EXPERIMENTAL INVESTIGATION OF RIGID FRAMES INCLUDING KNEE CONNECTION STUDIES -FRAME FR1 TESTS-

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CHAPTER I

INTRODUCTION

A series of full scale tests was conducted in Fears Structural Engineering Laboratory, School of Civil Engineering and Environmental Science, University of Oklahoma, using standard rigid frames produced by MESCO Metal Buildings Corporation, hereafter referred to as MESCO. The objectives of these tests were to determine the structural strength and stiffness of the rigid frames as well as the adequacy of the analysis and design procedures currently employed by MESCO.

MESCO fabricates the frame components using plate material having a nominal yield strength of 50 ksi. Welding of the rafter and column flange-to-web connection is done only on one side of the web plate using the submerged arc process. A325 bolts are used in the rafter-to-column connections. The frames are designed using a computer program developed by MESCO. Applicable provisions of the AISC Specification are satisfied.

The frames, designated FR1, were constructed using two different types of columns commonly used in pre-engineered buildings. This variation was employed in order to obtain information relating to frames composed of either type of column. The columns differed in that one, designated FC4, had

an extended top plate supporting the eave strut so that the steel line was formed beyond the exterior column flange. The column at the opposite end, designated FC3, had no top plate extension resulting in the steel line being formed at the exterior column flange. The rafter, designated type UBM, tapered from a maximum depth at midspan to a minimum depth at the column connection and was symmetrical with respect to the centerline of the span.

The test specimens were fabricated as part of standard production runs. The test set-up consisted of two frames spaced 24'-0" center-to-center connected by simple span purlins and girts and braced by tension rods as shown in FigureS 1.1 and 1.2. Gravity loads were simulated using combinations of gravity load simulators. Lateral loads were applied using hydraulic cylinders attached to the reaction columns. The tests conducted were designed to simulate the action of unbalanced live load, lateral load only, combined unbalanced live and lateral loads as well as full dead plus live load.

Simulated live loads were applied as concentrated loads at eight locations, four on each rafter slope of one frame for the full live load tests. For the tests involving unbalanced live loads, four concentrated loads were applied to the same slope of each frame. Simulated wind loading was applied as single concentrated loads to the outside leeward column flange of each frame at the elevation of the knee reentrant corner.

MESCO provided the working live and wind load levels used in the tests -- 2.05 kips per simulated live load application point and 3.54 kips at each simulated wind load application point. These loads, when combined with the dead load due to weight of the frames and roof system, produce a

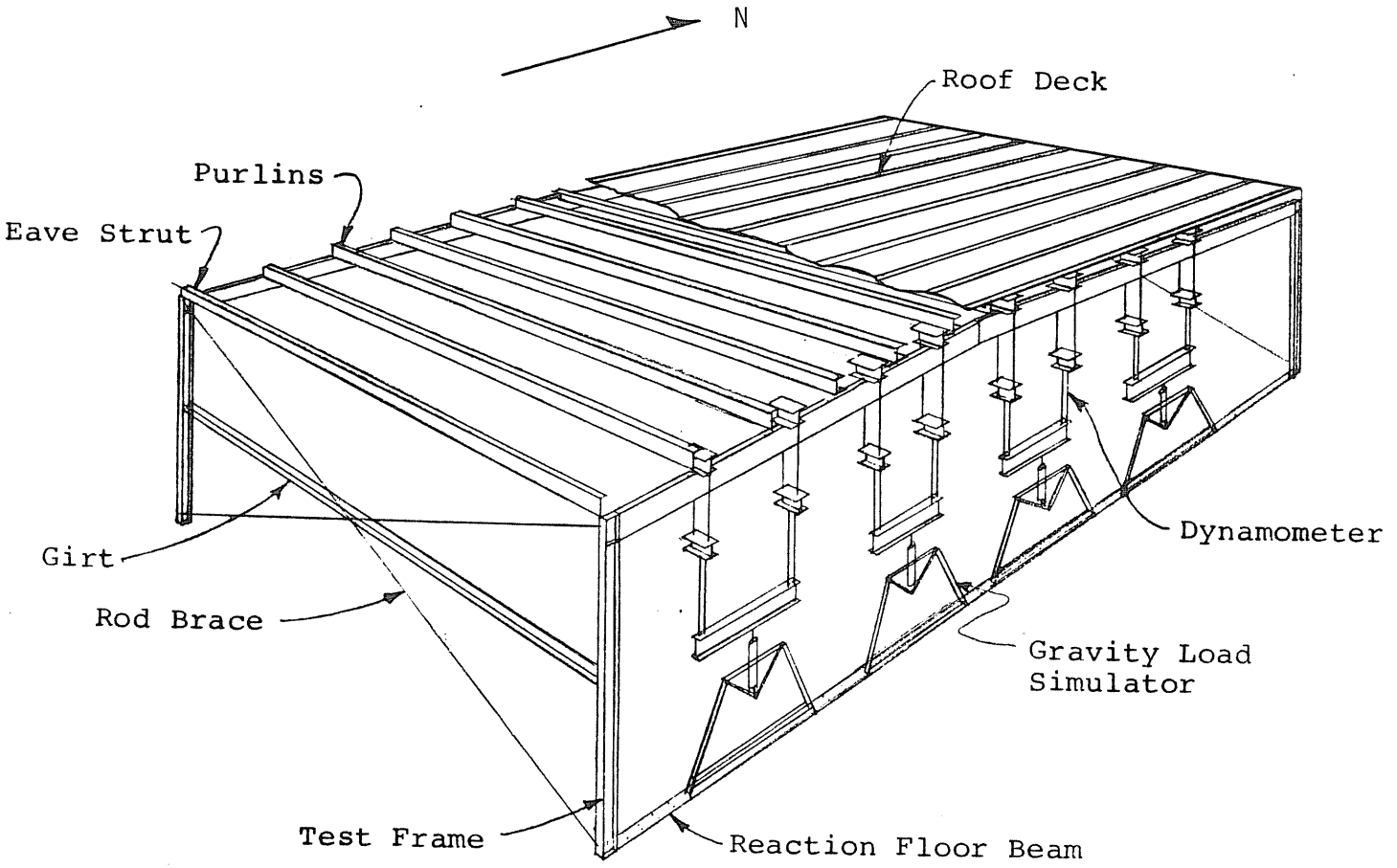
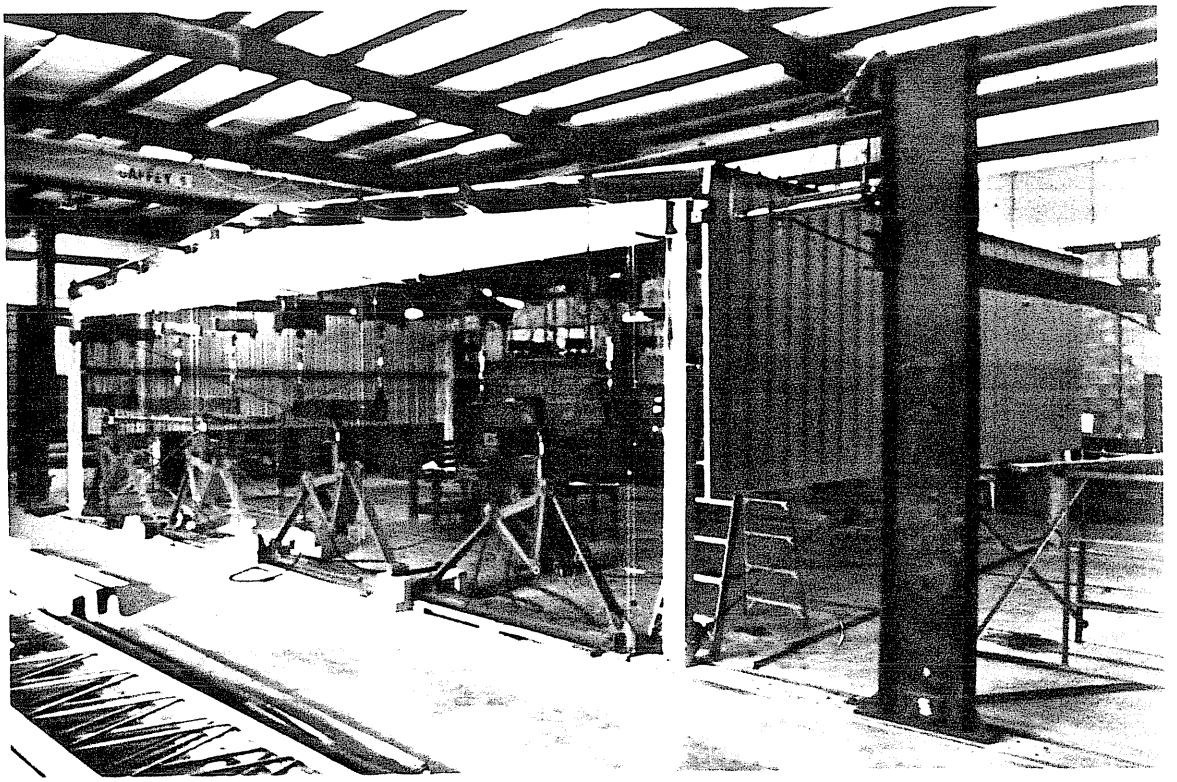
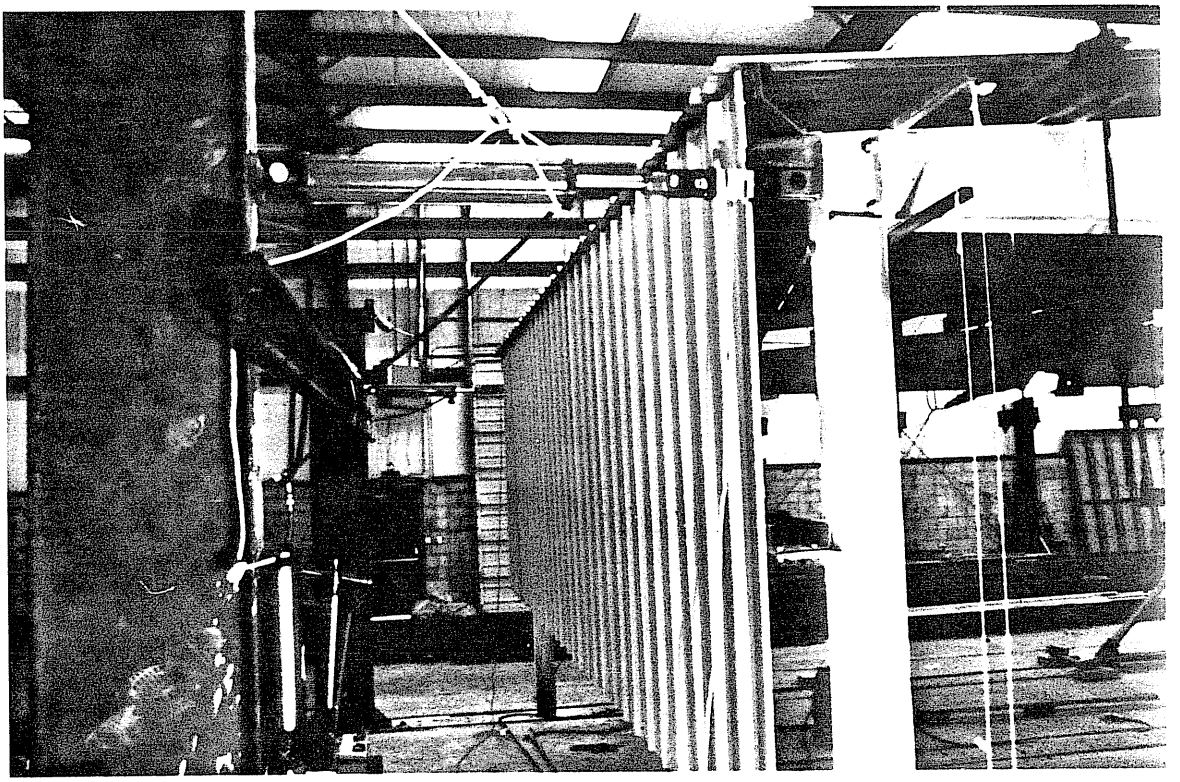


FIGURE 1.1 OVERALL VIEW OF TEST SET-UP



a) Overview



b) Lateral Loading Details

FIGURE 1.2 PHOTOGRAPHS OF TEST SETUP

combined stress ratio (AISC interaction equation value) near 1.0. Appendix H contains analyses based on nominal dimensions and 50 ksi yield stress. After all testing was completed, coupon tensile tests were conducted using material removed from the frame. New analyses were then performed using the measured yield stresses. Appendix I contains analyses based on measured dimensions and actual yield strength. The basis of the failure load calculations found in Appendix A is the results found in Appendix I.

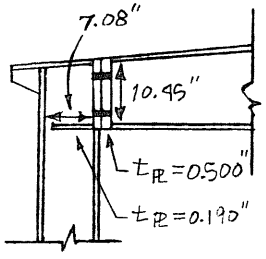
CHAPTER II

TEST DETAILS

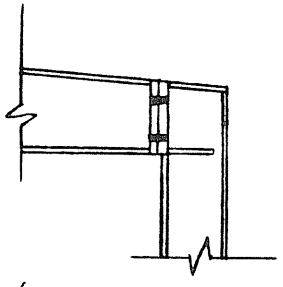
2.1 Test Structure

The test structure consisted of two rigid frames connected by a roofing system and partial side walls. The roofing system consisted of simple span cold formed C-purlins decked with steel ribbed panels as shown in Figure 1.1. In addition, channel section eave struts and girts formed the steel line on the sides of the building. Steel ribbed panels were attached to these channels to construct partial side walls extending down 8 ft. from the roof to within 3 ft. of the laboratory floor. Bracing, made of steel rods, was placed in the side walls to provide lateral resistance in the direction transverse to the frames.

The frames themselves consisted of a Mesco type UBM rafter spanning 39'-11" between two columns. The rafter was symmetrical with respect to the centerline of the span and tapered from a maximum depth of 26.6 in. at the centerline to 10.45 in. at the column connection. These and other relevant dimensions are shown in Figure 2.1. The bottom flange of each rafter was horizontal and the top flange had a slope of 1:12. The bottom flange of each rafter was braced laterally at four points by braces extending diagonally from the flange to the purlins as shown in Figure 2.1.

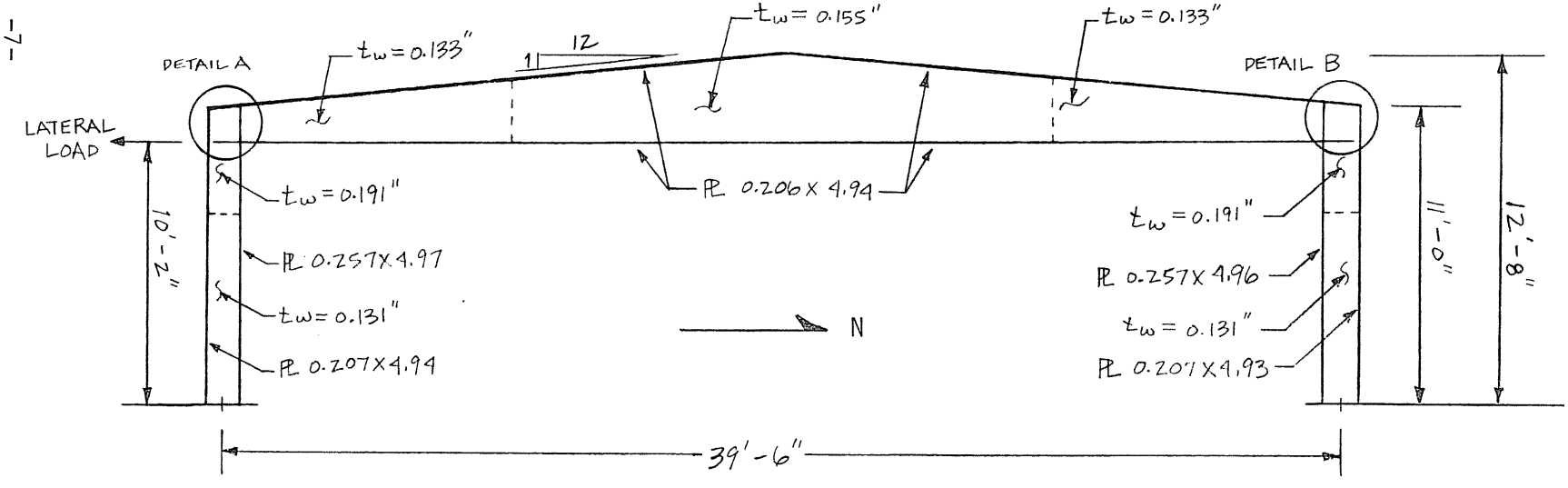


Detail A



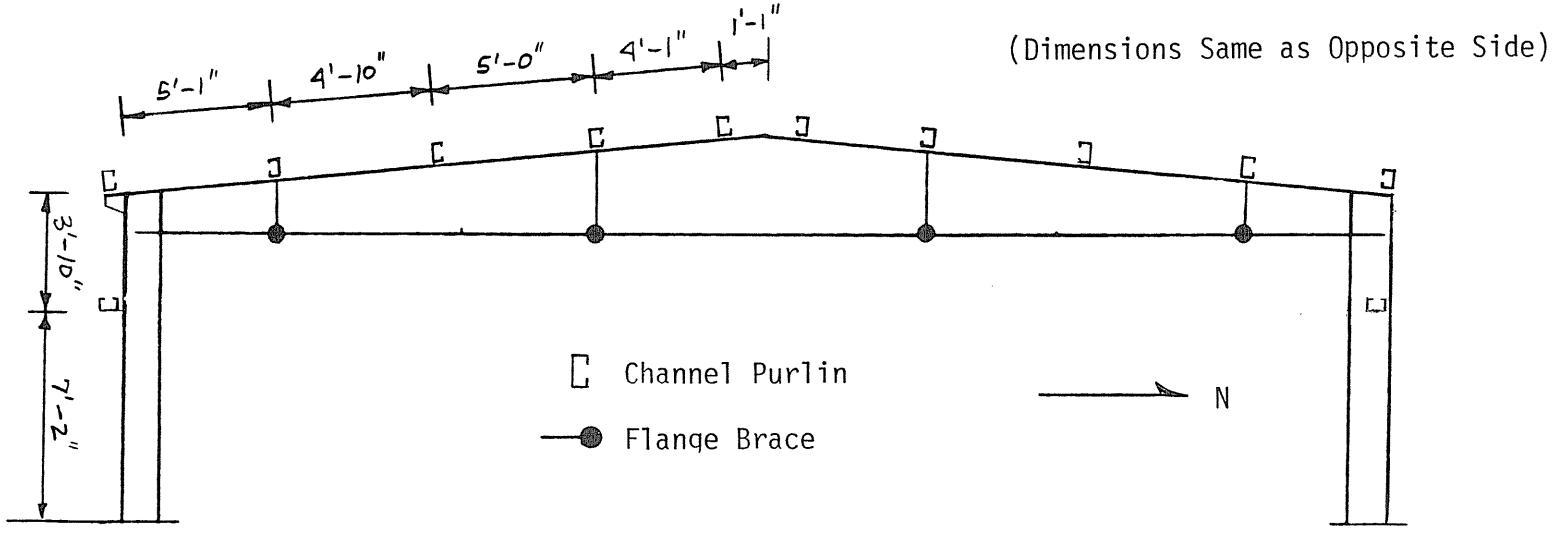
(DIMENSIONS ARE SAME AS DETAIL A)

Detail B



a) Frame Dimensions

FIGURE 2.1 FRAME DETAILS AND LATERAL BRACE LOCATIONS



b) Lateral Brace Locations

FIGURE 2.1 FRAME DETAILS AND LATERAL BRACE LOCATIONS (CONTINUED)

The columns on opposite ends of the rafter differed in that one had an extended top plate while the other did not. The extended top plate resulted in the steel line being one channel section depth (7 in.) beyond the column exterior flange. This required that the side wall girt be attached to the outside of the columns at 7 ft. 2 in. above the column base plate. Using the flush top plated columns at the opposite end of the rafter created a steel line at the column exterior flange and required that the girt be placed between the column flanges, again at 7 ft. 2 in. above the column base plate. Otherwise, the columns were identical.

2.2 Test Set-up

The frames were erected inside the Fears Structural Engineering Laboratory on the laboratory reaction floor. The floor is a reinforced concrete slab 30 ft. by 60 ft. by 3 ft. 6 in. deep with four W36x150 steel beams embedded in concrete. The slab weighs one million pounds and is capable of reacting 320,000 lb. in any one location. The frames were erected directly over two of the embedded W36 beams, spaced 24 ft. 0 in. apart. Purlins and girts at standard spacings were connected between the frames along with standard rod bracing in both side walls as previously indicated. Compression flange braces at the standard locations were connected between the purlins and the bottom flanges of the rafters. Ribbed steel decking covered the roof and upper 7 ft. 6 in. of the side walls.

The column base plates were bolted to the reaction floor beams as shown in Figure 2.2. Four 3/4 in. diameter, A325 bolts were used at the rafter-to-column connection. The erection procedure was as near as possible to standard

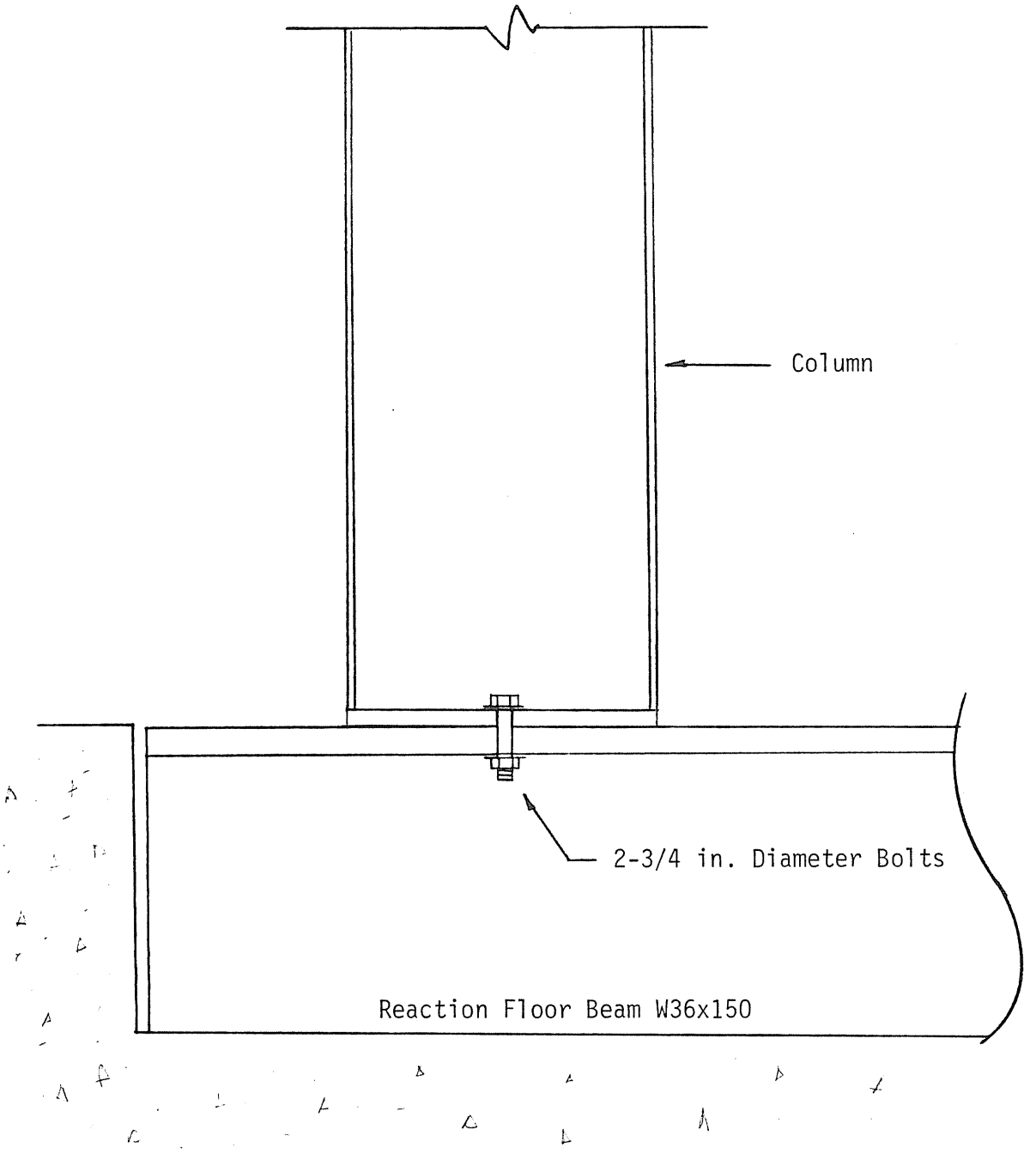


FIGURE 2.2 DETAILS OF COLUMN-TO-REACTION FLOOR CONNECTION

practice. One or more of the bolts on the tension side of column-to-rafter end-plate connection were instrumented so that correct pre-tensioning of bolts could be accomplished and changes in bolt force could be monitored during the tests.

2.3 Load Applications

Simulated live load was applied using the loading apparatus shown in Figure 2.3. The loading apparatus consists of a gravity load simulator (Figure 2.4), a 35 kip tension-compression hydraulic cylinder, spreader beam, two calibrated dynamometers and spreader beams and tension rods attached to the frame. The simulator is a device which permits horizontal movement of the point of load application while maintaining a vertical line of action of the applied load. For the simulator used in these tests, the point of application of the load can move left or right a maximum of 10 in. and the hydraulic ram will remain vertical.

Lateral load was applied using a reaction column constructed adjacent to the frame with hydraulic cylinders and calibrated load cells positioned as shown in Figure 2.5. For all lateral load applications, load was applied to both frames simultaneously using two identical hydraulic cylinders connected in series to an electric hydraulic pump.

Four loading schemes were used as shown in Figure 2.6. Figure 2.6(a) shows full gravity loading applied to one frame. For this loading condition, four hydraulic cylinders were connected in series to the electric pump. Figure 2.6(b) shows gravity load being applied to one half of the span to simulate unbalanced live load. For this loading, both frames were loaded simultaneously with the four hydraulic rams connected in series. Figure 2.6(c) is lateral load only, applied as

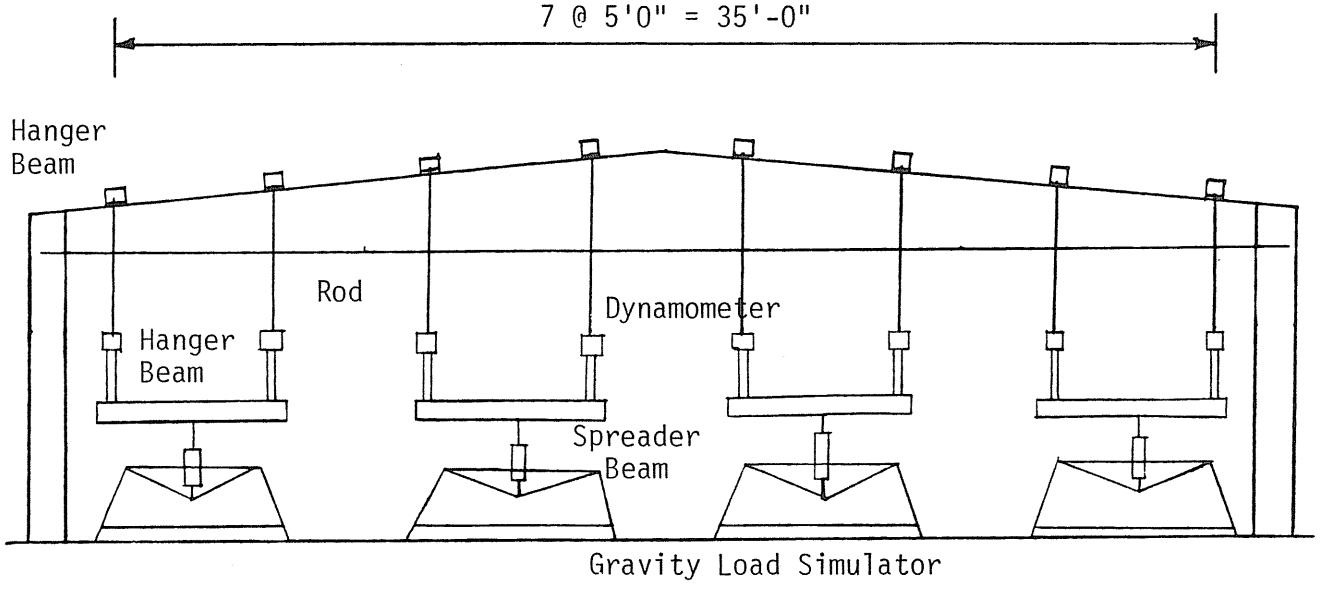


FIGURE 2.3 SIMULATED LIVE LOADING TEST SETUP

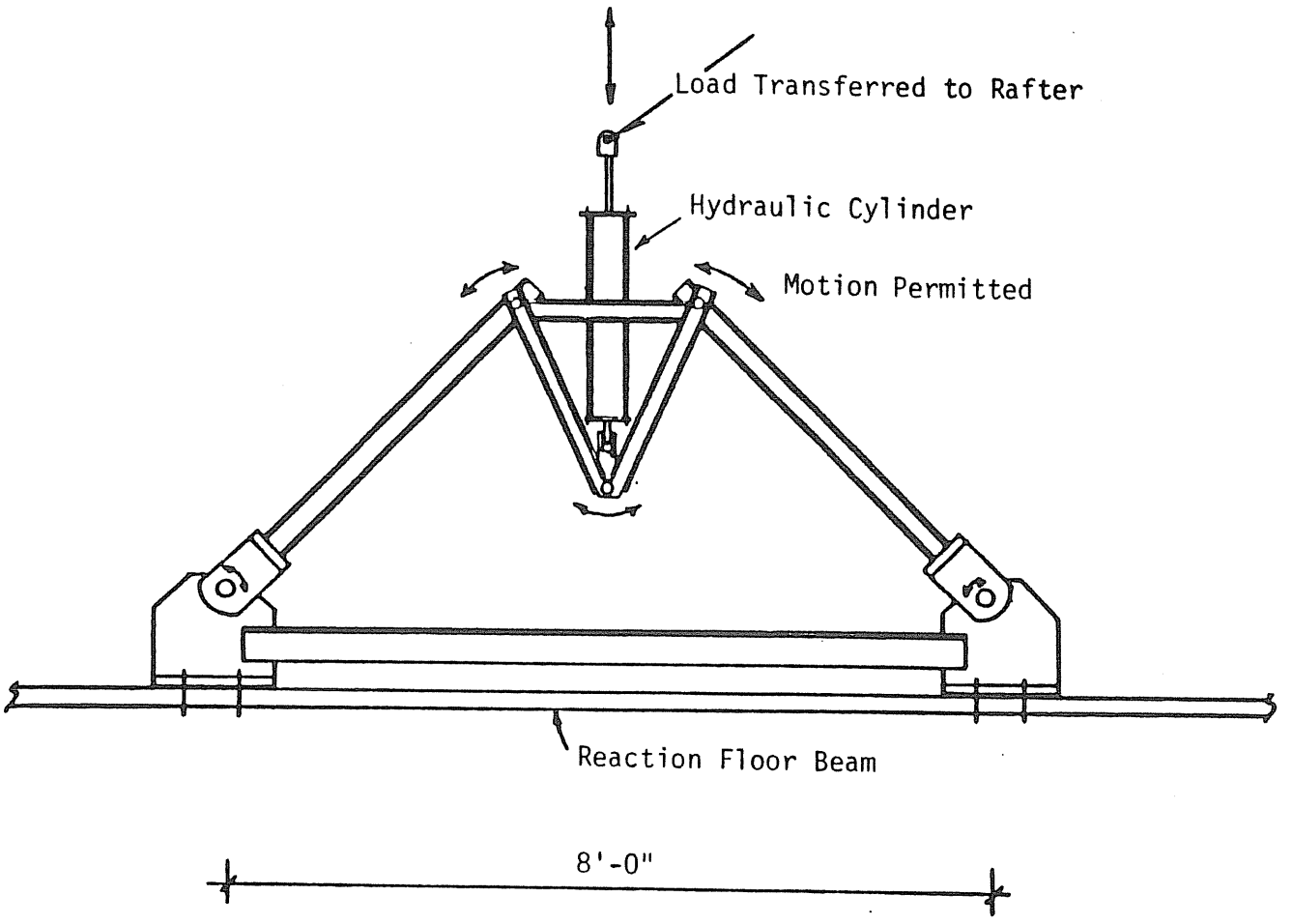


FIGURE 2.4 GRAVITY LOAD SIMULATOR

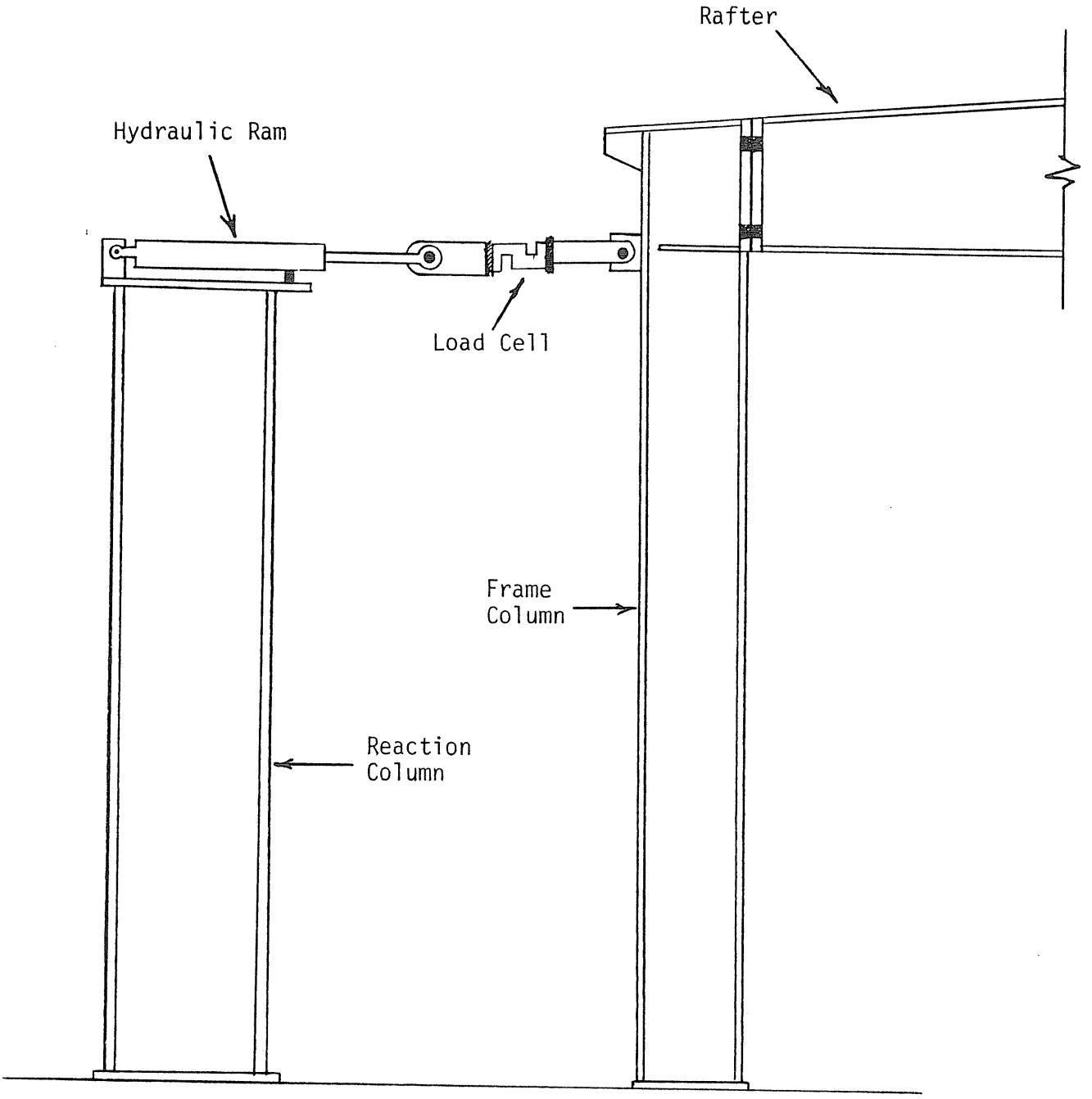


FIGURE 2.5 METHOD OF LATERAL LOAD APPLICATION

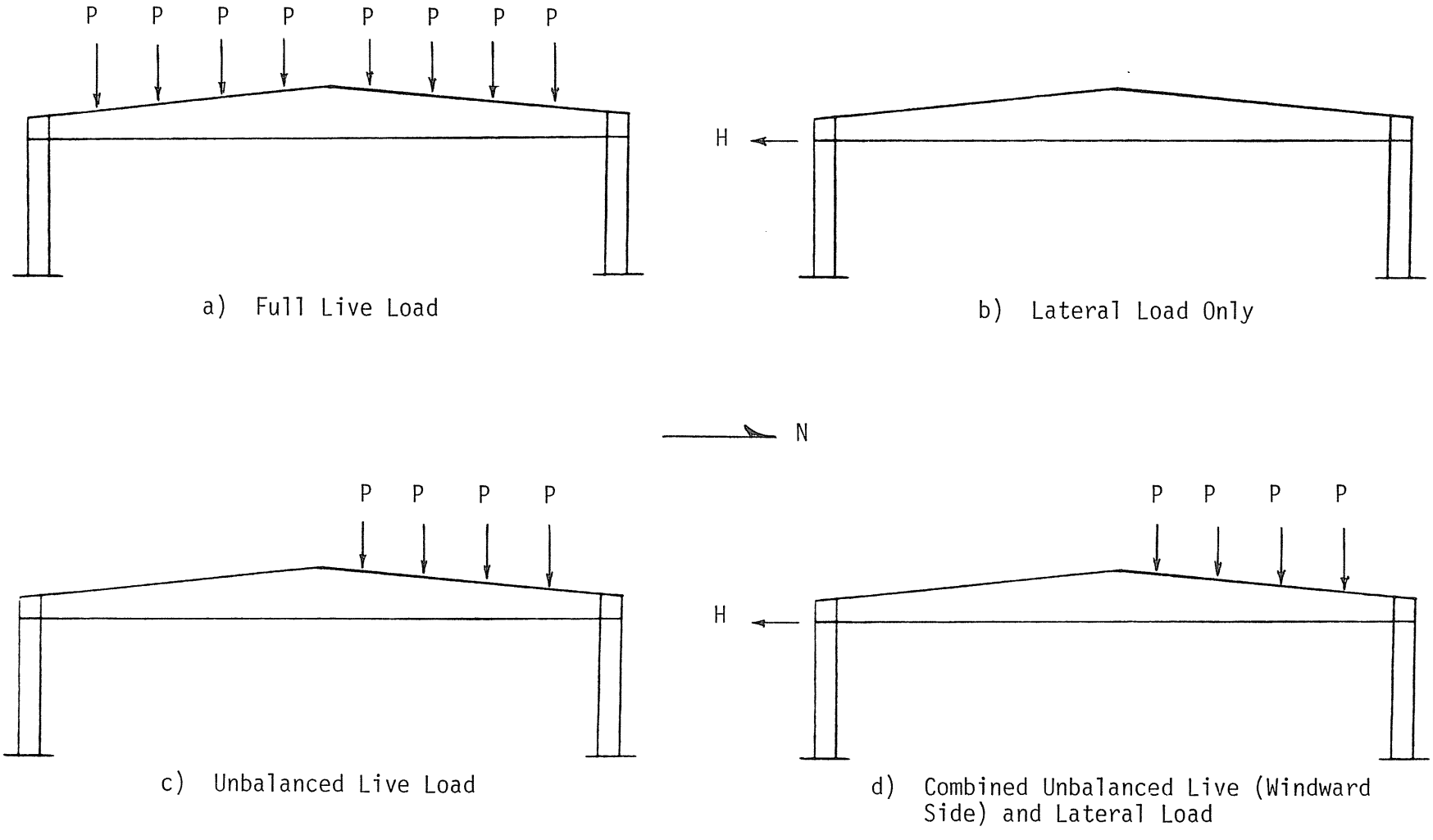


FIGURE 2.6 LOADING CONDITIONS

described above. Figure 2.6(d) shows combined lateral load with unbalanced live load applied on the windward side.

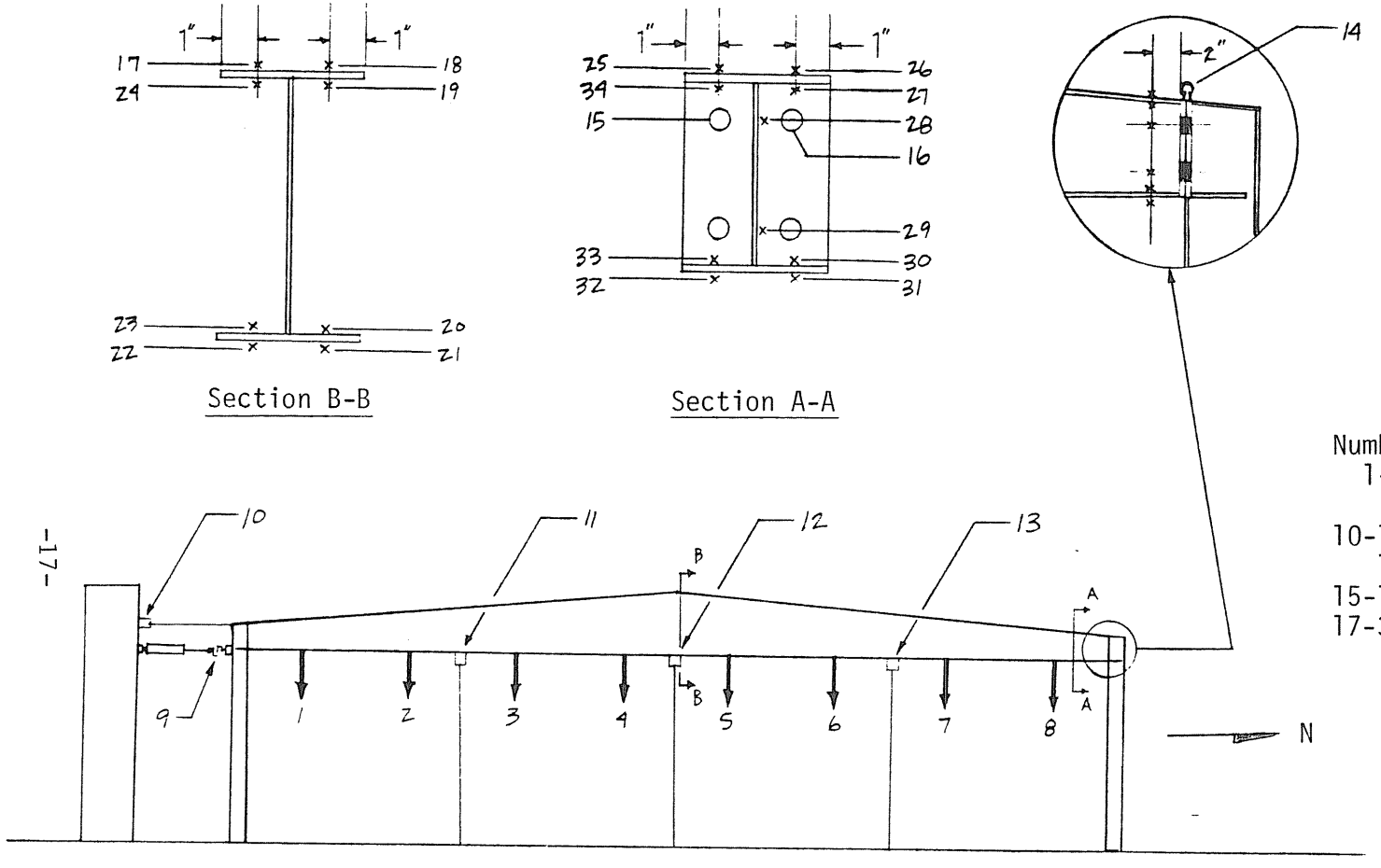
2.4 Instrumentation

Instrumentation consisted of calibrated dynamometers, load cells, calipers, displacement transducers and linear strain gages. Gravity loads wre measured using the dynamometers as positioned in Figure 2.3. Lateral loads were measured by placing the load cells in series with the hydraulic cylinders as in Figure 2.5. Vertical deflections at the centerline and quarterpoints of the frames were measured by the wire transducers as shown in Figures 2.7 and 2.8. In addition, the calibrated calipers were positioned to measure connection plate separations at various locations.

Linear strain gages were placed at several locations on the frame. Specifically, gages were placed on the tension and compression flanges of the east frame at both the midspan and near the north connection with the column. At the connection, strain gages were also placed on the rafter web opposite the tension and compression bolts, Figures 2.7 and 2.8. On the west frame strain gages were located at the connection only.

To determine bolt forces, a small hole was first drilled thru the head of the bolt into the unthreaded shank. A special strain gage was then inserted into the hole and the hole filled with epoxy. After curing of the epoxy, the bolt was calibrated using a universal testing machine.

Lateral (out-of-plane) movements of the frame were measured by using weighted strings suspended from angles attached to the flanges of the frame rafter and columns. A taunt wire running the length of the frame provided a fixed



Legend

Number	Description
1-8	Dynamometers
9	Load Cell
10-13	Displacement Transducers
14	Clip Gage
15-16	Instrumented Bolts
17-34	Strain Gages

FIGURE 2.7 VIEW OF EAST FRAME INSTRUMENTATION

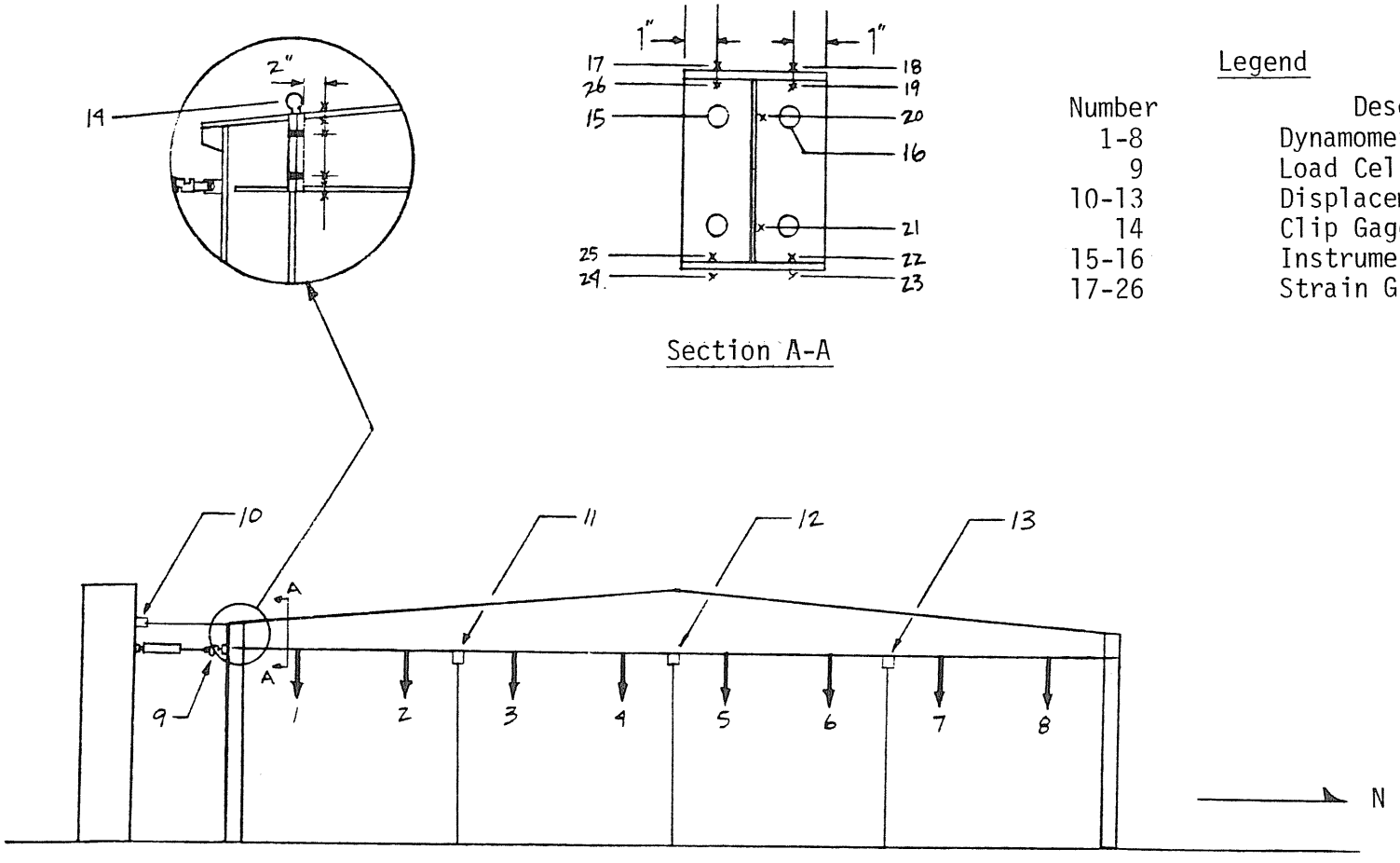


FIGURE 2.8 VIEW OF WEST FRAME INSTRUMENTATION

reference for measurements. Scales were used to measure the relative movements between the strings and wire or, equivalently, the lateral movements of the frames flanges.

2.5 Test Procedures

Prior to actual testing an overall check of the testing apparatus and instrumentation was performed. The instrumented bolts were first pretensioned to 28 kips. Zero readings for the instrumentation were then recorded. Following this, an initial test was performed by applying a load equivalent to approximately 30% of the design load. The data gathered from this test was then compared to the corresponding values predicted by the stiffness analysis. Large deviations of the data from the theoretical analysis were regarded as signs of potential malfunctioning of the data acquisition system and corrective action was taken. Once the instrumentation was yielding acceptable data actual testing commenced.

In general, loading was applied in increments ranging from 0.2 to 0.5 kips. After each load increment, deflection and strain gage readings were taken and the specimen was checked for signs of yielding. Yielding was detected by the flaking of the mill scale under the whitewash. When testing to failure, the load was increased until the specimen could sustain no further increases. This was recorded as the maximum load and the load was then removed in an incremental manner.

2.6 Loading Cases

The following six loading cases were applied:

a) Full live load on east frame, Figure 2.5(a); maximum

load was 2.05 kips each application point (working level live load).

b) Simultaneous lateral load on both frames, Figure 2.5(b); maximum load was 4.43 kips on each frame (1.25 x working level wind load).
c) Unbalanced live load on north slopes of both frames simultaneously, Figure 2.5(c); maximum load was 3.46 kips at application point (1.67 x working level full live load).
d) Unbalanced live load on windward slopes followed by lateral load on both frames, Figure 2.5(d); maximum live load 2.05 was kips at each load point and maximum lateral load was 3.54 kips per frame.
e) Full live load to failure on west frame, Figure 2.5(a).
f) Full live load to failure on east frame, Figure 2.5(a).

For the case of unbalanced live load with lateral load, the similated live load was applied until the maximum test load was reached. The gravity load was then maintained at that level while the lateral load was applied in 1 kip increments.

2.9 Supplementary Tests

Upon completion of all testing, sections of undamaged flange and web plate were cut from the specimens. Standard ASTM E8 rectangular tension test specimens were machined from the plate and tensile tests conducted in a universal testing machine. Results are found in Section 3.8.

CHAPTER III

TEST RESULTS

3.1 General

Test results consists of load versus deflection curves, load versus plate separation curves, load versus bolt force and load versus stresses at critical points. In addition, photographic record and description of behavior of test specimens during the tests are included. Each of the loading cases explained earlier in Section 2.6 is designated as one test.

Experimental results are compared to theoretical or predicted results obtained from the results of analyses provided by MESCO, as found in Appendix H of Volume II. The effects of distributed dead load were removed from these results for comparison to results obtained from the laboratory applied loads.

Detailed results for each test are found in Appendices B to G. Each appendix contains a test summary sheet and above mentioned plots. The following sections describe each test.

3.2 Test 1 - Working Level Live Load on East Frame.

During this test working level live load was applied to both slopes of the east frame. Gravity load simulators were used to apply vertical forces at eight points along the east

frame (Figure 2.6(a)) to simulate full live loading. This loading was applied in increments of approximately 0.2 kips until the desired working load of 2.05 kips was attained. Strain gage and displacement transducer data were recorded after each loading increment. Graphical representations of recorded data are included in Appendix B along with the theoretical predictions provided by Mesco.

As shown in Figure B.1, the experimentally determined load centerline deflection relationship is almost identical to the theoretical prediction at loads less than 1.3 kips. Figures B.2 and B.3 indicate that both of the quarter point deflections conform closely to the prediction in this range as well. However, very small amount of softness is observed beyond the 1.3 kips load level. At test loads exceeding approximately 1.3 kips, the centerline defections began to slightly exceed those of the theoretical analysis. At the maximum test load of 2.06 kips the centerline deflection of 1.469" exceeds the theoretical value of 1.410" by 4%. Similar behavior was observed at the north quarter point; deflections conformed very closely to the theoretical expectation prior to a load of approximately 1.2 kips and then began to deviate slightly. Deviation from the theoretical began at a considerably lower test load for the south quarter point. At this location deflections began to exceed the theoretical prediction at 0.6 kips.

In addition, the two tension bolt forces monitored at the north end-plate change gradually up to 1.3 kips load (Figure B.5). Beyond this load the change is more pronounced. The bolt on the outside underwent a slight decrease from the pretension force of 28 kips to a force of 26.88 kips at a test load of 1.41 kips. Conversely, the force in the inside bolt increased to 29.76 kips for the same load.

At higher test loads, the bolt force in the inside tension bolt increased at a slightly greater rate. A maximum force of 31.0 kips was measured in this bolt at the maximum test load. Conversely, the force in the outside bolt continued its slight but steady decrease to a final value of 26.88 kips. The plate separation prior to 1.4 kips of test load increases somewhat irregularly (Figure B.4) to 0.010 in. at 1.41 kips of test load. In addition, the monitored plate separation continued to increase to a final value of 0.016 in. at the maximum test load of 2.05 kips.

During this loading interval and through to the final load application, all strain gage data indicated a linear relationship between the stress increase at the monitored locations and the increase in test load. Stresses discussed here are calculated from actual measurement of strain by multiplying strain by an assumed elastic modulus of 29,000 ksi. Data from the strain gages adjacent to the end-plate show the stresses on the compression flange to be slightly exceeding those on the tension flange (Figure B.6 and Figure B.7). This phenomenon is consistent with the theoretical analysis and is due to axial compressive stresses, as well as, flexural stresses.

The magnitudes of the experimentally determined flange stresses are less consistent with the theoretical analysis. The stresses observed in the flanges were consistently less than those predicted, while those in the web areas adjacent to the connection bolts were considerably larger than predicted. For example, at the maximum test load of 2.06 kips, the 7.77 ksi stress monitored in the compression flange is 41% less than the 13.23 ksi stress predicted. Similarly, the experimentally determined stress of 6.9 ksi in the tension

flange is 38% less than the 11.92 ksi stress predicted.

In contrast to the flange stresses, the web stresses at the gaged locations exceeded those predicted in the theoretical analysis by a substantial margin (Figures B.8 and B.9). The 23 ksi stress observed in the compression region at the maximum test load of 2.06 kips exceeds the theoretical prediction of 9.14 ksi by 151%. Likewise, the 21.9 ksi stress monitored in the tensile region exceeds the prediction of 7.83 ksi by 180%. In contrast to the stresses observed at the rafter end, the stresses indicated by the strain gage data at the midspan conform closely to the theoretical prediction (Figures B.10 and B.11). The 15.0 ksi stress occurring on the tension flange at the maximum load of 2.05 kips exceeds the theoretical value of 14.6 ksi by 2.7%. The experimentally determined stress of 14.8 ksi on the compression flange is 1.9% less than the 15.5 ksi predicted value.

Once the working load of 2.05 kips was attained the load was removed in increments and testing was terminated.

3.3 Test 2 - Factored Wind Load on Both Frames

In Test 2, wind loading was simulated by applying horizontal forces simultaneously to both frames at the height of the reentrant corner. The maximum horizontal load applied to each frame was equal to 1.25 times the working wind load level. As shown in Figure 2.5, the force appplied to each column was monitored independently by two load cells. The horizontal load was increased in 0.5 kips increments with strain gage and deflection readings being taken at each increment. Instrumentation failure resulted in erroneous data from the gaged bolts and clip gages measuring plate separation and is not reported. Plots of the remaining data is included

in Appendix C along with the theoretical predictions.

As shown in Figure C.1, lateral displacement of the top of the frames differed significantly from each other but both exhibited greater lateral stiffness than predicted by the theoretical analysis. Except for two loading increments, the load deflection relationship was esstentially linear for both frames throughout the loading sequence. The west frame's maximum lateral deflection fo 2.21 in. at a lateral load of 4.75 kips is 20% less than the 2.80 in. predicted. For the east frame the maximum of 4.26 kips resulted in a lateral deflection of 2.19 in. This deflection is 12.6% less than the theoretical value of 2.51 in. From examining Figure C.1, it can be seen that the load vs. lateral deflection relationship of the east frame is nearly linear in the interval from 0.5 to 3.5 kips. The stiffness in this interval is 0.49 in. per kip. Similarly, the relationship is linear for the west frame from a test load of 0.5 to 3.0 kips with corresponding stiffness of 0.47 in. per kip. Both of these stiffnesses are substantially greater than the 0.59 in. per kip stiffness predicted by the analysis.

Likewise, data from the quarter point vertical displacement transducers indicate that the stiffnesses at these locations varied from the theoretical prediction. Figures C.2 and C.3 show that the vertical deflections at the north quarter points (windward side) were considerably less than anticipated. At the maximum load of 4.75 kips, the north quarter point deflection of the west frame was 0.119 in., which is 25% less than predicted. Likewise, the deflection of 0.067 in. recorded on the east frame is 58% less than anticipated. However, the deflections at the south quarter points, Figure C.4 and C.5, conformed more closely to the prediction.

The stresses monitored at the rafters ends also differed significantly from the theoretical analysis. For both frames the stresses on the flanges were less than those predicted while those in the web were greater. As shown in Figure C.6, the stress on the compression flange of the east frame increased linearly with the increasing test load to a maximum value of 13.05 ksi at 4.26 kips of lateral load. This stress is 7% less than the predicted value of 14.11 ksi. For the tension flange, the deviation from the theoretical prediction was even greater (Figure C.7). The experimentally obtained stress of 10.4 ksi is 30% less than the predicted stress of 15.27 ksi.

Similarly, the stress in the web of the east rafter increased linearly with load, Figures C.8 and C.9. The magnitude of these stresses were consistently higher than predicted, however. For example, the 28.8 ksi maximum stress recorded in the compression area of the web is substantially greater (189%) than the predicted value of 9.96 ksi. Likewise, the maximum stress of 36.8 ksi monitored in the tension area is 260% greater than predicted.

Similar load-stress behavior was observed in the west frame. As shown in Figure C.10, the maximum predicted stress on the compression flange of 18.37 ksi exceeds the experimentally determined value of 12.68 ksi. Similarly, on the tension flange the maximum theoretical stress of 19.39 ksi exceeds the experimental value of 10.93 ksi, Figure C.11.

As in the east frame, the web stresses in the west frame were greater than predicted. The maximum web compressive stress at the monitored location was 29.6 ksi which exceeds the predicted value of 12.97 ksi by 228%, Figure C.12. The

maximum tensile stress of 31.3 ksi exceeds the theoretical value of 13.8 ksi by 126%, Figure C.13.

As expected, the stresses monitored at the centerline of the east frame were negligable. As shown in Figure C.14, no stresses were detected on the compression flange. And as indicated by Figure C.15, the stresses on the tension flange were very low (0.5 ksi).

Figures C.16 and C.17 show variation of normal stresses over the depth of the cross section. In Figure C.16, which corresponds to rafter end, the variation differs significantly from classical elastic beam theory prediction ($f = Mc/I$). Stresses at the extreme fibers tend to be smaller than stresses along the bolt lines. Figure C.17 corresponds to the centerline section. As anticipated, bending moment in this section was almost zero so the stresses are generally negligible.

3.4 Test 3 - Unbalanced Live Load on Both Frames

To simulate unbalanced live loading gravity load simulators were used to apply vertical loads simultaneously at four points on the north slopes of both frames. These loads were increased from zero to the maximum desired test load of 3.46 kips in approximately 0.3 kip increments. Strain and displacement data were collected at each load increment. Graphical representation of this data is included in Appendix D along with the corresponding theoretical predictions.

Centerline deflection data, Figure D.1, agrees well with the theoretical prediction prior to a test load of 2.4 kips. At the 2.4 kip level, the deflections began to slightly exceed those predicted. This deviation from the theoretical

prediction was accompanied by signs of yielding in the columns. Flaking of the whitewash was observed on both columns at the loaded ends of the rafters. This yielding was localized on the column's compression flanges in the vicinity of the column web splice. At the maximum test load of 3.51 kips a centerline deflection of 1.30 in. was recorded for the east frame and 1.29 in. for the west frame. These values exceed the theoretical prediction of 1.13 in by 14.6%.

Likewise, the deflections recorded at the quarter points of the frames exceeded predicted values at loads greater than 0.75 kips. Figures D.2 and D.3 show close agreement between the experimentally determined quarter point deflections and those from the theoretical analysis for the east frame at loads less than .75 kips. At greater test loads, the deflections increased substantially beyond those predicted. At the maximum load of 3.51 kips, the 1.18 in. observed deflection at the north quarter point exceeded the theoretical value of 0.95 in. by 28% while the 0.80 in. deflection at the south quarter point exceeded the theoretical value of 0.62 in. by 29%. Similarly, the deflections of the west frame exceeded the theoretical values as depicted in Figures D.4 and D.5. However, unlike the east frame, these deflections were greater than predicted from the onset of loading. At the maximum test load, a deflection of 1.28 in. was measured at the north quarter point exceeding the prediction by 26% while the measured 0.83 in. deflection at the south quarter point is 35% in excess of the predicted value.

The changes in bolt forces in the four strain gaged bolts was consistent and gradual throughout the loading sequence with the exception of one bolt. The bolt force data plotted in Figure D.6 shows that the force in the bolt on the outside at the north end of the east frame incresed gradually

from the pretension force of 28 kips to a final value of 30.0 kips. The force in the bolt on the inside of the frame at this location decreased sharply to 27.3 kips during the first 0.3 kip load increment and then decreased more gradually through the rest of the loading sequence to 26.8 kips at the maximum test load. The bolt in the outside of the west frame south end plate experienced a very nearly constant force throughout the loading sequence. A final force of 28.1 kips was recorded for this bolt. In contrast to this constant behavior the force in the bolt on the inside of this end plate was considerably more erratic; first decreasing and then increasing. The final force recorded for this bolt was 25.6 kips.

