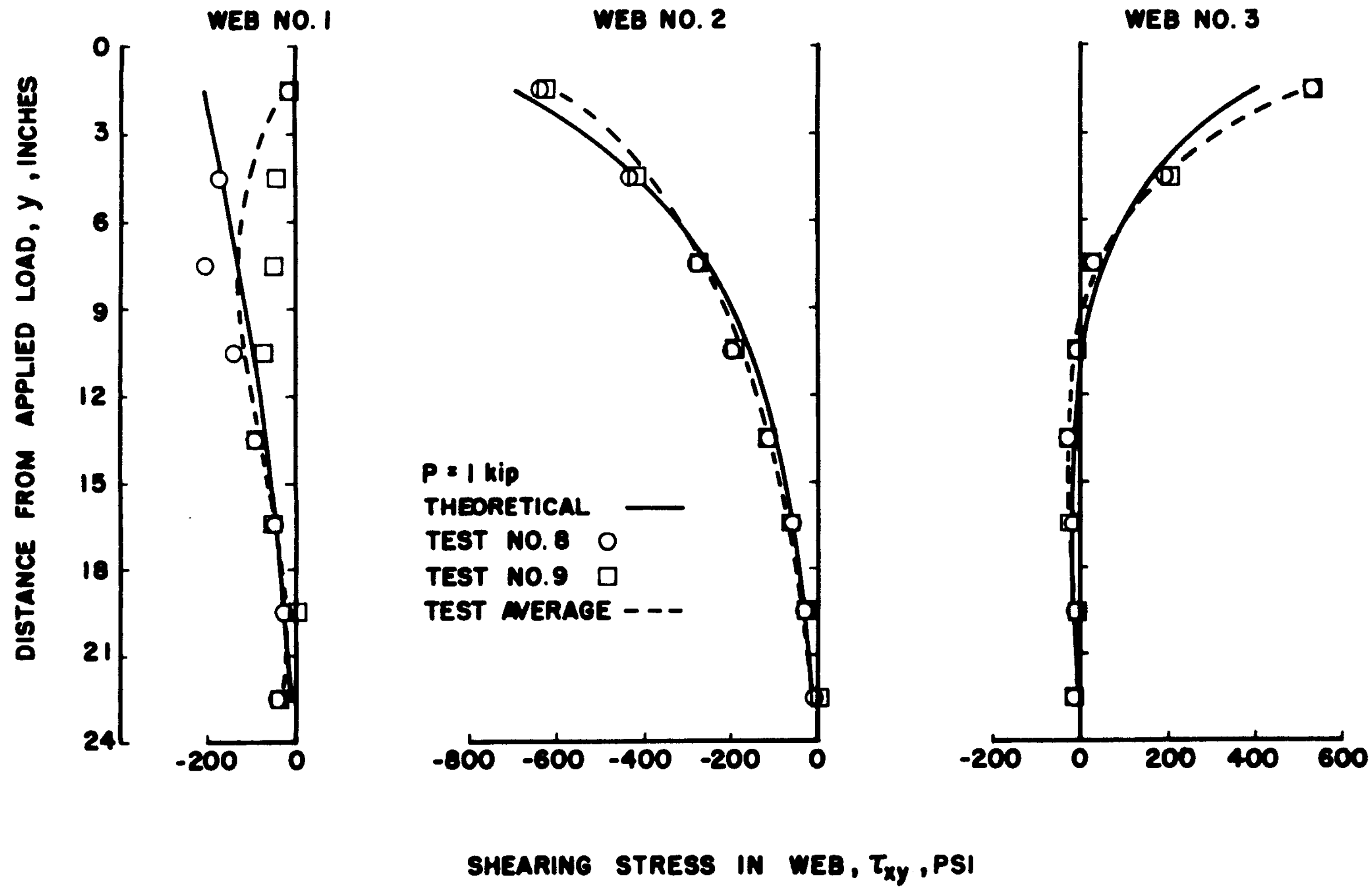



FIGURE 47.—SHEARING STRESS IN WEB OF PANEL C FOR LOADING CONDITION III.

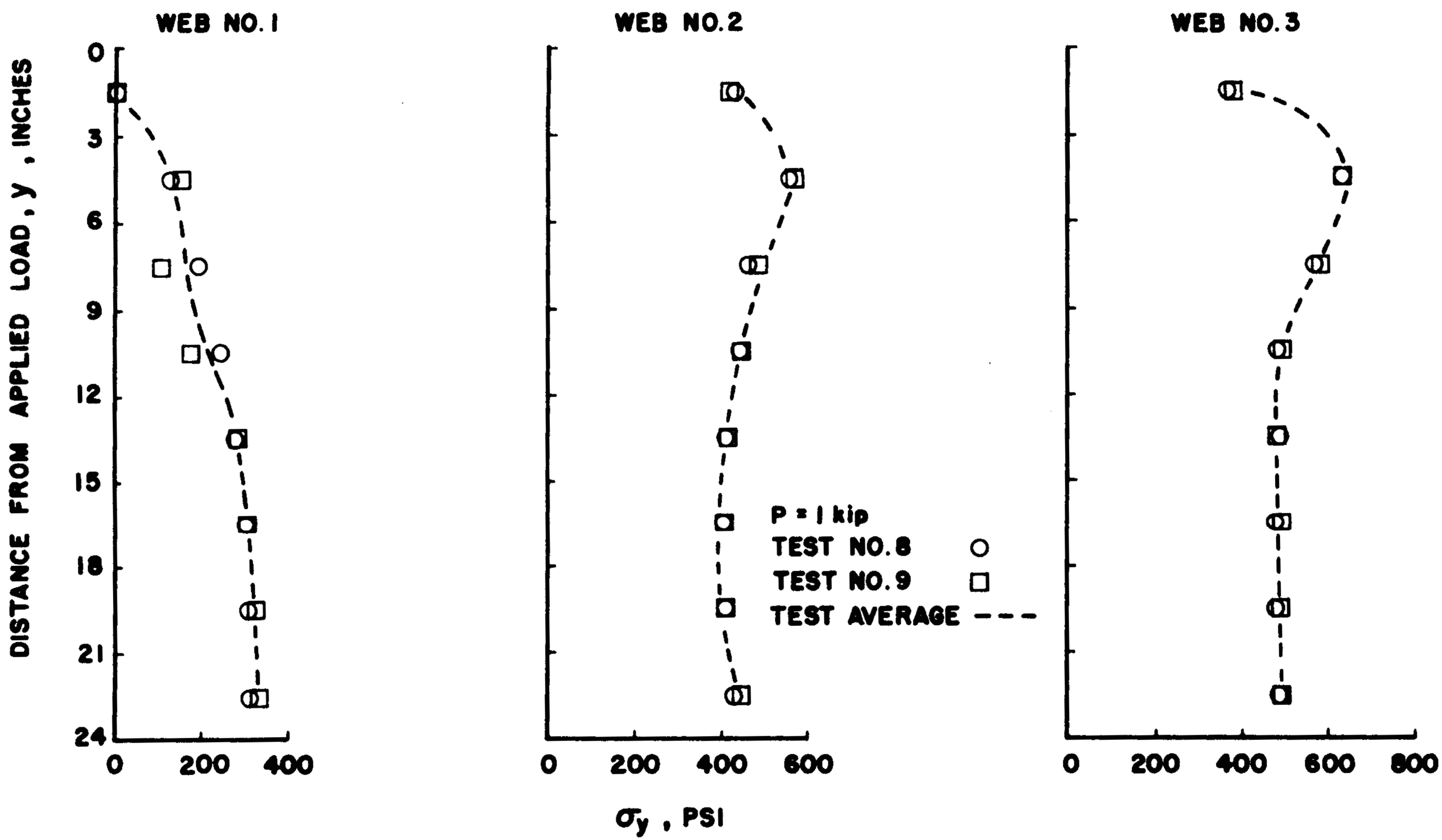



FIGURE 68.—NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION III.

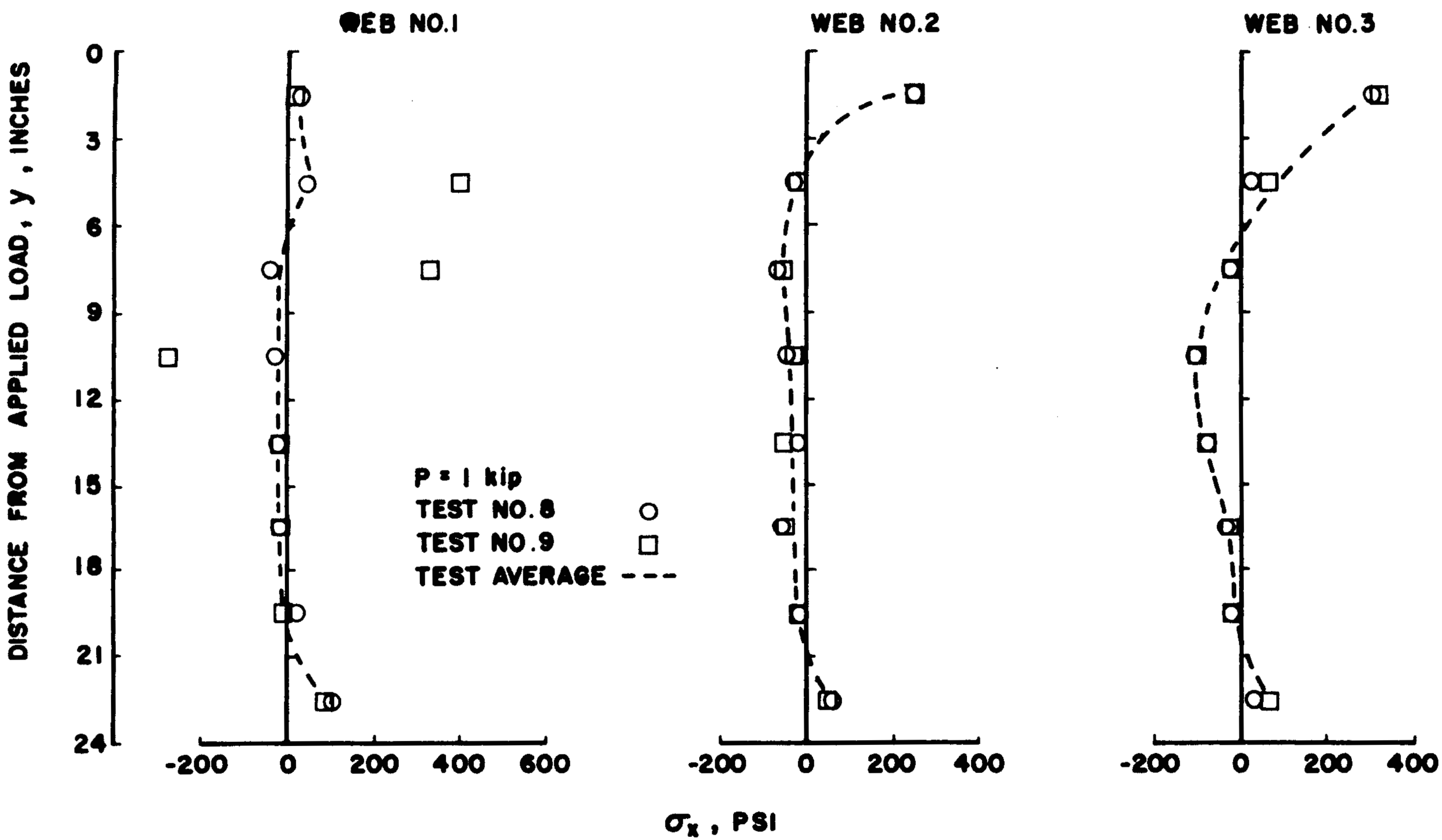



FIGURE 49. — NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION III .

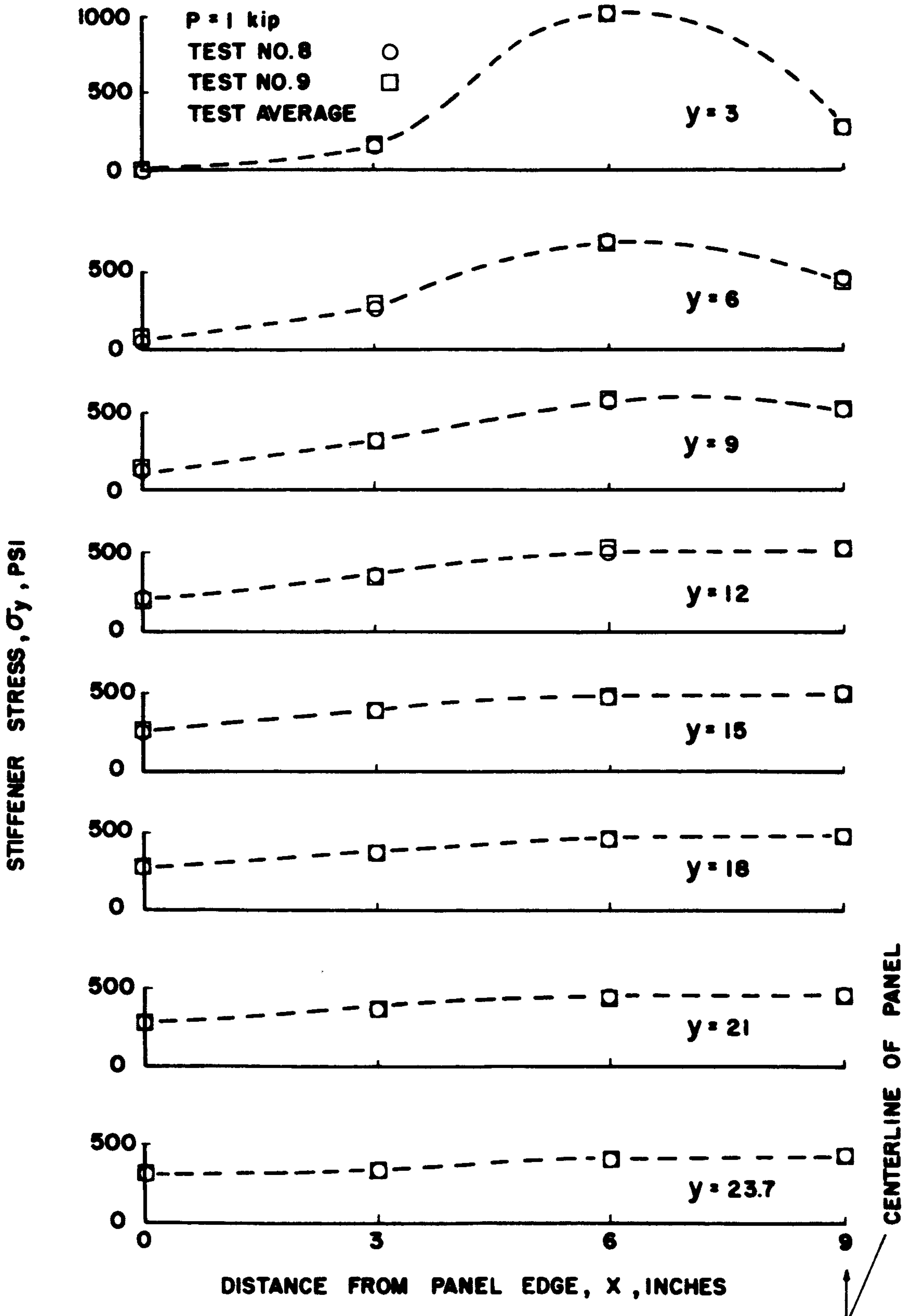



FIGURE 50.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL C FOR LOADING CONDITION III.

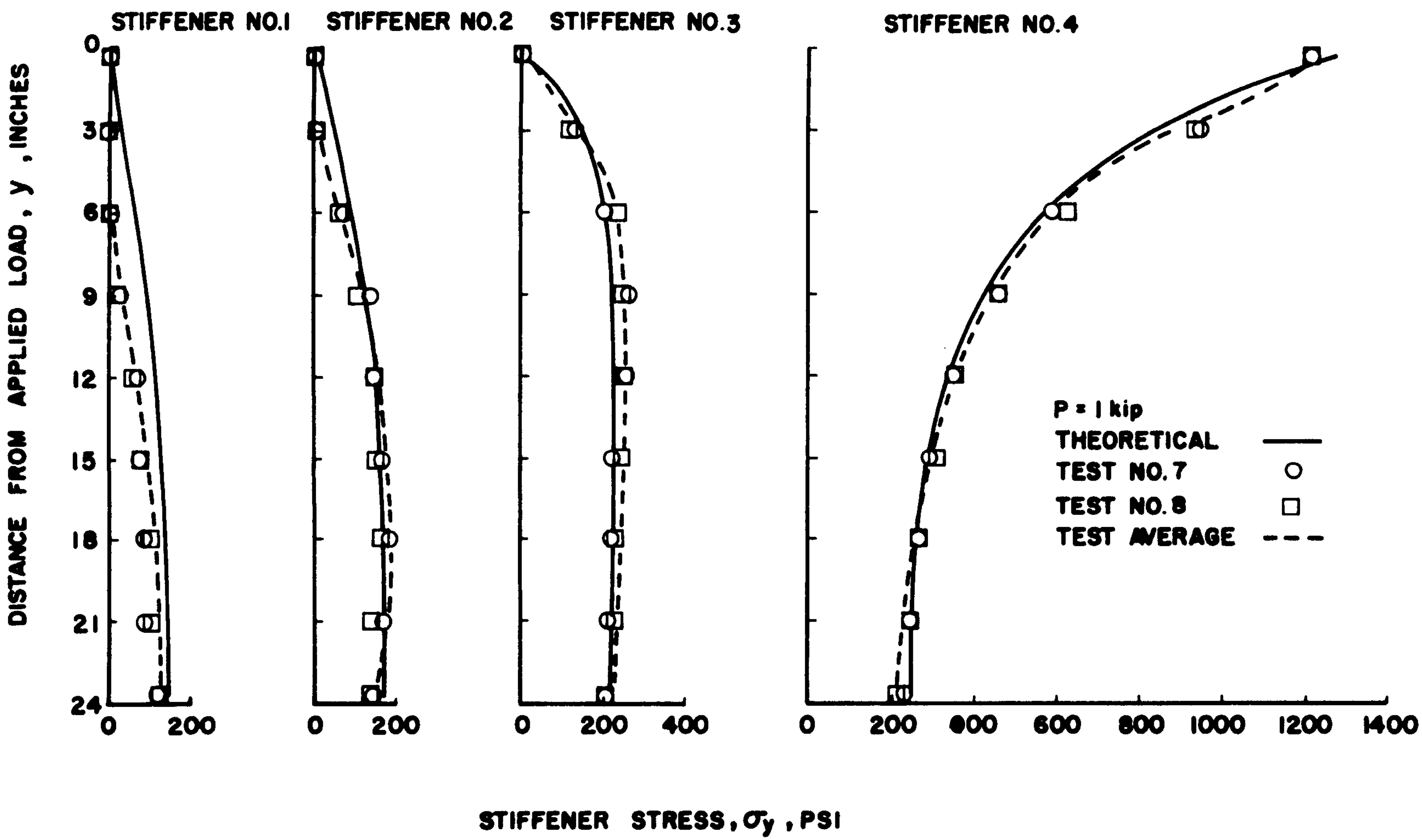



FIGURE 51. — NORMAL STRESS IN STIFFENERS OF PANEL C FOR LOADING CONDITION IV.

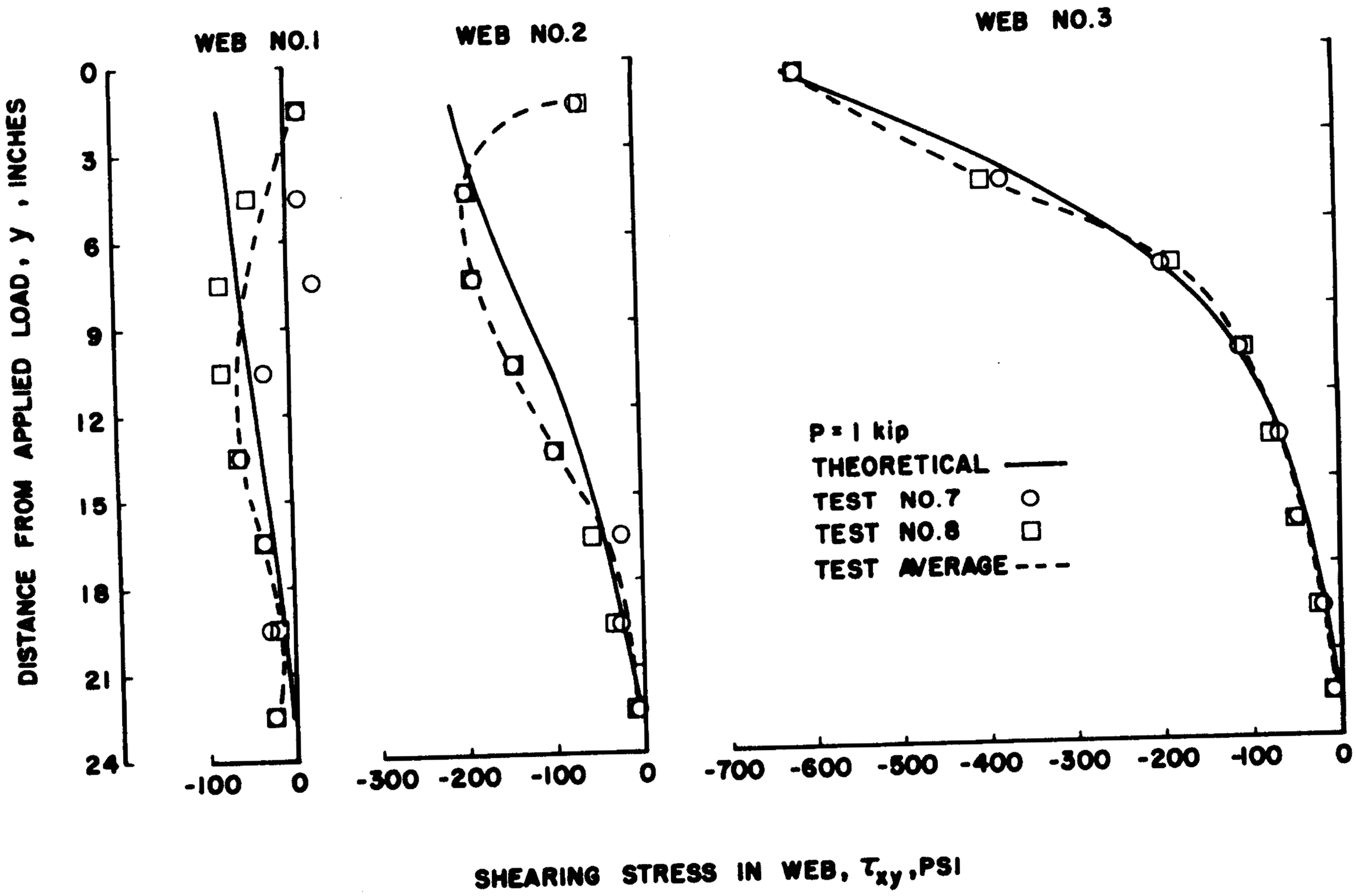



FIGURE 52.– SHEARING STRESS IN WEB OF PANEL C FOR LOADING CONDITION IV.

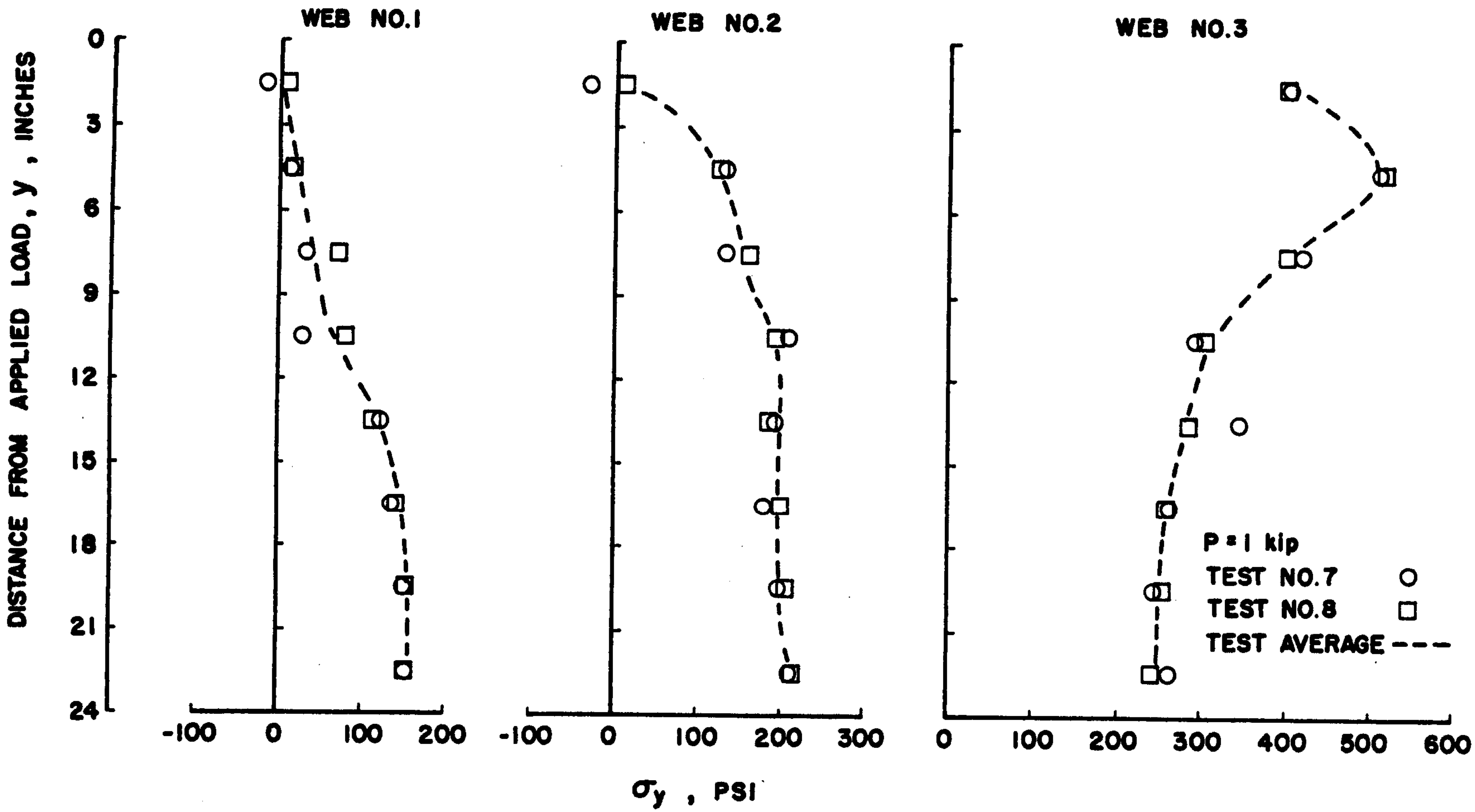



FIGURE 53.– NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION IV.