Data from the strain gages located at the ends of the rafters and the midspan of the east rafter indicate that the stresses at these monitored locations increased in a linear manner with respect to load, although they deviated considerably from the theoretical predictions. For the west frame the strains were monitored in the flanges and web of the rafter at the end of the non-loaded slope. As in previous tests the experimentally obtained flange stresses were substantially less than predicted adjacent to the connection. The tension flange stress on the west frame increased in a linear manner to a maximum value of 7.75 ksi which is 25% less than the theoretical value of 10.17 ksi (Figure D.7). The load stress relationship of the compression flange was slightly less linear, with the stress increasing at a greater rate with respect to test load at the higher loading levels (Figure D.8). Nevertheless the maximum stress of 6.98 ksi recorded at this location is 39% less than the predicted value of 11.27 ksi.

In contrast to the flange stresses, the web stress

adjacent to the tension and compression connection bolts exceeded the theoretical prediction by a substantial margin. As shown in Figure D.9, the experimentally determined 21.8 ksi compressive stress exceeds the 8.88 ksi predicted value by 145%. Likewise, the maximum tensile stress of 21.2 ksi is 191% in excess of the 7.27 ksi predicted value (Figure D.10). The variation of the stresses across the end span section are shown in Figure D.19.

Similar trends were observed in the end of the loaded slope of the east rafter. The maximum observed flange tensile stress of 5.15 ksi (Figure D.11) is 54% less than the 10.31 ksi stress predicted. Similarly, the maximum compressive stress of 5.75 ksi is 46% less than the 11.27 ksi predicted value (Figure D.12). Again, the stresses in the web were larger than predicted, as shown in Figures D.13 and D.14. The 18.5 ksi tensile stress in the web adjacent to the connection bolt is 148% in excess of the 7.45 ksi theoretical value. Also,the 19.3 ksi compressive stress exceed the theoretical value of 7.98 ksi by 141%. The variation of these stresses across the section is depicted in Figure D.17.

Unlike the flange stresses at the rafter end, the flange stresses at the midspan of the east rafter were greater than predicted (Figures D.15 and D.16). Although both the tension and compression flange stresses increased linearly with load application, the 15.37 ksi stress in the compression flange exceeds the theoretical value of 10.33 ksi by 49%. However, it should be noted that one of the four strain gages contributing to this average indicated a stress of 20.7 ksi. If this larger stress were discounted, the average would be 12.7 ksi. Like the compression flange stress, the tension flange stress increased linearly with load application and was consistently larger than predicted. The maximum tensile stress of 12.75 ksi

exceeds the predicted value of 9.30 ksi by 37%. Figure D.18 shows the variation of these stresses across the section.

3.5 Test 4 - Unbalanced Live Load Plus Wind Load on Both Frames

The simultaneous action of unbalanced live and wind loads was simulated by first applying the vertical loads followed by the horizontal loads. The gravity loads were applied to the north slopes of both frames in increments until the desired test load of 2.0 kips was reached. Data from the displacement transducers on both frames and the strain gages on the east frame were collected at each increment. The 2.0 kip gravity load was then held constant as increments of lateral load were applied to both frames. Again, data were collected at each interval until the final lateral load of 3.63 kips was applied. The resulting plate separation and bolt force data were so erratic that they are not presented herein. The remaining data are depicted graphically in Appendix E and discussed in the following.

Displacement transducers at the centerline of both frames indicate that the vertical deflections at these locations corresponded closely to the theoretical predictions throughout the gravity loading interval (Figure E.1). The vertical deflections at the quarter points, however, exceeded the predicted values for both the north and south quarter points of the two frames (Figures E.2 through E.5). The deflection of the north quarter point on the east frame exceeded its predicted value by 14% at the maximum vertical load of 2.0 kips. Likewise, the south quarter point deflection was 27% greater than predicted. Similar behavior was observed in the west frame; the north quarter point deflection exceeded the theoretical value by 14% and the south

quarter point by 24%.

As in the previous unbalanced live load test, strain gage data indicated that the stresses on both flanges at the midspan of the rafter, as well as, on the web at the rafter's end were greater than predicted by the theoretical analysis when subjected to unbalanced gravity loads. And, again, the stresses in the flanges at the ends of the rafter were less than predicted.

Similarly, the effect on stresses by the lateral loads was much the same as for the previous wind load test. As predicted, the stresses at the rafter's centerline were not effected by the application of wind load (Figures E.6 and E.7) while those at the connection were substantially altered. The stresses in the area of the web adjacent to the knee which were in tension due to the action of gravity loads were reversed to compressive stresses by the application of lateral loads (Figure E.8). As in the previous lateral load test, the effect of the loading was greater on stresses in this area than predicted. The final observed stress of 13.6 ksi exceeds the 7.22 ksi theoretical stress by 88%. A similar pattern of stress accumulation was observed in the adjacent area of the web which experienced compressive stresses due to gravity loads (Figure E.9). The stress reversal from compression to tension also occurred at a greater rate than predicted by the theoretical analysis. At the maximum test load the stress of 17.4 ksi is 269% greater than the stress predicted.

In contrast, the stresses on the flanges at the end of the rafter were less than predicted due to the action of both the gravity and lateral loads (Figures E.10 and E.11). At the maximum test load, the 6.48 ksi compressive stress monitored on the flange is 35% less than predicted. The 5.83 ksi

tensile stress on the opposite flange is 50% less than the theoretical value. The variation of stresses across the end and midspan sections of the east frame are shown in Figures E.12 and E.13 and the end span of the west frame in Figure E.14.

Vertical deflections of the frames remained close to the predicted deflections under the action of the lateral loads. Slight upward deflections of 0.003 in. in the east frame and 0.032 in. in the west frame at the centerlines were measured when none were predicted by the theoretical analysis. Finally, the deflections at the quarter points of both frames corresponded closely to the predicted behavior in this interval.

Lateral deflections measured at the south ends of the frames during the gravity loading sequence were substantially less than predicted. Figure E.2 shows that the lateral deflections of the east frame were 58% less than anticipated at the maximum gravity load. Similarly, the lateral deflection of the west frame was 51% less than the predicted value. The lateral stiffnesses of the frames with respect to the applied lateral loads were consistent with the theoretical analysis, however.

3.6 Test 5 - Live Load on East Frame To Failure

In the final test of the east frame, vertical loads were applied at eight points along the rafter of the frame to simulate full live loading. These loads were increased incrementally until the frame was unable to resist any further increases. The data collected at each loading increment is displayed graphically in Appendix F. Data from the analysis found in Appendix I is used for comparison. The results

generally indicate a linear elastic behavior of the specimen through the first half of the loading sequence. Considerable nonlinear behavior was observed upon further loading and failure occurred at 3.97 kips at each application point. (This load does not include the dead weight of the test assembly or loading apparatus).

All of the data collected prior to the test load of approximately 2.4 kips varies linearly with load application. As indicated by Figure F.1, the load centerline deflection relationship is linear in this interval but has a slope which is slightly less than that predicted. For instance, at 2.0 kips of test load the deflection was 1.49 in. which exceeds the predicted value of 1.31 by 14%. Likewise, the deflections at the north and south quarter points at this load exceeded the theoretical value by 11% and 14%, respectively (Figures F.2 and F.3).

Stress increases are also linear with respect to load in this interval, although they deviated from their predicted values. As in previous tests, the flange stresses at the connection end of the rafters are substantially less than predicted, while those on the web are greater (Figures F.6 through F.9). For example, the 6.95 ksi stress recorded on the tension flange at 2.0 kips is 40% less than the 11.65 ksi stress predicted and the 22.8 ksi stress on the web adjacent to the tension bolts exceeds the theoretical value of 9.9 ksi by 130%. Conversely, Figures F.10 and F.11 show the stresses on the flanges at midspan to be virtually identical with those predicted. The variation of stresses across the end and midspan sections are depicted in Figures F.12 and F.13.

The separation of the north connection plates occurs in a generally linear manner with respect to load (Figure F.4) in

this range. Figure F.5 shows that the forces in the tension bolts increased gradually with load application in this interval. The force in the west bolt had increased to 30.5 kips from the pretension force of 28.0 kips at 2.0 kips of test load while the east bolt increased to 29.4 kips.

As the test load was increased to 2.4 kips, the first signs of material distress were observed; the web of the rafter began to buckle. This buckling was most severe at the midspan of the rafter although it extended as far as the first flange braces.

This buckling was accompanied by other changes in the frames behavior. The deflections at the centerline began a greater rate of increase with respect to load as did those at the quarter point. The load deflection relationships changed from linear to curvilinear at this load.

Likewise, flange stresses at the centerline began to increase at a greater rate. Despite this fact, the stresses at the end of the rafter continued their linear increase. Like the stresses at midspan, the plate separations at the north connection began to increase at a greater rate with respect to load than previously. In addition, flaking of the whitewash was observed around the tension bolts of the north connection indicating some localized yielding in this area.

Further increases in load resulted in additional inelastic behavior. At a load of 3.0 kips flaking of the whitewash indicated yielding on the compression flanges of the columns near the web splice as well as adjacent to the connection plates. An increased rate of deflection at the centerline and quarter points shows additional softening of the frame at this load. At 3.6 kips the deflection at the

centerline was 3.31 in. which exceeds the 2.35 in. predicted deflection by 40%. In addition, the plate separation at the north connection had increased to 0.045 in. The stresses at this location continued to increase linearly with load.

As the loads were increased further, additional degradation of the frames stiffness was observed. Large increases in the vertical deflections at the midspan and quarter points were occurring with load application in this range. Yielding was extensive on the compression flanges of the columns. In addition, considerable flaking of the whitewash occurred on the rafter web. Buckling of this web was very prounced at this point. Finally, the buckling became so severe that the frame could resist no load higher than 3.97 kips. This was then considered to be the failure load and unloading was commenced. Figure 3.1 shows the condition of the south column under maximum loading.

All of the aforementioned parameters decreased in a linear manner with load removal. At 0 kips a permanent deflection of 0.85 in. remained at the centerline.

3.7 Test 6 - Live Load on West Frame To Failure

In the final test of the west frame, full live loading was applied to the frame until failure occurred. The load was simulated by applying vertical loads at eight locations along the top flange of the rafter of the frame. These loads were increased incrementally until the frame could resist no further loading. The data collected after each loading increment is displayed graphically in Appendix G.

Both the centerline and quarter point deflections increased linearly with load applications throughout the

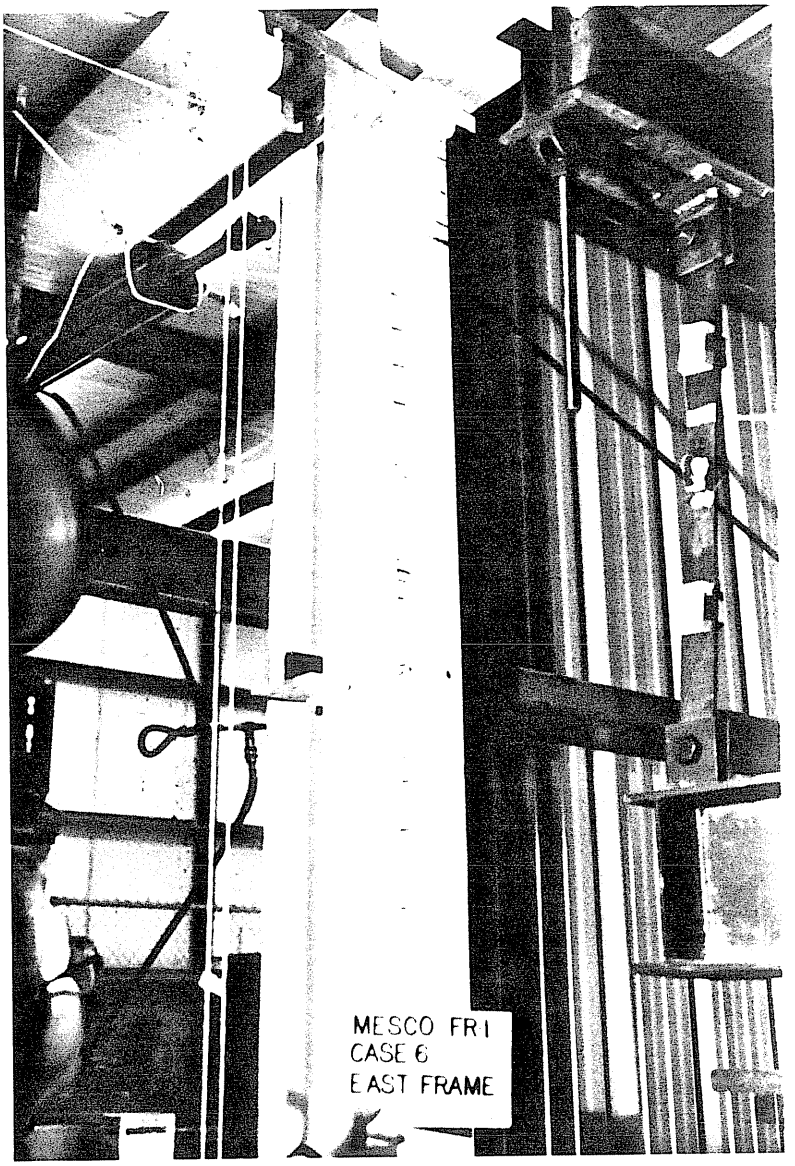


FIGURE 3.1 PHOTOGRAPH OF SOUTH COLUMN UNDER MAXIMUM LOADING, TEST 5

working load range (Figures G.1 through G.3). As the load was increased above the working load to 2.8 kips yield lines were observed around the tension bolts of rafter to column connections at both the north and south connections. Flaking of the whitewash was observed on the compression flange of the south column near the connection and on the north column near the web splice. At this load an increase in the rate of vertical deflections with respect to applied load was also observed.

As the load was increased to 3.2 kips, buckling of the rafter web was observed near the centerline. This was accompanied by the appearance of additional yield lines on the aforementioned locations of the compression flanges. The shape of the load deflection curves become nonlinear at this load. With the further increase of the load to 3.5 kips diagonal yield lines appeared on the web and the buckling became more pronounced. This buckling became so severe that the frame could resist no further load increases beyond 3.8 kips. Figure 3.2 is a photograph of the buckled rafter web.

The strain gage data collected on the tension flange immediately adjacent to the north rafter connection indicates that the stresses increased in a linear manner with load application throughout most of the loading sequence (Figure G.4). The magnitude of these stresses, however, was larger than predicted by the theoretical analysis. In addition, as the test load reached approximately 2.8 kips the rate of stress increase declined substantially with respect to the rate of load application. Likewise, the stress on the web adjacent to the connection tension bolts increased linearly with load application until yielding occured and was substantially larger in magnitude than predicted. The yield stress of 50 ksi was achieved at the same 2.8 kip test load at

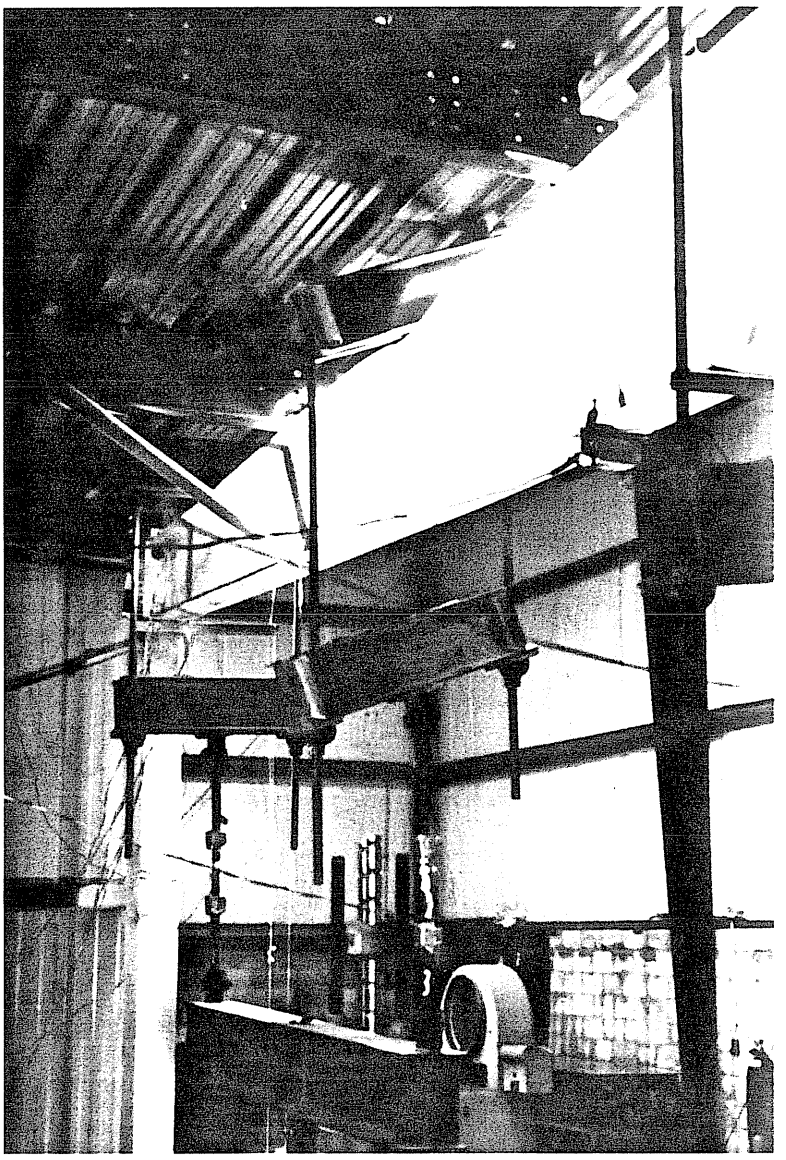


FIGURE 3.2 PHOTOGRAPH OF BUCKLED RAFTER, TEST 6

which the rate of flange stress increases began to decline (Figure G.5). The relative magnitude of these stresses indicates that the stress variation over the cross section is nonlinear with high stress concentrations occuring in the vicinity of the tension bolts and considerably lesser stresses present on the flanges.

3.8 Supplementary Test Results

Results of the tensile coupon tests are given in Table 3.1. The average yield stress from the first three tests, 54.6 ksi, was used in the failure load comparisons described in Section 4.2.

Table 3.1

Coupon Test Results

Frame	Location	Yield Stress (ksi)	Ultimate Strength (lsi)	Elongation (%)
East	Rafter Web	59.3	69.3	41.0
West	Rafter Web	54.1	69.5	36.3
East	Rafter Flange	50.3	86.5	37.8
West	Rafter Flange	45.2	87.4	35.8

CHAPTER IV

FAILURE LOAD COMPARISONS AND RECOMMENDATIONS

4.1 Failure Load Comparisons

To determine the adequacy of the frames with respect to strength, comparisons between the experimental and predicted failure loads were made. The experimental failure load due to simulated live load for each frame was calculated as the sum of the maximum applied load, the weight of the loading apparatus (0.3 kips per application point), and an equivalent concentrated load at each application point due to the weight of the frames, purlins and roof panel.

The predicted failure loads were determined using MESCO's computer program. The magnitude of the concentrated load at each application point which caused a combined stress ratio of 1.0 was first found by manual iteration. The average measured yield stress (54.6 ksi) and measured frame dimensions were used to make the calculations. Computer output is found in Appendix I. The equivalent weight of the frame, purlins and roof panel was then added to this value and the result multiplied by 1.67 to obtain the predicted failure load. Calculations are summarized in Appendix A.

The resulting predicted failure load for the east frame is 5.04 kips per application point and the corresponding

experimental failure load is 4.48 kips. The ratio of the predicted-to-experimental loads is then 1.125. The actual failure mode was rafter web buckling.

For the west frame, the experimental failure load was 4.31 kips per application point and the resulting predicted-to-experimental ratio is 1.169. The experimental failure mode was buckling of the rafter web.

The apparent undercapacity of the frames, as reflected in the above predicted-to-experimental ratios being greater than unity, is due to knee area flexibility which causes redistribution of moments within the frame [1].

4.2 Summary of Observations and Recommendation

A total of six tests were conducted using a test setup which consisted of two frames. The loadings were combinations of gravity and wind load, as described in previous chapters. The final test on each frame was gravity loading to failure.

A linear rate of increase with respect to load was observed for all deflections in the working range for all the loading cases. The centerline deflections were closely predicted by the stiffness analysis. In this range, the observed quarter point deflections slightly exceeded the predictions. Under wind and wind and gravity load combinations, the frames displayed greater lateral stiffness than predicted by the stiffness analysis.

A linear rate of strain increase with load application was observed throughout the entire range for all loading cases. At the centerline, the strains corresponded closely to their predicted values except in the unbalanced live load

case. With unbalanced loading, these strains slightly exceeded the anticipated values. In contrast to the centerline strains, the strains at the connections differed substantially from those predicted from the stiffness analysis and application of simple beam theory. The transfer of moment across the connection through the action of the bolt groups caused strains in the adjacent web to greatly exceed those predicted. The strains in the flanges were correspondingly reduced.

The load was increased beyond the working range during the final tests to failure, considerable inelastic behavior was evident. At a test load considerably less than the predicted ultimate load, buckling of the rafter web was observed. At about this same load level, localized yielding of the column compressive flanges also occurred. The initial degradation of the overall stiffness of the frame, as reflected in the centerline deflection plots, corresponded to the appearance of the rafter web buckling. This web buckling constituted the failure mode.

The frames failed at loads 12-15% below predicted values determined using measured cross-section data, tensile coupon test results and MESCO computer based analyses. This apparent undercapacity is due to knee area flexibility which causes adverse redistribution of moments in the frames. It is recommended that thicker panel zone plates be used as a means of stiffening the knee area. All other aspects of the performance of the frames were acceptably predicted by MESCO computer based analyses.

APPENDIX A

FAILURE LOAD ANALYSES

A.1 East Frame

Full Live Load, Test 5

Maximum Applied Load	3.97 kips
Weight of Loading Apparatus	0.30
Weight of Frame Assembly	0.21
Pu =	4.48 kips

Predicted Loads

Applied Load	2.81 kips
Weight of Frame Assembly	0.21
P =	3.02 kips
Predicted Failure Load = 1.67P	5.04 kips

This applied load results in a combined stress ratio of 1.0 at location 1. The three largest combined stress ratios in the frame are:

Location	f_a	F_a	f_b	F_b	CSR
1	3.15	27.72	28.00	30.93	1.002
2	3.16	27.72	28.05	35.35	0.890
3	0.44	22.46	24.86	30.75	0.822

Predicted-to-Failure Load Ratio

$$\frac{1.67P}{P_u} = \frac{5.04}{4.48} = 1.125$$

A.2 West Frame

Full Live Load, Test 6

Maximum Applied Load	3.80 kips
Weight of Loading Apparatus	0.30
Weight of Frame Assembly	0.21
Pu =	4.31 kips

Predicted Loads

Applied Load	2.81 kips
Weight of Frame Assembly	0.21
P =	3.02 kips
Predicted Failure Load = 1.67P	5.04 kips

This applied load results in a combined stress ratio of 1.0 at location 1. The three largest combined stress ratios in the frame are:

Location	f_a	F_a	f_b	F_b	CSR
1	3.15	27.72	28.00	30.93	1.002
2	3.16	27.72	28.05	35.35	0.890
3	0.44	22.46	24.86	30.75	0.822

Predicted-to-Failure Load Ratio

$$\frac{1.67P}{P_u} = \frac{5.04}{4.31} = 1.169$$

APPENDIX B

WORKING LEVEL FULL LIVE LOAD

TEST I

MESCO FRAME TEST SUMMARY

Project: Mesco Frame

Test no.: FR-1

Test Date: 10/31/84

Purpose: Test of Working Level Full Live Load

2.05 kips

Maximum Test Load:

Failure Mode:

Discussion:

- Gravity load was applied at eight points along the span of the east frame. The load was increased from zero to 2.05 kips with strain and displacement data being taken at .20 kip intervals.

- The observed centerline deflection for the first run was virtually identical to that predicted prior to a test load of .8 kips. At .8 kips, the load-deflection relationship began to deviate from its previously linear form; deflections increased at a greater rate with respect to load than analytically predicted. At 1.4 kips, yielding was indicated in the interior (compression) flanges of the columns near the web splices by flaking at the whitewash. At the maximum load of 2.05 kips, the deflection at midspan was 1.584". This value is 12% greater than the 1.41" predicted deflection. A permanent deflection of .189" remained after unloading.

- The observed deflections corresponded more closely to the theoretical prediction for the second run. As before, at low loads the agreement was virtually exact; prior to a test load of 1.0 kips the observed deflection was the same as that predicted. At loads higher than 1.0 kip, greater deflections occurred than were predicted although they were not as large as those observed in the first run. At the maximum load of 2.05 kips, the observed deflection was 1.469" which exceeds the predicted value of 1.41" by 4%. In addition, plate separation increased from 0" at 0 load to 0.016" at 2.5 kips in a linear manner. The separation decreased to 0 in a similar manner with unloading.

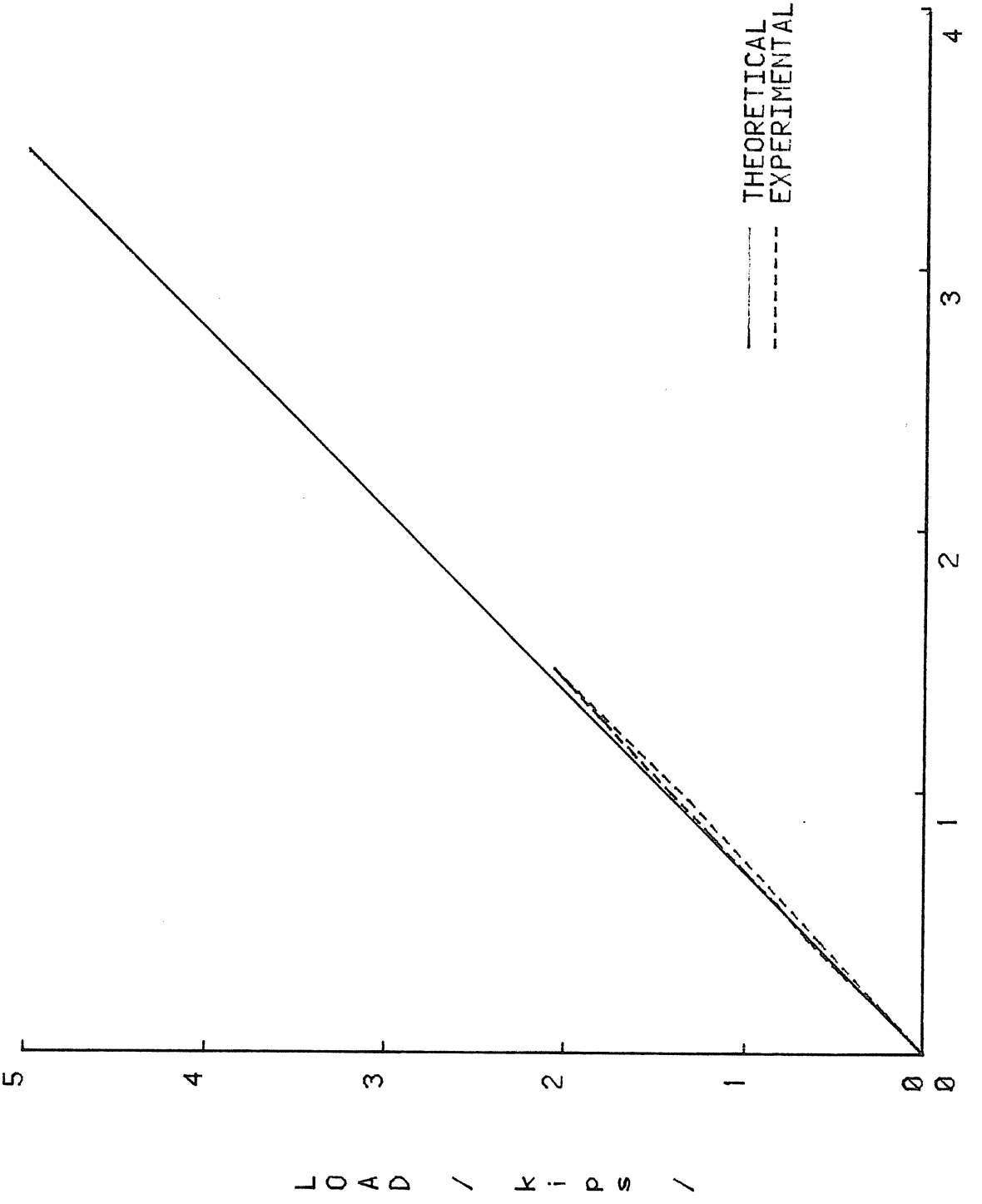


FIGURE B.1 LOAD VS CENTERLINE DEFLECTION, LL

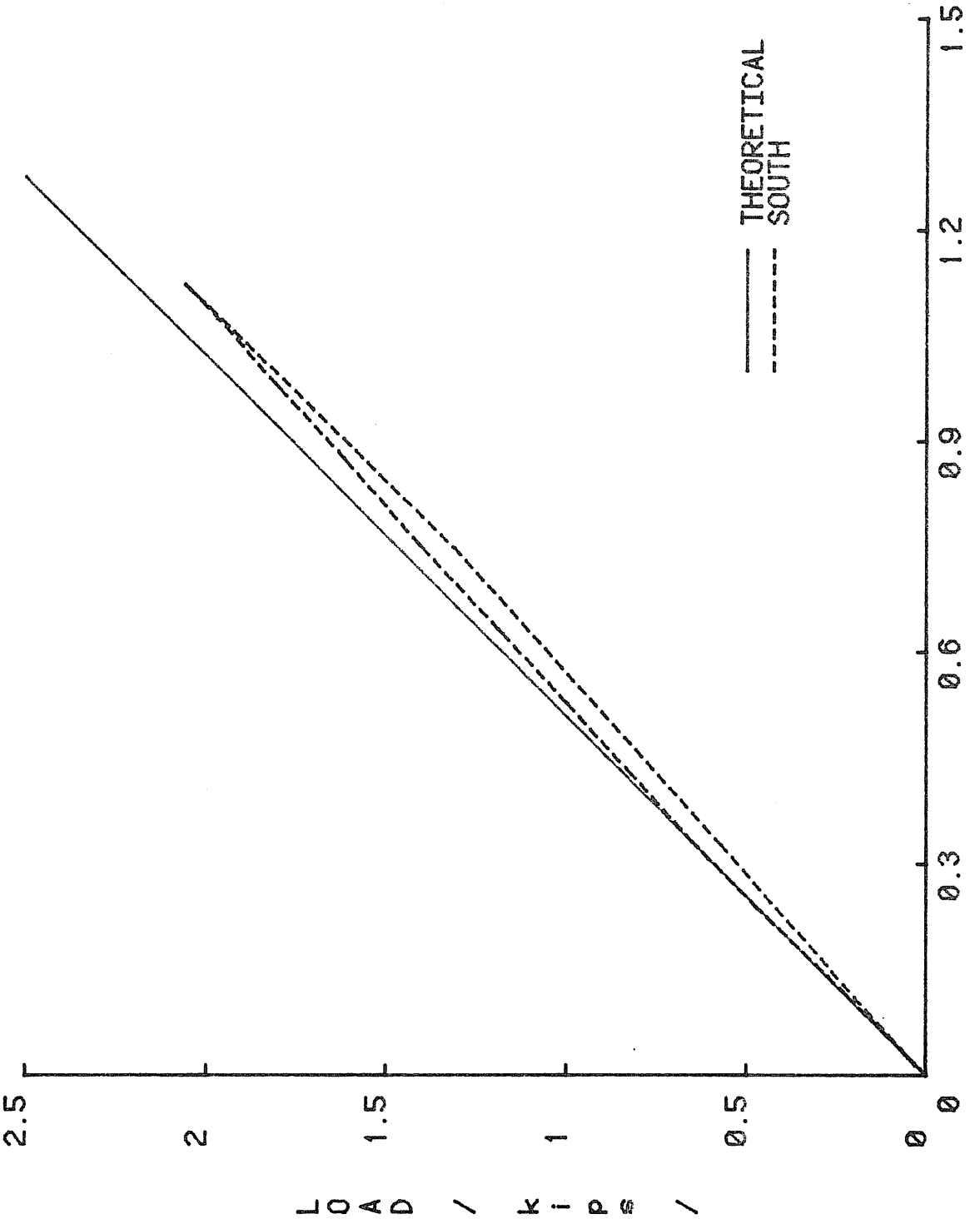


FIGURE B.2 LOAD VS QUARTER POINT DEFLECTION, LL

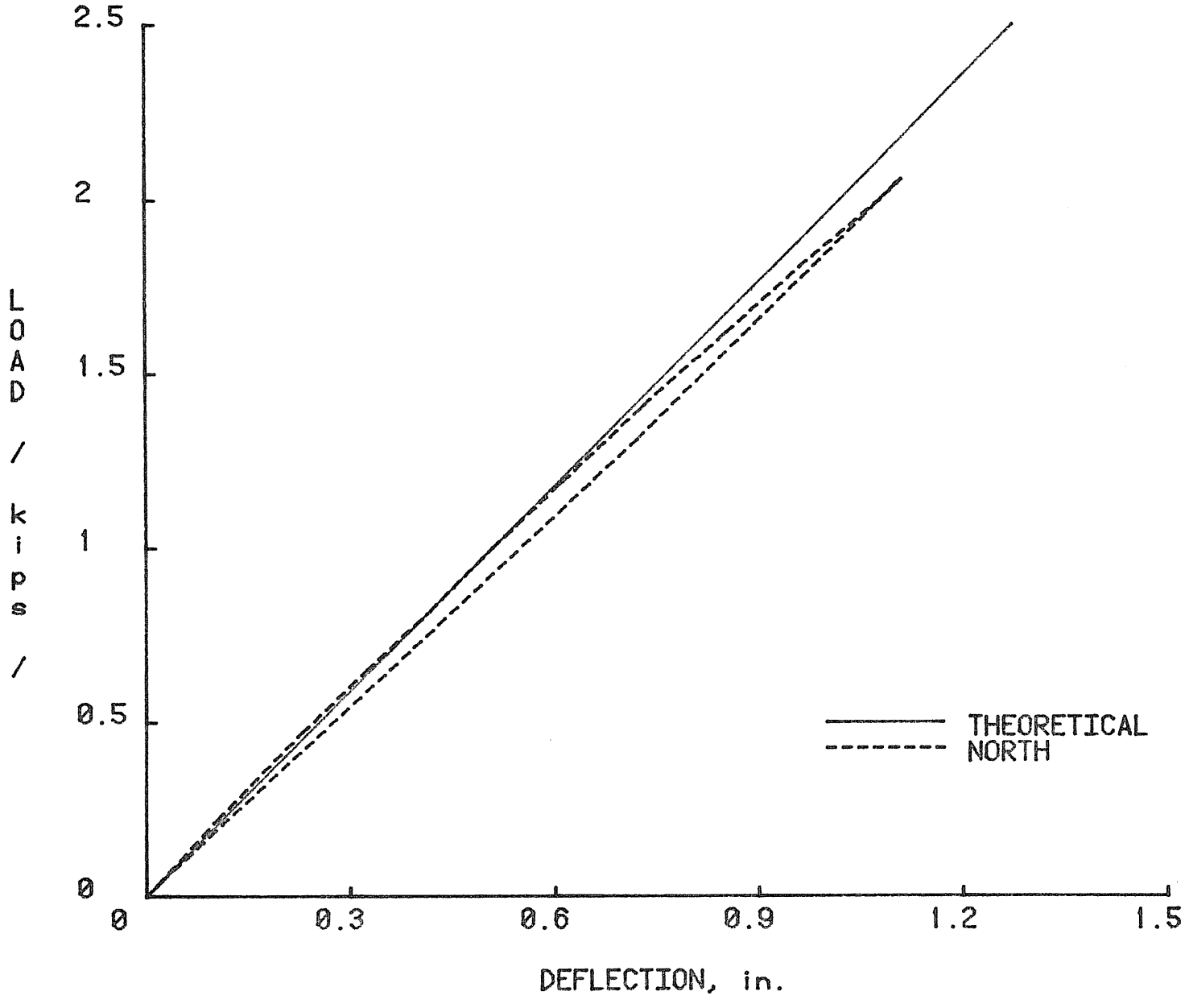


FIGURE B.3 LOAD VS QUARTER POINT DEFLECTION, LL

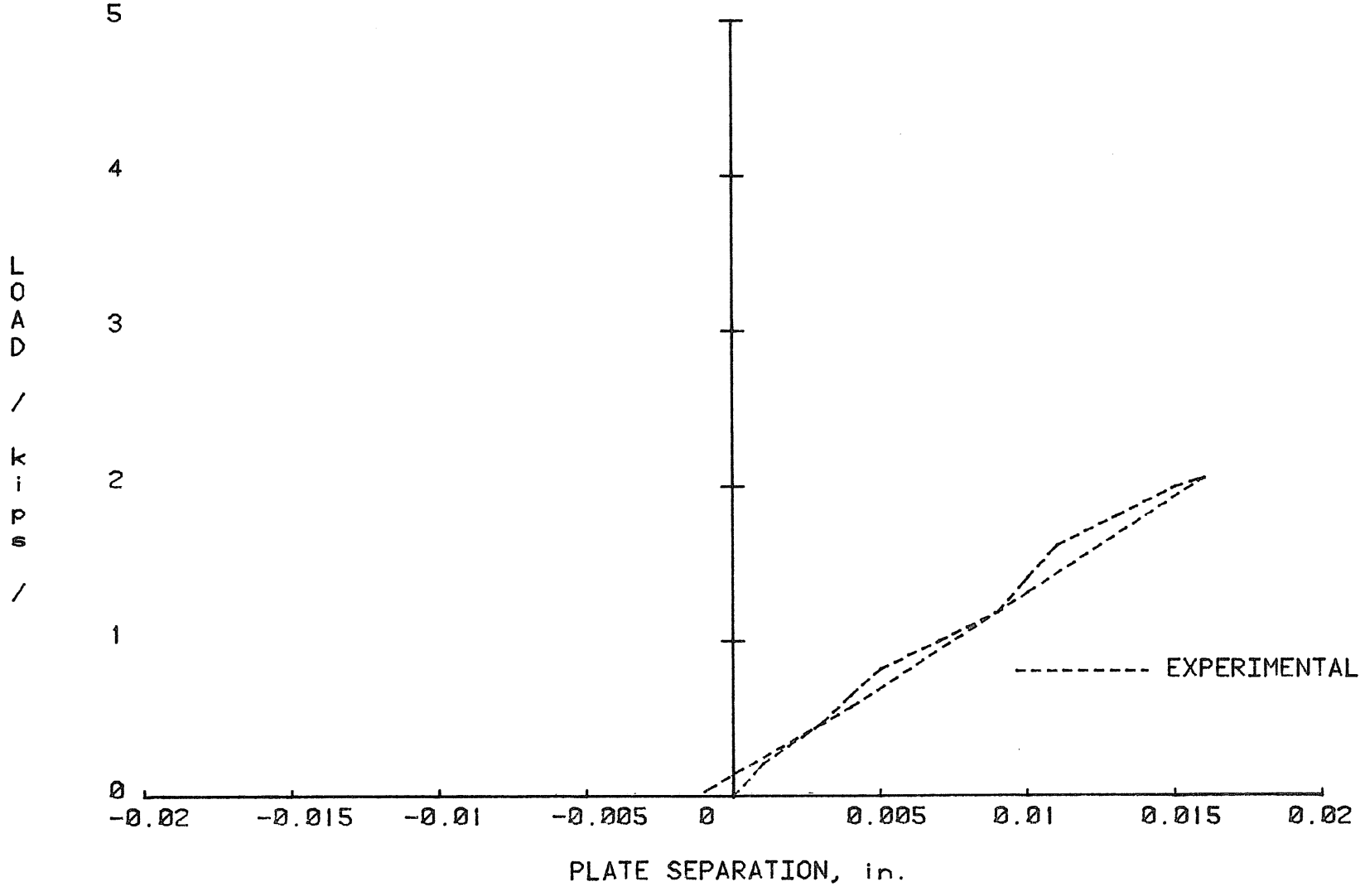


FIGURE B.4 LOAD VW PLATE SEPARATION, LL, NORTH CONNECTION

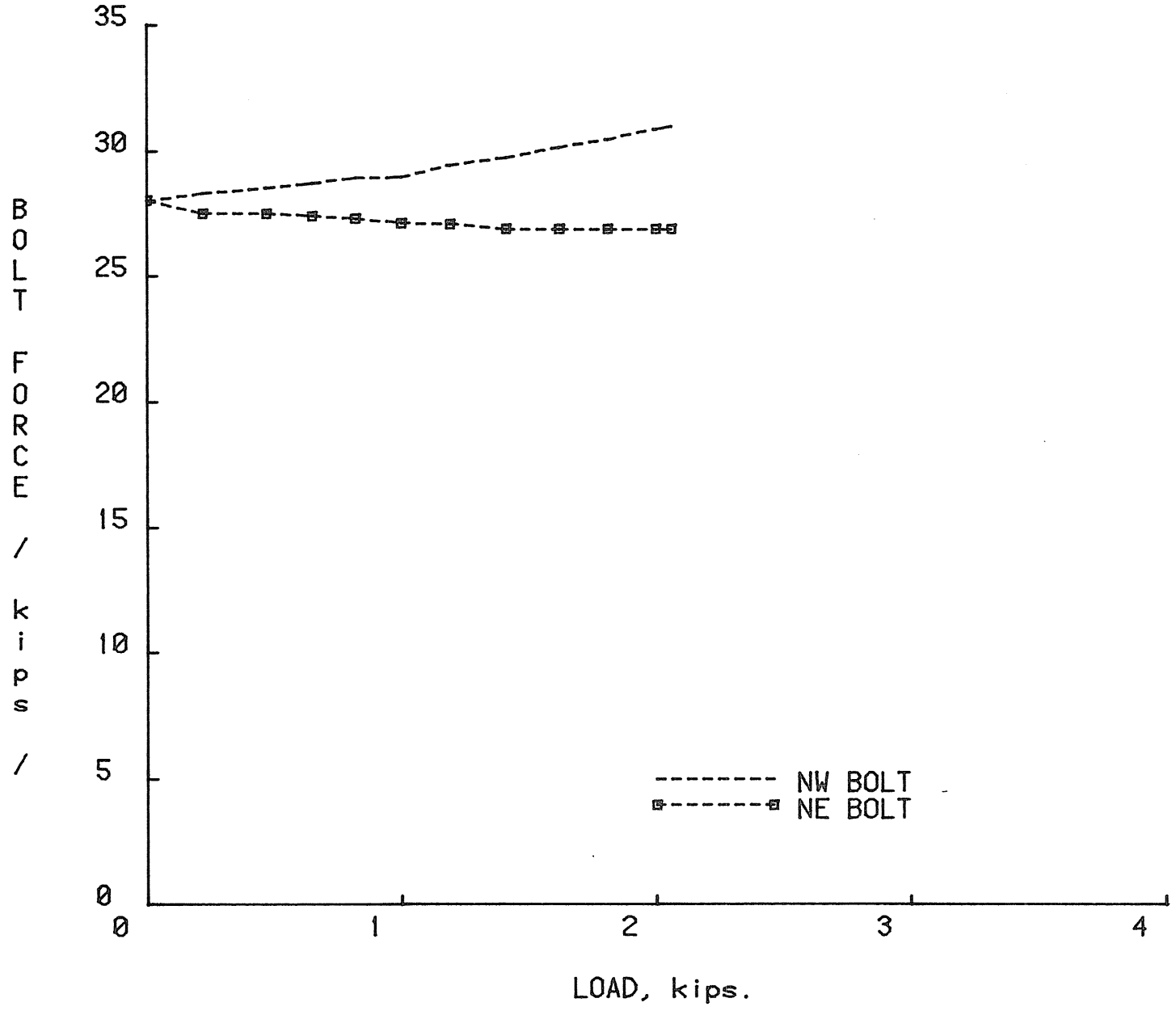


FIGURE B.5 BOLT FORCE VS LOAD, LL, NORTH CONNECTION

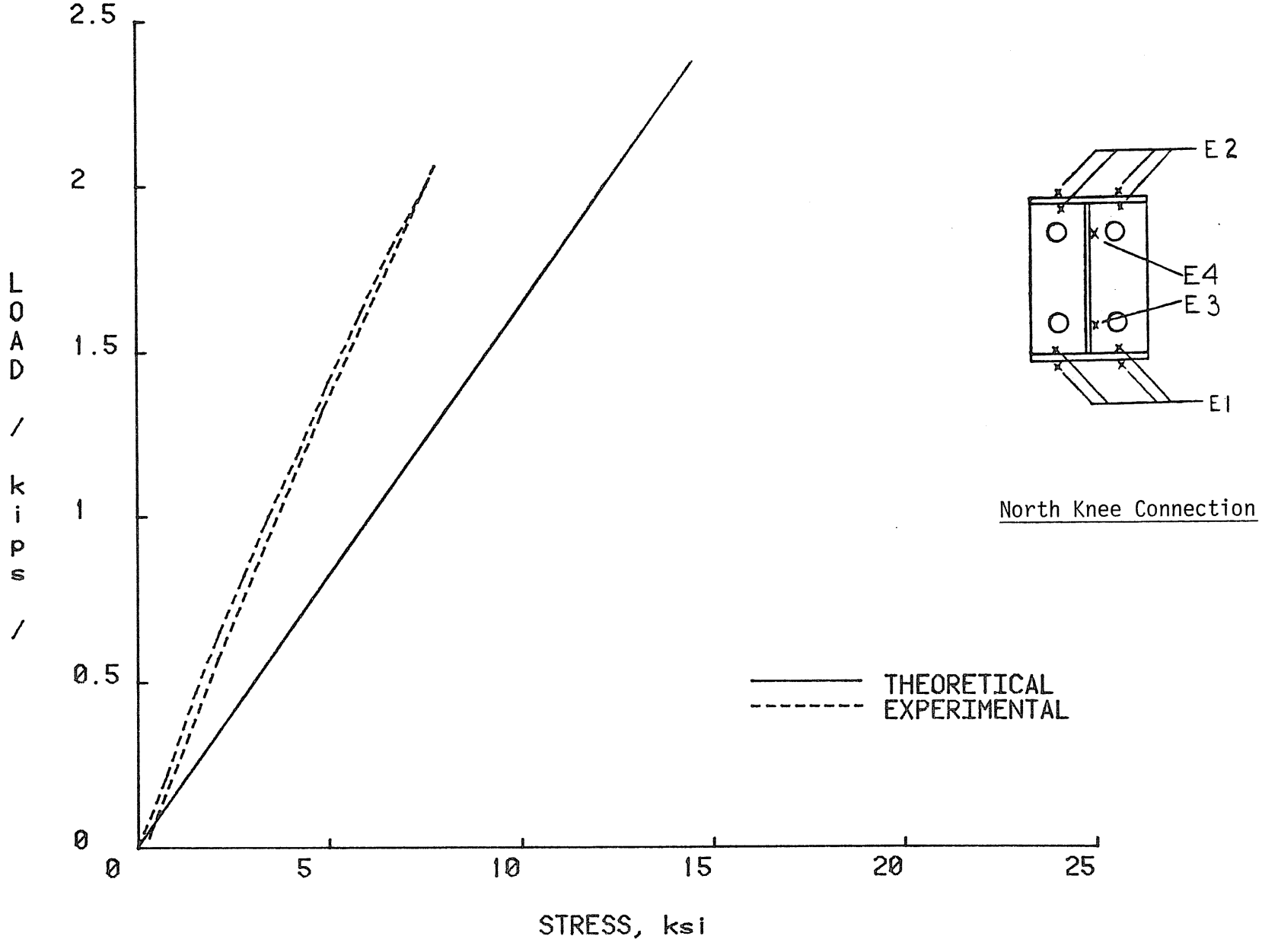


FIGURE B.6 LOAD VS STRESS AT LOCATION E1, EAST FRAME KNEE

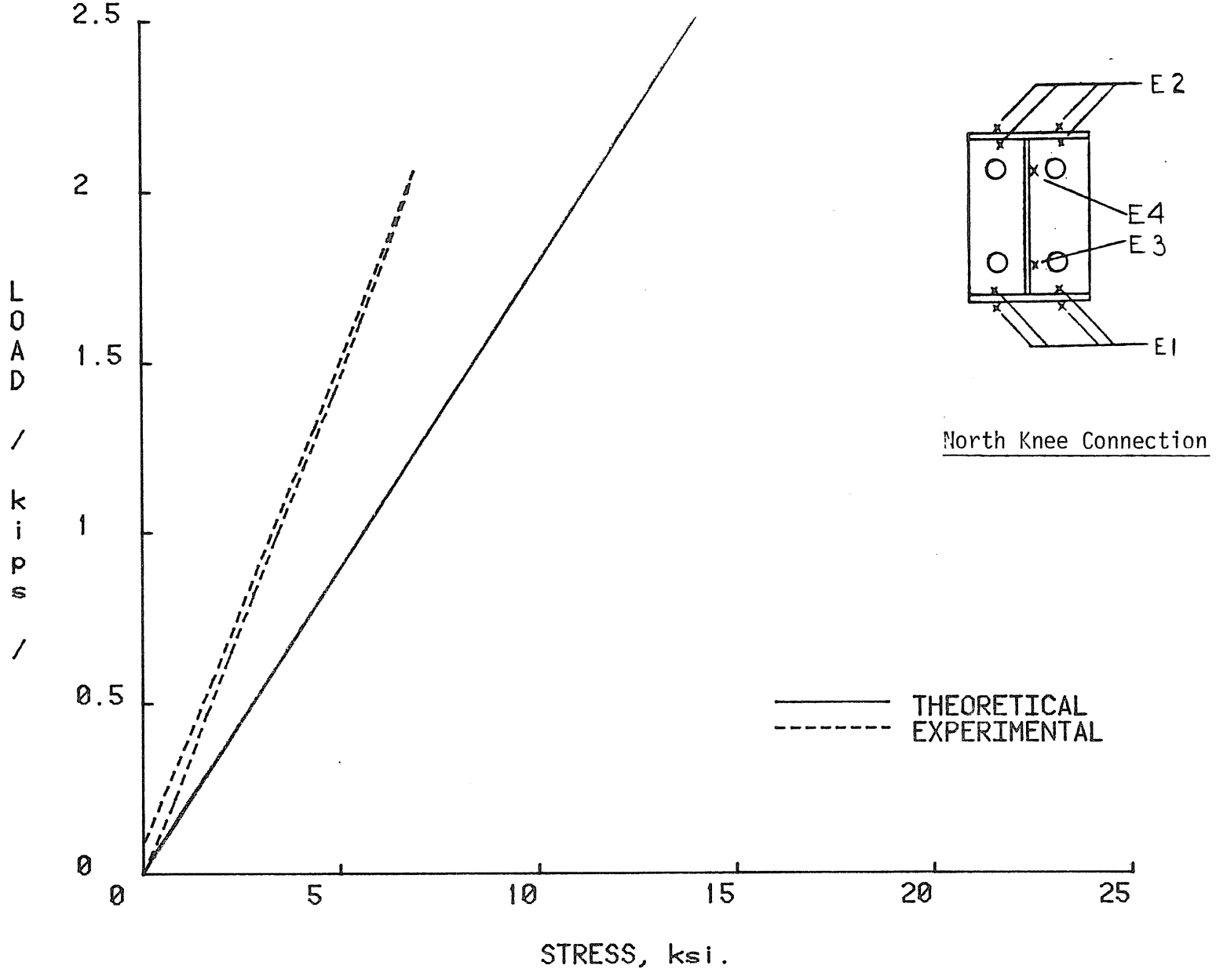


FIGURE B.7 LOAD VS STRESS AT LOCATION E2, EAST FRAME KNEE

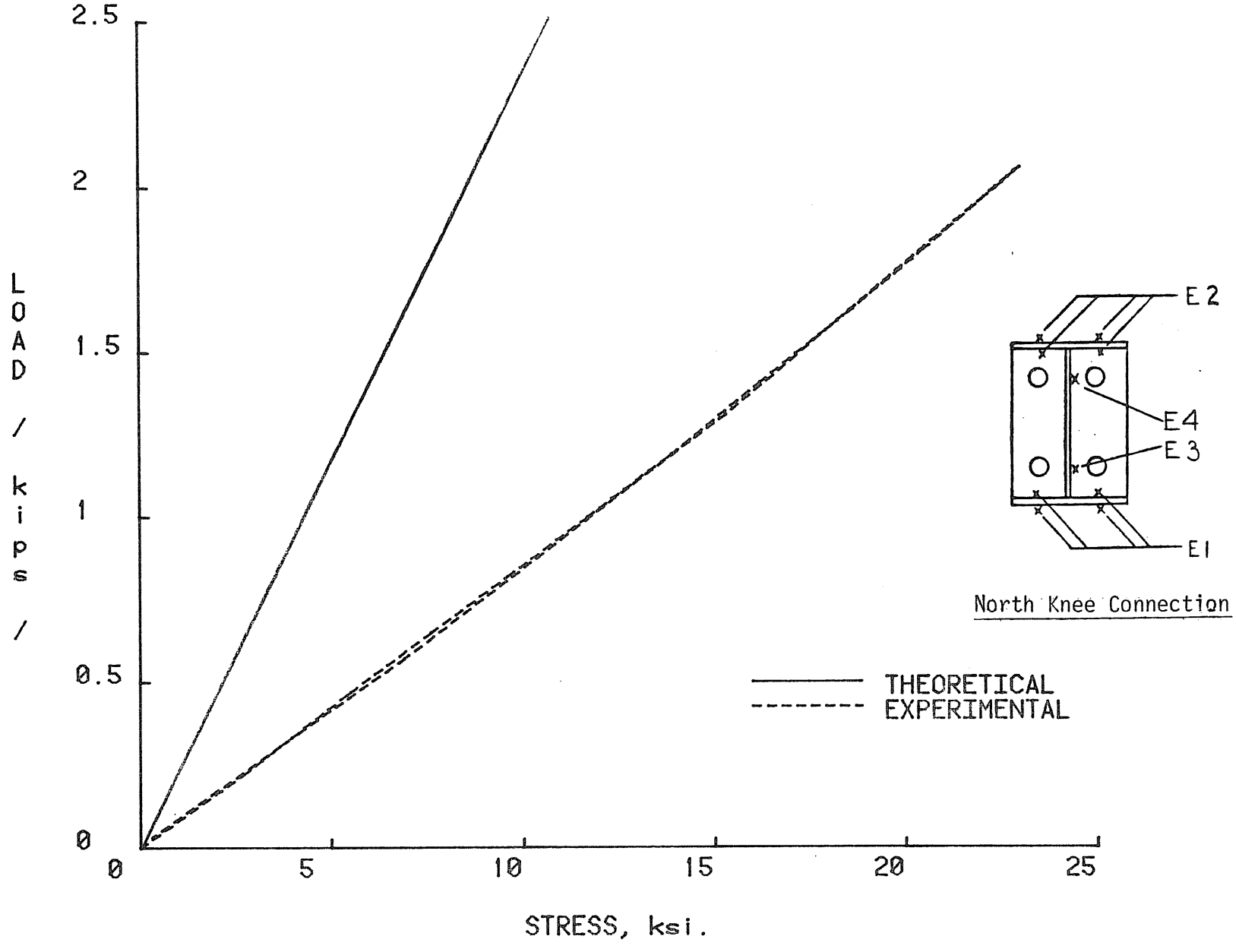


FIGURE B.8 LOAD VS STRESS AT LOCATION E3, EAST FRAME KNEE

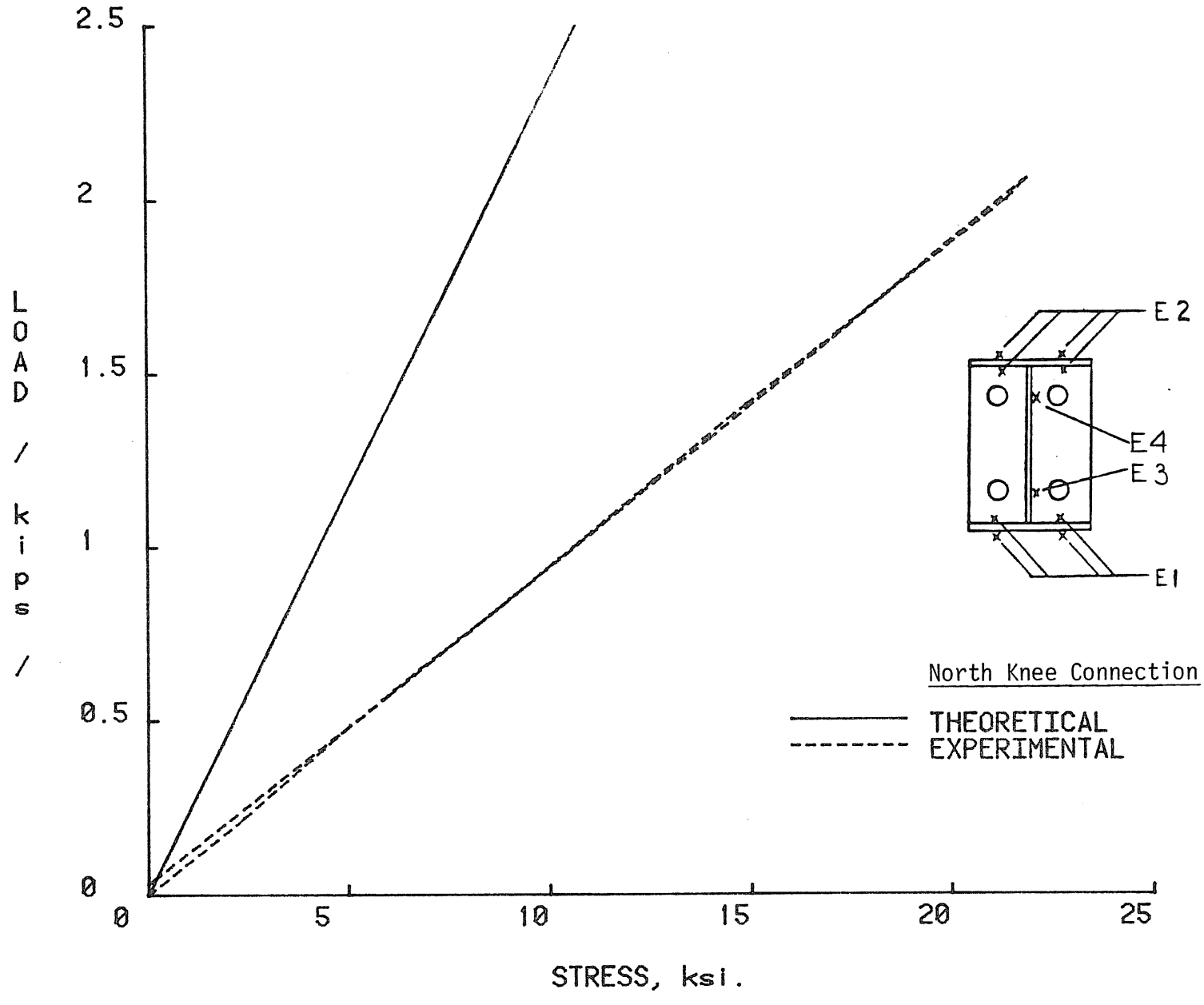


FIGURE B.9 LOAD VS STRESS AT LOCATION E4, EAST FRAME KNEE

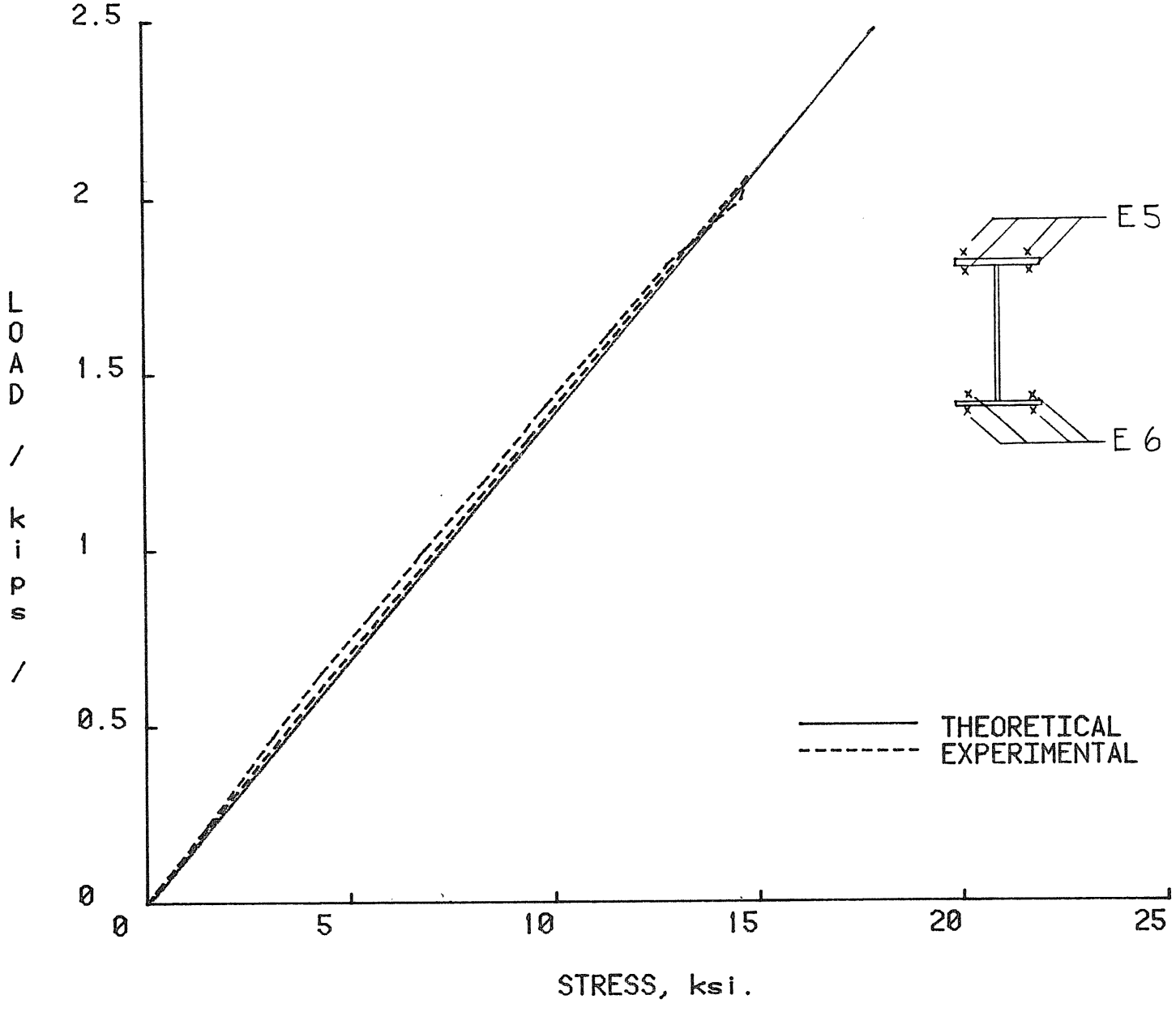


FIGURE B.10 LOAD VS STRESS AT LOCATION E5, EAST FRAME RIDGE

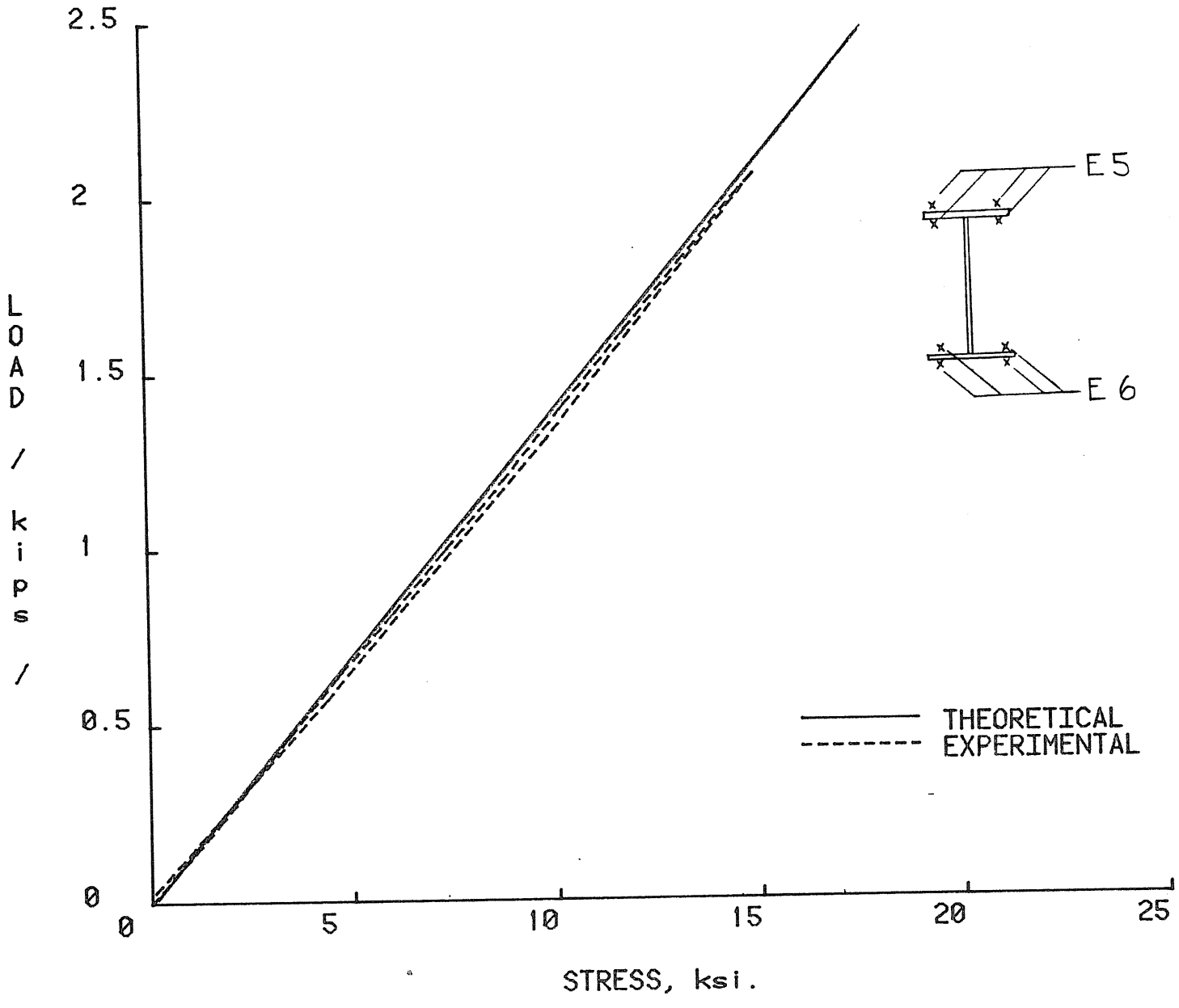


FIGURE B.11 LOAD VS STRESS AT LOCATION E6, EAST FRAME RIDGE

APPENDIX C

FACTORED WIND LOAD

TEST 2

MESCO FRAME TEST SUMMARY

Project: Mesco Frame

Test No.: Frl: Test 2

Test Date: November 7, 1984

Purpose: Test of factored wind load

Bolt Diameter: 3/4" **Pretension Force per Bolt:** 28^{k}

Maximum Test Load: 4.75^{k}

Discussion:

- The load vs lateral deflection relationship remained linear throughout the loading sequence. All stresses at the monitored locations remained well within the elastic range.
- The lateral stiffness of the frames were approximately 10 and 20% greater than predicted for the east and west frames, respectively.