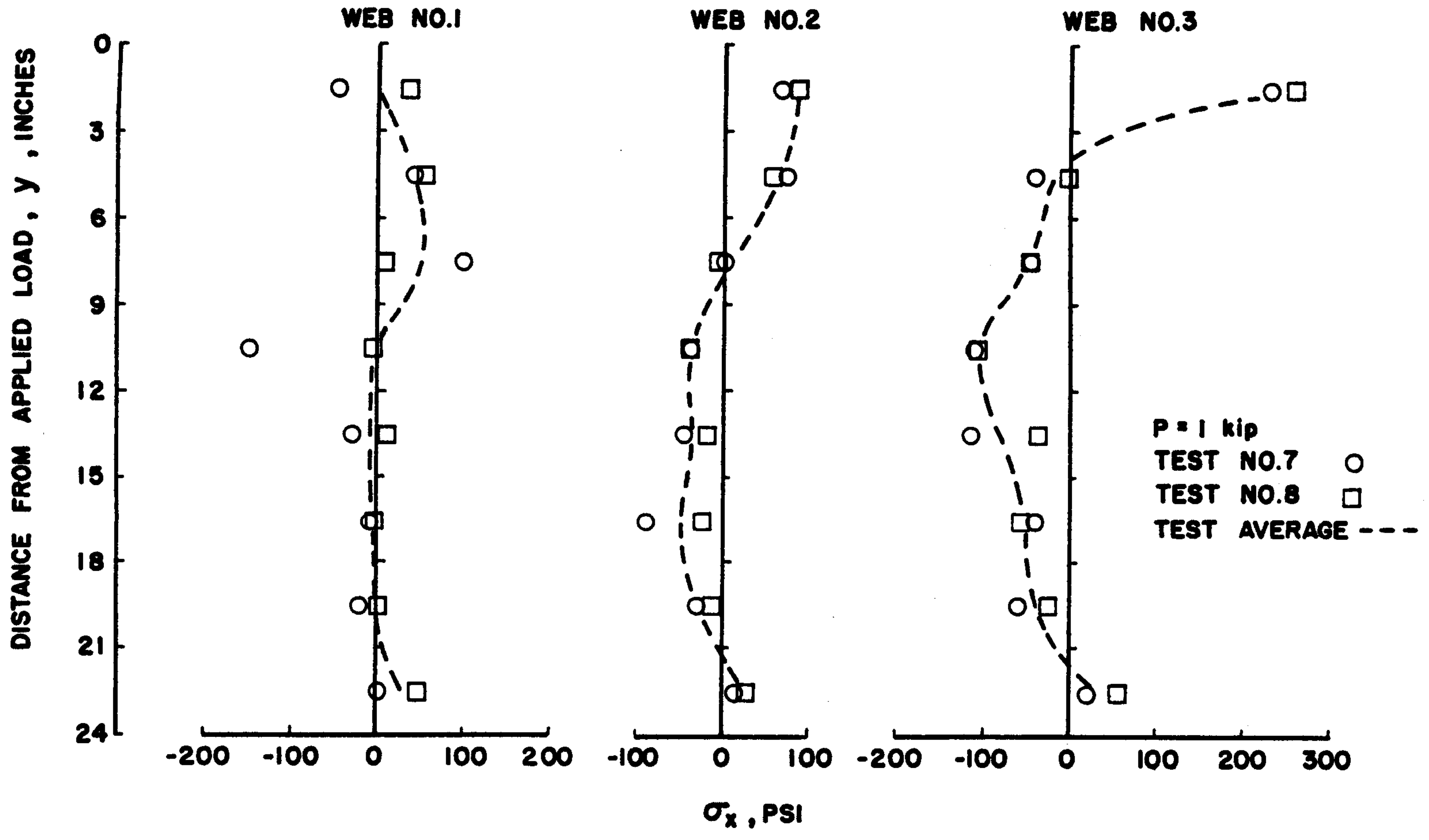



FIGURE 54.—NORMAL STRESS IN WEB OF PANEL C FOR LOADING CONDITION IV.

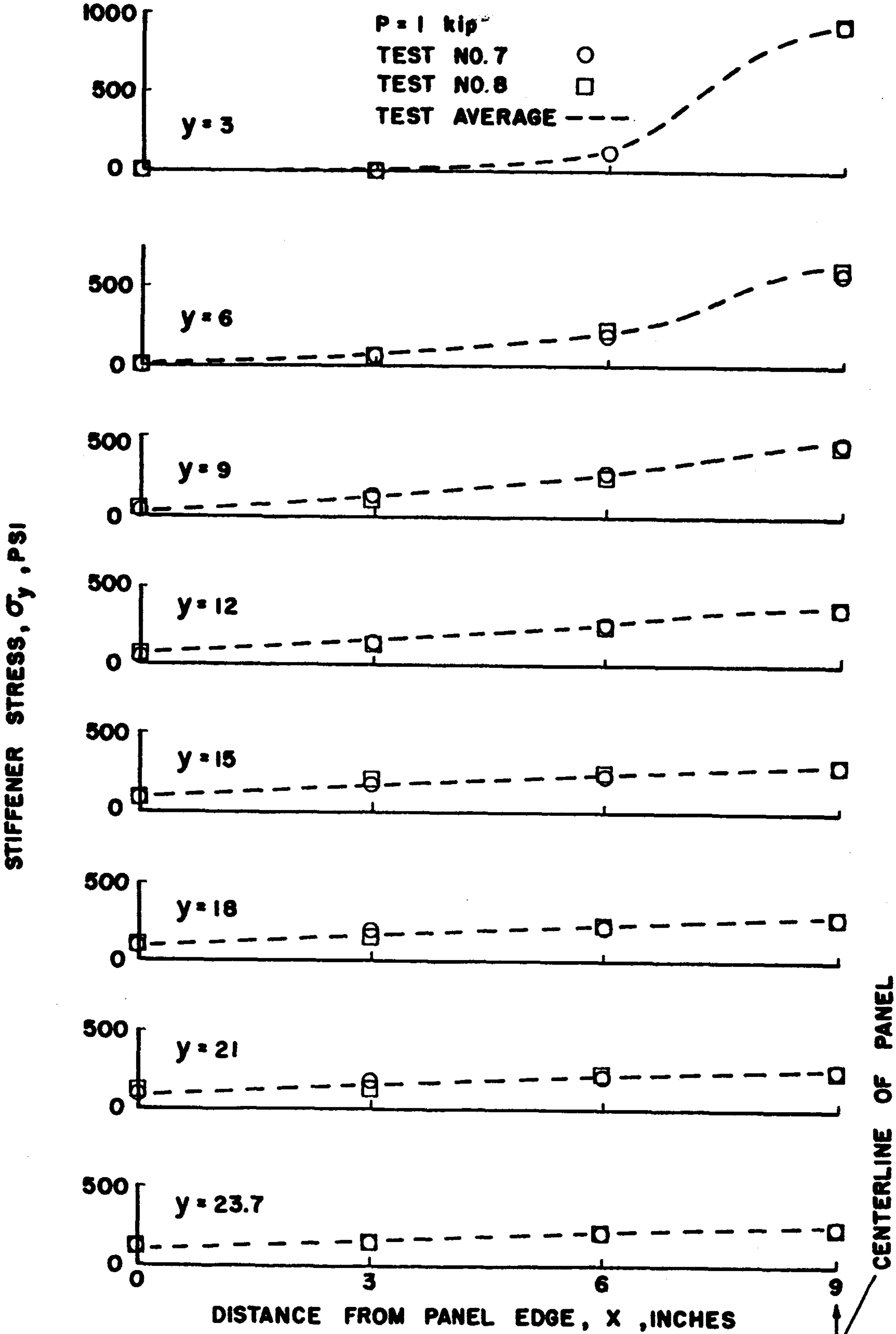



FIGURE 55.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL C FOR LOADING CONDITION IV.

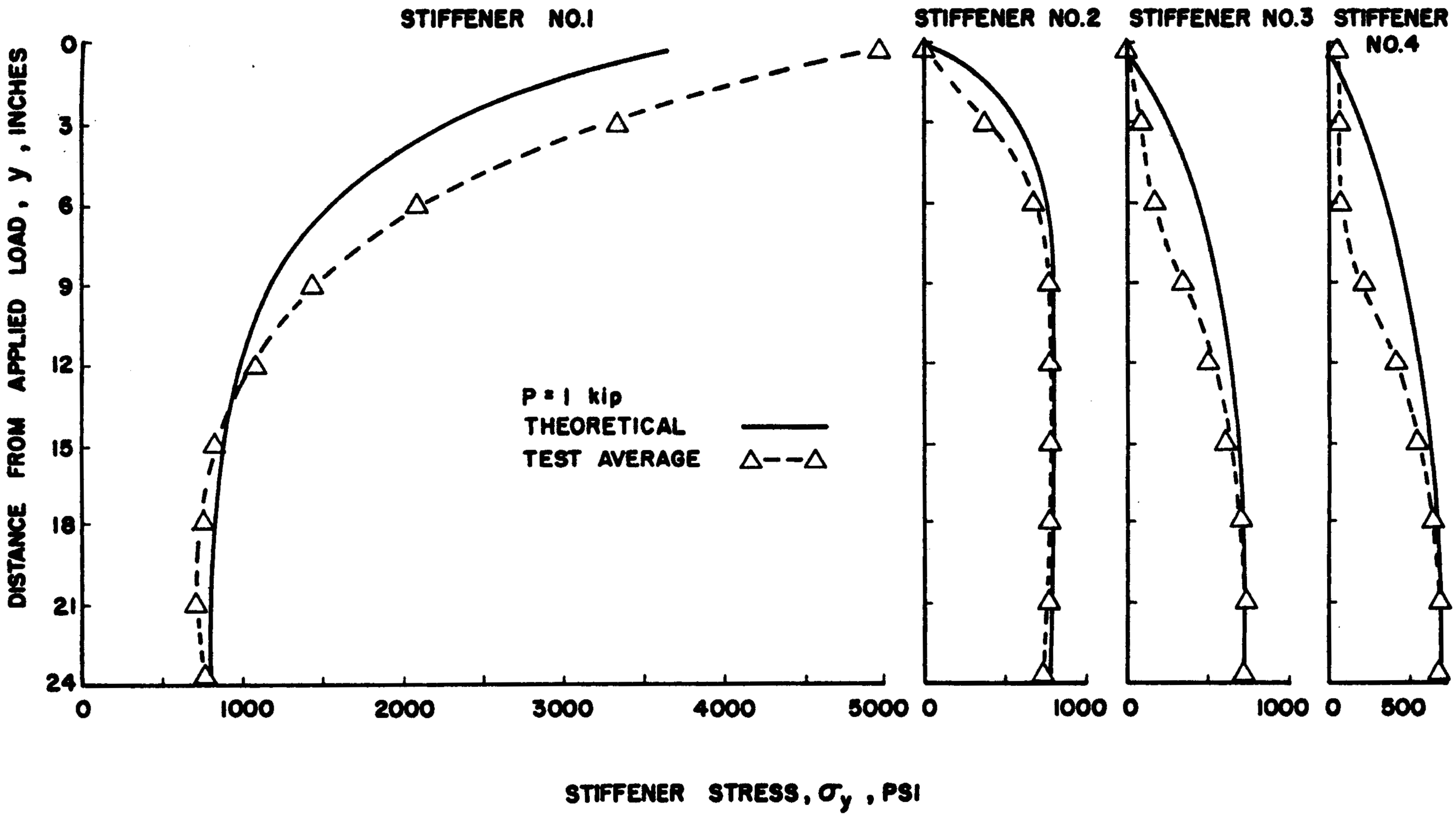



FIGURE 56.—NORMAL STRESS IN STIFFENERS OF PANEL D FOR LOADING CONDITION I.

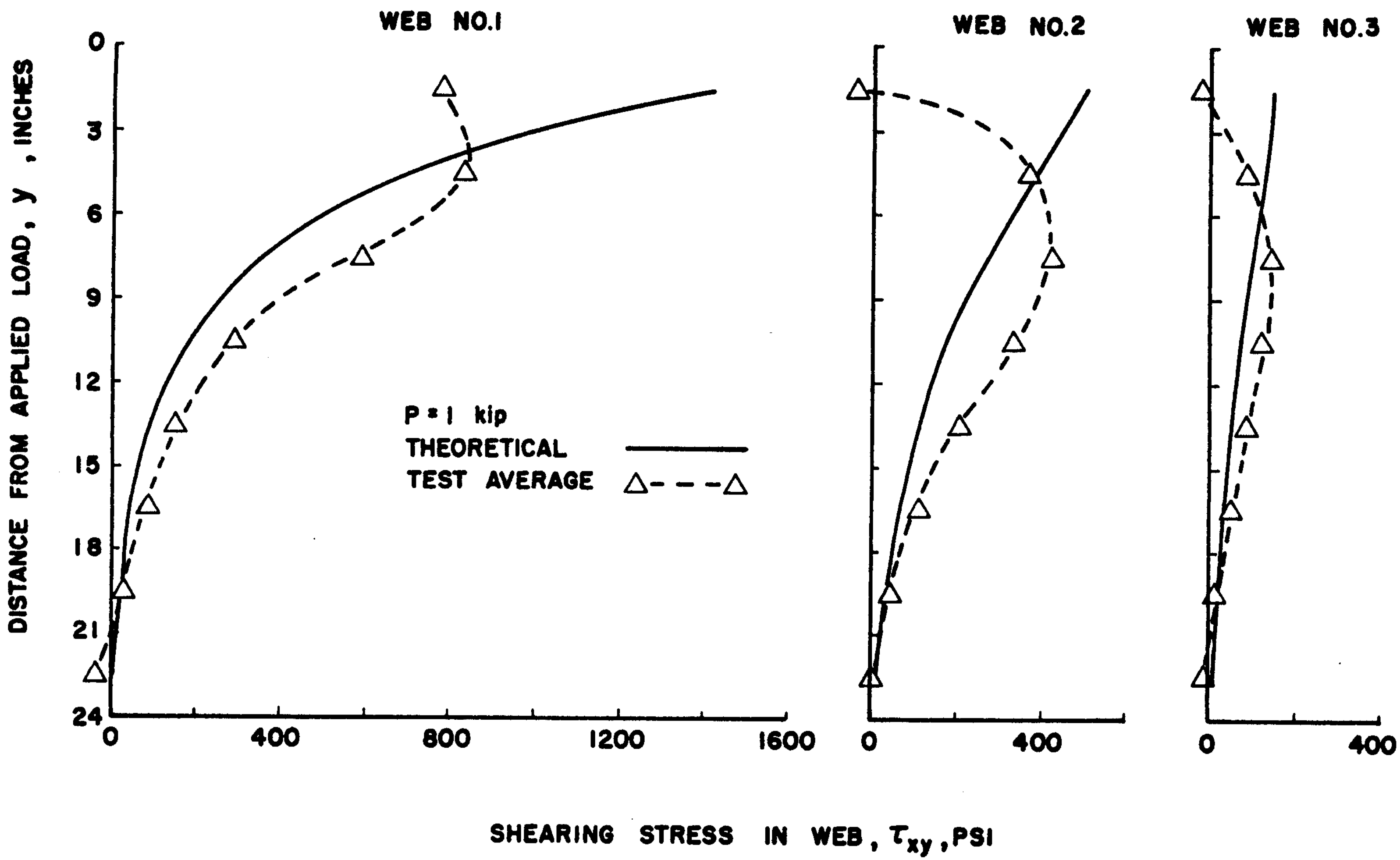



FIGURE 57.—SHEARING STRESS IN WEB OF PANEL D FOR LOADING CONDITION I.

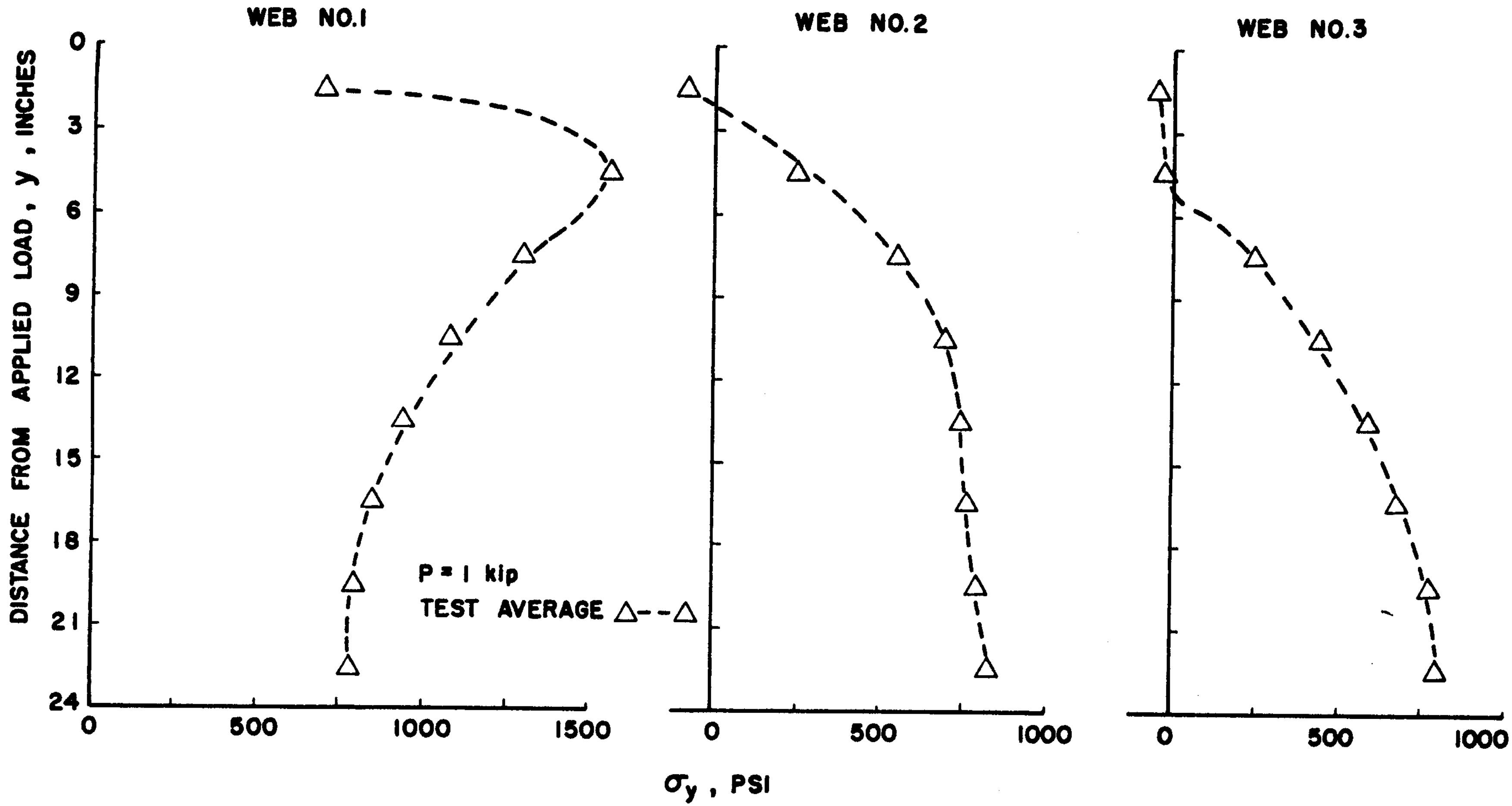



FIGURE 58.— NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION I.

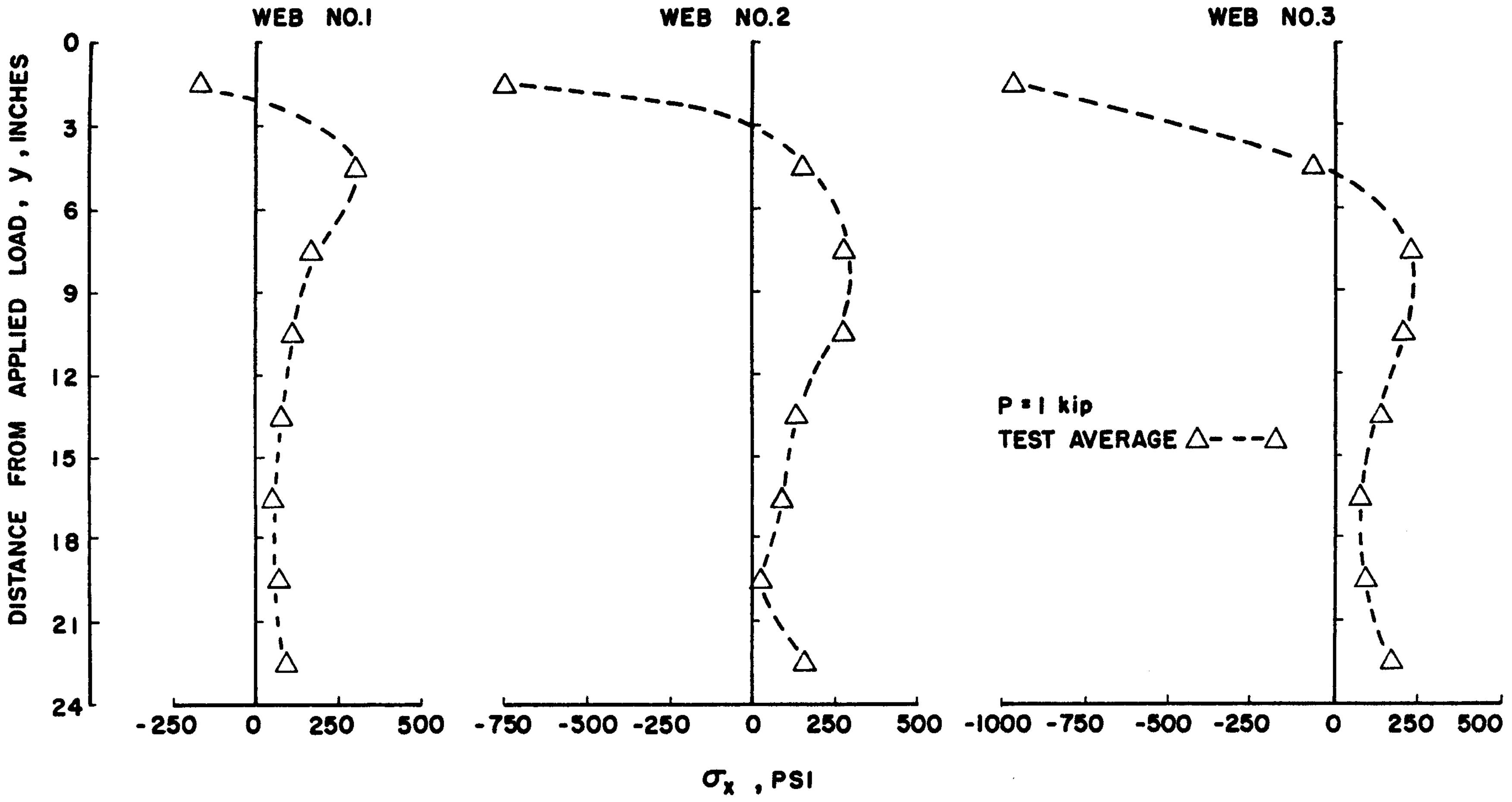



FIGURE 59.— NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION I.

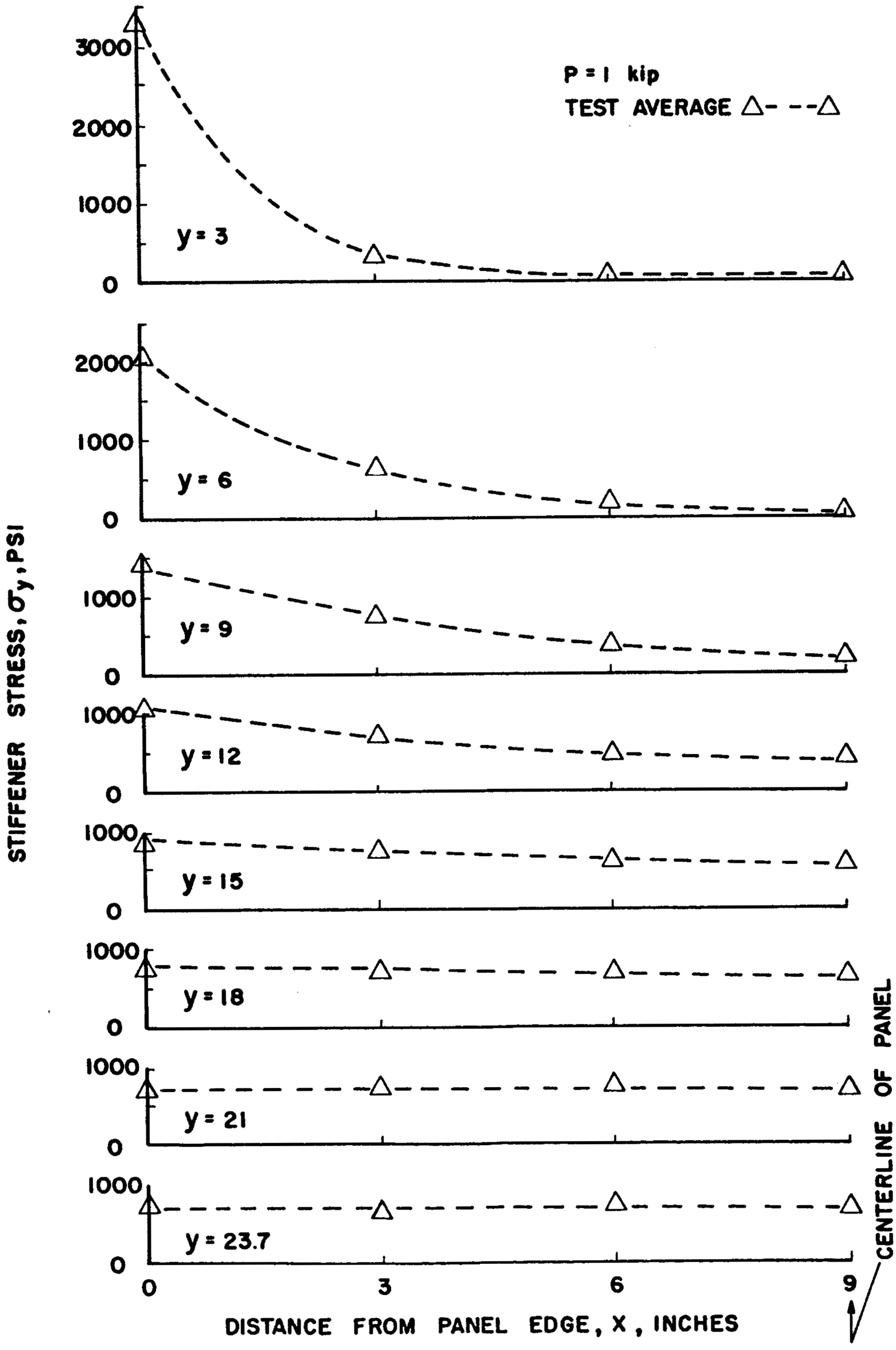



FIGURE 60.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL D FOR LOADING CONDITION I.

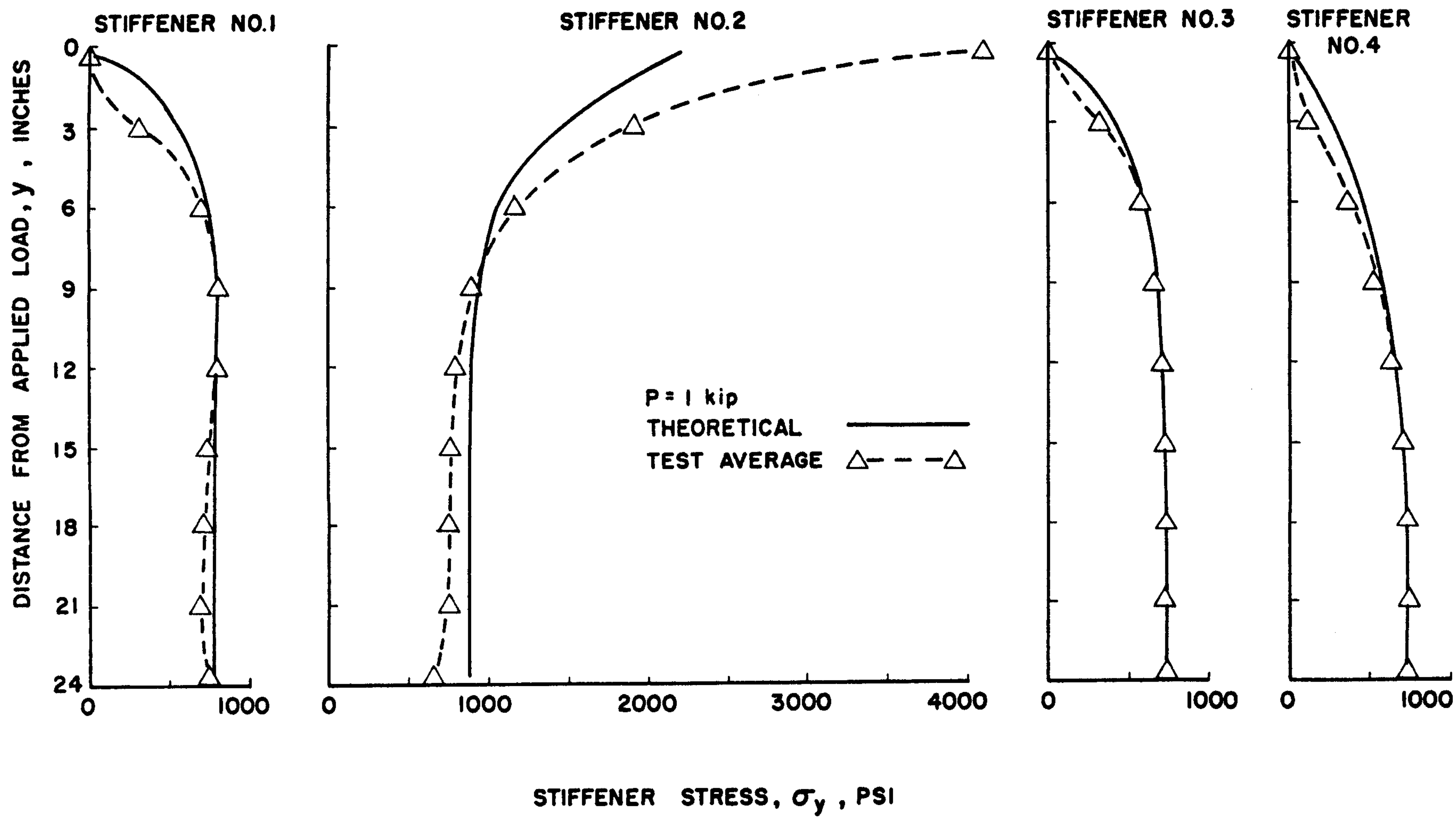



FIGURE 61. — NORMAL STRESS IN STIFFENERS OF PANEL D FOR LOADING CONDITION II.