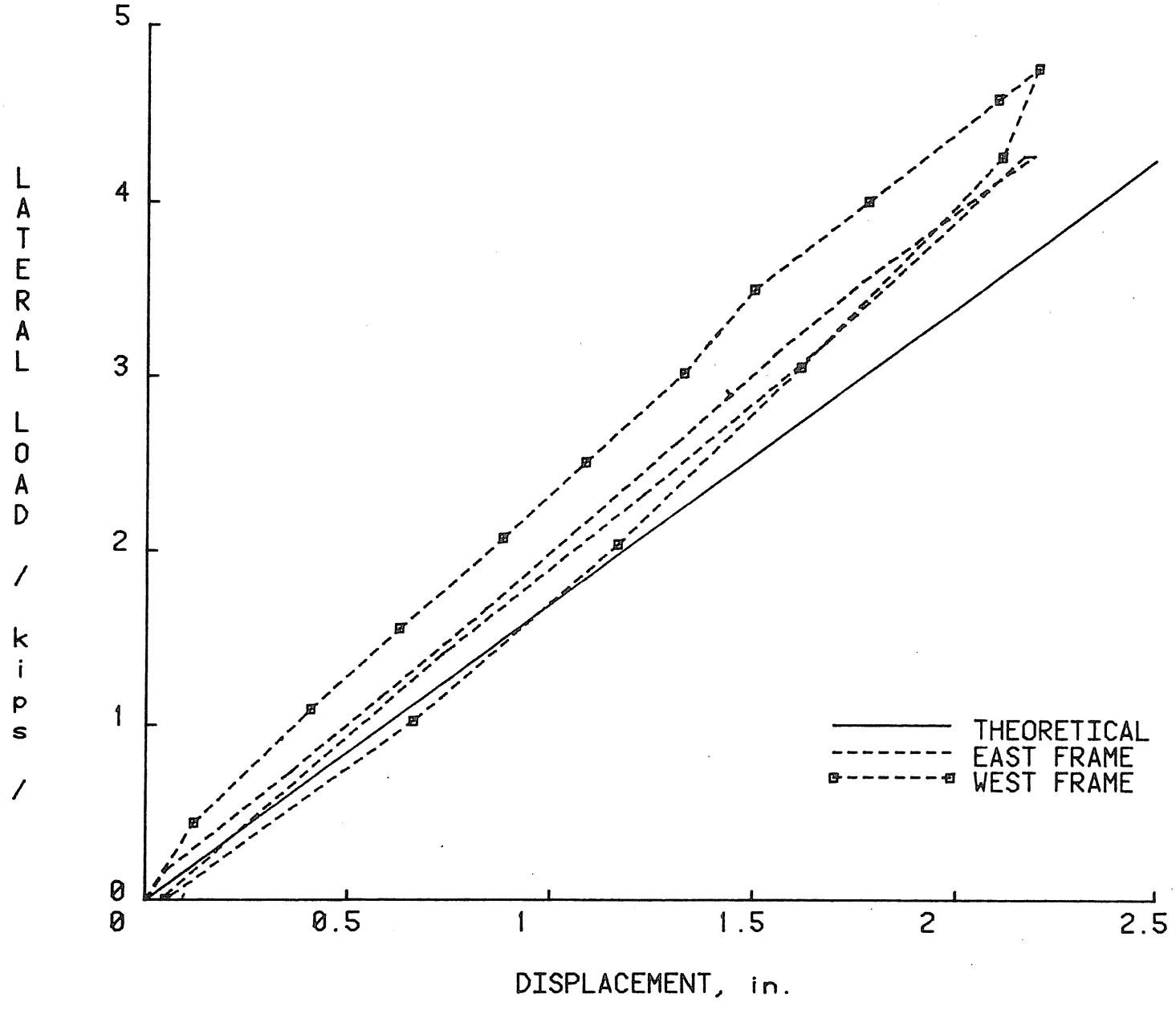


FIGURE C.1 LATERAL LOAD VS SIDESWAY

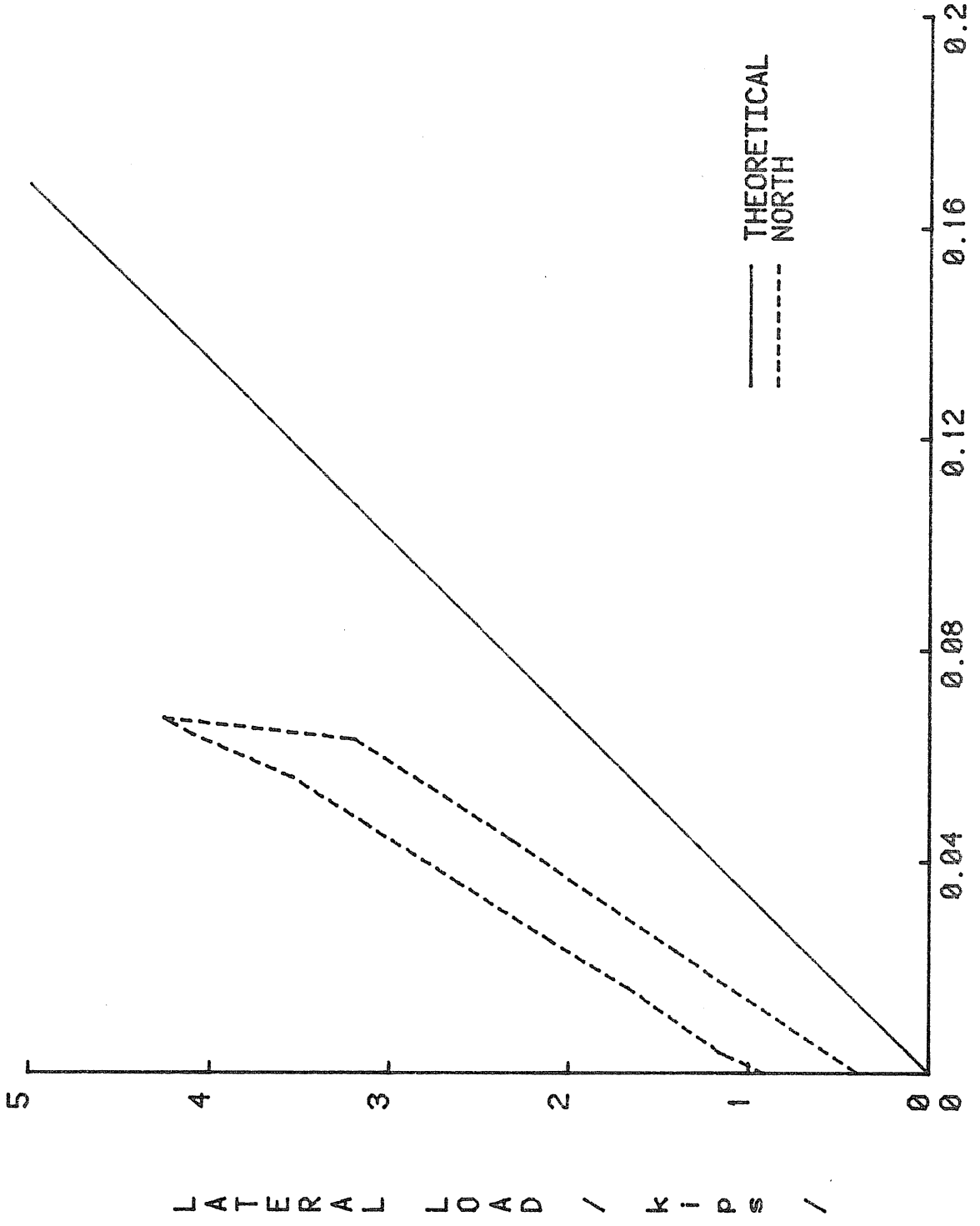


FIGURE C.2 LATERAL LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

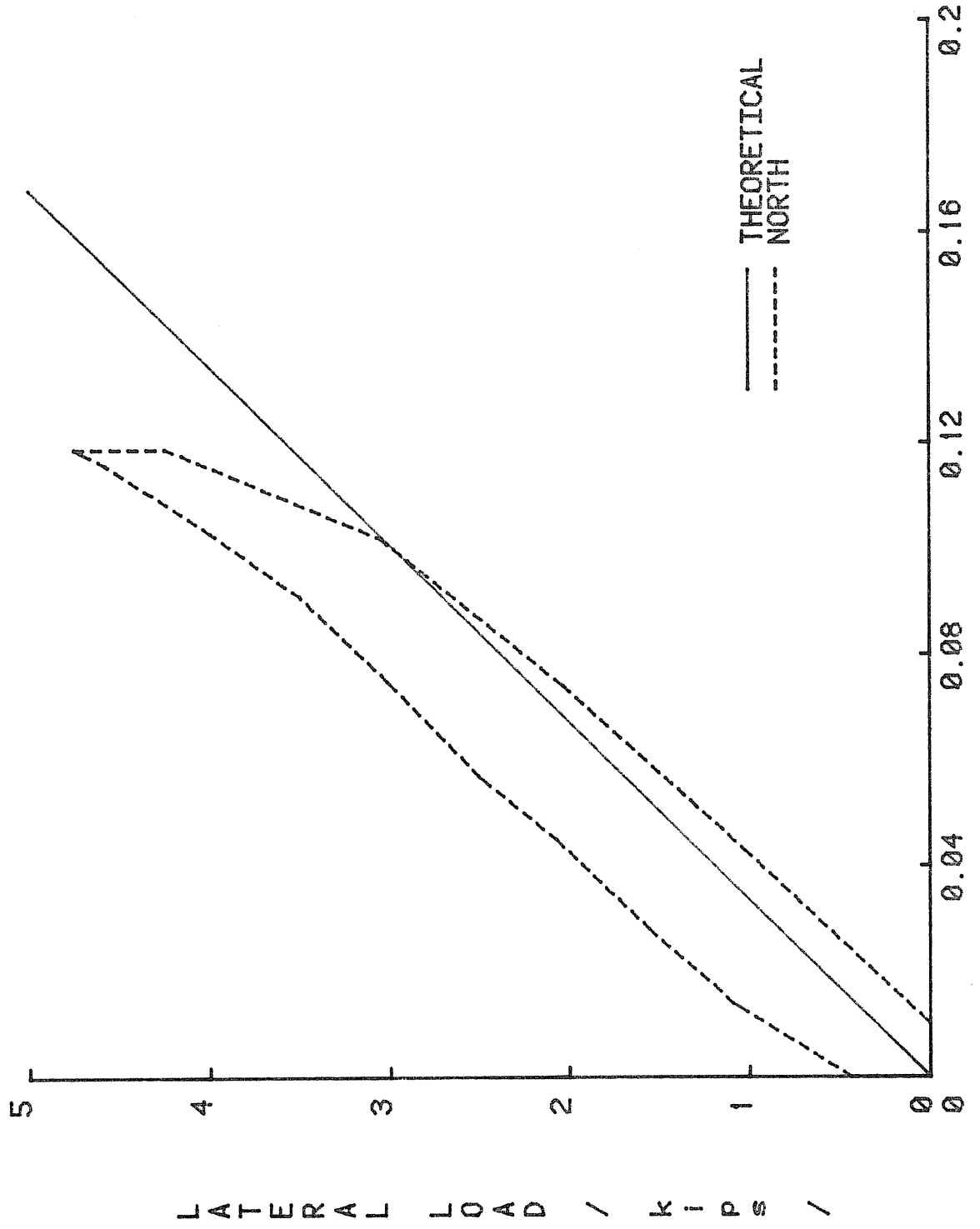


FIGURE C.3 LATERAL LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

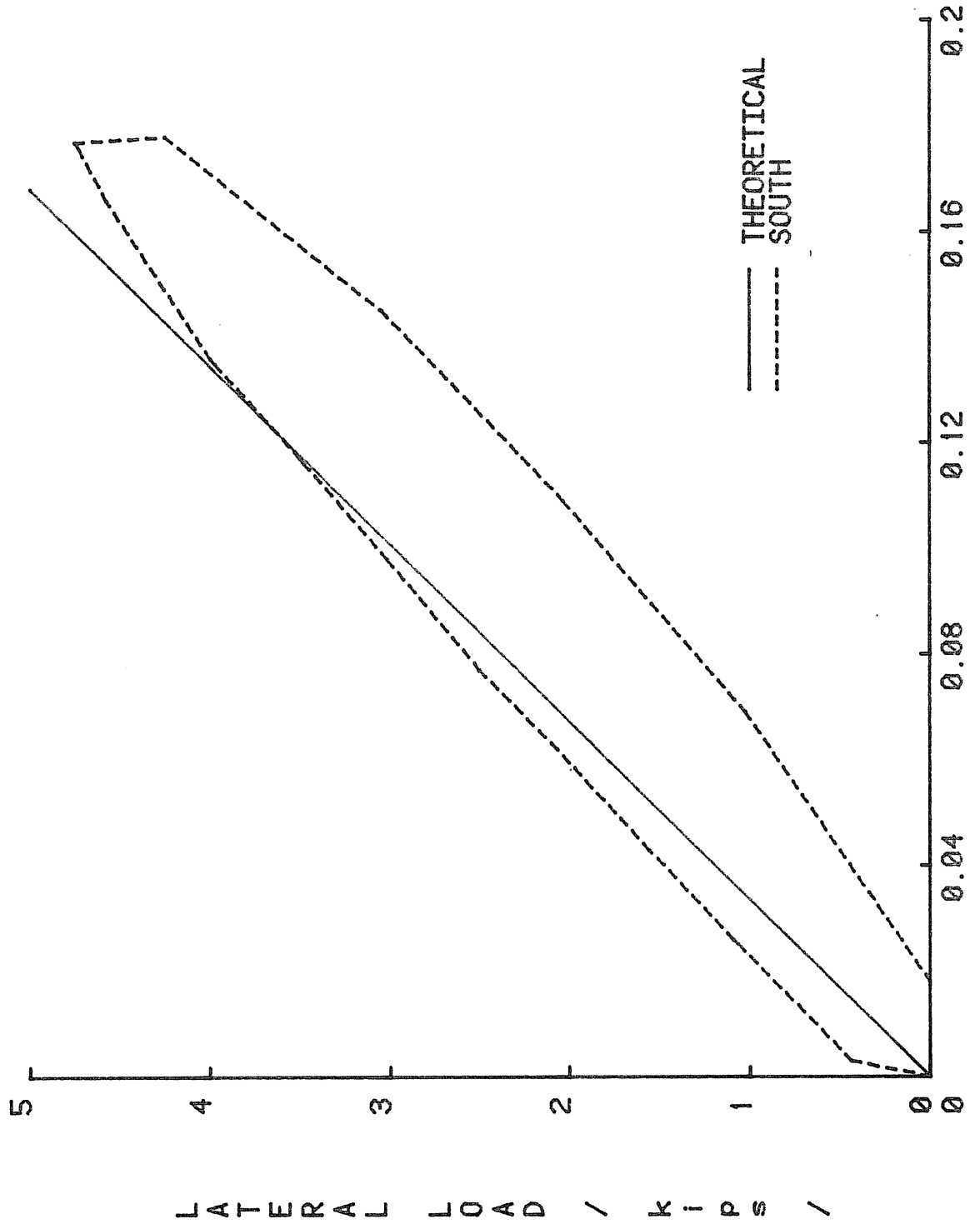


FIGURE C.4 LATERAL LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

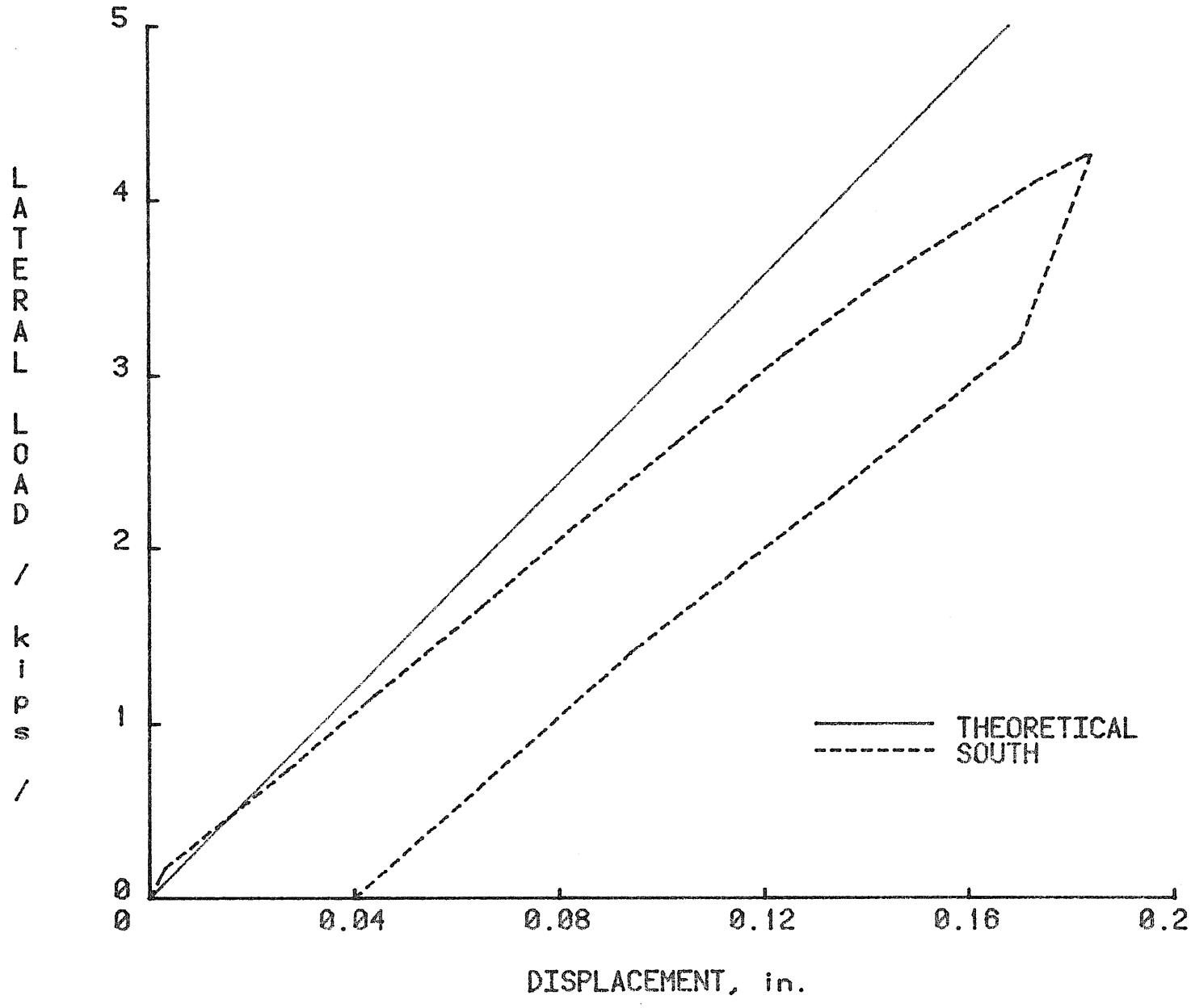


FIGURE C.5 LATERAL LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

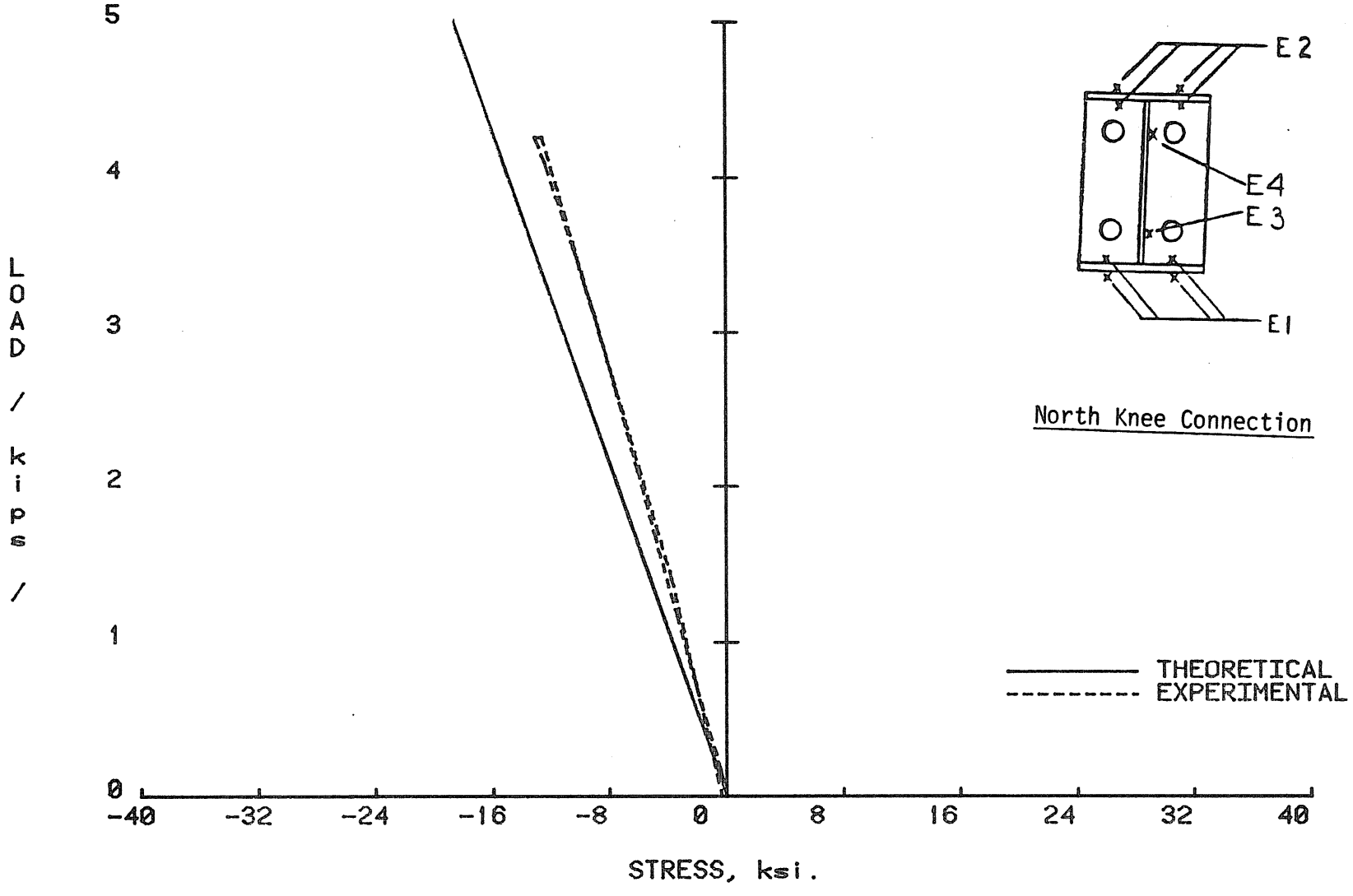


FIGURE C.6 LATERAL LOAD VS STRESS AT LOCATION E2, EAST FRAME

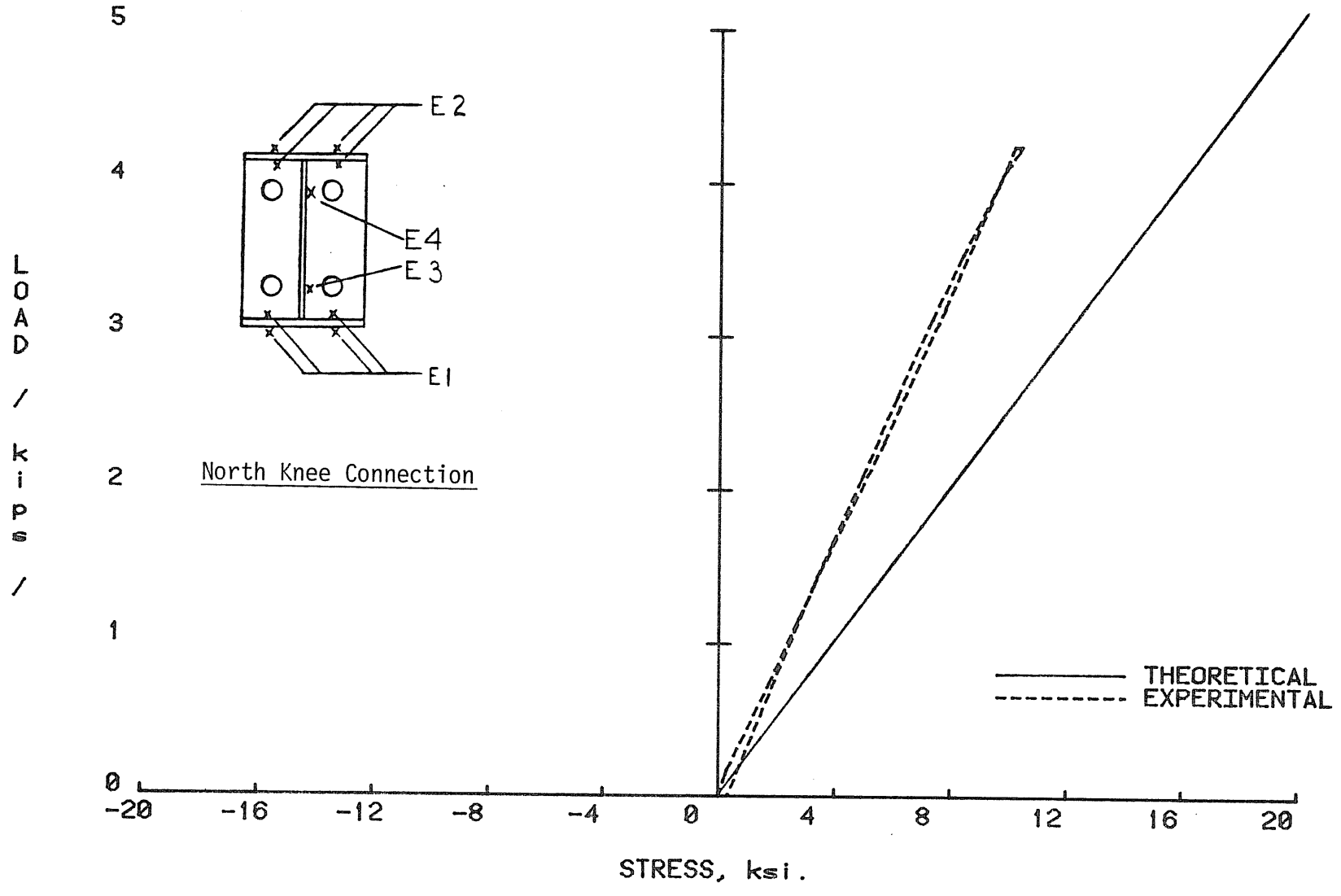


FIGURE C.7 LATERAL LOAD VS STRESS AT LOCATION E1, EAST FRAME KNEE

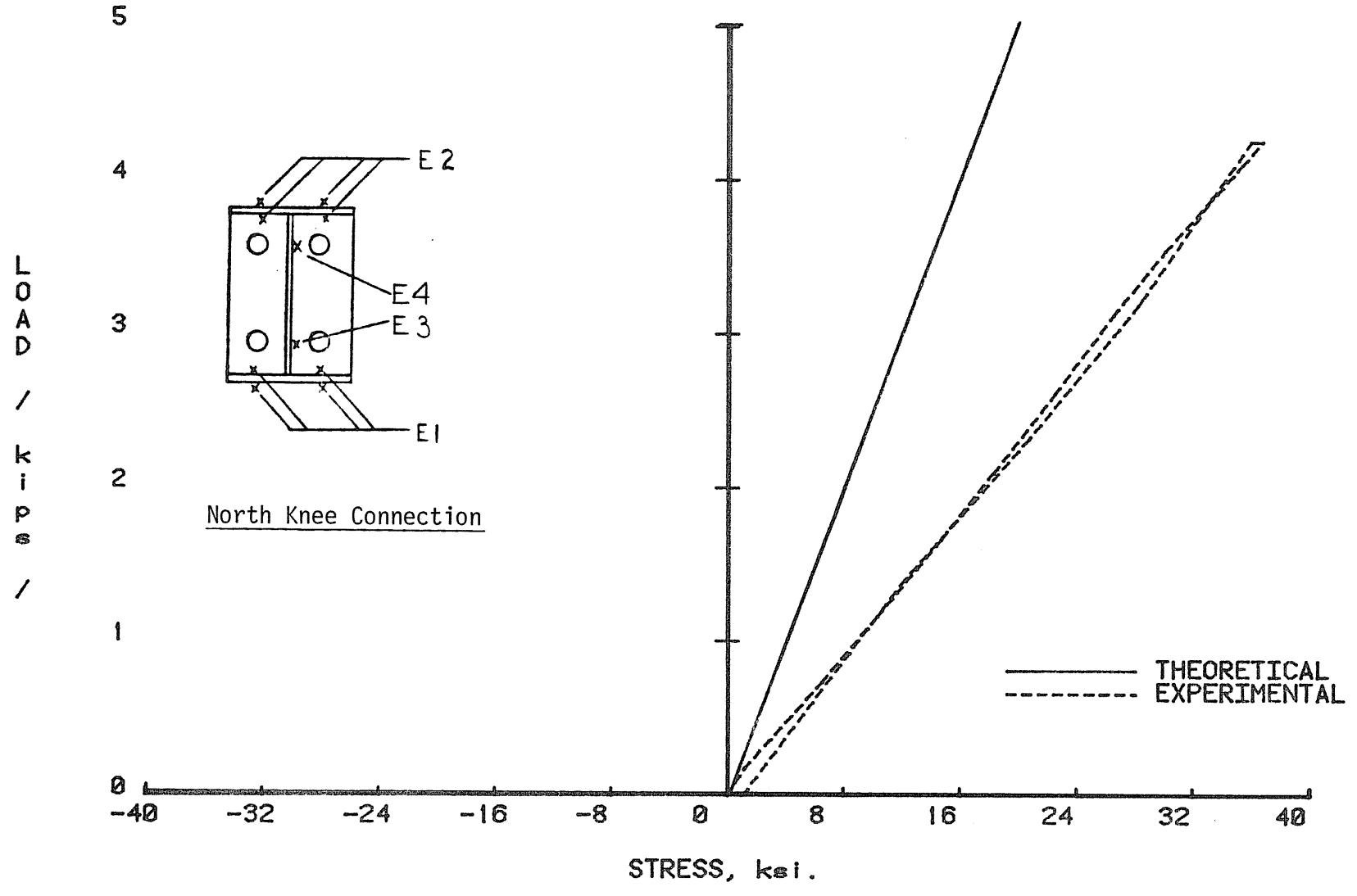


FIGURE C.8 LATERAL LOAD VS STRESS AT LOCATION E3, EAST FRAME KNEE

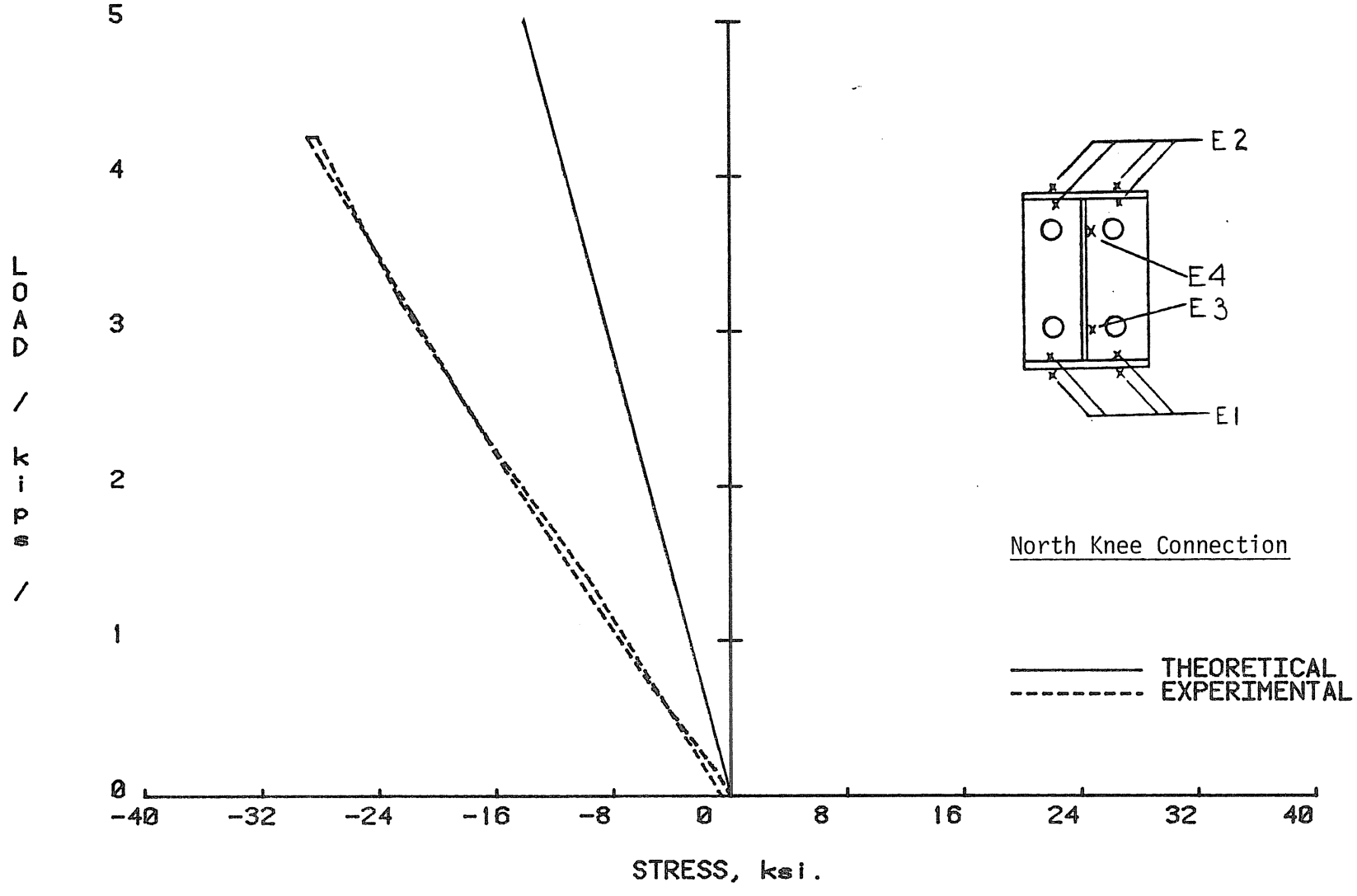


FIGURE C.9 LATERAL LOAD VS STRESS AT LOCATION E4, EAST FRAME KNEE

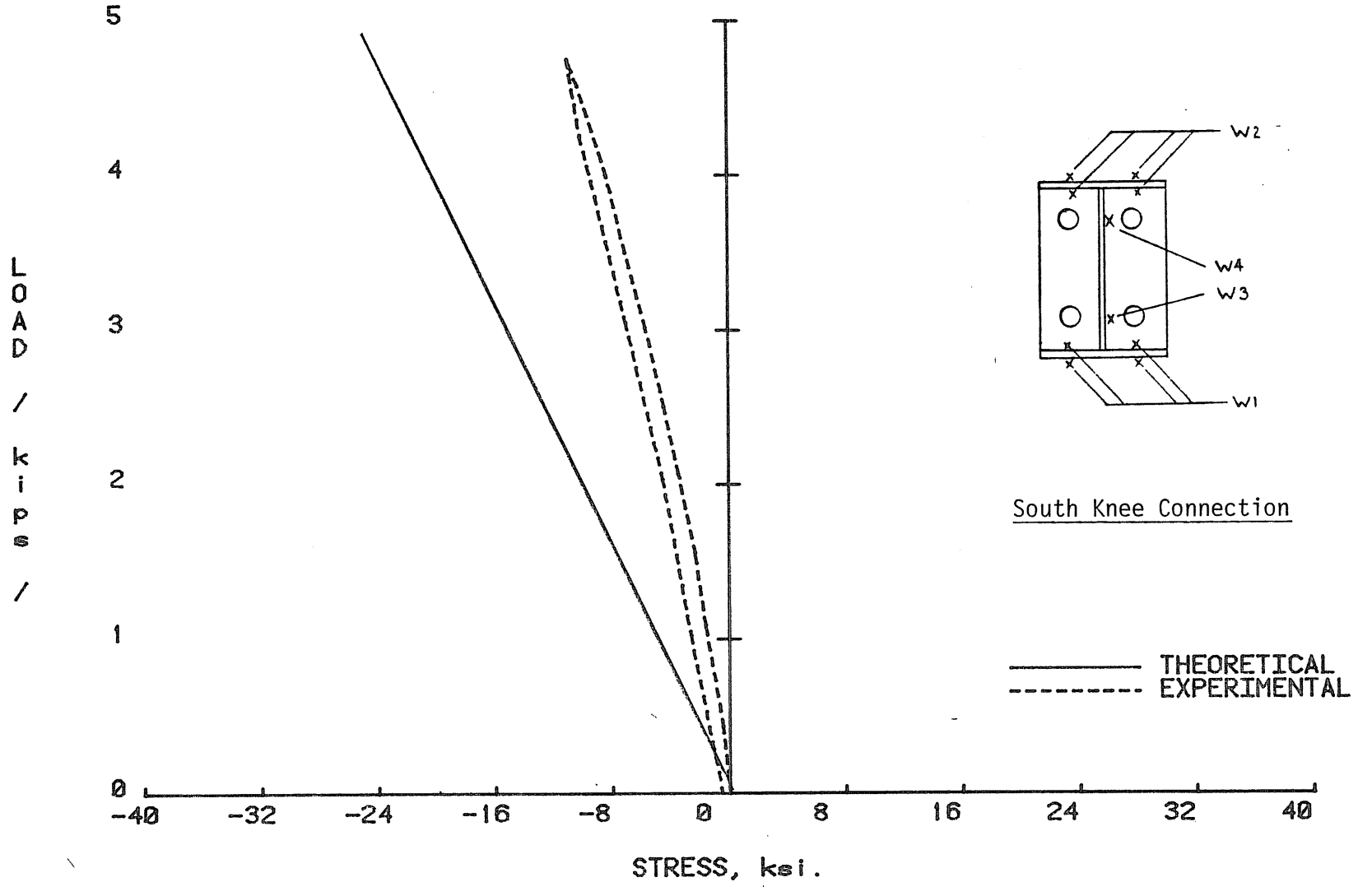


FIGURE C.10 LATERAL LOAD VS STRESS AT LOCATION W1, WEST FRAME KNEE

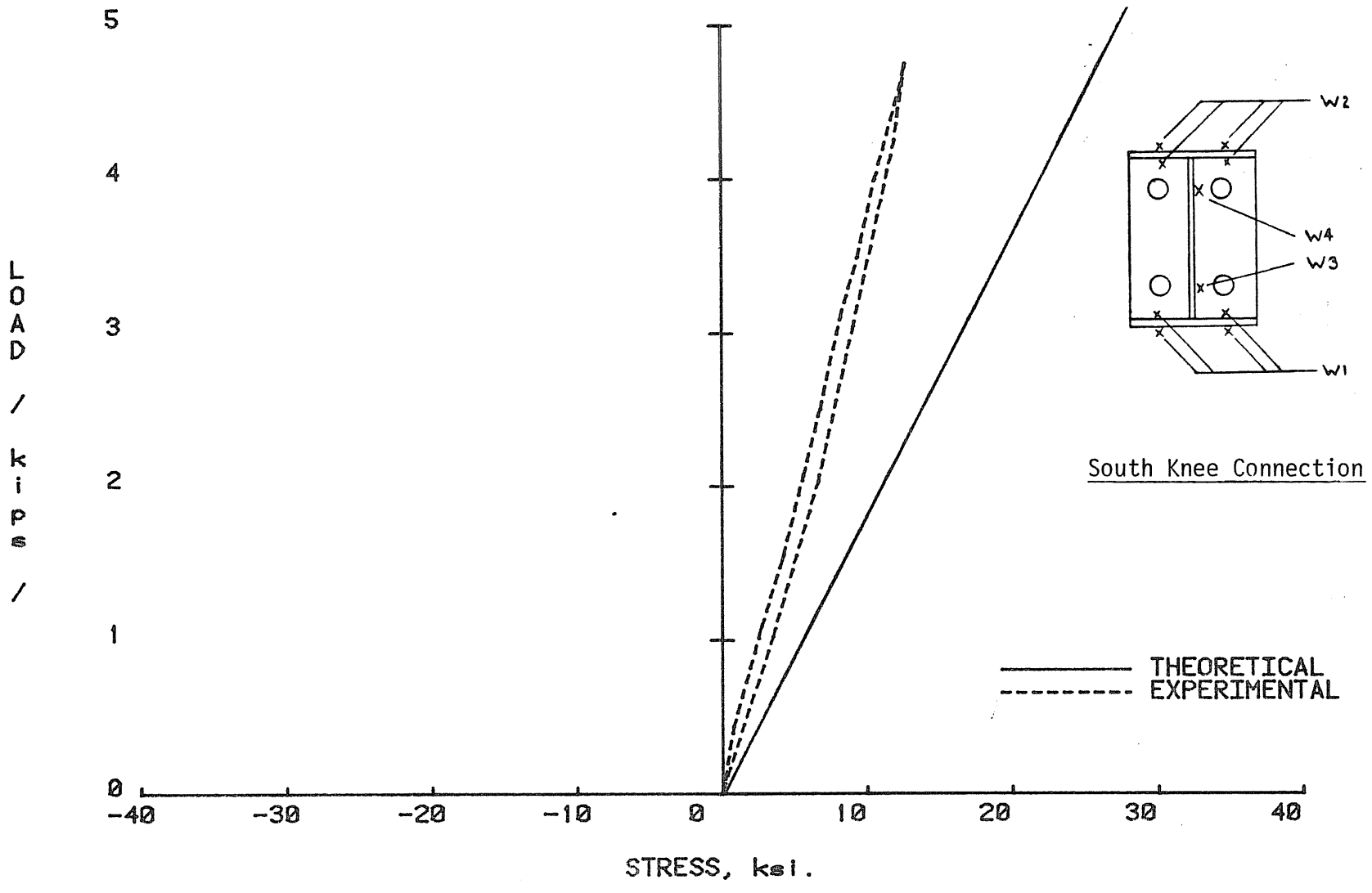


FIGURE C.11 LATERAL LOAD VS STRESS AT LOCATION W2, WEST FRAME KNEE

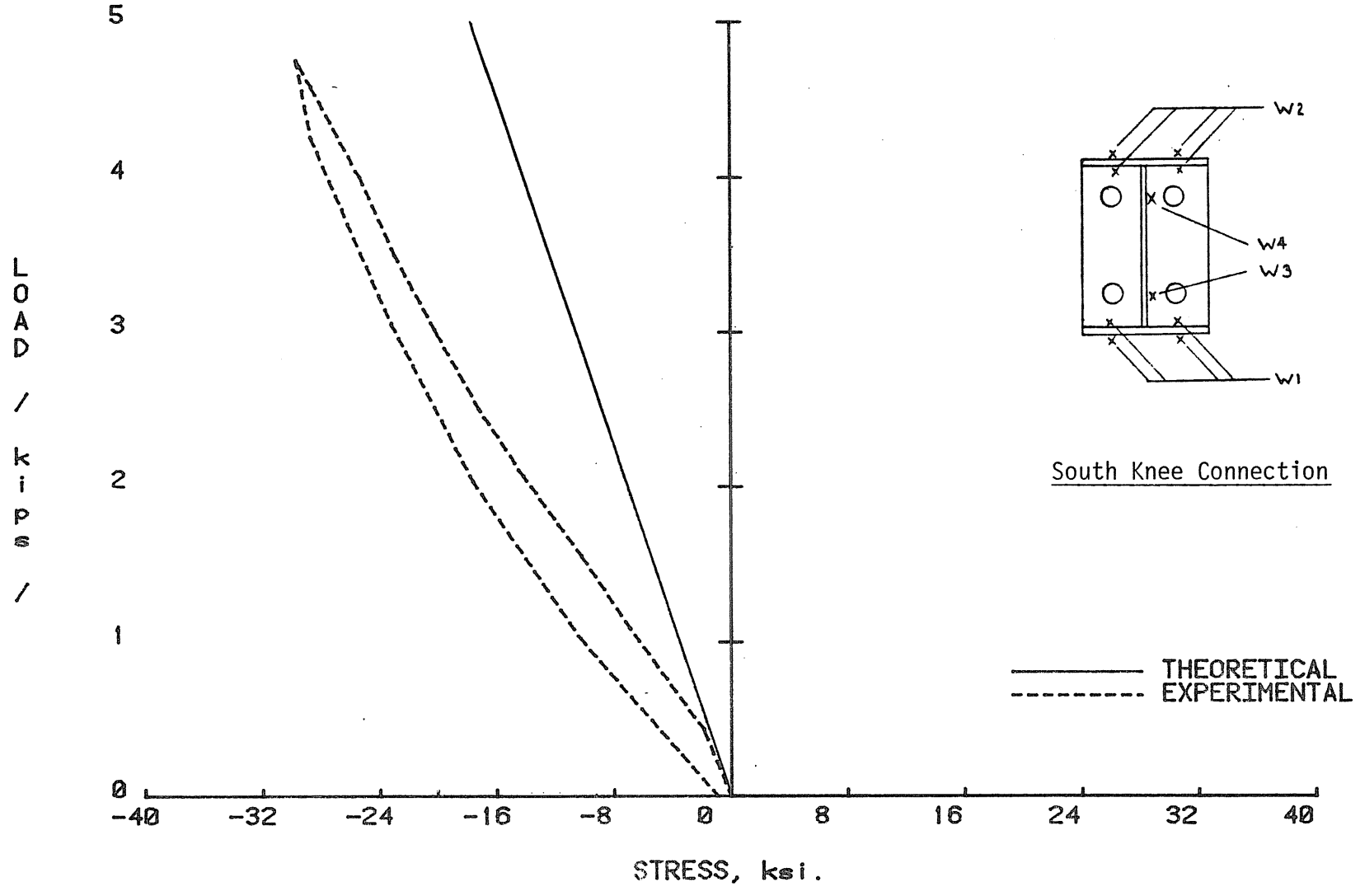


FIGURE C.12 LATERAL LOAD VS STRESS AT LOCATION W3, WEST FRAME KNEE

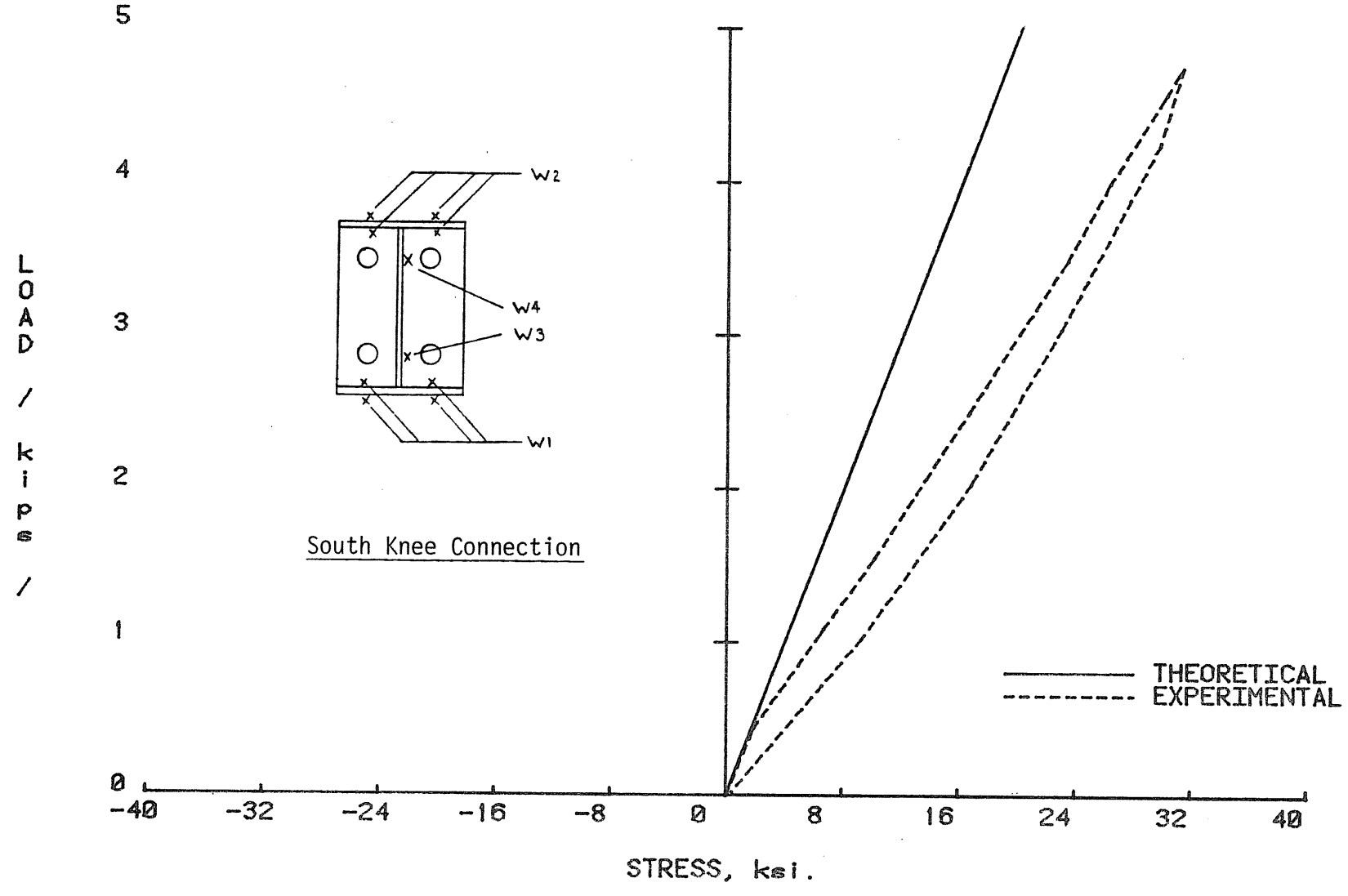


FIGURE C.13 LATERAL LOAD VS STRESS AT LOCATION W4, WEST FRAME KNEE

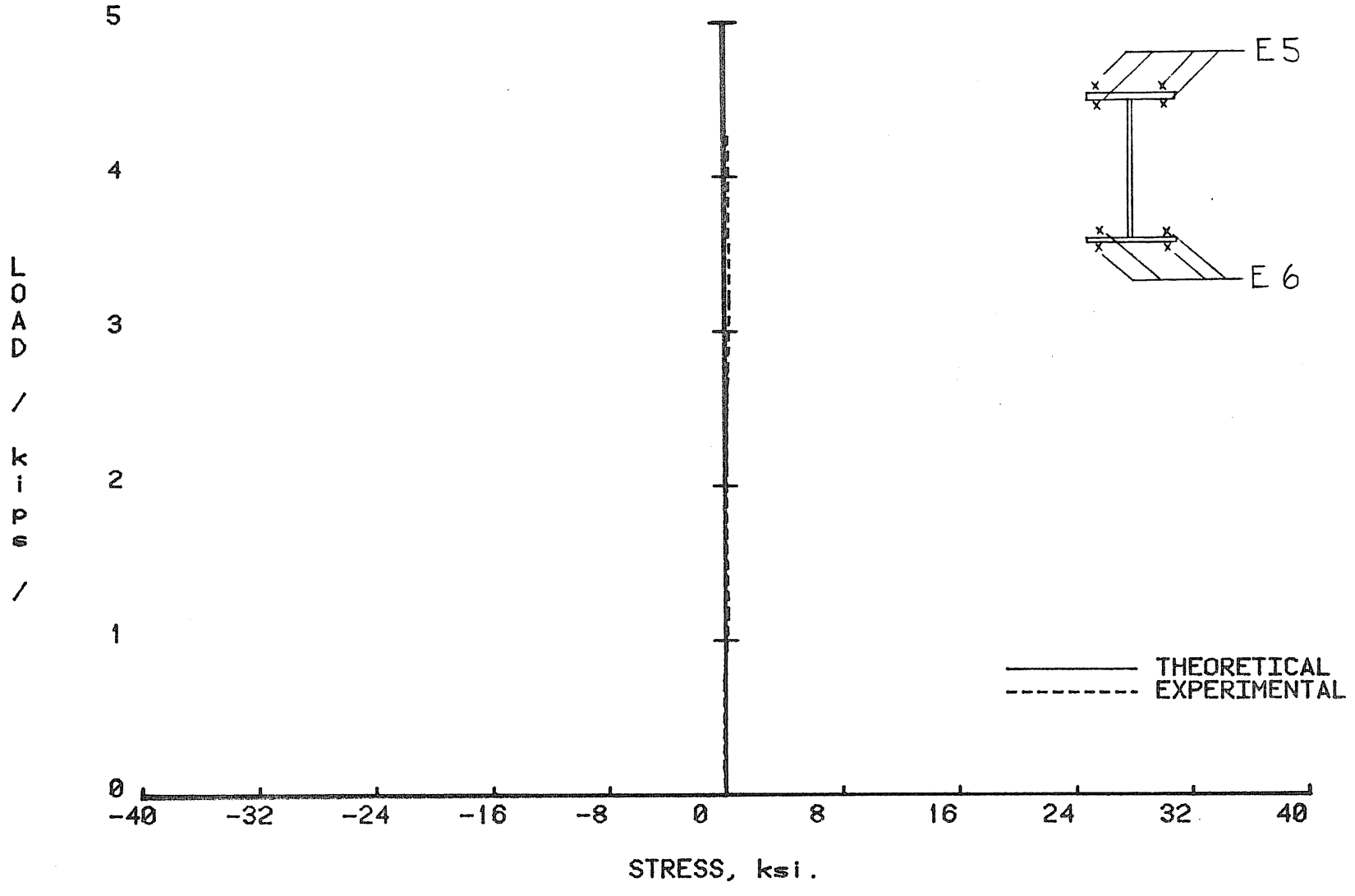


FIGURE C.14 LATERAL LOAD VS STRESS AT LOCATION E5, EAST FRAME RIDGE

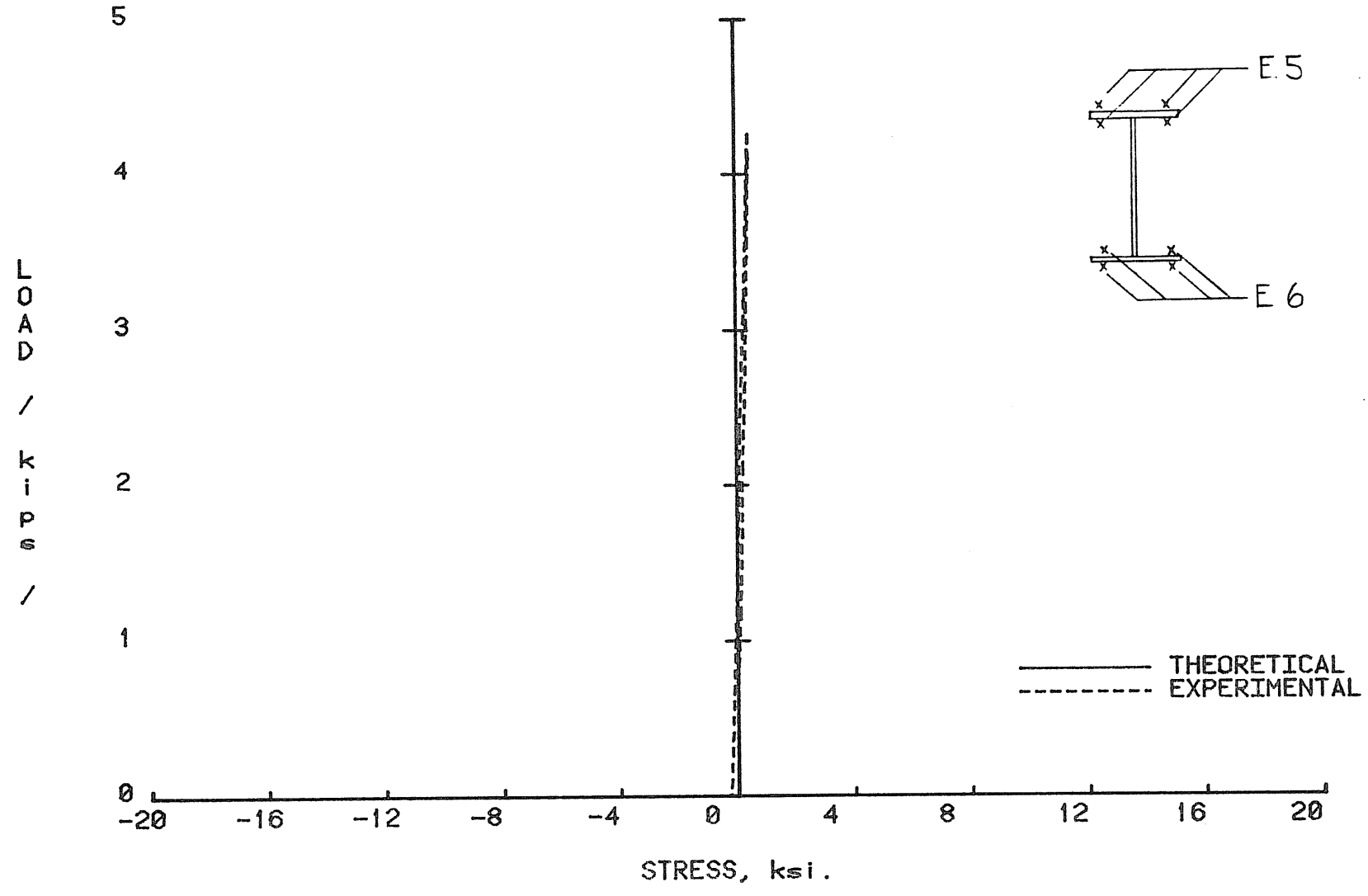


FIGURE C.15 LATERAL LOAD VS STRESS AT LOCATION E6, EAST FRAME RIDGE

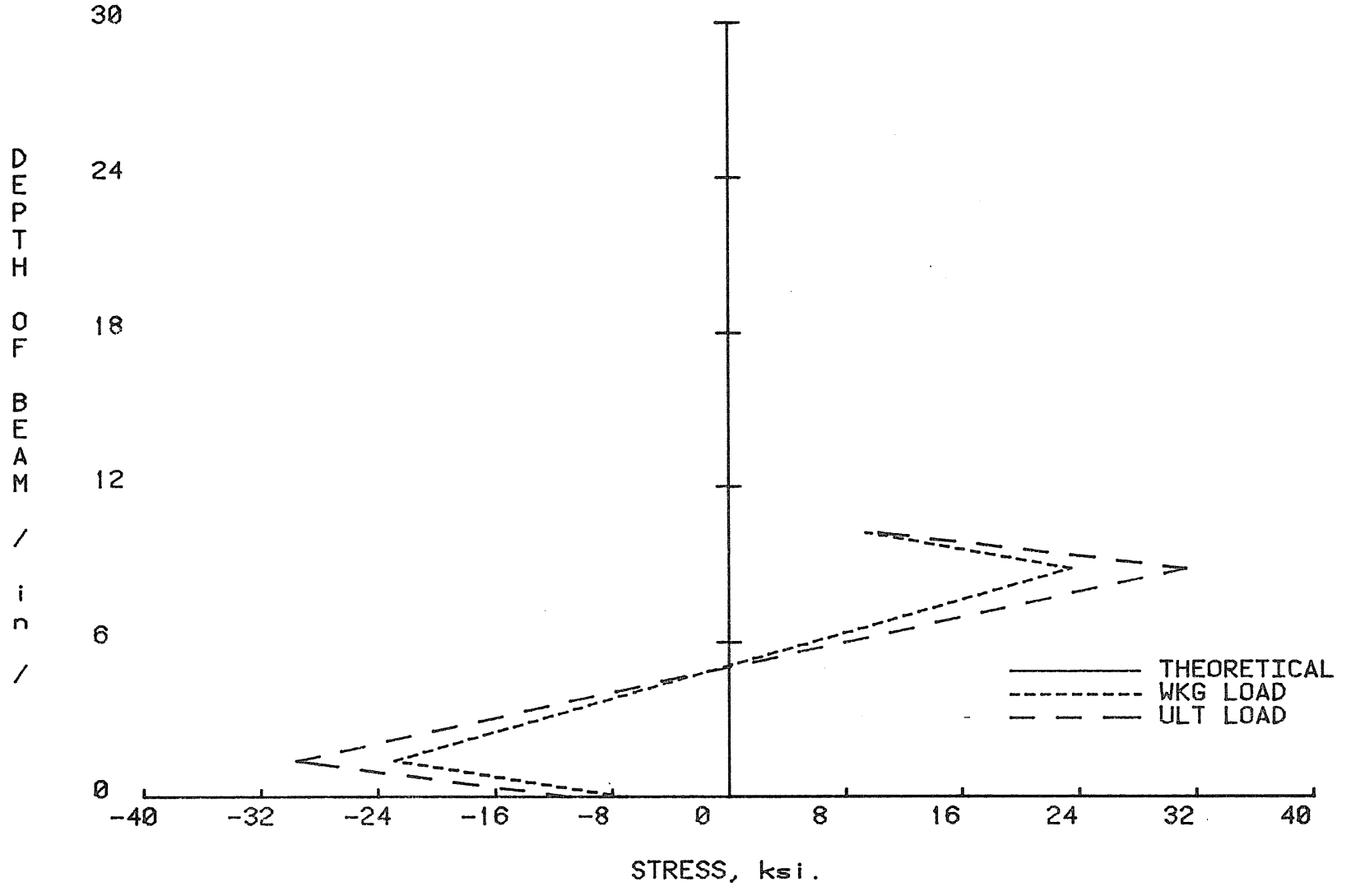


FIGURE C.16 DEPTH OF BEAM VS STRESS AT RAFTER END, WEST FRAME SOUTH END

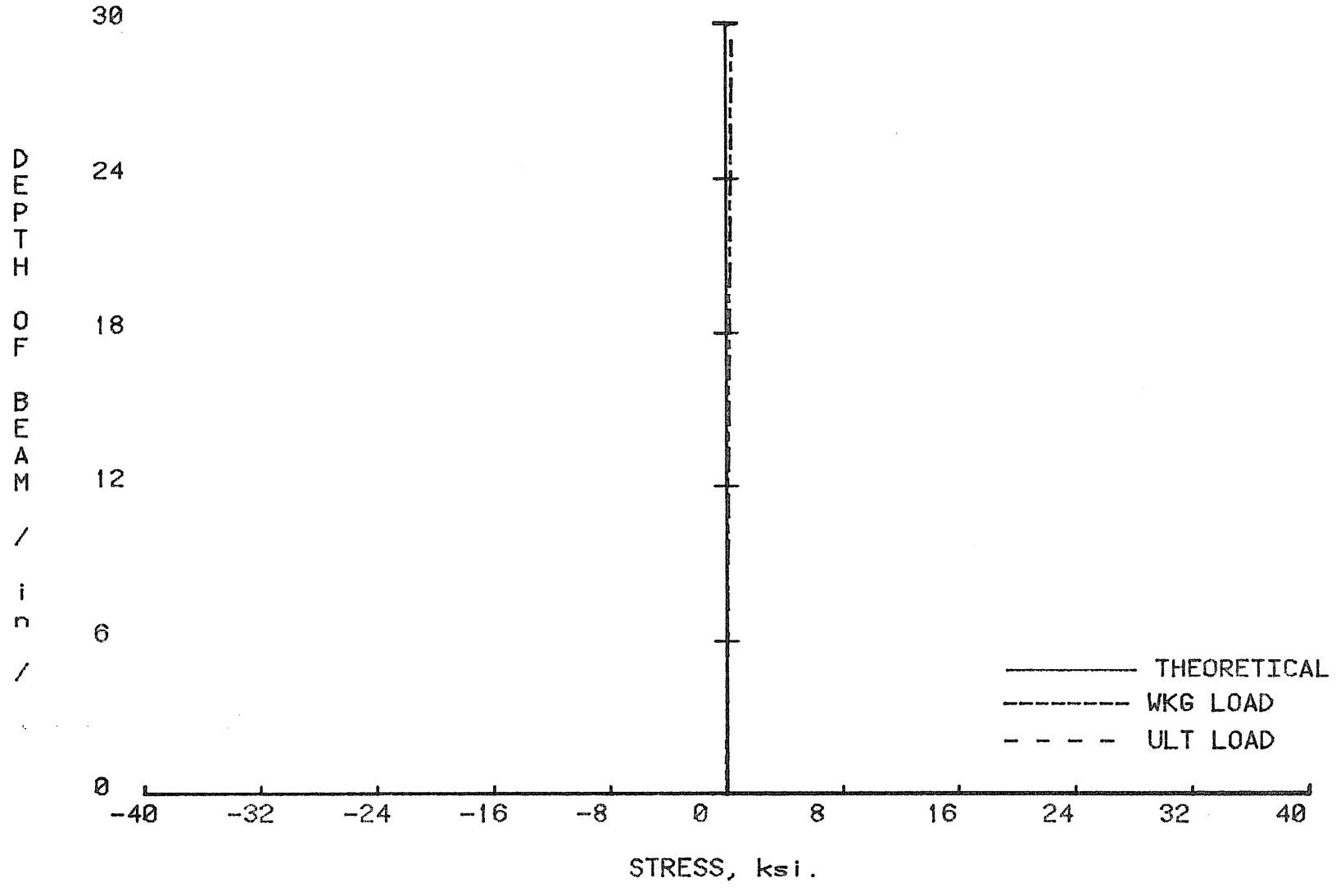


FIGURE C.17 DEPTH OF BEAM VS STRESS AT RAFTER CENTERLINE, EAST FRAME

APPENDIX D

FACTORED UNBALANCED LIVE LOAD

TEST 3

MESCO FRAME TEST SUMMARY

Project: Mesco Frame

Test No.: FRI: Test 3

Test Date: November 6, 1984

Purpose: Test of factored unbalanced live load

Bolt Diameter: 3/4" **Pretension Force per Bolt:** 28^{k}

Maximum Test Load: 3.51^{k}

Discussion:

- Centerline deflections agreed closely with the theoretical prediction prior to 3 kips at test load. At 3 kips they slightly exceeded the prediction.
- Quarter point deflections exceeded the theoretical prediction throughout the loading sequence.
- No inelastic behavior was indicated by strain gage data or significant degredation of the frames stiffness.