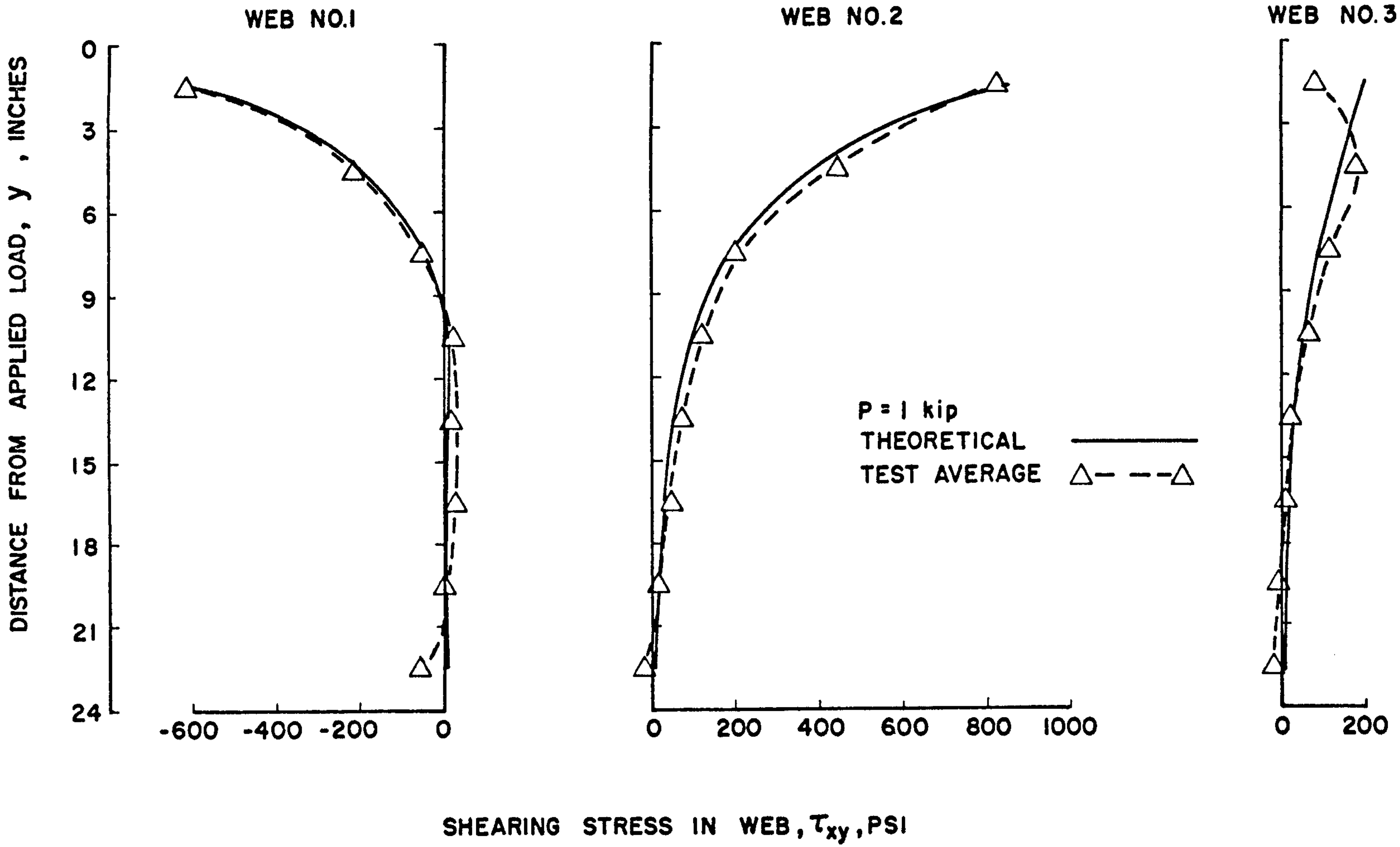



FIGURE 62. — SHEARING STRESS IN WEB OF PANEL D FOR LOADING CONDITION II .

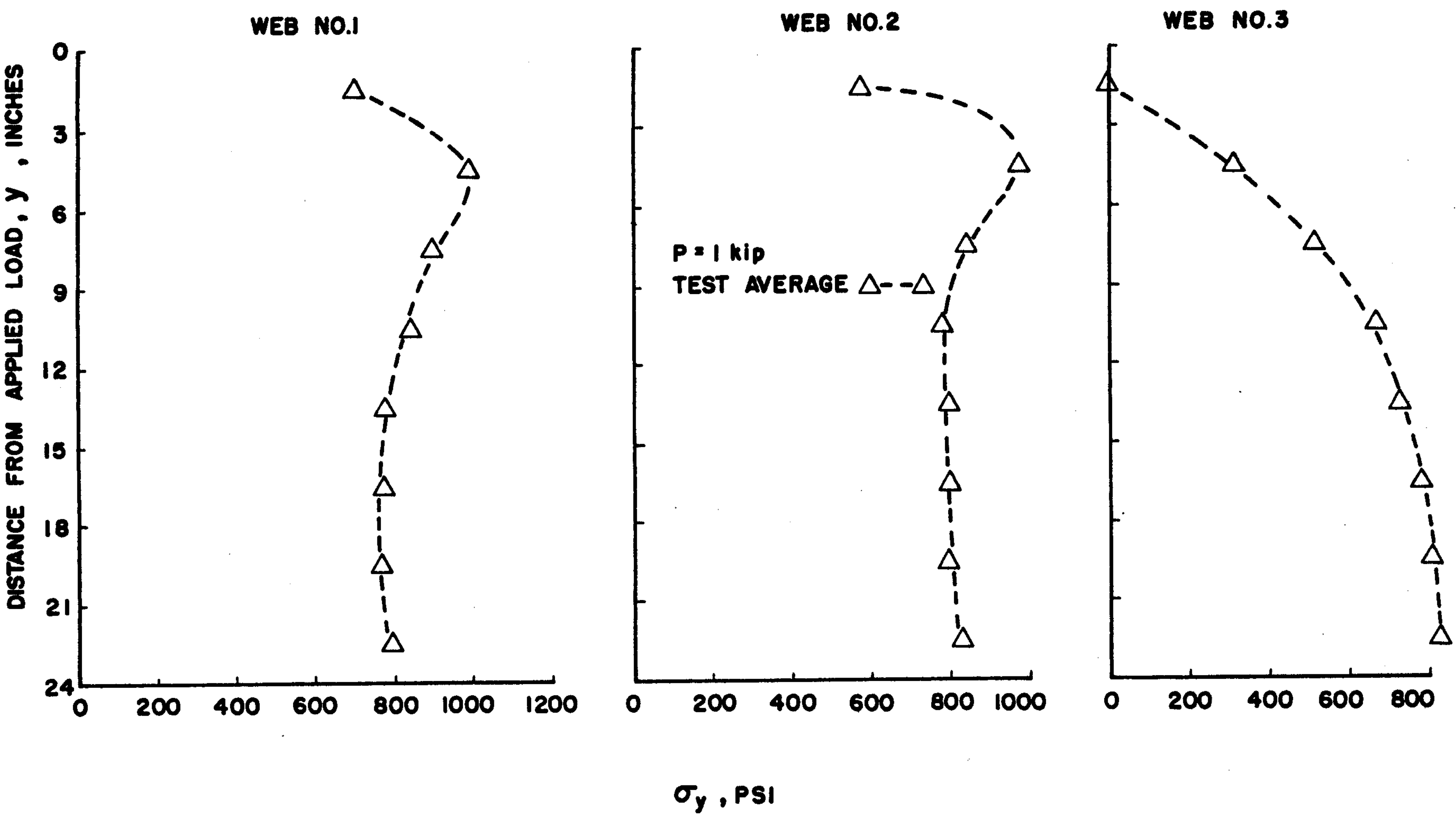



FIGURE 63.—NORMAL STRESS IN WEB OF PANEL D FOR LOAD CONDITION II .

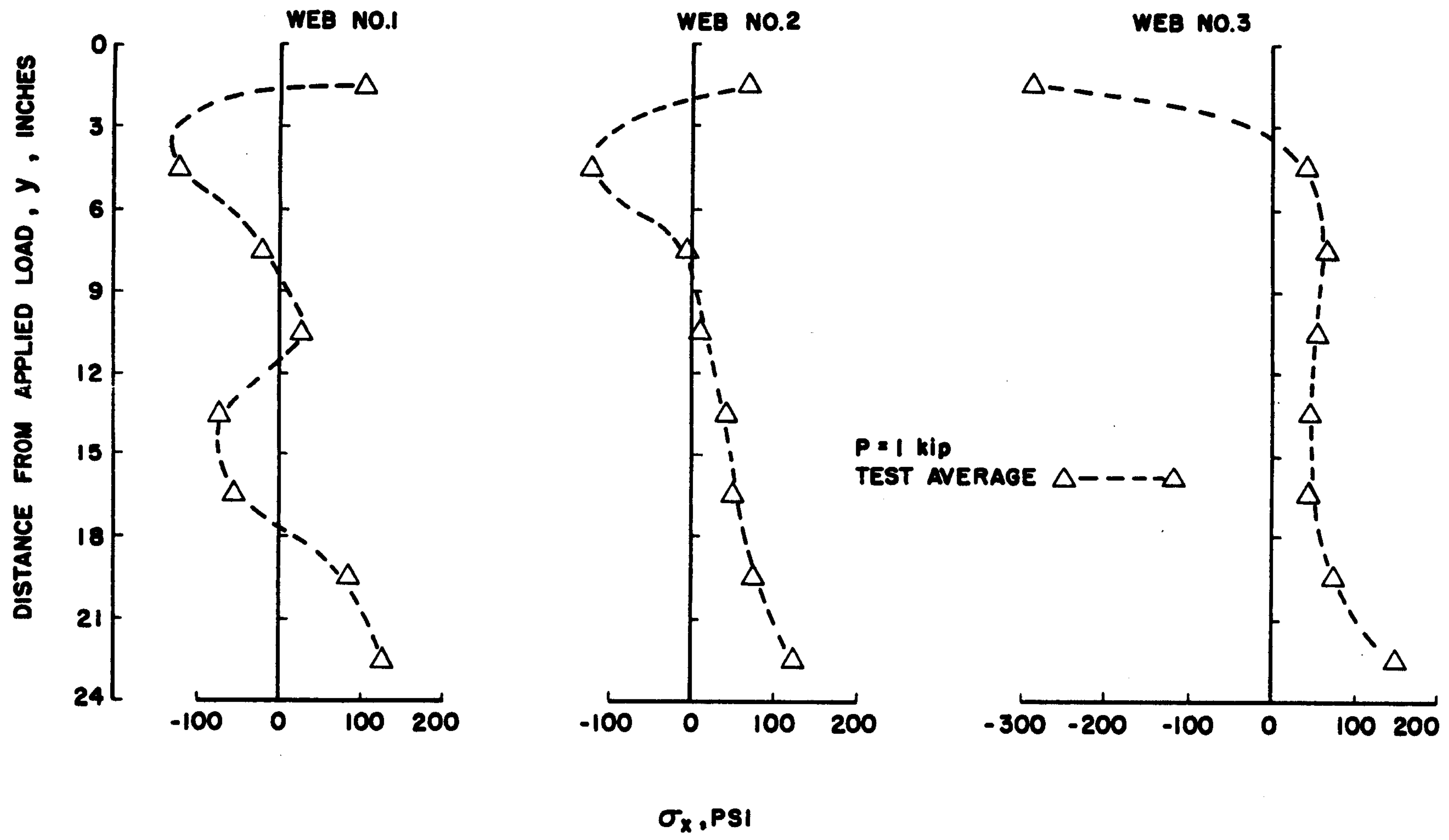



FIGURE 64.—NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION II.

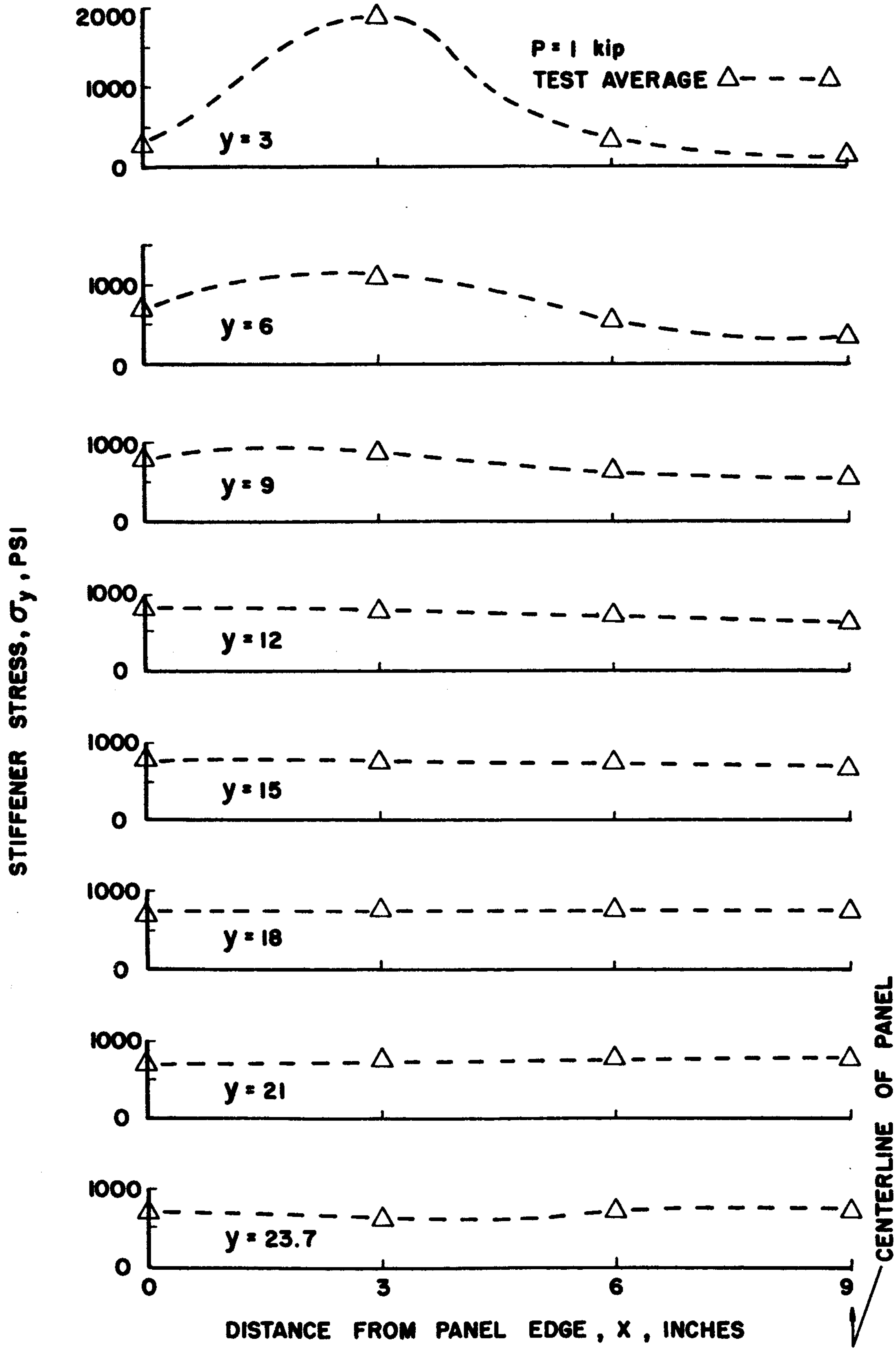



FIGURE 65.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL D FOR LOADING CONDITION II.

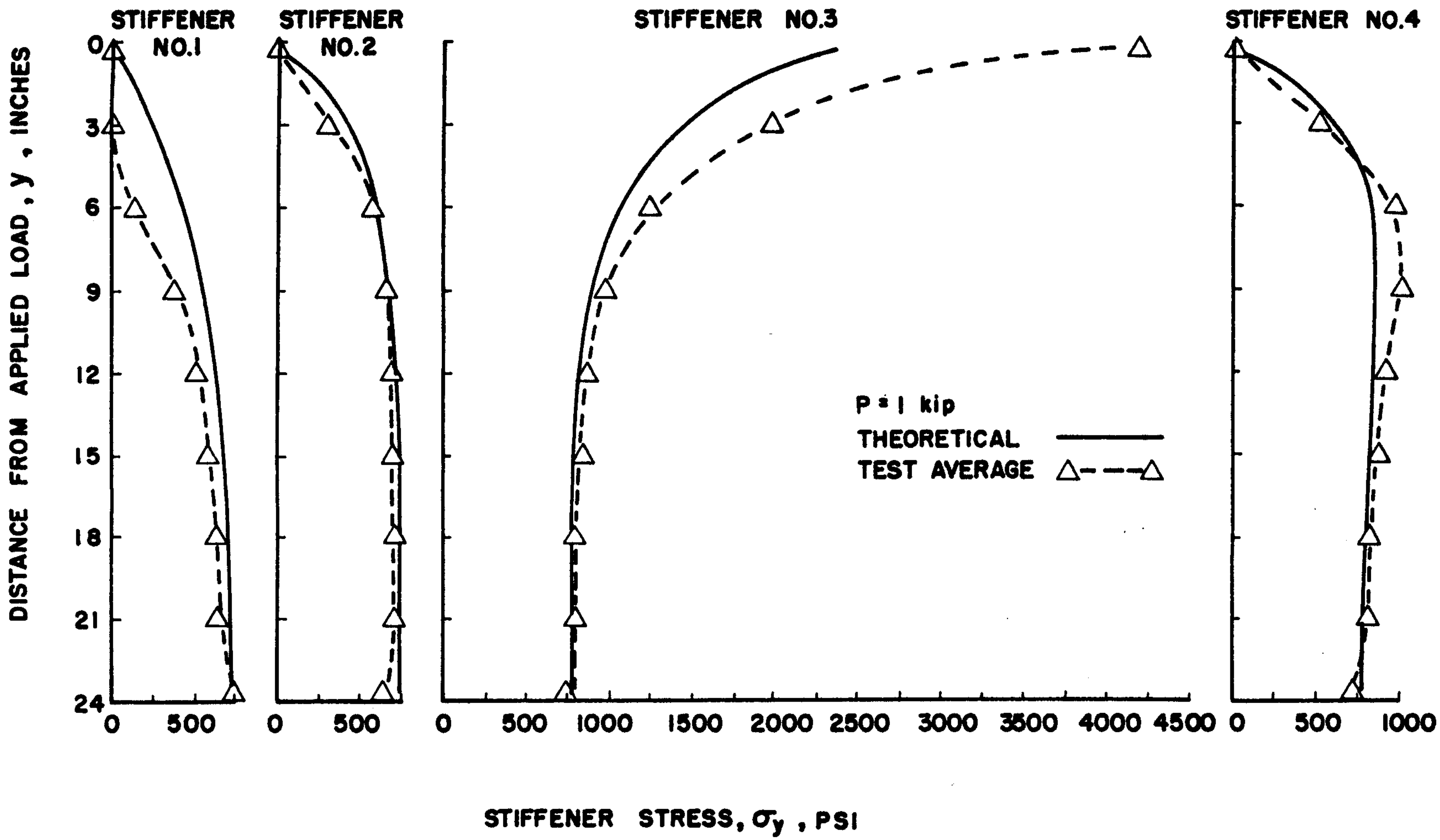



FIGURE 66. —NORMAL STRESS IN STIFFENERS OF PANEL D FOR LOADING CONDITION III

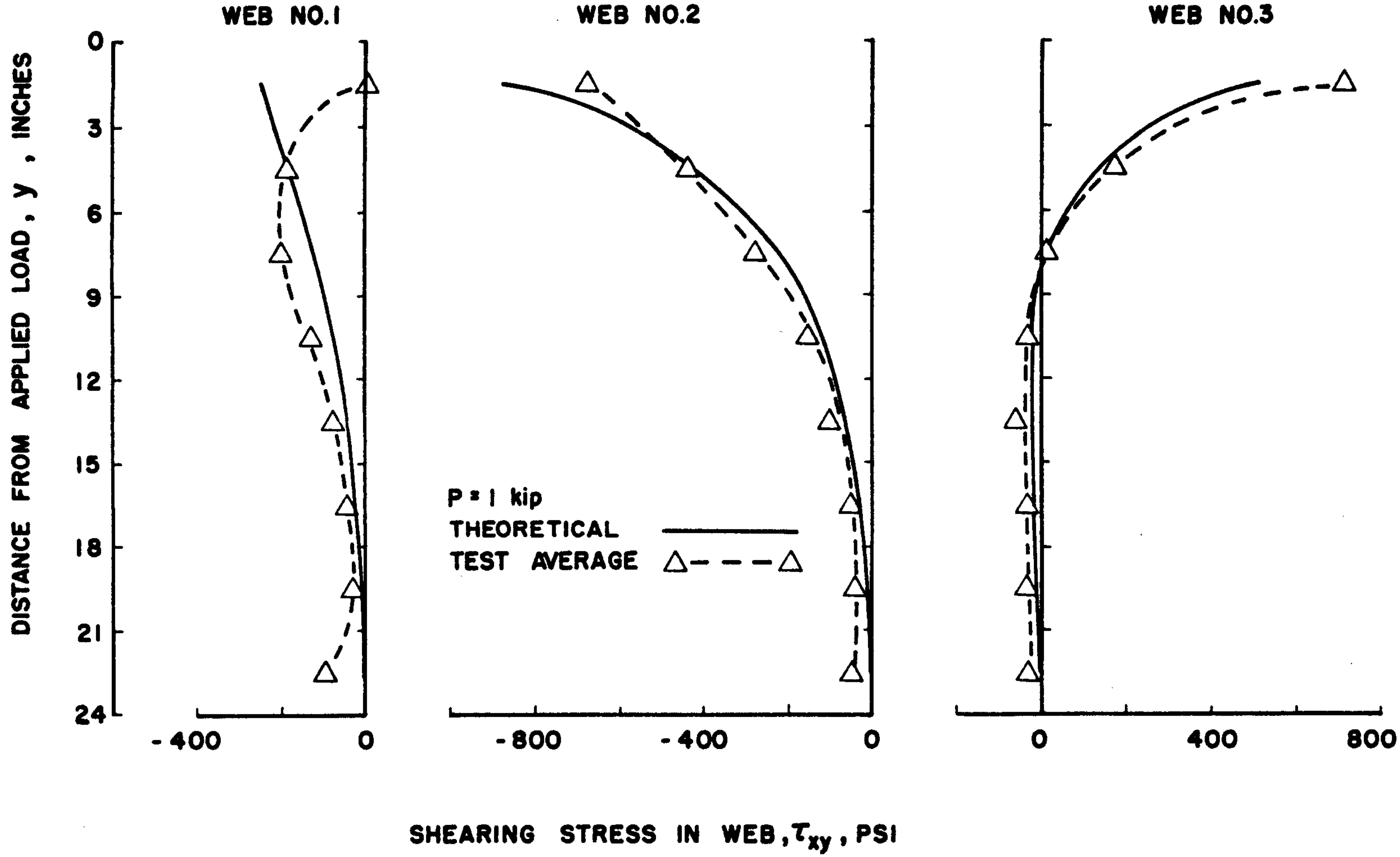



FIGURE 67. — SHEARING STRESS IN WEB OF PANEL D FOR LOADING CONDITION III .

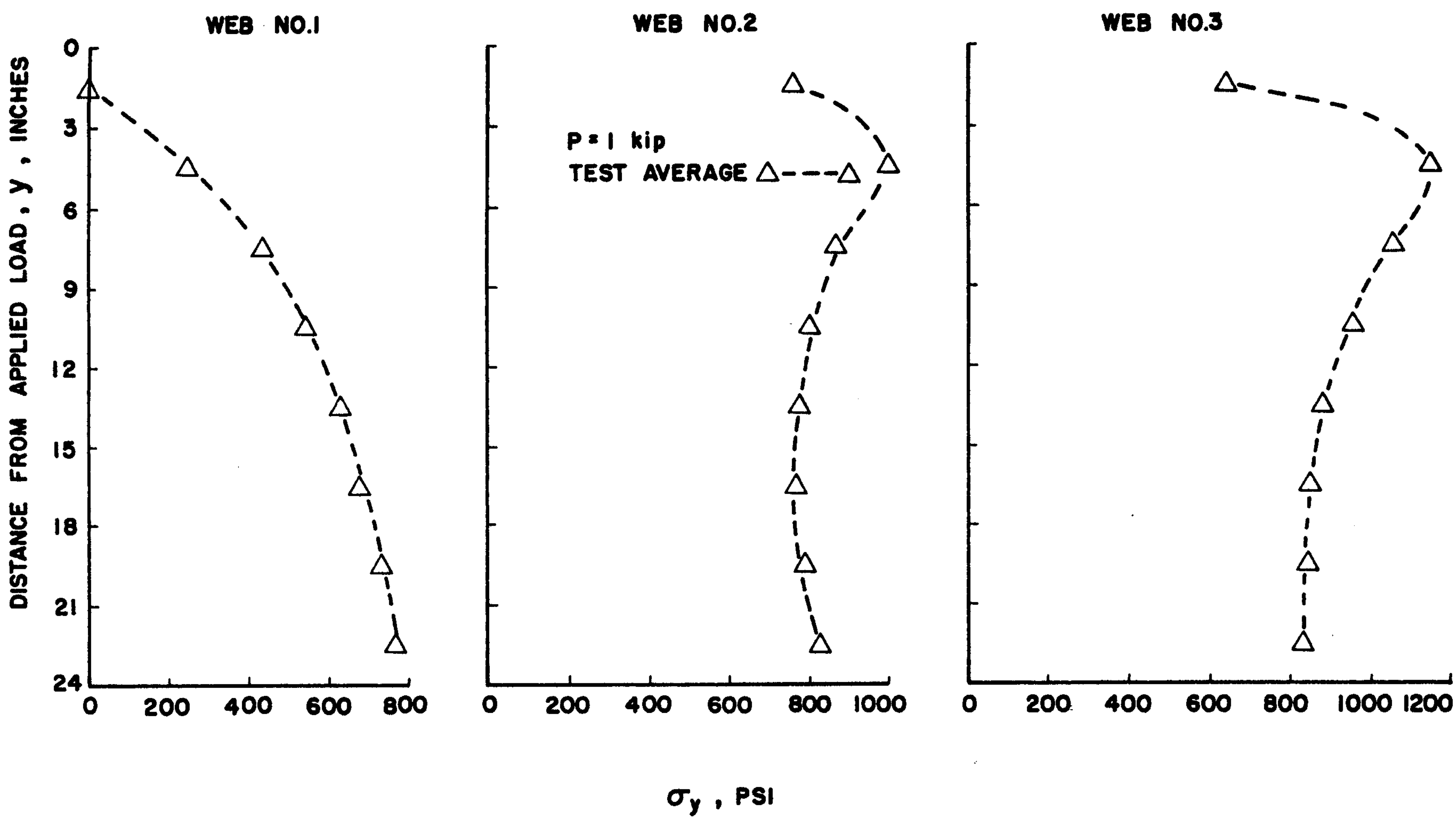



FIGURE 68.—NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION III.