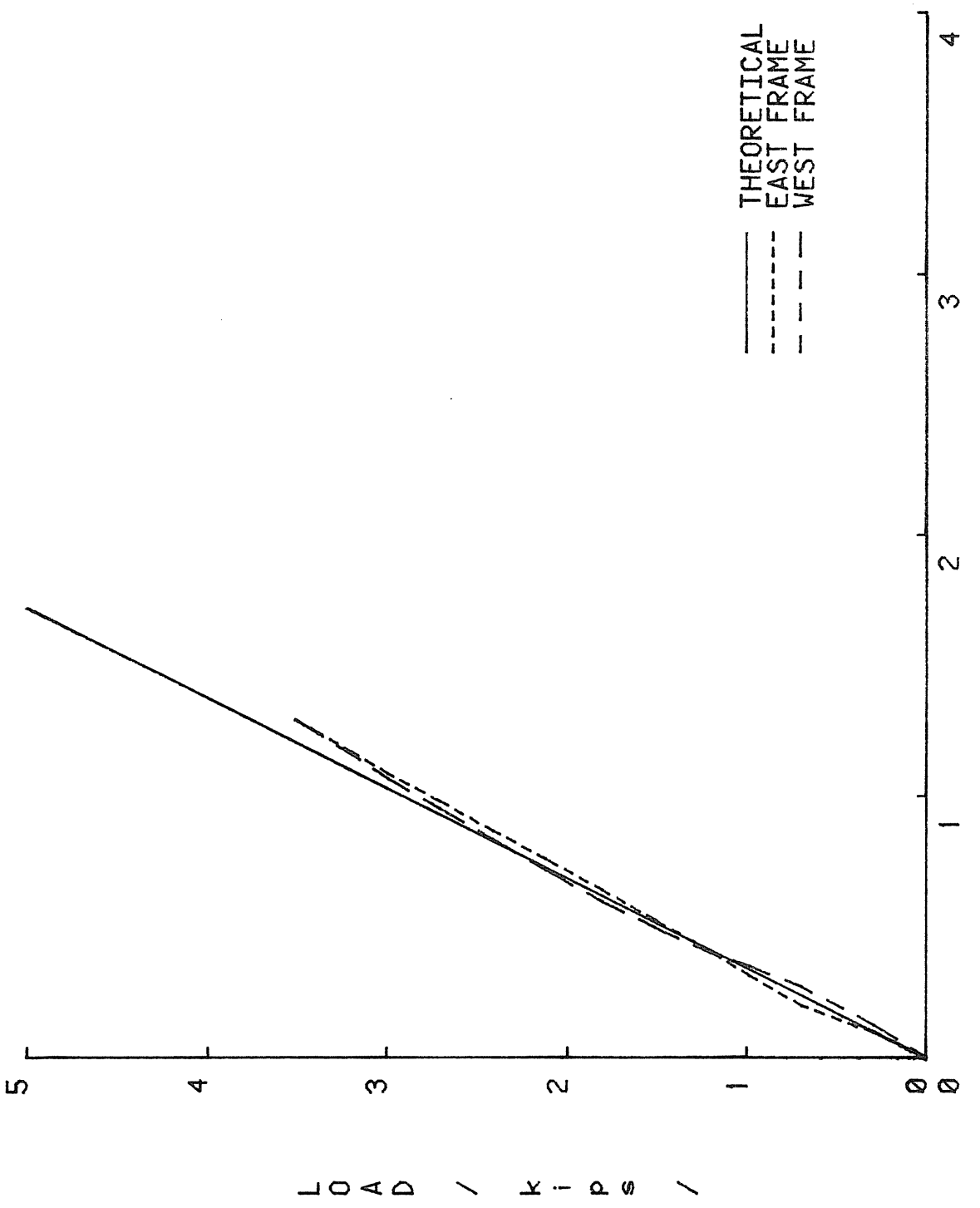


FIGURE D.1 LOAD VS CENTERLINE DEFLECTION

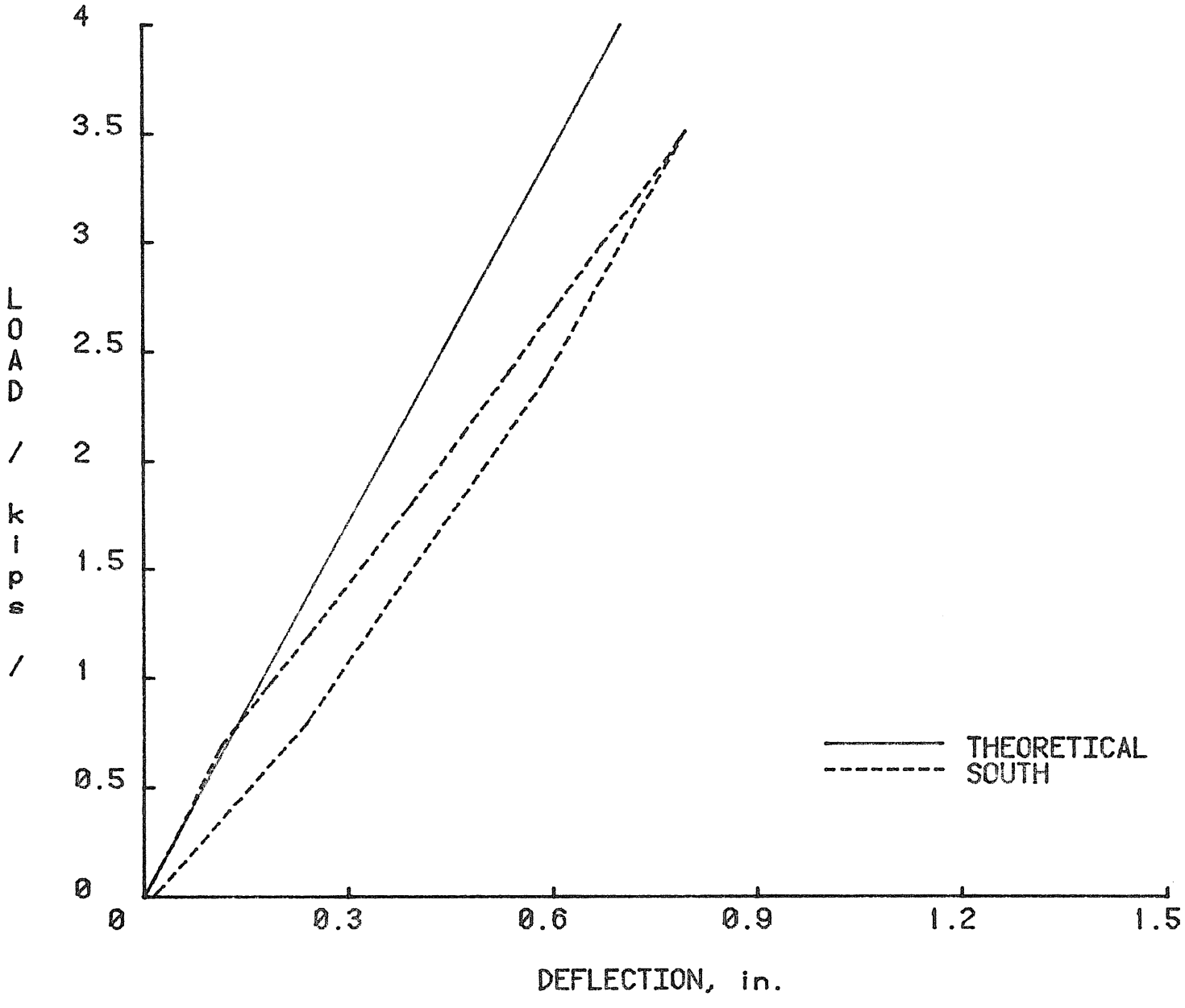


FIGURE D.2 LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

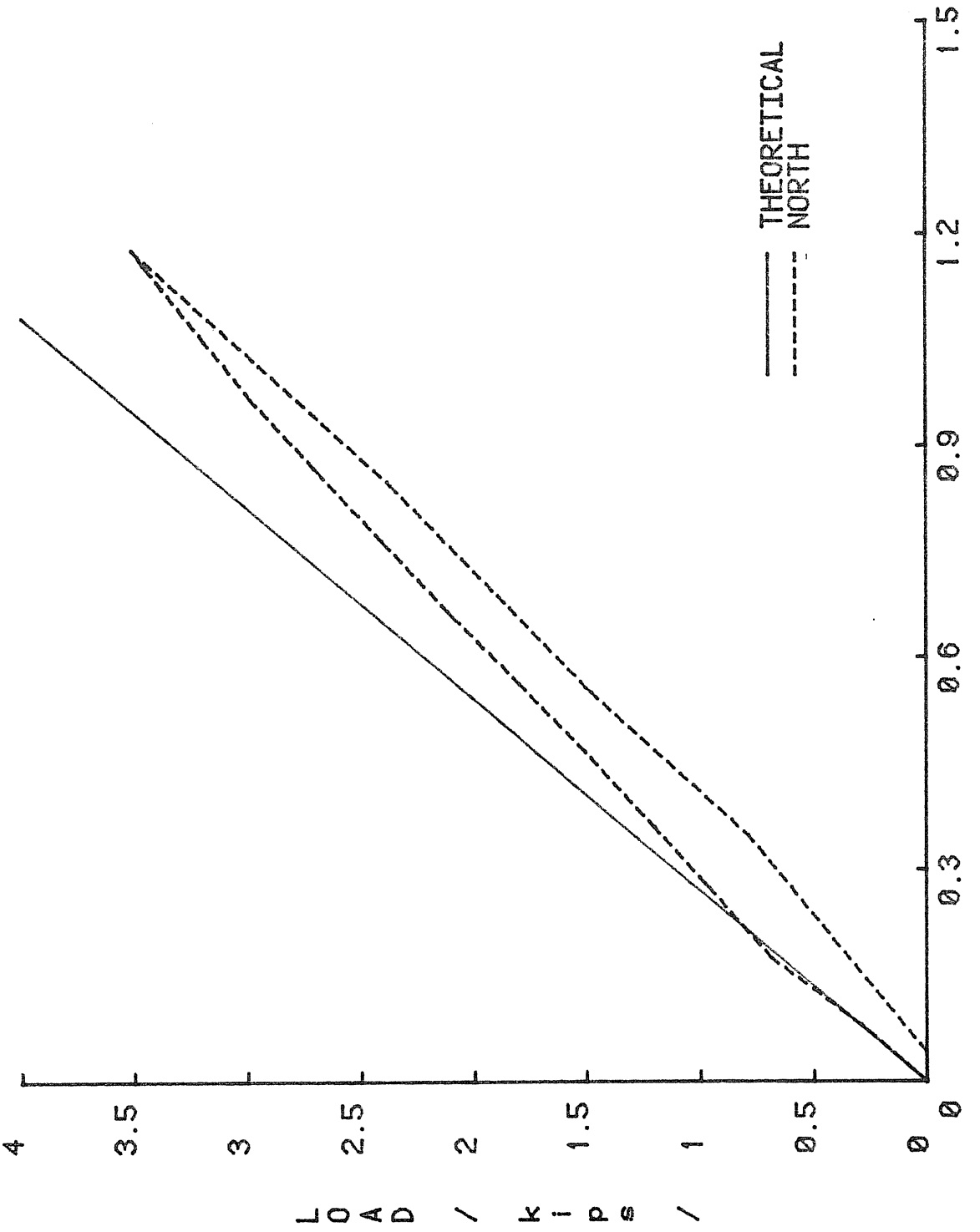


FIGURE D.3 LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

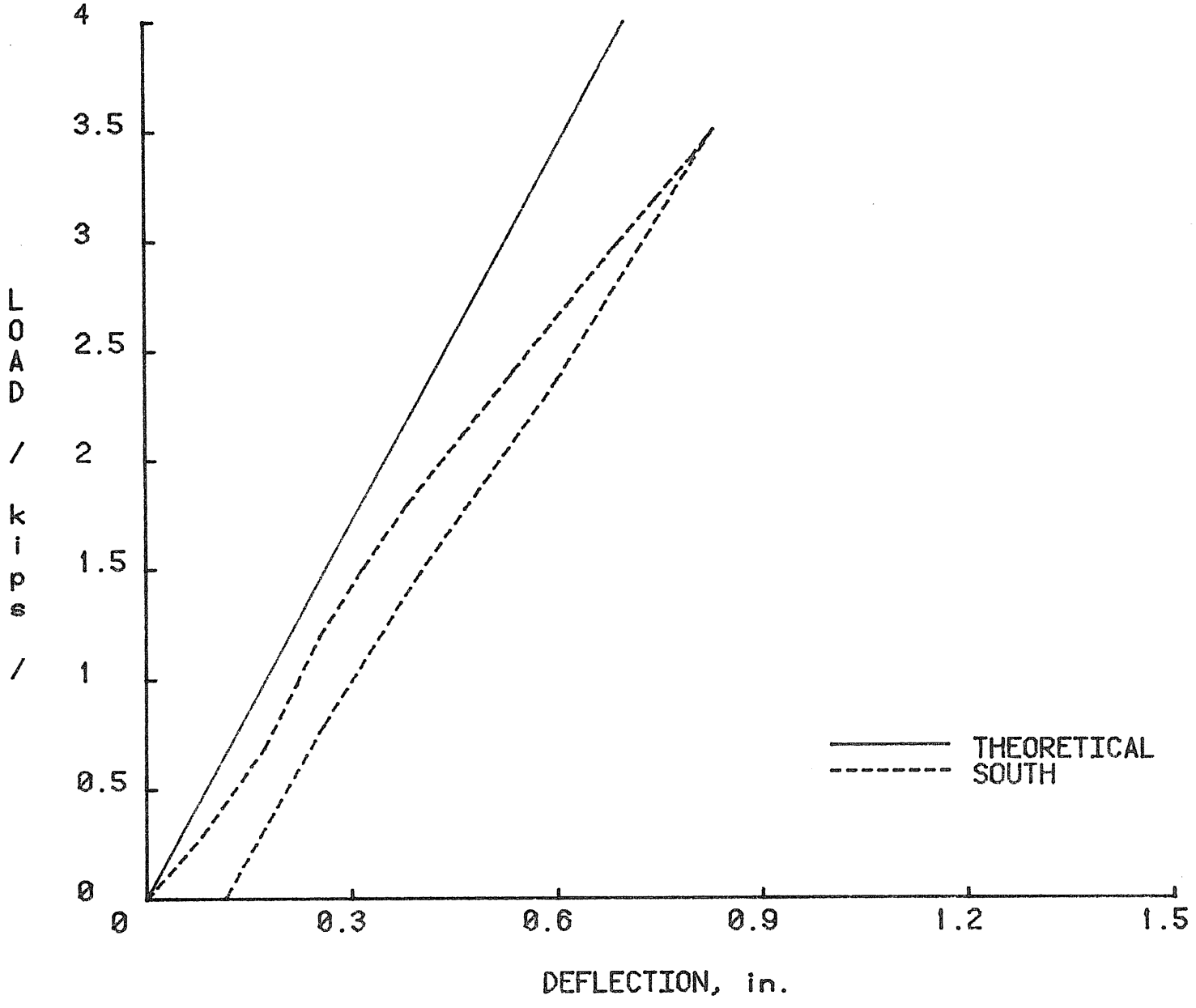


FIGURE D.4 LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

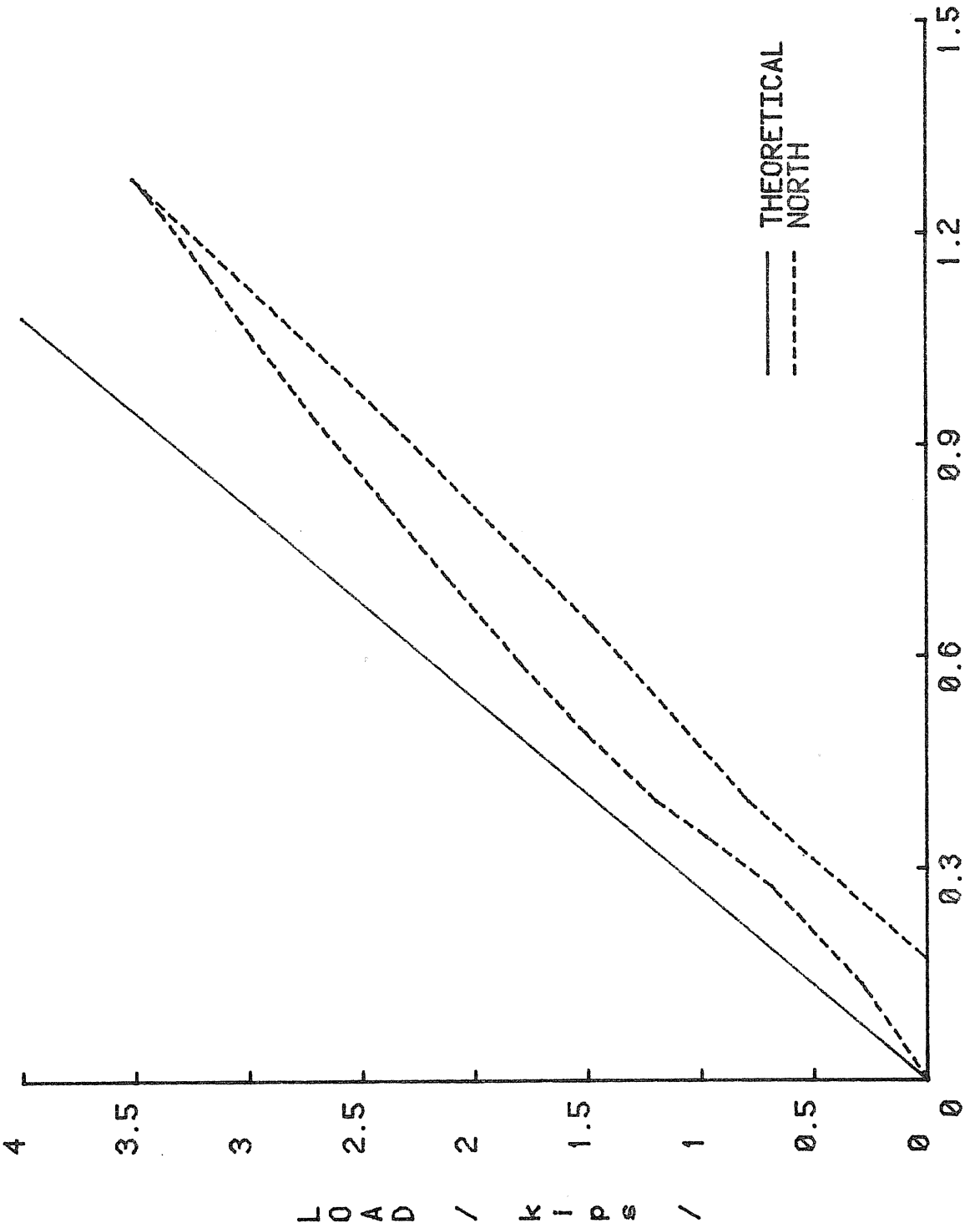


FIGURE D.5 LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

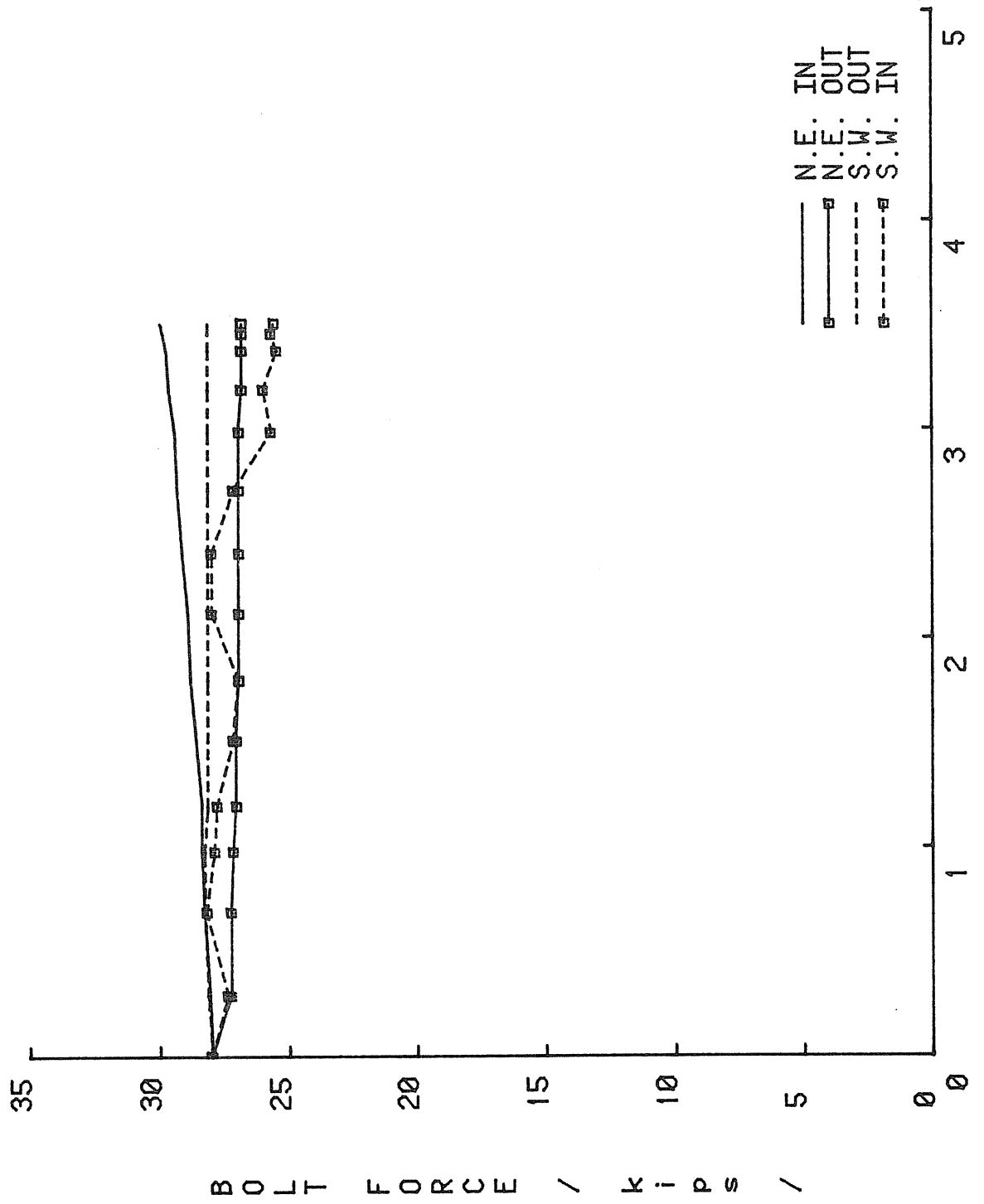


FIGURE D.6 BOLT FORCE VS LOAD

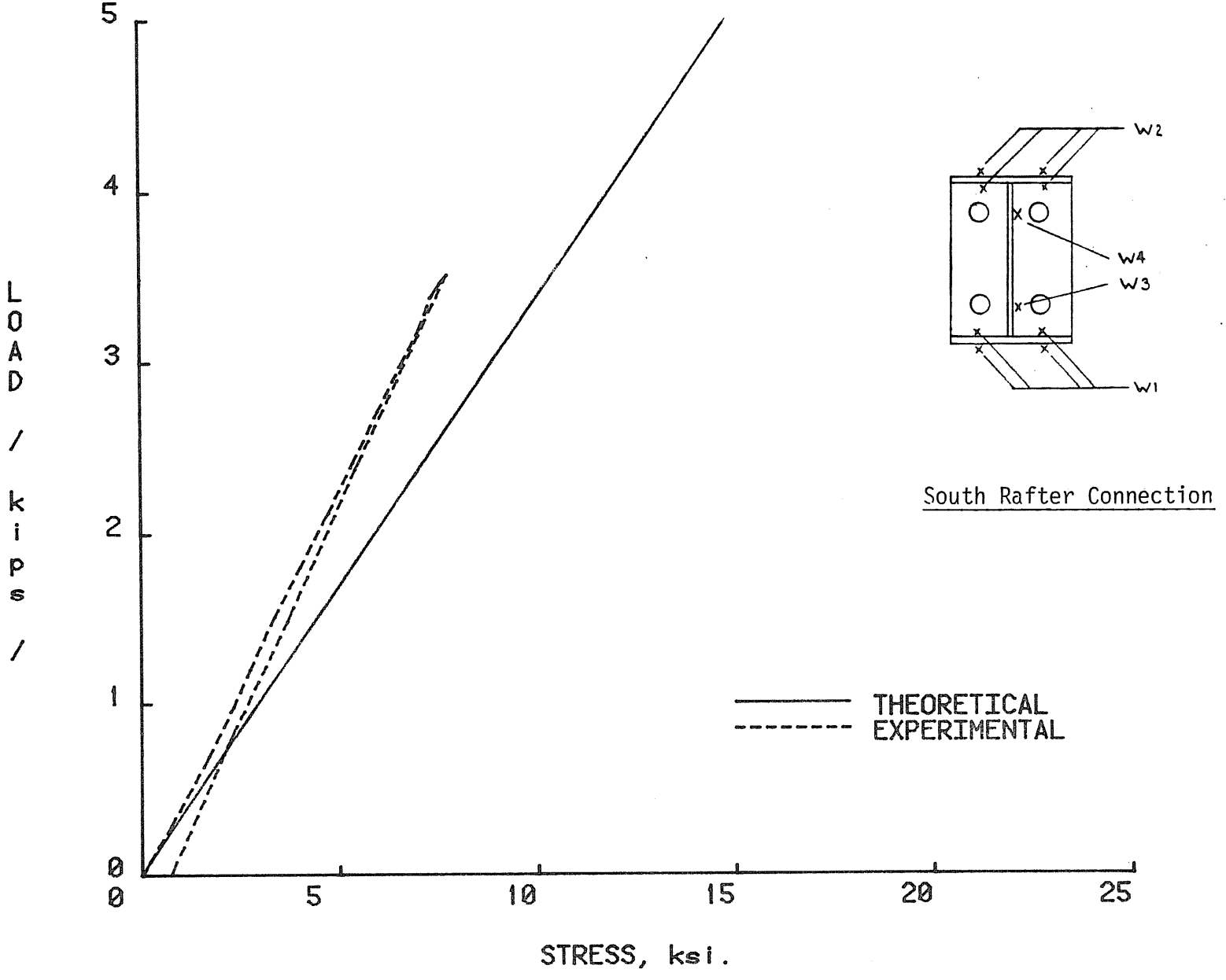


FIGURE D.7 LOAD VS STRESS AT LOCATION W2, WEST FRAME KNEE

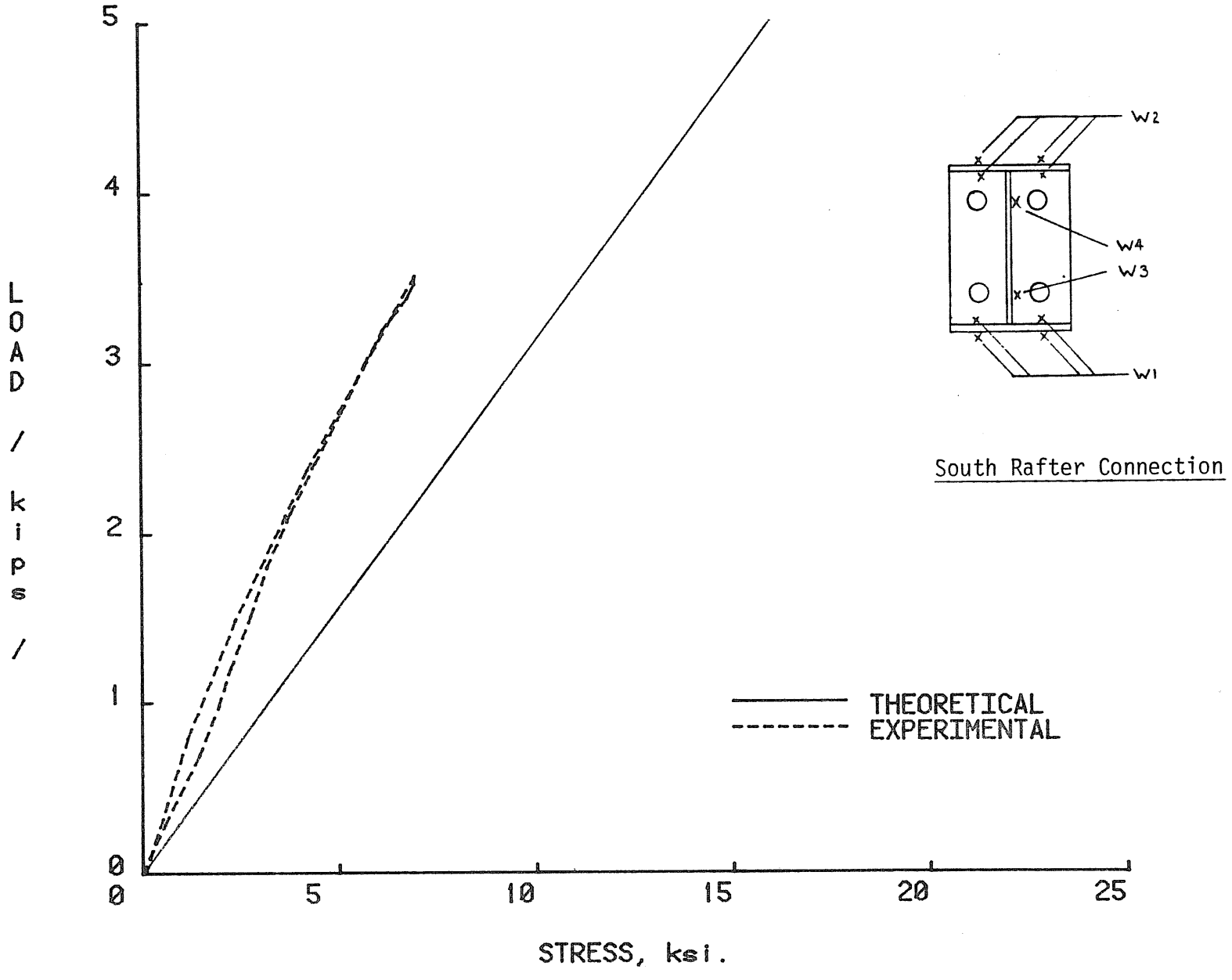


FIGURE D.8 LOAD VS STRESS AT LOCATION W1, WEST FRAME KNEE

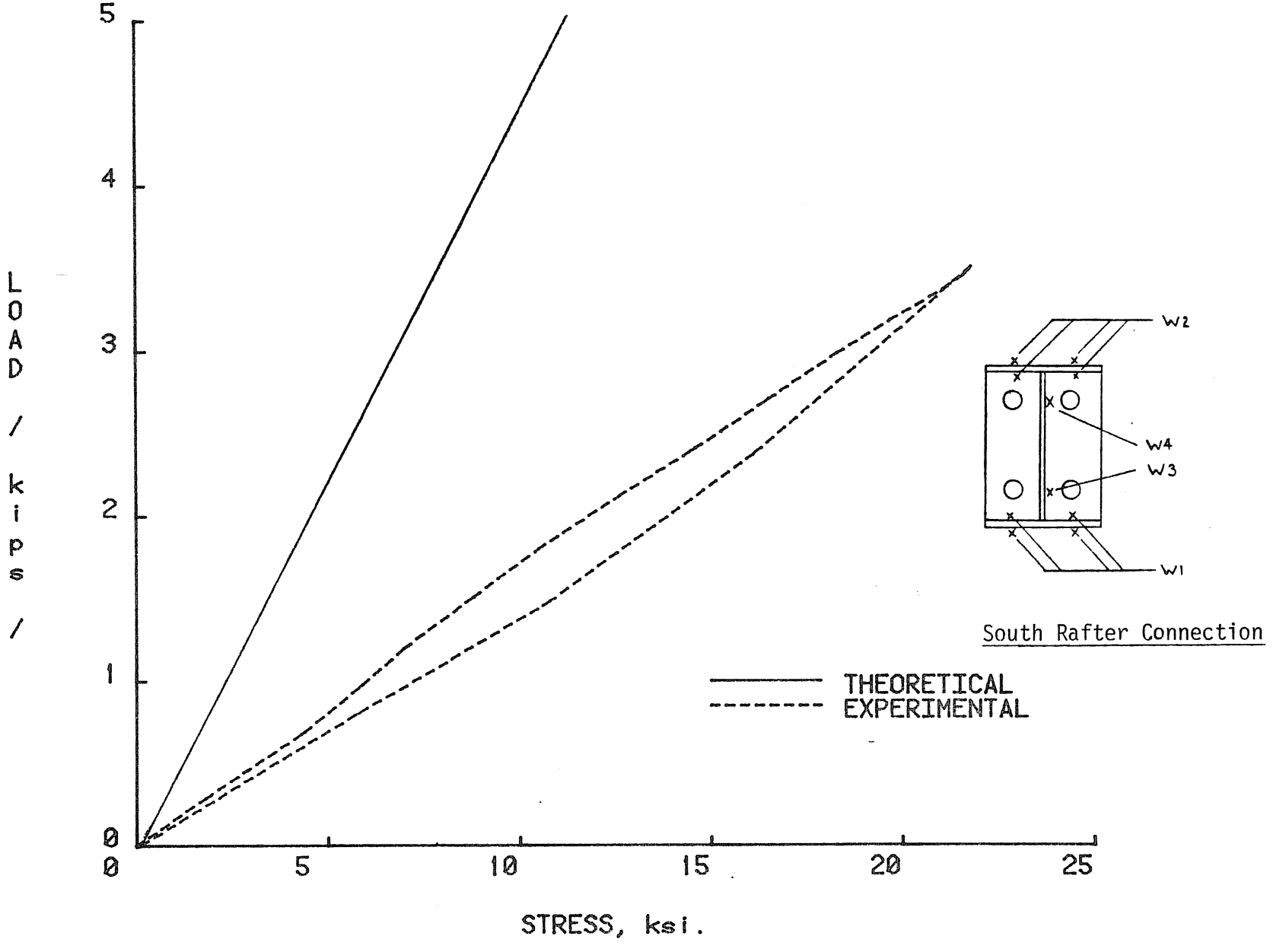


FIGURE D.9 LOAD VS STRESS AT LOCATION W3, WEST FRAME KNEE

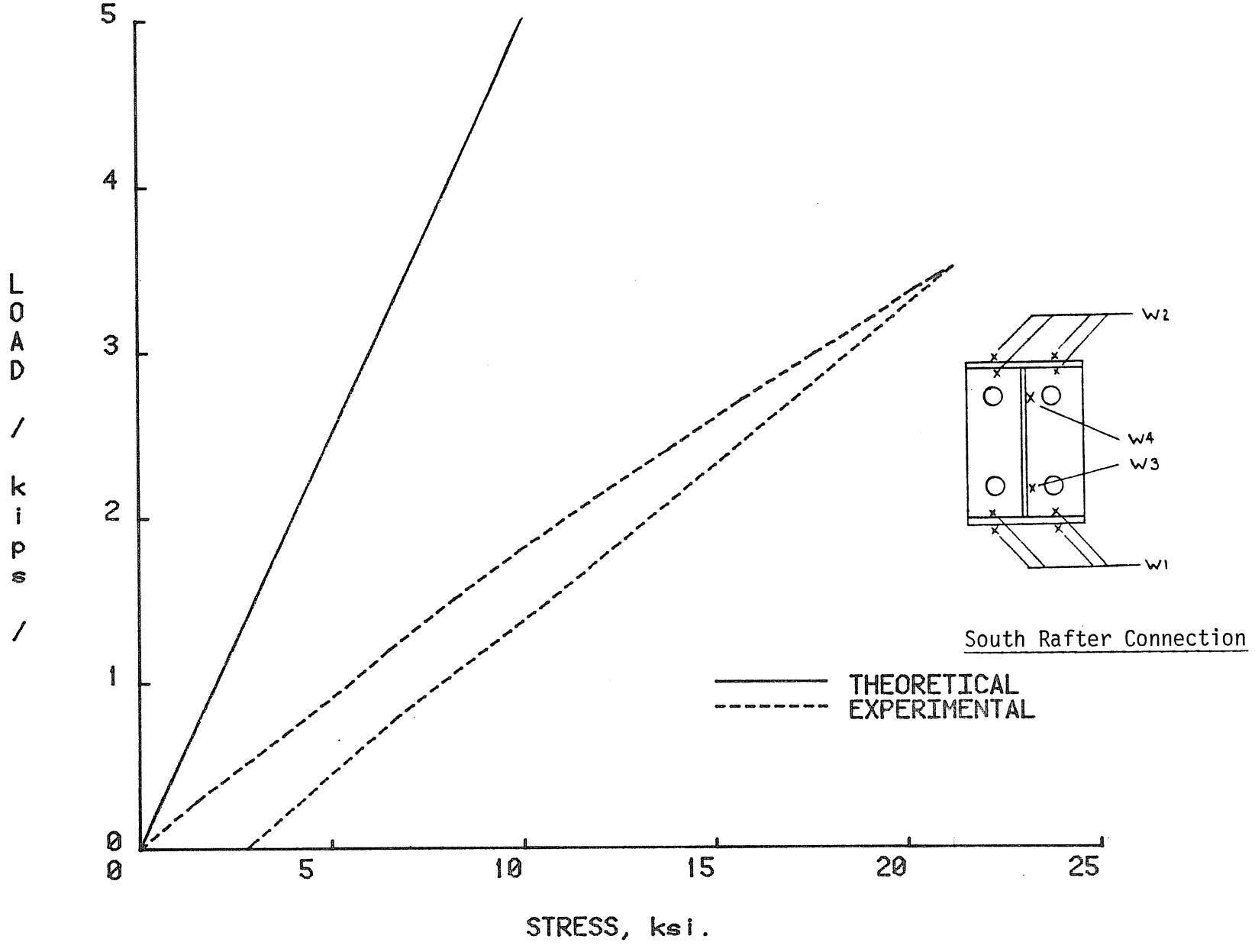


FIGURE D.10 LOAD VS STRESS AT LOCATION W4, WEST FRAME KNEE

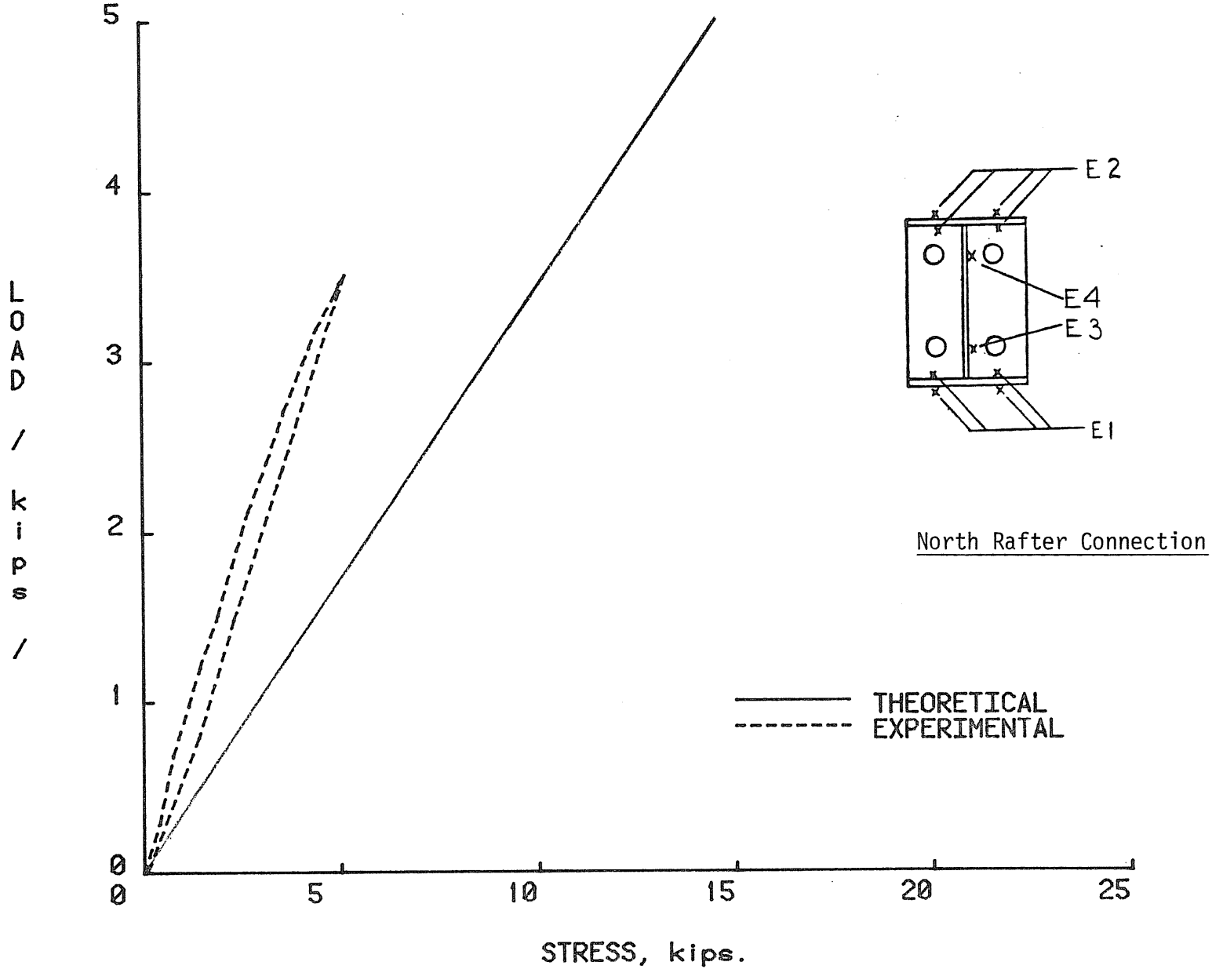


FIGURE D.11 LOAD VS STRESS AT LOCATION E2, EAST FRAME KNEE

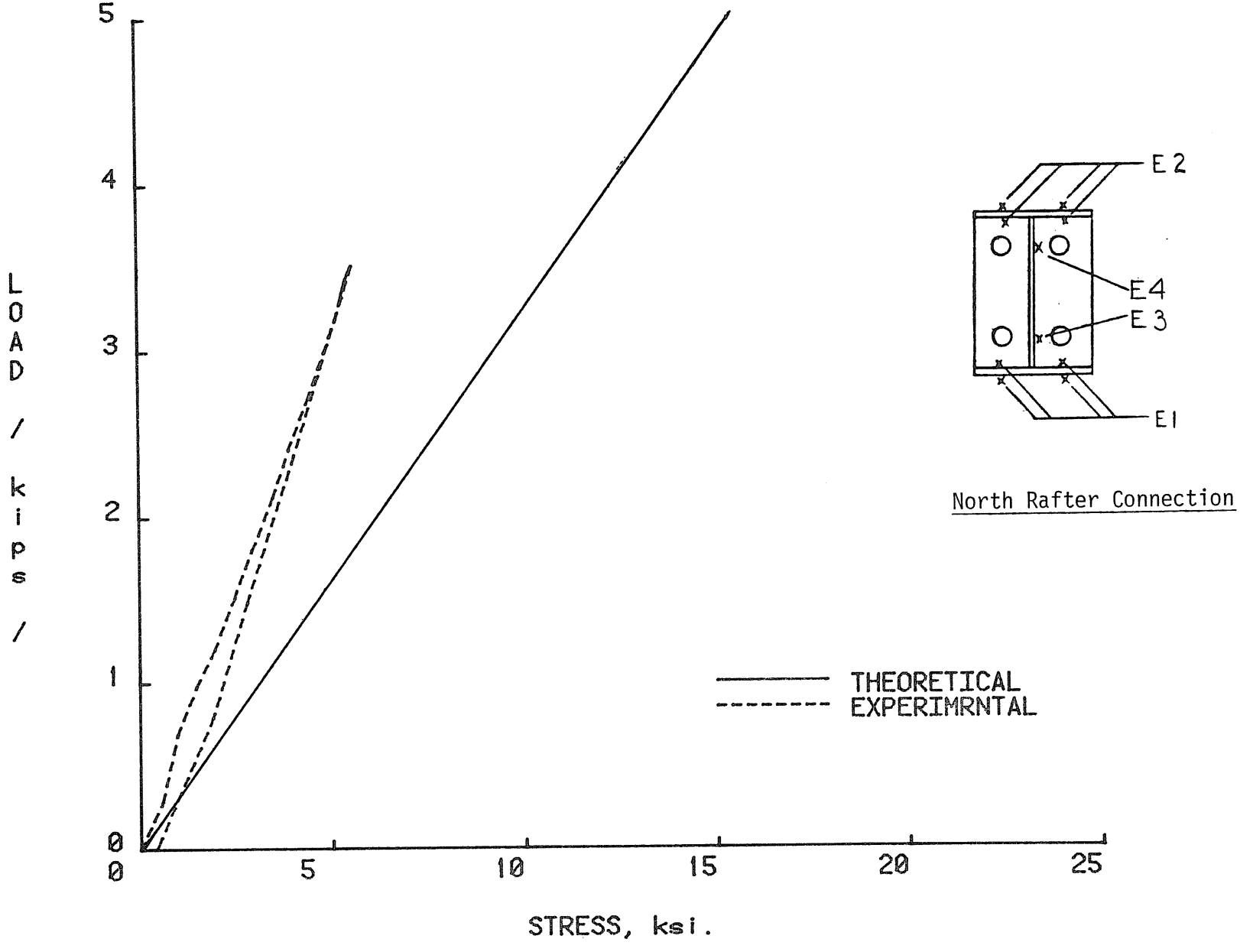


FIGURE D.12 LOAD VS STRESS AT LOCATION E1, EAST FRAME KNEE

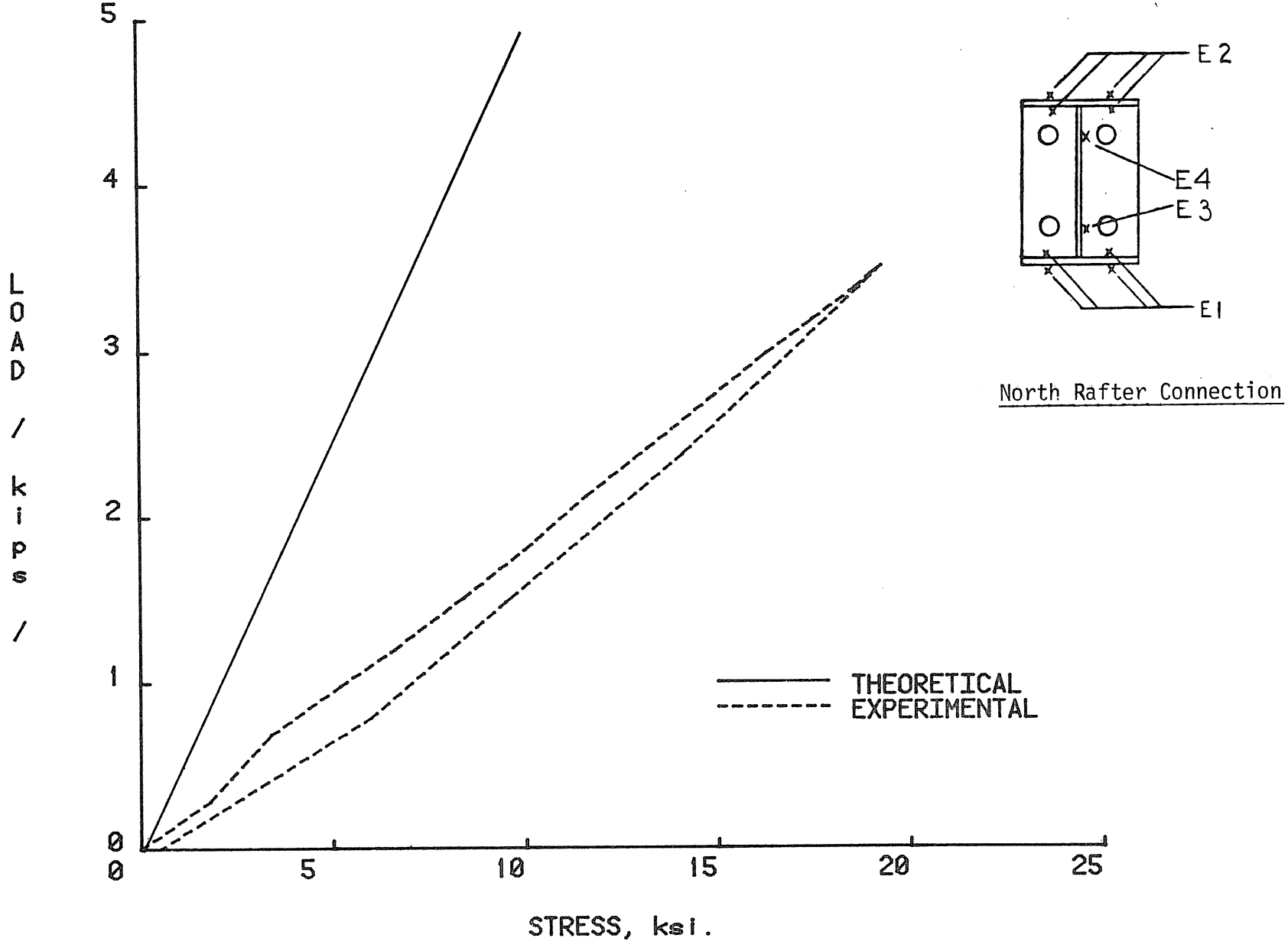


FIGURE D.13 LOAD VS STRESS AT LOCATION E4, EAST FRAME KNEE

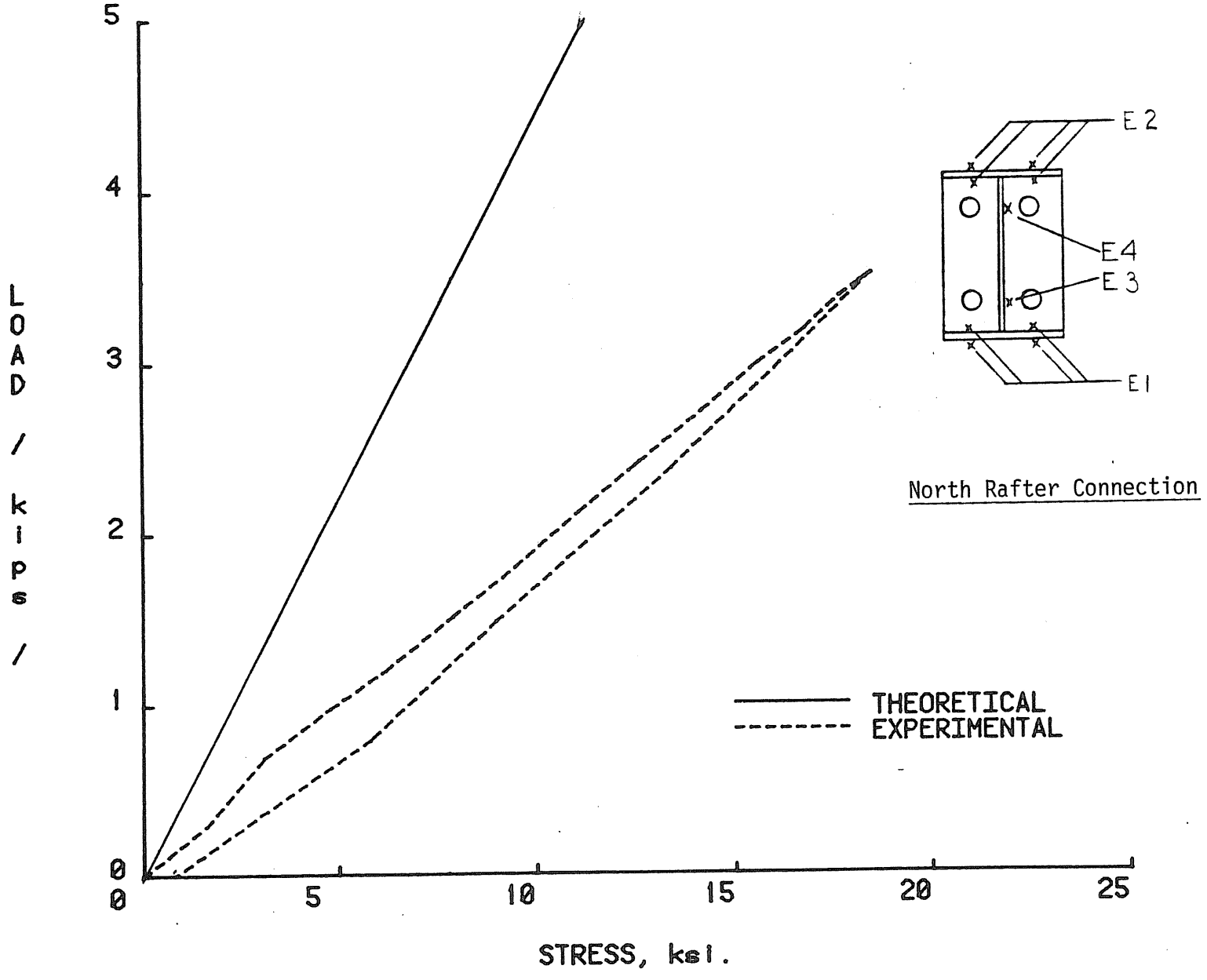


FIGURE D.14 LOAD VS STRESS AT LOCATION E3, EAST FRAME KNEE

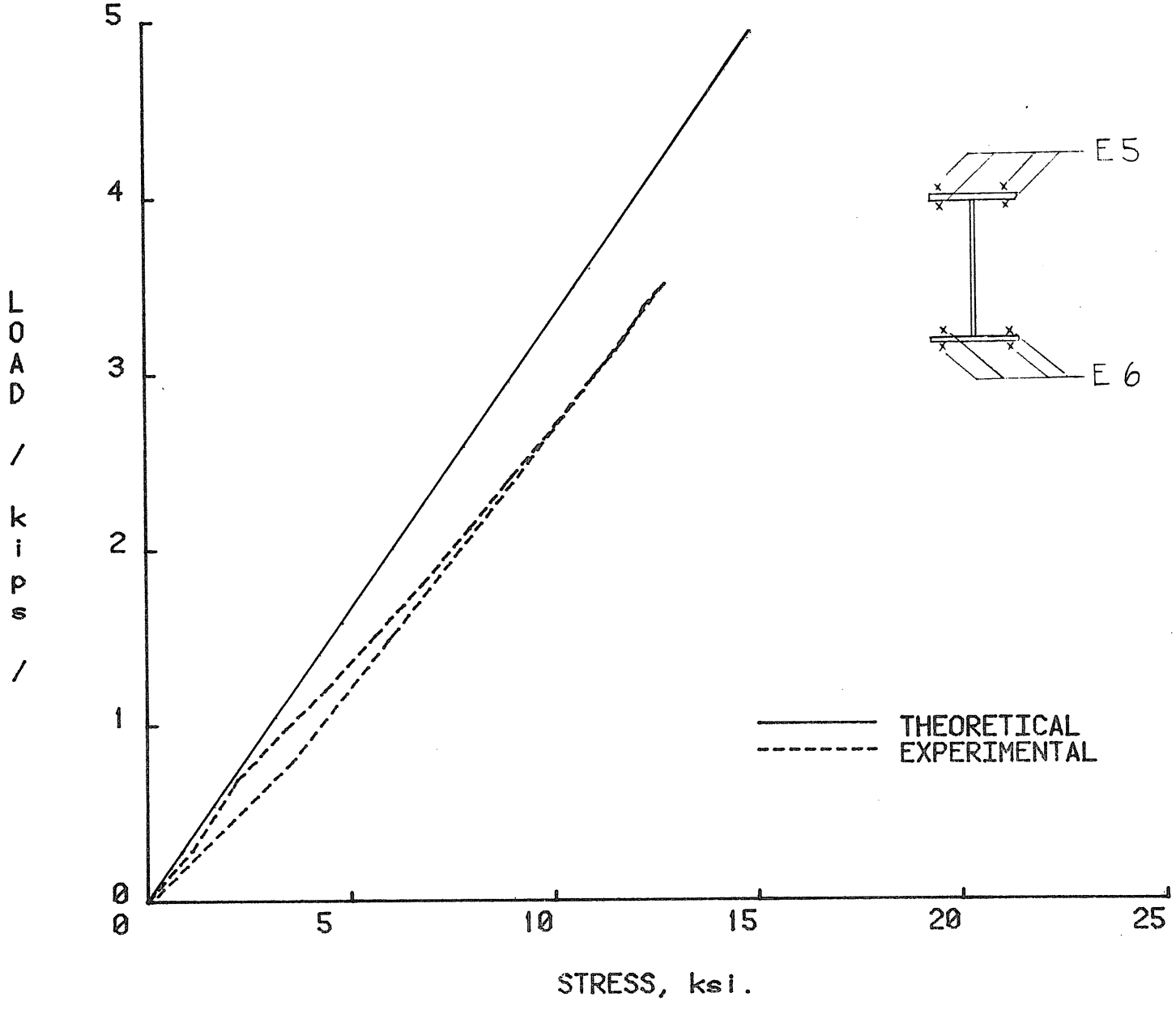


FIGURE D.15 LOAD VS STRESS AT LOCATION E6, EAST FRAME RIDGE

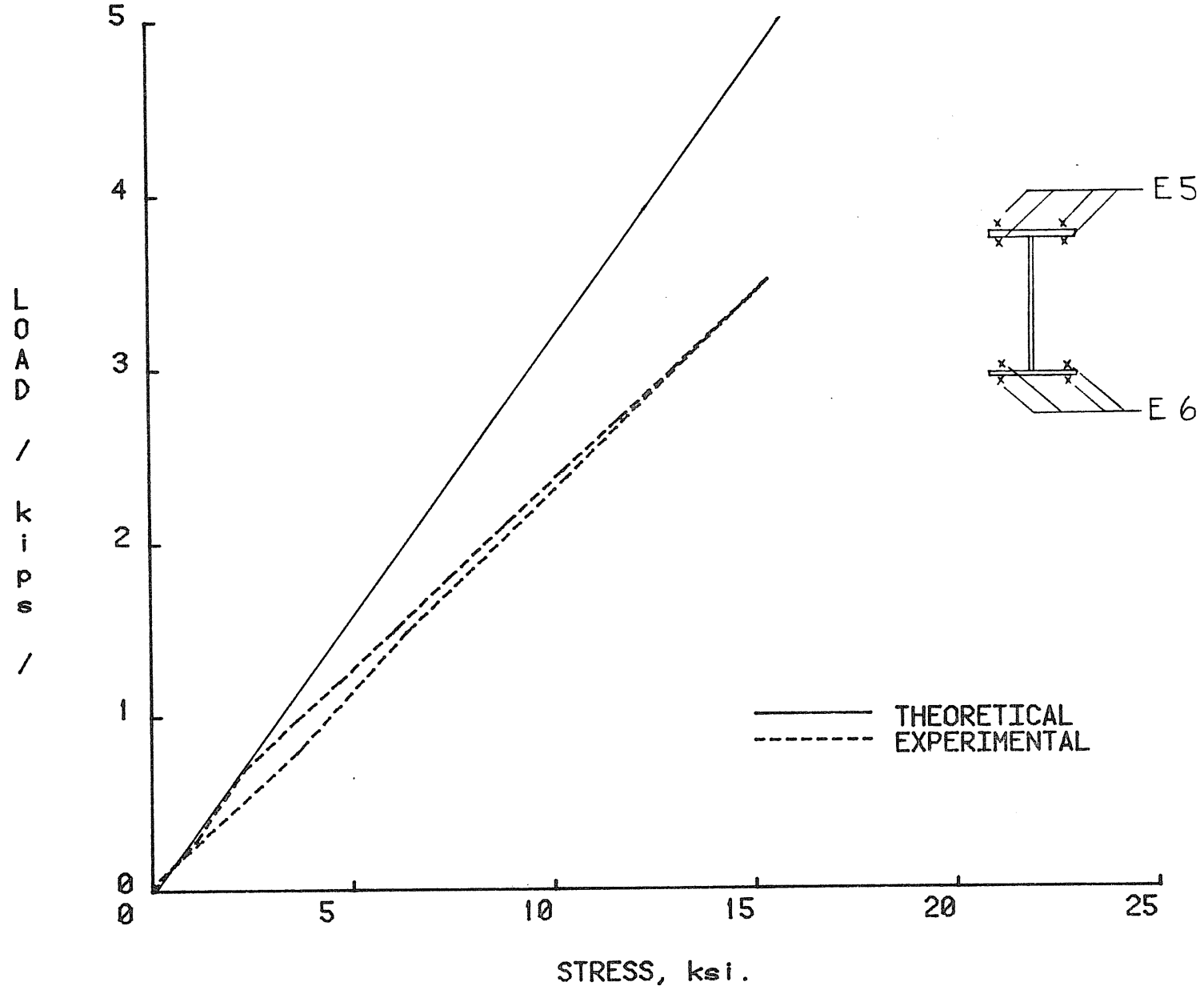


FIGURE D.16 LOAD VS STRESS AT LOCATION E5, EAST FRAME RIDGE

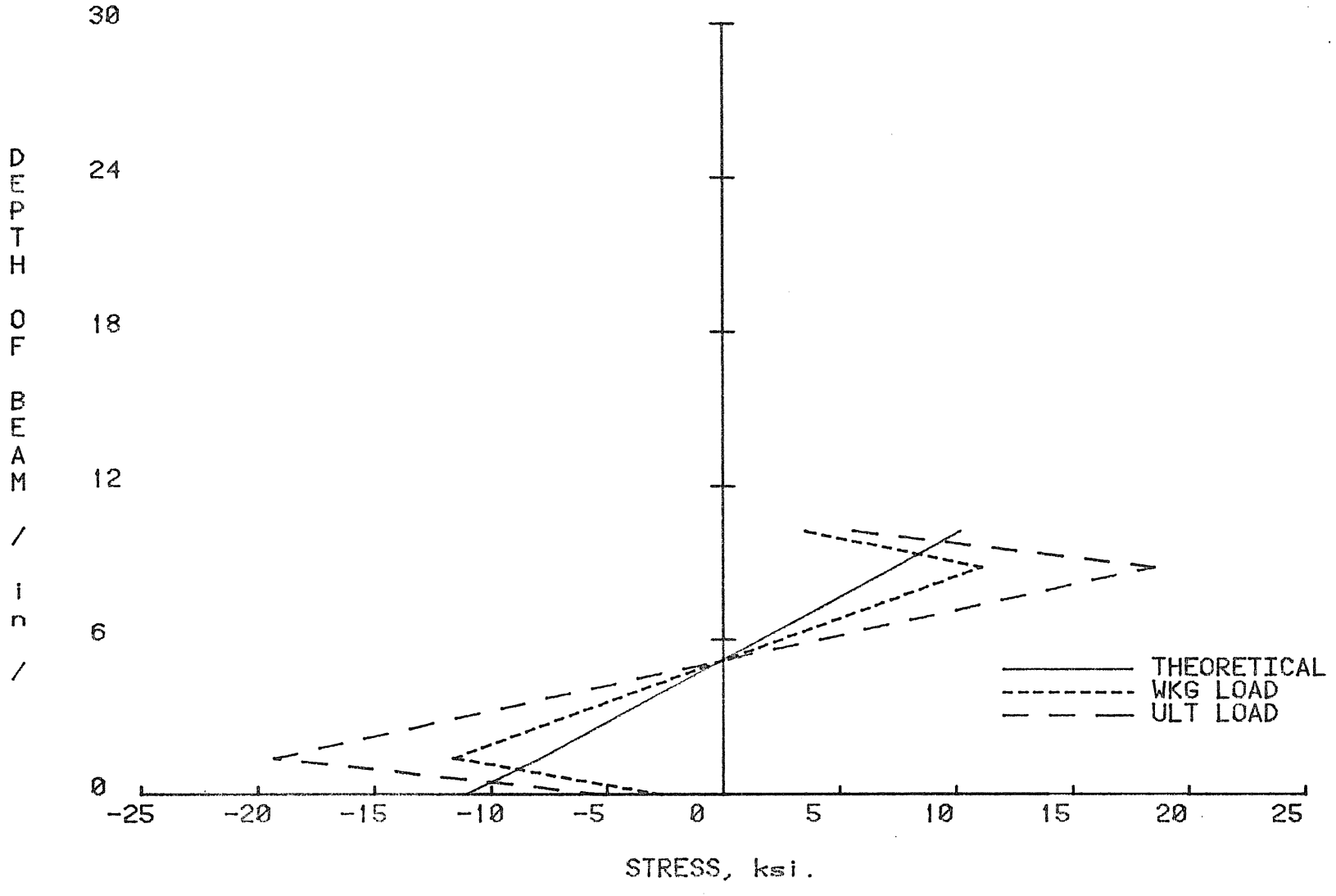


FIGURE D.17 DEPTH OF BEAM VS STRESS AT RAFTER END, EAST FRAME NORTH END

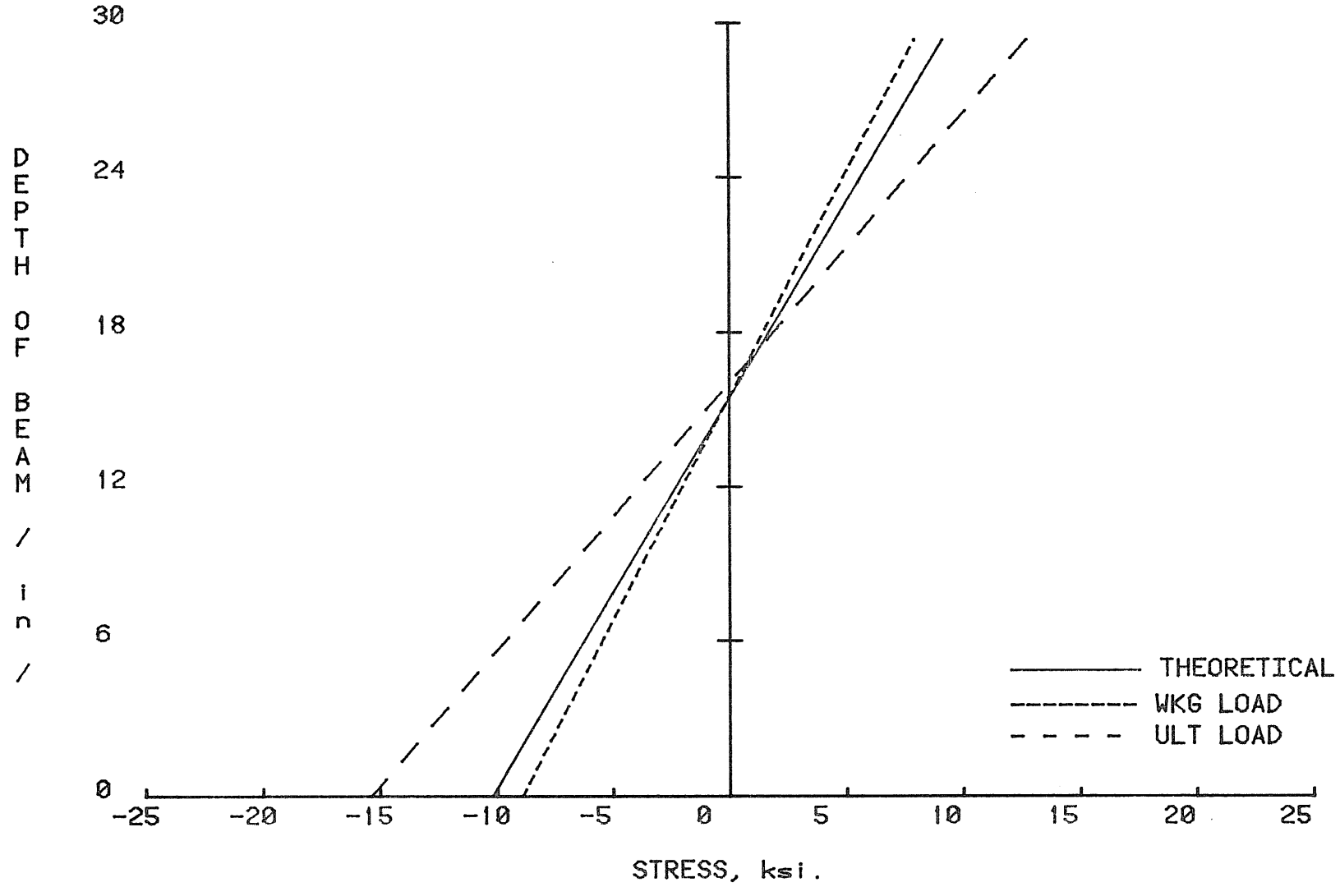


FIGURE D.18 DEPTH OF BEAM VS STRESS AT RAFTER MIDSPAN, EAST FRAME

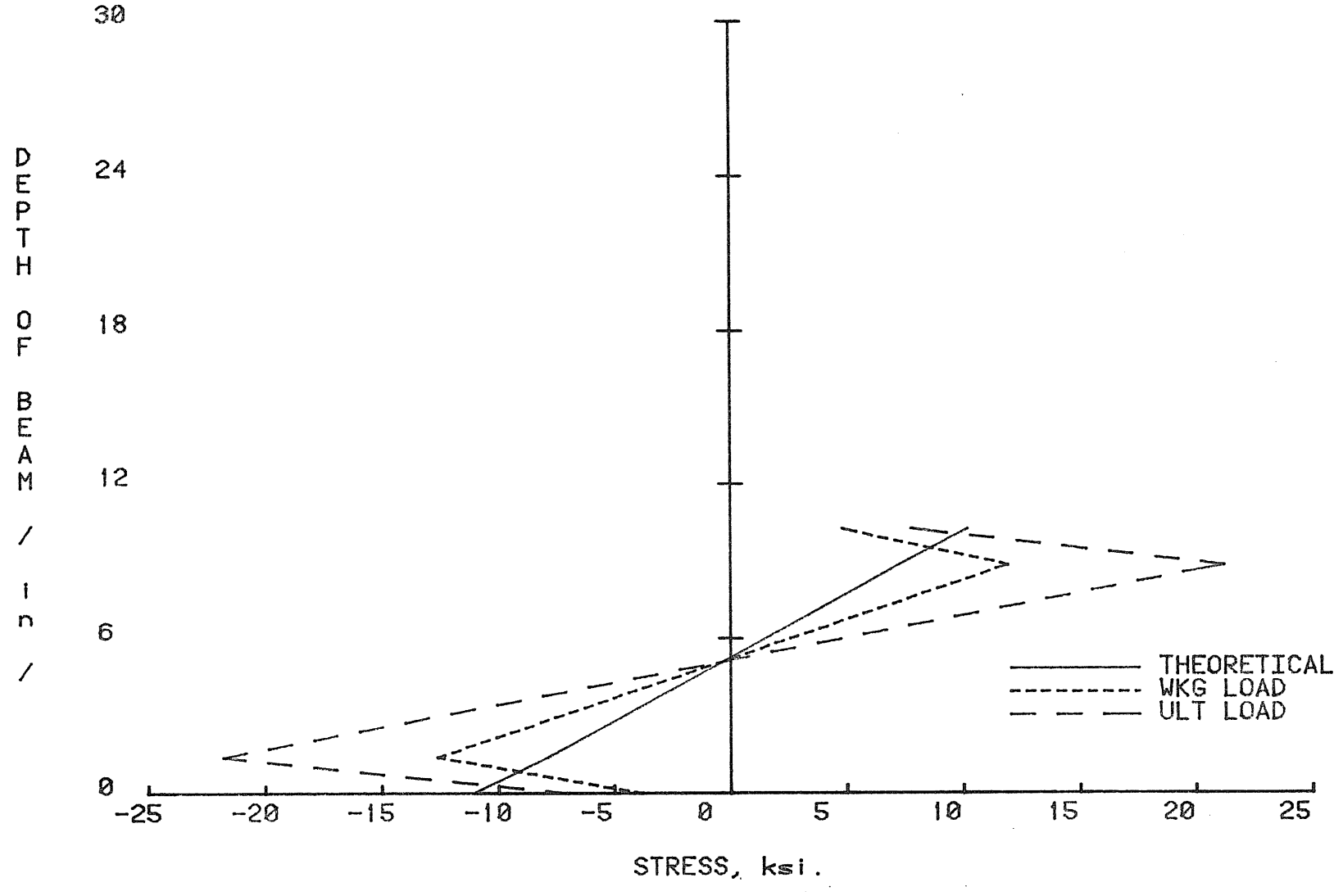


FIGURE D.19 DEPTH OF BEAM VS STRESS AT RAFTER END, WEST FRAME SOUTH END

APPENDIX E

WORKING LEVEL COMBINED WIND AND UNBALANCED LIVE LOAD

TEST 4

MESCO FRAME TEST SUMMARY

Project: Mesco Frame

Test No.: FR1: Test 4

Test Date: November 7, 1984

Purpose: Test of combined wind and unbalanced live load

Bolt Diameter: 3/4" **Pretension Force per Bolt:** 28^{k}

Maximum Test Load: Wind: 3.63 kips live: 2.01

Discussion:

- Strain gage and deflection data indicate that the frame's behavior remained elastic throughout the loading sequence.

- The centerline deflections of the west frame corresponded closely to the theoretical during the gravity loading sequence while the east frame exhibited slightly greater stiffness.

- During the lateral loading sequence the west frame deflected slightly at the centerline contrary to the prediction. The centerline deflections of the west frame were negligable as anticipated.

- In general, the theoretical prediction for the lateral load case predicted the frames behavior well while the unbalanced gravity load prediction differed slightly.

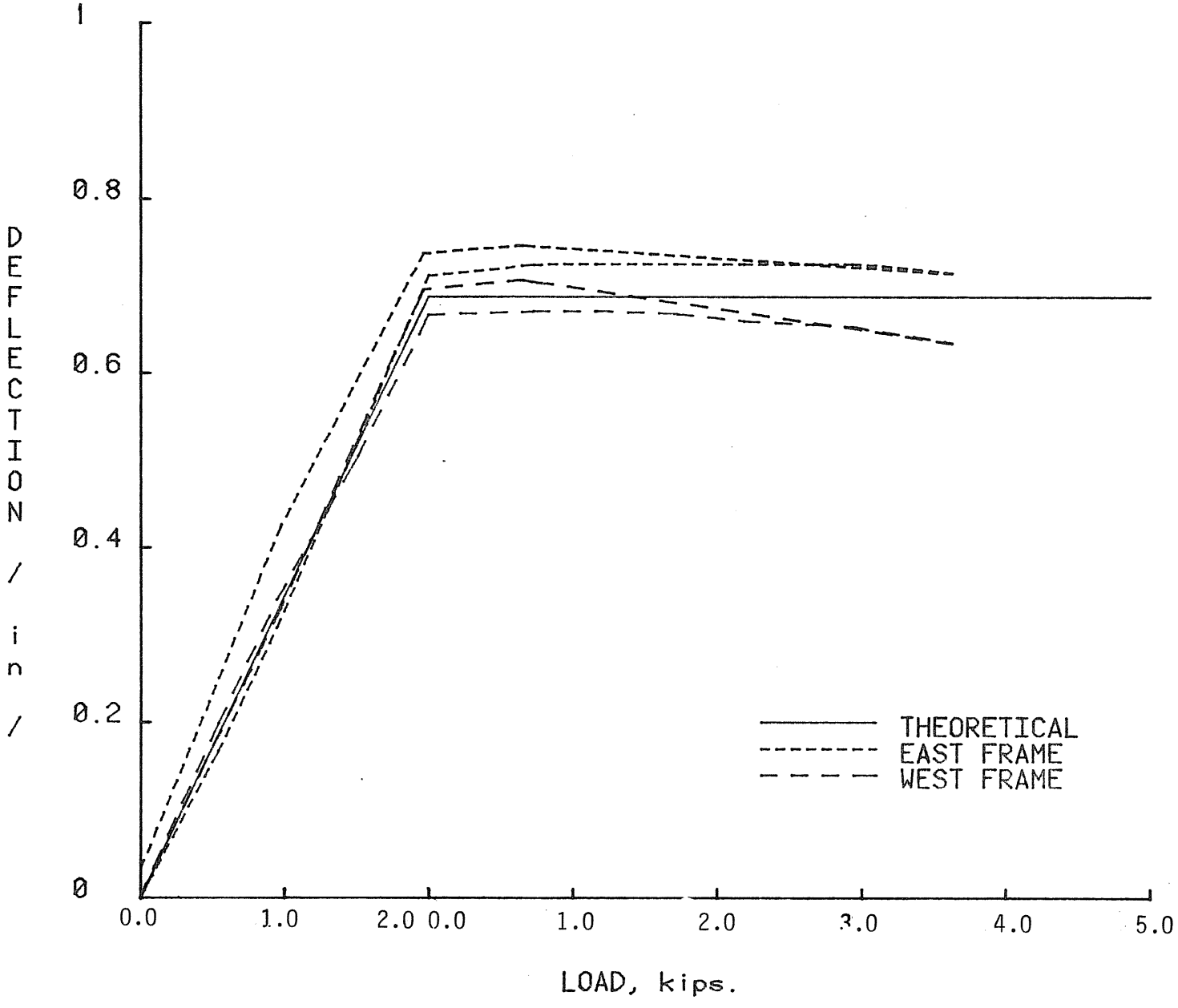


FIGURE E.1 LOAD VS CENTERLINE DEFLECTION

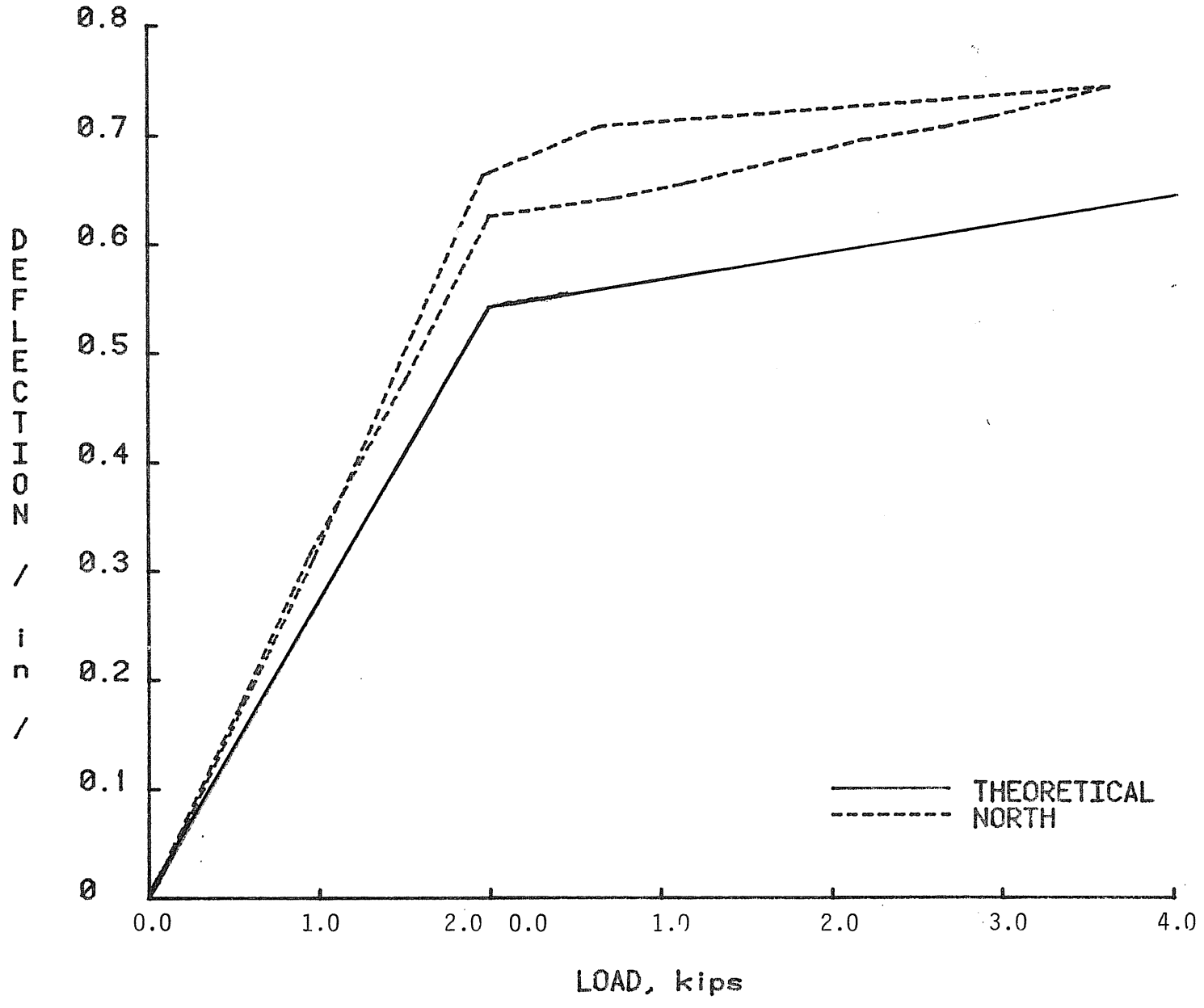


FIGURE E.2 LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

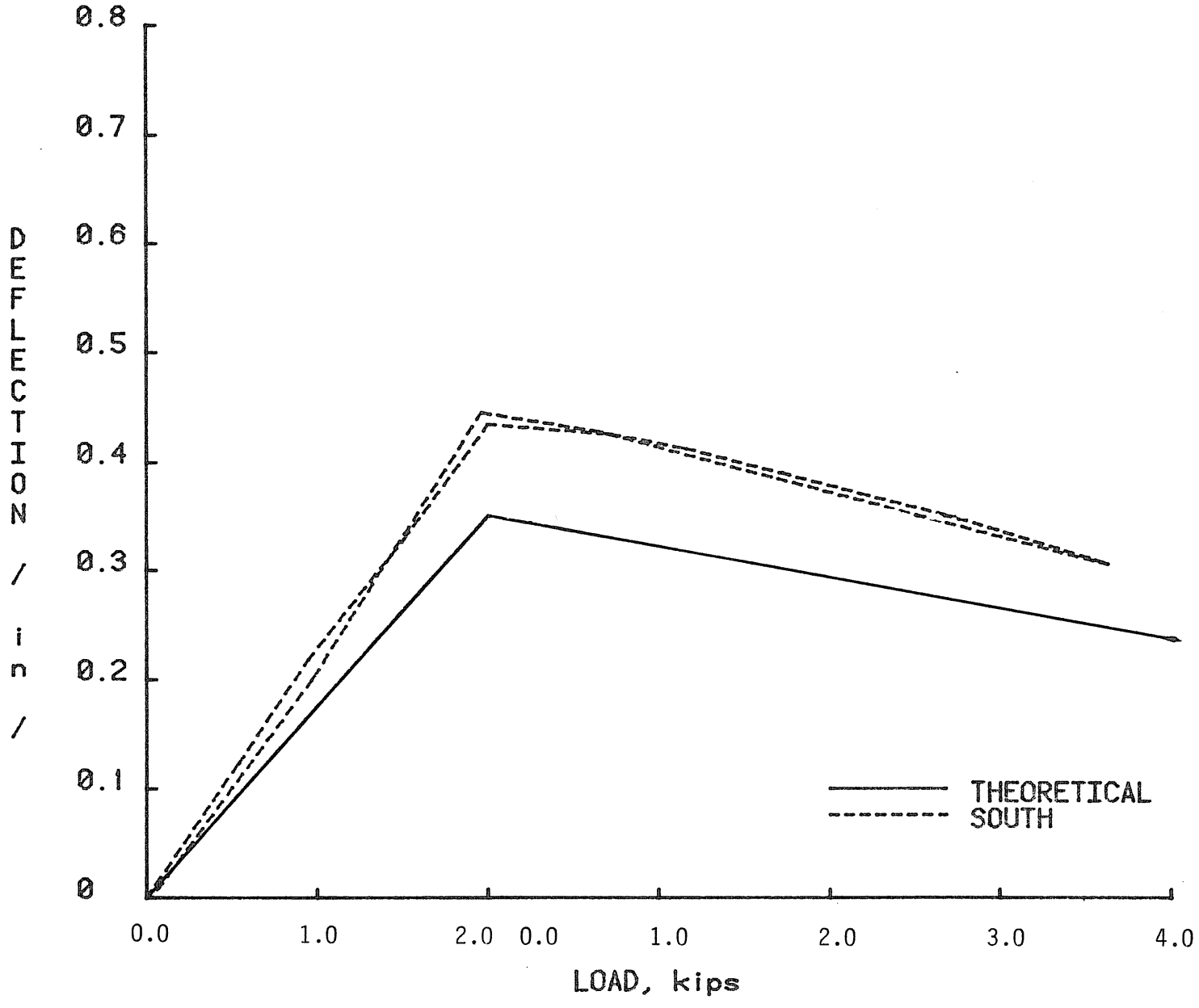


FIGURE E.3 LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

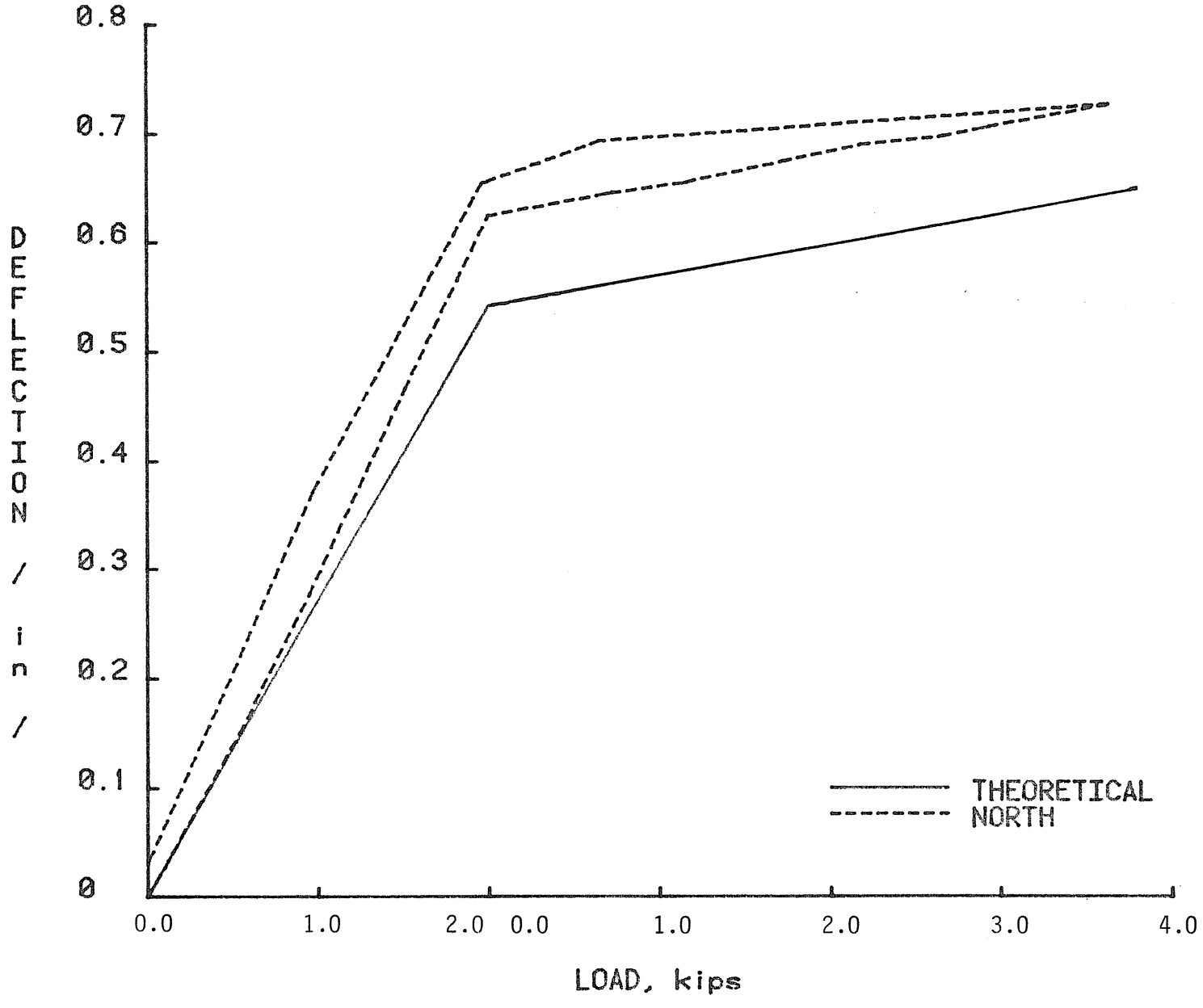


FIGURE E.4 LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

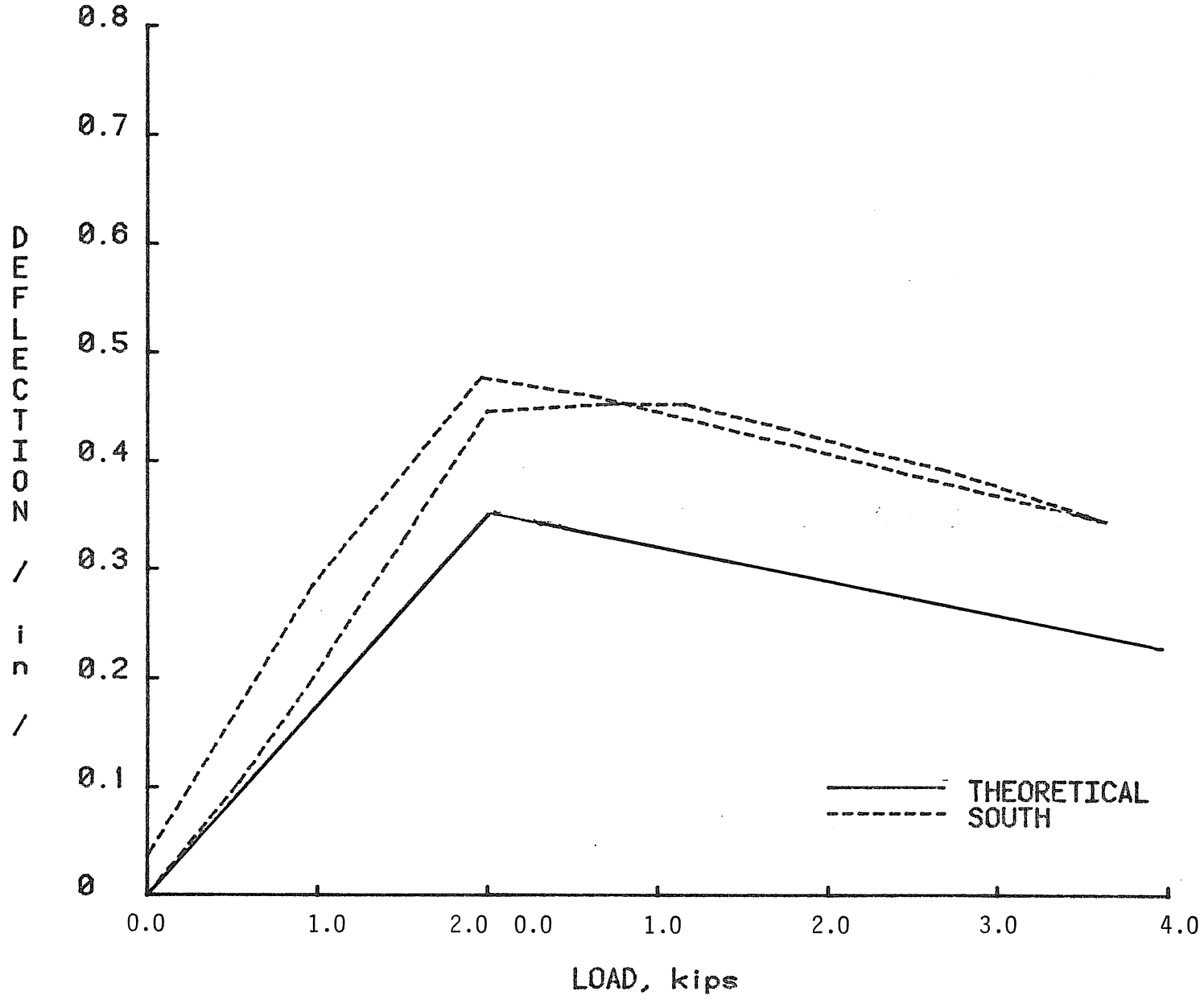


FIGURE E.5 LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

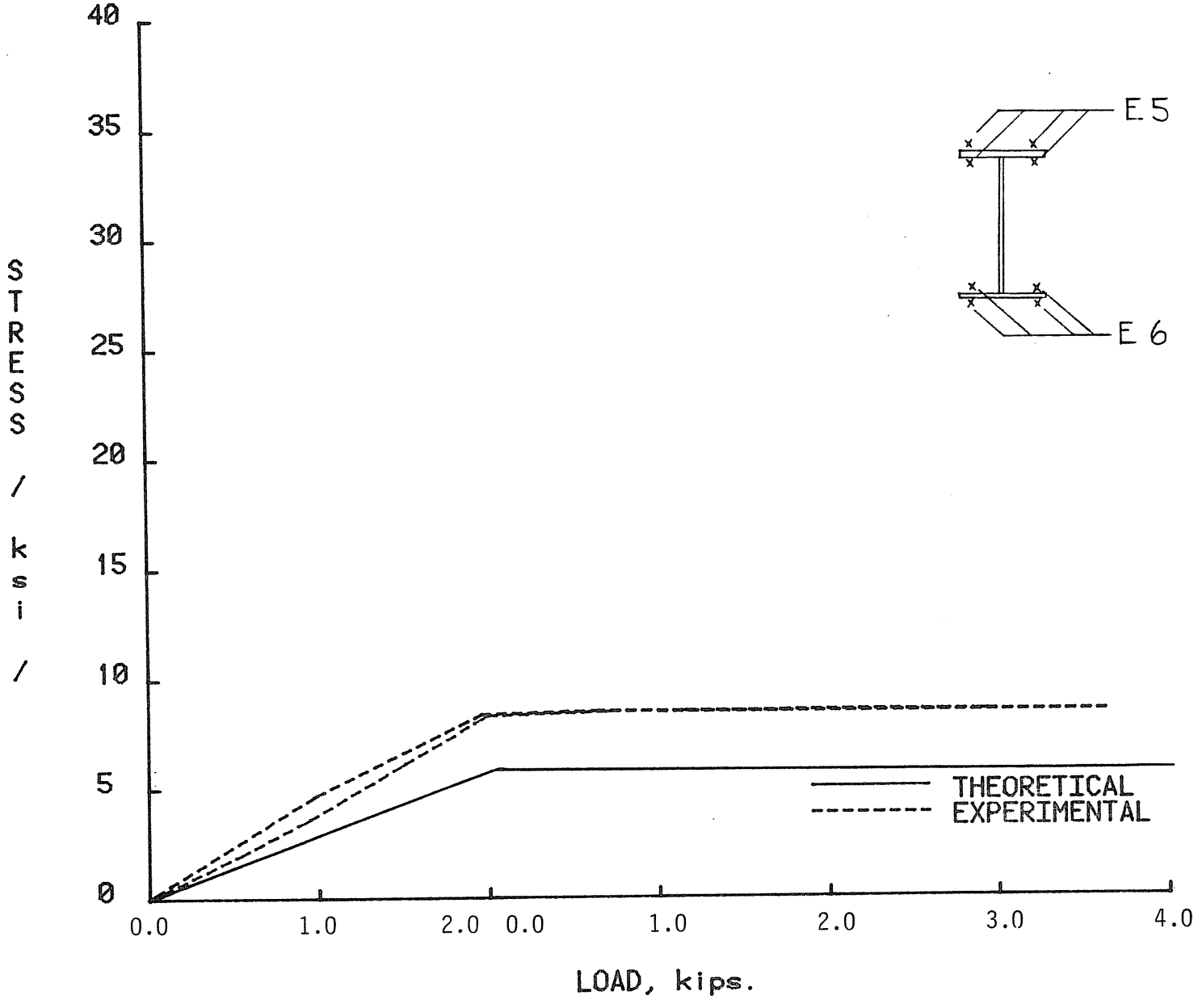


FIGURE E.6 STRESS VS LOAD AT LOCATION E5, EAST FRAME RIDGE

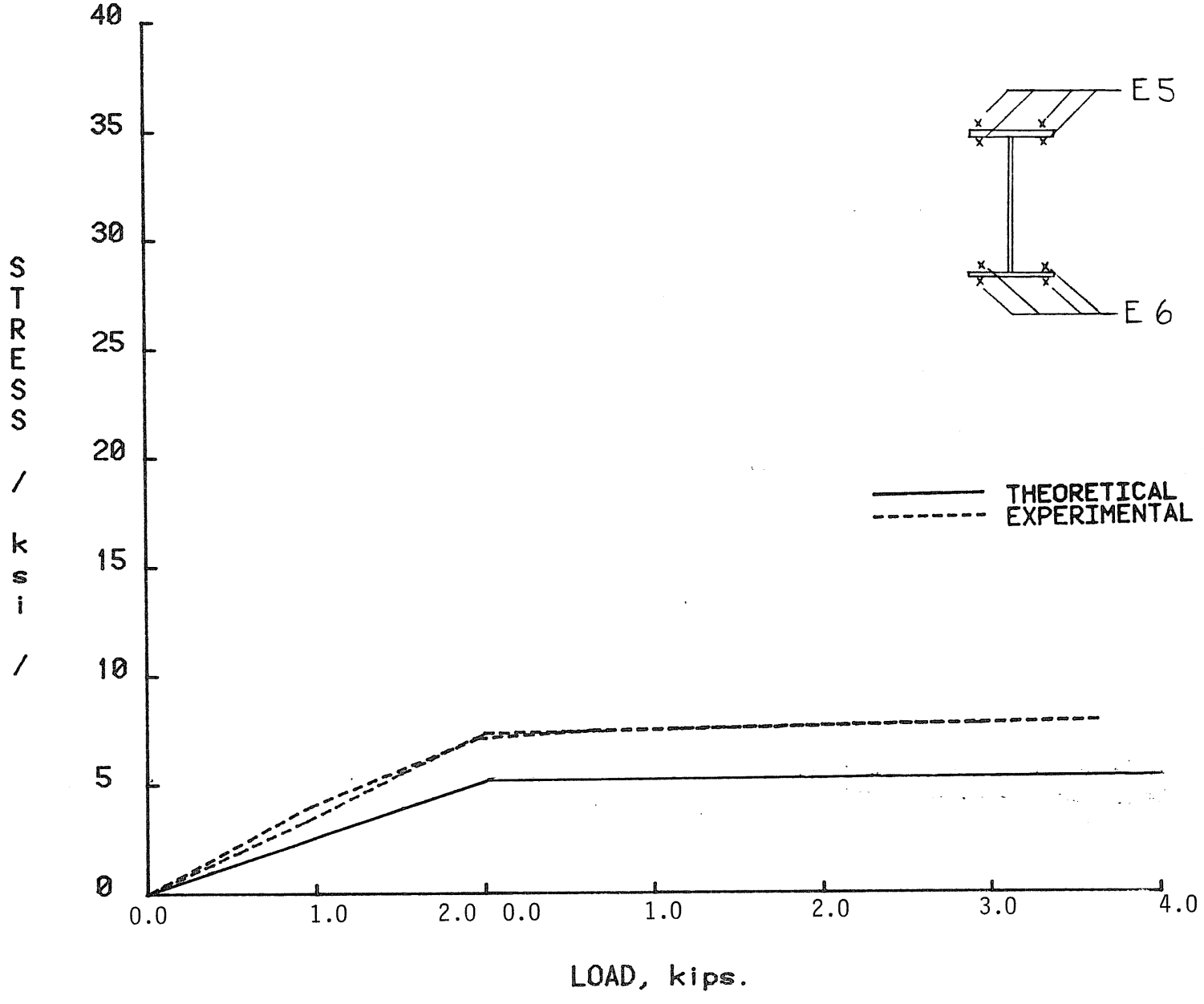


FIGURE E.7 STRESS VS LOAD AT LOCATION E6, EAST FRAME RIDGE

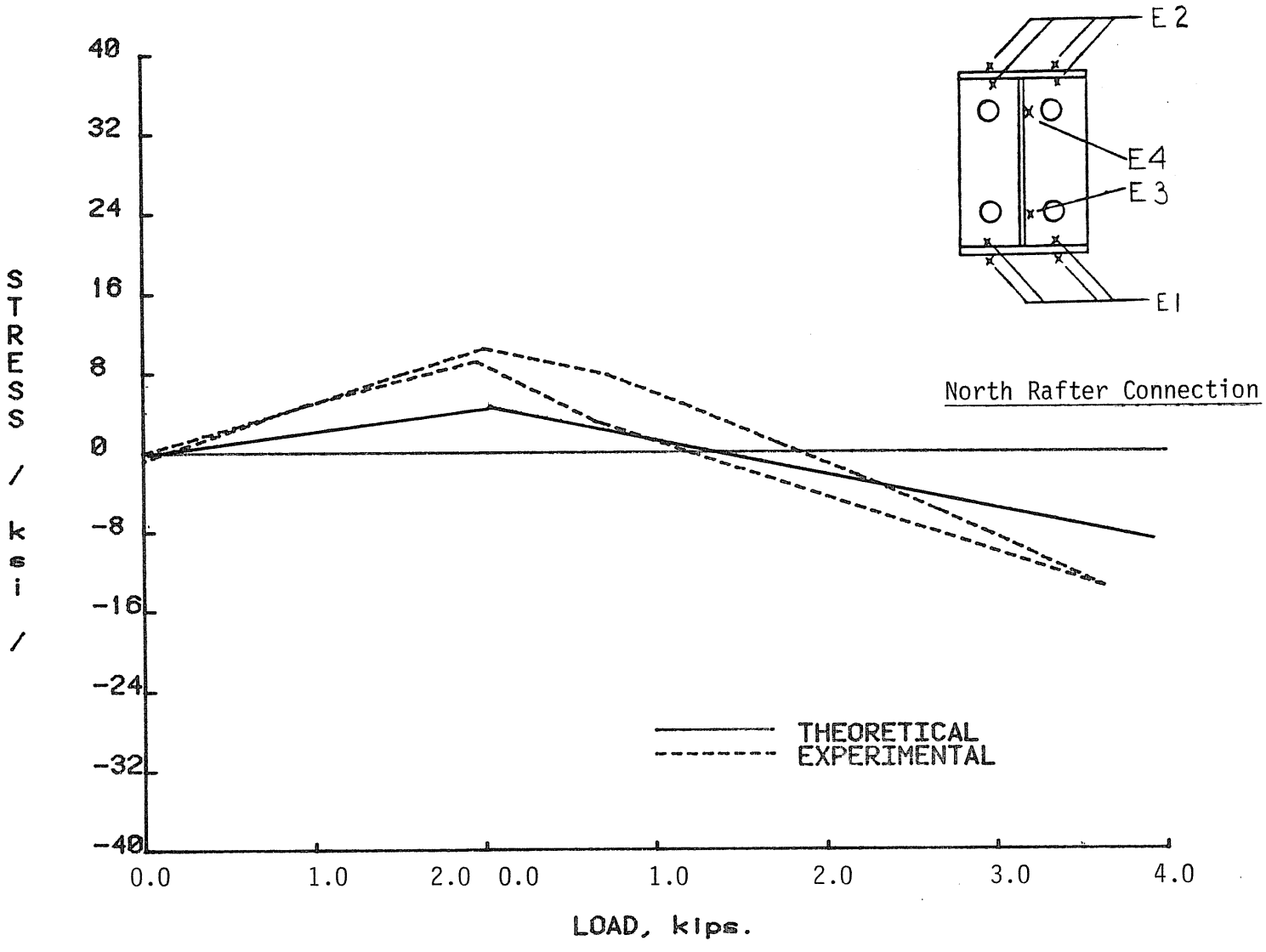


FIGURE E.8 STRESS VS LOAD AT LOCATION E4, EAST FRAME KNEE

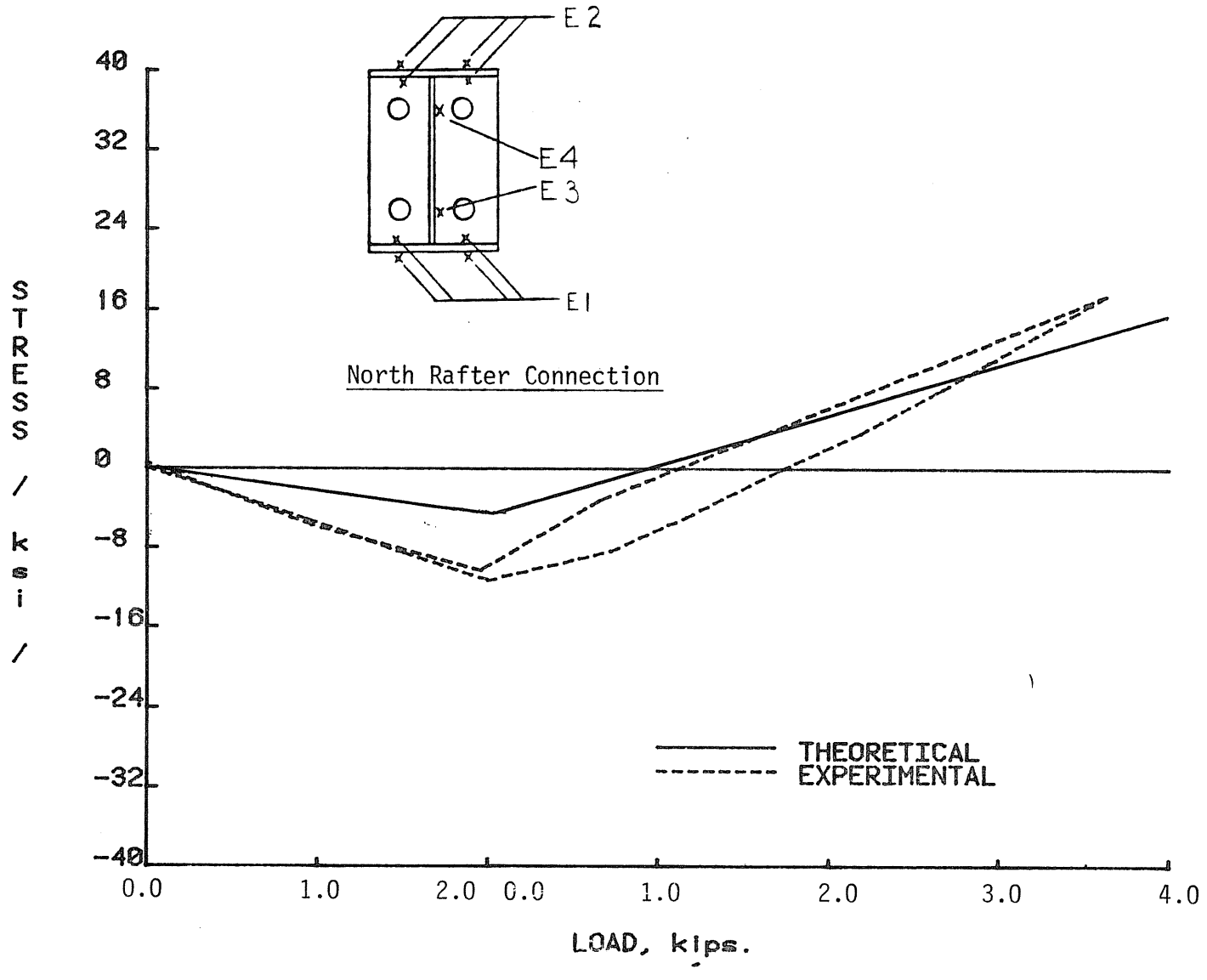


FIGURE E.9 STRESS VS LOAD AT LOCATION E3, EAST FRAME KNEE

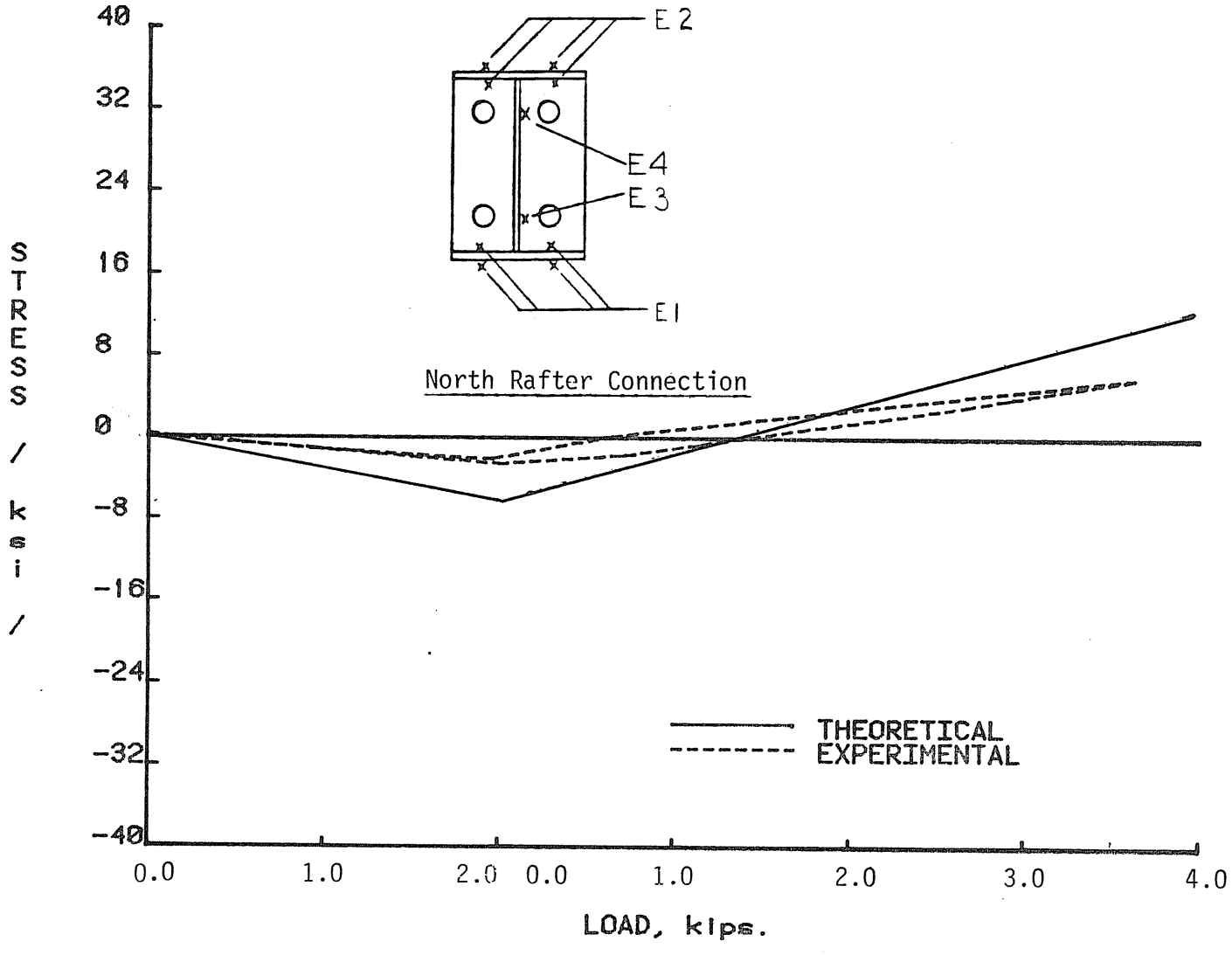


FIGURE E.10 STRESS VS LOAD AT LOCATION E1, EAST FRAME KNEE

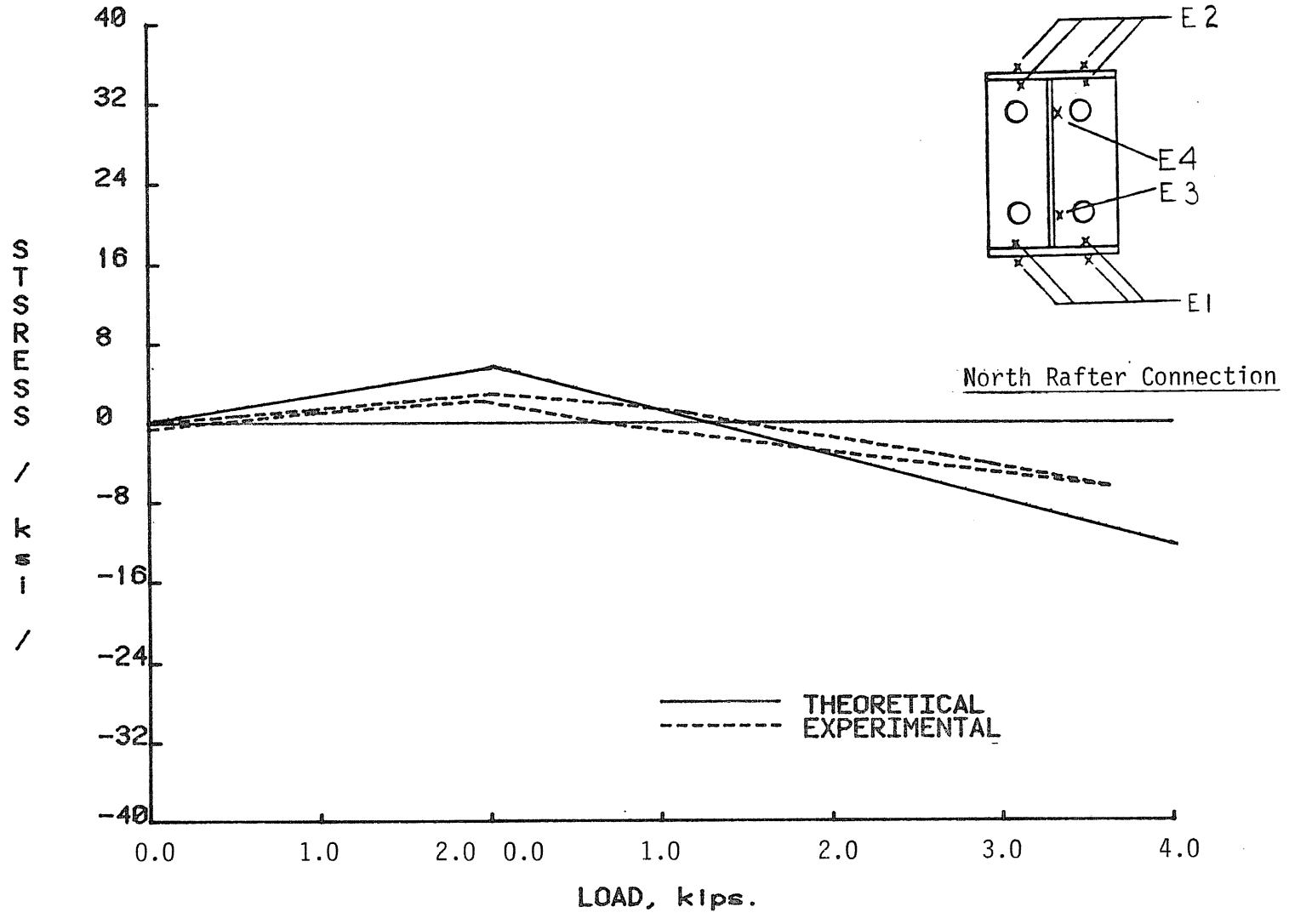


FIGURE E.11 STRESS VS LOAD AT LOCATION E2, EAST FRAME KNEE

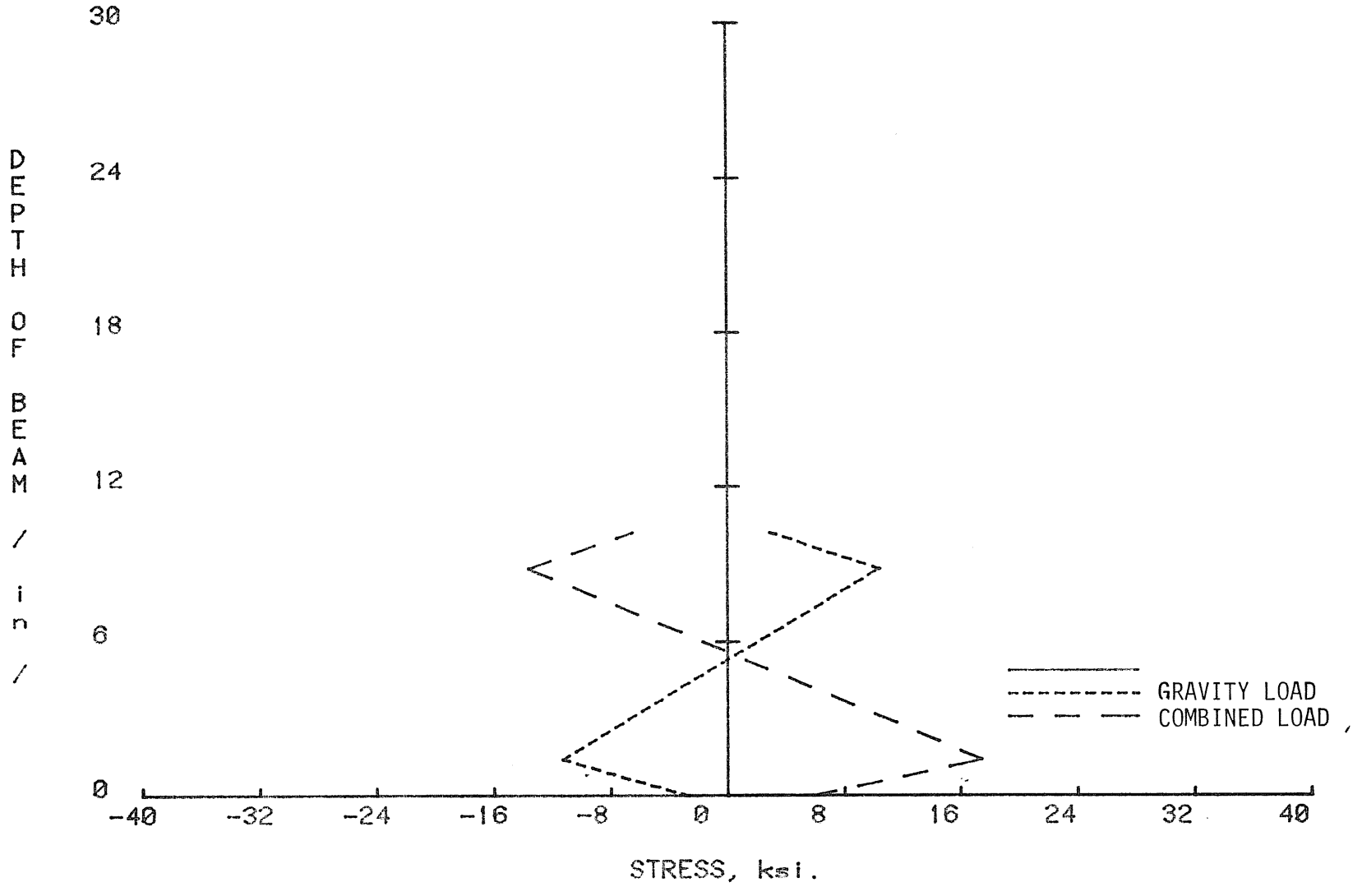


FIGURE E.12 DEPTH OF BEAM VS STRESS AT RAFTER END, EAST FRAME NORTH END

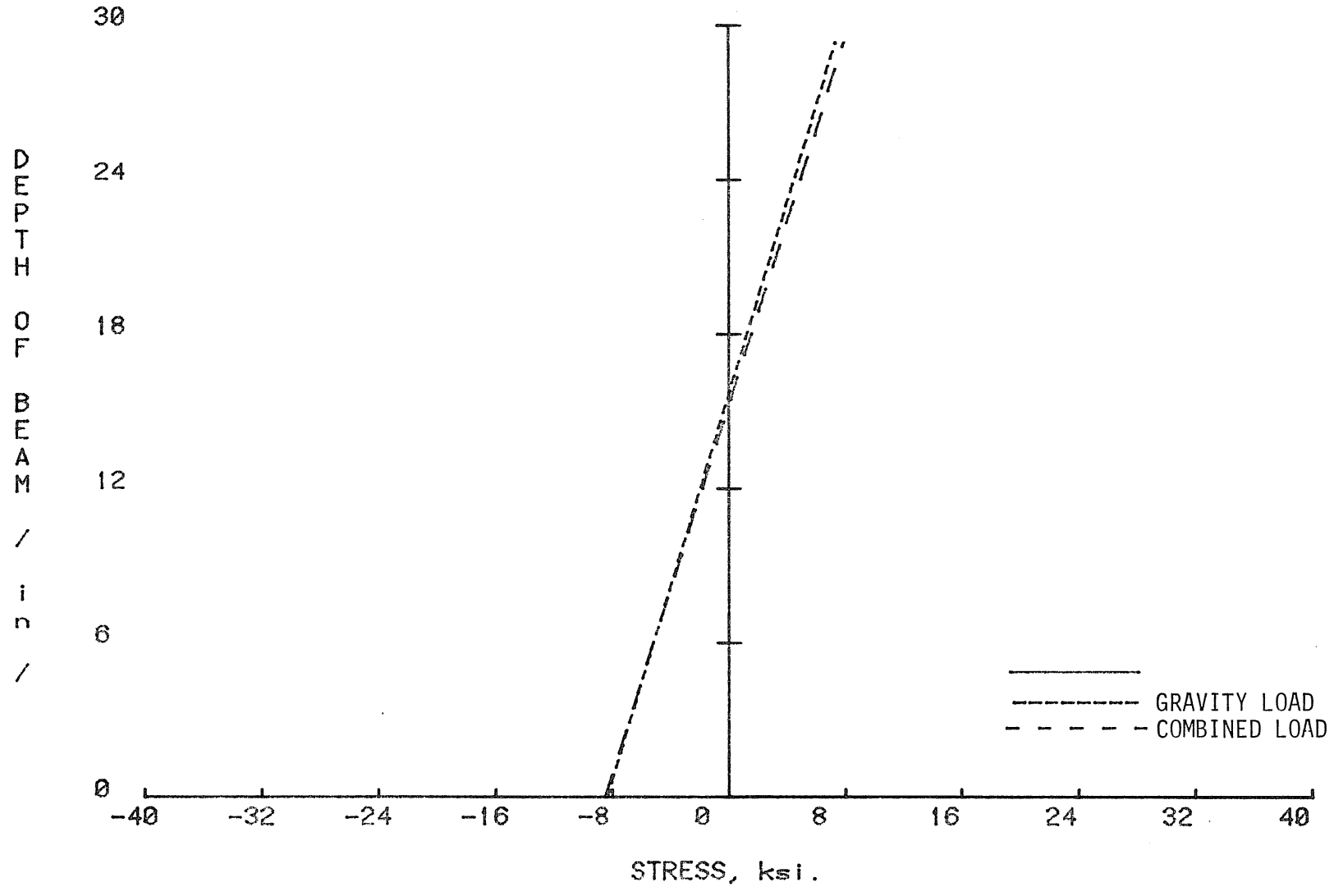


FIGURE E.13 DEPTH OF BEAM VS STRESS AT RAFTER MIDSPAN, EAST FRAME

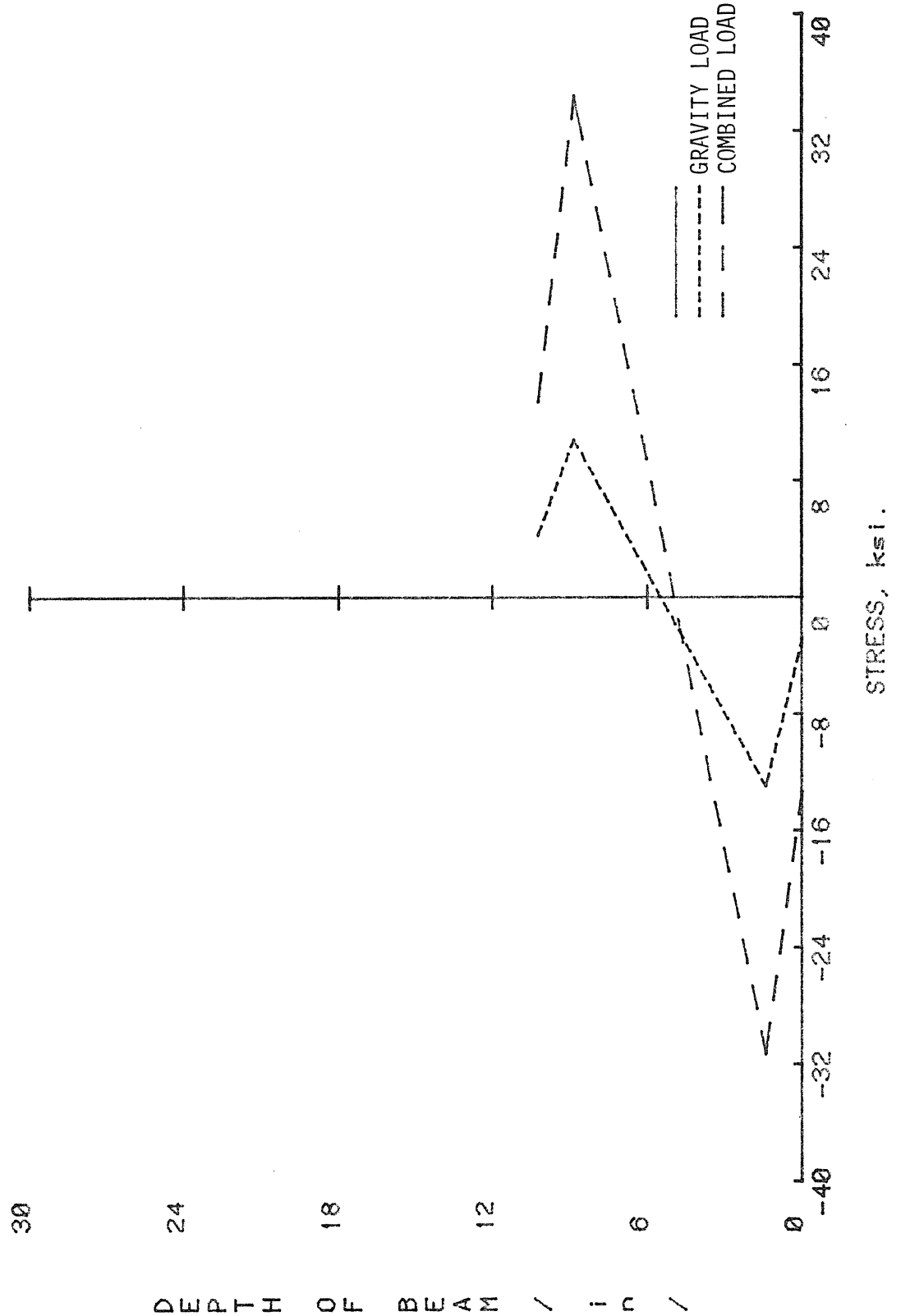


FIGURE E.14 DEPTH OF BEAM VS STRESS AT RAFTER END, WEST FRAME SOUTH END

APPENDIX F

FULL LIVE LOAD FAILURE OF EAST FRAME

TEST 5

MESCO FRAME TEST SUMMARY

Project: Mesco Frame

Test No.: Frl: Test 5

Test Date: November 15, 1984

Purpose: Test of full live loading on east frame until failure.

Bolt Diameter: 3/4" **Pretension Force per Bolt:** 28k

Maximum Test Load: 3.97k

Discussion:

- All of the data prior to a test load of approximately two kips varies linearly with load.
- Centerline and quarter point deflection slightly exceed the prediction prior to two kips.
- At 2.4 kips a buckled shape was observed along the rafter web. The vertical stiffness of the frame began to degrade at this load. In addition, flange stresses at the centerline began to increase at a greater rate.
- At 3.0 kips flaking of the whitewash indicating yielding was observed on the compression flanges of the columns near the column web splice and adjacent to the connection.
- At 3.6 kip flaking of the whitewash on the rafter web was observed. Yielding of the column compression flange was extensive.
- At 3.97 kips the buckling of the rafter web became so severe that the frame could sustain no further load increases.