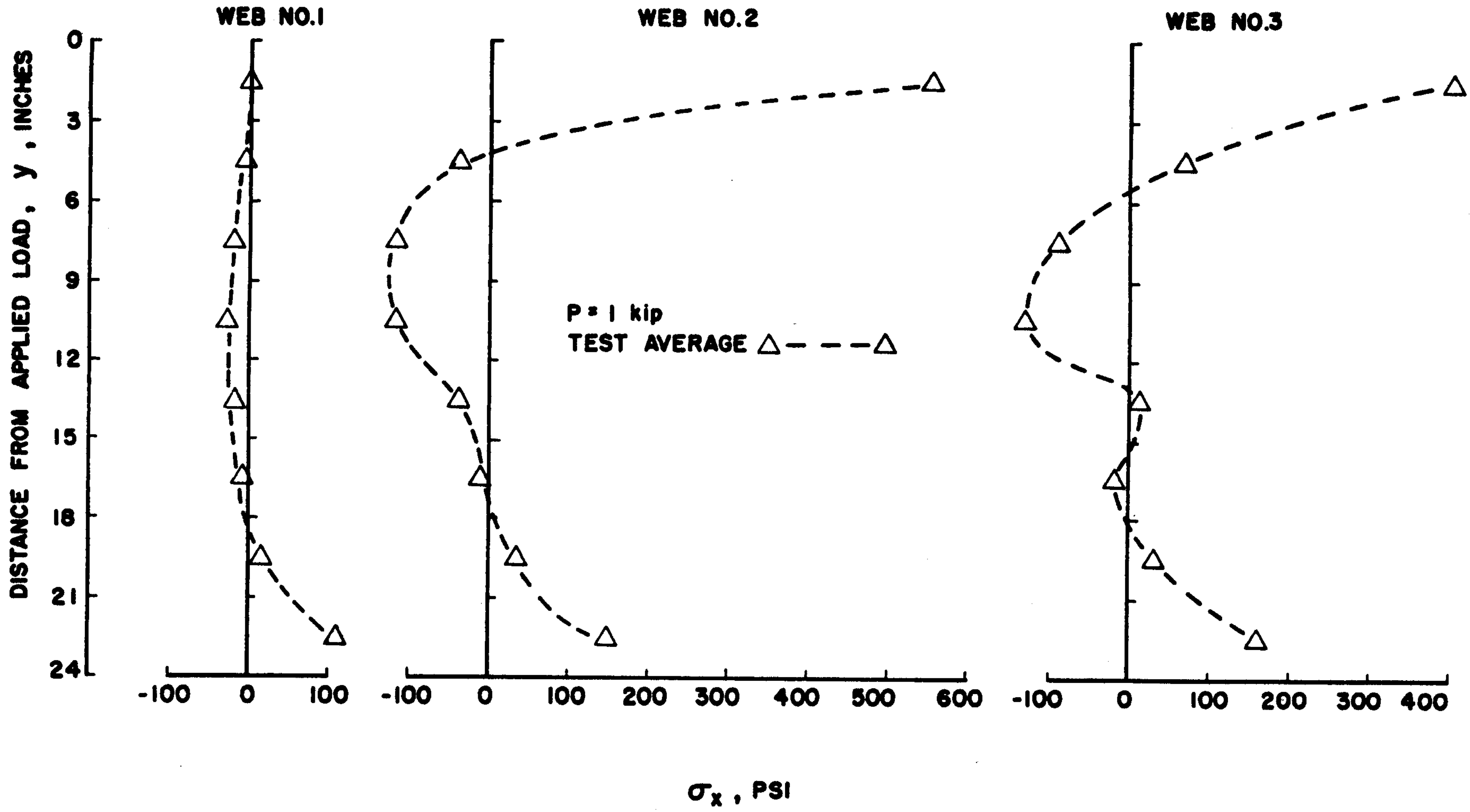



FIGURE 69.— NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION III .

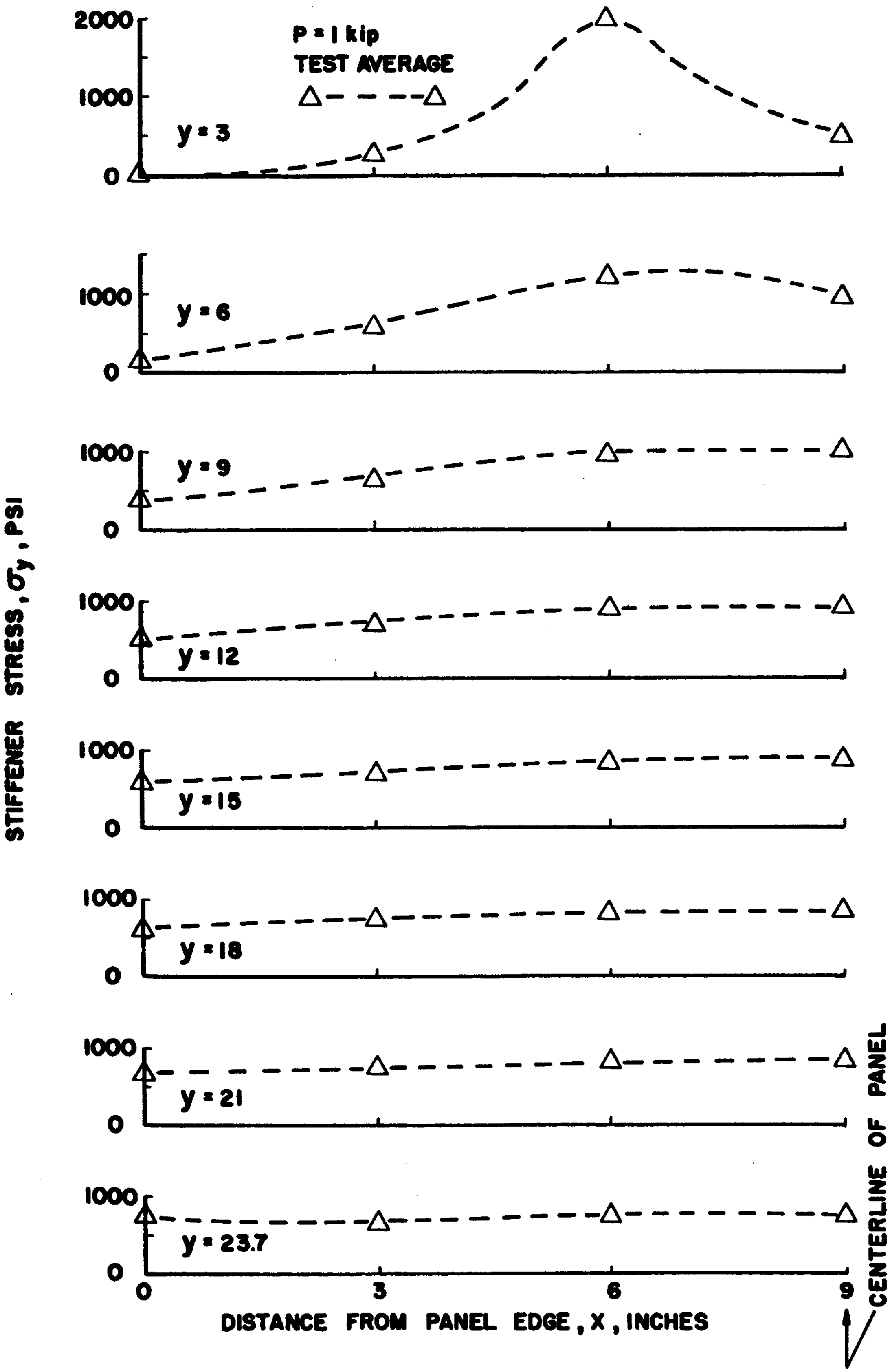



FIGURE 70.— CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL D FOR LOADING CONDITION III.

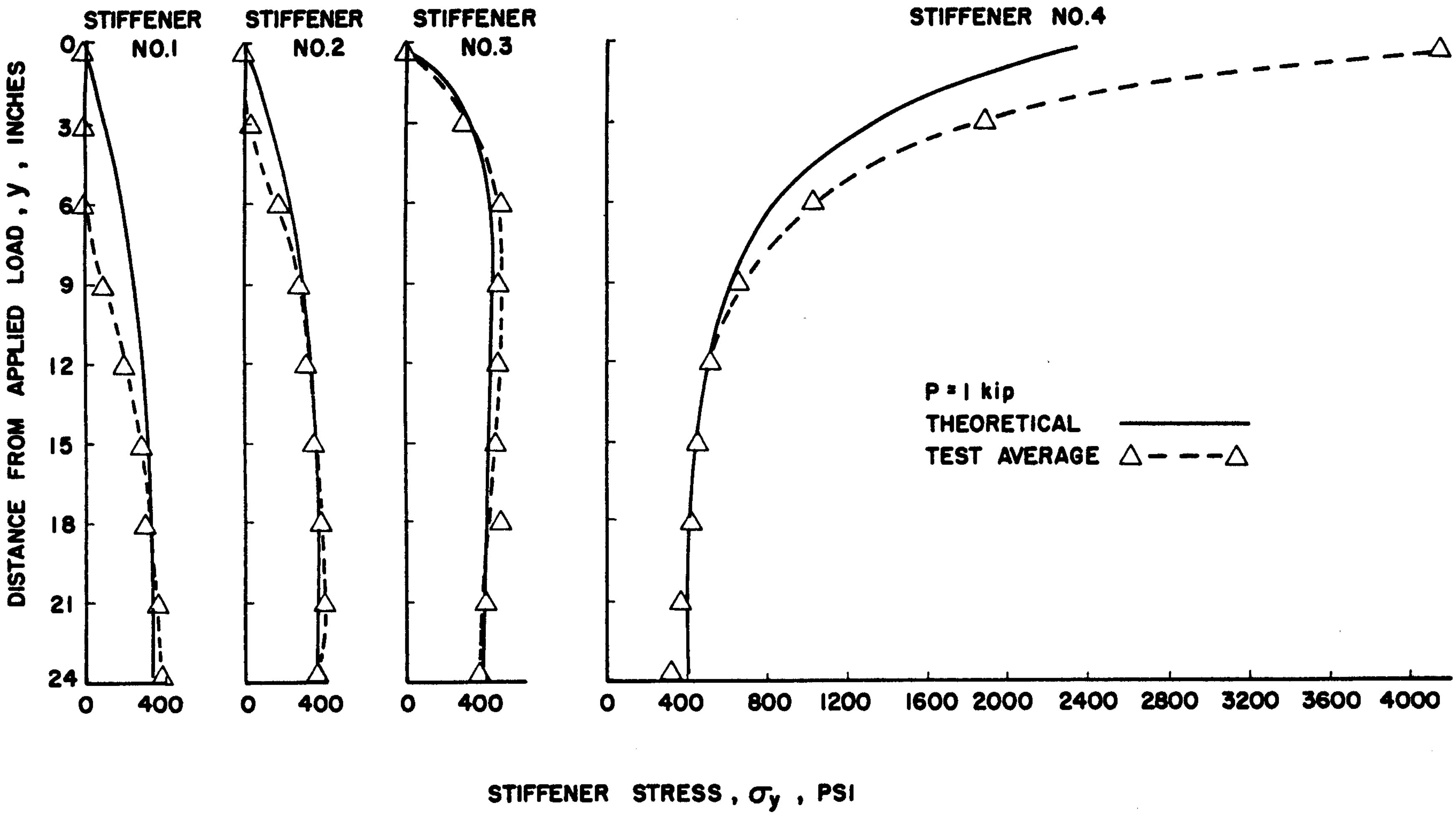



FIGURE 71. — NORMAL STRESS IN STIFFENERS OF PANEL D FOR LOADING CONDITION IV .