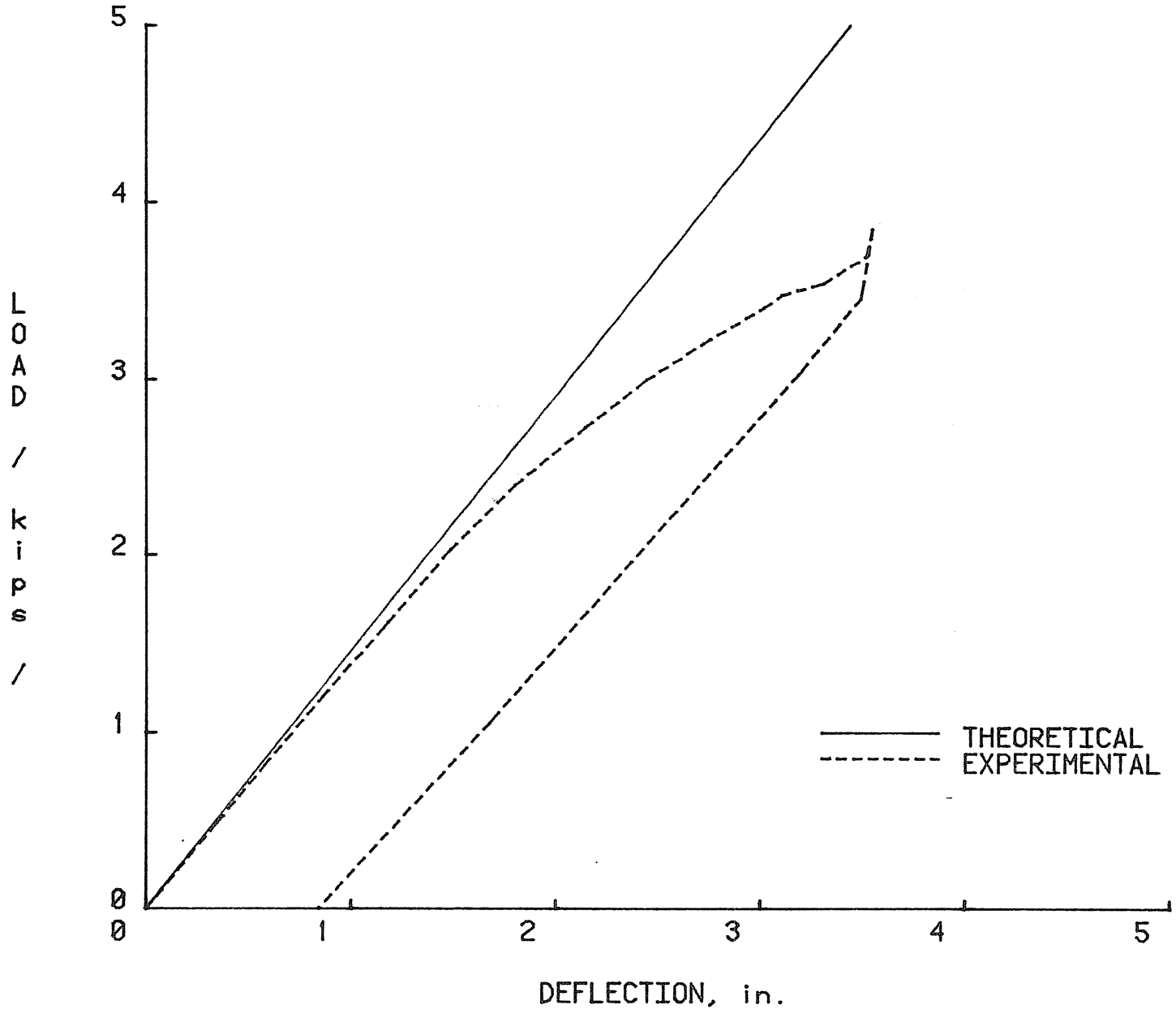


FIGURE F.1 LOAD VS CENTERLINE DEFLECTION, EAST FRAME

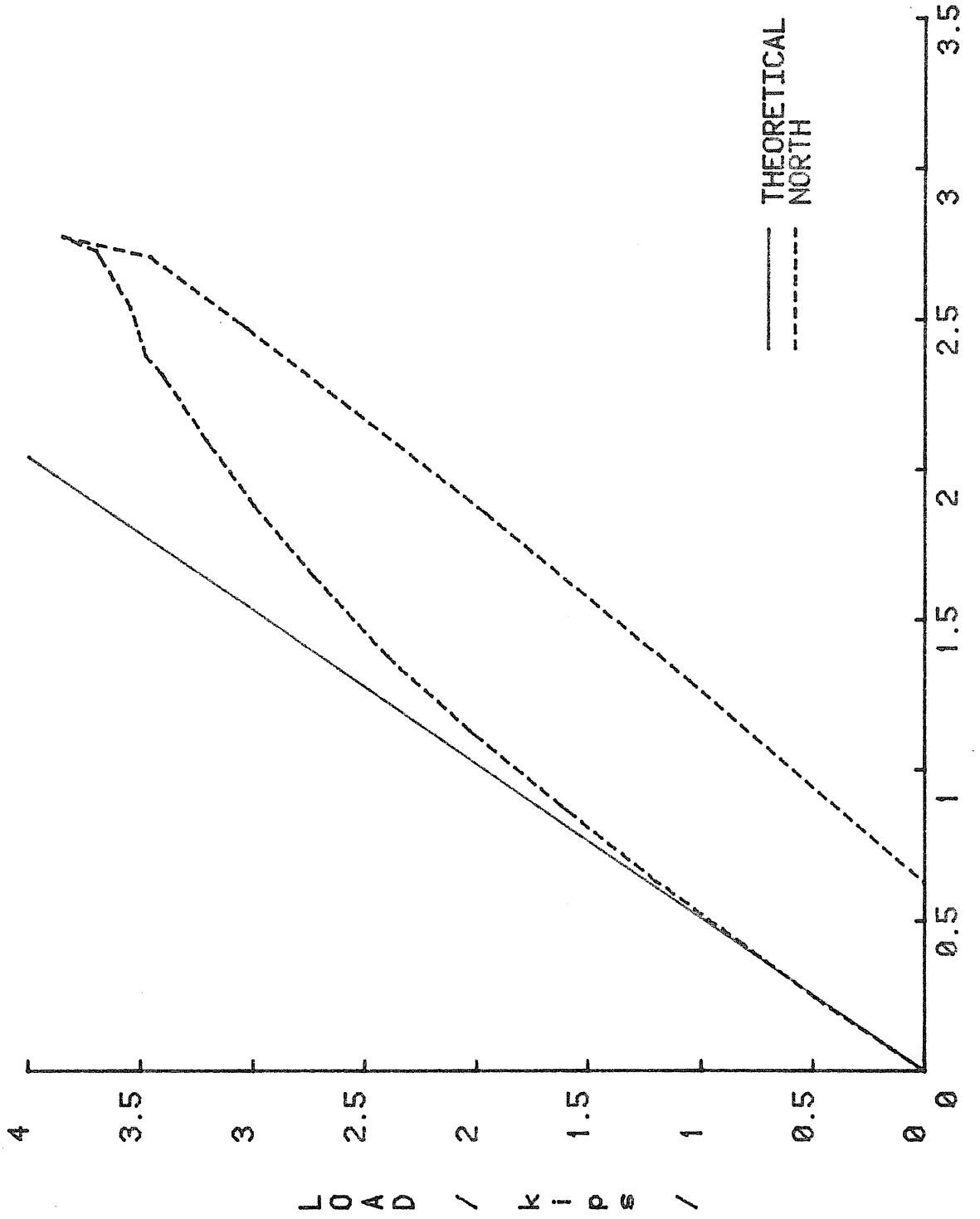


FIGURE F.2 LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

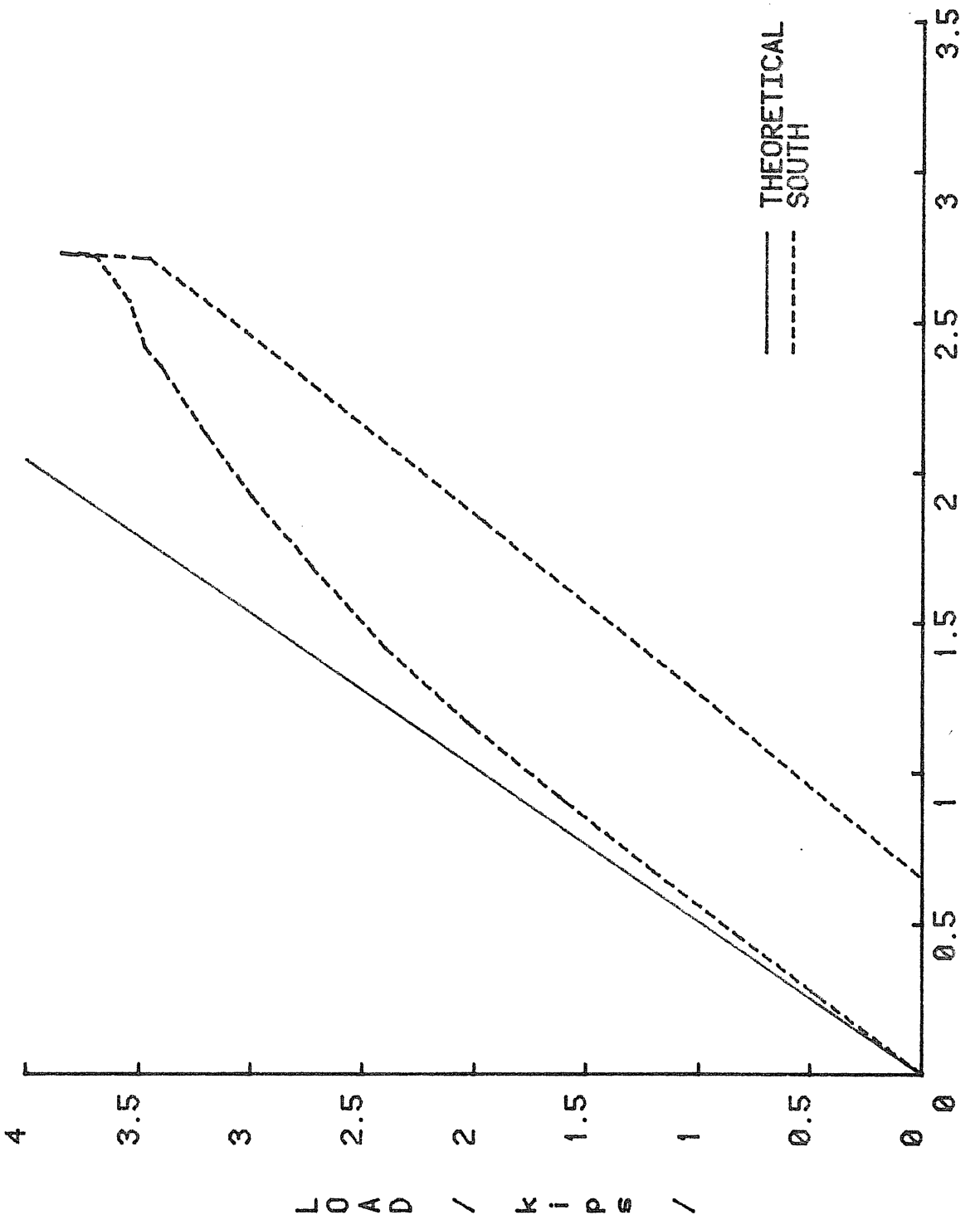


FIGURE F.3 LOAD VS QUARTERPOINT DEFLECTION, EAST FRAME

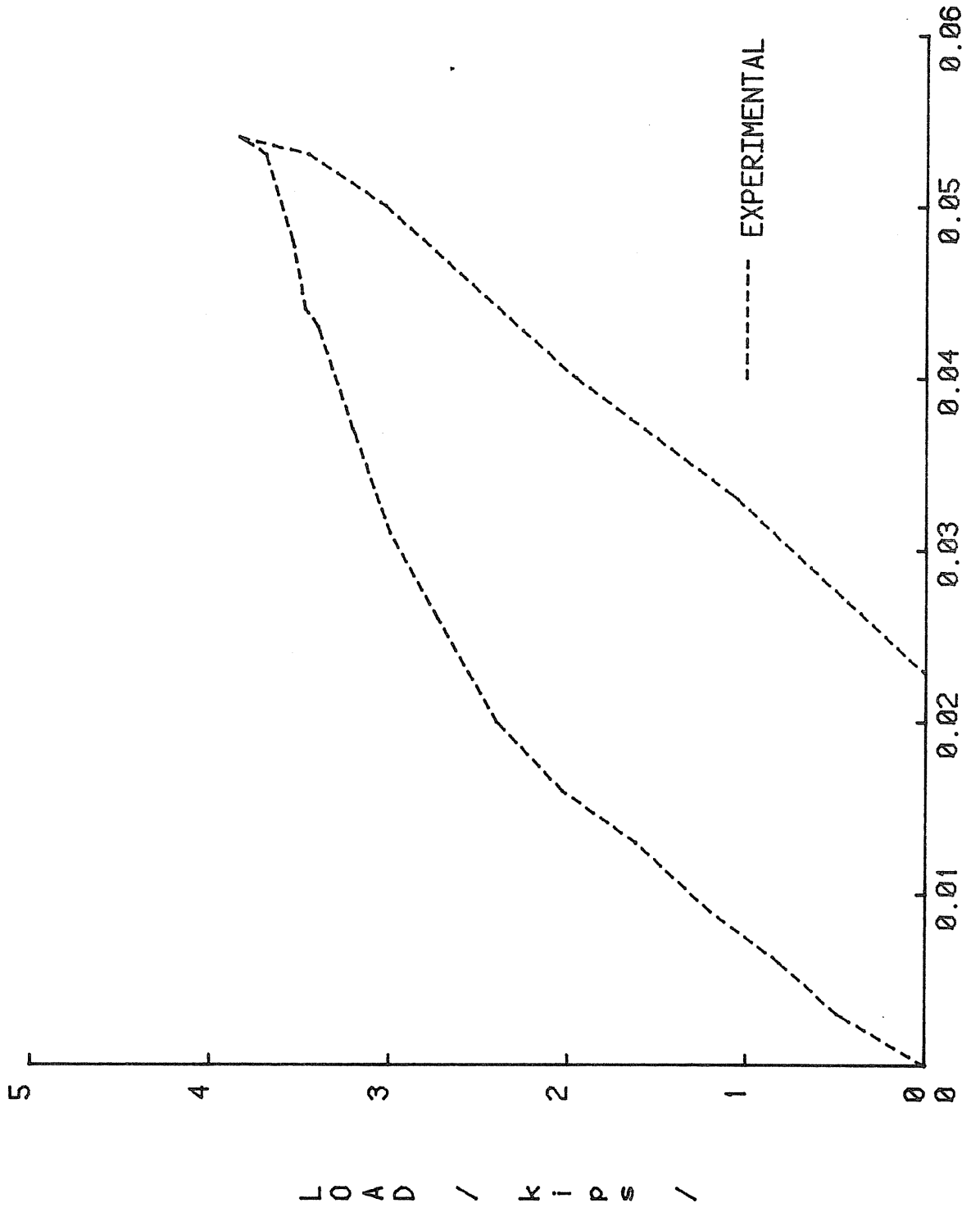


FIGURE F.4 LOAD VS PLATE SEPARATION, EAST FRAME NORTH CONNECTION

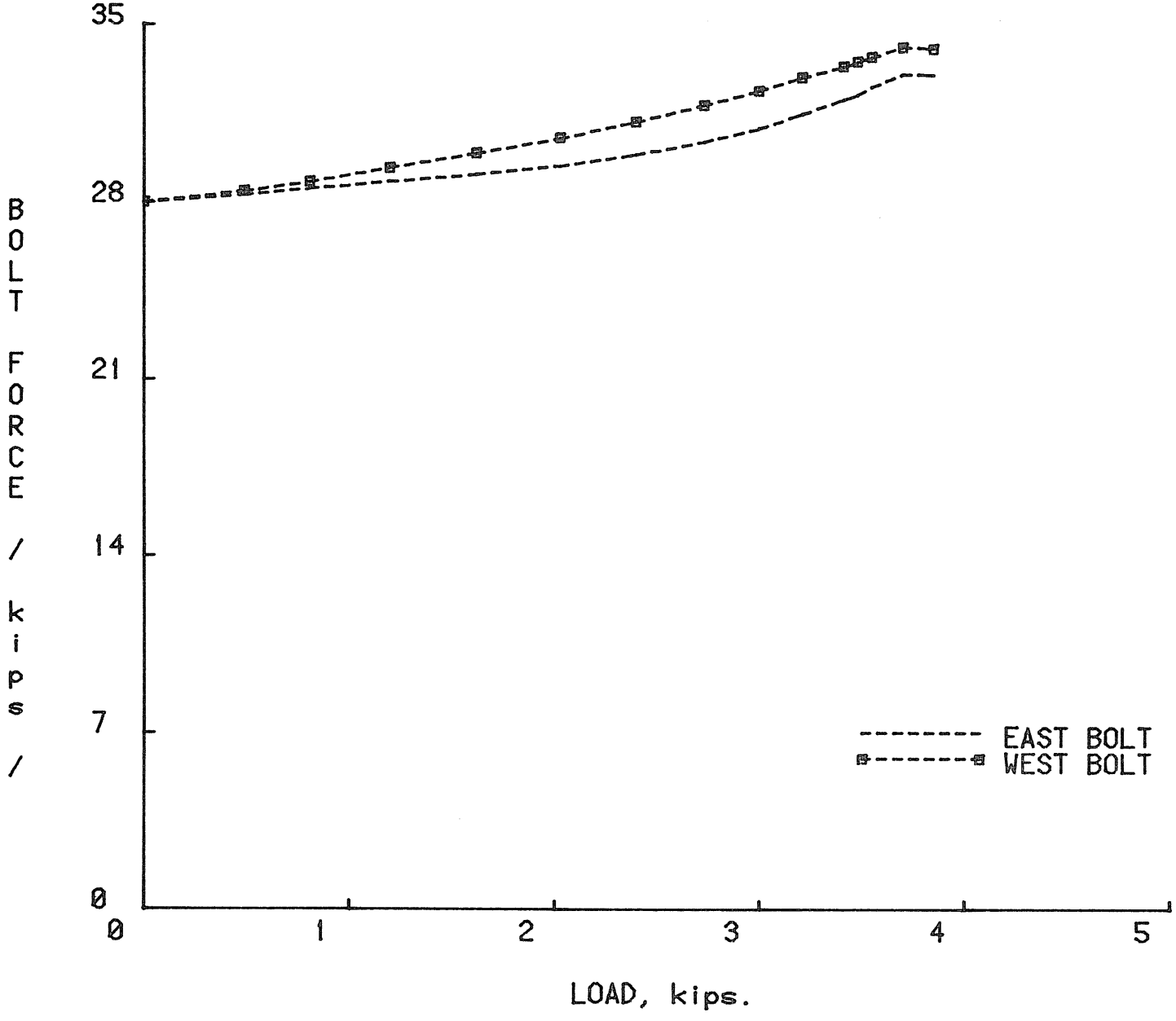


FIGURE F.5 LOAD VS BOLT FORCE, EAST FRAME NORTH CONNECTION

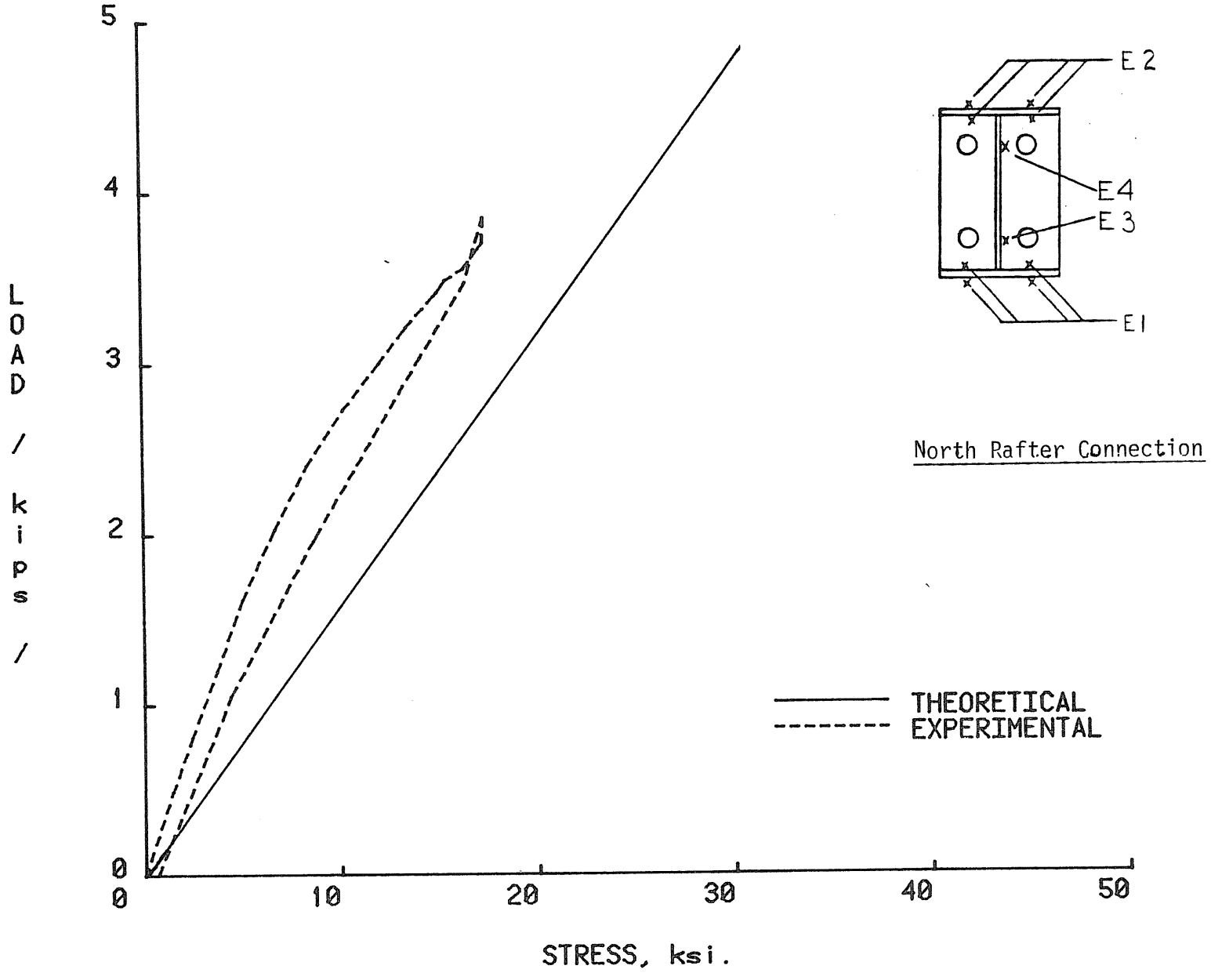


FIGURE F.6 LOAD VS STRESS AT LOCATION E1, EAST FRAME KNEE

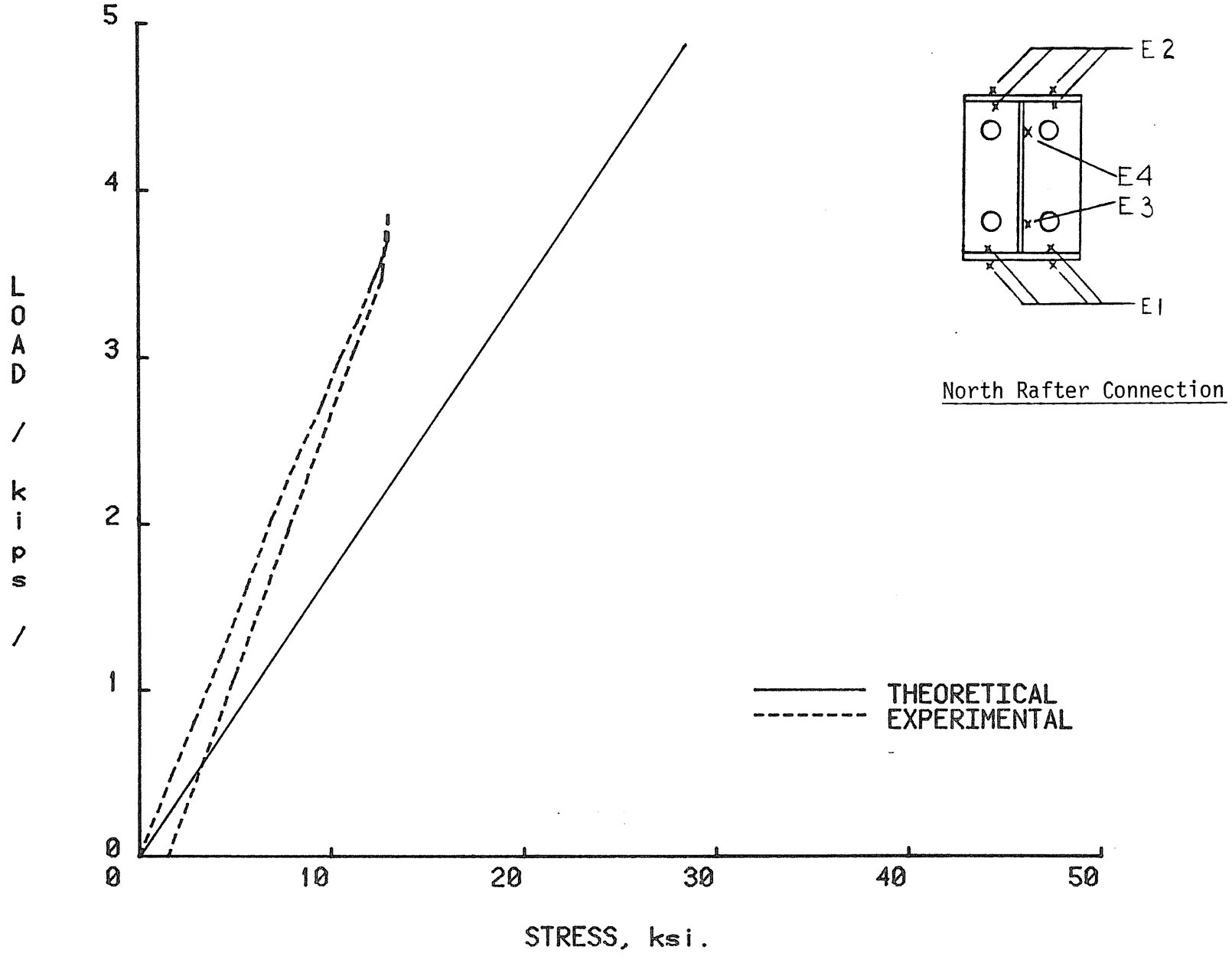


FIGURE F.7 LOAD VS STRESS AT LOCATION E2, EAST FRAME KNEE

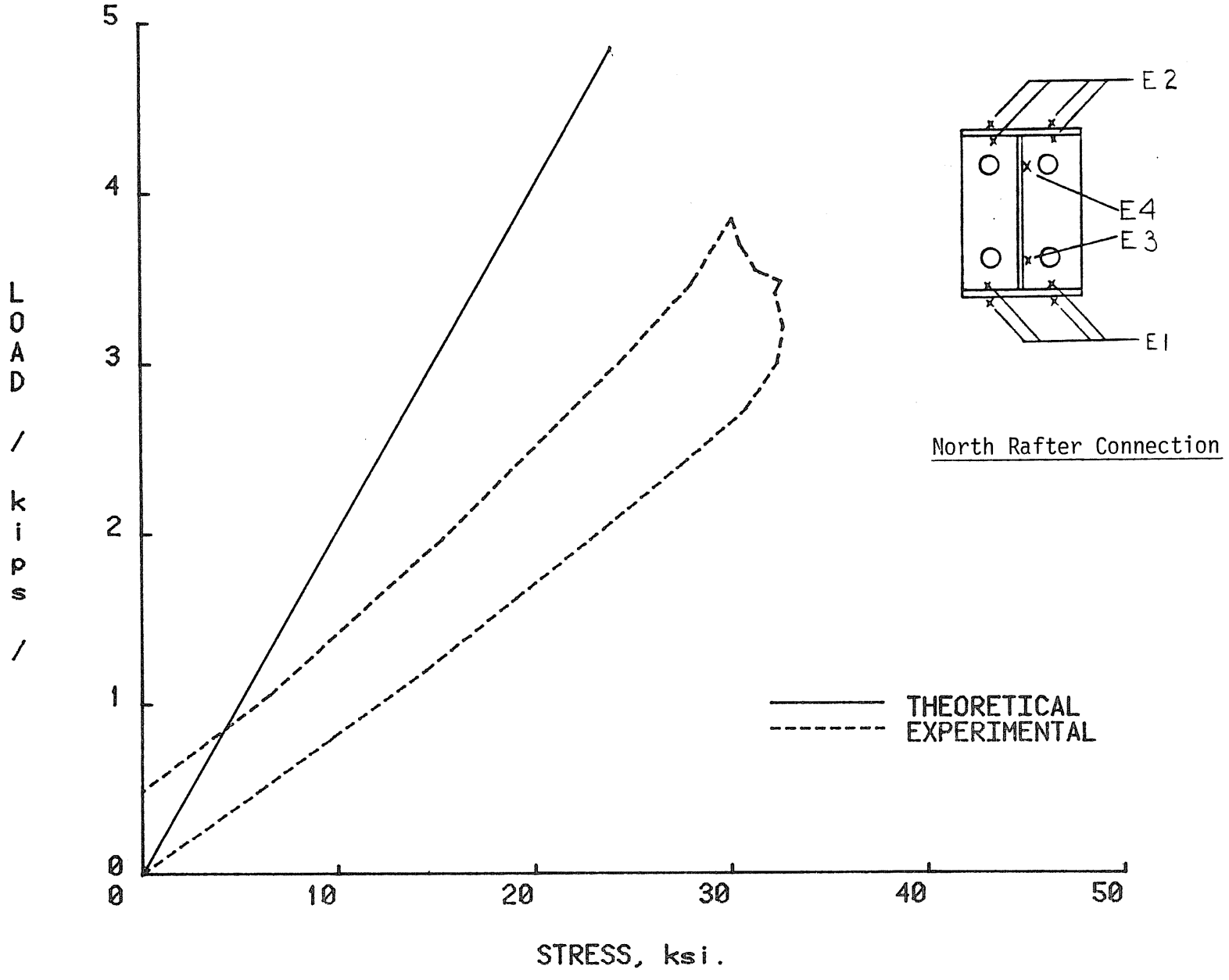


FIGURE F.8 LOAD VS STRESS AT LOCATION E3, EAST FRAME KNEE

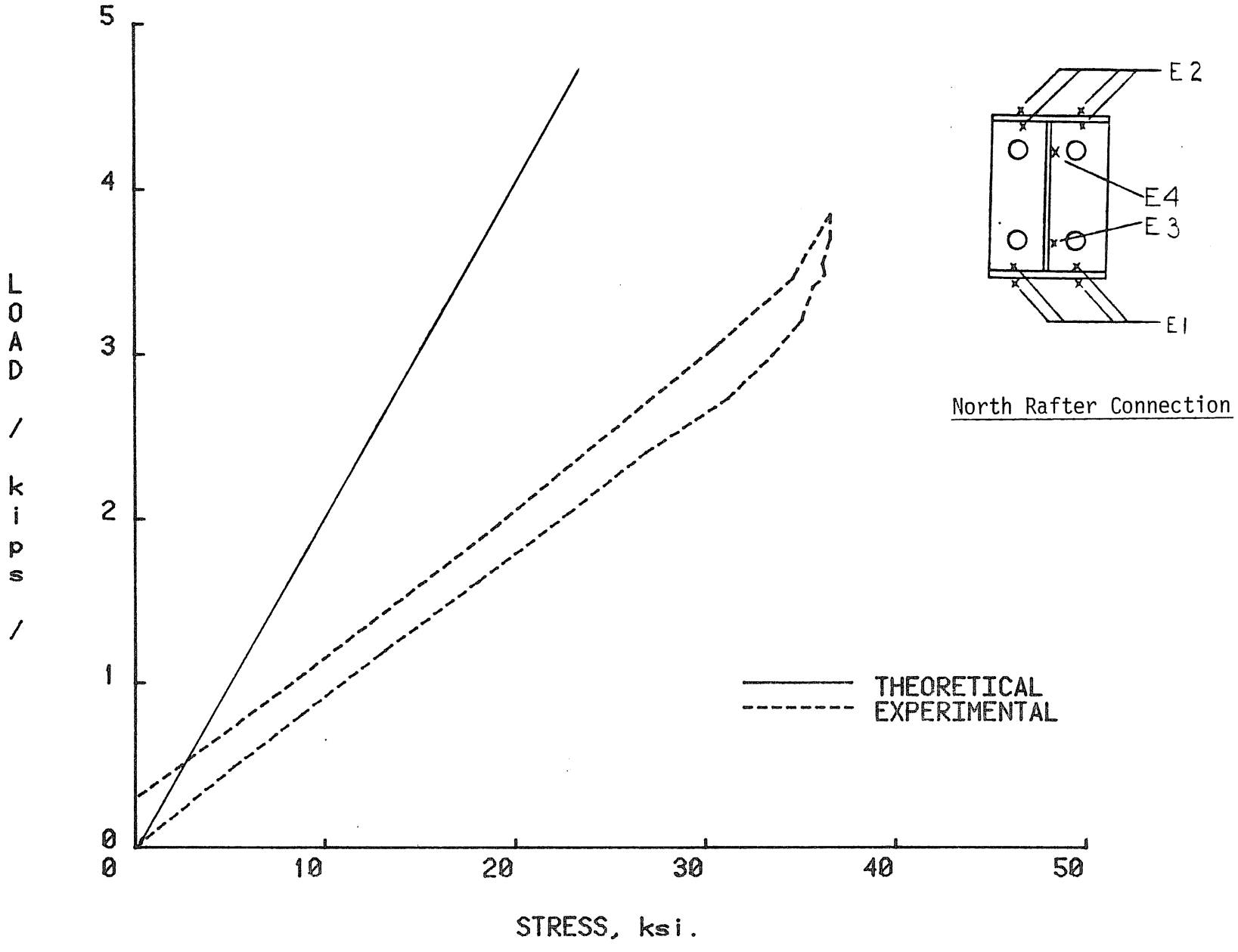


FIGURE F.9 LOAD VS STRESS AT LOCATION E4. EAST FRAME KNEE

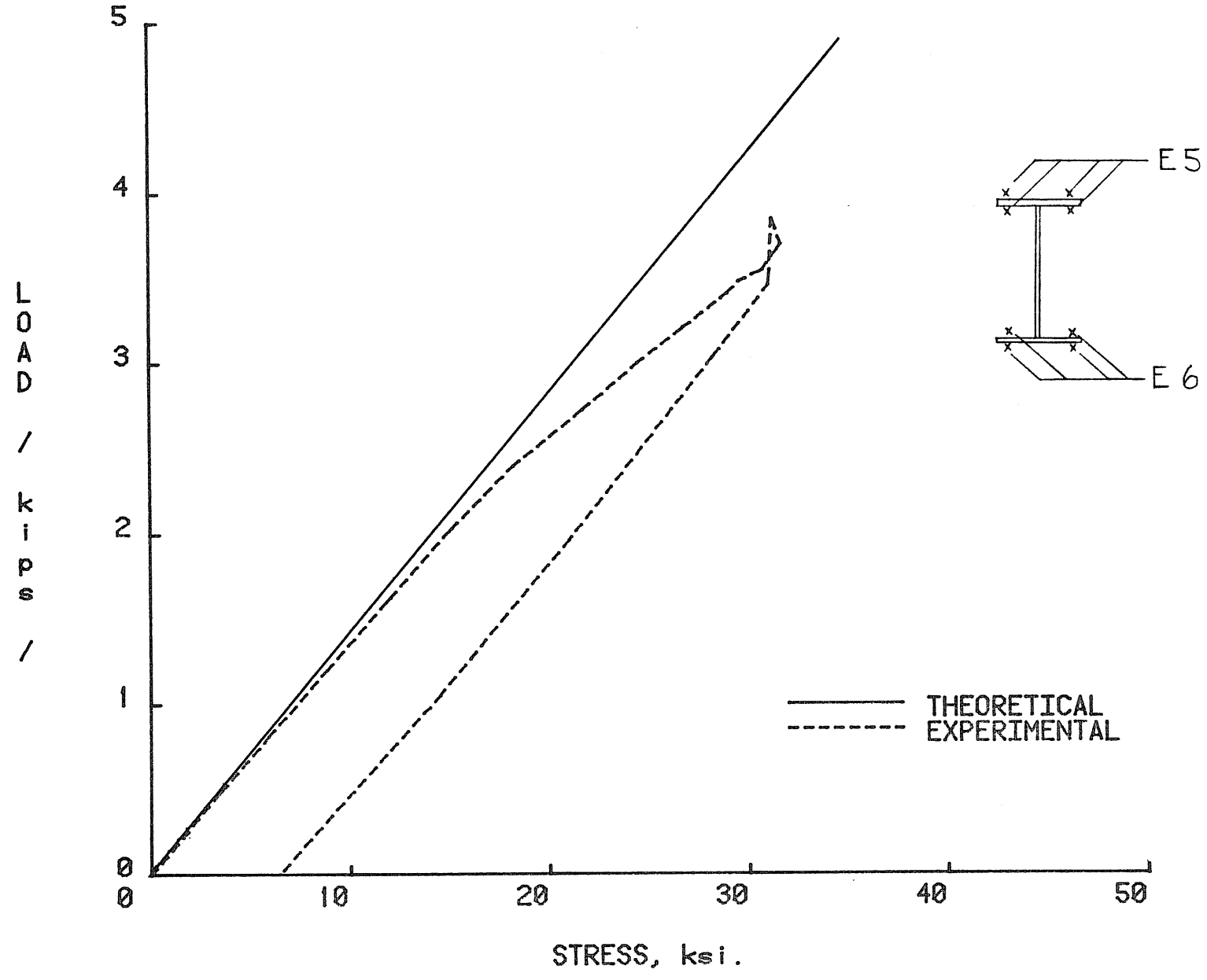


FIGURE F.10 LOAD VS STRESS AT LOCATION E6, EAST FRAME RIDGE

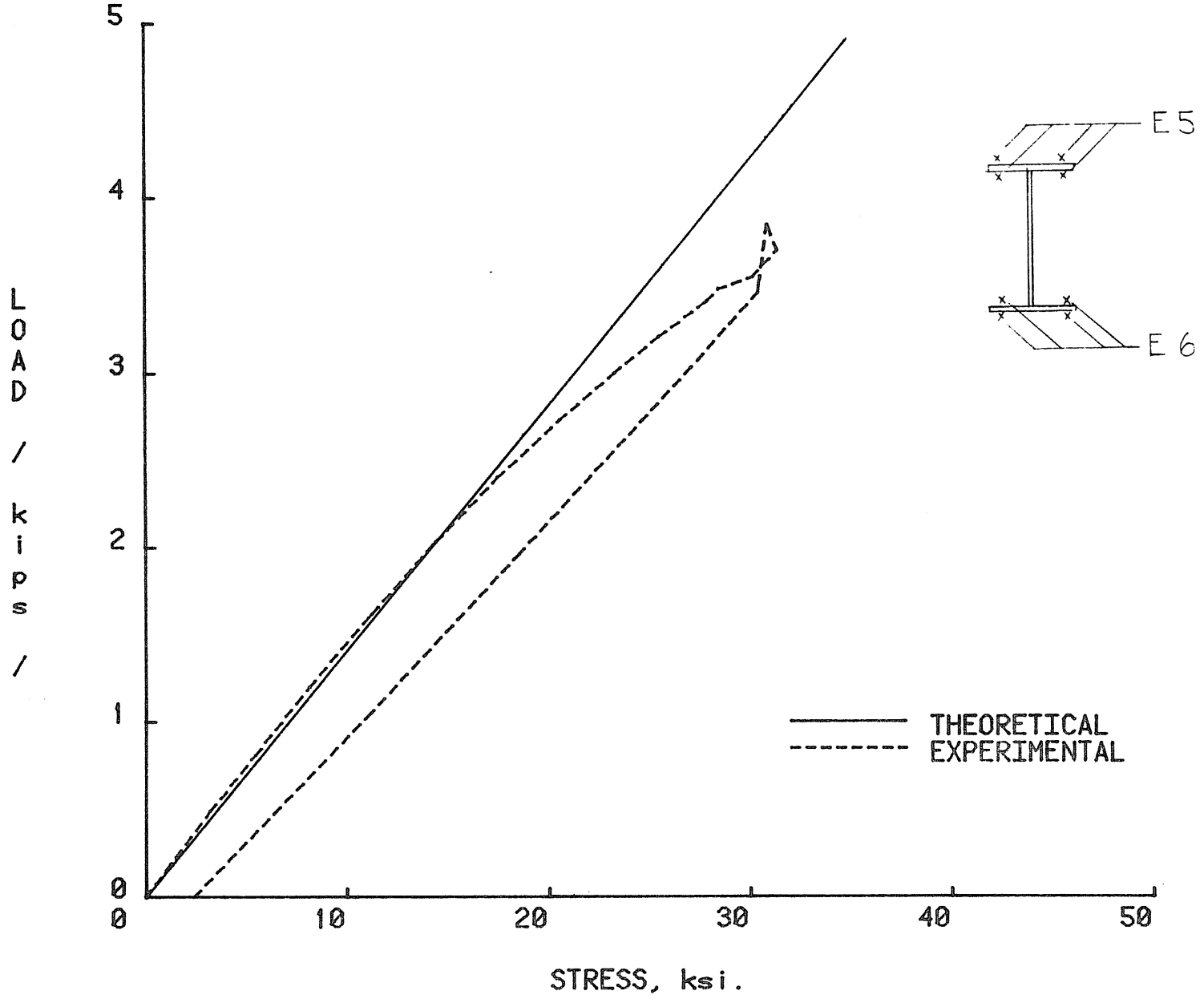


FIGURE F.11 LOAD VS STRESS AT LOCATION E5, EAST FRAME RIDGE

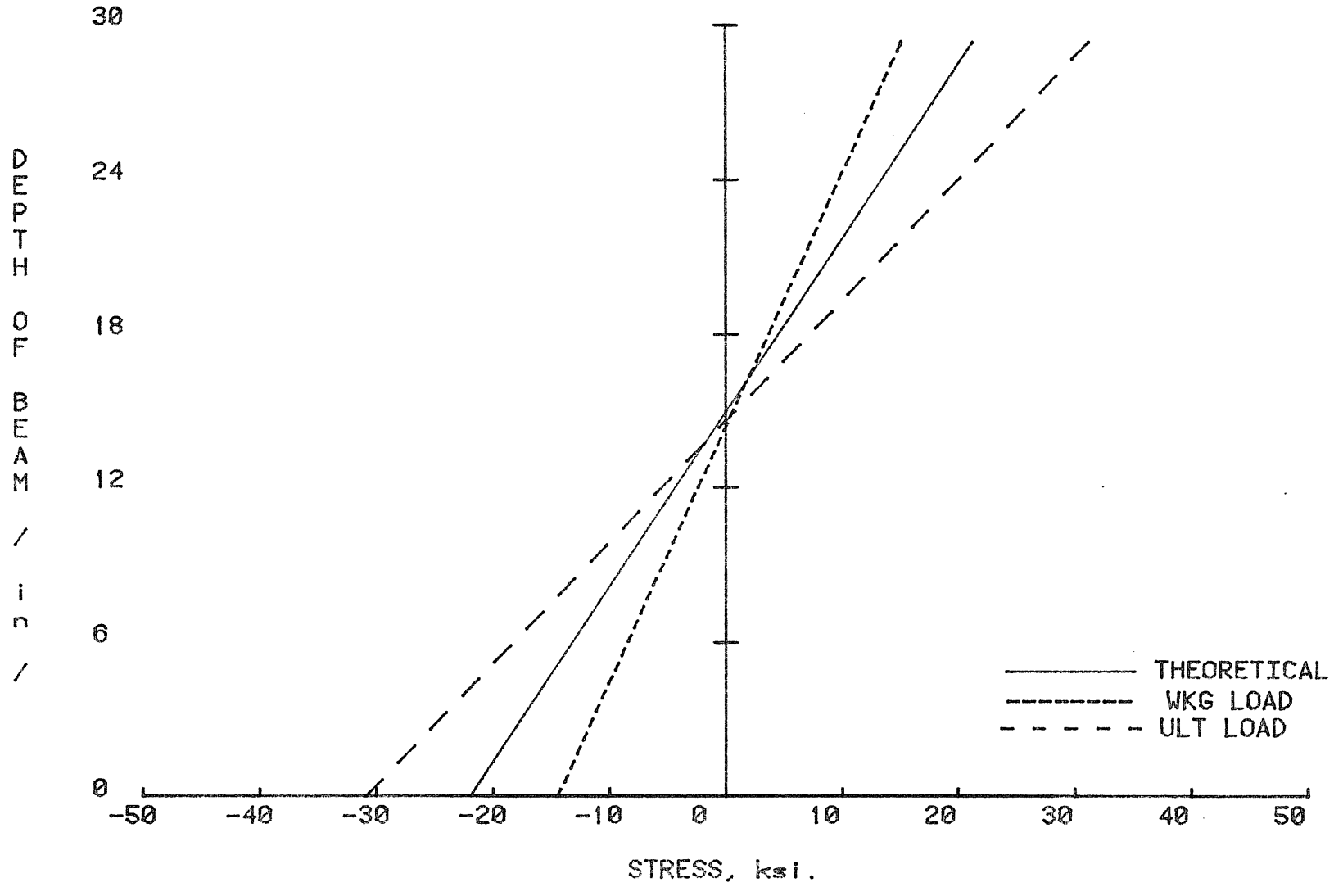


FIGURE F.12 DEPTH OF BEAM VS STRESS AT RAFTER MIDSPAN, EAST FRAME

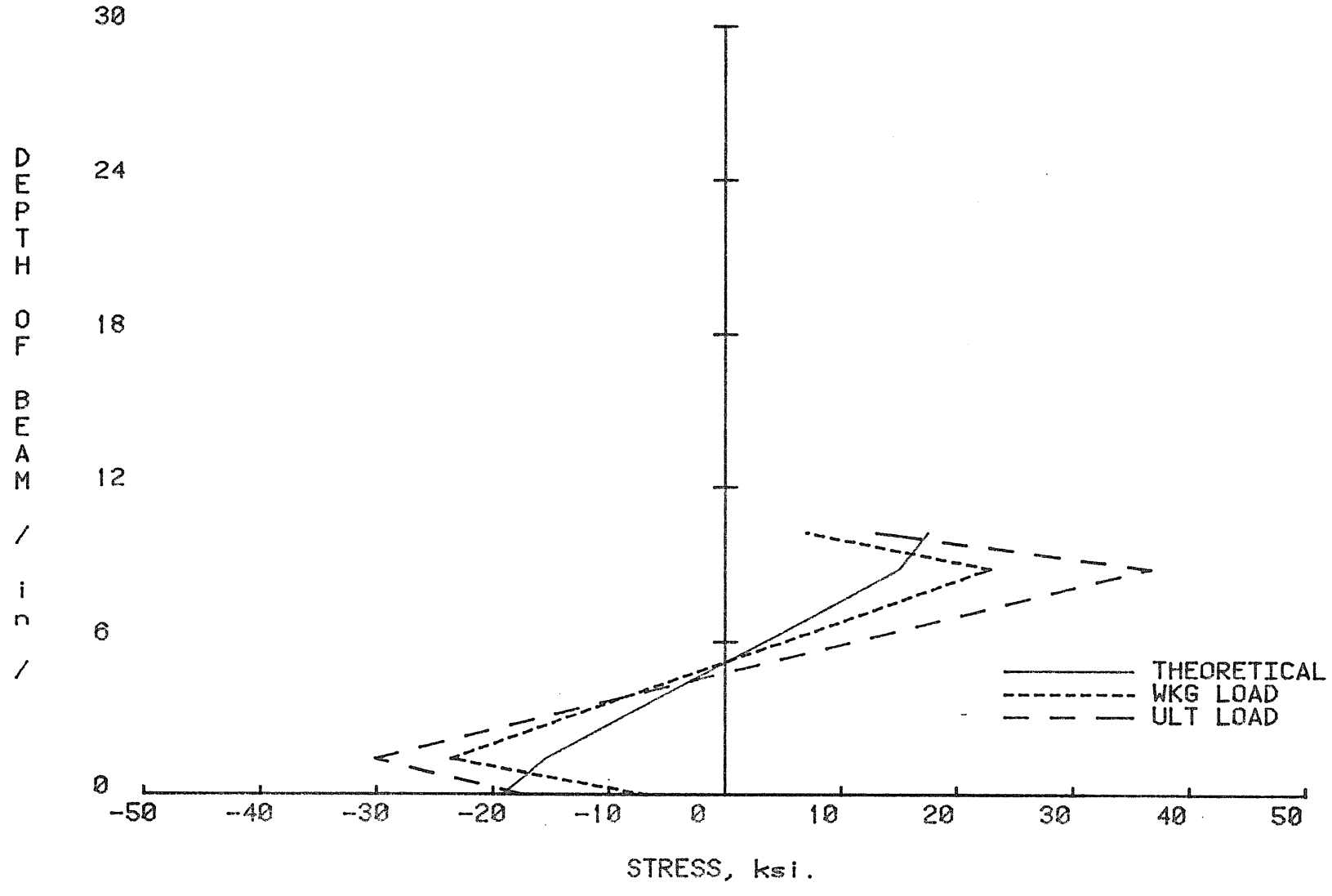


FIGURE F.13 DEPTH OF BEAM VS STRESS AT RAFTER END, EAST FRAME NORTH END

APPENDIX G

FULL LIVE LOAD FAILURE OF WEST FRAME

TEST 6

MESCO FRAME TEST SUMMARY

Project: Mesco Frame

Test No.: FR1: Test 6

Test Date: November 9, 1984

Purpose: Test of full live loading on west frame to failure

Bolt Diameter: 3/4" **Pretension Force per Bolt:** 28^{k}

Maximum Test Load: 3.8 kips

Discussion:

- Centerline and quarter point deflections increased linearly with load application in the working load range and agreed fairly well with the theoretical predictions.
- At 2.8 kips yield lines were observed in the whitewash around the tension bolts at both connections, on the compression flange of the south column adjacent to the connection and on the north column's compression flange near the column web splice. Vertical deflections were also increasing at a greater rate at this load.
- At 3.2 kips buckling in the rafter web was observed near the centerline. Increased flaking of the whitewash was also observed on the column's compression flanges at this load.
- At 3.5 kips diagonal yield lines appeared in the whitewash on the rafters web as the buckling became more severe.
- At 3.8 kips the rafter web buckling became so pronounced that the frame could resist no further load increases.