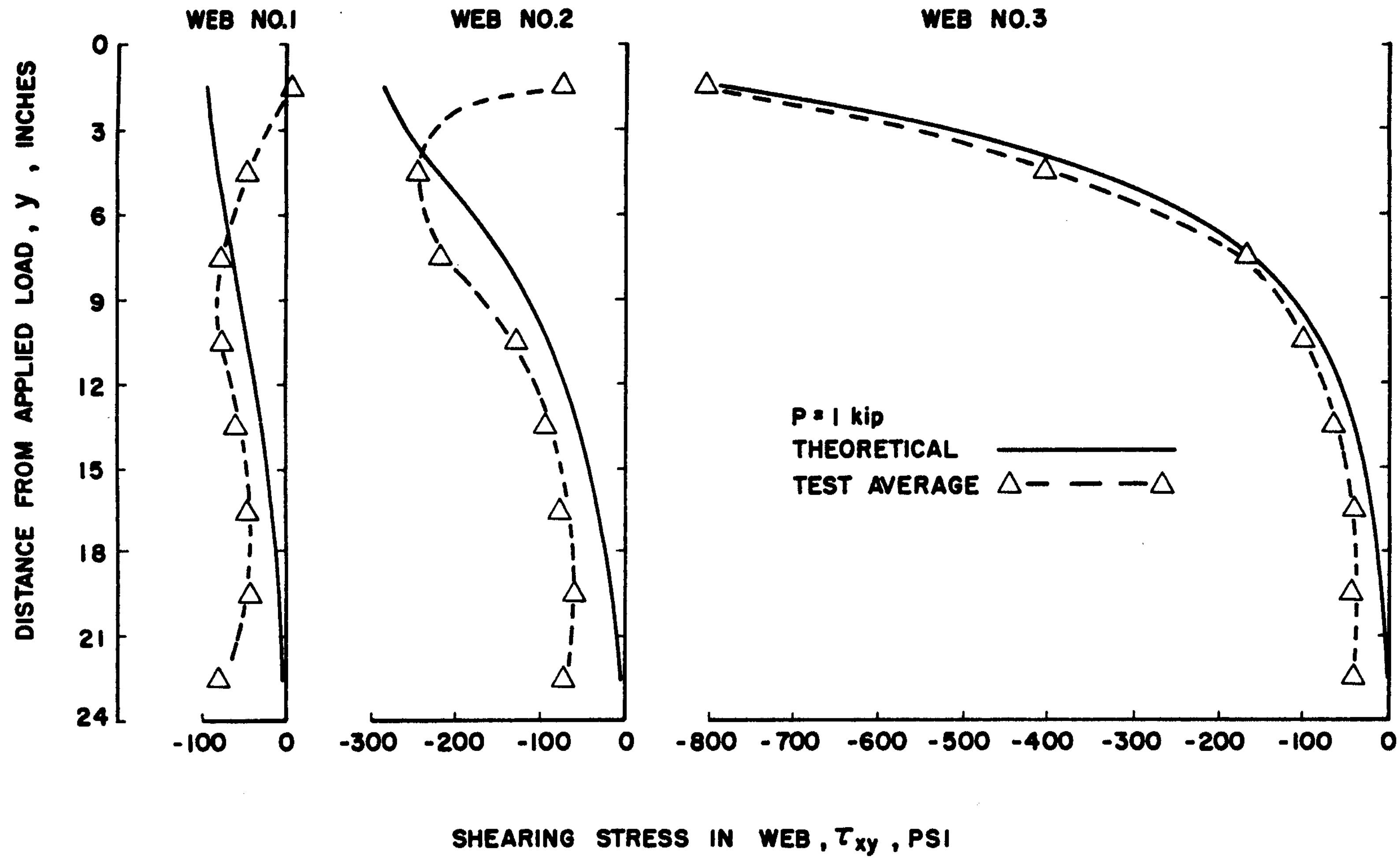



FIGURE 72.—SHEARING STRESS IN WEB OF PANEL D FOR CONDITION IV.

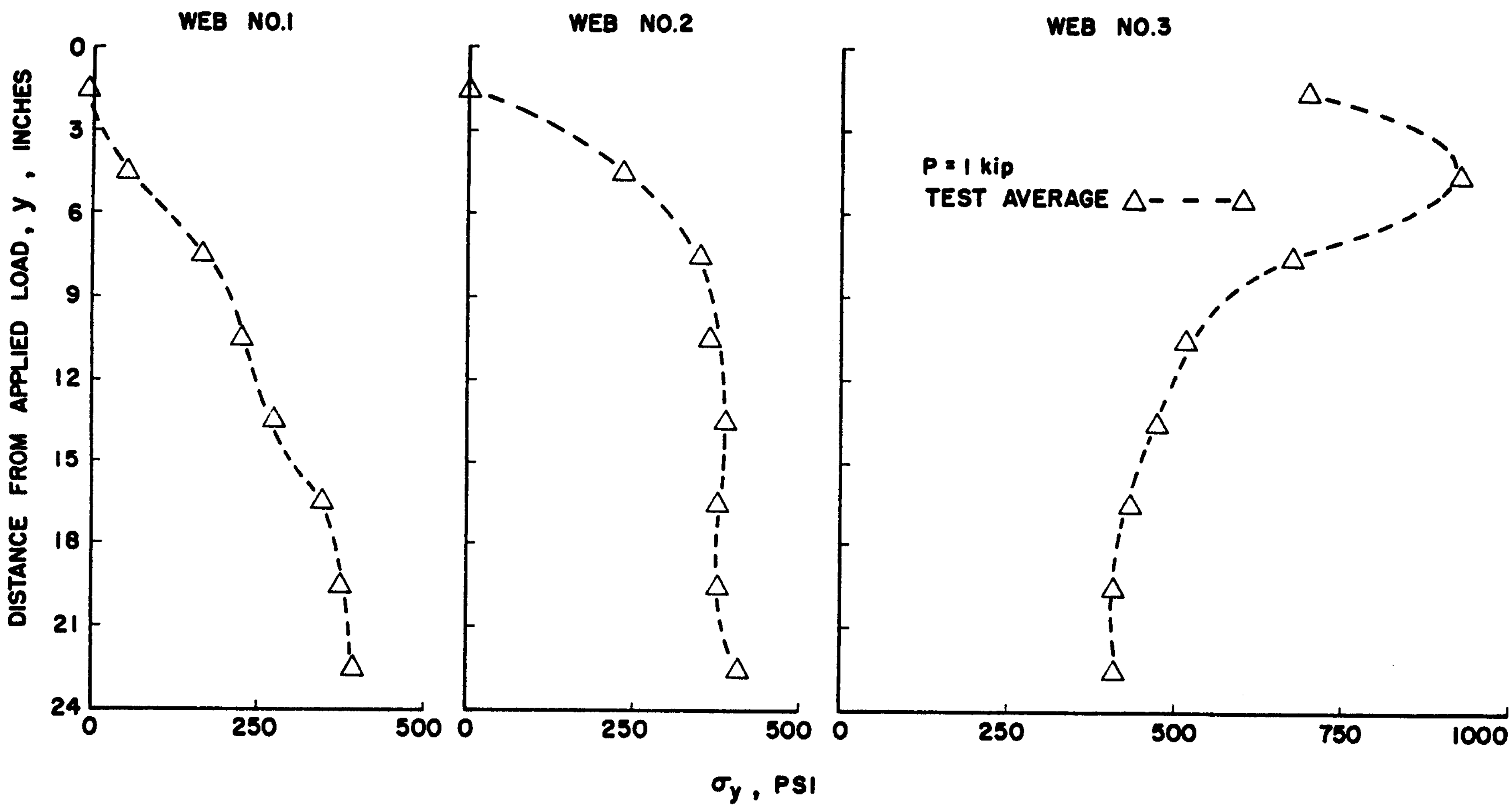



FIGURE 73.—NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION IV.

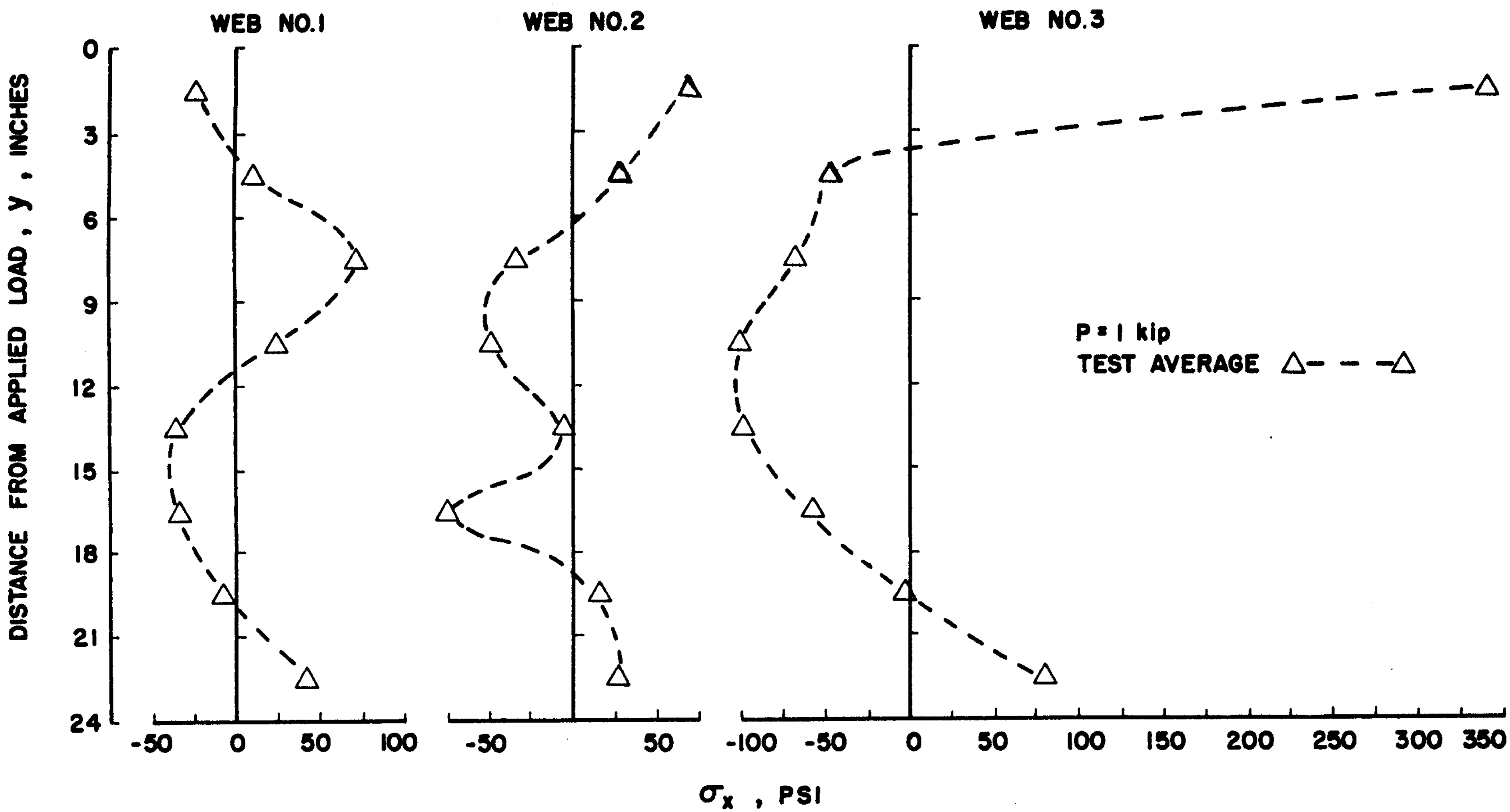



FIGURE 74.— NORMAL STRESS IN WEB OF PANEL D FOR LOADING CONDITION IV.

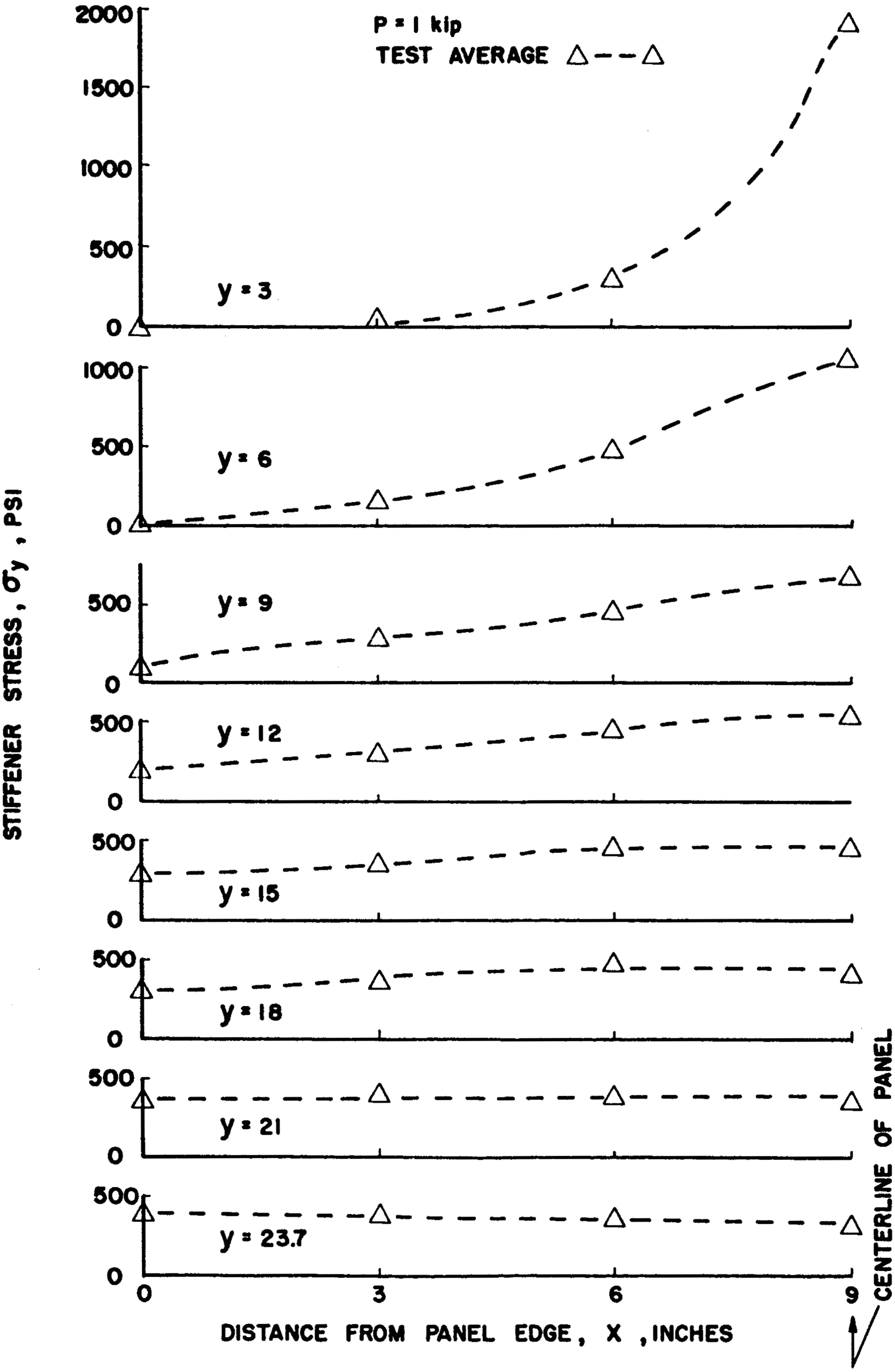



FIGURE 75. — CHORDWISE DISTRIBUTION OF STIFFENER NORMAL STRESS IN PANEL D FOR LOADING CONDITION IV.