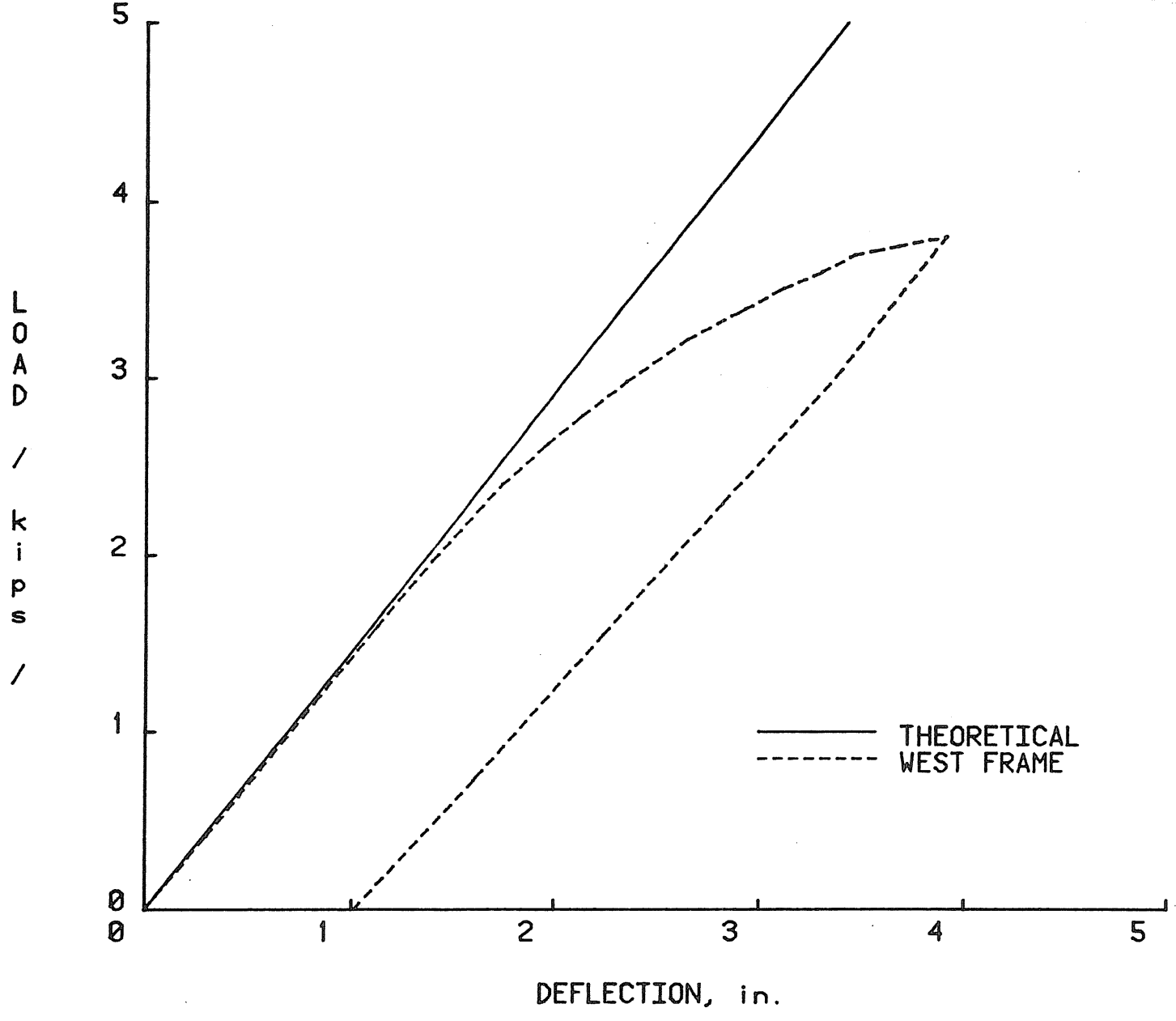


FIGURE G.1 LOAD VS CENTERLINE DEFLECTION, WEST FRAME

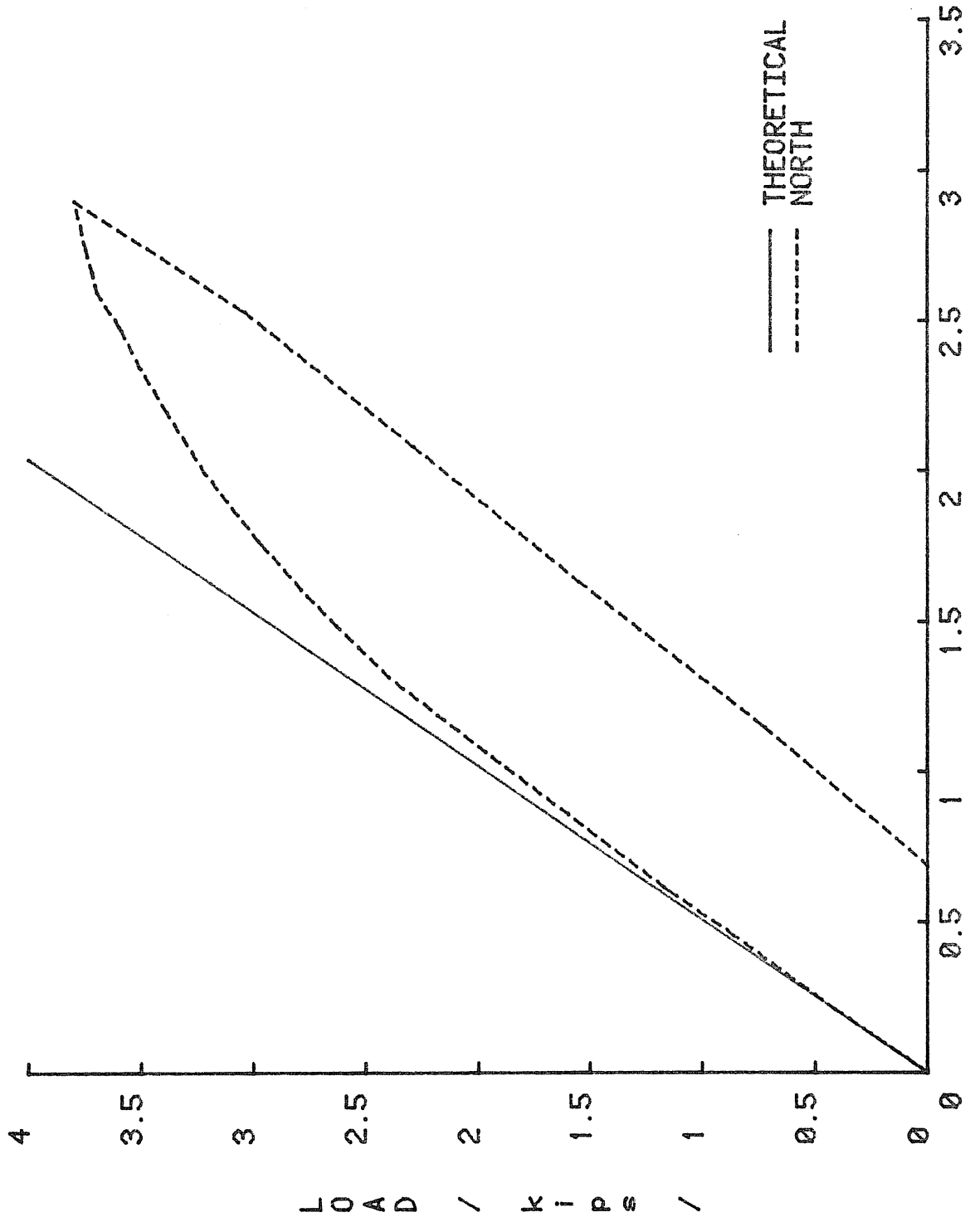


FIGURE G.2 LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

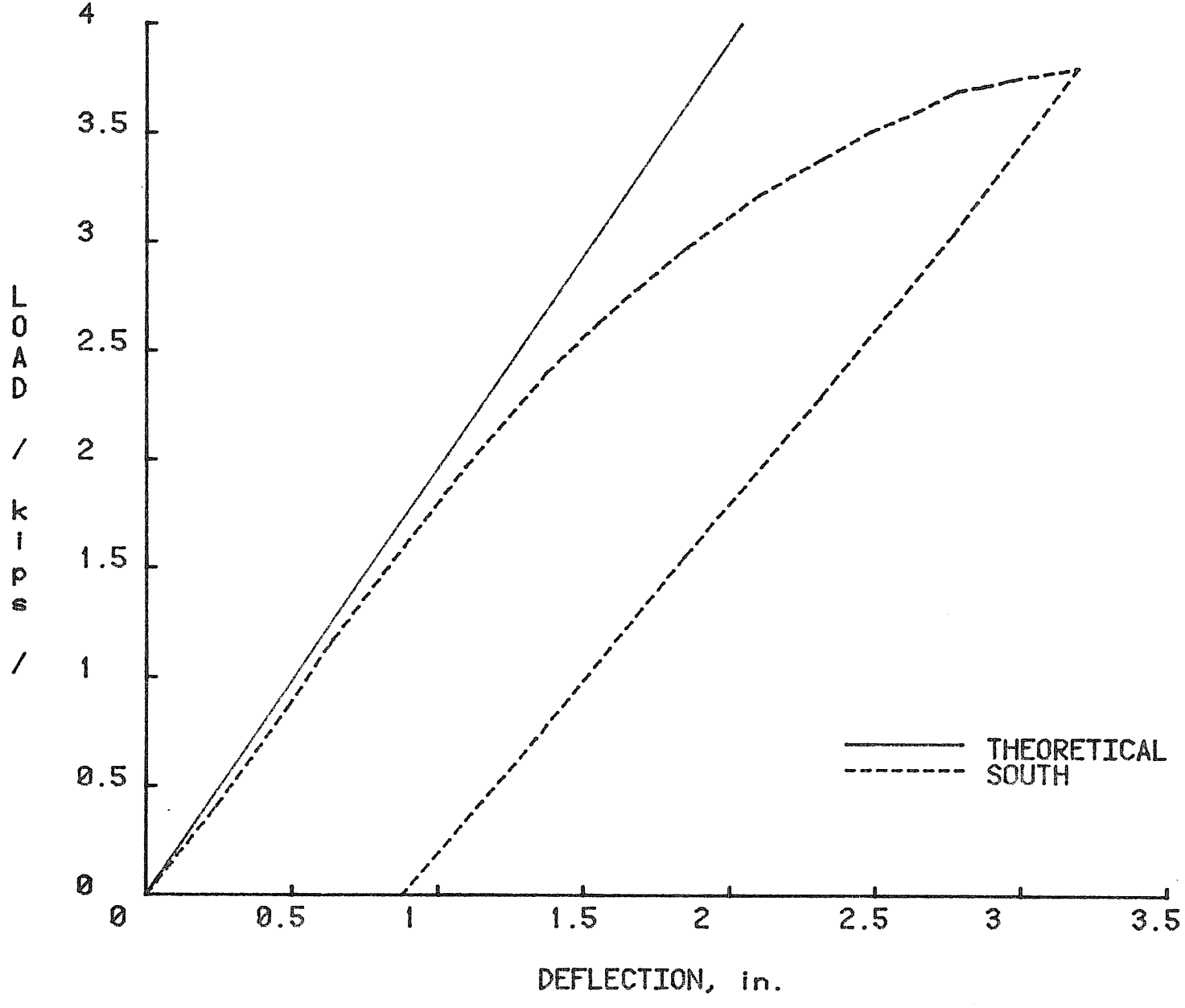


FIGURE G.3 LOAD VS QUARTERPOINT DEFLECTION, WEST FRAME

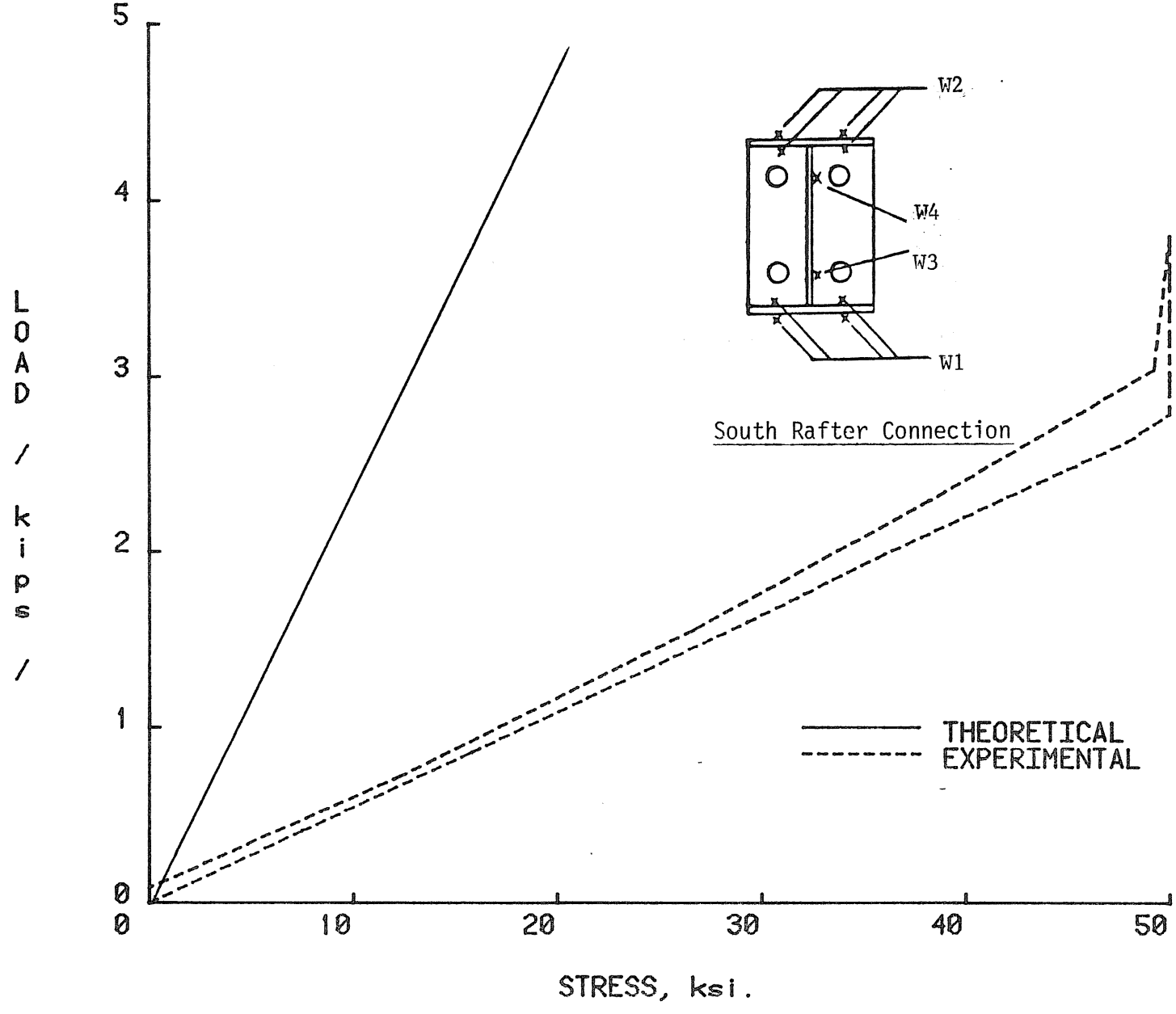


FIGURE G.4 LOAD VS STRESS AT LOCATION W3, WEST FRAME KNEE

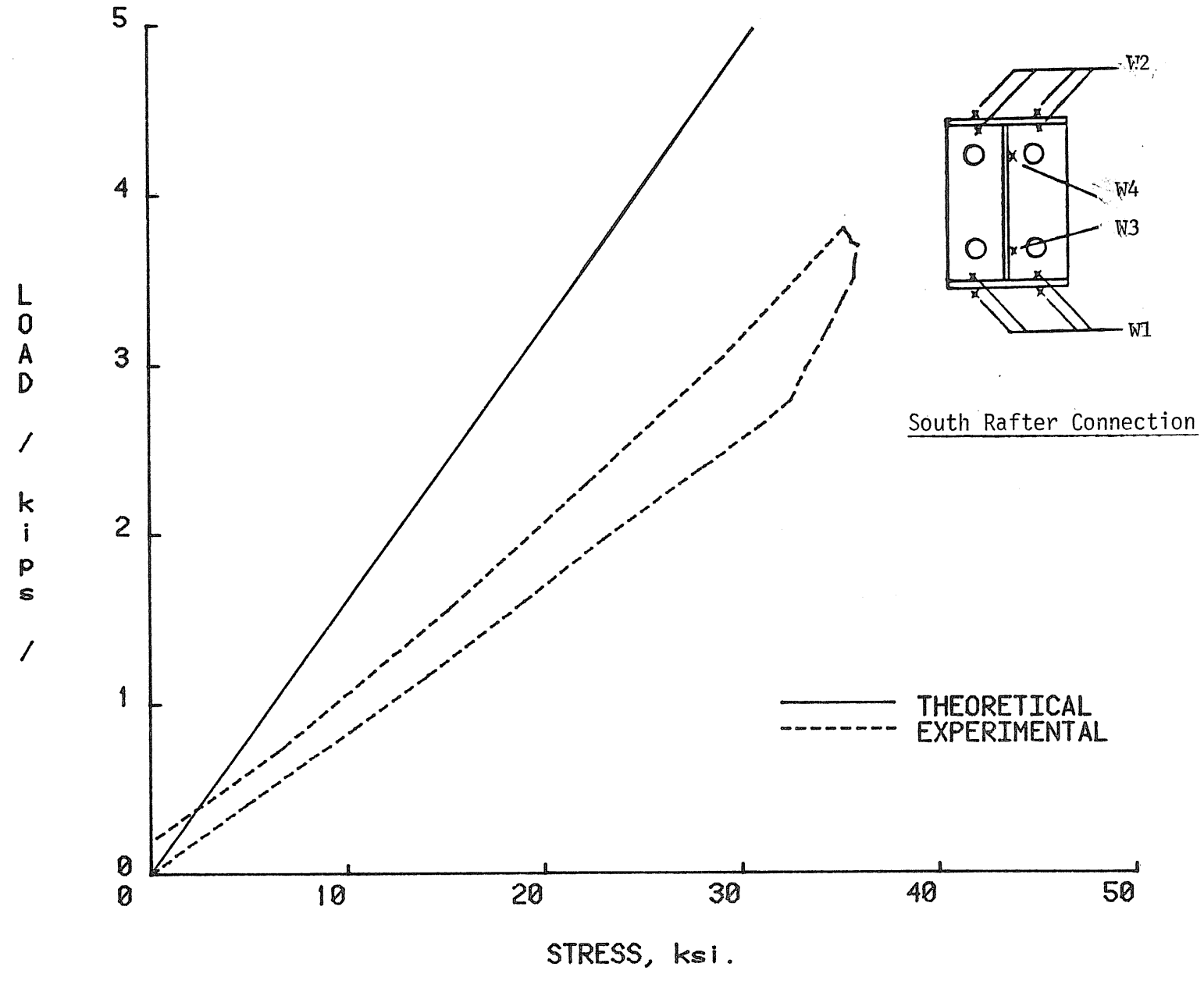


FIGURE G.5 LOAD VS STRESS AT LOCATION W3, WEST FRAME KNEE

APPENDIX H

MESCO WORKING LOAD COMPUTER ANALYSES

Nominal Dimensions

F_y = 50 ksi

1. Full Live Load--2.05 kips
2. Wind Load--4.43 kips (factored)
3. Unbalanced Live Load--3.46 kips
4. Unbalanced Live Load--2.05 kips
   plus Wind Load--3.54 kips

* * * G E N E R A L I N P U T * * * Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

1001 6 4 1 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI						11		HEAD RECORD
1 1 2	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
2 7 6	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
3 2 3		10.02	0.416	10.038	19.75	0.28		MEMB DESC
4 6 5 3		-10.02	0.416	10.038	19.75	0.28		MEMB DESC
5 3 4		9.74	0.404	19.75	29.188			MEMB DESC
6 5 4 3		-9.74	0.404	19.75	29.188			MEMB DESC
DEG	JT	NUMBER	BAND					
INDT	DISPL	SUPPORTS	WIDTH					
1	17	2	6					
1 112		50.	50.					HEADER
	5.0	0.187	5.0	0.25				FLANGE
86.	86.	1.75	86.	86.	1.75			BRACING
2	36.7	1.0	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
2 112		50.	50.					HEADER
	5.0	0.25	5.0	0.187				FLANGE
122.5	122.5	1.75	86.	86.	1.75			BRACING
1	122.5	1.75	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
3 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	60.2	1.0	56.7	53.4	1.0			BRACING
2	60.2	1.0	1	120.1	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
5 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	60.2	1.0	56.86	120.1	1.0			BRACING
1	48.5	1.0	1	121.1	1.0			BRACING
2	24.0	1.0						BRACING
				0.156				WEB
0.85	1.0	467.						BUCKLING
1 9	VERT CONC LOADS							LOADS
1 6	0.065							LOADS
3 3			2.05			2.25		LOADS
3 3			2.05			7.25		LOADS
5 5			2.05			2.23		LOADS
5 5			2.05			7.23		LOADS
4 4			2.05			2.25		LOADS
4 4			2.05			7.25		LOADS
6 6			2.05			2.23		LOADS
6 6			2.05			7.23		LOADS

NO ERRORS WERE DETECTED IN INPUT

PROJECT No. 1001 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

FRAME GEOMETRY

MEMBER NUMBER	LENGTH (FT)	PROJECTION HORIZ	PROJECTION VERT	INITIAL END JT No	INITIAL END X COORD.	INITIAL END Y COORD.	TERMINAL END JT No	TERMINAL END X COORD.	TERMINAL END Y COORD.
1	10.62	0.00	10.62	1	0.00	0.00	2	0.00	10.62
2	10.62	0.00	10.62	7	39.52	-0.00	6	39.52	10.62
3	10.03	10.02	0.42	2	0.00	10.62	3	10.02	11.04
4	10.03	-10.02	0.42	6	39.52	10.62	5	29.50	11.04
5	9.75	9.74	0.40	3	10.02	11.04	4	19.76	11.44
6	9.75	-9.74	0.40	5	29.50	11.04	4	19.76	11.44

	X	Y
MINIMUM JOINT COORDINATE	0.00	-0.00
MAXIMUM JOINT COORDINATE	39.52	11.44

PROJECT No. 1001 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	3.16	20.96	0.00	29.48	0.151	1	3.16	20.96	-0.00	30.00	0.151	1	0.111	1
2	3.16	20.96	-7.54	30.00	0.146	1	3.16	20.96	6.23	30.00	0.333	1	0.111	1
3	3.16	20.96	-15.09	30.00	0.398	1	3.16	20.96	12.45	30.00	0.520	1	0.111	1
4	3.16	25.78	-22.63	32.43	0.576	1	3.16	25.78	18.68	32.43	0.681	1	0.111	1
5	2.78	25.57	-21.22	32.43	0.546	1	2.78	25.57	17.96	32.43	0.646	1	0.074	1
6	2.78	25.57	-28.89	32.43	0.782	1	2.78	25.57	24.45	32.43	0.847	1	0.074	1

GEOMETRIC PROPERTIES FOR MEMBER 1

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
2	2.50	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
3	5.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
4	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.125	6.56	3.0	27.7	7.22	8.75
5	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11
6	10.21	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE FLANGE CB	POSITIVE FLANGE L/RT	POSITIVE FLANGE LD/AF	NEGATIVE FLANGE CB	NEGATIVE FLANGE L/RT	NEGATIVE FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
2	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
3	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
4	1.000	27.416	274.759	1.000	26.633	205.520	40.347	29.817	0.850	91.735
5	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196
6	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196

MEMBER FORCES FOR MEMBER 1

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	1.82	-0.00	9.48						
2	2.50	1.82	4.54	9.48						
3	5.00	1.82	9.08	9.48						
4	7.50	1.82	13.62	9.48						
5	7.50	1.82	13.63	9.48						
6	10.21	1.82	18.55	9.48						

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STRESS ANALYSIS FOR MEMBER 2

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	3.16	20.96	0.00	30.00	0.151	1	3.16	20.96	-0.00	30.00	0.151	1	0.111	1
2	3.16	20.96	6.23	30.00	0.333	1	3.16	20.96	-7.54	30.00	0.146	1	0.111	1
3	3.16	20.96	12.45	30.00	0.520	1	3.16	20.96	-15.09	30.00	0.398	1	0.111	1
4	3.16	25.78	18.68	30.00	0.728	1	3.16	25.78	-22.63	30.00	0.632	1	0.111	1
5	2.78	25.57	17.96	30.00	0.691	1	2.78	25.57	-21.22	30.00	0.599	1	0.074	1
6	2.78	25.57	24.45	30.00	0.908	1	2.78	25.57	-28.89	30.00	0.854	1	0.074	1

GEOMETRIC PROPERTIES FOR MEMBER 2

POINT	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
	POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	LOCATION (FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
2	2.50	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
3	5.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
4	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.125	6.56	3.0	27.7	8.75	7.22
5	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70
6	10.21	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 2

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
2	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
3	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
4	1.750	88.898	686.000	1.000	27.416	274.759	40.347	29.817	0.850	91.735
5	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196
6	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196

MEMBER FORCES FOR MEMBER 2

POINT		ABSOLUTE MAXIMUM	MOMENTS AND AXIAL FORCES							
No	LOCATION (FT)	SHEAR (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	1.82	-0.00	9.48						
2	2.50	1.82	-4.54	9.48						
3	5.00	1.82	-9.08	9.48						
4	7.50	1.82	-13.62	9.48						
5	7.50	1.82	-13.63	9.48						
6	10.21	1.82	-18.55	9.48						

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STRESS ANALYSIS FOR MEMBERS 3 TO 4 INCLUSIVE

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	0.71	12.33	-17.52	30.00	0.527	1	0.71	12.33	17.52	30.00	0.608	1	0.537	1
2	0.70	12.29	-15.58	30.00	0.462	1	0.70	12.29	15.58	30.00	0.543	1	0.544	1
3	0.70	12.28	-15.56	30.00	0.462	1	0.70	12.28	15.56	30.00	0.542	1	0.544	1
4	0.65	11.87	1.43	29.73	0.098	1	0.65	11.87	-1.43	30.00	0.007	1	0.631	1
5	0.63	11.87	1.44	29.73	0.096	1	0.63	11.87	-1.44	30.00	0.005	1	0.492	1
6	0.57	11.38	13.14	29.57	0.463	1	0.57	11.38	-13.14	30.00	0.388	1	0.580	1
7	0.53	10.95	20.36	29.42	0.710	1	0.53	10.95	-20.36	30.00	0.630	1	0.664	1
8	0.51	10.95	20.36	29.42	0.709	1	0.51	10.95	-20.36	30.00	0.632	1	0.467	1
9	0.46	10.55	22.73	28.57	0.811	1	0.46	10.55	-22.73	30.00	0.714	1	0.522	1

GEOMETRIC PROPERTIES FOR MEMBERS 3 TO 4 INCLUSIVE

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.28	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.21	3.1	61.6	11.64	11.64
4	2.25	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.00	3.4	87.4	14.13	14.13
5	2.25	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.00	3.4	87.5	14.13	14.13
6	4.75	5.0	0.187	60.2	5.0	0.187	120.1	0.125	14.49	3.7	132.4	17.82	17.82
7	7.25	5.0	0.187	60.2	5.0	0.187	120.1	0.125	16.98	4.0	188.8	21.76	21.76
8	7.25	5.0	0.187	60.2	5.0	0.187	120.1	0.125	16.98	4.0	188.8	21.76	21.76
9	10.03	5.0	0.187	60.2	5.0	0.187	120.1	0.125	19.75	4.3	266.1	26.44	26.44

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBERS 3 TO 4 INCLUSIVE

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	46.137	670.377	1.000	40.925	594.653	110.070	47.814	0.850	12.326
2	1.000	46.206	681.035	1.000	40.987	604.108	110.251	47.972	0.850	12.285
3	1.000	46.207	681.142	1.000	40.988	604.203	110.253	47.974	0.850	12.285
4	1.000	46.954	796.685	1.000	41.650	706.694	112.148	49.653	0.850	11.873
5	1.000	46.954	796.792	1.000	41.651	706.789	112.149	49.655	0.850	11.873
6	1.000	47.971	957.096	1.000	95.703	1909.423	114.571	58.502	0.850	11.376
7	1.000	48.967	1117.400	1.000	97.689	2229.232	116.771	60.922	0.850	10.952
8	1.000	48.967	1117.507	1.000	97.690	2229.445	116.772	60.923	0.850	10.951
9	1.000	50.050	1295.684	1.000	99.851	2584.911	118.989	63.504	0.850	10.547

PROJECT No. 1001 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

MEMBER FORCES FOR MEMBERS 3 TO 4 INCLUSIVE

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	9.38	16.66	2.21	16.66	2.21				
2	0.45	9.37	15.11	2.21	15.11	2.21				
3	0.45	9.37	15.09	2.21	15.09	2.21				
4	2.25	9.26	-1.69	2.20	-1.69	2.20				
5	2.25	7.21	-1.70	2.12	-1.70	2.12				
6	4.75	7.04	-19.51	2.11	-19.51	2.11				
7	7.25	6.88	-36.91	2.10	-36.91	2.10				
8	7.25	4.83	-36.92	2.02	-36.92	2.02				
9	10.03	4.65	-50.09	2.01	-50.09	2.01				

PROJECT No. 1001 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

STRESS ANALYSIS FOR MEMBERS 5 TO 6 INCLUSIVE

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.41	21.34	21.15	28.93	0.745	1	0.41	21.34	-21.15	30.00	0.686	1	0.269	1
2	0.38	20.92	22.09	28.76	0.781	1	0.38	20.92	-22.09	30.00	0.718	1	0.289	1
3	0.36	20.92	22.09	28.76	0.780	1	0.36	20.92	-22.09	30.00	0.719	1	0.158	1
4	0.34	20.47	20.98	27.77	0.767	1	0.34	20.47	-20.98	30.00	0.683	1	0.164	1
5	0.32	22.00	19.87	27.81	0.725	1	0.32	22.00	-19.87	30.00	0.648	1	0.167	1
6	0.30	22.00	19.87	27.81	0.725	1	0.30	22.00	-19.87	30.00	0.649	1	0.007	1
7	0.29	21.89	17.93	26.73	0.680	1	0.29	21.89	-17.93	30.00	0.585	1	0.004	1
8	0.29	21.89	17.93	26.73	0.680	1	0.29	21.89	-17.93	30.00	0.585	1	0.004	1
9	0.28	21.87	17.53	26.47	0.672	1	0.28	21.87	-17.53	30.00	0.571	1	0.006	1

GEOMETRIC PROPERTIES FOR MEMBERS 5 TO 6 INCLUSIVE

POINT	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
	POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	LOCATION (FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.00	5.0	0.187	60.2	5.0	0.187	120.1	0.156	19.75	5.0	286.0	28.42	28.42
2	2.23	5.0	0.187	60.2	5.0	0.187	120.1	0.156	21.91	5.3	364.9	32.76	32.76
3	2.23	5.0	0.187	60.2	5.0	0.187	120.1	0.156	21.91	5.3	365.0	32.76	32.76
4	4.73	5.0	0.187	60.2	5.0	0.187	120.1	0.156	24.33	5.7	468.2	37.91	37.91
5	7.23	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.75	6.0	588.0	43.36	43.36
6	7.23	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.75	6.0	588.1	43.36	43.36
7	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.74	6.4	700.0	48.08	48.08
8	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.75	6.4	700.1	48.09	48.09
9	9.75	5.0	0.187	24.0	5.0	0.187	121.1	0.156	29.19	6.4	726.7	49.16	49.16

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBERS 5 TO 6 INCLUSIVE

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	51.912	1295.684	1.000	103.566	2584.911	61.447	67.810	0.850	39.551
2	1.000	52.908	1434.639	1.000	105.553	2862.129	62.356	70.072	0.850	38.405
3	1.000	52.909	1434.743	1.000	105.554	2862.336	62.357	70.073	0.850	38.404
4	1.000	54.004	1590.529	1.000	107.738	3173.131	63.281	72.524	0.850	37.291
5	1.000	44.372	1406.915	1.000	110.794	3512.936	64.119	60.338	0.850	36.323
6	1.000	44.373	1406.998	1.000	110.795	3513.145	64.120	60.339	0.850	36.322
7	1.000	22.304	747.408	1.000	112.542	3771.296	64.753	30.615	0.850	35.615
8	1.000	22.304	747.449	1.000	112.544	3771.505	64.754	30.615	0.850	35.614
9	1.000	22.380	758.811	1.000	112.928	3828.832	64.888	30.781	0.850	35.467

PROJECT No. 1001 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

MEMBER FORCES FOR MEMBERS 5 TO 6 INCLUSIVE

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	4.65	-50.10	2.01	-50.10	2.01				
2	2.23	4.51	-60.31	2.01	-60.31	2.01				
3	2.23	2.46	-60.32	1.92	-60.31	1.92				
4	4.73	2.30	-66.26	1.91	-66.26	1.91				
5	7.23	2.14	-71.80	1.91	-71.80	1.91				
6	7.23	0.09	-71.80	1.82	-71.80	1.82				
7	9.29	0.05	-71.85	1.82	-71.85	1.82				
8	9.29	0.05	-71.85	1.82	-71.85	1.82				
9	9.75	0.08	-71.82	1.82	-71.82	1.82				

PROJECT No. 1001 40 X 12 X 20 UBM BAL LL NOMINAL, GAGES, 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:01

FORCES ACTING ON SUPPORTS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	SUPPORT No	HORIZONTAL (KIPS)	VERTICAL (KIPS)	MOMENT (K-FT)
1	VERT CONC LOADS	1	-1.82	9.48	-0.00
1	VERT CONC LOADS	7	1.82	9.48	-0.00
	TOTAL FORCES ACTING		0.00	18.97	-0.00
	TOTAL FORCES APPLIED		0.00	18.97	0.00

EXTERNAL MEMBER LOADS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	MEMBER NUMBER	UNIFORMLY DISTRIBUTED LOADS VERTICAL (K/FT)	UNIFORMLY DISTRIBUTED LOADS HORIZONTAL (K/FT)	CONCENTRATED LOADS LOCATION (FT)	CONCENTRATED LOADS VERTICAL (KIPS)	CONCENTRATED LOADS HORIZONTAL (KIPS)	CONCENTRATED LOADS MOMENT (K-FT)
1	VERT CONC LOADS	1	0.000	0.000				
1	VERT CONC LOADS	2	0.000	0.000				
1	VERT CONC LOADS	3	0.065	0.000	2.25	2.05	-0.00	0.00
					7.25	2.05	-0.00	0.00
1	VERT CONC LOADS	4	0.065	-0.000	2.25	2.05	-0.00	0.00
					7.25	2.05	-0.00	0.00
1	VERT CONC LOADS	5	0.065	-0.000	2.23	2.05	0.00	0.00
					7.23	2.05	0.00	0.00
1	VERT CONC LOADS	6	0.065	-0.000	2.23	2.05	-0.00	0.00
					7.23	2.05	-0.00	0.00

MEMBER END TRANSLATIONS

MEMBER NUMBER	LOADING CONDITION LC No	LOADING CONDITION DESCRIPTION	END TRANSLATIONS JOINT No	VERT (IN)	HORZ (IN)	JOINT No	VERT (IN)	HORZ (IN)
1	1	VERT CONC LOADS	1	0.00	0.00	2	-0.01	-0.06
2	1	VERT CONC LOADS	7	0.00	0.00	6	-0.01	0.06
3	1	VERT CONC LOADS	2	-0.01	-0.06	3	-1.29	-0.01
4	1	VERT CONC LOADS	6	-0.01	0.06	5	-1.29	0.01
5	1	VERT CONC LOADS	3	-1.29	-0.01	4	-1.65	0.00
6	1	VERT CONC LOADS	5	-1.29	0.01	4	-1.65	0.00

MODULUS OF ELASTICITY 29000. KSI

* * * G E N E R A L I N P U T * * * Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

1002 6 6 1 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI 11								HEAD RECORD
1 1 2	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
2 7 6	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
3 2 3		10.02	0.416	10.038	19.75	0.28		MEMB DESC
4 6 5		-10.02	0.416	10.038	19.75	0.28		MEMB DESC
5 3 4		9.74	0.404	19.75	29.188			MEMB DESC
6 5 4		-9.74	0.404	19.75	29.188			MEMB DESC
DEG	JT	NUMBER	BAND					
INDT	DISPL	SUPPORTS	WIDTH					
1	17	2	6					
1 112		50.	50.					HEADER
	5.0	0.187	5.0	0.25				FLANGE
86.	86.	1.75	86.	86.	1.75			BRACING
2	36.7	1.0	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
2 112		50.	50.					HEADER
	5.0	0.25	5.0	0.187				FLANGE
122.5	122.5	1.75	86.	86.	1.75			BRACING
1	122.5	1.75	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
3 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	60.2	1.0	56.7	53.4	1.0			BRACING
2	60.2	1.0	1	120.1	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
4 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	53.4	1.0	56.7	60.2	1.0			BRACING
1	120.1	1.0	2	60.2	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
5 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	60.2	1.0	56.86	120.1	1.0			BRACING
1	48.5	1.0	1	121.1	1.0			BRACING
2	24.0	1.0						BRACING
				0.156				WEB
0.85	1.0	467.						BUCKLING
6 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	120.1	1.0	56.86	60.2	1.0			BRACING
1	121.1	1.0	1	48.5	1.0			BRACING

* * * G E N E R A L I N P U T * * * Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

1002 6 6 1 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI 11								HEAD RECORD
1 1 2	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
2 7 6	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
3 2 3		10.02	0.416	10.038	19.75	0.28		MEMB DESC
4 6 5		-10.02	0.416	10.038	19.75	0.28		MEMB DESC
5 3 4		9.74	0.404	19.75	29.188			MEMB DESC
6 5 4		-9.74	0.404	19.75	29.188			MEMB DESC
DEG INDT	JT DISPL	NUMBER SUPPORTS	BAND WIDTH					
1	17	2	6					
1 112		50.	50.					HEADER
	5.0	0.187	5.0	0.25				FLANGE
86.	86.	1.75	86.	86.	1.75			BRACING
2	36.7	1.0	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
2 112		50.	50.					HEADER
	5.0	0.25	5.0	0.187				FLANGE
122.5	122.5	1.75	86.	86.	1.75			BRACING
1	122.5	1.75	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
3 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	60.2	1.0	56.7	53.4	1.0			BRACING
2	60.2	1.0	1	120.1	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
4 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	53.4	1.0	56.7	60.2	1.0			BRACING
1	120.1	1.0	2	60.2	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
5 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	60.2	1.0	56.86	120.1	1.0			BRACING
1	48.5	1.0	1	121.1	1.0			BRACING
2	24.0	1.0						BRACING
				0.156				WEB
0.85	1.0	467.						BUCKLING
6 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	120.1	1.0	56.86	60.2	1.0			BRACING
1	121.1	1.0	1	48.5	1.0			BRACING
			2	24.0	1.0			BRACING

H.10

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0.85       1.0       467.                                                    BUCKLING
1 2        HORIZ CONC LOADS REVERSE                                          LOADS
1 6        0.065                                                             LOADS
1 1                                      4.43              10.21             LOADS

NO ERRORS WERE DETECTED IN INPUT
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PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

FRAME GEOMETRY

MEMBER NUMBER	LENGTH (FT)	PROJECTION HORIZ	PROJECTION VERT	INITIAL END JT No	INITIAL END X COORD.	INITIAL END Y COORD.	TERMINAL END JT No	TERMINAL END X COORD.	TERMINAL END Y COORD.
1	10.62	0.00	10.62	1	0.00	0.00	2	0.00	10.62
2	10.62	0.00	10.62	7	39.52	-0.00	6	39.52	10.62
3	10.03	10.02	0.42	2	0.00	10.62	3	10.02	11.04
4	10.03	-10.02	0.42	6	39.52	10.62	5	29.50	11.04
5	9.75	9.74	0.40	3	10.02	11.04	4	19.76	11.44
6	9.75	-9.74	0.40	5	29.50	11.04	4	19.76	11.44

	X	Y
MINIMUM JOINT COORDINATE	0.00	-0.00
MAXIMUM JOINT COORDINATE	39.52	11.44

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	0.05	20.96	0.00	29.48	0.002	1	0.05	20.96	-0.00	30.00	0.002	1	0.124	1
2	0.05	20.96	8.47	29.48	0.289	1	0.05	20.96	-6.99	30.00	0.231	1	0.124	1
3	0.05	20.96	16.93	29.48	0.576	1	0.05	20.96	-13.97	30.00	0.464	1	0.124	1
4	0.05	25.78	25.40	30.05	0.847	1	0.05	25.78	-20.96	30.05	0.696	1	0.124	1
5	0.04	25.57	23.82	30.05	0.794	1	0.04	25.57	-20.16	30.05	0.669	1	0.083	1
6	0.04	25.57	32.42	30.05	1.080	1	0.04	25.57	-27.43	30.05	0.911	1	0.083	1
7	0.04	25.57	32.42	30.05	1.080	1	0.04	25.57	-27.43	30.05	0.911	1	0.097	1

GEOMETRIC PROPERTIES FOR MEMBER 1

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
2	2.50	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
3	5.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
4	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.125	6.56	3.0	27.7	7.22	8.75
5	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11
6	10.21	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11
7	10.21	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
2	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
3	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
4	1.000	27.416	274.759	1.000	26.633	205.520	40.347	29.817	0.850	91.735
5	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196
6	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196
7	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

MEMBER FORCES FOR MEMBER 1

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	2.04	-0.00	0.14						
2	2.50	2.04	-5.10	0.14						
3	5.00	2.04	-10.19	0.14						
4	7.50	2.04	-15.29	0.14						
5	7.50	2.04	-15.29	0.14						
6	10.21	2.04	-20.82	0.14						
7	10.21	2.39	-20.81	0.14						

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	LC No
1	0.81	20.96	-0.00	30.00	0.039	1	0.81	20.96	0.00	29.48	0.039	1	0.146	1
2	0.81	20.96	8.21	30.00	0.300	1	0.81	20.96	-9.94	30.00	0.293	1	0.146	1
3	0.81	20.96	16.41	30.00	0.574	1	0.81	20.96	-19.89	30.00	0.624	1	0.146	1
4	0.81	25.78	24.62	30.00	0.848	1	0.81	25.78	-29.83	30.00	0.963	1	0.146	1
5	0.71	25.57	23.67	30.00	0.813	1	0.71	25.57	-27.98	30.00	0.905	1	0.098	1
6	0.71	25.57	32.22	30.00	1.098	1	0.71	25.57	-38.08	30.00	1.242	1	0.098	1

GEOMETRIC PROPERTIES FOR MEMBER 2

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
2	2.50	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
3	5.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
4	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.125	6.56	3.0	27.7	8.75	7.22
5	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70
6	10.21	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
2	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
3	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
4	1.750	88.898	686.000	1.000	27.416	274.759	40.347	29.817	0.850	91.735
5	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196
6	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196

MEMBER FORCES FOR MEMBER 2

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	2.39	0.00	2.43						
2	2.50	2.39	-5.99	2.43						
3	5.00	2.39	-11.97	2.43						
4	7.50	2.39	-17.96	2.43						
5	7.50	2.39	-17.96	2.43						
6	10.21	2.39	-24.45	2.43						

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STRESS ANALYSIS FOR MEMBER 3

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.77	12.33	20.87	29.86	0.724	1	0.77	12.33	-20.87	30.00	0.633	1	0.001	1
2	0.76	12.29	20.47	29.84	0.711	1	0.76	12.29	-20.47	30.00	0.620	1	0.001	1
3	0.76	12.28	20.47	29.84	0.711	1	0.76	12.28	-20.47	30.00	0.620	1	0.001	1
4	0.69	11.75	15.77	29.69	0.554	1	0.69	11.75	-15.77	30.00	0.467	1	0.010	1
5	0.64	11.29	12.38	29.54	0.440	1	0.64	11.29	-12.38	30.00	0.356	1	0.026	1
6	0.59	10.89	9.78	29.39	0.353	1	0.59	10.89	-9.78	30.00	0.272	1	0.045	1
7	0.55	10.55	7.70	28.57	0.293	1	0.55	10.55	-7.70	30.00	0.205	1	0.069	1

GEOMETRIC PROPERTIES FOR MEMBER 3

POINT	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
	POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	LOCATION (FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.28	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.21	3.1	61.6	11.64	11.64
4	2.84	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.59	3.4	97.1	14.98	14.98
5	5.24	5.0	0.187	60.2	5.0	0.187	120.1	0.125	14.98	3.7	142.5	18.57	18.57
6	7.63	5.0	0.187	60.2	5.0	0.187	120.1	0.125	17.36	4.0	198.5	22.39	22.39
7	10.03	5.0	0.187	60.2	5.0	0.187	120.1	0.125	19.75	4.3	266.1	26.44	26.44

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 3

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	46.137	670.377	1.000	40.925	594.653	110.070	47.814	0.850	12.326
2	1.000	46.206	681.035	1.000	40.987	604.108	110.251	47.972	0.850	12.285
3	1.000	46.207	681.142	1.000	40.988	604.203	110.253	47.974	0.850	12.285
4	1.000	47.197	834.777	1.000	41.866	740.484	112.744	50.194	0.850	11.748
5	1.000	48.167	988.413	1.000	96.094	1971.901	115.017	58.983	0.850	11.288
6	1.000	49.118	1142.048	1.000	97.991	2278.405	117.091	61.285	0.850	10.892
7	1.000	50.050	1295.684	1.000	99.851	2584.911	118.989	63.504	0.850	10.547

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MEMBER FORCES FOR MEMBER 3

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	0.02	-19.85	2.39						
2	0.45	0.01	-19.85	2.39						
3	0.45	0.01	-19.85	2.39						
4	2.84	0.14	-19.69	2.39						
5	5.24	0.30	-19.16	2.38						
6	7.63	0.46	-18.25	2.37						
7	10.03	0.61	-16.97	2.37						

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STRESS ANALYSIS FOR MEMBER 4

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	0.80	12.33	26.06	30.00	0.895	1	0.80	12.33	-26.06	30.00	0.804	1	0.132	1
2	0.79	12.29	25.16	30.00	0.865	1	0.79	12.29	-25.16	30.00	0.774	1	0.133	1
3	0.79	12.28	25.15	30.00	0.865	1	0.79	12.28	-25.15	30.00	0.774	1	0.133	1
4	0.72	11.75	15.28	30.00	0.533	1	0.72	11.75	-15.28	30.00	0.448	1	0.153	1
5	0.66	11.29	9.13	18.24	0.523	1	0.66	11.29	-9.13	30.00	0.246	1	0.169	1
6	0.61	10.89	5.12	17.64	0.318	1	0.61	10.89	-5.12	30.00	0.114	1	0.181	1
7	0.57	10.55	2.43	17.04	0.182	1	0.57	10.55	-2.43	30.00	0.027	1	0.188	1

GEOMETRIC PROPERTIES FOR MEMBER 4

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.28	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.21	3.1	61.6	11.64	11.64
4	2.84	5.0	0.187	53.4	5.0	0.187	60.2	0.125	12.59	3.4	97.1	14.98	14.98
5	5.24	5.0	0.187	120.1	5.0	0.187	60.2	0.125	14.98	3.7	142.5	18.57	18.57
6	7.63	5.0	0.187	120.1	5.0	0.187	60.2	0.125	17.36	4.0	198.5	22.39	22.39
7	10.03	5.0	0.187	120.1	5.0	0.187	60.2	0.125	19.75	4.3	266.1	26.44	26.44

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 4

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	40.925	594.653	1.000	46.137	670.377	110.070	47.814	0.850	12.326
2	1.000	40.987	604.108	1.000	46.206	681.035	110.251	47.972	0.850	12.285
3	1.000	40.988	604.203	1.000	46.207	681.142	110.253	47.974	0.850	12.285
4	1.000	41.866	740.484	1.000	47.197	834.777	112.744	50.194	0.850	11.748
5	1.000	96.094	1971.901	1.000	48.167	988.413	115.017	58.983	0.850	11.288
6	1.000	97.991	2278.405	1.000	49.118	1142.048	117.091	61.285	0.850	10.892
7	1.000	99.851	2584.911	1.000	50.050	1295.684	118.989	63.504	0.850	10.547

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MEMBER FORCES FOR MEMBER 4

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	2.31	-24.78	2.49						
2	0.45	2.30	-24.40	2.49						
3	0.45	2.30	-24.40	2.49						
4	2.84	2.14	-19.08	2.49						
5	5.24	1.99	-14.13	2.48						
6	7.63	1.83	-9.55	2.47						
7	10.03	1.68	-5.34	2.47						

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STRESS ANALYSIS FOR MEMBER 5

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	0.48	21.34	7.17	28.93	0.264	1	0.48	21.34	-7.17	30.00	0.216	1	0.035	1
2	0.45	20.91	5.60	28.75	0.210	1	0.45	20.91	-5.60	30.00	0.165	1	0.049	1
3	0.42	20.48	4.27	27.81	0.168	1	0.42	20.48	-4.27	30.00	0.122	1	0.065	1
4	0.39	22.02	3.12	27.94	0.125	1	0.39	22.02	-3.12	30.00	0.086	1	0.082	1
5	0.37	21.89	2.12	26.73	0.092	1	0.37	21.89	-2.12	30.00	0.054	1	0.102	1
6	0.37	21.89	2.12	26.73	0.092	1	0.37	21.89	-2.12	30.00	0.054	1	0.102	1
7	0.36	21.87	1.94	26.47	0.085	1	0.36	21.87	-1.94	30.00	0.048	1	0.106	1

GEOMETRIC PROPERTIES FOR MEMBER 5

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	60.2	5.0	0.187	120.1	0.156	19.75	5.0	286.0	28.42	28.42
2	2.32	5.0	0.187	60.2	5.0	0.187	120.1	0.156	22.00	5.3	368.5	32.94	32.94
3	4.64	5.0	0.187	60.2	5.0	0.187	120.1	0.156	24.25	5.7	464.4	37.73	37.73
4	6.97	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.50	6.0	574.6	42.77	42.77
5	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.74	6.4	700.0	48.08	48.08
6	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.75	6.4	700.1	48.09	48.09
7	9.75	5.0	0.187	24.0	5.0	0.187	121.1	0.156	29.19	6.4	726.7	49.16	49.16

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

H.20

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 5

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	51.912	1295.684	1.000	103.566	2584.911	61.447	67.810	0.850	39.551
2	1.000	52.950	1440.450	1.000	105.635	2873.722	62.393	70.165	0.850	38.361
3	1.000	53.967	1585.216	1.000	107.665	3162.532	63.251	72.442	0.850	37.326
4	1.000	44.283	1393.756	1.000	110.570	3480.081	64.035	60.141	0.850	36.418
5	1.000	22.304	747.408	1.000	112.542	3771.296	64.753	30.615	0.850	35.615
6	1.000	22.304	747.449	1.000	112.544	3771.505	64.754	30.615	0.850	35.614
7	1.000	22.380	758.811	1.000	112.928	3828.832	64.888	30.781	0.850	35.467

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

MEMBER FORCES FOR MEMBER 5

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	0.61	-16.97	2.37						
2	2.32	0.76	-15.38	2.36						
3	4.64	0.91	-13.43	2.36						
4	6.97	1.06	-11.14	2.35						
5	9.29	1.21	-8.49	2.34						
6	9.29	1.21	-8.49	2.34						
7	9.75	1.24	-7.93	2.34						

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

STRESS ANALYSIS FOR MEMBER 6

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.50	21.34	2.26	15.85	0.159	1	0.50	21.34	-2.26	30.00	0.052	1	0.097	1
2	0.46	20.91	0.59	15.23	0.056	1	0.46	20.91	-0.59	30.00	0.003	1	0.098	1
3	0.43	20.48	-0.56	30.00	0.003	1	0.43	20.48	0.56	27.81	0.038	1	0.098	1
4	0.41	22.02	-1.34	30.00	0.026	1	0.41	22.02	1.34	27.94	0.062	1	0.095	1
5	0.38	21.89	-1.86	30.00	0.044	1	0.38	21.89	1.86	26.73	0.082	1	0.090	1
6	0.38	21.89	-1.86	30.00	0.044	1	0.38	21.89	1.86	26.73	0.082	1	0.090	1
7	0.38	21.87	-1.94	30.00	0.047	1	0.38	21.87	1.94	26.47	0.086	1	0.089	1

GEOMETRIC PROPERTIES FOR MEMBER 6

POINT	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
	POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	LOCATION (FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.00	5.0	0.187	120.1	5.0	0.187	60.2	0.156	19.75	5.0	286.0	28.42	28.42
2	2.32	5.0	0.187	120.1	5.0	0.187	60.2	0.156	22.00	5.3	368.5	32.94	32.94
3	4.64	5.0	0.187	120.1	5.0	0.187	60.2	0.156	24.25	5.7	464.4	37.73	37.73
4	6.97	5.0	0.187	121.1	5.0	0.187	48.5	0.156	26.50	6.0	574.6	42.77	42.77
5	9.29	5.0	0.187	121.1	5.0	0.187	24.0	0.156	28.74	6.4	700.0	48.08	48.08
6	9.29	5.0	0.187	121.1	5.0	0.187	24.0	0.156	28.75	6.4	700.1	48.09	48.09
7	9.75	5.0	0.187	121.1	5.0	0.187	24.0	0.156	29.19	6.4	726.7	49.16	49.16

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 6

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	103.566	2584.911	1.000	51.912	1295.684	61.447	67.810	0.850	39.551
2	1.000	105.635	2873.722	1.000	52.950	1440.450	62.393	70.165	0.850	38.361
3	1.000	107.665	3162.532	1.000	53.967	1585.216	63.251	72.442	0.850	37.326
4	1.000	110.570	3480.081	1.000	44.283	1393.756	64.035	60.141	0.850	36.418
5	1.000	112.542	3771.296	1.000	22.304	747.408	64.753	30.615	0.850	35.615
6	1.000	112.544	3771.505	1.000	22.304	747.449	64.754	30.615	0.850	35.614
7	1.000	112.928	3828.832	1.000	22.380	758.811	64.888	30.781	0.850	35.467

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

MEMBER FORCES FOR MEMBER 6

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	1.68	-5.34	2.47						
2	2.32	1.53	-1.62	2.46						
3	4.64	1.38	1.75	2.45						
4	6.97	1.23	4.77	2.45						
5	9.29	1.08	7.44	2.44						
6	9.29	1.08	7.44	2.44						
7	9.75	1.05	7.93	2.44						

PROJECT No. 1002 40 X 12 X 20 UBM WIND LOAD FCTR NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 11:50

FORCES ACTING ON SUPPORTS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	SUPPORT No	HORIZONTAL (KIPS)	VERTICAL (KIPS)	MOMENT (K-FT)
1	HORIZ CONC LOADS REVERSE	1	2.04	0.14	-0.00
1	HORIZ CONC LOADS REVERSE	7	2.39	2.43	0.00
	TOTAL FORCES ACTING		4.43	2.57	-0.00
	TOTAL FORCES APPLIED		4.43	2.57	0.00

EXTERNAL MEMBER LOADS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	MEMBER NUMBER	UNIFORMLY DISTRIBUTED LOADS VERTICAL (K/FT)	UNIFORMLY DISTRIBUTED LOADS HORIZONTAL (K/FT)	CONCENTRATED LOADS LOCATION (FT)	CONCENTRATED LOADS VERTICAL (KIPS)	CONCENTRATED LOADS HORIZONTAL (KIPS)	CONCENTRATED LOADS MOMENT (K-FT)
1	HORIZ CONC LOADS REVERSE	1	0.000	0.000	10.21	0.00	4.43	0.00
1	HORIZ CONC LOADS REVERSE	2	0.000	0.000				
1	HORIZ CONC LOADS REVERSE	3	0.065	0.000				
1	HORIZ CONC LOADS REVERSE	4	0.065	-0.000				
1	HORIZ CONC LOADS REVERSE	5	0.065	-0.000				
1	HORIZ CONC LOADS REVERSE	6	0.065	-0.000				

MEMBER END TRANSLATIONS

MEMBER NUMBER	LC No	LOADING CONDITION DESCRIPTION	JOINT No	END TRANSLATIONS VERT (IN)	END TRANSLATIONS HORZ (IN)	JOINT No	VERT (IN)	HORZ (IN)
1	1	HORIZ CONC LOADS REVERSE	1	0.00	0.00	2	-0.00	2.64
2	1	HORIZ CONC LOADS REVERSE	7	0.00	0.00	6	-0.00	2.65
3	1	HORIZ CONC LOADS REVERSE	2	-0.00	2.64	3	-0.32	2.65
4	1	HORIZ CONC LOADS REVERSE	6	-0.00	2.65	5	0.03	2.65
5	1	HORIZ CONC LOADS REVERSE	3	-0.32	2.65	4	-0.19	2.65
6	1	HORIZ CONC LOADS REVERSE	5	0.03	2.65	4	-0.19	2.65

MODULUS OF ELASTICITY 29000. KSI

* * * G E N E R A L I N P U T * * * Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

1003 6 6 1 40 X 12 X 20 UBM			UNBAL LIVE	NOM GAGES	50 KSI	11		HEAD RECORD
1 1 2	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
2 7 6	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
3 2 3		10.02	0.416	10.038	19.75	0.28		MEMB DESC
4 6 5		-10.02	0.416	10.038	19.75	0.28		MEMB DESC
5 3 4		9.74	0.404	19.75	29.188			MEMB DESC
6 5 4		-9.74	0.404	19.75	29.188			MEMB DESC
DEG	JT	NUMBER	BAND					
INDT	DISPL	SUPPORTS	WIDTH					
1	17	2	6					
1 112		50.	50.					HEADER
	5.0	0.187	5.0	0.25				FLANGE
86.	86.	1.75	86.	86.	1.75			BRACING
2	36.7	1.0	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
2 112		50.	50.					HEADER
	5.0	0.25	5.0	0.187				FLANGE
122.5	122.5	1.75	86.	86.	1.75			BRACING
1	122.5	1.75	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
3 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	60.2	1.0	56.7	53.4	1.0			BRACING
2	60.2	1.0	1	120.1	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
4 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	53.4	1.0	56.7	60.2	1.0			BRACING
1	120.1	1.0	2	60.2	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
5 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	60.2	1.0	56.86	120.1	1.0			BRACING
1	48.5	1.0	1	121.1	1.0			BRACING
2	24.0	1.0						BRACING
				0.156				WEB
0.85	1.0	467.						BUCKLING
6 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	120.1	1.0	56.86	60.2	1.0			BRACING
1	121.1	1.0	1	48.5	1.0			BRACING
			2	24.0	1.0			BRACING

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0.85      1.0       467.                                                  BUCKLING
1 5       WW VERT CONC LOADS                                              LOADS
1 4       0.065                                                           LOADS
3 3                            3.46                    2.25               LOADS
3 3                            3.46                    7.25               LOADS
5 5                            3.46                    2.23               LOADS
5 5                            3.46                    7.23               LOADS

NO ERRORS WERE DETECTED IN INPUT
*---------*---------*---------*---------*---------*---------*---------*---------*
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PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

FRAME GEOMETRY

MEMBER NUMBER	LENGTH (FT)	PROJECTION HORIZ	PROJECTION VERT	INITIAL END JT No	INITIAL END X COORD.	INITIAL END Y COORD.	TERMINAL END JT No	TERMINAL END X COORD.	TERMINAL END Y COORD.
1	10.62	0.00	10.62	1	0.00	0.00	2	0.00	10.62
2	10.62	0.00	10.62	7	39.52	-0.00	6	39.52	10.62
3	10.03	10.02	0.42	2	0.00	10.62	3	10.02	11.04
4	10.03	-10.02	0.42	6	39.52	10.62	5	29.50	11.04
5	9.75	9.74	0.40	3	10.02	11.04	4	19.76	11.44
6	9.75	-9.74	0.40	5	29.50	11.04	4	19.76	11.44

	X	Y
MINIMUM JOINT COORDINATE	0.00	-0.00
MAXIMUM JOINT COORDINATE	39.52	11.44

PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	3.69	20.96	-0.00	30.00	0.176	1	3.69	20.96	0.00	30.00	0.176	1	0.086	1
2	3.69	20.96	-5.87	30.00	0.073	1	3.69	20.96	4.85	30.00	0.319	1	0.086	1
3	3.69	20.96	-11.75	30.00	0.269	1	3.69	20.96	9.69	30.00	0.462	1	0.086	1
4	3.69	25.78	-17.62	32.43	0.400	1	3.69	25.78	14.54	32.43	0.571	1	0.086	1
5	3.25	25.57	-16.53	32.43	0.383	1	3.25	25.57	13.98	32.43	0.539	1	0.058	1
6	3.25	25.57	-22.50	32.43	0.567	1	3.25	25.57	19.04	32.43	0.695	1	0.058	1

GEOMETRIC PROPERTIES FOR MEMBER 1

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
2	2.50	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
3	5.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
4	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.125	6.56	3.0	27.7	7.22	8.75
5	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11
6	10.21	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE FLANGE CB	POS FLANGE L/RT	POS FLANGE LD/AF	NEGATIVE FLANGE CB	NEG FLANGE L/RT	NEG FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
2	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
3	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
4	1.000	27.416	274.759	1.000	26.633	205.520	40.347	29.817	0.850	91.735
5	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196
6	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196

MEMBER FORCES FOR MEMBER 1

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	1.41	0.00	11.08						
2	2.50	1.41	3.54	11.08						
3	5.00	1.41	7.07	11.08						
4	7.50	1.41	10.61	11.08						
5	7.50	1.41	10.61	11.08						
6	10.21	1.41	14.44	11.08						

PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	1.35	20.96	0.00	30.00	0.065	1	1.35	20.96	-0.00	30.00	0.065	1	0.086	1
2	1.35	20.96	4.85	30.00	0.207	1	1.35	20.96	-5.88	30.00	0.131	1	0.086	1
3	1.35	20.96	9.70	30.00	0.368	1	1.35	20.96	-11.75	30.00	0.327	1	0.086	1
4	1.35	25.78	14.55	30.00	0.530	1	1.35	25.78	-17.63	30.00	0.535	1	0.086	1
5	1.19	25.57	13.99	30.00	0.506	1	1.19	25.57	-16.53	30.00	0.505	1	0.058	1
6	1.19	25.57	19.04	30.00	0.675	1	1.19	25.57	-22.51	30.00	0.704	1	0.058	1

GEOMETRIC PROPERTIES FOR MEMBER 2

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
2	2.50	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
3	5.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
4	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.125	6.56	3.0	27.7	8.75	7.22
5	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70
6	10.21	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE FLANGE CB	POS FLANGE L/RT	POS FLANGE LD/AF	NEGATIVE FLANGE CB	NEG FLANGE L/RT	NEG FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
2	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
3	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
4	1.750	88.898	686.000	1.000	27.416	274.759	40.347	29.817	0.850	91.735
5	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196
6	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196

MEMBER FORCES FOR MEMBER 2

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	1.42	-0.00	4.06						
2	2.50	1.42	-3.54	4.06						
3	5.00	1.42	-7.08	4.06						
4	7.50	1.42	-10.61	4.06						
5	7.50	1.42	-10.62	4.06						
6	10.21	1.42	-14.45	4.06						

PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

STRESS ANALYSIS FOR MEMBER 3

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.60	12.33	-12.56	30.00	0.370	1	0.60	12.33	12.56	30.00	0.439	1	0.629	1
2	0.60	12.29	-10.43	30.00	0.299	1	0.60	12.29	10.43	30.00	0.368	1	0.637	1
3	0.60	12.28	-10.41	30.00	0.299	1	0.60	12.28	10.41	30.00	0.367	1	0.637	1
4	0.55	11.87	8.13	29.73	0.292	1	0.55	11.87	-8.13	30.00	0.224	1	0.741	1
5	0.51	11.87	8.14	29.73	0.291	1	0.51	11.87	-8.14	30.00	0.228	1	0.505	1
6	0.47	11.38	18.79	29.57	0.651	1	0.47	11.38	-18.79	30.00	0.585	1	0.597	1
7	0.43	10.95	25.26	29.42	0.873	1	0.43	10.95	-25.26	30.00	0.803	1	0.684	1
8	0.39	10.95	25.26	29.42	0.872	1	0.39	10.95	-25.26	30.00	0.806	1	0.350	1
9	0.36	10.55	25.24	28.57	0.896	1	0.36	10.55	-25.24	30.00	0.807	1	0.387	1

GEOMETRIC PROPERTIES FOR MEMBER 3

POINT	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
	POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	LOCATION (FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.28	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.21	3.1	61.6	11.64	11.64
4	2.25	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.00	3.4	87.4	14.13	14.13
5	2.25	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.00	3.4	87.5	14.13	14.13
6	4.75	5.0	0.187	60.2	5.0	0.187	120.1	0.125	14.49	3.7	132.4	17.82	17.82
7	7.25	5.0	0.187	60.2	5.0	0.187	120.1	0.125	16.98	4.0	188.8	21.76	21.76
8	7.25	5.0	0.187	60.2	5.0	0.187	120.1	0.125	16.98	4.0	188.8	21.76	21.76
9	10.03	5.0	0.187	60.2	5.0	0.187	120.1	0.125	19.75	4.3	266.1	26.44	26.44

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 3

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	46.137	670.377	1.000	40.925	594.653	110.070	47.814	0.850	12.326
2	1.000	46.206	681.035	1.000	40.987	604.108	110.251	47.972	0.850	12.285
3	1.000	46.207	681.142	1.000	40.988	604.203	110.253	47.974	0.850	12.285
4	1.000	46.954	796.685	1.000	41.650	706.694	112.148	49.653	0.850	11.873
5	1.000	46.954	796.792	1.000	41.651	706.789	112.149	49.655	0.850	11.873
6	1.000	47.971	957.096	1.000	95.703	1909.423	114.571	58.502	0.850	11.376
7	1.000	48.967	1117.400	1.000	97.689	2229.232	116.771	60.922	0.850	10.952
8	1.000	48.967	1117.507	1.000	97.690	2229.445	116.772	60.923	0.850	10.951
9	1.000	50.050	1295.684	1.000	99.851	2584.911	118.989	63.504	0.850	10.547

H.30

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MEMBER FORCES FOR MEMBER 3

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	10.99	11.94	1.87						
2	0.45	10.98	10.12	1.87						
3	0.45	10.98	10.10	1.87						
4	2.25	10.86	-9.58	1.87						
5	2.25	7.41	-9.59	1.72						
6	4.75	7.24	-27.90	1.72						
7	7.25	7.08	-45.80	1.71						
8	7.25	3.63	-45.81	1.57						
9	10.03	3.45	-55.63	1.56						

PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

STRESS ANALYSIS FOR MEMBER 4

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.51	12.33	14.63	30.00	0.504	1	0.51	12.33	-14.63	30.00	0.447	1	0.228	1
2	0.50	12.29	13.67	30.00	0.472	1	0.50	12.29	-13.67	30.00	0.415	1	0.230	1
3	0.50	12.28	13.66	30.00	0.472	1	0.50	12.28	-13.66	30.00	0.414	1	0.230	1
4	0.46	11.75	3.13	30.00	0.131	1	0.46	11.75	-3.13	30.00	0.066	1	0.273	1
5	0.42	11.29	-3.26	30.00	0.072	1	0.42	11.29	3.26	29.54	0.135	1	0.312	1
6	0.39	10.89	-7.31	30.00	0.208	1	0.39	10.89	7.31	29.39	0.261	1	0.346	1
7	0.36	10.55	-9.91	30.00	0.296	1	0.36	10.55	9.91	28.57	0.359	1	0.376	1

GEOMETRIC PROPERTIES FOR MEMBER 4

POINT	LOCATION	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
		POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	(FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.28	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.21	3.1	61.6	11.64	11.64
4	2.84	5.0	0.187	53.4	5.0	0.187	60.2	0.125	12.59	3.4	97.1	14.98	14.98
5	5.24	5.0	0.187	120.1	5.0	0.187	60.2	0.125	14.98	3.7	142.5	18.57	18.57
6	7.63	5.0	0.187	120.1	5.0	0.187	60.2	0.125	17.36	4.0	198.5	22.39	22.39
7	10.03	5.0	0.187	120.1	5.0	0.187	60.2	0.125	19.75	4.3	266.1	26.44	26.44

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 4

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	40.925	594.653	1.000	46.137	670.377	110.070	47.814	0.850	12.326
2	1.000	40.987	604.108	1.000	46.206	681.035	110.251	47.972	0.850	12.285
3	1.000	40.988	604.203	1.000	46.207	681.142	110.253	47.974	0.850	12.285
4	1.000	41.866	740.484	1.000	47.197	834.777	112.744	50.194	0.850	11.748
5	1.000	96.094	1971.901	1.000	48.167	988.413	115.017	58.983	0.850	11.288
6	1.000	97.991	2278.405	1.000	49.118	1142.048	117.091	61.285	0.850	10.892
7	1.000	99.851	2584.911	1.000	50.050	1295.684	118.989	63.504	0.850	10.547

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MEMBER FORCES FOR MEMBER 4

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	3.98	-13.91	1.58						
2	0.45	3.97	-13.25	1.58						
3	0.45	3.97	-13.24	1.58						
4	2.84	3.82	-3.91	1.58						
5	5.24	3.66	5.04	1.57						
6	7.63	3.51	13.63	1.56						
7	10.03	3.35	21.84	1.56						

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STRESS ANALYSIS FOR MEMBER 5

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	0.31	21.34	23.49	28.93	0.822	1	0.31	21.34	-23.49	30.00	0.768	1	0.199	1
2	0.29	20.92	23.19	28.76	0.816	1	0.29	20.92	-23.19	30.00	0.759	1	0.221	1
3	0.27	20.92	23.19	28.76	0.815	1	0.27	20.92	-23.19	30.00	0.760	1	0.001	1
4	0.25	20.47	20.03	27.77	0.730	1	0.25	20.47	-20.03	30.00	0.656	1	0.001	1
5	0.23	22.00	17.51	27.81	0.637	1	0.23	22.00	-17.51	30.00	0.573	1	0.001	1
6	0.21	22.00	17.50	27.81	0.636	1	0.21	22.00	-17.50	30.00	0.574	1	0.271	1
7	0.20	21.89	14.00	26.73	0.531	1	0.20	21.89	-14.00	30.00	0.458	1	0.292	1
8	0.20	21.89	14.00	26.73	0.530	1	0.20	21.89	-14.00	30.00	0.458	1	0.292	1
9	0.20	21.87	13.31	26.47	0.509	1	0.20	21.87	-13.31	30.00	0.434	1	0.296	1

GEOMETRIC PROPERTIES FOR MEMBER 5

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	60.2	5.0	0.187	120.1	0.156	19.75	5.0	286.0	28.42	28.42
2	2.23	5.0	0.187	60.2	5.0	0.187	120.1	0.156	21.91	5.3	364.9	32.76	32.76
3	2.23	5.0	0.187	60.2	5.0	0.187	120.1	0.156	21.91	5.3	365.0	32.76	32.76
4	4.73	5.0	0.187	60.2	5.0	0.187	120.1	0.156	24.33	5.7	468.2	37.91	37.91
5	7.23	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.75	6.0	588.0	43.36	43.36
6	7.23	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.75	6.0	588.1	43.36	43.36
7	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.74	6.4	700.0	48.08	48.08
8	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.75	6.4	700.1	48.09	48.09
9	9.75	5.0	0.187	24.0	5.0	0.187	121.1	0.156	29.19	6.4	726.7	49.16	49.16

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 5

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	51.912	1295.684	1.000	103.566	2584.911	61.447	67.810	0.850	39.551
2	1.000	52.908	1434.639	1.000	105.553	2862.129	62.356	70.072	0.850	38.405
3	1.000	52.909	1434.743	1.000	105.554	2862.336	62.357	70.073	0.850	38.404
4	1.000	54.004	1590.529	1.000	107.738	3173.131	63.281	72.524	0.850	37.291
5	1.000	44.372	1406.915	1.000	110.794	3512.936	64.119	60.338	0.850	36.323
6	1.000	44.373	1406.998	1.000	110.795	3513.145	64.120	60.339	0.850	36.322
7	1.000	22.304	747.408	1.000	112.542	3771.296	64.753	30.615	0.850	35.615
8	1.000	22.304	747.449	1.000	112.544	3771.505	64.754	30.615	0.850	35.614
9	1.000	22.380	758.811	1.000	112.928	3828.832	64.888	30.781	0.850	35.467

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MEMBER FORCES FOR MEMBER 5

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	3.45	-55.63	1.56						
2	2.23	3.45	-63.31	1.56						
3	2.23	0.01	-63.31	1.42						
4	4.73	0.01	-63.28	1.42						
5	7.23	0.01	-63.25	1.42						
6	7.23	3.47	-63.25	1.27						
7	9.29	3.47	-56.10	1.27						
8	9.29	3.47	-56.10	1.27						
9	9.75	3.47	-54.51	1.27						

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STRESS ANALYSIS FOR MEMBER 6

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	0.31	21.34	-9.22	30.00	0.293	1	0.31	21.34	9.22	28.93	0.329	1	0.194	1
2	0.29	20.91	-10.79	30.00	0.346	1	0.29	20.91	10.79	28.75	0.385	1	0.216	1
3	0.28	20.48	-11.90	30.00	0.383	1	0.28	20.48	11.90	27.81	0.437	1	0.238	1
4	0.26	22.02	-12.68	30.00	0.411	1	0.26	22.02	12.68	27.94	0.462	1	0.260	1
5	0.24	21.89	-13.22	30.00	0.430	1	0.24	21.89	13.22	26.73	0.503	1	0.282	1
6	0.24	21.89	-13.22	30.00	0.430	1	0.24	21.89	13.22	26.73	0.503	1	0.282	1
7	0.24	21.87	-13.31	30.00	0.433	1	0.24	21.87	13.31	26.47	0.511	1	0.286	1

GEOMETRIC PROPERTIES FOR MEMBER 6

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	120.1	5.0	0.187	60.2	0.156	19.75	5.0	286.0	28.42	28.42
2	2.32	5.0	0.187	120.1	5.0	0.187	60.2	0.156	22.00	5.3	368.5	32.94	32.94
3	4.64	5.0	0.187	120.1	5.0	0.187	60.2	0.156	24.25	5.7	464.4	37.73	37.73
4	6.97	5.0	0.187	121.1	5.0	0.187	48.5	0.156	26.50	6.0	574.6	42.77	42.77
5	9.29	5.0	0.187	121.1	5.0	0.187	24.0	0.156	28.74	6.4	700.0	48.08	48.08
6	9.29	5.0	0.187	121.1	5.0	0.187	24.0	0.156	28.75	6.4	700.1	48.09	48.09
7	9.75	5.0	0.187	121.1	5.0	0.187	24.0	0.156	29.19	6.4	726.7	49.16	49.16

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 6

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	103.566	2584.911	1.000	51.912	1295.684	61.447	67.810	0.850	39.551
2	1.000	105.635	2873.722	1.000	52.950	1440.450	62.393	70.165	0.850	38.361
3	1.000	107.665	3162.532	1.000	53.967	1585.216	63.251	72.442	0.850	37.326
4	1.000	110.570	3480.081	1.000	44.283	1393.756	64.035	60.141	0.850	36.418
5	1.000	112.542	3771.296	1.000	22.304	747.408	64.753	30.615	0.850	35.615
6	1.000	112.544	3771.505	1.000	22.304	747.449	64.754	30.615	0.850	35.614
7	1.000	112.928	3828.832	1.000	22.380	758.811	64.888	30.781	0.850	35.467

PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

MEMBER FORCES FOR MEMBER 6

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	3.35	21.85	1.56						
2	2.32	3.35	29.63	1.56						
3	4.64	3.35	37.41	1.56						
4	6.97	3.35	45.20	1.56						
5	9.29	3.35	52.98	1.56						
6	9.29	3.35	52.99	1.56						
7	9.75	3.35	54.52	1.56						

PROJECT No. 1003 40 X 12 X 20 UBM UNBAL LIVE NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:30

FORCES ACTING ON SUPPORTS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	SUPPORT No	HORIZONTAL (KIPS)	VERTICAL (KIPS)	MOMENT (K-FT)
1	WW VERT CONC LOADS	1	-1.41	11.08	0.00
1	WW VERT CONC LOADS	7	1.42	4.06	-0.00
	TOTAL FORCES ACTING		0.00	15.14	-0.00
	TOTAL FORCES APPLIED		0.00	15.14	0.00

EXTERNAL MEMBER LOADS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	MEMBER NUMBER	UNIFORMLY DISTRIBUTED LOADS VERTICAL (K/FT)	UNIFORMLY DISTRIBUTED LOADS HORIZONTAL (K/FT)	CONCENTRATED LOADS LOCATION (FT)	CONCENTRATED LOADS VERTICAL (KIPS)	CONCENTRATED LOADS HORIZONTAL (KIPS)	CONCENTRATED LOADS MOMENT (K-FT)
1	WW VERT CONC LOADS	1	0.000	0.000				
1	WW VERT CONC LOADS	2	0.000	0.000				
1	WW VERT CONC LOADS	3	0.065	0.000	2.25	3.46	0.00	0.00
					7.25	3.46	0.00	0.00
1	WW VERT CONC LOADS	4	0.065	-0.000				
1	WW VERT CONC LOADS	5	0.000	0.000	2.23	3.46	0.00	0.00
					7.23	3.46	0.00	0.00

MEMBER END TRANSLATIONS

MEMBER NUMBER	LC No	LOADING CONDITION DESCRIPTION	JOINT No	END TRANSLATIONS VERT (IN)	END TRANSLATIONS HORZ (IN)	JOINT No	END TRANSLATIONS VERT (IN)	END TRANSLATIONS HORZ (IN)
1	1	WW VERT CONC LOADS	1	0.00	0.00	2	-0.02	0.37
2	1	WW VERT CONC LOADS	7	0.00	0.00	6	-0.01	0.47
3	1	WW VERT CONC LOADS	2	-0.02	0.37	3	-1.18	0.41
4	1	WW VERT CONC LOADS	6	-0.01	0.47	5	-0.82	0.43
5	1	WW VERT CONC LOADS	3	-1.18	0.41	4	-1.27	0.42
6	1	WW VERT CONC LOADS	5	-0.82	0.43	4	-1.27	0.42

MODULUS OF ELASTICITY 29000. KSI

* * * G E N E R A L I N P U T * * *

Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

1004 6 6 1 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI						11		HEAD RECORD
1 1 2	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
2 7 6	11	0.	10.62	6.563	6.563		0.41	MEMB DESC
3 2 3		10.02	0.416	10.038	19.75	0.28		MEMB DESC
4 6 5		-10.02	0.416	10.038	19.75	0.28		MEMB DESC
5 3 4		9.74	0.404	19.75	29.188			MEMB DESC
6 5 4		-9.74	0.404	19.75	29.188			MEMB DESC
DEG	JT	NUMBER	BAND					
INDT	DISPL	SUPPORTS	WIDTH					
1	17	2	6					
1 112		50.	50.					HEADER
	5.0	0.187	5.0	0.25				FLANGE
86.	86.	1.75	86.	86.	1.75			BRACING
2	36.7	1.0	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
2 112		50.	50.					HEADER
	5.0	0.25	5.0	0.187				FLANGE
122.5	122.5	1.75	86.	86.	1.75			BRACING
1	122.5	1.75	2	36.7	1.0			BRACING
7.5				0.125	0.187			WEB
0.85	1.	122.5						BUCKLING
3 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	60.2	1.0	56.7	53.4	1.0			BRACING
2	60.2	1.0	1	120.1	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
4 121		50.	50.					HEADER
0.167	5.0	0.187	5.0	0.187				FLANGE
	5.0	0.187	5.0	0.187				FLANGE
56.7	53.4	1.0	56.7	60.2	1.0			BRACING
1	120.1	1.0	2	60.2	1.0			BRACING
				0.125				WEB
0.85	1.0	467.						BUCKLING
5 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	60.2	1.0	56.86	120.1	1.0			BRACING
1	48.5	1.0	1	121.1	1.0			BRACING
2	24.0	1.0						BRACING
				0.156				WEB
0.85	1.0	467.						BUCKLING
6 121		50.	50.					HEADER
	5.0	0.187	5.0	0.187				FLANGE
0.458	5.0	0.187	5.0	0.187				FLANGE
56.86	120.1	1.0	56.86	60.2	1.0			BRACING
1	121.1	1.0	1	48.5	1.0			BRACING
								BRACING

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0.85       1.0        467.                                                    BUCKLING
1 6        WW VERT LDS + WIND                                                 LOADS
1 6        0.065                                                              LOADS
1 1                                    3.54                 10.21             LOADS
3 3                          2.05                           2.25             LOADS
3 3                          2.05                           7.25             LOADS
5 5                          2.05                           2.23             LOADS
5 5                          2.05                           7.23             LOADS

NO ERRORS WERE DETECTED IN INPUT
*---------*---------*---------*---------*---------*---------*---------*---------*
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PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

FRAME GEOMETRY

MEMBER NUMBER	LENGTH (FT)	PROJECTION HORIZ	PROJECTION VERT	INITIAL END JT No	INITIAL END X COORD.	INITIAL END Y COORD.	TERMINAL END JT No	TERMINAL END X COORD.	TERMINAL END Y COORD.
1	10.62	0.00	10.62	1	0.00	0.00	2	0.00	10.62
2	10.62	0.00	10.62	7	39.52	-0.00	6	39.52	10.62
3	10.03	10.02	0.42	2	0.00	10.62	3	10.02	11.04
4	10.03	-10.02	0.42	6	39.52	10.62	5	29.50	11.04
5	9.75	9.74	0.40	3	10.02	11.04	4	19.76	11.44
6	9.75	-9.74	0.40	5	29.50	11.04	4	19.76	11.44

	X	Y
MINIMUM JOINT COORDINATE	0.00	-0.00
MAXIMUM JOINT COORDINATE	39.52	11.44

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	AXIAL STRESS ALLOWABLE (KSI)	BENDING STRESS COMPUTED (KSI)	BENDING STRESS ALLOWABLE (KSI)	STRESS RATIO	LC No	WEB SHEAR RATIO	WEB LC No
1	2.18	20.96	0.00	29.48	0.104	1	2.18	20.96	-0.00	30.00	0.104	1	0.048	1
2	2.18	20.96	3.30	29.48	0.201	1	2.18	20.96	-2.72	30.00	0.013	1	0.048	1
3	2.18	20.96	6.60	29.48	0.299	1	2.18	20.96	-5.45	30.00	0.078	1	0.048	1
4	2.18	25.78	9.90	30.05	0.402	1	2.18	25.78	-8.17	30.05	0.187	1	0.048	1
5	1.92	25.57	9.29	30.05	0.373	1	1.92	25.57	-7.86	30.05	0.186	1	0.032	1
6	1.92	25.57	12.64	30.05	0.485	1	1.92	25.57	-10.69	30.05	0.281	1	0.032	1
7	1.92	25.57	12.63	30.05	0.484	1	1.92	25.57	-10.69	30.05	0.281	1	0.112	1

GEOMETRIC PROPERTIES FOR MEMBER 1

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
2	2.50	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
3	5.00	5.0	0.187	86.0	5.0	0.250	86.0	0.125	6.56	3.0	27.7	7.22	8.75
4	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.125	6.56	3.0	27.7	7.22	8.75
5	7.50	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11
6	10.21	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11
7	10.21	5.0	0.187	36.7	5.0	0.250	36.7	0.187	6.56	3.4	29.2	7.70	9.11

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE FLANGE CB	L/RT	LD/AF	NEGATIVE FLANGE CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
2	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
3	1.750	64.244	643.850	1.750	62.410	481.600	40.347	69.870	0.850	91.735
4	1.000	27.416	274.759	1.000	26.633	205.520	40.347	29.817	0.850	91.735
5	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196
6	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196
7	1.000	28.317	274.759	1.000	27.238	205.520	41.866	31.762	0.850	85.196

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

MEMBER FORCES FOR MEMBER 1

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	0.79	-0.00	6.55						
2	2.50	0.79	-1.99	6.55						
3	5.00	0.79	-3.97	6.55						
4	7.50	0.79	-5.96	6.55						
5	7.50	0.79	-5.96	6.55						
6	10.21	0.79	-8.11	6.55						
7	10.21	2.75	-8.11	6.55						

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	1.40	20.96	-0.00	30.00	0.067	1	1.40	20.96	0.00	29.48	0.067	1	0.168	1
2	1.40	20.96	9.42	30.00	0.361	1	1.40	20.96	-11.41	30.00	0.313	1	0.168	1
3	1.40	20.96	18.84	30.00	0.675	1	1.40	20.96	-22.83	30.00	0.694	1	0.168	1
4	1.40	25.78	28.25	30.00	0.989	1	1.40	25.78	-34.24	30.00	1.087	1	0.168	1
5	1.24	25.57	27.17	30.00	0.947	1	1.24	25.57	-32.11	30.00	1.022	1	0.112	1
6	1.24	25.57	36.99	30.00	1.274	1	1.24	25.57	-43.71	30.00	1.409	1	0.112	1

GEOMETRIC PROPERTIES FOR MEMBER 2

PT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
2	2.50	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
3	5.00	5.0	0.250	122.5	5.0	0.187	86.0	0.125	6.56	3.0	27.7	8.75	7.22
4	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.125	6.56	3.0	27.7	8.75	7.22
5	7.50	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70
6	10.21	5.0	0.250	122.5	5.0	0.187	36.7	0.187	6.56	3.4	29.2	9.11	7.70

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE FLANGE CB	POS FLANGE L/RT	POS FLANGE LD/AF	NEGATIVE FLANGE CB	NEG FLANGE L/RT	NEG FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
2	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
3	1.750	88.898	686.000	1.750	64.244	643.850	40.347	69.870	0.850	91.735
4	1.750	88.898	686.000	1.000	27.416	274.759	40.347	29.817	0.850	91.735
5	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196
6	1.750	90.916	686.000	1.000	28.317	274.759	41.866	31.762	0.850	85.196

MEMBER FORCES FOR MEMBER 2

PT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	2.75	0.00	4.22						
2	2.50	2.75	-6.87	4.22						
3	5.00	2.75	-13.74	4.22						
4	7.50	2.75	-20.61	4.22						
5	7.50	2.75	-20.62	4.22						
6	10.21	2.75	-28.06	4.22						

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

STRESS ANALYSIS FOR MEMBER 3

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.96	12.33	9.24	29.86	0.364	1	0.96	12.33	-9.24	30.00	0.230	1	0.367	1
2	0.96	12.29	10.16	29.84	0.392	1	0.96	12.29	-10.16	30.00	0.261	1	0.371	1
3	0.96	12.28	10.17	29.84	0.392	1	0.96	12.28	-10.17	30.00	0.261	1	0.371	1
4	0.89	11.87	18.07	29.73	0.638	1	0.89	11.87	-18.07	30.00	0.527	1	0.428	1
5	0.87	11.87	18.07	29.73	0.637	1	0.87	11.87	-18.07	30.00	0.529	1	0.289	1
6	0.79	11.38	21.33	29.57	0.748	1	0.79	11.38	-21.33	30.00	0.641	1	0.335	1
7	0.73	10.95	22.96	29.42	0.805	1	0.73	10.95	-22.96	30.00	0.699	1	0.377	1
8	0.71	10.95	22.96	29.42	0.804	1	0.71	10.95	-22.96	30.00	0.701	1	0.180	1
9	0.65	10.55	21.13	28.57	0.761	1	0.65	10.55	-21.13	30.00	0.643	1	0.189	1

GEOMETRIC PROPERTIES FOR MEMBER 3

POINT	LOCATION	SECTION DESCRIPTION: POSITIVE FLANGE			NEGATIVE FLANGE			WEB		FULL SECTION PROPERTIES:			
		WIDTH	THK	UNBR LGTH	WIDTH	THK	UNBR LGTH	THK	HEIGHT	AREA	MOM OF INERTIA	SECTION MODULUS POSITIVE	SECTION MODULUS NEGATIVE
No	(FT)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN2)	(IN4)	(IN3)	(IN3)
1	0.28	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	60.2	5.0	0.187	53.4	0.125	10.21	3.1	61.6	11.64	11.64
4	2.25	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.00	3.4	87.4	14.13	14.13
5	2.25	5.0	0.187	60.2	5.0	0.187	53.4	0.125	12.00	3.4	87.5	14.13	14.13
6	4.75	5.0	0.187	60.2	5.0	0.187	120.1	0.125	14.49	3.7	132.4	17.82	17.82
7	7.25	5.0	0.187	60.2	5.0	0.187	120.1	0.125	16.98	4.0	188.8	21.76	21.76
8	7.25	5.0	0.187	60.2	5.0	0.187	120.1	0.125	16.98	4.0	188.8	21.76	21.76
9	10.03	5.0	0.187	60.2	5.0	0.187	120.1	0.125	19.75	4.3	266.1	26.44	26.44

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 3

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	46.137	670.377	1.000	40.925	594.653	110.070	47.814	0.850	12.326
2	1.000	46.206	681.035	1.000	40.987	604.108	110.251	47.972	0.850	12.285
3	1.000	46.207	681.142	1.000	40.988	604.203	110.253	47.974	0.850	12.285
4	1.000	46.954	796.685	1.000	41.650	706.694	112.148	49.653	0.850	11.873
5	1.000	46.954	796.792	1.000	41.651	706.789	112.149	49.655	0.850	11.873
6	1.000	47.971	957.096	1.000	95.703	1909.423	114.571	58.502	0.850	11.376
7	1.000	48.967	1117.400	1.000	97.689	2229.232	116.771	60.922	0.850	10.952
8	1.000	48.967	1117.507	1.000	97.690	2229.445	116.772	60.923	0.850	10.951
9	1.000	50.050	1295.684	1.000	99.851	2584.911	118.989	63.504	0.850	10.547

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

MEMBER FORCES FOR MEMBER 3

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	6.41	-8.79	3.01						
2	0.45	6.40	-9.85	3.01						
3	0.45	6.40	-9.86	3.01						
4	2.25	6.28	-21.28	3.01						
5	2.25	4.23	-21.29	2.92						
6	4.75	4.07	-31.66	2.92						
7	7.25	3.91	-41.64	2.91						
8	7.25	1.86	-41.64	2.82						
9	10.03	1.68	-46.56	2.82						

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

STRESS ANALYSIS FOR MEMBER 4

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	0.93	12.33	29.49	30.00	1.014	1	0.93	12.33	-29.49	30.00	0.907	1	0.234	1
2	0.93	12.29	28.22	30.00	0.972	1	0.93	12.29	-28.22	30.00	0.865	1	0.236	1
3	0.93	12.28	28.21	30.00	0.971	1	0.93	12.28	-28.21	30.00	0.865	1	0.236	1
4	0.85	11.75	14.24	30.00	0.507	1	0.85	11.75	-14.24	30.00	0.403	1	0.281	1
5	0.78	11.29	5.55	18.24	0.346	1	0.78	11.29	-5.55	30.00	0.116	1	0.321	1
6	0.72	10.89	-0.13	30.00	0.061	1	0.72	10.89	0.13	29.39	0.070	1	0.356	1
7	0.67	10.55	-3.95	30.00	0.068	1	0.67	10.55	3.95	28.57	0.189	1	0.388	1

GEOMETRIC PROPERTIES FOR MEMBER 4

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.28	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.04	3.1	59.4	11.41	11.41
2	0.45	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.20	3.1	61.5	11.64	11.64
3	0.45	5.0	0.187	53.4	5.0	0.187	60.2	0.125	10.21	3.1	61.6	11.64	11.64
4	2.84	5.0	0.187	53.4	5.0	0.187	60.2	0.125	12.59	3.4	97.1	14.98	14.98
5	5.24	5.0	0.187	120.1	5.0	0.187	60.2	0.125	14.98	3.7	142.5	18.57	18.57
6	7.63	5.0	0.187	120.1	5.0	0.187	60.2	0.125	17.36	4.0	198.5	22.39	22.39
7	10.03	5.0	0.187	120.1	5.0	0.187	60.2	0.125	19.75	4.3	266.1	26.44	26.44

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 4

PT No	POSITIVE FLANGE CB	POS FLANGE L/RT	POS FLANGE LD/AF	NEGATIVE FLANGE CB	NEG FLANGE L/RT	NEG FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	40.925	594.653	1.000	46.137	670.377	110.070	47.814	0.850	12.326
2	1.000	40.987	604.108	1.000	46.206	681.035	110.251	47.972	0.850	12.285
3	1.000	40.988	604.203	1.000	46.207	681.142	110.253	47.974	0.850	12.285
4	1.000	41.866	740.484	1.000	47.197	834.777	112.744	50.194	0.850	11.748
5	1.000	96.094	1971.901	1.000	48.167	988.413	115.017	58.983	0.850	11.288
6	1.000	97.991	2278.405	1.000	49.118	1142.048	117.091	61.285	0.850	10.892
7	1.000	99.851	2584.911	1.000	50.050	1295.684	118.989	63.504	0.850	10.547

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

MEMBER FORCES FOR MEMBER 4

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	4.09	-28.04	2.92						
2	0.45	4.08	-27.37	2.92						
3	0.45	4.08	-27.36	2.92						
4	2.84	3.92	-17.78	2.91						
5	5.24	3.76	-8.58	2.91						
6	7.63	3.61	0.25	2.90						
7	10.03	3.45	8.71	2.90						

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

STRESS ANALYSIS FOR MEMBER 5

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.57	21.34	19.66	28.93	0.698	1	0.57	21.34	-19.66	30.00	0.629	1	0.097	1
2	0.53	20.92	18.37	28.76	0.656	1	0.53	20.92	-18.37	30.00	0.587	1	0.098	1
3	0.52	20.92	18.37	28.76	0.656	1	0.52	20.92	-18.37	30.00	0.588	1	0.033	1
4	0.48	20.47	15.40	27.77	0.571	1	0.48	20.47	-15.40	30.00	0.490	1	0.048	1
5	0.45	22.00	12.94	27.81	0.480	1	0.45	22.00	-12.94	30.00	0.411	1	0.066	1
6	0.43	22.00	12.94	27.81	0.480	1	0.43	22.00	-12.94	30.00	0.412	1	0.226	1
7	0.41	21.89	10.15	26.73	0.394	1	0.41	21.89	-10.15	30.00	0.320	1	0.254	1
8	0.41	21.89	10.15	26.73	0.394	1	0.41	21.89	-10.15	30.00	0.320	1	0.254	1
9	0.41	21.87	9.59	26.47	0.376	1	0.41	21.87	-9.59	30.00	0.301	1	0.260	1

GEOMETRIC PROPERTIES FOR MEMBER 5

POINT	LOCATION	SECTION DESCRIPTION: POSITIVE FLANGE			NEGATIVE FLANGE			WEB		FULL SECTION PROPERTIES:			
		WIDTH	THK	UNBR LGTH	WIDTH	THK	UNBR LGTH	THK	HEIGHT	AREA	MOM OF INERTIA	SECTION MODULUS POSITIVE	SECTION MODULUS NEGATIVE
No	(FT)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN)	(IN2)	(IN4)	(IN3)	(IN3)
1	0.00	5.0	0.187	60.2	5.0	0.187	120.1	0.156	19.75	5.0	286.0	28.42	28.42
2	2.23	5.0	0.187	60.2	5.0	0.187	120.1	0.156	21.91	5.3	364.9	32.76	32.76
3	2.23	5.0	0.187	60.2	5.0	0.187	120.1	0.156	21.91	5.3	365.0	32.76	32.76
4	4.73	5.0	0.187	60.2	5.0	0.187	120.1	0.156	24.33	5.7	468.2	37.91	37.91
5	7.23	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.75	6.0	588.0	43.36	43.36
6	7.23	5.0	0.187	48.5	5.0	0.187	121.1	0.156	26.75	6.0	588.1	43.36	43.36
7	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.74	6.4	700.0	48.08	48.08
8	9.29	5.0	0.187	24.0	5.0	0.187	121.1	0.156	28.75	6.4	700.1	48.09	48.09
9	9.75	5.0	0.187	24.0	5.0	0.187	121.1	0.156	29.19	6.4	726.7	49.16	49.16

	FLANGES	WEB
YIELD STRESSES (KSI)	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 5

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	51.912	1295.684	1.000	103.566	2584.911	61.447	67.810	0.850	39.551
2	1.000	52.908	1434.639	1.000	105.553	2862.129	62.356	70.072	0.850	38.405
3	1.000	52.909	1434.743	1.000	105.554	2862.336	62.357	70.073	0.850	38.404
4	1.000	54.004	1590.529	1.000	107.738	3173.131	63.281	72.524	0.850	37.291
5	1.000	44.372	1406.915	1.000	110.794	3512.936	64.119	60.338	0.850	36.323
6	1.000	44.373	1406.998	1.000	110.795	3513.145	64.120	60.339	0.850	36.322
7	1.000	22.304	747.408	1.000	112.542	3771.296	64.753	30.615	0.850	35.615
8	1.000	22.304	747.449	1.000	112.544	3771.505	64.754	30.615	0.850	35.614
9	1.000	22.380	758.811	1.000	112.928	3828.832	64.888	30.781	0.850	35.467

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

MEMBER FORCES FOR MEMBER 5

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	1.68	-46.56	2.82						
2	2.23	1.54	-50.14	2.81						
3	2.23	0.51	-50.14	2.73						
4	4.73	0.68	-48.66	2.72						
5	7.23	0.84	-46.77	2.71						
6	7.23	2.89	-46.76	2.63						
7	9.29	3.02	-40.69	2.62						
8	9.29	3.02	-40.68	2.62						
9	9.75	3.05	-39.29	2.62						

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

STRESS ANALYSIS FOR MEMBER 6

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	0.58	21.34	-3.68	30.00	0.095	1	0.58	21.34	3.68	28.93	0.147	1	0.199	1
2	0.54	20.91	-6.03	30.00	0.175	1	0.54	20.91	6.03	28.75	0.228	1	0.213	1
3	0.51	20.48	-7.65	30.00	0.230	1	0.51	20.48	7.65	27.81	0.292	1	0.224	1
4	0.48	22.02	-8.75	30.00	0.270	1	0.48	22.02	8.75	27.94	0.329	1	0.233	1
5	0.45	21.89	-9.48	30.00	0.295	1	0.45	21.89	9.48	26.73	0.370	1	0.240	1
6	0.45	21.89	-9.48	30.00	0.295	1	0.45	21.89	9.48	26.73	0.370	1	0.240	1
7	0.45	21.87	-9.59	30.00	0.299	1	0.45	21.87	9.59	26.47	0.377	1	0.241	1

GEOMETRIC PROPERTIES FOR MEMBER 6

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POSITIVE FLANGE THK (IN)	POSITIVE FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEGATIVE FLANGE THK (IN)	NEGATIVE FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.187	120.1	5.0	0.187	60.2	0.156	19.75	5.0	286.0	28.42	28.42
2	2.32	5.0	0.187	120.1	5.0	0.187	60.2	0.156	22.00	5.3	368.5	32.94	32.94
3	4.64	5.0	0.187	120.1	5.0	0.187	60.2	0.156	24.25	5.7	464.4	37.73	37.73
4	6.97	5.0	0.187	121.1	5.0	0.187	48.5	0.156	26.50	6.0	574.6	42.77	42.77
5	9.29	5.0	0.187	121.1	5.0	0.187	24.0	0.156	28.74	6.4	700.0	48.08	48.08
6	9.29	5.0	0.187	121.1	5.0	0.187	24.0	0.156	28.75	6.4	700.1	48.09	48.09
7	9.75	5.0	0.187	121.1	5.0	0.187	24.0	0.156	29.19	6.4	726.7	49.16	49.16

YIELD STRESSES (KSI)	FLANGES	WEB
	50.0	50.0

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 6

PT No	POSITIVE FLANGE CB	POSITIVE FLANGE L/RT	POSITIVE FLANGE LD/AF	NEGATIVE FLANGE CB	NEGATIVE FLANGE L/RT	NEGATIVE FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	103.566	2584.911	1.000	51.912	1295.684	61.447	67.810	0.850	39.551
2	1.000	105.635	2873.722	1.000	52.950	1440.450	62.393	70.165	0.850	38.361
3	1.000	107.665	3162.532	1.000	53.967	1585.216	63.251	72.442	0.850	37.326
4	1.000	110.570	3480.081	1.000	44.283	1393.756	64.035	60.141	0.850	36.418
5	1.000	112.542	3771.296	1.000	22.304	747.408	64.753	30.615	0.850	35.615
6	1.000	112.544	3771.505	1.000	22.304	747.449	64.754	30.615	0.850	35.614
7	1.000	112.928	3828.832	1.000	22.380	758.811	64.888	30.781	0.850	35.467

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

MEMBER FORCES FOR MEMBER 6

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	3.45	8.71	2.89						
2	2.32	3.30	16.56	2.89						
3	4.64	3.15	24.05	2.88						
4	6.97	3.00	31.20	2.88						
5	9.29	2.85	37.99	2.87						
6	9.29	2.85	38.00	2.87						
7	9.75	2.82	39.30	2.87						

PROJECT No. 1004 40 X 12 X 20 UBM UBLL + WIND, NOM GAGES 50 KSI Version: 07/10/85 16:25 Run: 06 Aug 85 13:37

FORCES ACTING ON SUPPORTS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	SUPPORT No	HORIZONTAL (KIPS)	VERTICAL (KIPS)	MOMENT (K-FT)
1	WW VERT LDS + WIND	1	0.79	6.55	-0.00
1	WW VERT LDS + WIND	7	2.75	4.22	0.00
	TOTAL FORCES ACTING		3.54	10.77	-0.00
	TOTAL FORCES APPLIED		3.54	10.77	0.00

EXTERNAL MEMBER LOADS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	MEMBER NUMBER	UNIFORMLY DISTRIBUTED LOADS VERTICAL (K/FT)	UNIFORMLY DISTRIBUTED LOADS HORIZONTAL (K/FT)	CONCENTRATED LOADS LOCATION (FT)	CONCENTRATED LOADS VERTICAL (KIPS)	CONCENTRATED LOADS HORIZONTAL (KIPS)	CONCENTRATED LOADS MOMENT (K-FT)
1	WW VERT LDS + WIND	1	0.000	0.000	10.21	0.00	3.54	0.00
1	WW VERT LDS + WIND	2	0.000	0.000				
1	WW VERT LDS + WIND	3	0.065	0.000	2.25	2.05	-0.00	0.00
					7.25	2.05	-0.00	0.00
1	WW VERT LDS + WIND	4	0.065	-0.000				
1	WW VERT LDS + WIND	5	0.065	-0.000	2.23	2.05	0.00	0.00
					7.23	2.05	0.00	0.00
1	WW VERT LDS + WIND	6	0.065	-0.000				

MEMBER END TRANSLATIONS

MEMBER NUMBER	LOADING CONDITION No	LOADING CONDITION DESCRIPTION	END TRANSLATIONS JOINT No	VERT (IN)	HORZ (IN)	JOINT No	VERT (IN)	HORZ (IN)
1	1	WW VERT LDS + WIND	1	0.00	0.00	2	-0.01	2.33
2	1	WW VERT LDS + WIND	7	0.00	0.00	6	-0.01	2.39
3	1	WW VERT LDS + WIND	2	-0.01	2.33	3	-0.95	2.37
4	1	WW VERT LDS + WIND	6	-0.01	2.39	5	-0.47	2.38
5	1	WW VERT LDS + WIND	3	-0.95	2.37	4	-0.91	2.36
6	1	WW VERT LDS + WIND	5	-0.47	2.38	4	-0.91	2.36

MODULUS OF ELASTICITY 29000. KSI

APPENDIX I

MESCO FAILURE LOAD COMPUTER ANALYSES

Measured Dimensions

F_y = 54.6 ksi

Full Live Load--2.81 kips

* * * G E N E R A L I N P U T * * * Version: 07/10/85 16:25 Run: 30 Aug 85 15:09

1010 6 4 1 40X12X20		UBM BAL LL ULT, MSRD, GAGES,			54.6 KSI	11		HEAD RECORD
1 1 2	11	0.	10.62	6.616	6.616		0.41	MEMB DESC
2 7 6	11	0.	10.62	6.616	6.616		0.41	MEMB DESC
3 2 3		10.02	0.416	10.038	19.75	0.28		MEMB DESC
4 6 5 3		-10.02	0.416	10.038	19.75	0.28		MEMB DESC
5 3 4		9.74	0.404	19.75	29.188			MEMB DESC
6 5 4 3		-9.74	0.404	19.75	29.188			MEMB DESC
DEG	JT	NUMBER	BAND					
INDT	DISPL	SUPPORTS	WIDTH					
1	17	2	6					
1 112		54.6	54.6					HEADER
	4.93	0.207	4.96	0.257				FLANGE
86.	86.	1.75	86.	86.	1.75			BRACING
2	36.7	1.0	2	36.7	1.0			BRACING
7.5				0.131	0.191			WEB
0.85	1.	122.5						BUCKLING
2 112		54.6	54.6					HEADER
	4.97	0.257	4.94	0.207				FLANGE
122.5	122.5	1.75	86.	86.	1.75			BRACING
1	122.5	1.75	2	36.7	1.0			BRACING
7.5				0.131	0.191			WEB
0.85	1.	122.5						BUCKLING
3 121		54.6	54.6					HEADER
0.167	4.94	0.206	4.94	0.206				FLANGE
	4.94	0.206	4.94	0.206				FLANGE
56.7	60.2	1.0	56.7	53.4	1.0			BRACING
2	60.2	1.0	1	120.1	1.0			BRACING
				0.133				WEB
0.85	1.0	467.						BUCKLING
5 121		54.6	54.6					HEADER
	4.94	0.206	4.94	0.206				FLANGE
0.458	4.94	0.206	4.94	0.206				FLANGE
56.86	60.2	1.0	56.86	120.1	1.0			BRACING
1	48.5	1.0	1	121.1	1.0			BRACING
2	24.0	1.0						BRACING
				0.155				WEB
0.85	1.0	467.						BUCKLING
1 8	VERT CONC LOADS							LOADS
3 3			2.81			2.25		LOADS
3 3			2.81			7.25		LOADS
5 5			2.81			2.23		LOADS
5 5			2.81			7.23		LOADS
4 4			2.81			2.25		LOADS
4 4			2.81			7.25		LOADS
6 6			2.81			2.23		LOADS
6 6			2.81			7.23		LOADS

NO ERRORS WERE DETECTED IN INPUT

PROJECT No. 1010 40X12X20 UBM BAL LL ULT, MSRD, GAGES, 54.6 KSI Version: 07/10/85 16:25 Run: 30 Aug 85 15:09

FRAME GEOMETRY

MEMBER NUMBER	LENGTH (FT)	PROJECTION HORIZ	PROJECTION VERT	INITIAL END JT No	INITIAL END X COORD.	INITIAL END Y COORD.	TERMINAL END JT No	TERMINAL END X COORD.	TERMINAL END Y COORD.
1	10.62	0.00	10.62	1	0.00	0.00	2	0.00	10.62
2	10.62	0.00	10.62	7	39.52	-0.00	6	39.52	10.62
3	10.03	10.02	0.42	2	0.00	10.62	3	10.02	11.04
4	10.03	-10.02	0.42	6	39.52	10.62	5	29.50	11.04
5	9.75	9.74	0.40	3	10.02	11.04	4	19.76	11.44
6	9.75	-9.74	0.40	5	29.50	11.04	4	19.76	11.44

	X	Y
MINIMUM JOINT COORDINATE	0.00	-0.00
MAXIMUM JOINT COORDINATE	39.52	11.44

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STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	3.55	22.07	0.00	31.71	0.161	1	3.55	22.07	-0.00	32.76	0.161	1	0.114	1
2	3.55	22.07	-8.27	32.76	0.144	1	3.55	22.07	7.14	32.76	0.354	1	0.114	1
3	3.55	22.07	-16.53	32.76	0.396	1	3.55	22.07	14.27	32.76	0.546	1	0.114	1
4	3.55	27.95	-24.80	35.35	0.574	1	3.55	27.95	21.41	35.35	0.714	1	0.114	1
5	3.16	27.72	-23.44	35.35	0.549	1	3.16	27.72	20.60	35.35	0.679	1	0.078	1
6	3.16	27.72	-31.90	35.35	0.789	1	3.16	27.72	28.05	35.35	0.890	1	0.078	1

GEOMETRIC PROPERTIES FOR MEMBER 1

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	4.9	0.207	86.0	5.0	0.257	86.0	0.131	6.62	3.2	29.8	7.86	9.10
2	2.50	4.9	0.207	86.0	5.0	0.257	86.0	0.131	6.62	3.2	29.8	7.86	9.10
3	5.00	4.9	0.207	86.0	5.0	0.257	86.0	0.131	6.62	3.2	29.8	7.86	9.10
4	7.50	4.9	0.207	36.7	5.0	0.257	36.7	0.131	6.62	3.2	29.8	7.86	9.10
5	7.50	4.9	0.207	36.7	5.0	0.257	36.7	0.191	6.62	3.6	31.3	8.31	9.46
6	10.21	4.9	0.207	36.7	5.0	0.257	36.7	0.191	6.62	3.6	31.3	8.31	9.46

YIELD STRESSES (KSI)	FLANGES	WEB
	54.6	54.6

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 1

PT No	POSITIVE FLANGE CB	POS FLANGE L/RT	POS FLANGE LD/AF	NEGATIVE FLANGE CB	NEG FLANGE L/RT	NEG FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	64.907	596.643	1.750	63.097	477.658	39.871	70.677	0.850	93.936
2	1.750	64.907	596.643	1.750	63.097	477.658	39.871	70.677	0.850	93.936
3	1.750	64.907	596.643	1.750	63.097	477.658	39.871	70.677	0.850	93.936
4	1.000	27.699	254.614	1.000	26.926	203.838	39.871	30.161	0.850	93.936
5	1.000	28.508	254.614	1.000	27.518	203.838	41.291	31.990	0.850	87.586
6	1.000	28.508	254.614	1.000	27.518	203.838	41.291	31.990	0.850	87.586

MEMBER FORCES FOR MEMBER 1

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	2.16	-0.00	11.24						
2	2.50	2.16	5.41	11.24						
3	5.00	2.16	10.82	11.24						
4	7.50	2.16	16.23	11.24						
5	7.50	2.16	16.24	11.24						
6	10.21	2.16	22.10	11.24						

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STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	3.55	22.11	0.00	30.93	0.161	1	3.55	22.11	-0.00	32.76	0.161	1	0.114	1
2	3.55	22.11	7.12	30.93	0.364	1	3.55	22.11	-8.25	32.76	0.144	1	0.114	1
3	3.55	22.11	14.25	30.93	0.569	1	3.55	22.11	-16.50	32.76	0.395	1	0.114	1
4	3.55	27.95	21.37	30.93	0.799	1	3.55	27.95	-24.75	32.76	0.629	1	0.114	1
5	3.15	27.72	20.57	30.93	0.761	1	3.15	27.72	-23.40	32.76	0.600	1	0.078	1
6	3.15	27.72	28.00	30.93	1.002	1	3.15	27.72	-31.85	32.76	0.858	1	0.078	1

GEOMETRIC PROPERTIES FOR MEMBER 2

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POS FLANGE THK (IN)	POS FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEG FLANGE THK (IN)	NEG FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.00	5.0	0.257	122.5	4.9	0.207	86.0	0.131	6.62	3.2	29.9	9.11	7.87
2	2.50	5.0	0.257	122.5	4.9	0.207	86.0	0.131	6.62	3.2	29.9	9.11	7.87
3	5.00	5.0	0.257	122.5	4.9	0.207	86.0	0.131	6.62	3.2	29.9	9.11	7.87
4	7.50	5.0	0.257	122.5	4.9	0.207	36.7	0.131	6.62	3.2	29.9	9.11	7.87
5	7.50	5.0	0.257	122.5	4.9	0.207	36.7	0.191	6.62	3.6	31.4	9.47	8.33
6	10.21	5.0	0.257	122.5	4.9	0.207	36.7	0.191	6.62	3.6	31.4	9.47	8.33

YIELD STRESSES (KSI)	FLANGES	WEB
	54.6	54.6

PROPERTIES FOR STRESS ANALYSIS FOR MEMBER 2

PT No	POSITIVE FLANGE CB	POS FLANGE L/RT	POS FLANGE LD/AF	NEGATIVE FLANGE CB	NEG FLANGE L/RT	NEG FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.750	89.687	679.016	1.750	64.767	595.435	39.865	70.515	0.850	93.967
2	1.750	89.687	679.016	1.750	64.767	595.435	39.865	70.515	0.850	93.967
3	1.750	89.687	679.016	1.750	64.767	595.435	39.865	70.515	0.850	93.967
4	1.750	89.687	679.016	1.000	27.639	254.099	39.865	30.092	0.850	93.967
5	1.750	91.654	679.016	1.000	28.445	254.099	41.283	31.914	0.850	87.623
6	1.750	91.654	679.016	1.000	28.445	254.099	41.283	31.914	0.850	87.623

MEMBER FORCES FOR MEMBER 2

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	2.16	-0.00	11.24						
2	2.50	2.16	-5.41	11.24						
3	5.00	2.16	-10.82	11.24						
4	7.50	2.16	-16.23	11.24						
5	7.50	2.16	-16.24	11.24						
6	10.21	2.16	-22.10	11.24						

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STRESS ANALYSIS FOR MEMBERS 3 TO 4 INCLUSIVE

PT No	POSITIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	POSITIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	POSITIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	POSITIVE EXTREMITY STRESS RATIO	POSITIVE EXTREMITY LC No	NEGATIVE EXTREMITY AXIAL STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY AXIAL STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY BENDING STRESS COMPUTED (KSI)	NEGATIVE EXTREMITY BENDING STRESS ALLOWABLE (KSI)	NEGATIVE EXTREMITY STRESS RATIO	NEGATIVE EXTREMITY LC No	WEB SHEAR RATIO	WEB LC No
1	0.78	12.43	-19.28	32.76	0.526	1	0.78	12.43	19.28	32.76	0.612	1	0.539	1
2	0.78	12.39	-17.15	32.76	0.461	1	0.78	12.39	17.15	32.76	0.547	1	0.539	1
3	0.77	12.39	-17.13	32.76	0.460	1	0.77	12.39	17.13	32.76	0.547	1	0.539	1
4	0.72	11.97	1.62	32.02	0.106	1	0.72	11.97	-1.62	32.76	0.011	1	0.631	1
5	0.69	11.97	1.63	32.02	0.104	1	0.69	11.97	-1.63	32.76	0.008	1	0.472	1
6	0.63	11.46	14.26	31.83	0.467	1	0.63	11.46	-14.26	32.76	0.380	1	0.570	1
7	0.59	11.03	22.31	31.64	0.723	1	0.59	11.03	-22.31	32.76	0.628	1	0.668	1
8	0.56	11.03	22.31	31.64	0.722	1	0.56	11.03	-22.31	32.76	0.630	1	0.443	1
9	0.51	10.63	24.82	30.91	0.819	1	0.51	10.63	-24.82	32.76	0.709	1	0.515	1

GEOMETRIC PROPERTIES FOR MEMBERS 3 TO 4 INCLUSIVE

POINT No	LOCATION (FT)	SECTION DESCRIPTION POSITIVE FLANGE WIDTH (IN)	POSITIVE FLANGE THK (IN)	POSITIVE FLANGE UNBR LGTH (IN)	NEGATIVE FLANGE WIDTH (IN)	NEGATIVE FLANGE THK (IN)	NEGATIVE FLANGE UNBR LGTH (IN)	WEB THK (IN)	WEB HEIGHT (IN)	FULL SECTION PROPERTIES AREA (IN2)	MOM OF INERTIA (IN4)	SECTION MODULUS POSITIVE (IN3)	SECTION MODULUS NEGATIVE (IN3)
1	0.28	4.9	0.206	60.2	4.9	0.206	53.4	0.133	10.04	3.4	64.6	12.37	12.37
2	0.45	4.9	0.206	60.2	4.9	0.206	53.4	0.133	10.20	3.4	66.9	12.61	12.61
3	0.45	4.9	0.206	60.2	4.9	0.206	53.4	0.133	10.21	3.4	66.9	12.61	12.61
4	2.25	4.9	0.206	60.2	4.9	0.206	53.4	0.133	12.00	3.6	95.0	15.30	15.30
5	2.25	4.9	0.206	60.2	4.9	0.206	53.4	0.133	12.00	3.6	95.0	15.30	15.30
6	4.75	4.9	0.206	60.2	4.9	0.206	120.1	0.133	14.49	4.0	143.6	19.28	19.28
7	7.25	4.9	0.206	60.2	4.9	0.206	120.1	0.133	16.98	4.3	204.6	23.52	23.52
8	7.25	4.9	0.206	60.2	4.9	0.206	120.1	0.133	16.98	4.3	204.6	23.53	23.53
9	10.03	4.9	0.206	60.2	4.9	0.206	120.1	0.133	19.75	4.7	288.0	28.57	28.57

YIELD STRESSES (KSI)	FLANGES	WEB
	54.6	54.6

PROPERTIES FOR STRESS ANALYSIS FOR MEMBERS 3 TO 4 INCLUSIVE

PT No	POSITIVE FLANGE CB	POSITIVE FLANGE L/RT	POSITIVE FLANGE LD/AF	NEGATIVE FLANGE CB	NEGATIVE FLANGE L/RT	NEGATIVE FLANGE LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	46.602	618.185	1.000	41.338	548.357	109.622	48.176	0.850	12.427
2	1.000	46.670	627.978	1.000	41.399	557.044	109.804	48.332	0.850	12.385
3	1.000	46.671	628.076	1.000	41.399	557.131	109.806	48.334	0.850	12.385
4	1.000	47.412	734.236	1.000	42.056	651.299	111.706	50.003	0.850	11.967
5	1.000	47.412	734.335	1.000	42.057	651.386	111.707	50.005	0.850	11.967
6	1.000	48.421	881.621	1.000	96.600	1758.848	114.131	58.883	0.850	11.464
7	1.000	49.409	1028.907	1.000	98.571	2052.687	116.331	61.290	0.850	11.035
8	1.000	49.409	1029.005	1.000	98.572	2052.883	116.333	61.292	0.850	11.034
9	1.000	50.485	1192.713	1.000	100.718	2379.482	118.550	63.861	0.850	10.625

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MEMBER FORCES FOR MEMBERS 3 TO 4 INCLUSIVE

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.28	11.14	19.87	2.63	19.87	2.63				
2	0.45	11.14	18.02	2.63	18.02	2.63				
3	0.45	11.14	18.00	2.63	18.00	2.63				
4	2.25	11.14	-2.07	2.63	-2.07	2.63				
5	2.25	8.33	-2.08	2.51	-2.08	2.51				
6	4.75	8.33	-22.91	2.51	-22.91	2.51				
7	7.25	8.33	-43.73	2.51	-43.73	2.51				
8	7.25	5.53	-43.74	2.40	-43.74	2.40				
9	10.03	5.53	-59.09	2.40	-59.09	2.40				

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STRESS ANALYSIS FOR MEMBERS 5 TO 6 INCLUSIVE

PT	POSITIVE EXTREMITY						NEGATIVE EXTREMITY						WEB	
	AXIAL STRESS		BENDING STRESS		STRESS	LC	AXIAL STRESS		BENDING STRESS		STRESS	LC	SHEAR	LC
No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	COMPUTED (KSI)	ALLOWABLE (KSI)	COMPUTED (KSI)	ALLOWABLE (KSI)	RATIO	No	RATIO	No
1	0.47	22.91	23.66	31.19	0.773	1	0.47	22.91	-23.66	32.76	0.702	1	0.325	1
2	0.44	22.46	24.86	30.75	0.822	1	0.44	22.46	-24.86	32.76	0.739	1	0.361	1
3	0.42	22.46	24.86	30.75	0.821	1	0.42	22.46	-24.86	32.76	0.740	1	0.178	1
4	0.39	21.95	23.58	29.64	0.808	1	0.39	21.95	-23.58	32.76	0.702	1	0.197	1
5	0.37	23.63	22.45	29.99	0.760	1	0.37	23.63	-22.45	32.76	0.670	1	0.217	1
6	0.35	23.63	22.45	29.99	0.759	1	0.35	23.63	-22.45	32.76	0.671	1	0.007	1
7	0.33	23.50	20.24	28.98	0.708	1	0.33	23.50	-20.24	32.76	0.604	1	0.008	1
8	0.33	23.50	20.24	28.98	0.708	1	0.33	23.50	-20.24	32.76	0.603	1	0.008	1
9	0.33	23.47	19.79	28.72	0.699	1	0.33	23.47	-19.79	32.76	0.590	1	0.008	1

GEOMETRIC PROPERTIES FOR MEMBERS 5 TO 6 INCLUSIVE

POINT	SECTION DESCRIPTION								FULL SECTION PROPERTIES			
	POSITIVE FLANGE			NEGATIVE FLANGE			WEB			MOM OF	SECTION MODULUS	
No	LOCATION (FT)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	WIDTH (IN)	THK (IN)	UNBR LGTH (IN)	THK (IN)	HEIGHT (IN)	AREA (IN2)	INERTIA (IN4)	POSITIVE (IN3)	NEGATIVE (IN3)
1	0.00	4.9	0.206	60.2	4.9	0.206	120.1	0.155	19.75	5.1	302.1	29.97	29.97
2	2.23	4.9	0.206	60.2	4.9	0.206	120.1	0.155	21.91	5.4	384.7	34.47	34.47
3	2.23	4.9	0.206	60.2	4.9	0.206	120.1	0.155	21.91	5.4	384.7	34.47	34.47
4	4.73	4.9	0.206	60.2	4.9	0.206	120.1	0.155	24.33	5.8	492.3	39.80	39.80
5	7.23	4.9	0.206	48.5	4.9	0.206	121.1	0.155	26.75	6.2	616.9	45.43	45.43
6	7.23	4.9	0.206	48.5	4.9	0.206	121.1	0.155	26.75	6.2	617.0	45.43	45.43
7	9.29	4.9	0.206	24.0	4.9	0.206	121.1	0.155	28.74	6.5	733.2	50.29	50.29
8	9.29	4.9	0.206	24.0	4.9	0.206	121.1	0.155	28.75	6.5	733.3	50.30	50.30
9	9.75	4.9	0.206	24.0	4.9	0.206	121.1	0.155	29.19	6.6	760.8	51.41	51.41

YIELD STRESSES (KSI)	FLANGES	WEB
	54.6	54.6

PROPERTIES FOR STRESS ANALYSIS FOR MEMBERS 5 TO 6 INCLUSIVE

PT	POSITIVE FLANGE			NEGATIVE FLANGE						
No	CB	L/RT	LD/AF	CB	L/RT	LD/AF	KL/RX	KL/RY	CM	F'E
1	1.000	51.725	1192.713	1.000	103.193	2379.482	60.652	66.752	0.850	40.594
2	1.000	52.661	1320.384	1.000	105.059	2634.188	61.554	68.902	0.850	39.412
3	1.000	52.661	1320.479	1.000	105.060	2634.378	61.555	68.904	0.850	39.411
4	1.000	53.691	1463.614	1.000	107.114	2919.935	62.475	71.237	0.850	38.259
5	1.000	44.069	1294.474	1.000	110.037	3232.181	63.312	59.211	0.850	37.254
6	1.000	44.070	1294.551	1.000	110.038	3232.373	63.313	59.212	0.850	37.254
7	1.000	22.134	687.609	1.000	111.684	3469.561	63.948	30.022	0.850	36.517
8	1.000	22.134	687.647	1.000	111.685	3469.753	63.948	30.022	0.850	36.517
9	1.000	22.206	698.086	1.000	112.047	3522.424	64.083	30.180	0.850	36.363

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MEMBER FORCES FOR MEMBERS 5 TO 6 INCLUSIVE

POINT No	LOCATION (FT)	ABSOLUTE MAXIMUM SHEAR (KIPS)	MOMENTS AND AXIAL FORCES							
			MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)	MOMENT (K-FT)	AXIAL (KIPS)
1	0.00	5.53	-59.10	2.40	-59.10	2.40				
2	2.23	5.53	-71.41	2.40	-71.41	2.40				
3	2.23	2.72	-71.42	2.28	-71.42	2.28				
4	4.73	2.72	-78.21	2.28	-78.21	2.28				
5	7.23	2.72	-85.00	2.28	-85.00	2.28				
6	7.23	0.09	-85.00	2.16	-85.00	2.16				
7	9.29	0.09	-84.82	2.16	-84.82	2.16				
8	9.29	0.09	-84.82	2.16	-84.82	2.16				
9	9.75	0.09	-84.78	2.16	-84.78	2.16				

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FORCES ACTING ON SUPPORTS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	SUPPORT No	HORIZONTAL (KIPS)	VERTICAL (KIPS)	MOMENT (K-FT)
1	VERT CONC LOADS	1	-2.16	11.24	-0.00
1	VERT CONC LOADS	7	2.16	11.24	-0.00
	TOTAL FORCES ACTING		-0.00	22.48	-0.00
	TOTAL FORCES APPLIED		0.00	22.48	0.00

EXTERNAL MEMBER LOADS

LOADING CONDITION No	LOADING CONDITION DESCRIPTION	MEMBER NUMBER	UNIFORMLY DISTRIBUTED LOADS VERTICAL (K/FT)	UNIFORMLY DISTRIBUTED LOADS HORIZONTAL (K/FT)	CONCENTRATED LOADS LOCATION (FT)	CONCENTRATED LOADS VERTICAL (KIPS)	CONCENTRATED LOADS HORIZONTAL (KIPS)	CONCENTRATED LOADS MOMENT (K-FT)
1	VERT CONC LOADS	3	0.000	0.000	2.25	2.81	-0.00	0.00
					7.25	2.81	-0.00	0.00
1	VERT CONC LOADS	4	0.000	0.000	2.25	2.81	-0.00	0.00
					7.25	2.81	-0.00	0.00
1	VERT CONC LOADS	5	0.000	0.000	2.23	2.81	0.00	0.00
					7.23	2.81	0.00	0.00
1	VERT CONC LOADS	6	0.000	0.000	2.23	2.81	-0.00	0.00
					7.23	2.81	-0.00	0.00

MEMBER END TRANSLATIONS

MEMBER NUMBER	LOADING CONDITION LC No	LOADING CONDITION DESCRIPTION	END TRANSLATIONS JOINT No	VERT (IN)	HORZ (IN)	JOINT No	VERT (IN)	HORZ (IN)
1	1	VERT CONC LOADS	1	0.00	0.00	2	-0.01	-0.07
2	1	VERT CONC LOADS	7	0.00	0.00	6	-0.01	0.07
3	1	VERT CONC LOADS	2	-0.01	-0.07	3	-1.44	-0.02
4	1	VERT CONC LOADS	6	-0.01	0.07	5	-1.44	0.01
5	1	VERT CONC LOADS	3	-1.44	-0.02	4	-1.84	-0.00
6	1	VERT CONC LOADS	5	-1.44	0.01	4	-1.84	-0.00

MODULUS OF ELASTICITY 29000. KSI